The Effect of Land Annexation Policy on Housing Values and Land Supply in Oregon Cities

Winston Hovekamp
Megan McGowen
Ryan Sherrard

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Under the supervision of Professor Joe Stone

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Executive Summary

Oregon's land policy has long reflected the seemingly conflicting goals of preventing urban sprawl and promoting economic growth. The existence of Urban Growth Boundaries (UGBs) has a substantial effect on the amount of vacant land that cities can develop on. This elevates the importance of municipal annexation policies, which can further restrict the quantity of developable land and may have important ramifications for housing prices and economic development. Municipal annexation policies can roughly be split into two categories: those that require voter approval for all annexations and those that don't. This paper examines the effect that voter-approved annexation policies have on housing value by developing a Fixed Effects regression model that estimates how measures of available land within the city limits are affected by the existence of a voter-approved annexation policy, the effect on number of residential units built, and whether this more restrictive annexation policy has a significant effect on market housing valuations. We find that the existence of a voter-approved annexation policy in a city has a significantly negative effect on the amount of vacant land available for residential development and a significant, positive effect on market housing values, but no direct significant effect on the number of parcels developed.

I. Introduction/Objectives

City planners and other policy makers face a continual land use conflict along the urban-rural line. Growing cities face constant pressure to expand new residential and industrial developments outward onto cheaper land farther from the city center. This "urban sprawl" creates significant environmental consequences and threatens nearby agricultural land. True to its reputation as a state known for environmental consciousness and a predominant agricultural sector, Oregon has gone unusually far in its efforts to protect rural land by requiring all cities to establish UGBs to demarcate the limit of acceptable urban growth in the near future. Though UGBs are mandated to include sufficient land to accommodate twenty years of city growth, some researchers claim that UGBs inhibit economic development and inflate housing prices by restricting land supply, or at least perceptions of land supply. This leaves planners the challenge of using other land-use tactics to influence the amount of available land within their respective territories.

Annexation is the process through which a city increases the amount of available land within its boundaries by adding unincorporated land adjacent to its jurisdiction. In general, annexation policies fall under two broad categories: those that require only the approval of a municipal board, and those that have to be voted on by the municipality's constituents. The implementation of a voter-approved annexation policy is a technique commonly used to create a sense of community, democracy, and public input. However, the added complexity of the approval process often inhibits the land acquisition process, thus adding a sometimes insurmountable hurdle to annexation. Previous studies done on annexation examine the effect that stricter annexation policies have on cities economic growth through population growth, and have generally found that stricter annexation policies inhibit city growth due to the aforementioned reason.

Oregon has a somewhat unique situation in that each city is permitted under state law the right to craft their own annexation policy. The first voter-approved annexation policy appeared in 1976 in the city of Corvallis. A second city didn't adopt the policy until the early 1990's;

however, their entrance was only the first of a series of cities who adopted the policy over the following two decades. Annexation policies quickly became a controversial issue both locally and statewide as citizens, municipalities, and legislators grappled with increasingly complex webs of contradicting land laws. Local laws and State laws often clashed, especially when city annexation policies overlapped with Oregon UGB laws. Activists and lobbyists quickly organized on both sides of the conflict, resulting in a wave of Oregon Supreme Court decisions and congressional legislation efforts which ultimately affirmed a municipality's right to have voter-approved annexation. Proponents of the voter-approved annexation policies claim that not only do voters have the right to decide what land is brought into the city limits, but that the mere existence of a voter-approved policy forces developers to cater their proposals to what will be best for the city, thus promoting smart growth. Opponents of voter-approved annexation policies, perhaps unsurprisingly, are often land developers, construction companies, and realtors. Their argument against voter approval on annexations is primarily an economic one, mainly that the existence of an unnecessary and cumbersome electoral process on every annexation will be an economic burden, and slow the growth, development, and economic well-being of cities. Questions surrounding who has the right to annex land are also highly politically charged. Small and big government activists clash over these policies, believing the salient question to be one of political rights rather than economic pragmatism.

This paper adds to the literature concerned with annexation policy by focusing specifically on how voter-approved annexation policy interacts with the available land supply and development of residential units within the city limits, and how this affects the valuation of residential units. Using cross-sectional data from 2012 and panel data from 1990-2010 gathered from the Oregon Census and the Oregon County Tax Lot and Assessment Data, we estimate how this interaction affects market housing value level and the development of residential housing accounting for housing attributes, geographic location, and regulatory characteristics. Significant results will highlight unintended consequences of voter-approved annexation on the land supply, assessed housing value and the number of single-family residences built, allowing Oregonians to understand the full effect of implementing voter-approved annexation policies.

II. Prior research

While there have been few to no studies on the effects of differing annexation policies and available land supply on housing prices within UGBs, there is substantial literature on our question's constituent pieces which serve as a theoretical basis for our analysis. There is a somewhat staggering amount of research regarding the possible effect of UGBs on economic growth and housing prices, with the vast majority of it focusing on the Portland Metro Area. While there has been no clear consensus built regarding the effects of UGB on growth there has been some significant work regarding UGBs effects on specific economic indicators, namely housing prices. Phillips and Goodstein (2000) find that UGBs exhibit an upward pressure on housing prices, noting the possibility that "popular perceptions of a UGB-induced land shortage have helped fuel such as speculative wave." The speculative increases which UGBs exert on housing prices, because it is based merely on perceptions of land supply, could in fact be exacerbated by the existence of a voter-approved annexation policy, a relationship which this paper seeks to sort out.

The literature examining the general relationship between land supply and housing prices (as opposed to specifically discussing UGBs) has been somewhat inconclusive; primarily due to the difficulties in enacting empirical studies of the contradictory effects which land-supply could hypothetically have on price. Standard economic theory seems to imply that any decrease in land supply, holding demand constant, should increase the price of land. Things get murky however as it can be difficult to measure consumers' response to increased land prices, as in some cases consumers may respond by decreasing lot size and quality, which would in turn drive prices back down (Wassmer and Baass, 2006). While the economic theory behind the relationship between land supply and housing values is inconclusive, there exists a fairly large body of research that seems to imply a positive relationship between restrictions on the land supply and housing prices (see Brueckner 1990, Katz and Rosen 1987). Ho and Ganesan (1998) find that "Speculative demand and land supply have a significant but modest impact on housing prices," while Glaeser and Gyourko (2002) find that zoning and land use policies can have an effect on housing valuations by influencing the quantity of available land, specifically examining extreme examples such as in southern California. Essentially, although there is not a clear empirical model that estimates the positive relationship between housing values and the restrictions on the land supply, there is a growing consensus regarding its likely validity.

Scholarship examining the effects of land controls in general has been much more consistent than those examining the land supply specifically. There is near unanimity regarding the positive relationship between the existence of land controls and higher housing values (Brueckner, 1990, Dowall and Landis 1982, Glaeser and Gyourko 2002, Katz and Rosen 1987, Schwartz, Hansen and Green 1981, Quigly and Rosenthal 2005), although the mechanism through which land controls affect housing values is a bit more ambiguous. As noted above, one possible explanation is that land controls limit the supply of developable land, thus increasing the price of land and consequently the price of housing. However, another possible explanation deals not with restricting the land inside the city limits, but with preserving the land outside of it.

Especially in a state such as Oregon where natural capital plays a significant role in the economy, the preservation of the natural resources outside of city limits can have a significant effect on housing prices. Whitelaw and Niemi (1989) find that those who live in areas with easy access to natural amenities receive a sort of *second paycheck* derived from the consumer surplus provided by the increased quality of life resulting from these amenities. This *second paycheck* can have very real repercussions on a city's economic landscape, notably by decreasing wage and increasing housing prices. This finding is supported by Bruckner (1990), which states that "by preserving a community's 'quality of life,' controls create an amenity whose value is then capitalized into housing prices."

Also relevant to our analysis is the academic literature surrounding the relevant price elasticities of housing supply and demand. Generally the literature supports the assertion that the price elasticity of demand is very inelastic, in large part due to the nature of the good (Hanushek and Quigley 1980, Eberts and Gronberg 1982). These findings are supported both by empirical analysis and economic theory, as it makes sense that demand would be inelastic due the general necessity of housing and the relative difficulty of changing one's housing situation. Housing supply on the other hand seems to be very elastic (Glaeser and Gyourko 2002, Rydell 1982). This again lies in accordance with economic intuition, as while in the short term housing supply would be very inelastic, in the long term (the time frame of our analysis) housing developers can be fairly flexible in adjusting the quantity built.

There has been significantly less work examining annexation policies and their possible influence on housing prices and city growth. Academic research on annexation policies began in earnest in the 1960's with Frank Sengstock (1960) who established the typology for differing annexation policies, and whose definitions are commonly used in the annexation debate. Namely he distinguishes between five varieties of annexation policies, each of which is named for the political body that determines annexation: legislative determination, popular determination, municipal determination, judicial determination, and quasi-legislative determination. For the purposes of our paper we will primarily be examining municipal determination, wherein city officials can enact annexation without public approval, and popular determination wherein all annexation decisions are subject to a popular vote. The possible effects of each kind of annexation policy lie in their respective ease of implementation, with municipal determination being less restrictive and thus easier to implement. The ease of implementation of annexation policies has been shown to play a statistically significant role on the growth of cities, however the extent of and nature of the effect thus far remains inconclusive. Smirnova and Ingals (2007) find that the varying restrictiveness (or ease of implementation) of annexation policies across municipalities has effects on the growth of cities; however their analysis is unable to conclusively comment on urban growth specifically due to methodological problems.

Finally, in our tax-lot analysis we utilize a rent-gradient, basing our basic methodology on the work of Eberts and Gronberg (1982). Also apparent in our methodology are elements of hedonic price modeling, first pioneered by Sherwin Rosen (1974).

III. Theoretical Analysis

Given the aforementioned economic literature on urban land use economics, we estimate that voter-approved annexation policies will have a negative effect on land supply. In turn, this will act as an upward pressure on housing prices. We also hypothesize that the effect on number of parcels developed will be minimal to non-existent. In order to test our hypotheses we examine the effects of annexation policies at both the city and individual tax lot levels.

Among the assumptions we are making in our theoretical analysis are the price elasticities of housing supply and demand. As noted above, the relevant literature strongly implies that housing supply is relatively elastic, while housing demand is very inelastic. Because of this, we expect that controls on the housing supply such as the annexation policy will have a larger, significant effect on price than the quantity of parcels developed, which is largely a function of demand. This assumption is further supported by the nature of the housing market as one that inherently rarely clears and is slow to react, possibly dampening the short-term marginal effects of supply and demand shifts.

We split our analysis into two different categories of models based upon which data set they draw upon. This is to examine the possible effect of voter-approved annexation policies on two different levels. The city level models allow us to see the effect of the policy on citywide development and land variables, while the tax lot level models offer a glimpse into the values of individual properties. Thus we are able to examine the citywide effect on land supply and parcels developed, as well the as the possible housing value increases of individual parcels.

3.1 City Level Models:

Model 1: Percent Vacant Land as Endogenous Variable

$$VacantLand_{it} = \boldsymbol{\gamma}_i + \beta_1 \bullet Annex_{it} + \beta_2 \bullet ParcelsDev + \beta_3 G_{it} + \beta_4 \bullet \boldsymbol{D}_{it} + \beta_5 \bullet Y_{it} + \varepsilon_{it}$$

Our first model (Model 1 shown above) examines the effect of voter-approved annexation on the percentage of vacant land within Oregon cities. Our model is constructed using an Ordinary Least Squares (OLS) regression that includes city and year fixed effects (as denoted by $\boldsymbol{\gamma}_i$ and $Y_{it,}$ respectively). City fixed effects help to account for the unobserved heterogeneity, such as location specific factors, across cities over time. Including these in the model will decrease omitted variable bias, allowing us to more accurately tease out the effect of the annexation policies. The coefficient on our variable of interest *Annex*, β_1, describes the effect that the presence of a voter-approved annexation policy has on the amount of available land within cities. Also included in this model are various demographic (*D*) and geographic (*G*) variables. By including covariates, such as total population, average density, and other variables that could potentially affect the amount of available land within cities, we hope to minimize the amount of omitted variable bias and separate the effect that voter-approved annexation is having on the land supply. A full list of the variables used in our regression can be found in Figure 2 in our appendices.

Model 2: Parcels Developed as Endogenous Variable

$$Log\_UnitsBuilt_{it} = \gamma_i + \beta_1 \cdot Annex_{it} + \beta_2 \cdot VacantLand_{it} + \beta_3 \cdot G_{it} + \beta_4 \cdot D_{it} + \beta_5 \cdot Y_{it} + \varepsilon_{it}$$

We included a second model (Model 2 shown above) using the logged number of single-family residential units developed as our dependent variable in order to test whether our data is congruent with the theory regarding the inelasticity of housing demand. Similar to Model 1, this regression is also an Ordinary Least Squares regression that accounts for both city (γ_i) and year (Y_{it}) fixed effects. The main variable of interest in this regression is *Annex*, whose coefficient, β_1, will describe the magnitude of the relationship between the number of single family homes developed in cities with the voter-approved annexation policies and those without. By establishing the significance of this coefficient, we are able to analyze whether the effect of voter-approved annexation policy is significant on the demand side. If we do find a significant direct effect, this would contradict both our hypothesis as well as our theoretical understanding of the housing market.

In order to ensure the accuracy of our estimate, we include control variables in addition to the city and year fixed effects. These demographic and geographic controls, the same as those included in our first model, can be found in Figure 2 in our appendices.

3.2 Tax lot Models

Model 3: Annexation as an Intercept

$$\text{Price}_i = \beta_0 + \beta_1 \bullet \textit{Log\_DistanceCBD}_i + \beta_2 \bullet \textit{Log\_DistanceCBD}^2_i + \beta_3 \bullet \textit{Annex}_i + \beta_4 \bullet H_i + \beta 5 \bullet G_i + \beta \bullet D_i + \varepsilon_i$$

Model 4: Relationship Between Distance and Housing Value, Disregarding Annexation

$$\text{Price}_i = \beta_0 + \beta_1 \bullet \textit{Log\_DistanceCBD}_i + \beta_2 \bullet \textit{Log\_DistanceCBD}^2_i + \beta_3 \bullet H_i + \beta_4 \bullet \gamma_{ij} + \varepsilon_i$$

Model 5: Interaction Between Distance and Annexation, Including City Fixed Effects

$$\text{Price}_i = \beta_0 + \beta_1 \bullet \textit{Log\_DistanceCBD}_i + \beta_2 \bullet \textit{Annex\_LogDistance}_i + \beta 3 \bullet \textit{Log\_DistanceCBD}^2_i + \beta_4 \bullet H_i + \beta_5 \bullet \gamma_{ij} + \varepsilon_i$$

We split our tax lot level analysis into three models which each offer a unique perspective into the possible effect of voter-approved annexation policies. Although the data is only cross-sectional, there are two main benefits to looking at the effects of annexation policies at this level. First, it allows us to use market value as a dependent variable. We chose to use market value rather than assessed value so as to capture any speculative increases in value that could be caused by the voter-approved annexation policy. The variable is logged in order to account for the fact that the data is right-skewed and to create results that are easier to read and interpret. Additionally, a tax lot level analysis creates the opportunity to incorporate housing characteristics, in addition to geographic and demographic characteristics, into our models.

In our first model (Model 3) voter-approved annexation policy exists as a dummy intercept variable along with a number of controls for city size, population, and income (represented above in our geographic and demographic characteristics) and the various housing characteristics (such as square feet, lot size, and age). A full list of our variables used can be found in *Figure 5* in our appendices. Although we are still controlling for distance to the nearest central business district (*distanceCBD*), our variable of interest in this model is *Annex*.

For our second and third models (Models 4 and 5 respectively), in order to take advantage of city fixed effects, we removed the *Annex* dummy variable and replaced it with a distance to Central Business District (CBD) based rent gradient. The inclusion of city effects at the tax lot level addresses omitted variables, such as some demographic and geographic variables, that are heterogeneous across tax lots within each city; because our data is cross-sectional, voter-approved annexation policy is captured in this coefficient. Model 4 shows the rent gradient with no interaction with *Annex* while Model 5 interacts the two. The purpose of the rent gradient is twofold: first it allows us to have a variable to interact with *Annex*, permitting us to test the effect of the annexation policies while using fixed effects. Second, it adds a spatial dimension to our analysis of the possible effects of the annexation policy, as it is theoretically possible that the voter-approved annexation policies could have an effect not just on housing prices generally, but on the price gradient throughout the city.

IV. Empirical Testing

As established above, we base our analysis on two different data sets, one where observations are at the tax lot level, and the other at the city level. Both models we constructed from the same three primary sources. In each model, the individual lot and housing variables, as well as the city averages of these characteristics, are derived from Oregon County Tax Lot and Assessment Data, 2014. Because we are examining the effect of annexation policies on residential land supply and housing values, we have limited our data to only Class 100 Residential Properties of half an acre or less, disregarding large lots and multi-family complexes. In addition, we had to omit roughly half of the observations due to inconsistencies in reporting between counties. This leaves a cross-sectional set of over 170,000 individual tax lot observations in 60 cities for the year 2012, which forms the basis of our first data set. To this we merge in data from the 2010 Census as an approximation of the corresponding citywide demographic variables. Finally, we add our annexation policy data, which we derive primarily from the League of Oregon Cities and supplemented with information from the Oregon Communities for a Voice in Annexation and our own research into individual city charters.

Our other data set is a panel set of 115 Oregon cities from 1990-2010, which we constructed by aggregating figures from the lot level set based on the year the tax lot was improved, and then merging in demographic data from the census. We use the three time periods 1990, 2000, and 2010 to correspond with the decennial census years, and because they give us a good window into the long term effects of voter-approved annexation policies. We calculate a number of variables measuring the Class 100 land supply and development, such as quantity in acres of land which was designated Class 100 and quantity in acres of improved residential land (residential land upon which there has been an improvement of 10,000 dollars or greater) for each of our three periods, as well as the number of parcels developed in the interim. We use the first two of these variables to construct our *VacantLand* variable, which we use to measure the supply of vacant land available for development within the city limits. Two key variables to note are the quantity of parcels developed, designated *UnitsBuilt,* and the average density of these newly developed parcels, designated *Density.* Both of these variables we construct by aggregating the parcels developed in a five-year range centered on their nominal time period. In doing this, we hoped to bypass short-term cycles and spikes in the housing market. The demographic variables gathered from the census data we use mainly as controls. Among these are race and ethnicity dummy variables, poverty and employment rates, and average city incomes and commute times. The census provides all of these variables in terms of the number of people belonging to each group, but for our analysis we transform many of these variables into percentages or approximate median values in order to more easily use and interpret them. Our final regression uses logs of *Population UnitsBuilt Density Income* and *CommuteTime* in order to simplify the results and resolve issues of scale.

We would have liked to include information regarding the amount of land between the UGB and the city limits in order to study possible interactions between annexation policies and UGBs. However, obtaining useable data on this subject proved to be infeasible.

Figure 1: Condensed City Level Output

VARIABLES	(Model 1) VacantLand	(Model 2) log_UnitsBuilt
Annex	-0.0466***	0.0664
	(0.0135)	(0.222)
log_Population	-0.293***	1.106**
	(0.0188)	(0.434)
Density	-0.00859***	0.155***
	(0.00293)	(0.0467)
log_UnitsBuilt	0.0116***	
	(0.00421)	
VacantLand		2.971***
		(1.082)
Observations	337	337
R-squared	0.888	0.512

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from our city level regression seem to support our initial hypothesis regarding the annexation policies. The voter approval restrictions on annexation seem to have a significant negative effect on the percentage of vacant residential land in the cities, yet do not seem to have a direct effect on the number of parcels built. There is, however, evidence of a possible indirect effect of voter annexation on parcels developed, as there is a significant effect of voter annexation on the percentage of vacant land, which has a significant effect on the number of units built. Ultimately this implies that the existence of the voter annexation policy might indirectly reduce parcels developed by 13.8%. The existence of the restriction in a city also had a significant positive relationship with the average urban density of the city. This is consistent with the previous literature that associates zoning policies with land supply restrictions, and supports our hypothesis that any effect of the annexation policies would be reflected on the supply side of the housing market.

Figure 2: Condensed Tax Lot Output

VARIABLES	(Model 3) log_Price	(Model 4) log_Price	(Model 5) log_Price
log_DistanceCBD	-0.284***	-0.478***	-0.499***
	(0.0162)	(0.0136)	(0.0143)
Annex_DistanceCBD			-0.0483***
			(0.00235)
log_Distance2	0.0195***	0.0312***	0.0336***
	(0.000928)	(0.000785)	(0.000842)
Annex	0.0812***		
	(0.00169)		
Observations	169,643	173,824	173,824
R-squared	0.661	0.733	0.734

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Our tax lot analysis adds further support to our hypothesis concerning Annexation Policy. In Model 3 we find that the presence of a voter-approved annexation policy seems to increase the market value of a residence by about 8.12%. Although this estimation is hampered by the lack of city fixed effects, the significance of our result at the 1% level and the fact that we controlled for the most important city effects such as population, median income, and unemployment makes us confident in the positive relationship between the existence of voter-approved annexation policies and housing values.

As we were exploring other ways these annexation policies might affect housing phenomenon, we discovered a notable phenomenon. The rent gradient seems to have a substantially different behavior in cities with voter-approved annexation policies than in those without. In Model 4 we find that, in general, the cities in our sample all exhibit a U-shaped rent gradient with relatively high housing prices both very close and very far from the central business district. Our results from Model 5 indicate that this gradient is, at least for the region relatively near the CBD, about 10% steeper in cities with voter-approved annexation policies when compared to cities without. Because this is not the main focus of our project, we will leave a deeper analysis of this effect on rent gradients to future researchers. However, these results do directly lend some value to our core project. Steeper rent gradients are generally found to imply higher intercept housing values, so this gradient effect is consistent with our predicted positive relationship between housing prices and the presence of a voter-approved annexation policy. Furthermore, this demonstrated spatial inequity has its own set of policy implications that we would like to make clear to public planners as a part of our greater report on voter-approved annexation policies.

V. Conclusion

The policy implications of our results, while likely applicable to many annexation questions across the country, are especially relevant in Oregon due to the important role which annexations play in its political landscape. However, as with many economic analyses, we seek to provide descriptions regarding the effects of these voter-approved annexation policies rather than prescriptions regarding the wisdom of their possible implementation. We find that the existence of a voter-approved annexation policy in a city will have a significant negative effect on the amount of vacant land available for residential development and a significant positive effect on market housing values, but no direct significant effect on the number of parcels developed. Thus our results imply that voter-approved annexation policies do not directly affect the development of new housing units, although there may be an indirect effect. That being said, there are a number of welfare implications to the decreased land supply and increased housing values that result from the implementation of these policies.

The burden of the price increase is largely regressive, disproportionately affecting the young and poor. The shift in the housing market caused by the policy is also possibly economically inefficient, as it shifts the market away from its optimal equilibrium and, according to standard economic theory, creates deadweight loss. This analysis, of course, is examining solely some of the economic considerations surrounding the implementation of voter-approved annexation policies, and thus ignores any possible politically normative recommendations that could arise from our findings. We leave those to the municipalities, who must weigh the pros and cons on their own and make their decision based on which values are salient to their community. Our analysis, much like our predecessors', does not create a predictive dynamic model regarding the relationship between land restrictions and housing values, primarily due to a lack of the data necessary. That remains for future research.

VI. References

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VII. Appendices

Figure 3: Oregon Cities with Voter-Approved Annexations

Voter-Approved Annexations*

(Cities whose charter requires voter-approved annexations)

City	2012 Pop.
Albany	50,710
Banks	1,775
Canby	15,865
Corvallis	55,055
Culver	1,370
Estacada	2,850
Gates	485
Grants Pass	34,740
Jefferson	3,140
King City	3,225
Lake Oswego	36,770
McMinnville	32,435
Metolius	705
Molalla	8,110
Monmouth	9,755
Newberg	22,300
North Plains	1,990

City	2012 Pop.
Oregon City	32,500
Philomath	4,620
Phoenix	4,570
Rogue River	2,145
Salem	156,455
Sandy	9,880
Sherwood	18,265
Sisters	2,080
St. Helens	12,920
St. Paul	420
Stayton	7,660
Talent	6,115
Tangent	1,180
Turner	1,865
West Linn	25,370
Wheeler	415
Yachats	705

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[1] See Figure 1.

Figure 4: Description of Variables

VARIABLES	Variable Description
Annex	Dummy variable: =1 if annexation policy is voter-approved, = 0 if municipal.
log_Population	Log of total population
Density	Average density in 5 year range centered around nominal time period
HispanicORLatino	Percent of total population that is Hispanic or Latino
Unemployment_Rate	Unemployment rate
log_Income	Log of median household income
log_CommuteTime	Log of median commute time
log_UnitsBuilt	Log of number of single family residential homes built
VacantLand	% of total residential land that is unimproved
log_DistanceCBD	Log of distance to the central business district
Annex_DistanceCBD	(Annexation Dummy) x (Distance to the nearest CBD)
log_DistanceCBD2	(Log of distance to the CBD)^2
strucsqft	Square footage of house
LotSize	Acres of tax lot
age	Number of years since year built
log_DistanceHwy	Log of distance to the nearest highway

LandinTaxlots	Total amount of land in tax lots within city limits (acres)

Figure 5: City Level Variables

VARIABLES	(1) Model 1	(2) Model 2
Annex	-0.0466***	0.0664
	(0.0135)	(0.222)
log_Population	-0.293***	1.106**
	(0.0188)	(0.434)
Density	-0.00859***	0.155***
	(0.00293)	(0.0467)
HispanicORLatino	0.144*	-0.331
	(0.0866)	(1.396)
Unemployment_Rate	-0.0599	-1.675
	(0.101)	(1.609)
log_Income	0.0443*	0.843**
	(0.0226)	(0.362)
log_CommuteTime	-0.0311	0.564
	(0.0219)	(0.350)
log_UnitsBuilt	0.0116***	
	(0.00421)	
2000.Year	-0.0417***	0.742***
	(0.00978)	(0.155)
2010.Year	-0.0740***	-0.252
	(0.0120)	(0.208)
VacantLand		2.971***
		(1.082)
Constant	2.430***	-17.68***
	(0.270)	(4.942)
Observations	337	337
R-squared	0.888	0.512
Number of Cities	115	115

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 6: Tax Lot Level Output

VARIABLES	(3) Log_Price	(1) Log_Price	(2) Log_Price
log_DistanceCBD	-0.284***	-0.478***	-0.499***
	(0.0162)	(0.0136)	(0.0143)
Annex_DistanceCBD			-0.0483***
			(0.00235)
log_distance2	0.0195***	0.0312***	0.0336***
	(0.000928)	(0.000785)	(0.000842)
strucsqft	0.000353***	0.000354***	0.000353***
	(1.43e-06)	(1.37e-06)	(1.37e-06)
LotSize	0.500***	0.666***	0.672***
	(0.00983)	(0.00897)	(0.00898)
age	-0.00261***	-0.00314***	-0.00323***
	(3.38e-05)	(3.07e-05)	(3.14e-05)
4.City1		0.0126	0.423***
		(0.0126)	(0.0234)
5.City1		-0.217***	-0.212***
		(0.0168)	(0.0166)
8.City1		-0.0300**	-0.0397***
		(0.0136)	(0.0133)
9.City1		0.0163	0.0104
		(0.0123)	(0.0119)
10.City1		0.172***	0.164***
		(0.0164)	(0.0161)
11.City1		-0.442***	-0.451***
		(0.0136)	(0.0133)
12.City1		0.761***	0.748***
		(0.0559)	(0.0553)
13.City1		0.0853***	0.441***
		(0.0130)	(0.0215)
14.City1		-0.00551	-0.0435***
		(0.0122)	(0.0120)
15.City1		-0.694***	-0.689***
		(0.0322)	(0.0321)
16.City1		0.163***	0.152***
		(0.0136)	(0.0133)
17.City1		0.987***	0.971***
		(0.0162)	(0.0160)
19.City1		-0.0586***	-0.0568***
		(0.0140)	(0.0137)
22.City1		-0.00939	-0.0129
		(0.0148)	(0.0145)
23.City1		0.285***	0.266***

	(0.0156)	(0.0155)
24.City1	0.254***	0.663***
	(0.0122)	(0.0233)
27.City1	-0.0715***	-0.0841***
	(0.0122)	(0.0118)
28.City1	-0.168***	-0.171***
	(0.0134)	(0.0130)
29.City1	0.141***	0.138***
	(0.0168)	(0.0165)
30.City1	0.0592***	0.0563***
	(0.0125)	(0.0121)
36.City1	0.608***	0.599***
	(0.0164)	(0.0162)
37.City1	-0.218***	-0.222***
	(0.0141)	(0.0137)
39.City1	0.0582***	0.0498**
	(0.0221)	(0.0220)
42.City1	0.530***	0.520***
	(0.0126)	(0.0123)
43.City1	0.0960***	0.0872***
	(0.0134)	(0.0130)
44.City1	-0.132***	-0.143***
	(0.0130)	(0.0126)
45.City1	-0.106***	-0.117***
	(0.0189)	(0.0187)
47.City1	-0.0343**	0.341***
	(0.0133)	(0.0225)
49.City1	0.0450***	0.0258**
	(0.0121)	(0.0117)
50.City1	-0.518***	-0.547***
	(0.0133)	(0.0131)
51.City1	-0.0681***	-0.0786***
	(0.0130)	(0.0127)
52.City1	-0.257***	-0.262***
	(0.0128)	(0.0124)
54.City1	-0.395***	-0.399***
	(0.0219)	(0.0215)
55.City1	-0.0345***	0.361***
	(0.0122)	(0.0228)
57.City1	0.0158	-0.0233
	(0.0163)	(0.0162)
59.City1	-0.0447***	0.343***
	(0.0123)	(0.0225)
60.City1	-0.235***	-0.230***
	(0.0220)	(0.0217)
62.City1	0.133***	0.524***

		(0.0121)	(0.0225)
63.City1		0.291***	0.276***
		(0.0188)	(0.0185)
64.City1		0.114***	0.468***
		(0.0145)	(0.0227)
68.City1		0.0647***	0.443***
		(0.0128)	(0.0225)
71.City1		-0.368***	-0.402***
		(0.0122)	(0.0120)
73.City1		-0.111***	0.309***
		(0.0122)	(0.0235)
74.City1		-0.0328***	-0.0503***
		(0.0125)	(0.0121)
75.City1		-0.320***	-0.313***
		(0.0197)	(0.0193)
76.City1		-0.221***	-0.221***
		(0.0322)	(0.0320)
77.City1		0.371***	0.365***
		(0.0135)	(0.0131)
80.City1		-0.287***	-0.307***
		(0.0134)	(0.0131)
81.City1		0.0918***	0.0794***
		(0.0125)	(0.0121)
82.City1		0.0136	0.377***
		(0.0151)	(0.0235)
84.City1		-0.178***	0.216***
		(0.0124)	(0.0227)
85.City1		0.0898***	0.437***
		(0.0180)	(0.0245)
87.City1		0.00144	0.385***
		(0.0122)	(0.0222)
88.City1		0.103***	0.0961***
		(0.0125)	(0.0122)
89.City1		-0.598***	-0.600***
		(0.0340)	(0.0338)
93.City1		-0.00650	-0.00973
		(0.0134)	(0.0130)
97.City1		-0.0781***	-0.107***
		(0.0135)	(0.0133)
99.City1		-0.132***	-0.153***
		(0.0124)	(0.0121)
100.City1		-0.108***	-0.106***
		(0.0164)	(0.0160)
Annex	0.0812***		
	(0.00169)		
log_distancehwy	0.0619***		

	(0.000770)		
Density	0.0455***		
	(0.000775)		
log_UnitsBuilt	0.0688***		
	(0.00186)		
VacantLand	-0.386***		
	(0.0117)		
log_Income	0.142***		
	(0.00701)		
log_CommuteTime	-0.124***		
	(0.00412)		
HispanicORLatino	0.229***		
	(0.00811)		
Unemployment_Rate	-3.961***		
	(0.0371)		
log_Population	-0.108***		
	(0.00219)		
LandinTaxlots	-6.57e-06***		
	(1.74e-07)		
Constant	11.76***	13.26***	13.29***
	(0.102)	(0.0593)	(0.0616)
Observations	169,643	173,824	173,824
R-squared	0.661	0.733	0.734

Figure 7: City Level Summary Statistics

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
Annex	351	.111111	.314718	0	1
log_Population	351	8.10401	1.50268	3.496508	11.95903
Density	337	5.261128	1.44274	2.06	14.88
HispanicORLatino	351	.0931693	.1086933	0	.6868687
Unemployment_Rate	351	.086448	.0447345	0	.4285714
log_Income	351	10.6673	.2366668	9.923032	11.37939
log_CommuteTime	351	2.84940	.3683743	1.877702	3.774402

log_UnitsBuilt	337	3.943628	1.70756	0	8.330623
VacantLand	351	.3763768	.1728144	.0203871	.9524419