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ABSTRACT: One challenge states face in designing an income tax system is deciding how to treat non-resident earners. Numerous states have entered into reciprocity agreements with other states that exclude non-residents' income from the tax base. These agreements provide a unique opportunity to explore the nature of state tax competition. We demonstrate that not only do reciprocity agreements dampen competition over income taxes, but the states that enact agreements also exhibit decreased levels of competition over other tax bases. This suggests that reciprocity agreements are a credible vehicle for states to act cooperatively and avoid a potential race to the bottom.

JEL Codes: H7, R5.

Keywords: Spatial econometrics, interjurisdictional competition, state taxation, reciprocity.

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1. Introduction

One challenge to states in designing their income tax systems is how to treat non-resident earners. If more than one state taxes its residents on their income and taxes non-resident earners on their income earned within the state, non-resident earners will often be subject to double taxation on their income: once in their home state, and once in their state of employment. One way states have circumvented this double taxation issue is to enter into a reciprocity agreement with another state. Such agreements allow income to be taxed in the state of residence even though it is earned in another state. These agreements are most prevalent between states that experience a great deal of cross-border commuting.

By entering into a reciprocity agreement, a state can no longer think of non-resident workers as part of their personal income tax base. Indeed, the tax base simply becomes the set of residents within the state. As a result, states may have less incentive to engage in income tax competition with neighboring states, as non-resident workers no longer contribute to the tax base. Because these non-resident workers do cross borders, however, they represent a mobile component for other tax bases, such as those employing sales taxes and excise taxes.

Having compiled the starting (and in some cases, ending) dates of all state income tax reciprocity agreements, we will demonstrate that not only do such agreements dampen competition over the state's income tax rate, but the states that adopt reciprocity agreements also exhibit decreased levels of competition over another (highly mobile) tax base – cigarette taxation. We interpret our findings as indicating that reciprocity agreements serve as a credible way for states to act cooperatively with one another, thereby preventing states from engaging in a full-blown race to the bottom.

In the following sections of the paper we present a brief history of state income tax reciprocity agreements, review the tax competition literature and discuss the potential effects of reciprocity agreements, present our empirical results, and offer concluding remarks.

2. The Why and How of Reciprocity Agreements

The notion that states can tax all their residents on all their income regardless of where it is earned, and can tax the income of all nonresidents earned within its borders, has

been in place for many years. One consequence of such a system is that if all states adhere to this belief, numerous individuals would be subject to double taxation of their income: once by their state of residence, and once by their state of employment. Thus, states have devised various measures to prevent double taxation from occurring.

The first approach involved a system of resident and nonresident credits. A resident credit allows residents to credit taxes paid to other states, most often without regard to if the state of employment reciprocates. Some states allow a credit to non-residents for their liability in their own state; most states require the other state be willing to reciprocate. While such a system helps minimize double taxation, it often fails to eliminate it in its entirety because some states have different definitions of resident/non-resident status.

Such a system worked very well when industry was concentrated in a few states. As more states created an industrial base, the need for interstate commuting fell, causing fewer states to feel compelled to tackle the double taxation issue for non-residents. As an example, in 1961, Wisconsin passed legislation exempting nonresidents from Wisconsin tax if other states did likewise. It just so happened that Minnesota repealed its nonresident credit in 1961 in response to a previous repeal by North Dakota. As a result, Minnesotans could not take advantage of the Wisconsin law, and both states collected income from each other's residents and allowed a credit to each of their residents.[1]

The advent of withholding state income taxes further complicated this issue. Oregon became the first state to implement withholding in 1948, and by 1967 only three states who imposed taxes on personal income failed to have such a system.[2] Since withholding income tax is the responsibility of the employer, it became very easy for states to collect revenue from non-resident workers. Over time, this led to the further elimination of the non-resident credit by many states.[3]

By 1965, the burden on interstate commuters had thereby increased, as they were required to file income tax returns with two states, with the resident state often

[1] A similar scenario happened after New Jersey imposed a commuter tax in 1961 in order to tax commuters between the two states. New York repealed its nonresident credit as retaliation, and as a result, Delaware could no longer give a credit to its residents working in New York because its credit required reciprocation by other states. See the ACIR for more details on both NY-NJ-DE and MN-WI-ND.

[2] According to the ACIR, Mississippi, North Dakota and California did not have general withholding in 1967, although California did impose withholding on non-residents.

[3] As reported by the ACIR, most states that dropped their non-resident credit did so while installing a withholding system at the same time.

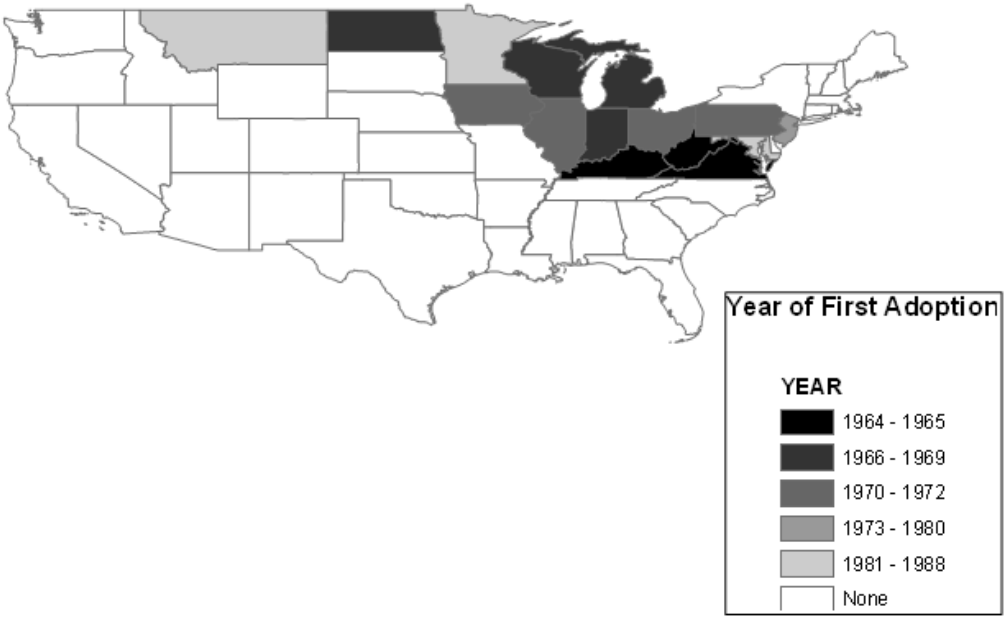
offering a credit for taxes paid by the resident to the state of employment. States had wildly differing definitions of residence status, and some were beginning to revoke their credits as a retaliatory measure against other states. As a result, in October of 1965, the ACIR (Advisory Council on Intergovernmental Relations) produced two recommendations:

(1) "all States continue to allow credits to their residents for personal income taxes they pay to other States and that those States that now allow a nonresident credit repeal such nonresident provision."
(2) "the State tax agency be authorized to enter into reciprocal agreements to eliminate potential double taxation that might result from conflict in interpretation of the residence rule."

--from Federal-State Coordination of Personal Income Taxes, October 1965, p.24 and 29

The ACIR's call was heard, and the rise of the income tax reciprocity agreement began.

Figure One – Year of First Income Tax Reciprocity Agreement



The first income tax reciprocity agreement that came in to existence was between Virginia and Kentucky in September of 1964. Figure 1 shows when states entered their first reciprocity agreement, with Maryland being the last state to enter into its first agreement in 1988. Note that the states having reciprocity agreements are clustered in the Midwest and Mid-Atlantic. Moreover, there are three distinct waves when states first enter an agreement. The first was the mid to late 1960's, when in conjunction with the release of the ACIR report, eight states began an agreement. The second wave occurred in the early 1970's, when four states started agreements. The three remaining states began agreements in the late 1970's or 1980's. By 1992, 30 bilateral reciprocity agreements involving 15 states were in place, the last being between Maryland and Virginia. 12 states have more than one agreement, with Kentucky leading the way with seven. Iowa, Montana and New Jersey are the only states to have one reciprocity agreement (with Illinois, North Dakota and Pennsylvania, respectively). Table 1 lists the starting date of each income tax reciprocity agreement.

Table 1 -- Year of Adoption of Income Tax Reciprocity Agreements, by State

Illinois (4 agreements)

Kentucky	1971
Michigan	1971
Iowa	1972
Wisconsin	1973
Indiana	1977-1998

Indiana (5 agreements)

Michigan	1968
Kentucky	1977
Ohio	1977
Pennsylvania	1977
Wisconsin	1977
Illinois	1977-1998

Iowa (1 agreement)

Illinois	1972

Kentucky (7 agreements)

Virginia	1964
Michigan	1968
West Virginia	1968
Wisconsin	1968
Illinois	1971
Ohio	1972
Indiana	1977

Maryland (3 agreements)

West Virginia	1988
Pennsylvania	1990
Virginia	1992

Montana (1 agreement)

North Dakota	1982

Minnesota (3 agreements)

Wisconsin	1968
North Dakota	1969
Michigan	1984

Michigan (6 agreements)

Wisconsin	1967
Kentucky	1968
Indiana	1968
Illinois	1971
Ohio	1972
Minnesota	1984

New Jersey (1 agreement)

Pennsylvania	1978

North Dakota (2 agreements)

Minnesota	1969
Montana	1982

Ohio (5 agreements)

Kentucky	1972
Michigan	1972
West Virginia	1972
Indiana	1977
Pennsylvania	1978

Pennsylvania (5 agreements)

West Virginia	1972
Indiana	1977
Ohio	1978
Virginia	1982
Maryland	1990

Virginia (4 agreements)

Kentucky	1964
Pennsylvania	1982
West Virginia	1988
Maryland	1988

West Virginia (5 agreements)

Kentucky	1965
Pennsylvania	1972
Ohio	1972
Virginia	1988
Maryland	1988

Wisconsin (5 agreements)

Kentucky	1967
Michigan	1967
Minnesota	1968
Illinois	1973
Indiana	1977

An income tax reciprocity agreement results in income being taxed as though it were earned in the state of residence, as opposed to the state of employment. By entering a reciprocity agreement, states agree not to withhold tax for their state from the employee. Employees simply fill out a form with their employer[4] declaring they are exempt from employer state taxation. States are not bound to withhold taxes for the state of residence, although most do.

In some cases, the reciprocity agreement results in an aggregate revenue loss to a state, which often becomes a flashpoint in maintaining the agreement. According to the Wisconsin Joint Committee on Finance (2001), Illinois estimated that the net loss in 1997 from its reciprocity agreement with Wisconsin at $11 million[5]. Illinois threatened to end the agreement[6], resulting in the passage of Wisconsin Act 63 in which Wisconsin made payments to Illinois to compensate for part of the shortfall. Wisconsin has a similar provision with Minnesota, although in 2002, then Gov. Jesse Ventura announced plans to eliminate the reciprocity agreement to help balance the budget, as fiscal analysts with the Minnesota House of Representatives estimated the a loss of $2.2 million, despite payments of nearly $58 million from Wisconsin. The Minnesota Legislature ultimately preserved the reciprocity agreement, which is still in place today.

3. The Tax Competition Literature

A key component in models of tax competition is capital mobility[7]. In these models, capital will flow between jurisdictions as it searches for the highest after tax rate of return. By lowering its tax on capital, a state can encourage capital to flow into its state. If the resulting inflow is large enough, the jurisdiction would be able to increase overall revenue despite the lower tax rate.

The problem for the state, however, is that other states are free to respond in kind by lowering their tax rates as well. If capital is perfectly mobile, meaning it can cross borders without cost, states will enter into a race to the bottom scenario where, in equilibrium, both states ultimately have zero tax rates. Since most capital does incur relocation costs, however, small changes in tax rates may not result in large capital

[4] For example, North Dakota residents would file form NR-2 in Montana.
[5] Wisconsin, by contrast, estimated the loss at $9 million.
[6] Interestingly, the agreement between Illinois and Indiana was terminated in January 1998, presumably for the same reason.
[7] The condensed summary we provide shortchanges the richness in tax competition models. See Wilson (1999) for a thorough survey of the theoretical work on tax competition.

flows, since the tax savings cannot compensate for the relocation costs. The mobility of capital still puts downward pressure on tax rates, but how low taxes will go depends on the degree of this mobility.

The search for empirical examples of tax competition has been long and varied. The literature has focused on property taxation (e.g., Ladd 1992, Heydels and Vuchelen, 1998; Brueckner and Saavedra, 2001; Revelli, 2001; Bordignon et al, 2003; Sole-Olle, 2003; Allers and Elhorst, 2006), in part because the level of government, is small. Since the distance needed to traverse borders between these jurisdictions is relatively small, Tiebout-type migration in response to changing taxes becomes likely. Not surprisingly, most studies have found evidence of competition over the property tax, with neighboring jurisdictions reacting positively to each other's choice of rate. And while specific estimates of the degree of competition have varied by study, a neighboring jurisdiction increasing property tax rates by ten percent typically results in an own-source property tax rate increase of approximately 4 percent. The empirical support for tax competition appears to be quite robust across specifications employing different time periods, jurisdictions, control variables, and even countries.

While the majority of research has been on property taxes, other taxes have also been explored in the literature. Taxes on personal income (Case, 1993; Besley and Case, 1995; Rork, 2003; Hill, 2007), corporate income (Brett and Pinkse, 2000; Buettner, 2001; Rork, 2003), general sales and excise taxes (Rork, 2003; Luna, 2004; Egger et al, 2005) and even estate and inheritance taxation (Conway and Rork, 2004) have all been shown to exhibit evidence of interjurisdictional competition at relatively the same strength as property taxes. The consistency in these results has led the literature to begin moving away from exploring explicit tax rates. More recent studies of interjurisdictional competition have discovered evidence of competition in such varied areas as tax progressivity (Chernick, 2005), composition of sales tax bases (Fletcher and Murray, 2006), and implicit taxes such as lottery taxes (Brown and Rork, 2005).

Our purpose in this paper is to explore the impact reciprocity has on tax competition between states. Entering into a reciprocity agreement essentially limits the mobility of the state's income tax base, as out of state workers no longer form part of

the base. This means that the incentive to engage in competition over the income tax is lessened, since out of state workers have no reason to respond.[8]

While the potential tax base for income taxes becomes more inelastic as a result of the reciprocity agreement, states have other dimensions to compete over. And some of these taxes, such as tobacco and motor fuels, have exhibited a high degree of elasticity and are potentially ripe for competition (Rork, 2003). The question becomes do states become more aggressive over courting these sources of capital, since the income tax reciprocity agreement has essentially tied their hands in one dimension? Or, do these reciprocity agreements foster an overall atmosphere of cooperation between states? The answer is an empirical one, which we set forth to discover in the next section.

4. Empirical Specification

Modeling tax competition

We extend the basic empirical tax competition models utilized by Rork (2003) to explore the impact of reciprocity agreements on state-level tax competition. Our model is applied to the 48 contiguous states over the period from 1967 to 2003, resulting in 1776 observations.[9] Although other studies could also serve as a suitable starting point for our model, we follow Rork's empirical specification for several reasons. First, Rork investigates interjurisdictional competition for a variety of taxes and finds evidence of direct competition over mobile tax bases such as cigarette, gasoline, and corporate income, and indirect competition over immobile bases such as sales and individual income. Using such a model allows us to investigate the potential effects of an income tax reciprocity agreement on tax bases with differing mobility. Additionally, Rork uses a sizable number of fiscal, political, and demographic regressors to control for other factors that may be correlated with a state's tax rate decisions.

[8] One could argue that lowering the income tax could result in non-resident workers changing their state of residence. In fact, Coomes and Hoyt (2008) show that when choosing where to locate in a multi-state MSA, most people will pick the lower tax side. Most of their sample, however, involves people moving into the geographic region from far away. In our case, people have already chosen where to locate within the geographic area, and it seems unlikely that small changes in the income tax will cause people to revisit that decision.

[9] We follow Rork (2003) and begin our sample period in 1967 since, prior to that year, various tax data (such as corporate income and personal income tax revenues) were aggregated together in some states.

The now-standard spatial lag specification that we estimate is given by:

$$y_{it} = \rho \boldsymbol{W} y_{it} + \beta \boldsymbol{X}_{it} + \delta_i + \theta_t + \varepsilon_{it} \ : i = 1,..., N;\ t = 1,..., T, \qquad [1]$$

where y_{it} is a (TN×1) vector of the tax rate of interest in state i at time t, $\boldsymbol{X_{it}}$ is a (TN×K) matrix of regressors in state i at time t assumed to be correlated with the state's tax rate of interest, ε_{it} is the error term, and $\boldsymbol{W}y_{it}$ is the spatial lag term. The model includes both state-specific fixed effects (δ_i) and time-specific fixed effects (θ_t) to control for unobserved factors that may be related to a state's tax rates. $\boldsymbol{W}$ is a weighting matrix that assigns weights to each jurisdiction, thereby determining which jurisdictions are neighbors to one another. Any weighting matrix $\boldsymbol{W}$ is an exogenous (TN×TN) block diagonal matrix composed of a single cross-sectional (N×N) weights matrix $\boldsymbol{w}$ along T block diagonal elements. In other words, given an identity matrix of dimension T, denoted $\boldsymbol{I}$, each (TN×TN) weighting matrix is simply $\boldsymbol{W} = \boldsymbol{w} \otimes \boldsymbol{I}$.[10] Finally, the scalar ρ is the spatial lag coefficient that must be estimated. Evidence of positive interjurisdictional competition exists if $\rho > 0$, negative interjurisdictional competition if $\rho < 0$, and no interjurisdictional competition if $\rho = 0$.

Since reciprocity agreements directly eliminate non-residents from a state's personal income tax base and may influence competition over other tax bases, we apply the model to personal income tax rates and cigarette tax rates. Cigarette tax rates provide a useful contrast to income tax rates because every state taxes cigarettes, the tax base is highly mobile and uniform across states, and there is considerable evidence that states engage in strong interjurisdictional competition over this base.

To maintain consistency with the tax competition literature and to assess the robustness of our results, we estimate equation [1] using both a standard contiguity weighting matrix and a population-contiguity weighting matrix. The contiguity weighting matrix sets the individual elements of $\boldsymbol{w}$ (denoted ω_{ij}) equal to unity if states i and j ($i \neq j$) share a common border, and to zero otherwise. When the population-contiguity weights are employed, then the individual elements of $\boldsymbol{w}$ are set equal the population of state i's common-border neighbor.[11] Each weighting matrix is also row-

[10] If the model is applied to a cross-section of data, then $I = 1$ and W reduces to w.

[11] The population-contiguity weighting matrix is formed using each state's mean population over the sample period (1967 – 2003).

standardized, which implies that states are assumed to react to the weighted average of their neighboring states' tax rates.

The matrix ($\boldsymbol{X_{it}}$) includes the set of fiscal, political, and demographic variables employed by Rork (2003) to account for other factors that may affect a state's decision to alter its tax rate. These variables include the state's per capita outstanding debt, per capita federal transfers, indicator variables that equal unity if year *t* was an election year and if the legislature and governor are of the same political party, unemployment rate, and the percentage of the state's population over age 65. Complete variable descriptions, data sources, and descriptive statistics are provided in Table 2.

Table 2 – Data Sources and Descriptive Statistics, 1967 – 2003

VARIABLE	*MEAN (ST DEV)*	*DESCRIPTION*	*SOURCE*
Percent 65 and older	11.671 (2.061)	Percentage of the state's population age 65 and older (% * 100)	Statistical Abstract of the United States
State per capita income	14.696 (9.040)	Per capita personal income in thousands of current dollars	Statistical Abstract of the United States
Election year dummy	0.269 (0.443)	=1 if year *t* was an election year for the state, =0 otherwise	Statistical Abstract of the United States
Same party Democrat	0.300 (0.458)	=1 if legislature and governor are controlled by Democrats in year *t*, =0 otherwise	Statistical Abstract of the United States
Same party Republican	0.162 (0.368)	=1 if legislature and governor are controlled by Republicans in year *t*, =0 otherwise	Statistical Abstract of the United States
Unemployment rate	5.724 (2.055)	State's unemployment rate (rate * 100)	Statistical Abstract of the United States
Per capita fed transfers	0.492 (0.403)	Per capita federal transfers in thousands of current dollars	Statistical Abstract of the United States
Per capita debt	1.098 (1.259)	State's outstanding per capita debt in thousands of current dollars	State Government Finances
Reciprocity indicator	0.273 (0.445)	=1 if the state has an active reciprocity agreement with any other state at time *t*	Individual states
Reciprocity agreements	0.957 (1.877)	number of active income tax reciprocity agreements a state has at time *t*	Individual states
Income tax rate	5.913 (4.763)	State's top (statutory) marginal income tax rate applied to personal income	University of Michigan World Tax Database
Cigarette tax rate	21.519 (19.416)	State's tax rate on cigarettes in cents per package	State Government Finances

Notes: Our sample includes 48 states over the period from 1967 to 2003, resulting in 1776 observations. Alaska and Hawaii are excluded.

In terms of the reciprocity agreements, we collected the starting (and in the case of Indiana-Illinois, ending) dates for all state income tax reciprocity agreements in the US since the first agreement was adopted in 1964. When the start date was not easily attained in state tax codes or on state tax department websites, we contacted officials in a state's department of revenue for the date. In the odd case where we received different

dates from different states, we went with the earliest date as we discovered that the latter date was often a renewal date.

We incorporate the information regarding reciprocity agreements into our empirical model using both indicator variables and interaction terms. The variable *Reciprocity Indicator* equals unity if a state has an active agreement with any other state at time *t*, while the variable *Reciprocity Agreements* equals the number of active agreements for the state at time *t*. Since it is plausible that both the existence and number of active reciprocity agreements may affect a state's decision to alter its tax rates independent of the existence or magnitude of any tax competition, the use of indicator variables will permit us to capture any such effects.

On the other hand, reciprocity agreements clearly have the potential to alter the nature of state tax competition by directly altering the relevant tax base. We explore the possibility that reciprocity agreements alter the nature of state tax competition by interacting both of our reciprocity variables with the spatial lag term from equation [1]. These specifications allow us to assess, at the margin, whether or not a state reacts in a different manner to the tax rate changes of neighboring states when a reciprocity agreement is in place.

Econometric Issues

In addition to the 'usual' endogeneity caused by the spatial lag term, incorporating a state's decision to enter into a reciprocity agreement with other states in equation [1] introduces an added endogeneity concern. It is certainly reasonable to believe, and perhaps to even expect, that a state's decision to enter (or not enter) into a reciprocity agreement with neighboring states is related to the state's preference for taxes and, therefore, tax rates. Hence, to obtain accurate estimates of how state tax rates react following the adoption of reciprocity agreements requires us to take into account that a state's tax rates could influence the decision to enact a reciprocity agreement, which, in turn, may affect the state's decision to alter its tax rates.

Although spatial lag models are most widely estimated using maximum likelihood methods, such an approach cannot be extended to allow for multiple endogenous regressors. Consequently, we select instruments for both the spatial lag term and reciprocity indicator variables and estimate our model using two-stage least squares (2SLS).

In terms of selecting instruments, we follow Kelejian and Robinson's (1993) finding that consistent parameter estimates can be obtained from utilizing spatially lagged exogenous regressors as instruments for the spatial lag term.[12] The challenge in finding valid instruments for the reciprocity indicators is that we must identify variables that are related to a state's decision to enact a reciprocity agreement (or agreements), yet are unrelated to a state's fiscal preferences. We use four variables that are based on interstate compact agreements to serve as instruments for both the *Reciprocity Indicator* variable and *Reciprocity Agreements* variable. Interstate compacts are binding legal contracts that two or more states may enter into regarding virtually any topic or issue. Moreover, member states may not unilaterally abandon an enacted interstate compact unless doing so is stipulated in the compact. As a recent study by The Council of State Governments notes, few interstate compacts were enacted before 1920 and most of these compacts dealt exclusively with border disputes. However, the use of such agreements has expanded considerably in recent decades as states have voluntarily entered into more than 150 different interstate compacts in the past 75 years, covering topics ranging from information sharing to emergency management.

Although interstate compacts do exist regarding fiscal matters, including tax issues, we use of information from non-fiscal interstate compact agreements to serve as instruments for the existence (and number) of income tax reciprocity agreements for two reasons.[13] First, states that are members of current interstate compacts (and members with more agreements) may have an underlying willingness to cooperate with neighboring states that is related to their willingness to enact one or more income tax reciprocity agreements with neighboring states. Second, given the variety of topics

[12] The use of spatially lagged exogenous variables as instruments is derived from the reduced form of the spatial lag mode (see, for instance, Kelejian and Robinson 1993). Specifically, the exogenous variables that we spatially lag to serve as instruments for the spatial lag term include: state per capita income, same party Democrat, same party Republican, election year dummy, each state's tax revenue as a share of total state revenue lagged 4 and 5 periods, each state's general fund surplus/deficit as a share of total state revenue lagged 4 and 5 periods, and each state's tax rate of interest (income or cigarette, depending on the model) lagged 4 and 5 periods. Descriptions and documentation are provided in Appendix Table A1.

[13] Interstate compacts differ from income tax reciprocity agreements in several important ways. First, compacts are, in a legal sense, contracts between states. This implies that legislative and executive branches in member states must accept identical compact language and the contract becomes effective when the required number of states agree to the compact's terms. Moreover, compacts have the effect of statutory law and states are therefore obligated to follow the compact even if doing so is inconsistent with other state laws. Finally, states may be compelled by Congress or the courts to comply with interstate compacts. In contrast, state Revenue Commissioners (or equivalent) are generally granted sole authority by state legislatures to enter into unilateral income tax reciprocity agreements with other states. Hence, for example, Kentucky's reciprocity agreement with West Virginia may be vastly different from Kentucky's agreement with Indiana.

covered by interstate compacts, there are numerous compacts that could be related to a state's willingness to cooperate with neighboring states and remain unconnected to the state's fiscal preferences.

Specifically, our four instruments for the existence and number of reciprocity agreements are defined as follows. First, an indicator variable that equals unity if a state is part of any interstate compact (in year *t*) to provide forest fire protection to other member states. Next, an indicator variable that is equal to the number of years a state has been part of any interstate compact to provide forest fire protection (in year *t*). Third, an indicator variable that equals unity if a state is part of an adoption assistance compact (in year *t*) that provides for the protection of children in interstate adoption cases. Finally, an indicator variable that equals unity if a state is part of an adoption and medical assistance compact (in year *t*) that promises protections and medical assistance to special needs children involved in interstate adoptions. Complete documentation and descriptive statistics of our instruments for the spatial lag term and reciprocity variables are provided, respectively, in Appendix Tables A1 and A2.

An additional area of concern in estimating a spatial lag model is the presence of spatial autocorrelation in the error term. As Anselin (1988) describes, such correlation can arise from measurement error or from the fact that unobserved factors affecting a state's tax rates may be related across different states. Applying Anselin and Kelejian's (1997) LM test for residual autocorrelation to our two-stage least squares residuals from equation [1] indicated the presence of statistically significant residual correlation in half of our specifications. To correct for this problem, we estimate our standard errors using the recently developed robust heteroskedastic and autocorrelation (HAC) technique for spatial models developed by Kelejian and Prucha (2007). Their spatial HAC estimator is a non-parametric approach to estimating the asymptotic covariance matrix using weighted averages of the cross-products of the two-stage least squares residuals that is robust to heteroskedasticity and residual spatial correlation of unknown form.

If we define a matrix ($\boldsymbol{Q}$) as being comprised of the exogenous regressors from equation [1] and the instruments for both the spatial lag and reciprocity variables, then, as Kelejian and Prucha (2007) demonstrate, the spatial HAC estimator requires us to obtain a consistent estimate of $\hat{\boldsymbol{\Psi}} = \boldsymbol{Q}'\hat{\boldsymbol{\Sigma}}\boldsymbol{Q}$, where $\hat{\boldsymbol{\Sigma}}$ is the covariance matrix of the 2SLS residuals. For an individual $(r,s)^{\text{th}}$ element of $\hat{\boldsymbol{\Psi}}$, Kelejian and Prucha (2007) show that the HAC estimator is given by:

$$\hat{\boldsymbol{\Psi}} = N^{-1} \sum_{i=1}^{N} \sum_{j=1}^{N} q_{ir}\, q_{js}\, \hat{\varepsilon}_i\, \hat{\varepsilon}_j\, K(d_{ij} / d) \qquad [2]$$

where $\hat{\varepsilon}$ is the 2SLS residual vector, q_i and q_j are individual elements of the matrix $\boldsymbol{Q}$, and K is a kernel function that determines which (i,j) pairs are included in the cross products based upon the distance between any two cross-sections (d_{ij}) and the bandwidth parameter d (or maximum distance threshold). If $d_{ij} \geq d$, then $K(d_{ij} / d) = 0$. Otherwise, the kernel function 'weights' the covariances and, as Kelejian and Prucha (2007) note, numerous kernel functions are satisfactory. We opt to use the Epanechnikov kernel, $K(d_{ij} / d) = 1 - (d_{ij} / d)^2$, and a distance threshold of 1200.[14] With an estimate of [2] in hand, the asymptotic HAC covariance matrix is obtained from:

$$\text{HAC} = (\tilde{\boldsymbol{V}}'\tilde{\boldsymbol{V}})^{-1} \boldsymbol{V}'\boldsymbol{Q}(\boldsymbol{Q}'\boldsymbol{Q})^{-1} \hat{\boldsymbol{\Psi}} (\boldsymbol{Q}'\boldsymbol{Q})^{-1} \boldsymbol{Q}'\boldsymbol{V} (\tilde{\boldsymbol{V}}'\tilde{\boldsymbol{V}})^{-1} \qquad [3]$$

where $\boldsymbol{V} = [\, \boldsymbol{W}\mathbf{y}, \mathbf{X}]$ and $\tilde{\boldsymbol{V}} = \boldsymbol{V}'\boldsymbol{Q}\,(\boldsymbol{Q}'\boldsymbol{Q})^{-1}\boldsymbol{Q}'\boldsymbol{V}$ **.**

5. Empirical Results

We estimate four variations of equation [1] for each tax rate that we explore to assess the possible effects of reciprocity agreements on tax competition. Table 3 presents the two-stage least square results for the state's highest (statutory) marginal income tax rate using both weighting matrices (contiguity and population-contiguity) and both income reciprocity variables (*Indicator* and *Agreements*), while Table 4 reports the same specifications for cigarette tax rates. As is also evident from the tables, we fail to reject the null hypothesis of instrument exogeneity using the Sargan test in each of the eight regressions that appear in this section. We begin with income tax rates before turning our attention to cigarette taxes.

[14] Distances were measured as the difference between each state's population centriods from the 2000 Census. A distance threshold of 1200 miles implies that, on average, each state's unobserved variation in tax rates is correlated with the unobserved variation in 30 other states (with nearer neighbors having a greater influence). We also explored the use of the Bartlett and Parzen kernels and found no difference in the statistical significance of the estimated regression coefficients.

Table 3 – The Effect of Reciprocity Agreements on State Income Tax Rate Competition
(† denotes an endogenous variable)

	Contiguity Weights		*Population-Contiguity Weights*	
Constant	11.0014 ***	12.2627 ***	6.0242	7.9936 *
	(2.5410)	(3.9326)	(3.9338)	(4.6515)
Percentage 65 & older	-0.2132 *	-0.2715 *	-0.0815	-0.2134
	(0.1234)	(0.1387)	(0.0881)	(0.1310)
Per capita income	-0.1458 **	-0.1659 **	-0.0970	-0.1197
	(0.0618)	(0.0738)	(0.1057)	(0.1301)
Election dummy	-0.0611	-0.0815	-0.0784	-0.0869
	(0.0689)	(0.0628)	(0.0761)	(0.0639)
Democrat dummy	-0.3247 ***	-0.3135 ***	-0.2732 *	-0.2711 ***
	(0.0926)	(0.1059)	(0.1408)	(0.0753)
Republican dummy	0.4142 ***	0.3995 ***	0.3803 ***	0.2842 ***
	(0.1241)	(0.0267)	(0.1225)	(0.0860)
Unemployment rate	0.2146 ***	0.1440 ***	0.2277 ***	0.1753 ***
	(0.0164)	(0.0116)	(0.0187)	(0.0479)
Per capita federal transfers	0.0842	-0.2784	-0.1058	-0.3732
	(0.5212)	(0.5440)	(0.7059)	(0.5296)
Per capita outstanding debt	-0.0311	0.0095	-0.1252	-0.0622
	(0.0368)	(0.0655)	(0.1156)	(0.1181)
Reciprocity indicator (=1 if any agreement) †	-6.6657 ***		-6.2822 *	
	(2.4272)		(3.2145)	
Reciprocity agreements (= # of agreements) †		-2.8192 ***		-2.0149
		(0.7592)		(1.6336)
Neighbors tax rate†	-0.7368 ***	-0.6152 ***	-0.4586 *	-0.3578 ***
	(0.1488)	(0.1932)	(0.2435)	(0.0817)
(Neighbors tax rate * Reciprocity indicator) †	1.1569 *		0.8873	
	(0.6071)		(0.7414)	
(Neighbors tax rate * Reciprocity agreements) †		0.5156 ***		0.3897 *
		(0.0773)		(0.2195)
Anselin-Kelejian LM test for error autocorrelation	2.165	1.575	2.217	0.879
P-value for Anselin-Kelejian LM test	0.015	0.575	0.0132	0.189
Sargan test	11.704	7.895	6.984	3.280
P-value for Sargan test	0.3862	0.722	0.800	0.986

Notes: Estimation was by two-stage least squares with Kelejian and Prucha's (2007) spatial HAC standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported. The significance of Anselin and Kelejian's (1997) LM test for error autocorrelation confirms the need to utilize Kelejian and Prucha's (2007) HAC technique.

Focusing on the control variables in the income tax rate models, we find, for instance, that when competitors are defined on the basis of contiguity, higher income states and states with larger elderly populations tend to have significantly lower top marginal rates. This may be due to the fact these segments of the population are relatively mobile. In

addition, regardless of how potential competitors are defined, we find that states with higher unemployment rates also have higher top marginal income tax rates. In fact, a one percentage point increase in a state's unemployment rate is correlated with nearly a .14 to .22 percentage point increase in the top marginal rate, *ceteris paribus*. Finally, our results show the unified Democratic control corresponds to significantly lower top rates, while unified Republican control leads to significantly higher top rates.

In terms of tax competition, our results are consistent with Rork (2003) and demonstrate that states compete indirectly over the personal income tax base. Considering all of the specifications in Table 3, our results indicate that a 10 percent increase in a neighboring states' top marginal income tax rate induces a reduction in the home state's top rate between 3.5 and 7.3 percent. Rork (2003) contends that the general lack of mobility among income earners may produce an inelastic tax base and therefore be responsible for the indirect competition.

In terms of our reciprocity variables, our results yield some interesting insights. First of all, we find that top marginal income tax rates are significantly lower in states that have at least one active reciprocity agreement in place. Specifically, top marginal rates are between 6.2 and 6.6 percentage points lower in states with at least one active agreement relative to states with no reciprocity agreements. Moreover, the interaction between the reciprocity variables and the tax rates in neighboring states suggests that, at the margin, the competition between states is significantly reversed after a reciprocity agreement is in place. That is, while (on average) states compete indirectly over the personal income tax when no reciprocity agreement exists, their competition is significantly dampened once an agreement is enacted. Even considering that the decision to enact a reciprocity agreement may be endogenous, our results seem to suggest that states are strategically altering their post-reciprocity behavior such that they are avoiding a race to the bottom.

Since reciprocity agreements appear to eliminate tax competition along the income tax dimension, an agreement could induce a state to compete more aggressively over other (more mobile) tax bases or it may bring about a more cooperative environment in setting tax rates and therefore could lessen the degree of competition. Table 4 below demonstrates how reciprocity agreements have influences state cigarette tax competition, which is known to be a highly mobile (and competitive tax base).

Table 4 – The Effect of Reciprocity Agreements on State Cigarette Tax Rate Competition

(† denotes an endogenous variable)

	Contiguity Weights		*Population-Contiguity Weights*	
Constant	24.0871 ***	46.2532 **	16.7176	14.0769
	(6.7538)	(21.7648)	(11.0114)	(19.8699)
Percentage 65 & older	-2.5632 ***	-2.7471 ***	-1.9490 ***	-1.0181
	(0.5694)	(0.5346)	(0.5332)	(0.8010)
Per capita income	1.2816 ***	1.0885 ***	1.5342 ***	1.5237 ***
	(0.2649)	(0.2413)	(0.1775)	(0.1001)
Election dummy	-0.5514 **	-0.5256 **	-0.4971 **	-0.5374 *
	(0.2300)	(0.2471)	(0.2130)	(0.3259)
Democrat dummy	0.4795 ***	0.2653	0.9538 ***	0.9633
	(0.1623)	(0.3734)	(0.2823)	(0.5982)
Republican dummy	0.0794	0.2461	-0.2823	-0.3917
	(0.4596)	(0.4166)	(0.4332)	(0.4746)
Unemployment rate	0.2237	-0.6034 *	0.0793	-0.1392
	(0.1909)	(0.3236)	(0.1720)	(0.3115)
Per capita federal transfers	-2.9745	-5.0243	-2.4892	-4.1591
	(4.0959)	(4.3575)	(3.7740)	(4.4803)
Per capita outstanding debt	-0.3885 *	-0.1174	-0.4193	-0.5063
	(0.2188)	(0.2609)	(0.3052)	(0.5511)
Reciprocity indicator (=1 if any agreement) †	16.3641		32.1357 **	
	(16.5350)		(15.2162)	
Reciprocity agreements (= # of agreements) †		10.2799 **		4.7794
		(4.0081)		(3.1591)
Neighbors tax rate†	0.8406 ***	0.8606 ***	0.7005 ***	0.6891 ***
	(0.0370)	(0.0998)	(0.0585)	(0.0431)
(Neighbors tax rate * Reciprocity indicator) †	-0.1001		-0.6029 ***	
	(0.2894)		(0.1863)	
(Neighbors tax rate * Reciprocity agreements) †		-0.2192 ***		-0.2055 ***
		(0.0795)		(0.0179)
Anselin-Kelejian LM test for error autocorrelation	5.366	1.204	0.020	0.357
P-value for Anselin-Kelejian LM test	0.000	0.114	0.491	0.360
Sargan test	9.117	11.237	7.265	14.306
P-value for Sargan test	0.611	0.425	0.777	0.216

Notes: Estimation was by two-stage least squares with Kelejian and Prucha's (2007) spatial HAC standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported. The significance of Anselin and Kelejian's (1997) LM test for error autocorrelation confirms the need to utilize Kelejian and Prucha's (2007) HAC technique.

Consistent with Rork (2003), our results in Tables 3 confirm the high degree of direction competition that occurs over state cigarette tax rates. Across all specifications, we find that a 10 cents per pack tax increase on cigarettes by nearby states induces a 6.8 to 8.6 cent increase at home. These results demonstrate the risk that policymakers bear

when relying on excise taxes because the tax bases appear to be highly vulnerable to erosion from neighboring states.

Concentrating on the reciprocity variables, we find some weak evidence that cigarette tax rates are higher (between 10 and 30 cents per pack) with reciprocity agreements in place. In contrast, however, we find solid evidence that competition over the cigarette tax base has also diminished since the adoption of a reciprocity agreement. Our results show that, depending on the model, home states react to a 10 cent tax increase by the neighbors on the order of 4.8 to 6.6 cents per pack post-reciprocity agreement, compared to 6.8 to 8.6 cents pre-reciprocity agreements. Thus, while enacting an income tax reciprocity agreement does not appear to eliminate tax competition over highly mobile and competitive bases, our results suggest that active agreements may foster a more cooperative environment and help states avoid a race to the bottom.

Finally, we ran two very simple robustness checks on our results. First, instead of utilizing Kelejian and Prucha's (2007) HAC spatial errors, we re-calculated our standard errors in Tables 3 and 4 using White heteroskedastic-consistent errors and found our results were consistent, so that the use of the HAC estimator was not driving any of our results. Second, we re-estimated our models by limited information maximum likelihood (LIML), since LIML has been found to outperform conventional instrumental variables estimators in the presence of weak estimates. Once again, the conclusion of our models remained unchanged.

6. Conclusion

The evolution of the state income tax reciprocity agreement provides us with a unique opportunity to look at the dynamics of state competition. We show that states entering a reciprocity agreement are less likely to engage in income tax competition with their neighbors. More importantly, however, we also show that these states are also less likely to engage in competition in other tax dimensions, such as tobacco, which traditionally has a very mobile base.

Although states have not entered any new reciprocity agreements since 1988, our results are particularly relevant for two reasons. First, California and Hawaii, as well as Kansas and Missouri, have recently explored entering a bilateral reciprocity

agreement with one another. Combined with the recent spat between Minnesota and Wisconsin over maintaining their reciprocity agreement, these examples show that the reciprocity agreement is still an active part of a state's tax policy portfolio.

More importantly, however, has been the advent of states joining the streamlined sales tax project (SSTP). The purpose of the SSTP is to help create a more uniform sales tax system among states which join the group. With our results indicating that states entering cooperative reciprocity agreements tend to engage in less income tax competition, it may be the case that the SSTP will serve a similar capacity by ushering in a new era of reduced competition over the state sales tax.

Appendix Table A1 – Instruments for Spatial Lag Term (all pre-multiplied by weighting matrix *W*)

VARIABLE	*MEAN (ST DEV)*	*DESCRIPTION*	*SOURCE*
State per capita income	14.696 (9.040)	Per capita personal income in thousands of current dollars	Statistical Abstract of the United States
Election year dummy	0.269 (0.443)	=1 if year *t* was an election year for the state, =0 otherwise	Statistical Abstract of the United States
Same party Democrat	0.300 (0.458)	=1 if legislature and governor are controlled by Democrats in year *t*, =0 otherwise	Statistical Abstract of the United States
Same party Republican	0.162 (0.368)	=1 if legislature and governor are controlled by Republicans in year *t*, =0 otherwise	Statistical Abstract of the United States
Tax revenue share lagged 4 periods	48.377 (11.199)	State's tax revenue as a share of total revenue lagged 4 periods in the past (share * 100)	Statistical Abstract of the United States
Tax revenue share lagged 5 periods	48.627 (11.101)	State's tax revenue as a share of total revenue lagged 5 periods in the past (share * 100)	Statistical Abstract of the United States
General fund surplus/deficit lagged 4 periods	1.843 (5.933)	State's general fund surplus/deficit as a share of general fund revenue lagged 4 periods	Statistical Abstract of the United States
General fund surplus/deficit lagged 5 periods	1.765 (5.969)	State's general fund surplus/deficit as a share of general fund revenue lagged 5 periods	Statistical Abstract of the United States

Notes: Our sample includes 48 states over the period from 1967 to 2003, resulting in 1776 observations. Alaska and Hawaii are excluded.

Appendix Table A2 – Instruments for Income Tax Reciprocity Variables

INSTRUMENT	*MEAN (ST DEV)*	*DESCRIPTION*	*SOURCE*
Forest Fire Compact	0.506 (0.500)	=1 if a state is part of any interstate compact (in year *t*) to provide forest fire protection to other member states; =0 otherwise.	*Interstate Compacts & Agencies 2003*, The Council of State Governments (p. 39-42)
Fire History Compact	14.908 (17.515)	= to the number of years a state has been part of any interstate compact to provide forest fire protection (in year *t*).	*Interstate Compacts & Agencies 2003*, The Council of State Governments (p. 39-42)
Adoption Compact	0.082 (0.275)	=1 if a state is part of an adoption assistance compact (in year *t*) that provides for the protection of children in interstate adoption cases; =0 otherwise.	*Interstate Compacts & Agencies 2003*, The Council of State Governments (p. 28)
Special Needs Compact	0.171 (0.376)	=1 if a state is part of an adoption and medical assistance compact (in year *t*) that promises protections and medical assistance to special needs children involved in interstate adoptions; =0 otherwise.	*Interstate Compacts & Agencies 2003*, The Council of State Governments (p. 29-30)

Notes: Our sample includes 48 states over the period from 1967 to 2003, resulting in 1776 observations. Alaska and Hawaii are excluded.

Summary of Reviewer's Appendix

Reviewer's Tables 1 & 2

These results are identical to the estimates reported in the paper (Tables 3 and 4) except that the standard errors are White's heteroskedastic-consistent errors instead of Kelejian and Prucha's (2007) HAC spatial errors.

The results in Reviewer's Tables 1 & 2 confirm that the statistical significance of our reciprocity variables remains robust when using 'conventional' standard errors. While Anselin and Kelejian's (1997) LM test for residual spatial autocorrelation supports the use of the spatial HAC estimator, our results are not dependent upon this estimator.

Reviewer's Tables 3 & 4

Due to growing concern over weak instruments, Reviewer's Tables 3 & 4 show our results from estimating our models by limited information maximum likelihood (LIML) with Kelejian and Prucha's (2007) spatial HAC errors. Recent work by Flores-Lagunes (2007) indicates that LIML outperforms conventional instrumental variables estimators (in terms of point estimates and coverage rates) in the presence of weak instruments.

The results in Reviewer's Tables 3 & 4 confirm that the statistical significance of our reciprocity variables using an estimator that is more robust to the problems caused by weak instruments.

Reviewer's Table 5

This table shows the results from our first-stage regressions of our two reciprocity variables *Reciprocity Indicator* and *Reciprocity Agreements*.

Reviewer's Table 1
The Effect of Reciprocity Agreements on State Income Tax Rate Competition

(Estimation by two-stage least squares with White's heteroskedastic-consistent standard errors)
(† denotes an endogenous variable)

	Contiguity Weights		*Population-Contiguity Weights*	
Constant	11.0014 ***	6.0242 **	12.2627 ***	7.9936 ***
	(3.6944)	(2.9715)	(3.4959)	(2.7265)
Percentage 65 & older	-0.2132 **	-0.0815	-0.2715 ***	-0.2134 *
	(0.0997)	(0.0956)	(0.0964)	(0.1140)
Per capita income	-0.1458 ***	-0.0970 *	-0.1659 ***	-0.1197 **
	(0.0444)	(0.0517)	(0.0444)	(0.0488)
Election dummy	-0.0611	-0.0784	-0.0815	-0.0869
	(0.1456)	(0.1399)	(0.1389)	(0.1337)
Democrat dummy	-0.3247 **	-0.2732 **	-0.3135 ***	-0.2711 **
	(0.1348)	(0.1098)	(0.1209)	(0.1083)
Republican dummy	0.4142 **	0.3803 **	0.3995 **	0.2842 *
	(0.2066)	(0.1705)	(0.1860)	(0.1586)
Unemployment rate	0.2146 ***	0.2277 ***	0.1440 ***	0.1753 ***
	(0.0432)	(0.0479)	(0.0422)	(0.0567)
Per capita federal transfers	0.0842	-0.1058	-0.2784	-0.3732
	(0.3576)	(0.3467)	(0.3733)	(0.3766)
Per capita outstanding debt	-0.0311	-0.1252	0.0095	-0.0622
	(0.0494)	(0.0919)	(0.0474)	(0.0784)
Reciprocity indicator (=1 if any agreement) †	-6.6657 *	-6.2822 **		
	(3.9420)	(2.5655)		
Reciprocity agreements (= # of agreements) †			-2.8192	-2.0149
			(1.7400)	(1.3161)
Neighbors tax rate †	-0.7368 **	-0.4586 ***	-0.6152 ***	-0.3578 ***
	(0.3071)	(0.1481)	(0.2196)	(0.0896)
(Neighbors tax rate * Reciprocity indicator) †	1.1569	0.8873 **		
	(0.7211)	(0.4030)		
(Neighbors tax rate * Reciprocity agreements) †			0.5156 *	0.3897 **
			(0.2770)	(0.1846)

Notes: Estimation was by two-stage least squares with White's heteroskedastic-consistent standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported.

Reviewer's Table 2
The Effect of Reciprocity Agreements on State Cigarette Tax Rate Competition

(Estimation by two-stage least squares with White's heteroskedastic-consistent standard errors)
(† denotes an endogenous variable)

	Contiguity Weights		*Population-Contiguity Weights*	
Constant	24.0871 *	46.2532 **	16.7176	14.0769
	(14.2721)	(23.2740)	(18.2726)	(17.9362)
Percentage 65 & older	-2.5632 ***	-2.7471 ***	-1.9490 ***	-1.0181
	(0.5592)	(0.6705)	(0.6351)	(0.6803)
Per capita income	1.2816 ***	1.0885 **	1.5342 ***	1.5237 ***
	(0.3636)	(0.4507)	(0.4495)	(0.3781)
Election dummy	-0.5514	-0.5256	-0.4971	-0.5374
	(0.6201)	(0.7290)	(0.6854)	(0.6593)
Democrat dummy	0.4795	0.2653	0.9538	0.9633
	(0.6001)	(0.6747)	(0.6217)	(0.6971)
Republican dummy	0.0794	0.2461	-0.2823	-0.3917
	(0.8732)	(0.9945)	(0.9539)	(0.9979)
Unemployment rate	0.2237	-0.6034	0.0793	-0.1392
	(0.1962)	(0.5459)	(0.2290)	(0.3999)
Per capita federal transfers	-2.9745	-5.0243	-2.4892	-4.1591
	(2.5607)	(3.0951)	(2.9476)	(3.1626)
Per capita outstanding debt	-0.3885	-0.1174	-0.4193	-0.5063
	(0.3219)	(0.3719)	(0.3945)	(0.4658)
Reciprocity indicator (=1 if any agreement) †	16.3641 **		32.1357 ***	
	(7.7352)		(10.5238)	
Reciprocity agreements (= # of agreements) †		10.2799 *		4.7794
		(5.3407)		(3.8894)
Neighbors tax rate†	0.8406 ***	0.8606 ***	0.7005 ***	0.6891 ***
	(0.0980)	(0.1100)	(0.0858)	(0.0910)
(Neighbors tax rate * Reciprocity indicator) †	-0.1001		-0.6029 ***	
	(0.1620)		(0.1697)	
(Neighbors tax rate * Reciprocity agreements) †		-0.2192 *		-0.2055 ***
		(0.1131)		(0.0679)

Notes: Estimation was by two-stage least squares with White's heteroskedastic-consistent standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported.

Reviewer's Table 3
The Effect of Reciprocity Agreements on State Income Tax Rate Competition

(Estimation by limited information maximum likelihood with Kelejian and Prucha's (2007) HAC spatial standard errors)
(† denotes an endogenous variable)

	Contiguity Weights		*Population-Contiguity Weights*	
Constant	15.5271 ***	13.5948 ***	6.2238	7.8552 *
	(3.6171)	(3.6828)	(4.0693)	(4.6913)
Percentage 65 & older	-0.2817 **	-0.2855 **	-0.0795	-0.2076
	(0.1103)	(0.1369)	(0.0865)	(0.1316)
Per capita income	-0.1677 ***	-0.1728 **	-0.0943	-0.1150
	(0.0391)	(0.0682)	(0.1086)	(0.1318)
Election dummy	-0.0412	-0.0825	-0.0775	-0.0875
	(0.0663)	(0.0617)	(0.0775)	(0.0640)
Democrat dummy	-0.4561 ***	-0.3451 ***	-0.2866 **	-0.2733 ***
	(0.0882)	(0.0949)	(0.1435)	(0.0749)
Republican dummy	0.6075 ***	0.4519 ***	0.4075 ***	0.2867 ***
	(0.1355)	(0.0330)	(0.1288)	(0.0846)
Unemployment rate	0.2335 ***	0.1379 ***	0.2345 ***	0.1794 ***
	(0.0157)	(0.0123)	(0.0044)	(0.0485)
Per capita federal transfers	0.3038	-0.3339	-0.0811	-0.3978
	(0.5956)	(0.5539)	(0.7166)	(0.5268)
Per capita outstanding debt	-0.0100	0.0176	-0.1321	-0.0672
	(0.0393)	(0.0685)	(0.1221)	(0.1229)
Reciprocity indicator (=1 if any agreement) †	-12.1737 ***		-7.1788 **	
	(2.3264)		(3.3876)	
Reciprocity agreements (= # of agreements) †		-3.6971 ***		-2.2514
		(0.6167)		(1.6512)
Neighbors tax rate†	-1.1536 ***	-0.7119 ***	-0.5023 **	-0.3635 ***
	(0.1357)	(0.1784)	(0.2543)	(0.0837)
(Neighbors tax rate * Reciprocity indicator) †	2.1838 ***		1.0263	
	(0.6467)		(0.7795)	
(Neighbors tax rate * Reciprocity agreements) †		0.6612 ***		0.4240 *
		(0.1425)		(0.2222)

Notes: Estimation was by limited information maximum likelihood with Kelejian and Prucha's (2007) spatial HAC standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported.

Reviewer's Table 4
The Effect of Reciprocity Agreements on State Cigarette Tax Rate Competition

(Estimation by limited information maximum likelihood with Kelejian and Prucha's (2007) HAC spatial standard errors)
(† denotes an endogenous variable)

	Contiguity Weights		*Population-Contiguity Weights*	
Constant	25.3452 ***	87.1287 ***	17.8675	54.7491 ***
	(6.3151)	(11.8576)	(13.3372)	(18.1336)
Percentage 65 & older	-2.5997 ***	-3.4180 ***	-1.8943 ***	-1.5289
	(0.5593)	(0.5279)	(0.6131)	(1.0507)
Per capita income	1.2520 ***	0.5707	1.5213 ***	0.9395 ***
	(0.2762)	(0.4775)	(0.1495)	(0.2423)
Election dummy	-0.5409 **	-0.3734 *	-0.4820 **	-0.3451
	(0.2282)	(0.2199)	(0.2014)	(0.3113)
Democrat dummy	0.4735 ***	0.0151	0.9732 ***	0.5008
	(0.1691)	(0.7621)	(0.2650)	(0.8594)
Republican dummy	0.0747	0.2180 *	-0.2772	-0.0203
	(0.4446)	(0.1204)	(0.3677)	(0.6499)
Unemployment rate	0.2080	-1.7378 **	0.0394	-1.3124 **
	(0.1968)	(0.8592)	(0.1918)	(0.6300)
Per capita federal transfers	-3.0211	-7.7640	-2.8773	-6.8153
	(4.0710)	(5.3669)	(3.7017)	(6.0312)
Per capita outstanding debt	-0.4023 *	0.1635	-0.5095	-0.4410
	(0.2314)	(0.3746)	(0.3572)	(0.8405)
Reciprocity indicator (=1 if any agreement) †	17.8670		36.2831 **	
	(16.7292)		(15.6599)	
Reciprocity agreements (= # of agreements) †		21.9150 **		17.1198 **
		(10.7167)		(8.6603)
Neighbors tax rate†	0.8479 ***	0.9211 ***	0.7153 ***	0.7915 ***
	(0.0360)	(0.1602)	(0.0592)	(0.0563)
(Neighbors tax rate * Reciprocity indicator) †	-0.1137		-0.7106 ***	
	(0.2879)		(0.2003)	
(Neighbors tax rate * Reciprocity agreements) †		-0.4734 *		-0.4476 **
		(0.2427)		(0.1900)

Notes: Estimation was by limited information maximum likelihood with Kelejian and Prucha's (2007) spatial HAC standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported.

Reviewer's Table 5
First-Stage Regressions for State Income Tax Reciprocity Variables

	Reciprocity Indicator	*Reciprocity Agreements*
Constant	-0.9529 ***	-3.9573 ***
	(0.1499)	(0.7150)
Percentage 65 & older	0.0370 ***	0.2368 ***
	(0.0068)	(0.0355)
Per capita income	0.0157 ***	0.0427 ***
	(0.0037)	(0.0154)
Election dummy	-0.0071	-0.0081
	(0.0115)	(0.0467)
Democrat dummy	0.0003	0.0719 *
	(0.0092)	(0.0389)
Republican dummy	0.0159	-0.0829
	(0.0147)	(0.0662)
Unemployment rate	0.0105 ***	0.0814 ***
	(0.0033)	(0.0144)
Per capita federal transfers	-0.0110	-0.2541 **
	(0.0166)	(0.1046)
Per capita outstanding debt	-0.0088	-0.1095 *
	(0.0053)	(0.0571)
Forest fire compact	-0.0432 *	-0.2835 ***
	(0.0254)	(0.1076)
Fire History compact	0.0012 **	0.0022
	(0.0005)	(0.0022)
Adoption compact	-0.0316 **	-0.1068 *
	(0.0160)	(0.0681)
Special needs compact	0.0119	0.1246 **
	(0.0128)	(0.0532)
F-test for joint significance of instruments	2.971 **	3.644 ***
Adjusted R^2	0.882	0.880

Notes: Estimation was by OLS with White's heteroskedastic-consistent standard errors reported in parentheses. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Models were applied to 48 states (excludes Alaska and Hawaii) over the period 1967 – 2003 and include both state and year fixed effects that are not reported.

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