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Split-Rate Taxation and Business Establishment Location: Evidence from the Pennsylvania Experience

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Abstract

This paper estimates the relationship between business establishment location and split-rate property taxation. Using variation in split-rate adoption and intensity by municipalities across Pennsylvania, I apply data from the Census County Business Patterns between 1994 and 2017, to estimate difference-in-difference (DID) style models. Findings suggest that moving from conventional property taxation to a split-rate system is associated with an immediate increase of between 60–107 business establishments. The number of business establishments does not appear to be sensitive to changes in the split-rate ratio after implementation, but the initial increase in the number of establishments declines each year after implementation by between 3.3–5.5 establishments, or about 5 percent.

Keywords: Property Tax; Split-Rate; Land Tax; Business Location

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Split-Rate Taxation and Business Establishment Location: Evidence from the Pennsylvania Experience

Introduction and Background

Local economic development policy in the United States generally focuses on the attraction and retention of businesses.[1] Often, local policymakers are focused on attracting a *single* large firm, such as a highly visible manufacturing facility, by offering a set of firm-specific incentives. The academic work examining the local economic effects of attracting a large employer is surprisingly thin, but the most compelling work in this area suggests that this strategy is likely flawed (Patrick 2016). This does not imply that attracting and retaining businesses is not an important goal for local economic development; but rather that the focus on a single, large employer is not likely to be an optimal economic development strategy.

An alternative economic development policy is to create a general local tax environment that is favorable to growth. This strategy would suggest removing local taxes that distort behavior, in favor of tax systems that encourage growth. As summarized by Banzhaf and Lavery (2010), local property taxes can reduce the resources devoted to development relative to a pure tax on land, and a split-rate tax (a higher tax rate on land than structures) may be a reasonable compromise between a property tax and a land-only tax. The move from conventional property taxation to a split-rate tax system may promote both a direct business establishment response and an indirect response. The split-rate tax makes capital (building structures) relatively less expensive than using land, so businesses that use more capital are likely to prefer locating in a jurisdiction with a split-rate tax. A split-rate tax is also likely to encourage the construction of structures and increase density, potentially inducing local multiplier effects and accelerating agglomeration economies.

Despite the potential for a split-rate tax to have positive effects on local business formation and retention, there have been no academic studies of this relationship. Pennsylvania municipalities have had extensive experience implementing, changing, and removing split-rate taxation dating as far back as 1913 (Banzhaf and Lavery 2010), offering the potential for further examination of the link between split-rate taxation and business establishment location. Although the largest municipality in the state, Philadelphia, has never had a split-rate tax, a split-rate has been implemented in Pittsburgh and many other municipalities across the state. Table 1 shows the year of implementation and the final year (if applicable) for the Pennsylvania municipalities that had a split-rate tax structure at any point during the 1994–2017 period.

[1] See Hanson (2019) for a recent review of the literature on taxes and economic development.

Table 1: Split-Rate Municipalities in Pennsylvania

			Land to Structure Ratio (1994–Final Year)	
Municipality	First Year	Final Year	Mean	Standard Deviation
ALIQUIPPA	1988	-	7.97	2.3
ALLENTOWN	1997	-	4.41	1.05
ALTOONA	2003	2016	16.73	19.32
CLAIRTON	1989	-	12.76	7.33
COATESVILLE	1991	2004	2.19	0.25
CONNELLSVILLE	1992	-	6.48	0
DUBOIS	1991	-	26.11	16.77
DUQUESNE	1985	-	1.75	0.28
EBENSBURG	2000	-	3.43	0.65
HARRISBURG	1975	-	5.33	1.05
LOCK HAVEN	1991	-	4.56	0.67
MCKEESPORT	1980	-	4.25	0.66
NEW CASTLE	1982	-	3.7	0.21
OIL CITY	1989	2002	3.25	0.09
PITTSBURGH	1913	2000	5.76	0
SCRANTON	1913	-	4.78	0.37
STEELTON	2000	2007	1.67	0.53
TITUSVILLE	1990	-	3.28	0.25
WASHINGTON	1985	-	20.59	7.7

Mean and Standard Deviation values are from municipal-year data merged with industry counts and have missing values for some municipality years. Mean and Standard Deviation values are from data beginning in 1994 and ending in 2017 (inclusive).

Source: Yang 2014, Updated 2020 by Yang.

To estimate the effects of split-rate taxation on business establishment location, I use variation from the Pennsylvania experience and difference-in-difference (DID) style regressions applied to data from the Census County Business Patterns ZIP code files. I rely on municipality implementation, removal, changes to the ratio, and length of time the policy is in effect to identify the relationship between split-rate taxation and business establishment location. I use a two-way fixed effects variant of the DID model to control for year and municipality fixed effects and isolate the effects of tax policy differences. Because the estimation relies on changes to split-rate policies, it is important to consider what municipalities changed policy during this time and what extent municipalities varied the ratio of the tax on land to the tax on structure. Table 1 shows that during the period of study there were four municipalities that implemented a split-rate system (Allentown, Altoona, Ebensburg, and Steelton), and five that went from a split-rate system back to a conventional property tax (Altoona, Coatesville, Oil City, Pittsburgh, and Steelton). Table 1 also shows that during the years when a split-rate tax is active, there are substantial differences both within and across municipalities in the ratio of the land to structure rate imposed.

I find that moving from conventional property taxation to a split-rate system (with an average ratio of land to structure tax of 7.73) is associated with an immediate increase of between 60–107 business establishments. The number of business establishments does not appear to be sensitive to marginal changes in the split-rate ratio after implementation, but the initial increase in the number of establishments declines each year after implementation by between 3.3–5.5 establishments, or about 5 percent. I also find notable differences across industry sectors, with split-rate implementation positively associated with business establishments in wholesale, retail, transportation, manufacturing, and construction and negatively associated with business establishments in the service and finance, insurance, and real estate (FIRE) sectors.

Empirical Methodology

To understand how the Pennsylvania experience with split-rate taxation has influenced business location decisions, I estimate several variants of difference-in-difference (DID) style models. These models are common for policy analysis as they isolate the effects of policy changes independent of other factors under reasonable assumptions. The basic idea behind the DID models is to compare places that undergo a policy change (treated groups) with places that did not undergo a policy change (comparison groups) across a period of time when the policy changes for treated groups.[2] In the Pennsylvania split-rate case, the primary policy change I analyze is the introduction or removal of a split-rate tax at the municipal level. I also use the model to analyze the length of time the split-rate tax has been in effect and the intensity of the split-rate as measured in the ratio of the tax on land to the tax on structures.

Standard DID models control for broad commonalities between all members of a treated group (in this case, municipalities that enact a split-rate tax) and for differences that occur "before" the policy change relative to "after." This set up is particularly effective in cases with one treated group, one comparison group, and two time periods. For cases with many different treated areas, many comparison areas, and over longer time periods, a two-way fixed effects version of the DID model offers a more extensive control for area-specific and time effects. Rather than controlling for common factors that are averaged out over the entire group of treated units (in this case, Pennsylvania municipalities), the two-way fixed effects model controls for any time-invariant factors unique to each municipality. In addition, rather than control for common factors across all years "after" policy implementation by averaging, the two-way fixed effects model instead controls for factors unique to each year.

The two primary assumptions of DID models are (1) that treated and comparison areas have a parallel trend in the outcome of interest before the policy begins, referred to as the parallel trend assumption; and (2) that the policy does not have an impact on the comparison areas, referred to as the non-interference assumption. The parallel trends assumption can be tested and is covered in the "Secondary Empirical Results" section of this paper. The non-interference assumption cannot truly be tested without the use of a secondary comparison area, something that is not

[2] See Greenstone, Hornbeck, and Moretti (2010) for an explanation of how the DID framework relates to a theoretical model of firm-level productivity and further explanation of the models implemented here.

available in the cases studied here.[3] For the non-interference condition to be violated in the context applied here, it would mean that when one municipality implements a split-rate tax, it has an effect on business establishment location in non-implementing municipalities. The effect on non-implementing municipalities could be positive if the split-rate municipality raises regional economic activity, or it could be negative if it induces relocation from within the state.

Within the two-way fixed effects framework, I estimate four separate models: A level-shift model, a slope over time model, a combination level-shift and slope over time model, and a policy-intensity model. Each of these models is outlined and explained below.

Level Shift Model

$$Y_{i,t} = \alpha + \beta \mathbf{1}[split\ rate]_{i,t} + \theta total_{i,t} + \gamma_i + \delta_t + \varepsilon$$

Where Y is the number of business establishments in year *i* in municipality *t*. **1** represents the indicator function, and *total* is a measurement of the total tax rate in municipality *i* in time period *t*. γ_i represent municipality fixed effects and δ_t represent year effects.

The coefficient of interest is β, which measures the effect of moving to a split-rate tax system on the number of business establishments in a municipality. This model tests for an immediate (occurring within the first year after implementing the split-rate policy) increase in the number of business establishments, that remains constant over the time period that the policy remains in effect. The level shift model estimates the effect of moving from no split-rate policy to the average split-rate policy among municipalities that implement a split-rate tax (or from removing the average split-rate policy). For the years of data in the sample, and the coverage of municipalities, this model shows the effect of moving from no split-rate to a split-rate with a ratio (land/structure) of 7.73.

Importantly, the model controls for the overall level of taxation on property, as noted in the *total* variable. The overall level of taxation is a factor that can (and does) change both across time and across municipalities. Controlling for the overall level of taxation is important for two reasons. First, it allows the results to be interpreted as a move to a split-rate system, given that the overall tax burden is held constant—it effectively highlights the differential taxation of land and structure rather than an overall lower or higher level of taxation. Second, it gives insight into how unobservable factors that vary across time and across municipalities may be affecting the estimation results.

The level-shift model leaves open the possibility of differential effects from moving to a split-rate tax structure over time, something that the slope over time model addresses directly.

[3] There is evidence that the non-interference assumption may be violated in the case of using DID models to study Empowerment Zone tax incentives on business relocation decisions. See Hanson and Rohlin (2013) for these results and further discussion.

Slope Over Time Model

$$Y_{i,t} = \alpha + \pi trend * \mathbf{1}[split\ rate]_{i,t} + \theta total_{i,t} + \gamma_i + \delta_t + \varepsilon$$

Where *trend* represents a time trend starting from the first year of the data set and running to the last. All other variables are the same as the level-shift model. Notice that the split-rate indicator variable is interacted with the time trend variable.

The coefficient of interest is π, how moving to a split-rate tax affects the number of business establishments in a municipality for each year the split-rate is in effect. Rather than measure a one-time change in business establishments, as in the level-shift model, this model allows for the effect to happen gradually over the years that the policy is in effect. This model tests for a differential trend in the number of business establishments happening in municipalities that implement a split-rate tax structure.

Combination Model

$$Y_{i,t} = \alpha + \beta \mathbf{1}[split\ rate]_{i,t} + \pi trend * \mathbf{1}[split\ rate]_{i,t} + \theta total_{i,t} + \gamma_i + \delta_t + \varepsilon$$

Where all variables are defined as in the level-shift and slope over time models above.

This model estimates both the β and π term simultaneously, allowing for the effect of split-rate taxation to have both an immediate/constant effect and a differential effect based on how long it has been in place. Estimating both the level shift and slope over time simultaneously provides insight into how these effects may interact with each other. For example, allowing the slope to change at the same time as the level shift may reveal that the immediate effects of the policy change are more muted and actually occur as the policy has been in place longer.

Policy Intensity Model

$$Y_{i,t} = \alpha + \rho ratio_{i,t} + \theta total_{i,t} + \gamma_i + \delta_t + \varepsilon$$

Where *ratio* is the tax rate on land divided by the tax rate on structures. Ratio measures the relative intensity of the split-rate policy across time and municipalities. All other variables are defined the same as the models above.

The coefficient of interest is ρ, which measures how a one-unit change in the ratio of the split-rate tax changes the number of business establishments in a municipality. This model is linear in that it treats a one-unit change in the ratio the same, regardless of where in the distribution that change is occurring. For example, it restricts the change from a ratio of 3 to 4 to be the same as a change from a ratio of 5 to 6. I also explored a non-linear relationship between the split-rate ratio and the number of business establishments, but these specifications strongly suggest a linear relationship is appropriate. The most accurate interpretation of the policy intensity model is to interpret the results as a move from the mean ratio (7.73) to one unit larger or smaller than that ratio.

The policy intensity model is estimated using only data from municipalities that have split-rate taxation, highlighting variation in the intensity of the policy among that group. This is done to remove selection bias that would occur if the policy intensity comparison was made between split-rate municipalities and non-split-rate municipalities. Including non-split-rate municipalities in this model would potentially confound the effects of *having* a split with the effects of having a different split-rate ratio.

Data for Estimation

To estimate the various two-way fixed effects models outlined above, I use data on business location and property tax policy in Pennsylvania.

Data used to measure business location come from the Census's County Business Patterns (CBP). I use data files at the ZIP code level, which begin in 1994 and run through 2017. For each ZIP code in Pennsylvania, there are counts of business establishments for the entire ZIP code, and in most cases counts across several industry sectors.[4] The underlying data on business establishment counts come from several survey-based sources within the Census—the annual Company Organization Survey, which tracks multi-establishment companies, as well as the Economic Census, Annual Survey of Manufactures, and Current Business Survey, which all track single-establishment companies. The Census also notes that some business establishment locations come from administrative records.

Data at the ZIP code level was used in favor of the more common county level data set produced by the CBP, so that a more accurate allocation could be made to municipalities (the unit of analysis for property tax policy). To allocate the ZIP code level data to the municipality level, I used three different crosswalk files based on the year of the data. It is necessary to update crosswalk files by geography, especially at the ZIP code level, as ZIP code boundaries are not static—they change along with population and other factors based on the delivery of mail. I use ZIP code to municipality boundary files for 1990, 2000, and 2010 from the University of Missouri's Geocorr database.[5] Intervening years between boundary files are matched to the closest file year available. The allocation of ZIP code data to municipalities is done using housing units as the allocative factor.

Using the CBP data, I create a municipality-year-industry database to match with local tax policy data. The CBP system for allocating business establishments to a particular industry changed nearly every year between 1994 and 2017. I classify all years of data using the Standard Industrial Classification (SIC) categories from 1994, at the largest industry level available at that time. The industrial categories I use (besides the "all" category that is generated as the total number of business establishments) are: agriculture, construction, FIRE (finance, insurance, real

[4] Prior to 2007, the CBP suppressed some industry-ZIP-year counts if they came from data on a small number of firms. After 2007, these low firm count areas were masked by introducing randomness into the data.
[5] Crosswalk files can be obtained from http://mcdc.missouri.edu/applications/geocorr.html for various years and across many levels of geography.

estate), manufacturing, mining, retail, services, transportation, and wholesale. In years after 1994, I allocate establishment counts by the sub-industry to the larger SIC industry categories based on where those sub-industries were categorized in 1994. In addition, the CBP switched to the North American Industry Classification System (NAICS) beginning in 1998. I create a correspondence to allocate NAICS industries to SIC industries based on sub-industry categories. I update the NAICS to SIC correspondence for each year of the data.

Data on tax policy in Pennsylvania municipalities was provided by Zhou Yang, and is an updated version of the tax variables used in Yang (2014), Yang (2015), and Yang (2018). The tax data details property tax levels for municipalities with conventional property taxation, as well as the separate rate on land and structures for municipalities that have split-rate taxation. Changes from conventional taxation to split-rate taxation (as well as changes in the other direction) are identified by coding an indicator variable for municipality-years where the tax rate on land is greater than the tax rate on structures.

Primary Empirical Results

Tables 2–5 show the results of estimating the two-way fixed effects models outlined in the previous section. Each table shows results for four different specifications of each model, with the difference in specifications being what fixed effects are included. By examining how including (or not) various fixed effects, we can gain insight as to how well the model controls for unobservable factors that would otherwise cause bias in estimation. I discuss the results of each model in detail below.

Table 2 shows the results of estimating the level shift model for how switching to a split-rate tax relates to the number of business establishments in a municipality. The four columns of table 2 show results for different specifications of the model, starting with a specification using no fixed effects in column (1) and ending with a full two-way fixed effects model in column (4).

Table 2: Level Shift Estimates for Business Establishment Location from Split-Rate Introduction

	(1)	(2)	(3)	(4)
β	702.37	698.51	62.22	60.91
	(34.02)	(34.05)	(4.00)	(3.99)
Place FE	N	N	Y	Y
Year FE	N	Y	N	Y

Standard errors in parentheses.

Columns (1) and (2) show the level-shift model results without controls for time-invariant differences across Pennsylvania municipalities. The results without controlling for municipality fixed effects suggest an extremely large, positive effect of introducing a split-rate tax on the number of business establishments—approximately a 700 establishment increase between the

two models. At an average base number of establishments, a 700-establishment increase is equal to nearly an 83 percent increase. These estimates are statistically significant at the 1 percent level.

Columns (3) and (4) of table 2 show the level-shift model results that add controls for time-invariant differences across Pennsylvania municipalities, with column (4) showing the full two-way fixed effects model results. The results suggest a much more modest, but still positive and large, relationship between the introduction of a split-rate tax system and the number of business establishments in a municipality. Across the two models that use municipality fixed effects, the results suggest that implementing a split-rate tax system is associated with an immediate and constant 60–62 establishment increase in a municipality. At an average base number of establishments, a 60–62 establishment increase is equal to 7.2–7.3 percent more business establishments. These estimates are statistically significant at the 1 percent level.

Comparing the results in table 2 between specifications suggests that the municipality fixed effects are able to control for a substantial amount of unobservable heterogeneity that would otherwise cause bias in estimation. The magnitude of the results that use municipal fixed effects is more than an order of magnitude smaller than the results that do not use municipal fixed effects, suggesting that the unobserved differences for places that have a split-rate tax are positively correlated with the number of business establishments in a municipality. Comparing across specifications also makes clear that there is not a substantial degree of unobservable heterogeneity across years of the data that is correlated with implementing a split-rate policy, as the year effects themselves to not substantially decrease the estimated β coefficient.

Table 3 shows the results of estimating the slope over time model. This model estimates how each year of having a split-rate tax policy is related to the number of business establishments in a municipality. As with table 2, the four columns of table 3 show results for different specifications of the model, adding the year and municipal fixed effects.

Table 3: Slope Over Time Estimates for Business Establishment Location from Split-Rate Introduction

	(1)	(2)	(3)	(4)
π	37.53	37.86	-3.54	-3.36
	(2.60)	(2.60)	(0.19)	(0.19)
Place FE	N	N	Y	Y
Year FE	N	Y	N	Y

Standard errors in parentheses.

Columns (1) and (2) of table 3 show the results of the slope over time model without controls for time-invariant differences across Pennsylvania municipalities. The results in columns (1) and (2) suggest a growth in the number of business establishments every year the policy is in effect. The magnitude of the effect suggests growth of about 37 business establishments for every year the split-rate tax is in place. At an average base number of establishments, a 37-establishment

increase is equal to a 4.4 percent annual increase in the number of establishments. These estimates are statistically significant at the 1 percent level.

As with the level-shift model, adding municipality fixed effects drastically changes the results of the slope over time model. Columns (3) and (4) of table 3 show the results of estimating the slope over time model, adding municipality fixed effects, with column (4) displaying the full fixed effects model. The results suggest that there is a negative relationship between the split-rate tax system and the number of business establishments. For every year the split-rate is in place, these results suggest a decline of between 3.3 and 3.5 business establishments, or about 0.4 percent of the base number of establishments in an area. These estimates are statistically significant at the 1 percent level.

Table 4 shows the results of estimating the model that combines the level-shift and slope over time components. The results of this model help to reconcile the seemingly conflicting results presented in tables 2 and 3. Across all specifications of the combination model, there is a clear pattern—implementing a split-rate policy is associated with an immediate increase in the number of business establishments, and the initial increase is followed by a slower decline.

Table 4: Level Shift and Slope Over Time Estimates for Business Establishment Location from Split-Rate Introduction

	(1)	(2)	(3)	(4)
β	988.18	970.66	107.66	105.08
	(63.06)	(63.49)	(4.30)	(4.30)
π	-25.85	-24.56	-5.52	-5.32
	(4.80)	(4.83)	(0.20)	(0.20)
Place FE	N	N	Y	Y
Year FE	N	Y	N	Y

Standard errors in parentheses.

As with the other model results, the combination model shows substantially larger effects when not controlling for municipality time-invariant effects, and that year fixed effects are much less important. Using municipality level fixed effects, the combination model shows an initial increase after implementing a split-rate tax between 105–107 business establishments. The magnitude of this result translates to an immediate 12.4–12.6 percent increase in the number of business establishments. The slope component of the combination model suggests that while initial implementation of the split-rate policy increases the number of establishments, this fades slowly over time. For each year after initial implementation, the combination model using municipality fixed effects suggest that the number of business establishments declines by 5.3–5.5, or about 5 percent of the initial increase. At the estimated rate of decay in the combination model, it would take about 20 years for the initial positive impact of the move to a split-rate tax to disappear. All results from the combination model are statistically significant at the 1 percent level.

Table 5 shows the results of estimating the policy intensity model on the number of business establishments in a municipality. The model is designed to test how changing the ratio of the split-rate tax, as measured as the tax rate on land divided by the tax rate on structures, correlates with changes in the number of business establishments. As with tables 2–4, the results in table 5 are displayed for four different specifications of the model that vary the type of fixed effects used.

Table 5: Policy Intensity Model for Business Establishment Location from Split-Rate Tax Ratio (Land/Structure)

	(1)	(2)	(3)	(4)
ρ	-11.59	-7.13	-1.24	0.17
	(9.08)	(9.56)	(0.58)	(0.58)
Place FE	N	N	Y	Y
Year FE	N	Y	N	Y

Standard errors in parentheses.

There are three notable features of the policy intensity model results. First, unlike the models that focus on implementing a split-rate, the policy intensity model is sensitive to the inclusion of year fixed effects. Second, in nearly every case, the policy intensity model, while producing some negative estimates, shows results that are not statistically significant. Finally, the policy intensity model that uses the full two-way fixed effects shows a near zero estimate, although even this estimate is not precisely estimated.[6]

Four broad results emerge from estimating the models. First, there is a sizable and statistically meaningful immediate increase in the number of business establishments that coincides with municipalities switching to a split-rate tax system. Second, the initial increase in the number of business establishments is followed by a slow, but not insignificant decline in the number of business establishments over time. Third, the municipal fixed effects seem to be removing a substantial amount of bias from the models, as these estimates are in most cases an order of magnitude smaller than results that do not include municipal fixed effects. Finally, beyond the initial land to structure ratio implemented, marginal changes to the split-rate ratio do not seem to coincide with changes in the number of business establishments in a municipality.
To put the broad results into more policy context, they can be interpreted at the average split-rate ratio in the data. The average split-rate ratio for municipalities that have a split-rate over the years of the data in the sample is 7.73. Municipalities going from conventional property taxation to a split-rate system with a ratio of 7.73 experience an average immediate increase in the number of business establishments between 60–107 across all models. The number of business establishments does not appear to be sensitive to marginal changes in the split-rate ratio after

[6] I also estimated a model that included a variable measuring the square of the split-rate ratio. This model attempts to determine any non-linear relationship between the split-rate ratio and the number of business establishments. The result of this model offers no additional insight into the relationship between the split-rate ratio and the number of business establishments—the linear term remains similar and the squared term is extremely close to zero.

implementation, but the initial increase in the number of establishments related to the 7.73 ratio declines each year after implementation by between 3.3–5.5 establishments, or about 5 percent.

As mentioned in the empirical methodology section, the two-way fixed effects models and the results they produce rely on two primary assumptions: the parallel trends assumption and the non-interference assumption. The results presented here suggest that substantial bias in estimation would occur if municipality fixed effects are not used in estimation, but these models cannot rule out sources of bias caused by time-varying municipality level unobservable factors being excluded from the models. In the next section, I discuss tests of the parallel trends assumption, but there are no available tests for the non-interference assumption.

Secondary Empirical Results

This section offers further investigation into the relationship between implementing a split-rate tax system and business establishment location by examining differential effects across industry sectors. I also discuss results of testing the parallel trends assumption of the DID style models, and some additional results from alternative specifications of the primary models.

Industry Sectors

Using broad industry classifications to group establishments, it is not entirely clear that a split-rate policy will have the same effect across or within an industry. A simple theory would likely suggest that establishments relying more on capital (buildings, etc.) and less on land as inputs to production would be more inclined to locate in a split-rate jurisdiction. It might also suggest that some industries such as construction would be likely to benefit if the split-rate results in building more or larger structures. An issue with classifying industries is and even within a broad industry, there are likely to be large differences in the use of inputs to production. Despite these challenges, looking at differential effects across industry sectors may provide broad insight into the types of business establishments that benefit most from implementing a split-rate system.

In addition to the primary results presented in the previous section, I explored how split-rate taxation impacts the number of business establishments in a municipality across different industry sectors. For simplicity of exploring these results, I present only results of the level-shift model estimated for seven different industry sectors in table 6. All results presented in table 6 come from estimating the full two-way fixed effects specifications.

Table 6: Level Shift Estimates for Business Establishment Location from Split-Rate Tax Introduction Across Major Industry Sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Wholesale	Services	Retail	Construction	Manufacturing	FIRE	Transportation
β	20.83	-130.48	69.30	5.69	10.49	-5.74	9.69
	(0.97)	(8.32)	(5.34)	(0.51)	(0.82)	(1.99)	(0.67)
Place FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y

Standard errors in parentheses.

Table 6 shows results for the wholesale, services, retail, construction, manufacturing, FIRE, and transportation sectors. These results suggest the potential for a highly heterogeneous impact of introducing a split-rate policy across different industry sectors. Broadly, the results suggest that implementation of a split-rate policy is associated with gains in the number of business establishments in the wholesale, retail, construction, manufacturing, and transportation industries, but with losses in the service and FIRE industries. The magnitude of the estimates suggests gains of 69 retail establishments and nearly 21 wholesale business establishments associated with implementing a split-rate tax. More modest, but still substantial increases are associated in manufacturing (10.5 establishments), transportation (9.7 establishments), and construction (5.7 establishments). These gains are met with an extremely large loss of service firms, with an average decline of over 130 establishments in a split-rate implementing municipality, and more modest loss of establishments in the FIRE industry (5.7).

In viewing the across-industry results, it is apparent that they do not sum to the total across all industries discussed in the previous section. This is driven by three factors. First, some establishments are not categorized into an industry, they are counted in the "all" results, but not for a specific industry. Second, some industries are excluded from these results. I do not show results for establishments classified as mining, agriculture, or other in the CBP data. Finally, some industry/year/municipality observations are not reported in the CBP data due to low counts. These data are reported as missing, so that the totals across industries in a given place/year will not add to the all industry totals in the data.

There are additional policy considerations that may affect both these results and the implementation of a split-rate policy on business establishment counts across industry sectors. Municipalities may offer special tax policies for establishments in a given industry, such as use-value assessment in the agricultural industry, or influence establishment location through the use of other incentives. Establishments across industry sectors may also be naturally less mobile, as they rely on different levels of inputs such as natural resources or skilled labor pools.

Testing the Parallel Trends Assumption

As outlined in the empirical methodology, one of the primary assumptions of DID style models is that treated and comparison groups have a parallel trend in the outcome of interest, prior to the treated group receiving treatment. For the empirical work presented here, this means that the trend in the number of business establishments prior to adopting a split-rate tax system should be the same for split-rate adopters and other municipalities. To test this assumption, I estimate the following regression:

$$Y_{i,t} = \alpha + \pi trend * \mathbf{1}[split\ rate\ adopt]_i + \gamma_i + \delta_t + \varepsilon$$

Where the *split rate adopt* indicator is equal to one for municipalities that began a split-rate policy during the study period,[7] and I estimate the model for all municipality-years where a split-rate tax system is not actually in effect. The coefficient of interest to determine if a parallel trend exists between split-rate adopters and non-adopters is π.

The result of the parallel trends model shows that π = -2.40 with a standard error of 0.73, for statistical significance at the 1 percent level. This result means that split-rate adopters were losing business establishments at a rate of 2.4 per year relative to non-adopters before beginning a split-rate policy, violating the parallel trends assumption.

While in technical violation of the parallel trends assumption of DID models, this result does not mean that the primary results presented here are necessarily biased. What would be most worrisome for bias, given the positive findings of the split-rate policy on business establishment counts, is if split-rate adopters were *adding* business establishments relative to non-adopters before starting a split-rate policy. The results suggest that because split-rate adopters are losing business establishments relative to comparison areas, if anything the primary results would be biased toward finding a negative effect of split-rate adoption. A possible exception to expecting negative bias would be if split-rate policies were timed to coincide with local low points in the number of business establishments, so that adoption would naturally correspond to an increase in the number of establishments. Policy timing seems an unlikely explanation in this case, as split rates are implemented across different jurisdictions and in different years, so they do not overlap with a national or regional economic cycle.

Application of Results: Split-Rate Taxation in Detroit

Given the positive impact on the number of business establishments estimated in the Pennsylvania case, other municipalities may be interested in implementing a split-rate policy as an economic development tool. A potentially interesting place to implement split-rate taxation is the city of Detroit. Using the CBP data for 2018 at the ZIP code level and allocating to the city

[7] Note that the adopters group is not the full treated group in the primary estimation sample, as there are municipalities that have either had split-rate policies over the entire study period, or that eliminate split-rate policies during the study period. It is not possible to estimate a trend prior to adoption for either of these groups, and estimating a trend after policy elimination would pick up a "negative" treatment.

level for Detroit, we can get some idea about how the Pennsylvania experience might translate to a move to a split-rate policy there.[8]

As of 2018, there are 10,335 business establishments located in the ZIP codes that make up the city of Detroit.[9] Among these business establishments, the industry mix varies, but primarily includes service establishments (52 percent), retail establishments (23 percent), and to a lesser extent FIRE (7 percent), manufacturing (4 percent), construction (4 percent), wholesale (4 percent), and transportation (3 percent) establishments. On average, municipalities in Pennsylvania that have a split-rate tax during the years of data in this study have 846 business establishments. The split-rate Pennsylvania municipalities have a fairly similar industry mix to Detroit, with large shares of service establishments (50 percent) and retail establishments (17 percent), and smaller shares of FIRE (5 percent), manufacturing (4 percent), construction (6 percent), and transportation (2 percent) establishments. The most noticeable difference between Detroit and Pennsylvania split-rate municipalities is the larger share of wholesale establishments (12 percent) in Pennsylvania (this is likely a function of the policy, given the empirical work presented here). We can use the Pennsylvania experience to get an idea for how business activity might react to a split-rate policy in a place like Detroit, but there are some important caveats to consider.

First, it is important to recognize that there are differences about these places that will interact with the policy and these cannot be fully accounted for in translating the Pennsylvania experience to Detroit. While the Pennsylvania estimates are independent of place-specific factors that are time-invariant, they cannot consider how these factors may have influenced the success of the policy change to a split-rate tax. One of these factors could be the industry mix, as the Pennsylvania experience suggests that the split-rate has a differential impact across industry sectors.

Second, the Pennsylvania experience primarily looks at changes happening in the 1990s and 2000s. Again, the Pennsylvania estimates are independent of year effects, and generally suggest that the length of time a split-rate is active are not factors in changing how the policy changes business establishment counts, but it is still possible that implementing a policy under different national or regional economic conditions would result in a different outcome.

Third, the policy studied in Pennsylvania shows the strongest effects happening immediately (the level-shift effect) and these are measured at the average split-rate ratio (7.73). It is unclear how implementing a different ratio would impact business establishments in another area, although the policy intensity results suggest that there are not likely to be large changes caused by small deviations from this ratio.

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[8] I use the Geocorr Database to map ZIP codes to the city level. This database lists the following ZIP codes as being part of the city of Detroit: 48201, 48202, 48203, 48204, 48205, 48206, 48207, 48208, 48209, 48210, 48211, 48212, 48213, 48214, 48215, 48216, 48217, 48219, 48221, 48223, 48224, 48225, 48226, 48227, 48228, 48234, 48235, 48236, 48238, 48239, and 48240.

[9] Note that the number of business establishments counted by the CBP is substantially lower than the number of firms reported by the Census Quick Facts program. Census Quick Facts reports 61,868 firms in the city of Detroit as of 2012.

Finally, it is not clear how to scale the measured impact of the split-rate tax in Pennsylvania to the Detroit case. The most reliable estimates from Pennsylvania suggest that the level-shift is an increase between 60–100 establishments, or between 7–11 percent of the base number of establishments. A safe prediction would stick to the estimated number of establishments and suggest that implementing a split-rate with a ratio of 7.73 would increase the number of establishments by the same amount.[10] A more bold prediction might scale the estimates as a percentage of the existing business establishment base, which would suggest a drastically larger increase in the number of business establishments in Detroit, on the order of 700–1100 net new establishments.

Conclusion

This paper uses the Pennsylvania experience with split-rate taxation to estimate the relationship between a split-rate tax system and business establishment location. Switching between conventional property taxation and a split-rate tax can be viewed as part of a broader push to reduce to the distortionary effects of local taxation and attract businesses. The findings presented here suggest that a move to split-rate taxation is associated with growth in the number of business establishments in a municipality.

I find that a switch from conventional property taxation to a split-rate system is associated with an increase of between 60–107 business establishments at an average land-to-structure ratio of 7.73. The initial increase in the number of establishments declines each year after implementation by between 3.3–5.5 establishments, or about 5 percent of the initial increase, but does not show sensitivity to smaller changes in the split-rate ratio. Estimates are extremely sensitive to including municipality fixed effects, but less sensitive to including year fixed effects, suggesting the importance of using a two-way fixed effects model. In addition to the primary result, I also find that split-rate taxation has a differential impact on business establishment location across industry sectors.

[10] The effects of implementing a split-rate with a drastically lower or higher ratio would likely have a different effect than the average presented here. The magnitude of the difference cannot be determined using the Pennsylvania case as there is not enough variation in implementing different ratios.

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