

IMPROVING EQUITY FUND ALPHA
ESTIMATES WITH A SECOND SIZE FACTOR



A study of equity fund alpha estimation

SCOTT D. STEWART, CORNELL UNIVERSITY

JOURNAL OF PORTFOLIO MANAGEMENT, JANUARY, 2023

WHAT IS THIS PAPER ABOUT?

Professional investors and advisors to individual investors seek to measure sources of return and manager skill

Regression models commonly used to evaluate sources of performance and skill.

This paper proposes a significantly improved, easy-to-apply Technique.

Coauthors **Nanqing Dong, Luka Jankovic, Anne Stewart**

Improving Equity Fund Alpha Estimates with a Second Size Factor

Nanqing Dong, Luka Jankovic, Anne Stewart, and Scott Stewart

Nanqing Dong
Is a PhD Candidate at the University of Oxford in Oxford in the United Kingdom.
nanqing.dong@cs.ox.ac.uk

Luka Jankovic
Is a head of GalaxyOne at Galaxy Digital in New York, NY.
ljm57@cornell.edu

Anne Stewart
Is a manager, financial planning and analysis at Panera, LLC, in Boston, MA.
ams687@cornell.edu

Scott Stewart
Is a clinical professor of finance and accounting at SC Johnson College of Business at Cornell

KEY FINDINGS

- Past evidence suggests stock returns are not linear in size, yet traditional alpha regression models assume otherwise.
- This is an important issue for evaluating active equity mutual fund performance because managers do not cap-weight holdings, frequently resulting in larger positions in small- and mid-cap stocks than held by indexes.
- Supplementing traditional asset pricing models with a second size factor significantly improves statistical fit when evaluating thousands of funds between 1984 and 2020.
- Use of improved models yields different alpha estimates, rankings, and evidence of manager skill.

ABSTRACT

Practitioners and researchers seek to accurately estimate the value added by active equity fund managers. The authors hypothesize that the asset pricing models used to study equity funds may better capture nonlinearity in stock returns across market capitalizations by replacing the commonly used single size factor with two new size factors. This extension is important for explaining equity mutual fund returns because active fund holdings are weighted toward mid- and small-cap stocks to a greater extent than holdings of

readily available on the Internet to researchers and practitioners alike.

WHAT ARE KEY TAKEAWAYS?

Past evidence suggests stock returns are not linear in size...yet traditional alpha regression models assume otherwise

- Important issue for active equity funds because they overweight small and mid-cap stocks
- Adding a second size factor to alpha regression models significantly improves fit
- New model yields different estimates of skill



ADDITIONAL BENEFIT

Data sources freely available on Internet

Proposed technique easy to apply

https://mba.tuck.dartmouth.edu/pages/faculty/ken.french

https://indexcalculator.ftserussell.com

FTSE Russell Index Calculator

FTSE Russell

HOME
BIOGRAPHY
CURRICULUM VITAL
WORKING PAPERS
DATA LIBRARY
• U.S. RESEARCH RETU
• U.S. RESEARCH BREA
• U.S. BOOK EQUITY DAT
• INTERNATIONAL
RESEARCH RETURNS
• DEVELOPED MAR
FACTORS AND RETI
CONSULTING

Return type: 1 | Output type: 2 | Standard returns: 3 | Return results: 4

STEPS: 1 2 3 4

< PREV | NEXT >

Choose indexes

Select one or more indexes. You may choose any mix of indexes across all capitalization groups.

Select all indexes

Broad-market indexes

Select all Broad-market indexes
 Russell 3000® Index

Mid-cap indexes

Select all Mid-cap indexes
 Russell Midcap® Index

A LITTLE BACKGROUND

Why do this study?



- Investors commonly estimate alphas
- PhD dissertation on small-cap liquidity
- Fidelity active equity strategies
- Aggressive growth funds' cap distributions
- Several talented students interested in research
- Interest in manager selection

ESTIMATING ALPHAS

Outperformance is good...but may be result of bias or increased risk

“...in evaluating the performance of portfolios the effects of differential degrees of risk...must be taken into account”

Michael Jensen, 1968

RISK, THE PRICING OF CAPITAL ASSETS, AND THE EVALUATION OF INVESTMENT PORTFOLIOS*

MICHAEL C. JENSEN†

I. INTRODUCTION

A. RISK AND THE EVALUATION OF PORTFOLIOS

THE main purpose of this study is the development of a model for evaluating the performance of portfolios of risky assets. In evaluating the performance of portfolios the effects of differential risk must be taken into consideration.¹ If investors are generally averse to risk, they will prefer (*ceteris paribus*) more certain income streams to less

certain streams. Under these conditions investors will accept additional risk only if they are compensated for it in the form of higher expected future returns. Thus, in a world dominated by risk-averse investors, a risky portfolio must be expected to yield higher returns than a less risky portfolio, or it would not be held.

The portfolio evaluation model developed below incorporates these risk aspects explicitly by utilizing and extending recent theoretical results by Sharpe [52] and Lintner [37] on the pricing of capital assets under uncertainty. Given these results, a measure of portfolio “performance” (which measures only a manager’s ability to forecast security prices) is defined as the difference between the actual returns on a portfolio in any particular holding period and the expected returns on that portfolio conditional on the riskless rate, its level of “systematic risk,” and the actual returns on the market portfolio. Criteria for judging a portfolio’s performance to be *neutral*, *superior*, or *inferior* are established.

* The research on this study was supported by fellowship grants from the U.S. Steel Foundation, the American Banking Association and a research grant from the Research Fund in Finance made available by the University of Chicago Graduate School of Business. Extensive computer time at the 7094 Computation Center at the University of Chicago was financed by the Graduate School of Business, and the College of Business of the University of Rochester provided additional time at the 360 Computation Center at the University of Rochester.

† Assistant professor, College of Business Administration, University of Rochester. I wish to acknowledge a great debt to my dissertation committee; Eugene Fama (chairman), Lawrence Fisher, Merton Miller (who originally suggested this area of research to me), and Harry Roberts, all of whom

ESTIMATING ALPHAS

Return-based
regression
techniques
popular

- Only need past returns
 - Portfolio
 - Benchmark/factors
- Single beta factor popular
- Fama & French introduce size and value/growth factors... also easy to apply

QUESTION

Can alpha estimates be improved with extension to size factor?



Can breaking down FF size factor into two parts yield better results?

TAKE A STEP BACK
IN TIME

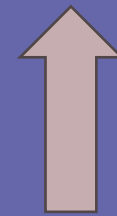
- Jensen (1968)

$$R_{it} - R_{ft} = a_i + b_i(RM_t - R_{ft}) + e_{it}$$

- Carhart (1997)
- Fama French (1993, 2010)

$$R_{it} - R_{ft} = a_i + b_i(RM_t - R_{ft}) + s_iSMB_t + h_iHML_t + e_{it}$$

Literature on
fund alpha
estimation...
linear in size



FF models "difficult to beat"
– Goetzmann (2020)

SIZE FACTOR MOTIVATION

Models assume
returns linear in
size, but...

- Banz (1981)
 - "no theoretical reason"
 - "not linear"
- Fundamental Characteristics

	<u>Large</u>	<u>Mid</u>	<u>Small</u>
Dividend Yield	2.0	1.7	1.3
EPS Growth	10.9	12.8	10.0
Debt/Equity	42.6	49.6	34.1
Health Care	15.1	8.9	13.7

SIZE FACTOR MOTIVATION

- Fidelity (late 1980's)
- BARRA (1998)
- Asness et al (2000)
- Switzer (2010)

Further
questioning of
size linearity

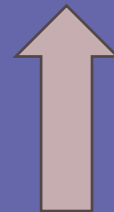
HYPOTHESIS

Replace the single size factor

- Small - Large
- with*
- Mid - Large
 - Small - Mid

$$a'_i + b'_i(RM_t - R_{ft}) + ml_i MML_t + sm_i SMM_t + h'_i HML_t$$

Can alpha estimates be improved with extension of size factor?




Why Important for active funds:

HYPOTHESIS

Test on Active US
Equity Mutual
Funds

Position Weights: Average US Equity Mutual Fund vs. Cap-Weighted S&P 500



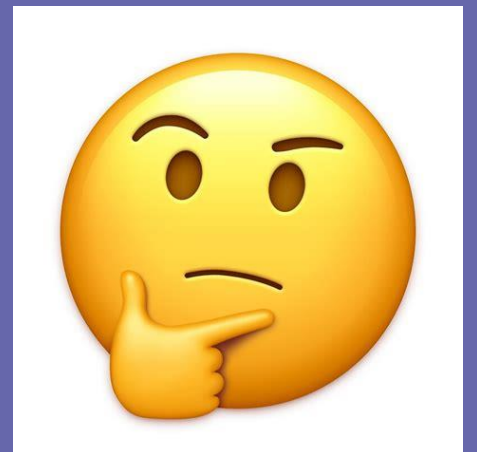
Decile	Fund	S&P 500
1	57.4%	82.7%
2	14.4%	14.8%
3	8.3%	2.4%
4	6.5%	0.0%
5	4.0%	0.0%
6	3.2%	0.0%
7	2.4%	0.0%
8	1.7%	0.0%
9	1.2%	0.0%
10	0.8%	0.0%
	100.0%	100.0%

DATA MINING ISSUE

How be sure not
spurious result?

Harvey et al (2016) note there are many, many equity factor studies

recommend researchers use t-stats of 3.0 (though theoretically-supported tests may use lower threshold)



DATA MINING ISSUE

Test minimizes
data mining risk



1. Look for t-stats > 3.0
2. Use observation identified prior to test period
3. Use theory that small, mid and large stocks differ
4. Use variables that were introduced prior to test period
5. Test versus FF 3 and 5 factor models

DATASET

Replicate the
Fama-French
(2010)
methodology

1. CRSP database beginning in 1984, ending in 2020
2. Active US Equity Funds > \$5 million AUM
3. Exist at least 5 years prior to test-period-end
4. At least 8 months of returns
5. Monthly FF factor returns from French website
6. Monthly large, mid, and small-cap index returns from Russell website

FIRST TEST

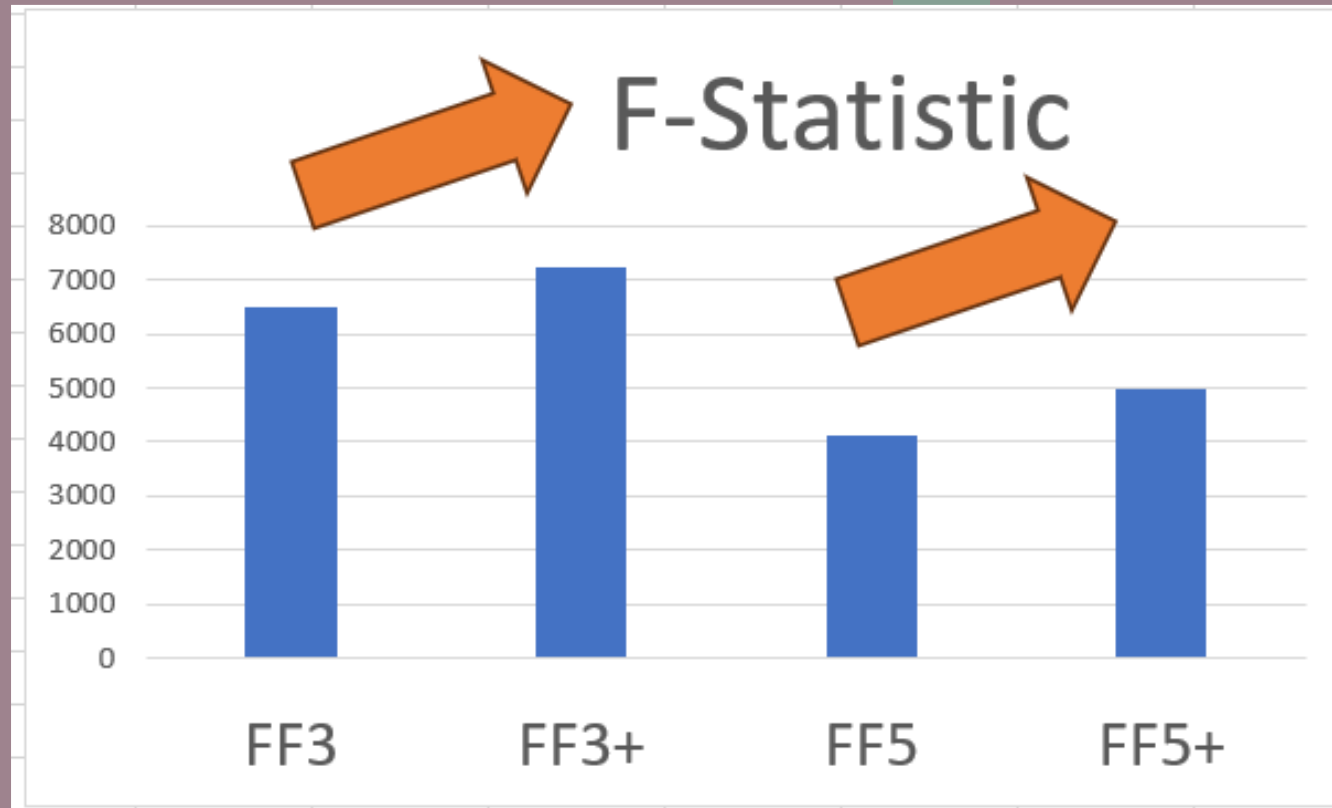


1. Compute average return across all funds for each month
2. Estimate four regression models
3. Conduct Chow Tests
4. Compare F-stats, R-squares and t-stats

FIRST TEST RESULTS

Chow tests confirm regression models improve with 1% statistical confidence

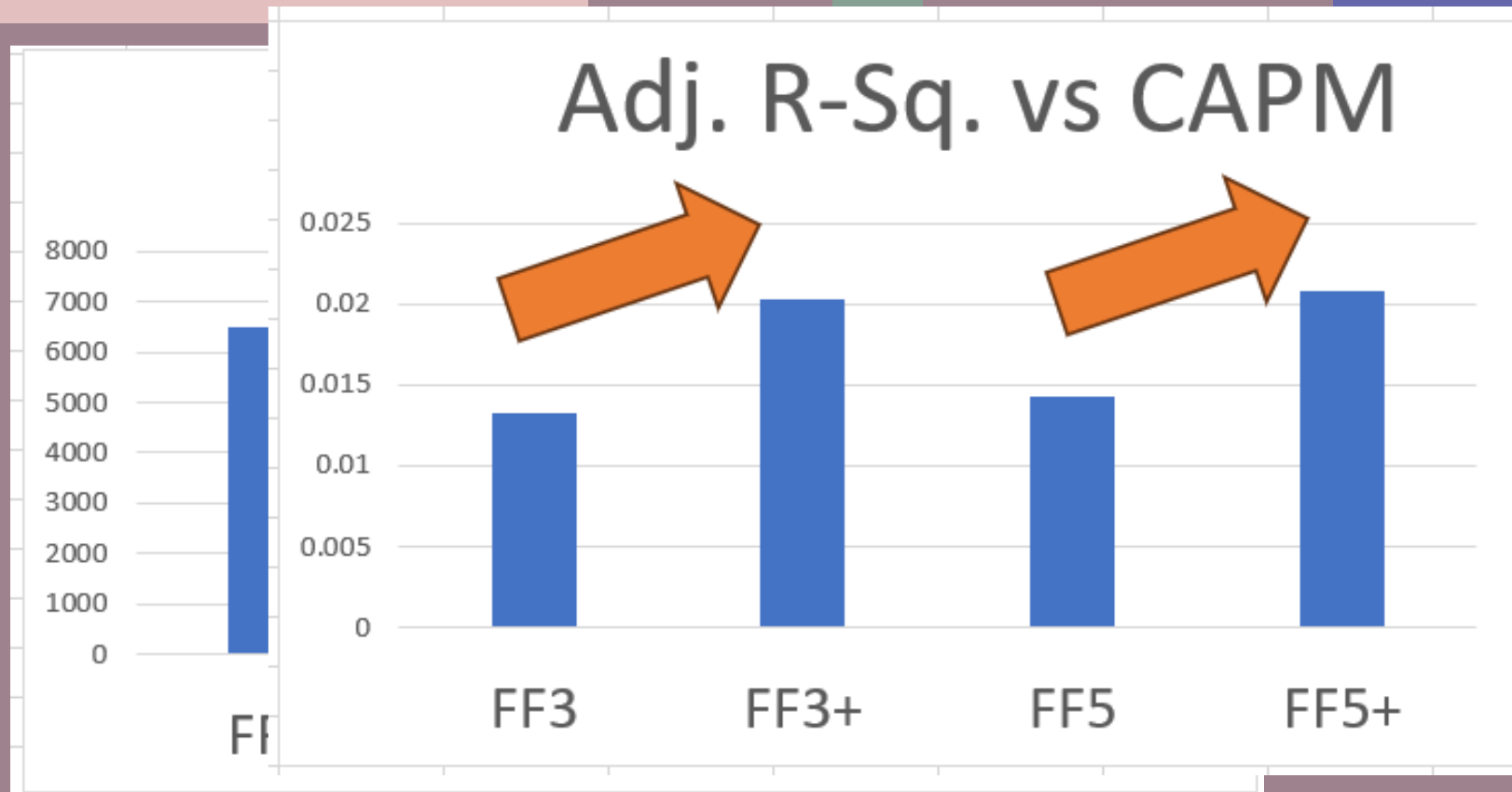
Standard Errors Lower too



FIRST TEST RESULTS

Chow tests confirm regression models improve with 1% statistical confidence

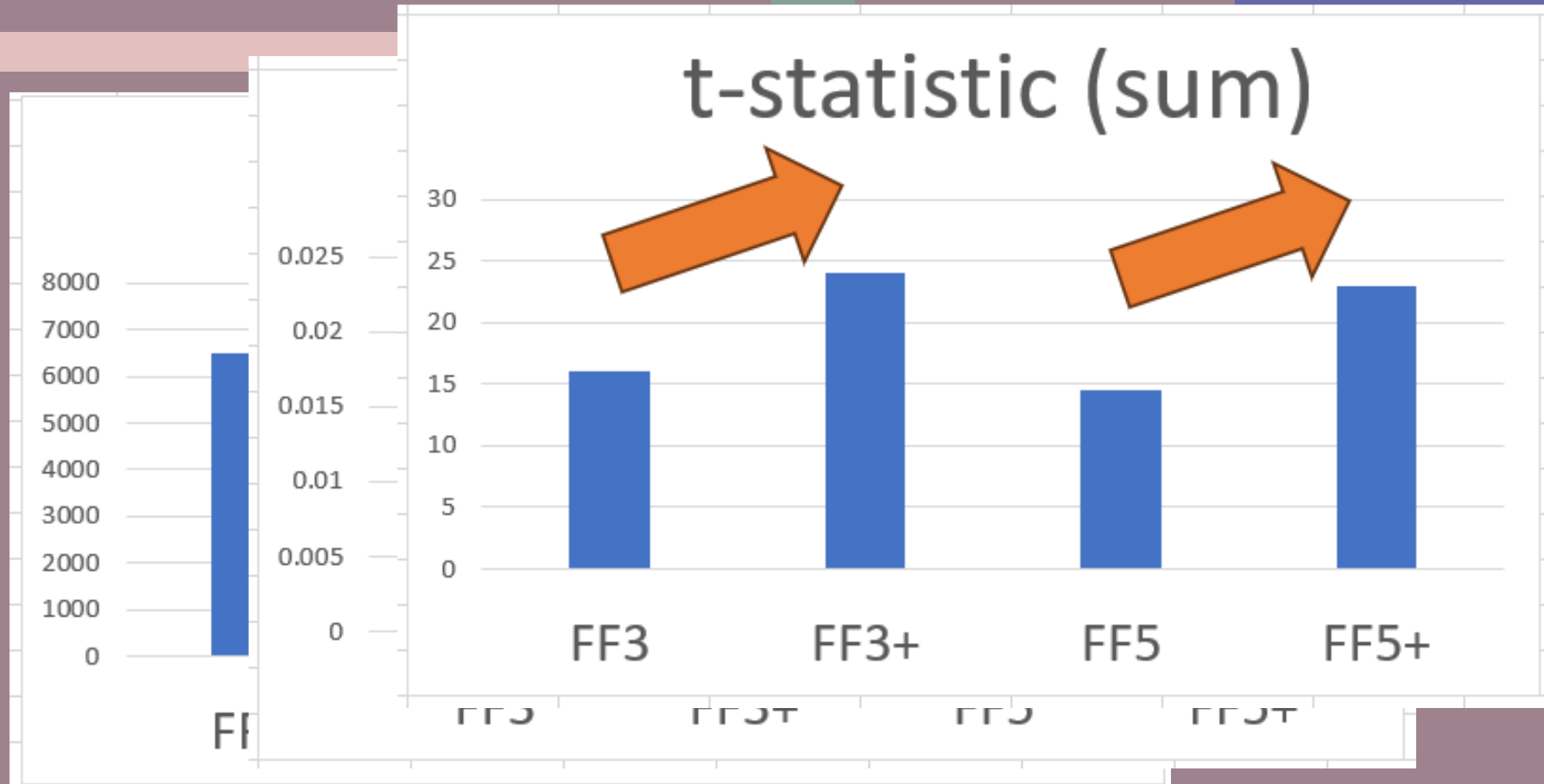
Standard Errors Lower too



FIRST TEST RESULTS

Chow tests confirm regression models improve with 1% statistical confidence

Standard Errors Lower too



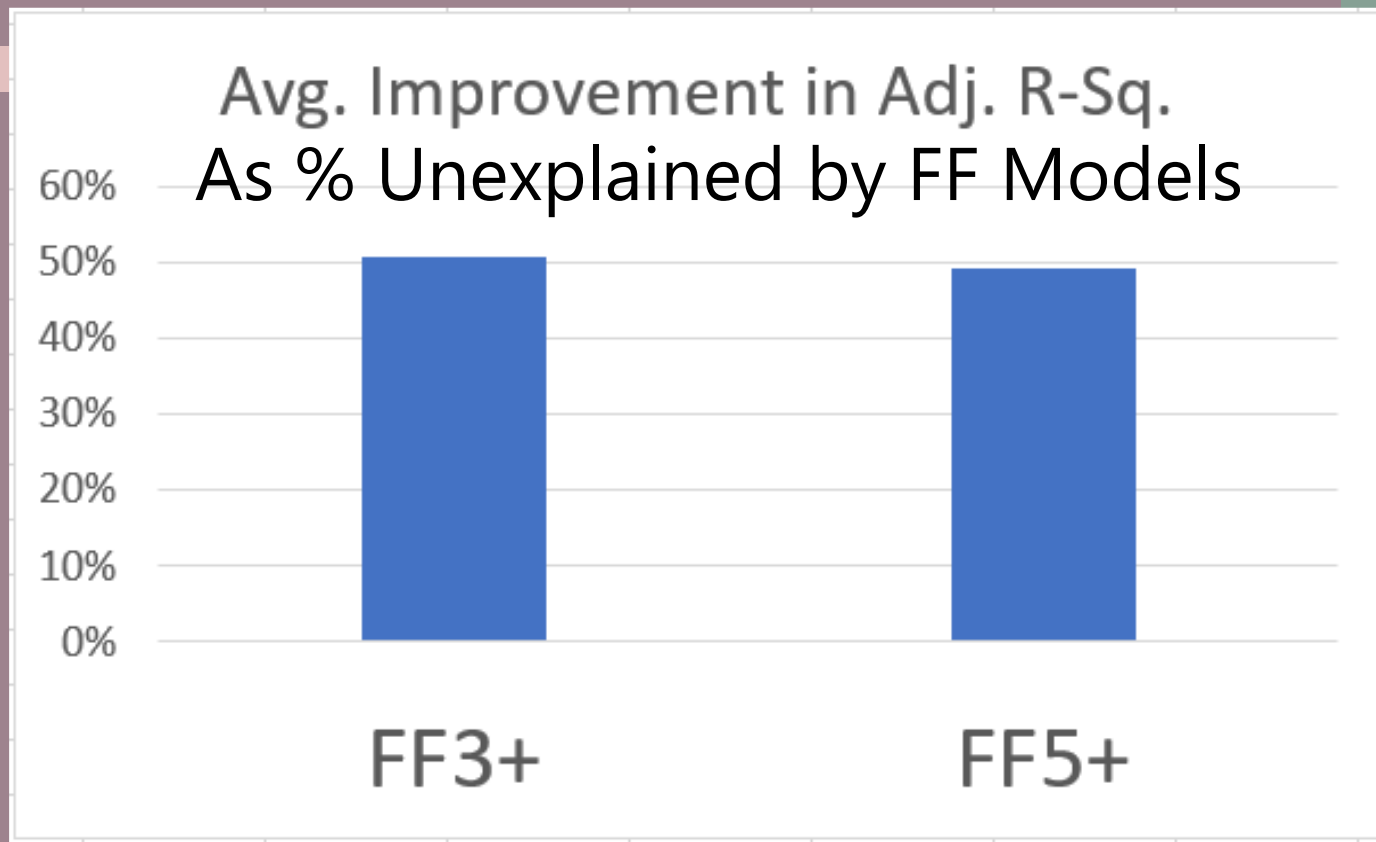
FIRST TEST RESULTS (Cont.)

1. New models explain over 30% of FF's unexplained variance
2. Model improvement better than improvement from FF3 to FF5

SECOND TEST

1. Estimate models for each and every fund
2. Compute % of Adjusted R-Squares that increase
3. Test % increase
4. Test for improvements in models for large, mid and small-cap funds

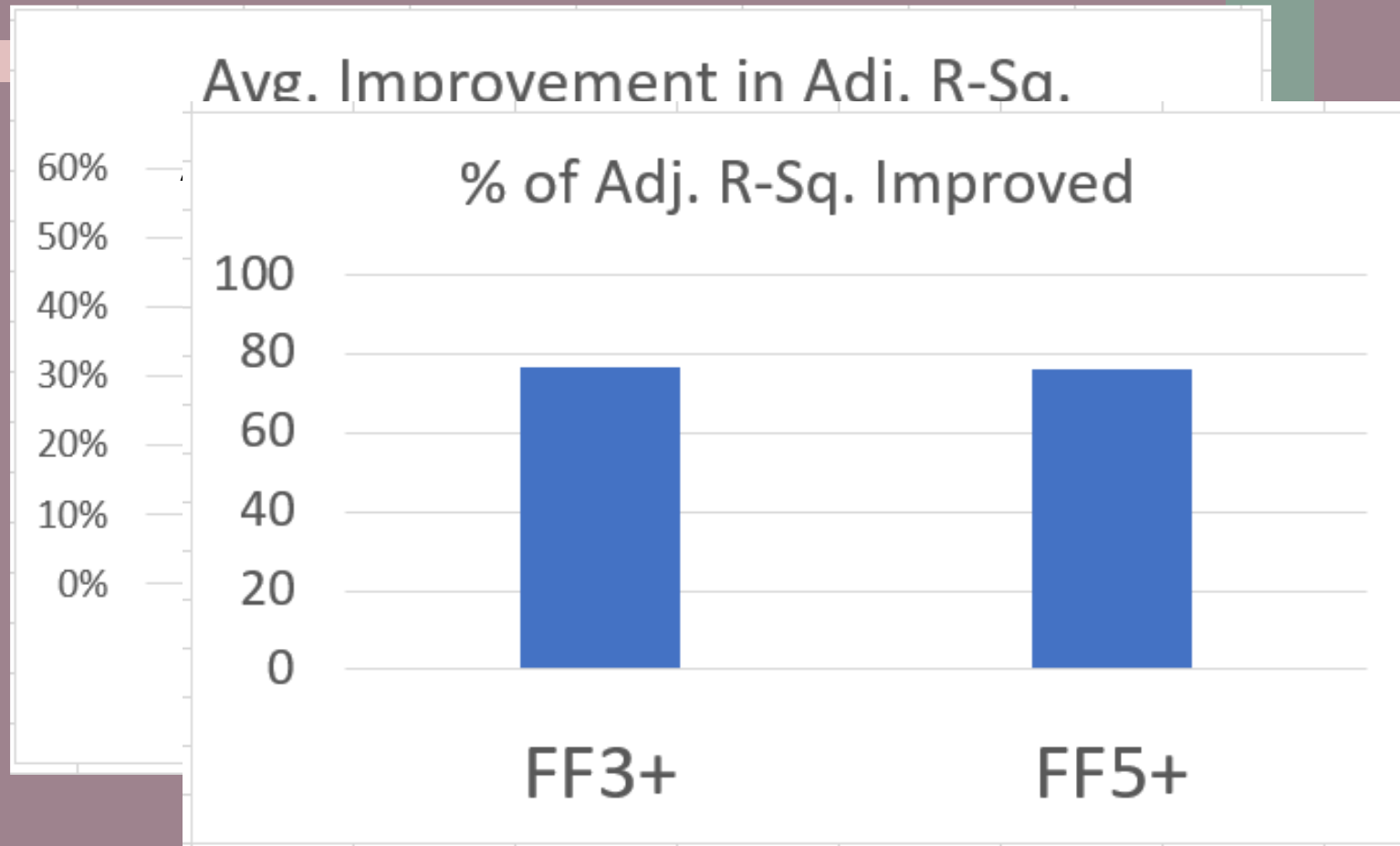
SECOND TEST RESULTS



Statistical tests on % improved, all at 1% confidence

- 1. t-Statistic*
- 2. Sign Test*
- 3. Signed Rank*

SECOND TEST RESULTS



Statistical tests on % improved, all at 1% confidence

- 1. t-Statistic*
- 2. Sign Test*
- 3. Signed Rank*

SECOND TEST RESULTS (Cont.)

1. Model improvement strongest for mid-cap, then small-cap
2. Model improvement similar for growth vs. other

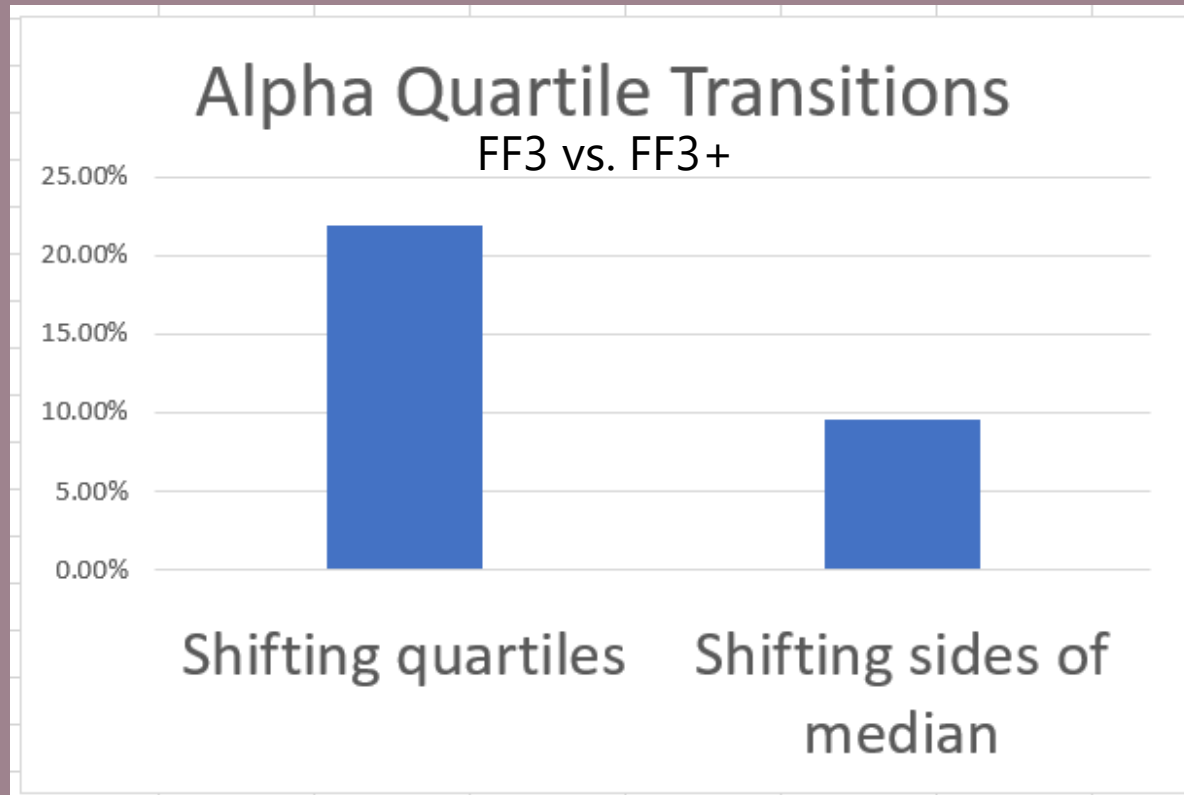
PRACTICAL IMPLICATIONS



Question: Do fund rankings change?

Test: Examine transitions between alpha quartiles

PRACTICAL IMPLICATIONS



1. *Investors select managers based in part on rankings*
2. *Managers compensated in part by performance*

CASE STUDY

Do fund-of-funds add value from manager selection?

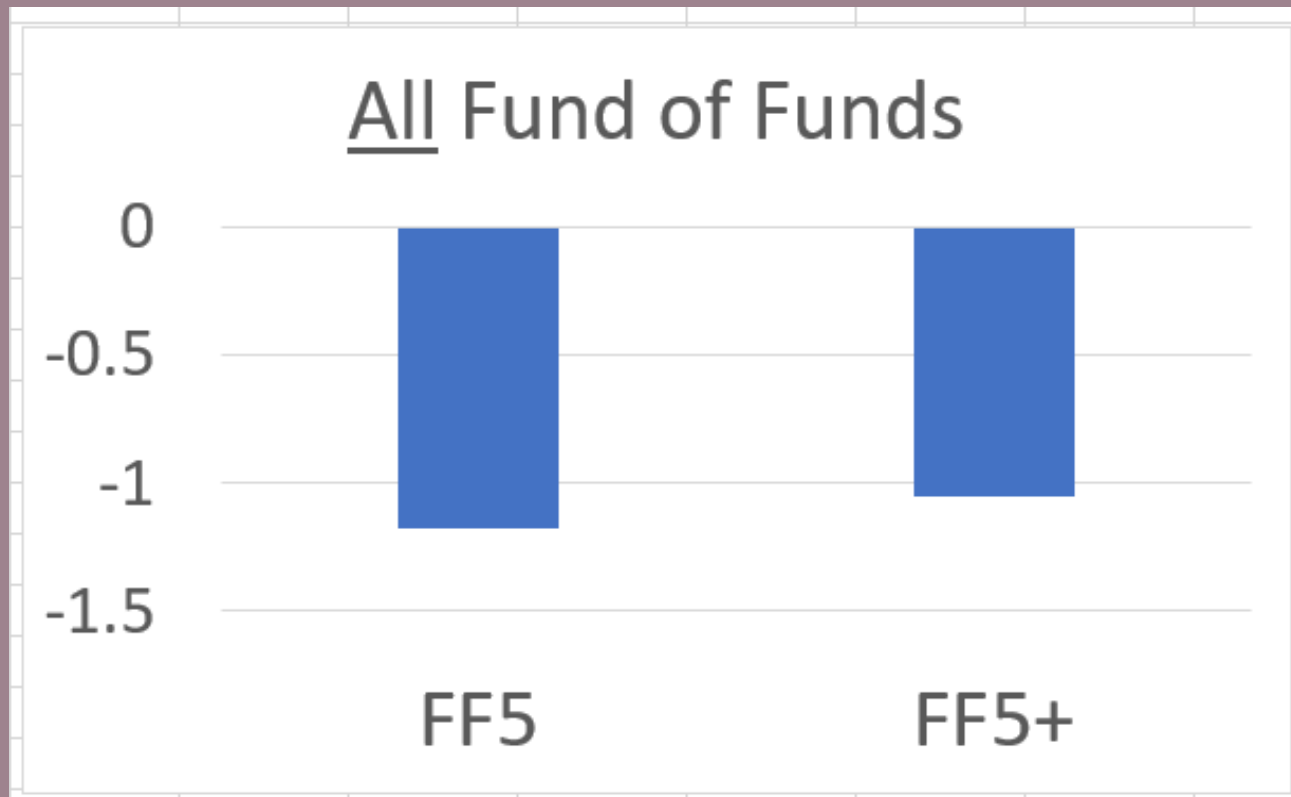
Does value-add differ between models?

Does difference depend on fund type?

STUDY:

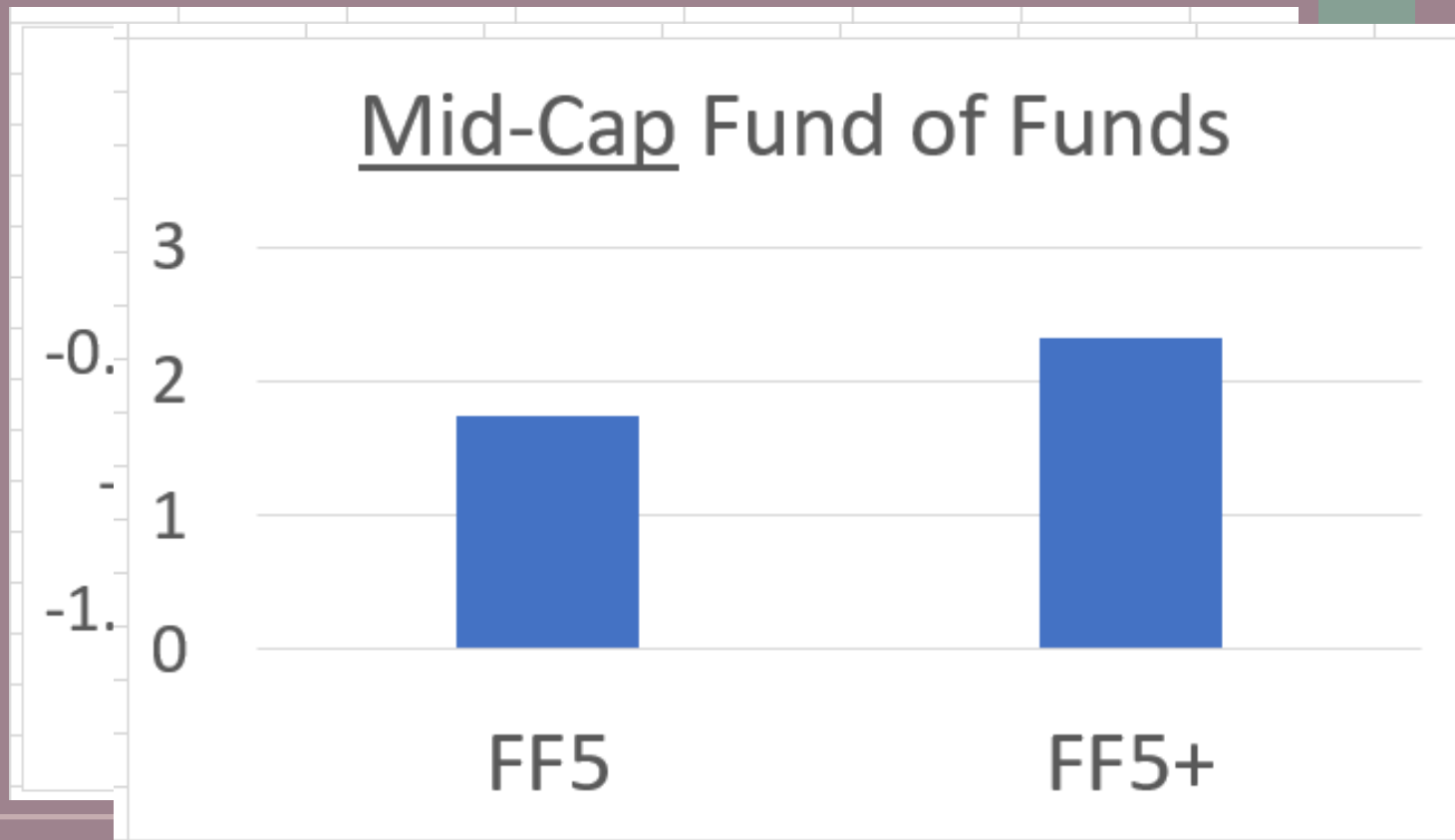
- 1. Collect returns of 73 fund-of-funds labeled by Morningstar*
- 2. Estimate models for full group, and within cap-ranges*

CASE STUDY: ALPHA RESULTS



- 1. All fund-of-funds destroy value on average, but two-size factors explain part of it*
- 2. Mid-cap funds generate value-added, and higher alpha is estimated with new model*

CASE STUDY: ALPHA RESULTS



- 1. All fund-of-funds destroy value on average, but two-size factors explain part of it*
- 2. Mid-cap funds generate value-added, and higher alpha is estimated with new model*

TAKEAWAYS

- 1. Adding a second size factor to alpha regression models significantly improves fit**
- 2. New model yields different estimates of skill
...especially salient for mid-cap funds**
 - 1. Easy to apply**



Johnson
Cornell
SC Johnson College of Business

Thank you

Scott D. Stewart

sds58@cornell.edu

View a story about the paper here: <https://news.cornell.edu/stories/2023/01/mutual-fund-analysis-benefits-added-size-metric>

Read the paper here: <https://eprints.pm-research.com/17511/85655/index.html?14171>