

Abstract: Residential single-family housing dominates the portfolio of the representative household. Most homeowners are neither diversified by asset type nor by geographic market. The same households that hold only one house are typically diversified in other financial markets, notably with the shifting of many investment assets to mutual funds. Information on the nature of household portfolios is provided, along with the extent of the cost in either greater risk or lower returns of an overly concentrated portfolio. The low correlations between single family housing markets implies a significant benefit from diversification across markets. Yet, most households are constrained from such diversification, resulting in either higher risk or lower return on personal portfolios.

Housing Returns and Restrictions on Diversification

by: Prof. Peter Chinloy, and Man Cho

Residential single-family housing dominates the portfolio of the representative household. At \$4.8 trillion in equity valuation, the asset accounts for 17% of the \$29 trillion in total wealth of the United States (Miles and Tolleson [1997]). This equity is held in diffused form by 66 million households who hold relatively concentrated and undiversified portfolios. There is \$3.8 trillion in mortgage debt on this housing, 13% of the investment universe, of which \$1.6 trillion is securitized in mortgage-backed securities and derivatives, and \$2.2 trillion is held in lender portfolios. For the representative household, home equity is a dominant asset. It accounts for about half the total wealth of the average household, from the Survey of Consumer Finances of the Board of Governors of the Federal Reserve System.

House equity differs in its characteristics from other types of investment. Most homeowners are neither diversified by asset type nor by geographic market. They are obliged by underwriting conditions in the mortgage market and personal and family constraints to hold one house in one market. Homeowners are vulnerable to downturns in that specific market, accentuated by the fact that their principal source of income, from employment, is frequently subject to the same local risk. Housing is typically excluded from efficient portfolio allocations, even though it accounts for a substantial portion of total wealth (Geltner, Miller, and Snively [1995]).

The same households that hold only one house are typically highly diversified in other financial markets, notably with the shifting of many investment assets to mutual funds. This article provides information on the nature of household portfolios, and the extent of the cost in either greater risk or lower returns of an overly concentrated portfolio.

Data

The data reported are for total returns for housing. With a total return, single-family housing can be compared with other investments in the asset universe. A total return requires the measurement of both current yield and changes in prices. Here a capital gains estimate and a measure of the cap rate (for current return estimates) on housing, or the net rent after operating expenses, per dollar of asset value is provided for analysis. Such return series should ideally be comparable across markets, so that an investor can evaluate the performance of a portfolio of mortgages or mortgage-backed securities. These series also facilitate the construction of equity portfolios of single-family housing, so that the \$4.8 trillion could become tradable and more liquid. Ulti-

mately, diversification in housing equity could be brought to the household. [1]

We report monthly returns to holding single-family housing in five metropolitan markets: San Francisco, Los Angeles, Chicago, New York, and Philadelphia. These five markets account for about 40% of the entire value of single-family housing in the U.S., or almost \$2 trillion in equity and \$1 trillion in debt. The time period is January 1975-June 1995. The return is the sum of capital gains and a cap rate, computed monthly. We first report on the procedures involved in construction of the return series. We summarize the correlation matrix for the five metro areas.

Amazing Diversification Potential Across Geographic Single-Family Housing Markets

We find that there are low correlation coefficients across single-family real estate markets. Adjustments for real returns lead to lower correlation coefficients, but this is a purely mathematical effect of smaller numbers. Some correlations are even negative, a rarity among equity stocks within the same asset class in other industries.

For example, half the correlation coefficients between metropolitan regions are negative. The largest positive correlations are no more than 0.3. For single-family housing, these correlation coefficients are considerably lower than those for commercial real estate, where more data are available. Ziering and Stoesser [1997] and Hartzell, Hekman, and Miles [1986] report correlation coefficients across property classes and metro markets that are usually positive and range between 0.3 and 0.7. There are clear benefits to diversification even between apparently similar markets. This conclusion is robust to whether returns are adjusted for domestic inflation within that market.

We construct efficient portfolios for the representative household under two scenarios. In the first, the existing situation obtains, where a household holds one house in a home market, and can hold other assets such as stocks, measured by the total return on the Standard & Poor's 500 with dividends reinvested, and a riskless asset, three-month Treasury bills with their yield to maturity. The efficient frontiers in each of the five cities are constructed separately. In the second scenario, households are permitted to hold a portfolio of housing that is diversified and efficient across markets.

Net Benefits to Housing Diversification

Results indicate that households could obtain at least a 2% additional return on their overall portfolio with no increase in risk if they could hold an efficient portfolio across these markets. Alternatively, households could maintain about a 10% return, yet cut their risk in half, if they were able to diversify the housing component of the portfolio. With the results that there are low or negative correlations across markets, these restric-

tions and the lack of a secondary market for housing equity units cause households to face an undiversifiable and greater risk.

Even liquid and wealthy households are typically constrained in one or two housing markets with focused geographic exposure. There may be social policy implications of preventing households from diversifying when the market indicates there are gains from such a strategy.

Returns to Single-Family Housing

The five cities selected have a consistent Consumer Price Index over the time period, monthly for January 1975-December 1995, including time series for residential rents and house operating costs. The return is the sum of capital gains and a cap rate used to estimate the net rental income per dollar from holding the house. The return to holding housing is the sum of the capital gains and the cap rate, or net operating income per dollar of value. The capital gain is

$$P[\text{sub } t] = (P[\text{sub } t] - P[\text{sub } t-1])/P[\text{sub } t-1]$$

based on price changes for a monthly repeat sale index P_t for the pooled data set. The cap rate is the gross rent $R[\text{sub } t]$, here the imputed or rental equivalent a homeowner saves by living in an owner-occupied house, less repair and maintenance expenditures $M[\text{sub } t]$, per dollar of house value, or

$$c[\text{sub } t] = (R[\text{sub } t] - M[\text{sub } t])/P[\text{sub } t].$$

Details of the return computations are in the appendix.

The capital gain is price changes for houses serving as the collateral for mortgages purchased by Fannie Mae and Freddie Mae. The properties are tracked at separate transaction dates, with each month in the sample period represented by a dummy variable. For the first transaction, such as March 1978, the variable for that month takes a value of negative unity, and for the second transaction, such as April 1990, the variable for that month is positive unity. All other months have a zero. An alternative procedure is to have a block of variables equal to 1 during the period of ownership, from March 1978 to April 1990, and zeroes otherwise.

The coefficients of these monthly dummy variables are the parameters of the price index, estimated after a weighted least squares procedure.^[2] This estimation is carried out separately for each metropolitan area, yielding a house price index monthly for each of the five metropolitan areas of San Francisco, Los Angeles, Chicago, New York, and Philadelphia. The price index is converted to dollars by pricing a standardized house for July 1991 from the U.S. Department's of Housing and Urban Development's

Annual Housing Survey (AHS) for each of the five cities. Growth rates of the price index on a monthly basis are the capital gains.

From the same AHS data, the rent for the same standardized house and operating expenses are constructed. Dollar rents for each month in the sample are obtained by multiplying the rent component of Consumer Price Index for that metropolitan area by the standardized house rent. Operating expense dollar values are obtained by multiplying the Consumer Price Index value by the standardized AHS value. Net rent after operating expenses divided by the dollar price is the cap rate. Separate systems are estimated for renters and owners. The owner equations determine the effect of given house characteristics on price. The renter equations determine the effect on rent. In the pooling, adjustments are made for the self-selection of rentals. Rental properties tend to be occupied by shorter-horizon residents, and suffer higher rates of depreciation.

Returns and Correlations in Housing Equity Markets

The total return is the sum of the capital gains and the cap rate. Excess returns are obtained by subtracting the risk-free rate, taken as the constant maturity yield on three-month Treasury bills. Housing returns in the examined markets are reported in Exhibit 1. The means and standard deviations are annualized based on monthly data for 1975-1995. The total return, the sum of the capital gain, and the cap rate range between 12% in Chicago to 20.5% in New York. New York is the riskiest market, with a standard deviation of 12.9%. The risk-adjusted return, related to the coefficient of variation, is the mean divided by the standard deviation. These risk-adjusted returns range from a ratio of 1.59 in New York to 3.49 in Los Angeles.

Exhibit 1

Housing Returns, 1975-1995 (annualized from monthly data)

	Chicago	Los Angeles	New York	Philadelphia	San Francisco
	A	B	C	D	E
Total return: capital gain plus cap rate					
Mean	0.12	0.122	0.205	0.13	0.15
Standard Deviation	0.075	0.035	0.129	0.066	0.063
Mean/Standard deviation	1.6	3.49	1.59	1.97	2.35
Excess return: capital gain plus cap rate less risk-free rate					
Mean	0.054	0.049	0.142	0.059	0.077
Standard Deviation	0.076	0.033	0.131	0.067	0.058
Mean/Standard deviation	0.71	1.48	1.08	0.88	1.33

market typified by Chicago, report commercial real estate returns of 8.5% over 1973-1994, (a comparable time period), with a 5.4% standard deviation. The mean return is 3.5 percentage points lower in commercial than in residential real estate. In a market typified by San Francisco, the mean return is 13.1% in commercial, as compared with 15.0% in residential. The commercial real estate risk is greater, with a 13.7% standard deviation.

With correlations across markets available, the risk of a portfolio in these markets, whether measured in nominal terms, real terms, or net of excess returns, can be computed. This issue is addressed in Exhibit 2, with correlations across markets. Among the five markets there are ten cross-correlation coefficients. Of these, five are negative, and the largest positive entry is 0.10 between San Francisco and Philadelphia. Chicago has negative correlations with three of the four other markets. The only positive entry is the correlation with Los Angeles at 0.09. The correlation coefficient between Los Angeles and San Francisco is -0.03. The range in Exhibit 2 is between -0.25 and 0.09, indicating a low degree of correlation and potential integration among domestic housing markets.

By comparison, in a commercial portfolio, and possibly because of holdings by national institutional investors, correlation coefficients range between 0.21 and 0.84. The gains from diversification are thus considerably smaller in a commercial portfolio than

Exhibit 2

Housing Total Return Correlations, January 1975-June 1995
(probability that correlation coefficient is nonzero in parentheses)

	Chicago	Los Angeles	New York	Philadelphia	San Francisco
Chicago	1.00				
Los Angeles	0.09 (0.17)	1.00			
New York	-0.03 (0.55)	-0.25 (0.00)	1.00		
Philadelphia	-0.24 (0.00)	0.02 (0.75)	0.04 (0.51)	1.00	
San Francisco	-0.06 (0.38)	-0.03 (0.64)	0.03 (0.67)	0.10 (0.11)	1.00

in a residential portfolio. There are implications for lenders in both markets. The holder of the default risk in a residential portfolio has a more diversified risk from a given set of allocations.

Exhibit 3 shows that the conclusions are relatively robust in excess returns. Housing markets have negative or low positive correlations, with the same five submarkets showing negative values. Goetzmann [1993] estimates correlation coefficients across

the four cities examined by Case and Shiller [1989], Chicago, Atlanta, Dallas, and San Francisco (Oakland). Caplin, Chan, Freeman, and Tracy [1997] find similar results for a series of cities using the joint Fannie Mae-Freddie Mac house price index. The results are similar, in that correlation coefficients across markets are low. The estimates here are generally lower, with several showing negative correlation coefficients.

Portfolio Strategies

What are the implications for portfolio holding at the representative household? This household is constrained to hold one house, although not constrained necessarily in holding financial assets. Exhibit 4 shows efficient portfolio frontiers, minimizing the variance of the portfolio at successive means, and prohibiting short-selling. Households hold a portfolio of “domestic” housing in their home market, stocks, as repre-

Exhibit 3.

	Housing Excess Return Correlations January 1975-June 1995 monthly (probability that correlation coefficient is nonzero in parentheses)				
	Chicago	Los Angeles	New York	Philadelphia	San Francisco
Chicago	1.00				
Los Angeles	0.08 (0.22)	1.00			
New York	-0.04 (0.58)	-0.23 (0.00)	1.00		
Philadelphia	-0.25 (0.00)	0.03 (0.64)	0.04 (0.52)	1.00	
San Francisco	-0.05 (0.41)	-0.04 (0.52)	0.03 (0.66)	0.10 (0.11)	1.00

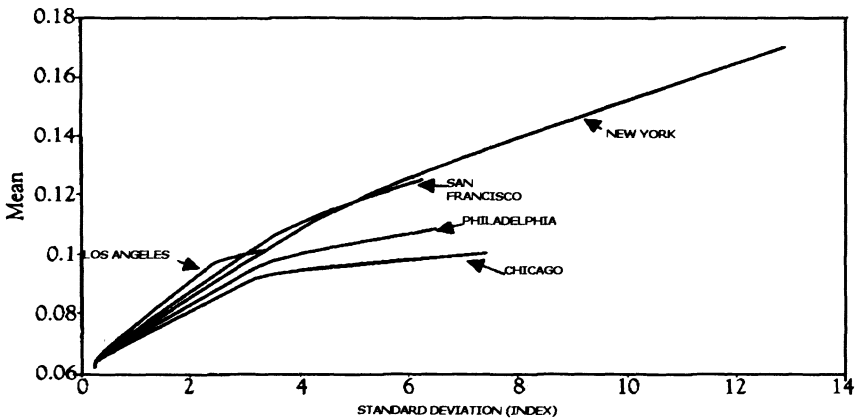
sented by returns on the Standard & Poor’s 500 index, and a riskless asset, three-month Treasury bills, on a yield-to-maturity basis.

Exhibit 4 shows the efficient portfolios for each of the five metropolitan areas. Households choose allocation shares to minimize the variance of the entire portfolio, subject to the mean return attaining specific levels, and all portfolio shares being non-negative. Negative shares could occur with short-selling, but as yet another market failure, there is no short-selling permitted in the housing market.

The efficient frontiers in each city intersect, indicating that there are potential gains from a mixed portfolio. The frontier extends further out for New York, because it has the highest returns during the sample period. The crossings in the lines for the five metropolitan areas suggest that the optimal mix within a market between stocks, housing, and Treasury bills differs.

EXHIBIT 4

**Existing Portfolio Possibilities:
U.S. Homeowners
(stocks, single house, riskless assets)**

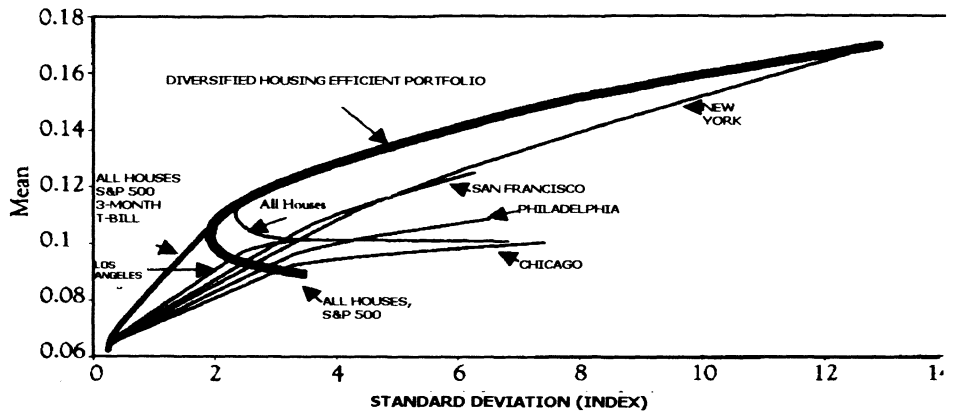


The comparison is in Exhibit 5. The three uppermost frontiers are for combinations with housing portfolios. The rightmost frontier has seven assets, the five types of housing, stocks, and the riskless asset. Such diversification across a real estate portfolio has been discussed by Goetzmann and Ibbotson [1990]. The other two are portfolios of the five types of housing and stocks, and the five types of housing. The results show that any type of diversification leads to a frontier above the envelope of the individual local markets. That is, the frontier is above the optimal point within each market, even if a household there were able to attain it.

There are two issues here. First, households may be unable to reach the efficient frontier point in their home market. Institutional and underwriting constraints prevent them from purchasing the amount of housing to attain the frontier. One-third of households are renters, and half own no stocks directly or indirectly. Down payment constraints limit access to the frontier.

Second, even if households are able to reach a domestic efficient frontier, they remain constrained by the "home market" requirement. Once having attained the two-thirds of households owning homes, and potentially able to reach the frontier of their home market, households are prevented by other institutional constraints from reaching the "foreign" efficient frontier. They cannot hold a portfolio with a mix of equity in San Francisco, Los Angeles, Chicago, New York, and Philadelphia in this sample, or with

Potential Efficient Portfolios with Diversified Housing



other cities added in a national sample. The results cause efficiency losses across the economy, measured as the differential between the efficient portfolio frontier and the envelope of the city-by-city markets.

Appendix

Construction of Housing Returns

The price of property i at transaction date t is $H_{it} = P_t \exp(X_{it})$, where P_t is the desired general price index and X_{it} measures its idiosyncratic characteristics. At a previous date $s < t$, another transaction price is $H_{is} = P_s \exp(X_{is})$. The capital gain over the transaction interval for the same property i is $h_{i,t,s} = \ln H_{it} - \ln H_{is} = \ln P_t - \ln P_s + X_{it} - X_{is}$. The capital gain has specification $p(s,t) = \ln P_t - \ln P_s = \beta_0 D_{io} + \dots$ where β are parameters and $D_{ij} = -1$ for $i = s$ the first transaction date, $D_{ij} = +1$ for $i = t$ the second transaction date,

and $D_i[\text{sub } j] = 0$ otherwise. The idiosyncratic term $X[\text{sub } it] - X[\text{sub } is]$ has mean $E[X[\text{sub } it] - X[\text{sub } is]] = 0$ and variance $E[X[\text{sub } it] - X[\text{sub } is]]^2 = \gamma[\text{sub } 0] + \gamma[\text{sub } t(t-s)] + \gamma[\text{sub } 2](t-s)^2$ with parameters γ . Weighted least squares, taking account of the holding-period heteroscedasticity in idiosyncratic components leads to the price index allowing the capital gain to be computed.

$$P[\text{sub } t] = P[\text{sub } 0] \exp (\text{Beta}[\text{sub } t])$$

The dividend yield on housing is the imputed dollar rent $R[\text{sub } t]R[\text{sub } B]$ less operating expenses $M[\text{sub } t]M[\text{sub } B]$ per dollar value of asset $P[\text{sub } t]P[\text{sub } B]$, or

$$R[\text{sub } t]R[\text{sub } B] - M[\text{sub } t]M[\text{sub } B] c[\text{sub } t] = P[\text{sub } t]P[\text{sub } B].$$

All three series are scaled by their values at a benchmark date and property quality B . The benchmarking is carried out because the time series on rents $R[\text{sub } t]$ and maintenance are from the Consumer Price Index, which is in index rather than dollar form, and the latter is required to compute returns. The derived price index P_t is also not in dollar form and requires scaling.

The scaling month B is July 1991, the date of the Annual Housing Survey (AHS) of the U.S. Department of Housing and Urban Development of that year. The dividend yield requires information on rents, operating expenses, and the price of the property. Operating expenses and prices are available for owner-occupied dwellings, with owners providing the market valuation. Rent data are from tenant-occupied dwellings. Apart from adjusting for the quality of the house, the quality of the owner and tenant populations may not be identical. Adjustments are made with self-selection corrections for the behavior of owners and renters.

Endnotes

1 One proposal for doing this is suggested by Geltner, Miller, and Snavely [1995], where HEITs stand for housing equity investment trusts that would provide a means to turn home equity units into tradable shares within a secondary HEITs market.

2 In the first stage, the logarithm of the capital gain, the price change over the two periods, is regressed on the time dummies. The residuals from this regression squared are regressed on the time between transactions and the square of the time between transactions. These estimates are used to transform and reestimate the capital gains, producing estimates of the parameters. The parameters themselves are then used via a lognormal transformation to create the underlying index.

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