2019
Volatility Index

UNISON INVESTMENT MANAGEMENT

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Introduction

In their groundbreaking 1987 paper, Karl Case and Robert Shiller revolutionized the residential real estate industry by launching the Case-Shiller index, a benchmark index for home price appreciation in the United States. They noted that "65 percent of all households owned their homes, and for most of those households the net equity in their homes represents the bulk of their net worth." Since then, an amazing amount of diligence has been applied to portfolio allocations spanning equities, fixed income securities, and alternative investments. Yet, "home equity is the largest part of a typical household's net worth, but it is rarely considered in an asset optimization." Case and Shiller have provided us with an invaluable tool for benchmarking long run expectations of home price appreciation. However, if we wish to properly integrate homes into a modern financial plan, benchmarking our expectation of risk is equally important. To solve this problem, we need a volatility index for single family, owner-occupied homes, which is what this paper introduces.

In addition to a demonstration of the volatility index, in this paper we offer three insights:

01 A single home is a risky asset.

The annualized volatility of a home is in line with that of a public equities index.

02 Homeowner portfolios are too risky.

Homeowner portfolios have residential real estate risk exposures far beyond the optimum, driven by the banality of very low down payment, high-leverage mortgages. This problem is most severe with recent home buyers, because they have the highest leverage at purchase (and haven't had time to accrue equity).

03 Home risk is mostly diversifiable.

The major component of home risk is diversifiable; it dissipates in a large diversified portfolio of homes. This makes single-family homes a far more attractive investment for institutional investors than for homeowners.

The paper concludes by proposing the emergence of an efficient equity market for residential real estate, a conventional solution for distributing financial risk. To help make this solution a reality, a measure of individual home risk needs to be adopted. With the volatility index presented herein, we hope to inspire individual households, financial advisors and institutions to re-engineer the modern household portfolio.

Inevitably, homeowners will be able to sell equity in their individual homes into large diversified institutional portfolios. When this happens, trillions of dollars of value-at-risk for homeowner households will be eliminated.

A Volatility Index for a Single Home

Figure 1 illustrates the dynamics of single-family residential real estate since the year 2000. The series is generated by estimating the dynamic volatility parameter which best explains the dispersion of returns of tens of millions of American homes purchased and sold between 1994 and 2019.
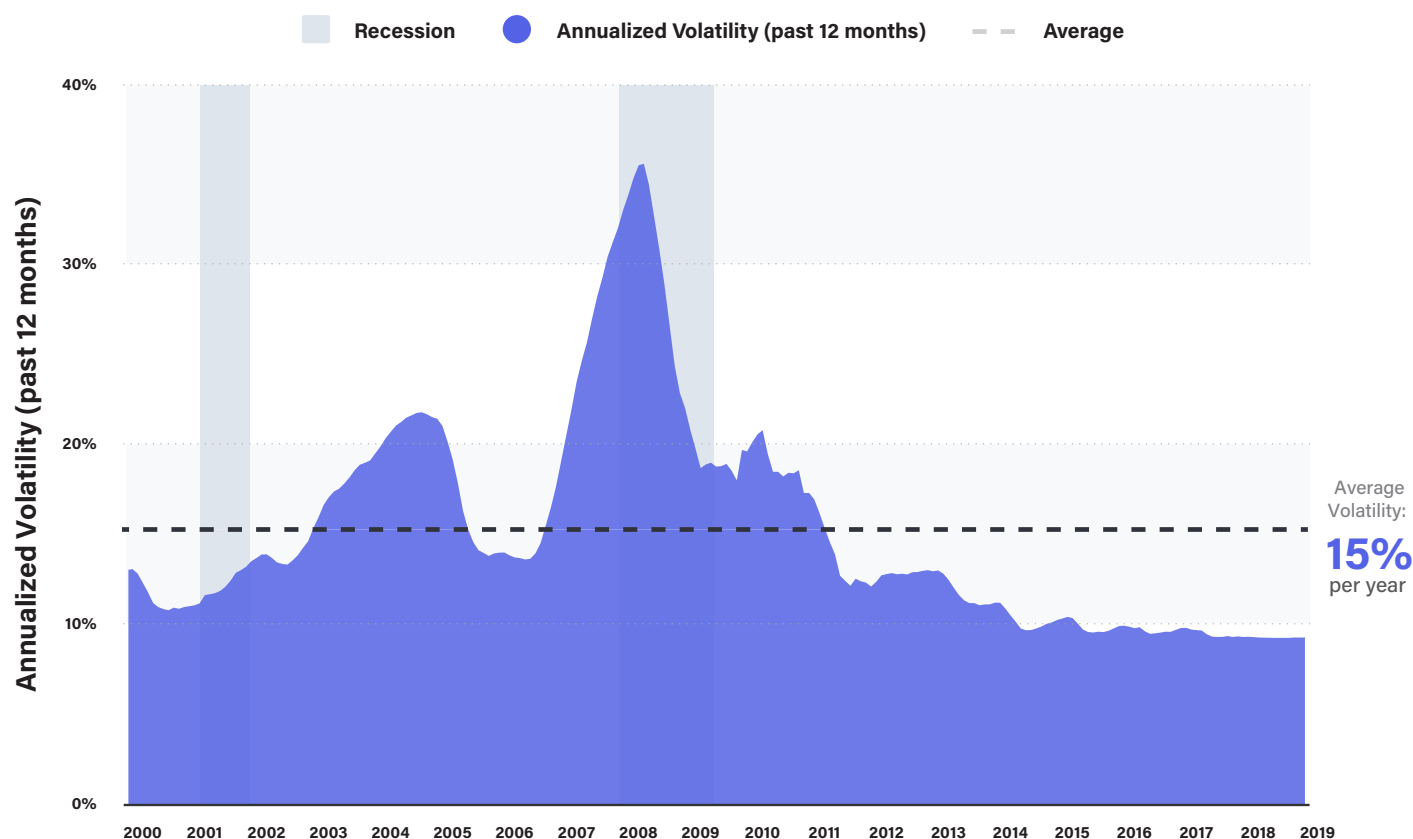
Figure 1: A volatility index for individual homes in the U.S. The index represents the annual volatility of individual home returns over the previous 12 months.

The long run average annualized volatility of home returns has been approximately 15% per year. Notably, the index spikes to more than 35% per year in the heat of the 2008 financial crisis, stoking the fear that, like equities and fixed-income securities, financial risk of residential real estate is amplified during a financial crisis.

A Single Home is a Risky Asset

Figures 2a and 2b compare the annualized volatility of an individual home with the volatility of asset classes that are commonly held in a homeowner's portfolio. It should come as a surprise that the volatility of a home is on par with that of an equity index, especially considering that a home buyer who borrows 95% of the value of their home is taking 20x leverage on this investment.
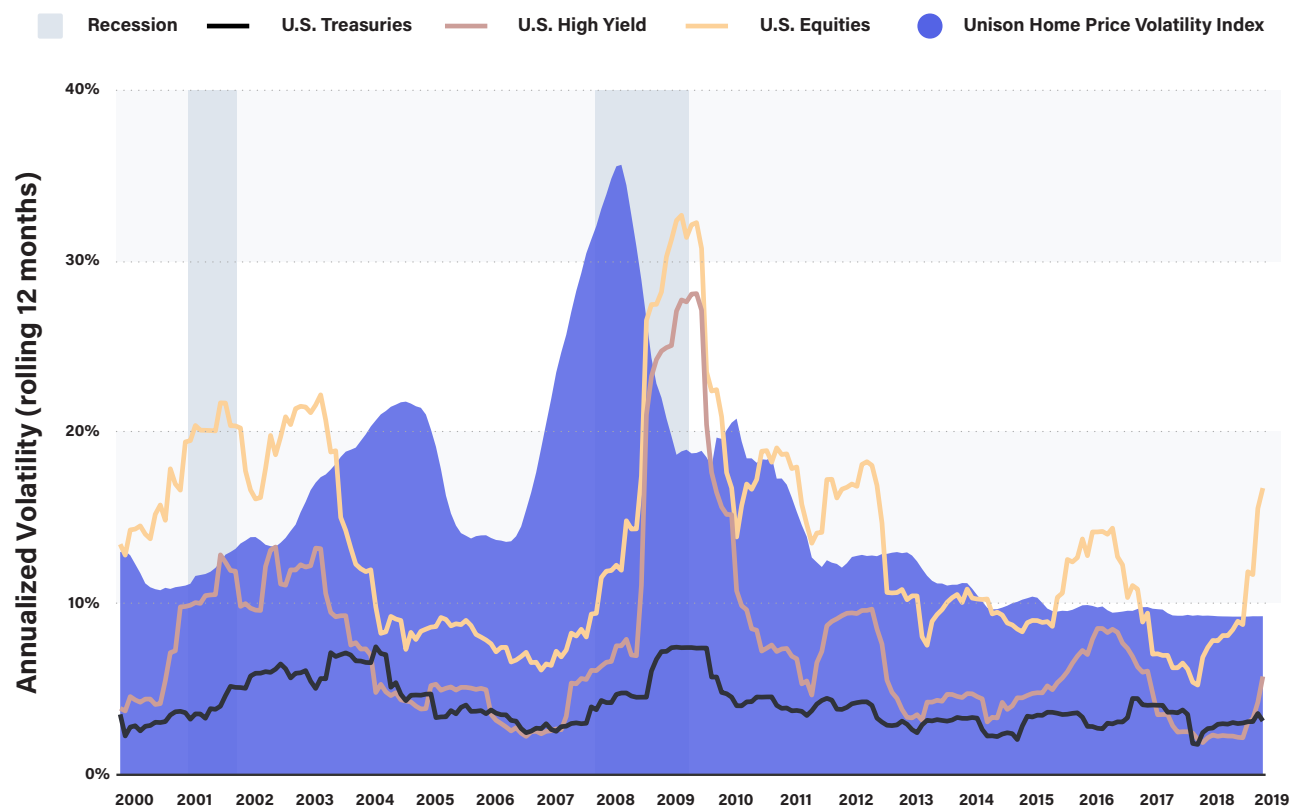
Figure 2a

Figure 2a: The annualized volatility (rolling 12 months) of an individual home is compared to asset classes (Source: Bloomberg) commonly held in a homeowner's portfolio.
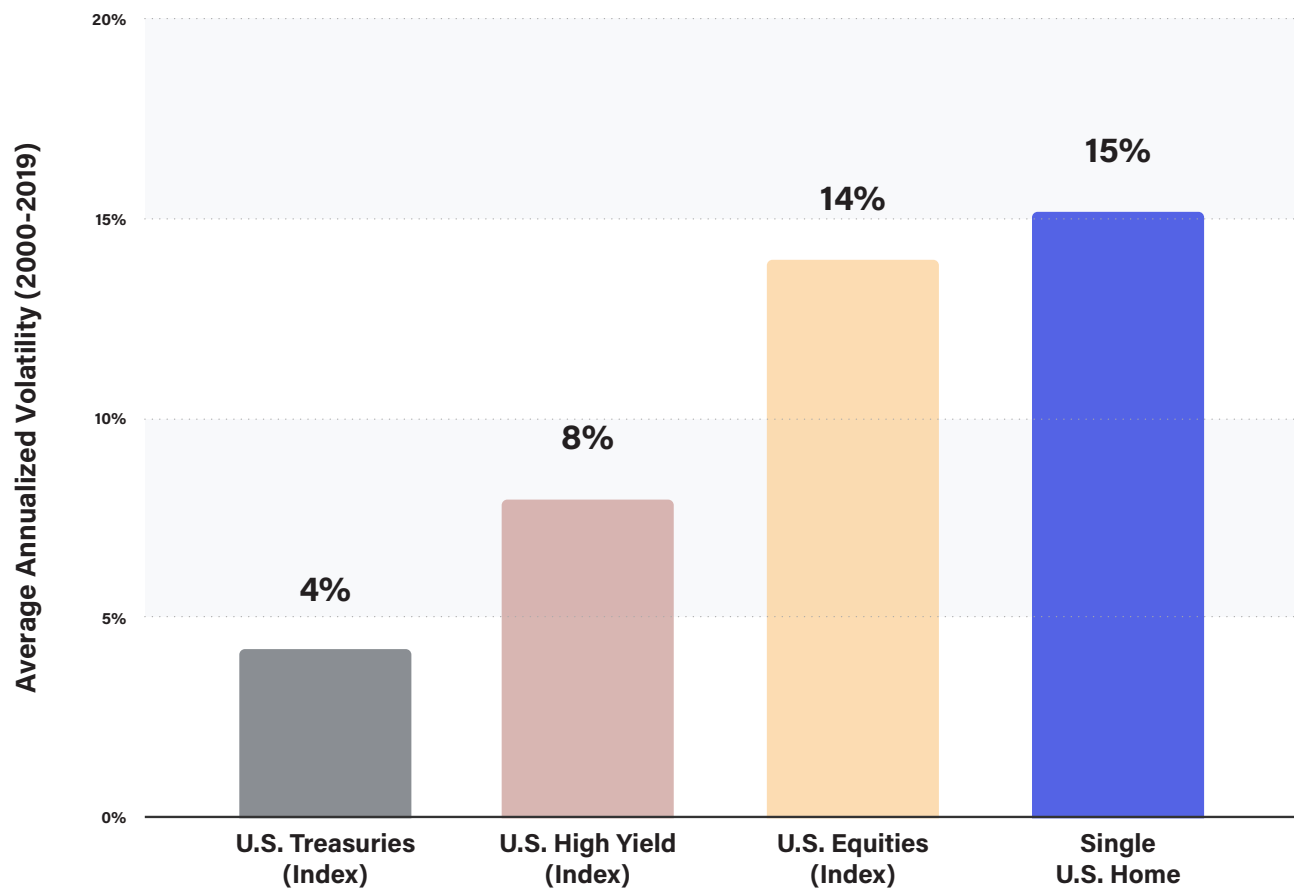
Figure 2b: The average annualized volatility of an individual home is compared to asset classes (Source: Bloomberg) commonly held in a homeowner's portfolio.

Table 1 summarizes the volatility and representative indices for each asset class.

Table 1

Asset Class	Annualized Volatility	Representative Index
U.S. Treasuries	4%	Bloomberg Barclays U.S. Treasury
U.S. High Yield	8%	Bloomberg Barclays U.S. Corporate High Yield
U.S. Equities	14%	Russell 3000
U.S. Home	15%	Unison Volatility Index

Table 1: Summary of annualized volatilities and representative indices for asset classes commonly held in a homeowner's portfolio.

Homeowner Portfolios are too Risky

Modern portfolio theory states that if an individual is presented with a multiplicity of portfolios with the same expected return performance, the one with the lowest expected volatility is preferred. If we take these claims for granted, we're led to the same conclusion presented famously by Harry Markowitz when he claimed that diversification is "the only free lunch." Diversifying investments across large numbers of different equities and bonds can minimize the risk of a portfolio without sacrificing return.

In the modern financial world, diversification is a mainstream strategy, popularized by mutual funds and exchange-traded funds (ETFs) which invest in and track large portfolios of assets. When it comes to a portfolio of stocks and bonds, a financial advisor can achieve very efficient trade-offs between risk and reward by constructing a portfolio of ETFs.

Consider now, that this same financial advisor recommends taking your entire net worth, borrowing between 5x and 20x this amount with a mortgage, and betting all of it on a single undiversified asset, your new home. If this were any other asset, you would immediately lose respect for this professional. Yet, when it comes to a home, millions of Americans make this trade every year and, as for the past 5 years, half will borrow a mortgage worth 95% of the value of the home and pay the expensive private mortgage insurance mandated by such a high leverage loan (Source: Urban Institute Housing Finance At A Glance, A Monthly Chartbook, April 2019). A home is where you live and it's illiquid - it should be the place to be conservative.

How much risk are American homeowner households taking if we include the home in addition to the brokerage account? To answer this question, we will compute the portfolio volatility, an industry standard measure of risk representing one standard deviation of returns after one year, of the median homeowner household portfolio both with and without including the home.

Figure 3a illustrates a sharp contrast between the perception of a homeowner's portfolio volatility and the reality of that volatility when the home is included.
To add some perspective, the most aggressive portfolio compositions offered by automated financial advisory platforms ("Robo-advisors") will allocate most investments into a small-cap stock index, which experiences an annualized volatility of about 20%, less than the typical homeowner household.

Figure 3a

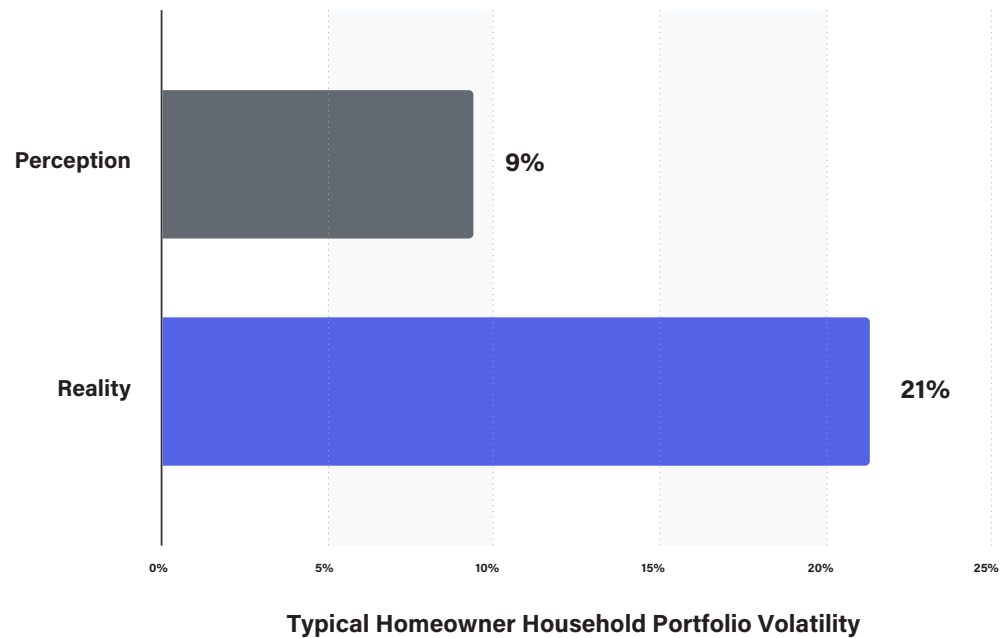**Typical Homeowner Household Portfolio Volatility**

Figure 3a: The estimated volatility of household wealth for (1) a typical household excluding the home, (2) including the home.

We repeat the exercise in Figure 3b for a new home buyer who just purchased a home using a mortgage worth 80% of the value of the home, and then one worth 95% of the value of the home.   A new homebuyer who borrows 5 to 20 times their net worth is taking so much risk that they have a realistic chance of losing their entire net worth and becoming insolvent.

Figure 3b

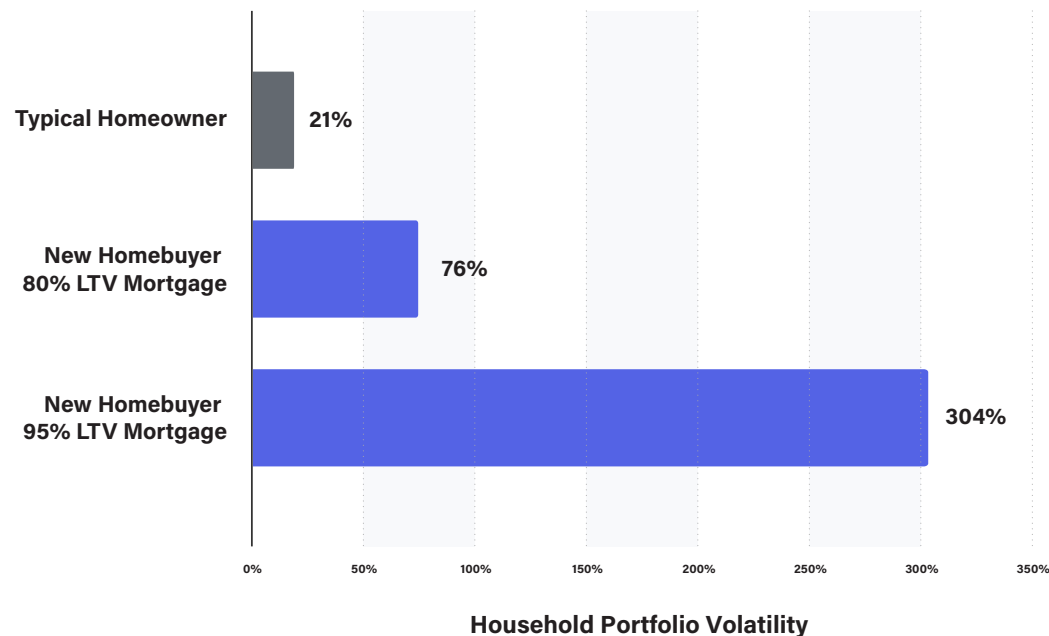**Household Portfolio Volatility**

Figure 3b: The estimated volatility of household wealth for (1) a typical household, (2) a new homebuyer borrowing an 80% loan-to-value mortgage and (3) a new homebuyer borrowing a 95% loan-to-value mortgage.

Table 2 summarizes the wealth composition of a typical homeowner household in the United States based on the 2015 Census. For the typical homeowner household, a majority of their $156.4k in net worth is locked up in $95.8k of home equity. That home equity represents the balance between a $215.8k home and a $120.0k mortgage.

Table 2

Median Household Wealth Composition

Total Net Worth

$156,400

Home Equity		**Liquid Assets**	
$95,800		$60,600	
Home Value	$215,800	**Stocks**	$40,000
Mortgage	($120,000)	**Cash, Bonds & Other Savings**	$20,600

Table 2: Approximate decomposition of owner-occupied household wealth in the U.S. as of the 2015 Census. (Source: 2015 Census, Wealth & Asset Ownership Data Tables)

The Majority of Home Risk is Diversifiable

Figure 4 illustrates the benefits of diversifying a residential real estate portfolio. Yet, almost the entire stock of the $27tn in residential real estate value is held as undiversified assets in individual homeowner household portfolios. By diversifying this risk away, an aggregate of $3tn of privately held, household annual portfolio volatility can be eliminated from the U.S. economy.

To make this claim more concrete, consider the experience of the worst performing 10% of homeowner households. In a given year, the worst 10% of homeowners will lose over 15% of the value of their home. This loss equates to $32k for our typical U.S. household. However, if we were to build large diversified portfolios of residential real estate, the worst 10% of these well-diversified portfolios can be expected to experience a loss of just over 2%, or $4k per home in this fictitious portfolio.*

Though it isn't practical or desirable to fully absorb all residential real estate risk into a large diversified portfolio, this thought experiment demonstrates the amount of risk that could be reduced and value that could be unlocked if thoughtful financial engineering could facilitate the absorption of at least some of this homeowner household risk into a large institutional portfolio.
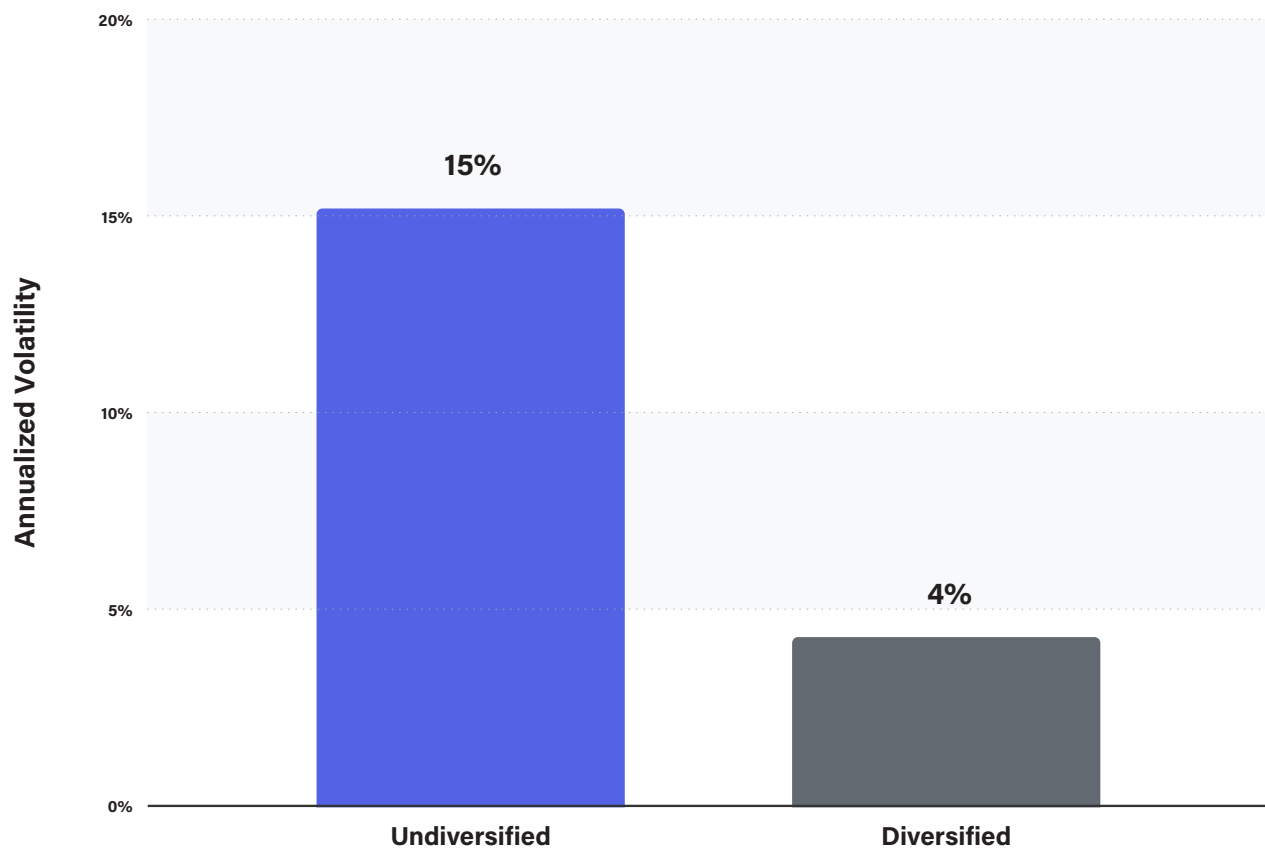
Figure 4

Figure 4: The annualized volatility of a diversified portfolio of U.S. residential real estate is significantly lower than that of an individual home.

*This approximation considers that log-returns are normally distributed with a long-run average return for homes of 3.5% per year, an undiversified volatility of 15% per year and a diversified volatility of 4% per year.

Conclusion

Classical analysis of the affordability of home prices focuses on two constraints: (1) households looking to buy a home need enough savings to afford a down payment and (2) households with a mortgage need enough income to cover monthly payments. Since the early 1980s, mortgage rates have been decreasing steadily. Freddie Mac 30-year average mortgage rates have dropped from 18% in 1981 to just under 4% in 2019. In addition, the mainstream adoption of low-down payment mortgage programs has driven half of home buyers with a mortgage to borrow 95% of the value of their homes (compared to 80% in the early 2000s). If we only consider these two constraints, so long as rates and down payment requirements continue to decrease, homes can theoretically continue to be affordable at unbounded price levels. However, adding a third constraint on the latent but crucial dimension of household financial risk, underscores the desirability of engineering a technology to allow homeowners to offload the risk of home price volatility if homes are to remain affordable at current price levels.

Unison's solution to this problem, inspired by public equity markets for corporations, has been to develop an equity market for residential real estate wherein investors may buy a partial claim on the future change in value of homes. This benefits the homeowner household who is taking far too much risk on one undiversified asset. It benefits the institutional investor who, to date, has been unable to invest in a portfolio of diversified residential real estate. Finally, it benefits the public by reducing the harsh negative externality of household debt.

Methodology

A maximum likelihood estimate of the volatility parameter for a time-varying volatility model is trained using data provided by CoreLogic Solutions. Specifically, each estimate in the chart represents the best estimate of the average annualized volatility (of the previous 12 months) of 19mm pairs of purchase and sale transactions of homes in the United States. Single family residences, condos, and duplexes are included. Non-owner occupied properties are excluded. Homes must have been purchased at least once and sold at least once between 1994 and 2019. The home must have been held by a homeowner for at least one year. Refer to "Robust Home Price, Return and Volatility Indices, Fast and robust algorithms for computing benchmark indices" whitepaper for a detailed description of the methodology.

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