

Introduction to Back Testing
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Welcome!

My Background

- BS in Computer Science
- 25+ years of software development experience
- 8 years trading the stock market
- 5 years back testing quantified trading strategies
- Currently Director of Research for Connors Research LLC

Agenda

1. **What is back testing?**
2. **Why should you back test?**
3. **What you need**
4. **Basic approach to back testing**
5. **Avoiding pitfalls**
6. **Conclusion and Q&A**

What is Back Testing? An Overview

Back Testing Overview

Definition

Back testing is the process of applying a set of rules to historical data with the goal of assessing the strategy's effectiveness.

Caveat #1

Past performance is not a guarantee of future results!

Back Testing Overview

To produce valid back test results, it is essential to use a quantified approach:

1. Define a set of quantified rules for ranking, entering, exiting, and managing each trade.
2. Apply those rules consistently to all members of your trading universe, as that universe existed at the time of the trade.

Back Testing Overview

Back tests can range from relatively simple to quite complex. Here are some different types of tests that might provide interesting results:

1. Metrics
2. All Trades Tests
3. All Days Tests
4. Portfolio Tests

Back Testing Overview

Metrics

Metrics encompass any type of measurement or summary information. One example of a common metric is Frequency of Occurrence.

For example, we might be interested to know how many times the S&P 500 has declined by more than 5% in a single day since January 1, 2001.

Any guesses?

Back Testing Overview

Metrics

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For example, we might be interested to know how many times the S&P 500 has declined by more than 5% in a single day since January 1, 2001.

The answer is 13:

- 11 times in 2008
- Once in 2009
- Once in 2011

Back Testing Overview

All Trades Tests

All Trades Tests use quantified entry and exit rules to define trades. However, they do not impose any of the limitations of real trading such as capital requirements or position sizing.

Back Testing Overview

All Trades Tests

The purpose of an **All Trades Test** is to answer questions such as:

1. If I could take every trade signal generated by my strategy, what would be my average % gain or loss over the long term?
2. What percentage of my trades would be winners?
3. How many signals would my system generate?
4. Would the signals be bunched up on certain days or in certain years?

Back Testing Overview

All Trades Tests

However, there are also disadvantages to an All Trades Test:

1. Most importantly, it does not simulate real trading, and therefore does not reflect achievable results.
2. You cannot accurately calculate metrics that are important to most traders, like Compound Annual Return.

Back Testing Overview

All Days Tests

An **All Days Test** is very similar to the All Trades Test that we just discussed. The primary difference is that the All Days Test allows you to take every entry signal even if you're already in a trade.

This approach might be useful if you're trying to answer a question such as “what is the average 5-day return of a stock that has an RSI(2) value less than 10?”

Back Testing Overview

Portfolio Tests

A **Portfolio Test** is intended to simulate your actual trading as closely as possible. In addition to quantified entry and exit rules, it must incorporate all of the following:

1. A position sizing algorithm
2. Ranking of multiple trade candidates
3. Commissions and fees
4. Use of margin, if any

Back Testing Overview

Portfolio Tests

Running a **Portfolio Test** allows us to see what would have happened if we had diligently traded our strategy rules over some period of time in the past.

We can also accurately calculate portfolio metrics that could not be derived from the other types of tests, including:

1. Compound Annual Return (CAR)
2. Max Drawdown
3. Average Overnight Exposure
4. Sharpe Ratio, Sortino Ratio, Ulcer Index, CAR/MDD and other similar metrics

Back Testing Overview

So why not always jump immediately to Portfolio Testing every time you develop a new strategy?

1. Position sizing can make a tremendous difference in performance. Dr. Van Tharp and Dr. Howard Bandy have both written extensively on this topic.
2. If you have many more trade signals than you can actually take, then the ranking function that you use can skew the results. If you have no baseline to compare to, you may reject a strategy simply because your ranking rules happen to favor the less profitable trades.

Why Should You Back Test?

Why Back Test?

Reason #1: Gain insight into your own trading methodology.

- Frequency of Trading Signals
- Per Trade & Portfolio Metrics
- Performance & Consistency in Various Market Conditions
- Evaluate Potential Changes

Increasing your confidence in a strategy makes it more likely that you will follow it faithfully.

Why Back Test?

Other Reasons:

- Develop New Quantified Strategies
- Compare Multiple Strategies
- Validate Assertions of Others:
 - Articles & Blogs
 - Trading Services
 - “Conventional Wisdom”

What You Need: Requirements for Back Testing

Back Testing Requirements

To perform a back test requires a minimum of two things:

1. Historical Price Data
2. Back Testing Tools

You may also benefit from other supporting data, such as:

- Volume
- Historical Index Constituency
- Fundamental Data

Back Testing Requirements

Historical Price & Volume Data - Things to Consider:

1. Delisted Securities & Survivorship Bias
2. Adjusted vs Unadjusted Prices
 - Splits
 - Dividends

Back Testing Requirements

Back Testing Tools:

1. AmiBroker

- Powerful back besting & analysis package
- Scripting language (AFL) is similar to C
- Requires an external data source
 - Free sources such as Yahoo Finance
 - Paid subscriptions such as Norgate Premium Data
- Price < \$400

Back Testing Requirements

Back Testing Tools:

2. TradeStation

- Full-fledged trading platform with flexible scripting language
- Includes real-time data
- Pricing depends on what data & tools you need, how many live trades you're making, etc.

Back Testing Requirements

Back Testing Tools:

3. Microsoft Excel

- Typically not suitable for conducting All Trades or Portfolio back tests.
- Great for analysis and summarization of preliminary results produced by a back testing tool such as AmiBroker.
 - Formatting
 - Filtering & Sorting
 - Charting
 - Pivot Tables

Basic Approach to Back Testing

Basic Approach

1. Start with a **thesis**, for example “volatile, oversold stocks tend to revert to the mean, and thus represent buying opportunities”.
2. Express your thesis as a set of **quantified rules**.
In our example, we might use:
 - Minimum Price & Volume (as traded)
 - 100-Day Historical Volatility $> X$
 - 2-Day RSI $< Y$ for Entry
 - 2-Day RSI $> Z$ for Exit
3. Build and run the **back test**

Basic Approach

Sanity Checks:

1. Results are NOT too good to be true!
2. When testing different strategy parameter values, there is a reasonable and predictable progression of results.

Basic Approach

Identify the limitations of your approach

1. All Trades vs. Portfolio Tests – each have pros and cons
2. Are there enough trading signals to draw valid conclusions on future performance? How many is “enough”?
3. How accurate is your data, and how can you tell?

Basic Approach

Try to find a partner who can help verify your work.

1. Best method is a completely independent implementation of the strategy rules.
2. Where you find differences in the results, ask yourself if you and your partners interpreted the rules differently, and if so, which is the better interpretation (not which produces the better results).
3. Even just being able to discuss ideas with a “trading buddy” can be very beneficial.

Avoiding Pitfalls

Avoiding Pitfalls

To make your back testing results as representative of real trading as possible, avoid the following:

1. “Untradeable” rules

- Looking ahead in the data

Enter the trade on a limit order, using today's ATR(14) value as the stop amount.

- Not allowing for scan or calculation time.

At the open, short the five stocks with the highest HV(100) which gapped up by at least 3% from yesterday's close.

2. Curve Fitting or Cherry Picking

If the only variation of your strategy with attractive results is the one that uses the entry rule “RSI(9) < 17”, then you probably don't have a robust strategy!

Q&A

Thank You!

Please feel free to contact me for assistance with any of the following:

- AmiBroker Coding
- Strategy Development & Back Testing
- Microsoft Excel Consulting

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