Does Zoning Cause Sprawl?

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Introduction

Zoning regulations, typically implemented as minimum lot sizes, are one of the primary land-use policies used to reduce rural land conversion. When zoning is binding, homeowners are required to consume larger lots than desired (Pasha 1996; McConnell, Walls, and Kopits 1996; Lichtenberg and Hardie 2007). As a result, zoning may actually exacerbate sprawl if the rate of farmland conversion is not also reduced.

Research Question

The purpose of this study is to analyze the effect of a major rural downzoning policy on the rate of farmland conversion in Baltimore County, Maryland. This research seeks to answer the following:

- How does downzoning affect both the *rate* and *density* of development?

Econometric Model of Land Development

We implement a two stage difference-in-difference model of land development. Each model is estimated over a ten year control and treatment window to eliminate any baseline model selection. The first stage is a panel probit model to estimate the landowner's discrete decision on whether to develop or remain developable. Conditional on development in the first stage, the second stage estimates a truncated negative binomial model to predict the number of buildable lots in the subdivision. Zoning is modeled as a categorical variable with the least restrictive zone class set as the baseline.

First Stage Panel Probit:

$$y_{it} = Z_{it}\beta_1 + Z_{it} \times \tau_t\beta_2 + \alpha\tau_t + X_{it}\gamma + T_t\delta + \varepsilon_{it},$$
$$y_{it} = \{0,1\}, \varepsilon_{it} \sim N(0,1)$$

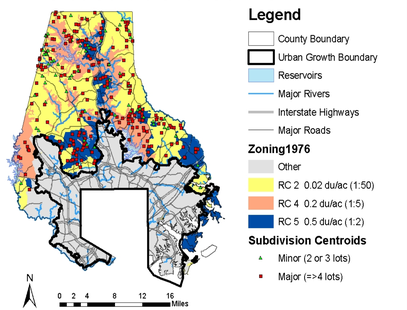
Second Stage Zero Truncated Negative Binomial:

$$[L_{it}|y_{it} = 1] = Z_{it}\theta_1 + Z_{it} \times \tau_t\theta_2 + \lambda\tau_t + X_{it}\psi + T_t\xi + \eta_{it},$$
$$L_{it} = \{\mathbb{Z}^+/0\}$$
$$y_{it}: development\ outcome, L_{it}: count\ of\ lots\ developed, \tau_t: treatment$$
$$Z_{it}: zone\ classes, X_{it}: parcel\ attributes, T_t: time\ dummies$$

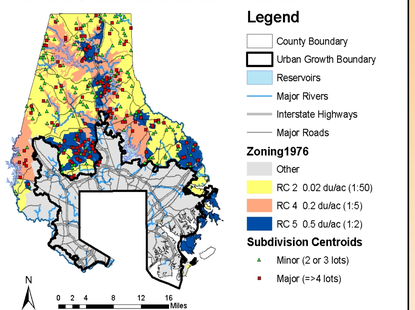
Development in Baltimore County

We use a spatially explicit panel data set of parcel subdivisions from 1967-1986 in Baltimore County, Maryland. Baltimore County witnessed a major downzoning event in 1976 which created three primary Rural Conservation (RC) zone classes (RC2, RC4 and RC5). Prior to downzoning, all rural parcels were allowed a maximum density of one dwelling per acre in the period 1967-1976. After downzoning in 1976, RC2 zoning for agricultural preservation allowed a maximum density of one dwelling per 50 acres and RC4 zoning for watershed protection allowed one dwelling per 5 acres. RC5 zoning for rural residential allowed one dwelling per 2 acres and serves as the baseline zoning category. Figures below display the distribution of zoning types as well as the level of development before and after the 1976 downzoning event.

RC Subdivisions 1967-1976



RC Subdivisions 1977-1986



RC Zoning Marginal Effects (1977-1986)

	Probit Model		Count Model	
***RC* 4**	-0.0020	(0.0011)	-0.069	(0.337)
RC* 4 × *treatment	-0.0025	(0.0014)	-3.457**	(0.514)
***RC* 2**	-0.0078**	(0.0016)	-0.732*	(0.312)
RC* 2 × *treatment	-0.0028*	(0.0015)	-3.366**	(0.427)

Standard errors clustered at the parcel level and reported to the right of coefficients.
****significant at the 1% level, *significant at the five percent level**

Probit/Count Model Results (1967-1986)

Variables	Probit Model		Count Model	
Zoning Variables (baseline = RC5)				
RC 4	-0.116	(0.072)	-0.022	(0.107)
RC 4 × treatment	-0.149	(0.090)	-1.102**	(0.160)
RC 2	-0.374**	(0.061)	-0.233*	(0.098)
RC 2 × treatment	-0.151*	(0.075)	-1.073**	(0.145)
treatment	0.855**	(0.173)	-0.479	(0.273)
Land Quality Variables				
Distance to Baltimore	-0.004	(0.003)	-0.010*	(0.005)
Distance to Roads	-0.003	(0.027)	0.080	(0.053)
Ln(Stream Density)	-0.018**	(0.007)	-0.039*	(0.016)
Ln(Subdivision Area)	0.220**	(0.015)	1.089**	(0.036)
Slope	-0.004	(0.004)	-0.042**	(0.009)
Elevation	0.024**	(0.005)	-0.027**	(0.009)
Flood Plain Area	-0.565*	(0.238)	-0.518	(0.546)
Existing House	-0.155**	(0.034)	-0.109	(0.064)
Surrounding Land Use Variables (0.5 km buffer)				
Non-residential	-0.352	(0.324)	1.459*	(0.627)
Parkland	0.239	(0.155)	-0.420	(0.284)
Residential	0.777**	(0.141)	0.652*	(0.284)
N	88,674		559	

Standard errors clustered at the parcel level and reported to the right of coefficients.
****significant at the 1% level, *significant at the five percent level**

Conclusions

The 1976 downzoning event significantly decreased the density (i.e., increased average lot size). Only RC2 significantly reduced the rate of development, with a modest -0.3% annualized reduction in the probability of development. The primary effect of 1976 downzoning was to shift the type of development from major subdivisions into minor subdivisions in the RC2 area.

References:

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McConnell, V., M Walls, and E. Kopits. 2006. "Zoning, TDRs and the Density of Development" Journal of Urban Economics 59: 440–457.

Pasha, H. 1996. "Suburban Minimum Lot Size Zoning and Spatial Equilibrium." Journal of Urban Economics 40:1–12.