Owner Occupied Housing as Insurance Against Rent Risk

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ABSTRACT

One frequently overlooked but potentially important benefit to homeownership is avoiding the uncertainty of renting. Homeowning, with its long-term fixed-rate mortgage and owner-determined maintenance costs, provides a predictable way of paying for housing services. With renting, the long-term cost of obtaining housing is unknown. We show in a simple stylized model that risk-averse people should be willing to pay a premium over the capitalized rental value for a house to own it solely to avoid rent uncertainty. Using data from the Current Population Survey matched to MSA-level rent data, we find that the rent insurance benefit of owning significantly increases the homeownership rate: a one standard deviation increase in the effective rent variance would lead to a 2.4 to 3.0 percentage point increase in the homeownership rate. Older households are particularly sensitive to rent risk, with people aged 65 residing in places with above-median rent variance 3.8 percent more likely to be homeowners than people of the same age in low rent variance MSAs. Confirming that this effect is due to the insurance value of homeowning, the probability of homeownership drops most rapidly with age for elderly who live in high rent variance places, consistent with their insurance value declining with their remaining lifetimes. Finally, we find evidence that some of the insurance benefit of homeowning shows up in the multiple of rents people are willing to pay for houses. When MSAs have a one standard deviation higher rent variance their house prices increase 1.3 to 4.5 percent relative to the rental value of the housing stock.

In the U.S., 68 percent of families own the houses they live in. In addition, owner-occupied housing accounts for a large portion of families' wealth, 27 percent on average [Poterba and Samwick (1997)]. For households aged 65 and over, housing wealth comprises 45 percent of their non-Social Security net worth, implying that significant equity that could be used to finance consumption is tied up in housing equity. In addition, allocating so much net worth to housing puts wealth at risk due to house price fluctuations and distorts a family's portfolio allocation [Flavin and Yamashita (1998)]. So why do so many families, especially older ones, own their houses and why does it comprise such a large share of their net worth?

One possibility is that homeownership provides a hedge against rent risk. In particular, a homeowner with a fixed-rate mortgage enjoys the comfort of knowing her out-of-pocket spending is fixed at a constant nominal level for the duration of her stay in her dwelling, while a renter is subject to periodic rent adjustments. In essence, bundled into the house purchase is insurance against nominal rent fluctuations. Since housing costs comprise such a large budget share for most Americans, approximately one third of annual income, the ability to lock in the cost of housing services may be quite valuable. However, long-term rent contracts do not appear to exist. Genesove (1999) reports that 97.7 percent of all leases are for terms of one year or less. In addition, one cannot purchase a "rent swap" to exchange variable rent for fixed.[1] Thus the only way to insure against uncertain housing costs is to own a house instead of renting it.

To the extent that a family values this insurance benefit of owner-occupied housing, they would be willing to pay a premium above the value of the service flow from the house in order to own the dwelling rather than rent it. Depending on the elasticity of supply for owned housing

[1] We can only surmise why. One possibility is that the contracting is quite difficult. Presumably the swap would have to terminate if one party moved. But if rents fell and the renter owed a sufficient amount of money on their half of the swap, they would simply move and exit the contract. In addition, it may be expensive to put such a swap in place for a long term.

units, this heightened demand may show up in a higher homeownership rate, a higher price for a given house, or both.

We find empirical evidence that the rent insurance benefit of homeownership in particular has a significant effect both on house prices and the homeownership rate, for the population as a whole and especially for the elderly. We begin by motivating the empirical work with a stylized model of the ownership decision that reduces the problem to one of minimizing the risk-adjusted cost of housing services. While both rents and house values may fluctuate, renters must pay different rents each period but homeowners only realize a change in house value when they sell. Thus markets with large rent variances should have higher probabilities of homeownership and/or higher house prices relative to rental values. Owners who expect to stay in their houses longer are shown to experience a greater benefit from the rent insurance from homeownership.

Of course, there are many other reasons why people might own their houses. However, avoiding rent risk appears to be an important one. We estimate our model using cross sectional data from the Current Population Survey matched to metropolitan area-level rent data. To control for metropolitan area heterogeneity, we consider how the probability of homeownership differs for people with varying expected lengths of stay in markets with different rent variance. We find that a one standard deviation increase in the effective rent variance raises the average probability of homeownership by 2.4 to 2.8 percentage points, to 68 percent. This result is particularly pronounced for the elderly. People aged 65 are 3.8 percentage points more likely to own their home if they live in a market with above-median rent variance. However, as the end of life approaches, the insurance afforded by homeownership becomes less valuable as the number of periods for which a homeowning household expects to be insured against rent risk falls. Indeed, we find that the very old in high rent variance markets have a more steeply declining probability of homeownership with age. Finally, people in markets with higher rent variance also are willing to pay a greater multiple of market rents in order to own their residence. We find that a one standard deviation increase in the rent variance raises the average price-to-rent ratio in a market from 15.7 to between 15.9 and 16.4, an increase of between 1.3 and 4.5 percent depending on whether controls for metropolitan statistical area [MSA] fixed effects are included.[2]

Choosing to own rather than rent in order to obtain the insurance benefit of homeowning may be costly. Our results suggest the insurance benefit of homeownership may provide a partial explanation for the failure of the elderly to transit out of homeownership as early as life-cycle models would predict. [Venti and Wise (2000); Megbolugbe, *et al* (1997)]. One potential reason for their failure to draw down housing equity is that seniors do not wish to face the risk of renting and avoid it by continuing to be homeowners.[3] This could reduce their non-housing consumption. In addition, homeownership can distort a family's portfolio allocation [Brueckner (1997), Goetzmann (1993), Flavin and Yamashita (1998), and Fratantoni (1997)] and may affect savings and consumption behavior. [Engelhardt (1996), Skinner (1989)]

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[2] Little previous research is concerned with the value of housing as insurance against rent fluctuations. The standard user cost literature, e.g. Rosen (1979), Poterba (1984), Hendershott and Slemrod (1983), estimates housing demand simply as a function of expected returns on housing. Another strand of the literature, such as Skinner () and Summers (), considers the risk of the asset value of the house. Cocco (2000) and Haurin (1991) investigate the effects of income risk, with Cocco adding interest rate risk in a parameterized structural model of housing investment, but he rules out the possibility of renting. Only Rosen *et al* (1984) and Ekman and Asberg (1997) address rent risk. Ekman and Asberg construct a two-period model where families either rent or own in the first period and must rent in the second period, and show that families will choose homeowning if house price variance is less than the variance in the price of rental apartments bought by landlords. However, in their model homeowning does not insure against rent risk because duration of stay under each tenure mode is only one period. Instead, their result is generated when families trade off a lower, but uncertain, cost of homeowning against a higher, fixed rent that compensates landlords for the capital risk they take. In a time series study, Rosen *et al* finds that one predictor of the aggregate homeownership rate is the difference between the unforecastable volatility of the user cost of homeownership and rents. However, their measure of user cost volatility assumes that homeowners realize their capital gain every year, whereas this paper exploits cross-sectional variation in households' expected holding period. Rosen *et al* also assume that rental housing and owner-occupied housing are independent goods. Hence they do not allow for an endogenous relation between house prices and rent. Eckman also assumes that the price processes for owner-occupied housing and apartment buildings are independent.

[3] Presumably the transactions costs of moving combined with a desire to continue to consume housing services prevents seniors from trading down to a smaller house. This finding underscores the need for viable reverse mortgage

The remainder of this paper proceeds as follows. In the first section, we present a simplified model of the benefit of homeowning as a mechanism to reduce the risk in housing costs. Section two describes our data sources and variable construction. The empirical methodology and results are reported in the third section. Section four briefly concludes.

I. Modeling the rent insurance value of owner-occupied housing

This section presents a stylized model of how rent risk affects the demand for and price of owner-occupied housing. To isolate the effect of rent risk we abstract from other features of housing markets that do not directly bear on the dynamic relationship between house prices and rent risk. The previous literature has focused on essentially static (1 period) and deterministic models of the user cost, for example concentrating on identifying the effects of taxes. The dynamic, stochastic effects at issue here apply above and beyond these previously studied features of the tenure decision.

Consider a household with an N-year horizon for housing services, which has already decided on the optimal quantity of housing space it wants to consume each year, for simplicity assumed to be constant. The household's goal is therefore to minimize the risk-adjusted cost of securing its desired housing services.

To begin with, suppose the household is choosing between a) renting for all N years, versus b) buying a house in year 0 and then selling it in year N. The current real rent r_0 and house price P_0 are observable, but the future rents $r_1, r_2, \ldots, r_N$ and terminal house sale price P_N are stochastic. For convenience we assume that the rental unit and the house are normalized to provide the same flow

markets to enable households to avoid rent risk by continuing to own their houses while annuitizing their housing wealth. To date, these markets have not been particularly successful [Caplin ()].

of housing services.[4] Accordingly the household's goal in choosing between a) and b) is to minimize the expected utility of the present discounted value of its housing outlays.[5] The discount rate δ reflects the opportunity cost of funds, the same as in the traditional definition of user cost. For simplicity we abstract from the other components of the user cost, such as maintenance, depreciation, and taxes. Such costs associated with homeowning can be shown to bid down the price of homes in order to compensate homeowners, but they will not change the comparative statics at issue here regarding the effects of increases in the variance of rent, σ^{rent}.[6]

In equilibrium the expected utility of owning must equal the expected utility of renting. Hence the risk-adjusted cost of owning $P_0 - \delta^N P_N$ must equal the risk-adjusted cost of renting $r_0 + \delta r_1 + \delta^2 r_2 + \ldots + \delta^N r_N$. In a stationary environment the analogous condition applies for the people buying the house in period N and subsequently. This implies that the current price P_0 must equal the present discounted value of expected future rent payments, *plus* N-1 risk premia associated with the rent payments *minus* a risk premium for the terminal house price on selling after N periods. If the rent payments and house prices are deterministic, or if agents are risk neutral, P_0 will reflect only the discounted expected future rent payments as in Poterba (1984). But if rent is stochastic, risk averse agents will bid up P_0 because of the insurance benefit the house provides against rent risk. House prices then must be higher relative to rental rates – i.e., the price-to-rent ratio P_0/r_0 must increase – to leave households indifferent between owning versus renting in the face of rent risk. In particular P_0/r_0 will increase with agents' risk aversion and the magnitude of rent risk σ^{rent}.

[4] Equivalently, the household can be though of as choosing between owning or renting the same house. The comparative statics below can be generalized to allow the services from the owner-occupied house to exceed those from renting (perhaps due to agency problems).

[5] We have intentionally abstracted from capital market imperfections leading households to want to smooth their year-to-year housing expenditures. While we believe this may be an important effect that drives the rent insurance value of homeowning, modeling it would be unnecessarily complex and we expect it would not provide any different predictions than the ones outlined here, but only would increase their strength.

We will test for a positive relation between price-to-rent ratios P/r and the rent risk σ^{rent} using cross-MSA data. Of course, depending on the elasticity of housing supply some of the hedging demand for housing will show up in higher homeownership rates. Hence we also test for a positive effect of σ^{rent} on the probability of homeowning, using individual level data.

Further, note that there are N-1 risk premia for rent risk, each increasing with σ^{rent}, and that the single risk premium for the terminal house price will be discounted by δ^{2*N}.[7,8] Hence the price-to-rent ratio P_0/r_0 will generally increase in the expected holding period for the house, N. That is, the greater the number of rent risks the house will insure the owner against, the greater its hedging value and so its price. The effect of increasing the holding period ($\uparrow$N) rises with σ^{rent}, the magnitude of each rent risk; equivalently, the effect of larger rent risk ($\uparrow\sigma^{rent}$) increases with the expected holding period. To test for these effects we will interact σ^{rent} with households' expected holding periods, or equivalently their probability of moving (mobility). In addition, for elderly people, a reasonable proxy for the expected holding period is their remaining lifespan. Thus, the model predicts that as an individual ages and is closer to the end of her life, the insurance value of homeownership should decrease, given σ^{rent}. However, as before, the insurance benefit will increase with σ^{rent}, given the remaining lifetime.

Although the model presented in this section is stylized, its implications are quite general. Among the advantages and disadvantages of owning a home, one potentially important but

[6] Since interest rates are nearly constant across the country and depreciation schedules are set at the federal level, variance in them over time will not effect our empirical results. Maintenance is deferrable by a homeowner so its timing is not a big issue, but we abstract from uncertainty about maintenance costs across MSAs.

[7] As usual the quantitative results for risk premia are in general based on local approximations, but for exponential preferences they hold exactly.

[8] The magnitude of the risk premium for the terminal house price P_N depends on the stochastic process for rent, but does not change the comparative static results at issue. The result is analogous to term structure models of long versus short maturity bonds. Here the input into the model is the process for one period (short) rental rates, reflecting, for example, shocks to demand for housing space. In the case where the rent shocks are IID, the variance of P_N can be shown to be proportional to $\delta^{2N}*\sigma^{rent}$.

neglected advantage is the insurance it provides against rent risk. This insurance benefit will be capitalized into house prices, and so the price-to-rent ratio P/r should increase with the standard deviation of rent σ^{rent}, as will the probability of homeownership. The hedging demand for housing will decrease with mobility and the interaction of mobility and σ^{rent}.[9] The following sections test these implications.

II. Data and variable construction

To estimate the models described in section I, we need rent and house price data at the market level and individual level information on homeownership and demographic characteristics. To this end we combine four data sets.

For rent variance and growth rate, a time series of median apartment rents by MSA was obtained from Reis, a commercial real estate information company.[10] The series runs annually from 1981 to 1998, with 47 MSAs observed consistently throughout the sample. For most of the empirical work, we calculate a de-trended variance over a 10-year period. The growth rate is defined as the constant exponential trend that best fits the 10-year rent series. Rent variance is based on the percentage deviation from that trend over the preceding decade.

House price growth is computed in a similar manner in each MSA using the Freddie Mac repeat-sales house price index over the same time periods. To obtain the level of house prices in a given year, we inflate the MSA's median house price from the 1990 Census by the growth in the Freddie Mac index. To estimate the effect of rent variance on house prices, we merge the rent and house price data sets by MSA, yielding 44 MSA-level observations per year. Due to the lags

[9] The effect of mobility will be even larger insofar as moving costs are larger for homeowners than renters. If moving costs for homeowners include components proportional to house prices, in risk-adjusted terms they will increase with the standard deviation of house prices and so with rent risk, reinforcing the effect of mobility interacted with σ^{rent}.

[10] Reis collects its data from surveys of apartment building owners in each MSA.

required, we can compute rent variance only for the 1990-1998 period, giving us a total of 396 MSA-year observations when the data is pooled.

Those 396 observations are summarized in the first two columns of table 1, where we can see that there is substantial variation in all the variables. The mean standard deviation of rent (within MSAs) is 2.6 percent and the standard deviation of that average (across MSAs) is 1.7 percentage points. Homeowners typically pay nearly 16 times the MSA's annual median apartment rent for their houses, though this figure varies considerably across MSA's.[11] Both rents and prices grow approximately 4 percent per year, which is reassuring since we expect house prices within an MSA to be a fairly constant multiple of rents.

When we examine the summary statistics for 1998 alone, in the last two columns of table 1, it is clear that much of the variation comes from the cross section of 44 MSAs rather than over time. The average standard deviation of rent in 1998 was 0.02 with a standard deviation of 0.01, similar to the decadal figures. The other means and standard deviations in 1998 are equally close to the average over the 1990-1998 period.

Homeownership rates and individual-level data are obtained from the 1999 Current Population Survey's (CPS) March Annual Demographic Supplement. For each household, the CPS reports whether they own or rent their dwelling, the household's total income, and a number of demographic variables such as age, race, education, occupation, number of children, and marital status. In addition, we impute the probability of an individual's moving in the next year as the proportion of people in that person's age-occupation-marital status cell, excluding the individual in question, who moved in the last year. The sample averages of the key variables are reported in

[11] Part of the reason that owner-occupied housing commands such a large multiple to rent is that the median house price reflects a greater quantity of (equivalently, "nicer") house than the median apartment rent does. As long as the difference between the amount of housing in the median house and in the median apartment does not spuriously vary across MSAs in a way that is correlated with rent variance, it will not affect our estimation.

table 2. In particular, 65 percent of persons in the CPS live in an owner-occupied house and 15 percent have moved in the last year.

The market-level rent and house price data is matched to each CPS household based on their MSA of residence. MSA-level homeownership rates are computed by taking the average across all CPS households in an MSA. Table 3 reports the standard deviation of rent, price-to-rent ratio, and homeownership rate for all 47 MSAs in 1998. Across MSAs, rents have a standard deviation anywhere from 0.9 percent in Pittsburgh to 4.6 percent in San Jose. Once we de-trend, the standard deviation in rents does not necessarily correspond to high growth cities (San Francisco and New York are unexceptional) or to the expected elasticity of land supply (Atlanta and Phoenix, for example, do not have low standard deviations of rent). Reassuringly, the price-to-rent multiple seems to incorporate expectations about future growth in rents as it is highest in the boom towns of Seattle and San Francisco and bottoms out in Pittsburgh, Houston, and San Antonio.[12] The cross sectional variation in homeownership rate is enormous, especially considering the national average homeownership rate has changed only 2 percentage points in the last 20 years, from 65 to 67 percent. While 81 percent of people in Richmond own their house, only 33 percent of those in New York and 53 percent of those in San Jose do.

III. Empirical methodology and results

We expect the benefit of homeowning as a rent insurance mechanism, outlined in section I, to increase the demand for homeownership. If owner-occupied residences were perfectly elastically supplied, people who live in markets with higher rent variance would simply be more

[12] Just as a price-earnings multiple for stocks should be higher for companies with higher expected future earnings growth, house prices should be higher for cities with higher expected future rent growth.

likely to be owners and the homeownership rate would be higher in those MSAs.[13] On the other hand, if owner-occupied houses are at all inelastically provided, at least some of the increase in demand for ownership will be capitalized into a higher price of housing rather than showing up in the homeownership rate. The insurance benefit of homeownership does not affect the underlying demand for space to live in and therefore should not affect the rental price of space. However, owners would be willing to pay a higher premium over the rental value to own the space rather than rent it in places with higher rent variance. Since we do not have strong prior beliefs about the elasticity of supply of owner-occupied housing, we investigate the effect of rent variance both on the homeownership decision and the price-to-rent multiple.

III.1 The effect of rent variance on homeownership

One simple prediction of the model in section I is that families in markets with higher rent variance should be more likely to be homeowners since they place a greater value on the rent insurance benefit of homeownership. Thus we estimate the following linear probability model on individual level data from the 1999 CPS:

$$OWN_{ik} = b_0 + b_1 s_k^{rent} + qX_i + yZ_k + w_i + h_k + e_{ik} \qquad (1)$$

where *i* indexes the individual and *k* the MSA she lives in. "Own" is an indicator variable that takes the value of one if the person owns their house and zero otherwise. The standard deviation of rent in market *k* is denoted by σ_k and is computed over the 1989-1998 period; X_i is a vector of individual level controls from the CPS including log income, the log tax price, and dummy variables for race, education, occupation, 10-year age categories, and marital status. MSA-level

[13] The supply of owner-occupied houses in this context could be quite elastic even if land is inelastically supplied. The insurance benefit of homeownership should only affect how a family obtains their housing service flow – by purchasing the house or renting it – and not the quantity of housing they demand. Thus in a market where a high rent

controls in the Z_k vector include the median apartment rent and median house price in 1998, and the average rent and house price growth rates over the 1989-1998 period. Unobservable individual level characteristics are denoted by ω_i and MSA-level factors by η_k. Since a number of variables, including the standard deviation of rent, only vary across markets, we correct the standard errors to account for the correlated shocks within MSAs.

As long as ω_i and η_k are not correlated with the standard deviation of rents and the probability of homeownership, we can estimate equation (1) without fixed effects and the results will not suffer from omitted variable bias. The estimated coefficients are reported in the first column of table 4. The positive coefficient on the standard deviation of rent indicates that people who live in markets with higher rent variance are more likely to be homeowners, consistent with our hypothesis that homeownership helps to avoid rent risk. However, the estimated coefficient is statistically indistinguishable from zero. This outcome is not surprising for two reasons. First, the assumption of no relevant MSA-level heterogeneity may be too strong. Second, the rent variance may not matter much for the homeownership decision for the average person, especially since that person may expect to move frequently and thus would not reap much rent insurance benefit from homeowning.

We solve both potential problems by utilizing our result that the rent insurance benefit of homeowning increases with the amount of time a family expects to stay in its house. Then one would expect to find that families with longer expected lengths-of-stay should be more sensitive to the rent variance when deciding whether to own or rent. In other words, the insurance value of homeowning for a family that expects to move after a year or two does not increase as much when the rent variance rises as does the value for a family that expects to remain in the house for a long

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variance induces more families to own, it is not necessary to develop new housing, merely convert rental into owner-occupied housing.

time. Empirically, we should expect to see that the difference in the probability of homeowning between longer and shorter expected duration families should increase with the rent variance. To test this hypothesis, we estimate an expanded specification:

$$OWN_{ik} = b_0 + b_1 s_k^{rent} + b_2 MOBILITY_i + b_3 s_k^{rent} \times MOBILITY_i + qX_i + yZ_k + w_i + h_k + e_{ik} \quad (2)$$

where "mobility" is the family's expected probability of moving in the next year. We impute expected mobility as the average probability of moving in the last year for other people in the same age, occupation, and marital status categories.[14] Due to transactions costs of buying and selling a house, high expected mobility families are predicted to be less likely to be homeowners; thus β_2 should be negative.

The interaction of mobility and the standard deviation of rent tests the hypothesis that the sensitivity of homeownership to the rent variance should increase with expected stay or, equivalently, decrease with mobility. Thus a significantly negative value for β_3 will confirm the importance of the rent insurance value of homeowning. In addition, while unobservable MSA level characteristics may bias the estimated coefficient β_1 on the standard deviation of rent, β_3 still should be consistent since it depends only on the interaction of individual level characteristics with the MSA-level rent variance. Since we are in effect comparing the homeownership probabilities of high- and low-mobility families within MSA, in order to bias our result the MSA-level unobservable characteristics would need to affect the homeownership decision for high- and low-mobility families differently in each MSA, and that differential impact would have to vary across

[14] We have also imputed mobility based on the 10-year age category alone since age is completely exogenous and the broad age categories do not suffer from small cell sizes. We obtain qualitatively and quantitatively similar results for the homeownership regressions in this case. The same holds true for imputing by occupation – the results are qualitatively the same and continue to be quite statistically significant. In both cases, the estimated effects of a one-standard deviation increase in the standard deviation of rents is larger than in the reported regressions. Imputing by marital status alone yields statistically significant results only when individual and MSA covariates are included and typically has a smaller economic effect than our base case.

MSAs in a way that happened to be correlated with the rent variance. We believe this to be unlikely.

Similarly, if unobservable individual level characteristics happen to be correlated with rent variance and the homeownership decision, our estimated coefficient on the standard deviation of rent could be biased. However, as long as those characteristics are constant within mobility groups across MSAs, the interaction of mobility and rent variance will be unaffected.

Returning to table 4, columns 2 and 3 report the results from estimating equation (2) without and with the individual-level demographic controls, respectively. In both cases, in the third row the estimate of β_3 for the interaction of rent risk and mobility is negative and statistically significant, indicating that low expected mobility (high expected duration) families are more likely to be homeowners, relative to high expected mobility families, in markets with higher rent variance. This result supports our hypothesis that the rent insurance aspect of homeowning increases the demand for homeownership. Adding individual demographic controls in column 3 has only a small effect on β_3 – it declines from –10.0 to –8.6 (3.4) – suggesting that our empirical strategy may control for unobservable heterogeneity as well. The estimated coefficient on the standard deviation of rent increases in magnitude in these richer specifications and, in the second row, mobility has the expected negative effect on the probability of homeownership.

The last row of table 4 translates the coefficient on the mobility/rent variance interaction term into a more economically meaningful number by multiplying by the standard deviation of the interaction, which we consider to be a measure of the exposure to rent risk. The estimates show that the rent insurance benefit of homeowning has a large effect on the homeownership rate; a one standard deviation decrease in the interaction term from the mean would increase the probability of homeownership by 2.2 to 2.6 percentage points from a base of 67 percent.

Since our variable of interest is a combination individual/MSA-level effect, we can control for all possible observable and unobservable MSA characteristics and still identify β_3. In columns 4 and 5, we include MSA dummies for that purpose, at the expense of not identifying purely MSA-level characteristics, such as the standard deviation of rent alone. The estimated coefficient on and economic significance of the mobility/rent variance interaction increases in magnitude slightly, but there is no statistically significant difference.[15]

III.2 Rent variance affects housing demand for the elderly

The value of homeownership as rent insurance may provide a partial explanation for why homeownership rates are so high among the elderly. If older or retired households are more risk averse, they will value more highly the insurance benefit of owning and will be more likely to own. Counteracting that effect, however, is that the closer a homeowner is to the end of her life, the less insurance value she receives from homeowning. Thus we would expect to find that older people should generally be more likely to own, but the probability of owning should decline as they approach the end of their lifetimes.

While we would like to attribute a rising-then-falling life-cycle pattern of homeownership to the rent insurance value of owning, there are many other possible explanations. For example, low mobility among the elderly may explain their higher homeownership rates and declining health may cause them to be more likely to move out as they age further. However, the rent insurance hypothesis predicts that homeownership rates among the elderly should be highest in high rent variance places since the value of the rent insurance would be the largest there. In addition, the decline in the probability of homeownership should be steepest in high rent variance places since

[15] The number of MSAs available increases to 47 since one MSA for which we observed the rent series but not the house price series can now be included as the house price variables are subsumed by the MSA dummies.

the insurance value is much more sensitive to the time until death. The life-cycle pattern of homeownership that is driven by other causes should not be affected by rent variance.

This exact difference in life-cycle patterns of homeownership can be seen in the unconditional homeownership rates by age. We pooled the 1990 and 1999 CPS cross-sections and divided our 44 MSAs into high- and low-variance markets depending upon whether they were above or below the median rent variance, and computed the average unconditional homeownership rate by age in each type of market.[16] The result, smoothed for readability by averaging the homeownership rate across five adjacent ages, is presented in figure 1. In both high- and low-rent variance MSAs, 25-year-olds have the same homeownership rates, approximately 40 percent.[17] However, by age 35, the homeownership rates start diverging, with higher rent variance markets having higher homeownership rates. This gap peaks for people in their late 60s, with 67-year-olds exhibiting homeownership rates of 75 percent in low-variance places and 82 percent when rent variance is high. While the unconditional probability of homeownership declines with age starting in the late 60s, it falls fastest for people in high rent variance MSAs, matching the more rapid decline in the value of the rent insurance there. By the time people are in their late 70s, with presumably short expected remaining lifetimes, the homeownership rate in high- and low-rent variance MSAs has converged to a 3 percentage point difference or less.

While figure 1 presents unconditional homeownership rates by age, we would like to control for other observable factors that may vary systematically by age or with rent variance. Estimating the homeownership rate by 10-year age categories in high- and low-variance markets and conditioning on a complete set of individual controls including income, year, MSA, race, education, occupation, and marital status yields age profiles that look very similar to those in figure

[16] The number of MSAs drops from 46 to 44 because two MSAs that are present in 1999 data are not available in 1990.

1. In this model, after correcting the standard errors for any correlation of the shocks within each of the MSAs, the hypothesis that the age profiles in the high- and low-variance MSAs are the same can be rejected at the 99 percent confidence level.

We test these hypotheses with a more parametric specification by estimating the following equation:

$$\begin{aligned} OWN_{ik} = g_0 + g_1 AGE_i + g_2 OVER65_i + g_3 HIGH_k + g_4 AGE \times HIGH_{ik} + g_5 OVER65 \times AGE_i + \\ g_6 OVER65 \times HIGH_{ik} + g_7 OVER65 \times AGE \times HIGH_{ik} + qX_i + yZ_k + h_k + u_{ik} \end{aligned} \quad (3)$$

where AGE is the age in years of individual *i*, OVER65 is an indicator variable that takes the value of one if the person is 65 years old or greater, and $HIGH_k$ is a dummy variable that equals one if MSA *k* has an above-the-median rent variance. OVER65xAGE tests whether the age profile of homeownership has a different slope for people aged 65 and over. The hypothesis that older families are more sensitive to rent variance is tested by the OVER65xHIGH interaction, and OVER65xAGExHIGH tests whether the age-ownership profile is more steeply declining in high variance places. The equation is estimated on a sample that pools the 1990 and 1999 CPS cross sections and the rent variance for each MSA is estimated over the previous nine years.[18] Once again, detailed individual controls are included for income, year, MSA, race, education, occupation, and marital status, and the standard errors are corrected for any correlation of the shocks within each of the 44 MSAs.

The results, in the first column of table 5, bear out the predictions of the rent insurance hypothesis. As a baseline, in MSAs with below-median rent variance the homeownership rate increases with age at a rate of 7 percent for every decade and people aged 65 or over are on average

[17] One reason that the homeownership rate for the young may not differ between high and low rent variance places is that this age group may be the most sensitive to the higher housing prices in high variance markets.
[18] 1990 is our earliest available year of data and 1999 is the most recent when we maximize the amount of time between observations and the potential variation in rent variance. Since the rent variance for 1990 is estimated over the

40 percent more likely to own homes. Supporting our hypothesis, homeownership among older households is sensitive to the rent variance. In high rent variance MSAs, people aged 65 are 2.8 percent more likely to be homeowners than people of the same age in low rent variance places.

True to our predictions, elderly homeownership declines more rapidly with age in high rent variance places. Relative to people over 65 in low rent variance places, the probability of homeownership for people over 65 in high rent variance MSAs falls 0.4 percent (0.2) more per year of age. This is a considerable difference because, controlling for other covariates, the probability of homeownership for people over 65 in low rent variance places is basically flat over their remaining lifetimes.[19] But for older people in high rent variance places, the conditional probability of homeownership is declining at a rate of 2 percent per decade of age.[20]

These results are robust to a number of specification changes. The second column of table 5 summarizes the results for a specification where the age profile of homeownership is quadratic in age and allows that profile to be different in high- and low-variance places. Again, older people in high variance places have a higher overall probability of homeownership but a steeper decline with age, with the differences being statistically significant at conventional levels. However, this specification does not capture the decline in the probability of homeownership at high ages as well as the linear spline in column one. We have also replaced the "over 65" indicator with a CPS measure of retirement, with similar qualitative results.

III.3 The effect of rent variance on house prices

1981-1989 time period and the 1999 rent variance is computed from 1990-1998, there is no overlap in our rent variance sample when we combine 1990 and 1999.

[19] For people aged 65 or higher in below-median rent variance MSAs, the probability of homeownership increases 1 percent every ten years. The one percent figure comes from adding the 0.007 coefficient on age to the –0.006 coefficient on AGExOVER65.

[20] This figure comes from adding 0.007 (AGE) , 0.001 (AGExHIGH), –0.006 (AGExOVER65), and –0.004 (OVER65xAGExHIGH).

The model in section I predicts that families should be willing to pay an insurance premium to own a dwelling rather than rent it and that premium should be increasing in the variance of rent. In the previous subsections, we found evidence that some of the insurance demand for housing was met by increasing the supply of owner-occupied housing and thus increasing the homeownership rate. In this subsection we look for direct evidence in house prices. We estimate the following OLS equation on the 44 MSA-level observations:

$$\frac{P_k}{R_k} = d_0 + d_1 s_k^{rent} + yZ_k + m_k, \qquad (4)$$

where P/R is the price-to-rent multiple in MSA k, σ_k is the standard deviation of rent, and Z_k is a vector of observable MSA characteristics, namely the average rent and house price growth rates. Since R_k captures the effect of overall demand for living space, the rent insurance value of ownership should show up as a higher multiple of rents. That is, using the ratio of prices to rents controls for shocks to the overall housing market, which impact both owner-occupied housing and rental housing. Controlling for the growth rate of rent, the price-rent multiple then will include the risk premia associated with rent variance.

We begin by estimating this model on a panel of 44 MSAs observed over the 1990-1998 time period. We calculate rent variance and growth over the prior nine-year period, so 1990 (with σ_k calculated over 1981-1989) is our earliest available year and 1998 (with σ_k calculated over 1990-1997) is the latest. The first column of table 6 presents the results from the pooled cross section. Places with a higher standard deviation of rent have a significantly greater price-to-rent multiple, with the estimated coefficient on δ_1 being 43.5 (11.9). The last row of table 6 gives some insight into the economic significant of this result – a one standard deviation increase in σ_k, 0.017, is estimated to increase the price-to-rent ratio by 0.71. Since the mean price-to-rent ratio is 15.7, this amounts to a 4.5 percent rise in house prices for a given rent. In addition, expected rent growth is capitalized into the price-to-rent multiple with a one standard deviation increase in rent growth (0.02) leading the multiple to be 0.98 higher (0.22 standard error).

We next incorporate MSA fixed effects to control for MSA level observable and unobservable characteristics that do not change over time. We also add year dummies to control for factors that may affect both the rent variance and house price multiple over time. Thus we are using the within-MSA variation in rent variance, rent growth, and the price-to-rent ratio over time to identify the rent insurance effect. If MSA-level heterogeneity is driving our previous results, adding the MSA dummies should correct the problem. However, doing so removes a potentially powerful source of variation in rent variance – differences across MSAs.

Even controlling for MSA and year fixed effects, in column 2 we find that when rent variance in a given MSA is higher, the price-to-rent ratio is higher. The estimated coefficient on the standard deviation of rent, 12.3 (4.76), indicates that a one standard deviation increase in σ_k leads to a 0.2 increase in the price-to-rent multiple. While economically smaller than the previous result, it accounts for a 1.3 percent increase in house prices for a given rent level and is statistically significant. When one considers that this result applies to changes for a given MSA rather than differences across MSAs, the magnitude of the effect seems to be reasonable.[21] Rent growth, too, continues to have the expected positive effect when MSA and year dummies are included, with an estimated coefficient of 13.85 (3.46).

III.4. What are some determinants of cross-MSA differences in rent variance?

[21] In any case, it jibes with our expectation that it is not excessively costly to change the mix of owned and rented housing stock given that the overall quantity of housing stock does not need to change when the rent variance does.

To this point, we have assumed that MSAs are endowed with their underlying rent variances. Our prior belief is that fluctuations in rents are determined by movements in the demand for living space, presumably caused by local economic growth, combined with the elasticity of supply of housing. We expect MSAs with volatile housing demand to have more rent variance. MSAs with more inelastic housing supply should also exhibit higher rent variance as the housing or apartment stock is less able to adjust to demand fluctuations. In this subsection, we try to find some empirical evidence on which underlying factors affect rent variance. Due to the nature of this exercise, however, the regressions will largely be descriptive in nature. In other words, we will be looking for MSA-level factors that presumably do not change over time that affect MSA rent variance. That limits us to trying to find empirical effects in a cross section of a few dozen MSAs, with all the accompanying problems due to noisy data, a small sample, and our inability to control for heterogeneity in a cross-section.

With that caveat, we turn to table 7, where we regress the de-trended standard deviation of rents in an MSA on a proxy for the volatility of demand for space and proxies for the elasticity of housing supply. The demand proxy is the de-trended standard deviation in the MSA's aggregate employment, constructed in a parallel manner to the rent variance. We proxy for the inelasticity of supply of living space with two variables from Mayer and Somerville (2000), whether the MSA charges impact fees to developers and the number of months it takes to obtain a building permit. The former adds a transaction cost to building so that developers would wait for a larger increase in rents before adding more housing stock. The latter reduces the speed in which developers can respond to demand shocks and adds uncertainty to the development process, which is another transaction cost.

Variation in demand for space has a strong effect on rent variance. In the first column, we include only the standard deviation of MSA employment on the right-hand-side. This leaves us with our full sample of 43 MSAs in 1998. The coefficient on employment volatility is positive and significant, with a coefficient of 0.52 (0.17) and the regression has an R-squared on 0.19. Thus an MSA with a one standard deviation higher standard deviation of employment (0.008 on a mean of 0.019) has a one-half standard deviation higher standard deviation of rent.

Our proxies for whether supply in inelastic in the MSA also appear to have an effect. In column two, we use the indicator variable for whether the MSA charges impact fees and the time-to-obtain-permit variable as covariates. Our sample size falls to 38 since the supply elasticity variables are not available for all MSAs in our sample. The impact fee dummy has a strong and statistically significant impact on rent variance with an estimated coefficient of 0.0084 (0.0026). Presumably, our impact fee variable proxies for other deterrents to development in the market. The estimated coefficient on the length of time to obtain a development permit variable has the expected positive sign, 0.00069 (0.00036), and is significant at the 93 percent confidence level.

In column 3, we show that both the demand- and supply-side factors have an effect on rent variance in the MSA by including all three covariates. The point estimate on the standard deviation of employment changes only slightly, falling to 0.42 (0.18). The impact fee dummy remains statistically significant: its estimated coefficient of 0.0061 (0.0027) implies that rent variance is about 30 percent higher than the mean of 0.020 in markets where impact fees are charged. The coefficient on the development permit variable falls in magnitude to 0.00040, reducing its t-statistic of just over one so it is not statistically distinguishable from zero. This outcome is not surprising, given the measurement error in the variable and our limited number of observations. The R-squared increases to 0.38, suggesting that we are able to account for a substantial portion of the variation across MSAs in rent variance with this small set of explanatory variables.[22]

While the regression in column three suggests that both demand variance and supply inelasticity contribute to rent variance in a market, one might expect that both factors must work in concert to create high rent variance. In other words, demand fluctuations may be innocuous if housing supply can easily adjust and inelasticity of supply would be moot if demand were not volatile. We provide a crude test of that hypothesis in column 4 by interacting the impact fee dummy variable with the employment variance variable. Indeed, only the interaction term matters in that regression, showing that the standard deviation of employment affects rent variance only in markets with impact fees. The point estimate of 0.63 (0.35) is significant at the 90 percent confidence level.

IV. Conclusion

One frequently overlooked but potentially important benefit to homeownership is avoiding the uncertainty of renting. We examine one aspect of the risk of renting – the unpredictability of rental costs. Homeowning, with its long-term fixed-rate mortgage and homeowner-determined maintenance costs, provides a predictable way of paying for housing services. With renting, the

[22] One may be tempted to instrument for rent variance with employment variance, especially since in a regression of rent variance on employment variance, MSA dummies, and year dummies on 43 MSAs over the 1989-1998 period produces a statistically significant coefficient on employment variance of 0.17 (0.06) and an R-squared of 0.62. However, while employment variance explains rent variance, it probably is not orthogonal to the rent/own decision. In particular, given the transactions costs of ownership, uncertainty about income probably discourages people from homeownership. [Cocco (2000), Haurin (1991)] In our regressions, excluding employment variance from the set of covariates would cause us to *under*estimate the effect of rent variance on homeownership since our primary effect of higher rent variance causing people to be more likely to desire to be homeowners would be partially offset by people with higher income variance wanting homeownership less. Indeed, the estimated coefficients on the rent variance and standard deviation of rent interacted with mobility variables increase in magnitude slightly when we add the standard deviation of MSA employment on the right-hand-side. However, when we include individual covariates, the MSA employment volatility variable is not itself statistically different from zero. One reason that omitting this variable has such a limited impact on our baseline results is that we examine the difference in homeownership rates between two

cost of obtaining housing is unknown. While renting a given property may be less expensive than owning it, homeowning provides insurance against rent risk.

We show in a simple model that risk-averse people should be willing to pay a premium over the capitalized rental value for a house to own it rather than rent it solely to avoid uncertainty about the total cost of homeownership over their expected stay in the residence. Thus, to the degree that the insurance benefit is capitalized into house prices, the price-to-rent multiple should be higher in places with higher rent variance and, to the degree that the supply of owned housing is elastic, the probability of homeowning should also rise with the variance of rent. The model also implies that the insurance value of homeownership increases with expected duration.

We use these results to motivate an empirical investigation into the effect of rent variance on the probability of homeowning and on house prices. We control for MSA-level heterogeneity and other factors by comparing groups that should be differentially affected by rent variance because of different expected durations in their homes. We find that the rent insurance benefit of owning significantly increases the homeownership rate: a one standard deviation increase in the exposure to rent variance (mobility interacted with the variance of rent) would lead to a 2.4 to 3.0 percent increase in the homeownership rate. Older households are particularly sensitive to rent risk, with people aged 65 residing in places with above-median rent variance 3.8 percent more likely to be homeowners than people of the same age in low rent variance MSAs, conditional on observable individual characteristics and controlling for MSA fixed effects. Confirming that this effect is due to the insurance value of homeowning, the probability of homeownership drops most rapidly with age for elderly who live in high rent variance places, consistent with their insurance value declining with their remaining lifetimes. Finally, we find evidence that some of the insurance benefit of

groups that have different sensitivities to rent variance. Thus the overall level of employment variance in the MSA is subsumed by the MSA fixed effects.

homeowning shows up in the multiple of rents people are willing to pay for houses. Even controlling for MSA-level fixed effects, we find that when MSAs have higher rent variance their house prices increase relative to the rental value of the housing stock.

These results have a number of implications for housing markets and other areas where housing wealth is important. The rent insurance benefit of homeownership appears to be a significant factor in the demand for homeownership. For comparison, a typical cross-section estimate of the user cost elasticity of homeowning would imply that a one standard deviation increase in user cost would lead to about a 2.5 percentage point rise in the homeownership rate, similar in magnitude to our result for rent risk.[23]

For older households, the rent insurance aspect of homeowning may help explain why the elderly usually do not become renters and, when they do, it is very late in life. [Venti and Wise (2000); Megbolugbe *et al* (1997)] Because they value insuring against rent risk so highly, it is more costly for them to become renters than previous analyses have assumed. This effect also implies that one should not simply assume that all housing wealth of the elderly is available for consumption. In the absence of viable reverse mortgage markets that let elderly consume their housing wealth, the insurance benefit of homeowning may keep many elderly from selling their housing asset.[24] Those elderly that would be most likely to sell are ironically those that live in the highest rent variance places, though they would not sell until late in life.

The results suggest some interesting avenues for future research. In our model, people own houses to avoid uncertainty about total housing costs. Presumably, they would need to save less to buffer those costs than if they were renting the same unit. Also, if one extends the model to

[23] The results for price are more difficult to compare since the price multiple has not received much attention in the housing demand literature.
[24] We presume that the transactions costs involved in moving to a smaller owned unit make such a transition not worthwhile for most elderly.

encompass imperfect capital markets, so people own houses to smooth their housing costs over time, one should see that homeowners actually enjoy less variable consumption than renters.

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Table 1: Summary statistics for MSA-level data

Variable	1990-1998 Mean	1990-1998 Std. Dev.	1998 only Mean	1998 only Std. Dev.
Standard deviation of rent	0.026	0.017	0.020	0.010
Price-to-rent ratio	15.72	4.08	15.52	3.57
Rent growth	0.036	0.019	0.032	0.013
House price growth	0.041	0.031	0.029	0.021
Rent	7,142.24	1,794.09	8,280.00	1,972.26
Median house Price	115,767.00	55,851.67	131,947.80	59,410.71
Number of observations	396		44	

Notes: The standard deviation of rent, rent growth, and house price growth are all computed over the 1989-1998 time period. The rent data are obtained from Reis. House price growth is computed from the Freddie Mac repeat sales house price index. To compute house prices, the MSA median house price from the 1990 Census is inflated to the current year using the Freddie Mac index.

Table 2: Summary statistics for CPS data (1999)

	Mean	**Standard deviation**
Proportion owning	0.652	0.476
Probability of moving	0.149	0.106
Standard deviation of rent	0.018	0.009
Moving x standard deviation of rent	0.003	0.003

Notes: Number of observations is 35,723. The standard deviation of rent is computed over the 1989-1998 time period. The rent data are obtained from Reis. Moving is defined as having moved in the last year.

Table 3: Market-level rent data

Market	Standard deviation of rent	Price-to-rent ratio	Ownership percent
Atlanta	0.026	14.68	0.73
Austin	0.035	15.07	0.64
Baltimore	0.021	16.50	0.73
Boston	0.044	15.16	0.62
Charlotte	0.033	14.03	0.79
Chicago	0.019	15.63	0.68
Cincinnati	0.018	15.15	0.80
Cleveland	0.015	15.02	0.77
Columbus	0.015	16.27	0.64
Dallas	0.026	14.63	0.65
Denver	0.019	19.76	0.72
Detroit	0.016	13.29	0.77
District of Columbia	0.015	19.74	0.58
Fort Lauderdale	0.008	12.42	0.73
Fort Worth	0.012	13.30	0.61
Houston	0.028	12.78	0.62
Indianapolis	0.011	14.26	0.74
Jacksonville	0.011	13.48	0.70
Kansas City	0.021	13.34	0.74
Los Angeles	0.017	23.77	0.48
Memphis	0.018	13.76	0.65
Miami	0.019	14.42	0.60

Table 3: Market-level rent data, continued

Market	Standard deviation of rent	Price-to-rent ratio	Ownership percent
Milwaukee	0.016	14.34	0.71
Minneapolis	0.019	13.89	0.77
Nashville	0.039	15.02	0.74
New Orleans	0.021	16.03	0.62
New York	0.017	16.60	0.33
Norfolk	0.013	16.41	0.65
Oakland-East Bay	0.028	25.10	0.63
Orlando	0.012	14.68	0.68
Palm Beach	0.023	12.55	0.68
Philadelphia	0.011	13.53	0.79
Phoenix	0.043	15.87	0.68
Pittsburgh	0.009	10.21	0.79
Portland	0.028	20.00	0.66
Raleigh-Durham	0.024	16.14	0.67
Richmond	0.016	15.12	0.81
Sacramento	0.032	24.04	0.60
San Antonio	0.017	11.58	0.70
San Bernardino	0.017	20.10	0.70
San Diego	0.018	25.03	0.57
San Francisco	0.032	28.21	0.56
San Jose	0.046	28.43	0.53
Seattle	0.028	30.07	0.73
St. Louis	0.022	13.41	0.76
Tampa-St. Petersburg	0.013	12.85	0.70

Table 4: Greater rent variance yields an increase in homeownership

	(1)	(2)	(3)	(4)	(5)
Standard deviation of rent	0.037 (1.339)	2.007 (1.762)	1.310 (1.271)		
Probability of moving (mobility)		-1.215 (0.082)	-0.473 (0.068)	-1.194 (0.091)	-0.448 (0.075)
Mobility x standard deviation of rent		-10.041 (3.341)	-8.558 (3.365)	-10.716 (3.756)	-9.370 (3.725)
Median rent	-0.022 (0.012)	-0.026 (0.016)	-0.023 (0.011)		
Median house price	-0.294 (0.338)	-0.212 (0.449)	-0.290 (0.338)		
Rent growth	-2.150 (1.362)	-2.316 (1.745)	-2.078 (1.360)		
House price growth	2.012 (0.760)	2.603 (0.966)	1.975 (0.758)		
Individual controls	Yes	No	Yes	No	Yes
MSA dummies	No	No	No	Yes	Yes
Number of Observations	34,681	35,153	34,657	35,723	35,221
Number of MSAs	46	46	46	47	47
R-squared	0.25	0.14	0.26	0.17	0.27
A one standard deviation in mobility x standard deviation of rent leads to…		-0.026 (0.009)	-0.022 (0.009)	-0.028 (0.010)	-0.024 (0.010)

Notes: Robust standard errors in parenthesis, clustered on market. Dependent variable takes the value of one if family is a homeowner. Individual controls include dummies for occupation, age, race, education, marital status, and controls for log income and log tax price.

Table 5: Rent Insurance Makes Elderly More Likely to Own

	Spline	Quadratic
Age	0.007 (0.000)	0.013 (0.002)
Over 65	0.402 (0.078)	
High variance dummy	-0.044 (0.031)	-0.092 (0.052)
Age × high variance	0.001 (0.001)	0.004 (0.002)
Over 65 × age	-0.006 (0.001)	
Over 65 × high variance	0.277 (0.106)	
Over 65 × age × high variance	-0.004 (0.002)	
Age^2		-0.073 (0.013)
Age^2 × high variance		-0.034 (0.015)
R-squared	0.27	0.27

Notes: Robust standard errors in parentheses, clustered on 44 markets. The dependent variable is an indicator that takes the value of one if the individual is a homeowner. These regressions pool the 1990 and 1999 data, for a total of 71,261 observations. Controls that are included in the regressions but are not reported here are log income and dummies for year, MSA, race, education, occupation, and marital status.

Table 6: Greater rent variance yields a higher price-to-rent multiple

	(1)	**(2)**
Standard deviation of rent	43.51 (11.89)	12.30 (4.76)
Rent growth	48.90 (10.78)	13.85 (3.46)
Constant	12.81 (0.57)	13.31 (0.38)
MSA dummies	No	Yes
Year dummies	No	Yes
Number of observations	396	396
R-squared	0.07	0.95
A one standard deviation increase in standard deviation of rent leads to…	0.71 (0.19)	0.20 (0.08)

Notes: Standard errors in parentheses. Dependent variable is the price-to-rent ratio. Number of observations equals 44 MSAs over the 1990-1998 time period.

Table 7: Some Factors That Affect Rent Variance

	(1)	(2)	(3)	(4)
Standard deviation of MSA employment	0.52 (0.17)		0.42 (0.18)	0.08 (0.29)
Dummy - Use Impact Fees		0.0084 (0.0026)	0.0061 (0.0027)	-0.0061 (0.0068)
Months for permit, >50 Units		0.00069 (0.00036)	0.00040 (0.00037)	
SD employment X use impact fees				0.63 (0.35)
Constant	0.010 (0.003)	0.011 (0.003)	0.011 (0.003)	0.014 (0.005)
R-squared	0.19	0.29	0.38	0.41
Observations	43	38	37	38

Notes: Dependent variable is the detrended standard deviation of rents, as defined in the text. Standard errors in parentheses. Sample year is 1998.

Figure 1: Age profile of homeownership, by rent variance