



Zoning effects on housing change vary with income, based on a four-decade panel model after propensity score matching



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ABSTRACT

Zoning is one of the oldest policy tools for regulating private land use, but its effect on housing change is disputed. We define housing change as the difference over time in the number of housing units in a given jurisdiction. We conducted a cross-jurisdictional study of zoning effects on housing change, comparing zoned and unzoned townships in Michigan, USA ($n = 709$) after propensity score matching. Four-decade (1970–2010) panel models predicted zoned townships to have on average 2.2% fewer housing units a decade after zoning adoption compared to similar unzoned townships, but this effect was tempered by other variables. Higher-income townships had more housing units a decade after zoning adoption compared to higher-income unzoned townships, whereas lower-income townships with zoning had fewer housing units than similar unzoned townships. This study highlights the heterogeneous effects of zoning on rural and exurban housing change.

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1. Introduction

Zoning is an important policy tool for managing land use, but its effects on housing change are unclear and inconsistent (Wallace, 1988; Esparza and Carruthers, 2000; Croissant and Munroe, 2002). We define “housing change” as the positive or negative difference over time in the number of housing units in a given jurisdiction, and refer to this measurement as “housing growth” when the difference is positive. Ninety-seven percent of the developable land in the United States is considered rural (<6 housing units/km²) or exurban (6–147 housing units/km²), and development in these areas is a major driver of land-use change (Theobald, 2005). However, many studies on the impact of zoning on housing change do not consider rural and exurban areas and are constrained to single jurisdictions (Pogodzinski and Sass, 1990). We develop a unique dataset that tracks zoning implementation across the U.S. state of Michigan, allowing us to compare housing change across zoned and unzoned jurisdictions in a wide variety of settings and to provide a more robust estimate of the impacts of zoning on housing change.

Building and road development outside of urban centers is expanding rapidly in many countries (Nilsson et al., 2013), and has been called the dominant “spatial planning challenge of the twenty-

first century” (Ravetz et al., 2013). In the U.S., 39% of houses are located within the 9% of the land base considered “wildland-urban interface,” an intermix zone of housing and forests or grasslands (Radeloff et al., 2005). In Europe, the area of land covered by non-urban settlements is growing four times faster than urban land area, and is projected to double in 30–50 years (Nilsson et al., 2013). Exurban and rural development can have significant human and environmental impacts. Land converted to residential, commercial or industrial uses tends to persist as such (Nusser and Goebel, 1997) in contrast with more fluid and reversible land-use transitions between forest and cropland (Hamilton et al., 2013). Urban sprawl can have significant impacts on vehicle miles travelled (Bento et al., 2005) and associated air pollution (Ewing et al., 2003), water quality and quantity (Allan, 2004; Saunders et al., 1991), species extinction (Dirzo and Raven, 2003), farmland loss (Egan and Luloff, 2000; Heimlich, 2001; Theobald, 2001) and wildfire management (Cohen, 2000).

In developed nations with highly mobile populations, housing growth outside of cities is due both to “spillover” as people seek low-cost housing near urban centers, and to “counterurbanization” as people seek out areas far from urban centers for recreation opportunities, access to natural resources, and privacy (Esparza, 2011). Suburbanization at the urban fringe can be described as a succession from agriculture-dominated to commuter-driven landscapes, the former reliant on neighborly relations to reconcile land-use and the latter formal land-use controls to manage growth

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(Rudel, 1989). In contrast, growth outside of urban commuting distance often occurs in areas embodying picturesque pastoral and forested landscapes, with space between neighbors and opportunities for relaxation and recreation (Preissing et al., 1996; Stedman, 2003; Tilt et al., 2007). One example of counterurbanization is the American “rural renaissance” of the 1970s in which seasonal and recreational home development outpaced population growth in many high-amenity rural areas (Radeloff et al., 2010). In forested northern Wisconsin, USA, housing units increased 113% between 1940 and 1990 even though population increased only 6% (U.S. Census Bureau, 1990).

Tools available to governments for shaping and managing growth include zoning and other regulations, development rights transfer programs, taxation, and acquisition of land or conservation easements (Bengston et al., 2004). Zoning is one of the most widely used public policy tools for regulating private land development in North America and Europe (Hirt, 2012; Pendall et al., 2006). In its standard (Euclidean) form, zoning ordinances define districts separated by land uses (e.g., residential, commercial, industrial, agricultural, open space) to prevent a comingling of so-called incompatible uses. Enabling laws allowing local zoning have been enacted in all 50 U.S. states, and over 90% of jurisdictions in major U.S. metropolitan areas have adopted zoning (Pendall et al., 2006). However, many non-metropolitan municipalities remain unzoned (Locke and Rissman, 2015). Land-use policies reflect governmental and community goals that are often at odds with each other, including increased tax revenue generation, job growth, environmental and open space protection, and timber and agricultural production.

In the past century, the question of whether and how zoning shapes housing change has been widely debated (Pogodzinski and Sass, 1990). In rural areas, large-lot zoning (requiring lots of over 2 ha) may preserve “rural character” (Tilt et al., 2007) by restricting housing growth in agricultural and forested areas (Croissant and Munroe, 2002; Robinson and Brown, 2009; Pogodzinski and Sass, 1990). However, resulting dispersed housing patterns can lead to forest and farmland fragmentation (Egan and Luloff, 2000; Heimlich, 2001; Theobald, 2001) and drive up per-capita public service costs (Carruthers and Ulfarsson, 2003; Haight et al., 2004). Some argue that the U.S. focus on strict separation of land uses (Hirt, 2012) has caused the sprawling, car-reliant suburbs in which 60% of U.S. residents live (Pendall, 1999; Warren, 2009) and a displacement of development from regulated urban areas to rural, less regulated areas (Carruthers and Ulfarsson, 2003; Esparza and Carruthers, 2000). Others note that higher valued lands tend to be zoned for residential development while marginal lands are zoned for other uses (Wallace, 1988). These scholars argue that the delineation of zoning districts and the allowance of variances “follows the market” and thus zoning has no effect on development beyond that of a free land market (Wallace, 1988).

A limitation of many zoning studies is that they examine a single jurisdiction such as a county (Pogodzinski and Sass, 1994; Thorson, 1994; Wallace, 1988), and thus give limited insight into how development patterns and political processes interact in various contexts. Cross-jurisdictional studies present the difficulty of establishing meaningful control groups to overcome issues of endogeneity. Zoned jurisdictions tend to be wealthier, more urban, and less conservative than unzoned jurisdictions (Locke and Rissman, 2015; Rolleston, 1987), and studies of zoning effects on housing change must account for the strong possibility that characteristics that lead communities to zone also impact their housing change outcomes (Butsic et al., 2011). Zoning studies have dealt with endogeneity using computer modeled counterfactual scenarios (Robinson and Brown, 2009), maximum likelihood estimation without matching (York and Munroe, 2010), hedonic methods to model development decisions (Lewis and Plantinga, 2007; Lewis et al., 2009), and quasi-experimental designs resulting from policy

changes (Carrión-Flores and Irwin, 2016). Few have used matching methods or discontinuity analysis to take full advantage of variation in the data (Butsic et al., 2011). Propensity score matching allows for causal inferences with few assumptions (Abadie et al., 2004; Ho et al., 2007; Wooldridge, 2011), and has been used to show the effect of moratoria on residential development (Bento et al., 2007), and the effect of purchase of development rights programs in preventing farmland conversion (Liu and Lynch, 2011).

Here we present the first large-*n* longitudinal study of zoning effects on housing change in non-urban areas, using propensity score matching as a preprocessing step to minimize selection bias. Our primary objectives are to quantify the effect of zoning adoption on housing change, and determine what factors influence this effect. Focusing on a large sample of Michigan townships (*n* = 709), we compared changes in housing unit counts in zoned and unzoned townships at four decadal timesteps (1970–2010). A panel regression analysis allowed us to take into account spillover effects, and to show how the effect of zoning on housing change varies with household income and other covariates.

2. Methods

2.1. Study area

The state of Michigan provides a fitting study area to answer land-use policy questions, specifically those related to zoning. Counties in Michigan are divided into civil townships, municipalities that govern unincorporated land (land outside of city or village boundaries). Townships contain over 96% of Michigan’s land base and provide a unit of analysis appropriate for longitudinal analyses—Michigan alone contains 1240 townships (typical size 93 km²), each with authority to make policy decisions affecting land use (Michigan Townships Association, 2014). The state has diverse land uses, including agricultural southern Michigan, populous suburbs outside of Detroit and other municipalities, and the forested Upper Peninsula.

The consequences of housing growth vary across the state. By 2040, urbanization in western lower Michigan is predicted to reduce the area of prime farmland, reduce wildlife habitat in coastal areas along Lake Michigan, and impair small watersheds in southwestern Michigan (Pijanowski et al., 2002). In northern lower Michigan, 278,850 ha are considered high-risk fire areas where fuels and buildings intermix (Haight et al., 2004). Despite having the eighth highest number of housing units and fourth highest number of recreational housing units out of all 50 states in 2010, Michigan’s rate of housing growth between 1970 and 2010 was relatively modest (ranking 40th out of 50 states).

State enabling legislation passed in the 1920s and 1930s granted zoning authority to cities, villages, townships, and counties. Zoning was advanced as a New Deal innovation to restore the forests of the Great Lakes cutover and bring rational planning to land use (Kates, 2001). In Michigan, county-level zoning is rare, and the decision to regulate unincorporated areas is generally left to townships. In a survey of local governments collected by Michigan State University’s Institute for Public Policy and Social Research in 2003, 64% of Michigan’s 1240 townships had adopted a township zoning ordinance, 19% had adopted county-level zoning, 10% had no zoning, and 7% gave no response (Institute for Public Policy and Social Research, 2004). 254 townships were excluded from this study because of missing data on zoning adoption date and 94 townships were excluded because they were zoned before 1970 and were therefore unable to be matched based on pre-treatment characteristics. The remaining 892 townships served as inputs to the matching process. Once we had a sample that fit matching criteria

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