TAX INCREMENT FINANCING, SPILLOVERS, AND SCHOOL DISTRICT REVENUE

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INTRODUCTION AND BACKGROUND

Over the years the urban development financing tool known as Tax Increment Finance (TIF) has been a controversial topic as it relates to fiscal impacts on school districts. The essential point of concern is about TIF effects on tax revenue. This paper addresses an important question related to this issue: Does TIF affect non-TIF district property value within the school district? The question is explored by developing a theoretical model that describes the relationship between TIF and school finance and estimating an empirical model that tests the hypotheses stemming from the theoretical model. Although the results are mixed, there is some evidence that TIF does affect non-TIF district property value in the school district.

The theoretical model describes the spillover effect of TIF on non-TIF district property values, permitting nonlinear spillover effects on the growth rate of non-TIF district property values. Testable hypotheses that flow from this model indicate that at lower levels of TIF intensity the spillover effect is positive, but at higher levels the spillover effect is negative. This theoretical result leads to exploration of the optimal TIF intensity that maximizes the positive spillover effect.

Using data from Minnesota school districts for the years 1992 through 2007, we estimate the relationship between non-TIF district property value growth for school districts and a measure of TIF intensity. Five regressions have statistically significant results supporting the theoretical model's testable hypotheses. Using the coefficient estimates from estimated equations, the optimal TIF intensity was 21 percent in 1993, 15 percent in 1996, 10 percent in 2000, 8 percent in 2002, and 6 percent in 2003. These results indicate that over time the optimal TIF intensity decreased.

Previous Literature

School districts first entered the TIF literature as part of a concern that overlapping jurisdictions may subsidize TIF districts (Huddleston 1981, 1984). This relationship stimulated interest in the relationship between TIF and city population growth. Anderson (1990) finds evidence supporting the relationship between TIF use and property value growth, but cautions against concluding that TIF causes growth. He suggests that TIF authorities may be capturing growth that would have occurred otherwise. Man and Rosentraub (1998) also find a positive relationship between TIF adoption and property value growth. Dye and Merriman (2000), however, find evidence of a negative relationship and suggest the cost of higher growth in the TIF district is lower growth elsewhere in the city. Skidmore et al. (2009) confirm this, finding that TIF decreases growth in non-TIF property value of the city but increases growth in total property value of the city. Weber et al. (2007) find evidence of negative spillovers from commercial or industrial TIF districts and positive spillovers from mixed-use TIF districts that contain both commercial and residential property. These spillover effects have important implications for school finance. Since non-TIF property value is not frozen, increases or decreases due to spillovers from TIF increase or decrease the school district's tax base. Our model extends the current literature by showing the impact of TIF on school finance through spillover effects.

A MODEL OF PROPERTY VALUE WITH TIF AND SPILLOVER EFFECTS

The theoretical model developed in this paper shows the effect of TIF on expenditures per pupil via spillovers. It includes the school district's budget constraint and incorporates the spillover effects

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of Skidmore et al. (2009), extending the effects to the entire school district.

School District Expenditures Per Pupil Without TIF

The school district's budget constraint is an identity that reflects the equality of a school district's total revenue and total expenditure. The school district's budget constraint is

$$(1)\quad K(s) = F_l + F_s + F_f,$$

where total expenditures, $K(s)$, equals revenue from local sources F_l, state sources, F_s, and federal sources, F_f.

Local revenue is determined by applying a local tax rate, t_l, to all property in the school district,

$$(2)\quad F_l = t_l V.$$

In some states, state funding is also a function of local property value. Foundation aid is $F_{s,f} - t_s V$, where $F_{s,f}$ is the foundational level of total expenditures and t_s is the foundation aid tax rate that is applied to local property values. Total state revenue includes state aid and other revenue from grants, special education, and other state sources, denoted by $F_{s,o}$,

$$(3)\quad F_s = F_{s,f} - t_s V + F_{s,o}.$$

Federal revenue, F_f, is for child nutrition and other categorical reasons.

Including local, state, and federal revenue, the school district's per pupil budget constraint can be written in terms of property value,

$$(4)\quad \frac{K(s)}{P} = (t_l - t_s)\frac{V}{P} + \frac{F_{s,f}}{P} + \frac{F_{s,o}}{P} + \frac{F_f}{P}.$$

School District Expenditures Per Pupil With TIF

For school districts that have one or more TIF districts, the school district does not collect tax revenue from the total property value of the TIF districts. Instead, it collects tax revenue only from the frozen, pre-TIF property value. To illustrate this, suppose there are two neighborhoods, *a* and *b*, within a school district. Neighborhood *a* includes all TIF district property within the school district, and neighborhood *b* includes all non-TIF district property within the school district. In neighborhood *a*, property value increases over the frozen value; this increase is the capture. The school district does not collect revenue from the capture, only from the frozen property value, V_a°. Therefore, with TIF, expenditures per pupil is,

$$(5)\quad \frac{K(s)}{P} = (t_l - t_s)\frac{V_a^\circ + V_b}{P} + \frac{F_{s,f}}{P} + \frac{F_{s,o}}{P} + \frac{F_f}{P},$$

where V_a° is the frozen property value from the TIF district and V_b is the remaining non-TIF district property value.

School District Expenditures Per Pupil With TIF Spillovers

Now suppose that TIF creates externalities in neighborhood *b*, as suggested by Skidmore et al. (2009). Then, property value in neighborhood *b* is a function of TIF used in neighborhood *a*, where *TIF* denotes the property value increase in neighborhood *a* due to TIF,

$$(6)\quad V_b = V_b(TIF).$$

Making this substitution, the school district's budget constraint is,

$$(7)\quad \frac{K(s)}{P} = (t_l - t_s)\frac{V_a^\circ + V_b(TIF)}{P} + \frac{F_{s,f}}{P} + \frac{F_{s,o}}{P} + \frac{F_f}{P}.$$

Differentiating expenditures per pupil with respect to *TIF* provides the effect of *TIF* on expenditures per pupil,

$$(8)\quad \frac{\partial \frac{K(s)}{P}}{\partial (TIF)} = \left(\frac{t_l - t_s}{P}\right)\frac{\partial V_b(TIF)}{\partial TIF}.$$

The sign of the first term depends on the relationship between the school district's tax rate and the foundation aid tax rate. The sign of the second term depends on the spillover effect $\partial V_b(TIF)/\partial(TIF)$. If the school district's tax rate exceeds the foundation aid tax rate, as it often does, the first term on the right is positive, and the sign of the overall effect depends on the spillover effect. If neighboring properties benefit from TIF, $\partial V_b(TIF)/\partial(TIF) > 0$, then expenditures per pupil increase due to increases in property values that are not excluded from school district taxation. Some of the revenue generated from the increase in property values in local revenue is offset by a decrease in state aid. If the school district's tax rate exceeds the foundation aid tax rate and neighboring property values suffer from TIF, $\partial V_b(TIF)/\partial(TIF) < 0$, then expenditures per pupil decrease. In this case, part of the decrease is offset by an increase in state aid. If there are no spillovers, then $\partial V_b(TIF)/\partial(TIF) = 0$, and TIF has no effect on expenditures per pupil because the property tax base is not affected.

With positive spillovers, an increase in TIF increases expenditure per pupil, *ceteris paribus*. This is the ideal outcome for the school district, because the school district can have higher expenditure per pupil without an increase in the tax rate. With negative spillovers, an increase in TIF decreases expenditure per pupil, *ceteris paribus*. This is the worst outcome for the school district because they will have to decrease expenditures per pupil. If an increase in TIF has no spillovers, expenditure per pupil is not affected.

School District Expenditures Per Pupil With TIF Intensity

The nature of the spillover effect depends on TIF intensity, which is the capture as a percent of the total property value within the school district, $INT = capture/V_a + V_b$. First, non-TIF district property value is written as a function of TIF intensity. The equation is assumed to be quadratic to account for a nonlinear effect. This will provide a way to test if the nature of the spillover effect changes with respect to TIF intensity. The growth rate of the non-TIF district property value is given by the following equation,

$$(9)\quad \frac{V_b - V_{b-1}}{V_{b-1}} = \alpha_o + \alpha_1 INT + \alpha_2 INT^2 + e,$$

where e represents a normally distributed error term.

Taking the derivative of the growth rate with respect to TIF intensity yields,

$$(10)\quad \frac{d\left(\frac{V_b - V_{b-1}}{V_{b-1}}\right)}{dINT} = \alpha_1 + 2\alpha_2 INT.$$

Setting this equation equal to zero indicates the level of TIF intensity that maximizes property value growth. That value is

$$(11)\quad INT = \frac{-\alpha_1}{2\alpha_2}.$$

Testable Hypotheses

This model includes two parameters, α_1 and α_2. If the effect of TIF on non-TIF district property value growth is linear, α_2 will be zero. However, if there is a nonlinear effect, α_2 will be nonzero. Although Skidmore et al. (2009) find evidence of negative spillovers, they do not allow for a nonlinear effect. If $\alpha_2 = 0$, then there is evidence of a linear effect. However, if $\alpha_2 \neq 0$, then there is evidence of a nonlinear effect.

We hypothesize that there may be positive spillovers with low levels of TIF intensity but negative spillovers with high levels of TIF intensity. TIF may be used sparingly or for small projects in areas of blight that would otherwise deter neighboring development. In these cases, TIF could be the impetus that attracts development and spurs property value growth in neighboring, non-TIF district property. Although TIF may initially stimulate non-TIF property value growth, after a certain point the spillover effect may be negative. If TIF is used excessively, it may attract development that would have occurred elsewhere in the school district in the absence of TIF. If businesses think they are likely to get approval for TIF, they may wait on non-TIF developments. If these hypotheses are true, then estimations of the values of α_1 and α_2 should be positive and negative respectively.

The TIF intensity that maximizes non-TIF district property growth is $INT = -\alpha_1/2\alpha_2$. If evidence supports this relationship, estimates of α_1 and α_2 can be used to estimate this TIF intensity. In addition, we can determine what levels of TIF intensity actually lead to a decline in non-TIF district property growth. Furthermore, the same TIF intensity that maximizes non-TIF district property growth also maximizes expenditures per pupil.

EVIDENCE FROM MINNESOTA

We empirically test hypotheses derived from the theoretical model using data from Minnesota to determine the nature of the spillover effect of TIF on school finance. We also compare the results of the empirical estimation with the averages of the school districts to determine the spillover effects they have been experiencing in the 1990s and 2000s.

Data for the empirical analysis come from the Minnesota Department of Revenue, the Department of Education, and the Office of the State Auditor. Data were provided for each year from 1992 through 2007. Data for TIF districts are from the Office of the State Auditor. These variables include the original net tax capacity, the current net tax capacity, and the change in net tax capacity for every TIF district in the state. The change in net tax capacity is the difference between the current and original net tax capacities and represents the property value that the school district cannot tax. The values for these variables are aggregated for all TIF districts within a school district to get the totals for each school district. The change in net tax capacity will be used to generate the TIF intensity of the school district and the current net tax capacity will be used to generate the non-TIF district property value. Total Real and Personal Net Tax Capacity for each school district was provided by the Department of Revenue. This is used to calculate the TIF intensity for each school district.

In addition, we include data on three other variables to provide a context for the size and location of the school districts. First, we include the average number of students in each school district, provided by the Department of Education. Next, we identify the school districts that are located in the Seven County Metropolitan Area. We use this to control for differences between metro and non-metro school districts related to economic development and property values. We also identify the school districts that are in the seven Iron Range counties. Due to mining in these counties, the taconite production tax is, "a major source of revenue to the counties, municipalities and school districts with the taconite assistance area," (Mining Tax Guide, 2010, pg. 1). It is important to control for this in empirical estimation because of its effect on school finance in the school districts in these counties. Table 1 includes the description and source of each variable.

Table 1
Variable Description and Sources

Variable	*Description*
Pupils[a]	Total resident ADM of all district residents, pre-kindergarten through grade 12
Original Net Tax Capacity[b]	The original net tax capacity of the TIF district. The original value is the base year value plus any adjustments for applicable classification changes, class rate changes, growth adjustment for economic development districts where applicable, etc.
Current Net Tax Capacity[b]	The current net tax capacity of all payable taxable property located within the TIF district that is payable in that year.
Net Tax Capacity Change[b]	The net tax capacity change equals the current net tax capacity minus the original net tax capacity. The net tax capacity change is set equal to zero when the calculated amount is negative.
Total Real and Personal Net Tax Capacity[c]	The total fully taxable real and personal taxable market value within the school district.
TIF Intensity	Net Tax Capacity Change divided by the Total Real and Personal Net Tax Capacity
Non-TIF Property Value Growth Rate	The growth rate of the difference between The Total Real and Personal Net Tax Capacity and the Current Net Tax Capacity.
Metro[b]	A dummy variable indicating whether the school district is located in the Seven County Metro Area. These include: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties.
Iron Range[e]	A dummy variable indicating whether the school district is located in the Iron Range. These include: Aitkin, Cook, Crow Wing, Itaska, Lake, and St. Louis counties.

Source:

a. Minnesota Department of Education

b. Definitions from Minnesota Department of Revenue, Data from Minnesota Office of the State Auditor, Tax Increment Financing Division

c. Minnesota Department of Revenue, Property Tax Division

e. Minnesota Department of Revenue, Mining Tax Guide

Empirical Estimation

Using the data described above, we estimate equation (9) with the inclusion of three additional variables: school districts in the Seven County Metropolitan Area (*METRO*), school districts in the Iron Range (*IRON*), and school districts that were consolidated between the two years of the growth rate (*CONSOL*),

$$(9') \quad \frac{V_b - V_{b-1}}{V_{b-1}} = \alpha_o + \alpha_1 INT + \alpha_2 INT^2 + METRO + IRON + CONSOL + e.$$

The non-TIF property value growth rate ($V_b - V_{b-1}/V_{b-1}$) is calculated by taking the growth rate of the difference in real and personal net tax capacity and the current net tax capacity of the school district. The difference between the real and personal net tax capacity and the current net tax capacity represents the non-TIF property value of the school district. TIF intensity (*INT*) is calculated by dividing the change in net tax capacity of the school district by the real and personal net tax capacity of the entire school district. In other words, this is the capture as a portion of the total property value in the school district.

The model is estimated by ordinary least squares using data from each of 15 time periods. Because of possible heteroskedasticity, White's heteroskedasticity-consistent covariance matrix estimator is used to obtain coefficient standard errors.

Results for the model are reported in tables 2a and 2b. The R^2 ranges from less than 1 percent to almost 20 percent. A test of joint significance for the control variables indicates that at least one of the control variables is significant in all years except 1995, 1998, 2005, and 2006. Of the remaining equations, five have a positive coefficient for *INT* and a negative coefficient for INT^2 (1993, 1996, 2000, 2002, and 2003). These results also provide evidence of an initial positive spillover effect followed by a negative spillover effect. For the remaining years, the results remain mixed.

In order to determine the TIF intensity that maximizes the property value growth, we can use the estimates of α_1 and α_2 to calculate $INT = -\alpha_1/2\alpha_2$. Using the coefficient estimates from table 2a, the

Table 2a
Regression Results for TIF Intensity and Controls, 1992-1999

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
INT	-.3010**	.6012***	.1505	-.1133	.2692***	-.0067	.1754	.1323
	(.1257)	(.1341)	(.1167)	(.1643)	(.1045)	(.1201)	(.1614)	(.1995)
INT^2	1.3568**	-1.4629**	-.4782	.6525	-.9118**	-.0306	-1.3133	-1.5891*
	(.5808)	(.6171)	(.7492)	(.9417)	(.4551)	(..8223)	(1.4110)	(.8715)
METRO	-.0480***	.0184**	.0063	.0088	.0213***	.0171***	.0157***	.0322***
	(.0081)	(.0082)	(.0071)	(.0095)	(.0069)	(.0065)	(.0056)	(.0060)
IRON	-.0114	.0698***	.0231***	.0010	-.0089	-.0092	.0064	-.0048
	(.0111)	(.0092)	(.0073)	(.0080)	(.0081)	(.0093)	(.0071)	(.0066)
CONSOL	-.0012	-.0405**	.0044	-.0001	-.0121	-.0383***	-.0078	-.0672
	(.0130)	(.0186)	(.0070)	(.0233)	(.0151)	(.0107)	(.0120)	(.0468)
R^2	.0923	.1969	.0339	.0053	.0751	.0385	.0243	.0283
n	408	390	376	356	349	343	340	339
F-test[a]	8.172***	18.828***	2.594**	.371	5.567***	2.701**	1.665	1.936*
F-test[b]	11.879***	20.484***	3.556**	.284	4.273***	7.671***	2.869**	11.761***

* 10 percent level of significance

** 5 percent level of significance

*** 1 percent level of significance

a. tests the overall significance of model, which tests the joint hypothesis that all coefficients equal zero

b. tests model specification, which tests the joint hypothesis that the coefficients on METRO, IRON, and CONSOL equal zero

Table 2b
Regression Results for TIF Intensity and Controls, 2000-2006

	2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
INT	.6045***	-.0878	.3384*	.3563*	.0333	-.1387	-.2744**
	(.1343)	(.1926)	(.1766)	(.1820)	(.1509)	(.1124)	(.1289)
INT^2	-3.0225***	-.2033	-2.2054**	-3.0318***	-.9472	-.2382	.3498
	(.7369)	(.7725)	(1.0830)	(1.1070)	(.7349)	(.4814)	(.5671)
METRO	.0447***	-.0664***	.0291***	.0291***	.0190***	.0035	-.0006
	(.0061)	(.0097)	(.0074)	(.0081)	(.0067)	(.0050)	(.0060)
IRON	-.0131	-.0287**	.0097	.0339***	.0189**	.0028	-.0058
	(.0085)	(.0128)	(.0084)	(.0091)	(.0096)	(.0096)	(.0116)
CONSOL[a]	-.1849***	-.0508***					-.0140***
	(.0040)	(.0054)					(.0052)
R^2	.1996	.1396	.0563	.0663	.0305	.0188	.0102
n	339	338	337	337	337	337	334
F-test[b]	16.613***	10.772***	4.956***	5.897***	2.610**	1.590	.677
F-test[c]	889.369***	43.816***	7.927***	11.898***	5.369***	.269	3.890***

* 10 percent level of significance

** 5 percent level of significance

*** 1 percent level of significance

a. There were no school district consolidations from 2001-02, 2002-03, 2003-04, and 2004-05.

b. This tests the overall significance of model, which tests the joint hypothesis that all coefficients equal zero.

c. This tests model specification, which tests the joint hypothesis that the coefficients on METRO, IRON, and CONSOL equal zero.

optimal TIF intensity in 1993 was 21 percent. This means that below 21 percent, more TIF intensity is associated with a higher non-TIF district property value growth rate, but above 21 percent, a higher TIF intensity is associated with positive but lower non-TIF district property value growth rate. Using the coefficient estimates from tables 2a and 2b, the optimal value was 15 percent in 1996, 10 percent in 2000, 8 percent in 2002, and 6 percent in 2003. According to the model, over this time period the optimal TIF intensity decreased, decreasing the length of the positive spillover effect.

SUMMARY AND CONCLUSIONS

This paper finds some evidence in support of spillovers from TIF on non-TIF property value growth within school districts, but the overall finding is mixed. These spillovers are positive with low levels of TIF intensity but negative with high levels of TIF intensity. If a school district is experiencing positive spillovers, the school district benefits from higher revenue, whereas if there are negative spillovers the school district suffers from lower revenue. Evidence from Minnesota suggests that most school districts are benefiting from TIF through positive spillovers. However, some school districts have more than the optimal amount of TIF intensity. In these situations, school districts would be better off with less TIF and should be cautious about additional TIF districts.

The significant contributions of this paper are the use of school districts as units of observations, the inclusion of nonlinear spillovers, and the measure of TIF intensity that uses property values. By focusing on school districts, we are able to begin to understand how TIF affects school finance. Including nonlinear effects allows for the possibility of both positive and negative spillovers, depending on the magnitude of TIF within the school district. Measuring TIF with property values provides a richer measure of the size of TIF districts relative to all property value. This is a richer measure than a simple count of TIF districts. All of these contributions jointly shed light on the answers to the questions originally posed in the introduction. First, it appears that TIF does affect non-TIF district property value within the school district. The non-linear effect is initially positive for low proportions of TIF but negative for high levels of TIF. However, more research should be undertaken to support this conclusion. As for the second question, this paper only answers that theoretically. Theoretically, TIF does affect expenditures per pupil.

The above results provide evidence that school districts may or may not benefit from TIF within the school district, depending on the amount of TIF intensity. Based on the average TIF intensity, it appears that most school districts have benefited from positive spillover effects on non-TIF district property value. Although these results are supported by five of the fifteen years of data, the mixed results of the remaining ten years indicate that additional research is necessary to strongly conclude these results.

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