The Spillover Effects of the Two-Rate Property Taxes in Pennsylvania: a Zero-Sum Game or a Win-Win Game?

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Abstract

This project is the first to empirically investigate the spillover effects of two-rate (split-rate) property taxation in Pennsylvania. Using a rich dataset, this paper extends the existing research by offering important evidence on the impact of two-rate property taxation on adjacent municipalities as well as the spatial dynamics of the spillover effects. The empirical model separately identifies the externalities associated with two-rate property taxation while controlling for the influence of traditional property taxation on adjoining jurisdictions. The study shows interesting results that two-rate property taxation slows down employment growth in close neighbors but speeds up employment growth in neighbors within a longer distance. The findings suggest that two-rate property taxation exhibits differential spillover effects across space.

Keywords: Two-Rate Property Taxation, Land Value Taxation, Spillover Effects

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The Spillover Effects of the Two-Rate Property Taxes in Pennsylvania: a Zero-Sum Game or a Win-Win Game?

Introduction

Advocacy for land value taxation has a long history dating back to 1750s. In theory, the land value tax is an efficient tax instrument with few undesirable effects. Because land is fixed in supply, an increase in the tax rate on land value will raise revenue without distorting the incentives for owners to invest in and use their land assuming the land assessments are based on the best possible use. In addition, Henry George argued in his Progress and Poverty (1879) that such taxes would benefit the poor by increasing the labor/land ratio in the production process, increasing the returns to labor. Modern economists compare land value taxes with conventional property taxes and show that land value taxes are less distorting than property taxes and can be used as a tool to combat urban sprawl. A variant of land value taxation in practice is the two-rate property tax, also referred to as the graded property tax or split-rate tax. The two-rate property tax values land and improvements (structures on the land) separately and levies a higher tax rate on land. Approximately 20 cities in the United States, mostly in Pennsylvania, implemented the two-rate property tax. Recently, Connecticut governor signed a bill that allows for a pilot program for up to three municipalities to implement a two-rate property tax.[1] Intuitively, the two-rate tax would encourage improvements on land because such improvements would be taxed at a lower rate than the land itself, raising the capital intensity of land development. Further, the increased incentive for improving structures would lead to a higher level of economic development. A number of third-class Pennsylvania cities adopted the tax as an effort to stimulate urban economic development and reverse the economic decline by attracting new investment.[2]

Research on the effects of replacing traditional property tax with the two-rate tax has had a resurgence with a growing number of articles over the past few decades (Bruecker 1986, 2001; Oates and Schwab 1997; Nechyba 1998; Plassmann and Tideman 2000; England 2003, 2004; England and Zhao 2005; Arnott and Petrova 2006; Banzhaf and Lavery 2010; Yang 2014). Despite the rich discussions on land value taxation and its variants, empirical evidence on the effect of the two-rate property tax is still limited. Moreover, none of the existing empirical studies investigate the effect of the two-rate property taxation on employment growth and the potential impacts on economic activity in surrounding municipalities.[3] As discussed earlier, two-rate property taxation has been implemented to encourage improvements on land as well as to stimulate economic growth and employment. Existing studies have shown that adoption of the two-rate tax system raises the capital intensity of land development by providing more housing units. One would expect to see increased production in construction and related industries within these two-rate jurisdictions. However, if the implementation of the two-rate property tax system simply diverts production activity and job opportunities from neighboring jurisdictions, causing a redistribution of output and resources across municipalities, the system would work like a zero-sum game from the state perspective. On the other hand, if the adoption stimulates local econo-

[1] HB 6706, Section 329.

[2] See Bourassa (2009) for detailed discussions on adoptions of the two-rate property tax.

[3] Theoretical and simulation studies find that two-rate property taxation can lead to increased output and employment.

my and generates some agglomeration spillovers to surrounding municipalities, it would be a win-win game.

This study is the first to explore the employment effect as well as the spillover effect of the two-rate property taxation. The empirical model allows for separate identifications of the externalities associated with two-rate property taxation and the influence of traditional property taxation on adjoining jurisdictions. Using a rich dataset and a different empirical model, this paper extends the existing research by offering important evidence on the impact of the two-rate property taxation on adjacent municipalities and the spatial dynamics of the spillover effect. The study finds that two-rate property taxation has a negative impact on the growth rate of employment in municipalities within a short distance (5 miles) from the two-rate municipalities. Interestingly, the negative impact disappears in neighboring municipalities within a 10-mile distance and then the effect turns positive as the neighborhood distance ring further expands. The results suggest that two-rate property taxation exhibits differential spillover effects across space and offer a picture of the spatial dynamic responses to the two-rate property taxation.

The remainder of this paper is organized as follows. The next section provides a brief literature review summarizing the findings of previous empirical studies, followed by the section on estimation methods and data description. The last two sections present the empirical results and conclude the paper with further discussions.

Literature Review

Existing theoretical research and simulation studies have shown that the benefits of land value taxation include increased capital intensity, employment, output, and reduced market distortions (Brueckner 1986, 2001; Capozza and Li 1994; Nechyba 1998, 2001; Anderson 1999; England 2003; Arnott 2005). Empirical evidence on the effect of two-rate property tax system is very limited.[4] Most empirical studies in the United States focus on the effect of property tax changes in Pennsylvania because it is the only state that has adopted the two-rate property tax since 1913. Mathis and Zech (1982) did not find any significant impact on construction activity associated with the adoption of the two-rate tax using cross-sectional data of 27 PA cities. Bourassa (1990) examined the effects of land-value taxation on housing development in three cities of Pennsylvania: Pittsburgh, McKeesport, and New Castle. The paper finds that decreases in the tax rate on improvements encourage improvements on the land, resulting in more efficient use of land in Pittsburgh.

Oates and Schwab (1997) utilized a richer dataset covering both residential and nonresidential sectors and showed that lowering the tax rate on structures relative to land helped to spur downtown commercial construction in Pittsburgh during the 1980s, despite the sharp decline of the city's steel industry. They recognized that the results are based on a single city in a particular macroeconomic environment at the time; therefore, the findings may be subject to sample selection bias. In a more recent study, Plassmann and Tideman (2000) compared 15 Pennsylvania cities taxing land value at a higher rate than improvements with similar sized Pennsylvania

[4] See Anderson (2009) for a detailed review of evidence.

cities taxing land and improvements at the same rate between 1972 and 1994. The results suggest that taxing land at a higher rate than structures on the land promotes construction activity within the jurisdiction.

Banzhaf and Lavery (2010) employed panel data over the period 1970–2000 and developed a different empirical strategy to explore the effect of the two-rate tax. The paper takes an interesting approach by decomposing the improvement effect of the two-rate tax into the density and dwelling size effects. The results indicate that the adoption of the two-rate tax leads to increased capital/land ratio. More importantly, the improved capital intensity relies on more housing units, rather than bigger units, suggesting the two-rate tax can be used to control urban sprawl. Yang (2014) overcame the major data limitations in the existing literature by constructing a unique dataset covering recent adoptions and rescindments of the two-rate property tax. These recent policy changes provide important variation in the data, creating a unique opportunity to investigate the effect of the two-rate property tax. Further, the study utilizes two empirical strategies and explores both short-run and long-run impacts.

Previous studies provide important evidence that helps guide policy decision making; nevertheless, none of the existing studies examine the potential impact of the two-rate property taxation on other jurisdictions. In addition, almost all empirical evidence concentrates on changes in construction activity and capital intensity of land development. To my knowledge, little is known about observed effects on other aspects of the local economy. A number of Pennsylvania cities adopted the two-rate property tax to encourage development of large land holdings while others implemented the tax to spur economic development and revitalize the municipalities.

After adopting the two-rate tax, several cities have increased the land-to-structure tax ratio whereas some cities have reduced the tax rate ratio. Further, five cities repealed the two-rate tax and switched back to the traditional property tax during recent decade. These policy changes not only affect the economic activity within the jurisdiction but may also influence economic development in surrounding jurisdictions. On one hand, the adoption of the two-rate tax could have a positive spillover effect on adjoining jurisdictions if it helps generate sufficient agglomeration economies that benefit the surrounding jurisdictions. On the other hand, the implementation of the two-rate tax could have a negative impact on neighboring jurisdictions by diverting more resources and job opportunities from the neighbors.

This paper extends the research on two-rate property taxation by exploring new evidence on the influence of two-rate property taxation. In particular, this study provides the first evidence on the spillover effects of two-rate property taxation. In addition, the research offers the first empirical evidence on the employment impact of the two-rate tax.

Estimation Methods and Data

To explore the spillover impacts of two-rate property taxation on employment, this paper utilizes an empirical model that includes the property taxation in neighboring jurisdictions as well as the property tax structure in a given jurisdiction. Because a municipality may have both two-rate (a higher tax rate on land than on structures) and single-rate (a uniform tax rate on land and structures) neighbors, the empirical model allows for differences between the impacts of two-rate neighbors and those of single-rate neighbors. To investigate the spatial dynamics of the spillover effect, I construct multiple neighborhood distance rings for each municipality. Further, different distance measures are also considered to account for transportation networks in Pennsylvania and to validate the differential spillover effects across space.

Empirical Specification

Spatial econometric models are often used to explore the interactions between jurisdictions. Depending on the specific goal of the research, various spatial models have been employed in the studies on policy evaluations. This paper focuses on the spillover effects of property taxation on employment; thus, a variant of the spatial panel Durbin model is considered. In particular, the model includes property tax structures in neighboring jurisdictions in addition to the property tax structure in a given jurisdiction. Moreover, this research identifies the impact of the two-rate property tax on employment growth in surrounding jurisdictions while controlling for possible influences of conventional property taxation on adjacent jurisdictions. The following baseline model is used to estimate the effect of the two-rate property taxation:

$$PCT\Delta Emp_{it,t-1} = \alpha_i + \delta\tau_{it}^{L} + \theta TR_{it} + \lambda \mathrm{W}_t^{TR}\tau_{it}^{L} + \rho \mathrm{W}_t^{TR} TR_{it} + \eta \mathrm{W}_t^{SR}\tau_{it}^{L} + \beta' X_{it-1} + Y_t + \varepsilon_{it}, (1)$$

where $PCT\Delta Emp_{it,t-1}$ measures the growth rate of employment in county subdivision i from decade $t-1$ to t.[5] τ_{it}^{L} denotes the tax rate on land whereas TR_{it} is the difference between land tax rate and the tax rate on structures characterizing the two-rate tax system.[6] W_t^{TR} is a spatial weight matrix with main diagonal elements, W_{iit}, equal to zero and off-diagonal elements, $W_{ijt} = \begin{cases} 1, d_{ij} \leq m \text{ } and \text{ } TR_{jt} > 0 \\ 0, otherwise \end{cases}$, where d_{ij} is the distance between the centroids of jurisdictions i and j and m is a given distance threshold. Row-standardization is performed on the weight matrix to ensure the weights sum up to 1 for each row; therefore, $\mathrm{W}_t^{TR}\tau_{it}^{L}$ and $\mathrm{W}_t^{TR} TR_{it}$ measure the spatial average tax rate on land and spatial average tax rate difference in two-rate neighbors respectively. Similarly, $\mathrm{W}_t^{SR}\tau_{it}^{L}$ measures the spatial average property tax rate in single-rate neighbors[7], controlling for the effect of traditional property taxation in surrounding jurisdictions. Further, multiple neighborhood distance rings (varyingm) are constructed to explore the spatial dynamics of the spillover effects. X_{it-1} is a vector of lagged county subdivision demographic and other characteristics influencing the outcome. α_i and Y_t denote jurisdiction and decade fixed effects respectively; ε_{it}, a normally distributed error. Specific definitions of all variables are discussed below.

[5] Various employment measures are considered and discussed in the data section.

[6] Tax rates on land and tax rate differences (land-structures) are adjusted by assessment ratios to reflect effective tax rates and tax rate differences in county subdivisions. In addition, tax rates and tax rate differences are averaged over the decade and enter the equation in log form.

[7] For W_t^{SR}, off-diagonal elements before row-standardization, $W_{ijt} = \begin{cases} 1, d_{ij} \leq m \text{ } and \text{ } TR_{jt} = 0 \\ 0, otherwise \end{cases}$

The dependent variable measures the percentage change in employment in a given county subdivision.[8] Four measures of employment are considered: construction employment, total employment, female employment and male employment. One would expect that construction employment is more responsive to the implementation of two-rate property taxation. In addition, one might also expect some responses from male employment given the nature of the jobs in construction and related industries. All four employment measures are utilized to allow for a broader investigation on employment responses to changes in property tax policy.

Property tax structure variables include the tax rate on land and the tax rate difference (tax rate on land - tax rate on structures) within a given jurisdiction as well as property tax structure in adjacent jurisdictions. All tax rate and tax rate difference variables enter the equation in log form. A dummy variable is used to control for the impact of changes in the assessment base. The empirical model separately identifies the spillover effect of two-rate property taxation and the influence of the traditional property taxation on adjoining jurisdictions. The former impact is identified from municipalities with two-rate neighbors that change their tax rate differentials whereas the latter is identified from those with single-rate neighbors that change their property tax rates. The main coefficient of interest is the coefficient (ρ) on the spatial average tax rate difference which captures the spillover effect of the two-rate property tax. If $\rho > 0$, it suggests the existence of a positive spillover. If $\rho < 0$, it implies jurisdictions experience a slowdown in employment growth if their two-rate neighbors raise their tax rate differences on average.

As noted before, multiple neighborhood distance rings are employed to identify the surrounding jurisdictions. In particular, rings of 5 miles, 10 miles, 15 miles and 20 miles are included. By varying the distance ring from a ring of 5 miles to a ring of 20 miles, one can explore the spatial dynamics of the spillover effect, that is, how the spillover effect differs across the space. Further, two sets of distance measures are considered. One measure identifies the neighbors within a radius of a given length mentioned above without controlling for actual transportation networks (e.g. street network). The other one takes transportation networks into consideration and specifies neighbors within a certain driving distance. By construction, the number of neighbors within a specified distance using the first distance measure is larger than that using the second one.

Control variables consist of lagged demographic and economic variables often used in the relevant literature as well as the squares of those terms. Table 1 reports the mean values of these variables. Further, the log of employment in previous decade is included to control for the possibility that jurisdictions with low initial employment can grow at a faster rate. In addition, the empirical model incorporates the interactions between decade dummies and latitude, the interactions between decade dummies and longitude as well as the interactions of decade dummies, latitude and longitude. These interactions can control for time-varying unobservables in any geographical areas of the spatial surface. To account for other taxes influencing employment growth, the ratio of other tax revenues to aggregate family income in each county subdivision is included.

[8] As discussed in a previous study (Banzhaf and Lavery 2010), the presence of jurisdiction fixed effect in the context of a differenced dependent variable implies that the model is a difference-

in-difference-in-differences approach.

One possible concern with the empirical model is the endogeneity of the two-rate tax variable (tax rate difference). It is worth noting that the fixed effects help reduce concerns about the endogeneity of the two-rate tax variable. One might argue that county subdivisions adopt the two-rate tax in response to slow employment growth, but any endogeneity in the model would have to be conditional on pre-existing trends. To better address this issue, I test for potential endogeneity. The lagged share of vacant housing units and local government debt are used as IVs to perform the Hausman-Wu endogeneity test. It is reasonable to believe that these two variables directly affect the implementation of the two-rate tax, but they have no direct influence on current employment growth. The test cannot reject the null hypothesis that the two-rate tax variable is exogenous.

Data

About twenty county subdivisions implemented the two-rate property tax over my sample period 1980–2010.[9] Figure 1 shows a map of Pennsylvania counties and the stars on the map indicate the locations of two-rate municipalities in Pennsylvania. Most of the two-rate jurisdictions are cities except for Ebensburg and Steelton boroughs. In general, relatively more two-rate municipalities are located in the west of Pennsylvania.

Municipalities adopted the two-rate tax in different years. Pittsburgh and Scranton were the first two cities that adopted the two-rate property tax in 1913, followed by Harrisburg and other municipalities. Over my sample period, the property tax data exhibits sufficient amount of variation in the tax rate differential across jurisdictions and time. There had been a growing number of two-rate municipalities prior to 2001; however, five cities repealed the two-rate tax and returned to the traditional property tax during recent decade. Further, about ten municipalities have increased the tax differential a number of times since 2000 whereas about eight cities have reduced the tax differential a few times since 2001. The average land-to-structure tax ratio in the two-rate cities trends upward over the sample period. In addition, property tax rates in single-rate municipalities vary across municipalities and time as well.

[9] The property tax data are mostly obtained from tax assessment offices and/or city treasurer's offices in Pennsylvania.

Figure 1: Adoptions of Two-Rate Property Taxation in Pennsylvania

Source: Data from Tax Assessment Offices in Pennsylvania. The map includes all municipalities that ever adopted the two-rate tax except for Uniontown which abolished the two-rate tax in about a year.

The data on demographic and economic controls at the county subdivision level are obtained from the Census Bureau and National Historical Geographic Information System database. Table 1 reports the mean values of these variables for two-rate municipalities as well as those for single-rate municipalities. A simple glance at the table suggests that two-rate municipalities have much higher population density compared to single-rate municipalities. In addition, almost all housing units in two-rate municipalities are in urban areas. In contrast, single-rate municipalities have a much lower share of housing units in urban areas. On average, two-rate municipalities appear to be poorer and have a lower share of housing units occupied by the owner.

Results

Regression results from the specifications that employ different spatial weight matrices based on driving distances are summarized in Tables 2–5. Table 2 highlights the main results from the specifications that define neighbors as those within a driving distance of 5 miles whereas Table 3 shows the main results from specifications that define neighbors as those within a driving distance of 10 miles. Similarly, Tables 4 and 5 present the ones using a driving distance of 15 miles and 20 miles respectively. Each table summarizes the results for the main property tax structure variables, including the tax structure in a given jurisdiction as well as tax structures in neighboring jurisdictions. In addition, each column in a given table corresponds to the regression that uses one of the four employment measures as the dependent variable.

As shown in Table 2, the coefficient on the spatial average tax rate difference in two-rate neighbors is negative across all model specifications, but it is only significant in the models that estimate total employment growth (Model 2) and female employment growth (Model 3). The results suggest that two-rate property taxation hurts total employment growth and female employment growth in surrounding jurisdictions.[10] A one-unit increase in the log of the average tax rate difference in the neighbors is estimated to result in a reduction in the growth rate of total employment by 4.5% points on average. In addition, the level of taxation on land in two-rate neighbors has a positive impact on the growth of construction employment (Model 1) and female employment (Model 3) in home jurisdiction whereas the level of property taxation in single-rate neighbors negatively influences the growth of all three employment measures (Models 2–4) except construction employment. The effect of two-rate property taxation on a jurisdiction's own construction employment growth is positive but insignificant.

Interestingly, as one includes neighbors within a greater distance, the results are different. Table 3 reports the results based on neighbors within a driving distance of 10 miles. None of the coefficients on the neighbors' property tax structure variables are significant. Surprisingly, as the size of the neighborhood distance ring further expands to a ring of 15 miles, the coefficient on the spatial average tax rate difference turns positive and significant (Model 9) as demonstrated in Table 4, suggesting a positive spillover effect on construction employment growth. Model 9 estimates an effect of 7.5% points increase in construction employment growth for a one-unit increase in the log of the spatial average tax rate difference. In addition, the coefficient on the level of property taxation in single-rate neighbors also turns positive and significant. Table 5 summarizes the results based on neighbors within a driving distance of 20 miles. The coefficient on the spatial average tax rate difference remains positive and significant (Model 13) although the magnitude is smaller than the one reported in Table 4. All other neighborhood tax variables are insignificant.

Combing all results from Tables 2–5, it appears that two-rate property taxation slows down employment growth in close neighbors but speeds up employment growth in neighbors within a longer distance. These findings reflect interesting spatial dynamics of the spillover effect. This phenomenon seems to suggest that there might be two opposing effects driving the results, the negative force dominates in neighbors within a short distance whereas the positive effect dominates in neighbors within a greater distance. For instance, if the two-rate property tax makes firms (e.g. construction companies) within the jurisdiction more competitive than those located in nearby single-rate jurisdictions driving some firms in those neighboring areas out of business, it would result in resources and jobs growth diverted into the two-rate jurisdictions. However, if two-rate property tax generates stronger agglomeration economies as the size of the market and the degree of specialization rise with the size of neighboring areas, the positive influence can dominate. Whether these are the actual explanations for the dynamics of the spillover effect across space is debatable and beyond the purpose of this paper. It deserves further investigations and requires a deeper understanding of the microeconomic foundations of possible economic linkages.

As robustness checks, the second distance measure that does not control for transportation networks is used and a set of neighborhood distance rings are created to capture the property tax structure in neighboring jurisdictions. Table 6 summarizes the results from the specifications that define neighbors as those within a 5-mile radius. The results are similar to the ones reported above but the magnitudes of coefficient estimates are larger with a higher level of significance in

[10] Note that a negative coefficient does not necessarily mean a lower level of employment, but rather a lower growth rate given the dependent variable is measured in percentage change.

several cases. In particular, the coefficient on the spatial average tax rate difference is negative and significant across all model specifications, suggesting close neighbors of the two-rate jurisdictions exhibit a reduction in the growth rate of employment. Note that the effect is presented in all four measures of employment. In addition, the coefficient on the level of taxation on land in two-rate neighbors remains positive and becomes significant in all model specifications. Consistent with previous findings, a higher level of property taxation in single-rate neighbors hurts total employment growth as well as male employment growth. The coefficient on a jurisdiction's own tax rate difference is positive but insignificant as mentioned above. Table 7 presents the dynamics of the spillover effect on construction employment growth using this second distance measure. The results are similar to the spatial dynamics reported above. The coefficient on the spatial average tax rate difference is significantly negative in neighbors within a 5-mile radius, and then it becomes insignificant in neighbors within a 10-mile radius, but turns significantly positive in neighbors within a radius of 15 miles. The variation in the spillover effect across space remains robust.

To perform additional robustness checks, I replace the difference between land tax rate and the tax rate on structures by two alternative measures used in the literature: the land-to-structure tax rate ratio and a dummy variable indicating whether the county subdivision adopted a two-rate tax over the relevant decade. The results remain qualitatively unchanged with a higher level of significance in some cases. The spillover effect of the two-rate tax based on a neighborhood distance ring of 15 miles is significant across all models that employ the dummy variable. In addition, the spillover effect based on a neighborhood distance ring of 20 miles becomes more significant in both alternative specifications.

Conclusion

Empirical work on the effect of two-rate property taxation focuses on the increased capital intensity of land development. Theoretical predications and simulation results in the existing literature encompass much broader impacts. Empirical evidence to date on the impact of the two-rate tax is still quite limited despite that the number of studies continues to grow. In addition, existing studies typically investigate the influence of the two-rate tax within the jurisdiction itself but the implementation of the two-rate tax potentially affects economic activity in adjoining jurisdictions.

This study is the first to explore the spillover effect of two-rate property taxation. Additionally, it explores employment responses to two-rate property taxation. The empirical model allows for separate identifications of the spillover effect of two-rate property taxation and the external effect of traditional property taxation on adjoining jurisdictions. Using a rich dataset and a different empirical model, this paper contributes to the existing research by offering important evidence on the influence of two-rate property taxation on employment growth in adjacent municipalities as well as the spatial dynamics of the spillover effect. The study finds that two-rate property taxation negatively affects the rate of employment growth in close neighbors. Interestingly, the negative impact disappears in neighbors within a distance ring of 10 miles and then the effect turns positive as the neighborhood distance ring further expands. To sum up, two-rate property taxation slows down employment growth in close neighbors but speeds up employment growth in neighbors within a longer distance. The evidence suggests that two-rate property taxation exhibits differential spillover effects across space providing a picture of the spatially dynamic responses to two-rate property taxation.

This interesting variation in the spillover effect across space seems to suggest that there are two opposing effects driving the results and the negative impact dominates in neighbors within a short distance whereas the positive effect dictates in neighbors within a greater distance.[11] The study considers possible explanations for the dynamics of the spillover effect across space. To identify the actual driving forces behind the results, further investigations and a deeper understanding of the microeconomic foundations are necessary.

It is worth noting that the results indicate that two-rate property tax does not have a significant impact on the growth rate of employment within the taxing jurisdiction itself. Nevertheless, the implementation of the tax still promotes construction activity and capital intensity of land development within the jurisdiction based on previous studies. Putting all findings together, two-rate property taxation differentially affects economic activity across space and the overall impact depends on the specific activity as well as the spatial distribution of such activity.

[11] The effect is expected to eventually disappear as the neighborhood distance ring further expands.

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Tables

Table 1: County Subdivision Demographic and Economic Characteristics

Variable	Two-Rate County Subdivisions (Mean)	Single-Rate County Subdivisions (Mean)
Pct age < 15	23.75%	25.60%
Pct age > 65	18.69%	14.48%
Pct Black	19.12%	1.42%
Pct White	77.73%	97.50%
Pct Hispanic	2.71%	0.74%
Pct male	46.15%	49.06%
Pct age ≥ 25 with no high school diploma	6.38%	7.95%
Pct age ≥ 25 with bachelor's degree and above	8.28%	8.55%
Pct in poverty	19.98%	9.60%
Pct housing units <10 years old	3.40%	15.52%
Pct housing units >30 years old	83.65%	55.08%
Pct houses occupied by owners	55.05%	78.43%
Pct houses in urban areas	99.96%	31.89%
Average housing value	23602.86	37419.74
Population per square mile	4259.34	1230.57
Rooms per square mile	10434.67	2974.41
Households per square mile	1740.70	486.42
Median Income	22307.91	28160.59
Unemployment rate	9.32	6.57

Notes: The statistics for the two-rate county subdivisions are based on all county subdivisions that had ever implemented the two-rate property tax over the sample period excluding Uniontown. The demographic and economic controls are lagged one decade in the model; thus, the statistics are calculated using 1980, 1990 and 2000 Census data.

Table 2: Effects of the Two-Rate Tax on Employment Growth (Neighbors within 5-Mile Driving Distance)

	Model 1	**Model 2**	**Model 3**	**Model 4**
Property Tax Variable	Construction Employment	Total Employment	Female Employment	Male Employment
Land tax rate	-0.0221	0.0277***	0.0351**	0.0318***
	(0.0347)	(0.0105)	(0.0171)	(0.0117)
Tax rate difference (land-building)	0.0189	-0.0130	-0.0217	-0.0092
	(0.0201)	(0.0116)	(0.0160)	(0.0108)
Two-Rate neighbors' land tax rate	0.1150**	0.0236	0.0382**	0.0075
	(0.0461)	(0.0158)	(0.0158)	(0.0196)
Two-Rate neighbors' tax rate difference	-0.0711	-0.0454**	-0.0700***	-0.0262
	(0.0605)	(0.0221)	(0.0216)	(0.0282)
Single-Rate neighbors' land tax rate	0.0214	-0.0297***	-0.0336*	-0.0379***
	(0.0366)	(0.0112)	(0.0173)	(0.0122)
Observations	7,589	7,639	7,636	7,639
Adjusted R^2	0.569	0.559	0.604	0.524

Notes: The table summarizes the results for the main property tax variables in the empirical model. Coefficient estimates are reported with robust standard errors in parentheses. The demographic and economic control variables include those listed in Table 1 plus squares of those terms, and decade interactions with latitude, longitude and latitude × longitude. In addition, the empirical model also controls for other tax burden and changes in the assessment base. ***, ** and * denote two-tail test significant at 1%, 5% and 10% respectively.

Table 3: Effects of the Two-Rate Tax on Employment Growth (Neighbors within 10-Mile Driving Distance)

	Model 5	**Model 6**	**Model 7**	**Model 8**
Property Tax Variable	Construction Employment	Total Employment	Female Employment	Male Employment
Land tax rate	-0.0238 (0.0472)	0.0125 (0.0144)	-0.0005 (0.0203)	0.0222 (0.0193)
Tax rate difference (land-structures)	0.0197 (0.0207)	-0.0116 (0.0116)	-0.0181 (0.0163)	-0.0084 (0.0108)
Two-Rate neighbors' land tax rate	-0.0003 (0.0391)	0.0044 (0.0078)	0.0061 (0.0104)	-0.0002 (0.0081)
Two-Rate neighbors' tax rate difference	0.0437 (0.0548)	-0.0082 (0.0106)	-0.0066 (0.0136)	-0.0032 (0.0117)
Single-Rate neighbors' land tax rate	0.0205 (0.0569)	-0.0072 (0.0170)	0.0184 (0.0222)	-0.0235 (0.0238)
Observations	7,589	7,639	7,636	7,639
Adjusted R^2	0.569	0.558	0.603	0.523

Notes: The table summarizes the results for the main property tax variables in the empirical model. Coefficient estimates are reported with robust standard errors in parentheses. The demographic and economic control variables include those listed in Table 1 plus squares of those terms, and decade interactions with latitude, longitude and latitude × longitude. In addition, the empirical model also controls for other tax burden and changes in the assessment base. ***, ** and * denote two-tail test significant at 1%, 5% and 10% respectively.

Table 4: Effects of the Two-Rate Tax on Employment Growth (Neighbors within 15-Mile Driving Distance)

	Model 9	**Model 10**	**Model 11**	**Model 12**
Property Tax Variable	Construction Employment	Total Employment	Female Employment	Male Employment
Land tax rate	-0.0385	-0.0047	-0.0144	-0.0002
	(0.0377)	(0.0103)	(0.0129)	(0.0114)
Tax rate difference (land-structures)	0.0223	-0.0099	-0.0167	-0.0062
	(0.0211)	(0.0118)	(0.0166)	(0.0108)
Two-Rate neighbors' land tax rate	-0.0307	0.0038	0.0108	-0.0020
	(0.0313)	(0.0058)	(0.0073)	(0.0060)
Two-Rate neighbors' tax rate difference	0.0747*	-0.0062	-0.0127	0.0005
	(0.0450)	(0.0081)	(0.0098)	(0.0087)
Single-Rate neighbors' land tax rate	0.0476	0.0226	0.0485**	0.0115
	(0.0520)	(0.0140)	(0.0189)	(0.0157)
Observations	7,589	7,639	7,636	7,639
Adjusted R^2	0.569	0.558	0.604	0.523

Notes: The table summarizes the results for the main property tax variables in the empirical model. Coefficient estimates are reported with robust standard errors in parentheses. The demographic and economic control variables include those listed in Table 1 plus squares of those terms, and decade interactions with latitude, longitude and latitude × longitude. In addition, the empirical model also controls for other tax burden and changes in the assessment base. ***, ** and * denote two-tail test significant at 1%, 5% and 10% respectively.

Table 5: Effects of the Two-Rate Tax on Employment Growth (Neighbors within 20-Mile Driving Distance)

	Model 13	**Model 14**	**Model 15**	**Model 16**
Property Tax Variable	Construction Employment	Total Employment	Female Employment	Male Employment
Land tax rate	-0.0195	-0.0017	-0.0024	-0.0020
	(0.0332)	(0.0089)	(0.0111)	(0.0098)
Tax rate difference	0.0163	-0.0095	-0.0170	-0.0055
(land-structures)	(0.0207)	(0.0116)	(0.0164)	(0.0107)
Two-Rate neighbors'	-0.0298	0.0067	0.0082	0.0047
land tax rate	(0.0234)	(0.0050)	(0.0063)	(0.0050)
Two-Rate neighbors'	0.0642*	-0.0052	-0.0016	-0.0042
tax rate difference	(0.0354)	(0.0070)	(0.0092)	(0.0071)
Single-Rate neighbors'	0.0131	0.0218	0.0324	0.0194
land tax rate	(0.0544)	(0.0144)	(0.0200)	(0.0160)
Observations	7,589	7,639	7,636	7,639
Adjusted R^2	0.569	0.558	0.604	0.523

Notes: The table summarizes the results for the main property tax variables in the empirical model. Coefficient estimates are reported with robust standard errors in parentheses. The demographic and economic control variables include those listed in Table 1 plus squares of those terms, and decade interactions with latitude, longitude and latitude × longitude. In addition, the empirical model also controls for other tax burden and changes in the assessment base. ***, ** and * denote two-tail test significant at 1%, 5% and 10% respectively.

Table 6: Robustness Check Using Alternative Distance Measure (Neighbors within 5-Mile Radius; No Controls for Transportation Networks)

	Model 1'	**Model 2'**	**Model 3'**	**Model 4'**
Property Tax Variable	Construction Employment	Total Employment	Female Employment	Male Employment
Land tax rate	-0.0277 (0.0423)	0.0291** (0.0137)	0.0350 (0.0222)	0.0322** (0.0139)
Tax rate difference (land-structures)	0.0192 (0.0205)	-0.0137 (0.0116)	-0.0222 (0.0161)	-0.0098 (0.0109)
Two-Rate neighbors' land tax rate	0.0949*** (0.0352)	0.0347*** (0.0111)	0.0480*** (0.0123)	0.0221* (0.0131)
Two-Rate neighbors' tax rate difference	-0.0879* (0.0455)	-0.0554*** (0.0148)	-0.0717*** (0.0159)	-0.0423** (0.0178)
Single-Rate neighbors' land tax rate	0.0283 (0.0449)	-0.0293** (0.0149)	-0.0311 (0.0232)	-0.0355** (0.0149)
Observations	7,589	7,639	7,636	7,639
Adjusted R^2	0.569	0.559	0.604	0.524

Notes: The table summarizes the results for the main property tax variables in the empirical model. Coefficient estimates are reported with robust standard errors in parentheses. The demographic and economic control variables include those listed in Table 1 plus squares of those terms, and decade interactions with latitude, longitude and latitude × longitude. In addition, the empirical model also controls for other tax burden and changes in the assessment base. ***, ** and * denote two-tail test significant at 1%, 5% and 10% respectively.

Table 7: Robustness Check on Spatial Dynamics of the Spillover Effect Using Different Distance Rings (Neighbors within 5-, 10-, 15- and 20-Mile Radius; No Controls for Transportation Networks)

Property Tax Variable	**5-Mile** Construction Employment	**10-Mile** Construction Employment	**15-Mile** Construction Employment	**20-Mile** Construction Employment
Land tax rate	-0.0277	-0.0413	-0.0170	-0.0087
	(0.0423)	(0.0372)	(0.0331)	(0.0295)
Tax rate difference	0.0192	0.0210	0.0150	0.0117
(land-structures)	(0.0205)	(0.0206)	(0.0207)	(0.0209)
Two-Rate neighbors'	0.0949***	-0.0266	-0.0375	-0.0107
land tax rate	(0.0352)	(0.0317)	(0.0283)	(0.0181)
Two-Rate neighbors'	-0.0879*	0.0659	0.0713*	0.0368
tax rate difference	(0.0455)	(0.0446)	(0.0404)	(0.0273)
Single-Rate neighbors'	0.0283	0.0529	0.0082	-0.0115
land tax rate	(0.0449)	(0.0493)	(0.0534)	(0.0579)
Observations	7,589	7,589	7,589	7,589
Adjusted R^2	0.569	0.569	0.569	0.569

Notes: The table summarizes the results for the main property tax variables in the empirical model. Coefficient estimates are reported with robust standard errors in parentheses. The demographic and economic control variables include those listed in Table 1 plus squares of those terms, and decade interactions with latitude, longitude and latitude*longitude. In addition, the empirical model also controls for other tax burden and changes in the assessment base. ***, ** and * denote two-tail test significant at 1%, 5% and 10% respectively.