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Government Regulation and Changes in the Affordable Housing Stock

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Abstract

This paper identifies the relationship between government controls on housing supply and changes in the stock of market housing affordable to low-income households. In studies of housing, policy makers and academics have focused considerable attention on both the shortage of good-quality affordable rental housing for low-Income households and the effect of land use regulations on house prices and the supply on new residential units without linking the two topics. This is the first effort we know of to test how government controls on the construction of new units affects the supply of affordable rental accommodations. We conduct these tests using a filtering model, where units move between quality sub-markets depending on demand and the maintenance, renovation, and repair decisions of landlords. Here, we take advantage of the panel nature of the AHS metropolitan surveys to identify the relationship between restrictions on new construction and rent control policies and the movement of individual housing units in and out of the stock of units affordable to low-income households. First, we find that the greater the supply elasticity for new construction, the less likely are affordable rental units to filter up and out of the affordable stock. Second, our empirical results suggest that restrictions on new construction are likely to reduce the affordable stock as it increases the probability that an affordable unit becomes unaffordable. Third, the relationship between affordable uncontrolled units and the presence of rent control is more confusing. We find the surprising result that as the percentage of rent controlled units in an area rises, the remaining affordable non-rent controlled units actually have a lower probability of filtering up relative to staying affordable. We suspect that this is an artifact of a selection bias in the identification of market-rate units that are affordable in the presence of rent control. This process might result in uncontrolled units that remain affordable when rent control is more pervasive having much lower unobserved quality or the presence of negative externality from poorly maintained rent control stock. Both of these factors would reduce the probability that these units filter up.

Introduction

The primary public policy focus of economists on housing issues has been on affordability of home ownership, mortgage availability, land use regulation, and rent control. Studies of land use regulation focus on the effects of regulation on the price of owner-occupied housing. Work on low-income housing has concerned itself more with issues of measurement and the debate of supply vs. demand-side subsidies. In this paper we look at the relationship between these two issues to examine how government regulation affects the dynamics of the low-income housing stock. We find that consistent with theoretical models of housing, restrictions on the supply of new units lowers the supply of affordable units. This occurs as increases in demand for higher-quality units raises the return to maintenance, repairs, and renovations of lower-quality units as landlords have a stronger incentive to upgrade them to a higher-quality and higher return housing sub-market. This result is disturbing as it highlights how policies targeted towards new higher income owner-occupied suburban housing can have unintended negative consequences for lower income renters.

This research differs from most studies of affordable housing in that we are not concerned with identifying the size of the affordable stock or matching it to the number of low-income households. The gap between the housing needs of low income households and the stock of units deemed affordable has been demonstrated in a large number of other research efforts.[1] Here we build on Somerville and Holmes's (2001) study of the effects of the unit, neighborhood, and market characteristics on the probability that a unit will stay in the stock of rental units affordable to low-income households by looking at how government regulations affect this

[1] Among the many papers in this literature are Bogdon, Silver, and Turner (1994) on the relationship between affordability and adequacy, Nelson (1994) on the match between the affordable stock and low-income households, O'Flaherty (1996) on the economics of homelessness, and especially Nelson and Vandenbroucke's (1996) seminal work charting the size of and change in the aggregate low-income housing stock.

probability. Our approach is to look at individual units in successive waves of the American Housing Survey (AHS) metropolitan area sample. In doing so, we follow Nelson and Vandenbroucke (1996) and Somerville and Holmes (2001) who both use the panel nature of the American Housing Survey (AHS) metropolitan area survey data to chart the movements of individual units in and out of the low-income housing stock.

The remainder of the paper is structured as follows. First, we layout the theoretical framework for our analysis. We follow this with a discussion of our data. Finally, we present the empirical results, both for measures of constraints on the supply of new residential units and the pervasiveness of rent control in an area.

Theoretical Framework

We model movements of units in and out of the stock of affordable housing as the filtering of units down through successive housing sub-markets. The filtering model describes the housing market as a series of sub-markets differentiated by unit quality. Rents fall as quality declines, so units lower on the quality ladder have lower rents than those of the same size in the same location at the top. Without expenditures on maintenance, renovation, and repairs, units decline in quality as they depreciate physically and technologically. As this occurs, they move down the quality ladder. The cost to maintain a given level quality is assumed to increase with unit age. Extra expenditures on maintenance and renovation can move units back up the hierarchy. Relative rents in the different sub-markets vary with the distribution of income across households (demand) and the supply of units in that sub-market. When quality is cheapest to provide at the time units are built, new units will be of a high quality level. The supply of the most affordable, lowest quality, units will be those built in earlier periods that have been allowed

to depreciate and move down – filter down – the quality hierarchy. Landlords will choose a level of maintenance to maximize profits, which determines into which housing sub-market their unit will fall. When incomes, population, and the stock raise rents in the sub-market for higher quality units relative to those in the sub-market for lower quality units, landlords in the latter market have a greater incentive to increase maintenance, renovation, and repair expenditures to cause units to filter up, i.e. move to the higher quality sub-market. By reducing the supply of low-end affordable units, this can potentially exacerbate affordability problems for the least well-off. Although this may occur when the entire demand curve for a neighborhood's amenities shifts out, we do not formally model neighborhood gentrification, focusing instead on unit specific decisions.

The focus of this paper is on using the filtering model to explain the effect of restrictions on new construction and rent control on the movement in units in and out of the low-income housing stock. We expect factors that lower the market's new construction supply response to increases in demand will reduce the affordable housing stock. This occurs because the increase in demand that is unmet with new construction increases the return to landlords for moving units up the quality hierarchy. These factors can include or an explicit government land use regulations that constrain the new supply or an area's market supply elasticity, which for reasons of unobserved regulation, land supply, and builder industry organization can differ across markets.

One of the major forms of government regulation of housing markets with important implications for the affordable housing stock is rent control. The question of interest for this paper is what effect rent control has on the uncontrolled affordable housing stock. We know from Early and Phelps (1999) and Fallis and Smith (1984) that rent control lowers the supply of

uncontrolled affordable housing because excess demand for units raises rents in this segment. This suggests that it raises the probability that in any period of time the uncontrolled units that remain affordable would be more likely to filter-up. Alternatively, there may be reasons why these units remain affordable and cannot easily filter up. The units could be of particularly low quality or there may be negative neighborhood effects from surrounding poorly maintained rent-controlled buildings. Finally, an application of the labor markets efficiency wage model suggests some landlords who prefer to keep rents low to give them an advantage of being able to select from a larger pool of prospective tenants, increasing their ability to weed out those who may be more likely to be bad tenants.

Existing Literature

This paper draws from a wide variety of existing work. There is a literature on filtering stretching back to Ratcliff's (1949) discussion of the phenomenon. Government land use regulation as it applies to new construction has spawned a voluminous theoretical and empirical literature looking at zoning restrictions on use and density, development fees, greenbelts, growth controls, and factors that delay and slow the new supply response to demand shocks. Finally, for an area where economists mostly agree with one another, there is a copious literature on rent control and its effects on rents, maintenance, and housing market equilibriums. All of these bear on this paper.

Sweeney (1974) is credited with the first thorough theoretical treatment of filtering, where the level of maintenance affects the rate of depreciation. The theoretical literature includes papers that expand his model to include other issues.[2] Most of the recent existing

[2] The older empirical treatments of filtering are well surveyed by Brzeski (1977). Arnott, Davidson, and Pines (1983) allow for maintenance and rehabilitation, and Braid (1981) studies filtering in rental housing markets.

empirical filtering literature does not directly examine individual units, but looks for outcomes consistent with filtering. Phillips (1981) uses cross-sectional data to compare mean neighborhood income with descriptive statistics of the neighborhood housing stock. Using aggregate data, Weicher and Thibodeau (1988) test for the effect of new construction on the low-income housing stock. A more targeted study is Susin's (1999) examination of the effect of Section 8 housing vouchers on rents for the least expensive third of units. He uses the AHS neighborhood sample and finds a fairly inelastic supply curve and little downward filtering as rents are clearly higher in the presence of vouchers. The notable exception to these studies with aggregated data is Somerville and Holmes (2001). They use micro-data to describe the relationship between individual unit, neighborhood, and market characteristics and the probability that units filter up or down.

We look at the effect of land use regulations on filtering. While no work has explicitly done this, there is a considerable body of research that studies the theoretical and empirical effects of various land use regulations on urban form, development patterns, and the price of housing. Nearly all of the existing empirical work, see Fischel (1990) for a review of the older literature, explores the impact of regulation on house prices, with the bulk of the papers finding that increased local regulation leads to higher house prices. Constraints on supply result in higher house prices, but so too does the capitalization of benefits that regulations provide for local residents. A much smaller literature specifically looks for the effects of regulation on new construction and finds lower levels of construction in the presence of higher regulatory barriers and fees.[3] This latter literature is relevant for our analysis because we expect the effect of

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Among a number of their papers on this topic, Bond and Coulson (1989) analyze neighborhood change in a model where the value of housing is related to neighborhood characteristics.

[3] Somerville and Mayer (2000) formally test the effects of regulation on the dynamics of the supply response to demand shocks.

restrictions on new development to affect the supply of affordable units from the existing stock by creating excess demand in the market for newer and higher quality units, which increases the incentives to landlords to upgrade their units.

We also examine the relationship between rent control and filtering. There is a copious literature on rent control, highlighting aspects of the aggregate welfare losses associated with rent control. [4] Olsen (1998) provides a brief of summary of the economics of rent control. Other important work is Glaeser (1996) and Glaeser and Luttmer (1997) on the welfare losses from the mis-allocation of housing under rent control; and the seminal empirical analysis by Olsen in 1972.

Data Description

We use the AHS metropolitan surveys to create a data set of individual rental units in MSAs covering the years 1984 to 1994 for those MSAs for which we have land use regulation data. An observation is an individual rental unit that is included in two successive AHS surveys. Each MSA is surveyed every 3 or 4 years in waves of approximately 11 MSA per survey, so that we have potentially two observations per unit for 23 of the MSAs and one observation per unit in the remaining 21. As a result, our time periods of analysis are not constant across MSAs. However, our right hand-side variables are either survey period-specific or assumed to be time-invariant within an MSA. Observations per unit are constrained by the introduction of a new survey questionnaire in 1984 and a new sample in 1995.[5] For examining rent control, we only look at the MSAs that include jurisdictions that impose significant rent control.

[4] An exception is Arnott (1995) who identifies several potential welfare benefits of rent control.
[5] DiPasquale and Somerville (1995) demonstrate how to merge the 1974-83 AHS data with that from 1984-94, but the earlier period does not report precise rents. Combining to the two sets would introduce bias in our results since we must set a precise cutoff for affordability.

In this paper we define the affordable housing stock as those units for which the gross rents are less than or equal to 30 percent of household income for a household with 35 percent of the median MSA household income. We map this cutoff to different unit sizes using HUD's methodology for calculating differences in fair market rents (FMRs) by unit size.[6] Throughout we use rent to refer to gross rents.[7] While there are a variety of different approaches to defining affordability and we have a taken a naïve approach. We do not believe that how we define the stock should cause problems. Our test is of the effect of a vector of variables on the probability the probability a unit crosses a threshold, relative to not doing so. How we define the threshold only matters if the effect of explanatory variables varies systematically along the quality ladder.

This study analyzes how restrictions on new construction and rent control affect the evolution of the affordable stock. Units must appear in at least two surveys to be included in our sample. As a result, we exclude units that for whatever reason appear in only one survey. A unit identified as affordable in the first survey year can have one of four outcomes in the subsequent survey year, assuming the occupants respond to the second survey. First it can remain affordable. Second, the unit's rent can exceed the affordability cut-off, i.e. filter up. Third, a unit can become owner-occupied. And fourth, it can be abandoned, demolished or converted.[8] For rental units that were identified as unaffordable in the first survey year, we have a similar set of possible outcomes except the baseline is remaining unaffordable and option two is to filter down and become affordable.

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[6] Rents are a percentage of the 4 person family 30% cutoff as follows: 0 bedrooms 70%, 1 bedroom 75%, 2 bedrooms 90%, 3 bedrooms 104%, 4 bedrooms 116%, and then increasing by 12 percentage points for each additional bedroom up to 14 bedrooms.

[7] In 1989 the survey question about utility costs was changed, resulting in a shift in responses. To correct for this we follow Nelson and Vandenbroucke (1996) and adjust reported utility costs for 1989 and later years.

[8] The category demolished or converted includes units that were converted to business use, eliminated in a conversion, abandoned, destroyed by disaster, demolished or condemned. It also includes units with an interior now exposed to the elements and mobile home sites that no longer have a home on it.

We pursue a mixed strategy to private market units where the occupant receives a subsidy. Unpublished work by McArdle at the Joint Center for Housing Studies indicates that in many cases in the AHS one cannot distinguish between the actual gross rent and the gross rent paid (net of the subsidy). We choose to exclude units where the occupant receives a subsidy in the first survey year. However, a unit whose occupying household did not receive a subsidy in the first survey, but did in the second survey is considered to be affordable in the second survey. This approach does not bias our results as treating subsidized units as a separate category to which units can move does not qualitatively change our results.

Table 1 shows the frequency of each outcome for both movements out of the affordable stock and out of the unaffordable stock, between any two AHS metropolitan surveys. Similar to Nelson and Vandenbroucke (1996), we find substantial movement in and out of the affordable stock. Not surprisingly, units in the unaffordable stock are less likely to become government-subsidized or be demolished, but more likely to convert to owner-occupancy than are units initially classified as affordable. These figures show an increase of approximately 1,700 units. This result may be misleading because AHS will tend to exclude units with a change in occupant, in successive surveys. This leads to bias because these are the units most likely to experience rent increases.[9]

In Table 2 we show the distribution of rent-controlled units for those MSAs with rent control policies. The number of rental units subject to rent control varies widely, from a low of 4 percent in Boston to a high of over 25 percent in San Francisco. The principal determinant appears to be whether the central city itself imposes rent control. Even in cities with little rent

[9] We expect that a new occupant is less likely to respond to the AHS survey than an occupant who has responded in the past. Rents for a unit tend to increase more with unit turnover. Thus, we are likely to undercount units who rents rise, resulting in an undercount of those units that move out of the affordable stock because the new rent exceeds the affordability cut-off.

Table 1 - Changes in the Affordable Stock

Units Beginning as Affordable	Number	Percentage
Remains affordable	4,171	45.3%
Becomes unaffordable	2,928	31.8%
Becomes subsidized	760	8.3%
Becomes owner-occupied	506	5.5%
Is demolished or converted	837	9.1%
TOTAL	9,202	
Units Beginning as Unaffordable		
Remains unaffordable	54,298	78.1%
Becomes affordable	6,007	8.6%
Becomes subsidized	3,185	4.6%
Becomes owner-occupied	4,703	6.8%
Is demolished or converted	1,369	2.0%
TOTAL	69,562	

Notes:

1: For the top 2 tables, only the units that had observations for two consecutive years are included . We exclude units that are initially government subsidized or classified as public housing.

2: A unit is defined to be affordable if the sum of ent and utilities is less than 30% of household income for a household at 35% of the median income for 4 person families for that year in that city. To reflect different unit sizes, an adjustment is made based on the number of bedrooms.

3: These aggregate data are likley to underestimate the number of units that become unaffordable, because rents tend to increase more when tenants change, but new tenants are less likley to become AHS respondents.

Table 2 - Rent Control Descriptive Statistics
Percentage of Rent Controlled Units in Rental Stock

MSA	MSA Mean	Number of zones in the MSA	Percentage of Rental Units that are rent controlled in the zone				
			Average across zones	25th Percentile across zones	Median across zones	75th Percentile across zones	90th Percentile across zones
Boston	4.0%	31	2.3%	0.0%	0.0%	1.8%	5.7%
Los Angeles	25.0%	44	19.2%	2.1%	8.0%	39.0%	47.9%
New York	17.1%	83	11.6%	0.0%	9.3%	18.0%	28.7%
San Francisco	25.5%	22	17.6%	0.9%	4.2%	36.1%	56.4%
San Jose	10.1%	10	9.2%	5.5%	6.9%	12.7%	16.5%
Washington	9.3%	23	6.6%	0.8%	2.0%	4.1%	25.9%

control, there is at least one zone for which rent control units make up over 10 percent of the rental stock.

In the analysis we include unit and neighborhood variables that enter into the landlord's optimal maintenance and renovation decision as well as the MSA land use and supply restriction variables. All regressions also include a set of control variables. We include unit characteristics such a dummy variable for if the unit is defined as adequate by AHS standards, unit age, a dummy for multi-unit buildings, and the number of units in the structure. Adequacy is an AHS-coded summary variable based on responses to questions about physical problems in the unit. The lack of hot piped water or a flush toilet would classify a unit as severely inadequacy, while multiple leaks and holes in the floor and walls would result in the unit being classified as moderately inadequate.

Neighborhood effects enter the decision to invest in a unit's quality. We use AHS zones, socio-economically homogeneous areas of approximately 100,000 people, as our definition of a neighborhood. While larger than a neighborhood, this is the most geographically disaggregated variable available in the AHS metropolitan survey. For each zone we estimate the ratio of rental units to all units, affordable units to all rental units, public housing units to all rental units, and subsidized to all rental units in the zone. We also measure the average age of the rental stock, percentage of households headed by an African-American, and median household income in the zone.

Both market and unit measures act as control variable. The first controls for the effect of aggregate MSA changes in house prices and rents in causing movements of individual units into and out of the affordable stock. We use DiPasquale and Somerville's (1995) methodology to generate hedonic price and rent series from the AHS, with mean values of the affordable stock to

describe the bundle. The second is the ratio of a unit's rent to the affordability conditions that the most marginally affordable units are more likely to filter up.

Data on land use regulation comes from the Wharton Urban Decentralization Project (Linneman and Summers 1991). These data summarize surveys sent to local planners in a sample of 60 MSAs, of which we have price data and AHS survey information for 38. We include two measures of regulation, a count of the number of ways growth management techniques have been introduced in the MSA and whether development or impact fees are imposed in the cities in the MSA. The number of growth management techniques is the sum of five different dummy variables, which each indicate whether one of the following approaches for introducing growth management policies are prevalent in the MSA: citizen referendum, legislative action by municipalities, counties, and the state, and administrative action by public authorities. We assume that the more kinds of actions taken and the greater the number of groups that act to control development, the more constrained the regulatory environment. These variables vary by MSA, but are constant over time. This forces us to assume that the regulatory environment described by these variables is time invariant.

In Table 3 we present descriptive statistics for these variables separately for affordable units and unaffordable units. Comparing these two sets, difference of means t-tests reject equality of means for nearly all variables. Qualitatively, affordable units are in poorer condition and in older and smaller buildings. Tenants have a notably longer mean stay in the affordable units, 6.3 vs. 2.9 years. Affordable units are both more concentrated in space than are rental units in general, and are much more likely to be in areas with a higher proportion of African-Americans. While other differences are statistically significant, they are not meaningful. The rent changes, which are calculated at the zone rather than unit level, differ by class because

Table 3 - Descriptive Statistics

		Affordable units			Unaffordable units			
Category of Variable	Variable	Count	Mean	Stnd. Dev.	Count	Mean	Stnd. Dev.	T-test on mean diff.
Unit	Adequacy of unit (1 if adequate, 0 otherwise)	9,202	0.72	0.45	69,562	0.90	0.30	37.44
	Age of the unit	9,202	46.56	19.58	69,562	27.91	20.64	85.33
	Unit is part of multi-unit building (1 if yes, 0 if no)	9,202	0.70	0.46	69,562	0.76	0.43	12.43
	Number of units in building	9,202	8.35	19.00	69,562	13.63	29.19	23.25
Neighborhood	Ratio of subsidized units to rental units in zone	9,202	0.11	0.06	69,562	0.10	0.06	19.52
	Average age of rental units in the zone	9,202	37.15	13.67	69,562	28.28	12.92	58.85
	Ratio of public housing units to rental units in the zone	9,202	0.07	0.07	69,562	0.04	0.05	39.15
	Ratio of rental units to all units in zone	9,202	0.48	0.17	69,562	0.44	0.15	21.53
	Ratio of affordable units to rental units in zone	9,202	0.31	0.17	69,562	0.14	0.13	92.42
	Percentage African-American head-of-hholds in zone	9,202	0.27	0.30	69,562	0.13	0.18	44.67
	Median household income in the zone	9,202	21,487	8,665	69,562	27,650	8,998	63.83
Regulation	New Single Family Permits - Supply Elasticity	7,502	15.96	8.64	56,552	14.37	7.38	15.25
	Jurisidctions in MSA Use Impact Fees (dummy)	8,571	0.36	0.48	61,708	0.51	0.50	27.35
	Number of Approaches to Growth Management	8,215	0.54	0.83	59,713	0.69	0.89	14.66
	Pct Rent Control in Zone > 10% (1 if yes, 0 if no)	761	0.47	0.50	8,302	0.30	0.46	9.04
	Pct Rent Control in Zone	761	0.14	0.16	8,302	0.10	0.14	6.67
Control	Hedonic price change in the MSA (affordable units)	9,202	0.07	0.38	69,562	0.08	0.34	1.95
	Hedonic rent change in the MSA (affordable units)	9,202	0.23	0.11	69,562	0.21	0.12	19.54
	Number of years current resident has occupied unit	7,878	6.33	8.60	60,907	2.92	4.96	34.39
	Ratio of the rent to the cutoff of affordability	9,202	0.76	0.20	69,562	1.62	0.46	319.24

Notes:

1: Only the units that were included in two consecutive surveys are included in the above table. Units that drop out of the sample in successive surveys are excluded.

2: All price and rent changes measured in nominal dollars.

3: The mean values in the Affordable units column and the Unaffordable units column for the hedonic price and rent changes differ because these two categories of units are not distributed identically across MSAs .

4: Rent control avriables are only for Boston, Los Angeles, Newark, San Francisco, San Jose, and Washington, D.C. AHS surveys.

5: Supply elasticities and regulation variables are only available for 38 of 44 AHS survey MSAs.

affordable and non-affordable units do not have the same distribution across space while price and rent changes vary by area. Those MSAs with more affordable units are likely to have higher supply elasticities and less land use regulation.

Empirical Results

We estimate the model using a multinomial logit specification where any observation i=1 to n can fall into one of k groups. For a unit currently in the low-income stock these groups are remaining in the low-income stock, filtering up (defined as having a rent that surpasses the affordability threshold), converting to owner-occupied, or being demolished. For each observation we have a probability:

$$\Pr(i \in j) = \frac{e^{X\beta_j}}{\sum_{j=1}^{k} e^{X\beta_k}} \qquad \text{for all } k = 1 \text{ to } 4 \text{ groups.} \qquad (1)$$

Equation (1) is unidentified unless we set $e^{X\beta_1} = 1$. The standard procedure is to present the odds ratio, the ratio of the probability that $i \in k$ (k...1) relative to the probability that $i \in 1$. For instance:

$$\frac{\Pr(i \in 2)}{\Pr(i \in 1)} = \frac{e^{X\beta_2}}{1 + \sum_{j=2}^{k} e^{X\beta_k}} \Bigg/ \frac{1}{1 + \sum_{j=2}^{k} e^{X\beta_k}} = e^{x\beta_2} \qquad (2)$$

The multinomial regression results are presented in the appendix. There, Appendix Tables 1 and 2 present the effects of land use regulation on affordable and unaffordable units, while Appendix Table 3 does the same for the effect of the rent control variables. The relative

small number of degrees of freedom at the MSA level causes us to separate these two into distinct tables.

Multinomial logit regression output can be difficult to interpret. The coefficients are both exponentiated and relative to the baseline outcome, which in our case when the unit's affordability status remains unchanged. We present the results in a set of tables that show the sensitivity of relative probabilities to given changes in the values of right hand side variables. These describe the percentage point change in the probability of outcome i, relative to remaining affordable, for a 10 percent change in the explanatory variables. These results are like elasticities, but applied to relative rather than absolute probabilities.

Table 4 shows the effects of the unit characteristics, neighborhood quality measures, and control variables. Adding the government regulation variables to these variables does not change these results, so for clarity of presentation, we show them just once. The results in column (1) describe the sensitivity that an affordable unit filters up, relative to staying affordable. Several factors stand out. Older units are less likely to filter up, as the cost of improving quality is higher. Neighborhood effects matter, filtering up is more likely to occur in neighborhoods with lots of rental units, but less likely if those units are mostly affordable. The control variables matter: units are more likely to become unaffordable if rents are rising in the market and the closer the unit's initial survey rent is to the cutoff. Being in better shape relative to the neighborhood also matters. From columns (2) and (3), the older the zone average, controlling for the unit's own age, the more likely the unit is to become owner-occupied, and the less likely it is to be demolished, though conversion to owner occupancy is falling and demolition or conversion is rising in the unit's own age. For units initially unaffordable, columns (3)-(6), median zone income and market conditions are extremely important. Units are dramatically less likely to

TABLE 4 - PERCENTILE CHANGE IN RELATIVE PROBABILITIES
10% CHANGE IN MEAN VALUES

Variable	Filters up - Becomes Unaffordable AFFORDABLE UNITS	Converts to Owner Occupied AFFORDABLE UNITS	Converted or Demolished AFFORDABLE UNITS	Filters Down - Becomes Affordable UNAFFORDABLE UNITS	Converts to Owner Occupied UNAFFORDABLE UNITS	Converted or Demolished UNAFFORDABLE UNITS
Adequacy of unit	2.28%	n.s	-5.26%	n.s.	n.s.	-7.36%
Age of the unit	-5.03%	-6.38%	8.35%	1.90%	n.s.	9.63%
Unit is part of multi-unit building	1.24%	-10.82%	-2.37%	-2.91%	-14.55%	-5.46%
Number of units in building	-0.68%	n.s	n.s.	0.26%	n.s.	n.s.
Ratio of subsidized units to all units in zone	n.s.	n.s	n.s.	2.32%	n.s.	n.s.
Average age of rental units in zone	n.s.	5.98%	-10.38%	1.00%	n.s.	-7.66%
Ratio of public housing units to rental units in zone	n.s.	n.s	n.s.	0.25%	0.37%	n.s.
Ratio of rental units to all units in zone	6.89%	n.s	n.s.	-1.22%	-1.97%	n.s.
Ratio of affordable units to rental units in zone	-4.62%	n.s	n.s.	0.89%	1.48%	1.03%
% of African-American head-of-households in zone	-0.96%	-2.17%	n.s.	0.45%	-0.80%	0.94%
Median income in zone	0.00%	0.00%	n.s.	-24.16%	n.s.	-24.16%
Hedonic price change in the MSA (affordable units)	0.13%	n.s	n.s.	0.35%	n.s.	n.s.
Hedonic rent change in the MSA (affordable units)	4.89%	2.64%	n.s.	-39.01%	13.62%	-26.17%
Number of years current resident has occupied unit	-0.90%	`	-1.10%	0.17%	0.28%	-0.54%
Ratio of the rent to the cutoff of affordability	5.29%	n.s	-6.27%	0.00%	0.00%	0.00%

Notes:

1: The figures in the above table report changes in the odds ratios due to a 10% increase from the mean, and due to an increase equal to 1 standard deviation from the mean. The odds ratios are relative to the outcome with the unit remaining affordable or becoming subsidized.

2: The MSA dummies are used in specification 1 but are not reported.

3: "n.s." means that the variable was not significant at the 5% level and a dash "-" indicates that the variable was not used in this specification.

filter down or be demolished/converted the higher median zone income and the greater the increase in rents.

Table 5 presents the effects of changes in regulation measures on changes in the stock of affordable units. All of the regression specifications used in Table 5 include the full set of unit, neighborhood, and control variables presented in Table 4. The results here are consistent with the filtering model, the more constrained the supply response for new residential units to demand shocks, the greater the probability an affordable unit filters up and out of the affordable stock relative to staying in the stock. Explicitly, the greater the supply elasticity of new single family construction, the lower this relative probability as builders are able to respond much more quickly to demand shocks. With more units coming in more quickly in response to an increase in demand, relative rents between high and low quality markets diverge less, reducing the returns to upgrading a unit so that it can filter up. The sign is robust across specifications, though the coefficient is not uniformly statistically different from zero. We find this a compelling result, clearly identifying the linkage between construction of new high and standard quality homes and the affordable stock consisting of lower quality units.

In regressions (2) and (3) we add the two measures of government land use regulation, the presence of impact fees and measures of the number of growth management techniques used in the MSA. We argue that both describe constraints on supply. In both cases, greater regulation results in an increase in the probability that an affordable rental unit filters up to become unaffordable. This is consistent with the predictions of the filtering model as the constraints on new development can be expected to increase the returns to maintenance and renovation because with less new construction, relative rents for units of higher quality or will be greater. The effects of elasticity and regulation variables on the relative probability of conversion to owner-

TABLE 5: EFFECT OF 10% CHANGE IN REGULATION VARIABLES AFFORDABLE UNITS

Variables	Specification 1	2	3
FILTERS UP			
New Single Family Permits - Supply Elasticity	-1.19% *	-0.53%	-1.23% **
Jurisidctions in MSA Use Impact Fees (dummy)		0.92% ***	
Number of Approaches to Growth Management			0.33% *
CONVERTS TO OWNER-OCCUPIED			
New Single Family Permits - Supply Elasticity	1.46%	1.55%	1.40%
Jurisidctions in MSA Use Impact Fees (dummy)		0.15%	
Number of Approaches to Growth Management			-0.28%
DEMOLISHED OR CONVERTED			
New Single Family Permits - Supply Elasticity	0.83%	1.20%	0.80%
Jurisidctions in MSA Use Impact Fees (dummy)		0.50%	
Number of Approaches to Growth Management			-0.34%

The above table reports % change in the odds ratios due to a 10% increase from the mean,
The odds ratios are relative to the outcome with the unit remaining affordable or becoming subsidized.
*The significance level 1%/5%/10% is denoted by ***/**/*.*

occupied status or being demolished or converted are not statistically different from their effect on a unit remaining affordable.

We believe that the negative effect of supply regulations is more pronounced than is suggested by the absolute magnitude of these coefficients. When we compare the quasi-elasticities in Table 5 with those in Table 4, 10 percent increases in each of the elasticity and regulations variables have no more than one quarter the effect of a similar increase in unit age and less than half the effect for unit quality. The effect is also less than one-quarter that of the neighborhood measures, mix of rental, owner-occupied, and affordable units in the zone. However, to say that the effects of regulations are unimportant would be erroneous. Our regulation measures are quite crude, yet they still provide robust theoretically compelling results. More importantly, an increase in these measures affects all units in the affordable stock, so that even with a small effect per unit, the aggregate effect on affordable housing can be substantive. In contrast, unit age or quality affects the unit alone

In Table 6 we present the same results for units unaffordable to low-income renters. Regulation variables have no effect on the relative probability that one of these leaves the stock. However, the new construction supply elasticity does matter. Higher end rental units are less likely to become owner-occupied and less likely to be demolished or converted when the supply response to a given demand shock is greater. This is consistent with the spirit of the filtering model, particularly if we think of the purchase of an existing rental unit and its conversion to owner-occupied and the redevelopment of an existing structure as inferior to new greenfield development.

Table 7 presents the effects of rent control. Our prior is that in a rent control environment uncontrolled units are more likely to filter up. Early and Phelps (1999) and Fallis and Smith

TABLE 6: EFFECT OF 10% CHANGE IN REGULATION VARIABLES UNAFFORDABLE UNITS

Variables	Specification 1	2	3
FILTERS DOWN			
New Single Family Permits - Supply Elasticity	-0.38%	-0.27%	-0.38%
Jurisidctions in MSA Use Impact Fees (dummy)		0.24%	
Number of Approaches to Growth Management			0.10%
CONVERTS TO OWNER-OCCUPIED			
New Single Family Permits - Supply Elasticity	-0.92% **	-0.88% **	-0.92% **
Jurisidctions in MSA Use Impact Fees (dummy)		0.09%	
Number of Approaches to Growth Management			0.00%
DEMOLISHED OR CONVERTED			
New Single Family Permits - Supply Elasticity	-1.25%	-1.48% *	-1.26% *
Jurisidctions in MSA Use Impact Fees (dummy)		-0.58%	
Number of Approaches to Growth Management			-0.18%

The above table reports % change in the odds ratios due to a 10% increase from the mean,
The odds ratios are relative to the outcome with the unit remaining affordable or becoming subsidized.
*The significance level 1%/5%/10% is denoted by ***/**/*.*

TABLE 7
EFFECT OF 10% CHANGE IN RENT CONTROL MEASURES AFFORDABLE UNITS

Variables	Specification 1		Specification 2	
FILTERS UP				
Percentage of units in the zone that are rent controlled >10%	-3.65%	***		
Percentage of units in the zone that are rent controlled			-2.18%	*
CONVERTS TO OWNER-OCCUPIED				
Percentage of units in the zone that are rent controlled >10%	-4.99%	*		
Percentage of units in the zone that are rent controlled			-5.25%	
DEMOLISHED OR CONVERTED				
Percentage of units in the zone that are rent controlled >10%	0.32%			
Percentage of units in the zone that are rent controlled			1.02%	

*All regressions have MSA fixed effects and a dummy if the unit is in the MSAs central city. The above table reports % change in the odds ratios due to a 10% increase from the mean, The odds ratios are relative to the outcome with the unit remaining affordable or becoming subsidized. The significance level 1%/5%/10% is denoted by ***/**/*.*

(1984) demonstrate that rent control increases the rents for uncontrolled rental units. However, we find that an uncontrolled unit in an area with more rent control is less likely to filter-up or become owner-occupied and more likely, though the effect is not statistically different from zero, to be demolished or converted. In trying to explain this outcome, the other results do shed some light on the apparent paradox. While not robust in significance, as the percentage of rental units subject to rent control in an area rises, uncontrolled units are less likely to convert to ownership, relative to remaining affordable, and more likely to be demolished or converted. Given that rents for uncontrolled units will be higher, and that rent control is typically imposed in locations where rents are high and rising, this suggests two possible explanations. First, uncontrolled units that remain affordable in the presence of rent control are more likely to be very low quality units, suggestion selection bias. Despite the presence of rent control, the quality of these units means they are less appealing for owner-occupants, unable to filter up, and more likely to be demolished. Second, if there are strong negative neighborhood externalities from being in an area with an under-maintained rent-controlled stock, this might reduce the return to maintenance and renovation on uncontrolled units. Even though there is an incentive for their rents to rise, this second effect would work in the opposite direction. Both of these approaches allow for uncontrolled rents to be higher, while the return to maintenance, for filtering up, to be lower. We are reluctant without a better sense of the data to reach any strong conclusion from this result and would caution the readers to use discretion in interpreting this result.

Conclusion

This paper takes a new approach to studying the effects of land use regulation. Instead of focusing on the effects of supply restrictions, both explicit and implicit, on new construction, we

examine how it affects the filtering process. This allows us to examine the dynamics of the relationship between housing affordable to low income households and local government imposed land use regulations. Our approach, which borrows from Somerville and Holmes (2001), looks at how regulation affects the probability that a rental unit currently deemed affordable becomes unaffordable, owner-occupied, or demolished, relative to staying affordable.

We find that regulation does matter, when new construction is more constrained, as measured either by a lower supply elasticity or the presence of certain regulations, affordable units are more likely to become filter up and become unaffordable, relative to remaining in the affordable stock. We find this result to be quite compelling and to offer an important lesson for policy makers. The effects of land use regulation are not limited to raising the price of owner-occupied housing and reducing access to homeownership. It also has a clear negative impact on the most vulnerable. Given the ample efforts to document the difficult and worsening affordability crisis for the least well off, this has to be a concern.

There are a number of aspects of this report that should caution against using this work to predict the effects of any new policies on the affordable stock. We examine the dynamics of the stock, but our supply control variables are MSA specific and time invariant. Consequently, we know little of the timing of these processes. Given the long-run nature of the filtering process, this suggests that the outcome of short-run changes in policy would be hard to predict. Still, our approach to examine changes in the stock of affordable units across MSAs, rather than the size of the MSA stock itself, we are able to avoid some of the more egregious problems of MSA level excluded variable bias.

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Appendix Table 1 Affordable Rental Units
Multinomial Logit - Excluded Option - Remain Affordable

	Specification 1 Pseudo R^2 = 7.94%			Specification 2 Pseudo R^2 = 8.01%			Specification 3 Pseudo R^2 = 7.98%		
Variables	Rent Rises	Owner-occupied	Demolished/ Converted	Rent Rises	Owner-occupied	Demolished/ Converted	Rent Rises	Owner-occupied	Demolished/ Converted
Adequacy of unit (1 if adequate, 0 otherwise)	1.4121	1.2719	0.5504	1.4045	1.2731	0.5488	1.4134	1.2773	0.5507
	(4.26)	(1.54)	(5.38)	(4.19)	(1.54)	(5.40)	(4.27)	(1.56)	(5.37)
Average resident's evaluation of the unit (scale of 1-worst to 10-best)	0.9936	1.0340	0.8649	0.9945	1.0341	0.8652	0.9940	1.0334	0.8643
	(0.48)	(1.28)	(7.21)	(0.41)	(1.28)	(7.20)	(0.46)	(1.26)	(7.24)
Age of the unit	0.9899	0.9856	1.0198	0.9900	0.9856	1.0198	0.9899	0.9857	1.0200
	(5.16)	(3.92)	(5.70)	(5.09)	(3.91)	(5.71)	(5.17)	(3.89)	(5.74)
Unit is part of multi-unit building (1 if yes, 0 if no)	1.1901	0.2005	0.7236	1.1924	0.2006	0.7245	1.1894	0.2006	0.7245
	(2.40)	(11.80)	(2.79)	(2.42)	(11.80)	(2.78)	(2.39)	(11.80)	(2.78)
Number of units in building	0.9930	0.9902	0.9975	0.9927	0.9902	0.9973	0.9929	0.9903	0.9977
	(3.93)	(1.78)	(0.73)	(4.06)	(1.78)	(0.78)	(3.96)	(1.77)	(0.66)
Ratio of subsidized units torental units in the zone	1.6727	2.2670	0.4304	1.2908	2.1206	0.3801	1.6012	2.3343	0.4278
	(0.85)	(0.72)	(0.81)	(0.42)	(0.65)	(0.92)	(0.78)	(0.74)	(0.81)
Average age of rental units in the zone	0.9982	1.0118	0.9752	1.0003	1.0121	0.9764	0.9975	1.0121	0.9757
	(0.45)	(1.49)	(3.65)	(0.08)	(1.50)	(3.40)	(0.60)	(1.52)	(3.56)
Ratio of public housing unitsto rental unitsin the zone	0.6161	0.9293	5.2494	0.6336	0.9471	5.5030	0.5255	1.0082	6.0647
	(0.74)	(0.06)	(1.73)	(0.70)	(0.04)	(1.78)	(0.98)	(0.01)	(1.86)
Ratio of rental units to all units in zone	4.0005	1.5240	0.8627	3.3228	1.4826	0.7920	3.8044	1.6012	0.8900
	(4.96)	(0.72)	(0.30)	(4.20)	(0.66)	(0.47)	(4.76)	(0.79)	(0.23)
Ratio of affordable units to rental units in zone	0.1852	0.8163	0.6334	0.1771	0.8132	0.6191	0.2046	0.7675	0.5854
	(6.08)	(0.39)	(1.04)	(6.22)	(0.40)	(1.09)	(5.61)	(0.50)	(1.19)
Average resident's evaluation of the neighborhood (scale of 1-worst to 10-best)	1.0298	1.3643	0.8603	1.0852	1.3724	0.8874	1.0296	1.3590	0.8596
	(0.41)	(2.13)	(1.22)	(1.11)	(2.11)	(0.94)	(0.41)	(2.10)	(1.23)
% of African-American head-of-households in zone	0.7339	0.4705	0.9249	0.8793	0.4789	1.0162	0.7493	0.4635	0.9080
	(2.03)	(2.44)	(0.31)	(0.79)	(2.23)	(0.06)	(1.89)	(2.48)	(0.38)
Median Income in the zone	1.0000	1.0000	1.0000	(0.79)	1.0000	1.0000	1.0000	1.0000	1.0000
	(3.22)	(0.52)	(0.20)	(0.79)	(0.44)	(0.02)	(3.04)	(0.61)	(0.27)
Hedonic price change in the MSA (affordable units)	0.9855	1.8291	0.8197	(0.79)	1.8519	0.8390	0.9892	1.8245	0.8283
	(0.12)	(2.50)	(0.87)	(0.79)	(2.54)	(0.77)	(0.09)	(2.50)	(0.83)
Hedonic rent change in the MSA (affordable units)	6.6865	2.5710	0.7265	(0.79)	2.6750	0.8462	6.3513	2.6997	0.7892
	(5.16)	(1.36)	(0.56)	(0.79)	(1.36)	(0.28)	(4.99)	(1.42)	(0.41)
New Single Family Permits - Supply Elasticity	0.9925	1.0091	1.0052	(0.79)	1.0097	1.0075	0.9923	1.0087	1.0050
	(1.96)	(1.23)	(0.78)	(0.79)	(1.23)	(1.06)	(2.01)	(1.19)	(0.76)
Jurisdictions in MSA Use Impact Fees (dummy)				(0.79)	1.0421	1.1484			
				(0.79)	(0.26)	(1.00)			
Number of Approaches to Growth Management							1.0623	0.9490	0.9395
							(1.69)	(0.71)	(0.97)
Number of years current resident has occupied unit	0.9877	1.0044	0.9823	0.9876	1.0043	0.9823	0.9874	1.0047	0.9826
	(3.23)	(0.65)	(2.57)	(3.26)	(0.65)	(2.57)	(3.30)	(0.70)	(2.52)
Ratio of the rent to the cutoff of affordability	2.0477	0.8783	0.3351	2.1028	0.8805	0.3388	2.0585	0.8782	0.3331
	(4.16)	(0.40)	(4.07)	(4.31)	(0.39)	(4.03)	(4.19)	(0.40)	(4.09)

N=6168

Notes

1: The dependent variable has 4 possible values. An affordable unit can remain affordableowner occupied, or be demolished. (excluded outcome in regressions), become unaffordable, converted. The excluded outcome is to remain affordable.

2: The top number reported is the unit odds ratio e^b, and the bottom number (in brackets) is the Z statistic. The odds ratio is the probability of outcome i divided by the probability of the null (or excluded) outcome, and is equal to e^{XB}. The unit odds ratio is the odds ratio for a 1 unit increase to the independent variable. So it is not b that is reported in the table, but eb. The Z statistic is based on the null hypothesis that b=0, which is equivalent to the unit odds ratio e^b=1.

Appendix Table 2 Unaffordable Rental Units
Multinomial Logit - Excluded Option - Remain Unaffordable

	Specification 1 Pseudo R^2 = 14.58%			Specification 2 Pseudo R^2 = 14.59%			Specification 3 Pseudo R^2 =14.58%		
Variables	Rent falls/ Subsidized	Owner-occupied	Demolished/ Converted	Rent falls/ Subsidized	Owner-occupied	Demolished/ Converted	Rent falls/ Subsidized	Owner-occupied	Demolished/ Converted
Adequacy of unit (1 if adequate, 0 otherwise)	0.8675	1.0149	0.4966	0.8685	1.0153	0.4953	0.8680	1.0150	0.4966
	(2.93)	(0.19)	(7.11)	(2.91)	(0.19)	(7.13)	(2.92)	(0.19)	(7.11)
Average resident's evaluation of the unit (scale of 1-worst to 10-best)	1.0016	1.0284	0.9096	1.0018	1.0285	0.9092	1.0017	1.0284	0.9094
	(0.22)	(2.71)	(5.48)	(0.25)	(2.71)	(5.51)	(0.24)	(2.70)	(5.50)
Age of the unit	1.0082	1.0021	1.0336	1.0082	1.0021	1.0336	1.0082	1.0021	1.0337
	(8.58)	(1.66)	(13.61)	(8.59)	(1.65)	(13.60)	(8.59)	(1.66)	(13.61)
Unit is part of multi-unit building (1 if yes, 0 if no)	0.6930	0.1333	0.4521	0.6931	0.1333	0.4516	0.6932	0.1333	0.4517
	(10.14)	(43.85)	(9.27)	(10.14)	(43.84)	(9.29)	(10.14)	(43.85)	(9.28)
Number of units in building	1.0016	0.9991	1.0007	1.0016	0.9991	1.0007	1.0016	0.9991	1.0007
	(2.74)	(0.94)	(0.35)	(2.74)	(0.95)	(0.37)	(2.75)	(0.94)	(0.35)
Ratio of subsidized units torental units in the zone	8.0568	0.6546	0.2030	7.7836	0.6535	0.2141	7.9195	0.6545	0.2078
	(7.44)	(1.08)	(1.94)	(7.29)	(1.08)	(1.87)	(7.36)	(1.08)	(1.90)
Average age of rental units in the zone	1.0032	1.0028	0.9732	1.0036	1.0029	0.9720	1.0031	1.0028	0.9734
	(1.64)	(1.05)	(5.34)	(1.83)	(1.09)	(5.48)	(1.57)	(1.05)	(5.29)
Ratio of public housing unitsto rental unitsin the zone	1.3729	1.2864	0.0738	1.3555	1.2731	0.0734	1.3328	1.2862	0.0777
	(0.88)	(0.43)	(2.73)	(0.84)	(0.41)	(2.73)	(0.79)	(0.43)	(2.66)
Ratio of rental units to all units in zone	0.6826	0.4465	0.8638	0.6644	0.4429	0.9040	0.6763	0.4465	0.8693
	(2.79)	(4.06)	(0.41)	(2.95)	(4.08)	(0.28)	(2.85)	(4.06)	(0.39)
Ratio of affordable units to rental units in zone	2.6278	4.1712	3.7485	2.5791	4.1394	3.9768	2.6867	4.1674	3.5933
	(5.88)	(5.47)	(3.15)	(5.74)	(5.43)	(3.27)	(5.93)	(5.39)	(3.00)
Average resident's evaluation of the neighborhood (scale of 1-worst to 10-best)	1.0327	0.9513	0.9293	1.0430	0.9561	0.9040	1.0344	0.9511	0.9267
	(0.89)	(0.95)	(0.77)	(1.14)	(0.83)	(1.03)	(0.93)	(0.95)	(0.80)
% of African-American head-of-households in zone	1.4736	0.5119	1.8318	1.5326	0.5225	1.6618	1.4840	0.5118	1.8133
	(4.54)	(4.18)	(2.84)	(4.70)	(3.86)	(2.22)	(4.60)	(4.15)	(2.79)
Median Income in the zone	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	(6.80)	(1.31)	(4.44)	(6.92)	(1.36)	(4.24)	(6.84)	(1.31)	(4.41)
Hedonic price change in the MSA (affordable units)	1.3389	1.1121	1.0197	1.3478	1.1140	1.0070	1.3404	1.1122	1.0225
	(4.94)	(1.37)	(0.12)	(5.04)	(1.39)	(0.04)	(4.95)	(1.37)	(0.14)
Hedonic rent change in the MSA (affordable units)	0.1328	1.8894	0.3134	0.1379	1.9044	0.2891	0.1305	1.8912	0.3240
	(13.40)	(3.24)	(3.10)	(12.90)	(3.26)	(3.26)	(13.38)	(3.19)	(2.98)
New Single Family Permits - Supply Elasticity	0.9973	0.9936	0.9913	0.9981	0.9939	0.9897	0.9974	0.9936	0.9912
	(1.37)	(2.32)	(1.64)	(0.92)	(2.11)	(1.89)	(1.33)	(2.32)	(1.66)
Jurisdictions in MSA Use Impact Fees (dummy)				1.0474	1.0184	0.8917			
				(1.26)	(0.39)	(1.23)			
Number of Approaches to Growth Management							1.0141	0.9996	0.9743
							(0.84)	(0.02)	(0.58)
Number of years current resident has occupied unit	1.0105	1.0162	0.9610	1.0104	1.0161	0.9612	1.0104	1.0162	0.9612
	(3.92)	(4.04)	(3.89)	(3.88)	(4.03)	(3.88)	(3.89)	(4.04)	(3.87)
Ratio of the rent to the cutoff of affordability	0.1101	1.9436	0.5795	0.1100	1.9413	0.5827	0.1099	1.9438	0.5829
	(45.98)	(15.53)	(5.07)	(45.99)	(15.46)	(5.01)	(45.95)	(15.43)	(4.99)

N=48347

Notes

1: The dependent variable has 4 possible values. An unaffordable unit can remain unaffordable (excluded outcome in regressions), become affordable, owner occupied, or be demolished. converted. The excluded outcome is to remain affordable.

2: The top number reported is the unit odds ratio e^b, and the bottom number (in brackets) is the Z statistic. The odds ratio is the probability of outcome i divided by the probability of the null (or excluded) outcome, and is equal to e^{XB}. The unit odds ratio is the odds ratio for a 1 unit increase to the independent variable. So it is not b that is reported in the table, but eb. The Z statistic is based on the null hypothesis that b=0, which is equivalent to the unit odds ratio e^b=1.

Appendix Table 3 Affordable Rental Units
Multinomial Logit - Excluded Option - Remain Affordable

Variables	Specification 1 Pseudo R^2 = 10.79%			Specification 2 Pseudo R^2 = 10.35%		
	Rent Rises	Owner-occupied	Demolished/ Converted	Rent Rises	Owner-occupied	Demolished/ Converted
Adequacy of unit (1 if adequate, 0 otherwise)	2.1860	1.2212	0.4240	2.0122	1.0494	0.4315
	(2.74)	(0.29)	(1.74)	(2.47)	(0.07)	(1.71)
Average resident's evaluation of the unit (scale of 1-worst to 10-best)	0.9240	1.1128	0.9087	0.9282	1.1147	0.9095
	(1.86)	(0.95)	(1.12)	(1.77)	(0.97)	(1.11)
Age of the unit	0.9976	0.9697	1.0114	0.9973	0.9698	1.0117
	(0.37)	(2.11)	(0.84)	(0.41)	(2.10)	(0.86)
Unit is part of multi-unit building (1 if yes, 0 if no)	1.7279	0.1558	0.2353	1.6745	0.1617	0.2357
	(2.19)	(3.03)	(2.77)	(2.09)	(3.02)	(2.75)
Number of units in building	0.9911	0.9973	0.9954	0.9915	0.9968	0.9950
	(1.77)	(0.33)	(0.42)	(1.72)	(0.39)	(0.45)
Ratio of subsidized units torental units in the zone	0.7921	0.0002	0.2915	0.4865	0.0001	0.2465
	(0.13)	(2.05)	(0.28)	(0.41)	(2.20)	(0.32)
Average age of rental units in the zone	0.9698	0.9700	0.9290	0.9735	0.9829	0.9262
	(1.66)	(0.67)	(1.76)	(1.42)	(0.36)	(1.78)
Ratio of public housing unitsto rental unitsin the zone	0.0040	0.0318	0.1173	0.0122	0.0915	0.0888
	(2.39)	(0.73)	(0.43)	(1.97)	(0.53)	(0.50)
Ratio of rental units to all units in zone	0.7950	4.9530	104.5796	0.9647	8.5545	77.8929
	(0.23)	(0.71)	(1.99)	(0.03)	(0.92)	(1.83)
Ratio of affordable units to rental units in zone	0.7486	11.9466	1.9007	0.5920	13.4601	1.9701
	(0.25)	(0.81)	(0.23)	(0.45)	(0.84)	(0.24)
Average resident's evaluation of the neighborhood (scale of 1-worst to 10-best)	1.1137	1.2297	1.1343	1.1639	1.4238	1.0564
	(0.49)	(0.43)	(0.27)	(0.66)	(0.69)	(0.11)
% of African-American head-of-households in zone	0.4929	0.0373	0.2794	0.4870	0.0352	0.2909
	(1.11)	(1.82)	(0.88)	(1.12)	(1.79)	(0.87)
Median Income in the zone	0.9999	0.9999	1.0000	0.9999	0.9999	1.0000
	(2.63)	(1.49)	(0.21)	(2.46)	(1.33)	(0.22)
Hedonic price change in the MSA (affordable units)	0.7749	0.2247	5.0766	0.7991	0.2322	4.9279
	(0.43)	(1.07)	(0.98)	(0.38)	(1.05)	(0.96)
Hedonic rent change in the MSA (affordable units)	0.0368	0.0000	0.0000	0.2773	0.0000	0.0000
	(0.51)	(1.23)	(0.93)	(0.20)	(0.99)	(0.96)
Dummy variable =1 if the percentage of units in the zone that are rent controlled >10%	0.4516	0.3349	1.0714			
	(3.04)	(1.85)	(0.12)			
Percentage of units in the zone that are rent controlled				0.2057	0.0210	2.0694
				(1.66)	(1.62)	(0.35)
Dummy variable = 1 of the zone is in the central city	1.4884	2.7934	1.3968	1.2578	2.5738	1.3405
	(1.33)	(1.50)	(0.50)	(0.78)	(1.39)	(0.45)
Dummy variable = 1 for Washington, D.C.	0.4480	0.0682	0.1614	0.5596	0.1001	0.1613
	(0.68)	(0.99)	(0.87)	(0.50)	(0.84)	(0.87)
Dummy variable = 1 for New York City	0.6799	0.5997	0.6003	0.6866	0.4254	0.7762
	(0.55)	(0.32)	(0.37)	(0.52)	(0.52)	(0.17)
Dummy variable = 1 for San Francisco	0.4021	0.0914	0.2025	0.4563	0.1195	0.1935
	(0.97)	(1.10)	(0.94)	(0.84)	(0.96)	(0.97)
Dummy variable = 1 for San Jose	0.3275	0.1017	0.2308	0.4102	0.1489	0.2342
	(1.26)	(1.04)	(0.88)	(1.00)	(0.86)	(0.87)
Dummy variable = 1 for Boston	1.2361	5.1691	3.2279	1.2339	3.4391	4.1158
	(0.34)	(1.14)	(0.88)	(0.32)	(0.83)	(0.94)
Number of years current resident has occupied unit	0.9990	0.9866	1.0083	0.9982	0.9859	1.0080
	(0.11)	(0.55)	(0.39)	(0.19)	(0.58)	(0.38)
Ratio of the rent to the cutoff of affordability	0.6567	1.0654	1.1459	0.6721	1.1626	1.0885
	(0.90)	(0.06)	(0.13)	(0.85)	(0.14)	(0.08)
N=592						

The dependent variable has 4 possible values. An affordable unit can become unaffordable due to a rent increase, they can become owner-occupied or they can be demolished or converted. The excluded outcome is to remain affordable.
The top number reported is the unit odds ratio e^b, and the bottom number (in brackets) is the Z statistic. The odds ratio is the probability of outcome i divided by the probability of the null (orexcluded) outcome, and is equal to e^{XB}.
The unit odds ratio is the odds ratio for a 1 unit increase to the independent variable. So it is not b that is reported in the table, but e^b. The Z statistic isbased on the null hypothesis that b=0, which is equivalent to the unit odds ratio e^b=1.
Excluded MSA dummy is for Los Angeles.