

ISyE 6785 Presentation

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A New Anomaly: The Cross-Sectional Profitability of Technical Analysis

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Table of Contents

Explanation on the topic

Prior work, their motivation and Innovation

Contents of their research

- What approach did they apply? -- Moving average timing strategy
- What did they get? -- The profitability and statistics

Analysis

- Robustness of the moving average timing strategy
- Comparison with momentum

Explanation on the topic

Explanation on the topic

- What does the title suggest?

A New Anomaly: The Cross-Sectional Profitability of Technical Analysis

- *We first need to figure out the meaning of these technical terms:*
 - *Anomaly*
 - *Cross-Sectional*
 - *Technical Analysis*

Technical Terms: Anomaly

- Anomaly

A market anomaly (or market inefficiency) is a price and/or rate of return distortion on a financial market that seems to contradict the efficient-market hypothesis (EFH).

- Efficient-market hypothesis (EFH)

The EMH states that it is impossible to “beat the market” because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. Stocks always trade at their fair value on stock exchanges

Technical Terms: Anomaly

- Types of anomalies

Fundamental

- value effect
- small-cap effect
- low-volatility anomaly

Calendar related

- patterns in stock return from year to year or month to month

Technical

- momentum effect
- A new anomaly

Technical Terms: Cross-Sectional Study

- In medical research and social science
- A type of observational study that involves the analysis of data collected from a population, or a representative subset, at **one specific point in time** — that is, cross-sectional data.
- Differ from time series analysis, in which the behavior is traced through time

Technical Terms: Technical Analysis

- A security analysis methodology for forecasting the direction of prices through the study of past market data, primarily price and volume
- Basic principles
 - Market action discounts everything
 - Prices move in trends
 - History tends to repeat itself
- The efficacy of technical analysis is disputed by the efficient-market hypothesis which states that stock market prices are essentially unpredictable. But technicians say that EMH ignores the way markets work, in that many investors base their expectations on past earnings or track record.

An easy-to-understand explanation

A New Anomaly: The Cross-Sectional Profitability of Technical Analysis

- A new market anomaly is found
- Based on this anomaly, we can build up a new trading strategy
- The new trading strategy gains more profit than past trading strategy

Questions in mind

- What is the new anomaly?
- How to establish a trading strategy based on it?
- How good/efficient the new trading strategy is?

Before we get into these questions, let's have a look at the background and prior work.

Prior work, motivation and
innovation

Background, Prior work

Introduction

1. Technical analysis is widely used in the industry

Technical analysis uses past prices and perhaps other past data to predict future market movements. In practice, all major brokerage firms publish technical commentary on the market and many of the advisory services are based on technical analysis. Many top traders and investors use it partially or exclusively (see, e.g., Schwager, 1993, 1995; Covel, 2005; Lo and Hasanhodzic, 2009). Whether technical analysis is profitable or not is an issue with empirical studies go at least back to Cowles (1933) who found inconclusive evidence. Recent studies, such as Brock, Lakonishok, and LeBaron (1992) and Lo, Mamaysky, and Wang (2000), however, find strong evidence of profitability of using technical analysis, primarily the moving averages, to forecast the market. Although Sullivan, Timmermann, and White (1999) show that Brock et al.'s (1992) results are much weakened after 1987, the consensus appears that technical analysis is useful in making investment decisions. Zhu and Zhou (2009) further demonstrate that technical analysis can be a valuable learning tool about the uncertainty of market dynamics.

2. Technical analysis is valuable and profitable.

Innovation & Breakthrough

- Provides what appears the first study on the cross-sectional profitability of technical analysis.
- Unlike existing studies that apply technical analysis to either market indices or individual stocks, they apply it to volatility decile portfolios, i.e., those portfolios of stocks that are sorted by their standard deviation of daily returns.

Research Motivation

1. View technical analysis as one of the signals investors use to make trading decisions
2. Theoretical models, such as Brown and Jennings (1989), show that rational investors can gain from forming expectations based on historical prices and the gain is an increasing function of the volatility of the asset
3. Use of technical analysis focus on applying the popular moving averages to time investments. To understand the cross-sectional profitability of technical analysis, it is a sensible starting point to examine the volatility decile portfolios

Research

What is the new anomaly?

How to establish a trading strategy based on it?

How good/efficient the new trading strategy is?

What is the new anomaly?

- Moving Average (simple moving average)
The un-weighted mean of the previous n data

$$SMA = \frac{p_M + p_{M-1} + \dots + p_{M-(n-1)}}{n}$$



Moving Average Timing Strategy

- The idea of the Moving Average

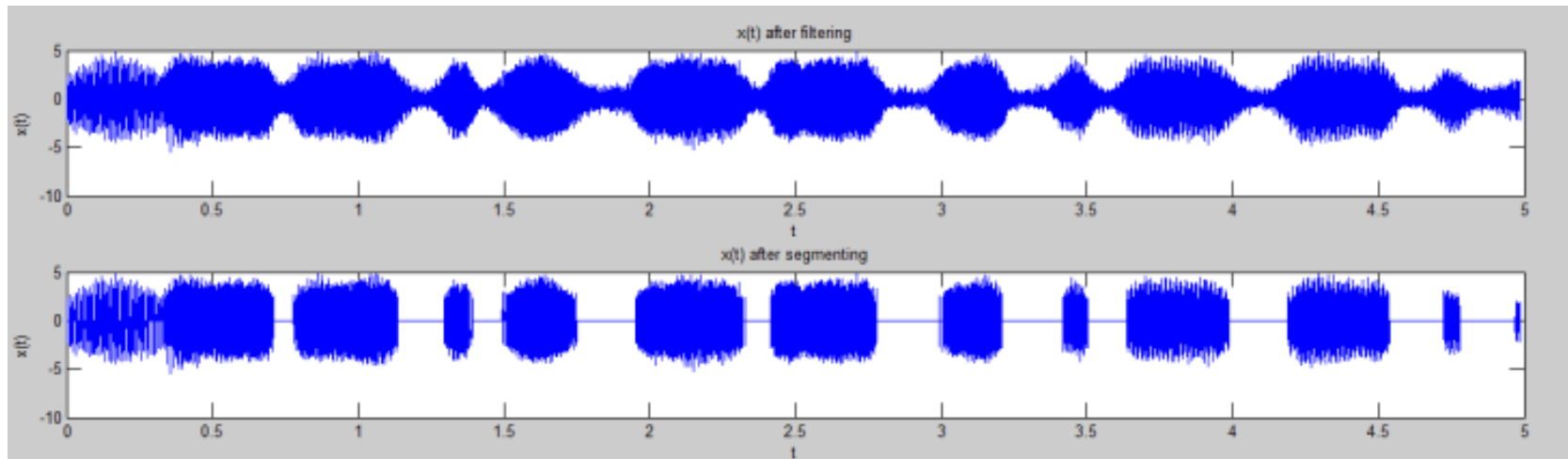
An investor should

- Hold an asset when the asset price is on an uninterrupted up trend
- Get out of the asset when the trend is broke



Recall the DTMF Signal Decoding Project

- ECE 6500 Fourier Transform and its Application
- Distinguish dialing tones from white noise.
- Average magnitude in the near region goes up suggests a tone is reached.



4 Data Sets

- Nasdaq stocks sorted into ten groups (decile) by their annual standard deviations using the daily returns within the year. Once stocks are assigned to portfolios, portfolio index levels (prices) and daily returns are calculated via equal-weighting. The portfolios are rebalanced each year at the end of the previous year.
- The second set is constructed similarly but with NYSE/Amex stocks instead, with different time span:
 - Nasdaq volatility decile portfolio from January 2, 1973 to December 31, 2009
 - NYSE/Amex volatility decile portfolio from July 1, 1963 to December 31, 2009.

4 Data Sets

- The third set is constructed similarly but with NYSE stocks only.
- The fourth set is 10 value-weighted size decile portfolios sorted by firm size with stocks traded on the NYSE/Amex/Nasdaq. Sample period: from July 1, 1963 to December 31, 2009.

Symbols

- R_{jt} ($j = 1, 2, \dots, 10$): return of decile portfolios on day t
- P_{jt} ($j = 1, 2, \dots, 10$): corresponding portfolio prices (index levels)
- The moving average (MA) at time t of lag L

$$A_{jt,L} = \frac{P_{jt-L-1} + P_{jt-L-2} + \dots + P_{jt-1} + P_{jt}}{L}$$

- In this paper, we consider 10-, 20-, 50-, 100- and 200-day moving average

Mathematical Form of MA Time Strategy

- On each trading day, we will
 - invest in the decile portfolio j for the trading day t , if the last closing price P_{jt-1} is above the MA price $A_{jt-1,L}$.
 - Invest in the 30-day Treasury bill, otherwise
- The returns on the MA timing strategy

$$\tilde{R}_{jt,L} = \begin{cases} R_{jt}, & \text{if } P_{jt-1} > A_{jt-1,L} \\ r_{ft}, & \text{otherwise} \end{cases}$$

r_{ft} is the return on the risk-free asset, the 30-day Treasury bill

How good/efficient the new trading strategy is?

- We consider the performance relative to the buy-and-hold strategy
- Focus on the cross-sectional profitability of the MA timing strategy relative to the buy-and-hold strategy of the volatility decile portfolios.

⇒ how $\tilde{R}_{jt,L}$ outperforms $R_{jt,L}$, i.e. $\tilde{R}_{jt,L} - R_{jt,L}$

- The return on the MA portfolio (MAP)

$$MAP_{jt,L} = \tilde{R}_{jt,L} - R_{jt,L}, \quad j = 1, 2, \dots, 10$$

- The abnormal performance of the MAPs indicate the profitability of the MA investment timing strategy.

Summary Statistics (Table I)

Rank	Avg Return	Std Deviation	Avg Return	Std Deviation	Avg Return	Std Deviation
	Panel A		Panel B		Panel C	
	Volatility Decile Portfolios		MA(10) Timing Portfolios		MAP	
Low	14.91	7.75	20.06	5.06	5.17	5.83
2	16.36	9.87	22.09	6.46	5.78	7.43
3	17.15	11.88	26.02	7.62	8.92	9.05
4	16.53	13.38	27.87	8.51	11.37	10.24
5	18.74	15.04	32.69	9.68	14.03	11.39
6	19.15	16.36	35.94	10.49	16.87	12.40
7	19.57	17.10	38.59	10.89	19.09	13.00
8	24.34	17.88	45.46	11.73	21.23	13.26
9	29.86	18.67	51.38	12.26	21.61	13.81
High	70.62	20.65	89.12	15.31	18.55	13.41
Nasdaq	23.66	13.71				

Summary Statistics

- The simple summary statistics clearly show that the MA timing performs well. The MA timing portfolios outperform decile portfolios with higher Sharpe ratios by having higher average returns and lower standard deviations. But it is unclear whether the extra returns can be explained by a risk-based model.
- This motivates our next topic of examining their portfolio return differences, the MAPs, in the context of [factor models](#).

Alpha, using CAPM and three-factor model

- CAMP regression of the zero-cost portfolio returns on the market factor

$$MAP_{jt,L} = \alpha_j + \beta_{j,mkt}(R_{mkt,t} - r_{ft}) + \epsilon_t, \quad j = 1, 2, \dots, 10$$

where $R_{mkt,t}$ is the return on market

- Alphas based an Fama and French (1993) three-factor model

$$MAP_{jt,L} = \alpha_j + \beta_{j,mkt}(R_{mkt,t} - r_{ft}) + \beta_{j,smb}R_{smb,t} + \beta_{j,hml}R_{hml,t} + \epsilon_t$$

Alpha, using CAPM and three-factor model

Rank	α	β_{mkt}	Adj. R^2	α	β_{mkt}	β_{smb}	β_{hml}	Adj. R^2	Table II
Panel A: CAPM				Panel B: Fama-French					
Low	6.17** (6.47)	-0.20** (-11.49)	31.79	7.48** (8.05)	-0.25** (-12.26)	-0.19** (-9.56)	-0.16** (-5.90)	41.88	
2	7.14** (6.20)	-0.27** (-13.26)	36.20	8.62** (7.80)	-0.33** (-13.32)	-0.28** (-11.16)	-0.15** (-5.00)	47.59	
3	10.65** (7.94)	-0.34** (-15.71)	40.10	12.24** (9.67)	-0.41** (-15.29)	-0.36** (-13.24)	-0.15** (-4.15)	51.69	
4	13.37** (9.08)	-0.40** (-17.24)	41.87	14.74** (10.74)	-0.46** (-16.37)	-0.41** (-15.49)	-0.10** (-2.64)	53.09	
5	16.22** (10.09)	-0.44** (-19.13)	40.60	17.38** (11.83)	-0.50** (-17.86)	-0.48** (-16.64)	-0.04 (-1.06)	53.11	
6	19.24** (10.99)	-0.47** (-20.18)	40.05	20.10** (12.74)	-0.53** (-18.57)	-0.52** (-16.59)	0.01 (0.34)	52.68	
7	21.53** (11.48)	-0.48** (-19.47)	38.46	22.53** (13.49)	-0.55** (-18.00)	-0.56** (-16.13)	0.00 (0.04)	51.41	
8	23.59** (11.58)	-0.47** (-19.47)	34.61	24.15** (13.49)	-0.53** (-18.66)	-0.56** (-14.79)	0.07 (1.54)	47.75	
9	23.93** (10.75)	-0.46** (-17.58)	30.90	24.44** (12.39)	-0.52** (-17.01)	-0.56** (-12.37)	0.08 (1.62)	42.98	
High	20.56** (9.04)	-0.40** (-13.86)	24.41	21.38** (10.17)	-0.46** (-13.28)	-0.51** (-10.34)	0.02 (0.30)	34.51	

Explanations on efficiency

- Large alphas indicates the profitability of using technical analysis, the MA strategy in particular.
- But why it can be profitable in the competitive financial markets?

The **PREDICTABILITY** of the market!

- The predictability of stock returns permits the possibility of profitable technical rules
- From a theoretical point of view, incomplete information on the fundamentals is a key for investors to use technical analysis. MA can help to learn about the predictability.
- Trend-following: the more a trend is to continue, the more the profit the strategy may have

Analysis

Robustness

Comparison with momentum

Robustness Examination

- Alternative Lag Lengths
- Alternative Volatility Decile Portfolios
- Value-Weighted Size Decile Portfolios
- Average Holding Days, Turnover Rate and Transaction Costs
- Subperiods

Alternative Lag Lengths, Table III

Rank	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α
	MAP(20)		MAP(50)		MAP(100)		MAP(200)	
Low	5.19** (4.58)	7.69** (8.25)	4.10** (3.49)	6.84** (7.09)	3.19** (2.79)	6.15** (6.50)	2.32* (2.09)	5.33** (5.66)
2	5.41** (3.77)	8.44** (7.50)	3.98** (2.70)	7.20** (6.09)	2.81 (1.95)	6.45** (5.60)	1.97 (1.41)	5.71** (4.98)
3	8.33** (4.85)	11.84** (9.50)	6.28** (3.47)	10.10** (7.60)	3.09 (1.74)	7.26** (5.35)	1.93 (1.12)	6.36** (4.72)
4	10.93** (5.59)	14.43** (10.56)	7.61** (3.74)	11.24** (7.66)	4.06* (1.98)	8.35** (5.55)	1.67 (0.85)	6.03** (4.00)
5	12.53** (5.66)	16.02** (10.65)	8.54** (3.69)	12.23** (7.65)	3.98 (1.72)	8.24** (4.95)	2.44 (1.08)	6.74** (3.96)
6	14.30** (5.94)	17.74** (10.72)	10.24** (4.04)	13.95** (7.91)	5.36* (2.10)	9.74** (5.30)	2.38 (0.96)	6.64** (3.49)
7	17.08** (6.65)	20.72** (11.69)	11.67** (4.36)	15.51** (8.23)	6.94* (2.57)	11.34** (5.72)	3.56 (1.34)	8.02** (3.93)
8	18.72** (6.95)	21.70** (11.52)	12.82** (4.55)	15.92** (7.86)	7.24* (2.52)	10.75** (4.95)	3.72 (1.31)	7.28** (3.25)
9	19.19** (6.82)	22.09** (10.81)	13.46** (4.60)	16.53** (7.57)	8.39** (2.79)	11.60** (4.97)	3.98 (1.31)	7.15** (2.90)
High	17.49** (6.30)	20.39** (9.34)	11.52** (4.00)	14.65** (6.26)	6.37* (2.20)	9.55** (3.91)	3.17 (1.13)	6.19* (2.47)

The results are fundamentally the same as before, but two interesting features emerge.

- The MA timing strategy still generates highly significant abnormal returns relative to the buy-and-hold strategy. However, the magnitude of the abnormal returns does decrease as the lag length increases.
- MA timing strategies still generate monotonically increasing abnormal returns across the deciles. However, differences in the abnormal returns between the highest and the lowest deciles decline as the lag length increases.

Alternative Volatility Decile Portfolios, Table IV

Rank	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α
	MAP(10)		MAP(20)		MAP(50)		MAP(100)		MAP(200)	
Low	8.48** (9.28)	9.83** (12.32)	6.55** (7.10)	7.93** (9.71)	4.52** (4.59)	5.89** (6.68)	2.48* (2.53)	3.76** (4.17)	1.81 (1.87)	3.09** (3.46)
2	8.60** (7.08)	11.02** (11.43)	7.00** (5.72)	9.50** (9.75)	4.63** (3.64)	7.23** (7.10)	2.58* (2.03)	5.24** (5.09)	1.50 (1.21)	4.04** (3.93)
3	8.69** (6.12)	11.58** (10.85)	7.32** (5.09)	10.30** (9.46)	4.80** (3.23)	7.97** (7.09)	2.37 (1.59)	5.58** (4.85)	1.92 (1.33)	5.05** (4.44)
4	9.88** (6.18)	13.34** (11.43)	7.57** (4.59)	11.03** (9.02)	5.15** (3.07)	9.00** (7.26)	2.95 (1.75)	6.99** (5.58)	2.24 (1.38)	6.12** (4.89)
5	11.33** (6.34)	15.45** (12.15)	8.30** (4.43)	12.47** (9.15)	5.46** (2.87)	9.96** (7.16)	3.09 (1.63)	7.95** (5.70)	1.44 (0.78)	6.18** (4.35)
6	12.49** (6.46)	16.96** (12.56)	9.82** (4.87)	14.31** (10.05)	6.20** (3.00)	11.06** (7.45)	3.95 (1.92)	9.12** (6.14)	2.01 (1.00)	7.03** (4.65)
7	13.26** (6.34)	18.00** (12.50)	11.00** (5.06)	15.74** (10.46)	7.23** (3.23)	12.36** (7.88)	4.22 (1.87)	9.64** (6.00)	2.06 (0.92)	7.44** (4.52)
8	17.02** (7.53)	21.87** (14.40)	14.19** (6.04)	19.17** (12.13)	9.52** (3.86)	14.77** (8.82)	5.77* (2.32)	11.31** (6.57)	2.58 (1.03)	7.97** (4.42)
9	19.00** (8.00)	23.72** (14.57)	15.71** (6.42)	20.78** (12.65)	10.56** (4.07)	15.53** (8.69)	5.59* (2.10)	10.78** (5.69)	2.44 (0.91)	7.68** (3.91)
High	15.92** (6.87)	20.29** (11.79)	13.65** (5.72)	18.18** (10.42)	8.52** (3.42)	12.94** (6.99)	2.96 (1.18)	7.08** (3.54)	1.63 (0.66)	5.71** (2.77)

NYSE/Amex volatility decile portfolios.

- The results are fundamentally similar Nasdaq volatility decile portfolios.
- Generate slightly higher performance for the first two decile portfolios, but slightly lower performance for the rest of the decile portfolios

Alternative Volatility Decile Portfolios, Table V

Rank	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α
	MAP(10)		MAP(20)		MAP(50)		MAP(100)		MAP(200)	
Low	0.53 (0.32)	3.22** (2.77)	-0.99 (-0.58)	1.93 (1.63)	-1.35 (-0.79)	1.85 (1.55)	-0.16 (-0.09)	3.16** (2.61)	0.65 (0.39)	4.04** (3.38)
2	6.73** (3.88)	10.62** (8.82)	4.42* (2.42)	8.43** (6.69)	2.91 (1.60)	7.12** (5.48)	1.89 (1.04)	6.29** (4.87)	1.37 (0.76)	5.81** (4.40)
3	9.22** (5.18)	13.38** (10.86)	6.50** (3.56)	10.62** (8.24)	4.43* (2.38)	8.79** (6.57)	2.56 (1.38)	7.10** (5.33)	1.19 (0.65)	5.84** (4.32)
4	9.25** (5.02)	13.66** (10.64)	6.49** (3.41)	10.91** (8.22)	3.85* (2.00)	8.38** (6.02)	2.60 (1.35)	7.62** (5.54)	1.21 (0.64)	6.17** (4.39)
5	10.07** (5.37)	14.92** (11.42)	7.94** (4.20)	12.89** (9.73)	5.09** (2.62)	10.10** (7.20)	3.12 (1.62)	8.58** (6.18)	1.60 (0.85)	7.07** (5.02)
6	10.84** (5.70)	15.73** (11.85)	7.78** (4.07)	12.79** (9.55)	4.75* (2.38)	9.86** (6.93)	3.33 (1.68)	8.80** (6.24)	2.12 (1.10)	7.36** (5.11)
7	11.37** (6.10)	15.96** (12.02)	8.89** (4.72)	13.64** (10.17)	6.52** (3.38)	11.40** (8.30)	4.49* (2.31)	9.74** (7.02)	2.31 (1.21)	7.45** (5.20)
8	12.09** (6.67)	16.48** (12.70)	8.87** (4.84)	13.22** (9.92)	6.63** (3.49)	11.13** (8.16)	4.56* (2.38)	9.40** (6.76)	2.38 (1.28)	7.08** (5.01)
9	13.81** (7.78)	17.85** (13.90)	10.93** (6.06)	15.10** (11.46)	8.37** (4.55)	12.57** (9.31)	5.38** (2.85)	9.78** (6.96)	2.88 (1.54)	7.20** (5.02)
High	15.12** (8.24)	18.81** (13.62)	12.62** (6.73)	16.37** (11.59)	9.00** (4.67)	12.67** (8.72)	5.00* (2.50)	8.71** (5.66)	1.65 (0.82)	5.40** (3.42)

NYSE volatility decile portfolios.

- Except the first decile, the results are very similar to earlier ones.

Combine with Table IV:

- The fundamental result of the profitability of the MA timing strategy is completely unaltered with the use of the alternative volatility decile portfolios

Value-Weighted Size Decile Portfolios,

Table VI

Rank	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α
	MAP(10)		MAP(20)		MAP(50)		MAP(100)		MAP(200)	
Low	19.86** (10.18)	21.87** (14.39)	18.37** (9.23)	20.39** (12.96)	13.52** (6.50)	15.42** (8.93)	8.20** (3.83)	10.34** (5.58)	3.24 (1.50)	5.22** (2.73)
2	20.11** (10.56)	22.37** (15.68)	18.15** (9.50)	20.44** (14.16)	13.79** (6.94)	16.08** (10.50)	9.00** (4.45)	11.52** (7.06)	4.94* (2.46)	7.24** (4.30)
3	19.37** (9.94)	21.92** (15.50)	17.73** (8.93)	20.38** (14.23)	13.45** (6.56)	16.15** (10.64)	8.31** (3.98)	11.27** (7.01)	4.67* (2.26)	7.54** (4.57)
4	17.45** (8.58)	20.60** (14.43)	15.76** (7.66)	18.98** (13.02)	12.12** (5.77)	15.62** (10.45)	7.35** (3.48)	11.11** (7.09)	4.28* (2.06)	8.04** (5.04)
5	14.88** (6.78)	19.05** (12.70)	14.05** (6.42)	18.37** (12.59)	10.36** (4.55)	15.08** (9.70)	6.58** (2.89)	11.90** (7.52)	3.64 (1.63)	9.01** (5.49)
6	12.90** (5.65)	17.24** (11.27)	12.45** (5.49)	16.86** (11.10)	9.16** (3.92)	14.06** (8.95)	5.17* (2.23)	10.70** (6.80)	2.43 (1.05)	8.10** (4.92)
7	12.24** (5.37)	16.50** (11.14)	10.91** (4.70)	15.39** (10.10)	7.27** (3.02)	12.08** (7.58)	4.04 (1.70)	9.45** (5.85)	1.80 (0.78)	7.25** (4.42)
8	10.80** (4.76)	15.04** (10.15)	8.65** (3.68)	13.00** (8.27)	5.66* (2.35)	10.54** (6.53)	3.36 (1.42)	8.88** (5.55)	1.27 (0.55)	6.94** (4.20)
9	9.82** (4.44)	13.70** (9.49)	7.83** (3.41)	11.68** (7.60)	4.64* (1.98)	8.85** (5.57)	2.70 (1.15)	7.58** (4.74)	0.89 (0.39)	5.95** (3.63)
High	0.18 (0.09)	2.91* (2.12)	-0.01 (-0.00)	2.88* (2.06)	0.01 (0.01)	3.45* (2.44)	-0.34 (-0.17)	3.42* (2.38)	0.80 (0.40)	4.79** (3.27)

Result:

The profitability of the MA timing strategy remains strong even with the use of value-weighted size decile portfolios.

Average Holding Days, Turnover Rate, Table VII

Rank	Holding	Turnover	Holding	Turnover	Holding	Turnover	Holding	Turnover	Holding	Turnover
	MA(10)		MA(20)		MA(50)		MA(100)		MA(200)	
Low	15.83	0.13	28.68	0.07	66.91	0.03	114.78	0.02	176.93	0.01
2	12.24	0.16	20.75	0.10	44.43	0.05	74.68	0.03	138.81	0.01
3	11.77	0.17	21.41	0.09	42.78	0.05	66.72	0.03	101.23	0.02
4	11.06	0.18	19.44	0.10	38.65	0.05	69.34	0.03	129.82	0.02
5	11.38	0.18	19.32	0.10	41.24	0.05	64.16	0.03	87.16	0.02
6	11.45	0.17	19.72	0.10	41.88	0.05	65.22	0.03	112.97	0.02
7	11.28	0.18	19.12	0.10	39.95	0.05	67.32	0.03	91.39	0.02
8	11.69	0.17	20.44	0.10	50.18	0.04	65.84	0.03	131.42	0.02
9	12.38	0.16	21.21	0.09	44.75	0.04	91.69	0.02	165.09	0.01
High	14.43	0.14	25.97	0.08	56.03	0.04	98.59	0.02	233.22	0.01

- Longer lag length results in longer average holding days.
- The ‘turnover’ (fraction of days when the trades occur relative to all the days) is inversely related the lag length.

Transaction Cost, Table VIII

Rank	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α	Avg Ret	FF α
Transaction Cost $\tau = 25$ bps										
	MAP(10)		MAP(20)		MAP(50)		MAP(100)		MAP(200)	
Low	-0.94 (-0.78)	1.39 (1.34)	1.63 (1.37)	4.12** (4.08)	2.31 (1.92)	5.03** (4.96)	2.19 (1.90)	5.14** (5.33)	1.88 (1.68)	4.88** (5.13)
2	-1.10 (-0.73)	1.73 (1.41)	1.24 (0.83)	4.26** (3.51)	1.86 (1.24)	5.09** (4.11)	1.76 (1.21)	5.39** (4.59)	1.34 (0.95)	5.06** (4.37)
3	1.89 (1.04)	5.21** (3.76)	4.15* (2.35)	7.66** (5.76)	4.47* (2.44)	8.27** (6.04)	1.70 (0.95)	5.88** (4.25)	1.17 (0.68)	5.58** (4.10)
4	4.36* (2.17)	7.74** (5.21)	6.70** (3.35)	10.20** (7.05)	5.49** (2.67)	9.12** (6.04)	2.76 (1.34)	7.06** (4.62)	0.64 (0.32)	5.00** (3.27)
5	7.13** (3.23)	10.49** (6.64)	8.44** (3.73)	11.91** (7.53)	6.50** (2.78)	10.19** (6.20)	2.67 (1.15)	6.93** (4.11)	1.61 (0.71)	5.90** (3.44)
6	9.98** (4.18)	13.21** (7.86)	10.14** (4.13)	13.57** (7.83)	8.24** (3.23)	11.95** (6.63)	4.05 (1.58)	8.43** (4.53)	1.33 (0.53)	5.60** (2.92)
7	12.11** (4.81)	15.55** (8.73)	13.03** (4.98)	16.68** (9.03)	9.57** (3.55)	13.40** (6.98)	5.78* (2.13)	10.18** (5.09)	2.88 (1.08)	7.33** (3.58)
8	14.56** (5.52)	17.48** (9.23)	14.93** (5.46)	17.91** (9.19)	10.92** (3.85)	14.02** (6.82)	6.01* (2.09)	9.52** (4.34)	2.83 (1.00)	6.39** (2.84)
9	15.13** (5.41)	17.95** (8.67)	15.26** (5.33)	18.17** (8.60)	11.62** (3.94)	14.68** (6.63)	7.27* (2.41)	10.48** (4.46)	3.34 (1.10)	6.50** (2.62)
High	13.00** (4.81)	15.81** (7.23)	14.36** (5.10)	17.26** (7.72)	10.15** (3.51)	13.27** (5.61)	5.57 (1.92)	8.76** (3.57)	2.62 (0.93)	5.63* (2.24)

Transaction cost of 25 basis points per trade.

- The transaction cost has reduced the abnormal returns across the various MA timing strategies.
- All of the MAPs still have significantly positive abnormal returns except the first two deciles of the 10-day MA.

Overall, transaction costs have little impact on performance, and MAPs still have economically highly significant abnormal returns

Subperiods, Table IX

Panel A: Period Jan 02, 1973 - June 30, 1991									Panel B: Period July 01, 1991 - December 31, 2009								
Rank	α	β_{mkt}	Adj. R^2	α	β_{mkt}	β_{smb}	β_{hml}	Adj. R^2	Rank	α	β_{mkt}	Adj. R^2	α	β_{mkt}	β_{smb}	β_{hml}	Adj. R^2
Panel A1: CAPM				Panel A2: Fama-French					Panel B1: CAPM				Panel B2: Fama-French				
Low	10.23** (8.70)	-0.12** (-5.55)	23.12	11.08** (10.37)	-0.20** (-6.00)	-0.24** (-6.43)	-0.06** (-2.92)	45.35	Low	2.15 (1.43)	-0.25** (-10.36)	37.75	3.27* (2.24)	-0.27** (-10.87)	-0.13** (-6.61)	-0.16** (-5.39)	43.48
2	13.51** (8.79)	-0.19** (-6.24)	27.33	14.56** (10.82)	-0.30** (-6.41)	-0.37** (-6.88)	-0.06* (-2.04)	51.55	2	0.81 (0.47)	-0.32** (-11.76)	41.91	2.10 (1.25)	-0.34** (-11.85)	-0.21** (-10.14)	-0.16** (-4.68)	48.17
3	15.94** (9.23)	-0.23** (-7.21)	29.97	17.05** (11.55)	-0.36** (-7.31)	-0.44** (-7.77)	-0.05 (-1.66)	54.30	3	5.42** (2.64)	-0.41** (-14.26)	46.61	6.77** (3.43)	-0.44** (-13.80)	-0.28** (-11.53)	-0.15** (-3.67)	52.54
4	17.74** (9.17)	-0.27** (-7.84)	31.00	18.67** (11.41)	-0.41** (-7.91)	-0.50** (-9.71)	-0.01 (-0.26)	55.32	4	9.07** (4.08)	-0.47** (-15.84)	48.74	10.18** (4.77)	-0.50** (-14.84)	-0.32** (-12.31)	-0.09* (-2.18)	54.06
5	19.95** (9.67)	-0.31** (-9.92)	31.61	20.75** (12.38)	-0.46** (-9.81)	-0.58** (-11.28)	0.03 (0.76)	57.55	5	12.57** (5.10)	-0.51** (-16.79)	46.34	13.49** (5.78)	-0.53** (-15.65)	-0.39** (-12.54)	-0.04 (-0.73)	52.85
6	20.40** (9.12)	-0.34** (-11.38)	31.35	21.09** (11.57)	-0.49** (-10.95)	-0.63** (-11.83)	0.06 (1.48)	57.10	6	18.15** (6.76)	-0.55** (-17.40)	45.58	18.74** (7.50)	-0.57** (-16.00)	-0.42** (-11.78)	0.03 (0.66)	52.38
7	22.34** (9.49)	-0.37** (-10.41)	32.18	23.19** (12.02)	-0.53** (-10.02)	-0.67** (-12.23)	0.04 (0.93)	57.30	7	20.78** (7.13)	-0.55** (-16.28)	42.56	21.57** (8.05)	-0.57** (-15.35)	-0.47** (-10.89)	0.01 (0.24)	50.04
8	22.63** (9.21)	-0.36** (-11.03)	29.43	23.40** (11.43)	-0.52** (-10.62)	-0.67** (-12.93)	0.05 (1.16)	54.44	8	24.61** (7.60)	-0.54** (-15.79)	38.07	24.92** (8.51)	-0.54** (-15.64)	-0.47** (-9.39)	0.10 (1.71)	46.11
9	23.55** (8.69)	-0.38** (-10.55)	27.28	24.69** (10.86)	-0.56** (-10.51)	-0.73** (-11.73)	0.02 (0.30)	50.94	9	24.36** (6.90)	-0.51** (-13.82)	33.24	24.58** (7.62)	-0.52** (-13.92)	-0.45** (-7.69)	0.11 (1.78)	40.56
High	21.62** (7.70)	-0.35** (-9.34)	22.23	22.74** (9.15)	-0.53** (-9.63)	-0.71** (-11.38)	0.01 (0.27)	43.95	High	19.53** (5.45)	-0.43** (-10.56)	25.76	20.15** (5.93)	-0.44** (-10.34)	-0.39** (-6.19)	0.02 (0.28)	31.27

The results continue to support that the MAPs, especially those high decile ones, constitute a new anomaly in asset pricing.

Comparison with momentum

- What is momentum?

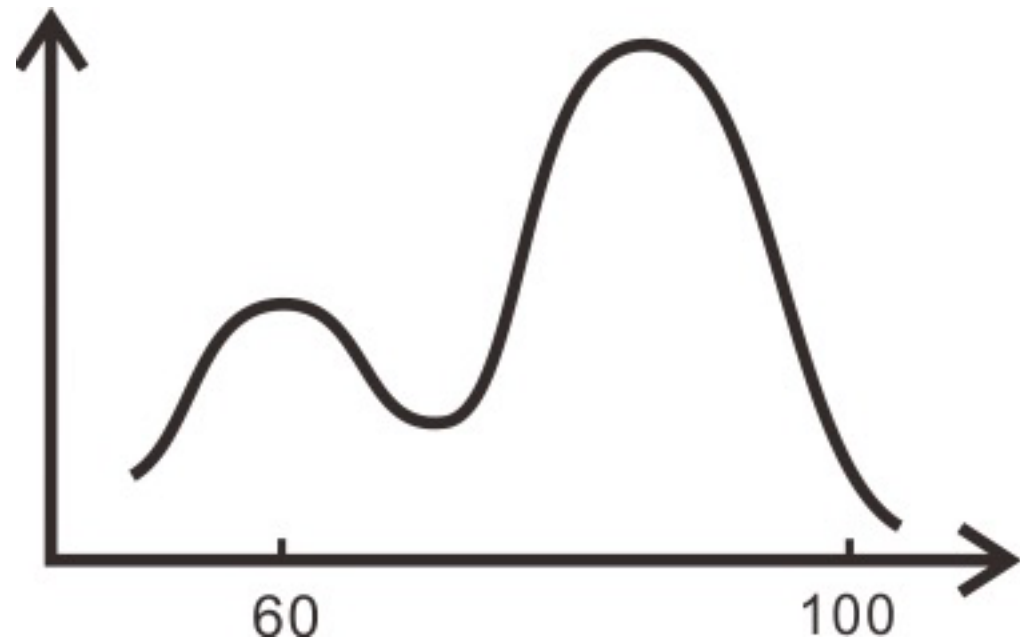
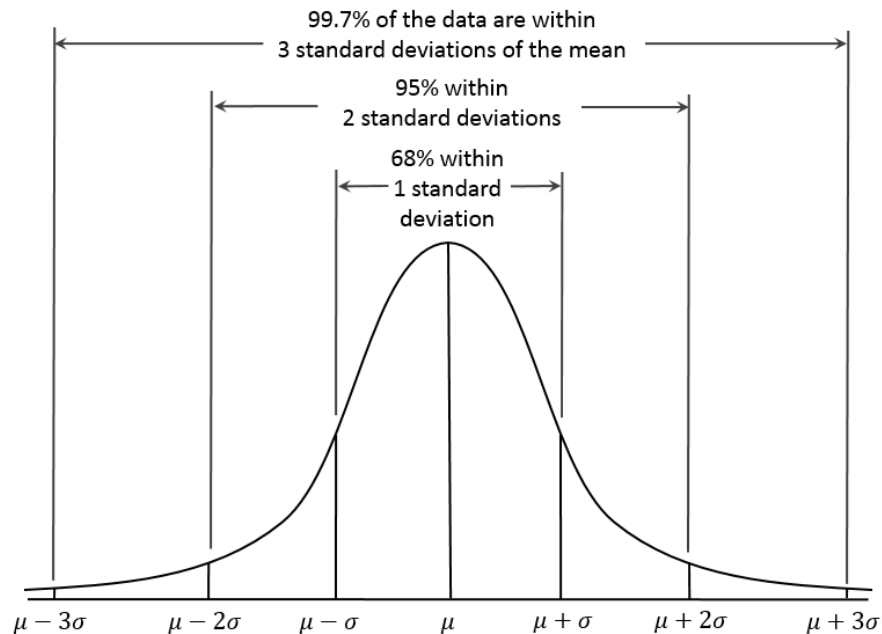
In finance, momentum is the empirically observed tendency for rising asset prices to rise further, and falling prices to keep falling. For instance, it was shown that stocks with strong past performance continue to outperform stocks with poor past performance in the next period with an average excess return of about 1% per month.

- Why does momentum exist?

Many explanations have been published by researchers. Here comes my own understanding: Confidence.

My explanation on momentum anomaly

- The difference in performance results from the confidence people have towards these stocks.
- My guess: In a one-dimensional grading system/metric, i.e. the price, the test grades, it is natural for polarization to happen.



Compare MA with Momentum

In order to demonstrate that MA and Momentum are different anomalies, we compare them in three aspects

- Business Cycles (Table X)
- Default Risk (Table XI)
- Liquidity Risk (Table XI)

Results show that MA and Momentum have different behaviors in these aspects.

Summary

Concluding Remarks

- A standard use of moving averages, a popular form of technical analysis, in investing portfolios sorted by volatility, generates investment timing portfolios that outperform the buy-and-hold strategy greatly, with returns that have negative or little risk exposures on the market factor and the Fama-French SMB and HML factors.
- While the moving average timing strategy is trend-following similar to the momentum strategy, its performance has little correlation with the momentum strategy, and behaves differently over business cycles, default and liquidity risks.

Future works

- It will be likely fruitful to examine the profitability of technical analysis in various markets and asset classes by investigating the cross-sectional performance, especially focusing on those sorted by volatility.
- The study presents an exciting new anomaly in the anomaly literature.

Thank you!

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