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What is a mutual fund worth?

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- Until the 1980s, U.S. households participated in the stock market mostly through undiversified portfolios of directly held stocks. In the decades since, mutual and exchange-traded funds (ETFs) have accounted for a steadily rising share of household stock market exposure.

- This shift has reduced the risk of stock market participation, producing enormous gains in investor welfare. We use a utility function to estimate the dollar value of these gains, or, put differently, what investors would need to have been paid to forsake funds for the one-, two-, and three-stock portfolios that predominated before the mid-1980s. We put the total value at some $700 billion.

- Utility functions are unintuitive, but the estimates can complement alternative quantifications of diversification's benefits. Bessembinder (2018) finds that since 1926, just 4% of publicly traded stocks have accounted for the U.S. stock market's entire net gain, underscoring the risk of missing the few stocks that drive returns. Tidmore et al. (2019) demonstrate that the odds of outperformance increase as portfolio diversification rises.

In 1952, Harry Markowitz published "Portfolio Selection" in the *Journal of Finance.* In this short paper, Markowitz introduced mathematical statistics to the qualitative practice of portfolio construction. He contributed "efficient frontier" to the investment lexicon. He demonstrated that the "optimal" portfolio balances return and risk.

And this Nobel Prize-winning insight bore no resemblance to the way people actually invested. In the early 1950s, 4.2% of the U.S. population participated in the stock market, almost entirely through directly held stocks (Federal Reserve Board, 2019). These investors held undiversified portfolios—a median of two stocks. Half held one stock. Only 538,000 investors—0.35% of the population—held more than ten stocks (Kimmel, 1952). Stock investing resembled a game of portfolio roulette. One spin of the wheel might come up Amazon. The next might be Enron.

This approach predominated until the 1980s. Since then, the use of diversified vehicles such as mutual and exchange-traded funds has made Markowitz's insights available to the masses. We use a utility function (see accompanying box, "Utility values for funds and concentrated stock portfolios") to estimate the value of investors' shift from directly held U.S. stocks to U.S. stock funds.[1] Our analysis suggests that this shift has produced a welfare benefit—a measure that accounts for risk, return, and investor preferences—of some $700 billion.

Making Markowitz real

The first modern mutual fund, Massachusetts Investors Trust, began operations in 1924. By design and statute, mutual funds provide investors with diversification across a range of securities, a page from the Markowitz playbook.

Until the 1980s, however, mutual funds played almost no role in household portfolios. In 1950, mutual funds made up 3.1% of household exposure to the stock market; in 1970, the figure was 8.3%; in 1980, mutual funds accounted for 6.2%, and investors' directly held stocks remained undiversified (Federal Reserve, 2019, and Blume and Friend, 1975). As recently as the 1990s, Barber and Odean (2001) and Goetzmann and Kumar (2008) found, the average number of holdings for an investor at a large discount brokerage ranged from four to seven.[2]

Figure 1 displays the difference in risk—standard deviation—between concentrated stock holdings and diversified funds. We chart the 1950s and the 2000s, the least and most volatile decades since the publication of "Portfolio Selection." The standard deviations represent the average values from 10,000 randomly selected portfolios. The diversified funds, plotted on the same chart, represent the average standard deviations of U.S. stock mutual funds in each decade.

Figure 1. The more, the milder. As the number of holdings increases, risk declines
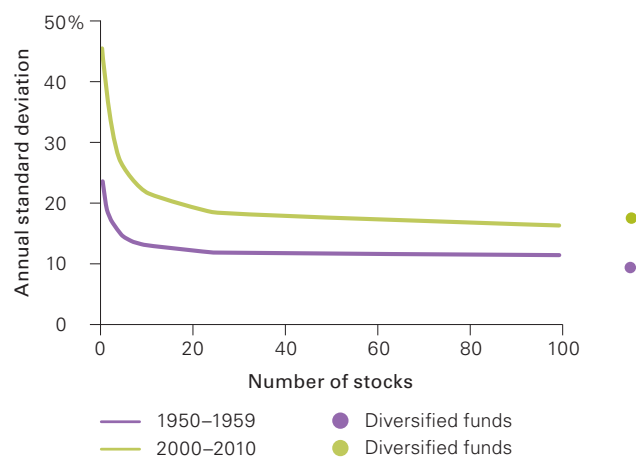
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1 We restrict our analysis to U.S. stocks and stock funds, which have the most extensive data. A similar framework can be used to analyze shifts in other asset classes from concentrated holdings to diversified vehicles.

2 This finding doesn't necessarily imply poor diversification in a given investor's portfolio. An investor may hold a handful of stocks and diversified funds. We observe this kind of behavior among Vanguard brokerage clients. This nuance doesn't affect our analysis, which examines the aggregate benefit of investors' shift to diversified funds.

The Markowitz dividend

What is the value of reducing that risk? The answer is, obviously, "something." But the quantification of that "something" is subjective. It depends on assumptions about risk preference and portfolio theory. We assume that stock-specific risk—risk that can be diversified away—is, on average, uncompensated (Sharpe, 1964). A single stock has a wider range of possible returns than the market, but its expected, or prospective average, return is the same. We also assume that investors are risk-averse. If two investments have the same expected return, we prefer the one with the smaller range of possible outcomes.

We use a utility function to account for this return expectation and risk preference, an approach similar to that of Poterba (2003), who quantified the cost of concentrated stock holdings in 401(k) plans. Our attempt to assign a dollar value to diversification also shares similarities with microeconomics research on the value of services that, like diversification, have no explicit cost. Search engines and social media networks are prominent examples. Brynjolfsson et al. (2019) used "massive online choice experiments" to estimate that users value Facebook at $42.17 per month. From 2003 to 2017, according to this analysis, Facebook contributed $231 billion to U.S. consumer welfare. In a separate study, Corrigan et al. (2018) estimated the annual value of Facebook to U.S. users at $240 billion.

Figure 2 displays the mix and the combined value of household stock and fund holdings over time. To estimate investor gains from this shift:

1. We use decade-by-decade shifts in funds' share of household stock market exposure to calculate the dollar value of the assets shifted. For example, from 1950 to 1960, the household mix of stocks and funds shifted from 96.9% stocks to 94.4% stocks, a 2.5-percentage-point increase in favor of funds. In 1960, the combined value of household stocks and funds was $358 billion. When we multiply that figure by 2.5%, we get a $9 billion shift from stocks to funds over the decade.

2. We multiply that $9 billion by the difference in utility scores for the undiversified stock and diversified fund portfolio. In the 1950s, the fund utility score was about 3 percentage points higher than that of an undiversified portfolio. When we multiply $9 billion by ~3%, we calculate that the shift to funds produced an investor welfare gain of about $260 million from 1950 to 1960.

3. We repeat these steps for each decade. We also continue to credit the assets shifted in earlier decades with the higher utility scores earned in every period after their shift.

A simple interpretation of this cumbersome calculation is that the total is what investors would need to have been paid to forsake funds for undiversified stock portfolios.

Figure 2. Since the 1980s, household stock market exposure has shifted from stocks to funds

- U.S. stocks
- U.S. stock funds
- Household assets in U.S. stocks
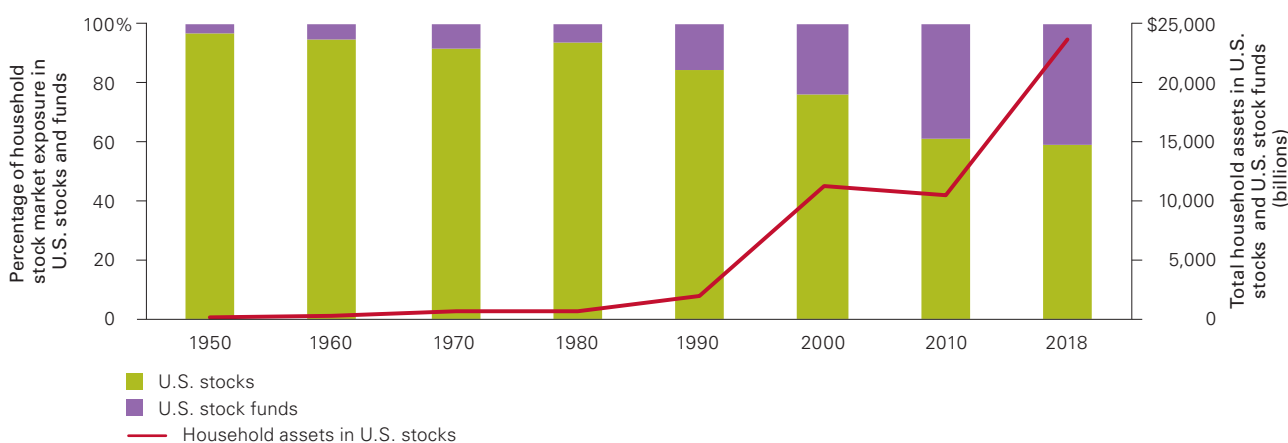
Notes: In the Federal Reserve's Financial Accounts of the United States' report on household balance sheets, "mutual funds" includes all long-term mutual funds (stock, bond, hybrid). ETFs are included in "corporate equity" holdings. To create the U.S. stock fund and corporate equity categories for our analysis, we use data from the Investment Company Institute (ICI) to make adjustments to the Federal Reserve data. We remove bond and non-U.S. stock funds from the mutual fund category (we make no adjustment for the small hybrid funds category). We also subtract the estimated household ownership of stock ETFs from corporate equities and add these values to the mutual fund category.
Sources: U.S. Federal Reserve, Investment Company Institute, Vanguard calculations.

To calculate the investor benefit produced by diversified funds, we use the following utility function:

$$U = E[R] - (.005)A\sigma^2,$$

where $E[R]$ is expected return; A is a risk-aversion coefficient; and σ^2 is variance. A scaling factor of 0.005 allows us to express the utility score, U, in percentage points (Bodie et al., 1993). We base our estimates of return and variance on the following calculations and assumptions:

- For each decade, we randomly select 10,000 three-stock portfolios from the CRSP database of U.S. stock returns and simulate their returns, with no rebalancing, for the ten-year period. We calculate the average standard deviation of these portfolios. (Monthly rebalancing produces a modest reduction in volatility.)

- For funds, we use the average volatility of U.S. stock funds for each decade.

- We assume that the expected returns of the concentrated portfolio and the diversified funds are equal to the return of the U.S. stock market return for each decade.

- We reduce the diversified fund's expected return by an estimate of fund costs—the asset-weighted expense ratio and a sales-weighted estimate of the sales charges, or loads, paid by investors in each decade. We amortize the sales charge over ten years.[3] We ignore stock market transaction costs—commissions, bid-ask spreads—which are incurred by both concentrated portfolios and diversified funds. In reality, funds have the technology, expertise, and scale to manage these costs more effectively than individual investors.

- We use a risk-aversion coefficient of 3, consistent with moderate risk aversion (Bodie et al., 1993). The coefficient has no inherent meaning. It's a parameter used to capture investors' observed aversion to risk. A coefficient of 0 implies that an investor is indifferent to risk, meaning risk reduction has no value. Appendix **Figure A-1** includes estimates of investor welfare gains based on higher and lower coefficients.

From 1950 until 1980, the modest shift from directly held stocks to diversified funds produced investor welfare gains, but the amount of assets shifted was too small to produce meaningful benefits for stock market investors as a group. In the 1980s, that changed.

That decade marked the rise of the 401(k) plan, a defined contribution plan that has since become the centerpiece of the U.S. retirement savings system. Mutual funds account for two-thirds of 401(k) plan assets; their role in workplace retirement plans has fueled their adoption outside these plans (ICI, 2019). By the end of the 1980s, mutual funds had increased from 6.2% of household stock market exposure to 15.2%, a roughly $200 billion change in the composition of household balance sheets. Investors' welfare gain—their Markowitz dividend—amounted to $15 billion.

Welfare gains increased in the 1990s and 2000s as funds' share of household balance sheets continued to rise. At the start of 2010, diversified vehicles accounted for 39.1% of household stock exposure. At the end of 2018, it was 43.1%, powered in part by changes in the financial advice business.

Financial advisors have begun to move from transaction-based models, in which compensation depends on the sale of individual stocks or funds, to fee-based models, in which compensation depends on an advisor's success in helping clients increase the value of their portfolios. Advisors are increasingly using low-cost ETFs in these arrangements. In 2011, fee-based advisors held 10% of client assets in ETFs. By 2017, the figure had risen to 28%. Full-service brokers have made a similar shift (Cerulli, 2018, and ICI, 2019).

3 Since 1980, investors' actual holding periods for stock mutual funds have ranged from three to eight years on average (ICI, 2019).

The sum total

In the nearly 70 years since Markowitz published "Portfolio Selection," the shift from U.S. stocks to U.S. stock funds has produced hundreds of billions of dollars in investor benefits. We estimate the total at $731 billion (Figure 3). And today, investors pay less to secure this benefit, enhancing its value. As price competition has driven fund expense ratios lower, and investors have favored these lower-cost funds, the cost of risk reduction has declined, as shown in Figure 4.

Figure 3. The shift from stocks to stock funds has produced cumulative investor welfare benefits of some $700 billion
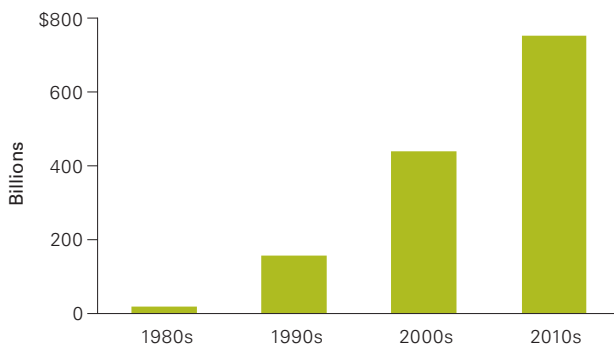
Note: We multiply changes in the household mix of directly held stocks and mutual funds by the difference between the estimated utility scores of a three-stock portfolio and a diversified fund.

Sources: U.S. Federal Reserve Board, Morningstar, ICI, Vanguard calculations.

Figure 4. The all-in cost of stock fund ownership is falling
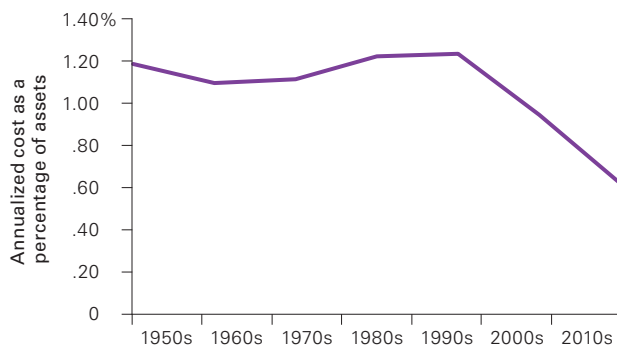
Notes: All-in costs are the sum of U.S. stock funds' asset-weighted expense ratio and a sales-weighted estimate of the sales charges, or loads, paid by investors. We amortize this sales charge over ten years.

Sources: Morningstar, Arthur Wiesenberger & Company, ICI, Vanguard calculations.

The investor benefit is bigger

Different risk-aversion coefficients and different modeling assumptions produce different estimates, but they all tell the same story. Mutual and exchange-traded funds have been a transformative technology. As with other technologies, funds have steadily improved, providing more diversification power at lower cost.

Figures 5 and 6 provide one example of these improvements—the expansion of the investment opportunity set. Figure 5 displays an efficient frontier based on the global stock markets in the 1950s. The frontier consists of realized returns for U.S. and non-U.S. stock markets for the ten years ended December 31, 1959. In the lower right, the plot includes the asset-weighted performance of mutual fund investors in the 1950s. And near the frontier's inflection point we plot a 60% U.S./40% non-U.S. stock portfolio, Vanguard's current equity allocation guideline for U.S. investors, a reference point for the expansion of the opportunity set over time.

In the 1950s, U.S. mutual fund investors captured most of the U.S. stock market's returns but almost none of the returns from non-U.S. stocks. The first non-U.S. stock funds—Scudder International Fund and Templeton Growth Fund—debuted in the mid-1950s. Their assets were modest and their portfolios bore little resemblance to the non-U.S. stock market.

Figure 5. The 1950s' underdeveloped investment options limited access to the efficient frontier
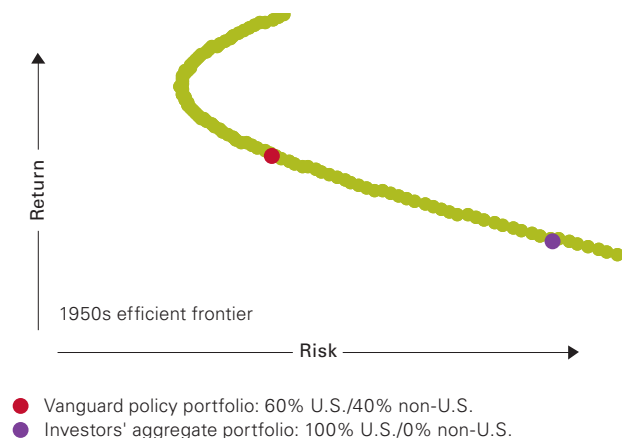
● Vanguard policy portfolio: 60% U.S./40% non-U.S.
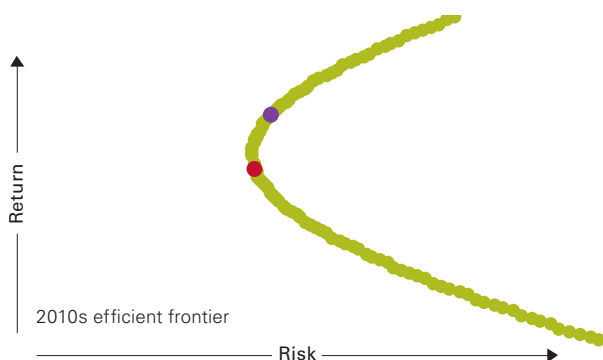● Investors' aggregate portfolio: 100% U.S./0% non-U.S.

Notes: The return of the U.S. stock market from 1950 to 1959 is represented by the Ibbotson Associates US Large Stock Return Index; for non-U.S. stocks, we construct a GDP-weighted index of major non-U.S. markets (Goetzmann and Jorion, 1997).

Sources: Ibbotson, Morningstar, Wiesenberger, Global Financial Data.

Compare the 1950s with the current decade. Today, every portfolio on the global stock market frontier is accessible to investors. Over the past nine years, investors journeyed northwest toward the optimal spot on the frontier with an asset allocation made up of 73% U.S. and 27% non-U.S. stock funds (Figure 6). The benefit? In the 1950s, the existing mutual fund "technologies"—U.S.-only portfolios—produced 61% of the policy (or baseline) portfolio's Sharpe ratio, a measure of risk-adjusted return that shares some similarity to a utility score. From 2010 to 2018, the more broadly diversified fund investor earned 86% of the policy portfolio's Sharpe ratio.

These Sharpe ratios are time-period-dependent, sensitive to the relative strength of U.S. and non-U.S. stocks. The comparison of the 1950s and 2010s nevertheless highlights the potential benefits of mutual fund innovation that has provided additional diversification opportunities.

Conclusion

Until the 1980s, directly held stocks accounted for the bulk of household stock market exposure. These households played a risky game of portfolio roulette, typically investing their savings in one, two, or three stocks. The rise of mutual and exchange-traded funds has reduced the risk of participating in the stock market, producing enormous gains in investor welfare.

Our analysis suggests that the shift from stocks to U.S. stock funds has produced a cumulative welfare benefit of more than $700 billion. A more comprehensive analysis, accounting for the benefits delivered by funds that offer diversified exposure to other asset classes, would produce a higher estimate. Utility values are unintuitive, but they can complement alternative quantifications of the risk-reducing benefits of diversification.

Bessembinder (2018), for example, finds that just 4% of publicly traded stocks have accounted for the U.S. stock market's entire net gain since 1926. Globally, the fraction is smaller. Tidmore et al. (2019) demonstrate that the odds of outperforming a relevant market index increase as portfolio diversification rises.

In their shift from directly held stocks to funds, investors have stated with their dollars that they place a high value on these benefits—maybe even $700 billion.

Figure 6. Today, the full global stock market frontier is accessible to investors

● Vanguard policy portfolio: 60% U.S./40% non-U.S.
● Investors' aggregate portfolio: 73% U.S./27% non-U.S.

Notes: From 2010 to 2018, the return of the U.S. stock market is represented by the Russell 3000 Index; non-U.S. stocks are represented by the MSCI All Country World ex U.S. Index.
Sources: Russell, Morningstar, Wiesenberger, MSCI.

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Appendix

Figure A-1 displays estimates for the welfare benefit produced by investors' shift from stocks to stock funds for different levels of risk aversion. A negative risk-aversion coefficient implies that investors prefer risk. The risk-reduction benefits of a diversified fund detract from its value. A coefficient of 0 implies that the investor is indifferent to risk. For those investors, the three-stock and diversified portfolio are equally good choices. Positive coefficients imply that we dislike risk. The higher the coefficient, the more we dislike risk and value the opportunity to reduce it. Our analysis uses a coefficient of 3, consistent with the range of reported and observed risk preferences of the typical investor.

Figure A-1. Cumulative welfare benefit implied by different levels of risk aversion (1950–2018)

Relative risk aversion	Welfare benefit
−1	−$244 billion
0	$0
1	$244 billion
3	$731 billion
5	$1,200 billion

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