Anomalies and False Rejections

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The Review of Financial Studies (May 1, 2020)

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2020.12.05

Outline

- Introduction
- Basic methods
  - Multiple Hypotheses Testing
- Empirical analysis
  - Monte Carlo Simulations
  - Data and Trading Strategies
  - Researcher versus Econometrician
- Robustness Checks
- Conclusion

1.Introduction

1.1. Motivation

- Researchers in finance have long been worried about the possibility that a substantial number of reported discoveries might be false.
- The problem might be particularly severe for empirical asset pricing studies that investigate cross-sectional predictability in stock returns.
- Accounting for multiple hypotheses testing (MHT) might offer not only a way to determine the severity of the false rejection problem but also a solution to it.

1.Introduction

1.2. Research question

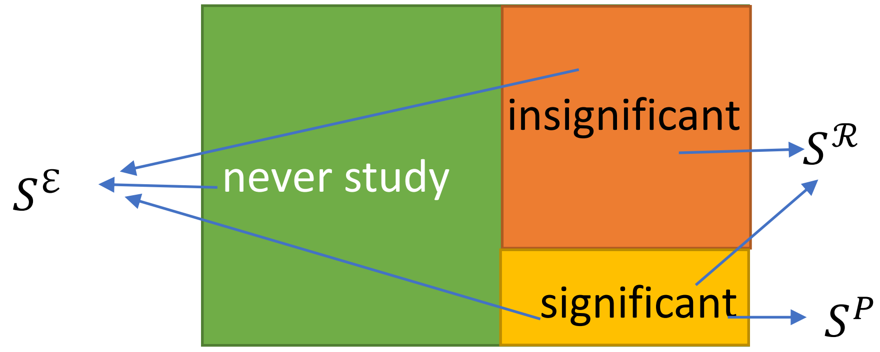
- Firstly, what is the proportion of false rejections ?
  - 45%

- Secondly, what is the thresholds that should be applied to test statistics to reduce false discoveries ?
  - At 3.8 and 3.4 for time-series and cross-sectional regressions under MHT

1.Introduction

1.3. Difficulties of research

How to get $S^{\mathcal{R}}$?



$S^{\mathcal{R}}$:all the strategies that researchers have attempted to test ---- get target threshold

S^{P}:the strategies that eventually become public-----produce a low threshold

$S^{\mathcal{E}}$:a large set of randomly generated strategies ------ produce a high threshold

- researchers have attempted but that were not significant.
- researchers have attempted but that were significant.
- researchers would never study because their economic foundation is not justifiable

It can be only indirectly inferred by making **explicit assumptions** about the data-generating process and about the ability of researchers to filter out strategies.

1.Introduction

1.4. Related researches

- The magnitude of the false discovery problem and the thresholds that should be applied to test statistics remain a matter of debate.
  - Harvey, Liu, and Zhu (2016) suggest a MHT t-statistic threshold higher than three.
  - Benjamini and Yekutieli (2001) :they calculate that 80 of the 296 discoveries (i.e., 27%) are rejected under SHT, but not under MHT.
- The method used to determine an MHT adjusted threshold and the set of trading strategies studied are different.
  - Yan and Zheng (2017) use a laboratory of over 18,000 randomly generated signals and find that a vast majority of them can be rejected using bootstrap method.
  - Harvey and Liu (2019) show that the bootstrap methods have severe size biases that lead to large overrejections.

1.Introduction

1.5. Contribution

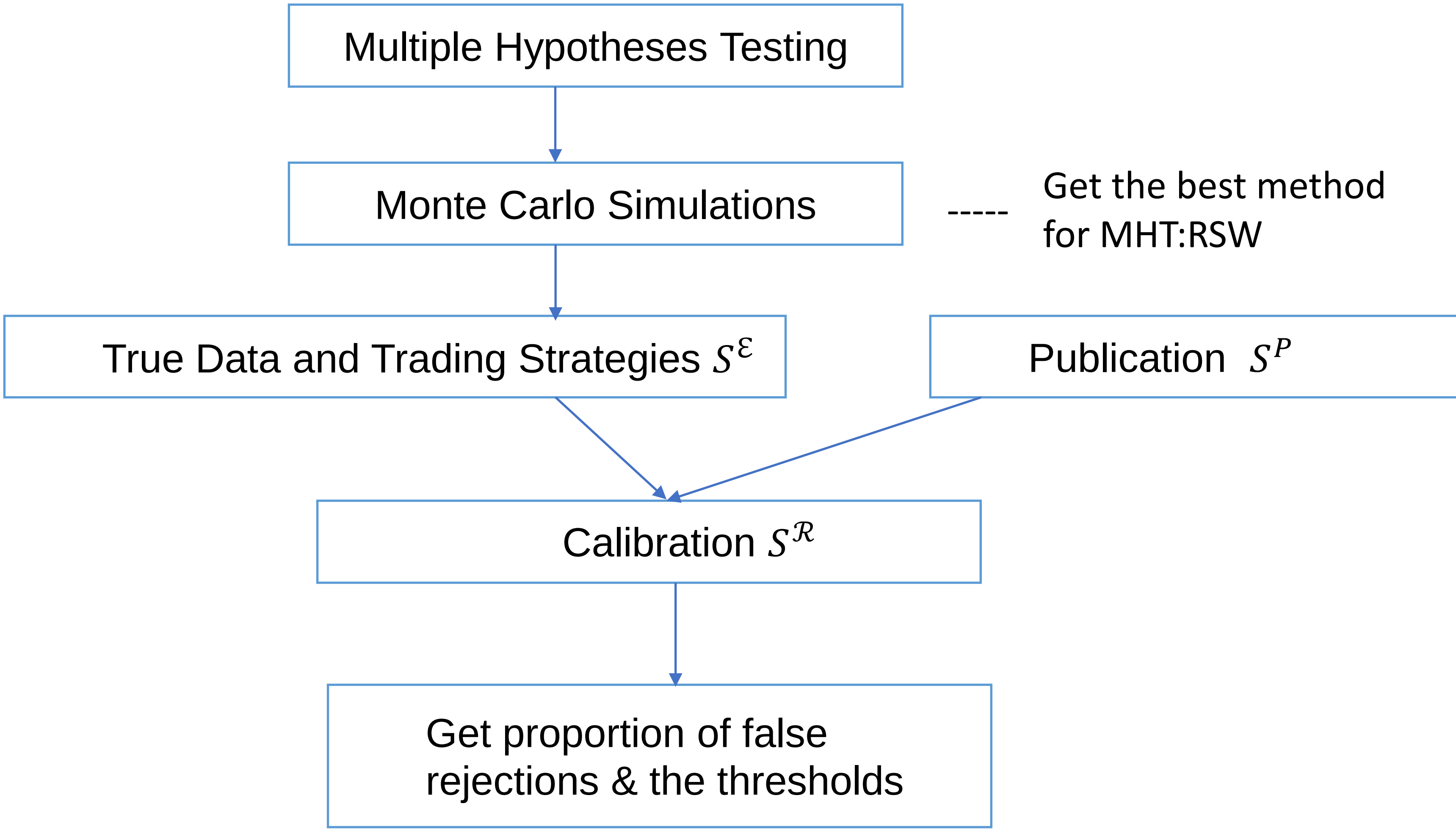
- Firstly,We propose a statistical model that use the information contained $S^{\mathcal{E}}$ and S^{P} to extract the set $S^{\mathcal{R}}$, and indirectly infer the proportion of false rejections under SHT.

- Secondly,Our statistical model also to quantify the proportion of false discoveries to be about 45%. MHT-adjusted thresholds for t-statistics of time-series alphas and cross-sectional FM regression slopes are 3.8 and 3.4.

- Thirdly, Our paper also contributes to the literature that studies the proliferation of discoveries of abnormally profitable trading strategies and data-snooping biases in finance.

1.Introduction

1.6. Framework



2. Basic methods-- Multiple Hypotheses Testing

- A total of S hypotheses ,in which R are rejected , S_0 (S_1) of these hypotheses are true (false) under the null H_0
- a confidence level α (e.g., 5%)

	H_0 not rejected	H_0 rejected	Total
H_0 true	T_0	F_1	S_0
H_0 false	F_0	T_1	S_1
	$S-R$	$R=F_1+T_1$	S

F_1/R : the false discovery proportion(FDP).
$\mathrm{F}_0/(S-R)$: the false nondiscovery proportion (FNDP)

The probability of making at least one false discovery is $1-0.95^{10}$=40%, over 99% when 100 hypotheses are tested .

Three broad approaches : familywise error rate (FWER), false discovery rate (FDR), and false discovery proportion (FDP)

2. Basic methods-- Multiple Hypotheses Testing

2.1. Familywise error rate(FWER)

	H_0 not rejected	H_0 rejected	Total
H_0 true	T_0	F_1	S_0
H_0 false	F_0	T_1	S_1
	$S-R$	$R=F_1+T_1$	S

$$FWER = Prob(F_1 \geq 1) \leq \alpha.$$

$$E(F1) = S \times \alpha^* = \alpha$$

$$\alpha^* = \alpha/S.$$

- In order to discover a larger number of true rejections. The *k*-FWER

$$k\text{−FWER} = Prob\,(F1 \geq k)$$

- Four main approaches can be employed to control FWER:
  - (1) Bonferroni (1936),
  - (2) Holm (1979),
  - (3) Bootstrap reality check of White (2000),
  - (4) StepM method of Romano and Wolf (2005).

2. Basic methods-- Multiple Hypotheses Testing

2.2. False discovery proportion(FDP)

An alternative to controlling the “number” of false rejections is to control the “proportion” F_1/R of false rejections (FDP).

$$Prob\ (FDP\ \geq \gamma\ ) \leq \alpha$$

We implement the **RSW** method proposed by Romano and Wolf (2007) and Romano, Shaikh, and Wolf (2008)

2.3. False discovery rate(FDR)

An alternative to controlling the tail behavior of FDP is to control its expected value, the FDR

$$FDR\ \equiv\ E(FDP)\ \leq \delta,$$

where δ is a tolerance level imposed by the researcher.

The two main FDR control methods :

- the Benjamini and Hochberg (1995) method (BH)
- Benjamini and Yekutieli (2001) (BHY)

3. Empirical analysis

3.1. Monte Carlo Simulations

- **Data-generating process: ----stock data**

$$R_{it} = \alpha_i + \beta_i' F_t + \epsilon_{it} \quad (1)$$

$$\alpha \sim N(0, \sigma_\alpha^2)$$

$$\epsilon \sim N(0,\ \sigma_\epsilon^2), \sigma_\epsilon = 15.1\%$$

N=2000:the monthly average number of stocks

T=500:the number of months in the data

Simulate a six-factor model :Fama and French (2015) factors +the momentum factor:

F_t, β_i, from a multivariate normal distribution with means and covariance matrix that match those of the actual distribution of factor returns/betas from the actual data

3. Empirical analysis

3.1. Monte Carlo Simulations

Signal data

In each period t, the econometrician draws S =10,000 noisy signals from a set $S^{\mathcal{E}}$,an informative signal with probability π =5%.

$$s_{it} = \begin{cases} \alpha_i + \eta_{it}^s & if\ the\ signal\ is\ informative, \\ \eta_{it}^s & if\ the\ signal\ is\ uninformative. \end{cases} \quad (2)$$

$$\eta^s \sim N\ (0, \sigma_\eta^2)$$

signal-to-noise ratio, $\pi \times \sigma_\alpha^2 / \sigma_\eta^2$

a constant correlation ρ among signals

3. Empirical analysis

3.1. Monte Carlo Simulations

- **Portfolios and cross-sectional regressions**

Portfolio sort :Every month, we sort stocks into deciles based on signal s to get 10-1.we run Time-series regression of the hedge portfolio returns, R_{st}, based on signal s, on factor returns F_t and record the t-statistic of the alpha, t_{α_s}.

$$R_{st} = \alpha_s + \beta_s' F_t + u_{st}. \qquad (3)$$

Every period t we also run a univariate cross-sectional regression of risk-adjusted returns, $R_{it} - \hat{\beta}_i' F_t$,on signal s_{it},to get t_{λ_s}.

$$R_{it} - \hat{\beta}_i' F_t = \lambda_{0t} + \lambda_{st} s_{it} + \psi_{it}$$

3. Empirical analysis

3.1. Monte Carlo Simulations

- **Properties of different MHT methods**

Table 1
MHT properties in simulations

	A. Signal-to-noise ratio						B. Correlation between signals				
σ_α	Bonf	Holm	BH	BHY	RSW	ρ	Bonf	Holm	BH	BHY	RSW
	Thresholds						Thresholds				
1.5	4.6	4.6	3.1	3.8	3.5	0	4.6	4.5	3.0	3.8	3.4
2.0	4.6	4.4	3.0	3.8	3.4	10	4.6	4.5	3.0	3.9	3.5
2.5	4.6	4.4	3.0	4.1	3.4	20	4.6	4.5	3.0	4.0	3.6
	Rejections						Rejections				
1.5	1.8	1.8	4.6	3.4	3.7	0	5.0	5.0	5.2	5.0	5.1
2.0	5.0	5.0	5.2	5.0	5.1	10	5.0	5.0	5.3	5.0	5.1
2.5	5.0	5.0	5.2	5.0	5.1	20	5.0	5.0	5.3	5.0	5.0
	E[FDP]						E[FDP]				
1.5	<0.1	<0.1	4.8	0.5	1.0	0	<0.1	<0.1	4.7	0.5	1.2
2.0	<0.1	<0.1	4.7	0.5	1.2	10	<0.1	<0.1	4.8	0.5	1.0
2.5	<0.1	0.2	4.7	0.5	1.2	20	<0.1	<0.1	4.8	0.5	0.8
	SD[FDP]						SD[FDP]				
1.5	0.1	0.1	1.0	0.4	0.5	0	<0.1	0.1	1.0	0.3	0.5
2.0	<0.1	0.1	1.0	0.3	0.5	10	<0.1	<0.1	2.3	0.5	0.8
2.5	<0.1	0.1	1.0	0.3	0.5	20	0.1	0.1	4.3	0.8	1.2
	E[FNDP]						E[FNDP]				
1.5	63.9	63.7	12.7	33.0	25.8	0	0.3	0.3	<0.1	<0.1	<0.1
2.0	0.3	0.3	<0.1	<0.1	<0.1	10	0.2	0.2	<0.1	<0.1	<0.1
2.5	0	0	0	0	0	20	0.3	0.3	<0.1	<0.1	<0.1

Table 1
(Continued)

	C. Proportion of informative signals						D. Number of signals				
π	Bonf	Holm	BH	BHY	RSW	S	Bonf	Holm	BH	BHY	RSW
	Thresholds						Thresholds				
0	4.6	4.5	3.0	3.8	3.4	5,000	4.4	4.4	3.0	4.1	3.5
10	4.6	4.5	2.8	3.5	3.2	10,000	4.6	4.5	3.0	3.8	3.4
20	4.6	4.5	2.6	3.3	2.8	100,000	5.0	5.0	3.0	3.7	3.4
30	4.6	4.5	2.4	3.2	2.6	500,000	5.2	5.2	3.0	3.7	3.4
	Rejections						Rejections				
0	5.0	5.0	5.2	5.0	5.1	5,000	5.0	5.0	5.2	5.0	5.0
10	10.0	10.0	10.5	10.0	10.2	10,000	5.0	5.0	5.2	5.0	5.1
20	19.9	20.0	20.8	20.1	20.4	100,000	4.9	4.9	5.2	5.0	5.1
30	29.9	29.9	31.1	30.1	30.6	500,000	4.9	4.9	5.2	5.0	5.1
	E[FDP]						E[FDP]				
0	<0.1	<0.1	4.7	0.5	1.2	5,000	<0.1	<0.1	4.7	0.5	0.9
10	<0.1	<0.1	4.4	0.5	1.5	10,000	<0.1	<0.1	4.7	0.5	1.2
20	<0.1	<0.1	3.9	0.4	1.8	100,000	<0.1	<0.1	4.7	0.4	1.2
30	<0.1	<0.1	3.5	0.4	2.1	500,000	<0.1	<0.1	4.7	0.4	1.2
	SD[FDP]						SD[FDP]				
0	<0.1	0.1	1.0	0.3	0.5	5,000	0.1	0.1	1.3	0.5	0.7
10	<0.1	<0.1	0.7	0.2	0.5	10,000	<0.1	0.1	1.0	0.3	0.5
20	<0.1	<0.1	0.4	0.1	0.4	100,000	<0.1	<0.1	0.4	0.1	0.3
30	<0.1	<0.1	0.3	0.1	0.4	500,000	<0.1	<0.1	0.3	0.1	0.3
	E[FNDP]						E[FNDP]				
0	0.3	0.3	<0.1	<0.1	<0.1	5,000	0.2	0.2	0	<0.1	<0.1
10	0.3	0.3	<0.1	<0.1	<0.1	10,000	0.3	0.3	0	<0.1	<0.1
20	0.3	0.2	<0.1	<0.1	<0.1	100,000	1.2	1.1	<0.1	<0.1	<0.1
30	0.3	0.2	0	<0.1	0	500,000	1.8	1.9	<0.1	<0.1	<0.1

➢ A preference for the **RSW** method:

FWER lacks power and is affected by the number of hypotheses;

FDR exposes a researcher to the possibility that the realized FDP varies significantly across applications.

3. Empirical analysis

3.1. Monte Carlo Simulations

- **Dual hurdles**

Table 2
Dual hurdles

π	σ_α	Threshold	Rejections		E[FDP]	
		RSW	RSW	SHT	RSW	SHT
		Portfolio alpha: t_α				
0	2.0	4.0	<0.1	4.9	—	—
5	1.5	3.5	3.7	9.6	1.1	48.7
5	2.0	3.4	5.1	9.7	1.2	48.2
5	2.5	3.4	5.1	9.7	1.2	48.4
		Fama-MacBeth: t_λ				
0	2.0	4.0	<0.1	5.0	—	—
5	1.5	3.2	5.1	9.8	2.7	48.9
5	2.0	3.2	5.1	9.8	2.7	48.9
5	2.5	3.2	5.1	9.8	2.8	48.9
		t_α and t_λ				
0	2.0	—	<0.1	1.5	—	—
5	1.5	—	3.7	6.3	0.2	22.0
5	2.0	—	5.0	6.4	0.2	21.8
5	2.5	—	5.0	6.4	0.2	21.9

➢ Dual hurdles helps in reducing the probability of false rejections for all testing methods, coupled with MHT methods.

3. Empirical analysis

3.2. Data and Trading Strategies

- **Data**
- CRSP :Monthly returns and prices
- The merged CRSP/Compustat files: Annual accounting data(the balance sheet, the income statement, the cash flow statement, and other miscellaneous items)
- Sample time period:1972-2015
- Trading signals: 2,393,641 possible signals.(developed by 185)

  (1)growth rates from one year to the next;

  (2)ratios of all possible combinations of two levels;

  (3)ratios of all possible combinations of three variables that can be expressed as the difference of two variables divided by a third variable (i.e., $(x_1 - x_2)/x_3$)

3. Empirical analysis

3.2. Data and Trading Strategies

- **Hedge portfolios**

- We sort firms into value-weighted deciles on June 30 of each year and rebalance these portfolios annually. The first portfolio formation date is June 1973 and the last formation date is June 2015.

- **Fama-MacBeth regressions**

$$R_{it} - \hat{\beta}_i' F_t = \lambda_{0t} + \lambda_{1t} X_{it-1} + \lambda_{2t} Z_{it-1} + e_{it} \qquad (4)$$

- X is the variable that represents the signal and Z’s are control variables: size ,natural logarithm of the book-to-market ratio, past 1- and 11-month return,asset growth, and profitability ratio.

3. Empirical analysis

3.2. Data and Trading Strategies

SHT: single hypothesis testing
MHT :multiple hypotheses testing
SnM : “single, but not multiple”rejections.

- **Raw returns, alphas, and FM coefficients**

94.1% (= 1 – 1.4/23.2)

Table 3
Significance of trading strategies

A. Statistics from SHT

	Mean	Median	SD	Min	Max	$\%\|t\| > 1.96$	$\%\|t\| > 2.57$
Return	−0.08	−0.10	1.21	−7.04	6.72	10.6	3.7
Alpha	−0.19	−0.19	1.62	−7.80	9.01	23.2	11.9
FM	0.07	0.03	1.64	−8.63	8.12	20.0	11.2

B. Statistics from MHT

	Alpha	FM	Alpha and FM
Threshold	4.0	3.3	—
Rejections	1.4	5.5	0.1
SnM rejections	94.1	72.7	97.9

- A large number of strategies have average return t-statistics that exceed conventional statistical significance levels under SHT.
- FM coefficient thresholds are lower than the corresponding alpha thresholds.
- Imposing the dual hurdles , the proportion of SnM rejections is 97.9% using the RSW method for FDP control.

3. Empirical analysis

3.2. Researcher versus Econometrician

- Econometrician: draw informative signals with probability π------ $S^{\mathcal{E}}$

  Researchers :draw informative signals with probability $\Omega \times \pi$, where $\Omega \geq 1$.- $S^{\mathcal{R}}$

  informative signals: $S^{\mathcal{R}} \geq S^{\mathcal{E}}$,equal when $\Omega = 1$

  S^{P}=$\{s \in S^{\mathcal{R}}, t_s > 1.96)$

π essentially defines the set $S^{\mathcal{E}}$. We calibrate π by asking the simulation to produce the same fraction of SnM discoveries that we observe in the data (i.e., SnM rejections in $S^{\mathcal{E}}$ = 97.9%).

The factor Ω that defines the superior ability of researchers to draw informative signals is calibrated by asking the simulation to produce the same proportion of SnM rejections in the set S^{P} (i.e., SnM rejections in S^{P} = 27.0%).

We calibrate σ_{η} by asking the simulation to match two quantities: the average of cross-sectional standard deviations of residuals from the cross-sectional FM regressions in Equation (4) (i.e., $SD(\psi)$ = 17:2%), and the ratio of (significant) portfolio alphas to (significant) stock alphas.

3. Empirical analysis

3.2. Researcher versus Econometrician

- **Table 4**
  False rejection rates and adjusted MHT thresholds

A. Calibrated parameters		
σ_η 4.8	π 0.06	Ω 29.0
B. Target quantities		
	Data	Simulation
SnM rejections in $\mathcal{S}^{\mathcal{E}}$	97.9	96.5
SD(ψ) in $\mathcal{S}^{\mathcal{E}}$	17.2	17.5
$E(\|\text{sign. } \alpha_s\|)/E(\|\text{sign. } \alpha_i\|)$ in $\mathcal{S}^{\mathcal{E}}$	0.12	0.12
SnM rejections in $\mathcal{S}^{\mathcal{P}}$	27.0	30.9
C. Outcome quantities in the set $\mathcal{S}^{\mathcal{R}}$		
Alpha threshold, $\mathcal{T}_\alpha$		3.8
FM threshold, $\mathcal{T}_\lambda$		3.4
SnM rejections		42.5
False rejections		45.3

➢ A proportion of false rejections of 45.3%under SHT, and thresholds of 3.8 and 3.4 for alpha and FM coefficient t-statistics under MHT, respectively

3. Empirical analysis

3.3. Discussion

- Thresholds:
  - (1)Limited application scope: for a specific context of empirical asset pricing studies that use a six-factor model and are concerned with abnormally profitable trading strategies.
  - (2) strong priors about the validity of a signal might require special considerations. (Harvey (2017) --Bayesian)
  - (3) higher thresholds might have the unintended consequence of increased data mining.
  - (4) use both thresholds to establish which signals are significant.
- False discoveries.
- Relation to out of sample.
- Relation to literature.

4. Robustness Checks

- 4.1 Alternative assumptions about stock returns and signals
  - Alpha: a normal distribution ---- >> a Pearson system with mean zero, standard deviation 1.9%, skewness of 1.17, and kurtosis of 18.01
  - Factor: from a multivariate normal distribution---->> resampling them in stationary blocks with replacement directly from the observed six-factor monthly returns.
  - residuals :drawn from a distribution with standard deviation of 14.7%, skewness of 0.83,and kurtosis of 6.38.
- 4.2 Alternative definition of SnM rejections in S^p
  - Harvey, Liu,and Zhu (2016)----->156signals that are available from Andrew Chen's Web site
- 4.3 Alternative specification of SnM rejections in S^ε
  - Different factor models: CAPM、FF3、BS(6)、HXZ(q)
  - Alternative definition and construction of strategies:
    - eliminating signals constructed as $(x_1 - x_2)/x_3$
    - 2 $\times$3 portfolios
    - in FM regressions, we replace raw variables with their ranks that run from zero to one

4. Robustness Checks

- 4.1 Alternative assumptions about stock returns and signals
  - Alpha: a normal distribution ---- >> a Pearson system with mean zero, standard deviation 1.9%, skewness of 1.17, and kurtosis of 18.01
  - Factor: from a multivariate normal distribution---->> resampling them in stationary blocks with replacement directly from the observed six-factor monthly returns.
  - residuals :drawn from a distribution with standard deviation of 14.7%, skewness of 0.83,and kurtosis of 6.38.

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4. Robustness Checks

Table 5
Alternative assumptions about stock returns and signals

	Data	Alpha	Factors	Residuals	$\rho=9\%$
A. Calibrated parameters					
σ_η		4.2	9.7	7.6	6.2
π		0.06	0.06	0.06	0.08
Ω		28.1	22.1	29.1	22.5
B. Target quantities					
	Data	Simulation			
SnM rejections in $\mathcal{S}^{\mathcal{E}}$	97.9	96.5	95.8	96.3	95.6
SD(ψ) in $\mathcal{S}^{\mathcal{E}}$	17.2	17.7	17.5	14.7	17.5
$E(\lvert\text{sign. } \alpha_s\rvert)/E(\lvert\text{sign. } \alpha_i\rvert)$ in $\mathcal{S}^{\mathcal{E}}$	0.12	0.10	0.13	0.10	0.12
SnM rejections in $\mathcal{S}^{\mathcal{P}}$	27.0	30.0	30.4	28.7	31.2
C. Outcome quantities in the set $\mathcal{S}^{\mathcal{R}}$					
Alpha threshold, $\mathcal{T}_\alpha$		3.8	4.4	3.8	3.8
FM threshold, $\mathcal{T}_\lambda$		3.3	3.5	3.4	3.3
SnM rejections		43.3	44.9	41.2	42.6
False rejections		45.9	46.3	42.8	45.5

4. Robustness Checks

- 4.2 Alternative definition of SnM rejections in S^p
  - Harvey, Liu,and Zhu (2016)----->156signals that are available from Andrew Chen's Web site
- **Table 6**
  Alternative definition of SnM rejections in $\mathcal{S}^{\mathcal{P}}$

A. Calibrated parameters		
σ_η	π	Ω
3.8	0.06	13.7

B. Target quantities	Data	Simulation
SnM rejections in $\mathcal{S}^{\mathcal{E}}$	97.9	96.8
SnM rejections in $\mathcal{S}^{\mathcal{P}}$	50.6	48.5
SD(ψ) in $\mathcal{S}^{\mathcal{E}}$	17.2	17.5
$E(\lvert\text{sign. } \alpha_s\rvert)/E(\lvert\text{sign. } \alpha_i\rvert)$ in $\mathcal{S}^{\mathcal{E}}$	0.12	0.13

C. Outcome quantities in the set $\mathcal{S}^{\mathcal{R}}$	
Alpha threshold, $\mathcal{T}_\alpha$	4.1
FM threshold, $\mathcal{T}_\lambda$	3.5
SnM rejections	63.1
False rejections	64.9

4. Robustness Checks

- 4.3 Alternative specification of SnM rejections in S^{ε}
  - Different factor models: CAPM、FF3、BS(6)、HXZ(q)
  - Alternative definition and construction of strategies:
    - eliminating signals constructed as $(x_1 - x_2)/x_3$
    - 2 $\times$3 portfolios
    - in FM regressions, we replace raw variables with their ranks that run from zero to one

4. Robustness Checks

Table 7
Different factor models

	Alpha	FM	Alpha and FM
		CAPM	
SHT rejections in $\mathcal{S}^{\mathcal{E}}$	23.4	24.8	7.7
RSW rejections in $\mathcal{S}^{\mathcal{E}}$	3.4	8.2	0.6
RSW SnM rejections in $\mathcal{S}^{\mathcal{E}}$	—	—	92.0
Thresholds in $\mathcal{S}^{\mathcal{R}}$	3.8	3.4	—
False rejections in $\mathcal{S}^{\mathcal{R}}$	—	—	40.1
		FF3	
SHT rejections in $\mathcal{S}^{\mathcal{E}}$	27.3	24.8	7.8
RSW rejections in $\mathcal{S}^{\mathcal{E}}$	4.9	8.3	0.4
RSW SnM rejections in $\mathcal{S}^{\mathcal{E}}$	—	—	94.3
Thresholds in $\mathcal{S}^{\mathcal{R}}$	3.8	3.4	—
False rejections in $\mathcal{S}^{\mathcal{R}}$	—	—	44.2
		BS	
SHT rejections in $\mathcal{S}^{\mathcal{E}}$	35.7	20.6	7.9
RSW rejections in $\mathcal{S}^{\mathcal{E}}$	10.6	5.6	0.7
RSW SnM rejections in $\mathcal{S}^{\mathcal{E}}$	—	—	91.1
Thresholds in $\mathcal{S}^{\mathcal{R}}$	3.8	3.4	—
False rejections in $\mathcal{S}^{\mathcal{R}}$	—	—	46.5
		HXZ	
SHT rejections in $\mathcal{S}^{\mathcal{E}}$	22.3	20.6	4.4
RSW rejections in $\mathcal{S}^{\mathcal{E}}$	0.4	4.9	0.1
RSW SnM rejections in $\mathcal{S}^{\mathcal{E}}$	—	—	99.2
Thresholds in $\mathcal{S}^{\mathcal{R}}$	3.8	3.4	—
False rejections in $\mathcal{S}^{\mathcal{R}}$	—	—	45.6

5. Conclusion

- Firstly, Control for multiple hypothesis testing, when searching for anomalies, at 3.8 and 3.4 for time-series and cross-sectional regressions, respectively.

- Secondly, We estimate the expected proportion of false rejections that researchers would produce if they failed to account for multiple hypothesis testing to be about 45% .