

Can We Beat the Stock Market?

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One useful description of the stock market is that it is a casino with a long-term uptrend. That is, a casino where the player has the edge. Philosophically, we have two camps:

- The stock market is a Markov chain: history does not affect the probabilities of what might happen next
- Past price trends can be analyzed and used to more accurately assess future price movements

Will our investigations find any strategy that is noticeably more successful...?

Background

We gathered a large amount of historical data on stock market prices, then used the data to test a variety of trading strategies. The following data were gathered:

- Dow Jones Industrial Average (“DJIA”) closing prices, for every trading day between December 31, 1912 and December 31, 2024.
- Consumer Price Index (CPI) measures, monthly, for the same time period
- Dividend yield rates for the 500 top US companies, S&P 500 companies, yearly, for the same time period

Our variable of study was the DJIA adjusted for:

- Inflation
- Dividend yields

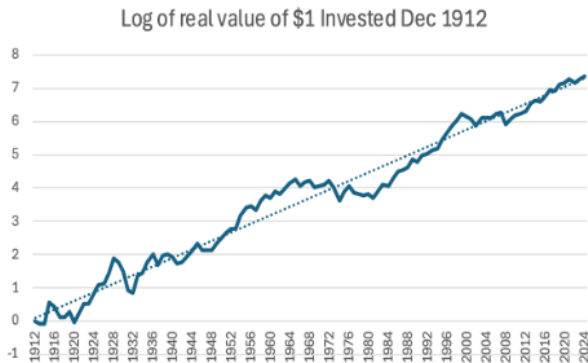


Figure: Log of Real Value of \$1 Invested Since December 1912

Cubic Spline

Annual Average Dividend Yields and CPI measures are released at less frequent time intervals as the DJIA, so we interpolate these data sets.

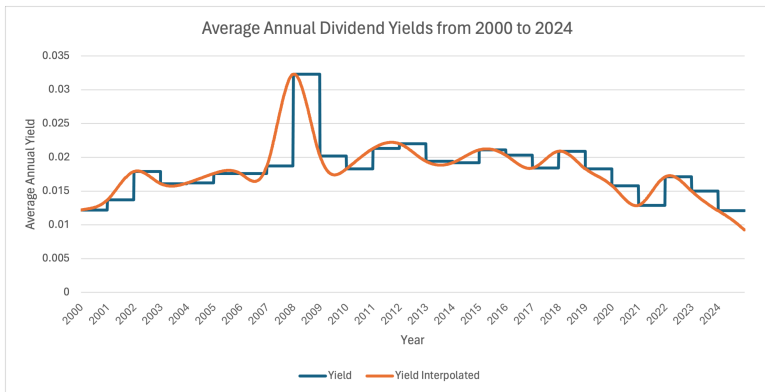


Figure: Interpolated vs Yearly Yield

Strategy: Random

Algorithm 1 Random Strategy Algorithm in R

for $i = 1$ to 1000 **do**

 Generation random, n from 100 to 1000

 Randomly select n days from the 29,797 trading days

 Invest \$1 on each of the n selected days

 Compute IRR (internal rate of return) for this investment strategy

 Calculate IRR for this iteration

end for

Strategy: Random

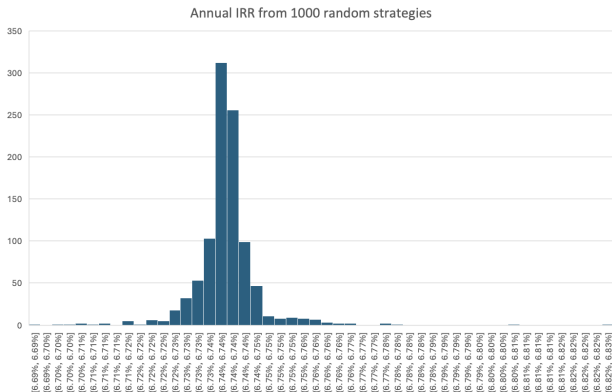


Figure: Histogram of IRR from 1,000 Random Strategies

- Average IRR: 6.74% (Annual Effective)
 - Used as the baseline value to determine if other strategies were successful in "beating the market"

Strategy: Dollar Cost Averaging (DCA)

Definition: Invest a fixed amount of money at regular time intervals, regardless of the market conditions

Why People Think It Works:

- LOWER AVERAGE price per share
- Buy more shares at lower prices and less shares at higher prices
- Long-run accumulation of wealth overtime without much impact from market's volatility

Strategy: DCA Findings

Strategy Application

- **Amount:** [1, 5, 10, 100, 1000]
- **Frequency:** [Daily, Weekly, Monthly, Yearly]
- **Time Frames:**
 - 1/2/1915- 12/31/2024
 - Generations: [Silent, Baby Boomer, Gen X, Millennials]

Applying DCA on all combinations of **[Amount, Frequency]**

- VERY minimal differences in IRRS
- IRR Range: 6.63% - 6.65%

Graph: Dollar Cost Averaging (DCA)

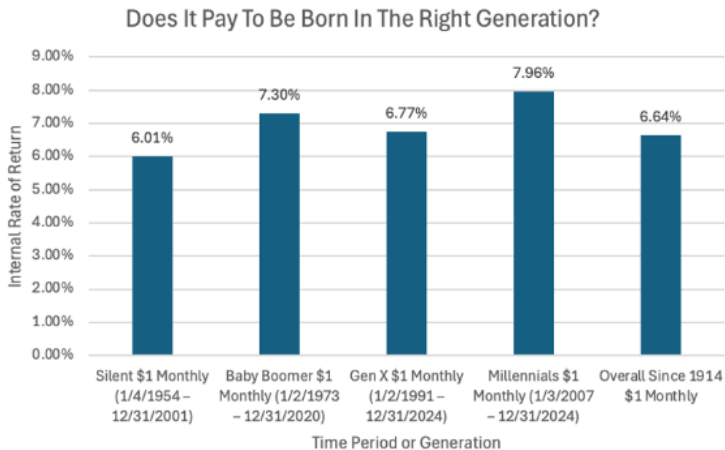


Figure: Does It Pay To Be Born In The Right Generation?

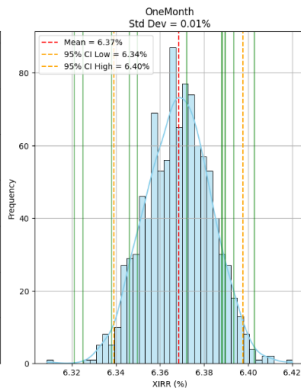
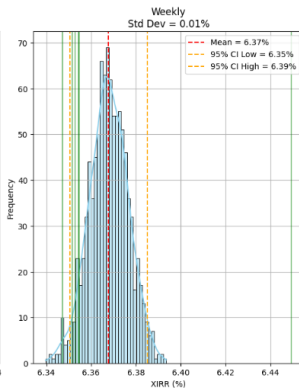
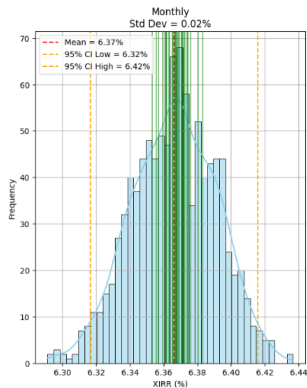
Strategy: Calendar-based

- Yearly: Do stocks experience yearly trends around the time of year? If so why?
- Monthly: What about beginning vs. end of the month?
- Weekly: What about start of the week vs. end of the week?
- How does this change when looking at specific sectors of the economy?
- Can this be explained by random chance, or is it statistically significant?

Graph: Calendar-based

Figure: XIRR Distributions for Calendar-Based Investing (Continuous Effective)

Bootstrapped XIRR Distributions

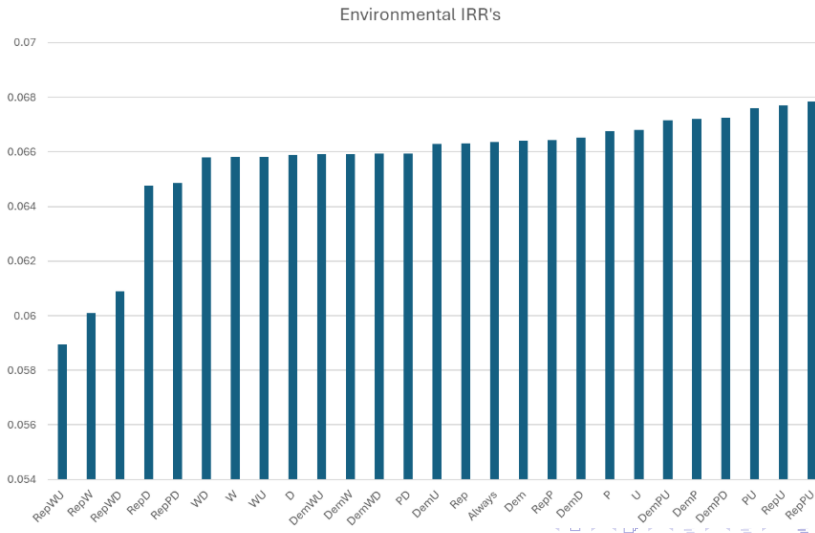


Strategy: Event based

- Can the events of the present impact the stock market?
- The program used within excel complied with the data: Dow/CPI, $\text{Log}(\text{Dow/CPI})$, $\text{Diff}(\text{Log})$, Yield per Day, $\text{Log}(1+\text{Yield})$, and the Daily ROR.
- The account values were created through the account value total divided by number of times invested to create the account value per dollar.
- From there, we were able to calculate internal rates of return within the system.

Graph: Event based

Figure: Event Based IRR



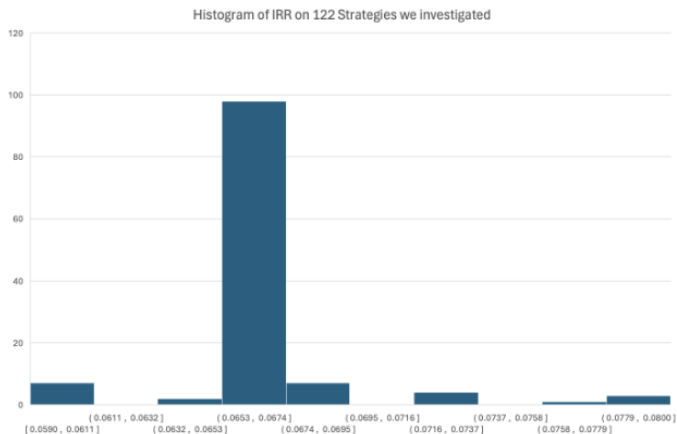
Conclusion

We identified some strategies that "beat the market", though only marginally. In fact, across the 122 strategies investigated, only a handful were outside of a very narrow range.

- DCA returns are only consistent with the market
- Investing on certain days of the month and/or days of the week do not produce significantly better investing results
- War is NOT a good time for the stock market

Conclusion

Figure: Histogram of IRR on 122 Strategies Investigated



Questions

