Tortured Data

Campbell R. Harvey
Duke University and NBER
The Man

"If you torture the data long enough, it will confess."

Ronald Coase, Nobel ‘91
Outline

• Strategic data selection
• Delegation of responsibility (relying on others’ data analysis) and the Garden of Forking Paths
• Multiplicity of methods
• Strategic manipulation of data
• Truth
• Implications for investors
The Overlooked Persistence of Active Outperformance

JOSEPH V. AMATO
President, Neuberger Berman
Chief Investment Officer—Equities

PETER D'ONOFRIO
Senior Vice President, Product Management

ALESSANDRA RAGO
Associate, Corporate Development and Strategy
The Overlooked Persistence of Active Outperformance

- When performance is examined through a lens that better reflects investor experience, active managers have been much more successful over the past decade than is commonly realized.
The Overlooked Persistence of Active Outperformance

- Instead of comparing the performance of an index against an entire universe of active strategies, it’s more appropriate to reframe the conversation to include only those managers in the top three quartiles of performance and thus eliminate a small cohort of poorly performing funds unlikely to attract significant investment flows. This comparison finds that approximately 84% of U.S. equity active managers have beaten the S&P 500 net of fees over the 20-year period ended December 2018.
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A TYPICAL PASSIVE ARGUMENT, RECONSIDERED—20 YEARS
Percentage of Active Funds that Have Outperformed the Index after Fees, January 1999 through December 2018
A TYPICAL PASSIVE ARGUMENT, RECONSIDERED—20 YEARS
Percentage of Active Funds that Have Outperformed the Index after Fees, January
Strategic Data Selection 1

Implication

• 100% of active managers beat the S&P ...
Strategic Data Selection 1

Implication

• 100% of active managers beat the S&P ... if you censor all managers that underperformed.
Strategic Data Selection 2

Influential 2014 paper:

Review of the Active Management of the Norwegian Government Pension Fund Global

20 January, 2014

Andrew Ang
Ann F. Kaplan Professor of Business
Columbia Business School

Michael W. Brandt
Kalman J. Cohen Professor of Business Administration,
Fuqua School of Business, Duke University

David F. Denison
Former President and CEO of the Canada Pension Plan Investment Board
Strategic Data Selection 2

2014 Report to Norges:

• “Abstracting from the financial crisis, we conclude that active management of both equity and fixed income has significantly contributed to the returns of the fund.”
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- “Abstracting from the financial crisis, we conclude that active management of both equity and fixed income has significantly contributed to the returns of the fund.”
Strategic Data Selection 2

Implication

• The model works ...
Implication

• The model works ... if you exclude the single most important economic episode -- the global financial crisis.
Delegation of Data Analysis

Early in my career, I get a telephone call my office line at about 9pm.

- The number is the familiar Goldman Sachs telephone number
Delegation of Data Analysis

Early in my career, I get a telephone call my office line at about 9pm.

• The number is the familiar Goldman Sachs telephone number
• To my shock, it is Fischer Black
• He has a problem with a table in my paper in the *Journal of Financial Economics*
Delegation

Black tells me he does not believe my Table 2

• He says that this is an example of “data mining”
• He argues that the predictability of stock returns I document is implausible and likely overfit
Table 2 tries to predict one-month ahead US stock returns using lagged information.

- He argues the $R^2$ is too high at 7.5%.
I argue he is wrong.

- There was no data mining. I report a single test based on past published research.
- I did not try to maximize the fit.
Delegation

Looking back in time, this telephone call is ironic given my research agenda is to improve research practices in finance and to call out the data miners.

• I decide to replicate and test my model (in a true) out of sample
Delegation: Market timing replication

Original sample to 1987 replicates well
• $R^2$ about the same

<table>
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<tr>
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Delegation: Market timing validation

Out of sample 1988-2018 fails

- $R^2$ now only 1.2% and not significant
- One-step ahead $R^2$ now effectively zero

### Table 5: Time Series Regression Coefficients, Original Data

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Campbell R. Harvey 2020
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Delegation: Market timing validation

Implication

• You might not have tortured the data ...
Delegation

Implication

• You might not have tortured the data ... however, relying on others who have tortured the data causes the same problems.
Garden of Forking Paths

It is even more complex

• Beware of the parallel universe problem

Garden of Forking Paths

• A researcher compiles a list of 20 variables to test for trading strategy. The first one “works”. The researcher stops and claims no overfitting.

• However, in a parallel universe, the researcher might start with #20 and only hit #1 after 20 tests. The finding could be just “lucky”.

• Both findings need to be treated equally.

I am approached by a high-profile organization to assess their one-month ahead global equity forecasting model (call it “GF”)

• First, for context, let’s return to my Fischer Black inspired example
What do my predictions look like?  4% full sample $R^2$

Variance of my predictions (blue) is 4% of the variance of the actual returns (orange)
Multiplicity of Methods

How the model works

• “...our model generates one-month-ahead forecasts on a strictly monthly basis. All forecasts are of MSCI indexes priced in USD.”

• “59 regional MSCI indexes. These cover all developed, emerging, and frontier markets, excepting only the following: Argentina, Bangladesh, Mauritius, Sri Lanka, Kuwait, Lebanon, Oman, Serbia, and UAE.”
Multiplicty of Methods

How the model was built

• The “model is the product of over two years of intensive data collection and statistical research.”

• “We have gathered and tested roughly 200 monthly variables for each market going back to the 1990s. These variables (some of them highly proprietary) cover market, economic, demographic, and political trends.”

• “All told, the model trains on over 3 million data points.”

• “Our statistical analysis is multi-stage and uses the most advanced machine learning algorithms.”
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Multiplicity of Methods

There are hundreds of ML techniques
Multiplicity of Methods

How accurate is the model?

• “Our accuracy is impressive”
• For “the ‘Big 25’ economies, our $R^2$ is 0.96”
• For “the total world (all 59 economies), our $R^2$ is 0.98”
Multiplicity of Methods

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Maybe this is a typo and they mean 0.98% which would be consistent with my results of 1% $R^2$
Multiplicity of Methods
Multiplicity of Methods

How accurate is the model?

• Worst month of the global financial crisis had a -35% return (October 2008)
• Blue square is the prediction; Red dot the realized return
• Forecast (made in September 2008) was -35%!
Multiplicity of Methods

GF model $R^2=0.98$

Harvey model $R^2=0.04$
Multiplicity of Methods

True out of sample??

OUT OF SAMPLE
Further development of the model

- “run alternative independent variables”
- “generate ‘now-cast’ forecasts at any time of the month”
- “These and other improvements are in store”
Multiplicity of Methods

The Bright Side of Unionization: The Case of Stock Price Crash Risk

Posted: 11 Jun 2019

Jeong-Bon Kim
City University of Hong Kong

Eliza Xia Zhang
University of Washington Tacoma

Kai Zhong
University of International Business and Economics (UIBE)

Abstract

This study examines whether and how labor unionization influences stock price crash risk. Using a regression discontinuity design that employs union elections as an exogenous shock yielding local variation in unionization, we find that unionization leads to a significant decline in stock price crash risk. We further explore the underlying
Multiplicity of Methods

“Regression Discontinuity Design”
RDD

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Stock Price Crash Risk
(NASBA Field of Study: Accounting)

Moderator: Jean Zeng, University of California, Berkeley

The Bright Side of Unionization: The Case of Stock Price Crash Risk.
Jeong-Bon Kim, City University of Hong Kong; Eliza Xia Zhang, University of Washington, Tacoma; Kai Zhong, University of International Business and Economics
“We initially estimate...using the polynomial order of 1, 2, 3, and 4 respectively. ...we find that the results using the polynomial order of 2 are the strongest.”
Multiplicity of Methods

Lead author has 15 papers trying to “explain” crash risk!

- Foreign Investors, External Monitoring, and Stock Price Crash Risk
- XBRL adoption and expected crash risk
- Analyst Coverage and Expected Crash Risk: Evidence from Exogenous Changes in Analyst Coverage
- China’s Closed Pyramidal Managerial Labor Market and the Stock Price Crash Risk
- Stock price crash risk and internal control weakness: presence vs. disclosure effect
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Campbell R. Harvey 2020
Strategic Manipulation of Data

Professor Brian Wansink, Cornell:

*If apples have an Elmo sticker on them, children more likely to eat the apple than a cookie*

Wansink, Just and Payne, *JAMA Pediatrics*

2012

208 students aged 8-11
Strategic Manipulation of Data

Preliminary research in 2008 was inconclusive. But then there was a “breakthrough”.

https://www.buzzfeednews.com/article/stephaniemlee/brian-wansink-cornell-p-hacking
Strategic Manipulation of Data

Payne email to Wansink: September 2008:

“I have attached some initial results of the kid study to this message for your report. Do not despair. It looks like stickers on fruit may work (with a bit more wizardry).”

https://www.buzzfeednews.com/article/stephaniemlee/brian-wansink-cornell-p-hacking
Strategic Manipulation of Data

Wansink, January 7, 2012:

One sticking point is that although the stickers increase apple selection by 71%, for some reason this is a p value of .06. It seems to me it should be lower. Do you want to take a look at it and see what you think. If you can get the data, and it needs some tweeking, it would be good to get that one value below .05.

Best,

Brian

https://www.buzzfeednews.com/article/stephaniemlee/brian-wansink-cornell-p-hacking
Strategic Manipulation of Data

Published with the p-value of 0.06 in *JAMA Pediatrics*

https://jamanetwork.com/journals/jamapediatrics/fullarticle/2654849
Strategic Manipulation of Data

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- Retracted and Replaced: September 17, 2017 with a p-value of 0.02

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- Fully Retracted: December 2017.

https://jamanetwork.com/journals/jamapediatrics/fullarticle/2654849
https://jamanetwork.com/journals/jamapediatrics/fullarticle/2659568
Strategic Manipulation of Data

Published with the p-value of 0.06

• Retracted and Replaced September 17, 2017 with a p-value of 0.02
• Fully retracted December 2017. Cornell investigated...
Professor Brian Wansink, Cornell:

...P-hacking shouldn’t be confused with deep data dives – with figuring out why our results don’t look as perfect as we want.
Strategic Manipulation of Data

Professor Brian Wansink, Cornell:
With field studies, hypotheses usually don’t “come out” on the first data run. But instead of dropping the study, a person contributes more to science by figuring out when the hypo worked and when it didn’t. This is Plan B. Perhaps your hypo worked during lunches but not dinners, or with small groups but not large groups. You don’t change your hypothesis, but you figure out where it worked and where it didn’t. Cool data contains cool discoveries.”

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Strategic Manipulation of Data

Published with the p-value of 0.06
• Retracted and Replaced September 17, 2017 with a p-value of 0.02
• Fully retracted December 2017. Sample not 8-11 year olds.
This Ivy League food scientist was a media darling. He just submitted his resignation, the school says.
Rudy Giuliani, August 19, 2018

- “Truth isn’t truth”
- “The truth is relative”
- Investigators “may have different versions of the truth”
Rudy Giuliani, August 19, 2018

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The Truth

Rudy Giuliani, August 19, 2018

- “Truth isn’t truth”
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Even philosophers can’t agree on what truth is

- Correspondence theory
- Coherence theory
- Constructivist theory
- Consensus theory
- Pragmatic theory
- Performative theory
- Redundancy theory
- Pluralist theory
- Truth in mathematics
- Truth in logic
- Semantic theory of truth
- Revision theory of truth
The Truth

Why does fake news go viral?
Answer: Short attention spans
The Truth

Why does fake news go viral?
Answer: Short attention spans

Paper goes viral, 99th percentile of media coverage

Limited individual attention and online virality of low-quality information

Xiaoyan Qiu1, Diego F. M. Oliveira2*, Alireza Sahami Shirazi3, Alessandro Flammini2, Filippo Menczer2,4

1 School of Economics and Management - Shanghai Institute of Technology
2 Center for Complex Networks and Systems Research - School of Informatics and Computing - Indiana University
3 Yahoo Research
4 Indiana University Network Science Institute

Abstract

Social media are massive marketplaces where ideas and news compete for our attention [1]. Previous studies have shown that quality is not a necessary condition for online virality [2] and that knowledge about peer choices can distort the relationship between quality and popularity [3].
The Truth

Why does fake news go viral?
Answer: Short attention spans
The Truth

Why does fake news go viral?

Answer: Short attention spans

This article was retracted on 07 January 2019

nature human behaviour

Limited individual attention and online virality of low-quality information

Xiaoyan Qiu1,2*, Diego F. M. Oliveira2*, Alireza Sahami Shirazi3, Alessandro Flammini2,4, Filippo Menczer2,3,4

1 School of Economics and Management - Shanghai Institute of Technology
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Abstract

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Conclusions

• We have all heard: “Let the data speak”
• Data do not speak
• The interpreter of the data speaks – often with an agenda and with a set of tools that can shape the narrative
• Investors need to be especially vigilant in this era of big data, large number of predictors, a plethora of methods, and the incentives to strategically manipulate the data to uncover a convenient “truth”.
False (and Missed) Discoveries in Financial Economics

Campbell R. Harvey

Duke University, Durham, NC 27708 USA
National Bureau of Economic Research, Cambridge, MA 02138 USA

Yan Liu*

Texas A&M University, College Station, TX 77843 USA

https://ssrn.com/abstract=3073799
Contact

http://linkedin.com/in/camharvey

cam.harvey@duke.edu

@camharvey

SSRN: http://ssrn.com/author=16198

PGP: E004 4F24 1FBC 6A4A CF31 D520 0F43 AE4D D2B8 4EF4
Recommended

https://statmodeling.stat.columbia.edu/