Based on the real data from 2006 to 2014

Momentum Effect in China

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Part one

DATA SET SUMMARY

Key features of the original data set

Date

From 2006-01-01, to 2014-11-17

17 months *

2147 trading days

Ticker

2569 unique stocks

Both SH & SZ market

GICS

Global Industry Classification Standard

Take values from 10 to 55

Each value stands for a sector

Close

Daily close price

Unit: RMB Yuan

1402842 NAs*

Volume
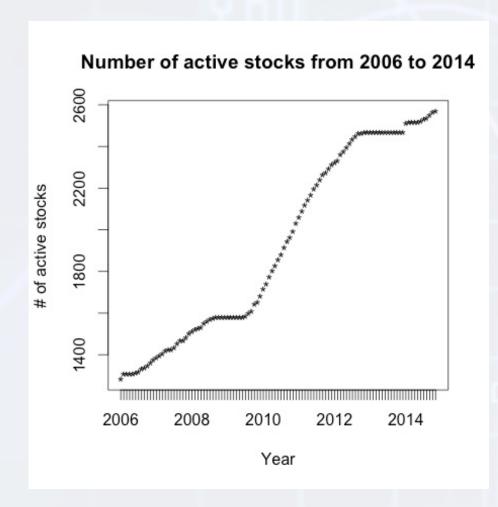
Daily trading volumes

1639761 NAs*

* NA values exist mainly due to different listing time of firms

DATA SET SUMMARY

Take a more detailed look

Number of active stocks from 2006 to 2014
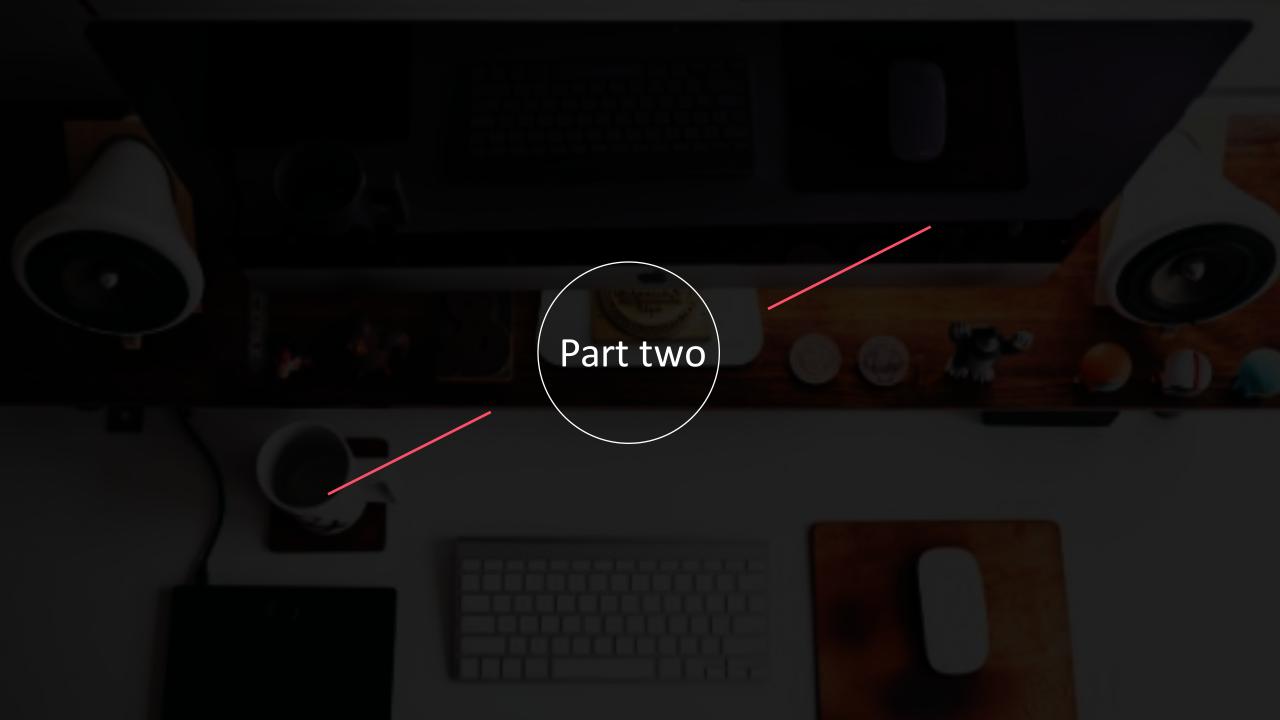

Number of active stocks change because:

1. New firms list on the stock market

2. Firms suspend trading shares in a specific period of time

3. Firms quit the stock market

Only 4% stocks have price record less than 1 year

Min	1st Q	Medium	3rd Q	Max
1282	1526	1856	2454	2569

Part two

MOMENTUM EFFECT

Data structure change

Time Range

Recorded in the first column of the new data frame for backtesting

2006.01   2007.01   2013.10   2014.10

Daily index was transformed into monthly index. Past and forward returns are available only in 2007.01 – 2013.10

Columns   Date   Ticker   GICS   Close   Volume

We calculate 3, 6, 9, 12 month past and forward returns

Month   Ticker   ret.3.0   ret.6.0   ret.9.0   ret.12.0   ret.0.3
ret.0.6   ret.0.9   ret.0.12   ret.wk.1   ret.wk.2   ret.wk.3

ret.x.0 --- past x month return (monthly)
ret.0.x --- forward x month return (monthly)
ret.wk.x --- past x week return (weekly)

Example

```
    Month      Ticker       ret.3.0
Jan 2007 000001.SZ  0.24718622
```
......
```
  ret.0.9    ret.0.12    ret.wk.1.0
0.2944084  0.19981434  0.056928839
```

On the first trading day of Jan 2007, stock "000001.SZ", has a 3 month past return of 24.72% per month.
If we buy it and hold for 9 months, we will receive a profit of 29.44% per month.
Also, it has a 1 week past return for 5.69% per week.

MOMENTUM EFFECT

Assumptions

- No transaction cost

- Stock can be short easily without costs

- All trading profits are subject to the same tax rate (or no tax rate)

- Dealing with NA in return data
  - All stocks with available returns data in the J months preceding the portfolio formation date are included in the sample from which the buy and sell portfolios are constructed
  - NA in forward returns are removed when calculating buy and sell portfolio returns

When calculating return:

- Instead of using log return (which works best when returns are small), we use normal return

  Return = $\frac{last\ price - inital\ price}{initial\ price}$

- All returns are normalized as monthly returns

- Monthly returns are calculated by simply dividing K-month returns by K, arithmetically

* Reverse effect is caused by bid-ask spread, price pressure, and lagged reaction effects, according to Jegadeesh and Lehmann (1990)

MOMENTUM EFFECT

Portfolio Construction

- Include portfolios with overlapping holding periods
- J-month/K-month strategy (Jegadeesh):
  Select stocks on the basis over the past J months
  and hold them for K months

Equally Weighted Portfolio

- Each decile has the same number of stocks
- Each stock value weighs $\frac{1}{N}$, where N is the total number of stocks in each portfolio
- For stock i, value weight = $\frac{1}{N \times P(i)} \times P(i) = \frac{1}{N}$

Zero Cost Portfolio

- Buy the winner portfolio and sell equal value of the loser portfolio, creating a zero cost portfolio
- The buy-sell portfolio return = return from winners portfolio – return from losers portfolio

At the first trading day of each month

Rank the securities in ascending order based on their returns in the past J months

Form 10 decile portfolios that equally weight the stocks contained in each decile

Buy "winners" portfolio (bottom decile) and sell "losers" portfolio (top decile), holding this position for K months

On the last trading day of Kth month

Close out the position initiated in month t-K and calculate returns

MOMENTUM EFFECT

First set of strategy –portfolios are formed immediately after the lagged returns are measured for the purpose of portfolio formation

- A total of 16 strategies
- Select stocks based on their returns over the past 3, 6, 9, and 12 months, denoted as J
- Consider holding periods that vary from 3, 6, 9, and 12 months, denoted as K

Second set of strategy – portfolios are formed 1 week after the lagged returns used for forming these portfolios are measured

- Skip a period (e.g. a month) between the portfolio formation period and the holding period
- By skipping period, we can avoid some of the bid-ask spread, price pressure, and lagged reaction effects

T-statistics

- Test whether the zero-cost portfolios have a significant return
- One-sample T-test
    - Null hypothesis: sample mean is zero

MOMENTUM EFFECT

Returns of J-month/K-month strategy

We mainly focus on Buy-sell rows.

3-month/3-month strategy exhibits a very significant positive return.

In panel A (form the portfolio immediately), as J and K increases, positive returns become less significant. When it comes to 12-month/12-month strategy, the positive return almost fades away.
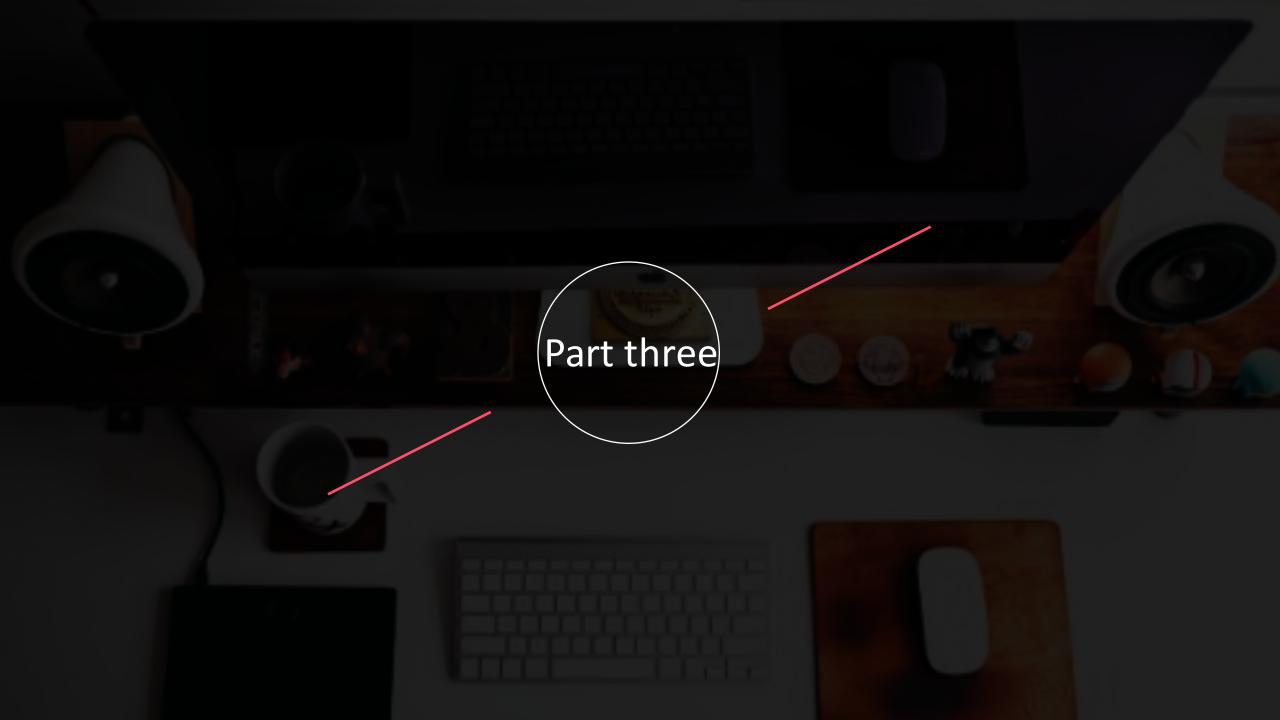
In panel B (1 month lag to form the portfolio), there are no obvious trend and ALL the strategies have significantly negative return.

Most significant positive return

J	K=	3	6	9	12	K=	3	6	9	12
		Panel A (no lag)					**Panel B (1 M lag)**			
3 Sell		-0.0055	0.0048	0.0053	0.0033		0.0228	0.0167	0.0128	0.0095
		-0.6643	0.6962	0.9305	0.7638		2.3656	2.3910	2.2311	2.1268
3 Buy		0.0565	0.0329	0.0240	0.0176		0.0052	0.0056	0.0045	0.0033
		6.0980	4.4426	3.6742	3.6188		0.7553	0.9762	0.9342	0.8654
3 Buy-sell		0.0620	0.0281	0.0187	0.0142		-0.0176	-0.0111	-0.0082	-0.0062
		16.7726	11.8843	8.3640	9.0847		-4.2319	-3.8577	-3.5450	-3.5696
6 Sell		0.0024	0.0078	0.0077	0.0060		0.0221	0.0159	0.0130	0.0101
		0.2759	1.1722	1.3458	1.3753		2.4372	2.4300	2.3165	2.3179
6 Buy		0.0427	0.0268	0.0202	0.0139		0.0049	0.0063	0.0050	0.0031
		4.9873	3.6637	3.1490	2.9565		0.7028	1.0487	1.0267	0.8045
6 Buy-sell		0.0404	0.0190	0.0125	0.0079		-0.0172	-0.0096	-0.0079	-0.0070
		11.3482	6.6410	5.2871	5.1378		-4.5289	-3.3165	-3.3688	-4.2746
9 Sell		0.0051	0.0097	0.0102	0.0079		0.0214	0.0166	0.0141	0.0112
		0.6009	1.3976	1.7153	1.7338		2.3774	2.4466	2.4780	2.4995
9 Buy		0.0402	0.0265	0.0190	0.0131		0.0075	0.0083	0.0056	0.0038
		4.4947	3.5728	3.0624	2.8182		0.9886	1.3689	1.1606	0.9841
9 Buy-sell		0.0350	0.0169	0.0088	0.0052		-0.0139	-0.0083	-0.0085	-0.0074
		9.1410	5.6134	3.9586	3.3028		-3.8844	-2.8287	-3.5432	-4.1385
12 Sell		0.0073	0.0117	0.0113	0.0092		0.0063	0.0068	0.0049	0.0034
		0.8332	1.6731	1.8897	1.9861		2.4484	2.5921	2.5742	2.6009
12 Buy		0.0351	0.0226	0.0163	0.0114		0.0226	0.0174	0.0145	0.0117
		4.1997	3.2385	2.7528	2.5623		0.8800	1.1653	1.0099	0.8933
12 Buy-sell		0.0278	0.0109	0.0050	0.0021		-0.0164	-0.0106	-0.0096	-0.0083
		6.8942	3.7270	2.2641	1.2787		-4.0621	-3.6538	-4.0289	-4.4487

Less significant

No obvious trend

Part three

REVERSAL EFFECT

Literature and introduction

Jegadeesh's finding on reversal effect

Jegadeesh (1990) documents profits of about 2% per month over 1934–1987 using a reversal strategy that buys and sells stocks on the basis of their prior-month returns and holds them for one month. *

Two possible explanations

1. Supported by Shiller (1984), Black (1986), Stiglitz (1989), Summers and Summers (1989)*

   Market prices reflect investor **overreaction to information**

2. Supported by Grossman and Miller (1988), Jegadeesh and Titman (1993)*

   Market prices change when large quantities of stocks are traded, or **price pressure**

Maybe they are not mutually exclusive

Hypothesis on Chinese stock market

We expect to see stronger reversal effect in China

Why?   -- Large number of individual investors, who tend to overreact towards information

              -- Poor market efficiency and stock prices are event-driven

* See Zhi Da (2014) A Closer Look at the Short-Term Return Reversal

REVERSAL EFFECT

Take holding period as the independent variable

We analyze reversal effect in lagging period scale, as well as holding period scale. Every time we control one variable constant and change the other variable.

First we take a glance at holding period scale. The table shows returns under different holding period.

Though there are no obvious trend in t statistics, we still observe something interesting!

Returns obviously decrease as J and K increases, but t statistics stay stable or even increase.

Let's check the standard deviation and kurtosis of returns.

J	K=	3	6	9	12
		Panel B (1 M lag)			
3 Sell		0.0228	0.0167	0.0128	0.0095
		2.3656	2.3910	2.2311	2.1268
3 Buy		0.0052	0.0056	0.0045	0.0033
		0.7553	0.9762	0.9342	0.8654
3 Buy-sell		-0.0176	-0.0111	-0.0082	-0.0062
		-4.2319	-3.8577	-3.5450	-3.5696
6 Sell		0.0221	0.0159	0.0130	0.0101
		2.4372	2.4300	2.3165	2.3179
6 Buy		0.0049	0.0063	0.0050	0.0031
		0.7028	1.0487	1.0267	0.8045
6 Buy-sell		-0.0172	-0.0096	-0.0079	-0.0070
		-4.5289	-3.3165	-3.3688	-4.2746
9 Sell		0.0214	0.0166	0.0141	0.0112
		2.3774	2.4466	2.4780	2.4995
9 Buy		0.0075	0.0083	0.0056	0.0038
		0.9886	1.3689	1.1606	0.9841
9 Buy-sell		-0.0139	-0.0083	-0.0085	-0.0074
		-3.8844	-2.8287	-3.5432	-4.1385
12 Sell		0.0063	0.0068	0.0049	0.0034
		2.4484	2.5921	2.5742	2.6009
12 Buy		0.0226	0.0174	0.0145	0.0117
		0.8800	1.1653	1.0099	0.8933
12 Buy-sell		-0.0164	-0.0106	-0.0096	-0.0083
		-4.0621	-3.6538	-4.0289	-4.4487

No obvious trend

No obvious trend

REVERSAL EFFECT

Take holding period as the independent variable

	Panel B Standard Deviation			
J	K=	3	6	9	12
3 Buy-sell		0.0301	0.0233	0.0178	0.0141
6 Buy-sell		0.0325	0.0268	0.0203	0.0150
9 Buy-sell		0.0333	0.0259	0.0195	0.0151
12 Buy-sell		0.0343	0.0249	0.0199	0.0161

	Panel B Kurtosis			
J	K=	3	6	9	12
3 Buy-sell		4.8367	3.5099	5.2484	3.7590
6 Buy-sell		4.1788	4.8195	9.0098	6.2909
9 Buy-sell		4.3725	4.2226	7.2191	3.7034
12 Buy-sell		5.8772	3.7495	6.6622	3.0104

SD decreases as holding period increases.

It is less risky to hold for longer period.

It seems to contradict with GBM assumptions: Volatility of stock returns is linear to the square root of time.

Chinese stock markets are, to some extent, predicable

Heavy tails are not severe in this strategy, which indicates that it is of little possibility to suffer extreme loss.

Evidence so far proved that Chinese stock market DO have a strong reversal effect, at least it is in 1M lagging period. Now we hope to examine different lagging periods.

REVERSAL EFFECT

Take the lagging period as the independent variable

We pick 3 month/3 month strategy for reversal effect analysis.

We test portfolio performance based on a sequence of: No lag, 1 week lag, 2 weeks lag, 3 weeks lag, 1 month lag, … up to 36 months lag.

We observe that in short term (less than 1 M), there are positive momentum effects. As lag period grows, positive returns fade away.
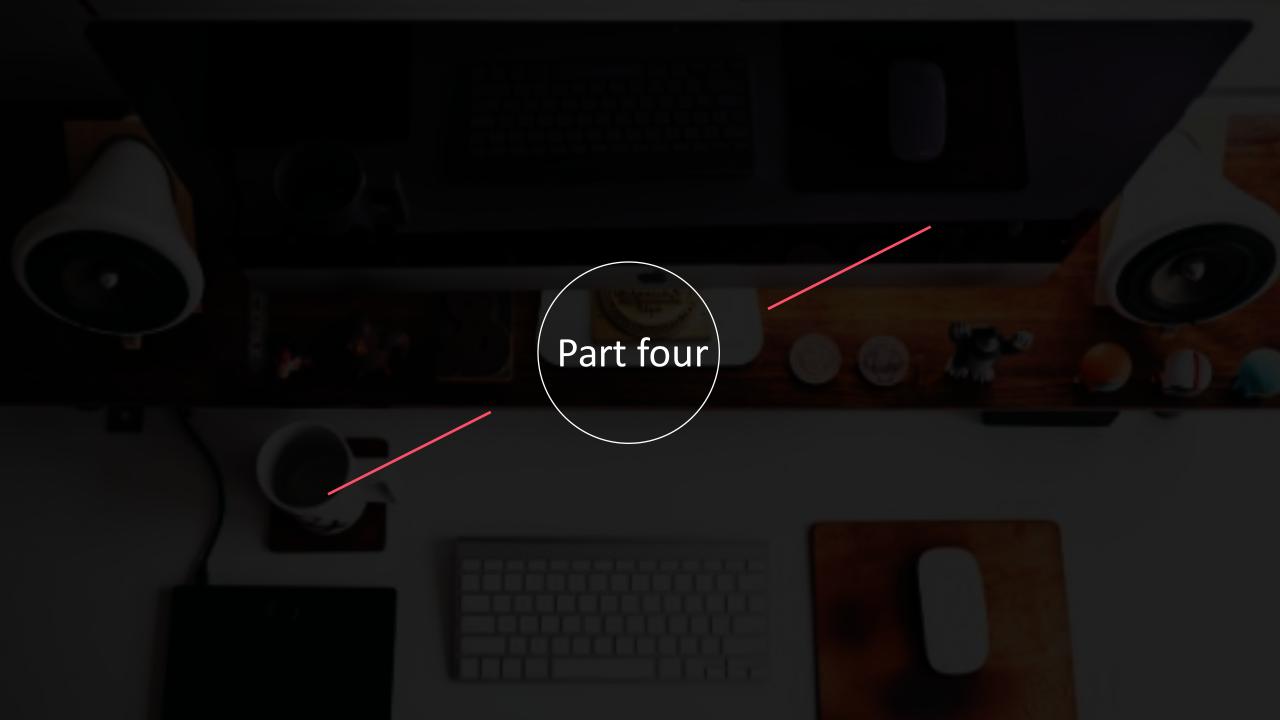
1 M < t < 16 M, there are reversal effects and returns tend to be negative.

However, in longer term, returns are positive again, though some of them are not significant.

Week lag		Month lag					
t	Monthly Return	t	Monthly Return	t	Monthly Return	t	Monthly Return
0	0.0620	1	-0.0176	13	-0.0075	25	-0.0099
	16.7726		-4.2319		-3.1377		-3.9999
1	0.0480	2	-0.0097	14	-0.0075	26	-0.0092
	14.7558		-2.8729		-3.4193		-3.4276
2	0.0302	3	-0.0083	15	-0.0041	27	-0.0091
	9.4006		-2.6656		-1.9062		-3.5560
3	0.0089	4	-0.0066	16	-0.0009	28	-0.0071
	2.5140		-2.2466		-0.3571		-3.2264
		5	-0.0061	17	0.0036	29	-0.0062
			-1.7256		1.7604		-2.7410
		6	-0.0037	18	0.0039	30	-0.0049
			-1.1992		2.0655		-2.2892
		7	-0.0034	19	0.0045	31	-0.0051
			-1.4043		2.1487		-2.1977
		8	-0.0005	20	0.0017	32	-0.0025
			-0.1876		0.8711		-1.0980
		9	0.0007	21	0.0018	33	0.0000
			0.2839		0.8005		-0.0221
		10	-0.0003	22	-0.0025	34	0.0029
			-0.1509		-1.2168		1.2479
		11	-0.0035	23	-0.0056	35	0.0031
			-1.4726		-2.3030		1.2876
		12	-0.0067	24	-0.0094	36	0.0027
			-2.9848		-3.9042		1.0300

Less significant

Positive again

Part four

CONCLUSION

01 Momentum

We indeed observed momentum effect in China and the strategy returns are significantly positive.
However, the momentum time scale distribution seems to be very different...

02 Short Term

Momentum in China tend to be short-term. It will be more profitable to form portfolio based on past return in a short period of time and hold it for a short time as well

03 Reverse

Chinese stock market has a strong reversal effect which changed the time structure of momentum

Commonly known momentum and reversal effect

< 1 M
Reverse

> 1 M
< 12 M
Momentum

> 12 M
Reverse

Momentum and reversal effect in China

< 1 M
Momentum

> 1 M
< 16 M
Reverse

> 12 M
Hard to predict

THANK YOU