

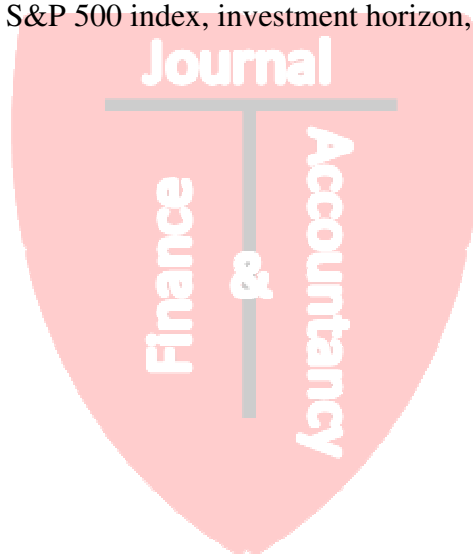
## Passive investing: luck or patience?

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### ABSTRACT

Passive investing over relatively long time-periods is a strategy followed by many individuals. In this paper, empirical evidence is presented beginning January 1950 that demonstrates that the success of this strategy is dependent not only on the length of the investment horizon, but also by the date of the initial investment. 10, 20, and 30-year periods are examined for both a lump sum initial investment and then for a monthly annuity investment. Longer horizons are shown to decrease the chance of an overall loss on a portfolio. However, different initial investment dates result in a wide range of ending portfolio values.

Keywords: passive investing, S&P 500 index, investment horizon, annuity, lump sum



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## INTRODUCTION

Investors are advised to commit capital to the markets as early as possible to capture the power of compounding. On the surface, this seems to be prudent advice as money will not increase in value while in an individual's pocket. However, we also know that the U.S. stock market can entail a great amount of risk for an individual. It is an investor's responsibility to gauge the respective level of risk they are willing to bear and then invest accordingly. The mathematics of finance provide investors with methods to manage risk. Portfolio diversification is the easiest method to improve an investor's risk-return trade-off. In this paper, we will use a passive investment strategy. Investors will invest passively in a well-diversified manner by placing their wealth in a Standard and Poor's (S&P) 500 index. Warren Buffett has advocated this type of investment. In his Berkshire Hathaway shareholder letter dated February 28, 2014 he states in regard to a trust for his wife "My advice to the trustee could not be more simple: Put 10% of the cash in short-term government bonds and 90% in a very low-cost S&P 500 index fund. (I suggest Vanguard's.) I believe the trust's long-term results from this policy will be superior to those attained by most investors – whether pension funds, institutions or individuals – who employ high-fee managers." Sharpe (1991) agrees with Buffett in terms of the superiority of passive over active investing and additional articles such as Doran, Peterson, and Wright (2010) indicate that investors often favor a passive investment strategy.

As will be demonstrated, an investor making a one-time investment in the stock market faces a wide range of potential payoffs that are dependent on the date of the initial investment as well as the length of the investment period. The date of the initial investment is somewhat a matter of luck as an individual cannot pick their birth date or the time they will have money available to invest. However, an investor generally has more influence over their investment horizon with a more patient investor willing to wait longer periods for a payoff.

This paper will also examine the consequences of making periodic payments into the passive fund over different lengths of time. Given constant inflows, this will result in more wealth being invested toward the end of the investment period than at the start. It will also be empirically shown that the date of the initial periodic investment results in a significant difference in the investor's final payoff.

## LITERATURE REVIEW

Wealth advisors have long advocated for placing money into funds and allowing the wealth to compound over longer periods due to the power of compound interest. One of the most efficient ways to accomplish this is through passive investment funds as will be done in this paper. Many researchers have detailed the benefits of passive management. Elton, Gruber, and de Souza (2019) state that assets under passive management has increased from 16.4% to 26% over the last five years. After building more rigorous benchmark portfolios, they conclude that investor returns in passive funds do outperform those in active funds of equivalent risk. Crane and Crotty (2018) find evidence that selection skill for index funds is present and that risk-averse investors should always choose a random index fund over a random active fund. Pedersen (2018) argues that a place exists in the investing world for both active and passive managers, but that active manager's returns after fees are less than impressive. As a result, passive investment will grow, but will not make up the entirety of the market. Blitz (2014) discusses the popularity of passive investing and argues that though passive investing is an appealing concept, it could

not exist in the absence of large-scale active investing. Banerjee and Hung (2013) compare returns for actively managed funds using momentum trading strategies to return of equally-weighted passively managed funds. Their findings do not show the active strategy to be beneficial relative to the passive strategy. Grover and Lavin (2009) find passive, index funds issued through Vanguard to be effective investment vehicles, but indicate that the funds can be optimized to result in better reward-to-risk ratios. Prondzinski and Miller (2018) find that Sharpe ratios for active and passive stock indices are insignificantly different from 2009 to 2017. They conclude that investors should consider the benefits of diversifying with a combination of active and index funds.

## DATA AND METHOD

The data drawn for this paper comes from two sources. Returns are obtained from the CRSP (Center for Research in Security Prices) Index File on the S&P 500. Specifically, value-weighted returns (including distributions) are used in this study.<sup>1</sup> Monthly returns starting with January 1950 through December 2018 are included in this study. The impact of inflation is controlled for in this study through the use of data obtained from the St. Louis Federal Reserve. Their monthly CPI index can be located at <https://fred.stlouisfed.org>. Real returns are calculated by subtracting the monthly change in the CPI from the return on the S&P 500 index.

When considering the investment of a single lump sum, the investor is assumed to initially invest \$1,000. This investment is placed into the S&P 500 index and changes each month in value based upon that month's S&P 500 return. No cash is assumed to be withdrawn until the end of the investment period. The impact of three different lengths for the investment period are examined including 10, 20, and 30 year periods. In order to show the impact of the initial date of the investment, the investor's ending portfolio value is calculated many times. For example, when using the 10-year period, the investor is first assumed to invest on January 1, 1950 and they withdraw their funds on December 31, 1959. Next, the investor is assumed to invest on February 1, 1950 and withdraw their funds on January 31, 1951. This process is repeated until it is no longer possible to invest for the entire 10-year period.

A similar process is used to compute the returns for an investor willing to make monthly annuity payments into the S&P 500 index. They are assumed to place \$50 into an S&P 500 index at the start of each month. If using a 10-year period, the investor is assumed to initially invest \$50 on January 1, 1950. They invest another \$50 on February 1, 1950. They continue to make monthly deposits into the fund with their last deposit being made on December 1, 1959. The total amount in the account at the start of each month is invested for that one month at the rate of return on the S&P 500 index for the given month. This process is repeated until it is not possible to invest for the entire 10-year period as was done for single-lump sum amounts.

In addition to the 10-year periods given in the above examples, longer investment periods of 20 and 30 years are also examined using a similar method. To account for differences in inflation over the time-period of the data used in the study, the rate of inflation is calculated using CPI (consumer price index) data obtained from the St. Louis Federal Reserve. Results on both nominal and real bases are reported.

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<sup>1</sup> Similar results can be obtained using the returns for the Standard and Poor's 500 index from Yahoo! Finance. However, these returns will not account for dividend payments and as a result will underestimate returns for the investor.

## RESULTS

### Single lump sum investment

Exhibit 1 (appendix) is a graph that shows the value after a 10-year investment period assuming a one-time investment of \$1,000 at the start of a given month.<sup>2</sup> In this discussion, the real value will be placed in parentheses behind the nominal dollar quantity. For example, if the initial investment is made on January 1, 1950, the investor will have \$5,896.36 (\$4,744.18) in their account at the end of 10 years. If the \$1,000 was invested instead on October 1, 1964, the ending value in the account would only have been \$1,050.28 (\$639.80). An individual fortunate enough to make their initial \$1,000 investment on September 1, 1990 would have ended up with \$6,046.18 (\$4,613.54) at the end of 10 years, but an unfortunate individual that initiated their investment on March 1, 1999 would only end up with \$727.63 (\$562.85). Exhibit 1 (appendix) clearly shows the importance of timing in the investment process. The difference in waiting one month to invest makes a large difference in ending value at times. If you would have invested on October 1, 1977, you would have ended with \$5,368.40, but if you had waited one month to invest your money on November 1, 1977, you would have ended with only \$4,394.42. One month's difference in starting date results in a difference of \$973.98. Another example of substantial differences is investing on either October 1, 1987 or November 1, 1987. The former would result in an ending investment worth \$3,970.18 while the latter would be \$4,897.62 – a difference of \$927.43.

Over a large number of 10-year investment periods, Exhibit 1 (appendix) shows that during most time periods, a passive investment scheme using an S&P 500 index would be superior to just retaining the \$1,000 in cash. However, there are 21 months in which on a nominal basis the investor would end up with less than their initial \$1,000. All of these periods occur starting on December 1, 1998 and ending with October 1, 2000. An individual unfortunate to commit their capital at the start of the month during this time-period experienced two recessions. A recession occurred between March 2001 and November 2001 and a second recession started in December 2007 and ended in June 2009. Even with diversification and a 10-year investment period, investors did not even earn a positive nominal return over these periods.

Exhibit 2 (appendix) expands the investment horizon from 10 years to 20 years. As before, nominal dollar quantities will be reported with real values in parentheses. In examining the potential ending values, it is clear that the most fortunate time to have invested the initial \$1,000 would have been on April 1, 1980. The ending value in the investors account would have grown to \$29,181.65 (\$13,680.25). The least amount a 20-year investor would receive is \$3,058.40 (\$1,106.94) and this occurred if they made the initial \$1,000 investment on January 1, 1999.

Over the sample period, the passive investment scheme using the S&P 500 index would have ensured the investor in a net gain on both a nominal and real basis. This can be contrasted with the results of a 10-year investing period in which it was possible to realize a net loss on both a nominal and real basis. An investor making their initial \$1,000 deposit anytime starting June 1989 or after would have included the two recessionary periods mentioned in the 10-year

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<sup>2</sup> All of the data used in this study is available upon request. For the 10-year period, there are 709 ending values dependent on the investment date which makes it infeasible to present all of the data in a tabular form.

investment horizon section. However, the results of the ending balances indicate that by expanding the investment horizon, the investor will still realize a net gain though the recessions still impact the ending value in a negative manner. Large swings in ending value still occur when investing for 20 years. Individual investing on March 1, 1980 and April 1, 1980 would have ending values of \$23,974.61 (\$11,133.36) and \$29,181.65 (\$13,680.25), respectively. By waiting one month, the investor would realize an additional \$5,207.04 (\$2,546.89).

Exhibit 3 (appendix) examines the impact of a 30-year investment horizon on the ending value of a one-time lump sum investment of \$1,000. The value of longer investment horizons becomes obvious as the investment horizon has increased from 10 years to 20 years and finally to 30 years. An individual that invested their \$1,000 on July 1, 1970 would end their 30-year period with \$59,621.59 (\$13,349.44). The unfortunate individual who invested on October 1, 1955 only ended up with \$13,693.31 (\$3,374.72). Even in the worst-case scenario, the investor more than triples their real spending power. This can be compared to the 20 and 10-year horizons where the real spending power remained nearly constant and decreased, respectively.

Similar to a 20-year investment horizon, Exhibit 3 (appendix) indicates that no matter the starting point for the \$1,000 lump sum investment, the individual will have increased their purchasing power through their willingness to commit to a longer investment horizon. Wide swings in ending value still occur over this longer horizon. An individual investing on November 1, 1970 would end with \$50,998.95 (\$11,479.90). Had that individual waiting one month to invest, they would have ended with \$44,582.64 (\$10,077.85) in their account. This is a difference of \$6,416.30 (\$1,402.05).

Exhibit 4 (appendix) provides descriptive results of the ending value for a one time investment of \$1,000 over the 10, 20, and 30-year investment periods. These results show that an investor's willingness to lock their wealth for longer time-periods into a passive S&P500 index is typically beneficial. On average, a passive investor that deposits \$1,000 will have a nominal value in their account of \$2,982.38 at the end of 10 years. This average ending value grows to \$8,864.45 by the end of twenty years and \$25,115.81 at the end of thirty years. In real terms, the average ending value grows from \$2,120.22 over the first ten years to \$7,145.27 over thirty years. An unfortunate investor is not guaranteed increased value in their account. As the minimum values indicate, a 10-year investor can end up with less than their initial value on a nominal basis (\$727.63) with decreased purchasing power as demonstrated by the real value (\$562.85). A willingness to invest for twenty or thirty years ensures that an investor will have a nominal gain and even a real gain over the sample period in this paper. The worst case real ending value over twenty and thirty years is \$1,106.94 and \$3,374.72. By investing for longer time-periods, investors are able to guard themselves against the volatility of the shorter 10-year period. Exhibit 5 (appendix) graphically depicts the best and worst investment scenarios referenced in Exhibit 4 (appendix) for the 10 and 30-year investment horizons. The disparity between the ending values is great for both of these periods, but as the exhibit reveals shorter-term investors appear to be at greater risk as they end with less wealth than they started. Even in the worst-case scenario, the 30-year has an increase in wealth.

### Monthly annuity investment

As demonstrated in the previous section, a one-time investment into a passive funds results in a wide range of potential ending values dependent upon the date of that investment. In practice, most investors do not make just one investment over their investing life. Instead,



investors tend to invest smaller amounts during the earlier period of their lives when starting a career and invest more as their career progresses. To replicate this investing cycle, an investor will be assumed to place \$50 into a passive S&P500 index at the start of each month over 10, 20 and 30 years investing periods. This pattern will result in greater quantities of wealth being invested as an individual ages. This investing style implicitly places importance on dollar-weighting.

Exhibit 6 (appendix) shows an investor's ending funds on both a nominal and real basis after ten years of investing. The individual places \$50 into a passive S&P500 index at the start of each month over this 10-year period. Similar to a one-time investment at the start of the period, a 10-year investment horizon does not ensure the investor of ending with more nominal wealth. There are 17 periods out of 709 calculated that result in the investor ending with less than the nominal \$6,000 they placed into the account over 10 years. Investors making their first deposit on the first trading day of September 1964, October 1964, November 1964, December 1964, January 1965, and February 1965, all end up with less than \$6,000. Most of these investors were impacted by two United States recessions. One recession ran from December 1969 to November 1970 and the other lasted from November 1973 to March 1975. Those investing on October 1, 1964 end with the least during this time frame at \$4,871.15. Additionally, investors making their initial deposit on the first trading day of the months starting with November 1998 and ending with September 1999, ended with less than \$6,000 on a nominal basis. These periods included both the early 2000s recession (March 2001 to November 2001) and the great recession of December 2007 through June 2009. The worst performance is for those with an initial deposit in March 1999 with a resultant ending value of \$4,169.91. When considered on a real basis, a 10-year investor's performance has an even greater probability of a loss in purchasing power. A total of 121 out of 709 periods result in the investor having less than their nominal \$6,000 investment in real terms. As can be seen in the exhibit, most of these periods occur for investors making their initial deposit on the first trading day of the month starting December 1963 through October 1972 and July 1998 through September 2000.

Exhibit 7 (appendix) shows the impact of an additional 10 years of investing. As previously described, investors are assumed to invest \$50 on the first trading day of each month into an S&P500 index over a 20 year time span. The graph shows the benefit imparted by the additional 10 years relative to the information shown in Exhibit 6 (appendix). No starting investment date out of a possible 589 exists that results in the investor having less than their nominal investment of \$12,000 placed into the account over 20 years of monthly investing, but there are 36 ending values in real terms that do fall below the \$12,000. As shown in Exhibit 7 (appendix), starting in the late 1950s through the early 1960s were not ideal times to initiate a constant amount monthly investment strategy. Investors during this time frame experienced numerous recessions in the U.S. economy including possibly the recession of 1958, 1960-1961, 1969-1970, 1973-1975, 1980, and 1981-1982. Perhaps surprisingly, investors were able to weather the inclusion of the recessions of 1990-1991, 2001, and the great recession of 2007-2009 during their investment time frame. As Exhibit 7 (appendix) shows, those recessions did impact their overall results but not enough to result in a negative real rate of return.

Exhibit 8 (appendix) plots the ending value in an investor's portfolio by initial investment date assuming a constant investment of \$50 made at the start of each month over a 30-year time period. The results over 30 years makes it clear why longer investment horizons are viewed as beneficial on average. Out of a total of 469 possible starting points, no investment period exists that results in either a negative nominal or negative real rate of return. An investor always ends

up with more than the \$18,000 that they nominally placed over time into a passive S&P500 index. This can be contrasted with both the 10 and 20 years investment horizons that both included negative nominal and real returns. The minimum nominal (real) ending investment value is \$65,540.67 (\$22,192.78) with a maximum nominal (real) ending investment value of \$339,379.64 (\$136,527.73). Clearly superior starting points exist, but the willingness and ability to invest for a longer time period results in a more uniformly positive outcome.

Exhibit 9 (appendix) provides descriptive statistics for investors making a monthly \$50 annuity investment over 10, 20, and 30 years. This investment strategy is intended to replicate a typical individual's investing cycle where they have little invested early in life but have a sizeable investment in their later years. The ability to invest for a longer timeframe is shown to be beneficial. On average, an investor willing to place \$50 at the start of each month into a passive S&P500 account will end up with a nominal amount of \$10,861.56, \$42,465.10, and \$143,100.28 when making those deposits for 10, 20, and 30 years, respectively. This pattern is replicated when examining real returns. The volatility as measured by standard deviation demonstrates that the accompanying returns are volatile. For example, the 30-year nominal ending value of \$143,100.28 has an accompanying standard deviation of \$65,783.04. Given a standard normal distribution, this indicates that there is less than a 2.5% chance for a nominal ending value of less than \$0 for a given period given a 30-year investment horizon. As described in previous sections, the minimum ending values in terms of nominal and real values indicate that for a 10-year horizon, it is possible, though not extremely likely to have an ending investment value that results in a negative return in both nominal and real terms. Over a 20-year investment horizon, negative returns only occur in real terms. Finally, over a 30-year horizon, no time period exists with either negative nominal or real returns. Exhibit 10 (appendix) shows the best and worst case scenarios for investors with 10 and 30-year horizons. A 30-year investor encounters no time periods where they do not realize at least a modest increase in wealth. In the worst-case scenario for the 10-year investor, the graph shows their wealth increasing until approximately year eight. However, they then faced a difficult market for two years which left them with less than their total nominal investment. As with the lump sum strategy, the ability to commit for a longer horizon resulted in at least modest gains.

## CONCLUSION

The results detailed in this paper indicate that the investment horizon length (persistence) as well as the timing of each investment (luck) impacts an investor's ending wealth. When considering a one-time investment, the ability and willingness to invest for longer periods is demonstrated to be beneficial. An individual that commits for 20 or 30 years over the time of this paper's sample is assured of a positive outcome though there is still a substantial difference on ending value based on the initial investment date. Though 10 years is still a relatively long investment period, investors are still shown to have lost wealth in both nominal and real terms over numerous time frames starting in 1950.

Still using a passive S&P500 index investment strategy, an individual that consistently makes additional contributions into their portfolio also realize more dependable positive results over longer investment horizons. Only individuals making monthly contributions over the 30-year horizon have positive returns on both a nominal and real basis over the sample period. Individuals that invest for 20 years realize positive nominal returns, but have periods with

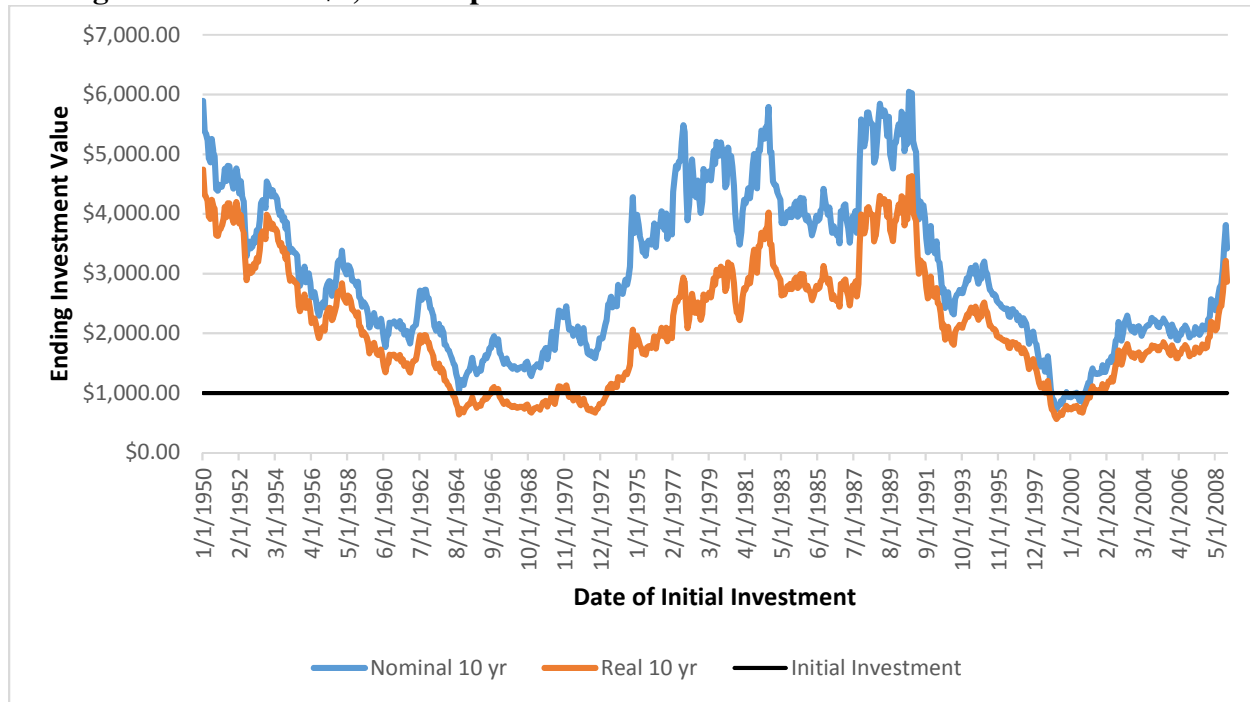
negative real returns. The shortest horizon investor examined (10 years) is shown to potential have negative returns on both a nominal and real basis.

This paper does not provide an investor with a method to maximize returns. An investor needs both luck and patience. The results indicate that longer investment horizons are beneficial, but that factors such as recessions for which an investor cannot account will have a critical impact on portfolio value even when investing through a relatively safe, passive method as is often advocated.

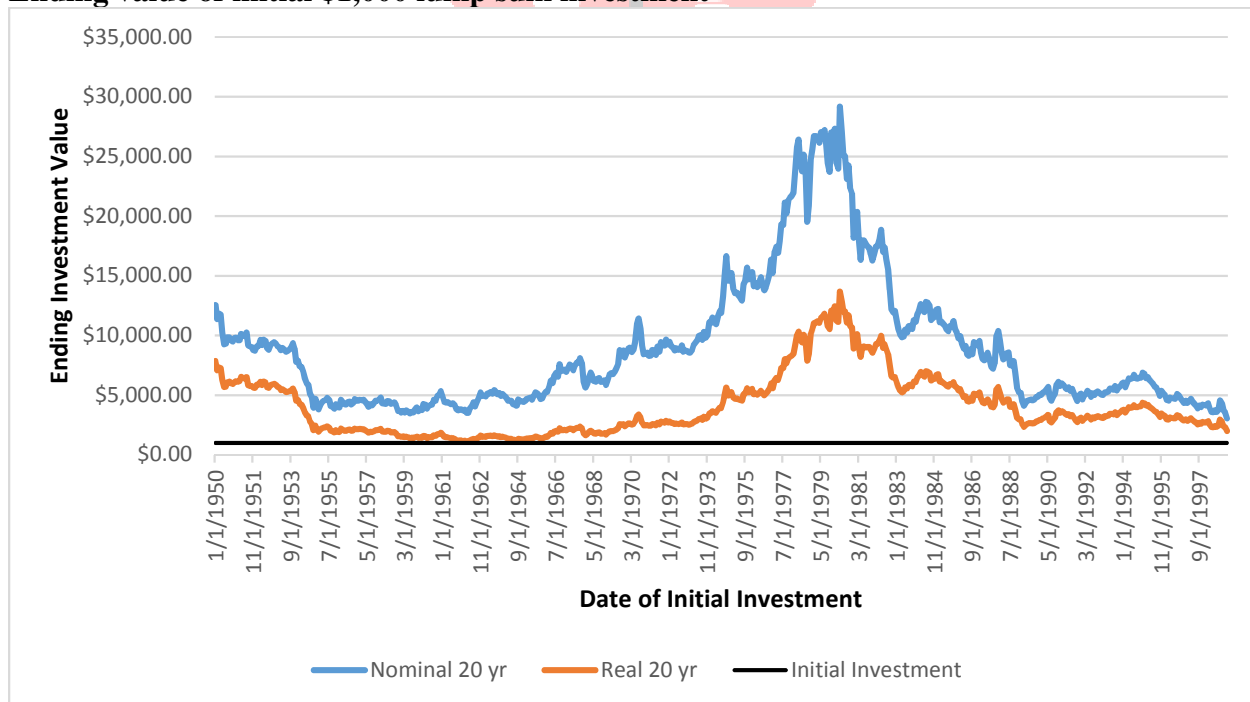




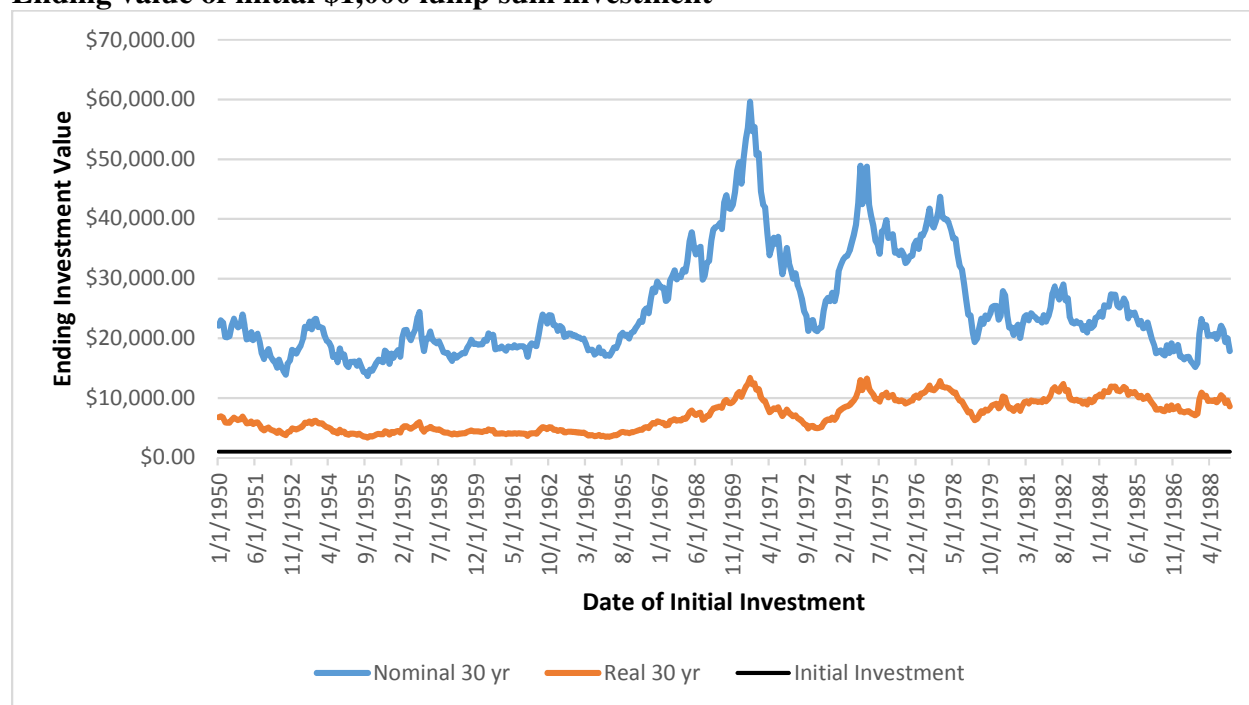
**Exhibit 1**  
**10 Year Investment Period**  
**Ending value of initial \$1,000 lump sum investment**



**Exhibit 2**  
**20 Year Investment Period**  
**Ending value of initial \$1,000 lump sum investment**



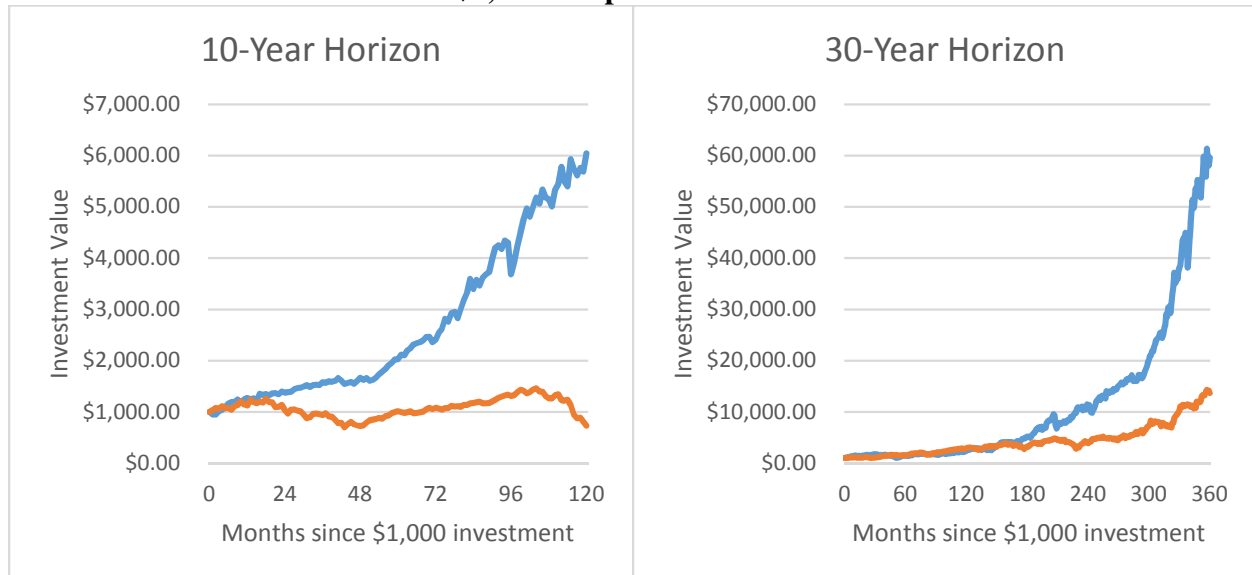
**Exhibit 3**  
**30 Year Investment Period**  
**Ending value of initial \$1,000 lump sum investment**



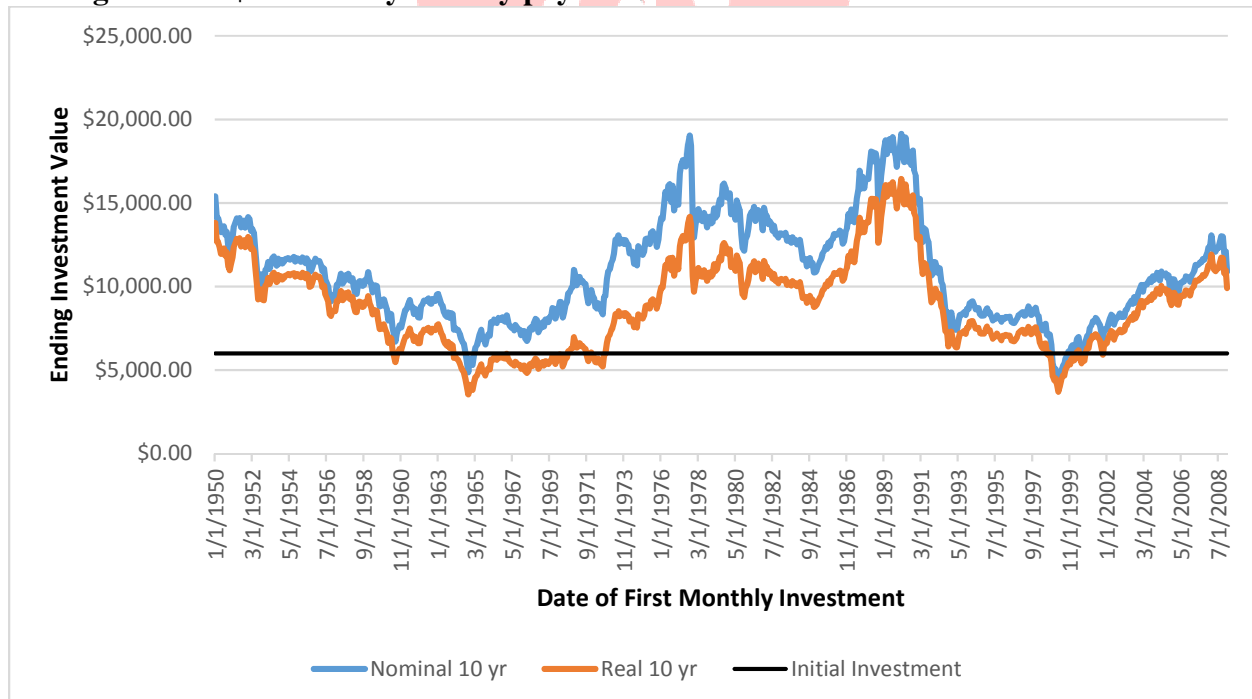
**Exhibit 4**  
**Descriptive statistics for \$1,000 lump sum investment**

	10 years		20 years		30 years	
	Nominal	Real	Nominal	Real	Nominal	Real
Average	\$2,982.38	\$2,120.22	\$8,864.45	\$4,069.49	\$25,115.81	\$7,145.27
Median	\$2,674.65	\$1,958.00	\$7,054.56	\$3,137.63	\$22,154.95	\$6,705.79
Maximum	\$6,046.18	\$4,744.18	\$29,181.65	\$13,680.25	\$59,621.59	\$13,349.44
Minimum	\$727.63	\$562.85	\$3,058.40	\$1,106.94	\$13,693.31	\$3,374.72
Std. Dev.	\$1,286.44	\$1,003.96	\$5,586.13	\$2,597.71	\$8,623.51	\$2,678.27

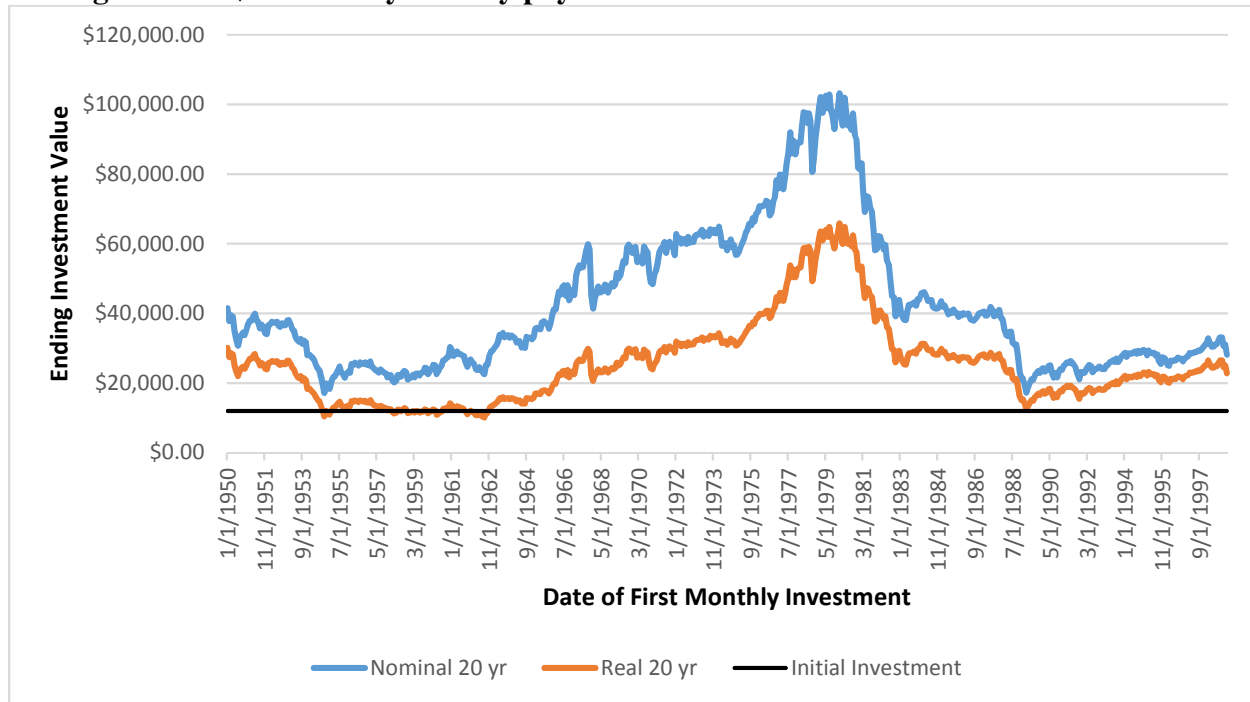
**Exhibit 5**  
**10 Year and 30-Year Investment Periods**  
**Best and worst case scenario for \$1,000 lump sum investment**



**Exhibit 6**  
**10 Year Investment Period**  
**Ending value of \$50 monthly annuity payments**



**Exhibit 7**  
**20 Year Investment Period**  
**Ending value of \$50 monthly annuity payments**

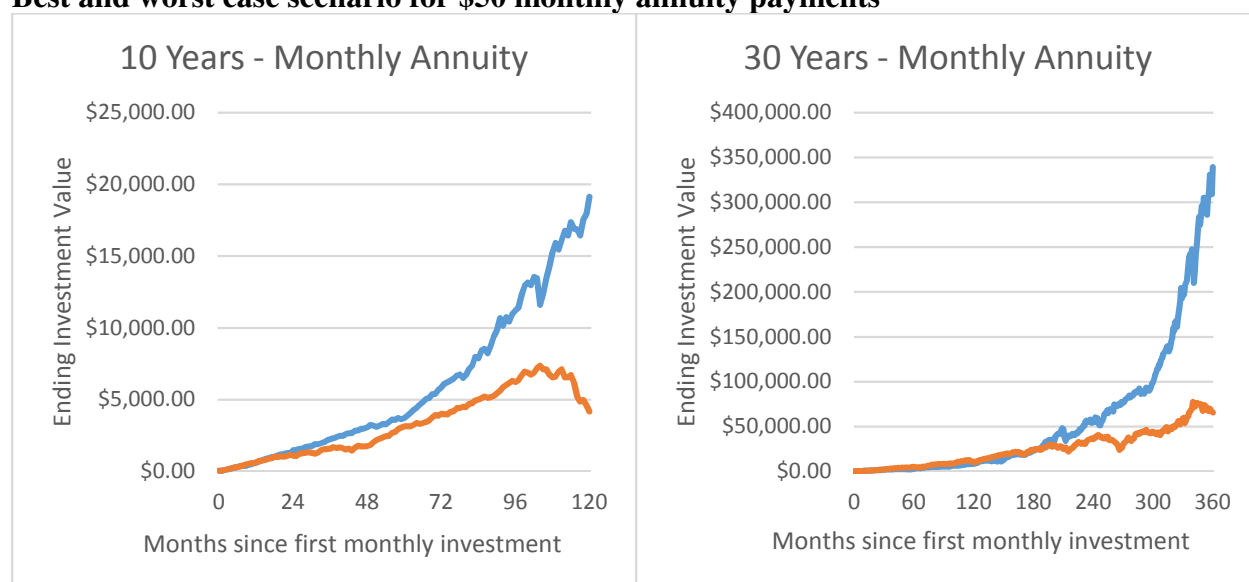


**Exhibit 8**  
**30 Year Investment Period**  
**Ending value of \$50 monthly annuity payments**



**Exhibit 9****Descriptive Statistics for \$50 Monthly Annuity Investments**

	10 years		20 years		30 years	
	Nominal	Real	Nominal	Real	Nominal	Real
Average	\$10,861.56	\$8,901.87	\$42,465.10	\$25,702.08	\$143,100.28	\$60,926.13
Median	\$10,496.09	\$8,954.08	\$36,612.76	\$23,902.78	\$125,573.73	\$54,565.19
Maximum	\$19,138.21	\$16,444.86	\$103,211.49	\$65,880.90	\$339,379.64	\$136,527.73
Minimum	\$4,169.91	\$3,538.80	\$17,153.35	\$10,103.37	\$65,783.04	\$22,192.78
Std. Dev.	\$3,090.87	\$2,682.72	\$20,532.45	\$12,174.16	\$62,783.04	\$25,115.40

**Exhibit 10****10 Year and 30-Year Investment Periods****Best and worst case scenario for \$50 monthly annuity payments**

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