Landscape and Urban Planning xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

Research paper

An economic analysis of complete streets policies

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A R T I C L E   I N F O

Keywords:
Complete Streets
Hedonics
Community design features
Difference-in-differences propensity score matching

A B S T R A C T

This paper tests whether adoption of a Complete Streets policy (a transport policy and design approach that requires streets to be designed and operated to allow equal access to all people and major forms of transportation, rather than just motor vehicles) has amenity value for local residents by analyzing the link between Complete Streets policy adoption and house prices using a difference-in-differences matching procedure (DIDMP). We employ this DIDMP because commonly employed least-squares-regression techniques may fail to fully account for selection effects. We show that commonly employed least-squares-regression techniques generally overestimate the effect of a Complete Streets policy and using DIDMP we find that Complete Streets policy adoption had no statistically significant effect on house prices.

1. Introduction

In 2005, a coalition of advocacy and trade groups including the American Public Transportation Association and the National Association of Realtors founded the National Complete Streets Coalition (NCSC). The NCSC aimed to advance so-called "Complete Streets," a transport policy and design approach that requires streets to be designed and operated to allow equal access to all people and major forms of transportation, rather than just motor vehicles. As of January 1, 2017, 1232 jurisdictions in the United States, including 955 municipalities, had adopted a Complete Streets policy (NCSC, 2017).

The design principles of Complete Streets include pedestrian infrastructure, traffic calming, and bicycle and public transit accommodations. These Complete Streets are defined as "[streets] designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities," and are meant to optimize and improve the ability, safety and ease of travel, shopping and other activities in the area (NCSC, 2016).

The most important components of Complete Streets include, "sidewalks, bike lanes (or wide paved shoulders), special bus lanes, comfortable and accessible public transportation stops, frequent and safe crossing opportunities, median islands, accessible pedestrian signals, curb extensions, narrower travel lanes, and roundabouts" (NCSC, 2016). Generally, Complete Streets components can include any type of additional road alteration or modified architecture that provides safety or increased accessibility for the user. To put it very simply, an "incomplete" street would be defined as one designed only for use by motor vehicles and is not safely accessible for anything or anyone else.

These complete streets are then realized through planning and execution by government organizations and engineers who design, build, and maintain these newly completed streets. Municipal governments typically commit to a Complete Streets policy via a resolution or ordinance. Following policy adoption, municipal officials often outline more detailed plans to implement the Complete Streets vision. In many cases, this takes the form of modifications to transportation plans. In other cases, town planners and public works officials simply modify future road projects to conform to the principles of Complete Streets.

The claimed benefits of these Complete Streets policies include increased safety, physical activity, and health (NCSC, 2016). Public transportation options also improve due to improved access and better planning. As a result of increased public transportation use, gas and oil consumption fall. However, there are no rigorous assessments of the value of Complete Streets policies. Because the costs associated with planning, logistics, and execution of pedestrian- and transit-oriented development are high and require continued commitment, evidence of benefits helps support expenditures on pedestrian- and transit-oriented development. Consequently, this paper attempts to assess the benefits of Complete Streets policy adoption using municipality-level data from New Jersey and New York. To capture these benefits/amenities, we follow the well-established practice of valuing amenities by observing differences in house prices.

This practice, first described in Rosen (1974), describes houses (and indeed all differentiated products) using their measured characteristics. These characteristics include property (e.g., acreage), neighborhood/environmental dimensions (e.g., school quality or percentage commercial tax base), and broader location variables (distance to the CBD).

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https://doi.org/10.1016/j.landurbplan.2017.11.004
Received 16 August 2016; Received in revised form 6 November 2017; Accepted 8 November 2017

Under competitive conditions, consumer and producer location decisions alter prices to ration the more desirable locations/characteristics. Consequently, house prices reflect the values consumers attach to each of the dimensions of the good and multivariate techniques allow us to identify the value of each dimension.

For instance, we may infer the value of increases in school quality using house price differences across school districts while controlling for other factors that affect house prices (Dhar & Ross, 2010). Similarly, we may value pedestrian- and transit-oriented development by examining house price differences across locations with more (or less) access to these developments (Bartholomew & Ewing, 2011). This paper tests whether adoption of a Complete Streets policy affects house prices using a difference-in-differences matching procedure (DIDMP) developed in Heckman, Ichimura, and Todd (1997) and Heckman, Ichimura, Smith, and Todd (1998).

We employ this DIDMP because commonly employed least-squares-regression techniques may fail to fully account for selection effects. More precisely, least-squares regression techniques assume that: 1) the covariates used to control for selection effects show similar distributions for treated and untreated observations; and 2) the relation between the covariates and outcomes is linear. As these assumptions are likely violated in observational data, we employ this differences-in-differences matching procedure (DIDMP). We show that in the case of Complete Streets policy adoption the covariates used to control for selection are not similarly distributed for treated and untreated observations and that commonly employed least-squares-regression techniques generally overestimate the effect of Complete Streets policies. Using DIDMP, we find that Complete Streets policy adoption had no significant effect on house prices.

2. Literature review

While there are no evaluations of the economic effects of Complete Streets, a series of papers evaluate the economic effects of some of the design elements and ideas embodied in Complete Streets. Because design characteristics, like other characteristics of real estate, are capitalized into house prices, the literature imputes the value of design characteristics by examining changes in house prices (i.e., hedonics) (Rosen, 1974). The recent literature on the value of design characteristics falls rather neatly into two groups: direct assessments of the value of design elements and assessments of the interaction between design elements and transit-oriented development (TOD) (Bartholomew & Ewing, 2011).

Many of the direct assessments of the value of design elements are analyses of the effect new urbanism or neo-traditional development (Dong, 2015; Guttery 2002; Plaut & Boarnet, 2003; Ryan & Weber, 2007; Song & Knaap, 2003; Song & Quercia, 2008; Tu & Eppli, 2001). This new urbanism seeks to build communities that have: 1) walkable streets; 2) public spaces surrounded by high-density development; 3) a variety of housing options; and 4) little physical separation between residential and commercial uses. To identify the effect of new urbanist design on house prices, Tu and Eppli (2001) compare house prices in new urbanist and conventional developments for three market areas and find houses in the new urbanist communities show significantly higher prices.

Song and Knaap (2003) use a somewhat more sophisticated approach to disaggregate the impact of new urbanist design on house prices. They consider the separate effects of street design and circulation systems, density, land-use mix (e.g., single-family residential versus other residential), accessibility to parks and commercial uses, transportation mode choice, and pedestrian walkability. Results show that some features of new urbanist development raise house prices (e.g., interconnected streets, shorter blocks, accessibility to light rail, walkability, and shorter distances to parks).

However, consumers also valued some features that were inconsistent with new urbanist design (e.g., cul-de-sac locations, neighborhoods with fewer connections to other locations, single-family homes as the dominant use, low population and housing-unit density, and longer distances to commercial locations). Because some of the valued attributes (e.g., interconnected streets) cannot be increased without decreasing other valued attributes (e.g., cul-de-sac locations), they compare price effects for the mean values of the design features for Washington County with the price effects for the mean values for a prototypical new urbanist development and find a $24,255 premium for the new urbanist development.

Consistent with Song and Knaap (2003), Plaut and Boarnet (2003) also show a premium for new urbanist development. Ryan and Weber (2007) compare traditional neighborhood designs (TND), enclave (or self-contained) development, and infill (or scattered site) development in high-poverty areas. TND is like new urbanism in that it seeks to replicate the design features of the surrounding neighborhood (e.g., interconnected street grids and street-facing housing). They find that infill development commands a value premium (based on assessed values) over TND and enclaves.

Further, Ryan and Weber (2007) suggest that separate evaluations of new urbanist design attributes may be misleading because the implicit prices of the design attributes vary across different neighborhoods. Indeed, Song and Quercia (2008) show that buyers in middle- and outer-ring suburbs place higher values on larger lots and lower density than consumers in inner-ring suburbs and the urban core. Similarly, buyers in the urban core are willing to pay more for properties with good external connectivity and increased pedestrian access to bus stops while these same attributes decrease prices in middle-ring suburbs.

There is also evidence that these "smart" land use patterns show less sensitivity to market downturns. Dong (2015) shows that housing units with both "smart" land use patterns (i.e., high residential densities, high proportions of multi-family homes, and mixed land uses) and wider transit options (i.e., accessibility to light rail and bike routes) held their value better than housing units without both smart land use and wider transit options (or just smart land use).

Like new urbanism, LEED (Leadership in Energy and Environmental Design) certification (offered by the U.S. Green Building Council) aims to encourage smart land-use patterns. The Council offers certification of both individual buildings as well as neighborhoods using a point system that values green construction, sustainable sites, as well as some elements of new urbanism at the neighborhood level. Freybote, Sun, and Yang (2015) find that while LEED building certification raises house prices by about 3.6%, neighborhood certification has no effect on house prices.

In addition to assessments of the value of new urbanist design, the literature also assesses the value of street layout (Matthews & Turnbull, 2007), trees and tree placement (Donovan & Butry, 2010; Netusil, Levin, Shandas, & Hart, 2014; Pandit, Polykov, Sorada, & Moran, 2013), walkability (Boyle, Barrilleaux, & Scheller, 2014; Dong, 2015; Li et al., 2015; Pivo & Fisher, 2011), and bicycle paths (Krizek, 2006).

Donovan and Butry (2010) assess the value of trees planted between the road and sidewalk (i.e., the parking strip) and find that, after controlling for housing characteristics and spatial dependencies, the two tree variables (number of trees and canopy cover) added on average about $8900 to the house price (about 3%). Pandit et al. (2013) use a similar design and find that broadleaf trees planted in the parking strip increased housing values about 4%. By contrast, broadleaf trees planted elsewhere and palm trees had no impact on housing values. Netusil et al. (2014) find similar effects.

To assess the effect of walkability on property values, Pivo and Fisher (2011) measure walkability by constructing an index (for each address) that is a declining function of distances to educational, retail, recreational, food, and entertainment destinations. They find that a one standard-deviation increase in the walk score is associated with a 20% increase in market value for office and retail properties.

Similarly, Li et al. (2015) measure walkability using sidewalk