Supplementary Material

"Competition in Local Land Use Planning?"

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A1 Robustness Checks

A1.1 Spatial 2SLS Models

Table A1 below lists the results of two robustness checks: for the spatial 2SLS models, WY is instrumented with WX, in order to control for both the endogeneity of commuting and zoning decisions and the simultaneity bias inherent to all spatial regression models. Despite the usage of commuting data from 1980, commuting is still co-determined by several other unobserved municipality characteristics that are likely to be also affected by zoning decisions, e.g., land and housing prices, or the quality of public services. The spatial lag WY is also likely correlated with the residual ε, as the spatial stimulus in Y, affecting zoning decisions in other municipalities, feeds back through WY. As a consequence, estimates of the spatial autoregressive coefficient are subject to simultaneity bias (Franzese and Hays 2007). The first two columns of Table A1 show that the results for the lagged explanatory variables WX as an instrument for WY are similar to the main results in Table 5 of the article. For the model without LDV in column one, the spatial autoregressive coefficient is slightly higher than it is for WY. This could be the result of additional endogeneity caused by tax competition. Columns three

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and four list the results of an alternative estimation using splm() in R (Millo and Piras 2012). The estimates are also very similar to the main models estimated with lagsarlm() in R, particularly so for the fourth column including the LDV.

Finally, the random effects model (estimated with spgm() in R; Millo and Piras 2012) in the last column allows to reproduce the result of the spatial Hausman test that is mentioned in the article. As a comparison of the estimates in the columns four and five shows, the fixed effect and random effect models are systematically different. This strongly indicates a violation of the core assumption necessary for employing a random effect model, i.e. that the unit-specific effects are uncorrelated with the explanatory variables in the model.

Table A1: Robustness Checks I: IV Estimation with GS2SLS, Spatial Panel MLE & GLM

Model	Structural Equivalence				
	IV Estimation GS2SLS		**Spatial Panel MLE**		**Spatial Panel GLM - RE**
Homeowners	-0.45***	-0.11	-0.71***	-0.11	0.02
	(0.13)	(0.08)	(0.14)	(0.08)	(0.02)
Environmentalists	0.05	-0.15*	0.03	-0.15*	-0.17**
	(0.11)	(0.06)	(0.14)	(0.07)	(0.06)
Development Interests	-0.21	-0.05	-0.09	-0.05	-0.04
	(0.16)	(0.10)	(0.15)	(0.10)	(0.04)
Administrative Capacity	-0.02	-0.03	-0.03	-0.03	-0.00
	(0.03)	(0.02)	(0.03)	(0.02)	(0.01)
Financial Health	0.13*	0.07*	0.12*	0.07*	0.10***
	(0.05)	(0.03)	(0.05)	(0.03)	(0.03)
Tax Rate	1.00	-0.37	2.29	-0.38	-0.51**
	(0.74)	(0.46)	(0.84)	(0.45)	(0.17)
Population Density	-0.81***	-0.24***	-0.83***	-0.24***	0.01
	(0.08)	(0.05)	(0.08)	(0.05)	(0.01)
Population Growth	-1.98***	-0.47**	-1.80***	-0.46**	0.17
	(0.28)	(0.17)	(0.27)	(0.17)	(0.11)
Developable Surface Area	-0.64	-0.01	-0.31	-0.01	0.02*
	(0.51)	(0.31)	(0.49)	(0.30)	(0.01)
Lagged Dependent Variable		0.84***		0.84***	0.99***
		(0.01)		(0.01)	(0.00)
Unit Fixed Effects	✔	✔	✔	✔	
Spatial Autoregressive Coefficient	0.92	0.10	0.81	0.10	-0.03
Standard Error	0.02	0.02	0.04	0.02	0.01
p-Value	0.00***	0.00***	0.00***	0.00***	0.00**
Error Variance			0.34	0.08	
p-Value			0.03*	0.56	
Adjusted R^2	0.55	0.80			
F-Statistic	454.47	1587.75			
p-Value	0.00***	0.00***			
Num. obs.					

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A1.2 Period Fixed Effects Models

As a further alternative model specification, Table A2 below lists the results of models including period fixed effects instead of LDVs (again estimated with splm() in R). Estimating both LDV and period fixed effects leaves very little variance and usually results in an upward bias of the estimate for the LDV (Plümper et al. 2005). Also, since the common trend in the dependent variable is presumably partly determined by spatial interdependence, the inclusion of period fixed effects and the LDV downward bias the spatial lag. This is both because they fully capture the time trend, and as a result of a spatial Hurwicz bias (Plümper and Neumayer 2010). As explained in Endnote 3 in the article, the temporal persistence of the density quota and the problems arising from joint estimations of period fixed effects and LDV make the combination of unit fixed effects and LDV the method of choice for the main results. With regard to Table A2, for Model 1, including both unit and period fixed effects, no significant spatial interdependence is detected, irrespective of the inclusion of the LDV. Moreover, the spatial autoregressive coefficient turns negative. The same holds for Models 2 and 3. Interpreting these results, i.e., disentangling the spatial and temporal associations in the dependent variable, is not trivial. The inclusion of period fixed effects aims at preventing common shocks affecting all units from biasing estimates of the spatial interdependence upwards. Therefore, they completely absorb the unobserved correlation of observations in the same year. Thus, the most appropriate explanation for the vanishing of spatial interdependence with the inclusion of period fixed effects is likely the distinct negative time trend in the density quota that is common to all municipalities. However, it is exactly this common negative trend that is supposed to be tested for spatial association. Coupled with the only marginal average within variation between major revisions of land use plans, joint unit and period fixed effects presumably fail to allow enough variance to detect spatial interdependence in yearly zoning data.

Table A2: Robustness Checks II: Results with Period Fixed Effects

Model	(1)		(2)	(3)
	Structural Equivalence Spatial Panel MLE		**Regional Planning Groups**	**Neighbour-hood**
Homeowners	-0.66***	-0.01	-0.73***	-0.82***
	(0.15)	(0.09)	(0.15)	(0.15)
Environmentalists	0.40	-0.16	0.40	0.25
	(0.24)	(0.15)	(0.25)	(0.25)
Development Interests	-0.22	-0.07	-0.25	-0.20
	(0.16)	(0.10)	(0.16)	(0.15)
Administrative Capacity	-0.02	-0.03	-0.01	-0.01
	(0.03)	(0.02)	(0.03)	(0.03)
Financial Health	0.12*	0.08*	0.14*	0.13*
	(0.05)	(0.03)	(0.05)	(0.05)
Tax Rate	2.54**	-0.76	2.28*	2.22*
	(0.88)	(0.54)	(0.90)	(0.91)
Population Density	-0.75***	-0.24***	-0.84***	-0.79***
	(0.08)	(0.05)	(0.08)	(0.08)
Population Growth	-1.88***	-0.47**	-1.70***	-1.79***
	(0.27)	(0.17)	(0.28)	(0.27)
Developable Surface Area	-0.69	0.07	-0.77	-0.84
	(0.49)	(0.30)	(0.50)	(0.49)
Lagged Dependent Variable		0.84***		
		(0.01)		
Unit Fixed Effects	✔	✔	✔	✔
Period Fixed Effects	✔	✔	✔	✔
Spatial Autoregressive Coefficient	-0.62	-0.17	-0.21	-0.09
Standard Error	0.74	0.31	0.27	0.10
p-Value	0.40	0.58	0.42	0.38
Error Variance	0.05	-0.49	0.35	0.26
p-Value	0.92	0.25	0.03*	0.00**
Num. obs.	3420	3420	3420	3420

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

References

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