The House Purchase Decision

Leo-Rey C. Gordon

This commentary provides a framework for the evaluation of a house purchase decision. The factors outlined can be used as an initial guide by which one can think about the decision. More specifically, a cost-benefit analysis, with a time-value dimension, is taken in which a consumer compares the option of renting to that of purchasing a house. It is shown that the purchase decision is dependent on the estimated cash saved from renting and the expected rates of return on capital if this savings can be invested.

The Decision

Let's take a consumer, Tobi, who has a tightly constrained budget frontier. Tobi can contemplate two distinct time periods.

i)   Time period $t_1 = 0 \rightarrow n$; time between the origination and the term of the mortgage, n.

ii)   Time period $t_2 = n \rightarrow D$; where D is that time period in which Tobi is unable to experience costs and benefits.

In time period t_1 house ownership equates to a mortgage down payment and Tobi's *house owner annuity*. This house owner annuity includes the frequent mortgage payments and all regular house maintenance expenditures. The former includes interest and principal payments, while the latter includes, but is not limited to - property tax liabilities, expenditures on utilities, insurance, and general upkeep. These characteristics are represented in the equality below. Down payment is the one time cash payment for the origination of the mortgage. Annuity is a vector of the house owner annuity which includes the mortgage payment and maintenance costs over time.

$$House\ Ownership_{t_1} \equiv Down\ Payment_0 + \sum_{t=0}^{n} annuity \begin{bmatrix} mortgage\ payment_t \\ maintenance_t \end{bmatrix} \quad (1)$$

In time period t_2 house ownership now includes two possibilities. In the first scenario it only includes the maintenance portion of the house owner annuity due to the mortgage being fully repaid. The second scenario involves the liquidation of the asset which provides one-time cash payment.[1]

---

[1] We limit the decision to liquidation after the mortgage is repaid but of course Tobi can sell the house at any time prior. The decision would still follow the logic subsequently presented.

These are presented below.

$$House\ Ownership_{t_2} \equiv \begin{cases} \sum_{t=n}^{D} maintenance_t \\ liquidation\ value_{t>n} \end{cases} \qquad (2)$$

Instead of purchasing a house Tobi has the option of renting. For the purpose of this commentary we will specify that the rental decision includes just the payment of rent until time D, or up until some period k in which Tobi decides to become a house owner. Also we will assume that the frequent rent payments include all maintenance that would otherwise be necessary by the property owner. The decision to rent then has two possibilities which are presented below.

$$Rent_t \equiv \begin{cases} \sum_{t=0}^{D} rent\ payment_t \\ \sum_{t=0}^{k} rent\ payment_t + \sum_{t=k}^{D} House\ Ownership_t \end{cases} \qquad (3)$$

The Decision

First considering time period t_1, let's assume that the market is such that rent payment is less than the house owner annuity for an equivalently valued property.[2] By renting Tobi will experience some frequent positive savings given by:

$$rental\ savings_t = \begin{bmatrix} mortgage\ payment_t \\ maintenance_t \end{bmatrix} - rent\ payment_t \qquad (4)$$

Recall that at the end of this time period, when the mortgage is fully repaid, the house owner has the option of liquidating the asset, receiving its fair market value in cash. If Tobi decides to liquidate, the critical question can now be asked in a number of ways. What yearly rental savings will make the consumer indifferent between renting and house ownership? What liquidation price will make house ownership more valuable than the yearly rental savings? What annual rental savings provides greater value than the future cash earning from liquidation? To answer these questions we can compare the future value of the yearly rental savings to that of the liquidation value at time n.

---

[2] In a perfect market one might expect that rental expenditure should be just equal to the expenditures associated with house ownership. However as will be shown later in the commentary median U.S rental rates are generally lower than an equivalent annual mortgage expense. This perhaps can be attributed to the fact that the value of house ownership is inflated due to non-monetary contributors.

The table below provides the annual rental savings amount that will make Tobi financially indifferent between renting and purchasing a house. These annual savings amounts are provided for house liquidation values of $200,000 and $300,000, and for various possible investment rates of return.

Table 1. Annual Rental Savings Equivalent to a $200,000 or $300,000 Liquidation Value, after 30 or 15 Years, Given the Range of Possible Annual Returns

Possible Annual Rates of Return (%)	After 30 years		After 15 Years	
	$200,000	$300,000	$200,000	$300,000
0	6,666	10,000	13,333	20,000
2	4,930	7,395	11,567	17,351
4	3,566	5,349	9,988	14,982
6	2,530	3,795	8,593	12,889
8	1,765	2,648	7,366	11,049
10	1,216	1,824	6,295	9,442

Annual rental savings is calculated as an equal annuity payment equivalent to the future liquidity amount given the stated annual interest rates. These estimates do not include the effect of the cash down payment made which would lower the annual rental values of indifference.

Based on the most aggressive bias towards house ownership in which a $300,000 liquidation value can be obtained after 15 years, and no interest is earned on rental savings, an annual rental savings of approximately $20,000 will create a position of indifference. In this case rental savings less than $1,667 per month will make the house purchase a financially superior decision for Tobi.[3]

Using a more conservative approach in which a $300,000 liquidation value can be obtained after 30 years and the opportunity cost of capital is 6%, the house purchase decision is advantageous only if rental savings is less than $3,795 per year, or equivalently $316 per month. Alternatively viewed, if after considering what would be paid in his mortgage premium and annual maintenance cost, if the monthly amount saved from paying rent for 30 years is greater than $316 dollars, then renting is the financially advantageous decision.

Nota Bene

There are a few critical assumptions and conceptual characteristics associated with the above stated outcome.

---

[3] The implication of the mortgage down payment is ignored in these estimates but would lower the annual rental savings required for indifference.

- Annual rental savings are invested at the stated possible rates of returns. Now these results would not change if Tobi used his rental savings for "needs" consumption as the additional income necessary for the house owner annuity would have been unattainable.
- The annual rental savings is constant over time. This was the implicit assumption when deriving the annual rental savings.
- One might consider the implications of differences in liquidation value from the original purchase price. This consideration, for example in the appreciation of house prices, is already implicitly included in the rental savings function. More specifically this original purchase price determines Tobi's frequent mortgage payment amounts and hence derived rental savings.

Considering time period t_2

It might be clear that the true advantage of house ownership manifests in time period t_2 after the mortgage is repaid and house ownership now only includes yearly maintenance. Between the time of no mortgage payments and time D, the house owner annuity, only includes maintenance and is less than would otherwise be paid in rent. The house owner now experiences a house owner savings.

The critical question now becomes how does the savings from house ownership in time period 2 compare to the dissaving experienced in time period 1? Note that cash flow cannot be enjoyed beyond period D, therefore this evaluation is made not in terms of the respective future values of house ownership savings but in terms of the level of cash available for use between time n and D.[4] This concept is presented in figure 1.

Figure 1 Renter's Savings and t₂ Cost of Living Comparison
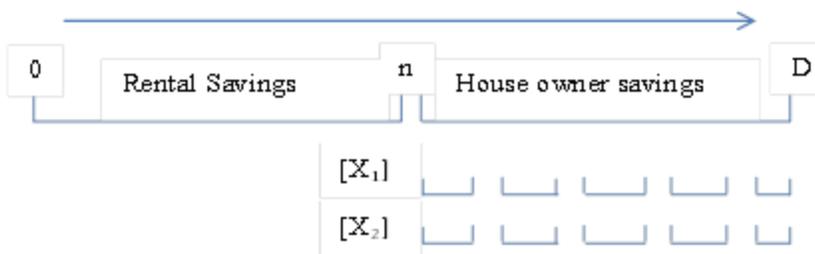
Assuming Tobi remained a renter, could his *rental savings* up to period n, X_1, provide subsistence for his cost of living in period 2, X_2?

---

[4] Significant house ownership value is created in bequeath, when there is liquidation value or rental savings received by some recipient after time period D. This commentary does not include such inter-generational properties but does acknowledge that it is a significant factor in the house purchase decision.

Tobi will determine the annuity value of possible rental savings up to time period n. This is then converted to expected annual cash availability between period n and D by dividing by the expected length of this time period. The decision is then made by comparing this expected annual rental savings to his expected living costs up to time period D.

Very Rough Estimates

Recall that the house ownership decision has two options as represented in equation 2. The home owner can liquidate or can maintain the house until time period D. Analysis of the U.S housing market will be used to obtain rough estimates of these options.[5]

First considering the option to liquidate; we can further recall that this decision can be made by comparing the liquidated value to the return possible from investing rental savings. This can be evaluated by obtaining the implied compounding annual rate of return of house ownership. By using historical appreciation of median housing prices, Tobi can determine how this appreciation rate compares with the opportunity cost of investing rental savings?

Figure 2. U.S Median House Price (1983-2010)

Source: http://www.census.gov/const/uspriceann.pdf
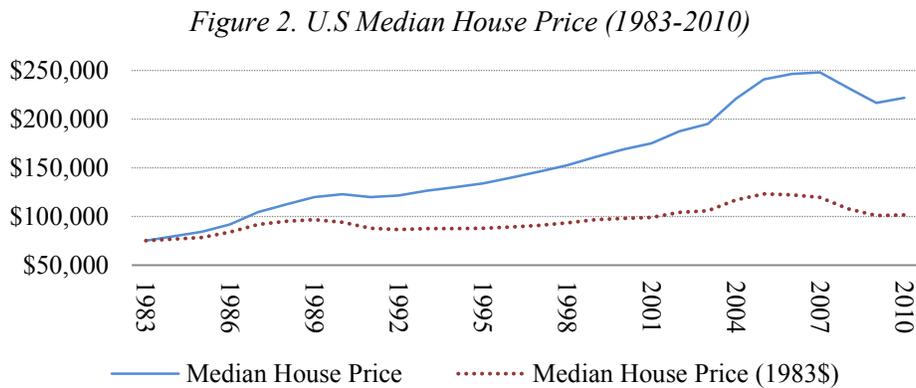
The figure below shows the median house price in the United States between 1983 and 2010. It also shows the median house price in 1983 dollars after controlling for inflation. Median housing prices stood at $75,300 in 1983 steadily increasing to $221,800 in 2010. This increase in house price equates to an

---

[5] This analysis should be considered with prudence as only median house values, mortgage rates, and renal rates are used.

approximately 4% annual rate of return. Based in this historical trend, Tobi would be better off as a house owner, on *a relative scale*, if he is unable to obtain a rate of return on rental savings above 4%.[6]

The second option is to buy the house maintaining it until time period D. This option is roughly evaluated by determining whether the house owner savings received in time period t_2 compensates for the lost renters savings that would have been received in time period t_1. For a house priced at $200,000 it is estimated that principal and interest payments would sum to approximately $12,000 annually while property taxes and insurance will sum to approximately $3,500 annually.[7] Estimates obtained show that average rental rates have historically stood at about 75% of mortgage payments. Therefore an equivalent annual rental cost is estimated at $900.[8]

The derivation can be presented as follows.

Annual house owner savings in period t_2= would be rental cost – house maintenance

$$= \$9,000 - \$3,500$$
$$= \$5,500$$

Lost renters savings = house owner annuity – would be rental cost

$$= (\$12,000 + \$3,500) - \$9,000$$
$$= \$6,500$$

Tobi can consider the annuity value of this lost rental savings and then determine whether his annual house owner savings in period t_2 exceeds the annual purchasing power this lost renters savings would have afforded.

The annuity value of lost renter's savings after 30 years at 6% rate of return is $513,900. Assuming that Tobi makes his decision at the age of 21 and time period D occurs at age 100, he will begin his house owners savings at age 51 and will obtain 49 years of house owners savings. Under these circumstances lost renters savings could have provided $10,488 per year; an amount just in excess rental costs. Relaxing the assumption that Tobi is able to invest rental savings in a 6% annuity for 30 years, a simple sum of his rental savings will only provide $195,000 by age 51, an amount inadequate to cover his rental costs

---

[6] However note that a key deciding element of the house purchase is that it provides access to an asset providing greater *absolute return* on investment without the sacrifice of scarce capital that is required for investing any rental savings.

[7] Estimates obtained from http://money.cnn.com/calculator/real_estate/mortgage-payment/

[8] Estimates are obtained from http://www.deptofnumbers.com/affordability/us/

between then and D. In this scenario Tobi would be able to provide only $3,980 of the $9,000 annual rental cost.

Summary

The commentary presents a general method by which a consumer can evaluate the house purchase decision. First a renter will experience savings when considering the down payment, mortgage and maintenance payments required in house ownership. These savings can be invested at a rate often in excess of median house price appreciation rates.

The house owner will experience this opportunity cost during the time of the mortgage, but will obtain significant value from the comparatively lower cost of living once the mortgage is repaid. Ultimately it is demonstrated that the simple house ownership decision is dependent on one's estimates of three main characteristics. These are the estimates of the renter's savings, annual rates of return on invested renter's savings, and the estimated cost of living reduction of the house owner once the mortgage is repaid.

It should be made clear that the benefits to house ownership and the creation of a home extend beyond the limits of a purely financial decision. Among these include the value in realizing the dream of self-reliance; the ability to demonstrate personal success, and the sense of security obtained by having claim on property. This commentary does not consider these benefits among others but acknowledges the magnitude of their significance. Further house ownership may act as a "buy-in" to asset investments of a magnitude that would have otherwise been unattainable.

The evaluation of these benefits should be coupled with the framework provided in this commentary when considering this asset purchase. The uncertainties inherently involved in this analysis should also be examined. The author of this commentary appreciates your viewing and would appreciate hearing from you on this or any related matter.