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The Effects of Property Tax Abatements on School District Property Tax Bases and Rates

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Abstract

The authors analyze the effects of property tax abatement on the property tax base and rates of school districts within a municipality offering the abatement using data from Franklin County, Ohio, one of the most populous counties in the United States. An increase in a school district's Community Reinvestment Area abatement intensity correlates with (a) a decrease in the mill rate for real property, (b) a decrease in effective residential and nonresidential property tax rates, and (c) an increase in total market value of property. While these effects are small, they indicate that a municipality's decision to abate has generated enough growth in property values, either through improvements to physical property or positive capitalization for existing property values, to offset the negative effects of an abatement. The reason for this may be that the restrictions and oversight used in this abatement program are greater than in most other places.

Keywords

abatements, property tax, taxes, incentives

State and local governments in the United States use a variety of tax incentives to attract and retain investment, create jobs, reduce blight, and pursue other economic and fiscal goals. Wassmer (2009) and Kenyon et al. (2012) offered summaries of the possible economic need for a local tax incentive in the form of property tax abatement, details on their structure, and actual use across the United States, and previous empirical evidence on their efficacy. Since these incentives totaled about $45 billion in 2015 and remain under continued scrutiny, they merit further evaluation (Bartik, 2017).

A property tax abatement offered by a jurisdiction offers the potential to attract or retain economic development within that jurisdiction. But if the economic development would have occurred without the incentive, the jurisdiction unnecessarily gave away tax revenue.[1] Such foregone revenue reduces funds available for local public services and/or requires their replacement with increased taxes or fees.[2] The concern of unnecessarily foregone revenue is particularly relevant for a school district that loses property tax base due to a municipally granted abatement, but often has little say in whether to grant the tax break. To mitigate the degree of foregone revenue due to tax incentives, and to perhaps protect school districts with little say in an abatement decision, states sometimes require some form of higher level review of their use (Pew Charitable Trusts, 2017). Good Jobs First, a citizen watchdog group, recommends such a review as an essential element of the greater public scrutiny needed to curb what it believes is the continuing abuse of tax incentives (Tarczynska, 2017).

Municipal governments in Franklin County, Ohio, grant most property tax abatements but obtain only 9% of their tax revenue from the property tax—with most municipal revenue coming from local income taxes. School districts in this county, on the other hand, obtain nearly 99% of their local tax revenue from the property tax. Thus, the potential exists for a property tax abatement decision made by a municipality that has far less "skin in the game" to harm a school district with far more at stake.[3] The goal of this research is to examine whether a municipality's use of greater property tax abatement in Franklin County, Ohio, results in changes in the (a) rates of property taxation in affected school districts and/or (b) market values of real property in affected school districts or neighborhoods. We have also conducted an extensive qualitative investigation of abatement use in this county.[4] This qualitative investigation revealed that Ohio has established, and Franklin County practices, greater restrictions and continuing oversight in the municipal granting of abatement than is typical elsewhere in the United States. This finding, together with the empirical finding that greater abatement use correlates with greater property value and lower rates of property taxation,

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confirms that the efficacy of abatement is likely to improve if more states impose greater restrictions and require greater oversight for the local property tax abatement programs they authorize.

The remainder of this article is divided into sections devoted to background information on property tax abatement in Ohio and Franklin County; the expected economic and fiscal impacts of abatement; a summary of some of the previous empirical research on the efficacy of abatement; a description of the regression model, data used, and panel data regression results; and policy implications from our findings.

Property Tax Abatement in Franklin County, Ohio: Community Reinvestment Areas

Thirty-seven states plus the District of Columbia currently have property tax abatement programs (Dalehite et al., 2005; Kenyon et al., 2012; Significant Features of the Property Tax—Lincoln Institute of Land Policy and George Washington Institute of Public Policy 2019). Property tax abatements were found to be the second most costly form of state and local government incentives in a recent national survey (Bartik, 2017).[5] Our empirical work focuses on property tax abatements granted in community reinvestment areas (CRAs). In 2016, CRA abatements were the most prevalent type of property tax abatement in Franklin County (accounting for 86% of value abated through all types of property tax abatement) and throughout the entire state of Ohio (accounting for 60% of abated value).[6]

CRAs are much like enterprise zones (EZs) employed in most states. The process of offering CRA abatements in the Ohio begins with a village council, city council, or county commission, after public notification of intent, adopting a resolution establishing a CRA within its boundaries.[7] Before proposing such a resolution, the state requires that the municipality or county to undertake a survey of the structures within the area proposed as a CRA. The results of the survey must offer evidence that ". . . the area included in the description is one in which housing facilities or structures of historical significance are located, and new housing construction and repair of existing facilities or structures are discouraged" (Ohio Rev. Code §3735.65 [B]). This statutory language leaves open the possibility for discouragement caused by local regulation or local market conditions that results in the proposed area being unattractive for private-sector housing investment without abatement. Through interviews we conducted with local economic development officials in Franklin County, we found the practical application of what constitutes a cause of "discouraged" to be quite expansive. Once established, CRAs in Ohio provide tax exemptions to property owners who construct or make improvements not only to their residential property but also to commercial or industrial property within the CRA. The original intent of property tax abatement within a CRA was property tax relief for construction or remodeling of housing, but most of the current tax savings under CRAs in Ohio and Franklin County go to industrial and commercial development.

Ohio offers two distinct types of CRAs (see Figure 1). CRA boundaries established before 1994 required no Ohio Development Services Agency (ODSA) approval and still exist. The individual tax abatements offered within these CRAs are time limited as negotiated between the municipality and abatement recipient and can never last for more than 15 years or be renewed. The CRA property tax abatement offered to a specific property will eventually run out, but the designation of a CRA zone in a municipality is permanent unless the municipality's governing body votes to rescind it or modifies it more than twice after 1994, in which case it must be reestablished as a post-1994 zone. In 2015, more than half the tax savings from CRA abatements in Franklin County occurred in zones established pre-1994.

For CRAs established after 1994, the state of Ohio must approve the establishment and geographical boundaries of the CRA. If the desired project is residential, the property owners can apply for an abatement, and a housing officer, chosen for the specific CRA, then determines if the property meets specified requirements. If the property granted abatement under a post-1994 CRA is for commercial or industrial use, the municipality or county must enter into a written agreement with the business entity that requires approval by its legislative authority, and in some cases, overlying school districts (ODSA, 2012). The starting requirement for the granting of a business CRA is a promise from the firm receiving it to generate new or retained jobs, increase payroll, and/or add new investment. Table 1 offers a summary of the requirements for Ohio's residential and nonresidential CRA abatement programs.

Transparency and Accountability for Franklin County's CRAs

Before discussing the economic theory that motivates our empirical analysis, it is useful to put Franklin County's use of CRAs into the broader context of local tax incentive programs in the United States. Bartik (2017) found that reliance on tax incentives varies markedly from state to state, and that Ohio relies less on tax incentives than many other states. Tax incentives as a percent of value added in Ohio were estimated to be 1.05% in 2015, which ranked Ohio 21st out of 32 states that Bartik examined. The intensity of tax incentive use was about four times higher in New Mexico, three times higher in New York, and nearly twice as high in Michigan. A second study by Good Jobs First (2017), which focused on disclosure of information on tax incentive programs by the

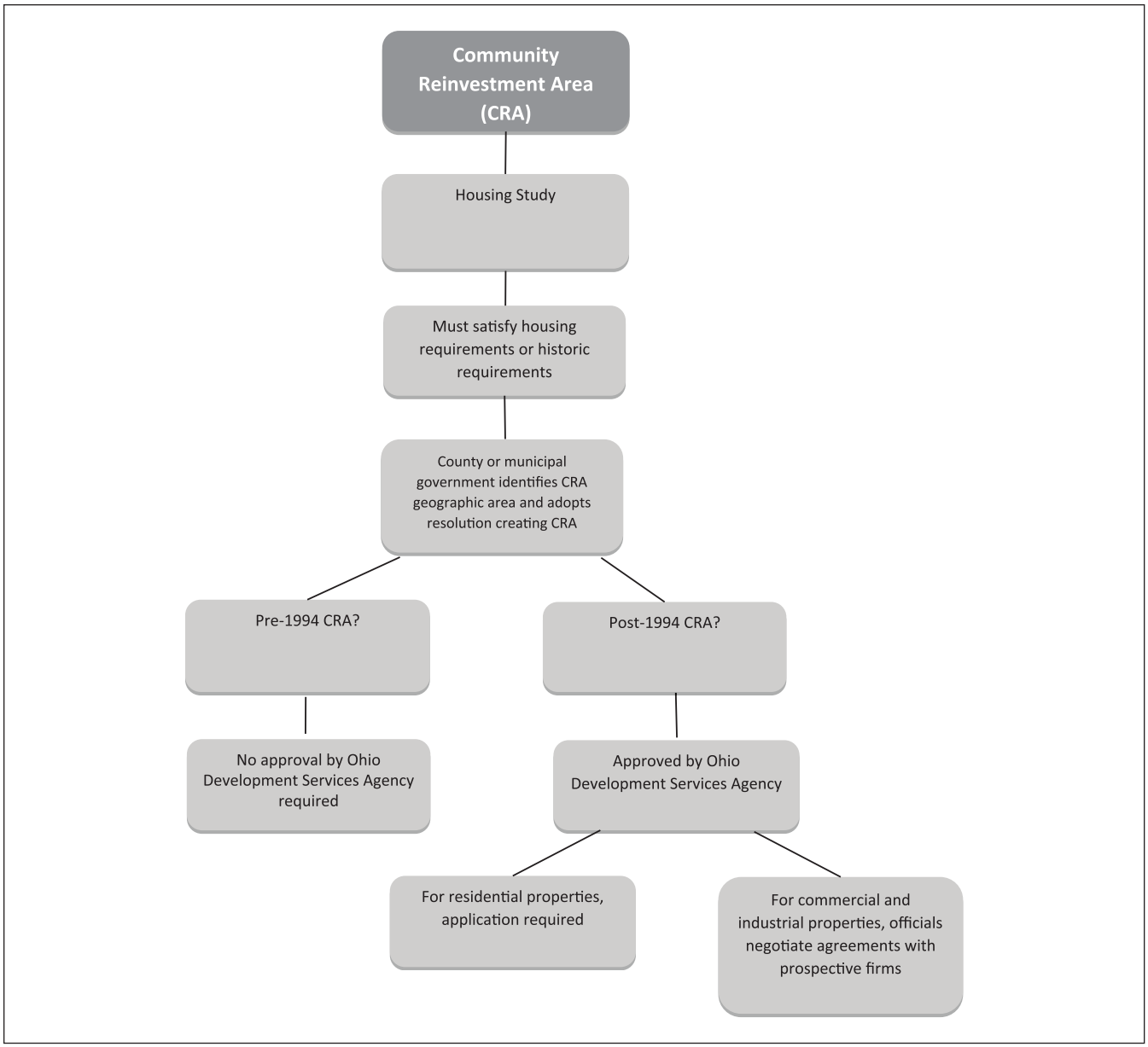

Figure 1. Approval processes for community reinvestment areas (CRAs).
Note. Although pre-1994 CRAs still exist, it is no longer possible to create pre-1994 CRAs.
Sources: Ohio Rev. Code § 3735.65 ~ § 3735.70; Ohio Rev. Code § 5709.61 ~ § 5709.69; County Commissioners Association of Ohio (2016); and DeWine (2015).

50 largest cities and counties in the United States, concluded that Franklin County's CRA program ranked fourth among all the programs in the amount of disclosure required. Franklin County was 1 of only 13 of the 50 localities studied to disclose the number of jobs created by at least one of its local tax incentive programs.

Dalehite et al. (2005) found that property tax abatements across the United States vary greatly, with some states imposing far stricter standards than others. According to their tabulation, Ohio's property tax abatement programs are for the most part subject to stricter regulations than those in other states. They are allowed only in targeted areas as in 14 other states and under the discretion of local governments like 22 other states, rather than granted as-of-right as in seven states. Ohio's abatements also contain clawback provisions as in 13 other states. On the other hand, Ohio's maximum duration for property tax abatements of 15 years is in the middle of the U.S. range of 1 to 25 years.

One important feature of Ohio's property tax abatement program, which may contribute to the empirical findings

Table 1. Property Tax Abatement Program Comparison.

	Community reinvestment areas (CRAs)	
	Residential	Commercial or industrial
Purpose	Revitalize existing housing and promote housing construction	Attract and retain business investment and new jobs
Industry focus	Housing	Commercial or industrial
Eligible area	Area in which housing or historical structure is located and in which new construction and repair of existing structures is discouraged	
Local government authority	Municipalities or counties	
Value eligible for abatement	Newly remodeled or constructed real property	
Abatement percentage	Pre-1994 zone: 100% Post-1994 zone: up to 100%	
Term of incentive	Up to 15 years	
Administered by	Locally appointed housing officer and housing council with state certification	
Written agreement required?	No	Yes
Accountability mechanism	Annual review by tax incentive review council with recommendation for continuation, modification, or cancellation.[a]	
School board notification required?	Yes	
School board approval required?	Pre-1994 zone: No Post-1994 zone: Yes, if exemption >50%	
Notification required to relocate jobs within Ohio?	N/A	Yes (state and municipality)
Extensions permitted	Pre-1994: 5 years Post-1994: 10 years for historic	Pre-1994: 5 years Post-1994: No
Clawbacks?	No	Optional in agreements
Grounds for revocation	Property not well maintained	Obligations in CRA agreement not met

Note. N/A = not applicable; Sources: State Statute; DeWine (2015); Ohio Development Services Agency (2012); County Commissioners Association of Ohio (2016).
[a]Each TIRC must have a member from the school board.

recorded here, is the post-1994 statutory requirement for abatement agreements for industrial or commercial properties, along with the use of local tax incentive review councils (TIRCs) to annually review company compliance with those agreements.[8,9] Under the abatement agreements, companies agree to create or retain full- and/or part-time jobs, to increase payroll, and to increase investment. The TIRC annually audits the companies receiving property tax abatements in the jurisdiction to evaluate success at reaching their job, payroll, and/or investment promises established at the beginning of the agreements. These councils then recommend continuation, modification, or cancellation to the local government body originally approving the tax incentive agreement. Sometimes the abatements are reduced or repealed if the company does not live up to its promises; occasionally the TIRC recommends enforcement of clawback provisions and the jurisdiction may force them to refund previous tax abatements.[10]

An analysis of data from TIRC meetings in 2015 to 2016 found that at least two thirds of companies were meeting their goals for new full-time jobs, retained full-time jobs, new payroll, and investment (Kenyon et al., 2017). While some companies fell short of their promises, other companies significantly exceeded their targets, so that within each city, companies almost always met their targets set in abatement agreements. Of course, TIRC review cannot determine whether an abatement was the decisive factor in the company's decision to increase construction or expand hiring. Although this approach to accountability seems reasonable, it is not widely practiced in other states.

Another important feature of Ohio's CRA program is the role of school boards in the approval of such abatements. When a local government considers enacting a CRA, it is required to notify the relevant school board. Each TIRC must include a member from the relevant school board. There is a provision in the Ohio revenue code allowing businesses that receive property tax abatements to set up school district compensation agreements. The role of school boards in Ohio has grown over time. For example, in the case of a pre-1994 CRA, school board approval is not required. However, for post-1994 CRAs, if the exemption exceeds 50%, school board approval is required. Ohio stands out as giving school boards a greater role in property tax abatements and tax increment finance (TIFs) than other states. A review of state law across the United States found that Ohio was one of only nine states granting school boards a formal role in granting property tax abatements (National Education Association, 2003).

Effects of Municipal Property Tax Abatement on Property Tax Base and Rates

As described in Wassmer (2009) and Kenyon et al. (2012), the economic motivation behind a local government offering a property tax abatement is to attract a business that would not have located in the municipality were it not for the abatement. The general conclusion from the literature on firm site selection is that within a metropolitan area (or a large urban county like Franklin) local cost differentials can make a significant difference in where firms locate. The reason is that other factors expected to determine business location like labor availability, supply chains, and market access are much the same for any location within a metropolitan area. Thus, differences in local property taxation (or reducing these differences through abatement) can make a difference. After reviewing previous studies that measure the long-run relationship between differences in property taxes for individual jurisdictions within a region and differences in employment, firm births, and relocations for these jurisdictions, Kenyon et al. (2012) reported a median finding that a 10% lower local rate of property taxation correlates with a 16% to 20% increase in local employment, firm births, or firm relocation.

Municipal officials desire greater business activity within their jurisdictional boundaries due to the job opportunities it offers for residents and the additional local tax revenues it can bring over and above the additional local expenditures it entails. Our desire here is to measure whether greater abatement use in a geographical entity corresponds with the potential fiscal benefit just described by estimating whether greater abatement use corresponds with an increase in the market value of the property tax base and/or a decrease in property tax rate.[11] If it does, then the abatement, when offered, has likely not done fiscal harm to the entity in the form of lower property tax revenue. To our knowledge, there have been few empirical examinations of this issue.

The issue of the possible capitalization of the rate of local property taxation into local land values is important when considering the influence of property tax abatement on residential and business location decisions. If a jurisdiction changes its policy from offering no property tax abatements to granting them to nearly all applicants, and this policy change is expected to continue into the foreseeable future, then the expected cost of residing or producing in the jurisdiction decreases. This subsequently generates an increase in demand for property in the jurisdiction that should raise the market value of land in that jurisdiction. However, the capitalization scenario just described is only one possible scenario. If abatement results in the construction of new buildings or an increase in the remodeling of existing buildings, this will also cause the market value of property to increase in that jurisdiction. However, if the abated property requires a greater value of new government services than it generates in property tax revenue, this could impose a higher rate of property taxation on all property within the jurisdiction and subsequently reduce market value through negative tax capitalization. Thus, it is only under very specific circumstances that greater abatement activity in a jurisdiction results in a higher market value of property in that jurisdiction purely due to the price of immobile land and property rising, and not the addition of greater real property.[12]

Literature Review

Wassmer (2009) summarized the limited empirical research on property tax abatements as rather inconclusive regarding their influence on property tax base and rate. Interestingly, Anderson and Wassmer (2000) found that a local abatement to manufacturing property in the Detroit Metropolitan Area correlated with greater value of manufacturing property and lower property tax rates in the municipality offering them, but only in the early years of their granting before competing municipalities did the same. Hultquist's (2014) research is a more recent example of the use of multiple regression analysis to detect the economic impact of incentives. It is highly relevant to this study, due to its examination of the impact of Ohio's EZ and Job Creation Tax Credit (JCTC) programs on employment and wage growth in Ohio zip codes between the years of 2000 to 2004.[13] He found that the cumulative value of both JCTC and EZ incentives exerts no influence on aggregate employment in a zip code and only a very modest positive influence on wages. Of concern to us is this study's reliance on only fixed-effect zip code dummies to control for the many factors that influence the economic outcomes observed in a zip code.[14]

Hicks and Faulk (2016) examined the fiscal impact of property tax abatements granted by local governments in Indiana.[15] In Indiana, real or personal property located in an economic revitalization area or EZ receives a property tax abatement for up to 10 years. Unlike Ohio, Indiana ramps down abatement intensity over time. Using a data set based on counties for the period 2002 to 2011, Hicks and Faulk's simple regression methodology of regressing effective tax rate in a county against its abated share of property found that each doubling of abated share increases the effective property tax rate by 12%. They cautioned the reader that this statistically significant finding can either mean that property tax abatements lead to higher effective property tax rates or that counties with higher property tax rates provide a greater amount of property tax abatements. They suggested that a more thorough regression analysis, with the inclusion of appropriate control variables, is necessary to sort this out. We take this suggestion seriously in our own choice of a regression analysis of the fiscal impact of abatement that purposely includes more control variables.

We found no articles that examined the impact of property tax abatement on school expenditures, but Nguyen-Hoang (2014) examined the impact of TIFs on educational expenditures in Iowa. He found that greater use of TIFs is associated with lower K-12 education expenditures. Although the effect is small, he also found that the impact is greater for low-wealth and low-income school districts than for better-off school districts. He claimed that his results support policy measures that can protect school districts from the harmful effects of tax increment finance.[16]

The analysis offered here broadly follows the Hultquist approach and previous regression-based studies of the economic impact of property tax abatement. One dependent variable we investigate is the market value of real property. We could not, unfortunately, obtain employment or payroll data to use as a dependent variable because it is not widely available for the smaller units of geography used in this analysis of only Franklin County. Our unit of analysis, as described below, is either the 16 school districts in Franklin County whose land area is at least half in the county or the 284 census districts that make up the county.[17] By focusing on school districts, we are not only able to estimate the economic and fiscal impacts of property tax abatements in Franklin County, but we are also able to estimate whether the property tax abatement decisions of municipalities adversely affect school districts. Using census tracts as our unit of analysis increases our degrees of freedom a great deal and offers a check on our school district regression results.

Regression Model, Methodology, and Data

Simple Model of What Determines a School District's Property Tax Rate

Since we want to understand the property tax base and property tax rate impacts of property tax abatement and other forms of economic development incentives on a school district, we first think about the overall relationship between a school district's rate of annual property taxation, the dollar value of annual education expenditures its residents desire, and the market value of the property tax base used to raise the dollars needed for education expenditure. For school district "i" we represent this as:

$$\text{Property Tax Rate}_i = \text{Local Education Expenditure}_i \,/\, \text{Taxable Property Value}_i \quad (1)$$

[18]

The assumption is that residents first decide upon an annual expenditure for their school district and then tax property within the district at an annual rate that yields the necessary revenue.

All three of the measures in Equation (1) are endogenous. To turn Equation (1) into a viable reduced-form regression model, we describe the exogenous factors expected to influence differences in the two endogenous variables listed on its right side:

$$\text{Local Education Expenditure}_i = f\left(\text{Resident Characteristics that Influence Demand}_i\right); \quad (2)$$

$$\text{Taxable Property Value}_i = f\left(\begin{array}{l}\text{Property Tax Abatement}_i,\ \text{Other Property Relevant Incentives}_i,\\ \text{Property Exempt from Taxation}_i,\ \text{Property Base Characteristics}_i\end{array}\right) \quad (3)$$

As described in Equation (2), residential characteristics expected to create greater demand for K-12 education in a school district can also increase the expected amount of observed education expenditures. As noted in Equation (3), a school district's taxable property value changes with the degree of property tax abatements and other relevant incentives offered within the district. A critical issue examined here is whether the use of abatement and other incentives causes an increase in taxable property value.

The next step in obtaining a viable regression model is specifying the available explanatory variables that represent the exogenous factors specified on the right side of Equations (2) and (3). These are:

$$\text{Resident Characteristics that Influence Demand}_i = f\left(\begin{array}{l}\text{Bachelor\_Plus\_Percent}_i^{19},\\ \text{Age19\_Less\_Percent}_i,\ \text{Enrollment}_i\end{array}\right); \quad (4)$$

$$\text{Property Tax Abatement}_i = f\left(\text{CRA\_Abate\_Percent}_i,\ \text{CRA\_Pre94\_Percent}_i\right); \quad (5)$$

$$\text{Other Property Relevant Incentives}_i = f\left(\begin{array}{l}\text{EZ\_Abate\_Percent}_i, \text{TIF\_Abate\_Percent}_i,\\ \text{EPA\_Abate\_Percent}_i,\ \text{JCTC\_Jobs\_Per\_100M\_MarketVal}_i\end{array}\right); \quad (6)$$

$$\text{Property Exempt from Taxation}_i = f\left(\text{Tax\_Exempt\_Property\_Percent}_i\right); \quad (7)$$

$$\text{Property Base Characteristics}_i = f\left(\text{Number\_Parcels}_i,\ \text{Parcels\_NonResidential\_Percent}_i\right). \quad (8)$$

As noted in Equation (4), we expect that demand for K-12 education expenditure will be greater, the larger the percentage of the adult population over age 25 holding at least a bachelor's degree. The enrollment and percentage of the population of school age in a school district should also exert a positive influence on demand for K-12 public education, while enrollment will also raise the cost of providing it.

In Equation (5), we account for the use of property tax abatements by using "abatement intensity" measured as the value abated through CRA abatements as a percent of total market value in a school district and the percentage of CRA abatement using pre-1994 rules. The latter explanatory variable offers a test of whether the type of CRA abatement matters.

Equation (6) accounts for the three other types of property tax abatement used in Franklin County. The first is EZs, which offer nonresidential property tax exemption on new real property inside the zone's perimeter and allow a firm to qualify for a reduction in the corporate franchise tax.[20] The second is environmental protection abatements (EPA) that promote brownfield development. These are relatively minor in scale (only about one-fiftieth of the use of CRA abatements) but included here for comprehensiveness. We also include TIF, which is a form of property tax earmarking rather than a form of tax exemption. We measure EZ, EPA, and TIF abatement as the value abated or earmarked through these respective programs as a percent of total market value in a school district. Equation (6) also accounts for the other major tax incentive program of JCTCs. JCTCs allow refundable credits against state individual income tax, corporate income taxes, and/or the insurance premiums tax. Eligible business owners must demonstrate that the project will create/retain jobs, is economically sound, and that the incentive is a major factor in the decision to go forward with the project. The value of the tax credit ranges from 50% to 75% of the firm's new or retained payroll for up to 15 years. Due to data limitations, we measure JCTC abatement intensity as the number of new or retained jobs per $1 million of market value.[21]

In Equation (7), we account directly for the percentage of a school district's property tax base exempt from taxation. Finally, Equation (8) controls for differences in the number of parcels in a Franklin County school district and the percentage of these parcels which are nonresidential.[22] CRA_Abate_Percent and other measures of property tax incentives (EZ, TIF, EPA) account for the percent of property value abated at a given time, not the new abatements approved in that year.

The data used here contain observations from 16 school districts for the 18 years between 1998 and 2015.[23] Details on where the data used in this analysis come from and how we transformed it into the final forms used here can be found in the online Supplemental Appendix A.

Using Regression Analysis to Detect the Fiscal Impact of Property Tax Abatement

We define the fiscal impact of property tax abatement in a school district as the effect it has on the district's property tax rate. Using the equations specified above, and substituting the exogenous factors in Equations (4) through (8) that influence the endogenous measures of education expenditures and taxable property value in Equation (1), yields the regression specification:

$$\text{Property Tax Rate} = f\left(\begin{array}{l}\text{Bachelor\_Plus\_Percent, Enrollment, CRA\_Abate\_Percent,}\\ \text{CRA\_Pre94\_Percent, EZ\_Abate\_Percent, TIF\_Abate\_Percent, EPA\_Abate\_Percent,}\\ \text{Exempt\_Percent, JCTC\_Jobs\_Per\_100M\_MarketVal, Parcels\_Number,}\\ \text{Parcels\_NonResidential\_Percent}\end{array}\right). \quad (9)$$

This is a reduced-form regression specification because we include only exogenous and independent variables in Equation (9) as causal right-side variables. The dependent variables used to detect the fiscal impact of property tax abatements are the actual mills assessed on real property in a school district, the effective rate of property taxation on residential property, and the effective rate of property taxation on nonresidential property. Ohio has a complex property tax system that includes the use of tax reduction factors that reduce the growth in taxes due to valuation increases. Property tax mills do not account for those tax reduction factors, whereas effective property tax rates do. Since the calculation of tax reduction factors occurs separately for residential property (Class 1) and nonresidential property (Class 2), effective property tax rates for residential and nonresidential properties are typically different.[24]

Our analysis of property tax abatement uses a pooled time-series and cross-section data set and thus allows for the calculation of school-district-specific fixed effects after controlling for other general factors driving differences in the dependent variables. Our use of fixed effects (controlling for both year and school district or census tract specific influences) panel data regression analysis to estimate the impact of CRAs on property values and property tax rates controls for factors that could exert a fiscal or economic impact, besides abatement, fixed in a jurisdiction over time. Thus, it allows greater confidence that when the regression analysis finds a fiscal or economic impact from abatement, it is a causal relationship rather than just a correlation.

For the regression analysis, we transform all the dependent variables in the regression analysis by taking their natural log. We do this to account for the fact that the relationship

Table 2. Descriptive Statistics for Variables Used in School District Fiscal/Economic Impact Regression Analysis (16 Franklin County School Districts Drawn From 18 Years Between 1998 and 2015).

Variable	*M*	*SD*	Minimum	Maximum	Source[a]
Dependent					
School_Mills_Real	38.29	7.89	22.95	55.76	FRANKLIN_CO
Real_Property_Market_Value	5,403,483,191	8,365,531,220	436,216,672	43,867,590,656	FRANKLIN_CO
Residential_Effective_Real_Rate	66.34	11.30	42.33	95.91	FRANKLIN_CO
Nonresidential_Effective_Real_Rate	76.46	12.27	53.41	103.37	FRANKLIN_CO
Explanatory					
Bachelor_Plus_Percent	41.21	20.66	7.80	74.20	CENSUS
Age19_Less_Percent	27.70	3.06	20.70	35.00	CENSUS
Enrollment	11,331	15,090	1,069	70,720	STATE
CRA_Abate_Percent	2.94	4.56	0.00	18.26	FRANKLIN_CO
CRA_Pre94_Percent	42.27	43.24	0.00	100.00	FRANKLIN_CO
EZ_Abate_Percent	0.06	0.14	0.00	0.70	FRANKLIN_CO
TIF_Abate_Percent	1.38	1.95	0.00	9.07	FRANKLIN_CO
EPA_Abate_Percent	0.03	0.09	0.00	0.69	FRANKLIN_CO
JCTC_Jobs_Per_100M_MarketVal	35.12	67.49	0.00	525.31	STATE
Tax_Exempt_Property_Percent	10.59	7.90	2.75	43.98	FRANKLIN_CO
Parcels_Number	25,481	41,506	2,919	187,842	FRANKLIN_CO
Parcels_Nonresidential_Percent	7.36	3.01	3.69	16.15	FRANKLIN_CO

[a]Source definitions are online in Supplemental Appendix A.

between the dependent and independent variables is not likely to be linear. Instead, we model this relationship as a one-unit change in an explanatory variable resulting in a percentage change in a dependent variable. Thus, a statistically significant regression coefficient indicates the expected influence of a one-unit change in the respective explanatory variable on the dependent variable in percentage terms. The exceptions to this occur where we transform the explanatory variables (enrollment and parcels) meant to account for differences in scale across zip codes or census tracts into natural log form. We do this because the regression coefficient will then measure the percentage change in the dependent variable due to a one–percentage point increase in the log-transformed explanatory variable.

As described by Hoechle (2007) and Cameron and Trivedi (2010), there are specific tests to perform before deciding on the optimal form of regression estimation for a panel data set. The first is to test whether the use of fixed or random effects is appropriate. The appropriate Hausman test indicates fixed effects at the 99% confidence level. Next, we used Pesaran's test of cross-sectional independence and found with 99.9% confidence that it was not an issue. Finally, we tested for the presence of autocorrelation in the regression using the Wooldridge test and found it present with greater than 99% confidence. Therefore, the appropriate regression process to use in STATA is "xtreg" with robust standard error estimation clustered on each school district. According to Hoechle (2007), this controls for autocorrelation specific to each panel and for heteroscedasticity. A control for school district (or census tract) fixed effects exists in this STATA estimation by specifying it as the group variable. The addition of a set of year-specific dummies account for year fixed effects.

Table 2 offers descriptive statistics for all variables used in the regression analyses based on 288 observations drawn from the 16 school districts during the 18-year span of 1998 to 2015. The first column of Table 3 reports the School_Mills_Real regression result. A concern is the possibility that the explanatory variables used to measure different forms of abatement (CRA_Abate_Percent, EZ_Abate_Percent, TIF_Abate_Percent, EPA_Abate_Percent) are highly correlated and could lead to multicollinearity. We checked for this by calculating the pairwise correlation coefficients between these three variables and found them at levels low enough (in absolute value, less than 0.20) to not likely yield concerns.

As noted in Table 3, a one percentage point increase in the value abated through CRA abatement, as a percentage of total market value in a school district, results in a statistically significant 2.8% decrease in a school district's property tax millage rate. If expressed instead in terms of the impact of a one standard deviation increase in CRA abatement of about 4.6%, this decrease in school district mill rate jumps to about a 12.8% decrease. The use of TIF also exhibited a statistically significant influence on school millage rate. A one percentage point increase in the value earmarked through TIF as a percentage of total market value in a school district results in about a 1.9% decrease in a school district's property tax millage rate. If expressed instead in terms of the impact of a one standard deviation increase in TIF use of about 2.0%, this decrease in school district mill rate jumps to about a 3.8% decrease.

Table 3. Regression Results Using Franklin County School District Data.

Dependent variable	(1) Ln_School_Mills_Real	(2) Ln_Residential_Effective_Real_Rate	(3) Ln_Non-Residential_Effective_Real_Rate	(4) Ln_Real_Property_Market_Value
Bachelor_Plus_Percent	0.0074 (0.0084)	−0.00089 (0.0045)	0.0019 (0.0054)	0.010*** (0.0019)
Age19_Less_Percent	−0.026 (0.017)	−0.026** (0.010)	−0.017 (0.011)	0.0052 (0.0052)
Ln_Enrollment	0.52** (0.22)	0.41** (0.14)	0.37** (0.16)	0.039 (0.086)
CRA/_Abate_Percent	−0.028*** (0.0060)	−0.0092* (0.0052)	−0.0083* (0.0046)	0.016*** (0.0019)
CRA_Pre94_Percent	0.00023 (0.00056)	−0.00012 (0.00035)	−0.00040 (0.00041)	0.00047 (0.00028)
EZ_Abate_Percent	−0.031 (0.066)	0.064* (0.031)	0.081* (0.042)	0.017 (0.034)
TIF_Abate_Percent	−0.019*** (0.0095)	−0.0023 (0.0077)	−0.0020 (0.0074)	0.011 (0.0078)
EPA_Abate_Percent	−0.077 (0.083)	−0.064 (0.054)	−0.048 (0.065)	−0.054 (0.078)
JCTC_Jobs_Per_100M_MarketVal	−0.00019 (0.00011)	−0.000066 (0.000080)	−0.000099 (0.000084)	0.000016 (0.000085)
Tax_Exempt_Property_Percent	−0.0013 (0.0034)	0.00089 (0.0020)	−0.0012 (0.0029)	0.0056* (0.0028)
Ln_Parcels_Number	0.099 (0.46)	−0.12 (0.30)	−0.25 (0.32)	0.71*** (0.22)
Parcels_NonResidential_Percent	−0.024** (0.011)	−0.0065 (0.0085)	−0.017*** (0.062)	−0.0016 (0.0048)
School district fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Within R^2	0.756	0.875	0.833	0.970
Observations	288	288	288	288

Note. Data on 16 Franklin County school districts drawn from 18 years between 1998 and 2015. Heteroscedastic and autocorrelated robust standard errors through clustering on school districts.
Statistical significance measured in two-tailed test: *** >99%, **95% to 99%, and *90% to 95%. Within R^2 measures the variance within the panel units (school districts) accounted for by the regression model.

When the dependent variable is an effective property tax rate instead of a mill rate, there is still a statistically significant impact of the CRA abatement on the property tax rate, but that effect is smaller for the nonresidential rate than for the residential rate. As shown in the second column of Table 3, a one percentage point increase in the value abated through CRAs as a percentage of total market value in a school district results in about a 0.9% decrease in a school district's residential effective property tax rate. If expressed instead in terms of the impact of a one standard deviation increase in CRA abatement of about 4.6 percentage points, this decrease in residential effective property tax rate grows to about 4%. To put this result in dollar terms, the regression analysis predicts that a one standard deviation increase in CRA abatement as a percent of a school district's total property value lowers the average residential property tax bill in that school district for that year by about $77 for the median property tax bill, and about $100 for the average tax bill.[25] For this regression, neither the TIF nor the JCTC variables are statistically significant. The EZ variable is statistically significant and EZ abatement increases a school district's residential effective property tax rate.

The third column of Table 3 presents the results for the regression where the dependent variable is the effective property tax rate for nonresidential property. Again, the CRA variable is statistically significant. A one percentage point increase in the value abated through CRA abatement as a percentage of total market value in a school district results in about a 0.8% decrease in a school district's nonresidential effective property tax rate. If expressed instead in terms of a one standard deviation increase in CRA abatement, this decrease in nonresidential effective property tax rate grows to about 4%. Neither the TIF nor the JCTC variables are statistically significant. The EZ variable again has a statistically significant positive impact on the effective property tax rate.

Using Regression Analysis to Detect the Economic Impact of Property Tax Abatement. We define the economic impact of property tax abatement in a Franklin County school district or census tract as the effect it has on the market value of property. For a school district (a) that sets its own property tax rate, an algebraic manipulation of Equation (1) yields:

$$\text{Taxable Property Value}_i = \text{Local Education Expenditures}_i \,/\, \text{Property Tax Rate}_i \quad (10)$$

From this, the reduced form regression, resulting after the appropriate substitutions from Equations (2) and (3), is

$$\text{Taxable Property Value}_i = f\begin{pmatrix} \text{Bachelor\_Plus\_Percent}_i,\ \text{Age19\_Less\_Percent}_i,\ \text{Enrollment}_i, \\ \text{CRA\_Abate\_Percent}_i,\ \text{EZ\_Abate\_Percent}_i,\ \text{CRA\_Pre94\_Percent}_i, \\ \text{TIF\_Abate\_Percent}_i,\ \text{EPA\_Abate\_Percent}_i,\ \text{JCTC\_Jobs\_Per\_100M\_MarketVal}_i, \\ \text{Tax\_Exempt\_Property\_Percent}_i,\ \text{Parcels\_Number}_i, \\ \text{Parcels\_NonResidential\_Percent}_i \end{pmatrix} \quad (11)$$

Table 4. Descriptive Statistics for Variables Used in Census Tract Economic Impact Regression Analysis (284 Franklin County Census Tracts Drawn From 14 Years Between 2002 and 2015).

Variable	*M*	*SD*	Minimum	Maximum	Source[a]
Dependent					
Real_Property_Market_Value	322,522,228	343,506,916	21,659,000	4,849,540,608	FRANKLIN_CO
Explanatory					
CRA_Abate_Percent	1.26	5.03	0	49.60	FRANKLIN_CO
CRA_Pre94_Percent	7.28	25.43	0.00	100.00	FRANKLIN_CO
EZ_Abate_Percent	0.16	0.93	0	13.30	FRANKLIN_CO
TIF_Abate_Percent	1.38	5.42	0.00	76.42	FRANKLIN_CO
EPA_Abate_Percent	0.049	0.48	0.00	11.61	FRANKLIN_CO
JCTC_Jobs_Per_100M_MarketVal	19.21	103.39	0.00	2,681.84	STATE
Tax_Exempt_Property_Percent	12.43	15.69	0.00	99.88	FRANKLIN_CO
Parcels_Number	1,466	815	15	6,506	FRANKLIN_CO
Parcels_NonResidential_Percent	12.78	16.75	0.071	100.00	FRANKLIN_CO

[a]Source definitions are online in Supplemental Appendix A.

We measure taxable property for both school districts and census tracts in Franklin County as the market value of property in the relevant entity. The data used to estimate Equation (11) for school districts are the same as described in Table 2.

Testing for the presence of fixed over random effects, cross-section independence, and autocorrelation, we again find their presence in this regression with a different dependent variable but the same set of explanatory variables. Thus, we employ the same regression technique as earlier. The fourth column of Table 3 contains the school-district-based results for our economic impact analysis. Regarding the economic impact of property tax abatement, we find that a one percentage point increase in CRA abatement as a percentage of a total market value in a school district results in about a 1.6% increase in the market value of property in a school district. A one standard deviation percentage point increase of 4.6 in the percentage of a school district's property tax base granted a CRA abatement results in about a 7.4% increase in the value of a school district's real property tax base.

As an additional test of the economic impact of property tax abatement, we also gathered annual data from the 284 census tracts in Franklin County from 2002 to 2015. These are not governmental jurisdictions and thus levy no property taxes. Their inclusion offers a unit of observation that results in many observations within Franklin County and thus are ideal as an additional way to examine the economic impact of property tax abatement on the market value of property. Referring to the earlier set of equations, we can only estimate the taxable property value relationship in Equation (3) and check how property tax abatement, other property-relevant incentives, property exempt from taxation, and other property-base characteristics influence it. Table 4 contains descriptive statistics for the variables included in the census tract estimation of Equation (3).

We find the presence of fixed over random effects, cross-section independence, and autocorrelation, making it necessary again to use the same regression technique. The census tract-based results for our economic impact analysis are in Table 5. Like the regression using school district data, we again discovered that CRA abatement exerts a statistically significant positive influence on the market value of property, just not as large. A one percentage point increase in abatement intensity in a census tract yields about a 0.4% increase in the market value of property. If measured in terms of a one standard deviation 5.2 percentage point increase in CRA abatement intensity, the associated increase in census tract property value rises to 2.1%. As found for a school district, TIF abatement also yields a positive influence on the market value of property in a census tract. A one percentage point increase in value earmarked for TIF as a percentage of total market value results in about a 1.4% increase in the market value of property in a census tract. If measured in terms of a one standard deviation 5.4 percentage point increase in TIF use, the associated increase in census tract property value rises to 7.6%.

For a census tract, unlike for a school district, jobs created or retained through a JCTC tax credit increase the market value of property. One job created or retained per $100 million of market value property in the census tract raises the tract's market value by 0.0082%. That is small. However, when measured in terms of the standard deviation of 103.4 more jobs created or retained of this JCTC measure for all school districts over the years observed, the effect on a Franklin County census tract's market value of property rises to about a 0.9% increase.[26]

Possible Endogeneity of Property Tax Rate, Property Value, and Property Tax Abatement Values. As noted by Bartik and Erickcek (2014) and others, the difficulty in trusting the regression coefficients derived from an analysis of the causal influence of property tax abatement on property value or property tax rate is that abatement awards are

Table 5. Regression Results Using Franklin County Census Tract Data.

Dependent variable	(1) Ln_Real_Property_Market_Value
CRA_Abate_Percent	0.0036* (0.0021)
CRA_Pre94_Percent	0.000074 (0.00019)
EZ_Abate_Percent	0.0033 (0.0076)
TIF_Abate_Percent	0.014*** (0.0017)
EPA_Abate_Percent	−0.0019 (0.0058)
JCTC_Jobs_Per_100M_MarketVal	0.000082** (0.000032)
Tax_Exempt_Property_Percent	0.0086*** (0.0025)
Ln_Parcels_Number	0.39*** (0.13)
Parcels_NonResidential_Percent	−0.0021 (0.0014)
School district fixed effects	Yes
Year fixed effects	Yes
Within R^2	0.548
Observations	3,976

Note. Data on 284 Franklin County census tracts drawn from 14 years between 2002 and 2015. Heteroscedastic and autocorrelated robust standard errors through clustering on cenus tracts. Statistical significance measured in two-tailed test: *** >99%, **95% to 99%, and *90% to 95%. Within R^2 measures the variance within the panel units (census tracts) accounted for by the regression model.

discretionary. If such discretion is likely to result in more abatements given by decision makers in jurisdictions that are more likely to grow, then a bias exists for finding that abatements have larger positive effects on property value increases and/or larger negative effects on property tax rates. Alternatively, if discretion in abatement offers result in them more likely given in jurisdictions with an impediment to growth, regression findings on the efficacy of abatements will have the opposite bias.

This potential problem of endogeneity of abatement use in a jurisdiction (our key explanatory variable) is not an easy one to solve in the traditional manner of finding instrumental variables that correlate well with abatement use and are uncorrelated with nonobservables influencing the dependent variables. We thought seriously about this issue when deriving our estimation strategy, and even had the advantage of interviews with public officials regarding their decision to abate.[27] Unfortunately, we find no evidence of factors exogenous to a jurisdiction in Franklin County, Ohio, during the period observed that could legitimately have caused the municipal officials to change their abatement activity in a systematic manner (either across jurisdictions or across time in a jurisdiction). Thus, we were not able to obtain an instrumental variable to use in the first stage of a two-stage endogeneity correction.

Instead, we approach the issue of endogeneity by pointing out that the jurisdiction making the decision on whether to offer an abatement in Ohio is a municipality (city or village). In Franklin County, there are 17 municipalities offering property tax abatements. However, the unit of analysis for our regressions is either the 16 independent school districts in Franklin County or the 284 census tracts that make up the county. No census tract in Franklin County is coterminous with a municipality and, for the most part, school districts are not coterminous with municipalities.[28] Thus, the argument that abatement use in a school district is decided in part by an official looking at the value of property or the property tax rate in the school district holds less credence since the decision maker represents a municipality that likely overlaps only part of the school district.[29] The validity of this argument increases when the unit of analysis shrinks to the census tract level.

We also took a third approach to the endogeneity issue. We tried a direct test of the reverse causality of property value or property tax rate influencing abatement activity by regressing the variable of CRA_Abate_Percent separately against lagged School_Mills_Real, Residential_Effective_Real_Rate, Non-Residential_Effective_Real_Rate, and Real_Property_Market_Value for school districts (with various lags at 1 through 5 years, and 10 years). For census tract observations, we did the same for CRA_Abate_Percent regressed against Real_Property_Market_Value. In all cases, we detected no statistically significant influence. This offers empirical support for the argument that we do not have an endogeneity problem.

An additional issue we explored through a regression (see Supplemental Appendix B online) is the influence of CRA abatement as a generator of local income tax revenue. Data on local income tax revenue for Franklin County are available for 17 municipalities but there is a concern both measures are endogenously determined. To overcome this, we regressed the natural log of municipal income tax revenue against the lagged causal variable of the CRA abated value per market value of property. This yields a clear positive and statistically significant relationship between the two. This favorable result may be an important reason, besides greater property tax base and lower property tax rate, for a municipality to grant property tax abatement.

Conclusion

In 2015, the most important property tax abatement program in Franklin County, Ohio, was CRAs. Tax savings from CRAs equaled 3% of property taxes paid. Our study investigates some economic and fiscal impacts of this loss in potential revenue. We use panel data regression analyses to estimate the impact of CRA abatements on property value and school property tax rates in this county. We found that the use of CRAs increased property values and decreased property tax rates as intended. Thus, our regression analysis reveals that CRA property tax abatements have exerted beneficial fiscal and economic impacts in Franklin County.[30] In school districts, a one–percentage point increase in the use of CRA abatements correlates with about a 1.6% increase in the market value of the district's property (economic impact), about a 2.8% decrease in the district's property tax millage rate for schools (fiscal impact), and a 0.9% and 0.8% decrease in effective tax rates on residential and nonresidential property, respectively (also fiscal impacts). For census tracts, the same increase in abatement correlates with a 0.4% increase in the market value of the tract's property (economic impact).

We also found that the use of TIF in Franklin County school districts over the observed decades exerted a negative impact on a school district's property tax millage rate, but no detectable influence on a district's residential or nonresidential effective property tax rate. TIF did have the anticipated positive impact on the market value of census tract property, but no statistically significant effect on the market value of school district property.[31]

This study of property tax incentives and JCTCs in a large Ohio county found modestly beneficial effects on property values and property tax rates in Franklin County's school districts. This is policy-relevant information, especially considering previous studies like *Protecting Public Education from Tax Giveaways to Corporations* (National Education Association, 2003, p. 2) which concluded that ". . . today's development subsidies may be enriching corporations at the cost of the education of tomorrow's work force," or Nguyen-Hoang (2014), which found greater use of TIF associated with lower K-12 education expenditures. Based on our extensive qualitative investigation of the components of the CRA abatement program in Ohio and its application in Franklin County, we offer at least three explanations for our findings of nonnegative impacts on school districts when the overlapping jurisdiction offers abatements. First, Ohio does not make as extensive use of business tax incentives as some other states (Bartik, 2017). Second, compared with other states, Ohio school districts have a greater role in either accepting or resisting the granting of property tax abatements. Third, the discretionary use of property tax abatements based on agreements with businesses with promises of increased jobs, payroll, and investment are annually reviewed through the mandated use of annual TIRCs. This process may illuminate particularly ineffective tax incentives and lead to more discretionary, and thus more effective, use. These reasons align with some of the key reforms suggested by Good Jobs First (2016) for promoting accountability in economic development that include (a) requiring disclosure of subsidy spending and company compliance; (b) protecting schools from tax giveaways; and (c) increasing accountability in the subsidy approval process.

Based on the results of the research presented in this article, we suggest that policy makers consider three courses of action. First, they should aim for limited, and not aggressive, use of property tax abatements to encourage economic development with specific targets for abatements regarding increased investment, employment, and/or payroll. The reason for this is that abatements in the state of Ohio are limited in ways not typically observed in most states, and our findings that greater CRA use in a jurisdiction offers the potential joint benefits of higher property values and lower property tax rates. Given that Ohio regulations ensure that school districts within a municipality have a "seat at the table" when property tax abatements within the municipality are debated, our second recommendation is that this practice become more widespread. Third, we recommend that other states require an annual review process like Ohio's TIRCs whereby company progress on their promises is examined. TIRCs are unique to Ohio and play an important role in keeping CRA abatement transparent and accountable. Through such a mechanism, governments can at least determine whether businesses have generated or retained the promised jobs, payroll, or investment. Perhaps policy makers should even consider the possibility of greater periodic reviews that go beyond TIRCs to attempt to determine, as this study did, whether the increased property value, jobs, payroll, or investment associated with business incentives would have materialized without the incentives.

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Supplemental Material

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Notes

1. As raised later in this article, it is also possible that a reduced rate of local property taxation occurring through local abatement activity is capitalized into higher property (land) values in the jurisdiction and thus offers no further encouragement for greater economic activity in the jurisdiction.
2. Through an innovative simulation using the results of previous empirical studies of the effect of taxation on business activity, Bartik (2018) concluded that for about three fourths of the firms granted an incentive, the firm would have made the same decision without it.
3. School districts in Ohio are independent governments with revenue raising power. There is no one-to-one correspondence between school districts and municipalities. One municipality can have multiple school districts and one school district can serve multiple municipalities. It is common for school districts to overlap municipal and even county boundaries.
4. In 2017, Census estimates placed Franklin County as the most populous county in Ohio. Franklin County is home to Columbus, which is the capital of Ohio. The qualitative portion of our investigation is at Kenyon et al. (2017).
5. The costliest form of state and local tax incentive is Job Creation Tax Credits (JCTCs), which are included, but not the focus, of this analysis.
6. Computed from the following table, omitting tax increment finance, which is not a property tax abatement: https://www.tax.ohio.gov/Portals/0/tax_analysis/tax_data_series/real_property/pe3/PE3TY16.pdf
7. In Ohio, either municipalities or counties can approve CRAs, but county authority is limited to unincorporated areas. In Franklin County in 2015, less than 1% of property tax abatements existed in unincorporated areas.
8. ORC 5709.85. For a plain English description of TIRCs, see County Commissioners Association of Ohio (2016) or DeWine (2015).
9. State law requires local governments to create TIRCs to grant certain tax exemptions, including CRA abatements. The county auditor or designee is the chairperson; the other members must include officers or representatives of the local governments, affected school districts, and members of the public. The makeup varies by the type of local government. TIRCs report annually to the local legislative authority, which may accept, reject, or modify the council's recommendations.
10. As an example, see Kovac (2018) about a Columbus City Council decision to dissolve a tax abatement in reaction to recent recommendations from the city's TIRC.
11. As noted below, the confounding effects of the possible positive capitalization of greater abatement activity into higher property value without necessarily an increase in economic activity makes the use of this measure a less reliable test of the fiscal benefit of abatement to a jurisdiction.
12. Kang et al. (2016) included a literature review of recent empirical work that demonstrated that differences in local property taxes are fully capitalized into the market value of property after controlling for other local factors that also affect this value. This study does fully control for those other factors and examines the influence of abatement on rate of property taxation.
13. Given the quantitative importance of CRAs in Ohio, it is surprising, and a concern for the validity of the results, that Hultquist did not include CRAs in his analysis.
14. We found only one study that examined the impact of CRAs, EZs, and JCTCs in Ohio. However, the focus of Greenbaum et al. (2010) was not the economic or fiscal impact of these tax incentives, but the degree of targeting in the use of these incentives.
15. Faulk (2002) also has a study of the impact of Georgia's Jobs Tax Credit (a form of JCTC). Since she focuses on its impact on employment rather than property values, we do not review that study here.
16. Merriman (2018) also reviewed some older empirical studies of the impact of TIF on school expenditures.
17. We exclude from our analysis six school districts that have a small number of parcels in Franklin County and are primarily in surrounding counties. For those six school districts, only 7.9% of the housing units are in Franklin County. We only have data on abatements, property values, and other variables for parcels within Franklin County. Thus, we would not have been able to measure the use of abatements offered in those school districts.
18. Note that we intend this to be a very simplified model where local education expenditure (LEE) is only funded by local property taxation. We never use LEE as an explanatory variable in our regression analysis due to likely endogeneity and instead rely on socioeconomic characteristics of citizens to proxy for it. This should also account for the possibility of higher LEE through state and federal grants related to these characteristics.
19. We also gathered data on median household income in a school district but exclude it here because of its partial correlation coefficient of 0.93 with bachelor's degree holders. When we include both as explanatory variables in these regression analyses, neither exhibited statistical significance due to multicollinearity.
20. The only exception to the requirement of exemption for new construction is for large manufacturing facilities or properties in a brownfield site (County Commissioners Association of Ohio, 2016).
21. Ideally, we would measure the dollar value of the JCTC tax credit to firms, but the ODSA (2012) from whom we obtained the data did not begin reporting these data until 2007. So instead we use an aggregate number of jobs as a proxy for the dollar value of JCTC. We would prefer to measure JCTC abatement intensity as the number of new or retained jobs as a share of total jobs by either census tracts or school district, but no data are available on total number of jobs, so we normalize using property value.
22. As suggested by a referee, it may be desirable to measure the residential verses nonresidential split of property in a municipality by acres. Unfortunately, such information is not available.
23. Later, for the 284 census tracts that we also analyze, we use data from the 14 years between 2002 and 2015.

24. What Ohio terms "effective property tax rates" for residential and nonresidential properties are not the same as what public finance economists usually refer to as an effective property tax rate (revenue raised divided by market value). The reason is that Ohio effective property tax rates do not account for other programs, which reduce property tax liability for residential property: the homestead exemption, 10% rollback credit and 2.5% rollback credit. See Lang (2016) and Sullivan and Sobul (2010).
25. To do this computation, it is important to know that Ohio uses a 35% assessment ratio and mill rates are tax rates per $1,000 of property. Using the parcel data collected from all Franklin County for the years 1998 to 2015, we find a median tax bill of $1,960, while the average is $2,547. In 2013 the median real estate taxes paid by an owner-occupied home in Ohio were $1,982.
26. Hanson (2009) also found that a wage tax credit (in this case, the federal empowerment zone) has a statistically significant positive impact on property value.
27. See http://www.lincolninst.edu/publications/other/evaluation-real-property-tax-abatements-franklin-county-ohio
28. For example, any general-purpose local government may share a school district with another local government or be served by more than one school district. Thus, the Southwestern School District, one of the largest in Franklin County, serves Grove City, Harrisburg, Urbancrest, part of Columbus, and some unincorporated areas. On the other hand, the city of Columbus is served by 15 other school districts in addition to the Columbus School District. In our assessment, there are not enough coterminous census tracts and municipalities/school districts to complete an analysis of such using data gathered by census tract.
29. See Hall (2013) for an analysis of the fiscal externalities that result when school districts and municipalities are not congruent. He used Ohio as his case study because, unlike many states, "school district borders frequently run without consideration for municipal borders" (p. 8).
30. Higher property values are in most cases beneficial, but this finding raises the issue of gentrification, which has negative effects such as pushing poorer people out of areas. We note that as discussed in Brueckner and Rosenthal (2009), gentrification is a more complex phenomenon than simply an increase in property values. Also, there are a range of policy responses to the negative effects of gentrification, such as legislatively imposed requirements for the provision of affordable housing.
31. In an earlier version of this analysis, we did not control for JCTC use in Franklin County (see Kenyon et al., 2017). In the regressions described here, we find that JCTC use raises the market value of property in census tracts. The inclusion of the JCTC variable only slightly changed the coefficients on CRA_Abate_Percent, our main explanatory variable. However, because of the inclusion of JCTC, we put greater credence in the results reported here than in our earlier working paper results.

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