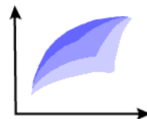


Efficient Frontier



*Editors Note: [Bill Jones](#) is a math professor and frequent contributor to the [Mutual Fund Interactive main board](#). I've seen many analyses of dollar cost averaging versus lump sum investing, but Bill's presentation of the conundrum as an insurance problem was both novel and elegant. With his kind permission *EF* reproduces it below.*

Do Not Dollar-Cost-Average for More than Twelve Months

Bill Jones

I am a strong believer in the advantages of DCA (dollar-cost-averaging). I recommend it to anyone making a substantial move from cash to mutual stock funds (unless they fancy themselves to be market-timers). In particular, if you have recently received an inheritance that increases your worth by over 50%, you should use DCA instead of putting it all in at once. If you have a large amount of money that you know you really ought to put into the stock market but you can't bring yourself to do it because you are afraid the market is too high, you should use DCA for 12 months instead of waiting.

However, I find that using DCA for any period longer than 12 months is a bad strategy. It may even be a good idea to DCA over a period as short as 6 months; the choice depends on an individual's balance between risk and return (6 months is a little more risky and a little more profitable in the long run).

I compare two alternative strategies: LUMP-SUM, where you move a substantial amount of money from your money market account to a mutual stock fund today, and DCA-N, where you move one Nth of that substantial amount at the beginning of each of N months starting today. I give historical data to support my conclusions, and I present a full analysis for DCA-6, DCA-12, DCA-18, DCA-24, and DCA-36 in the appendix.

The Logic

DCA is not for people who consider themselves competent market-timers. Market-timers lump-sum in at whatever time they judge that the market is very likely to go up in the near future. And they get back out of the market when they judge that the market is very likely to go down in the near future. The DCA choice is for people who fear that the market may drop drastically at any time, but do not feel competent to judge whether that is more or less likely now than at some other time.

I feel that the purpose of DCA is to avoid the damage from a substantial drop happening in the first few months after a lump-sum investment. 6-month DCA works fine if the drop happens in the first two or three months, because half of the money is invested at a lower cost. But DCA-6 is not effective if the drop happens in the fifth or sixth month. 12-month DCA gives good results for drops that happen in the first 7 or 8 months. My feeling is that, beyond that point, there is generally no substantial problem anyway, because when a drop does not happen for say 8 months, the market usually rises enough in those first 8 months that the net result is a gain.

An additional point is that, if you use say a 24-month DCA period in a particular instance and it is successful, i.e., the stock market falls significantly in the first 6 months, then the loss is more often than not made up in the following 6 months. But that means that the last half of the money is being DCA'd into the market at ever high prices. The operation is a success but the patient dies. Your caution is vindicated but you lose anyway. Logically, then, DCA should not be used over periods of 2 or 3 years, not even 18 months. A DCA period between 6 and 12 months is probably best.

Historical Support for DCA-6 Versus DCA-36

But all of the above is theoretical, a subjective opinion based on vague concepts of how stock markets behave. It is helpful to look at some concrete historical data to see how various periods would have turned out. For this, I need a well-defined process for investing. I implement e.g. DCA-12 as follows: Move 1/12 of the assets into the stock market on the first day of the first month and let the rest stay in the money market. One month later, move 1/11 of the remaining money market balance into the stock market, etc., for 12 months.

Equivalently: Divide the initial amount into N equal parts. Move the first part in immediately. Let the second part sit in the money-market for one month and then move it plus its interest into the stock market. Let the third part sit in the money-market for two months and then move it plus its interest into the stock market; etc. Thus the amounts moved in are steadily increasing in nominal dollars, but they are equal in time-value-adjusted terms.

Question: How do we measure the RISK against which we are insuring by DCA? I figure that the main thing to avoid is lump-summing an amount into the stock

market and finding out some months later that its value is LESS than we started with. Normally, if we move \$10,000 into the stock market in a lump-sum, then we hope to have \$11,000 or \$12,000 one year later. If we have \$10,500, that isn't bad; we would have had the same in a money market. If we have just \$10,000, that is disappointing and irritating, but we knew that stock investing wasn't a sure thing. Panic, depression, anger, and regret set in only if we actually have significantly less in nominal dollar terms than we started with.

For DCA-36, I looked at the 493 rolling 36-month periods within the 44 years 1953-1996. I calculated that each use of DCA-36 cost on average 7.40% of total assets compared with lump-summing (computed using the geometric mean, as is normal for computing returns). That is not 7.40% per year for 3 years, but 7.40% for the one decision to use DCA-36 instead of lump-summing.

But the cost is not the only consideration. We have to consider the RISK of severe loss. Note: Stock market returns in the following are based on total returns of the S&P500 including reinvested dividends. Money market returns are estimated using 3-month treasuries, to adjust for interest earned on the money not yet moved into the stock market using DCA. The stock market earned slightly over 5% more per year on the average in this 44-year period; the average dollar in DCA-36 is kept out of the market for 17.5 months, almost 1.5 years, so of course lump-summing beats DCA-36 by roughly 1.5 times 5%.

Unfortunately, there is no really good single number to measure the risk. We all know how unsatisfactory the standard deviation is as a measure of the risk involved in investing in stocks. So the following provides enough statistics to let you make your own decision as to the risks and rewards and costs involved in DCA.

There were only 30 of those 493 DCA-36 cases where a lump-sum had less at the end of 36 months than at the beginning. We want to ameliorate those 30 cases. But it doesn't help to DCA in those disastrous cases if DCA doesn't make it BETTER. So, I set the criterion of effectiveness that DCA should produce results at least 5% better than lump-summing in cases where lump-summing loses money, otherwise it does not offer much protection.

In the 30 cases where lump-summing lost money over 36 months, DCA-36 came out more than 5% better than lump-summing in only 16. Those 30 are easy to categorize: 7 began on 5/1/67 through 11/1/67; 1 of the 30 began on 12/1/68; The other 22 began on 5/1/71 through 2/1/73 (all periods start on the first-of-the-month). Note that the S&P500 lost 25.2% in the 3 months July-Sept 1974.

In the 22 cases involving 1974 where lump-summing lost money, DCA-36 didn't help much for the first 8 of those periods (it was WORSE in 6 cases, 0.2% and 2.1% better in 2 cases), came out 7.7% to 18.4% better for the next 8 periods, and came out 20.8% to 27.5% better than lump-summing for the last 6 of the 22 periods.

That is not a very effective insurance policy, considering the premium: an average loss of 7.40% of total assets for each use of DCA-36 instead of lump-summing. 14

of the 16 "effective" cases included the summer of 1974; the other two began 10/67 when lump-summing lost only 3.33% and 12/68 when lump-summing lost only 3.97%. In other words, DCA-36 is a moderately effective way of guarding against a re-occurrence of the summer of 1974 and is pretty much useless otherwise.

But the main problem is that most of the time DCA-36 doesn't even do what people expect of a DCA strategy: If you DCA-36 and the market tanks in the first 3 or 6 months, sure, you get to gloat that the lump-summer took a 15% loss and you didn't. Then for the next 30 months, you gradually feed piddling little amounts into the market while the lump-summer is making money hand-over-fist. Then when you are completely in, the market tanks again. Is that insurance???

Matters are quite different for DCA-6. I looked at the 523 rolling 6-month periods within the 44 years 1953-1996. Lump-summing came out only 1.11% better on average than DCA-6 (per use of DCA-6, not per year). DCA-6 came out better than lump-summing in 199 of the 523 cases. But that is not the point. We have to consider the RISK of severe loss.

There were 143 cases where a lump-summer had less at the end of 6 months than at the beginning. We want to ameliorate those 143 cases. In 122 of them, DCA-6 came out better than lump-summing. There were only 56 of the 523 cases in which DCA-6 came out more than 5% better than lump-summing, but 55 of those were cases where lump-summing lost money. So DCA-6 helps most where it is most needed.

Of the 32 cases where lump-summing lost over 10%, DCA-6 did better in 30 of them; in fact, in 26 of them, DCA-6 did more than 5% better. And in each of the 3 cases where lump-summing lost over 20%, DCA-6 did 6 to 11% better.

Conclusions

DCA-6 offers some significant protection against lump-summing into the stock market and losing more than 10% in the next 6 months, and it is at a small cost (1.11%). However, since there were only 15 cases in which DCA-6 gave at least 10% more than lump-summing, and in the best case gave just 19.9% more, you are in effect paying a 1.11% premium for an insurance policy that will only pay off well (10 to 20%) 3% of the time. Those are not really great odds.

The payoff is higher for a 12-month period of DCA. Lump-summing lost money in 114 12-month periods, and DCA-12 beat lump-summing in 100 of them, 64 by more than 5%. DCA-12 sometimes beat lump-summing by over 20%. There were 40 12-month periods where lump-summing lost over 10%; DCA-12 beat lump-summing in 39 of those 40. The only drawback is that each use of DCA-12 costs you an average of 2.50% of what you would have if you lump-summed; in general, you come out ahead when lump-summing loses, but gain less when

lump-summing wins. But that is what you expect when you dollar-cost-average anyway.

Since I defined effectiveness as meaning that DCA beats lump-summing by more than 5% in those instances where lump-summing loses money, we have: DCA-6 is effective in 55 of 143 cases; DCA-12 is effective in 64 of 114 cases; DCA-18 is effective in 46 of 77 cases; DCA-24 is effective in 31 of 45 cases; and DCA-36 is effective in 16 of 30 cases. Thus DCA-12 clearly produces the highest number of effective cases, but DCA-6 costs half as much and produces the second-highest number of effective cases.

NOTE 1: These results imply that the best timing for people who DCA quarterly is that the last of N equal quarterly payments should be made 6 to 12 months after the first. Thus there should be 3 to 5 equal quarterly payments. NOTE 2: If you DCA into a stock fund with a few hundred dollars a month from your paycheck over a period of many years, because that is all you can afford to save, that is DCA performe and not something that the above analysis contra-indicates. Personally, I prefer to save it up in a short-term bond fund that I empty once each 6 months, because it simplifies my book-keeping; but I know that slightly reduces my returns vis-a-vis DCA. NOTE 3: DCA is only valuable for moving from cash or bonds into stocks. If you are moving from one stock investment to another, DCA is pointless, because the chances of moving in to a market top are the same as the chances of moving out from a market top, so the risks balance out. On the other hand, it doesn't hurt either.

My conclusion is that DCA for 6 to 12 months is the most that one should use, and then only if moving more than 5% of your total assets (since even the worst case would cut your overall total returns by only 1% or so). If you are shifting 30% or more of your total assets from cash to stock, you could take up to but no more than 18 months; this once-in-a-lifetime sort of situation merits overly-excessive caution. But I provide the data below on which you can base your own opinion.

Appendix (uniform presentation for 5 different time periods)

DCA-6 beat lump-summing 199 of the 523 instances; the lump-summer gained 1.11% on average. Of the 143 instances where lump-summing lost money, DCA-6 beat lump-summing 122 times, 55 of them by at least 5%, and 15 of them by at least 10%. Of the 32 instances where lump-summing lost more than 10%, DCA-6 beat lump-summing 30 times, 26 of them by at least 5%, and 11 of them by at least 10%. Of the 3 instances where lump-summing lost over 20%, DCA-6 did 6.0% (1/62), 9.0% (3/74), and 11.2% (4/74) better. The 6 biggest relative gains for DCA-6 were 13.6% (5/74), 13.6% (6/74), 15.1% (7/74), 13.5% (8/87), 19.3% (9/87), and 19.7% (10/87) more than lump-summing.

DCA-12 beat lump-summing 175 of the 517 instances; the lump-summer gained

2.50% on average. Of the 114 instances where lump-summing lost money, DCA-12 beat lump-summing 100 times, 64 of them by at least 5%, and 30 of them by at least 10%. Of the 40 instances where lump-summing lost more than 10%, DCA-12 beat lump-summing 39 times, 34 of them by at least 5%, and 20 of them by at least 10%. Of the 8 instances where lump-summing lost more than 20%, DCA-12 beat lump-summing every time, all of them by more than 5%, and 7 of them by more than 10%. The 6 biggest relative gains for DCA-12 were 20.9% (11/73), 18.6% (2/74), 19.9% (3/74), 18.7% (4/74), 20.1% (9/87), and 19.4% (10/87) more than lump-summing.

DCA-18 beat lump-summing 170 of the 511 instances; the lump-summer gained 3.84% on average. Of the 77 instances where lump-summing lost money, DCA-18 beat lump-summing 69 times, 46 of them by at least 5%, and 33 of them by at least 10%. Of the 27 instances where lump-summing lost more than 10%, DCA-18 beat lump-summing all 27 times, 26 of them by at least 5%, and 22 of them by at least 10%. Of the 12 instances where lump-summing lost more than 20%, DCA-18 beat lump-summing every time, all of them by more than 12%. The 6 biggest relative gains for DCA-18 were 22.5% (8/73), 21.0% (9/73), 24.7% (10/73), 25.4% (11/73), 18.2% (9/87), and 19.7% (10/87) more than lump-summing. DCA-24 beat lump-summing 158 of the 505 instances; the lump-summer gained 5.06% on average. Of the 45 instances where lump-summing lost money, DCA-24 beat lump-summing 39 times, 31 of them by at least 5%, and 21 of them by at least 10%. Of the 24 instances where lump-summing lost more than 10%, DCA-24 beat lump-summing every time, 21 of them by at least 5%, and 15 of them by at least 10%. Of the 9 instances where lump-summing lost more than 20%, DCA-24 beat lump-summing every time, all of them by at least 5%, and 7 of them by at least 10%. The 6 biggest relative gains for DCA-24 were 24.0% (1/73), 24.4% (2/73), 23.7% (4/73), 23.2% (8/73), 24.1% (10/73), and 24.5% (11/73) more than lump-summing. 9/87 had a gain of 17.6% and 10/87 had a gain of 15.4% more than lump-summing.

DCA-36 beat lump-summing 127 of the 493 instances; the lump-summer gained 7.40% on average. Of the 30 instances where lump-summing lost money, DCA-36 beat lump-summing 22 times, 16 of them by at least 5%, and 14 of them by at least 10%. Of the 14 instances where lump-summing lost more than 10%, DCA-36 beat lump-summing 10 times, 9 of them by at least 5%, and 8 of them by at least 10%. Of the 2 instances where lump-summing lost more than 20%, DCA-36 beat lump-summing only once, by 7.7%. The 6 biggest relative gains for DCA-36 were 22.2%, 26.2%, 27.5%, 26.6%, 24.1%, and 24.1% more than lump-summing for the 6 periods beginning 11/72 through 4/73, respectively. 9/87 had a gain of 13.7% and 10/87 had a gain of 11.6% more than lump-summing.

Alternative Criterion

We could use an alternative definition of effectiveness based on the amount of protection provided in the worst 50 cases (out of the 500 or so, thus roughly 10% of

cases). Here are the results:

DCA-06 beat lump-sum 46 times, 34 by 5%, 11 by 10%. Lump-sum lost over 7.3% 50 times.

DCA-12 beat lump-sum 48 times, 40 by 5%, 22 by 10%. Lump-sum lost over 8.2% 50 times. DCA-18 beat lump-sum 47 times, 34 by 5%, 26 by 10%. Lump-sum lost over 3.6% 50 times.

DCA-24 beat lump-sum 41 times, 33 by 5%, 22 by 10%. Lump-sum gained under 1.2% 50 times.

DCA-36 beat lump-sum 36 times, 30 by 5%, 25 by 10%. Lump-sum gained under 9.1% 50 times.

By this criterion, the maximum "insurance protection" against the worst losses is offered by DCA for 12 to 18 months. But since the "insurance premium" is hefty and increases from 1.11% to 3.84% over this period, the best balance occurs around 6 to 12 months.

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