



School spending and new construction

David M. Brasington

Economics Department, University of Cincinnati, United States



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ABSTRACT

School districts that vote in favor of property tax levies may signal that they are education-oriented. Through Tiebout sorting and housing developer activity, new residents might move to such communities. New retail development may occur near these new residents, and office firms that rely on high-skilled residents might be drawn too. Using regression discontinuity we find school districts that renew property tax levies have a higher value of new construction than districts that do not renew these school expenditures. School tax levy renewal is responsible for 14% of new residential construction and 25% of new commercial construction.

1. Introduction

Education is an important good that takes up more spending than any other local service.¹ A large literature examines school district spending. Some investigate the return to schooling expenditures on wages later in life. Other research examines the relationship between school spending and house prices. Still another strand investigates the link between school spending and the performance of a school district.

The current study attempts to fill a gap in the literature by linking school spending to new residential and commercial construction. People Tiebout (1956) sort to local governments that provide the mix of taxes and public services that most closely match people's preferences. When a community passes a school property tax levy, it signals that it cares about education, drawing education-minded parents as well as people who believe that school spending protects property values. In turn an influx of new residents makes retail firms want to locate there to have access to shoppers. It draws office firms that want a location that lowers workers' commuting costs, especially if the office firms require a highly educated workforce.

It would make sense, then, for school spending to spur residential and commercial construction. The current study seems to be the first to document such a link. We collect school property tax voting data and new construction data from 1994 to 2014 in Ohio. Using regression discontinuity, we find passing a property tax levy in period t increases the value of residential construction. The increase seems to happen one

to three years after passage of the tax levy. The average treatment effect is \$418,000, or about 0.1% of total residential value and 14% of the total value of new construction. Passing a property tax levy in period t increases the value of commercial construction three and four years later, the timing of which is fairly consistent with some speed of adjustment studies. The average treatment effect is \$400,000, meaning the tax levy passage is responsible for about 25% of the value of new construction. This \$400,000 represents 0.5% of total commercial value in the typical Ohio school district. The effect on the value of new construction could include some combination of the number of new structures being built, the size of new structures with no change in number, or an increase in assessed value with no change in number or size.

2. Literature review

The current study is related to the literature on new construction and the literature on school spending.

Surprisingly little research talks directly about new residential construction. Brasington (2002) examines the link between the elasticity of new residential construction and the capitalization of fiscal variables into house prices. Mayer and Somerville (2000) and Quigley and Raphael (2005) study the effect of land use regulation on the quantity of new residential construction and house prices. Somerville (1999) finds that material and labor costs matter a lot for the quantity

E-mail address: david.brasington@uc.edu.

¹ 39%, according to U.S. Bureau of the Census Local Government Finances, Local Governments – Expenditures and Debt by State: 2008, <https://www.census.gov/library/publications/2011/compendia/statab/131ed/state-local-govt-finances-employment.html>, accessed June 6, 2016. Education is easily the single largest local government expenditure, consuming more than seven times that of police protection, the second-largest category.

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of new residential construction. Simons et al. (1998) examines the effect of new subsidized residential construction on residential sales prices. Archer et al. (1996) shows that areas with higher population growth have higher house price appreciation rates.

Some literature discusses commercial and industrial construction, mainly as it applies to the speed of adjustment to market disequilibrium. Eppli and Shilling (1995) tests a stock-adjustment model of real estate investment and finds the time it takes for the U.S. real estate market to be 90% adjusted is almost two years for offices, under one year for industry, and over 10 years for retail. Benjamin et al. (1995) suggests a lag of 5.3 years in adjustment for shopping center investment, and Benjamin et al. (1998) adds that there is considerable variation in this lag by urban area. Sivanidou and Sivanides (2000) finds the construction of new office and commercial space depends on the volatility of office and FIRE employment, net rental income flows, office employment growth levels, construction costs, vacancy rates, and the discount rate. They add that once decisions are made, 80% of investments are realized in about 3.5 years.

The current study looks at voting on school spending, and school spending has been examined in various ways. Brasington and Haurin (2006), Leguizamon and Ross (2012) and most of the studies surveyed by Nguyen-Hoang and Yinger (2011) find school expenditures per pupil is positively related to house prices. Cellini et al. (2010) finds spending on school buildings is positively related to house price.² Several studies examine the link between K-12 school expenditures and a person's earnings later in life. One such example is Grogger (1996), who finds school expenditures are positively related to post-schooling earnings, but only with an elasticity of 0.068. Other studies such as Card and Krueger (1996) suggest a stronger link between school expenditures and earnings. School spending should theoretically be associated with schooling achievement, and some studies find such a link, like the Card and Krueger (1996) study just cited; other studies do not find improved outcomes from increased spending on certain school inputs (Glewwe (2002); Hanushek (2003)). Glaeser (1994) finds that schooling levels are correlated with an increase in per-capita income not so much because schooling is an investment that spurs growth, but because schooling in time t fuels further growth in schooling in future time periods. In other words, current schooling decreases the costs and increases the benefits of future schooling.

3. Empirical approach

3.1. Regression discontinuity design

Regression discontinuity is a type of quasi-experimental design. It claims to find the causal effect of one variable on another by comparing, in our case, school districts that pass and fail to pass a school district property tax levy. Only districts that pass levies receive the funding, and because treatment (receiving the funding) is perfectly correlated with observable characteristics, it is orthogonal to unobservable characteristics.

Regression discontinuity starts by considering an assignment variable X , like the percent of voters who vote in favor of a property tax. In order for the tax levy to pass in Ohio, a critical value c of 50% must be breached. If school districts – even while having some influence – are unable to *precisely* manipulate the assignment variable, a *consequence* of this is that the variation in treatment near c is randomized as though from a randomized experiment (Lee and Lemieux, 2010). So whether a district is just above 50% or just below 50% is basically determined by a coin toss. A consequence of this

² We emphasize that our study does not examine the link between school building bond levy passage and the average sale price of houses in the school district like Cellini et al. (2010). We study the link between the passage of tax levies for all purposes, current expenses and school building spending combined; and our outcomes are new construction: the value of new housing and new commercial property completed in a given year.

random assignment of the treatment is that any effect of the treatment is a causal effect, not simply a correlation.³ The cleanness of the regression discontinuity approach allows identification of causal effects using ordinary least squares as in Eq. (1):

$$Y = \alpha + D\tau + X\beta + \varepsilon \quad (1)$$

In Eq. (1), Y is an outcome variable. The outcomes we consider in the current study are the value of new residential and commercial construction. α is an intercept which subsumes a series of year fixed effects dummies. D is a dummy variable that equals 1 if $X \geq c$; it equals 0 otherwise, so that a district that has over 50% of votes in favor of the tax levy receives the treatment τ , the renewed property tax funding. τ is a weighted average treatment effect across school districts, where the weights are the relative ex ante probability that the value of a school district's assignment variable will be in the neighborhood of the threshold c . Again, X is Percent For, the proportion of votes in favor of the tax levy. Finally, ε represents the error term.

While Eq. (1) is sufficient for consistent estimation of the treatment effect, researchers often add covariates W as in Eq. (2):

$$Y = \alpha + D\tau + X\beta + W\delta + \varepsilon \quad (2)$$

A covariate is a variable that is not influenced by treatment, but a variable that might affect the probability of treatment. The inclusion of covariates can increase the precision of the estimate of the treatment effect.

Although Eqs. (1) and (2) are often adequate for estimating treatment effects, an alternative specification estimates two separate regressions, one on each side of the cutoff point. It is convenient to run a pooled regression to estimate the treatment effect and its standard errors as in Eq. (3):

$$Y = \alpha_L + \tau D + \beta_L X + (\beta_R - \beta_L)X + \varepsilon \quad (3)$$

In Eq. (3) L refers to the left of the cutoff and R refers to the right of the cutoff point. One may add covariates to Eq. (3) as follows:

$$Y = \alpha_L + \tau D + \beta_L X + (\beta_R - \beta_L)X + W\delta + \varepsilon \quad (4)$$

Regression discontinuity is not applicable to many situations, but for those situations in which it can be used, it provides a powerful way to identify the causal effect of one variable on another. Its primary assumption—that individuals cannot precisely control the assignment variable—is testable. There are established ways in which to test this assumption described in Section 4.4, but Fig. 1 shows *prima facie* evidence.

There is a bin with no observations, but the density of votes seems fairly continuous, even at the 0.50 threshold. If the graph had shown a much larger number of votes just above 0.50 Percent in Favor with a much smaller number of votes below, for example, it would suggest a possible violation of the assumption of no precise control. Other challenges to identification include endogenous sorting by agents into treatment and random jumps in the data, both of which are examined in the Results section.

3.2. Estimation approach

Although it is traditional to perform regression discontinuity studies with simple ordinary least squares, the current data set contains an unbalanced panel of school districts over time. The panel nature of the data allows additional safeguards to identification over pooled time series cross sectional analysis.

We perform a random effects estimation. Recognizing that the assumptions of random effects are untenable, we also model unobserved heterogeneity with a two-way fixed effects estimator, to try to

³ Or, in a stroke of bad luck, instead of a true causal effect, the treatment effect could instead be capturing a spurious correlation between X and the error term, and there is no way to distinguish between these possibilities in practice (Lee and Lemieux, 2010).

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