

The Valuation of Houses in an Uncertain World with Substantial Transaction Costs

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Abstract

This paper presents a dynamic model of residential real estate valuation that takes into account the uncertain time paths of rents and prices and the substantial transaction costs. By temporarily postponing decisions, potential buyers and sellers obtain additional information about future rents and prices and may avoid transactions that are costly to reverse. One implication is that waiting to transact maintains a “flexibility” option that may be quite valuable. Another implication is that the combination of substantial uncertainty and large transaction costs can create a large wedge between a household’s reservation prices for buying and selling.

key words: housing market, buying versus renting, housing uncertainty

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In many ways housing can be viewed as investment, much like corporate stock, in that the owner anticipates receiving an uncertain cash flow over many years. With stock, the shareholder receives dividends; with a house, the homeowner receives housing services that would otherwise have to be paid for by renting. An important difference between the markets for stocks and houses is that people don't switch back and forth between owning and renting houses the way they jump in and out of stocks. One possible explanation is that rental and purchase properties are quite distinct, so that people with different preferences separate into renters and owners. This paper uses a dynamic model of residential real estate valuation with an uncertain cash flow and large transaction costs to show that there may be considerable inertia in the real estate market because there is a substantial option value to delaying real estate transactions. Substantial uncertainty and high transaction costs create a large wedge between a household's demand and supply reservation prices, so that once a household buys (or sells) for financial reasons it will take a large change in the price of housing to persuade the household that it should reverse this transaction.

Models of Housing Demand

The individual's joint tenure choice decision and demand for housing services are generally modeled as depending on the costs of buying and renting, household income, and socio-demographic variables (for example, Goodman [8], Mayo [16]. These models tend to view the buy/rent decision as an equilibrium with some households temporarily out of equilibrium (for example, Ihlanfeldt[12]; Dynaski [7]).

Although tenure choice models are generally static, Goodman [9, 10] analyzes a two-period model with infinite transaction costs and Amundsen [1] analyzes the optimal number and timing

of moves when the consumer has perfect foresight regarding income and housing prices. We will analyze an infinite-period model with finite transactions costs and substantial uncertainty about future housing rent and prices.

Others have analyzed the effects of income and price uncertainty on risk-averse households' housing demand (for example, Robst, Dietz, and McGoldrick [18]; Ioannides [13]). We have in mind a very different consequence of uncertainty that affects both buyers and sellers and that, as far as we can tell, has not been addressed in this literature. A household considering a housing transaction—either buying or selling—should consider the possibility that postponing the transaction may make available opportunities that are even more decisively favorable, or may give them the opportunity to avoid making a transaction that they will subsequently regret but is expensive to undo. These concerns affect both the timing and nature of transactions.

Titman [20] uses a two-period, two-state model to explain why vacant land may be left undeveloped, even in desirable urban areas. Uncertain of the returns from construction projects of different sizes or uses, landowners may choose to keep the land vacant until they know more about future economic conditions. The vacant land is implicitly an option to construct a building at some future date. Capozza and Helsley [2] analyze a similar model in which the developer chooses the optimal time to build a pre-specified project; Capozza and Li [3, 4] allow the developer also to choose the capital intensity (the amount of development per unit of land).

These dynamic models are concerned with housing construction. We have not found any analogous models of housing demand. Just as developers have an option to build houses on vacant land, so renters have an option to buy houses instead of renting. Just as the option value can persuade developers to leave land vacant, so the option value can persuade households to continue renting.

There are many kinds of uncertainties that create an option value for renters, including

uncertainty about future income, marital status, family size, job location, tax laws, rents, and housing prices. We focus on uncertainty about future rent and housing prices because these quantitative variables can be modeled in a relatively straightforward way. The same principles and conclusions apply to all uncertainties that might affect decisions to buy or sell houses.

Buying and Renting

Some households have compelling reasons for renting. Someone who knows their residence will be brief (a college student living off-campus her senior year, a consultant staying in Cleveland for six months) should not incur the large transactions costs involved in buying and then selling a home. Someone who doesn't have a sufficient downpayment and other financial resources will not be able to purchase a home. Our concern here is with households who have the means and motives to buy a home, but want to consider the possibility that renting is financially advantageous. Their hysteresis comes from the potential value of additional information, not necessity.

Buying and renting have sometimes been analyzed as demands for different commodities. Rosen [19] wrote that, "In many cases it is difficult (say) to rent a single unit with a large backyard. Similarly, it may be impractical for a homeowner to contract for the kind of maintenance services available to a renter." A decade later, Goodman [8] observed that, "Until recently, it was easier to purchase small (large) amounts of housing by renting (owning). As a result, households with tastes for small (large) units would rent (buy)."

Today, it is still true that rental and purchase properties differ, on average, in location and attributes. But, on the margin, close substitutes are generally available. It is possible to buy small condominiums and to rent houses with large yards. It is possible to buy or rent small or large houses. Many households have the option of buying houses in communities that provide services very similar to those received by most renters.

We consequently view buying and renting as viable alternatives. If a household has the opportunity to buy or rent very similar properties (perhaps even the same property), then the question is not which kind of property to inhabit, but whether to pay for these housing services by buying the property or renting it.

Housing prices and rents are tied together by the fact that the theoretical value of a house depends on the anticipated rents, in the same way that the theoretical value of bonds and stocks depends on the present value of the cash flow from these assets. However, just as bond and stock prices are not tied rigidly to coupons or dividends, so housing prices are not tied rigidly to rents. Among the many factors that affect the price-rent ratio are interest rates, risk premiums, changes in tax laws (including property taxes, depreciation, deductible expenses, and income tax brackets), and speculation.

The Bureau of Labor statistics has a consistent index for owner's equivalent rent of primary residence back to 1983; the Department of Housing and Urban Development has repeat sales price indexes for this same period. Over the period 1983-2003, the continuously compounded annual growth rates of the national rent and price indexes had means of 3.6% and 4.7% respectively, with a correlation of 0.60. The divergence between rent and price indexes is even larger in some narrower geographic areas.

Taxes

The implicit rental income from owner-occupied housing is an after-tax cash flow. If the homeowner would pay C in after-tax income to rent a house, then home ownership provides an extra C in after-tax cash that would otherwise be paid in rent. In addition, the homeowner can deduct mortgage interest and property taxes from ordinary income and, after having lived in a primary residence for at least two of the preceding five years, capital gains are not taxed up to \$250,000 for a single person or \$500,000 for a married couple filing jointly.

In contrast, a landlord has no capital gains exclusion and pays income taxes on the rental income (net of mortgage interest, property taxes, utilities, insurance, maintenance and other expenses, including depreciation). In comparison to the owner-occupier, the landlord pays taxes on rent, but is able to deduct a variety of expenses in addition to interest and property taxes. The landlord has a larger cash flow only if these other deductible expenses exceed the rent.

If these other expenses are larger than the rent, then the property must have a loss, but the tax-deductibility of losses may be restricted severely by the Internal Revenue Service's complicated passive activity rules [14]. For persons who are not real estate professionals, all rental activities are passive activities and passive-activity losses cannot be used to offset ordinary income. The "small-investor" exception allows an individual actively involved in the rental activity and with (modified) adjusted gross income of less than \$100,000 to claim up to \$25,000 in losses; the \$25,000 limit is phased out as adjusted gross income reaches \$150,000. Households that have the resources to make downpayments and monthly payments on their own house and also on rental properties are likely to have a limit of less than \$25,000.

Qualified real estate professionals can deduct their full losses if they meet two requirements: (a) more than half of the personal services they performed in all trades and businesses during the tax year were in real property trades or businesses; and (b) they performed more than 750 hours of services in real property trades or businesses during the tax year.

Our initial analysis is for owner-occupiers. We will then consider how the analysis might be modified for landlords.

The Intrinsic Value of a House

The intrinsic value of a stock is the present value of its cash flow. The same is true of a house. The intrinsic value V is the present value of the after-tax cash flow C_t , discounted by the required after-tax rate of return R :

$$V = \frac{C_1}{(1+R)^1} + \frac{C_2}{(1+R)^2} + \frac{C_3}{(1+R)^3} + \dots$$

The implicit after-tax cash flow from a house is the rent a homeowner would otherwise have to pay to live in this house minus the expenses associated with home ownership.

As with stocks, the constant growth model provides a simple and insightful starting point. If the cash flow grows as a rate $g < R$, then the present value formula simplifies to

$$V = \frac{C_1}{R - g} \quad (1)$$

A homebuyer can use the projected cash flow and a required rate of return to determine if a house's intrinsic value is above or below its market price. If the price is less than or equal to the intrinsic value, the house is indeed worth what it costs. If the market price is above intrinsic value, renting is more financially attractive.

Dougherty and Van Order [6] derive a similar equilibrium relationship between housing prices and rents. They show that the user cost of housing X is approximately

$$X = (S - \pi + \delta)P$$

where P is the house's price, S is the nominal after-tax interest rate, π is the inflation rate, and δ is the rate at which houses depreciate. They also show that in competitive equilibrium, landlords receiving the same tax breaks as owner-occupiers will charge a nominal rent net of operating costs equal to X . If we define Y as the nominal rent net of operating costs and depreciation, we have

$$Y = (S - \pi)P \quad (2)$$

This is clearly quite similar to (1) rearranged

$$C_1 = (R - g)V$$

However, there are some subtle differences. In (1), R is the after-tax required rate of return; in (2), S is the after-tax interest rate. In (1), g is the anticipated rate of growth of rent; in (2), π is the rate

of growth of housing prices. In (1), C_1 is the actual rent the homebuyer would have to pay to a landlord who does not receive the same tax advantages as an owner-occupier; in (2), Y is the theoretical equilibrium rent for a landlord who receives the same tax advantages as owner-occupiers. In (1), V is the value to a homebuyer of the anticipated rent savings, which may vary from person to person because of variations in R and g ; in (2), P is the house's actual price.

Modeling Uncertainty

As with stocks, uncertainty is a key aspect of the housing market. One enormous difference between stocks and real estate is that the transaction costs are trivial for the former and substantial for the latter. This combination of substantial uncertainty and high transaction costs has interesting implications for the valuation of houses because, in addition to the costs of the initial transaction, uncertainty creates the possibility that, at some future date, the household may want to undo the transaction and thereby incur additional transaction costs.

Renting implicitly involves a “flexibility option” that allows a potential buyer to obtain additional information. Even if a house currently has a positive net present value, it may be worthwhile to wait and obtain more information about future rents and prices. For example, the main cost of waiting is the rent that must be paid until the purchase is made, yet, delaying the purchase may be profitable if there is a decline in the present value of the price of the house that exceeds the net cost of renting during the interim. Delaying can also be profitable if rents do not rise as much as anticipated, so that buying the house turns out to be a mistake that the household would like to avoid. Analogous arguments apply to a homeowner considering a sale. Thus the combination of uncertainty and transaction costs can be powerful arguments for inertia.

A household considering the purchase of a home faces uncertainty regarding both the potential future rent savings from home ownership and changes in the price of a house. It should weigh the benefits from buying immediately against the costs of doing so, including the cost of exercising

the purchase option and thereby forfeiting the benefits from waiting for more information about the evolution of rent and prices.

Assume that the evolution of rent C can be described by this geometric Brownian motion equation:

$$\frac{dC}{C} = \alpha dt + \beta dz \quad (3)$$

where α is the trend rate of growth of rent and dz is the increment of a standard Wiener process.

The cost P of buying a house also evolves according to geometric Brownian motion:

$$\frac{dP}{P} = \alpha dt + \beta dz \quad (4)$$

The correlation coefficient between rent C and price P is ρ . Households can have different opinions about the value of the parameters. If a household believes that the price-rent ratio is unlikely to change, it might assume that $\alpha = \beta$ and ρ is close to 1.

The purchase of a house costs P and provides an expected present value V of the cash flow:

$$V = \frac{C}{R - \alpha} \quad (5)$$

where R is the risk-adjusted required rate of return.

There are transaction costs for both buyers and sellers, including brokerage fees, closing costs, and moving expenses. A seller also incurs fixup costs preparing the house for sale and disruptions caused by maintaining the house in showing condition. A buyer may incur costs for breaking a lease and fixup costs to reclaim a deposit. We assume that only sellers have transaction costs in order to demonstrate that seller transactions costs affect buyers too—since, before committing to a purchase, buyers should consider the likelihood that they may someday be sellers.

We know from the dynamic programming literature that the simple investment rule of buying when V is larger than P and selling when V is smaller than P is inappropriate in an uncertain

world where there is an option value to waiting to make investments that are costly to reverse (Jensen [15]; Pindyck [17]; Dixit [5]). Dynamic programming can be used to determine the value $F[C, P]$ of this option.

Setting the return on the option, rF , equal to the expected capital gain on the option and using Ito's Lemma, we obtain this differential equation for the region in which the household waits to purchase:

$$0 = 0.5\sigma^2 C^2 \frac{\partial^2 F}{\partial C^2} + 2\sigma C P \frac{\partial^2 F}{\partial C \partial P} + \sigma^2 P^2 \frac{\partial^2 F}{\partial P^2} + (r - R + \delta)C \frac{\partial F}{\partial C} + (r - R + \delta)P \frac{\partial F}{\partial P} - rF$$

A natural assumption that makes the analysis tractable is that the option value is homogeneous of degree one: $F[C, P] = Pf[C/P]$. The substitution of the requisite partial derivatives into our differential equation yields

$$0 = 0.5\sigma^2 \left(\frac{C}{P}\right)^2 f'' + (\delta - R) \frac{C}{P} f' + (R - r)f$$

where $\delta = \sigma^2 - 2\sigma\alpha + \alpha^2$.

This is a homogeneous second-order linear differential equation whose general solution has the form

$$f[C/P] = A_1(C/P)^a + B_1(C/P)^b$$

where

$$a = 0.5 + \frac{\delta - R}{\sigma^2} + \sqrt{\left(\frac{\delta - R}{\sigma^2}\right)^2 + \frac{2(R - r)}{\sigma^2}} > 1$$

$$b = 0.5 + \frac{\delta - R}{\sigma^2} - \sqrt{\left(\frac{\delta - R}{\sigma^2}\right)^2 + \frac{2(R - r)}{\sigma^2}} < 0$$

As the rent-price ratio C/P approaches 0, the value of the buy option does too; because the parameter b is negative, the term $B_1(C/P)^b$ does not approach 0 unless $B_1 = 0$. Therefore,

$$f[C/P] = A_1(C/P)^a \quad (6)$$

For the homeowner, the value $G[C, P]$ of the house includes the cash flow C and the value of the option to sell if the rent-price ratio falls sufficiently. Assuming this value to be homogeneous of degree one, $G[C, P] = Pg[C/P]$, the differential equation in the region where the home is held is:

$$0 = 0.5 \left(\frac{C}{P} \right)^2 g'' + \left(\frac{C}{P} \right) \frac{C}{P} g' - (R - \frac{C}{P})g + \frac{C}{P}$$

The general solution has the form

$$g[C/P] = A_2(C/P)^a + B_2(C/P)^b + \frac{C/P}{R - \frac{C}{P}}$$

As the rent-price ratio C/P increases, the value of the sell option approaches 0; therefore, $A_2 = 0$:

$$g[C/P] = B_2(C/P)^b + \frac{C/P}{R - \frac{C}{P}} \quad (7)$$

A household that is waiting to buy will do so when the rent-price ratio rises to the threshold \bar{C}_1 . At $C/P = \bar{C}_1$, the value of the buy option is equal to the value of owning the house net of the purchase price:

$$\begin{aligned} F[C, P] &= G[C, P] - P \\ f[C/P] &= g[C/P] - 1 \end{aligned}$$

Thus

$$f[\bar{C}_1] = g[\bar{C}_1] - 1 \quad (8)$$

The first derivatives are also equal at $C/P = \bar{C}_1$:

$$f'[\bar{C}_1] = g'[\bar{C}_1] \quad (9)$$

A homeowner waiting to sell will do so when the rent-price ratio falls to the threshold \bar{C}_2 . At $C/P = \bar{C}_2$, the value of the sell option is equal to the value of the buy option plus the sale price net of the proportional sales cost α

$$G[C, P] = F[C, P] + (1 - \alpha)P$$

$$g[C/P] = f[C/P] + (1 - \alpha)$$

Thus

$$g[\bar{c}_2] = f[\bar{c}_2] + (1 - \alpha) \quad (10)$$

and the first derivatives are equal at $C/P = \bar{c}_2$:

$$g'[\bar{c}_2] = f'[\bar{c}_2] \quad (11)$$

The substitution of the differential equations (6) and (7) into the value-matching and smooth-pasting conditions (8) - (11) gives these four equations,

$$0 = A_1 \bar{c}_1^a - B_2 \bar{c}_1^b - \frac{\bar{c}_1}{R} + 1$$

$$0 = aA_1 \bar{c}_1^{a-1} - bB_2 \bar{c}_1^{b-1} - \frac{1}{R}$$

$$0 = A_1 \bar{c}_2^a - B_2 \bar{c}_2^b - \frac{\bar{c}_2}{R} + (1 - \alpha)$$

$$0 = aA_1 \bar{c}_2^{a-1} - bB_2 \bar{c}_2^{b-1} - \frac{1}{R}$$

which can be solved for the thresholds \bar{c}_1 and \bar{c}_2 and the differential-equation parameters A_1 and B_2 . Our intuition is aided by working with the threshold price-rent ratios $1/\bar{c}_1$ and $1/\bar{c}_2$.

Illustrative Calculations

To illustrate this model, consider the following baseline case: $\alpha = 0.05$, $\beta = 0.10$, $\rho = 0.05$, $\sigma = 0.20$, $\gamma = 0.50$, $R = 0.10$, and $\delta = 0.08$. This household believes that rent has a 5% trend growth rate and 10% standard deviation, and that price has a 5% trend growth rate and 20% standard deviation. The correlation between rent and price is 0.50. The required rate of return is 10% and the transaction cost for house sales is 8% (including brokerage commission, legal fees, and fixup costs).

Using these parameter values, the present value of the rent is given by (5):

$$V = \frac{C}{R \square \square}$$

$$= \frac{C}{0.10 \square 0.05} > P \text{ iff } \frac{P}{C} < 20$$

If there were no transaction costs, the house should be bought when the price-rent ratio is below 20 and sold when the price-rent ratio is above 20. With an 8% sales cost, the threshold price-rent ratios given by the dynamic programming model work out to be $1/\square_1 = 14.5$ and $1/\square_2 = 29.4$. If waiting to buy, this household should do so when the price-rent ratio falls to 14.5; if it owns this house, it should sell when the price-rent ratio rises to 29.4. The reservation price-rent ratio for buying is far below 20 because a purchase has the additional cost of extinguishing the possibility of buying at terms that are even more favorable and also less likely to incur future transaction costs. The reservation price-rent ratio for selling is far above 20 because a sale incurs transaction costs and extinguishes the possibility of selling at more favorable terms that are less likely to be reversed sufficiently to persuade the seller to buy again. Figure 1 shows how increased transaction costs widen the thresholds.

These effects are substantial. A price-rent ratio of 20 implies that a house with a \$20,000 cash flow is worth $20(\$20,000) = \$400,000$. The 14.5 threshold implies that if this household is renting, it isn't willing to pay more than $14.5(\$20,000) = \$290,000$ to buy the house; the 29.4 threshold implies that if this household owns the house, it isn't willing to sell it for less than $29.4(\$20,000) = \$588,000$. With no uncertainty, the buy and sell thresholds would differ by the 8% transaction cost. With uncertainty, the sell threshold is more than double the buy threshold.

The other ceteris paribus comparative static multipliers are reasonable. A higher trend growth rate of rent or price would increase the thresholds for buying and selling. This is analogous to growth stocks which trade at high price-earnings ratios. The faster that rent and price are expected to increase in the future, the higher the price-rent ratio at which trades take place today.

Similarly, a higher required rate of return reduces the threshold ratios: for given growth rates, houses need a low current price-rent ratio to provide households with a high rate of return.

Larger standard deviations of rent and price increase the value of the buy and sell options and thereby make it more attractive to wait and not exercise these options. Thus the buy threshold is lower and the sell threshold is higher. Households waiting to buy should consider the possibility that, if they do buy now, the rent may subsequently fall, causing them to regret their purchase. They should also consider the possibility that, if they do not buy now, prices may subsequently fall, giving them the opportunity to buy at even more favorable terms that are less likely to be reversed in the future. Thus high standard deviations make waiting more attractive and necessitate a lower price-rent threshold for buying. On the other hand, homeowners who are waiting to sell should consider the possibility that, if they sell now, the rents may subsequently rise, causing them to regret their sale. They should also consider the possibility that, if they do not sell now, prices ratio may subsequently rise, giving them the opportunity to sell at even more favorable terms that are less likely to be reversed in the future. Thus high standard deviations make waiting more attractive and necessitate a higher price-rent threshold for selling.

Figure 2 shows the effects of the standard deviations on the thresholds. In these calculations, the standard deviation of price is fixed at twice the standard deviation of rent. As the standard deviations approach 0, the price-rent threshold for buying approaches 20 and the rent-price threshold for selling approaches 21.74, a difference equal to the 8% transaction cost. At a rent standard deviation of 5% and price standard deviation of 10%, the price-rent threshold for buying is 37% less than the sell threshold. At a rent standard deviation of 10% and price standard deviation of 20%, the threshold for buying is 50% less than the sell threshold.

Figure 3 shows that a higher price-rent correlation would increase the threshold for buying and reduces the threshold for selling because it is less likely that the price-rent ratio will change

significantly in the future. Put another way, the smaller the variability of the price-rent ratio, the smaller is the probability that conditions will be even more favorable in the future and the smaller, also, is the probability that the household will someday want to reverse a decision made today.

Multiple Households

This is a model of the choices made by individual households. With multiple households and diverse parameters, it can be the basis of a well-defined market with a market clearing price. Suppose that a certain area has 100 households and 100 very similar houses, 50 of which are rental property and 50 of which are owner-occupied. The rental properties might be owned by some of these households or by corporations, government agencies, or out-of-town investors.

Variations across households in any of the model's parameters can yield interesting demand and supply curves. For example, assume that these 100 households agree on all of the relevant parameters except the trend growth rates of rent and prices. Each household believes that $\pi = \pi$, but they disagree about the levels of π and π . The 50 renters, who are potential buyers, have a uniform distribution ranging from 0.00 to 0.08; the 50 owner-occupiers, who are potential sellers, have the same uniform distribution.

Figure 4 shows the implied demand and supply curves, as function of the price-rent ratio P/C . The market-clearing price-rent ratio is 17.5, with 13 transactions. The 13 renters who buy are those with the most optimistic rent and price projections; the 13 homeowners who sell are those with the most pessimistic projections.

This partial-equilibrium model determines the market-clearing value of P/C , but we need a general equilibrium model to determine the levels of P and C . Housing markets are linked by the multiple opportunities available to households. On the other hand, household demands are complicated by the fact that tax laws make housing more attractive for an owner-occupier than

for a landlord, and a household cannot owner-occupy more than one house at a time.

The decision rules for a landlord are analogous to those for an owner-occupier but because of tax laws, a household's prospective after-tax cash flow and reservation price-rent ratio are generally lower when considering purchasing of a home to rent than when considering purchasing the same home to live in. A real estate professional, on the other hand, may have higher thresholds. Even though each individual household considers purchasing a house to rent less financially attractive than purchasing a house to live in, some households will have parameter values (for example, sufficiently optimistic rent and price expectations) that justify becoming landlords. Thus we could augment the demand and supply functions depicted in Figure 4 with persons considering buying house(s) to rent and landlords considering selling their rental property.

Another piece of the market is real estate developers considering the construction of houses to sell to either owner-occupiers or landlords. These supply equations could utilize the models analyzed, for example, by Capozza and Helsley [2]. On the demand side, households can also move into or out of the area. As time passes, construction, demographic movements, and changes in each household's parameters will be among the factors that cause the demand and supply functions and market-clearing prices to change.

Conclusion

A financial analysis of housing should be based on the present value of the costs and benefits of home ownership. However, unlike stocks, bonds, and most financial assets, there are substantial transaction costs in the real estate market. This paper presents a dynamic model of residential real estate valuation where purchases and sales are affected by uncertain projections of rents and prices. The same principles apply to all of the uncertainties that affect housing transactions.

Higher anticipated growth rates of rent and prices and a lower required return increase the price-rent thresholds for both buyers and sellers. Higher transaction costs, higher standard deviations of rents and prices, and a lower correlation between rents and prices reduce the price-rent threshold for buyers and increase the threshold for sellers.

Inertia maintains an implicit option that may be quite valuable. Thus the combination of substantial uncertainty and large transaction costs can create a large wedge between a household's reservation prices for buying and selling. This wedge may explain why—unlike the stock market—so many real estate transactions seem motivated by socio-demographic necessity (marriage, divorce, relocation), rather than purely economic calculations. In the absence of this wedge, we would expect to see households shifting back and forth between renting and buying the same way they jump in and out of stocks. Because of this wedge, homeowners typically sell because they have to, not because they consider the sale price high enough to make renting more attractive than homeownership.

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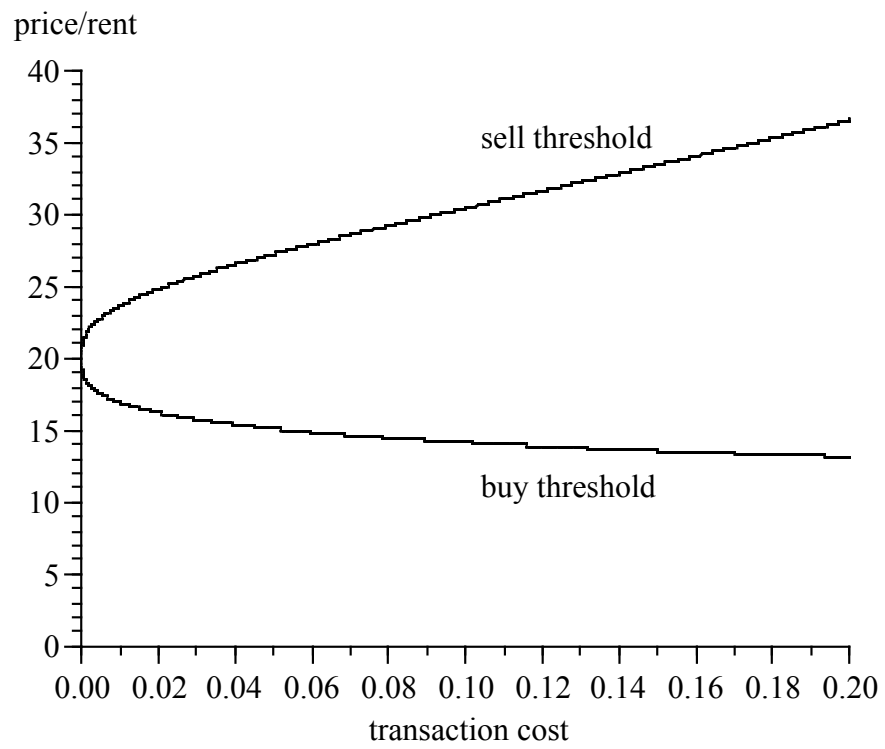


Figure 1 The Effect of Transaction Costs on the Thresholds

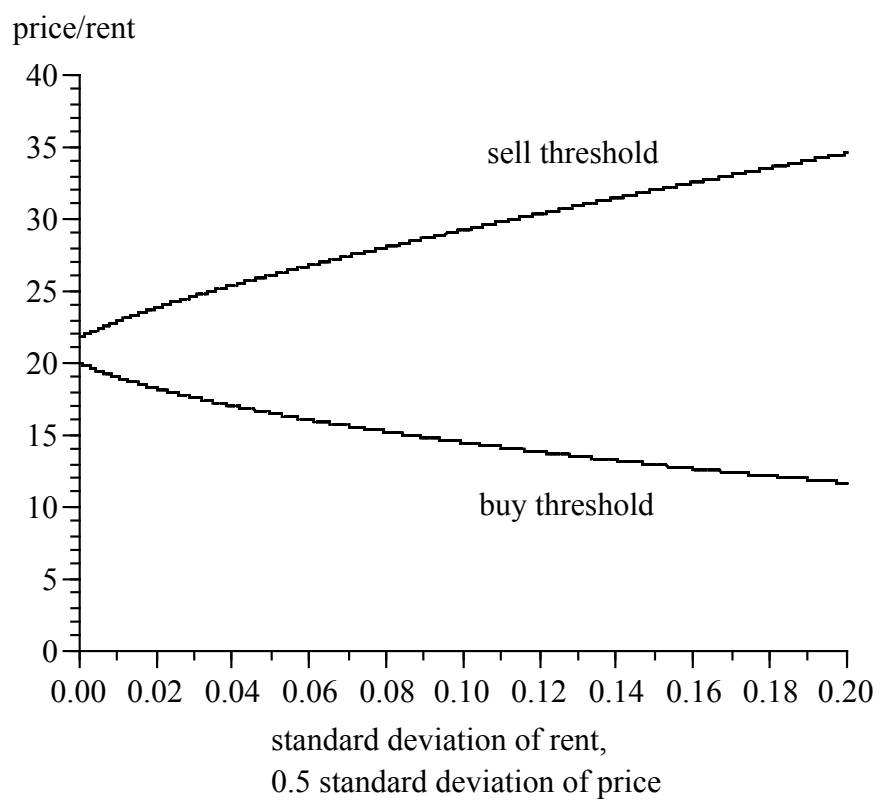


Figure 2 The Effect of Uncertainty on the Thresholds

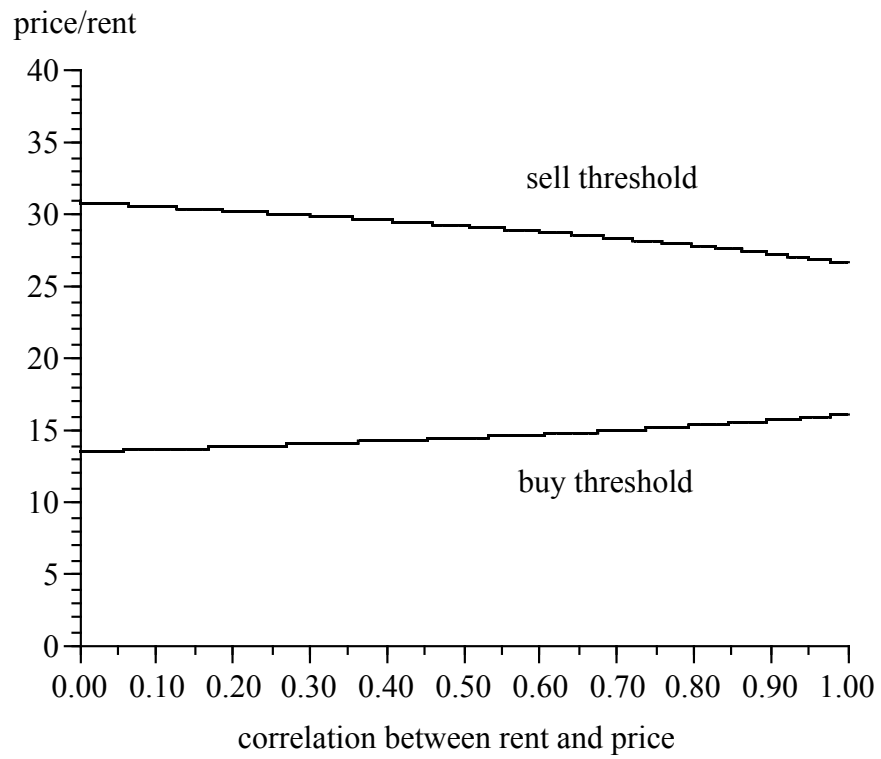


Figure 3 The Effect of the Rent-Price Correlation on the Thresholds

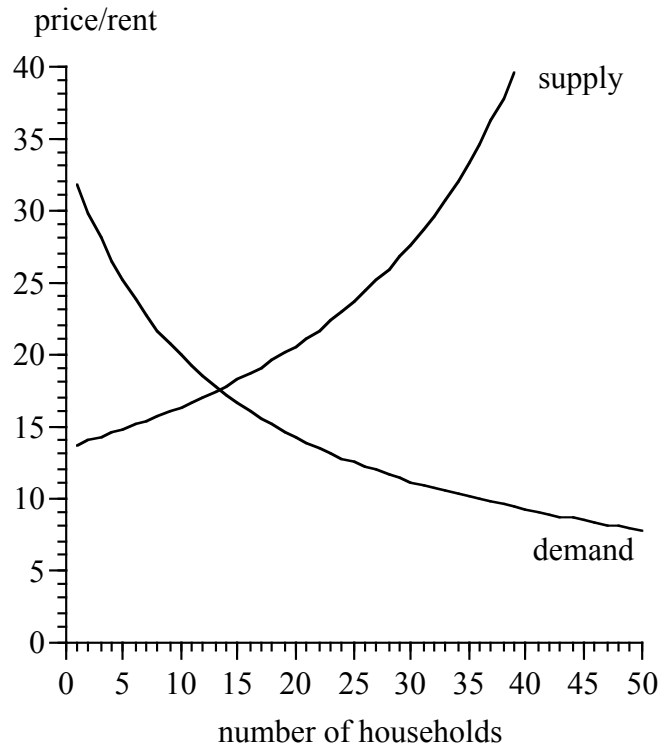


Figure 4 Demand and supply with uniform expectations of rent and price growth rates