



Backtesting and Market Research

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Outline:

- What is it and why do it?
- What skills and tools will you need?
- Specific methods
- Pitfalls and common mistakes
- Backtesting by hand



What is backtesting?

- Examining the results from following a set of trading rules using historical data.
 - May (but do not have to) consider other parameters.
 - Can (but do not have to) run “what if” scenarios?
 - Rules can be simple or complex
 - Historical data can be:
 - Long or short time periods
 - Single market or portfolio

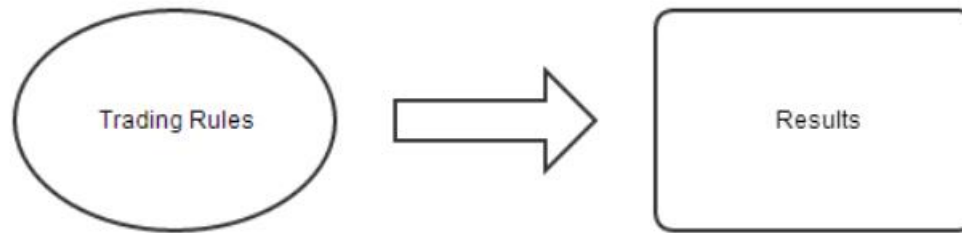


Why backtest?

- The most common answer is to create a trading system.
 - The idea is that maybe we can find a set of trading rules that have performed well in the past and apply them in the future.
 - What assumptions are embedded in this plan?
- We can also backtest to learn.
 - I call this “market research”, to differentiate from system-creation backtest.
 - Can be:
 - General or broad
 - Market-specific or applicable to prices in general



Is It This Simple?



What Do We Need to Backtest?

- Good, clean data.
 - Intelligent market selection.
 - Attention to time slices.
 - Robust research environment.
 - Ability to collect and compare results.
 - Correct statistical tools for analysis.
 - The right mindset.
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- None of these are easy, and all are important.



Issues with Data

- Data is rarely clean, even if you paid for it.
- Errors can range from minor to catastrophic.
- Most researchers find that the vast majority of their time (85% - 90%) is spent dealing with cleaning and wrangling datasets, and finance is no exception.
- High frequency data is especially susceptible to errors, but standard data sources sometimes include errors on daily and longer timeframes.



Examples of Data Errors

- Missing days
- Missing datapoints for some days
- Incorrect timestamps on the full series
- Incorrect timestamps on a single data point
- “Obvious” errors
 - $\text{Low} < \text{High}$
 - $\text{Close} < 0$
 - $\text{O or C} > \text{H or} < \text{L}$
 - Misplaced decimal point (e.g., 101.23, 103.45, 1,058.7)
- Incorrectly adjusted prices
 - Futures rolls
 - Stock prices for splits/dividends
- Mislabeled data files
- Wrong prices (e.g., 42 for 43)



Market Selection

- Some questions are easy:
 - Do you want to test an idea on futures and equities both?
- Some are trickier:
 - If you are testing currencies, do you need to test cash currency and futures both? What about exchange traded products?
- Some are really hard:
 - How many markets do you need and how much data is enough?
 - For instance, are 500 stocks better than 200?
 - What about correlation?



Market Selection

- Make sure you cover markets relevant to your trading situation and mandate.
- Reach broadly enough that you can examine the “edges” of your question.
 - Do all markets trade the same, as technical analysis teaches?
- Make an effort to include different market conditions and volatility regimes.
 - Bull, bear, and flat markets.
 - Quiet periods and highly volatile periods.
 - Periods with and without exogenous stresses.



Research Environment

- There are many pieces of software that claim to give tools for backtesting.
- Many blogs, of differing degrees of sophistication, giving ideas and guidelines.
 - When you are starting out, do not assume that everything you read is true.
 - You need to develop knowledge and skills to discriminate.



Clarify Your Objectives

- “Back of the envelope” testing.
 - Building complete trading systems
 - Creating HFT algos
 - Interfacing directly with execution software
 - Collecting market data (e.g., tick level)
 - Developing your trading skills/intuition
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- These are all very different and will require different tools.
 - The right tool for one job can be useless for another.



Options and Possibilities

No	Adequate	Good	Probably overkill
Retail-level platforms	Excel (Pencil and paper?)	Excel + VBA Python R Matlab, etc Stata, SAS, SPSS Java	C++



Special Mention: Excel

- Excel is a very useful tool, and many people get their first steps in quantitative analysis in Excel.
- There are good advantages:
 - Easy to visualize data.
 - Easy to manipulate data.
- But also disadvantages.
 - Slow
 - Lacks standard graphing capabilities (histograms)
 - Can be very cumbersome when projects get complicated.
- Is much more powerful when combined with VBA.
- My advice: learn it. Use it, but don't depend on it: Excel is probably not your final solution.



Programming Skills

- You are probably going to need to develop some programming skills.
- Can range from relatively simple, application specific (i.e., being able to operate a piece of software), to learning a complete language.
- If this scares you, don't be intimidated. It's a skill, like any other, than takes time to develop, but anyone can learn to do it.
 - There are some very good online resources.



Analyzing Results

- You have to be able to understand the statistics.
- For example:
 - What measure of central tendency is relevant?
 - How do you need to factor dispersion in?
 - What significance test (if any) is relevant?
 - How strong is the effect?
 - How stable is it?
- The simplest output might be three numbers: a mean, standard deviation, and sample size.
- There is no way around needing these skills, but, again, there are many free resources.



Mindset

- It can be constructive to take an objective, scientific approach to market problems.
- The scientific method and research protocols from other disciplines might be good models.
- There is also value in market experience (street smarts) and common sense.
- These are gained through experience and exposure to market data.
- Good research methodologies incorporate an element of art.
- Correct research methodologies can aid in the development of intuition and market sense.
- These are not opposed!



Discretionary vs. Quantitative

- This is not a division. Rather, it is a spectrum.
- There are purely quantitative traders.
 - Algorithmic traders.
 - System traders.
- Are there purely discretionary traders?
 - A successful, purely discretionary trader will, at the very least, draw on his own experience.
 - This is a form of backtesting and learning.
- Many traders blend the two.
 - Need rules.
 - Discipline is essential.



Specific Tools

- Simple pattern testing, using event study methodology.
 - *Event Studies in Economics and Finance*, MacKinlay, 1997
- Portfolio-level testing platform
 - Produce portfolio metrics
 - Should include some ability to optimize



Optimization: Not a Dirty Word

- Optimization is a technique that takes many different inputs (e.g., length of moving average) and finds which would have produced the best results.
 - (It is not “curve fitting”. That term is mis-used by technical analysis!)
- Over-optimization is bad. With enough parameters, virtually any trading system can be made to create impressive results on historical data.
 - “With four parameters I can fit an elephant and with five I can make him wiggle his trunk.” - John von Neumann
- There is a good word for the right optimization: **Learning.**



Optimization: Guarding Against Mistakes

- Backtesting results should always be suspect, but optimized backtest results especially so.
- (Errors can arise even when there is no intent to deceive.)
- Simple guidelines can help:
 - Do not optimize heavily.
 - Be suspicious of results that show a single impressive result in many poor tests.
 - Look for “areas” or “zones” of good results.
 - Maybe select a sub-optimal parameter set.
 - **Use out of sample data correctly.**



Out of Sample

- Out of sample data is data that is held back and not touched at all in the research process.
- The workflow is that you create your system, test it, refine it, and, as a last step, test it on out of sample data.
- You only get one shot!
 - This is **the** critical aspect of out of sample testing, and one that is often ignored.
- Once the out of sample has been used, even once, it is now in sample and **cannot** be used again.
- A question: if you are trading actively and experience market data, can it be used as out of sample?



“Sneaky” Optimization

- Imagine a process like this:
 - What happens if we put moving average X on a market? (2,000 trades)
 - What if we add indicator A? indicator B? indicator C? Let’s keep indicator B and C. (500 trades)
 - What if we only traded this on Mondays? Tuesdays? The results are so much better if we eliminated Wednesdays, so let’s do that. (100 trades)
 - What if we add a trend indicator? (50 really good trades...)
- This is a process of optimization, and can easily become over-optimization.
- Be careful of a process that starts with many events and filters down to “only the best trades”.



Be Careful of Ratio Metrics

- When comparing different results, what should you compare?
 - How much money you would've made?
 - How many trades?
 - How variable those results were?
 - Winning percentage?
- A typical quant module might simply compare Sharpe ratios of optimization runs, and pick the highest Sharpe.



Sharpe Ratio

- The concept is average return divided by standard deviation of those returns.
- Possible issues:
 - Does “average return” describe everything that needs to be considered?
 - Is standard deviation a good measure of risk?
 - Are there other factors to consider?
- In general, ratio metrics are questionable because they are very sensitive to changes in the denominator.
- There are other ratios and other metrics to consider.



Event Study

- Define a precise condition that will result in a trading signal.
 - Symmetrical for buy and sell.
- Work through each bar of the universe looking for the condition.
- Record returns for each bar following the condition.
- Combine all $N+1$, $N+2$, ... returns to get a composite for each bar following the signal.
- Create excess return measure (signal – baseline) for each bar.



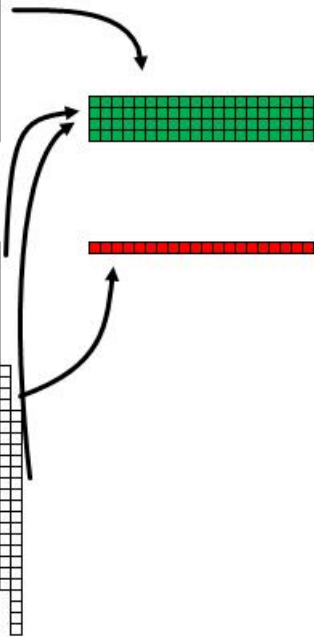
Event Study

12/30/2013	1039.75	1036.5	1039.5	1035.5
12/30/2013	1039.5	1036.5	1039.5	1035.5
12/30/2013	1039.25	1035	1039.5	1034.25
12/30/2013	1034.25	1035.25	1039.5	1035.25
12/30/2013	1035.25	1036.5	1034.5	1034.75
12/30/2013	1035	1036.25	1034	1035
12/31/2013	1039	1040.75	1037.25	1039.75
12/31/2013	1039.75	1043.5	1039.5	1042.25
12/31/2013	1042.25	1042.75	1040.75	1041.25
12/31/2013	1041.5	1042.25	1040	1041.25
12/31/2013	1041.25	1041.5	1039.75	1039
12/31/2013	1039.25	1039.75	1036.75	1039
12/31/2013	1039	1041.5	1039	1040.25
1/2/2014	1037.25	1038	1028.25	1031.5
1/2/2014	1031.5	1034	1030.25	1031.5
1/2/2014	1031.5	1031.75	1025.5	1026.5
1/2/2014	1026.5	1028	1024.25	1025.75
1/2/2014	1029.75	1028	1021.75	1029.25
1/2/2014	1029.25	1028.75	1023.25	1026.75
1/2/2014	1026.75	1023.25	1025.25	1026.25
1/3/2014	1028.75	1039	1028	1030.75
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1/3/2014	1030	1026.75	1030	1025.5
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1/3/2014	1026	1026	1025.25	1026.5
1/3/2014	1030.5	1031.25	1024.5	1025.25
1/4/2014	1031.25	1032.5	1029.5	1026.75
1/4/2014	1027	1027.75	1017.5	1019.25
1/4/2014	1043.5	1021.25	1018	1019.5
1/4/2014	1019.75	1021	1018	1019.25
1/4/2014	1019.75	1024.75	1019	1023.25
1/4/2014	1029	1028	1023	1024.25
1/4/2014	1024.75	1025	1020	1020.5
1/7/2014	1027.75	1031.25	1026.25	1032.25
1/7/2014	1032.25	1031.75	1031.5	1031.75
1/7/2014	1031.5	1032.5	1030	1031
1/7/2014	1031.25	1032.75	1030.75	1031.5
1/7/2014	1032.5	1033.25	1030.5	1032.75
1/7/2014	1032.75	1034.25	1030.5	1030.5
1/8/2014	1031.25	1034.25	1025.5	1030.5
1/8/2014	1031.5	1034.75	1030.25	1031
1/8/2014	1031	1034.25	1031	1032
1/8/2014	1032.25	1039	1029.75	1031.5
1/8/2014	1031.5	1034	1028.75	1030.75
1/8/2014	1030.75	1032.25	1026.25	1026.75
1/8/2014	1026.5	1033.5	1026.25	1032.25
1/9/2014	1037.75	1038	1021.5	1032
1/9/2014	1032	1035	1024.25	1026.75
1/9/2014	1027	1029.5	1026	1029.5
1/9/2014	1029.25	1032.5	1023.25	1031.5
1/9/2014	1031.5	1032.25	1024	1029
1/9/2014	1029	1034	1027.5	1033.25
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1/10/2014	1036	1039.75	1027.5	1034.25
1/10/2014	1031.5	1032	1027	1028.25
1/10/2014	1028.25	1031.25	1026.25	1030.5
1/10/2014	1030.5	1032.75	1030	1032
1/10/2014	1032.25	1033.5	1030	1031.5
1/10/2014	1031.5	1036.25	1031.25	1035.75
1/10/2014	1030.75	1034.25	1030	1037.5
1/10/2014	1031.5	1038	1032.25	1037.5
1/10/2014	1037.5	1038.25	1034.25	1034.75
1/10/2014	1034.75	1036.5	1030.25	1030.5
1/10/2014	1030.75	1034.75	1022.25	1029
1/10/2014	1025	1025.25	1019.25	1020.5
1/10/2014	1020.5	1020.75	1014.5	1019.5
1/10/2014	1019.75	1015.5	1008.5	1016
1/14/2014	1019.25	1022.75	1015.75	1024.25
1/14/2014	1024.25	1023.25	1020.75	1027
1/14/2014	1027	1031.5	1026.25	1030.25
1/14/2014	1030.5	1029	1029	1029.25
1/14/2014	1029.75	1032.5	1028.5	1031.25
1/14/2014	1029.25	1032.5	1028.5	1031.25
1/14/2014	1034	1034	1035.5	1034
1/15/2014	1042.25	1044.75	1040.25	1041.5
1/15/2014	1041.5	1044.5	1041	1040.75
1/15/2014	1040.75	1044	1040.5	1041.25
1/15/2014	1041.5	1044	1039.75	1042.75
1/15/2014	1040	1044.75	1040.75	1042.25
1/15/2014	1042.25	1044.75	1041	1041.5



Event Study

Date	Open	High	Low	Close
12/30/2013	1036.5	1038	1033.75	1033.75
12/31/2013	1033.75	1036.5	1033.5	1033.5
12/30/2013	1035.5	1036.5	1033.75	1033.75
12/30/2013	1034.25	1035	1033.5	1034.25
12/30/2013	1034.25	1035.25	1033.5	1035.25
12/30/2013	1035.25	1036.5	1034.5	1034.75
12/30/2013	1035	1036.25	1034	1035
12/31/2013	1039	1040.75	1037.25	1039.75
12/31/2013	1039.75	1040.5	1037.5	1040.25
12/31/2013	1042.25	1042.75	1040.75	1041.25
12/31/2013	1041.5	1042.25	1040	1041.25
12/31/2013	1041.25	1041.5	1039.75	1039
12/31/2013	1041.25	1041.5	1039.75	1039
12/31/2013	1039	1046.5	1039	1046.25
1/2/2014	1037.25	1038	1024.25	1031.5
1/2/2014	1034.5	1034	1028.25	1031.5
1/2/2014	1031.5	1031.75	1025.5	1026.5
1/2/2014	1026.5	1028	1024.25	1025.75
1/2/2014	1025.75	1028	1024.75	1023.25
1/2/2014	1023.25	1028.75	1023.25	1026.25
1/2/2014	1026.75	1025.25	1025.25	1026.25
1/3/2014	1020.75	1033	1020	1030.75
1/3/2014	1031.75	1032.25	1025.75	1026
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1/3/2014	1025.75	1026.75	1024.75	1025.75
1/3/2014	1025.5	1026.5	1023.5	1025.75
1/3/2014	1026	1032	1025.25	1030.5
1/3/2014	1030.5	1031.25	1024.5	1025.25
1/3/2014	1031.25	1032.5	1023.5	1026.75
1/3/2014	1029	1027.75	1019.25	1019.25
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1/3/2014	1010.75	1021	1010	1020.75
1/3/2014	1021.75	1024.75	1010	1023.25
1/3/2014	1020	1026	1020	1024.75
1/3/2014	1024.75	1025	1020	1020.5
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1/3/2014	1032.75	1034.25	1030.5	1030.5
1/3/2014	1031.25	1034.25	1025.5	1030.5
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1/3/2014	1032.25	1033	1028.75	1031.5
1/3/2014	1031.5	1034	1028.75	1030.75
1/3/2014	1030.75	1032.25	1026.25	1026.75
1/3/2014	1030.5	1033.5	1026.25	1032.25
1/3/2014	1027.75	1030	1014.5	1032
1/3/2014	1032	1033	1024.25	1026.75
1/3/2014	1027	1029.5	1026	1029.5
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1/3/2014	1029	1034	1027.5	1033.25
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1/3/2014	1030	1030.75	1027.5	1031.25
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1/3/2014	1035.75	1038.25	1035	1037.5
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1/3/2014	1037.5	1038.25	1034.25	1034.75
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1/3/2014	1031.75	1038.25	1032.25	1035
1/3/2014	1025	1025.25	1019.25	1020.5
1/3/2014	1025	1025.25	1019.25	1020.5
1/3/2014	1020.25	1020.75	1011.5	1019.5
1/3/2014	1019.75	1016.5	1013.5	1016
1/3/2014	1010.25	1022.75	1016.75	1021.25
1/3/2014	1021.25	1023.25	1024.75	1027
1/3/2014	1027	1021.5	1026.25	1030.25
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1/3/2014	1031.25	1034	1030.5	1030.5
1/3/2014	1034	1034.25	1031.25	1033
1/3/2014	1037.25	1040	1036.5	1042.25
1/3/2014	1040.25	1040.75	1044.25	1041.5
1/3/2014	1041.5	1044.5	1044	1043.75
1/3/2014	1044.5	1044.5	1044	1043.75

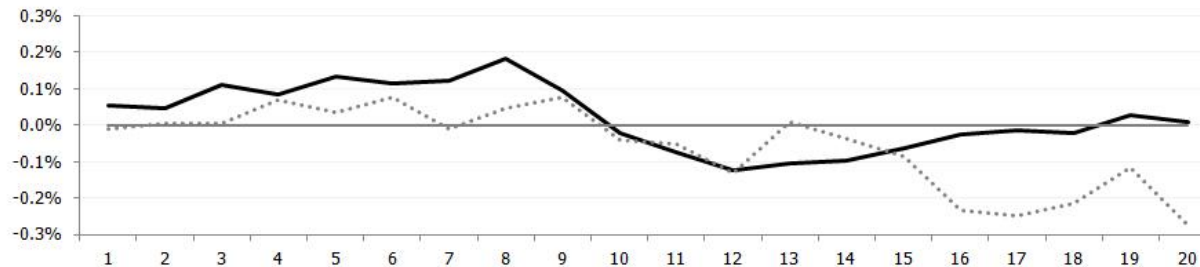


Event Study Output

Day	N	Raw			Excess				Baseline			p-val	
		Up Down	Mean	Median	Mean	StDev	Median	IQR	Up Down	Mean	StDev		Median
1	3,347	50.7% 48.3%	0.11%	0.04%	0.05%	2.69%	(0.01%)	2.10%	50.0% 48.5%	0.06%	5.31%	0.01%	0.00
2	3,347	51.5% 47.4%	0.13%	0.09%	0.05%	3.89%	0.00%	3.08%	51.1% 47.9%	0.08%	19.40%	0.08%	0.00
3	3,347	51.9% 47.1%	0.23%	0.13%	0.11%	4.63%	0.01%	3.67%	51.8% 47.4%	0.12%	30.17%	0.14%	0.00
4	3,347	52.5% 46.9%	0.24%	0.23%	0.08%	5.26%	0.07%	4.43%	52.2% 47.0%	0.16%	49.49%	0.20%	0.00
5	3,347	52.2% 47.0%	0.30%	0.21%	0.13%	6.71%	0.04%	4.88%	52.6% 46.7%	0.17%	68.40%	0.26%	0.00
6	3,347	53.4% 46.3%	0.38%	0.34%	0.11%	7.20%	0.08%	5.35%	53.0% 46.3%	0.26%	69.27%	0.33%	0.00
7	3,347	53.7% 45.7%	0.47%	0.34%	0.12%	8.45%	(0.01%)	5.77%	53.3% 46.0%	0.35%	68.21%	0.39%	0.00
8	3,347	53.5% 46.0%	0.57%	0.43%	0.18%	9.08%	0.04%	6.36%	53.7% 45.7%	0.39%	67.27%	0.46%	0.00
9	3,347	54.6% 45.2%	0.59%	0.57%	0.10%	8.57%	0.08%	6.69%	54.0% 45.3%	0.49%	62.93%	0.53%	0.00
10	3,347	53.8% 45.7%	0.57%	0.55%	(0.02%)	8.86%	(0.04%)	7.06%	54.2% 45.1%	0.59%	56.12%	0.58%	0.00
11	3,347	54.6% 45.1%	0.62%	0.64%	(0.07%)	9.16%	(0.05%)	7.41%	54.5% 44.8%	0.70%	52.75%	0.65%	0.00
12	3,347	54.8% 45.0%	0.67%	0.66%	(0.12%)	9.26%	(0.13%)	7.71%	54.7% 44.6%	0.79%	54.05%	0.72%	0.00
13	3,347	55.5% 44.1%	0.77%	0.89%	(0.11%)	9.56%	0.01%	7.90%	54.9% 44.5%	0.88%	60.92%	0.78%	0.00
14	3,347	55.5% 44.2%	0.81%	0.87%	(0.10%)	10.10%	(0.04%)	8.20%	55.1% 44.2%	0.91%	63.84%	0.84%	0.00
15	3,347	55.5% 44.4%	0.88%	0.86%	(0.06%)	10.64%	(0.09%)	8.83%	55.3% 44.0%	0.94%	66.25%	0.91%	0.00
16	3,347	54.6% 45.1%	0.95%	0.74%	(0.02%)	11.92%	(0.23%)	9.01%	55.4% 43.8%	0.98%	77.18%	0.97%	0.00
17	3,347	54.5% 45.1%	1.00%	0.77%	(0.01%)	12.24%	(0.25%)	9.21%	55.7% 43.6%	1.01%	80.28%	1.04%	0.00
18	3,347	55.4% 44.4%	1.07%	0.88%	(0.02%)	12.65%	(0.21%)	9.43%	55.8% 43.4%	1.10%	66.84%	1.10%	0.00
19	3,347	55.3% 44.4%	1.16%	1.02%	0.03%	13.07%	(0.12%)	9.83%	55.9% 43.3%	1.13%	70.37%	1.15%	0.00
20	3,347	54.7% 45.0%	1.20%	0.91%	0.01%	14.19%	(0.28%)	10.24%	56.0% 43.2%	1.19%	68.67%	1.20%	0.00

Baseline: Up: 50.0%, Down: 48.5%, Unch: 1.5%

Mean (solid) +/- 1σ and Median (dashed) Excess Returns by Bar Following Event



Example Workflow for Research

1. Formulate an idea about market action. Be precise.
 2. Come up with a plan for testing the idea.
 3. Gather correct data and tools for doing the analysis.
 4. Analyze the data.
 5. Analyze the results.
- Refine the question
 - Optimize
 - Use out of sample



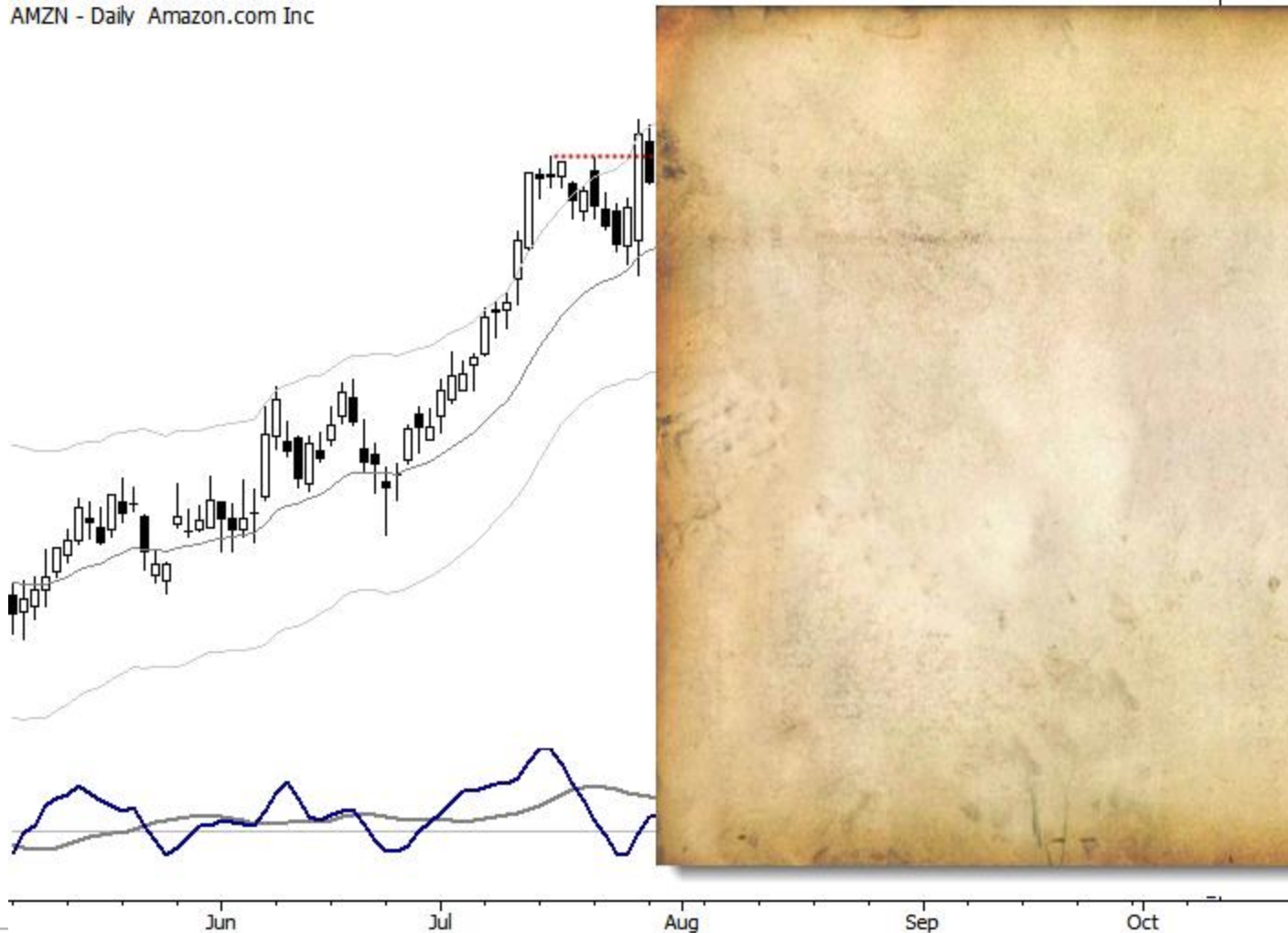
Manual Backtesting

- Automated backtesting has the advantage of breadth and precision.
 - Can look at many markets and hundreds of thousands of events.
 - Can easily examine different time periods and markets for stability.
- Manual backtesting, by contrast, is slow and may appear to be cumbersome.
 - But close contact with market data helps build intuition and market sense.
- Bar by bar testing is a good tool, but there are some pitfalls to consider.



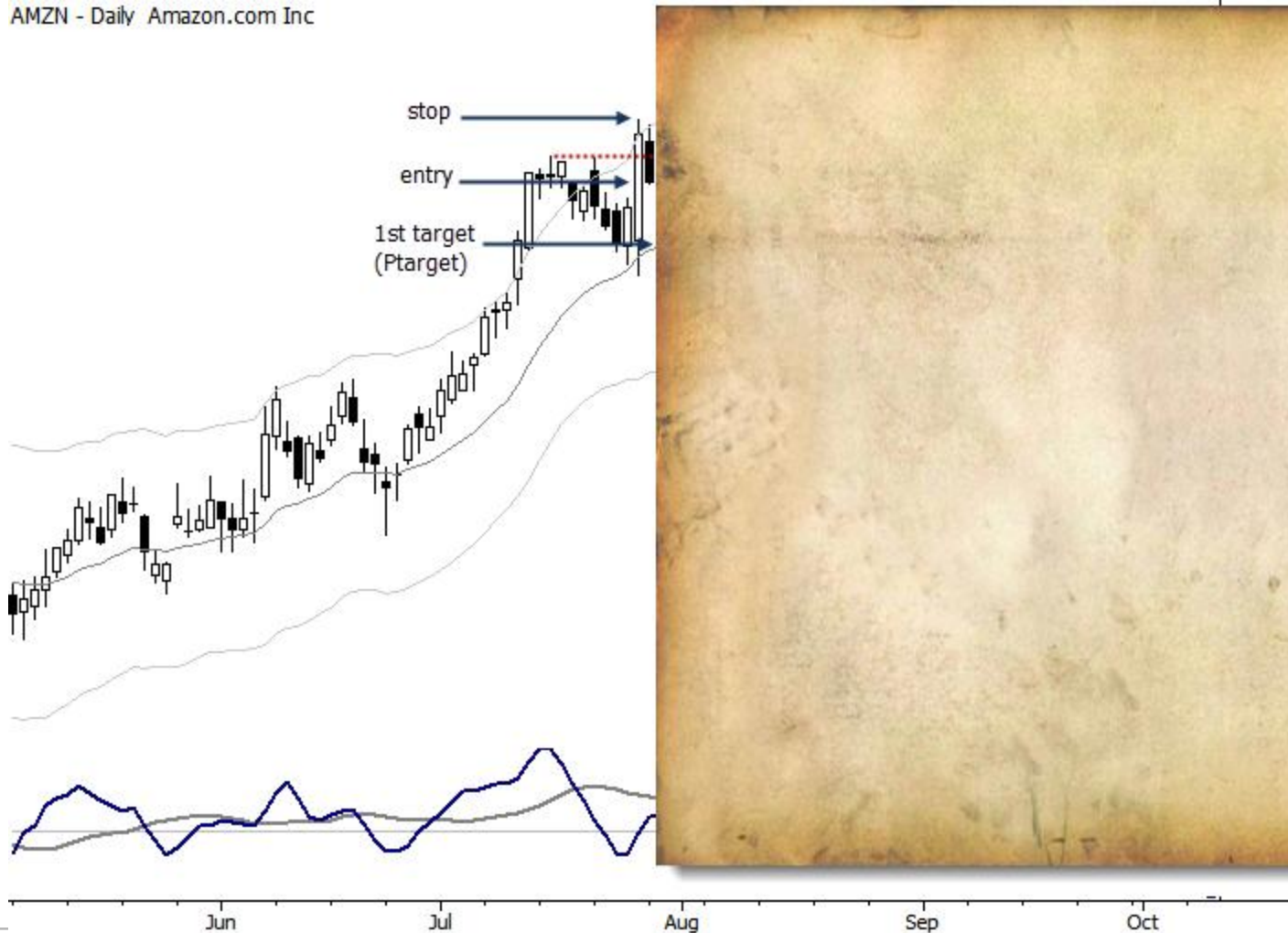
Bar by bar: Entry

AMZN - Daily Amazon.com Inc



Three Prices

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P&L Sheet Entry

	A	B	C	D	E	F	G	H	I	J	K	M	N	O
1		Date	Market	Type	Mult	L/S	#	PriceIn	PriceOut	InitStop	P&L	%R	Ptarget	Target?
2		7/29/2013	AMZN	FT	1	-1	1	306.10		313.62			298.58	
3														



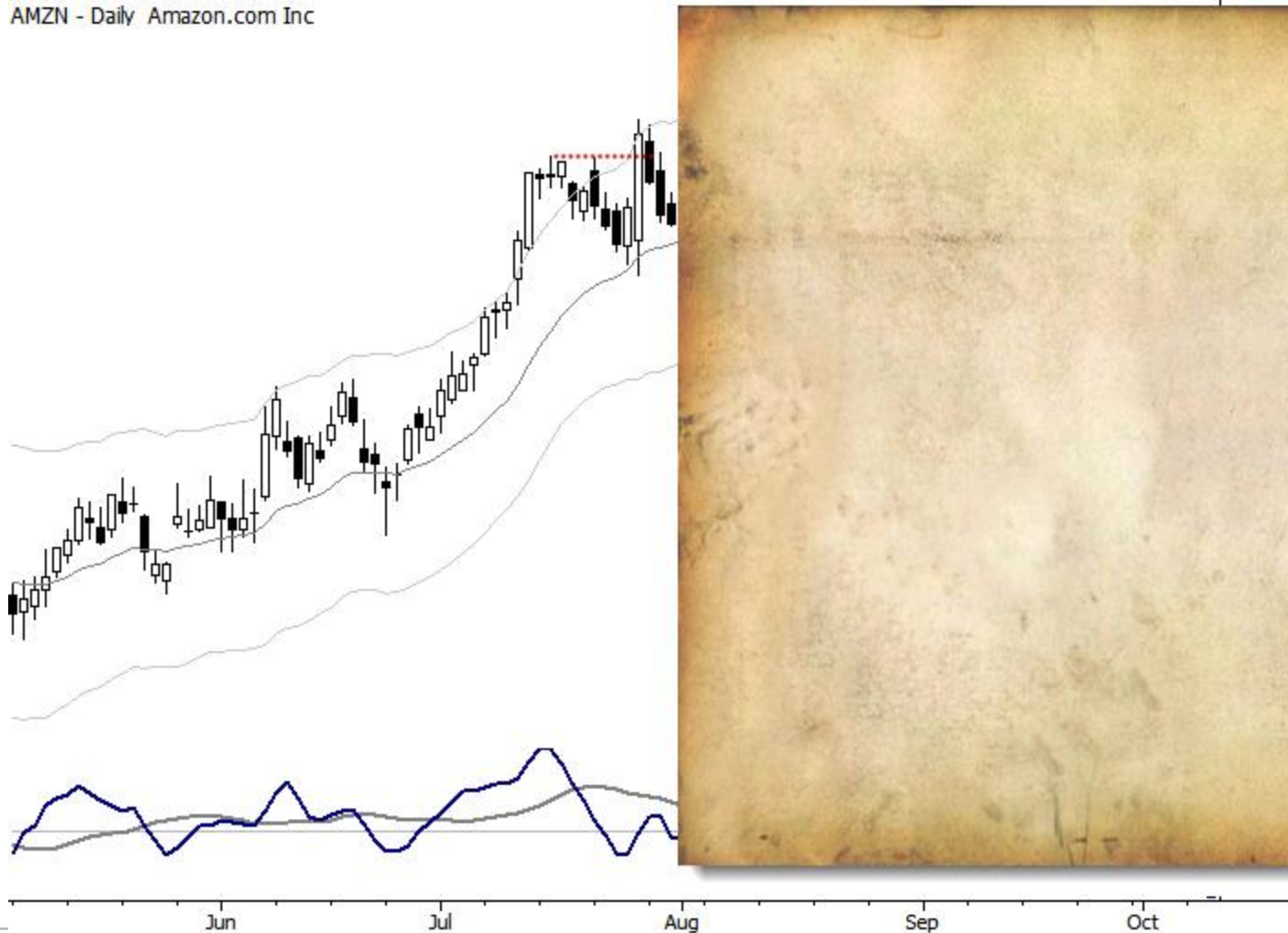
Bar by Bar...

AMZN - Daily Amazon.com Inc



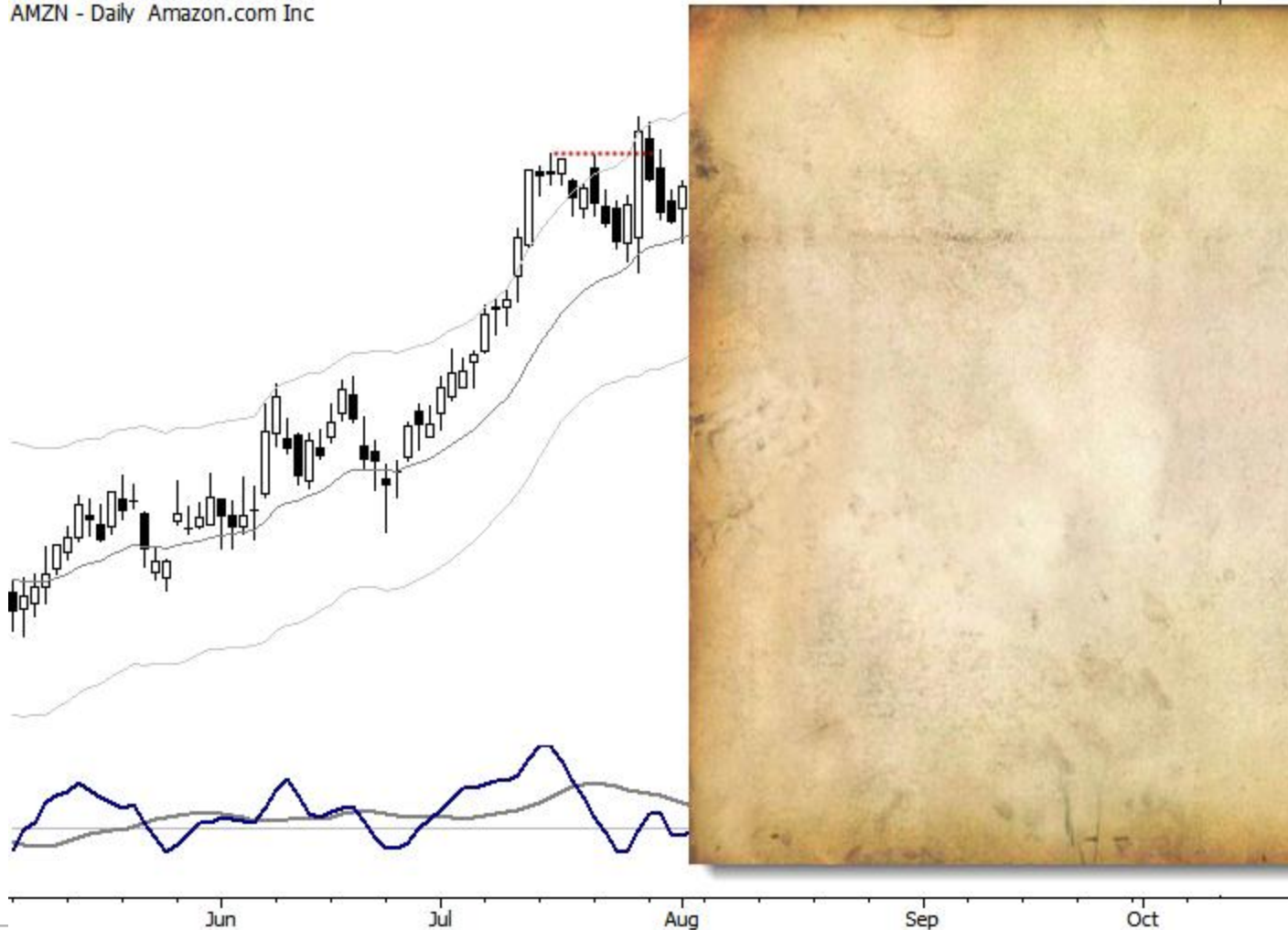
Bar by Bar

AMZN - Daily Amazon.com Inc



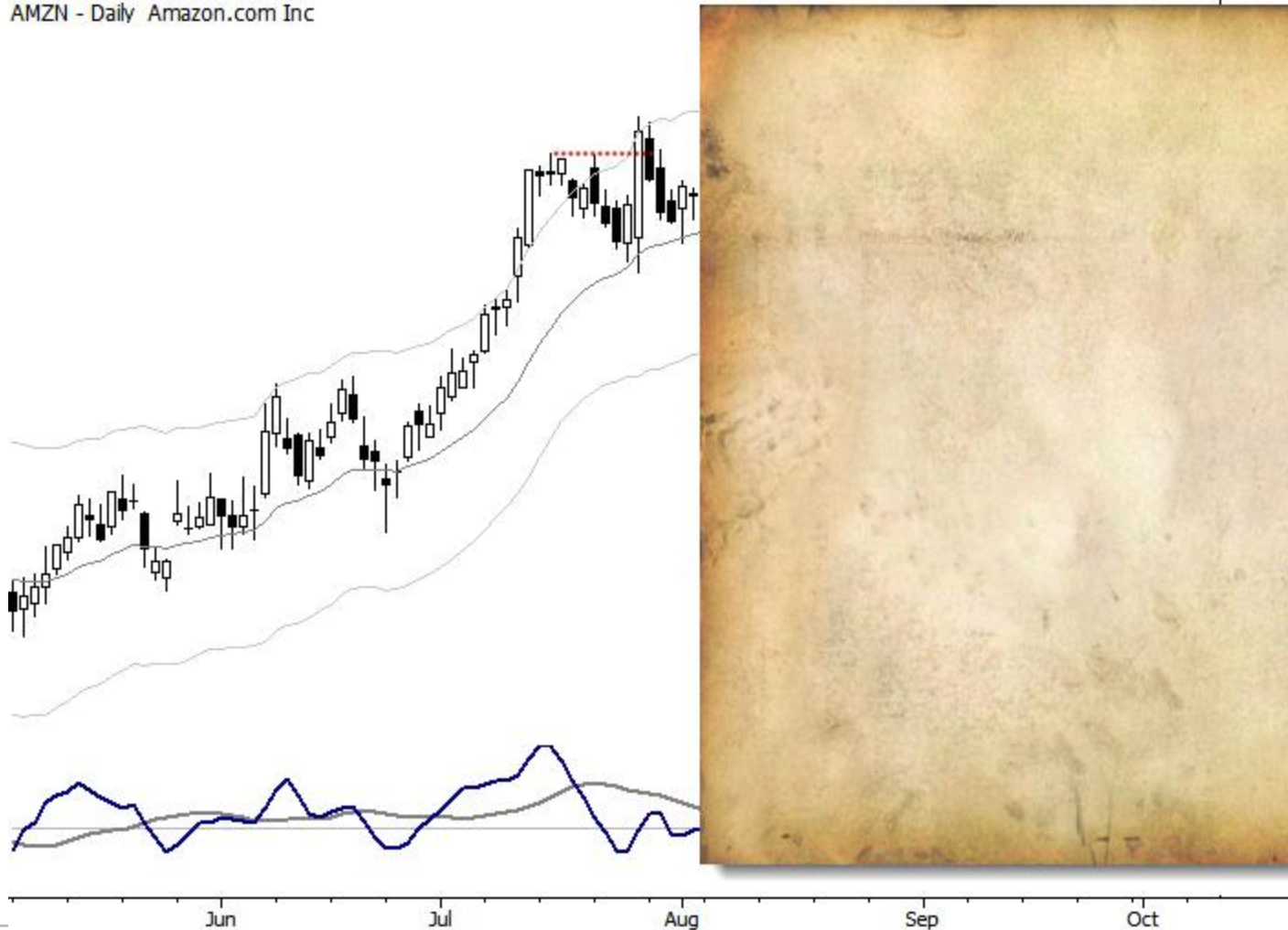
Bar by Bar

AMZN - Daily Amazon.com Inc



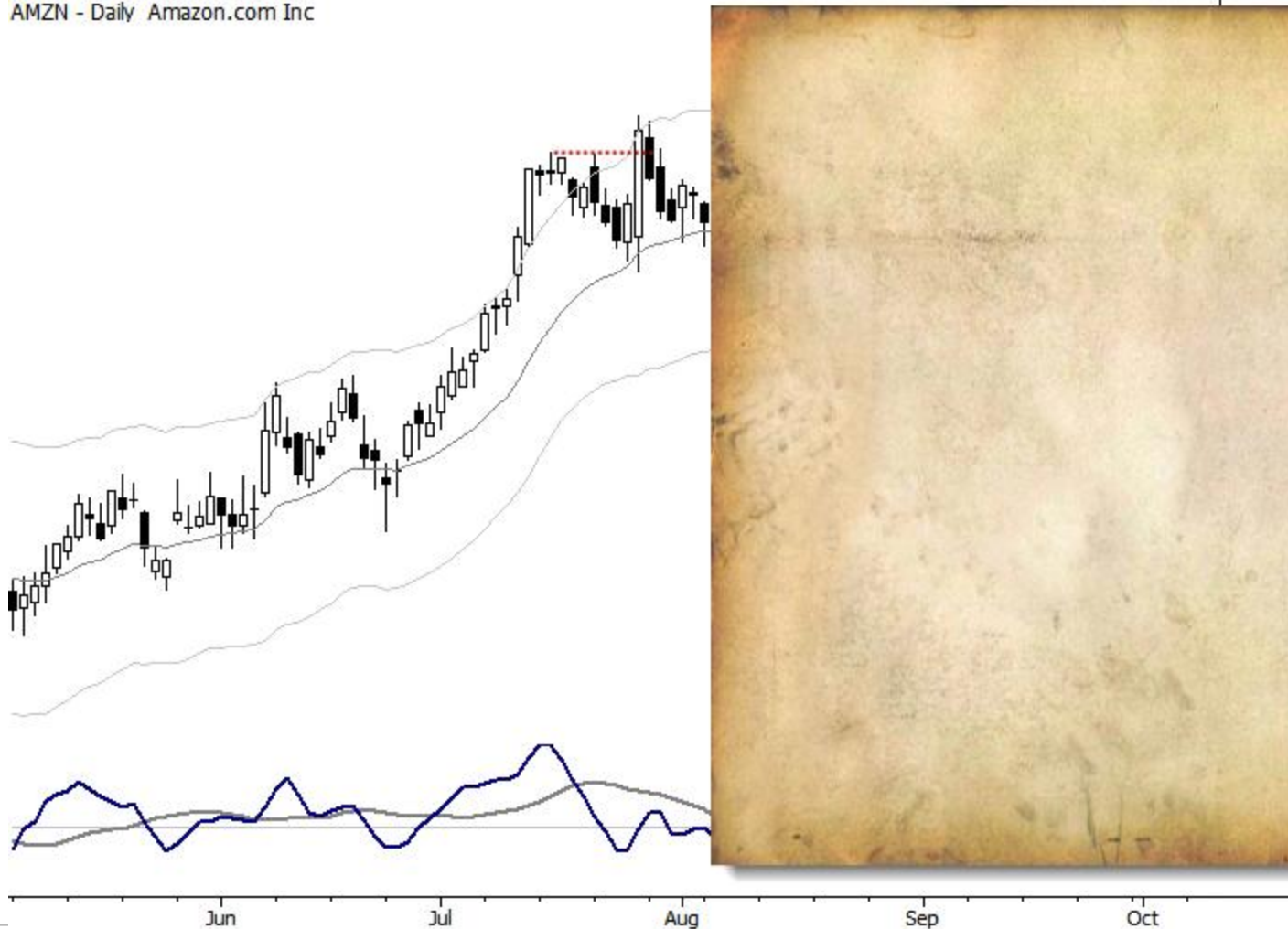
Bar by Bar

AMZN - Daily Amazon.com Inc



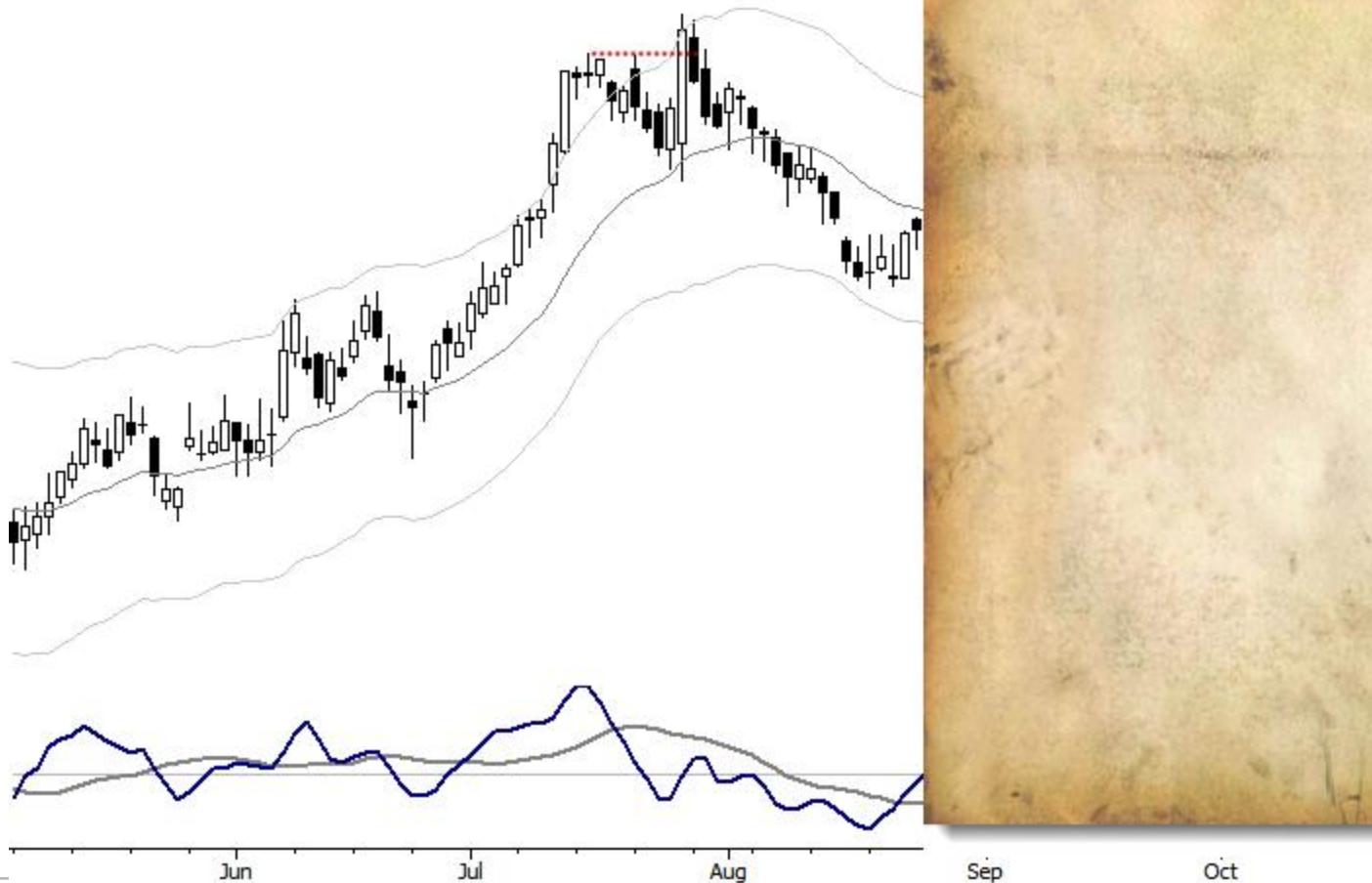
First Target Hit

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What is the Plan?

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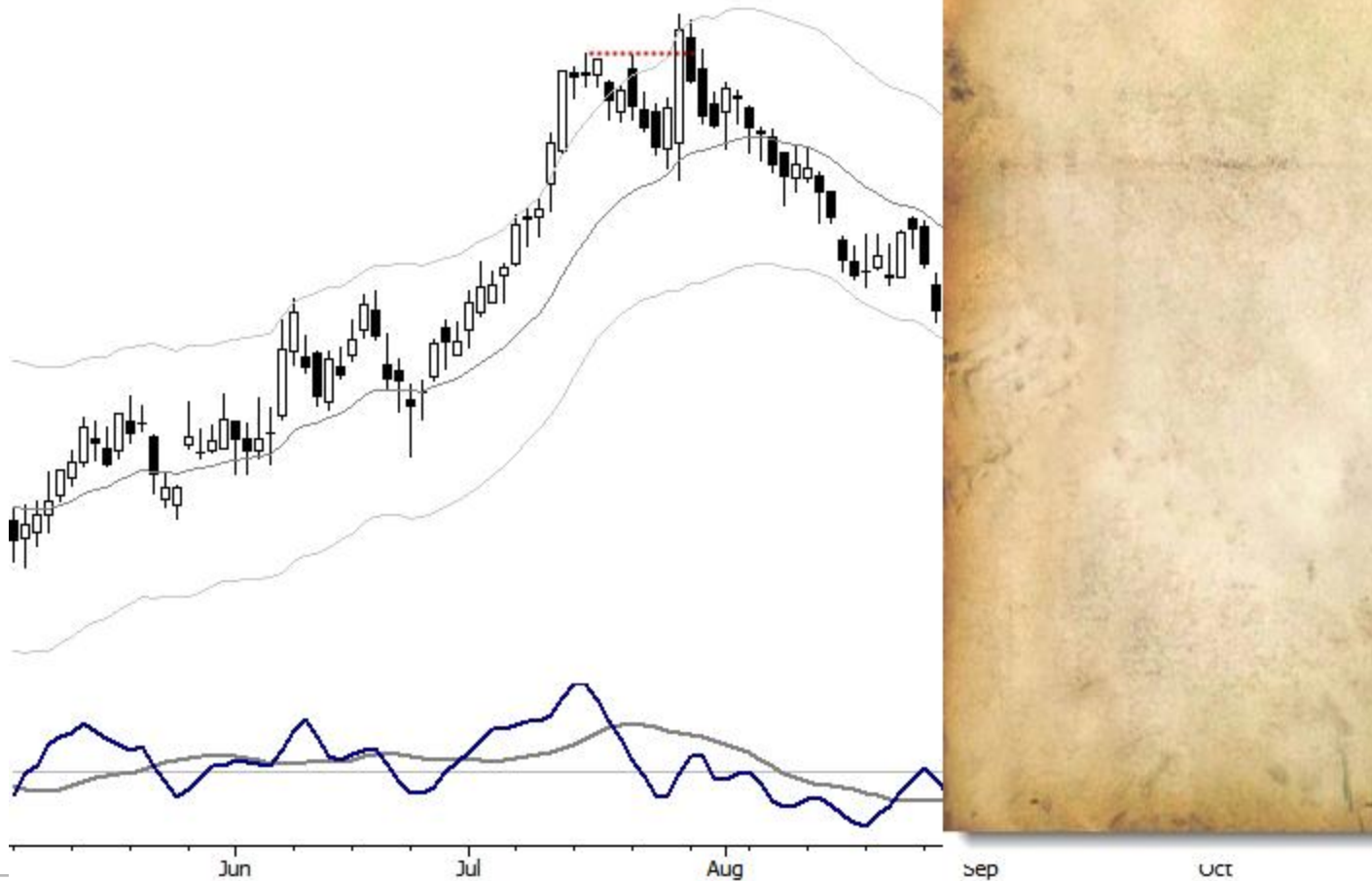
Bar by Bar

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Bar by Bar

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Continue Until You Exit

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Note Exit Price in Sheet

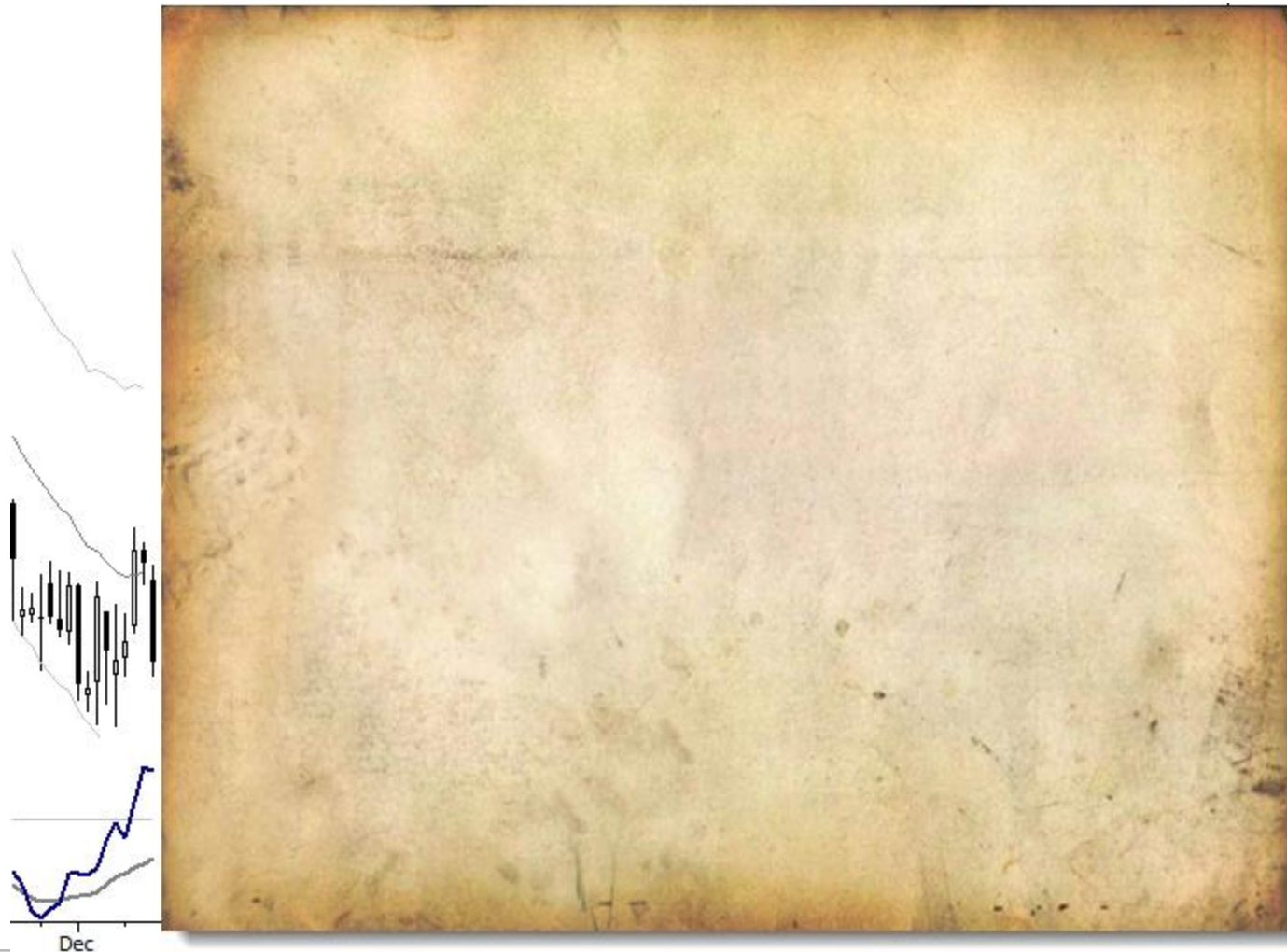
	A	B	C	D	E	F	G	H	I	J	K	M	N	O
1		Date	Market	Type	Mult	L/S	#	PriceIn	PriceOut	InitStop	P&L	%R	Ptarget	Target?
2		7/29/2013	AMZN	FT	1	-1	1	306.10	293.64	313.62	12.46	1.7x	298.58	1
3														



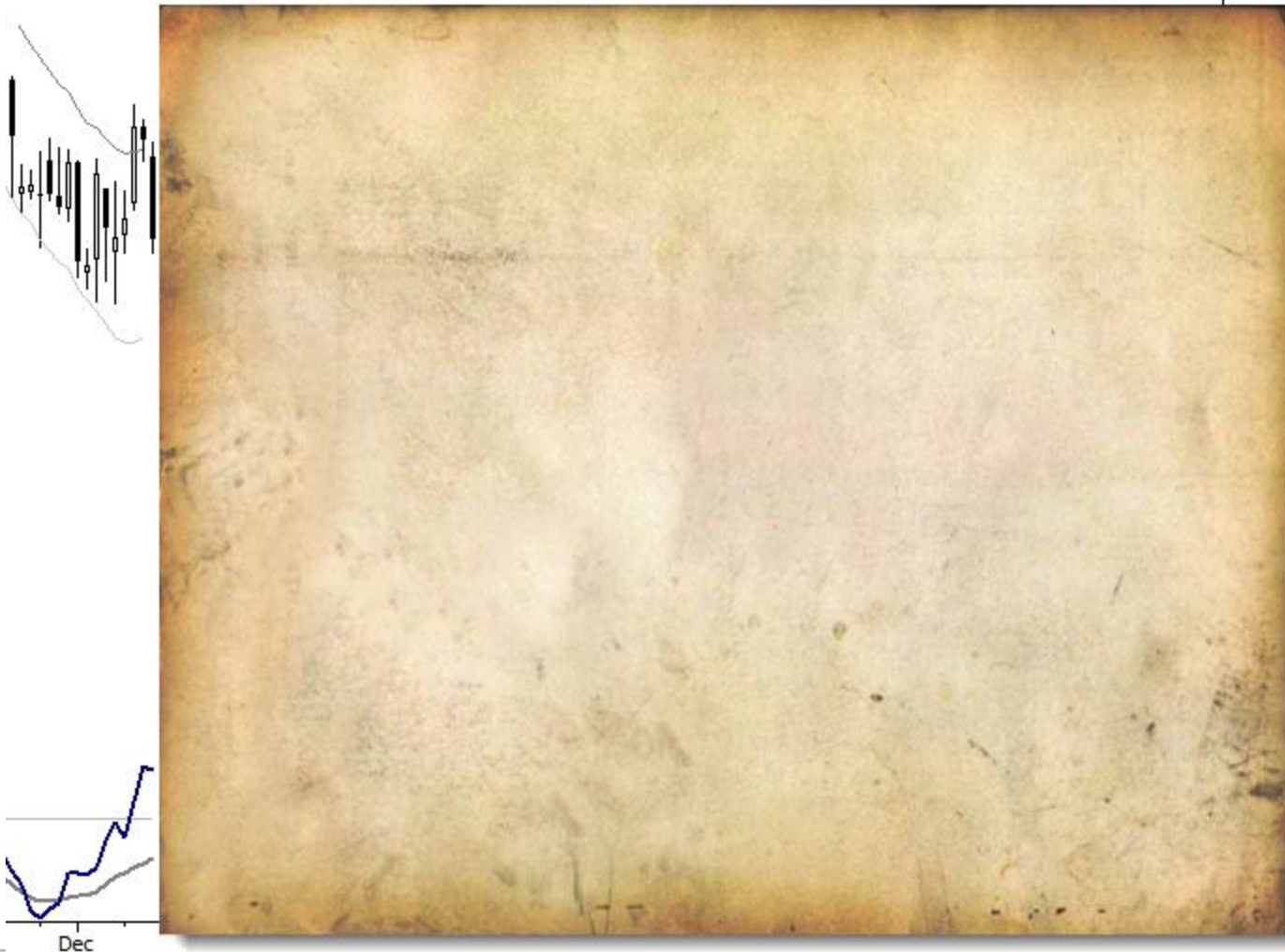
But there is a problem...



Bullish or Bearish Bias?



How About This One?



The Cardinal Rule

- In these tests, you must not access any information that you would not have had in real time.
- Any “leakage” will severely compromise your results.
 - Data snooping.
- Consider your decisions.
 - If you modify a decision even once, you have invalidated the whole process.
- Is there any way you are getting information from the future?

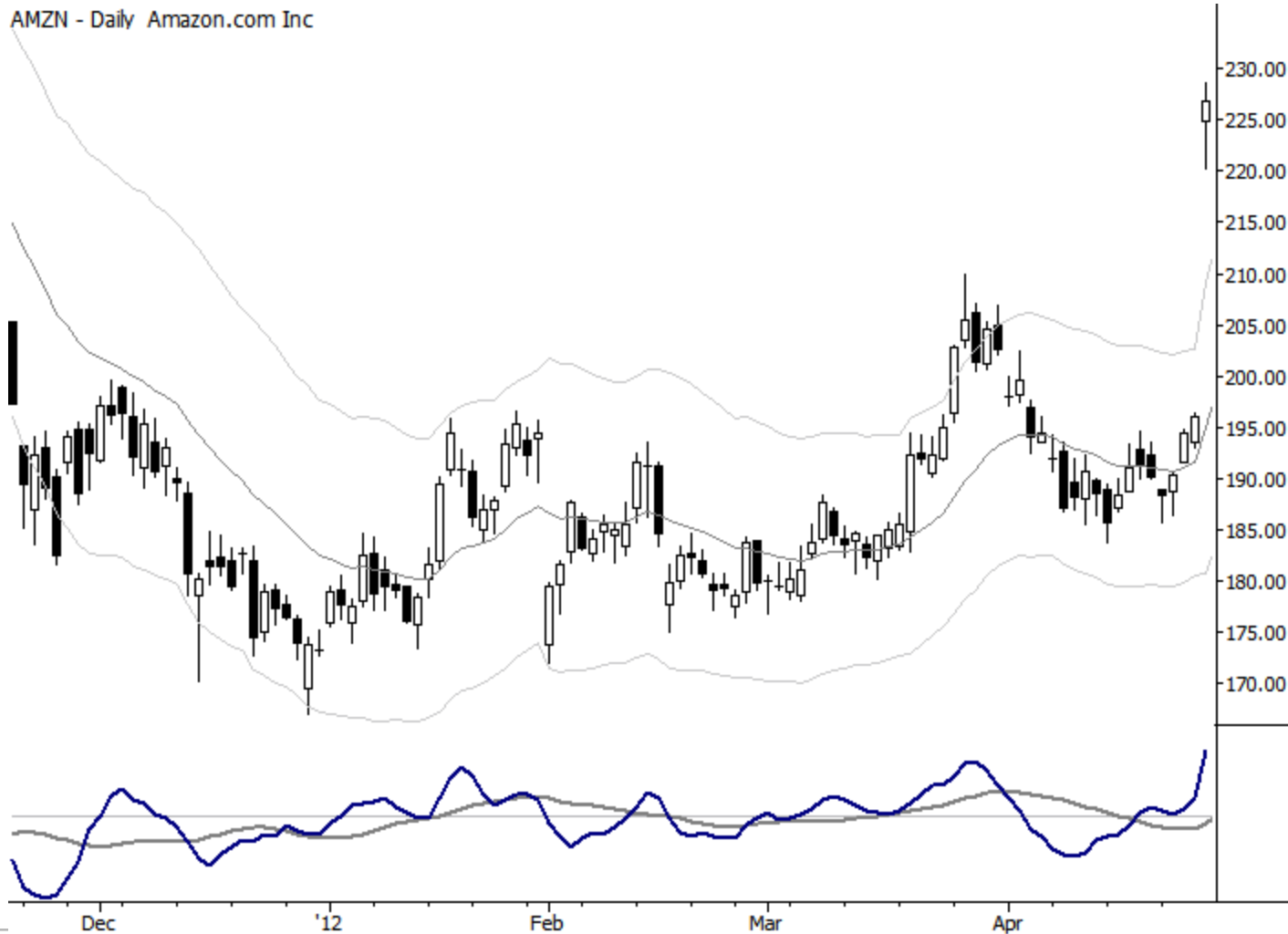


A Better Way

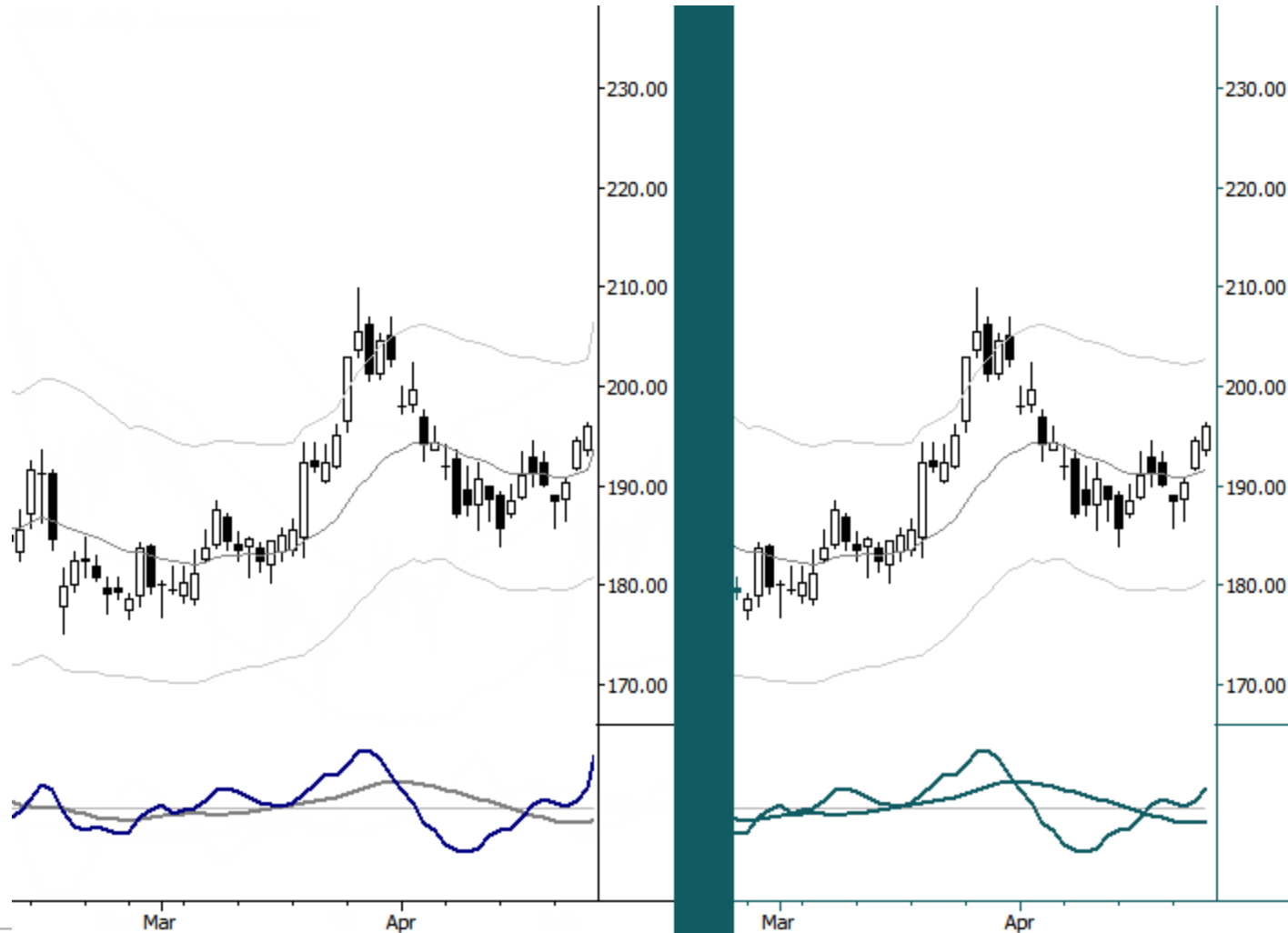
- Go bar by bar in your software.
- Even then, be careful.
 - Do you see hints of the next bar?
 - Can you get hints from your indicator lines?
- Do not underestimate the impact of leakage.



Consider this Gap



Would You Make a Different Decision?



Questions to Ask


- What is your exact entry price?
- Where is your stop?
- Are you using a profit target?
- What decisions would you have made bar by bar?
- Where is your final exit?
 - If multiples, what is average price?



Consider Manual Backtesting

- Done well, this can replicate some of the experience of decision making under uncertainty.
- Done well, this process can cross the line between backtesting and papertrading.
- Keep good records.
- Be patient.
- Be disciplined.



 WILEY Trading

MARKET STRUCTURE,
PRICE ACTION, AND
TRADING STRATEGIES

THE
ART AND SCIENCE OF
TECHNICAL
ANALYSIS

ADAM GRIMES



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Waverly Advisors' Process

- Our methodology is blended quantitative / discretionary.
- Quantitative work was both high-level and system-specific.
 - For breadth, went all the way back to commodity prices in the Middle Ages. It work.
- An interesting twist: our research was done to verify an existing, successful methodology, not to create one.
- The discretionary component is the input of a trader (me!) who has spent nearly every day of the past 20 years watching markets and prices, actively managing risk for much of that time.



Waverly Advisors' Research

- Specific systems, broad tendencies, and actionable ideas in major liquid markets.
 - Futures
 - Currencies
 - Stocks (indexes and individual names)
- Both trend-following and counter-trend components.
- Applicable to traders working on all timeframes.
 - Daytraders—swing traders—investors



Waverly Advisors, LLC:

Research Products

Tactical Playbook – Available on Interactive Brokers

- Written for the active trader on the daily/weekly timeframes
- Exact trade recommendations
 - Hybrid systematic-discretionary methodology
- In-depth technical “drill down” into a set of markets.
- Bigger-picture overview of all liquid asset classes.

Tactical Portfolio Outlook – Available on Interactive Brokers

- Written for the longer-term manager
 - Addresses both the allocator and the longer-term active trader.
- Emphasis on executing with ETFs in a long-only and long-short environment
- Focus on Equities, Equity Sectors, and other asset classes
- Macro perspective on risk factors and major economic events.

Options Market Outlook – Contact Waverly Directly

- Proprietary, quantitative analysis of options market
- Incorporates both volatility and directional analysis
- Macro risk factors and cross-asset perspective
- Actionable trade ideas



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