SIZE-BASED MOMENTUM AND CROSS MOMENTUM STRATEGIES

ZIYE ZHANG, BECKETT ZHANG, KAIXIN ZHANG, ISABELLE ZHAN

OVERVIEW

- I. Introduction
- II. Methodology
- III. DATA
- IV. Results
- V. Conclusion

INTRODUCTION

- Re-examine the momentum strategy

Correlation and R^2 with Fama-French Three Factor model

- Examine the momentum strategy at different size levels

Compute returns (also for different size cut-offs)

Hypothesis testing

Plotting evolution

- Propose a new strategy called cross momentum strategy (financial crisis)

METHODOLOGY

METHODOLOGY : METHODS OF CONSTRUCTING PORTFOLIOS

1. Calculating momentum effect

- Obtain market returns for each stock over 10 months

2. Constructing size-based portfolios

- Determine the size portfolio cut-offs by NYSE stocks
- Set minimum cut-off to be Min(ME from all exchanges). Set maximum cut off to be Max(ME from all exchanges)
- Allocate all stocks into 10 portfolios (1~10: smallest~largest ME)

METHODOLOGY: METHODS OF CONSTRUCTING PORTFOLIOS

3. Define large-cap stocks and small-cap stocks (first focus on the top 10% ME stocks and the bottom 10% ME stocks and change to top 20% and bottom 20%ME stocks and so on)
4. Group each size-based portfolio into 10 sub-portfolios by momentum (similar approach to constructing size-based portfolio, but in terms of past returns this time)
5. Skip for one month, hold the portfolio for 1 month and then reform.
6. Repeat the process
   Calculate monthly return for each sub-portfolios over 1959-2015

Graphical demonstration:

1 Smallest ME portfolio:

1 LOSER	2	3	4	5	6	7	8	9	10 winner

2
3
:
:
:
10 largest ME portfolio

1 Loser	2	3	4	5	6	7	8	9	10 winner

METHODOLOGY: TO COMPARE MOMENTUM STRATEGIES

1. Calculating average return for subgroups, and focus on the difference between:

- Small cap winner - small cap loser,
- Large cap winner - large cap loser
- This is the performance of momentum strategy between portfolios of different sizes

2. Plotting the evolution of returns for the two momentum portfolios against time, and observe patterns during recession and financial crisis

METHODOLOGY: TO EVALUATE MOMENTUM STRATEGIES

- 3. Evaluation whether momentum strategies is already largely explained by Fama-French three factor model
- Regress momentum on market, size and value
- $UMD_t = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_t$
- Measure correlations and R^2

METHODOLOGY: TO COMPARE MOMENTUM STRATEGIES

4. T-test

- Test the momentum strategy in both large-cap and small-cap portfolios have positive premium:

$$H_{a1}: \overline{UMD_B} > 0 \qquad and \qquad H_{a2}: \overline{UMD_S} > 0$$

- Compare the strength of momentum effect between large-cap and small-cap portfolios:

$$H_{a3}: \overline{UMD_{SMB}} > 0$$

METHODOLOGY:
TO CONSTRUCT CROSS MOMENTUM STRATEGIES

- Construct size portfolios by 20% cut-off
- Rank by their momentum, determine winner (top10%) and loser (bottom 10%)
- Long winner in the small-cap group, short loser in the large-cap group.
- Compare with market portfolio and Size-factor portfolio
- Compare with original small-cap momentum strategy, large-cap momentum strategy

DATA

DATA

- Historical stock return data: CRSP (Center for Research in Security Prices) database
- From Jan 1959 and June 2015
- We considered : all stocks that are listed in

  NYSE

  NASDAQ

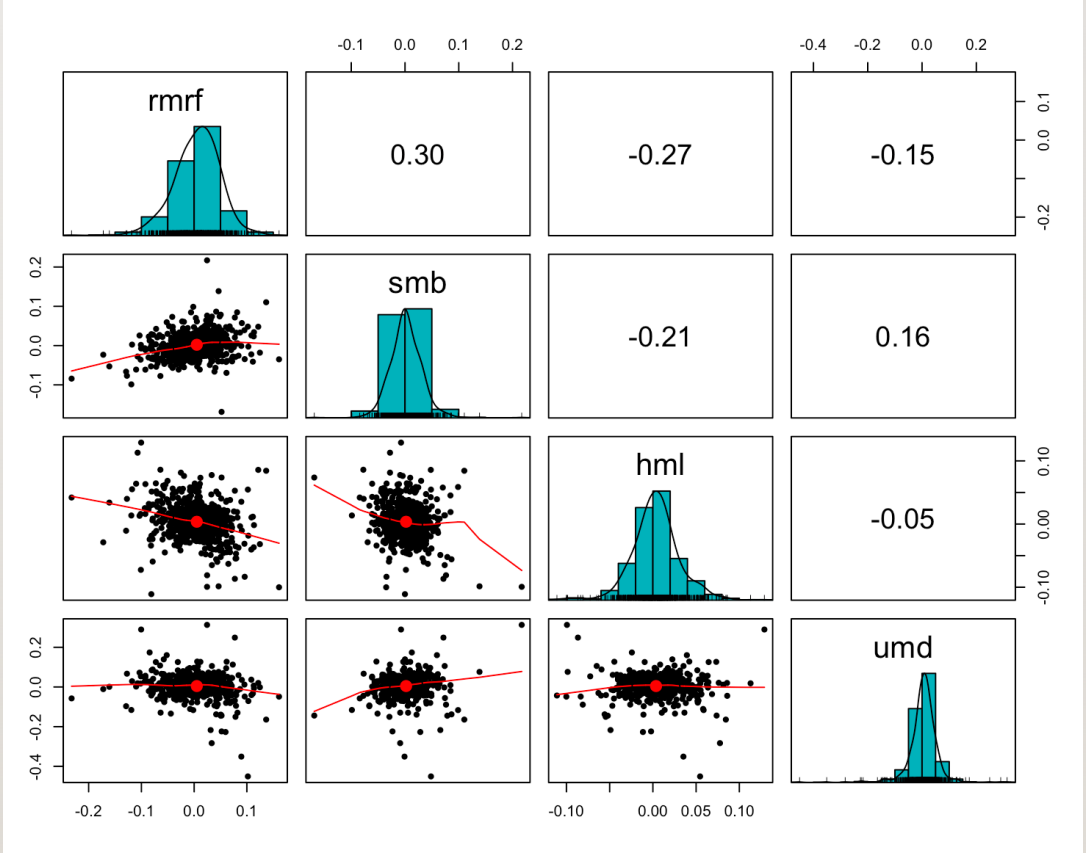
  AMEX

- Data from French's webpage : rmrf, smb and hml

RESULTS

RESULTS
RELATIONSHIP BETWEEN FOUR FACTORS

- Individual Level
- Distributions:
  - Approx normal
- Collinearity:
  - No
- Correlations:
  - Low



RESULTS
EXPLAINED BY FAMA-FRENCH MODEL?

- Aggregated Level
- $UMD_t = \underbrace{0.59\%}_{p\ value=0.005} - 0.29 * RMRF_t + 0.39 * SMB_t + 0.14 * HML_t + \epsilon_t$

$$Adjusted\ R^2 = \ 0.069 \ll 1$$

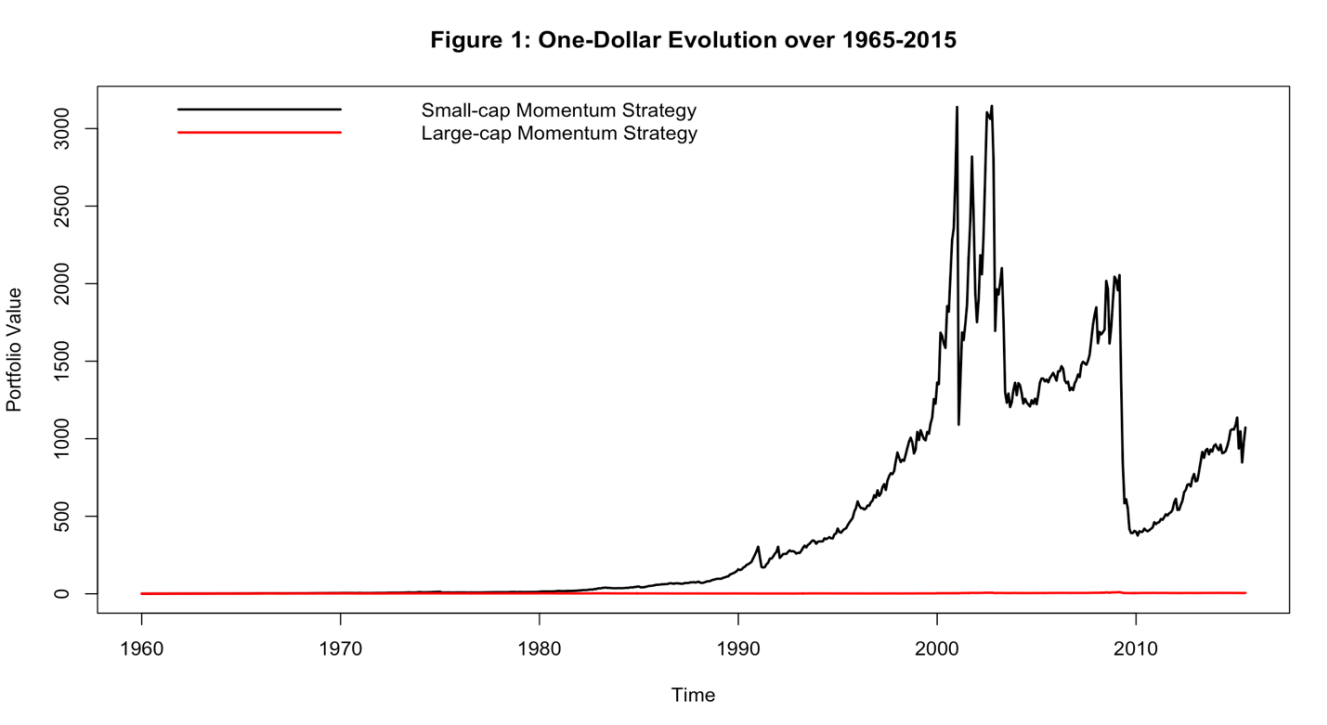
- Significant α; small R^2
- Carhart Four-factor model is a good practice.
- Indeed a good strategy

RESULTS: DETERMINE OPTIMAL SIZE CUT-OFF

Further Investigate

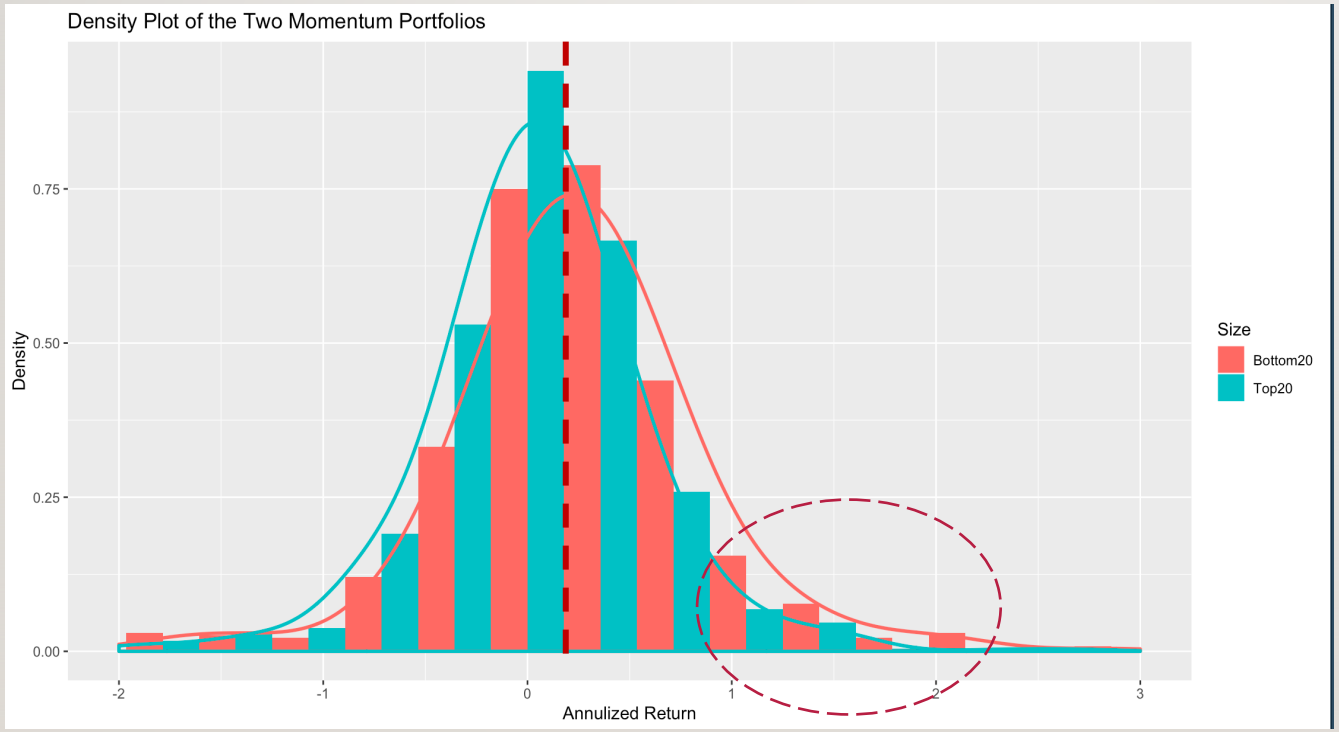
Cut-off	10% by Size		20% by Size (***)		30% by Size		40% by Size		50% by Size	
Group	Large cap	Small cap	Large cap	Small cap	Large cap	Small cap	Large cap	Small cap	Large cap	Small cap
Return	5.85%	13.65%	4.59%	16.24%	5.35%	15.51%	5.44%	14.11%	5.86%	12.42%
Volatility	17.85%	31.39%	17.18%	24.56%	16.96%	23.41%	16.98%	22.55%	17.02%	22.93%
Sharpe Ratio	0.065	0.285	-0.006	0.470	0.039	0.462	0.044	0.418	0.069	0.337

RESULTS: EVOLUTION OF RETURNS



- Small-cap Momentum Strategy >> Large-cap Momentum Strategy
- Sensitive to Financial Crises
- At EoP
  - Small-cap: 1027.24 $
  - Large-cap: 5.55 $
- Why?

RESULTS:
PLOT OF RETURNS



- Small-cap Momentum:
  - Right-skewed
  - Fat right tail
  - Thin left tail
- Large-cap Momentum :
  - Normally distributed
  - Negative returns offset positive returns

RESULTS
HYPOTHESIS TESTING 1 & 2

- H0: $R_{\textbf{large}\ \text{winner-loser}} <= 0$ Ha: $R_{\textbf{large}\ \text{winner-loser}} > 0$
- $\boldsymbol{t = 1.9913;\ p\ value = \ 0.02343}$
- Average monthly return 0.38% < risk-free rate 0.39%

- H0: $R_{\textbf{small}\ \text{winner-loser}} <= 0$ Ha: $R_{\textbf{small}\ \text{winner-loser}} > 0$
- $\boldsymbol{t = 4.9259;\ p\ value = \ 5.305e - 07}$
- Average monthly return 1.35%

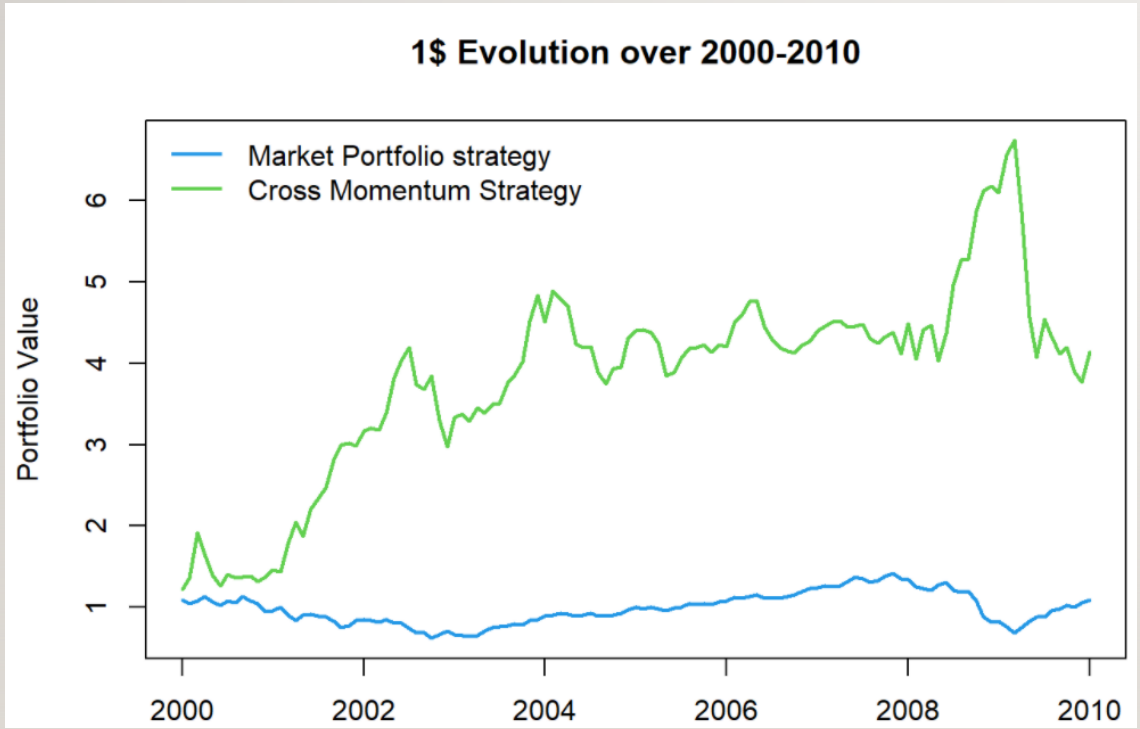
RESULTS
HYPOTHESIS TESTING 3

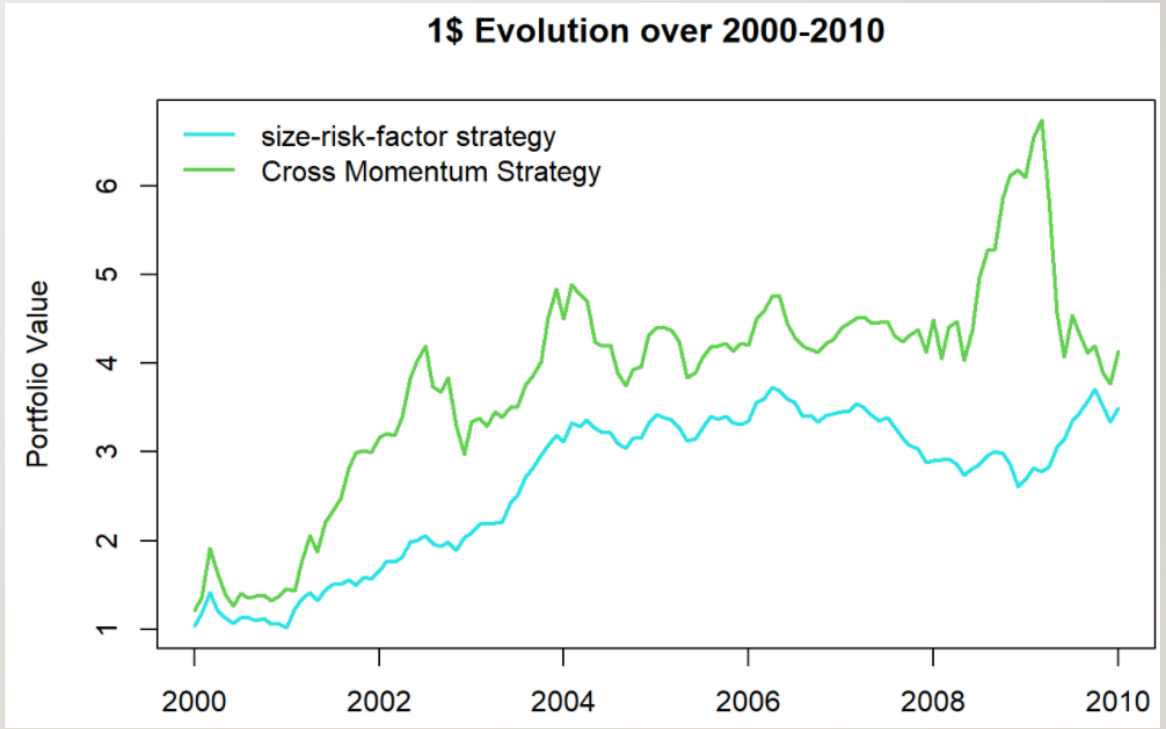
- H0: $R_{\text{small winner-loser}} <= R_{\text{large winner-loser}}$ Ha: $R_{\text{small winner-loser}} > R_{\text{large winner-loser}}$
- $\boldsymbol{t = 4.1575;\ p\ value\ = 1.819e - 05}$
- Performance depends on market size!

CROSS MOMENTUM STRATEGY

- During 2000-2010 (include 2 recessions)
- Long the small cap-winner portfolio and short the large cap-loser portfolio

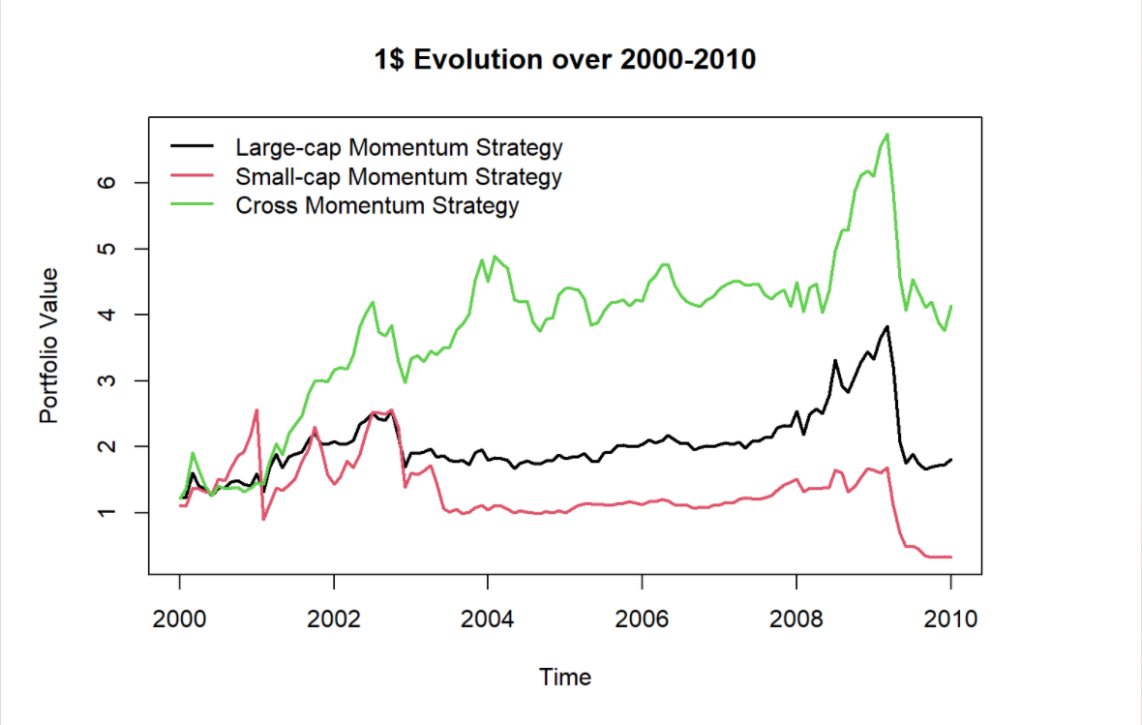
EVALUATE CROSS MOMENTUM STRATEGIES
COMPARE WITH MARKET & SIZE PORTFOLIO





EVALUATE CROSS MOMENTUM STRATEGIES

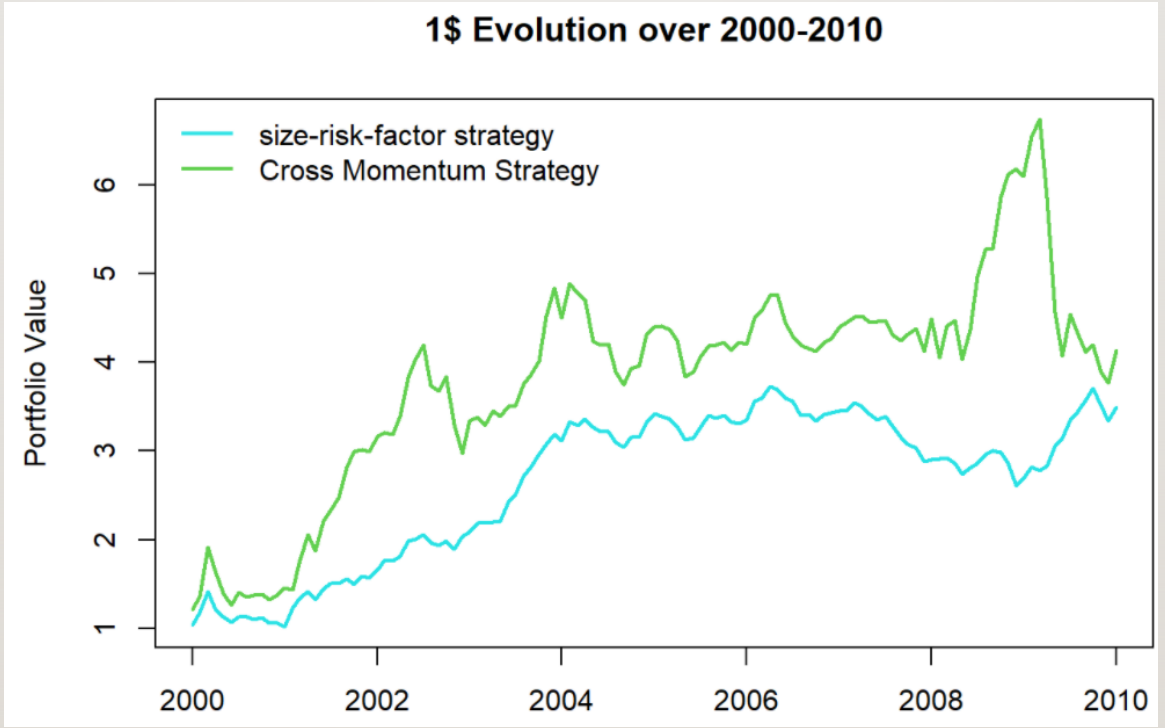
COMPARE WITH SMALL-CAP, LARGE-CAP MOMENTUM STRATEGY



EVALUATE CROSS MOMENTUM STRATEGIES STATISTICS

Key Statistics (annualized)	Market	Size Factor	Small-cap Momentum	Large-cap Momentum	Cross Momentum
Return (%)	2.31	12.53	0.85	10.33	18.05
Volatility (%)	17.21	17.13	43.21	29.43	28.56
Sharpe Ratio	-0.025	0.65	-0.044	0.26	0.54

EVALUATE CROSS MOMENTUM STRATEGIES
SHARPE RATIO WEAKNESS



CONCLUSIONS

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1. Adding a momentum factor to Fama-French Three Factor Model
2. Small-cap momentum strategy works better than large-cap momentum strategy
3. Cross-momentum strategy generates higher return
4. Data snooping problem & Test on later recessions

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