THE EFFECTS OF TAX INCREMENT FINANCING ON ECONOMIC DEVELOPMENT

by

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The Effects of Tax Increment Financing on Economic Development[1]

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ABSTRACT: Local governments attempt to influence business location decisions and economic development through use of the property tax. Tax increment financing (TIF) sequesters property tax revenues that result from growth in assessed valuation. The TIF revenues are to be used for economic development projects but may also be diverted for other purposes. We have constructed an extensive data set for the Chicago metropolitan area that includes information on property value growth before and after TIF adoption.

In contrast to the conventional wisdom, we find evidence that cities that adopt TIF grow more slowly than those that do not. We test for and reject sample selection bias as an explanation of this finding. We argue that our empirical finding is plausible and present a theoretical argument explaining why TIF might reduce municipal growth.

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I. Why economic development incentives?

Why do local governments find it in their interest to offer economic development incentives (EDIs)? Are EDIs desirable from the point of view of the entire metropolitan area or are they selfish actions on the part of one local government? There are at least four general reasons why EDIs might be offered. We give these four reasons the shorthand names: (1) market failure, (2) blighted areas, (3) bidding wars, and (4) intergovernmental revenue shifting.

First, EDIs might correct some market failure in the development process. If, for example, competitive markets fail to exploit agglomeration economies, governmental policies might engineer an appropriate mixture of industries in a particular area and improve on what private real estate developers would be able to bring forth. Of course, as we know from the national industrial policy literature, even though such benefits are theoretically possible, in practice they are unlikely to be realized (Krugman 1997). Use of EDIs to encourage economic growth requires governments both to withstand the temptation to curry favor by subsidizing influential industries and to have a sophisticated understanding of economic interactions.

EDIs might be used for the straightforward purpose of aiding economically distressed or "blighted" geographic areas. Governments aid blighted areas either to redistribute income (premised on the belief that poor people benefit disproportionately from subsidies to these areas) or because they care about the geographic, as well as interpersonal, distribution of income. Bartik (1991) argues that this sort of redistribution is efficiency enhancing "[b]ecause the most aggressive policies will be pursued by depressed areas that need growth the most .... Furthermore, widespread economic development subsidies may encourage an expansion of national employment, leading to a lower national unemployment rate" (pp. 206-7).

Thirdly, EDIs may have no positive social function but simply be the result of a bidding war among different localities. Competitive governments bidding for business development could be a zero-sum game with wins by some players offset by others' losses. Alternatively, Bogart (1998) suggests the bidding for business development presents the classic "prisoner's dilemma" problem of a negative-sum game in which the players would be better off if no one choose to play. Although local government revenues may be diminished by a bidding war, the outcome is not necessarily socially undesirable. Cities may charge business taxes exceeding the marginal cost of providing services to business (Oakland and Testa 1996). Businesses may threaten to (or actually) move in order to gain EDIs that bring their total tax burden down to the marginal cost of the services they consume. Whether this redistribution of income from city governments to businesses is socially desirable depends on the final incidence of tax revenue collected from business-a subject not settled in the economic literature.

In a federalist system, a fourth reason that governments may issue EDIs is that they can pass the cost along to another level of government. For example, many states have redistributive grant programs that give higher levels of state aid to local governments with smaller property tax bases. Depending upon the state aid formula, lower level governments may recoup some revenue foregone through EDIs with higher state aid. Similarly, when special purpose governments geographically overlap general purpose governments the general purpose government may issue tax relief at the expense of the special purpose governments.

The four reasons for adoption of EDIs have different implications for the growth in property values. Since we are concerned with a type of EDI that targets one area of the city, the following matrix summarizes the predictions for the impact in the target and non-target areas:

Motive	Predicted Impact on Growth in	
	Target Area	**Non-Target Area**
(1) Market Failure	+	0 or +
(2) Blighted Area	+	—
(3) Bidding War	0	0
(4) Revenue Shifting	0 or +	0 or —

A government subsidy to correct market failure should increase the growth rate of property values in the target area, and, depending on whether there are spillover effects, might also impact the rest of the city. The blight or redistributive motive should help the target area at a cost to the rest of the city. If, because of a prisoner's dilemma incentive, every town adopts EDIs, none will benefit with relative growth. If the motive is to move revenues from one layer of government to another, any positive effect in the target area should be offset by a negative effect elsewhere.

II. What is TIF?

In this paper we focus on a particular kind of EDI called tax increment financing (TIF). TIF is an economic development tool available to municipalities in forty-four states (Forgey 1993). What distinguishes TIF from many earlier EDI programs is the lack of a direct subsidy from higher levels of government. Instead of a direct subsidy, TIF district expenditures are financed out of "incremental" local property tax revenues. To qualify for TIF designation, an area usually must meet a state statutory definition of "blighted" status. The checklist of qualifications for blighted status is largely a carry over from earlier federal or state grant programs for local economic development.

Although the precise rules vary among states, the increment to the tax base is usually calculated as the difference between the current assessed value of property in the district and the assessed value of property at the time of inception of the district.[2] Incremental tax revenues are the product of the incremental tax base times the aggregate tax rate of all local property-taxing jurisdictions, not just the sponsoring municipality. The incremental tax revenues can be used to pay allowable economic development costs within the district, such as site assembly or infrastructure improvement. Because of timing differences between TIF expenditures and receipts, the usual practice is to use the TIF-district taxing authority to borrow for development expenditures in the early years and then pay off the bonds with incremental revenues in the later years.[3]

As established, designation of a portion of a municipality as a TIF district could cause an increase, decrease, or no change in the economic growth of the municipality. If TIF enables municipalities to correct market failures, municipalities with TIF districts will grow faster than they otherwise would have. If TIF redistributes growth toward blighted and intrinsically less suitable areas, municipalities that adopt TIF may grow more slowly than they otherwise would have. (A formalization of the argument that TIF-based redistribution might slow municipal growth is given in Appendix 1.) Finally, if these two effects balance out, or if TIF is merely a redistribution of revenue among different level of government with no effects on government spending, municipalities with TIF may have the same rate of growth as those without TIF.

The fact that the TIF district authority has access to incremental revenues calculated from the aggregate tax rate from all local taxing jurisdictions is crucial for understanding the politics and economics of TIF. The use of revenues that in the absence of TIF would belong to overlying governments to finance municipal economic development expenditures raises an important

[2] California has a slightly more complex system. See Dardia (1998) for details.

[3] For more on the mechanics of TIF, see Bland (1989), Calia (1997), Chapman (1998), Dye and Sundberg (1998), vmForgey (1993); Paetsch and Dahlstrom (1990), or Redfield 1995).

question: Does TIF adoption causes future growth in property values or does anticipated growth in property values cause the decision to adopt tax increment financing?

If the TIF district expenditures are the clear and sole cause of the future growth in property values, then the use of tax increment financing just links revenues that would not otherwise have existed to the development expenditures that gave rise to those revenues. In this case, allowing non-municipal governments to participate in future revenues without requiring them to participate in the development costs would be both unfair and inefficient. In most states, to establish a TIF district a municipality often must stipulate that there are no prospects for growth in property values “but for” the use of TIF. However, this attribution test is often criticized as a mere pro forma assertion made in the self-interest of the municipal government without reasonable standards of proof.

Why might municipalities have an incentive to adopt TIF even if the “but for” test is not met? If any increment to the property tax base-new development, improvements, real appreciation, or even merely inflationary increases in the values of existing properties-would have occurred independent of the TIF expenditures, then TIF becomes a device for “capturing” property tax revenues that otherwise would have gone to non-municipal governments, such as school districts. The mix of local tax rates varies enormously from town to town and state to state, but in Illinois the shares of the aggregate tax rate are roughly fifteen percent municipal, sixty percent school district, and twenty-five percent other types of local government. Therefore, for each fifteen cents of own revenues the average Illinois municipality diverts eightyfive cents of revenues from other governments into the TIF district budget.

The direction of causation-from TIF adoption to growth or from anticipated growth to TIF adoption-is thus an empirical question with important implications for policy.

III. Econometric methodology and sample selectivity results

We estimate the impact of TIF using a sample of 235 northeastern Illinois municipalities. The data set includes information on TIF status, fiscal structure, community type, and location for years both before and after the adoption of TIF by about one-third of the municipalities. For more on the extent of tax increment financing in northern Illinois see Appendix 2 and for more on the database see Dye (1997).

As pointed out earlier in the paper, a municipality's decision to adopt TIF may be made for a variety of reasons: TIF might be adopted because the municipality recognizes that the area is likely to be developed and wishes to capture the revenue increment from overlying governments. On the other hand, TIF might be used in an area that is hopelessly blighted on the theory that TIF designation does not risk any revenue.

In the first case, a comparison of the growth rates of TIF districts with the growth rate of other areas will tend to overstate the impact of TIF on growth-these areas were selected specifically because they were expected to grow. But in the second case, a comparison of the growth rates of TIF districts with the growth rate of other areas will tend to understate the impact of TIF on growth-these areas were selected specifically because they were less likely to grow.

In his econometric analysis of TIF in Michigan, Anderson (1990) recognized this issue and treated TIF adoption as a sample self-selection problem. Anderson estimated a structural probit model with equations explaining both TIF adoption and post-TIF property value growth rates and found evidence of significant sample selectivity. Summarizing his results in the probit equation explaining TIF adoption, Anderson states:

> [C]ities with growing populations . . . were more likely to adopt TIF plans . . . while those with declining populations were less likely to adopt .... It may well be that city officials, seeing growth

> occurring, use the TIF mechanism to capture property tax base, rather than use the mechanism to stimulate growth in the local economy. While this coefficient does not provide a definitive
> answer it strongly suggests that prior growth is responsible for TIF adoption. (p.160)

In a second stage, Anderson estimated separate property value growth equations for municipalities with and without TIF districts, making appropriate correction for the self-selected nature of the sample. We duplicated Anderson's procedure with our data set and could not reject the hypothesis of no sample selectivity bias. More detail on our procedures and regression specifications are given in Appendix 3.

Anderson's model allows TIF adoption to be a self-selected variable but does not explicitly incorporate TIF as a variable affecting a municipality's growth rate. Because we want to incorporate explicitly the impact of TIF on municipal EAV growth, we also investigated empirical models that treat TIF as a self-selected treatment (Greene 1993, and Barrow, Cain and Goldberger 1981). (See Appendix 3 for a formal comparison.) That is, we assume that TIF is self-selected and that TIF adoption may have an impact on a city's growth rate. An advantage to our econometric approach is that it produces an easily interpretable estimate of the effect of a TIF on a city's growth rate. [4]

Our first stage results (prediction of TIF adoption) are discussed in section IV .5 Our second stage results are reported in Appendix 3. We cannot reject the hypothesis of no sample

[4] A medical analogy may make clear the distinction between Anderson's and our econometric approaches. Imagine a disease that potentially stunts the growth of teenagers and a treatment (called TIF) which may enhance growth. There may be self-selection in who undergoes the treatment. Anderson's model allows for the possibility that those adopting treatment may be different than those that do not get treatment but does not explicitly measure how much the treatment stimulates growth. Our method explicitly measures this effect. Furthermore, our method allows us to measure the intensity of treatment (measured by the size of the TIF district compared to the city) and take into account that larger TIF districts may have stronger effects than smaller TIF districts.

[5] Initially we used this data set to estimate the time to TIF adoption for each municipality in the sample. We tried a variety of combinations of independent variables and specifications of the survival function (see Kiefer 1988). We had very little success in predicting the observed pattern of TIF adoptions. For all of the empirical specifications we

selection bias when estimating the impact of TIF on municipal growth rates. The estimated OLS coefficient on TIF is therefore an unbiased estimate of the effect of tax increment financing on property value growth.

The next two sections of the paper discuss the TIF adoption decision and property value growth equations separately.

IV. The TIF adoption decision.

Our TIF adoption equation includes four categories of variables: pre-adoption growth rate, fiscal structure, municipality type, and location. Table 1 presents the full definitions and means of the dependent variable (TIF) and the four groups of independent variables in the "adoption" equation as well as some additional variables introduced in the subsequent "growth" equations.

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examined our statistical models greatly under-predicted TIF adoption during the period 1984 to 1992. Because we were unable to predict the precise year of TIF adoption we refocused on the more modest goal of trying to understand which municipalities ever adopt TIF. See Anderson and Wassmer (1995) for a survival analysis of adoption of economic development incentives.

Table l: Variable Definitions and Means

NAME	DEFINITION	MEAN	
TIF Status:		Adoption Equation	Growth Equation
TIF	Dummy Variable for TIF Adoption: 1 if Adopted TIF in the 1984 to 1991 period, 0 if Never Adopted TIF	0.34	0.34
TIF Share	TIF District Share of Total Equalized Assessed Property Value 1992		2.28
Years Since	Number of Years Since TIF was Adopted to the 1992 Beginning of the Growth Period		1.55
Growth Rates:			
Prior Growth	Annualized Growth Rate in Total Municipal Equalized Assessed Value for the Pre-Adoption (1980-1984) Period (%)	4.63	
Total Growth	Annualized Growth Rate in Total Municipal Equalized Assessed Value for the Post-Adoption 1992-1995) Period (%)		6.55
Non-TIF Growth	Annualized Growth Rate in Non-TIF District Equalized Assessed Value for the Post-Adoption 1992-1995) Period (%)		6.42
Fiscal Structure:			
Municipal Tax Rate	Effective Tax Rate with respect to Equalized Assessed Property Value for Municipality (%) 1.07		
Aggregate Tax Rate	Effective Tax Rate with respect to Equalized Assessed Property Value for All Overlying Local Governments %)		8.46
Non-Municipal Tax Rate	Aggregate Tax Rate minus Municipal Tax Rate (%) 6.57		
Home Rule	Dummy Variable for Municipal Home-Rule Status	0.25	0.29
School Aid Formula	Dummy Variable for School Districts in the "Equalizing" Range of the State Aid Formula	0.46	
Community Type:			
Population	Municipal Population	13,413	14,992
Income Per Capita	Municipal Income Per Capita ($)	12,835	20,538
Poverty Rate	Share of Population with Income Below the Poverty Line (%)	4.43	4.44
Non-Residential Share	Non-Residential Share of Total Equalized Assessed Property Value (%)	35.93	34.21
EAV Density	Equalized Assessed Value divided by Land Area in Square Miles	2.27 E+07	4.61 E+07
Location:			
Du Page	Dummy Variable for Du Page County	0.11	0.11
Kane	Dummy Variable for Kane County	0.07	0.07
Lake	Dummy Variable for Lake County	0.17	0.17
McHenry	Dummy Variable for McHenry County	0.09	0.09
Will	Dummy Variable for Will County	0.10	0.10
Northern Cook	Dummy Variable for the Northern Cook County Assessment District	0.15	0.15
Southern Cook	Dummy Variable for the Southern Cook County Assessment District	0.31	0.31
Distance	Distance from Center of Chicago in Miles	28.68	28.68

The first variable is the pre-adoption-period growth rate in equalized assessed value (geav8084).[6] Dye and Sundberg (1998) show that independent of any causal impact of TIF expenditures on the growth rate, municipalities with higher expected future growth rates would have a greater incentive to adopt TIF. If, as seems plausible, expected future growth rates are positively correlated with past growth rates, we would predict a positive impact of past growth on TIF adoption. Another possibility is that TIF adoption is motivated by need, and would thus be negatively related to prior growth rates.

The second set of determinants of TIF adoption are characteristics of the fiscal structure. The municipal property tax rate (mrate83) should have a positive relationship to the municipal TIF adoption decision for two reasons: Anderson (1990) argues that the municipal tax rate represents the opportunity cost of raising extra municipal revenues without using TIF; Dye and Sundberg (1998) demonstrate that, if there is an expected positive impact of TIF on property values, a higher tax rate means larger future revenues for the town. The non-municipal property tax rate, the combined tax rate of the school district and all of the other overlying governments (nmrate83), represents the opportunity for municipal decision-makers to capture revenues from other governments.[7] We expect the non-municipal tax rate to be positively associated with TIF adoption. Home-rule status (hr83, with lies and 0=no) represents an Illinois institution that allows some municipalities, generally those with population over 25,000, much greater flexibility in setting property tax rates and greater access to non-property tax sources of revenue. As is the case in many other states, the State of Illinois school-aid formula calculates grants to local school

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[6] The four year 1980-84 pre-adoption growth period is chosen because during this period municipalities in Cook County were reassessed every fourth year.

[7] An alternative measure of the opportunity to capture revenues from other governments is the non-municipal tax rate as a share of the aggregate municipal and non-municipal tax rate. This measure, characterized as the TIF "subsidy

districts inverse to the amount of taxable property. School districts in the equalizing range of the formula (formula, with 1 =equalizing range and 0=not) are partially compensated for the loss of tax base to the TIF district and thus should be less resistant to TIF adoption.[8]

A third set of variables represents the type of the municipality. We use population (pop83) to measure the size of the community. Larger size may be associated with a greater probability of TIF adoption either because of increased need or opportunity to develop specific districts or as a proxy for the ability of the local government to devote specialized resources to economic development planning. The level of per capita income (pci83) is inversely correlated with the need to develop and is also a measure of ability to pay. Another measure of need or ability is the poverty rate (prate79). Since TIF is most suited to non-residential development projects, municipalities with a larger non-residential share of EAV (nrshare83) may be more prone to adopt TIF. A measure of the intensity or extent of prior development in the community is the value of EAV divided by the area of the municipality in square miles (eav83area).

Finally, a set of variables measures the location of the community. There are dummy variables representing each of the collar counties (Du Page, Kane, Lake, McHenry, and Will).s[9] In Cook County, there are dummy variables for the northern and southern portions (N. Cook, and S. Cook) since these areas have different types of towns and are re-assessed in different years. We also include a variable that measures the distance of each municipality from the center of Chicago in miles (distance).

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rate" in Huddleston (1981 and 1984), is used in Anderson's (1990) empirical study of TIF in Michigan, but is by definition negatively correlated with the municipal tax rate.

[8] See Dye and Sundberg (1998) for an elaboration of this point and Anderson (1990) for a similar school-aid variable.

[9] In much of the analysis it is necessary to combine the similar counties of Kane and McHenry into one dummy variable "McKane," because of the small number of TIF adoptions.

Table 2 presents the results from using these variable to predict the TIF-adoption decision (1=adopted TIF in the 1984 to 1991 period, 0=never adopted TIF) for the 235 sample municipalities using a probit model. The bottom of Table 2 indicates that the model predicts TIF-adoption status correctly in seventy-nine percent of cases. Specifically, 53 of the 81 TIF-adopters were correctly predicted and 132 of the 154 non-adopters were correctly predicted.

Note first from Table 2 that the measure of pre-adoption growth in property values (geav8084) has an insignificant impact on the TIF-adoption choice. Given that the confidence interval around the coefficient on growth includes both positive and negative values, we cannot reject the hypothesis that slow growth motivates the use of development incentives nor can we reject the competing hypothesis that high growth motivates the uses of TIF to capture future increases in tax revenues.

Table 2
Probit Estimation of TIF-Adoption Decision

Variable Category	**Variable**	**Coefficient** (z-ratio)
Prior Growth	geav8084 Growth in EAV 1980-1984	0.04 (1.04)
Fiscal Structure	mrate83 Municipal Tax Rate 1983	0.45 (2.51)
	nmrate83 Non-Municipal Tax Rate 1983	-0.05 (0.35)
	hr83 Home Rule 1983	-0.31 (0.96)
	formula School Aid Formula	0.21 (0.79)
Community Type	pop83 Population 1983	3.00E-05 (2.75)
	pci83 Income Per Capita 1983	-4.58E-05 (1.58)
	prate79 Poverty Rate 1979	-0.02 (1.00)
	nrshare83 Non-Residential Share EAV 1983	0.01 (2.03)
Location	eav83area EAV Density 1983	4.10E-09 (0.43)
	Dupage county	-0.08 (0.20)
	Lake county	-0.42 (0.77)
	Mchenry or Kane County	-1.60 (2.24)
	Will County	-0.66 (1.24)
	North Cook county	-0.41 (1.05)
	Distance from CBD	0.01 (0.49)
Intercept	constant	-0.971 (0.81)
	Number of observations	235
	chi^2(15)	58.81
	Prob. > chi^2	0.0000
	Pseudo R^2	0.2635
	TIF Adoptors	**Non-Adoptors**
# Predicted TIF	53	22
# Predicted Not	28	132
Total	81	154

As predicted, the municipal tax rate (mrate83) has a positive influence on TIF adoption. None of the other measures of fiscal structure-non-municipal tax rates (nmrate83), home-rule status (hr83), equalizing school-aid formula (formula)- have a statistically significant impact on the TIF-adoption choice. Population (pop83) has a strong, positive relationship with TIF adoption-whether out of increased sophistication or increased opportunity. As hypothesized, municipalities with larger shares of non-residential property (nrshare83) are significantly more likely to choose to designate a TIF district. Neither per capita income (pci83) nor the poverty rate (prate79) have a significant impact on the TIF-adoption decision. Among the location measures, only the dummy variable for location in either Kane or McHenry County ("McKane") is significant-with a negative impact on adoption.

V. What is the effect of TIF?

The next question is: Does TIF adoption significantly affect a municipality's EAV growth rate? We have no theoretical prior belief about whether TIF should increase municipal growth rates (by exploiting agglomeration economies), lower growth rates (by encouraging development of economically inefficient blighted areas), or have no effect on growth rates (by merely relocating economic activity geographically).

Raw data on mean annualized EAV growth rates by TIF status, shown in Table 3, suggest that TIF adoption has a devastatingly negative impact on municipal growth. In the pre-TIF period (1980 to 1984) municipalities that would later adopt TIF (TIF adopters) had a slightly higher mean annualized EAV growth rate than municipalities that did not later adopt TIF (4.94% versus 4.47% per year). However, in the post-adoption period (1992 to 1995), the EAV growth rate for TIF adoptors was far lower than for non-adopters (4.96% versus 7.38%).

Table 3
Annualized Growth Rates in Municipal EAV
for 1980-84 (Pre-adoption) and 1992-95 (Post-adoption) Periods
by TIF-Adoption Status

Period	TIF Status	#	Mean	Std. Dev.	Min.	Max.	Median
Pre-adoption 80-4)	TIF Adopters	81	4.94	2.61	-0.38	12.20	5.03
Pre-adoption (80-4)	Non-adopters	154	4.47	3.28	-6.22	20.97	4.48
Post-adoption (92-5)	TIF Adopters	81	4.96	3.32	0.03	19.23	4.07
Post-adoption (92-5)	Non-adopters	154	7.38	5.51	1.03	45.41	5.68
Growth in Non-TIF Portion of Municipal EAV:							
Post-adoption (92-5)	TIF Adopters	81	4.57	2.91	-0.07	15.47	4.08

The bottom row in Table 3 presents the post-adoption EAV growth rate in the non-TIF portion of TIF-adopting communities. This growth rate (4.57) is lower than the overall municipal growth rate of 4.96 since TIF areas grew faster than the municipality average.

On its face, this comparison of pre- and post-adoption means might suggest that TIF adoption costs municipalities more than 2% in EAV growth per year. A little reflection however provides opportunity to temper this conclusion. First, the samples are quite heterogeneous. The standard deviations of the sample means are quite large in all cases and sample means of postadoption growth in EAV of the TIF-adopting and non-adopting municipalities do not differ significantly from each other. In the post-adoption period, median growth rates are much closer than the means. Furthermore, the raw EAV growth rates do not account for any of the other differences between TIF adopting and non-TIF adopting municipalities. We know from Table 2 that TIF-adopting municipalities tend to have higher municipal tax rates, larger populations and are less likely to be located in the relatively rural areas of McHenry and Kane counties. Perhaps it is these characteristics, rather than the existence of a TIF, that resulted in relatively slower EAV growth rates in TIF-adopting communities.

To explore this question in greater depth, we perform statistical analyses designed to control for factors other than TIF that might affect the growth rate of a municipality's EAV. As noted, the concern that municipalities that adopt TIF may be a self-selected sample is addressed in Appendix 3 and test results suggest that self-selection bias is not a problem with this sample.

Our empirical analysis of EAV growth rates in the post-adoption period includes three types of control variables. The community type and community location variables in the growth equations are similar to those in the adoption equations but are measured at the end of the adoption period (1992) rather than the end of the pre-adoption period (1983). The fiscal structure measures that belong in a growth equation are, however, different than for an adoption equation. We hypothesize that growth will be negatively impacted by the aggregate tax rate for the municipality and all of the overlying governments (arate92), but not by the municipal or nonmunicipal rates separately. Also, there is no reason to believe that the range of the school-aid formula will impact growth in property values. Home-rule status (hr93) may affect a municipality's ability to influence its growth rate, and is also a proxy for large size.

Ordinary least-squares regression results are presented in Table 4, where the dependent variable is the annualized growth in total EAV between 1992 and 1995, and Table 5, where the dependent variable is the annualized growth in non-TIF district EAV between 1992 and 1995.

Table 4

Equations for Growth in Total Municipal Property Value 1992-95

Variable Category	**Variable** (t-ratio)	**Specification number:** 1	2	3	4
TIF Status	TIF	-0.79 (1.55)	-1.35 (2.75)	-1.68 (2.17)	-2.18 (2.88)
	tshare92		0.08 (1.98)		0.07 (2.02)
	yearsince			0.20 (1.27)	0.19 (1.22)
Fiscal Structure	hr92	-0.80 (1.72)	-0.79 (1.65)	-0.79 (1.70)	-0.78 (1.62)
	arate92	-0.23 (0.96)	-0.21 (0.87)	-0.22 (0.90)	-0.19 (0.82)
Community Type	pop92	1.10E-06 (0.10)	4.88E-06 (0.46)	-2.23E-06 (0.19)	1.69E-06 (0.15)
	pci89	-7.71E-05 (3.37)	-7.86E-05 (3.43)	-7.54E-05 (3.27)	-7.70E-05 (3.34)
	prate89	1.15E-02 (0.11)	-2.29E-03 (0.02)	8.65E-03 (0.08)	-4.72E-03 (0.05)
	nrshar92	2.04E-03 (0.10)	2.68E-03 (0.13)	2.39E-03 (0.11)	3.00E-03 (0.14)
Location	eav92area	-2.37E-08 (1.91)	-2.48E-08 (2.01)	-2.50E-08 (1.99)	-2.60E-08 (2.07)
	dupage	0.94 (1.06)	1.21 (1.38)	1.02 (1.13)	1.2 8 (1.44)
	lake	3.40 (2.39)	3.77 (2.73)	3.33 (2.33)	3.70 (2.65)
	mckane	2.34 (1.35)	2.77 (1.60)	2.27 (1.30)	2.70 (1.55)
	will	5.13 (4.15)	5.19 (4.17)	5.14 (4.11)	5.19 (4.12)
	ncook	1.43 (1.59)	1.63 (1.82)	1.39 (1.55)	1.58 (1.78)
	distance	0.04 (0.81)	0.03 (0.56)	0.04 (0.83)	0.03 (0.58)
Intercept	constant	8.69 (3.58)	8.70 (3.63)	8.62 (3.53)	8.64 (3.58)
R-squared		0.3689	0.3754	0.3708	0.3771

Table 5
Growth in Non-TIF Total Municipal Property Value 1992-95

Variable Category	**Variable** (t-ratio)	**Specification number:** 1	2	3	4
TIF Status	TIF	-1.31 (2.79)	-1.05 (2.24)	-1.90 (2.43)	-1.66 (2.12)
	tshare92		-0.03 (1.46)		-0.04 (1.50)
	yearsince			0.14 (0.94)	0.14 (0.97)
Fiscal Structure	hr92	-0.89 (1.92)	-0.90 (1.95)	-0.89 (1.90)	-0.89 (1.93)
	arate92	-0.09 (0.43)	-0.11 (0.47)	-0.09 (0.38)	-0.10 (0.43)
Community Type	pop92	4.33E-06 (0.42)	2.60E-06 (0.25)	2.12E-06 (0.20)	2.31E-07 (0.02)
	pci89	-7.98E-05 (3.56)	-7.91E-05 (3.52)	-7.87E-05 (3.51)	-7.79E-05 (3.46)
	Iprate89	-2.37E-02 (0.24)	-1.73E-02 (0.17)	-2.56E-02 (0.26)	-1.91E-02 (0.19)
	Inrshar92	4.15E-03 (0.20)	3.85E-03 (0.18)	4.38E-03 (0.21)	4.09E-03 (0.19)
Location	eav92area	-2.30E-08 (1.93)	-2.25E-08 (1.88)	-2.39E-08 (1.98)	-2.34E-08 (1.94)
	dupage	1.66 (2.02)	1.53 (1.83)	1.71 (2.04)	1.58 (1.86)
	lake	4.31 (3.19)	4.14 (3.04)	4.26 (3.14)	4.08 (2.99)
	mckane	3.25 (1.96)	3.06 (1.78)	3.21 (1.92)	3.01 (1.74)
	will	5.55 (4.52)	5.52 (4.50)	5.55 (4.48)	5.53 (4.47)
	ncook	1.98 (2.29)	1.89 (2.18)	1.95 (2.28)	1.85 (2.16)
	distance	0.02 (0.51)	0.03 (0.61)	0.02 (0.52)	0.03 (0.63)
Intercept	constant	7.58 (3.35)	7.57 (3.33)	7.54 (3.31)	7.53 (3.28)
R-squared		0.3774	0.3788	0.3782	0.3797

Specification 1 of Table 4 shows that the negative association between TIF adoption and growth, shown in Table 3, is substantially reduced but not eliminated by the inclusion of control variables for fiscal structure and community type. [10] According to specification 4.1, municipalities that had a TIF district had 0.79 percent slower annual growth in property values than those that did not. The coefficient on the TIF dummy is marginally significant (the t-statistic of 1.55 represents statistical significance at the 13% confidence level). [11]

The remaining specifications (2-4) in Table 4 have the same fiscal structure, community type, and community location variables as specification 1 but differ in the inclusion of three measures of TIF status: the TIF dummy; the share of total municipal EAV that is within a designated TIF district at the end of the adoption period (tshare92); and the number of years since TIF was adopted to the 1992 beginning of the growth period (yearsince).

Looking past the TIF-status variables, specifications 1-4 of Table 4 have similar results. Neither of the fiscal structure variables have a significant impact on growth. Two of the community type variables-per capita income in 1989 (pci89) and equalized assessed value per square mile at the start of the period (eav92area)-are statistically significant determinants of municipal growth rates. Both variables have negative coefficients, indicating that wealthier and more developed areas grew more slowly than other areas. Municipalities in the relatively rural counties of Lake and Will grew significantly faster than the excluded category of southern Cook County.

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[10] We note that the negative association between TIF adoption and growth in property values is robust to small changes in the independent variables that are included. When we dropped the entire set of fiscal structure variables we obtained coefficients on the TIF variable similar to those reported in Tables 3 and 4. Similarly, when we dropped the entire set of location variables we obtained coefficients on the TIF variable similar to those reported in Tables 3 and 4.

[11] We also experimented with a variable that measured the extent of TIF activity in neighboring communities, but this variable was never significant. Similarly, we examined a set of variables that represented the type of the TIF district, but had insignificant results-see Appendix 4.

TIF districts differ in size. Specification 2, in addition to the TIF dummy variable, includes a measure of the TIF EAV relative to total EAV at the beginning of the period (tshare92).[12] In Table 4 specification 2, the coefficient on the TIF-size variable (tshare92) is positive and significantly different from zero and the coefficient on the simple adopt-or-not dummy variable (TIF) is negative and significantly different from zero. This suggests that imposition of TIF lowers growth but that the magnitude of this effect is reduced as the size of the TIF district increases. This is exactly what one would expect if the main effect of a TIF district is to relocate economic activity within a municipality. The higher the share of the municipality that is in TIF the less inefficient the redistribution of economic activity and the lower the impact of TIF on growth. In the extreme, if the entire municipality was declared a TIF district no redistribution of economic activity would occur and TIF would have no impact on EAV growth. [13]

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[12] The TIF share variable (tshare92), is truncated at zero but we have not adjusted for selection bias. Arguably, we should have a tobit selection equation determining the variable Tshare92 in our growth equation. However, Greene (1995, p. 653) observes that:

> It is possible to use a tobit . . . model as the selection criterion . . . One simple way to estimate this revised model is to reformulate the tobit model as a probit model. We would recode the dependent variable as 0 as before and 1 for the existing [nonzero] observations .... This is a practical solution which may sacrifice some efficiency by discarding information in the dependent variable. This should show up in the standard errors of the selection equation's parameter estimates .... It is not necessarily true through, that there would be any efficiency loss in a finite sample. The reason is that . . ., in a finite sample, this nonlinear function of the parameters of the tobit model may be as variable as the estimates of the probit equation.

Thus, our failure to find sample selection bias using the 0,1 variable for TIF suggests that there is also no sample selection bias with respect to tshare92. We do not think much is to be gained by rerunning tests for sample selection bias with tshare92. Note that exactly analogous issues arise when "years since TIF adoption" is included as an independent variable.

[13] One colleague commented that declaring the entire municipality a TIF district might lower property values because it would inefficiently direct incremental property tax revenues to wasteful development expenditures and thus diminish property values.

It could be argued that it takes time for a TIF project to impact the overall growth rate of a municipality (Wassmer 1994). Accordingly, another measure of TIF-status is the number of years since TIF was first adopted (yearsince). Specification 3 in Table 4 includes both the TIF dummy and the years-since variable. In this specification the TIF dummy is again negative and significant while the years-since variable is insignificant. Finally, specification 4 includes all three TIF-status variables, and again the coefficient on the ever-TIF variable is negative and significantly different from zero.

Does the negative effect of TIF adoption on municipal growth come from slow property value growth within the TIF district borders or from slow property value growth in the rest of the municipality? Table 5 presents OLS regression results with the same four specifications as in Table 4, but a dependent variable that measures growth in non-TIF municipal EAV (total EAV minus TIF-district EAV). The coefficient on the ever-TIF variable in Table 5 is significantly negative in every specification. These regression results bolster the hypothesis that TIF redirects economic activity to TIF designated areas at the expense of the rest of the city. Specification 1 of Table 5 indicates that there is a significant decline in EAV growth in non-TIF areas when TIF is imposed in the city.

The higher the share of EAV in the TIF area the greater the decline in growth in the nonTIF area; as shown in specification 2 of Table 5. Comparing specification 2 of Tables 4 and 5, note the sign reversal on the coefficient of tshare92. This is exactly as we would expect if TIF resulted in relocation of economic activity from other parts of the city into the TIF district. For the municipality as a whole (Table 4) the coefficient on tshare92 is positive because larger TIF districts make it more likely that relocating businesses will find a suitable location in the TIF district. For the non-TIF portion of the city (Table 5), the coefficient on tshare92 is negative because larger TIF districts result in more competition for areas that do not have a TIF district.

In Table 5, the number of years since the TIF was established (yearsince) is not a significant determinant of property value growth either in specification 3 or 4.

If the use of tax increment financing spurs economic development that would not have happened but for the public expenditures, we would expect (after controlling for other growth determinants and for self-selection) a positive relationship between TIF adoption and growth. If the use of tax increment financing merely moves capital around within a municipality, relocating improvements from non-TIF areas of the town to within TIF district borders without changing the productivity of that capital, we would expect (after appropriate controls) to find a zero relationship between TIF adoption and growth. What we find, however, is a negative relationship between TIF adoption and growth. This is consistent with the hypothesis that government subsidies reallocate property improvements in such a way that capital is less productive in its new location. (See Appendix 1 for a formal presentation of this argument.)

This "inefficient relocation of development" explanation is consistent with the result that the negative relationship between TIF and property value growth is stronger outside the TIF district (Table 5) than for municipality-wide (Table 4). It also explains why the coefficient on the TIF-size variable (tshare92) is positive in specification 2 of Tables 4 and negative in specification 2 of Table 5-TIF subsidies might be helping growth within the district, but they are hurting growth outside the district by a larger amount.

VI. Comparison with other studies.

Our results are consistent with Dardia (1998) and also may be consistent with Wassmer (1994). Dardia studied a matched sample of California parcels, some of which were in designated TIF districts. He found that the parcels in TIF districts grew more rapidly than their matched pairs. Dardia did not test or control for sample selection bias. Hence it is not possible say whether the relationship he found is causal. We find that TIF districts grow faster than their surrounding cities so it would not be surprising if they also grew faster than similar areas located in other cities. However, we find that TIF district growth comes at the expense of surrounding properties-a relationship Dardia did not explore.

Wassmer (1994) studied economic development incentives in 25 cities in the Detroit, Michigan area. He found that (p. 1268): "Evaluated at the mean of the local characteristics, . . . of the . . . 12 significant cases, there were 7 instances of a negative relationship between an [economic development] incentive offer and local development." However, Wassmer goes on to conclude that (p. 1268): "it is unlikely that a negative relationship indicates that the incentive caused a decline in economic activity, but only that it was correlated with it." We do not think a negative impact should be so quickly dismissed in light of the theoretical argument (Appendix 1) that economic development incentives may cause a decline in EAV growth in non-target areas.

Anderson (1990) did not use his empirical results to explore whether TIF adoption caused changes in property value growth in his sample of Michigan cities. Man and Rosentraub (1998) studied changes in median housing prices in a sample of 151 Indiana cities, 23 of which adopted TIF during the 1980s. There are a number of reasons why their study is difficult to compare to ours. They focus on a different dependent variable (median house prices) and study a state (Indiana) with different fiscal institutions. Most notably, "Indiana does not require a finding of blight for the creation of a TIF program" (Man and Rosentraub, p. 538). Theirs is a statewide sample while ours has the advantage of being limited to cities in the same metropolitan area.

The salient finding in our study of TIF in northern Illinois municipalities is of a dative relationship between TIF adoption and growth rates. So in our case, the causation question becomes: Does TIF adoption depress growth by inefficiently allocating government and private resources (a game with losses) or is TIF adoption a policy handle grasped at by those facing depressed growth due to other forces (a game played by losers)? The "other forces" explanation is diminished by the result that the negative relationship persists with extensive controls for fiscal structure, community type, and community location. Statistical techniques using extensive controls for the pre-adoption period reject the hypothesis of sample-selection bias. Taken together, the results are consistent with the hypothesis that TIF-adoption causes depressed growth rates.

VII. What did we learn from this?

We find clear and consistent evidence that municipalities that adopt TIF grow more slowly after adoption than those that do not. Between 1980 and 1984 municipalities that would later adopt TIF (adopters) had a mean EAV growth rate nearly equal to those municipalities that later did not adopt TIF (non-adopters). However, between 1992 and 1995 adopters grew substantially slower than non-adopters (4.96% versus 7.38%). We find no evidence that sampleselection bias explains the relatively slow growth of TIF adopters. Even after controlling for a variety of municipal characteristics, TIF-adopters grew 0.79% per year less than non-adopters (Table 4 specification 1). Using the same set of controls, property values in non-TIF areas of the city for TIF-adopters grew 1.31 % per year less than for non-adopters (Table 5 specification 1).

These findings suggest that TIF trades off higher growth in the TIF district for lower growth elsewhere. This hypothesis is bolstered by other empirical findings. The larger the share of a municipality's EAV that is in the TIF district the slower is the growth in the area of the city but outside the TIF district (Table 5 specification 2).

Although we cannot unequivocally rule out the possibility of other sorts of specification or omitted-variables bias, the simplest explanation for our results is that TIF-adoption causes depressed assessed value growth rates. Our empirical results are most consistent with the "blighted area" or redistributive motive for economic development incentives discussed in section I. Targeted areas gain from TIF at the expense of non-target areas. Our empirical results reject both the market failure (target areas gain with no loss elsewhere) and bidding war (EDI's have no net impact on target or non-target areas) explanations. Some of our empirical findings (particularly the findings reported in Tables 4 and 5) are consistent with the revenue shifting explanation for TIFs. However, we reject revenue shifting as a goal of TIF adoption on the basis of the results reported in Table 2. These findings indicate that prior growth rates and the nonmunicipal tax rate do not significantly increase the probability that a municipality will adopt TIF.

In summary, the empirical evidence suggests that TIF adoption has a real cost for municipal growth rates. Municipalities that elect to adopt TIF stimulate the growth of blighted areas at the expense of the larger town. We doubt that most municipal decision-makers are aware of this tradeoff or that they would willingly sacrifice significant municipal growth to create TIF districts. Our results present an opportunity to ponder the issue of whether, and how much, overall municipal growth should be sacrificed to encourage the development of blighted areas.

Appendix 1. How does tax increment financing affect the rate of growth of a city's EAV?

TIF provides a mechanism that governments can use to target existing government revenues into particular geographic areas. As such, TIF is a device for reallocating existing government revenue rather than raising new revenue. Will reallocation of government revenues raise or lower a city's growth rate? If so, by how much.

In this section we present a bare bones theoretical model to examine the impact of a reallocation of government revenues toward areas with poor development prospects. This is a formalization of the blight or redistributive motive for TIF adoption discussed earlier in the paper. We use the model to argue that, contrary to received wisdom, it is possible for such redistribution to lower a city's economic output-as is common in economic policy choices, equity comes at the expense of efficiency. We simulate the magnitude of this effect from our parameter estimates.

Consider a town that has s square miles of blighted area, which will receive an increase in government funds when the TIF is put in place, and (1-s) square miles of non-blighted area, which will lose government funds when the TIF is activated. We specify the production functions for these areas as:

(1) blighted area output per square mile, $Y_B = \grave{e}f\ (K_B,\ G_B)$,
(2) non-blighted area output per square mile, $Y_{NB} = f\ (K_{NB},\ G_{NB})$.

Where:
Y = tctal output = $sY_B+(1\text{-}s)Y_{NB}$,
K = capital (or improvements) per square mile, G = government spending per square mile, 8 = efficiency parameter (productivity in blighted area as a percentage of productivity in nonblighted area, presumably è<1).

We specify two equilibrium conditions for the model:
(a) equimarginal allocation, $f_{K_{NB}} = \grave{e}fK_B = MP_K$,
(b) fixed government spending, $G = sG_B + (1\text{-}s)G_{NB}$.

Condition (a) assumes that the market for private capital is perfectly competitive so that the marginal product of capital in the region determines the marginal products in blighted and non-blighted areas. This condition may fail in the short-run, since improvements tend to be imperfectly mobile, but we believe it is approximately true for the long-run case on which we focus.

Condition (b) states that the total amount of government spending is unchanged by TIF. This may be a controversial assumption since some analysts believe that municipal governments use TIF to "capture" the revenue of overlying governments such as school districts. In this case, municipal governments might spend more while school districts spend less as the result of a TIF project. We wish to keep our model simple and consider only a single kind of government spending. [14]

Given equations (1) and (2) and assumptions (a) and (b), how does a TIF district that increases the share of government capital that goes to the blighted areas *(GB)* affect output in the city?

With a little algebra (see the derivation at the end of this Appendix) it can be shown that:

$$(3)\quad \frac{dY}{dG_B} = s\left[\left(MP_K * \Delta K\right) + \left(\theta f_{G_B} - f_{G_{NB}}\right)\right]$$

The first term inside the brackets is the marginal product of capital times OK, the change in the amount of capital in the city as a result of the TIF. OK can be positive (if more private capital is attracted to the blighted area than leaves the non-blighted area), negative (if more private capital leaves the non-blighted area due to decreased government services than is attracted to the blighted area), or zero (if the two effects balance). Thus, the first term may have either sign.

The second term inside the brackets in equation (3) is the difference between the marginal product of government capital in the blighted and non-blighted areas. This term also may be either positive or negative. While the scarcity of government services in blighted areas increases its marginal product, negative externalities in these areas may lower the marginal product of government spending.

In summary, from a theoretical perspective we cannot rule out the possibility that increased government spending in blighted areas will lower output in the city. In general, a decline in output will also result in a decline in equalized assessed values (EAV).

What do our empirical findings imply about the trade-off between the decline in EAV growth in the non-TIF area and growth in TIF area? The simulation below presents a simple application that gives some perspective to the parameter estimates reported in Tables 4 and 5. [15]

	Property Value in Year 1	**Property Value in Year 2**	**Annual Percentage Growth in Property Value**
Growth in property values if TIF is not adopted:			
Non-TIF Area	$ 95,000,000	$ 115,108,699	6.40%
TIF Area	$ 5,000,000	$ 6,058,353	6.40%
Total	$ 100,000,000	$ 121,167,052	6.40%
Growth in property values if TIF is adopted:			
Non-TIF Area	$ 95,000,000	$110,672,666	5.09%
TIF Area	$ 5,000,000	$7,656,488	14.20%
Total	$ 100,000,000	$118,329,154	5.61%

[14] If school district spending creates human capital that stays in the local area, this kind of qualitative shift in the type of government spending could result in diminished productivity-the same result derived with the narrower assumptions of this section.

[15] We thank Peter Bernstein for suggesting this method of looking at our results.

The simulation assumes that, in the absence of TIF, all parts of the municipality would have grown at the pre-TIF growth rate of about 6.4 percent. 16 Once tax increment financing is adopted, the post-TIF growth rate for the municipality as a whole falls by 0.79 percent (from Table 4 specification 1), while the post-TIF growth rate of the non-TIF portion of the municipality falls by 1.31 percent (from Table 5 specification 1). The annual growth in the TIF portion of the municipality is more than 14 percent per year (calculated from the difference between total and non-TIF property values in year 4). 17

The large increase within the TIF district may look like success to naive policymakers, but it is only part of the impact on the larger community. Our results suggest that the TIF area gain of $1.6 million in property value ($7.7 million minus $6.1 million) costs the non-TIF area $4.4 million (a decline from $115.1 million to $110.7 million). This seems a heavy price to pay to redistribute economic activity.

[16] The 6.4 percent benchmark is chosen to be close to the 6.2 percent average of post-adoption growth for TIFadoptors and non-adoptors from Table 2 and the 6.6 percent growth rate for the City of Chicago from the next footnote.

[17] These simulated magnitudes appear to correspond well with the real-world experience of the City of Chicago, which, though not in our data set, is an aggressive user of tax increment financing. In 1996, 4.9 percent of the City's EAV was in TIF districts. The growth in EAV for the City as a whole was 5.7 percent (down from 6.6 percent in 1993) while the growth in EAV in TIF districts was 10.9 percent (down from 17.3 percent in 1993). (City of Chicago 1998.)

Derivation of equation (3).

Note that:

(A1) $$\frac{dY}{dG_B} = s\frac{dY_B}{dG_B} + (1-s)\frac{dY_{NB}}{dG_B}.$$

From the equilibrium condition (b) (1-s)dG_{nb}=-sdG_b so equation (A1) can be rewritten as:

(A2) $$\frac{dY}{dG_B} = s\frac{dY_B}{dG_B} - s\frac{dY_{NB}}{dG_{NB}}.$$

Totally differentiate equation (1) to get:

(A3) $$dY_B = \theta\left(f_{K_B}\frac{\partial K_B}{\partial G_B} + f_{G_B}\right)dG_B = \theta\left(\frac{MP_K}{\theta}\frac{\partial K_B}{\partial G_B} + f_{G_B}\right)dG_B .$$

Totally differentiate equation (2) to get:

(A4) $$dY_{NB} = \left(f_{K_{NB}}\frac{\partial K_{NB}}{\partial G_{NB}} + f_{G_{NB}}\right)dG_{NB} = \left(MP_K\frac{\partial K_{NB}}{\partial G_{NB}} + f_{G_{NB}}\right)dG_{NB}.$$

Combine equations (A2), (A3) and (A4) to get:

(A5) $$\frac{dY}{dG_B} = s\theta\left(\frac{MP_K}{\theta}\frac{\partial K_B}{\partial G_B} + f_{G_B}\right) - s\left(MP_K\frac{\partial K_{NB}}{\partial G_{NB}} + f_{G_{NB}}\right),$$

which can be rewritten as:

(A6) $$\frac{dY}{dG_B} = s\left[MP_K\left(\frac{\partial K_B}{\partial G_B} - \frac{\partial K_{NB}}{\partial G_{NB}}\right) + \left(\theta f_{G_B} - f_{G_{NB}}\right)\right].$$

Equivalently:

(A7) $$\frac{dY}{dG_B} = s\left[\left(MP_K * \Delta K\right) + \left(\theta f_{G_B} - f_{G_{NB}}\right)\right],$$

Where $\Delta K = \left(\frac{\partial K_B}{\partial G_B} - \frac{\partial K_{NB}}{\partial G_{NB}}\right)$ = the net change in capital in the city resulting from the TIF.

Appendix 2. The extent of tax increment financing in northeastern Illinois.

Table A.2.1 gives some insight into the extent of TIF in the state of Illinois and our northeastern Illinois sample, which includes Cook County, home to the City of Chicago, and the surrounding collar counties of Du Page, Lake, Kane, McHenry, and Will.

Table A.2.1: Tax Increment Financing in Illinois
(Tax Year 1995)[18]

	Number of Municipalities	Number of Municipalities with TIF	Number of TIF Districts	TIF Taxes as share of total Property taxes	Number of Municipalities in Sample
Cook County	118	69	150	2.4%	107
Collar Counties	147	38	54	0.8%	128
Rest of Counties	1021	116	194	1.5%	0
State Total	1286	223	398	1.8%	235

As of 1995, there were 398 TIF districts in Illinois. With some municipalities having more than one TIF district, only 223 of the total number of 1,286 municipalities in the state had TIF districts. The value of property taxes collected by TIF districts in Illinois represented 1.8% of the total value of all local government property tax collection in the state. For older, industrialized Cook County, TIF taxes represented a higher share, 2.3%, of total property tax collections.

We have compiled a multiyear database for Cook and the collar counties that links property tax and other information for each municipality, each TIF district, and all other local governments in the region. The link to other governments is important because the TIF district collects revenues based on the aggregate tax rate of all overlying jurisdictions. (For a more detailed description of the database see Dye 1997.)

[18] In Illinois, a "tax year" is the year in which property is assessed. Taxes are actually collected in the following calendar year.

After excluding cases with problematic data, the sample includes 235 of the 265 total number of municipalities in Cook and the collar counties. [19] Table A.2.2 shows the breakdown of the sample's 81 TIF-adopting municipalities by the year in which they first adopted tax increment financing.

Table A.2.2
Number of Sample Municipalities
by Year of First TIF Adoption

	TIF Adoptors									**Non-**
	1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**Total**	**Adoptors**
Cook	4	4	12	11	7	2	11	3	54	53
Collar	1	2	8	2	3	5	5	1	27	101
Total	5	6	20	13	10	7	16	4	81	154

For each of the municipalities in the sample, information is available on TIF status, equalized assessed property value (EAV), location, population, income, tax rates, non-residential share of EAV, sales tax collections, home-rule status, and school-aid status. We have annual data from 1980 to 1995 that we divide into a pre-adoption period (1980-83), an adoption period (1984-91), and a post-adoption period (1992-95). This data set is used to examine two separate but possibly interrelated questions: the determinants of the TIF-adoption decision and the impact of TIF-adoption on subsequent growth.

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[19] The sample excludes: Chicago, which is not useful for comparative purposes due to its size and central-city status; three municipalities that first adopted TIF prior to 1983 and thus have incomplete information on pre-adoption growth rates; ten municipalities that first adopted TIF in 1992 or 1993 and thus have incomplete information on postadoption growth rates; and sixteen others with missing or incomplete data on key variables.

Appendix 3. Comparison of econometric models and tests of sample selection bias.

In this Appendix, we present a brief comparison of our econometric model with that used by Anderson (1990). We model city growth rates with a self-selected TIF treatment while Anderson models growth rates of two different (self-selected) populations: TIF cities and non-TIF cities.

Let: y = growth rate in EAV,
X = vector of independent variables describing city,
Z = a (potentially) different vector of independent variables describing city.

Anderson's Model (structural probit):

TIF Cities (Al) y_{1i} = $\hat{a}_1$' X_{1i} + ì $_{1i}$.

Non-TIF cities (A2) y_{2i} = $\hat{a}_2$' X_{2i} + ì $_{2i}$.

All Cities (A3) C_i = á'Z_i + ä(y_{1i} - y_{2i}) + ì $_i$.

All Cities (A4) TIF_1 = 1 if $C_i > k$ and TIF = 0 if $C_i < k$.

(Where k is the threashold value at which TIF is adopted.)

Allows for the non-zero correlation of ì $_{1i}$ ì $_{2i}$ and ì $_i$.

Unbiased estimation of the parameters (31 and (32 necessitates computation of a variable lambda calculated using the coefficients and residuals from (A3). (See Anderson 1990 and Greene 1993, pp.708-713, for details.)

Dye and Merriman's Model (self-selected treatment effect):

All cities (DM1) y_1 =$\hat{a}_1$' X_i+ðTIF$_i$+å$_i$.

All cities (DM2) TIF$_i$*=ã'Z$_i$+ù $_i$.

All cities (DM3) TIF$_I$ = 1 if TIF_i* > k and z = 0 if TIF_i* < k .

Allows for the non-zero correlation of ù $_i$ and å$_i$.

Unbiased estimation of the parameters $\hat{a}_1$ necessitates computation of a variable lambda calculated using the coefficients and residuals from (DM2). (See Greene 1993, pp. 713-714, for details.)

Note that these two modeling approaches are less different than they might at first appear, since the vector Z may contain all of the variables in vector X. Since y is a function of X, equation (DM2) is a reduced form of equation (A3).

The main difference in the two approaches is that the self-selected treatment effect model enforces equal coefficients on non-TIF variables for TIF and non-TIF cities (equation DM I) while Anderson allows the coefficients to differ (equations A1 and A2).

We present the results obtained by replicating Anderson's method with our data set in Table A.3.1 columns 1 (equation Al) and 2 (equation A2). The results obtained using the selfselected treatment effect are presented in Table A.3.1 column 3 (equation DM 1). In all cases, the results cannot reject the hypothesis of no sample selection bias.

Why do we find no sample selection bias while Anderson found significant evidence of this bias? A finding of no sample selection bias indicates that the error term in the propertyvalue growth equation is uncorrelated with TIF adoption. Sample selection bias may occur when few controls on community characteristics are available. For example, suppose no data is available on income and that low-income municipalities both grow faster and are more likely to adopt TIF compared with other municipalities. A property-value growth regression that excludes income will exhibit sample-selection bias because the error term will be correlated with TIF status. However, if income is included in the property-value growth regression the sample-selection bias vanishes—holding income constant there is no correlation between TIF status and the error term.

Table A.3.1
Growth in Municipal Property Value 1992-95
With Selectivity Correction Variable

Specification:		Al	A2	DMI
Sample:		TIF=1	TIF=0	Full
Variable Category	**Variable**	(t-ratio)	(t-ratio)	(z-ratio)
TIF Status	TIF			-3.21
				(1.17)
Fiscal Structure	hr92	-0.44	-1.08	-0.81
		0.64	0.91)	(1.07
	arate92	-0.82	0.17	-0.18
		(3.84)	(0.44)	(0.81)
Community Type	pop92	2.37E-05	2.54E-05	2.13E-05
		0.74	(0.44)	(0.69)
	pci89	-2.38E-04	-6.63E-05	-8.49E-05
		3.26	(1.54)	(2.57)
	povrate89	0.22	-1.23E-02	1.64E-02
		(2.45)	(0.14)	(0.25)
	nrshare92	-5.95E-02	2.88E-021	7.71E-03
		(3.14)	(1.17)	(0.45)
	eav92area	1.00E-08	-3.10E-08	-2.29E-08
		(0.68)	(1.54)	(1.68)
Location	dupage	-2.57	2.551	0.75
		(2.27)	(1.21)	(0.58)
	lake	-1.08	4.63	2.97
		-0.63	2.10)	2.01)
	mckane	I -3.74	3.18	1.53
		(1.48)	(1.10)	(0.82)
	will	0.63	6.35	4.73
		(0.40)	(2.81)	(3.12)
	ncook	-1.22	2.50	1.15
		(1.16)	(1.28)	(0.98)
	distance	-0.08	0.03	0.04
		(1.60)	(0.45)	(0.90)
Intercept	constant	14.61	4.81	8.89
		(3.99)	(1.04)	(3.00)
Selectivity	lambda	2.16	-1.79	1.49
		(1.35)	(0.59)	(0.91)
R-squared		0.60	0.32	0.37
N		81	154	235

*Using OLS, R-squared is not bounded in [0,1] in specification 3.

While we have many controls for community characteristics, Anderson included only four independent variables in his growth equations. Our richer data set allows us to control for differences in income and location more precisely. This difference may explain our failure to find evidence of sample-selection bias.

In a recent paper, Man and Rosentraub (1998) studied changes in median housing prices in a sample of Indiana cities, some of which adopted TIF. Like Anderson, Man and Rosentraub found evidence of negative sample selection bias. Even though Man and Rosentraub have many control variables, as discussed in section VI of the text, there are a number of reasons why their study is difficult to compare to ours.

Appendix 4. Type of TIF District and impact on neighboring communities.

The types of projects supported with tax increment financing vary. A categorization of the types of TIF districts is available from the Illinois Department of Commerce and Community Affairs. With some of the 81 TIF-adopting municipalities having multiple TIF districts and with some of the codes specifying multiple uses, the frequency of the different categories is as follows:

Central Business District (CBD)	26
Commercial	17
Industrial	13
Housing	4
Other (missing or "mixed use")	54

The large number of TIF districts that fall in the "other" category obviously limits the usefulness of this information.

Table A.4.1 shows the impact of adding dummy variables representing each of these TIFtype categories to estimates of the post-adoption period growth rate in municipal-wide property values (specification 1 of Table 4). None of the ever-TIF dummies or the TIF-type dummies is significant at the 5% confidence level, but the coefficient on the commercial TIF district variable in the second column is negative and significant at the 8% confidence level.

Table A.4.2 shows the impact of adding the TIF-type variables to estimates of the postadoption period growth rate in property values in the non-TIF portion of the municipality (specification 1 of Table 5). Except in the last column with the highly collinear other-TIF variable, the coefficients on the ever-TIF variables are significantly negative. Although significant at only the 20% confidence level, the coefficient on the commercial TIF district variable in the second column adds to the negative effect of TIF adoption on growth.

The data is limited and the results are not highly significant, but the implication is that the use of TIF for commercial development is particualrly problematic for municipal growth.

Table A.4.1
Growth in Total Municipal Property Value 1992-95
(Table 4 Specification 1 plus
Dummy Variable for TIF Type)

Variable Category	**Variable** (t-ratio)	**TIF Type** CBD	Commercial	Industrial	Housing	Other
TIF Status	TIF	-1.00 (1.78)	-0.52 (1.06)	-0.82 (1.68)	-0.75 (1.43)	-0.24 (0.30)
	Type Dummy	0.70 (1.12)	-1.43 (1.76)	0.22 (0.22)	-0.67 (1.19)	-0.82 (1.10)
Fiscal Structure	hr92	-0.80 (1.72)	-0.81 (1.75)	-0.80 (1.71)	-0.79 (1.71)	-0.84 (1.80)
	arate92	-0.25 (1.00)	-0.23 (0.98)	-0.23 (0.96)	-0.23 (0.96)	-0.24 (0.99)
Community Type	pop92	-1.55E-06 (0.14)	3.57E-06 (0.34)	9.48E-07 (0.09)	1.04E-06 (0.10)	1.36E-06 (0.13)
	pci89	-7.84E-05 (3.38)	-7.81E-05 (3.39)	-7.73E-05 (3.38)	-7.66E-05 (3.32)	-7.75E-05 (3.39)
	prate89	1.26E-02 (0.12)	1.62E-02 (0.15)	1.10E-02 (0.11)	1.08E-02 (0.10)	1.36E-02 (0.13)
	nrshar92	2.48E-03 (0.12)	3.62E-03 (0.17)	1.70E-03 (0.08)	2.25E-03 (0.11)	8.21E-04 (0.04)
Location	eav92area	-2.41E-08 (1.94)	-2.41E-08 1.94)	-2.35E-08 (1.88)	-2.37E-08 (1.91)	-2.34E-08 (1.89)
	dupage	0.81 (0.91)	0.88 (1.00)	0.94 (1.05)	0.91 (1.01)	0.78 (0.87)
	lake	3.29 (2.32)	3.54 (2.49)	3.40 (2.38)	3.36 (2.33)	3.36 (2.35)
	mckane	2.24 (1.28)	2.41 (1.40)	2.33 (1.33)	2.29 (1.31)	2.36 (1.35)
	will	5.01 (3.94)	5.12 (4.10)	5.13 (4.12)	5.12 (4.12)	5.12 (4.11)
	ncook	1.35 (1.54)	1.69 (1.84)	1.43 (1.58)	1.43 (1.58)	1.27 (1.40)
	distance	0.04 (0.78)	0.04 (0.82)	0.04 (0.82)	0.04 (0.83)	0.03 (0.67)
Intercept	constant	8.99 (3.60)	8.58 (3.56)	8.70 (3.58)	8.66 (3.56)	8.97 (3.63)
R-squared		0.3701	0.3730	0.3689	0.3691	0.3707

Table A.4.2

Growth in Non-TIF Municipal Property Value 1992-95
(Table 5 Specification 1 plus
Dummy Variable for TIF Type

Variable Category	**Variable** (t-ratio)	**TIF Type** CBD	Commercial	Industrial	Housing	Other
TIF Status	TIF	-1.38 (2.51)	-1.11 (2.55)	-1.24 (2.70)	-1.34 (2.83)	-0.59 (0.85)
	Type Dummy	0.23 (0.40)	-1.05 (1.28)	-0.46 (0.61)	0.73 (0.63)	-1.08 (1.78)
Fiscal Structure	hr92	-0.89 (1.92)	-0.90 (1.94)	-0.90 (1.93)	-0.89 (1.92)	-0.95 (2.04)
	arate92	-0.10 (0.44)	-0.10 (0.44)	-0.09 (0.42)	-0.09 (0.42)	-0.10 (0.47)
Community Type	pop92	3.46E-06 (0.32)	6.14E-06 (0.60)	4.66E-06 (0.45)	4.40E-06 (0.43)	4.67E-06 (0.45)
	pci89	-8.02E-05 (3.55)	-8.05E-05 (3.57)	-7.94E-05 (3.55)	-8.04E-05 (3.56)	-8.03E-05 (3.59)
	prate89	-2.33E-02 (0.23)	-2.02E-02 (0.20)	-2.26E-02 (0.22)	-2.29E-02 (0.23)	-2.09E-02 (0.21)
	nrshar92	4.29E-03 (0.20)	5.30E-03 (0.25)	4.87E-03 (0.23)	3.92E-03 (0.19)	2.54E-03 (0.12)
Location	eav92area	-2.32E-08 (1.92)	-2.33E-08 (1.94)	-2.34E-08 (1.93)	-2.30E-08 (1.92)	-2.26E-08 (1.89)
	dupage	1.61 (1.98)	1.61 (1.99)	1.66 (2.03)	1.69 (2.04)	1.45 (1.79)
	lake	4.27 (3.17)	4.41 (3.23)	4.31 (3.19)	4.35 (3.19)	4.25 (3.16)
	mckane	3.22 (1.92)	3.31 (2.00)	3.28 (1.98)	3.31 (1.98)	3.28 (1.97)
	will	5.51 (4.41)	5.54 (4.48)	5.57 (4.55)	5.56 (4.53)	5.53 (4.46)
	ncook	1.95 (2.31)	2.17 (2.40)	1.99 (2.30)	1.99 (2.29)	1.77 (2.05)
	distance	0.02 (0.50)	0.02 (0.52)	0.02 (0.49)	0.02 (0.47)	0.02 (0.36)
Intercept	constant	7.68 (3.30)	7.50 (3.32)	7.56 (3.33)	7.61 (3.36)	7.95 (3.52)
R-squared		0.3775	0.3796	0.3777	0.3777	0.3806

We also created a variable that we call nearTIF. This variable was designed to measure the amount of TIF activity that is outside the border of, but within the vicinity of each municipality. This variable is defined by:

$$\text{neartif}_i = \sum_{\substack{j=1 \\ i \neq j}}^{259} \textbf{tifeav}_j \left(\frac{1}{1 + \left(.25 D_{ij}\right)^{(3)}} \right)$$

Where

Neartif_i=value of neartif in municipality i.

Tifeav_j=the equalized assessed value of property within a TIF district at the start of the post-adoption period (1992) in municipality j. (The set of municipalities included in j includes all municipalities in the six county Chicago metropolitan area for which we could obtain longitude and latitude data except the City of Chicago. Thus, j includes some municipalities that had missing or problematic data on variables other than tifeav.)

D_{ij}=distance from the border of municipality i to the (population weighted) center of municipality j.

Distance was measured as:

$$D_{ij} = \max\left\{0, \left[\left(\sqrt{\left[69 * (L_i - L_j)\right]^2 + \left[52 * (\Lambda_i - \Lambda_j)\right]^2}\right) - \sqrt{\left(\frac{\text{area}_i}{\Pi}\right)}\right]\right\}$$

where L_i= latitude at the population weighted center of community i multiplied by 69 to convert it to approximate miles.

Ë =longitude at the population-weighted center of community i multiplied by 52 to convert it to approximate miles.

Area_i=the geographic area (in square miles) of community i.

Our calculation of the distance from the center of municipality i to the center of municipality j uses the Pythagorean theorem. We assume that municipality i is approximately circular in shape so that the distance from the center of municipality i to its border is approximately equal to the square root of its area divided by pi. Since not all municipalities are circular in shape this may result in a negative distance. Thus, we take the maximum of our measure of distance and zero. Only 20 of the 67,081 distances we calculated were set to zero.

Data on geographic area and on the population-weighted longitude and latitudes were obtained from GEOCORR Geographic Correspondence Engine which is at the World Wide Web site http://www.census.gov/plue.

The intuition for our neartif measure is that the term $\left(\frac{1}{1+\left(.25D_{ij}\right)^{(3)}}\right)$ is a weight attached to municipality j's TIF district. The larger is Dii the lower is the weight attached to the TIF as shown in the table below:

Weight given to TIF as a function of distance

D_{ij} (miles)	Weight= $\left(\frac{1}{1+\left(.25D_{ij}\right)^{(3)}}\right)$
0	1
5	0.34
10	0.06
20	0.01

A TIF on the border of community i (D_{ij}=0) is given a weight of 1. At a distance of five miles we assume the weight is only about one-third, and at ten miles we assign a weight of about one-seventeenth. TIF districts more than 20 miles from the border are assumed to have virtually no impact on the home city's growth.

We included this variable in a variety of regression specifications similar to those shown in Tables 4 and 5. The coefficient on nearTIF was never significantly different from zero and did not substantially alter the coefficients of other variables in the equations.

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