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Dollar-cost averaging just means taking risk later

Vanguard research

July 2012

Executive summary. If a foundation receives a \$20 million cash gift, what are the tradeoffs to consider between investing those funds immediately versus dollar-cost averaging the investment over time? How might an individual who receives a \$1 million windfall approach the same decision?

In this paper, we compare the historical performance of dollar-cost averaging (DCA) with lump-sum investing (LSI) across three markets: the United States, the United Kingdom, and Australia. On average, we find that an LSI approach has outperformed a DCA approach approximately two-thirds of the time, even when results are adjusted for the higher volatility of a stock/bond portfolio versus cash investments. This finding is consistent with the fact that the returns of stocks and bonds exceeded that of cash over our study period in each of these markets.

We conclude that if an investor expects such trends to continue, is satisfied with his or her target asset allocation, and is comfortable with the risk/return characteristics of each strategy, the prudent action is

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investing the lump sum immediately to gain exposure to the markets as soon as possible. But if the investor is primarily concerned with minimizing downside risk and potential feelings of regret (resulting from lump-sum investing immediately before a market downturn), then DCA may be of use. Of course, any emotionally based concerns should be weighed carefully against both (1) the lower expected long-run returns of cash compared with stocks and bonds, and (2) the fact that delaying investment is itself a form of market-timing, something few investors succeed at.

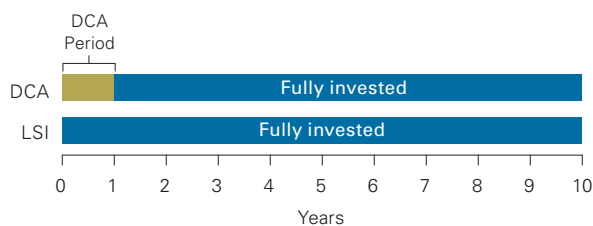
How the analysis is structured

Our case study uses monthly stock and bond returns in the United States, United Kingdom, and Australia to evaluate the historical performance of each strategy. For LSI, we assume that US\$1,000,000 (or £1,000,000 in the United Kingdom and A\$1,000,000 in Australia) is immediately invested into a stock/bond portfolio and then held for 10 years. For DCA, we assume that the same sum starts in a portfolio of cash investments and is then transferred in equal increments into a stock/bond portfolio over a period of 6, 12, 18, 24, 30, or 36 months (with 12 months being our baseline scenario in most examples and exhibits). Once the DCA investment period is complete, the DCA and LSI portfolios have identical asset allocations, and both remain invested through the end of year 10.

We then compare the ending portfolio values from each strategy to determine how each performed during the 10-year period. We repeat the comparison over rolling periods; i.e., the first comparison for U.S. markets covers the 10 years from January 1926 through December 1935, the second covers February 1926 through January 1936, and so on until we reach the 10 years through December 2011. We do the same for the relevant time periods in the United Kingdom and Australia.

In addition, we repeat the analysis for various stock/bond allocations ranging from 100% equities to 100% bonds, and for various holding periods ranging from 1 to 30 years. Ultimately, we calculate the probability and size of greater wealth accumulation in one strategy versus the other, as well as the risk-adjusted returns for each strategy during the initial DCA period. (See page 7 for more information about our methodology and a list of the benchmarks used in each market.)

Example



Notes on risk: All investments are subject to risk. Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index. Dollar-cost averaging does not guarantee that your investments will make a profit, nor does it protect you against losses when stock or bond prices are falling. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income.

Summarizing the historical outperformance of LSI versus DCA

Figure 1 displays the historical probability of outperformance for LSI versus DCA when the assets are invested into a 60% equity/40% bond portfolio in the local market. Despite the use of different international markets and time periods, our results are strikingly similar across the United States, United Kingdom, and Australia.

As we would expect, LSI led to higher portfolio values in approximately two-thirds of the periods analyzed, since the average returns of stocks and bonds exceeded that of cash over the full span in each market. These positive returns are responsible for the relative success of LSI over DCA. This is really quite intuitive—if markets are going up, it’s better to put your money to work right away to take full advantage of the market growth. We found that any factors unrelated to market trends had a minimal impact on the results.

How the DCA period length affects the results

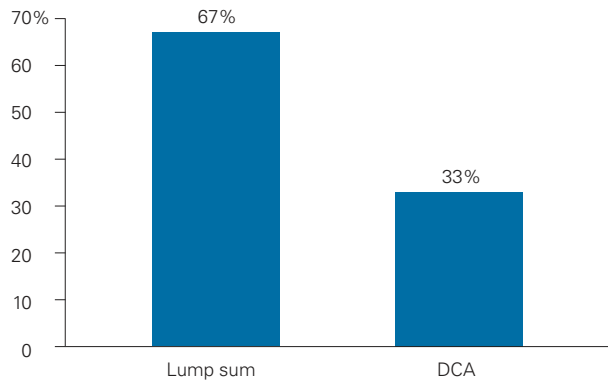
LSI outperformed DCA in a greater proportion of historical time periods regardless of the DCA period length. As noted earlier, in addition to the 12-month DCA shown in Figure 1, we calculated outcomes for 6-, 18-, 24-, 30-, and 36-month DCA investment periods, again using the rolling 10-year time frames in each market. In general, as the DCA period lengthened, the probability of higher portfolio values for LSI also increased. In the United States, for example, LSI outperformed 36-month DCA in approximately 90% of the 10-year spans.

As illustrated in Figure 2, on page 4, we found that LSI portfolios tended to record higher returns than DCA portfolios even when the strategic asset allocations were either 100% equities or 100% fixed income. Again, this result is consistent with the higher average returns of stocks and bonds over cash instruments during our historical sample period.

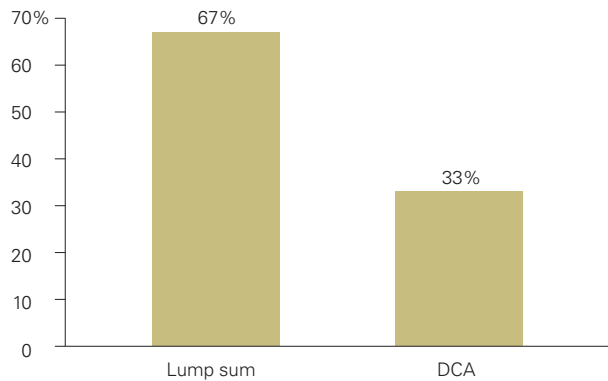
Figure 1. Relative historical probability of outperformance using 12-month DCA and a 60% stock/40% bond portfolio

Based on rolling 10-year periods in each market

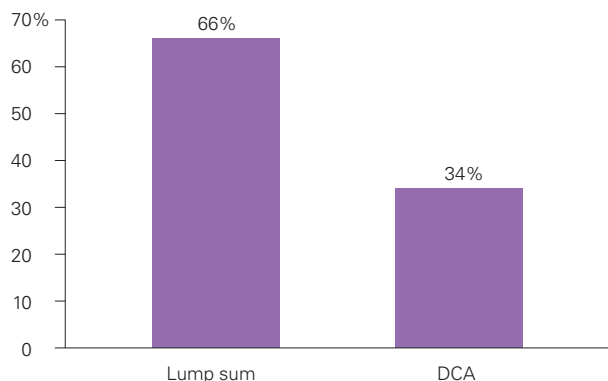
a. United States (1926–2011)



b. United Kingdom (1976–2011)



c. Australia (1984–2011)



Note: Each portfolio consists of a 60% allocation to the local equity market and a 40% allocation to the local bond market.

Source: Vanguard calculations based on benchmark data. See page 7 for a list of the benchmarks used.

DCA in the context of our research

To some readers, our research may seem to discount the benefits of dollar-cost averaging often cited in popular financial commentary. Such articles tend to recommend DCA largely on the ground that investing a consistent dollar amount at regular intervals allows investors to diversify the prices they pay for a security, buying more shares when prices are low and fewer when prices are high.

This is true, but there is a notable distinction between DCA as commonly discussed and as a subject for the research covered in this paper. Most popular commentary addresses DCA in

terms of consistent investments made using current income—i.e., an employee transferring a portion of each paycheck into a retirement account. In that case, investable cash becomes available only in relatively small amounts over time, which makes DCA a prudent way to invest (and really the only sound alternative to accumulating that money in cash and then actively trying to time the market at some later point).

Our research, in contrast, focuses on the strategies for investing an immediately available large sum of money. Here, the average performance results have favored lump-sum investing.

Figure 2. Relative historical probability of outperformance for LSI versus 12-month DCA at varying allocations

	United States (1926–2011)		United Kingdom (1976–2011)		Australia (1984–2011)	
	Lump sum	DCA	Lump sum	DCA	Lump sum	DCA
100% equity	66%	34%	68%	32%	62%	38%
60% equity/40% bonds	67	33	67	33	66	34
100% bonds	65	35	61	39	58	42

Source: Vanguard calculations based on benchmark data. See page 7 for a list of the benchmarks used.

Investors may also wonder whether the results would change if the overall holding period of the investment were to be shortened or lengthened. For instance, how would the results change if the total holding period were 5 years or 20 years instead of 10 years? Because our LSI and DCA portfolios have identical asset allocations at the end of the DCA period, whichever portfolio has the most assets at that point will stay ahead forever. However, it is possible for the length of the holding period to affect the size of the gap between them. The portfolio with the larger balance will have the potential for greater gains and losses over time, even though the returns of both portfolios in percentage terms are identical.

On average, by how much does LSI outperform DCA?

To calculate the average magnitude of LSI outperformance, we calculated the average ending values for a 60%/40% portfolio following rolling 10-year investment periods. In the United States, 12-month DCA led to an average ending portfolio value of \$2,395,824, while LSI led to an average ending value of \$2,450,264, or 2.3% more. The results were similar in the United Kingdom and Australia: U.K. investors would have ended with 2.2% more and Australian investors with 1.3% more, on average.

Figure 3. Differences between LSI and 12-month DCA portfolio values after 10 years

The figures represent rankings of LSI balances subtracted from DCA balances. At the 5th-percentile level, for example, 5% of the resulting amounts were lower than the amount listed and 95% were higher.

	United States (1926–2011)	United Kingdom (1976–2011)	Australia (1984–2011)
5th percentile	–US\$203,776	–£302,385	–A\$227,543
25th percentile	–US\$42,819	–£36,977	–A\$37,329
50th percentile	US\$55,151	£64,904	A\$42,930
75th percentile	US\$151,725	£174,865	A\$136,544
95th percentile	US\$309,133	£441,492	A\$281,275

Source: Vanguard calculations based on benchmark data. See page 7 for a list of the benchmarks used.

It is important to reiterate that these are average returns. Actual experience during any given period in the future may be much higher or lower, depending on market trends.

Measuring the dispersion of outcomes and risk-adjusted performance

Now that we have demonstrated the stronger returns and therefore higher portfolio values generated by an LSI strategy, it is important to look at its level of risk relative to DCA. To do this, we subtracted the ending portfolio values of an LSI strategy from the ending portfolio values of a 12-month DCA strategy (assuming 60%/40% ending allocations and 10-year holding periods for both strategies). We then ordered the results for each rolling 10-year period by percentile rank.

Figure 3 summarizes the 5th, 25th, 50th, 75th, and 95th percentiles of LSI performance relative to 12-month DCA. The 50th-percentile observation is positive (confirming LSI’s average outperformance), but there is a fairly wide distribution of outcomes. Obviously, it is possible for either strategy to underperform the other over a given period—potentially by a significant amount.

Next, we turn our focus to risk-adjusted returns. An investor who implements a 12-month DCA strategy is essentially decreasing the overall risk of the portfolio via the higher allocation to cash during that period. Does the degree of risk reduction achieved come at the expense of an even greater decline in potential returns? To answer this question, we measured the Sharpe ratios¹ for one strategy versus the other across all possible 12-month DCA periods.

Despite its lower average ending portfolio values, a DCA strategy might be more favorable if the risk-adjusted returns of a DCA portfolio during those first 12 months exceed the risk-adjusted returns of an LSI portfolio during that period. However, **Figure 4**, on page 6, shows that this is not the case. LSI has provided better returns *and* risk-adjusted returns, on average.

Risk of loss and emotional considerations

Even though LSI’s average outperformance and risk-adjusted returns have been greater than those of DCA, risk-averse investors may be less concerned about averages than they are about worst-case scenarios, as well as the potential feelings of regret that would occur if a lump-sum investment were made immediately prior to a market decline. These

¹ The Sharpe ratio measures an investment’s excess returns per unit of risk and can be useful when comparing the performance of two portfolios with different asset allocations.

Figure 4. Average annualized Sharpe ratios for LSI and 12-month DCA portfolios, measured over rolling 12-month periods in each market

	United States (1926–2011)		United Kingdom (1976–2011)		Australia (1984–2011)	
	Lump sum	DCA	Lump sum	DCA	Lump sum	DCA
100% equity	0.77	0.68	0.63	0.60	0.52	0.47
60% equity/40% bonds	0.81	0.72	0.62	0.59	0.54	0.50
100% bonds	0.80	0.72	0.36	0.33	0.34	0.29

Note: Sharpe ratios are calculated using local market returns and local rates on cash instruments.

$$\text{Sharpe ratio} = \frac{12 * \frac{1}{n} \sum_{i=1}^n (R_i^p - R_i^{\text{cash}})}{\sqrt{12 * \text{Var}(R_i^p - R_i^{\text{cash}})}}$$

R_i^{cash} = return of local cash rate for the i^{th} month

R_i^p = return of portfolio with a specific stock/bond allocation for the i^{th} month

Source: Vanguard calculations based on benchmark data. See page 7 for a list of the benchmarks used.

concerns are not unreasonable. We found that DCA performed better during market downturns, so DCA may be a logical alternative for investors who prefer some short-term downside protection.

Out of the 1,021 rolling 12-month investment periods we analyzed for the U.S. markets, LSI investors would have seen their portfolios decline in value during 229 periods (22.4%), while DCA investors would have seen such declines during only 180 periods (17.6%). Furthermore, the average loss during those 229 LSI periods was \$84,001, versus only \$56,947 in the 180 DCA periods. The allocation to cash during the DCA investment period decreases the risk level of the portfolio, helping to insulate it from a declining market.

It is essential to point out, however, that this temporarily cash-heavy asset allocation is much more conservative than the investor’s true target allocation (the one that will exist after the DCA period) and that, while this short-term deviation from the target provides some relative protection from market downturns, it does so by sacrificing some potential for greater portfolio gains. As with any asset allocation decision, investors must determine for themselves whether or not reducing their portfolio risk in an attempt to avoid losses and regrets is worth reducing the potential for higher returns.

Conclusion

Clearly, if markets are trending upward, it’s logical to implement a strategic asset allocation as soon as possible because it should offer a higher long-run expected return than cash.

Historically, a long-term upward trend has persisted for both equities and bonds, probably attributable to positive risk premia in the markets. In other words, positive returns have compensated investors for taking risks, hence the upward trend in those markets and the resulting probabilities of success for LSI. So, to the extent that an investor believes the positive risk premia are likely to exist in the future, LSI would remain the preferred method for investing an immediately available large sum of money. But if the investor is primarily concerned with reducing short-term downside risk and the potential for regret, then DCA may be a better alternative.

To be comfortable with either strategy, an investor must be fully aware of the fact that historical averages are only a guide—it is still possible for LSI or DCA to underperform or even lose money in any given period. If an investor is uncomfortable with the risks associated with a given market entry strategy, it may imply a low willingness to take risk in general, and if so, we recommend revisiting the target asset allocation to ensure that it appropriately addresses risk tolerance levels and investing goals.

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A summary of our methodology and benchmarks

Investable assets to start: US\$1,000,000, £1,000,000, or A\$1,000,000.

LSI: The LSI assets are fully invested immediately into a stock/bond portfolio based on the local market. Our study encompassed portfolio allocations ranging from 100% stocks to 100% bonds.

DCA: The DCA assets, including any interest earned from the cash portfolio, are invested into the same allocation in equal monthly increments over a given period (which we call the “DCA period”). DCA assets not yet invested are assumed to be held in cash instruments. We studied outcomes for DCA periods of 6, 12, 18, 24, 30, and 36 months.

Holding period: Both portfolios are held for 10 years. We compared outcomes for rolling 10-year periods over the full span of data available in each market.

Calculations: Both portfolios are rebalanced monthly to the target allocation. Portfolio returns are based on monthly index data. Transaction costs are not considered.

Market benchmarks used: The study periods for each market were determined by the availability of reliable and consistent index data. In each country, we selected the indexes deemed to best represent the relevant market, given the available choices.

United States. *Equities:* Standard & Poor's 90 (January 1926–February 1957), S&P 500 Index (March 1957–December 1974), Wilshire 5000 Index (January 1975–April 2005), MSCI US Broad Market Index (May 2005–December 2011). *Bonds:* S&P High Grade Corporate Index (January 1926–December 1968), Citigroup High Grade Index (January 1969–December 1972), Lehman Brothers U.S. Long Credit Aa Index (January 1973–December 1975), Barclays Capital U.S. Aggregate Bond Index (January 1976–December 2011). *Cash:* Ibbotson U.S. 30-Day Treasury Bill Index (January 1926–December 1977), Citigroup 3-Month U.S. Treasury Bill Index (January 1978–December 2011).

United Kingdom. *Equities:* MSCI UK Total Return Index (pounds) (February 1976–December 1985), FTSE All Share Total Return Index (pounds) (January 1986–December 2011). *Bonds:* FTSE British Government Fixed All Total Return Index (pounds) (February 1976–December 1998), Barclays Capital Sterling Hedged Index (January 1999–December 2011). *Cash:* Inferred from UK Interbank 1 Month–LIBOR (February 1976–January 1998), Citigroup World Money Market Index (February 1998–December 2011).

Australia. *Equities:* S&P/ASX 300 Accumulation Index (January 1984–December 2011). *Bonds:* UBS Australian Composite Bond Index (January 1984–December 2011). *Cash:* Australian Dealer Bill 90 Day Total Return Index (January 1984–August 1998), UBS Bank Bill Index (September 1998–December 2011).



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