Structure and Tenure

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Abstract: There is a basic correlation between housing tenure and structure. The 2009 American Housing Survey reports that 87% of single-family housing in the U.S. is owner-occupied while 86% of units in multi-family structures are rented. This correlation has been subject to only sparse analysis. To examine this structure-tenure correlation more carefully we ask a more fundamental question: what characteristics of residential *buildings* make them more likely to be owner-occupied? We examine three hypotheses. First, we consider free-rider issues in the governance of multi-unit buildings. We show that the appropriate measure of building ownership -- the rate of condominium ownership -- is increasing with the size of buildings, contradicting to a degree the free-rider hypothesis. Second, we considered the interaction between the demand for unit quality by homeowners and the fact that unit quality is typically lower in multi-unit buildings. Unit sizes, and other proxies for unit quality, are overwhelming influential in predicting both building ownership and unit tenure, regardless of structure type. Finally, we consider the risk accrued by owner-occupiers in different structure types. Following previous literature, we use data from the Panel Study of Income Dynamics but are unable to show that returns to multi-unit housing are more volatile than for single family housing, in part due to data limitations. The strongest evidence is in favor of the quality hypothesis. (JEL Code: R31)

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1 Introduction

According to Glaeser and Shapiro (2003, p. 8), "[t]here are few facts in urban economics as reliable as the fact that people in multi-family units overwhelmingly rent and people in single-family units overwhelmingly own." They are right. Data from the national American Housing Survey (AHS) of 2009 indicate that 87% of occupied single-family, detached housing in the U.S. is owner-occupied while 86% of occupied units in multi-family structures are rented. Nonetheless, this stylized empirical fact regarding homeownership has received little real scrutiny or explanation. Our purpose in what follows is to provide both a theoretical framework and empirical evidence on the relationship between structure type and household tenure.

As Glaeser (2011a, p 194) points out, beyond this mere correlation lies important policy implications. The political popularity of homeownership (i.e. Gabriel and Rosenthal (2005)), and the willingness of US households to take advantage of the resulting ownership subsidies causes not just more ownership, but because of this correlation between structure and tenure, more single-family housing than there otherwise would be. Single family houses occupy more land per household, and the availability of cheap land in the suburbs for those houses causes decentralization, or more pejoratively, sprawl. Decreased density has a number of ramifications including increased (and putatively wasteful) commuting (Gordon, Kumar and Richardson, 1989; Kahn, 2000), decreased productivity in the city as a whole (Ciccone and Hall, 1996) and increased mismatch of workers and vacancies in cities and suburbs (Coulson, Laing and Wang, 2001; Ihlanfeldt, 2006) There is also the question of what to do with the large stock of foreclosed single-family houses after the housing market upheaval of recent years. They do not seem destined to be purchased by new owner-occupiers, but the structure-tenure correlation seems to indicate it will be equally problematic to impose restrictions requiring assets to remain rental property.

Therefore it would seem to be of interest to examine this structure-tenure correlation more carefully. In doing so, we need to ask a more fundamental question: what characteristics of residential *buildings* make them more likely to be owner-occupied? This is somewhat different than the traditional examination of homeownership (e.g. Coulson and Dalton, 2010; Hilber 2008; Carillo and Yezer, 2009) which asks: what characteristics of *households* make them more likely to become owner-occupiers? Literature on the former issue is sparse. Glaeser (2011a, 2011b; see also Glaeser and Shapiro (2003)) somewhat informally argues that maintenance and upkeep are building-specific (as opposed to unit-specific) issues and so the problems of decentralized ownership of buildings makes condominiums and cooperatives difficult to manage, and that it is more efficient to put those decisions in the hands of a single owner—a landlord—and make multi-unit buildings rentals. Williams (1993) proposes a model of multi-unit structure ownership which trades off the rental externality described in Henderson and Ioannides (1983) against the economies of scale provided by landlords. Ambrose and Goetzman (1996), Turner (2003) and Hilber (2006) in varying ways find that the locational characteristics of buildings matter; where and when ownership is risky, dwelling ownership by individual households is less likely or at least less financially viable. None of these papers comes to grips with the basic structure-tenure correlation.

In the next section, we develop an effort-in-teams model of building management in order to formalize conjectures about free-riding in multi-family building governance. In subsequent sections we propose two additional hypotheses, which are not mutually exclusive with respect to each other or the free-rider hypothesis. First, assuming that the quality of a housing unit, and hence its value, are positively correlated with household decisions to own, and that single family housing typically provides higher quality housing units as compared to multi-family housing, then the structure-tenure correlation may be a by-product of the quality differences between single family and multi-family structures. Second, if the returns to housing in single family and multi-family buildings exhibit different levels of risk, then structure type may have implications for the propensity to own when households cannot adequately diversify their wealth portfolio.

Following the presentation of the three models, we briefly describe our use of the 2009 American Housing Survey, the data source for most of the empirical work that follows. In the following sections we in turn discuss each hypothesis explaining the structure-tenure correlation, extracting appropriate data from the AHS in order to conduct exploratory, nonparametric (albeit bivariate) analysis on the relationship between structural characteristics and tenure. The nonparametric analysis is useful mainly because it turns out that in a few instances the relationships in the data are highly nonlinear, and the examination of these nonlinearities turns out to be of importance.

The AHS asks two ownership and tenure-related questions on which we focus. First, interviewers ask if someone in the respondent's household owns or is purchasing the housing unit that they occupy. Second, they ask whether the housing unit is part of a condominium or cooperative. The first question is an indicator of unit tenure, while the second refers to the structure of building ownership. Condominiums, in particular, represent a legal form of building and unit ownership that provides a governance system among owners who individually own their units and jointly own the building(s) and land related to the units.[1] We show that unit tenure is only imperfectly correlated with building ownership because landlords may choose to owner-occupy a unit of housing within a rental building, and because condominium owners may rent their unit. Thus we use our building ownership measure (whether a condominium) to test the free-rider hypothesis and to corroborate insights about portfolio choices, and use the unit tenure measure in tests about housing quality and structure type.

[1] Because cooperative units are much less commonly found outside of New York City and a few other metropolitan areas, and for simplicity, we refer to these governance arrangements collectively as condominiums throughout this paper. Others distinguish between these collective ownership forms (Hansmann 1991).

We establish some novel structure-tenure facts, several of which are summarized in Figure 1 regarding multi-family housing. As is perhaps fairly well known, there is a tremendous drop off in homeownership between single-family and two unit structures: two unit houses are 21% owner-occupied while single family houses are 87% owner-occupied. (Single-family attached properties fall in between at 63% owner-occupied.) As building size increases, individual units become even less likely to be owner-occupied, especially over building sizes of 2-12 units. On the other hand, the propensity for *building* ownership to be organized as a condominium is increasing in building size, especially among 2-12 unit buildings. The corollary of falling owner-occupation and increasing condo ownership among multi-unit buildings is that over 40% of condominium units in the sample are rented. The underlying histogram in Figure 1 shows that the bulk of multi-family housing (62%) can be characterized as small, 2-12 unit buildings, emphasizing the need to come to grips with the determinants of small multi-family building tenure, in particular.

We also establish that while the average size of single family housing is more than twice the size of multi-family units, the relationship between owner-occupation and unit size within each structure type in the AHS is nearly monotonic. Along with other measures of unit quality, unit size is the most robust indicator of both unit tenure and building ownership that we employ.

Having established some basic observation, in the penultimate section we attempt to disentangle the relative importance of these various explanations with multivariate parametric models. It turns out that all three hypotheses find some support in the evidence. However, we think that unit size and the risk characteristics of multi-family housing hold the greatest promise for future research. We further conclude that structure does indeed influence homeownership in the U.S, although the relationship is surely more nuanced than the extant literature suggests. We discuss these and some policy implications in the conclusions.

2 MODEL

In this section we propose a model intended to formalize the nature of free-riding and other governance issues arise in the context of single-family and multi-unit buildings. If free-riding is an important characteristic of condominium ownership, then this governance problem may outweigh the known user costs advantages of homeownership.[2] To proceed, we modify a model of tenure choice under certainty in Henderson and Ioannides (1983) (see also Harding, et *al.* 2000) and introduce the need for building management in multi-family structures. Thus, agents in this model tradeoff a rental externality at the housing unit level when there is a single landlord against the free-rider problem in condominium building management as discussed by Glaeser (2011a, 2011b).[3]

The Condo Owner-Occupant

In a multi-family building, we assume that owner-occupants consume housing services only from their own housing unit but must maintain both the interior of their unit as well as the rest of the building and its land in order to enjoy this consumption. The cost of maintaining the unit is borne by the owner-occupier while the building level maintenance is shared equally among all owners within a building. To be clear, we allow unit occupants to determine their level of utilization of their housing unit (which influences both their level of consumption as well as the costs of maintenance), while abstracting away from the utilization of any common areas (which is assumed to be constant). The issue that arises with respect to the management and maintenance of building-level systems is the coordination of management effort among unit owners.

The utility function of a resident of a unit in an n-unit building is given by

$$U = x + v(u) - a + \delta W \tag{1}$$

[2] Substituting cooperatives for condominiums does not change the implications of the model explored here.

[3] Other governance issues may surely arise. For example, voting arrangements may be key for the efficiency of investment decisions (Barzell and Sass 1990).

where U is the utility level and x is non-housing consumption. The function v(u) conveys the fact that the enjoyment of a housing unit is delivered through the intensity of the utilization of the unit, notated by u, which is in turn translated into utility units through the function v, where $v' > 0$ and $v'' > 0$. Owners may also choose to manage and maintain the building's common areas and systems through a choice of effort, *a*, which is costly (in utility units). Finally, W is second period (i.e. ending) wealth, discounted at rate δ.

The period 1 budget constraint for owners is given simply as

$$y = x + P(n) \tag{2}$$

where y is income and P is the price of the unit, which we emphasize here will depend on the number of units in the building, n.

Second period wealth is given by

$$W = w + P(n) - c(u) - \frac{Q(a_1 \ldots a_n; n)}{n} \tag{3}$$

where w is non-housing wealth. Several features of the wealth function deserve comment. First note that c(u) is given as the "cost" of utilization. This may be thought of as cost of maintenance of the interior of the housing unit, translated into money terms. Second, a housing unit purchased for P(n) in period 1 retains its value in period 2. The required common area maintenance cost is Q; whatever effort is taken by owner-residents to manage and care for the building allows actual maintenance expenditure (for example, to third party contractors) to be reduced, given an assumed constant rate of deprecation. More specifically:

$$\frac{\partial Q}{\partial a_i} \leq 0; \ \frac{\partial^2 Q}{\partial a_i^2} \geq 0; \ \frac{\partial^2 Q}{\partial a_i a_j} \leq 0; \frac{\partial^2 Q}{\partial a_i n} \geq 0$$

so that *ex ante* effort exerted by any individual decreases *ex post* maintenance expenditure for all owners (but at a decreasing rate). In addition, the marginal gains from effort are increasing in the effort of others, but attenuated as the size of the building increases. Finally, we assume that the owner of each (identical) unit shares equally in funding the building's common maintenance costs.

Substituting (2) and (3) into (1) yields

$$U = y - P(n) + v(u) - a + \delta(w + P(n) - c(u) - \frac{Q(a_1 \ldots a_n; n)}{n} \qquad (4)$$

which is maximized in the two arguments a and u, conditional on residing in a building with n units. Each owner *i* takes the other owners' level of optimal care (a_j^*, $j \neq i$) as given when choosing her own care. The first order conditions are

$$v'(u) - \delta c'(u) = 0 \qquad (5)$$

which simply equates the marginal benefits and costs of utilization, and

$$-\frac{\delta}{n}\frac{\partial Q}{\partial a_i^*} - 1 = 0 \qquad (6)$$

where a_i^* is the level of a that optimizes owner i's utility conditional on the optimal effort level of other owners. The condition implied in (6) of course is that the marginal benefits and costs of individual effort be equalized. We are particularly interested in how the care of the individual owner responds to changes in n, the number of units. Again, the assumptions above provide sufficient conditions for $\frac{\partial a_i^*}{\partial n} \leq 0$. It is therefore clear that in order for utility to be equalized across all structure types, the price of the unit must be declining in n ($P'(n) \leq 0$).

Renters

We now consider the case of a renter in a landlord-owned building. Since renters are not liable for the *ex post* maintenance of the building, there is no incentive for them to exert effort to manage the building, so we set a=0 in the renter utility function. Moreover, we assume that renters do not pay for the full cost of their own-unit utilization—this is the "rental externality" of Henderson and Ioannides. The utility function reduces to

$$U = x + v(u) + \delta W \tag{7}$$

with a first period budget constraint of

$$y = x + R(n) \tag{8}$$

where R is the rental payment to the landlord. The ending wealth is

$$W = w - \tau(u) \tag{9}$$

with τ being the cost of utilization to the renter (and for any level of utilitization, $\tau(u) < c(u)$ and $\tau'(u) < c'(u)$).

Substituting (8) and (9) into (7)

$$U = y - R(n) + v(u) + \delta(w - \tau(u)) \tag{10}$$

and taking the derivative with respect to the only choice variable for the renter, u, yields the first order condition

$$v'(u) - \delta\tau'(u) = 0. \tag{11}$$

The conclusion is that since renters and condo owners get the same enjoyment out of utilization, but the renter pays less for that enjoyment *ex post*, the utilization rate for the renter will be higher.

The landlord owns all of the units in a building and is responsible for both unit and building-level maintenance. In a competitive market, she chooses building management effort to minimize costs, and profits are set equal to zero:

$$R(n) = a + (1-\delta)P(n) + \delta(c(u) - t(u) + \tfrac{Q(na;n)}{n}). \tag{12}$$

The import of (12) is that rent will equal the carrying cost of the housing asset plus the costs of management and maintenance (whether in first period or second period) plus the utilization costs that were not covered by the tenant. The landlord chooses the optimal level of a, a* to satisfy:

$$-\delta \frac{\partial Q}{\partial a^*} - 1 = 0. \tag{13}$$

The immediate conclusion is that for n>1, $a^* > a_i^*$ and the level of effort in building management (per unit) is higher in apartments than in condos. Note because of the additivity in the argument of Q that a* is independent of n. This, and $P' \leq 0$, implies that $R' \leq 0$ as well.

Analysis

Now consider whether an individual would prefer to own or rent a unit in a building with n units. If $n = 1$, then the rental externality dominates (since there is no shirking to be had in management effort when there are no other owners) and she prefers to own. At some $n > 1$, however, the user cost of renting may fall below the user cost of owner-occupation due the costs of the management externality in condo buildings. This cross-over may exist because changes in house prices exactly offset the increasing costs of the management externality as n increases, leaving the user cost of housing constant for owner-occupiers. However, because landlords set rent in a competitive environment, the user cost of rental housing, R, fall with n. Thus the main prediction of this model is that the probability of condominium ownership falls as the size of the building, measured by the number of units, increases.[4]

3 Data

We use the 2009 American Housing Survey (AHS) national sample public use files. The national survey, begun in 1973, is sponsored by the US Department of Housing and Urban Development and conducted by the Census Bureau in odd years. Through household interviews, data is collected about a wide variety of factors, and includes information about households, the nature of housing units, buildings and neighborhoods. From the national estimates published with the data, 69% of 125 million year-round housing units in the U.S. are single family homes, 25% are located in multi-unit buildings and the balance

[4] This model of course bears similarity to those describing the provision of public goods to groups of varying sizes (Olson (1965), Cornes and Sandler (1986))

are in manufactured housing. Among multi-unit buildings, the highest concentration of units is in buildings with 2 to 4 units (32%), and 70% of multi-family units are in buildings with less than 20 units.

The data in the 2009 national public use file contains information on just over 73,000 housing units. We limit our sample to include housing units classified as houses, apartments or flats (eliminating 15,724 observations) for which a household interview was conducted (eliminating another 14,606 observations). We also eliminate units owned by public housing authorities, and require that unit size and number of units in the building be non-missing. We finally eliminate single-family units that claim to have more than 5 floors as being miscoded. This culling of the data results in a sample of 37,847 observations representing 29,044 single family housing units (detached and attached) and 8,803 units in multi-unit buildings. We provide information on other data sources as they are introduced in the sections below.

4 Free-riding

The model of section 2 provides one framework for conceptualizing the relationship between tenure and building unit count. In this section we provide evidence on the correlation between these variables. A key component of section 2's model was that both maintenance of units, and care of common facilities is costly. Other things being equal, the inability to contract for optimal unit maintenance by tenants—i.e. the rental externality of Henderon and Ioannides (1983) – implies that buildings are always more valuable when they are owner-occupied. That owners do in fact provide higher maintenance is demonstrated in the literature by e.g. Galster (1983) and Harding, Miceli and Sirmans (2000) among others (but see also Gatzlaff, Green and Ling (1998)).

The model extends Henderson and Ioannides (1983) to the case of multi-unit structures, and notes the ability of condo owners to free ride on building care and management, along the lines suggested by Glaeser (2011). This will raise the *ex post* cost of building maintenance; as in any model of free riding in the presence of multiple agents (Cornes and Sandler (1986) the reduction in care increases as the number of agents increases.

In general, the free-riding argument with respect to building maintenance and management is somewhat unsatisfactory if unit owners are able to hire professional management. This puts a single management team on the same footing as the single-owner landlord, and thus overcomes a host of basic free-riding opportunities by individual owners on the other if mechanisms like liens can compel owners to make payments in support of a common budget.[5] Even if owners hire professional management, however, when ownership is divided among many parties, the owners still face a problem of collective decision-making and coordination in making future decisions (Hansmann 1991). For example, unit owners must still coordinate on the decision to hire and monitor management, as well as on future decisions regarding capital expenditures. Costs in multi-owner settings may arise from the costly process of decision-making, not only including free-rider and other collective action problems, but also from the fact that the optimal decisions may not obtain as a result of a particular collective decision-making process. In response to such problems, Barzel and Sass (1990) document variation in voting schemes among condominium homeowner associations and relate the findings to the corporate voting literature. Obviously, in the context of single-family homes this potential cost is mitigated, although other organizational problems, as when single family homeowners are restricted by covenants or rely on homeowner associations for various amenities within a community, may be similar.

The model is, to a certain extent, agnostic on these issues; it merely predicts that individual contributions to the care of common facilities falls as the number of units in the building rises, and this merely extends the logic of Glaeser and Shapiro (2003) on the difference between single and multi-family housing to the

[5] Recent anecdotal evidence about the rise in default on homeowner's association fees, however, make the point that this mechanism may be weak when house prices fall. Paradoxically, these costs may be higher when the number of units in the building is small.

differences between different types of multi-family housing. The test is clear: within the class of multifamily structures, *condominium ownership is more likely the fewer the number of units in the entire residential complex*. Some costs of free-riding may be mitigated as the number of tenants grows, however, affording unit owners an ability to hire professional managers for the main day-to-day operations. Similarly, a potential confounding effect is that the number of units may be correlated with other services and amenities that become feasible due to economies of scale, which may make units more desirable for owner-occupation through the quality effect to be described below.

For our initial investigation of this hypothesis we first seek an alternative indicator of building ownership that focuses on *buildings* as opposed to owner-occupation of units. Two types of errors can arise through the casual association of unit tenure with building ownership in the American Housing Survey (and we presume, in other data sources). First, condominium owners may rent their units. Thus, while the tenure of the particular unit is rental, the building is owned by multiple-owners, and the latter feature is central to the free-riding hypothesis to be explored. Using the tenure of the unit reported by the household would cause us to misclassify the building a having a single-owner. Second, owner-occupiers of a particular unit may also be the owner of the (typically small) multi-unit building in which the unit is located. The canonical example is double and triple-decker housing in places like Boston, where the owner occupies a ground floor unit and rents the remaining units in the building. In this context, the individual unit within a multi-unit building is owner-occupied but the building has a single owner who rents the remaining units. If we were to use household tenure as our indicator in this case, we would misclassify the building as having multiple owners. Therefore, in lieu of household tenure, we use the designation of units as belonging to a condominium association as an indicator of building ownership because it indicates the existence of a particular governance system for multiple-unit buildings.[6]

[6] It is indeed possible at common law to create ownership rights to a portion of a building without the use of condominium or cooperative law (Cribbet and Johnson 1989). However, there are many advantages to the use of

Table 1 displays a cross-tabulation of household tenure with whether a unit is a condominium or landlord-owned multi-family building. We distinguish the two measures of ownership with the dummy variable *owner-occupation* equal to 1 if the owner occupies her unit (as opposed to renting it) and with the dummy variable *condominium* equal to 1 if the unit is part of a condominium association (as opposed to a unit in a building owned by a single entity). The distinction, as just described, being that condo units may be occupied by renters and some single-owner buildings may have an owner-occupied unit.

As it turns out, the potential misclassification of building ownership is germane to 12% of the sample. However, the two types of misclassification almost offset each other, rendering little difference in the aggregate condominium ownership rate (15.71%) relative to the rate of owner-occupation of multi-unit buildings (16.08%). Nonetheless, misclassification is problematic because condo units are typically rented out in larger buildings, while owner-occupiers of non-condo buildings are observed among smaller buildings. Thus misclassification of building ownership biases the count of multiple-owner buildings upwards in the low end of the building size distribution and downwards at the upper end. In Figure 1, the graphs of these two measures of ownership on building size, smoothed by locally weighted regressions, emphasize the distinction in these definitions for building units < 12 (the graph is curtailed at building size of 50).

Overall, the fact that just 16% of the observations from multi-unit buildings in our sample are condominium units suggests that free-riding and other collective decision-making costs may deter multi-owner arrangements. On the other hand, in contrast to our hypothesis, the fraction of condos among multi-unit buildings appears to be increasing with the number of units in the building. This effect

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condominium law in particular, not the least of which is the ability to mortgage the individual unit, such that we believe this is an effective way of distinguishing ownership of units in multi-unit buildings.

appears particularly strong among the 2-12 unit buildings in the sample, which will be investigated further below.

5 Unit Quality

The second tenure-structure explanation that we consider is the relationship between unit quality and tenure status. This is suggested to us by casual empiricism not limited to the observation that in general units in multi-unit structures are smaller and of lower quality than single family homes, and by our theory model of section 2 which suggests that the higher utilization rate in rental property increases its user cost; this rental externality is potentially increasing in the size or quality of the unit.

There is, of course, a second explanation. The fixed cost of acquiring a housing unit for owner-occupation is greater than the cost of acquiring a housing unit for rent. There are of course the monetary transactions cost, which can include things like mortgage points, title searches, and whatever incidence from realtor fees are absorbed by the buyer. Moreover, the time and nuisance costs of applying for mortgage credit are greater than whatever hurdles are required by a potential landlord in negotiating a lease (Gyourko, Linneman and Wachter, 1999). Given the relative illiquidity of real estate, exit costs are also higher for owners than renters. This means that getting the right match of resident and residence is more valuable, which in turn means the upfront search costs are also probably higher for owners than renters.[7]

On the other hand, it is possible that the marginal costs of homeownership are less for owner-occupiers than for renters. This is the case in the United States given the deductibility of mortgage interest

[7] There is a surprising lack of studies which directly compare search costs in the owner and renter markets, but see Krysan (2008), who, in the context of examining discrimination using ethnic differentials in real estate search, finds that searchers in the ownership market conditionally experience "more difficult" search than renters, though in the multivariate model this difference is not statistically significant.

payments and local property taxes from taxable income, and may be the case in any country that does not tax the implicit rental income that accrues to homeowners (Poterba and Sinai, 2011). As long as such tax preferences exist, the cost of \$1 of additional housing quality costs only \$(1-t), where t is the appropriate marginal tax rate. Assuming t is constant, Figure 2 shows that there is a level of housing, h*, below which renting is the cost-minimizing alternative, and above which, ownership is presumably optimal. This, paired with the fact that residential units in multifamily structures are, for reasons of physical constraints and the absence of land, generally less expensive than single family units, may combine to create the observed structure-tenure correlation.

The fact that single family structures are larger and more expensive than units in multi-family structures and also are owner-occupied is not evidence in favor of the unit-quality-determines-tenure hypothesis. For that, we need to examine the correlation between quality and tenure *within* structure types. If such a correlation exists, holding structure type constant, then this will provide evidence for the proposed hypotheses. The best such test would be to use price as the measure of quality since this most directly relates to the tax advantages of ownership. Such a test is fraught with difficulty, however, because the reported prices of the two tenure types are different. Comparing the flow price of rental housing and asset price of owner-occupied housing requires making judgments about the capitalization rates, and it would be preferable to avoid such a computation. Therefore we use instead individual attributes as measures of quality; such measures are of course imperfect indicators of price, since housing is a hedonic commodity whose prices are based on a multidimensional vector of characteristics, but size, as measured in our case by square footage of interior area and of exterior area are surely among the most important of these characteristics.

Figures 3 through 5 show the result of a nonparametric regression of household tenure indicator (*owner-occupation*) where an owner-occupied unit has a value of 1 and renter is 0 on interior square feet, within the class of single family homes and multi-unit structures.[8] Each of the figures also displays (on the same scale) a histogram showing the distribution of sample fractions of SF at each sample size. This has two purposes: (a) to give an account of the density of the distribution and thus allows a comparison of these distributions across structure types; (b) to provide a sense of the density of observations along the support of the distribution of size. It can be seen, in these Figures and those that follow, that observations are often sparse at the right hand tail of the distribution.

As is demonstrated in the figures, the question of whether size of unit has an impact on tenure choice has a nearly unequivocal affirmative answer. In the class of single family structures the relationship between unit square feet and ownership probability is basically monotonic. Within the class of buildings with 2 or 3 units it is nearly so. Here the probability of ownership falls slightly with size for very small units (up to about 500 square feet) and then rises monotonically after that. If we omit observations from New York City, however, the line is somewhat convex, but strictly upward sloping. For structures with more than 3 units the curve is also upward sloping and somewhat convex until 1,000 square feet. The histograms contained in these figures also substantiate the obvious point that single family structures are much larger (in terms of unit square feet) than those in multi-family buildings. Thus the combination of the importance of quality (as measured by size) with respect to ownership, and single family homes being larger in size than units in multi-family buildings gives some credence to the quality explanation.

We obtain a very similar result using lot size as the measure of quality for the subset of single family units in our data (for no multi-unit structure is lot size provided), and similar conclusions are reached for a

[8]The nonparametric regression is locally-weighted least squares using the tricube weighting function. The AHS topcodes the reporting of the interior square feet variable (UNITSF in the AHS database) at about 4300 square feet. Any unit with a value greater than this is coded as having 10099 square feet. These latter observations (roughly 2% of the aggregate sample) are omitted from the nonparametric response function estimates in Figures 3-5 . These observations are included in the other estimates below.

large number of quality measures which for reasons of space we do not present. The overarching conclusion is that quality of the unit is highly correlated with ownership, for all structure types.

These stylized facts do not address whether it is tax preferences that lead to the correlation between tenure and quality. A test can be formulated on the basis of differences in state tax rates (and deductibility of mortgage interest), but regrettably the American Housing Survey does not provide information on the state of residence, only the Metropolitan Statistical Area (and even then not for every observation). While one could base a test on data from single-state MSAs, we instead have recourse to a simple model using the 2010 American Community Survey. The ACS surveys a large number of households each year. It does not have as rich a collection of housing data as the AHS, but does record the state of residence, and the number of rooms in the housing unit, which we take as a rough approximation of building size and quality. We restrict the sample to single family buildings of three or more rooms (but still have over 2,000,000 observations) and run a probit regression, with ownership as the dependent binary, on the number of rooms, the state plus federal tax rate as applied to mortgage interest and the interaction of these two variables.[9] The interaction term is the key coefficient. There might be multiple reasons for size and tenure to be correlated, but the tax hypothesis suggests more specifically that increases in size increase ownership propensity more dramatically the larger the tax break.

The probit regression estimates takes the form:

Probability of ownership=Φ(.736+.075*Rooms-3.35*Tax Rate+.397*(Tax Rate*Rooms))

[9] The tax rates are available on the public use site of the National Bureau of Economic Research http://www.nber.org/~taxsim/marginal-tax-rates/. The rates there are recorded as negative (because it's a deduction) percentages, which we convert to positive decimals.

where Φ is the normal cumulative distribution function. The t-statistics (based on standard errors clustered by state[10]) on the slope coefficient are all between 1.25 and 1.5, and so the estimates are not as precise as one might like. The positive rooms coefficient verifies the quality hypothesis for this sample; while the negative coefficient on the tax rate is not congruent with the tax version of the quality hypothesis, it is of course the case that taxes have both substitution and income effects and the negative coefficient indicates the latter is important. More to the point, the interaction term is positive and indicates that at the margin around the means of the regressors, an increase of one room raises the ownership probability by .015+.082*Tax Rate. A typical tax rate would be about .20, so at the margin the rise in ownership probability would be about 3 percentage points for each room. Thus the tax hypothesis does have substantive explanatory power.

6 Structure Risk

Housing is both a consumption and investment good for homeowners (Henderson and Ioannides 1983). The important tension that arises from this duality is that a household's optimal level of housing consumption and investment, in a mean-variance portfolio setting, may differ. Nonetheless, homeowners are constrained to invest in at least as much housing as they want to consume. This causes evidently inadequate diversification of household portfolios (Caplin et al, 1997). In particular, households for whom this constraint is binding will under-consume and over-invest in housing, relative to the unconstrained mean-variance efficient portfolio (Brueckner 1997). Homeowners for whom investment demand for housing exceeds consumption demand (housing investors) and renters have separable decisions with respect to housing investment and consumption and avoid this distortion.

[10] The clustering makes a real difference. The same t-ratios based on unclustered standard errors all greater than 10.

Flavin and Yamashita (2002; hereafter, FY) quantitatively investigate a set-up similar to Brueckner's (1997). They assume that households only adjust their housing consumption infrequently and can only borrow in the form of a mortgage. Therefore, the amount of housing and the maximum amount of debt that the family may have in their portfolio is fixed, at least in the short term. Using the covariance matrix of housing and other financial asset returns calculated over the period 1968-1992, FY estimate mean-variance efficient frontiers for portfolios, conditional on a fixed ratio of housing value to wealth (the "housing constraint"). Predictably, higher housing-to-wealth ratios produce the greatest distortions. These high ratios are typically held by young households for whom the remainder of their wealth (and available debt) is insufficient to optimally diversify their portfolio.

The take-away from this literature is that homeowners may contribute too much of their wealth to housing, making them bear more risk than they would if they were not homeowners. Based on this line of reasoning, Hilber (2004), for example, shows that owner-occupiers are more sensitive to neighborhood risk than renters. Similarly, if single family housing is characterized by a lower risk/return profile than multi-unit housing, then we suspect that owner-occupiers will prefer the lower risk structure type. On the other hand, housing investors and renters will be indifferent to structure type. Thus, the risk and return characteristics of structure may explain the clustering of owner-occupation in single family housing as well as the relatively high rate of investor ownership among condominium units.

To investigate whether single family housing has lower risk and expected returns than multi-unit housing, we first replicate and then extend the exercise undertaken by FY using the Panel Study of Income Dynamics (PSID).[11] The PSID survey includes a question about structure type, beginning with the start of the survey in 1968. While this question has changed somewhat over time, it is possible to

[11] The only other evidence that we found on this topic is Tong and Glascock (2000). They find that housing markets are segmented by structure type and that condominiums exhibit higher price volatility than town homes and single family homes in the Baltimore-Washington area.

distinguish between single family and multi-unit structures as well as mobile homes throughout most of the survey.[12] The survey also asks households to report their home value in each year they are interviewed. As discussed in FY (2002), while self-reporting raises concerns, the distortion is unlikely to be systematically large, and on the other hand, this dataset provides an attractive, nationally-representative sample over a reasonably long time-frame. To check robustness, FY compared their estimates to mean return and variance measures from the Case and Shiller (1989) data in four cities, and verify that the Case-Shiller data provides quite similar results to the PSID estimates.

We begin with 6,319 households interviewed in the1992 non-poverty PSID sample. We exclude households who did not own a home for at least 2 years during 1968-2009 and households for whom the PSID staff had ever assigned either home values or remaining mortgage balances during this time period, leaving a sample of 3,057 households. Split-off families are retained in the data with values of variables for the years prior to the split-off set to missing. In calculating housing returns, the observation was set to missing if the household moved during the interval since the last interview or if a female head was replaced by a non-sample individual. To differentiate by structure type, we first set returns to missing for all mobile homes and whenever the structure type is unknown.[13] We code single family housing as one-unit buildings and categorize all other non-missing and known structure types as multi-unit buildings.[14] The results are shown in Table 2.

In Table 2, we report the means and variance over different time periods for the sake of comparison with FY, and because after 1997 the PSID surveys took place biennially. FY report results through 1992

[12] The structure question is missing for 1973, 1974 and 1982. We use the prior and subsequent year structure types for owner-occupiers who do not move to impute structure type in these missing cases.

[13] With the exception of the imputed structure types for 1973, 1974, and 1982.

[14] Categories of other structure types vary by year, but include, two and three-family houses, row houses, apartments, townhouses and condos. The issue is that some of these housing types are likely owned in fee simple arrangements, not as condominiums. We group these observations together because in all cases there are at least shared party walls between housing units suggesting that some coordination with neighbors is necessary for maintenance and upkeep, among other issues.

and find a "housing" return of 6.59% and a standard deviation of .1424. Our calculation for the same period (not reported in the table) for all single-family and multi-unit structures is a bit lower in both regards at 6.40% and .1327, respectively, perhaps due to slight differences in sample sizes and the fact that we omit mobile homes.

Our results regarding structure type are disappointing, mainly because the multi-unit sample sizes are so small. Prior to 1986, we observe only 6 to 18 housing returns per year. In the later years, the multi-unit sample has 31-90 return observations per year. The typical number of annual housing returns calculated per household (over time) is just over 3, as compared to nearly 13 observations per household in the single family sample. In addition, the within sample variation, that is, the cross-sectional variation each year, is much greater for the multi-family observations.

For the whole sample of years, 1968 – 2009, we find a single family housing return of 6.29% with a standard deviation of .1246. Multi-unit structures exhibit a lower average return of 5.54% and a within group standard deviation of .1069. Over all time horizons reported here, the returns to the multi-unit housing are lower, as is the risk. In future work, we will re-examine the more recent years of the PSID data to see if we can augment the sample sizes.

7 Multivariate Models

The explanations above overlap with respect to the ownership of buildings. Smaller units may be constructed in buildings with more units, and/or in central cities where competition for land may cause higher-density structures. Multivariate models may be useful in this regard if the explanations proffered above are collinear. On that account, we estimate probit models with the condominium binary as the dependent variable and covariates including those examined above.

With respect to the indicators of quality, the univariate evidence suggests that condominium varies systematically with unit size, and we suspect, other measures of quality. Table 3 reports summary statistics for different types of buildings in our sample, although we focus on the multi-unit buildings in this section. We have data on the number of floors in a building, which might proxy for access to views or as a measure of prestige; building age; the type of parking associated with the building (none, off-street or garage); and whether the building has recreational amenities like a club, a golf course, access to trails or to a beach (rec area is equal to 1 if any of these latter amenities are present).

Neighborhoods are also important to the choice of tenure for any given structure. Partly this is homeowners' response to housing price risk. Those households that become owners typically hold a large percentage of their portfolios in real estate and rarely take explicit measures to diversify away from real estate risk (Caplin et al, 1997). Instead the literature has observed that individual homeowners become owners at times and places when real estate risk is minimized. Ambrose and Goetzmann (1998) observe that "Home owners are captive to the risk and cost of neighborhood conditions. Crime, education, city services, and retail all vary within metropolitan areas. Home ownership is a precommitment to a geographical exposure to these variables." Turner (2003) and Hilber (2006) also demonstrate that when and where ownership of real estate assets is risky, owner-occupation is less likely. Following Ambrose and Goetzman we include central city as a potential measure of price risk, and also create a variable which equals one if the respondent indicates the presence of serious crime.[15] Another measure of price risk is the age of the unit. Goodman and Thibodeau (1997) find, in the context of hedonic regressions, that the conditional variance of house prices is highly correlated with unit age. All of these may be considered measures of quality as well, so a separate treatment of risk as a motivating factor for tenure choice is difficult.

[15] Specifically, in the 2009 AHS respondents are asked ""To the best of your knowledge, have any serious crimes occurred in your neighborhood in the past 12 months? For example, burglary, robbery, theft, rape, or murder?". A yes answer is coded as a one in our variable *crime*.

A few additional coding and reporting issues are worth mentioning. We utilize a dummy variable to identify the highest top-coded value for unit square feet. Building height, measured in floors, is top-coded at 21, and we so use a categorical representation for low-rise (1-3 floors), mid-rise (4-6 floors) and high-rise (greater than 7 floors) to bypass this potential issue. Most of the housing units are located within MSAs (just 10% of our sample are rural). However, using MSA dummies results in significant sample size reductions since one-third of the sample is coded by a default MSA code unrelated to an actual place for reasons of confidentiality, and we lose other data when we further subdivide due to thin samples in some places. We therefore begin by controlling for central city and suburban location (omitted is non-MSA), the census region and their interactions in order to maximize sample size in Table 4. We utilize MSA dummies in specifications found in Table 5 for a subsample of observations with enough observations per MSA to provide a finer set of geographic controls. We report the central city and suburban coefficients in the tables that follow, but not those for region or MSA controls. We also control for building age in all specifications, but do not report the coefficients here. We divide the sample three ways: the full multifamily sample, the sample of multifamily structures with less than 12 units, and the sample of multifamily structures with 12 or more units. The dividing line of the latter two samples is suggested by graph of the function in Figure 1. The results of probit regressions are reported in Table 4.

Our dependent variable in these regressions is whether or not the unit is a condominium. We are interested in whether the number of units in a building is negatively correlated with whether the building is owned through a condominium structure, once we have controlled for other indicators of quality, etc. Specification 1 in Table 3 suggests a very weak, but negative relationship. Other indicia of quality enter with the expected signs. In the second specification, however, we limit the sample to buildings with less than or equal to 12 units. Here the number of units loads positively and significantly. The coefficients on most other quality measures, save for crime and rec area, retain their signs and significance. Neither does high-rise retain its significance, but the number of buildings in this category with less than 13 units is quite small. Next we examine buildings with more than 12 units and find that the number of units has a small, but negative correlation with whether the building is organized as a condominium. Of interest is the fact that central city location is strongly predictive for condo ownership, especially for large complexes. This is of interest because it is sometimes held that central cities have lower ownership rates because high density housing is largely part of the rental market. The positive coefficient on central city location in the large-building sample indicates that this is only partially true since units in large buildings are more often owned as condominiums when they are in central cities.

Because building ownership may vary by market, we use MSA dummies, at the expense of sample size in the second part of Table 4 so that we are identifying the coefficient on the number of units, in particular, based on within-MSA variation. The observed rate of condo ownership in these subsamples that exclude rural areas is higher – 19% for buildings with 12 or fewer units and 32% for larger buildings. Our basic results remain except for the fact that central city is no longer significantly different from zero at standards levels nor are building height dummies for buildings with more than 12 units. The existence of a building parking garage, effectively increasing unit quality, is robustly correlated with condominium ownership in all of these specifications.

Thus we are left with the verification of our initial non-parametric pictures in which condominium ownership is increasing in the number of units up to a point, and then relatively unimportant in explaining the form of building ownership at larger scales. Of course, the number of units is highly correlated with building height which enters positively in most specifications. This is especially so in specification 6 where the building height categories are replaced (in the "more than 12 units" sample) with a single indicator for a top-coded observation (i.e. over 21 floors). This is strongly positive for condominium ownership. While units and height are strongly correlated, height (depending on the exact specification) loads strongly but units does not (for larger unit counts) suggesting that larger buildings are condos because they are higher quality (with, e.g. better views) not because of the higher unit count, *per se*.

Regarding the economic significance of the coefficients, we estimate marginal effects from specifications 4 and 6 based on sample means. Among smaller multi-unit buildings, the addition of another unit to the building is associated with a 1% increase in the probability of condominium ownership. An additional 100 square feet of space increases the likelihood of condo ownership by about 1% in small buildings and 3% in buildings with more than 12 units. The transition from a low-rise to a mid-rise building is associated with a 10% increase condo ownership in the small building context, and the tallest buildings are nearly 13% more likely to be condominiums in the large building sample. A garage predicts a 9% increase in condo ownership among small buildings and a 23% increase in buildings with more than 12 units.

With respect to the increase in condos among small buildings as the number of units rises, we suspect that free-riding issues in the context of day-to-day operations decline with the realization of professional management. To provide evidence about this speculation, we obtained Multiple Listing Service data for condo listings in the state of Massachusetts during 2009. In the listings, brokers and owners specify the size of the building, top-coded at 100 units, and whether the building has professional management. A histogram of the percent of observations with professional management by the number of units in condominium buildings is reported in Figure 6. The picture closely resembles our picture of condominium ownership relative to units in Figure 1. While surely not conclusive, the steep rise in professional management among smaller buildings where the condo rate is also rising suggests that management may alleviate some aspects of free-riding on maintenance and management effort of one's neighbors. Most multi-unit buildings employ professional management as they reach scale. Nonetheless, the fact that single-entity ownership still dominates condominiums, even in larger buildings suggests, that other factors are necessary to explain this differential.

The largest drop in homeownership rates occurs between single family detached houses (87%) and duplexes (21%). Single family attached houses, housing sharing a common party wall, fall in between at 63%. Should the quality hypothesis trump the other hypotheses, then the measures of quality in our sample should explain these differences. To the extent that quality cannot explain these differences, we may interpret the results as supportive of the free-rider hypothesis or risk-bearing hypotheses. In results found in the first specification of Table 5, we evaluate the determinants of single family attached and detached housing along with duplexes. As in previous analysis, the size of the housing unit and whether a garage is associated with the unit are very significant and with similar magnitudes, supporting the quality hypothesis. Nonetheless, the marginal impact of a unit being in a duplex results in a highly significant decrease in the probability of homeownership by 55%. This estimate is sufficiently precise to be distinguished from the marginal effect for single family attached housing, which is equal to a 21% decrease in the likelihood of homeownership relative to single family, detached housing.

As a final exercise, we are curious about the rate at which condo units are owner-occupied versus rented. In our sample of AHS data, 40% of condos were rented in 2009. Table 5 compares determinants of owner-occupation of condos to those for single family detached and attached housing. The results largely confirm the overwhelming importance of unit quality for owner-occupation. Few other factors influence the owner-occupation as much as unit size. For smaller condo buildings, owner-occupation is correlated with serious crime, and of marginal significance, the higher the floor on which the unit is located, the lower the likelihood that the unit is owner-occupied. For larger condo buildings, high rise buildings have a 13% greater probability of owner-occupation (6% significance level), all else equal.

8 Conclusions

We set out to test three hypotheses regarding the observed structure-tenure correlation among the U.S. housing stock. We first explore and test the role of governance issues in multi-family buildings, and propose a building-level measure of ownership, *condominium*, which indicates when a governance system exits for multiple owners within the same building. Alternatively, a building may be owned by a single entity that rents the housing units. Agents in our model trades-off a rental externality against a free-rider problem in building management, and the model predicts that the likelihood of condominium ownership is decreasing with building size (measured by the number of units). However, we find a strong positive correlation between size and condo ownership in building between 2 and 12 units in size and an insignificant effect thereafter. We provide evidence that the rate of professional management among condo buildings is increasing with building size as one explanation of the upward sloping part of the relationship. We conclude that the management externality is particularly strong among small multi-family buildings which may not have adequate resources to enlist third-party management. Overall, however, even in larger buildings with almost uniform use of third-party management, the rate of condo ownership settles out between 26 and 32%, depending on the particular sample examined, implying that the rental mode of tenure is dominant.

We also considered the interaction between the demand for unit quality by homeowners (augmented by a variety of public policies) and the fact that unit sizes are typically smaller in multi-unit buildings. We rely on within-structure correlations to examine this hypothesis – that is, the variation in homeownership rates among units in single family and multi-family buildings, respectively. In all settings, the likelihood of homeownership is strongly related to the size of the housing unit. Other measures of quality, like the presence of a parking garage and building height, are also predictive. However, the quality hypothesis cannot explain away the biggest jump in homeownership rates – that between single family houses and duplexes.

Finally, we consider the role of risk in housing returns as a possible explanation of the structure-tenure correlation. Using the PSID from 1968 – 2009, we are unable to show that multi-family buildings exhibit higher risk or returns than single-family housing. We face small sample sizes and are concerned that the sample of returns is unlikely to be very representative of returns to condominiums, in particular, give the sample time frame.

Several other issues may hamper the interpretation of results presented here. In particular, the data may be inconsistent with respect to how the number of building units was counted. It seems possible that sometimes the count is for a single building and other times for the total units in a complex of buildings. We have no reason to believe there would be a particular bias one way or another in these counts, however. Further, our measures of quality are surely incomplete and sample sizes for the largest and tallest buildings are quite thin.

Overall, we find evidence that demand for homeownership is highly correlated with unit quality, and also influenced in important ways by the nature of multi-family governance. The governance issues seem to be particularly acute in small buildings between 2 and 12 units in size, and our findings are particularly important for policy-makers to consider as they seek ways to assist the market in absorbing foreclosed and REO housing stock. The re-conversion of small multi-family buildings from condominiums to small apartment buildings may be a more sustainable strategy for communities than the retention of condos. With respect to concerns about homeownership policies and sprawl, this evidence also suggests that well-conceived multi-family housing of sufficient scale and quality could make it more desirable for homeowners to re-enter cities.

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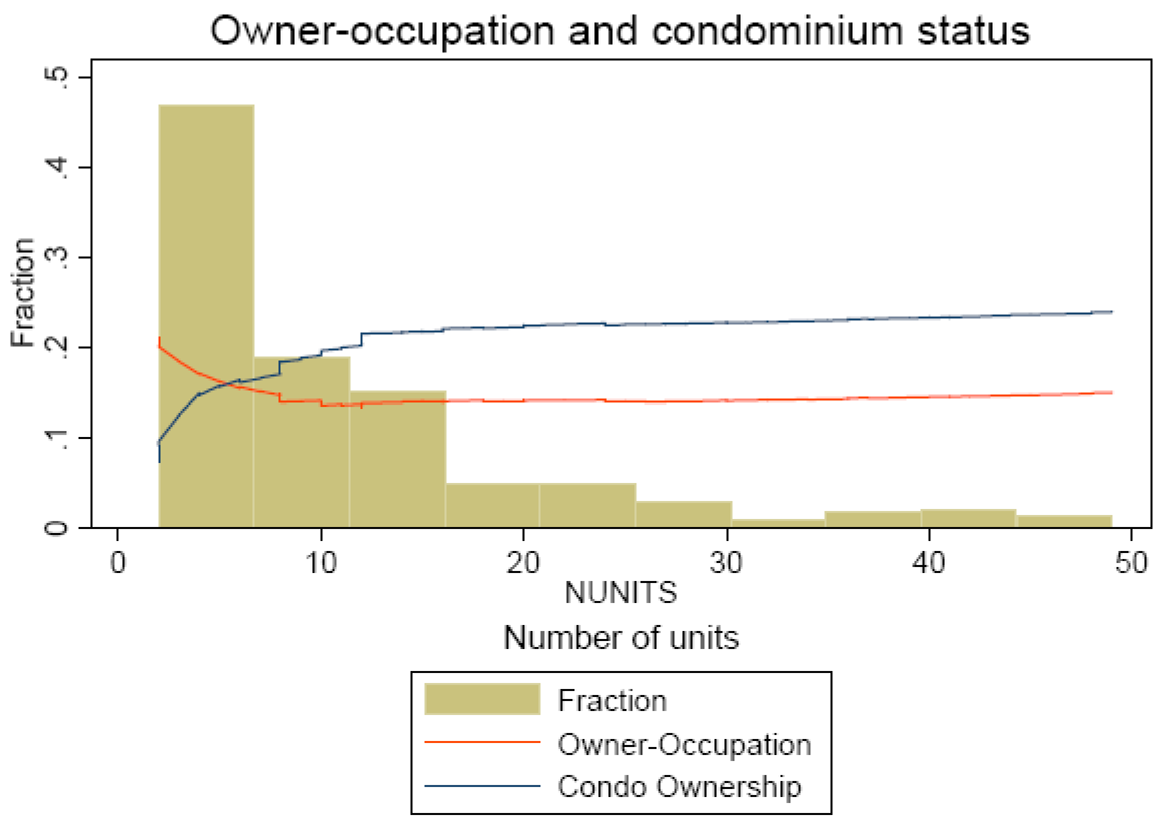

Figure 1: The lines represent the smoothed ownership probabilities for units in building of various unit counts. The red-line uses respondent answers to the question of whether the unit is owner-occupied. The black line represents respondent answers to whether the unit is a condo or not. The vertical bars portray the distribution of building sizes (unit counts) reported by each respondent. Sample fractions for the histogram are reported on the vertical axis.

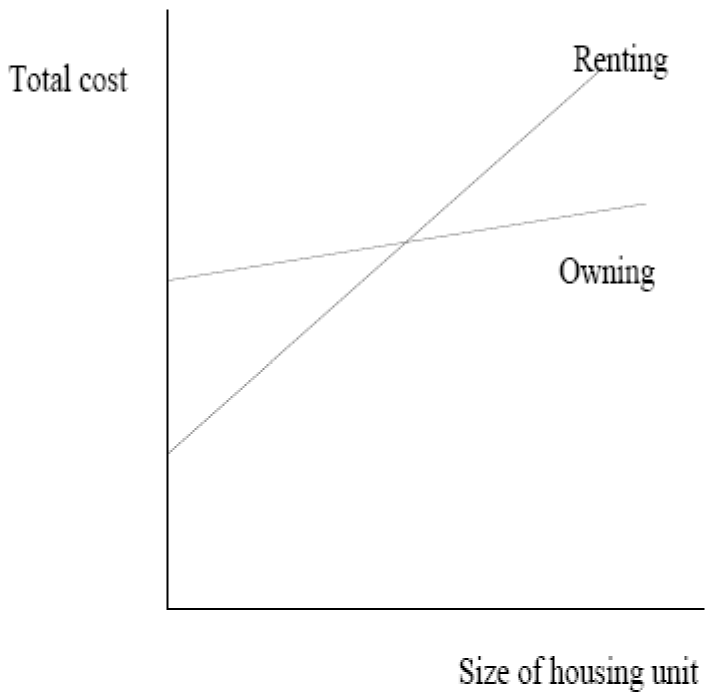

Figure 2: Theoretical relationship between rental and owning transaction costs and housing size.

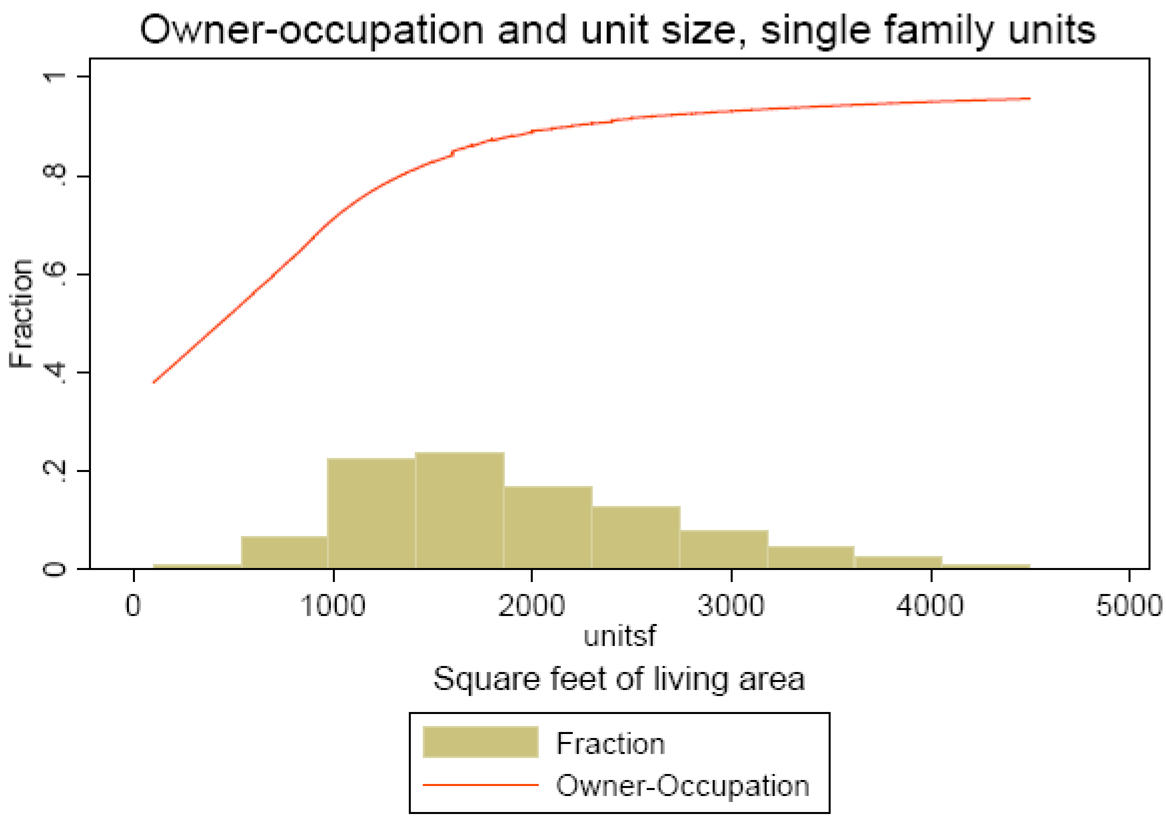

Figure 3: The solid line is a smoothed estimate of the ownership probabilities for single family units by unit size. The histogram is the sample distribution of housing sizes. See text for further details.

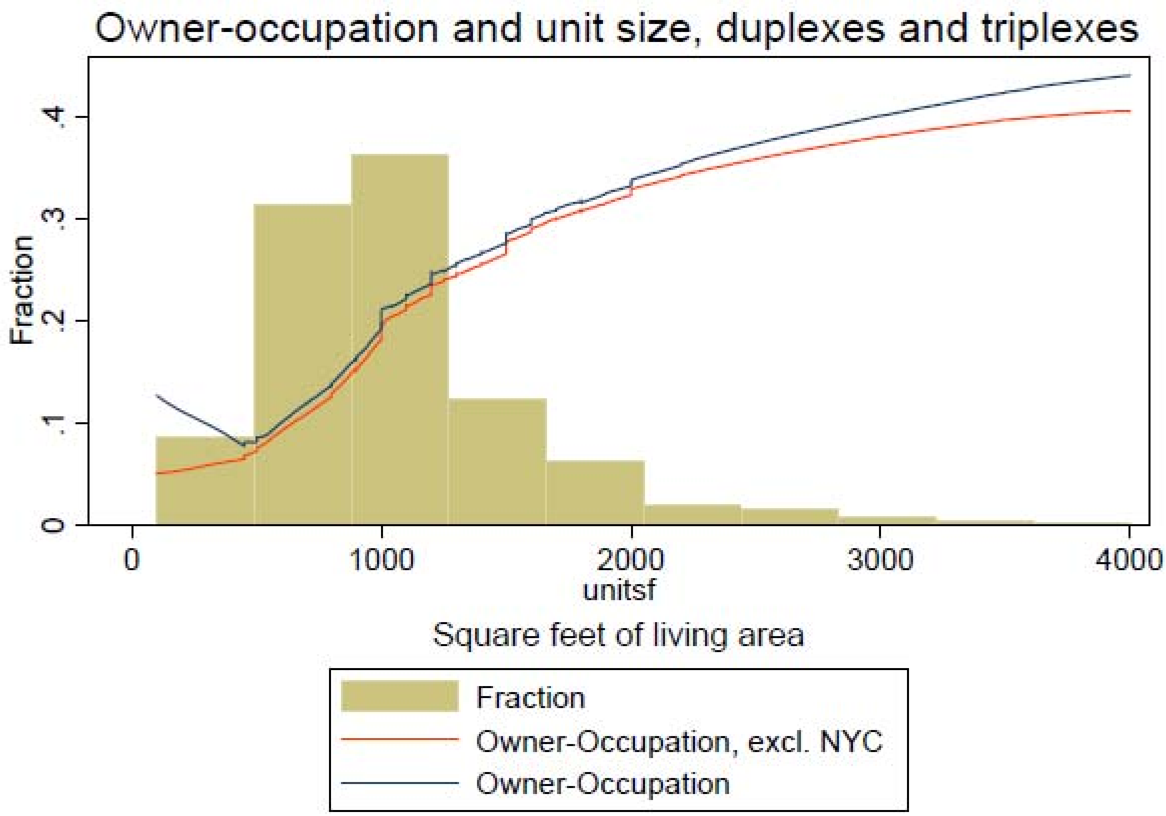

Figure 4: The solid line is a smoothed estimate of the ownership probabilities for 2- and 3- family units by unit size. The histogram is the sample distribution of housing sizes. See text for further details.

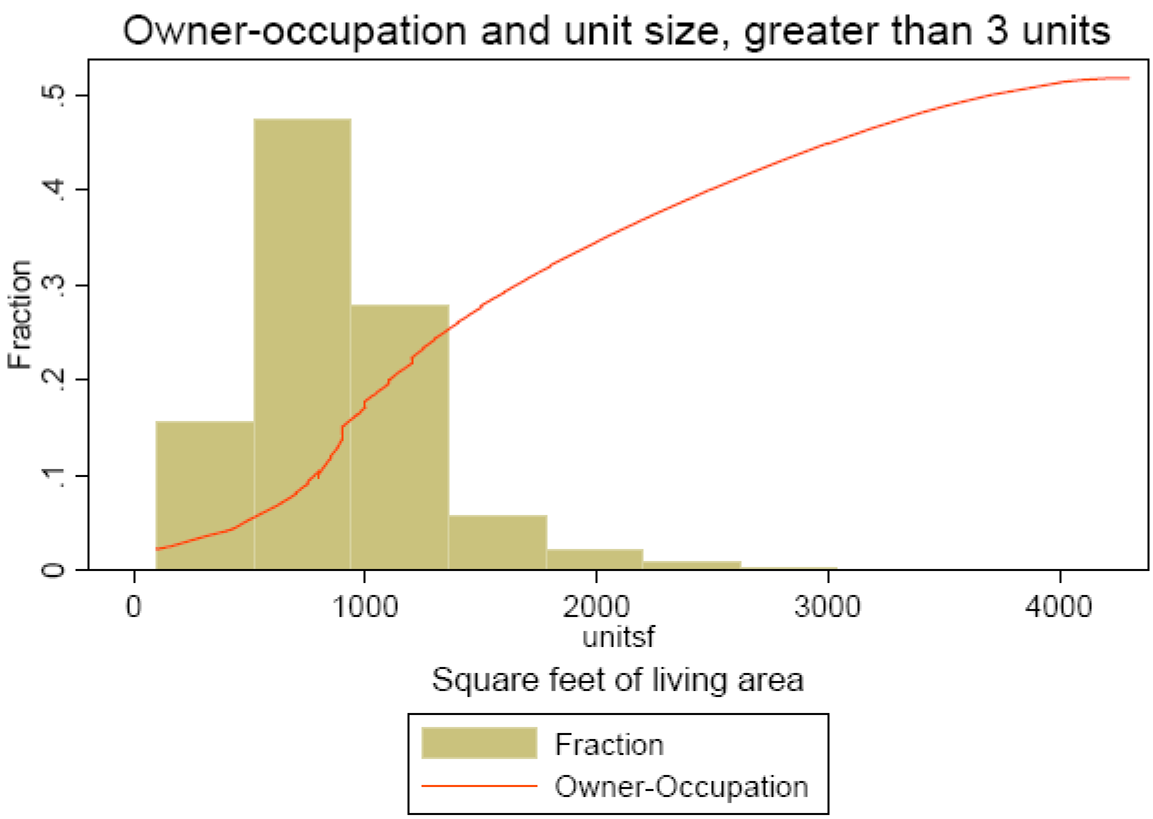

Figure 5: The solid line is a smoothed estimate of the ownership probabilities for buildings with more than 3 units by unit size. The histogram is the sample distribution of housing sizes. See text for further details.

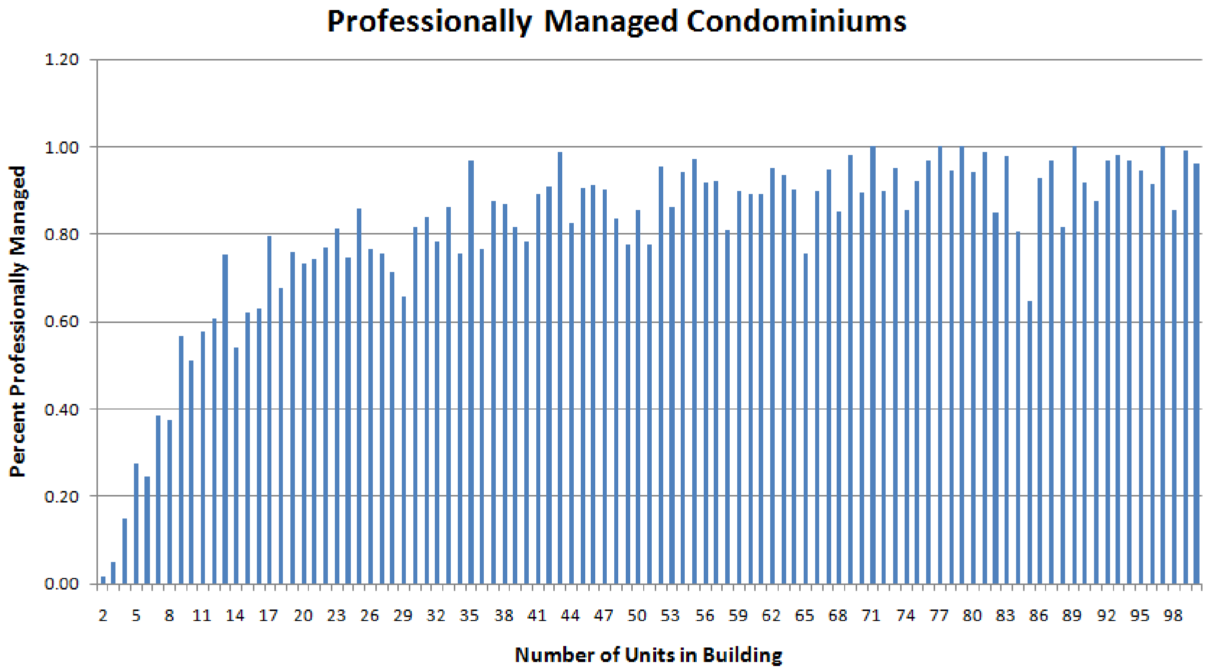

Figure 6: This table reports the rate at which buildings of different sizes are professionally managed as revealed by condo listings on MLS PIN in the state of Massachusetts during 2009. N = 53,303 listings with non-missing information about the number of units in the building and whether the building is professionally managed (either by on-site or off-site management). On the horizontal axis we report the number of units in the building, top-coded at 100. The bars represent the percent of each building size group bin that is professionally managed.

Table 1. Cross Tabulation of Ownership Measures

		Building		
		Single Owner	Condo	Total
Household	Renter	6,661	730	7,391
	Owner	350	1062	1,412
	Total	7,011	1,792	8,803

Note: This table presents a cross-tabulation of two measures of ownership in multi-unit buildings. The sample data is from the 2009 national American Housing Survey for units in buildings with 2 or more units. The rows report household tenure: rental or owner-occupation. The columns specify whether the building in which the household's unit is located is organized as a condominium (or cooperative) or is in a building owned by a single entity.

Table 2. Returns to Housing

	Single Family		Multi-Unit	
	mean	std. dev.	mean	std. dev
1968-1992	6.50%	0.1316	5.70%	0.0987
1968-1997	6.50%	0.1290	5.63%	0.1044
1968-2009	6.29%	0.1246	5.54%	0.1069

Note: This table reports mean returns and their standard deviation for owner-occupied housing units in single family versus multi-unit buildings. Data is from PSID for the years indicated based on a sample of households interviewed in 1992. Because the returns data is an unbalanced panel, we report the equally weighted mean of yearly means for single family housing. Because the sample size is very small for multi-family housing until the mid-eighties, we just report the mean based on all observations, equally weighted, for the multi-family sample. For both structure types, the standard deviation is based on the within-group (or family) standard deviation.

Table 3. Unit and Building Characteristics

	Mean	Std. Dev.	Min	Max
Single Family Detached (N = 26,516)				
Condominium	0.00	0.00	0	0
Owner-occupier	0.87	0.33	0	1
Number of units	1	0	1	1
Unit size (x100 sf)*	20.63	10.65	0.99	116
Floors in bldg.	1.87	0.84	1	5
Bldg. security	0.00	0.00	0	0
Off street park	0.14	0.35	0	1
Parking garage	0.84	0.37	0	1
Rec Area/Fac.	0.41	0.49	0	1
Crime	0.15	0.36	0	1
Year Built	1964	26	1910	2000
Central City	0.22	0.41	0	1
Surburban	0.55	0.50	0	1
Single Family Attached (N = 1,513)				
Condominium	0.00	0.00	0	0
Owner-occupier	0.63	0.48	0	1
Number of units	1	0	1	1
Unit size (x100 sf)*	16.37	12.40	0.99	111
Floors in bldg.	2.33	0.89	1	5
Bldg. security	0.00	0.00	0	0
Off street park	0.29	0.45	0	1
Parking garage	0.53	0.50	0	1
Rec Area/Fac.	0.43	0.49	0	1
Crime	0.24	0.42	0	1
Year Built	1962	29	1910	2000
Central City	0.45	0.50	0	1
Surburban	0.47	0.50	0	1
Multi-Unit Buildings (N=8,803)				
Condominium	0.20	0.40	0	1
Owner-occupier	0.16	0.37	0	1
Number of units	35	79	2	981
Unit size (x100 sf)*	9.68	7.47	0.99	110
Floors in bldg.	3.38	3.39	1	21
Bldg. security	0.29	0.46	0	1
Off street park	0.54	0.50	0	1
Parking garage	0.31	0.46	0	1
Rec Area/Fac.	0.50	0.50	0	1
Crime	0.23	0.42	0	1
Year Built	1963	26	1910	2000
Central City	0.49	0.50	0	1
Surburban	0.42	0.49	0	1

* Statistics reported without highest top-coded value included

Notes: This table reports summary statistics for the sample of units in single family and multi-unit buildings from the 2009 National American Housing Survey. Condominium indicates whether a multi-unit building is organized as a condominium. The alternative is that the building is owned by a single landlord-owner. Owner-occupier is equal to 1 if the household being surveyed owns the unit (as opposed to renting it).

Table 4. Condominium Multi-Unit Building Ownership

	(1) All multi-unit	(2) ≤ 12 units	(3) > 12 units
Number of Units	-0.0004	0.0320**	-0.0004
	[0.000]	[0.007]	[0.000]
Unit SF (100)	0.0674**	0.0572**	0.0985**
	[0.005]	[0.006]	[0.008]
Unit SF (100) Sq.	-0.0007**	-0.0005**	-0.0010**
	[0.000]	[0.000]	[0.000]
Mid-rise	0.4508**	0.3913**	0.3648**
	[0.053]	[0.097]	[0.070]
High-rise	0.7342**	0.6432	0.5807**
	[0.073]	[0.507]	[0.082]
Building Security	0.2269**	0.3108**	0.071
	[0.038]	[0.057]	[0.056]
Off-street parking	-0.1955**	-0.1782*	-0.1086
	[0.061]	[0.087]	[0.092]
Parking Garage	0.2490**	0.2674**	0.4233**
	[0.062]	[0.089]	[0.097]
Rec Area	0.0994**	0.0725	0.1306*
	[0.034]	[0.045]	[0.055]
Crime	-0.0936*	-0.0759	-0.1298*
	[0.040]	[0.054]	[0.062]
Central city	0.6676**	0.4355	1.0471*
	[0.197]	[0.223]	[0.491]
Suburban location	0.5825**	0.5421*	0.7923
	[0.196]	[0.219]	[0.491]
MSA Dummies	NO	NO	NO
Constant	-2.6974**	-2.6480**	-2.9636**
	[0.209]	[0.241]	[0.510]
Observations	8,803	5,468	3,335
Log-Likelihood	-3874	-2131	-1642
Psuedo R2	0.129	0.133	0.149

Standard errors in brackets
** p<0.01, * p<0.05

Notes: This table reports the results of probit regressions in which the dependent variable is *condominium* . The alternative is building ownership by a single landlord. Data are based on household interviews in the 2009 American Housing Survey national public use files. Explanatory variables include the number of units in the building, the size of the housing unit and its square, building height (low-rise is omitted), whether an entry system regulates building access, the type of parking provided with the unit (none is the omitted category), whether there are community recreational facilities and three categories of increasingly intense neighborhood crime indicators (the omitted category reflecting no reported neighborhood crime). Coefficients for dummies of central city and suburban location (relative to non-metro location) are reported but main effects and interactions with Census region are not reported here. Dummies for the decade in which the building was built are suppressed here, as well as a dummy for top-coded values of unit square feet.

Table 4, continued: Condominium Building Ownership

	(4) ≤ 12 units	(5) > 12 units	(6) > 12 units
Number of Units	0.0498**	-0.00005	-0.0001
	[0.010]	[0.0003]	[0.000]
Unit SF (100)	0.0515**	0.0915**	0.0916**
	[0.009]	[0.010]	[0.010]
Unit SF (100) Sq.	-0.0005**	-0.0009**	-0.0009**
	[0.000]	[0.000]	[0.000]
Mid-rise	0.3674**	0.0042	
	[0.114]	[0.094]	
High-rise	0.4705	0.1737	
	[0.523]	[0.107]	
Floors ≥ 21			0.3487*
			[0.158]
Building Security	0.2810**	0.1600*	0.1833**
	[0.073]	[0.071]	[0.069]
Off-street parking	-0.1273	0.0268	0.0433
	[0.112]	[0.114]	[0.115]
Parking Garage	0.3755**	0.6382**	0.6696**
	[0.111]	[0.118]	[0.118]
Rec Area	0.0773	0.1087	0.1147
	[0.062]	[0.068]	[0.068]
Crime	-0.0241	-0.115	-0.1175
	[0.071]	[0.075]	[0.075]
Central city	-0.1106	-0.0060	-0.0119
	[0.077]	[.087]	[0.086]
MSA Dummies	YES	YES	YES
Constant	-7.2613**	-1.1734	-1.1193
	[0.958]	[0.916]	[0.865]
Observations	3,023	2,291	2,291
Log-Likelihood	-1215	-1112	-1112
Psuedo R2	0.177	0.225	0.225

Standard errors in brackets
** p<0.01, * p<0.05

Notes: This table reports the results of probit regressions in which the dependent variable is condominium. The alternative is that a building is owned by a single landlord. Data are based on household interviews in the 2009 American Housing Survey national public use files. In specifications 4 - 6, we use dummy variables for each metro area. Because non-MSA locations are omitted in these specifications, urban areas are distinguished from suburban areas by a central city dummy.

Table 5. Probit Regression. Dependent Variable: Owner-Occupation of Unit

	1-2 Unit Bldgs	Condo, ≤12 units	Condo, >12 units	SF, Detached	SF, Attached
Single Fam. Attached	-0.7178**				
	[0.054]				
2 - Unit Bldg.	-1.6345**				
	[0.065]				
Number of Units		0.0031	-0.0001		
		[0.023]	[0.000]		
Unit Size (x100 sf)	0.0555**	0.1222**	0.1273**	0.0539**	0.0610**
	[0.003]	[0.024]	[0.019]	[0.004]	[0.010]
Unit Size Squared	-0.0005**	-0.0009**	-0.0012**	-0.0005**	-0.0005**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Mid-rise		0.0459	-0.1606		
		[0.294]	[0.171]		
High-rise			-0.3723		
			[0.197]		
Unit floor		-0.1187	0.0077		
		[0.069]	[0.014]		
Building Security	0.1875	0.1745	0.2102		
	[0.211]	[0.157]	[0.130]		
Off-street parking	0.1008	0.1188	-0.2414	0.1969*	0.283
	[0.068]	[0.326]	[0.190]	[0.098]	[0.145]
Parking Garage	0.6176**	0.5078	0.136	0.6568**	0.9551**
	[0.066]	[0.333]	[0.190]	[0.094]	[0.145]
Rec Area/Fac.	0.0028	0.1481	0.4375**	0.0127	-0.0074
	[0.032]	[0.145]	[0.126]	[0.036]	[0.104]
Crime	0.0105	0.4625**	-0.0316	-0.0038	-0.054
	[0.036]	[0.170]	[0.146]	[0.041]	[0.114]
Central City	-0.0332	0.0014	-0.2356	-0.0824	0.048
	[0.039]	[0.179]	[0.160]	[0.044]	[0.130]
Gated/Fenced	-0.2123**			-0.2279**	-0.1477
	[0.061]			[0.071]	[0.172]
Lot Size				0	-0.0005
				[0.000]	[0.000]
MSA Dummies	Yes	Yes	Yes	Yes	Yes
Constant	-0.4108	-1.397	-1.0403	-0.4708	-0.977
	[0.321]	[1.043]	[1.057]	[0.344]	[0.916]
Observations	12468	507	670	10,767	991
Log-Likelihood	-4554	-272.5	-369.6	-3615	-477.2
Psuedo R2	0.2452	0.197	0.164	0.129	0.251

Standard errors in brackets
** p<0.01, * p<0.05

Notes: This table reports the results of probit regressions of owner-occupation on a set of explanatory variables for different subsamples. First we compare the ownership probability for single family attached and detached housing along with 2 unit buildings. We then split multi-family buildings into small (less than or equal to 12 units) and large (greater than 12 units) builidings. Next we consider single family, detached housing. Third we look at single family, attached housing. The dependent variable is *owner-occupation:* whether the household interviewed owns the unit that they occupy. The alternative is that the household is renting the unit. Observations represent survey responses regarding housing units in the national 2009 American Housing Survey public use files. Results are not displayed for the MSA dummies. In addition, dummies for the decade in which the building was built are suppressed, as well as a dummy for top-coded values of unit square feet.