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Abstract

It is well accepted that homeowners, on average, have greater total wealth than renters. However, Beracha and Johnson (2012) show that in a strict ''horserace'' comparison, renting creates higher wealth than ownership in the majority of cases. In this paper, we revisit Beracha and Johnson's buy versus rent model to investigate factors affecting the wealth outcomes of the buy versus rent decision. Three key findings emerge: (1) the difference in wealth between renting and owning can be most affected by choices within the scope of the individual rather than through the impact of exogenous market variables; (2) households that fail to reinvest buy-rent cash flow differentials accumulate less wealth; and (3) property appreciation plays only a minor role in the results.

A variety of outcomes (economic and social) are associated with homeownership in the recent literature. For example, homeownership enhances civic pride and improves voter turnout (Rohe, Van Zandt, and McCarthy, 2002; Dietz and Haurin, 2003). In fact, dissatisfied homeowners are far more likely to participate in elections than any other state of tenure (Holian, 2011). There is also evidence that homeownership contributes to better societal outcomes—less crime, better familial environment, and higher educational outcomes (Haurin, Parcel, and Haurin, 2002). Recently, however, due mostly to self-selection issues, some doubt has been cast on these proffered benefits from homeownership accruing to the children of homeowners (Holupka and Newman, 2012). Regardless of this recent doubt, homeownership is still most often referred to as the ''American Dream'' (Tu and Eppli, 1998; Painter and Redfearn, 2002; Phillips and Vanderhoff, 2004; Cauley, Pavlov, and Schwartz, 2007; Matthews and Turnbull, 2007; among many others).

Perhaps the most hyped and commonly cited benefit of homeownership is that, on average, homeowners are financially better off than renters in terms of overall wealth. This association between wealth and homeownership is widely recognized and quantified in the academic literature (e.g., Engelhardt, 1994; Haurin, Hendershott, and Wachter, 1996; Rohe, Van Zandt, and McCarthy, 2002; Di, Belsky, and Liu, 2007). This understanding is also acknowledged by the average American who stigmatizes renters as the young, uninformed, or less financially capable. A common and casual explanation for the wealth gap between homeowners and renters asserts that ''renters only pay their landlord's mortgage.'' On the other hand, it is also casually argued that homeowners build wealth through home price appreciation and a steady reduction of mortgage debt, while simultaneously receiving beneficial tax treatment. However, the correlation between wealth and homeownership can clearly be attributed, at least in part, to selection biases. To mention a couple self-selection issues: (1) homeowners tend to be older than renters

(Haurin, Hendershott, and Wachter, 1996) and (2) owning a home requires some initial wealth in the form of down payment[1] and once individuals become homeowners they rarely revert back to renting (Sinai, 1997). These factors, among others, tend to create wealth and are correlated with current homeownership. These arguments are highlighted and controlled for in Di, Belsky and Liu (2007) resulting in a finding that homeownership leads to greater overall wealth accumulation.

Beracha and Johnson (2012) question the causality of this link and show that in a strict ''horserace,'' renting results in higher wealth accumulation. The authors compare two competing portfolios for the 1978 to 2010 time period. One portfolio accumulates wealth through equity of ownership. The second portfolio accumulates wealth through renting a comparable property and investing the initial down payment, closing costs, and any differential cash flows between ownership payments and rents. The traditional costs and benefits of ownership are accounted for over a holding period and portfolio values are compared. The findings in this work indicate that in a vast majority of the ''horseraces,'' renting (not ownership) leads to greater wealth creation. Thus, if renting produces higher wealth, on average, why do the majority of households continue to own their primary residence and yet remain financially better off than renters?

Employing the same horserace methodology as Beracha and Johnson (2012), we aim to solve this puzzle by investigating, in isolation, the model parameters that affect the buy versus rent wealth differential. This approach allows for a better understanding of which factors have the largest effect on the buy versus rent wealth accumulation puzzle. Additionally, observing the sensitivity of the buy versus rent wealth outcomes for these factors may help reconcile the gap between the empirical association between homeownership and wealth and the evidence that renting leads to higher wealth. This analysis should also shed new light on the concept of homeownership as the American dream.

By analyzing variation in the model parameters, we document three important findings. First, the factors that households are most able to control at or after the time of the buy-versus-rent decision have the largest effect on the buy-versus-rent wealth differentials compared with factors over which households have no control. This implies that actions taken by households influence the wealth outcome of the buy-versus-rent decision more than exogenous housing-related market events. Thus, households have more control over their final wealth than uncontrollable macroeconomic variables. Second, choosing not to reinvest the differential cash flows between buying and renting is, by far, the most significant single factor that tilts the buy-versus-rent wealth accumulation toward ownership. Said another way, renters' failure to reinvest rent savings leads to lower overall wealth accumulation relative to the wealth of homeowners. Hence, households can increase their wealth by using homeownership as a self-imposed savings commitment. Finally, contrary to popular belief, property appreciation appears to have only a minimal effect on holding period wealth accumulation, suggesting that wealth accumulation must come from another source.

These findings combine with evidence on renters spending behavior and the average higher quality of owner-occupied homes help reconcile the gap between Beracha and Johnson (2012) findings that renting is mostly preferred to buying and the common belief

that homeownership is the best path to wealth creation. That is, even though renting can generate more wealth than buying, buying a home can result in more wealth because it forces households to save more than they would otherwise. Therefore, society appears to have been telling people the right thing to do (own a home) but for the wrong reason. More specifically, it appears that homeownership forces saving and when combined with the tendency of households to remain homeowners once they initially switch to ownership (Sinai, 1997) explains why owners have more wealth.

A Brief Literature Review and Additional Motivation

Haurin, Hendershott, and Wachter (1996) document the financial benefits associated with homeownership. Specifically, homeowners have, on average, greater total household wealth than renters. Additionally, the household wealth of new homeowners increases at a faster pace than that of renters in the first few years of ownership. After controlling for several self-selection issues, Di, Belsky, and Liu (2007) provide additional support for this finding. Thus, it appears that homeownership drives wealth creation. A more recent paper by Rohe, Van Zandt, and McCarthy (2002) recognizes that homeownership provides a ready mechanism for families to borrow money in less expensive forms such as home equity loans. The authors suggest that the borrowed money allows homeowners to make purchases, invest in education or the financial markets resulting in greater wealth creation, all else being equal. The authors also note that asset accumulation through house price appreciation is the main financial benefit of homeownership and that the declining real monthly payment over time protects homeowners against unanticipated increases in rental costs. Thus, ownership is a hedge against rent increases, a source of credit, and a wealth creator through property appreciation.

Engelhardt (1994) provides evidence that renters' savings behavior is dependent on home prices in their area. In particular, Engelhardt shows that high home prices substantially reduce the probability of households saving for down payment. Additionally, the amount of savings households accumulate for home purchase is negatively related to home prices. The author's findings suggest that renters are likely to spend more and save less if the reward for saving is more distant compared with the immediate reward associated with spending. This is consistent with Americans' propensity to spend rather than save. According to the U.S. Department of Commerce's Bureau of Economic Analysis, the personal savings rate in the U.S. has remained significantly below 10% (often under 5%) during most of the last 50 years.[2]

U.S. Census Bureau data indicates that homeownership rates in the U.S. have ranged between a minimum of 63.6% (first quarter of 1968) to a maximum of 69.2% (fourth quarter of 2004). As of the third quarter of 2010, the homeownership level has fallen to 66.3%—level not seen since 1998.[3]

Beracha and Johnson (2012) create a strict ''horserace'' between buying and renting by comparing the wealth accumulation associated with homeownership against the renting alternative. The proceeds from the sale of the purchased property are evaluated against an investment portfolio held by a renter. The renter is assumed to initially seed the portfolio with an amount that otherwise would be spent on a home purchase and reinvest

any differential cash flow between owning and renting a like kind property. In the vast majority of the cases, over the time period examined, renting rather than ownership creates a greater portfolio value. Thus, in a fair competition, renting appears to be the superior financial choice in terms of wealth creation.

The combination of these disparate facts creates an interesting puzzle. Why do homeownership levels consistently remain so high? Are the virtues of homeownership so great that despite a drag on wealth accumulation individuals still prefer owning to renting? Are Beracha and Johnson (2012) correct and Americans should be renting in the majority cases? Might Engelhardt (1994) and Americans' propensity to spend rather than save offer an explanation? The remainder of this study is dedicated to solving this puzzle, and the answers appear to be surprisingly simple and enlightening.

The rest of the paper is organized as follows. In the next section, we employ an expected utility framework in order to better frame the research question. We then describe the data used in the analysis and the methodology employed. We next discuss the study's findings and then close with concluding remarks. We summarize Beracha and Johnson's (2012) model in the Appendix.

Wealth Accumulation in an Expected Utility Framework

We quantitatively compare two ways of wealth accumulation holding consumption and thus savings constant. Specifically, which choice rent or own results in greater wealth holding other things constant? Households, however, are not generally maximizing wealth. Instead, households maximize expected utility from consumption and housing. The purpose of this section is to place the ''horserace'' wealth comparison of Beracha and Johnson (2012) into the context of a representative household expected utility maximization framework.

Exhibit 1 illustrates the relation between the decision to own versus rent and subsequent flow of consumption and housing utility. Importantly, it highlights how we think about wealth accumulation and utility maximization. In the horserace comparison, we hold consumption constant, which implies that the households re-invests the difference between rent and the cost of owning.

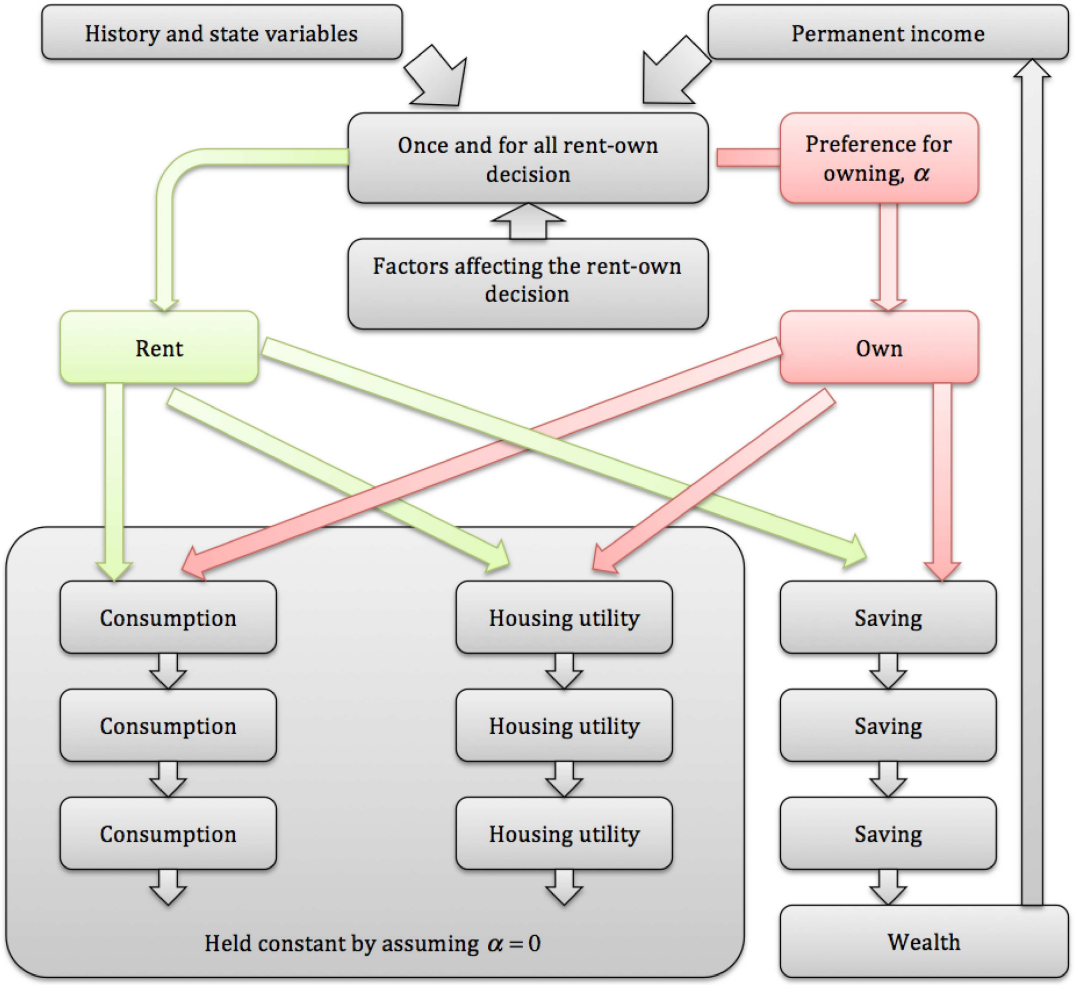
To simplify the comparison, we assume that the owners save only in terms of the value of the house while renters can save by investing into a comparable risk portfolio. We further assume that equity net of selling expenses can be costlessly converted into liquid assets that can be used to pay for current consumption.

In the setup, a household is maximizing expected utility by choosing the level of consumption and housing goods:

$$U = E[\max_c\{U^r, U^b\}],$$

where U^r is the utility from renting and U^b is the utility from owning a house. Household utility is maximized subject to allocating permanent income to consumption c or housing.

Exhibit 1. Diagram of the Own-versus-Rent Framework



A household's permanent income $\ddot{Y}$ at time t is given by the sum of current income Y_t and annuitized value of wealth w:

$$\ddot{Y}_t = Y_t + w.$$

The comparison between buying and renting makes sense only when both renting and ownership are feasible. Therefore, we implicitly consider only the cases when the current income is sufficient to cover either the operating cost of ownership or rental payments.

To focus on the wealth accumulation question, we further assume that once chosen, the household does not change its decision. This simplifies the model significantly because we do not need to consider the transition problems for either renters or owners.

$$U = E[U^r] \leftrightarrow E[U^r] > E[U^b].$$

Household-owner

The household's value function from owning can be expressed as:

$$U^b = \max_c \left\{ (1 - \beta) \left(\frac{c}{p^c} \right)^{1-\gamma/\theta} (1 + \alpha) + \beta E[\max(U^{r'}, U^{b'})^{1-\gamma}]^{1/\theta} \right\}^{\theta/1-\gamma},$$

subject to:

$$p_t^c c_t + p_t^{im} + T_t(1 - \tau) + m_t^p + m_t^i(1 - \tau) \leq \ddot{Y}_t,$$

where p_t^c is the current price level, p_t^{im} is the price of insurance and maintenance, T_t is the property tax, τ is the households effective marginal tax rate, m_t^p and m_t^i are respectively the principal and the interest portions of the mortgage payments. Parameter α represents the utility premium from housing.

The above utility is a standard way of parameterizing expected utility of consumption notably used by Epstein and Zin (1989). The coefficient of relative risk aversion γ reflects marginal utility of consumption in every period and determines benefits from consumption smoothing. β is the discount factor and θ is the constant elasticity aggregator that reflects intertemporal substitutability between current consumption and the expected utility of the future consumption. If $\theta = 1$, today's consumption is perfectly substitutable for the expected utility of the future consumption, where β is the rate of that substitution. θ is related to the elasticity of intertemporal substitution ψ as $\theta = (1 - \gamma)/(1 - 1/\psi)$.

To simplify matters, we assume that housing, either rented or owned, increases utility by a constant amount in every period and therefore is not relevant for utility maximization. The owners instead get higher utility from consumption. When $\alpha = 0$, the household is indifferent between renting and buying. When $\alpha > 0$, the household prefers owning to renting. If we further assume that $\alpha = 0$ so that the household is indifferent between renting and owning, then the household utility function is maximized when wealth is maximized. A useful way to view this parameter is to think that it captures the difference in housing attributes between an owned and a rented dwelling. It could be the ''pride of ownership'' or just the difference between rental and owned housing. For example, the nicest houses are not available for rent or that there are no rentals in a certain neighborhood. This parameter is germane for proper interpretation of our findings in the context of expected utility. Depending on the value of α, the household can prefer to own regardless of its implications for wealth accumulation. As a matter of fact, if α is sufficiently high, the household will always prefer to own. However, assuming $\alpha = 0$ is the federal government's default policy position concerning the efficacy of homeownership. Said another way, housing policy that examines the buy-versus-rent decision implicitly assumes that $\alpha = 0$ and therefore evaluates the buy-versus-rent decision strictly in a wealth accumulation framework.

The owner's wealth in period N is given by the sale price of the house:

$$W_N = p_N^b.$$

The expected transaction price of the house is calculated as:

$$p_N^b = p_0^b(1 + g^b)^N(1 - x) - b_0,$$

where p_0^b is the purchase price of the house, g^b is annual growth rate of housing prices, N is the duration of the holding period, x is the transaction cost of selling in ad valorem terms, and b_N is the mortgage balance at the end of the N-year holding period. The final mortgage balance is determined by subtracting the sum of the principal portion of the mortgage payments m^p from the initial mortgage balance b_0 as:

$$b_N = b_0 + \Sigma_{t=1}^N m_t^p.$$

In order to match the discrete time nature of the data used in the quantitative exercise, we setup the model in discrete time (i.e., each period is a year).

Household-renter

The household's value function from renting can be expressed as:

$$U^r = \max_c \left\{(1 - \beta)\left(\frac{c}{p^c}\right)^{1-\gamma/\theta} + \beta E[\max(U^{r'}, U^{b'})^{1-\gamma}]^{1/\theta}\right\}^{\theta/1-\gamma},$$

subject to:

$$p_t^c + c_t p_t^r \leq \ddot{Y}_t - s_t,$$

where p_t^r is the rent and s_t is the annual contribution to the investment portfolio of the renting household. Wealth of a renting household at the end of the N-year holding period equals the value of the investment portfolio in period N:

$$W = [p_0^b + l - b_0] + (\Sigma_{t=1}^N s_t + v_{t-1}r + p_0^r(1 + g^r)^t)(1 - \tau^k),$$

where r is the normal return on an investment portfolio of comparable risk, l is the closing cost, g^r is the annual increase in rent, τ^k is the capital gain tax, and v_{t-1} is the value of the investment portfolio in period $t - 1$. Notice that the term in the square brackets represents the initial contribution to the investment portfolio.

The annual contribution to the investment portfolio is endogenously determined based on the consumption level and permanent income. The assumption of costless transferability of permanent income into current period liquid assets is crucial because otherwise liquidity-constrained household will vary consumption, and thus savings, depending on the discount factor β. If the discount is large, such households will not save. This issue is not a concern for the relative decision to rent versus buy under the permanent income hypothesis assuming that households can costlessly borrow against equity. Higher wealth either in the renter's portfolio or owner's equity can be costlessly transferred into current period income.

In reality, the observed saving behavior of households often deviates from the theoretical benchmark presented in this section. In particular, households may fail to reinvest the differential cash flow from renting versus owning. This possibility is explored in the section on controllable factors.

The theoretical model presented in this section is capable of matching various behavior patterns, but our focus is on the maximization of welfare if we assume away the preference for housing. The model is also useful to illustrate that wealth maximization does not generally coincide with utility maximization. Most importantly, however, the model allows us to place our main question into the expected utility maximization context, and by setting $\alpha = 0$ allows for an examination of the buy-versus-rent ownership puzzle described earlier and its implications for public housing policy.

This framework omits multiple important real-life considerations that are undoubtedly present in a decision by the average household. Specifically, we have abstracted from shocks to the household state variables that might trigger a change in the rent-own decision. Additionally, we do not consider any preferences for the holding of liquid assets, or cost of borrowing against equity. Finally, a variety of state variables including overall level of income, location, temporariness of demand for housing, housing market conditions may make strictly renting or owning not the only feasible choice. While important these considerations lie outside the scope of our present analysis.

Operationalizing the Utility Maximization Model with $\alpha = 0$

Data

The same main data sources used in Beracha and Johnson (2012) are employed in our analysis. First, in order to identify the average U.S. rent-to-price ratio through time, we rely on a dataset constructed by Davis, Lehnert, and Martin (2008) for the stock of owner-occupied housing. This rent-to-price index is based on five micro datasets from the Decennial Censuses of Housing (DCH) surveys with price indexes for housing prices and rents between 1960 and 2000. To improve the quality of the index, Davis, Lehnert, and Martin use a hedonic model to control for the size, age, number of bedrooms, and location of the property. The authors use rent and house price indexes to interpolate rent-to-price ratios between the DCH surveys and to extrapolate them beyond the year 2000. The original dataset includes rent-to-price ratios for the 1978 and 2007 period on a semiannual basis.[4] We extrapolate the data to the end of 2010 by employing the same methodology described by Davis, Lehnert, and Martin. The extrapolation is based on the Bureau of Labor Statistics (BLS) rent indexes and home price indexes from the Federal Housing Finance Agency (FHFA).

Home price indexes from the FHFA for the U.S. are also employed to calculate housing price appreciation and volatility. The average 30-year fixed mortgage rates are obtained from Freddie Mac and converted from a monthly to a six-month average rate that was offered to borrowers during the first and second half of each year in the sample period.[5] Finally, the risk-free rate and the broad stock market returns are obtained from Ken French's data library.[6]

The Model and General Procedures

The analysis in this section is based on the model presented by Beracha and Johnson (2012) and flows from the general utility maximization decision outline in the previous

section. That is, a sensitivity analysis of the buy-versus-rent decision with $\alpha = 0$ is conducted. Readers who are not familiar with Beracha and Johnson's buy-versus-rent model and its assumptions may refer to the Appendix of this paper as a quick reference guide. A more general description of how the model provided by Beracha and Johnson is modified in order to enable this present work follows.

First, for the 1978–2010 period, an ex ante and ex post horserace comparison between buying and renting a home is executed using the default assumptions used in Beracha and Johnson (2012). Then, a sensitivity analysis in both ex ante and ex post is performed where single factors are changed in isolation.

When presenting the results, the factors that affect the monetary outcome of the buy-versus-rent decision are segmented into three groups. The first and second groups include factors that are not under the control of the buy-versus-rent decision maker and that are observable and unobservable at the time the decision is made, respectively. The third group includes factors that are partially or fully under the decision maker's control.

Buy versus Rent Comparisons: Sensitivity Analysis

To perform a sensitivity analysis with regard to the monetary outcome of the buy-versus-rent decision, each input factor is changed in isolation. By changing each input factor in isolation, it is possible to observe the magnitude of the contribution of each particular factor to the outcome. The input factors, as mentioned above, are classified into three groups. The first group includes factors on which the individual making the buy-versus-rent decision has no control, but are observable to the decision maker at the time of the buy-versus-rent decision. This grouping includes the initial mortgage interest rate[7] and the initial rent-to-price ratio.[8] The second grouping also includes factors over which the decision maker has no control; however, these factors, unlike the first grouping, are unobservable at the time of the buy versus rent decision. This grouping includes the return on investment earned on the renter portfolio (opportunity cost), the rate of home price appreciation, and the rate of rent price increase. Finally, the third grouping includes factors on which the decision maker has partial or full control over at (or after) the time of the buy-versus-rent decision. The factors included in this group are the amount of down payment, the property holding period, whether and how excess cash flows are reinvested, and the quality and size of the home the individual considers renting relative to the home the individual considers purchasing.

For each factor, the effect of a 10% and 20% change in expected value on the ex ante probability that renting is preferred to buying and on the ex ante expected value of the renter's investment portfolio divided by the buyer's sale proceeds is reported. An ex ante probability greater/less than 0.50 indicates renting/buying is the superior choice. An ex ante ratio greater/less than one of the expected value of the renter's investment portfolio to the buyer's sale proceeds indicates that renting/buying is expected to outperform buying/renting. Additionally, the values of each factor during the 1978–2010 period are segmented into quintiles and the ex post renter portfolio to buyer's sale proceeds outcome ratio associated with each quintile is also reported.

Results

Observable Factors

Exhibit 2 focuses on the mortgage interest rate and the rent-to-price variables. These factors are observable at the time of the buy-versus-rent decision, but the decision maker cannot control them. Panels A and B illustrate the effect of a higher or lower value of each factor on the ex ante model generated probability that renting is preferred to owning and on the expected value of the renter's investment portfolio divided by the owner's sale proceeds.

According to Panels A and B, the ex ante buy-versus-rent expected outcome displays similar sensitivity to changes in the rent-to-price ratio as it does to changes in the mortgage interest rate. Additionally, the effect of each of these factors in isolation on the buy-versus-rent expected outcome is moderate. For example, a rent-to-price ratio that is 20% higher, on average, than the observed rent-to-price ratio changes the expected probability that renting is preferred to buying from 75.6% to 60.8%, and the ratio of expected renter's portfolio value to buyer's sale proceeds ranges from 1.37 to 1.21. Similarly, mortgage interest rates that are 20% lower[9] than their observed values during the examined time period cause the ex ante probability that renting is preferred to buying to be 63.3% and the ratio of expected portfolio to sale proceeds to decrease to 1.21.

Panel C of Exhibit 2 reports the ex post effect of making a buy-versus-rent decision during periods of lower or higher rent-to-price ratio or mortgage interest rates. The results indicate that buying a home during times associated with low mortgage rates (4^{th} and 5^{th} quintile) results in higher wealth. The two lowest interest rate quintiles are both associated with a portfolio value to sale proceeds ratio that is lower than one, indicating that homeowners' sale proceeds are slightly higher than renters' investment portfolio, on average, at the end of the holding period. On the other hand, buying a home during times where initial mortgage rates are slightly higher (1^{st}, 2^{nd} or 3^{rd} quintiles) yields a renter's portfolio value to sale proceeds ratio that is materially higher than one and ranging from 1.62 to 1.92, on average. This suggests that despite the ability of mortgage refinancing,[10] renting is significantly better than buying during times associated with average or higher than average initial mortgage rates. Surprisingly, in hindsight, periods of higher rent relative to home prices are on average better times to rent rather than buy (portfolio value to sale proceeds of 1.71 in the 5^{th} quintile). However, periods with the lowest initial rent-to-price still favor renting over buying but by a smaller margin (portfolio value to sale proceeds ratio of 1.31 in the 1^{st} quintile). These results are counterintuitive, as one would expect that an initial lower rent-to-price ratio would benefit renters. A plausible explanation for these results is that other buy-favoring factors are likely to be more prominent at times when the rent-to-price ratio is low, hence offsetting the benefit embedded in a low rent-to-price ratio.

In summary, these observable but unactionable macro-market variables have only a moderate impact on the buy-versus-rent decision maker's wealth accumulation. The one possible surprising outcome occurs when higher rents are associated with renting as the superior decision.

Exhibit 2. Observable Factors

Panel A: Ex Ante Probability that Renting is Preferred

Rent-to-Price Ratio		**−20%**	**−10%**	**Original**	**+10%**	**+20%**
	Average	87.25	81.90	75.60	68.46	60.82
	Median	90.10	86.05	78.55	71.30	62.80
	Min.	56.30	43.80	33.30	22.70	16.80
	Max.	99.90	99.30	98.20	97.80	97.80
Interest Rate		**+20%**	**+10%**	**Original**	**−10%**	**−20%**
	Average	85.42	80.93	75.60	69.86	63.25
	Median	89.20	84.15	78.55	72.65	65.20
	Min.	47.70	40.20	33.30	26.70	21.00
	Max.	99.40	99.30	98.20	97.60	95.70

Panel B: Ex Ante Expected Portfolio Value Divided by Sale Proceeds

Rent-to-Price Ratio		**−20%**	**−10%**	**Original**	**+10%**	**+20%**
	Average	1.53	1.45	1.37	1.29	1.21
	Median	1.40	1.32	1.24	1.18	1.10
	Min.	1.05	0.97	0.91	0.84	0.77
	Max.	2.82	2.59	2.59	2.47	2.41
Interest Rate		**+20%**	**+10%**	**Original**	**−10%**	**−20%**
	Average	1.54	1.45	1.37	1.29	1.21
	Median	1.37	1.30	1.24	1.20	1.14
	Min.	1.00	0.95	0.91	0.86	0.83
	Max.	3.13	2.78	2.59	2.39	2.12

Panel C: Actual (Ex Post) Portfolio Value Divided by Sale Proceeds by Quintiles

Rent-to-Price Ratio		**1st**	**2nd**	**3rd**	**4th**	**5th**
	Average	1.31	1.47	1.35	1.40	1.71
	Median	1.24	1.63	1.06	1.30	1.70
	Std. Dev.	0.45	0.74	0.64	0.35	0.06
	Min.	0.77	0.64	0.68	1.02	1.62
	Max.	1.93	2.40	2.28	1.96	1.81
Interest Rate		**1st**	**2nd**	**3rd**	**4th**	**5th**
	Average	1.84	1.92	1.62	0.95	0.90
	Median	1.85	1.85	1.70	0.86	0.88
	Std. Dev.	0.12	0.30	0.34	0.22	0.25
	Min.	1.65	1.59	1.05	0.72	0.64
	Max.	2.04	2.40	2.19	1.36	1.32

Note: The 1st quintile is defined as the independently most beneficial for renters. 1st is lowest rent-to-price ratio and highest mortgage interest rate.

Unobservable Factors

We repeat the sensitivity analysis reported in Exhibit 2 for the variables on which the individual in their buy versus rent decision has no control and are also not observable at the time the decision is made. These variables include home price appreciation, rent price growth, and investment portfolio return. As in Exhibit 2, Panel A of Exhibit 3 illustrates the effect of a higher or lower value of each of the three factors on the ex ante model generated probability that renting is preferred to owning. Similarly, Panel B of Exhibit 3 reports the effect of a higher or lower value of each factor on the ex ante expected value of the renter's investment portfolio divided by the owner's sale proceeds. Finally, Panel C reports the ex post effects of making a buy versus rent decision during times that precede particularly high or low rates of price appreciation, rent growth, and portfolio return.

Lower home price appreciation and higher return on the renter investment portfolio have a similar effect on the expected monetary outcome of the buy-versus-rent decision. The sensitivity of the buy-versus-rent outcome to these two variables is also comparable to the sensitivity of the outcome to changes in the initial rent-to-price ratio or the mortgage interest rate presented in Exhibit 1. That is to say, their impact is rather marginal.

An assumption of home price appreciation that is 10% or 20% lower than originally expected increases the probability that renting is preferred to 81.7% and 86.6% from 75.6%, respectively. Given the same scenarios, the expected values of the renter's portfolio relative to purchaser's sale proceeds increase to 1.46 and 1.57, on average. A return on the renter's investment portfolio that is 10% (20%) higher than is expected value yields a 79.2% (82.7%) probability that renting is preferred to buying and a portfolio to sale proceeds ratio of 1.42 (1.47). The sensitivity of the buy-versus-rent outcome to changes in the expected future rent growth is materially smaller. For example, expected rent growth that is 20% higher or lower than original expected value only changes the ex ante probability that renting is preferred or the portfolio to sale proceeds ratio by less than 2%.

The results presented in Panel C in Exhibit 3 reveals that, ex post, buying is preferred to renting during time periods associated with the top 20% in terms of home price appreciation or with the bottom 20% in terms of portfolio return. These extreme time periods produce portfolio to sale proceeds ratios of 0.78 when price appreciation was high and 0.86 when return on investment portfolio was low. In all the other four quintiles, however, the portfolio to sale proceeds ratio is higher than 1, indicating that, ex post, renting was preferred to buying the vast majority of the time, conditioned on price appreciation or portfolio return. The ex post effect of lower or higher rent growth is inconsistent with the intuition that a lower (higher) rate of increase in rent is beneficial to renters (buyers). According to the results reported in Panel C, periods associated with the middle quintile of rent growth yielded a portfolio to sale proceeds ratio of less than 1, on average. However, both lower and higher observed rates of rent growth produced increasingly higher ratios that reach an average of 1.86 and 1.74 for the first and fifth quintiles, respectively.

In summary, the influence of these factors is also rather moderate. One surprise, however, does emerge here. The impact of property price appreciation is rather moderate. For

Exhibit 3. Unobservable Factors

Panel A: Ex Ante Probability that Renting is Preferred

Price Appreciation		**−20%**	**−10%**	**Original**	**+10%**	**+20%**
	Average	86.55	81.71	75.60	68.84	62.16
	Median	89.50	85.75	78.55	71.30	64.05
	Min.	53.30	43.60	33.30	23.00	17.20
	Max.	99.80	99.40	98.20	98.50	98.40
Rent Growth		**−20%**	**−10%**	**Original**	**+10%**	**+20%**
	Average	77.43	76.58	75.60	74.59	73.18
	Median	79.80	80.20	78.55	78.55	76.50
	Min.	35.80	32.60	33.30	31.30	29.90
	Max.	99.10	98.60	98.20	98.50	98.50
Portfolio Return		**+20%**	**+10%**	**Original**	**−10%**	**−20%**
	Average	82.67	79.24	75.60	71.85	67.86
	Median	87.30	83.35	78.55	74.75	70.00
	Min.	43.70	38.20	33.30	28.70	24.60
	Max.	99.60	99.00	98.20	98.40	97.60

Panel B: Ex Ante Expected Portfolio Value Divided by Sale Proceeds

Price Appreciation		**−20%**	**−10%**	**Original**	**+10%**	**+20%**
	Average	1.57	1.46	1.37	1.28	1.21
	Median	1.41	1.32	1.24	1.18	1.11
	Min.	1.05	0.97	0.91	0.85	0.80
	Max.	3.08	2.82	2.59	2.35	2.39
Rent Growth		**−20%**	**−10%**	**Original**	**+10%**	**+20%**
	Average	1.39	1.38	1.37	1.35	1.34
	Median	1.26	1.26	1.24	1.24	1.22
	Min.	0.94	0.91	0.91	0.89	0.87
	Max.	2.61	2.62	2.59	2.61	2.67
Portfolio Return		**+20%**	**+10%**	**Original**	**−10%**	**−20%**
	Average	1.47	1.42	1.37	1.32	1.28
	Median	1.37	1.30	1.24	1.20	1.15
	Min.	0.98	0.94	0.91	0.87	0.83
	Max.	2.73	2.67	2.59	2.61	2.42

Panel C: Actual (Ex Post) Portfolio Value Divided by Sale Proceeds by Quintiles

Price Appreciation		**1st**	**2nd**	**3rd**	**4th**	**5th**
	Average	1.92	1.50	1.59	1.44	0.78
	Median	2.03	1.66	1.69	1.47	0.73
	Std. Dev.	0.41	0.33	0.31	0.46	0.17
	Min.	1.16	0.84	1.12	0.84	0.64
	Max.	2.40	1.83	1.91	2.04	1.21

Exhibit 3. Unobservable Factors (continued)

Rent Growth		1st	2nd	3rd	4th	5th
	Average	1.86	1.47	0.85	1.32	1.74
	Median	1.86	1.46	0.85	1.64	1.85
	Std. Dev.	0.39	0.45	0.18	0.49	0.27
	Min.	1.32	0.84	0.64	0.66	1.21
	Max.	2.40	2.17	1.12	1.78	2.04
Portfolio Return		**1st**	**2nd**	**3rd**	**4th**	**5th**
	Average	1.74	1.68	1.88	1.07	0.86
	Median	1.85	1.70	2.03	0.97	0.81
	Std. Dev.	0.27	0.16	0.44	0.38	0.23
	Min.	1.21	1.36	1.12	0.68	0.64
	Max.	2.04	1.90	2.40	1.76	1.32

Note: The 1st quintile is defined as the independently most beneficial for renters. 1st is lowest price appreciation, lowest rent growth, and highest ROI.

example, a 20% increase in appreciation only decreases the ex ante probability that renting is preferred marginally (drops from 75.6% to 62.2%). Said another way, if over the study period property appreciation had been 20% higher, then renting was still the superior decision in the majority of cases.[11] Thus, homeownership does not appear to be the great levered equity creator through property appreciation as it has so often been casually touted and directly suggested in Rohe, Van Zandt, and McCarthy (2002).

Controllable Factors

Exhibit 4 illustrates the ex ante and ex post sensitivity of the buy-versus-rent outcome to factors that can be partially or fully controlled by the decision maker. These factors include the size or quality of the home purchased relative to the rented property, whether or not (and how) the renter chooses to reinvest the difference between the amount of rent paid and the total cash flow spent by homeowners, the holding period of the property before a different property is rented or purchased, and the initial amount spent on a down payment.

Panels A and B of Exhibit 4 show that the property holding period does not have a material effect on the buy-versus-rent outcome. Lengthening the holding period from 6 to 10 years only reduces the probability that renting is preferred to buying from 78.0% to 73.9%. Moreover, the ex ante expected portfolio to sale proceeds ratio actually increases from 1.35 to 1.39, on average, as the holding period lengthens. The low sensitivity of the buy-versus-rent outcome to the holding period is a result of the benefit from reducing the frequency of homeowner's fixed costs (closing costs and selling expenses) on the one hand set against a reduction in tax benefits from an interest deduction as the outstanding mortgage amount gradually decreases on the other hand.

Increasing the down payment amount from 20% to 40% has a smaller ex ante effect on the buy-versus-rent outcome compared with reducing the down payment amount from

Exhibit 4. Controllable or Partially Controllable Factors

Panel A: Ex Ante Probability that Renting is Preferred						
Home Size / Quality		**−20%**	**−10%**	**Equal**	**+10%**	**+20%**
	Average	87.25	81.90	75.60	68.46	60.82
	Median	90.10	86.05	78.55	71.30	62.80
	Min.	56.30	43.80	33.30	22.70	16.80
	Max.	99.90	99.30	98.20	97.80	97.80
Reinvesting			**Risk eq**	**Rf**	**Only dp**	
	Average		75.60	64.75	16.07	
	Median		78.55	64.30	14.45	
	Min.		33.30	23.60	5.30	
	Max.		98.20	98.50	39.80	
Holding Period		**6 years**	**7 years**	**8 years**	**9 years**	**10 years**
	Average	77.99	76.75	75.60	75.04	73.91
	Median	81.90	81.15	78.55	77.60	77.80
	Min.	36.70	35.70	33.30	30.50	29.10
	Max.	98.90	98.70	98.20	98.60	98.20
Down Payment		**40%**	**30%**	**20%**	**10%**	**0%**
	Average	78.98	77.44	75.60	72.71	60.01
	Median	80.80	80.00	78.55	75.40	65.40
	Min.	44.20	38.50	33.30	26.40	22.00
	Max.	99.70	98.90	98.20	97.70	84.10
Panel B: Ex Ante Expected Portfolio Value Divided by Sale Proceeds						
Home Size / Quality		**−20%**	**−10%**	**Equal**	**+10%**	**+20%**
	Average	1.53	1.45	1.37	1.29	1.21
	Median	1.40	1.32	1.24	1.18	1.10
	Min.	1.05	0.97	0.91	0.84	0.77
	Max.	2.82	2.59	2.59	2.47	2.41
Reinvesting			**Risk eq**	**Rf**	**Only dp**	
	Average		1.37	1.24	0.70	
	Median		1.24	1.11	0.70	
	Min.		0.91	0.84	0.58	
	Max.		2.59	2.50	0.94	
Holding Period		**6 years**	**7 years**	**8 years**	**9 years**	**10 years**
	Average	1.35	1.36	1.37	1.38	1.39
	Median	1.23	1.24	1.24	1.26	1.27
	Min.	0.93	0.92	0.91	0.90	0.89
	Max.	2.55	2.53	2.59	2.75	2.67
Down Payment		**40%**	**30%**	**20%**	**10%**	**0%**
	Average	1.25	1.29	1.37	1.54	1.28
	Median	1.22	1.24	1.24	1.31	1.16
	Min.	0.96	0.94	0.91	0.87	0.81
	Max.	1.87	2.14	2.59	3.45	2.29

Exhibit 4. Controllable or Partially Controllable Factors (continued)

Panel C: Actual (Ex Post) Portfolio Value Divided by Sale Proceeds by Quintiles

Home Size / Quality		**−20%**	**−10%**	**Equal**	**+10%**	**+20%**
	Average	1.62	1.52	1.45	1.33	1.23
	Median	1.81	1.71	1.61	1.51	1.41
	Std. Dev.	0.53	0.50	0.50	0.45	0.43
	Min.	0.75	0.70	0.64	0.59	0.54
	Max.	2.48	2.34	2.40	2.05	1.91
Investment dp only		**1st**	**2nd**	**3rd**	**4th**	**5th**
	Average	1.00	0.78	0.72	0.55	0.35
	Median	0.99	0.78	0.73	0.55	0.35
	Std. Dev.	0.10	0.02	0.04	0.07	0.04
	Min.	0.82	0.76	0.64	0.44	0.31
	Max.	1.14	0.82	0.76	0.64	0.41
Holding Period		**6 years**	**7 years**	**8 years**	**9 years**	**10 years**
	Average	1.43	1.42	1.45	1.44	1.46
	Median	1.48	1.55	1.61	1.59	1.62
	Std. Dev.	0.45	0.46	0.50	0.50	0.53
	Min.	0.66	0.63	0.64	0.67	0.72
	Max.	2.14	2.17	2.40	2.32	2.27
Down Payment		**40%**	**30%**	**20%**	**10%**	**0%**
	Average	1.31	1.36	1.45	1.53	1.70
	Median	1.47	1.54	1.61	1.69	1.79
	Std. Dev.	0.37	0.41	0.50	0.58	0.76
	Min.	0.67	0.66	0.64	0.61	0.58
	Max.	1.82	1.97	2.40	2.54	3.22

Notes: The 1st quintile is defined as the independently most beneficial for renters. Size/quality −20% means rental is 20% smaller/lower quality than the purchased home. 1st is highest portfolio return.

20% to 0%. With a 0% down payment, renting a home is expected to be preferred to owning a home 60.0% of the time while a 40% down payment is expected to favor renting 79.0% of the time. The driving factor here appears to be the forgone opportunities for reinvesting the down payment. The ratio of expected portfolio value to sale proceeds does not follow the same pattern as the probability that renting is preferred with regards to the down payment amount. As the down payment decreases, the ratio first increases and then decreases. The inconsistency between these two buy-versus-rent indicators is a product of the high volatility associated with extreme levels of leverage.

Choosing a rental property of a lower quality or size compared with the property considered for purchase has a material and mostly linear effect on the monetary outcome of the buy-versus-rent decision.[12] For each 10% change in quality or size, the expected ratio of portfolio value to sale proceeds changes by about 8%. Similarly, the probability that renting is preferred to buying decreased steadily from 87.3% where the rental

property is 20% smaller or of lower quality compared with the purchased property to 60.1% when the rental property is 20% larger or of higher quality compared with the purchased property. This result most certainly occurs because, on average, rental properties are smaller and of inferior quality compared with owner-occupied properties. Thus, the higher probability that renting is preferred becomes the most likely scenario.

While *how* a renter plans to invest the marginal monetary difference between the rent amount and the cash flows associated with homeownership matters (see risk equal versus risk-free reinvestment outcomes in Exhibit 4), *whether or not* a renter invests this marginal amount is by far the most crucial factor that affects the expected buy-versus-rent monetary outcome. For example, a renter, who chooses to invest all monies that otherwise would be spent on owning a home at the risk-free rate rather than at a risk-equal portfolio, is expected to end up with 24% rather than 37% more than the homeowner expected sale proceeds. At the same time, the renter reduces the ex ante probability that renting is preferred from 75.6% to 64.8%. However, a renter that only invests an amount equal to the down payment and closing costs, but fails to invest any additional expected differential cash flows resulting from the gap between the rent amount and the amount spent on owning is expected to end up with a portfolio value that is 30% *less* than the expected sale proceeds. Moreover, under this scenario, the probability that renting is preferred drops to 16%, which implies that buying is preferred to renting with an average ex ante probability of 84%.

The ex post results in Panel C of Exhibit 4 generally confirm the ex ante results from Panels A and B. The property holding period and the quality or size of the rental property compared with the owner-occupied property effect on the buy-versus-rent outcome is similar to the ex ante expectations. As in Panels A and B, the flip in favor of ownership remains staggering once the reinvestment requirement of differential cash flows is dropped. Even during the periods included in the worst quintile, the ratio of portfolio value to sale proceeds for homeowners does not favor renting. All the other periods favor ownership with a ratio of portfolio value to sale proceeds tumbling as low as 0.35, on average, for the 5th quintile. These results reinforce the argument that renters' spending or lack of saving behavior and attitude toward investments is the most important factor potential renters or homebuyers should consider when making such decisions. This suggests that individuals with the tendency to spend rather than invest any additional free cash flow resulting from renting should be buying a home. For these individuals, homeownership serves as a self-imposed saving vehicle where monthly amounts equal to the principal portion of the mortgage are deposited and carry a return equal to the mortgage interest rate.

Exhibits 5 and 6 further highlight this conclusion. They show the ex ante probability that renting is preferred to ownership plotted against the ex ante relation between renters' portfolio values to sale proceeds from ownership throughout the time period of the study. More specifically, these results are displayed both with and without reinvestment of differential cash flows. Once the monastic reinvestment requirement of Beracha and Johnson (2012) is removed, it becomes clear that ownership is preferable in most all of the ''horseraces.'' Exhibit 5 clearly shows that ex ante probabilities favor ownership after the reinvestment decision is removed. Exhibit 6 reveals the same in terms of the ratio of portfolio values to sale proceeds.

Exhibit 5. Ex Ante Probability that Renting is Preferred to Buying: 1978–2010

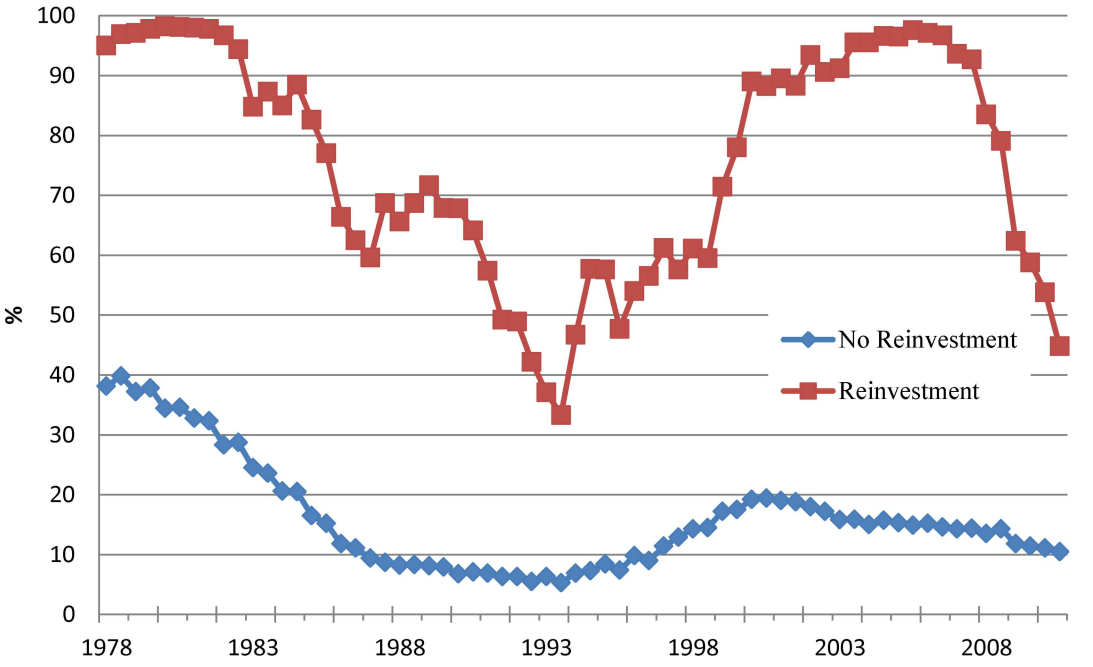
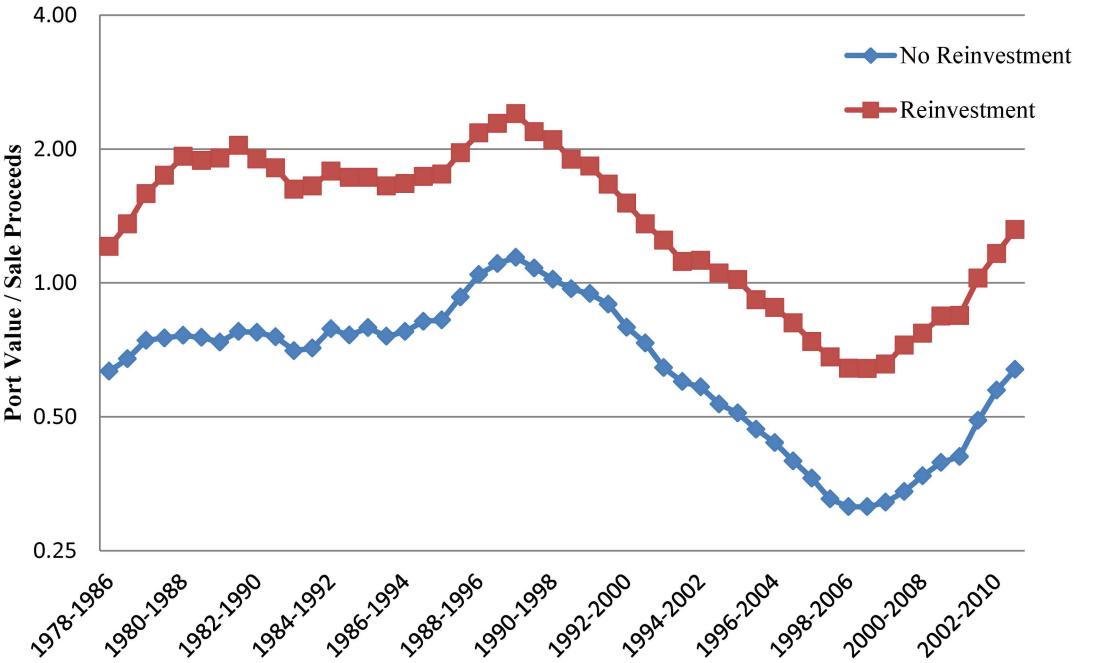


Exhibit 6. Ex Post Portfolio Value Divided by Sale Proceeds: 1978–2010



As for the ex post outcome sensitivity to the amount of down payment, the results show that the lower the down payment amount, the higher the average ratio between the renters investment portfolio and owner sale proceeds. A higher portfolio to sale proceeds ratio is also accompanied with a higher standard deviation of that ratio, which is expected when homeowners use more leverage to buy their home.

Conclusion

It has long been accepted that homeownership rather than renting is the preferable path to wealth creation (Haurin, Hendershott, and Wachter, 1996; Di, Belsky and Liu, 2007). Academics, policy makers, and the general citizenry have all been in agreement on this point. Singing in unison: ''Why rent when you can own,'' ''Don't throw your money away on rent,'' ''Buy now and get in on the appreciation,'' and ''Renters only pay their landlord's mortgage,'' are among other age-old standards that blindly support homeownership over renting. Even in light of the recent downturn in housing, the homeownership level remains at roughly 66%. Beracha and Johnson (2012) shed some doubt on this long held and passionately supported paradigm when they point out that in a strict ''horserace,'' where renters are forced to reinvest the differential cash flows between renting and owning, renting (not owning) turns out to be the superior decision in terms of wealth creation.

In this paper, we reconcile Beracha and Johnson (2012) with the ''American Dream'' of homeownership by performing a sensitivity analysis on the parameters found in their buy-versus-rent model, which is simply an operational model of the utility maximizing framework outlined herein with $\alpha = 0$. Three key results flow from the performance of this sensitivity analysis. First, households through their own actions have more control over their overall wealth than do uncontrollable market variables. Second, households that are likely to not reinvest buy-rent cash differentials should mostly own rather than rent their primary residence as ownership forces them to save. Finally, collateral results also stand out, such as the relative unimportance of property appreciation, further suggesting that ownership is a savings vehicle. Taken as a whole, these results suggest that the American Dream is alive and well but in need of revision. To that end, we offer, ''Not all but most should own rather than rent due to ownership's embedded commitment to save.'' This should be the new paradigm and public housing policy should reflect the full story behind American Dream of homeownership.

Finally, we suggest additional avenues of research. In particular, investigating the optimal homeownership level from a monetary standpoint seems warranted. The need for investigation into this avenue of research is highlighted when the reinvestment assumption is dropped from the buy-versus-rent model. When this is done, 16% of the outcomes result in renting outperforming ownership in wealth creation over the holding period. Thus, even under the most liberal conditions in favor of ownership, some individuals are still better off renting. This implies that an optimal level of homeownership exists. Said another way, not all people should own their residence. Clearly, the settlement of issues such as liquidity and credit impairments influence ownership levels (Calmen, Firestone, and Wachter, 2010), the relation between price and per capita income levels and ownership rates (Bischoff, 2012), and the cause(s) of property bubbles

(Agnello and Schuknecht, 2011), among others, will all need to be incorporated into the analysis of the optimal level of homeownership. While the determination of this optimal level of ownership is critical to future housing policy, it is, however, beyond the scope of this paper.

Appendix

Buy-versus-Rent Analysis: The Model

As per Beracha and Johnson (2012), a model that simulates an individual that faces a buy-versus-rent decision at different times and locations is constructed. Under the scenario that the individual buys a home, the model calculates the sale proceeds the individual expects to receive at the time of disposition of the property. The model does not allow sale proceeds to turn negative due to severe housing depreciation as any rational homeowner is assumed to take advantage of the mortgage default option in these situations. If the individual rents a home, the model calculates the expected value of an investment portfolio funded with money that otherwise would be used for homeownership at the end of the holding period. Higher expected proceeds from sale compared with the expected value of the renter's investment portfolio suggest that the individual is better off buying a home. Conversely, if the expected proceeds from sale are lower than the expected future value of the renter's portfolio, renting a home is recommended. More formally:

$$SP_{bp} < 0 \rightarrow SP_{bp} = 0$$

$$SP_{bp} \geq 0 \rightarrow SP_{bp} = SP_{bp} \tag{A.1}$$

and

$$SP_{bp} > IP_{bp} \rightarrow Buy$$

$$SP_{bp} < IP_{bp} \rightarrow Rent$$

$$SP_{bp} = IP_{bp} \rightarrow Indifferent \tag{A.2}$$

where SP_{bp} is the expected sale proceeds at the end of the holding period and IP_{bp} is the expected value of the investment portfolio at the end of the rent period. Thus, the model used in this piece does not seek to calculate the cost of ownership but rather to create a ''horserace'' between renting and owning by making a comparison between the value of an investment portfolio held by renters and the net selling proceeds collected by homeowners at the end of a holding period.

The original assumptions made in the Beracha and Johnson (2012) model regarding the buy scenario are the following. The individual uses a typical 20% down payment and the remaining balance is financed with a conventional 30-year fixed rate mortgage at the average market interest rate at the time of purchase. Additionally, following Verbrugge (2006), the individual pays closing costs[13] of 2% of the purchase price of the property, along with the original purchase price at the date of closing. The expected property

holding period is eight years,[14] and the individual pays 6% in selling fees at the end of the holding period. As per Himmelberg, Mayer, and Sinai (2005), the individual annually faces property taxes of 1.5% of the property value and maintenance and insurance expenses of an additional 2% during the holding period.[15] The individual also anticipates that all expenses associated with owning the property (property tax, insurance, and maintenance) will increase each year at a rate equal to the price appreciation of the property. Finally, in the model, it is assumed that the individual itemizes and is in the 25% marginal tax rate bracket. Symbolically, the sum of annual outflows (out-of-pocket expenses) for the individual from homeownership is:

$$OF_t = IM_t + PT_t * (1 - \tau_I) + P_t + i_t * (1 - \tau_I), \tag{A.3}$$

where OF_t is the sum of individuals cash outflows during year t, IM_t, and PT_t are the cost of insurance plus maintenance and property tax at time t, respectively. P_t and i_t are the portions of the mortgage payment that go toward principal and interest during year t, and τ_I is the individual's marginal tax rate. The expected sum of the proceeds from sale at the end of the holding period is calculated using:

$$SP_{bp} = Price_0 * (1 + A)^{bp} * (1 - SE) - MB_{bp}, \tag{A.4}$$

where $Price_0$, A, and SE are the original purchase price, average percentage annual price appreciation of the property, and selling expenses in percentage terms, respectively. The holding period in terms of years is defined as bp, and MB_{bp} is the mortgage balance at the end of the holding period calculated as:

$$MB_{bp} = MB_0 - \Sigma_{t=1}^{bp} P_t, \tag{A.5}$$

where MB_0 is the original mortgage balance and the other parameters are as defined previously. Alternatively, if the individual rents a home, it is assumed that he/she initially seeds an investment portfolio with a sum equaling the total of the down payment and closing costs (CC) under the buy scenario. At the end of each year, the individual deposits into the portfolio an amount equaling the difference between out-of-pocket expenses (OF_t) and the annual amount paid in rent. If the difference between the two happens to be negative, the individual withdraws rather than deposits that amount from the portfolio.[16] According to Himmelberg, Mayer, and Sinai (2005), the opportunity cost associated with homeownership equals the risk-free rate plus an additional risk premium to compensate for the higher risk of owning versus renting. On the other hand, the authors point out that owning a home serves as a hedge against future rent changes, which eliminates much of the risk associated with owning compared to renting.

In this paper, we determine the default opportunity cost (R), which is the return on the renter's investment portfolio calculated as the return on a portfolio of equal risk to their levered residence. Hereafter, this portfolio is referred to as a risk-equal portfolio and it includes a different mix of stocks and risk-free Treasuries to match the risk associated with an average levered residence in the U.S.[17] An opportunity cost that equals the risk-free rate is used as a part of the sensitivity analysis. A 20% capital gain tax (τ_{CG}) on the portfolio is applied and rent is expected to grow each year at rate G. Mathematically, the expected value of the renter's investment portfolio (IP) at the end of the holding period is:

$$IP_{bp} = IP_0 + (\Sigma_{t=1}^{bp}(IP_{t-1} * R + OF_t - Rent_0 * (1 + G)^t) * (1 - \tau_{CG})), \quad (A.6)$$

where:

$$IP_0 = Price_0 - MB_0 + CC \quad (A.7)$$

and

$$IP_t = IP_{t-1} * (1 + R) + OF_t - Rent_0 * (1 + G)^t \quad \text{for } t > 0 \quad (A.8)$$

Here τ_{CG} represents the tax rate for capital gains and $Rent_0$ represents initial rents. All other notations are as defined earlier. The initial rent and purchase prices are derived from the rent-to-price indexes described earlier by setting the price to 100 and calculating the rent price by multiplying the rent-to-price ratio by 100 at $t = 0$.

Equation (A.6) is of particular interest as it accounts for the homeowners benefit from a hedge against a future rise in mortgage payment while receiving constant quality of housing. Renters, on the other hand, face uncertain future rents for a constant quality home. Since we seek to make a ''horserace'' comparison between renting and owning, it is necessary to adjust either the rent or buy side for this accepted benefit from ownership. Accordingly, in order to account for this hedge, rents are grown annually at rate G, which is discussed in the next two subsections, thereby reducing the benefit from renting.

Buy versus Rent Decisions: Ex ante

In order to make an ex ante buy-versus-rent decision, the individual is required to make projections on the future opportunity cost, home price appreciation, and rent growth in the U.S. during the expected holding period. If these projections are employed in equations (A.4) and (A.6), SP_{bp} and IP_{bp} can be calculated and compared to formulate a decision.

The ex ante analysis begins with a decision process that is based on stochastic rent growth, price appreciation, and opportunity cost. Each of these three stochastic factors is assumed to be normally distributed with mean and standard deviation equal to the eight-year mean and standard deviation observed over the 25 years prior to each decision. The probability that renting will be preferred to buying for each period is estimated by running Monte Carlo simulation with 1,000[18] iterations to compare the expected renter's portfolio value to the expected home selling proceeds. To compensate homebuyers for the value of the prepayment and default option embedded in the mortgage, the present value of the mortgage is reduced by 2.9%, which is consistent with the estimated value of these options by Chen, Connolly, Tang, and Su (2009).[19] Additionally, because rent growth, price appreciation, and opportunity cost are correlated and not independent, each of the 1,000 iterations generates values for these three stochastic variables with the same correlation as observed during the 1978–2010 period. Finally, the probability that the potential homeowner stays in the home each year is set to 7/8 (probability of moving is 1/8). Using a staying probability of 7/8 rather than a constant holding period of eight years captures the uncertainty with regard to when selling fees will be paid and over what time period mortgage origination costs are spread.

Buy-versus-Rent Comparisons: Ex post

While future projection of home price appreciation, opportunity cost and rent growth are required in order to determine ex ante whether buying is preferred to renting, ex post comparison can be done by observing these values. This means that in hindsight it can be determined whether buying was preferred to renting assuming the average eight-year holding period. To further simulate homebuyer conditions, the buyer is allowed to take advantage of the mortgage prepayment option and refinance once a year in the event that the after-tax benefits associated with refinancing exceeds the cost of refinancing.[20] Finally, the ex post value of the hypothetical investment portfolio is compared to the amount of proceeds from sale. Comparing these two values provides economic meaning to the monetary difference between buying and renting a home. This comparison is calculated for each eight-year holding period from 1978–1986 through 2002–2010 for the U.S. as a whole and is expressed as the value of the investment portfolio divided by the amount of sale proceeds. A ratio that is larger than 1 indicates that renting was preferred to buying and a ratio that is smaller than 1 suggests the opposite.

Endnotes

[1] During some short time periods, however, when credit requirements are relaxed, most notably the housing boom of the early 2000s, purchasing a home with no down payment is not an uncommon practice.

[2] See http://research.stlouisfed.org/fred2/series/PSAVERT.

[3] The data are from the U.S. Census Bureau. See Table 5 Homeownership Rates at: http://search.census.gov/search?entqr=0&ud=1&output=xml_no_dtd&oe=UTF-8&ie=UTF-8&client=default_frontend&proxystylesheet=default_frontend&site=census&q=homeownership+rates.

[4] The data are available on Morris A. Davis' website: http://morris.marginalq.com/.

[5] Summary statistics traditionally reported are omitted in the interest of space. However, these statistics are available upon request from the authors.

[6] Data are available through Ken French's data library: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[7] Since the homeowner is assumed to take a fixed rate mortgage and refinancing is allowed, borrowing costs can only stay the same or improve during the homeownership period.

[8] The initial insurance amount and property tax are two additional factors on which the decision maker has no control, but are known at the time of the buy-versus-rent decision. These two factors are considered in the buy-versus-rent model, but are excluded from our sensitivity analysis because typical variations in their values have only minimal effect on the outcome.

[9] For example, a 20% lower mortgage rate would change the rate of 8% to 6.4%.

[10] In the model, we allow the home buyers to refinance their mortgage once a year if the after-tax present value of the interest saving is higher than the cost of refinancing, given the expected remaining time until the property is sold.

[11] During the time period examined, the average annual U.S. housing appreciation was 4.69% in nominal terms. A 20% higher price appreciation would yield an average annual housing appreciation of 5.63%.

[12] To simulate a rental property that is of higher or lower quality relative to the purchased property, the nominator of the rent-to-price ratio is modified by the given percentage change.

[13] Closing costs include discount points, mortgage initiation fees, appraisal, lawyer, and recording fees.

[14] According to Hansen (1998), the Census data show that eight years is the average home holding period in the U.S.

[15] In a comment to Smith and Smith (2006), Himmelberg, Mayer, and Sinai (2005) suggest a range of 2%–3% for maintenance and capital expenditure.

[16] This deposit or withdrawal ensures a fair comparison between the final value of the investment portfolio value and the property's proceeds from sale.

[17] Volatility of the broad stock market returns and home prices during the 1978–2010 period are used to calculate the particular risk-equal portfolio for each location. The risk equal portfolio includes a mix of stocks and risk-free Treasuries that yields the same eight-year standard deviation as the equity of a home purchased with 20% down payment.

[18] With 1,000 iterations, the standard deviation of the ex ante probability that renting is preferred to buying is below 1% (about 0.8%). The standard deviation with only 500 iterations is significantly higher at around 1.7%, but an increase in the number of iterations to 3,000 or 5,000 yields only a modest improvement in accuracy.

[19] The value of 2.9% is derived by averaging Chen, Connolly, Tang, and Su (2009) results for a fixed rate mortgage with 0.04 and 0.07 standard deviations in spot rate and 2% refinancing fee. This figure is also in line with the observed value of these options during the 1978–2010 period, which is calculated to be 2.7% and 3.7%, on average, with and without tax consideration, respectively.

[20] The benefit from refinancing is defined as the present value of the after-tax cash flows associated with the marginal interest rate decrease, given the remaining expected mortgage holding period and discounted at the new mortgage rate (i.e., it is an NPV decision).

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