S&P Dow Jones Indices

A Division of S&P Global

Returns, Values, and Outcomes: A Counterfactual History

"All we have to decide is what to do with the time that is given us."

– J.R.R. Tolkien, *The Fellowship of the Ring*

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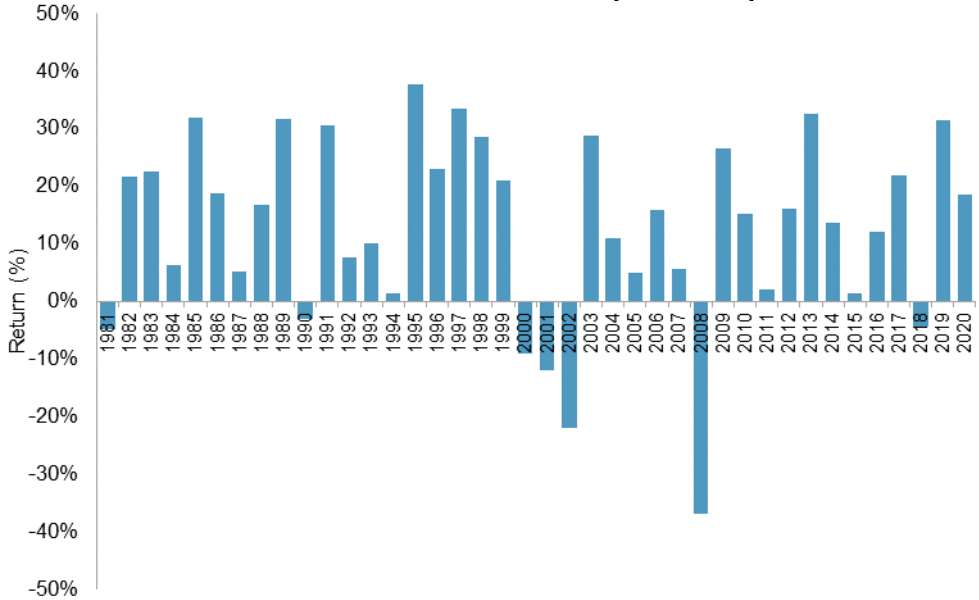
EXECUTIVE SUMMARY

- Any analysis of investment policy or strategy must be based on historical data. Even if an analyst wants to extrapolate into the future (which we do not), extrapolations must start with the past.
- But the historical data that we observe were not inevitable; **history might have turned out differently than it actually did**.
- In this paper, we construct a counterfactual history of the last 40 years of U.S. equity returns, and explore what those histories could imply for investment policy.
- Although the range of possible outcomes is quite wide, one consistent conclusion is that long-term investors in large-capitalization U.S. equities would have been advantaged by choosing passive rather than active management.

Exhibit 1: Annual Performance of the S&P 500® (1981-2020)



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1980, through Dec. 31, 2020. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

INTRODUCTION

Investors live not with a series of returns, but rather with portfolio values.

We often write about equity markets and the potential implications of various investment strategy choices. What are the implications of the choice between active and passive management?[1] How have factor or "smart beta" strategies performed in various economic environments?[2] What do market dynamics tell us about the investment opportunity set?[3]

All of these questions, and others like them, are important, but all are questions about *returns*. Investors, however, live not with a series of returns, but rather with portfolio *values*. In this paper, we model the connection between returns and portfolio values over a long-term historical horizon.

FORTUNA IMPERATRIX MUNDI – THE MODELING PROBLEM

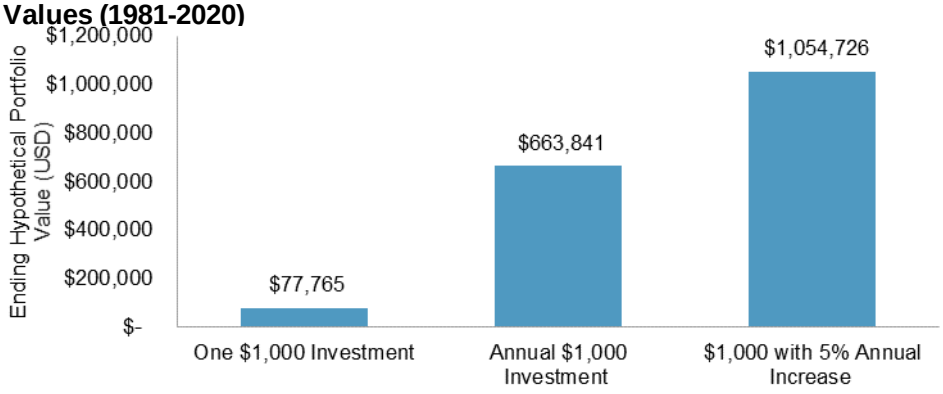
For the 40 years between 1981 and 2020, results for the S&P 500 varied substantially.

For anyone whose recollection requires refreshment, a glance at Exhibit 1 will illustrate the wide fluctuations in the annual performance of the U.S. stock market, as measured by the S&P 500. For the 40 years between 1981 and 2020, results varied substantially, ranging from a 37% loss in 2008 to a 38% gain in 1995. The market's compound annual return over this period was 11.5%.

What would the market's return mean for the value of a hypothetical portfolio during that period?

Having said that, what would the market's return mean for the value of a hypothetical portfolio during that period? Obviously, a portfolio's value would have depended not just on the market's returns, but also on the amount and timing of contributions. Exhibit 2 illustrates the potential impact of hypothetical contributions on final portfolio values in three scenarios.

Exhibit 2: More Inflows Would Have Produced Bigger Hypothetical Portfolio Values (1981-2020)



Source: S&P Dow Jones Indices LLC. Portfolio values are hypothetical. Data from Dec. 31, 1980, through Dec. 31, 2020. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

[1] For example, see Ganti, Anu R. and Craig J. Lazzara, "Shooting the Messenger," S&P Dow Jones Indices, December 2017.

[2] For example, see Chan, Fei Mei and Craig J. Lazzara, "Defense Beyond Bonds: Defensive Equity Strategies," S&P Dow Jones Indices, October 2018.

[3] For example, see Lazzara, Craig, "Man Bites Dog: The Year for Active Management," S&P Dow Jones Indices, Feb. 23, 2021 and Edwards, Tim, "A Reversal, or Two," S&P Dow Jones Indices, Jan. 7, 2021.

The three scenarios depicted are defined as follows:

Larger contributions theoretically could have led to larger portfolio values, and this would not have been just a function of the increased contribution.

- "One $1,000 Investment" assumes a $1,000 investment at the beginning of 1981, with no further contributions.
- "Annual $1,000 Investment" assumes a $1,000 investment at the beginning of every year. The total cumulative investment therefore would have been $40,000.
- "$1,000 with 5% Annual Increase" assumes a $1,000 investment at the beginning of 1981, increasing by 5% every year. The total cumulative investment in this case would have been $120,800.

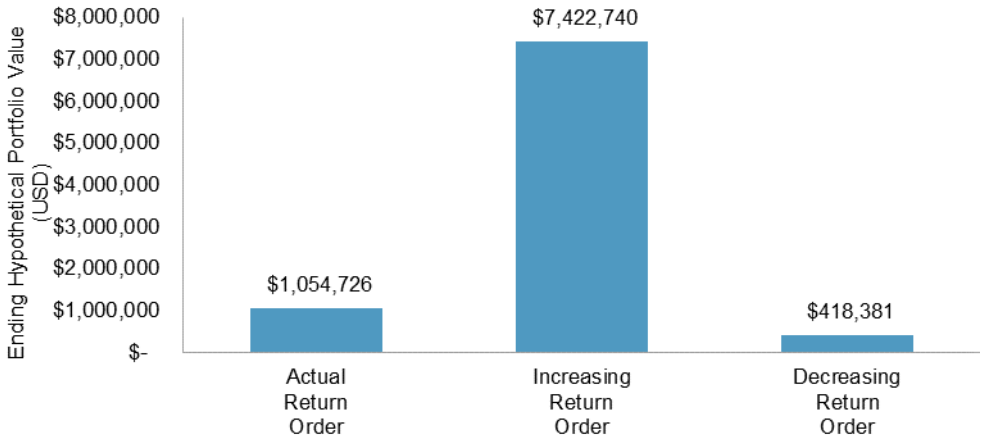
Each scenario assumes that all dividends are reinvested, but does not take into account expenses and transaction costs.[4] Unsurprisingly, larger contributions theoretically could have led to larger portfolio values, and this would not have been just a function of the increased contribution. Accounting profits[5] were far higher in the third scenario, despite the higher investment, than in either of the other two.

The market didn't do all the work; the final value of the hypothetical portfolio would have depended critically on the investor's ability and willingness to make contributions.

All three hypothetical scenarios in Exhibit 2 are based on *actual* S&P 500 returns (as shown in Exhibit 1). The obvious message of Exhibit 2 is that **the market didn't do all the work; the final value of the hypothetical portfolio would have depended critically on the investor's ability and willingness to make contributions**. With the market compounding at 11.5% annually, the more an investor put in, the more he could ultimately take out. This result is self-evident—and not especially insightful. History has a bit more to teach us, however, as shown in Exhibit 3.

With the market compounding at 11.5% annually, the more an investor put in, the more he could ultimately take out.

Exhibit 3: The Sequence of Returns Is Decisively Important to Final Portfolio Values



Source: S&P Dow Jones Indices LLC. Portfolio values are hypothetical. Data from Dec. 31, 1980, through Dec. 31, 2020. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

[4] It is not possible to invest directly in an index. Allocation to an asset class represented by an index may be available through investable instruments based on that index.

[5] "Accounting profits" denotes the difference between the portfolio's final value and the cumulative value of contributions.

In each scenario, we use the actual returns of a hypothetical investment in the S&P 500, but arrange the order differently.

In Exhibit 3, we again assume a $1,000 investment at the beginning of 1981, increasing by 5% every year, for a total contribution of $120,800. But now we *change the order* in which returns occur. In each scenario, we use the actual returns of a hypothetical investment in the S&P 500, but arrange the order differently. The "Increasing Return Order" scenario assumes that the worst return came first, then the next-to-worst, and so on until the best return occurred in year 40. The "Decreasing Return Order" scenario makes the opposite assumption; the best return would have occurred first, and the worst in year 40.

For all three scenarios in Exhibit 3, the market's compound growth rate is the same. For all three scenarios, the amount and timing of the investor's hypothetical contributions are the same. And yet the highest hypothetical portfolio value is nearly 18 times greater than the lowest. Clearly, **the order in which returns could have occurred matters a great deal**. Actual index historical performance lies between the two extremes (and is much closer to the lower than to the upper bound).

Clearly, the order in which returns could have occurred matters a great deal.

There's a simple intuition behind Exhibit 3, of course. In the "Increasing Return Order" scenario, the best returns occurred at the end—i.e., when our hypothetical portfolio was relatively large. The worst returns occurred at the beginning when the portfolio had less to lose. The "Decreasing Return Order" scenario did the opposite—it earned high returns when the portfolio was small, but incurred losses later on when the portfolio was much bigger.[6]

Exhibits 2 and 3, in combination, call our attention to an important truth: **a portfolio outcome depends in part, but only in part, on the returns the market delivers**. A portfolio's value also depends importantly on the order of returns, and on the level and timing of contributions. Contributions are easy to model—they are volitional and more or less any reasonable assumption will do—but modeling the level and order of returns is a different thing altogether.

It's helpful to think that there is a "true" distribution of annual returns; what we experienced in the last 40 years was simply 40 random draws from this distribution.

Modeling historical returns requires a broad perspective: we need to remember that **the history that actually occurred is not the only history that *might* have occurred**. It's helpful to think that there is a "true" distribution of historically possible annual returns and that what we experienced in the last 40 years was simply 40 random draws from this distribution.

The distinction between actual and possible history is not as profound as it may sound on first hearing. Imagine, for example, that you walk into a casino and go to a roulette table. You can observe the wheel and therefore

[6] The actual historical order of returns was front loaded. In 1981-2000, the compound annual return of the S&P 500 was 15.7%; in the next 20 years, the compound annual return was 7.5%. This helps explain why the "Actual Return Order" scenario was closer to the worst case than to the best case.

can observe the *true* distribution of possible returns. Suppose, however, that all you can observe is the results of each spin of the wheel—in other words, the *actual* distribution. With enough observations, you might form some inferences about the nature of the wheel, but you can never be certain that you understand it fully.[7] That's the position of any analyst of financial market returns.

Although we can't observe the true distribution of returns directly, we can make some inferences about it by observing the results that actually occurred.

We attempt to address this epistemological problem through simulations. Although we can't observe the true distribution of returns directly, we can make some inferences about it by observing the results that actually occurred. We can then use these inferences to model the market's historical returns over a series of possible 40-year iterations by following this procedure:

1. We create a model of possible passive returns by using the performance history of the S&P 500 between 1981 and 2020 (the period pictured in Exhibit 1). In those years, the average annual return of the S&P 500 was 12.8%, with a standard deviation of 16.2%. Our simulation model therefore assumes that the true distribution of returns is normally distributed with a mean of 12.8% and a standard deviation of 16.2%.
2. Drawing from this distribution, we create a set of 40 hypothetical annual returns for an investment tracking the S&P 500.
3. We repeat steps 1 and 2 an additional 999 times. This gives us 1,000 simulated histories, each covering a 40-year hypothetical investment horizon.

These return series let us model a stream of hypothetical portfolio values. As in Exhibits 2 and 3, our simulations begin with a $1,000 investment in year one, increasing by 5% every year, for an overall contribution of $120,800 spread over 40 years.

One of the most striking things about our 1,000 simulated scenarios is the range of outcomes they encompass.

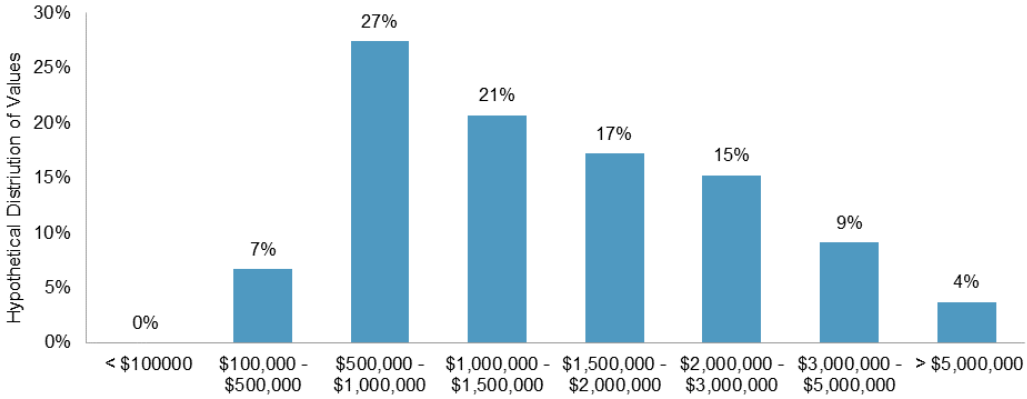
THE RANGE OF OUTCOMES

One of the most striking things about our 1,000 simulated scenarios is the *range* of outcomes they encompass, as shown in Exhibit 4. The *median* final portfolio value was $1,379,692; the interquartile range was a comparatively wide $1,301,737. The gap between the 90th and 10th percentile outcomes was more than $2.7 million. That there is a range of outcomes isn't surprising—we're looking at 1,000 different cases, each of which comprises 40 years of simulated data. Even though every year is drawn from the same distribution, different runs will lead to different results. (Notably, the hypothetical portfolio value associated with the *actual*

[7] For example, since the highest number on a standard roulette wheel is 36, you would never observe a number higher than this. You might conclude that numbers between 1 and 36 are equally probable results, but this is only an inference; you can't be sure unless you can see the wheel.

distribution of 1981-2020 returns lies at the 36th percentile of Exhibit 4's distribution.)

Exhibit 4: Hypothetical Distribution of Passive Portfolio Values



Source: S&P Dow Jones Indices LLC. Portfolio values and returns are hypothetical. Chart is provided for illustrative purposes.

The wide variance in our model's outcomes comes from two factors, of which the most important is simply the compound return.

The wide variance in our model's outcomes comes from two factors, of which the most important is simply the compound return. One thousand simulations produce a wide range of compound returns: the median was 11.8%, with the interquartile breakpoints at 9.8% and 13.5%. Obviously, the higher the return, the higher we expect the final value of the portfolio to be, and Exhibit 5 shows that this expectation is correct for the values of our simulated passive portfolios. The correlation between simulated compound annual return and simulated portfolio value is 0.817.[8]

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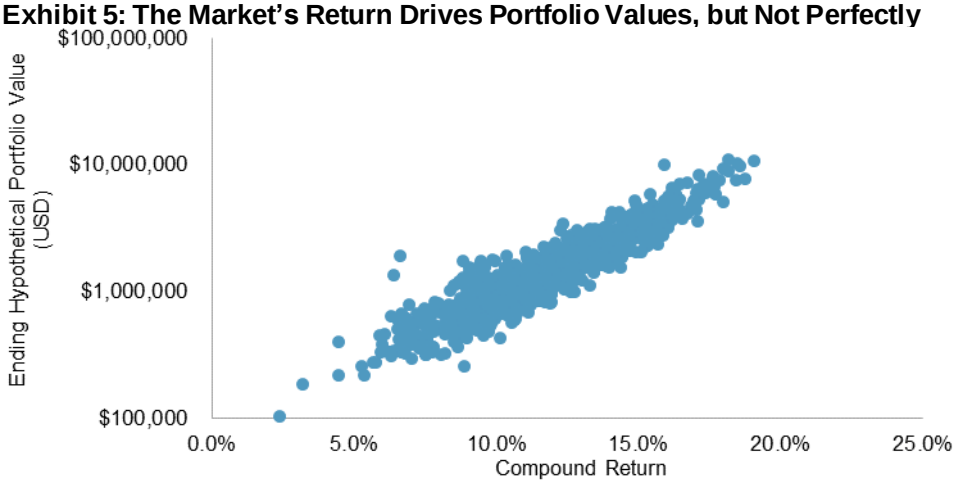
Exhibit 5: The Market's Return Drives Portfolio Values, but Not Perfectly



Source: S&P Dow Jones Indices LLC. Portfolio values are in log scale. Portfolio values and returns are hypothetical. Chart is provided for illustrative purposes.

A portfolio's value will be larger if the best returns occur late in the simulated period, when there are more assets for the returns to affect.

A given set of yearly returns will produce the identical *compound* return regardless of the order in which they occur. As we saw in Exhibit 3, however, when modeling portfolio *values*, the *sequence* of returns also plays a major role. A portfolio's value will be larger *if the best returns occur*

[8] The correlation estimate uses the logarithm of portfolio value. Notice that the vertical axis in Exhibit 5 is in log scale.

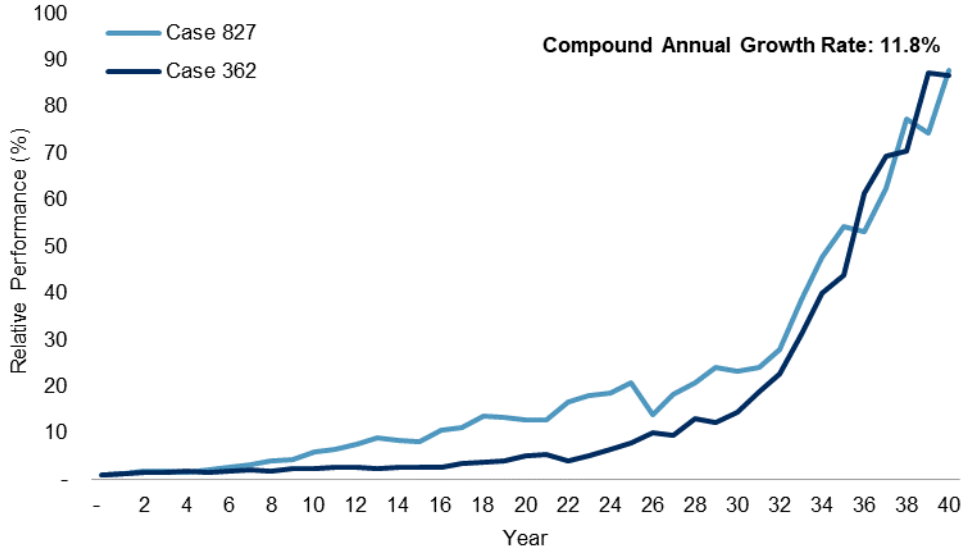
late in the simulated period, when there are more assets for the returns to affect. If the best returns come early, they have less influence because the portfolio's value is smaller at the beginning.

Exhibits 6-8 illustrate this in an emphatic way. Of our 1,000 cases, the median geometric return (to one decimal point accuracy) was 11.8%. There were 19 cases with a geometric return of 11.8%, and the difference in ending hypothetical values between the best and worst outcomes was nearly $800,000.

Case 827 did quite well early, while case 362 lagged for most of the simulation before staging a furious rally in the final decade.

Exhibit 6 highlights the best and worst of these cases, looking only at the sequence of returns. Case 362 and case 827 end up in more or less the same place (which is why they have the same geometric return). But they followed very different paths. Case 827 did quite well early, while case 362 lagged for most of the simulation before staging a furious rally in the final decade.

Exhibit 6: Two Paths to the Same Endpoint…

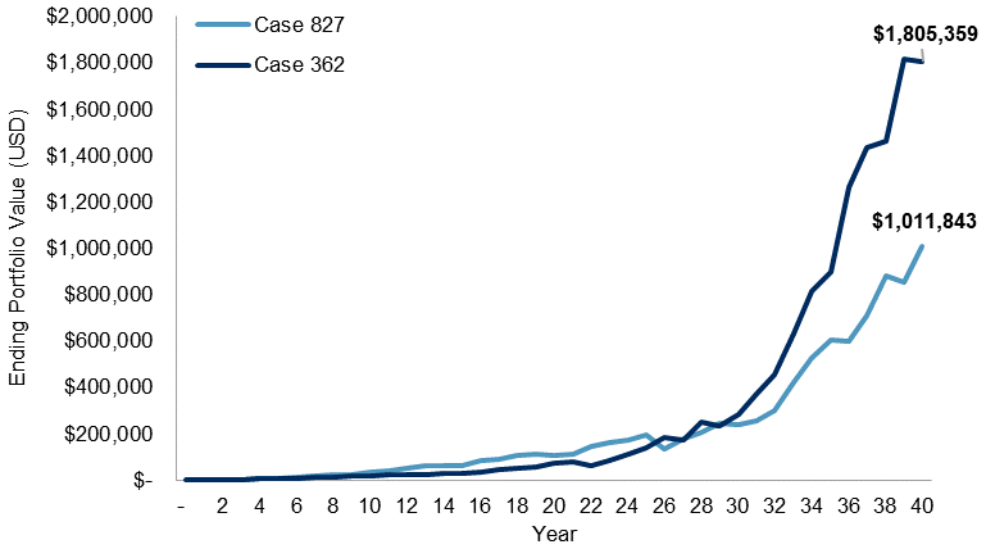


Source: S&P Dow Jones Indices LLC. Portfolio values and returns are hypothetical. Chart is provided for illustrative purposes.

Case 827's returns were more attractive at the beginning of the simulation, when the portfolio was worth relatively little.

This means that, when we model annual contributions, most of case 827's cash flows were invested at relatively high prices, while the opposite was true for case 362. And when case 362's returns accelerated near the end of the simulation, they operated on a relatively larger portfolio size. Case 827's returns were more attractive at the beginning of the simulation, when the portfolio was worth relatively little. Exhibit 7 shows the dramatic impact of sequencing on simulated portfolio values.

Exhibit 7: Despite Similar Returns, Final Portfolio Values Can Be Radically Different



Source: S&P Dow Jones Indices LLC. Portfolio values and returns are hypothetical. Chart is provided for illustrative purposes.

Case 362's returns were lackluster at the beginning, which turned out to be relatively unimportant because those poor returns operated on a low base.

Exhibit 8 provides more detail on the stream of returns for each of these two cases. Case 827 enjoyed its best returns at the beginning of the 40-year period, when its asset value was relatively low. Meanwhile, case 362's returns were lackluster at the beginning, which turned out to be relatively unimportant because those poor returns operated on a low asset base. But in the final decades, case 362 performed better. **Compounding needs something to work with.**

Compounding needs something to work with.

Exhibit 8: Two Cases with Similar Average Returns but Different Patterns

YEARS	CAGR (%)	
	CASE 827	CASE 362
1-10	19.6	9.5
11-20	8.0	7.3
21-30	6.0	11.2
31-40	14.2	19.5
Full Period	**11.8**	**11.8**
Final Portfolio Value	**$1,011,843**	**$1,805,359**

Source: S&P Dow Jones Indices LLC. Portfolio values and returns are hypothetical. Table is provided for illustrative purposes.

AGENCY

What we've seen so far tells us that portfolio values depend on three things:

1. The *true distribution* of returns;
2. The returns that come from that distribution *during the years the investor is building his portfolio*; and
3. The *order* in which those returns occur.

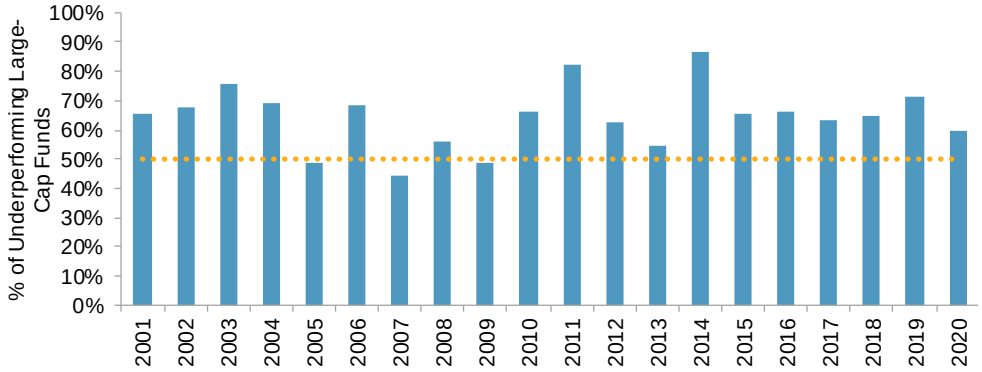
One thing the investor can control is the choice between active and passive management.

Yet the investor controls none of these things (and can't even observe the first of them directly). There are, however, some things that the investor can control. One of them is the choice between active management and passive management.[9]

The evidence that most active managers underperform the benchmarks against which they're compared is long-established and compelling.

The evidence that most active managers underperform the benchmarks against which they're compared is long established and compelling.[10] Indeed, the index fund was invented in response to the evident failings of active management.[11] Since 2001, our firm's SPIVA® (S&P Index Versus Active) Scorecards have contributed to the active versus passive debate by tracking the performance of various categories of mutual funds relative to index benchmarks.

Exhibit 9: Most U.S. Large-Cap Funds Underperform the S&P 500 Most Years



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2000, through Dec. 31, 2020. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

In only 3 of the last 20 years did a majority of active large-cap funds outperform the S&P 500.

SPIVA results (as summarized in Exhibit 9) reflect the difficult challenge faced by actively managed funds. In most years, most active funds underperformed their benchmarks. For example, in only 3 of the 20 years summarized in Exhibit 9 did a majority of active large-cap U.S. funds outperform the S&P 500. Over those 20 years, the S&P 500 returned a cumulative 322%, while the average actively managed fund gained 257%.

Historically, then, investors would have benefited from choosing passive management rather than an average active manager for this market.[12] But as before, **the history that actually occurred is not the only history that might have been.** We can combine data from SPIVA with the returns of our simulated passive portfolios to achieve more insight into the probable historical range of hypothetical portfolio values.

[9] Another is the timing of contributions; at the risk of oversimplification, more and earlier is better than less and later.

[10] Ellis, Charles D., "The Loser's Game," *Financial Analysts Journal*, July/August 1975; Sharpe, William F., "The Arithmetic of Active Management," *Financial Analysts Journal*, January/February 1991.

[11] Malkiel, Burton G., *A Random Walk Down Wall Street*, 1973; Samuelson, Paul A., "Challenge to judgment," *Journal of Portfolio Management*, Fall 1974. See also Bogle, John C., "The Professor, the Student, and the Index Fund," Sept. 6, 2011.

[12] This result is not unique to large-cap U.S. funds. See Liu, Berlinda and Gaurav Sinha, SPIVA U.S. Scorecard, S&P Dow Jones Indices, Year-End 2020.

When we simulated index returns, we assumed that the true distribution of returns was well-modeled by observed historical returns. We now assume that the true incremental return of active management is well-modeled by our SPIVA history. In other words:

Simulated Active Return = *Simulated Passive Return* + *Simulated Active-Passive Spread*

1. To each of the 40 passive returns in each of our simulated cases, we add the hypothetical value provided (or lost) by active management. We estimate the value of active management using SPIVA data: between 2001 and 2020, the mean value added by large-cap active U.S. managers was -0.8%, with a standard deviation of 1.9%.[13]
2. This provides us with a set of 40 annual returns for a simulated actively managed portfolio.
3. Repeat for the remaining 999 passive portfolios. We then have a series of 1,000 simulated active and passive returns for a 40-year investment horizon.

We assume that the average active manager is no more likely to outperform in a rising market than in a falling market…

Importantly, for step 1, we assume that there is no relationship between the return of the S&P 500 and the incremental return of active management—in other words, that the average active manager is no more likely to outperform in a rising market than in a falling market. Exhibit 10 shows that this assumption is justified; the correlation between the market's return and the average manager's "alpha" was 0.15.

…which is justified, as the correlation between the market's return and the average manager's "alpha" was 0.15.

Exhibit 10: Fund Return Differentials Show No Correlation with the Performance of the S&P 500

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, through Dec. 31, 2020. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

[13] Data on active fund performance are taken from the annual asset-weighted average return of "All Large-Cap Funds" from the SPIVA database. For details of fund classification, see Liu and Sinha, *op. cit.*, p. 28. We used annual data from the SPIVA database, spanning the years 2001-2020. Note that some of the funds that existed and contributed data for 2001 no longer exist, and some of the funds that contributed data for 2020 didn't exist in 2001.

THE COST OF ACTIVE MANAGEMENT

The median active portfolio lagged well behind the median passive portfolio, by $255,490, which is not trivial, considering the total amount contributed was $120,800.

Exhibits 11-13 summarize the results of these simulations, assuming the same contribution level for active and passive strategies. Recall that the final value of the *median* hypothetical passive portfolio was $1,379,692. The median active portfolio lagged well behind at $1,124,202, a difference of $255,490.[14] Since the total amount contributed over a 40-year horizon was assumed to be $120,800, this difference is not a trivial sum.

Exhibit 11: Breakpoints of 1,000 Simulated Active and Passive Portfolios

PERCENTILE	PASSIVE	ACTIVE	DIFFERENCE
10th Percentile	$561,915	$464,648	$97,267
25th Percentile	$830,005	$699,389	$130,616
50th Percentile	$1,379,692	$1,124,202	$255,490
75th Percentile	$2,131,742	$1,753,136	$378,606
90th Percentile	$3,290,210	$2,762,338	$527,873

Source: S&P Dow Jones Indices LLC. Results and portfolio values are hypothetical. Table is provided for illustrative purposes.

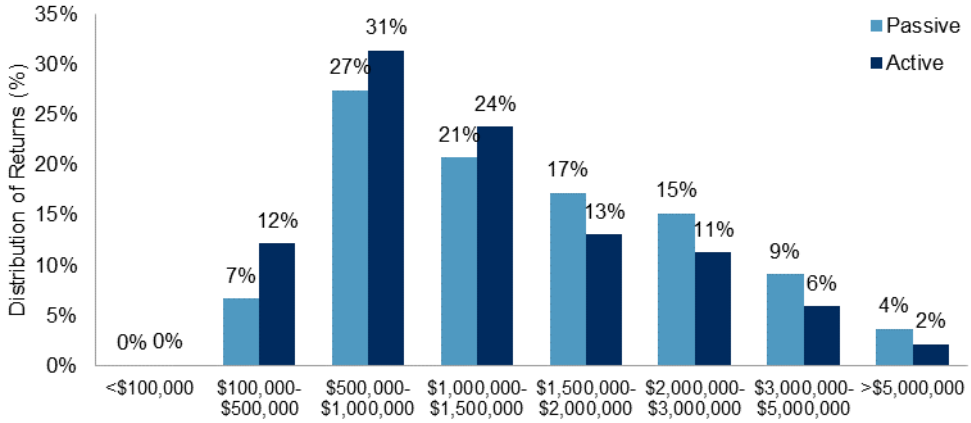
The distribution of the passive portfolios has a relatively long right tail, with more cases valued at more than $1 million than below.

We saw the pattern of passive outcomes in Exhibit 4; the distribution has a relatively long right tail, with more cases valued at more than $1 million than valued below. Of the 1,000 cases, 37 (or 4%) are particularly fortunate, theoretically returning over $5 million, with the most extreme case earning $10.8 million.

The overall hypothetical distribution of active portfolios (Exhibit 12) has a similar shape, although results were generally not as good. Of the hypothetical active portfolios, 43% were worth *less* than $1 million, and there were fewer active portfolios in the highest return groups.

The overall distribution of active portfolios has a similar shape, although results are generally not as good, with fewer active portfolios in the highest return groups.

Exhibit 12: Distribution of Active Returns



Source: S&P Dow Jones Indices LLC. Results and portfolio values are hypothetical. Chart is provided for illustrative purposes.

[14] Statistically minded readers will observe that the difference between the median passive value and the median active value is not necessarily the same as the median difference. This is correct; in fact, the median gap between active and passive outcomes was $216,608. We use the difference between the medians to minimize potential confusion.

The ratio of the values of the median passive portfolio and the median active portfolio was 1.23. **A passive approach, in other words, would have added approximately 23% to the final value of the median investor's portfolio of large-cap U.S. equities**.

The ratio of the values of the median passive portfolio and the median active portfolio was 1.23.

The last statement oversimplifies somewhat, because the gap between the median passive portfolio and the median active portfolio is not exactly equal to the median gap. To address this difficulty, Exhibit 13 summarizes the results of our 1,000 simulations, sorted in order of the passive-active gap. The final active value exceeded the final passive value in only 13 out of our 1,000 cases. In other words, **the likelihood that an investor's outcome would have been advantaged by choosing passive management in the large-cap U.S. equity space was greater than 98%**. The median spread between passive and active strategies was $216,608, with 81% of the cases recording a spread greater than $100,000.

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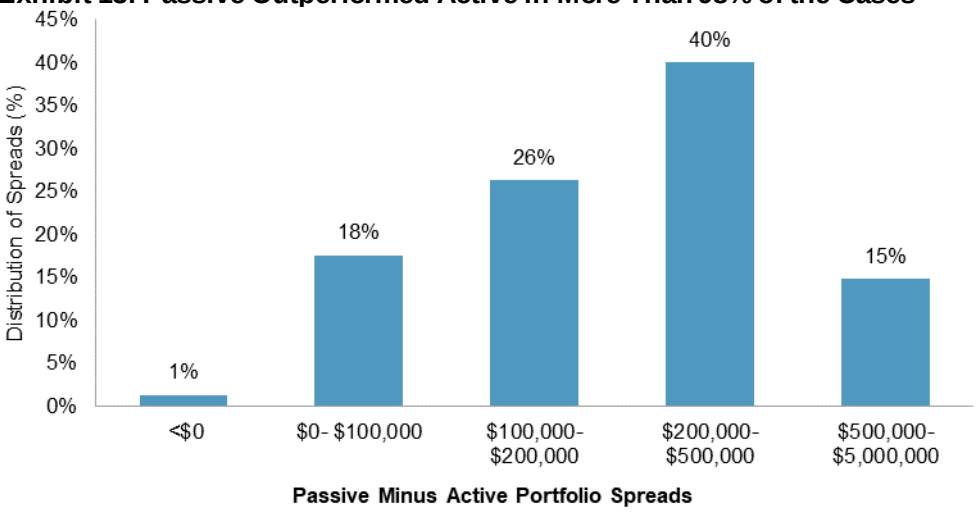
Exhibit 13: Passive Outperformed Active in More Than 98% of the Cases



Source: S&P Dow Jones Indices LLC. Results and portfolio values are hypothetical. Chart is provided for illustrative purposes.

THE LAST REFUGE

Active managers sometimes argue that, although index funds outperform in rising markets, active management shows its true value in bear markets.

Active managers sometimes argue that, although index funds have a performance advantage in rising markets, active management shows its true value in bear markets. SPIVA data (cf. Exhibit 10) show little support for this view. Our simulations provide another way to test the hypothesis by comparing active and passive results, contingent on the level of passive performance.

Exhibit 14 sorts our data by the ending value of the passive portfolios, and reports average portfolio values within each category.[15] For example, the *average* value of the worst-performing 10% of all passive portfolios was

[15] This contrasts with the breakpoints reported in Exhibit 11.

$432,694. When passive values are in their worst decile, the corresponding average active value was $364,460, or $68,234 less.

Active management was unlikely to outperform passive, regardless of the overall market environment.

Exhibit 14: Active and Passive Outcomes Contingent on Passive Performance

GROUPING	AVERAGE PORTFOLIO VALUES			PROBABILITY OF ACTIVE OUTPERFORMANCE (%)
	PASSIVE	ACTIVE	SPREAD	
Lowest Decile	$432,694	$364,460	$68,234	1.00
Lowest Quartile	$592,221	$497,475	$94,747	2.00
Second Quartile	$1,086,343	$901,043	$185,300	1.20
Third Quartile	$1,703,882	$1,405,193	$298,689	0.80
Fourth Quartile	$3,609,267	$2,966,785	$642,482	1.20
Highest Decile	$5,102,712	$4,183,415	$919,297	1.00

Source: S&P Dow Jones Indices LLC. Portfolio values and results are hypothetical. Table is provided for illustrative purposes.

The final column of Exhibit 14 shows that active management was unlikely to outperform passive, regardless of the overall return environment.

One thing the investor can control is the choice between active and passive management.

FINAL THOUGHTS

Long-term investment results depend on a number of variables that an investor is powerless to influence. We don't know the true distribution of equity market returns; we can't control what the draws from that distribution will be during the years that are relevant for us; we can't choose the order in which those returns occur. **One thing the investor *can* control is the choice between active and passive management**. Overwhelmingly, the data show that passive portfolios outperformed active portfolios.

APPENDIX A: AN ALTERNATE APPROACH

What is the "true distribution" of stock market returns? We argued in the body of the paper that the true distribution is essentially unknowable; all we can do is form inferences based on our observations. We did this by assuming that the true distribution is characterized by the same mean and standard deviation as our sample of observations. We could then ask what range of outcomes *might* have occurred over the last 40 years, rather than being limited to the outcomes that actually *did* occur.

There are other ways to address this question. An alternate approach is to draw returns directly from the historical sample, without assuming an intervening mean and standard deviation. We can follow a similar approach in estimating the true active-passive spread. Instead of calculating the mean and standard deviation from SPIVA data, we can simply draw future spreads directly from the historical values.

Exhibit 15 follows that procedure and supports the conclusion we drew earlier: investors historically would have been better served by choosing passive rather than active management with respect to the large-cap U.S. equity market.

Exhibit 15: Breakpoints for 1,000 Simulations Using Random Draws

GROUPING	PASSIVE	ACTIVE	SPREAD
Lowest Decile	$523,775	$438,626	$85,149
Lowest Quartile	$776,907	$652,214	$124,694
Second Quartile	$1,271,575	$1,043,933	$227,642
Third Quartile	$2,103,276	$1,730,180	$373,096
Highest Decile	$3,275,516	$2,621,904	$653,612

Source: S&P Dow Jones Indices LLC. Results are hypothetical. Table is provided for illustrative purposes.

PERFORMANCE DISCLOSURE/BACK-TESTED DATA

Past performance of the Index is not an indication of future results. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results. Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations. Back-tested performance is for use with institutions only; not for use with retail investors.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI's ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices maintains the index and calculates the index levels and performance shown or discussed but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US $10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US $1,650), the net return would be 8.35% (or US $8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US $5,375, and a cumulative net return of 27.2% (or US $27,200).

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