Comparison of Different Stock Sectors Based on Momentum and Mean-Reversion Strategies

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Abstract. People are always interested in better predicting the future stock price to both earn interest and analysis the future economy. To reach this target, people have made many strategies to predict future trends. However, in the stock market, different industrial sectors will have different characteristics and those characteristics determined the performances of different trading strategies. In this paper, the author analyzes some characteristics of different US stock industrial sectors by analyzing the performances of the momentum strategy and mean-revision strategy. After simulating the performance of using the two strategies by using the past 13 years' real stock price of different stock sectors, the linear regression analysis, factors analysis, and returns comparisons were taken. The result shows basic materials, utilities, and real estate sectors have relatively stable values and stronger tendencies. Their stock price could show more information about their companies. On the other hand, the stock sectors like the technology sector's stock prices don't tell a lot of information. Those stock sectors asked for additional information to make a nice investing strategy.

Keywords: Stock Market · Factors Analysis · Return Rate · Price Cycle

1 Introduction

With the birth of stocks in 1602, people increasingly rely on them as a tool to measure the importance of an enterprise. Ideally, the stock's price could show how important an enterprise is (to what extent the enterprise could benefit society) and the enterprise's potential. People could also earn some profit through the stock market by predicting future stock prices. Some companies even survive on the stock market. In this case, predicting the trends of stock prices are crucial both for individuals and for the whole society. Since the stock market's structure, people could gain huge profits through buying winners and selling losers, welly reward people who rightly predict the future stocks prices, people have paid huge effort.

To better predict stock prices, people have done extensive research. Some research deals with finding the factors that may affect the stock price. For example, the classic model, the Fama-French model, points out that stock is affected by Rm − Rf, SMB, and HML. Xin Chang digger into the benefits and drawbacks of higher liquidity [1]. Higher liquidity means the stockholder could easily sell it to currency, but also means a higher

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risk that the stock price crash [1]. Some research deals with finding some patterns of stocks. For instance, the mean-revision strategy. This strategy is based on the theory that the stock market always overreacts, either in an up way or a down way. Overreaction is one of the common patterns in the stock market which has been well-tested a long time ago [2]. Another example of classic patterns study would be the momentum strategy in that people believe the stocks that performed well in the past will continuously perform well in the future. Jegadeesh, Narasimhan, and Sheridan Titman are some researchers who engaged in the analysis of this pattern [3]. Some research deals with the link between stocks and real-world prices. For example, Stavros Degiannakis has found that there is a strong relationship between oil prices and stock markets [4].

As technology improves, computers become stronger and stronger, we have many new tools to analyze the stock market. Unlike previously we could only find some correlations that are both statistically and logically evident, we could further study some undetectable parts of the stock market. Yan, Xuemin (Sterling), and Lingling Zheng used a computer program to analyze 18000 fundamental signals from financial statements [5]. They found that many signals work very well in predicting future stock performance [5]. Wenjun Zhang used a data study model called Attention-BiGRU through the SARIMA time sequence forecasting method to fit the stocks in CSI 300 Index to study the efficiency of using a neural network correlation algorithm on predicting stocks [6]. Some people even begin letting computers themselves study the stock market. Mullainathan, Sendhil, and Jann Spiess argue that machine learning could better cover the patterns that not include in the database which means work relatively better out-of-sample [7].

With so many kinds of strategies and models to predict the stock market, some people begin to focus on evaluating different strategies and optimizing them based on their opinion. Dongwan Hu tests the robust models' performance under an unstable environment [8]. She found that the greater the robustness, the lower the returns which means the best strategy would always change [8]. Wanling Fu tests whether the Fama-French model suits for China stock market and compare its performance with the CAPM model [9]. She also added the liquidity factors in the model and found it better suits the stock market [9]. Similar to Ms. Fu, Jiangyue Li tested whether the VaR theory works well in China [10]. Ms. Li also add the HLVar, a new factor, in the model to better fit the stock market [10].

However, currently, there is limited research about analysis about comparisons between different stock sectors like Agriculture and manufacturing sectors through different strategies performances. This kind of comparison could both help future researchers choose the model to fit the stock market and help the people who buy stock without using models choose the appropriate strategy. To fill the gap, the author would analyze momentum and mean-revision strategies' performance in different American stock industry sectors. Analyzing different stock sectors' up-and-down cycle, value stability, and many other characteristics based on the past 13 years' real stock price find in yahoo.

Table 1. Stock list (only listed top tens)

Basic material	Financial Services	Real Estate	Health Care	Utilities	Communication services	Energy	Technology	Industrials
BHP	BRK-A	PLD	UNH	NEE	GOOGL	XOM	AAPL	UPS
LIN	BRK-B	AMT	JNJ	DUK	GOOG	CVX	MSFT	RTX
RIO	V	EQIX	NVO	SO	META	SHEL	NVDA	HON
CTA-PB	JPM	CCI	LLY	NEE-PR	DIS	TTE	TSM	BA
VALE	JPM-PC	SPG-PJ	MRK	DUK-PA	TMUS	COP	AVGO	LMT
APD	MA	PSA	ABBV	NGG	VZ	BP	ASML	UNP
SCCO	JPM-PD	SPG	PFE	SRE	CMCSA	EQNR	ORCL	DE
SHW	BAC	O	TMO	AEP	T	ENB	CSCO	CAT
CTA-PA	BAC-PK	PSA-PH	AZN	D	NFLX	SLB	CRM	GE
FCX	BAC-PL	PSA-PK	DHR	EXC	AMOV	PBR	ACN	ADP

2 Methods

2.1 Data Source

The data of this study includes the top 50 stocks in different NYSE and NasdaqG5 stock sectors including the healthcare sector, basic material sector, financial services sector, real estate sector, utility sector, communication services sector, energy sector, industrials sector, technology sector. Each stock includes the daily close prices from 2010,1,1 to 2023,3,11. The data is coming from yahoo finance and is massive downloading by using the yfinance library. The abstractions of the stock's names are listed Table 1.

To analyze different stock sectors separately, the data was divided into different CSV files with companies' abstractions as headers and dates as indexes based on different industrial sectors.

2.2 Research Method

In this research, the author did simulations of buying stocks in different stock industrial sectors and analyze different stock sectors' characteristics based on the simulations' performances. The portfolios that have been used in the simulations are either based on the mean-revision strategy and momentum strategy.

Mean-revision strategy functions [2]:

$$P_{t+1} = P_t + \lambda(P_{expect} - P_t) + \varepsilon_{t+1} \tag{1}$$

Momentum strategy functions [2]:

$$R^e_{t+1} = \alpha + \sum_{i=1}^{M} \beta_i f_t^i + \varepsilon_{t+1} \tag{2}$$

Here, R stands for future return. α stands for constant return rate. f stands for each stock's "momentum". And, ε stands for error. To find the "momentum", we have the function:

$$MA_t^N = \frac{1}{N} \sum_{s=t-N}^{t} R_s^e \tag{3}$$

Here, MA stands for average "f" and N stands for the look back period.

3 Results and Discussion

In order to analyze the performances of two strategies when they are used in different stock sectors, finding the best fitting parameter is a key step. In addition, the best-fitting parameter also includes a lot of information. When looking through all parameters, there is one parameter that is very important in both strategies: the look-back period. Both the mean-revision strategy and momentum strategy assume that tomorrow's stock price is related to the stock state and the stock state could be analyzed through the previous days' stock prices. In this case, how many days before should be analyzed is essential and is different in different stock sectors. Also, many important characteristics like how long a sector's stock value stays and how fast a sector's stock trend alters. When look back period is inappropriate, the result will be very different.

Figure 1 shows the simulated cumulative return of using momentum strategy to buying stocks in communication services sector when the look-back period is inappropriate. Even though this "inappropriate" is mostly cause by COVID-19 era's special circumstance, we can see that inappropriate look-back period could cause the strategy fail to predict the future stock trend.

Figure 2 shows the simulated cumulative return of using momentum strategy to buying stocks in communication services sector with appropriate look-back period. According to the differences between two graphs above, an appropriate look-back period could help reduce the drawdown and increase the return.

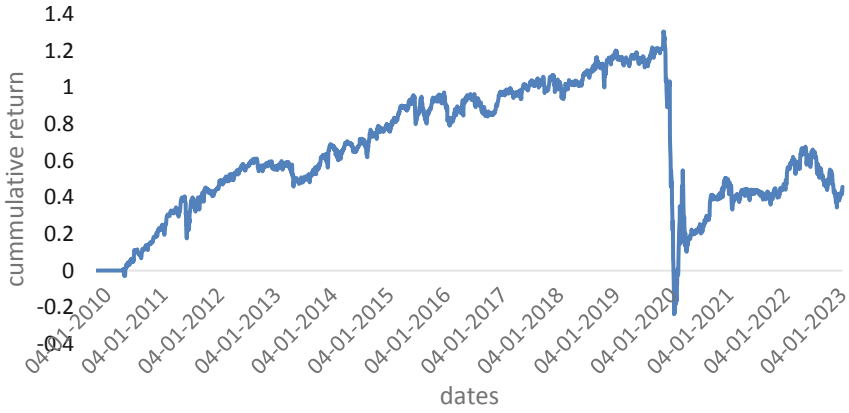

Fig. 1. Performance of momentum strategy on Communication Services sector (Note: this performance is when look-back period is 19 which is inappropriate).

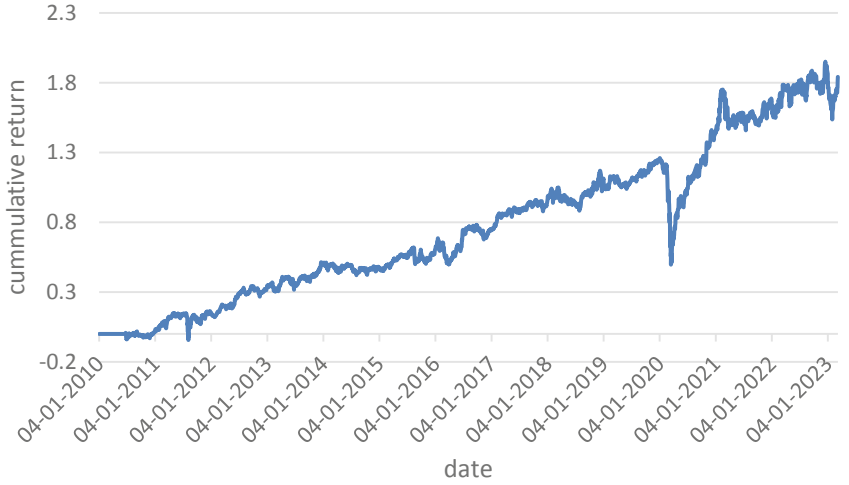

Fig. 2. Performance of momentum strategy on Communication Services sector (Note: this performance is when look-back period is 7 which is appropriate).

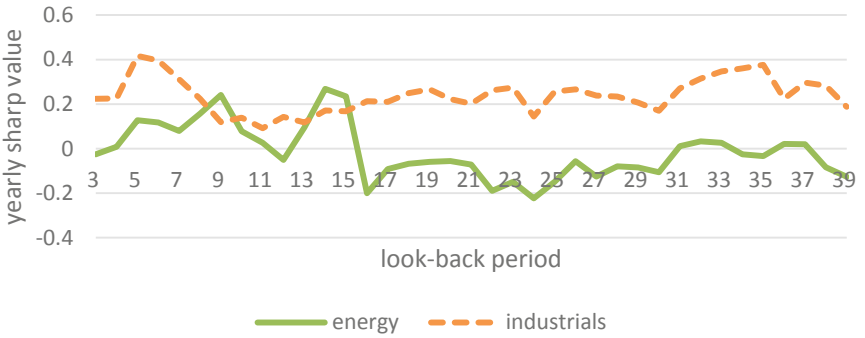

Fig. 3. Momentum strategy performances with different look-back period (Note: this graph includes the two sector that not suit momentum strategy well).

Since it is massive to use one graph to show the performances of momentum strategy for all sectors, the author separates one graph to three graphs according to different sectors' performance. According to Fig. 3, 4 and 5, shorter look-back period (3–9 days) could help improve the performance of momentum strategy on utilities, real estate, financial services, and basic material sectors. But for other 5 sectors, the correlations between the look-back period and performance are not significance.

Figure 6 shows the yearly sharp value of using the mean-revision strategy to simulate all nine stock sectors with different look-back periods. According to the graph, the mean-revision strategy clearly suits the basic material sector better compare with other sectors. Among these 9 sectors, the basic material sector, technology sector, energy sector, and communication services sector have declining performance when increasing the look-back period of mean-revision strategy. There is no significant evidence to show the

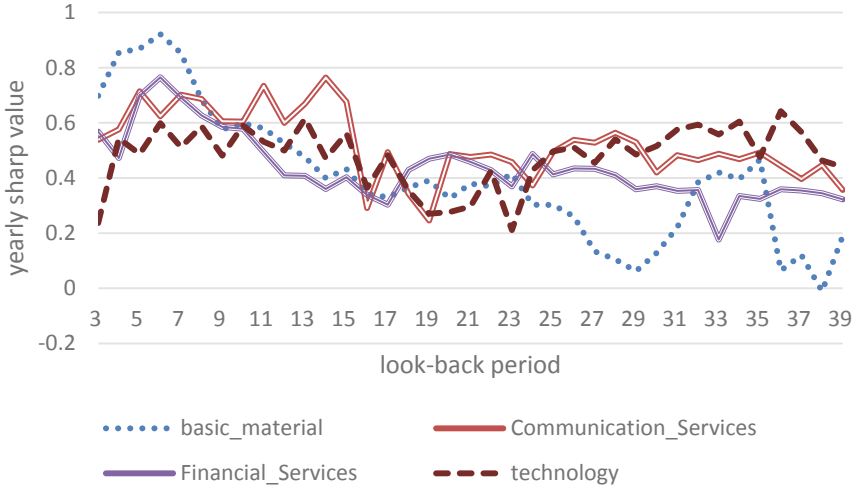

Fig. 4. Momentum strategy performances with different look-back period (Note: this graph includes the two sector that suit momentum strategy).

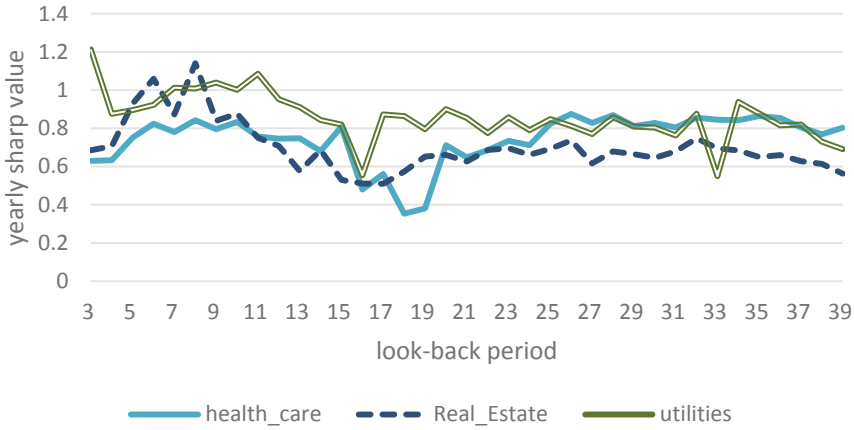

Fig. 5. Momentum strategy performances with different look-back period (Note: this graph includes the two sector that suit momentum strategy very well).

correlation between the performance of using mean-revision strategy and look-back period length in Financial services, industrials, real estate, and healthcare sectors. For the energy sector, it seems that it suits a longer look-back period more than the shorter one.

In addition to the look-back period, the performances of using momentum strategy and mean-revision strategy to simulate different stock sectors could also offer some information.

Figure 7 shows the maximum yearly sharp value and the mean of the top five yearly sharp values by using the mean-revision strategy to simulate all nine stock sectors.

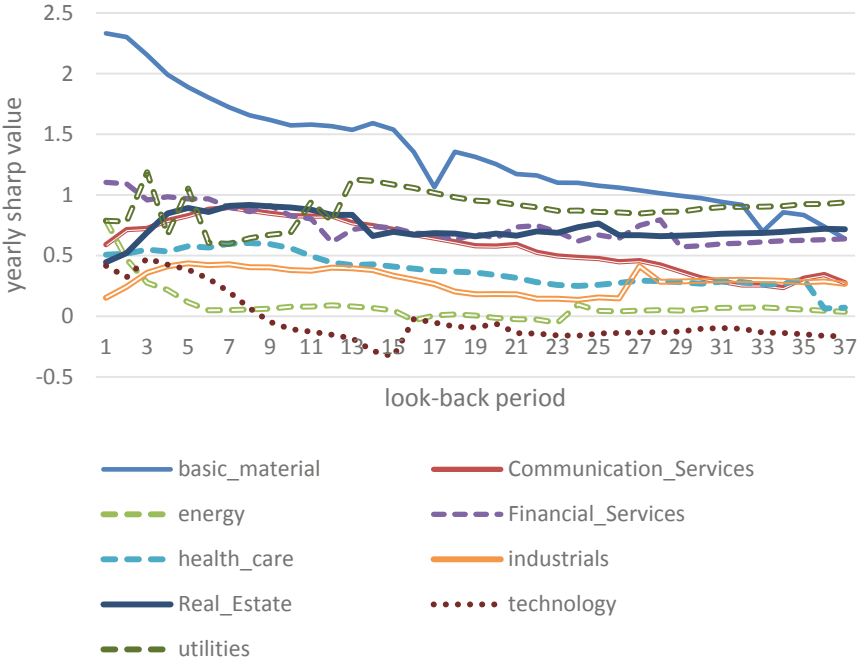

Fig. 6. Mean-revision strategy performances with different look-back period (Note: this graph includes all 9 sectors mentioned in Table 1).

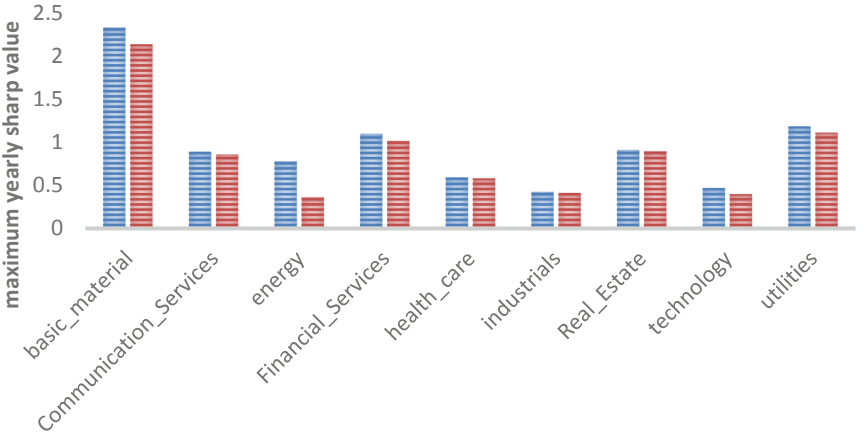

Fig. 7. Maximum yearly sharp value based on mean-revision strategy (Note: blue is the maximum sharp value, orange is the mean of top five sharp value).

According to the graph, the basic material sector suits the mean-revision strategy significantly well. The yearly sharp value could reach 2.2. This yearly sharp value is equivalent to about 30% yearly returns with a 0.3 maximum drawdown. The financial services sector, real estate sector, utility sector, and communication services sector also suit mean-revision strategy well, the maximum shape values are all around 1. Even though the maximum sharp value of the energy sector is very close to the communication services sector, its low top five sharp values mean tells that its high maximum might is just an accident, not reliable. Based on the graph, basic material companies' value is very stable. Communication services companies, financial services companies, real estate companies, and utility companies have relatively stable value. The value of energy companies, health care companies, industrial companies, and technology companies are relatively unstable. This is reasonable because these sectors' companies related to technology improve which is not predictable.

Similar to Fig. 7, Fig. 8 provided a ranking of the performances of using the momentum strategy to simulate different sectors. According to the graph, the tendency of the utility sector and real estate sector are relatively more reliable, and the tendency of the energy sector and industrials sector are not very reliable. People may find that in the energy sector and industrials sector, previous days' returns are not related to tomorrow's return. This might be because the industrials sector's companies and energy sector's companies are closely related to "policies". The large effect of out-market factors might be the reason why the momentum strategy doesn't suit the energy and industrials sectors.

Table 2 shows the maximum drawdown of using the mean-revision strategy and momentum strategy on 9 different stock sectors. Unlike sharp value, maximum drawdown only represents the risk of using a strategy to simulate a stock market. According to the table, the risk is high when using a mean-revision strategy to fit the real estate,

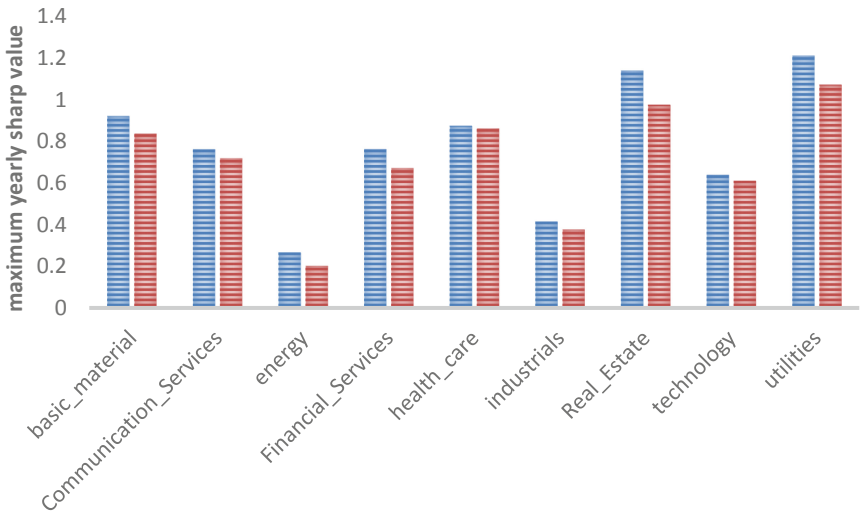

Fig. 8. Maximum yearly sharp value based on momentum strategy (Note: blue is the maximum sharp value, orange is the mean of top five sharp value).

Table 2. Least maximum drawdown table.

Stock sectors	Mean-revision	Momentum	Stock sectors	Mean-revision	Momentum
Basic material	0.125	0.236	Communication services	0.190	0.278
Financial Services	0.155	0.183	Energy	0.308	0.234
Real Estate	0.310	0.383	Technology	0. 409	0.268
Health Care	0.111	0.206	Industrial	0.262	0.163
Utilities	0.255	0.190	-	-	-

Table 3. Stock sectors' ranking.

Ranking	Value stability	Tendency	Ranking	Value stability	Tendency
1	Basic material	Utilities	6	Health Care	Financial Services
2	Utilities	Real Estate	7	energy	Technology
3	Financial Services	Health Care	8	Industrial	Industrial
4	Real Estate	Basic material	9	Technology	energy
5	Communication services	Communication services	-	-	-

energy, and technology sectors. The risk is high when using a momentum strategy to fit the real estate, communication services, and technology sectors. Since the risk is high for both strategies in the technology sector and real estate sector, it seems the fluctuation of these two sectors is relatively larger than other sectors. People need ready for these two sectors' stocks to drop suddenly.

In Table 3, This ranking is an overall ranking, the sectors could divide into smaller parts and different parts would have different value stability and tendency. Like both in the Industrial sector, steel stocks have different tendencies related to cloth stocks.

4 Conclusion

By analyzing the performances of using mean-revision strategy and momentum strategy to simulate different stock sectors, the basic material sector, utility sector, and financial services sector have high value-stability. The energy sector, industrial sector, and technology sector have low value-stability. According to this result. People who want

to investigate stocks based on their past performances in the stock market should consider the basic material sector, utility sector, and financial services sector instead of the energy sector, industrial sector, and technology sector. For the tendency part, the utility, real estate, and healthcare stock sectors have a stronger tendency but the technology, industrial, and energy sectors' tendency are relatively weak. People who want to invest in stock sectors like the technology sector need additional information to determine to buy which bond because the correlation between past stock price data and future stock price is relatively weak. For example, to judge which technology company would succeed, people need to have some professional knowledge to help them make the determination instead of only looking for the company's previous stock price.

Interestingly, energy and industrial stocks' values are not stable. COVID and the war might be two important factors that affect these two stock sectors' stabilities. As getting the yearly sharp values, the author also found that, overall, the appropriate look-back period is become shorter especially cut during the COVID period which could be further analyzed. In the future, people could dig deeper into different stock sectors' characteristics by analyzing other models' performances. More characteristic means deeper understanding, better model, and saving time.

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