Housing and wealth portfolios

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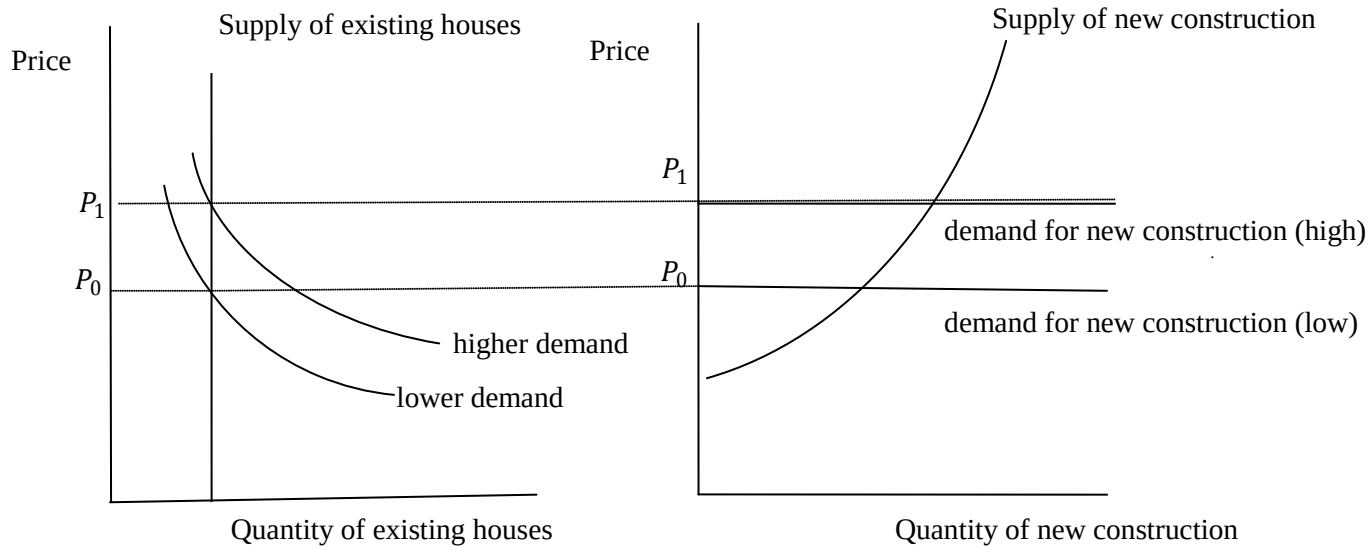
The household's decision to invest in a home is complicated by the fact that owner-occupied housing plays a dual role as both a physical good generating housing services, and as a component of the wealth portfolio. For many homeowners, housing represents both the largest single element of the monthly expenditure, and the most important asset in the wealth portfolio. Given the availability of rental markets for houses, a family could, in principle, independently choose its desired level of consumption of housing services and its desired holdings of residential real estate as an asset; for example renting a 2,500 square foot single family house for its own use, and at the same time owning and renting out a 1,000 square foot condo. However, using rental markets in order to separate the consumption decision (the quantity of housing services consumed) from the investment decision (the quantity of residential real estate held as an asset) would require the household to engage in the landlord/tenant relationship (once and a landlord and once as a tenant) on both houses. Understandably, the vast majority of homeowners avoid the double landlord/tenant roles by choosing a single residential property, which then simultaneously determines the family's level of consumption of housing services, and the quantity of real estate in the portfolio. We consider the role of owner-occupied housing in the asset portfolio, assuming that the household owner-occupies a particular house, and thus the

quantity of housing held as an asset coincides with the household's consumption of housing services.

Both the expected return and the risk associated with investment in residential real estate depend on the behavior of house prices over time. To understand the determination of real estate prices and identify the main factors that drive house prices, consider the interaction of supply and demand in two markets: the market for existing, or resale, houses, and the market for new construction. As drawn in the figures below, a distinctive feature of the market for existing houses is the vertical, or completely inelastic, supply curve. That is, the stock of existing houses is fixed in the short run in the sense that driving up the price of existing houses will not increase the stock of available houses immediately. Of the pool of existing houses, it may be the case that in response to an increase in house prices, a greater fraction of houses are formally listed as "for sale". However, by the "supply of existing houses" we are referring to the entire stock of houses currently habitable, whether or not the house is listed as "for sale". An owner-occupied house that is not formally listed for sale can be thought of as both one unit of the supply of existing housing and is currently satisfying the demand (on the part of the owner) for one unit of housing.

Markets for existing homes and for new construction



While different houses have different individual values, depending on their location, size, and physical attributes, consider a house price index, P, which reflects the average level of house prices at a point in time. If the demand for houses is relatively low, as indicated by the demand curve to the southwest in the left hand graph, the average level of house prices, P, will be the price at which the demand for houses is equated with the current, fixed supply of existing houses,. Since the price of resale homes determines the price at which builders can sell their newly constructed homes, the market price of new construction homes will also be P_0. (More realistically, a newly constructed home probably sells for a premium over an otherwise comparable resale home. However, if the premium paid for a newly constructed house is reasonably constant, the market price of existing homes will move one-for-one with the market price of resale homes. While a positive premium for new construction could be incorporated, it would not affect the basic mechanism which determines the market price of new construction.)

While the supply of existing homes is fixed at any moment, and changes only slowing over time as new houses are built, the demand for houses can shift rapidly due to changes in 1) mortgage interest rates, 2) the strictness of mortgage underwriting standards, 3) the level of per capita income, 4) population size and demographics, 5) expectations concerning the path of future house prices. The effect of the first four factors on the demand for housing is straightforward. For a given house purchase price, a lower mortgage interest rate reduces the monthly mortgage payment required to buy the house, increasing the pool of buyers who are able to afford the house, and shifting the demand curve to the right. Similarly, relaxation of mortgage underwriting standards in the form of lower required down payments, no-documentation loans, and "interest-only" or negative amortization loans will increase the pool of buyers at a given price level. An increase in population, an increase in household formation, or an increase in per capita income will also increase the pool of potential buyers who can afford to buy at a given price level, and therefore shift the demand curve to the right. Since, in the short run, the supply of existing houses is fixed, any factor that shifts the demand curve to the right – for example, a reduction in the mortgage interest rate, relaxation of underwriting standards, or an increase in population – will require a higher price in order to maintain equilibrium in the real estate market.

If the price of a unit of the existing housing stock rises from P_0 to P_1, the price of newly constructed homes also rises, inducing builders to increase the rate of construction of new homes. Over time, as these newly built houses are added to the housing stock, the supply of existing houses will increase (shift to the right).

The final factor that affects the demand for houses is the expected path of future home prices. In contrast to most of the goods it purchases, the household plans to resell the house at some point in the future. Consider a household deciding between renting a home or owning a

comparable home, and assume that the monthly expenses on both homes are equal in the sense that the rental rate on the rental is approximately the same as the monthly expenses (mortgage payments, property taxes, and insurance) on the purchased home. If real estate values are expected to rise over time, the household will prefer to own rather than rent (even if the houses and the monthly expenses are comparable) because by owning the household expects to benefit from the capital gain on the house. Therefore an increase in the expected growth rate of real estate values (from 4% annually to 8% annually, for example), shifts the demand curve to the right. Note that an increase in the expected rate of appreciation of houses increases the demand for the asset, and increases the current price. Likewise, a decline in the expected rate of appreciation or an expected decline in house prices will shift the demand curve to the left, and cause the current price to fall.

Because an owner-occupied house is an investment, or asset, its risk and return can be defined analogously to the risk and return to financial assets such as stocks and bonds. The holding period return to a stock or share of equity has two components, the capital gain and the dividend payment. Expressed as a rate of return, or the return as a percentage of the value of the stock at the beginning of the period, the holding period return, R_S, to a stock is:

$$R_s = \frac{P_{t+1}^S - P_t^S + D_t}{P_t^S}$$

where P_t^S is the value of the stock at the beginning of the period, P_{t+1}^S is the value of the stock at the end of the period, and D_t is the total dividend payments during the period. Analogously, the holding period return to an owner-occupied home, R_H, can be thought of as:

$$R_H = \frac{P_{t+1} - P_t + NRV_t}{P_t}$$

Here the prices refer to the value of the stock at the beginning and the end of the period, and NRV_t refers to the net rental value of the house over the time interval. The asset income generated by an owner-occupied house is received in the form of the flow of housing services provided by the house during the holding period. To the extent that the homeowner incurs maintenance costs, the net rental value would be the market rents the house would command on the rental market (that is, imputed rent), net of the homeowner's maintenance costs.

With this notion of the holding period return to an owner-occupied home, the expected return and variability of returns on housing can be compared with the risk and return characteristics of financial assets. Table 1 reports the average return and the standard deviation of return on short term government debt (T-bills), long term government debt (Bonds), the S&P 500 stock market index (stocks), 30-year fixed rate mortgages (Mortgage), and owner-occupied homes (House), for the US over the period 1968-1992. All returns are annual, after tax returns, and have been adjusted for inflation.

Table 1: Average return and standard deviation of return on T-bills, Bonds, Stocks, Mortgage, and Houses

	T-bills	**Bonds**	**Stocks**	**Mortgage**	**House**
average return	-0.0038	0.0060	0.0824	0.0000	0.0659
standard deviation	0.0435	0.0840	0.2415	0.0336	0.1424

Source: Flavin and Yamashita (2002).

Stocks provide the highest after-tax inflation-adjusted return at 8.24%. The after-tax, inflation adjusted return to government debt was close to zero in the case of long term bonds, and slightly negative in the case of short term Treasury-bills. Because mortgage interest payments are tax-deductible in the US, and because the 1968-1992 period was characterized by high, unexpected inflation, holders of long-term fixed rate mortgages ended up paying, on average, an after-tax, inflation adjusted mortgage interest rate of zero. At 6.6%, the inflation-adjusted return

to housing is comparable to, although somewhat smaller than, the return to stocks. With a standard deviation of 14.24%, the variability of the return to houses is substantially smaller than the variability of stock returns.

When constructing a portfolio of assets, the household cares about the expected, or average, return to the portfolio as a whole. Similarly, the "riskiness" of an individual investment depends on how the riskiness, or variability of return, to the portfolio as a whole is affected by the addition of the asset. Because the household ultimately cares about the average return and riskiness of return to the portfolio as a whole, the optimal holding of a particular risky asset – such as a house – depends on the asset's contribution to the diversification of the portfolio as a whole. For example, if we consider two risky assets, A and B, which are identical in terms of their individual average return and a standard deviation of return, the two assets will nevertheless make very different contributions to the effective diversification of the overall portfolio if the return to asset A is strongly positively correlated with the return to the portfolio (that is, asset A tends to have higher than average returns when the return to the rest of the portfolio is higher than average) while the return to asset B is negatively correlated with the return to the portfolio (that is, asset B tends to have higher than average returns when the return to the rest of the portfolio is lower than average, and vice versa). Thus even if the return to risky asset B has the same average return and variability of return as risky asset A, by having a return which is negatively correlated with the rest of the portfolio, the addition of asset B provides more effective diversification than asset A. By creating greater diversification of the portfolio, asset B will allow the household to achieve a lower level of portfolio risk than asset A.

Thus in assessing the contribution of owner-occupied housing to the risk and return of the overall portfolio, it is important to determine whether the return to housing is positively

correlated (like asset A) or negative correlated (like asset B) with returns to the financial assets that make up the rest of the portfolio. Using the same data series as Table 1, Table 2 reports the correlation coefficients for each pair of assets.

Table 2: Correlation between returns to pairs of assets

	T-bills	**Bonds**	**Stocks**	**Mortgage**	**House**
T-bills	1				
Bonds	0.69	1			
Stocks	0.02	0.20	1		
Mortgage	0.84	0.68	0.47	1	
House	-.03	-.01	0.00	0.00	1

Source: Flavin and Yamashita (2002).

T-bills, bonds, and mortgages are each debt contracts, and differ primarily in the maturity of the contract and the nature of the issuer. Not surprisingly, the returns to any pair of these three assets are strongly positively correlated, with correlation coefficients ranging from 0.68 to 0.84. Stock returns are positively correlated with the returns to T-bills, bonds, or mortgages, but the degree of correlation is smaller, ranging from a correlation of 0.47 between stocks and mortgages, to a correlation of 0.02 between stocks and T-bills. The correlation between the return to owner-occupied housing and any of the financial assets is either slightly negative, in the case of T-bills or bonds, or zero, for stocks and mortgages. Since the correlation coefficients are either zero, or if negative, close to zero, the bottom row of Table 2 indicates that the return to owner-occupied housing is essentially uncorrelated with the returns to any of the financial assets, and therefore provides substantial diversification to the portfolio as a whole. Owning a home rather than renting is a good investment for several reasons: First, the average annual return to housing, after taxes and adjusting for inflation, is 6.6%, almost as large as the average return to stocks. Second, adding owner-occupied housing to a portfolio of financial assets is an effective way of achieving diversification and thus lowering the risk of the overall portfolio.

Owner-occupied housing as an asset has several disadvantages compared to financial assets. Financial assets are extremely liquid in the sense that they can be bought or sold quickly, and in the sense that the transactions costs incurred in a purchase or sale are very small relative to the value of the asset that changes hands. In contrast, the seller of a house incurs significant monetary costs in order to liquidate his investment in real estate, in addition to the time and effort required to physically move from one house to another. Less obvious, but probably more important is the fact that housing investment is not divisible in the way comparable to financial investments. While an investor has complete control over the scale of his investment in shares of equity, given the ability to buy one share or a thousand shares at essentially the same price per share, an investment in owner-occupied housing is "lumpy" in the sense that the choice is between not owning at all (that is, and investment of zero) or owning an entire housing unit. For homeowners with mortgages, their equity in the house may be small compared to the value of the house. However, since a homeowner with a mortgage still bears all of the risk associated with changes in real estate prices, the magnitude of the investment is determined by the value of the house, rather than value of the equity.

Once the household determines its desired level of consumption of housing services – that is, once the household determines the quantity of housing it prefers for consumption purposes – it then faces the decision of whether to own the house, or to rent. In contrast to most financial assets, for which the optimal strategy is to own small amounts of a large number of asset, the fact that housing serves a dual role as both a consumption good and as an asset implies that the household must choose between being a renter (and investing in no real estate at all), or being a homeowner (and therefore making a large investment in real estate). The idea that, for homeowners, the quantity of housing held as an asset must coincide with the quantity of housing

chosen for consumption purposes is referred to as the "housing constraint" on the wealth portfolio.

In order to purchase a house, most households borrow funds in the form of a mortgage. After acquiring both the mortgage and the house, the net wealth or equity of the household may be fairly modest. However, instead of considering the household's net position (the home equity), the portfolio analysis both the gross investment in the house and the borrowing in the form of a mortgage as separate asset positions. The household can also invest in T-bills, bonds, and stocks. Since the typical household does not buy stocks on margin or sell stocks short, the portfolio analysis assumes that the household can hold T-bills, bonds, and stocks only in non-negative amounts. Further, it is assumed that the household can only borrow in the form of a mortgage, and that the size of the mortgage is no greater than 100% of the value of the house when initially purchased.

Table 3 reports the average holdings of cash (defined as bank deposits and short term debt such as T-bills), bonds, stocks, owner-occupied housing, and mortgages for a sample of US families in 1989. All amounts are expressed as a fraction of the household's net wealth. Since a mortgage is a liability rather than an asset, the fraction of net wealth held in the form of a mortgage is expressed as a negative number. Since each of the assets in Table 3 is a component of net wealth (and because the mortgage is represented as a negative asset), the five numbers in any row of Table 3 add up to unity by construction.

Table 3: ratio of particular assets to net worth, average for US households in 1989

Age of head	Cash	Bonds	stocks	house	mortgage
18-30	0.193	0.072	0.056	3.511	-2.833
31-40	0.169	0.067	0.068	2.366	-1.671
41-50	0.148	0.060	0.085	1.588	-0.882
51-60	0.200	0.058	0.092	0.969	-0.319
61-70	0.254	0.048	0.113	0.757	-0.171
71+	0.264	0.029	0.098	0.648	-0.038

Source: Flavin and Yamashita (2002).

In Table 3, the data is broken into subsamples according to the age of the head of household, and the allocation of net wealth across different assets is reported separately for each age group. For the youngest cohort of homeowners, with household heads age 18-30, the value of the house is about 350% of net wealth. On average, this cohort of homeowners are encumbered with a mortgage with a principal value about 280% of net wealth. About 19% of their wealth is held in the form of bank deposits (checking accounts, savings account, CD's) and short term government debt, 7% in bonds, and 6% in equities. On average, the household's net wealth increases with age. Since the consumption of housing services is relatively stable over the lifecycle, the fact that net household wealth increases with age implies that the ratio of the value of the house to net wealth falls with age. For the cohort aged 51-60, average net wealth is approximately equal to the value of the house. While the typical household in this age group could (almost) pay off their mortgage, doing so would involve holding no financial assets, including cash. Instead, the typical household in the 51-60 age group carries a mortgage with remaining principal equal to about 30% of the value of their home, and owns substantial amounts of cash, equities, and bonds. The value of the house as a fraction of net wealth, and the remaining principal on the mortgage continue to fall as the household passes age 61 and 71.

Even in the absence of housing as an asset, the optimal portfolio of will depend on the household's degree of risk aversion. A simple way of characterizing risk aversion in this context

is to think of the household as evaluating different possible portfolios by computing the following function of the average, or expected return, $E(r_p)$, and the variability, or variance of return, σ_p^2.

$$E(r_p) - \frac{A}{2}\sigma_p^2$$

All households are assumed to be risk averse in the sense that for a given average return, they would like to minimize the riskiness of the portfolio, as measured by the variability of its return. However, households differ in the degree of their risk aversion, as reflected by the value of the parameter A. A household with a relatively high degree of risk aversion (for example, A=10) is more sensitive to portfolio risk than a household with a low degree of risk aversion (for example, A=1). Depending on their degree of risk aversion, households will choose different portfolios on the risk and return trade-off: relatively risk averse households will choose portfolio with modest expected returns and low variability of return, and relatively risk tolerant households will choose portfolios with higher expected returns and higher variability (risk).

With the addition of owner-occupied housing to the list of assets, and assuming that the quantity of housing held is determined by the household's consumption demand for housing services, an additional constraint is imposed on the household's portfolio allocation problem. At any given moment, both the value of housing owned, and the total net wealth of the household are fixed, and therefore the ratio of house value to net wealth is a fixed value. The household's optimal holdings of financial assets will depend on both the value of the housing constraint (that is, the ratio of house value to net wealth) and on their degree of risk aversion.

Table 4: Optimal portfolios

Ratio of house value to net wealth	Assets in Portfolio	Degree of risk aversion		
		Low	Moderate	High
0 (renters)	T-bills	0	.47	.83
	Bonds	0	.15	0
	Stocks	1	.38	.17
3.51	T-bills	0	0	0
	Bonds	0	.60	.81
	Stocks	1	.40	.19
	Mortgage	-1	-1	-1
2.37	T-bills	0	0	0
	Bonds	0	.61	.79
	Stocks	1	.39	.21
	Mortgage	-1	-1	-.93
1.59	T-bills	0	0	0
	Bonds	0	.61	.70
	Stocks	1	.39	.30
	Mortgage	-1	-1	-.72
0.97	T-bills	0	0	0
	Bonds	0	.52	.51
	Stocks	1	.48	.49
	Mortgage	-1	-.76	-.28
0.76	T-bills	0	0	0
	Bonds	0	.47	.38
	Stocks	1	.53	.62
	Mortgage	-1	-.61	0
0.65	T-bills	0	0	.38
	Bonds	0	.44	.20
	Stocks	1	.56	.42
	Mortgage	-1	-.47	0

Table 4 reports the optimal portfolio for different levels of the housing constraint, and for low, moderate, and high degrees of risk aversion. The first row reports the optimal portfolios when the ratio of house value to net wealth is zero; that is, for non-homeowners. In this table, the holdings of T-bills, bonds, and stocks are stated as a percentage of the sum of those three assets, and the size of the mortgage is stated as a percentage of the value of the house (i.e., -1 for the mortgage indicates that the mortgage is 100% of the value of the house).

Households with a very low degree of risk aversion will hold a portfolio with high expected return (and high risk) by continuing to borrow against their home in the form of a 100% mortgage, and investing all of their net wealth in stocks. By maintaining the 100% mortgage, these risk-tolerant households leverage their portfolio and hold only the two highest average return assets, houses and stocks. For households of moderate to high risk aversion, young families with a high value of the ratio of house value to net wealth will achieve their optimal portfolio by creating leverage with a 100% mortgage and dividing their net wealth among bonds and stocks. As the household ages, and the ratio of house value to net wealth falls, the optimal portfolio involves less leverage in the sense that the mortgage principal, as a percentage of house value, falls. Highly risk averse household pay off their mortgages sooner in the lifecycle than households of moderate risk aversion, since paying off the mortgage reduces the degree of leverage and reduces portfolio risk. For a given level of the ratio of house value to net wealth, more risk averse households also reduce risk by holding relatively smaller amounts of stocks and relatively greater amounts of bonds and T-bills.

References:

Flavin, Marjorie and Takashi Yamashita, "Owner-Occupied Housing and the Composition of the Household Portfolio", **American Economic Review**, March 2002, pp. 345-362.