Momentum Trading in Chinese Derivatives Market: Investigation and Reflection

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Abstract. Momentum trading strategies are universally popular among investors and financial institutions. However, momentum trading is juvenile in China due to the lack of diversity in China's derivatives market. This study examines the feasibility of momentum trading strategies in discretionary and systematic trading in the Chinese financial derivatives market. The research uses quantitative methods to implement the trading strategy: an algorithm based on relative strength indexes for foreign exchange forward trading, an algorithm combining moving average convergence and divergence with a 5-day moving average for commodities and derivatives trading and risk-parity weight assignment. In the 5-year backtest evaluation of systematic trading in the Chinese derivatives market, this approach yields satisfactory outcomes despite the exclusion of some practical factors. The study discovers that although momentum trading faces challenges from market incompleteness and a limited reservoir, momentum trading strategies in the Chinese derivatives market have great potentials. With the expansion of the Chinese derivatives market and more robust momentum trading strategies integrating advanced ones from the Western market, momentum trading in China embraces lots of opportunities.

Keywords: Momentum Trading · Financial Derivatives · Chinese Market · Systematic Trading · Trading Algorithms

1 Introduction

Momentum trading is a popular style in financial derivatives trading. Momentum trading has a straightforward starting point: looking for future trends in asset price changes. For different asset classes, they have various indicators to predict movements of price changes. However, the ultimate goal is to find buying opportunities over a short time interval and selling opportunities when the portfolio loses its profitability trend. From the long haul, investors can repeat this process to update their portfolios. With the rapid

development of data science and growing automation in financial transactions, high-frequency momentum trading has played a significant role in the financial market. This article will mainly explore momentum trading strategies of foreign exchange (Forex), futures, and options.

In the experiments involving different models, we choose the universe to be the Chinese financial market. The Chinese financial market is rapidly developing after the introduction of financial derivatives. Hence, the Chinese market is a desirable proving ground of momentum trading strategies, as there are few state-of-art momentum strategies in the Chinese market currently. Although, as Wu states, momentum trading strategies do not have satisfactory results in Chinese stock markets, their effectiveness in the Chinese derivatives market still worth studying due to different characteristics of the asset classes [6]. Such specification specifies our concentration on investigating the feasibility of momentum strategies and reflecting on experimental outcomes in the Chinese market. Topics will cover model establishment, trading presentations (discretionary), systematic trading strategy back-testing, and research into further topics.

The bedrocks of our research are basic momentum trading models. Regarding the basic models, we use different indicators to make trading decisions on each asset class respectively. We apply the basic models in our discretionary trading decisions in Sect. 2; the basic models will also be the basis of systematic trading models in Sect. 3. For Forex forward trading, the model the team uses is RSI (relative strength index) for the forward rate: long when RSI is low and short when RSI is high.

Interpretation and calculation of the RSI indicator will be illustrated in further sections. For commodity trading, the indicators are MA5 (5-day moving average) of the forward rate for the Forex and the commodities. When the current forward price or futures price is above the MA5, we take it as the sign to buy and vice versa. Compared to models in Forex and commodity, the decision-making process in option trading is less formulated. For option trading, we choose IV (Implied volatility) as the indicator to select options in the portfolio. If the implied volatility of one option is expected to increase dramatically, we will long that option. If the implied volatility is expected to decrease sharply, we will short that option.

The remainder of this study is organized as follows: Sect. 2 presents portfolios and performance in discretionary trading; Sect. 3 describes the derivation, implementation and result presentation of systematic trading; Sect. 4 outlines insights from more advanced momentum strategies; Sect. 5 serves as conclusion and reflection.

2 Discretionary Trading

Different from systematic trading, discretionary trading involves decision processes made by investors. Under a momentum style, the team has made four discretionary trading decisions every week. The universe for the discretionary trading covers financial derivatives available in the Chinese market: forwards, commodity futures, and options (including Hong Kong stock options and index options). The period for discretionary trading is 2021-03-08 to 2021-04-02, covering 20 trading days.

Regarding the construction of the portfolio, the team selects assets using the basic model. The team makes trading decisions by looking at indicators above for Forex forward prices, commodity futures contract prices, and the Implied Volatility for options.

Table 1. First Week Discretionary Trading

Forex (90%):

Name	CHF	JPY	AUD	CAD
Long/Short	Long	Long	Short	Short
Open Price	0.931	108.382	1.302	1.266
Close Price	0.9247	108.555	1.2841	1.2531

Commodities (9%):

Name	CLK21	HGK21	GCM21
Underlying	Crude Oil	Copper	Gold
Long/Short	Long	Long	Short
Open Price	65920	101750	1725200
Close Price	65640	103500	1722400

Derivatives (1%):

Underlying Name	AAPL	TSLA
Call/Put	Call	Put
Exercise Date & Strike	2021-04-01 & 120	2021-04-01 & 600
Long/Short	Long	Short
Open Price	3.75	65.00
Close Price	4.33	16.27

Regarding portfolio construction: for weight assignment among asset classes in each portfolio, the team follows the risk-parity based on data in the previous week. Moreover, within each asset class with the same long/short type, the team assigns equal weights to each component; the team also chooses a long-short neutral strategy between long and short assets.

The selected portfolio for the weeks is presented in the following charts. The "open price" and "close price" are taken as the forward rates for Forex, price per contract for commodities, and price per share for derivatives.

Week 1: in this week's trade, we assume that the numeraire for all the assets is RMB (which should be USD in reality) as a simplification. The currencies we long show a comparatively lower RSI while we short those with higher RSI; the futures we long and short respectively have spot prices above and below the 5-day moving average. For options, we long when historical volatility is higher than implied volatility and short vice versa. The portfolio is presented in Table 1.

Week 2: starting from this week, we change the universe to be products available in the Chinese market. Due to limited Chinese mainland option market choices, we choose the universe for options trading to be stock options available at Hong Kong Exchanges and Clearing. The currencies we long show a comparatively lower RSI while we short those with higher RSI; we long the futures when the MACD is higher than MA5 (a strategy similar to the systematic trading case). For options, we long when historical

Table 2. Second Week Discretionary Trading

Forex (71%):			
Name	USD	JPY	RMB
Long/Short	Long	Long	Short
Open Price	0.1583	17.213	1
Close Price	0.1580	17.242	1
Commodities (27%):			
Name	CF9999	AL2104	
Underlying	Cotton	Aluminum	
Long/Short	Long	Long	
Open Price	17310	15870	
Close Price	17415	15260	
Derivatives (2%):			
Underlying Name	MTR	Meituan	
Call/Put	Put	Call	
Exercise Date & Strike	2021-03-21 & 33	2021-03-21 & 330	
Long/Short	Short	Long	
Open Price	0.04	14.83	
Close Price	0.06	19.54	

volatility is higher than implied volatility and short vice versa. The portfolio is presented in Table 2.

Week 3: we are following the same rules as the previous week. The portfolio is presented in Table 3.

Week 4: we are following the same rules as in previous weeks. The portfolio is presented in Table 4.

The accumulative return for the portfolio is illustrated in Fig. 1 (assume the portfolio is self-financing; transaction cost ignored for simplicity).

The performance is satisfying over the period of March 8th to April 2nd. Over the period, the portfolio has reached a return of 6% with a Sharpe ratio of 5.06 where the benchmark is the risk-free interest rate in China (yearly 2.9%) (Table 5).

Overall speaking, this portfolio is growing steadily: all the four trades assign most of the weights in the asset of Forex and Commodities. On the one hand, compared to the least volatile Forex trading, the portfolio return is not that modest thanks to the inclusion of futures contracts. On the other hand, the portfolio has well controlled the volatility based on the risk-parity weight assignment.

In conclusion, the idea of constructing portfolio based on RSI/MACD/MA5 indicators and the strategy of risk-parity is effective in reality. The following section about systematic trading is an extension of the criterion in discretionary trading.

Table 3. Third Week Discretionary Trading

Forex (63%):

Name	HKD	EUR	CHF	JPY
Long/Short	Short	Long	Long	Long
Open Price	1.2186	0.1334	0.1477	17.242
Close Price	1.2117	0.1342	0.1488	17.134

Commodities (36%):

Name	FG105	ZC105	WH105	SK105
Underlying	Glass	Steam coal	Wheat	Sugar
Long/Short	Long	Long	Long	Long
Open Price	2084	670	2770	5386
Close Price	2051	695.8	2775	5337

Derivatives (1%):

Underlying Name	Ali Health	HKE	CREC
Call/Put	Call	Call	Call
Exercise Date & Strike	2021-3-30 & 18.5	2021-03-30 & 185	2021-03-30 & 4.3
Long/Short	Short	Long	Long
Open Price	3.85	278.2	0.01
Close Price	4.85	282.01	0.03

Table 4. Fourth Week Discretionary Trading

Forex (63%):

Name	CHF	JPY	SGD	USD
Long/Short	Long	Long	Short	Short
Open Price	0.1571	17.152	0.2114	0.1488
Close Price	0.1565	17.337	0.2106	0.1483

Commodities (36%):

Name	FG105	CF105	SR105	UR105
Underlying	Glass	Cotton	Sugar	Urea
Long/Short	Long	Long	Long	Long
Open Price	14755	2044	5300	1981
Close Price	14875	2117	5333	1923

Table 4. (*continued*)

Derivatives (1%):			
Underlying Name	Ali Health	Gearing Auto	Galaxy
Call/Put	Call	Call	Call
Exercise Date & Strike	2021-04-29 & 20	2021-04-29 & 18.5	2021-04-29 & 67.5
Long/Short	Short	Long	Long
Open Price	2.22	1.81	5.03
Close Price	3.34	2.40	5.48
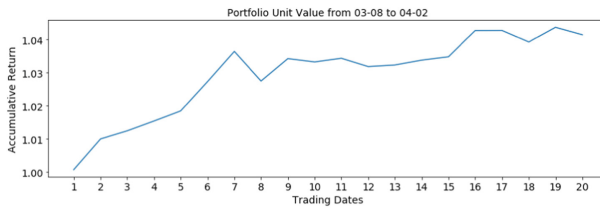
Fig. 1. Unit Value of Discretionary Trading Portfolio

Table 5. Discretionary Trading Performance Analysis

Annualized Return	49.77%
Maximum Drawdown	0.86%
Annualized volatility	9.24%
Sharp Ratio	5.06

3   Systematic Trading

3.1   Overview

Systematic momentum trading involves high-frequency trading under persistent rules for momentum indicators. Different from discretionary trading, all the selections of assets are made by programming without investors' intervention. Indicators vary among other asset classes, and the standard rebalancing frequency is daily for Forex. In designing the algorithm and evaluating, the team makes the portfolio self-financing and the initial capital CNY100,000,000 without adding cash flows into the portfolio. The following subsections illustrate the team's systematic trading strategies for different asset classes under a consistent momentum style. The complete version of python codes for data processing and backtest evaluation is available in GitHub (github.com/JamesWu0710/cis2021_momentum_trading).

3.2   Forex Trading

3.2.1   Rules

The team chooses RSI as the primary indicator to determine the portfolio breakdown. RSI stands for Relative Strength Index, measuring the magnitude of recent price changes (oscillations) to evaluate overbought or oversold conditions in asset price. It is an essential indicator in trading with Forex: it compares price momentums in increasing and decreasing trend. A large RSI usually manifests an overbought signal, showing potential future decreases in the prices, and a minor RSI demonstrates opposite movements. Hence, the team's strategy is to long the oversold ones and short the overbought ones to follow the underlying trend of price movements. The calculation of RSI over P days is as follows:

$$\text{RSI} = 100 - \frac{100}{\text{RS} + 1}$$

$$\text{RS} = \frac{\text{Average Gain} \cdot (P - 1) + \text{Last Day Gain}}{\text{Average Loss} \cdot (P - 1) + \text{Last Day Loss}}$$

Based on formulas above, below is the implementation structure of the Forex portfolio construction rules:

1. On each trading day, select 20-day historical data till the previous trading day for each forward contract.
2. Calculate the most recent 5-day RSI for each currency and store as scores and 5-day average return as auxiliary indicators.
3. Consider the overall bearishness: if the maximum average return in past 5 days is negative (quite often), then the signal is a "Short," meaning that the strategy deposits money in Chinese bank and do short-selling only (zero position in longing).
4. Rank the scores and select currencies with 1 highest RSI and 2 lowest RSIs. Based on long-short neutral principle, the strategy longs currencies with 2 lowest RSIs with equal weights and short currencies with the highest RSI with total money to short tantamount to total money to buy.

3.2.2   Data Description

Due to the limited access to historical prices data for forward contracts in Forex trading, the team decides to implement a simulation of forwarding prices data. The group obtains the following raw data:

1. Regarding exchange rates, the team collects 5-year daily historical data of currency pairs: CNY versus other currencies. The currencies are the commonly traded ones in the Chinese Forex market: USD, AUD, CAD, SGD, JPY, CHF, EUR, GBP, and HKD. The primary data sources are Yahoo Finance and Bloomberg. For simplicity, we ignore the possible pegging relationship between some of currencies an consider all currency pairs are freely tradable.

2. Regarding inteest rates in different nations, the team collects 5-year monthly historical data of short-term interest rates in different countries corresponding to the currencies (including China). The data source is https://research.stlouisfed.org/, an open-source website for economic data.
1. Based on the raw data, the team has completed the following steps to simulate forward prices:
2. Missing data processing: the team implements linear interpolation for missing data in exchange rates. This yields reasonable predictions of missing exchange rate data.
3. Extension of monthly data: under the assumption that interest rates are constant in the same month, the team assigns short-term interest rates for each country on each trading day. For example, the short-term interest rate in China on 2020–03-05 is the same as that in 2020–03-28.
4. Data simulation: the team uses the Interest Rate Parity to simulate the short-term forward prices on each trading day. Formula for the calculation is:

$$F_{sim}(t) = \frac{(1 + r_{CNY})}{(1 + r_{FOR})} \cdot S(t)$$

where r_CNY, r_FOR denote the interest rate in China and targeted foreign country respectively and S(t) is the corresponding spot rate at time t. The team will adopt the simulated data for forward portfolio selection and evaluation.

3.2.3 Backtest Evaluation

In the 5-year back-test on Forex trading, the RSI strategy does decent jobs in capturing the underlying price movements most of the time. The performance is presented in Fig. 2 (Table 6).
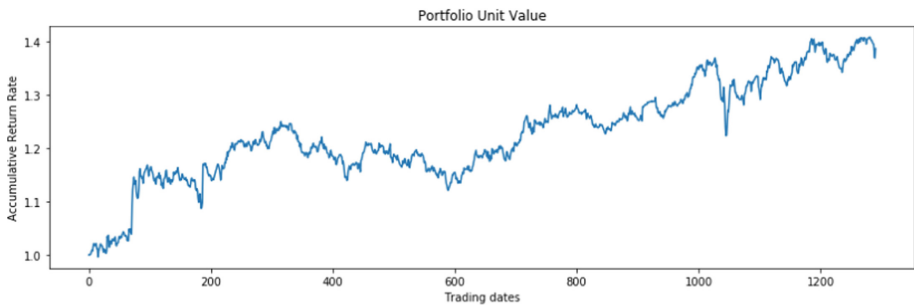

Fig. 2. Systematic Forex Trading Portfolio Unit ValueIt reaches a return of 38.7% in the 5-year scale and is significantly better than similar assets like depositing or longer-period holding of currency pairs. Moreover, the common status of long-short neutral in this portfolio helps balance the Forex portfolio to avoid high volatility and to increase return levels.

Table 6. Systematic Forex Trading Performance Analysis

Annualized Return	7.74%
Maximum Drawdown	10.67%
Annualized volatility	12.94%
Sharp Ratio	0.37

3.2.4   Conclusion

The above result shows excellent performance. However, the outcome might deviate from reality due to several limitations in the experiments. Firstly, the simulation uses short rates on a discrete basis, which leads to less accurate results. Secondly, the trading simulations do not consider the transaction cost and trading time availability. Real-world restrictions would influence the performance and execution of the above trading. Those fallacies might somehow hurt the experimental outcome, but the feasibility of the strategy will remain. Conclusively, systematic trading on the forward contracts using the RSI indicator is an approach in Chinese market Forex trading with great potential.

3.3   Commodities Trading

3.3.1   Rules

The team chooses MACD and 5-day moving average as indicators to help us make our transaction. MACD stands for Moving Average Convergence Divergence, which shows us the relationship between two moving average of a certain security.

The calculation of MACD is below:

1. EMA, the Exponential Moving Average, uses the weighted arithmetic average to measure the trend. The formulas for calculations are:

$$EMA_N = EMA_{N-1} * \left(\frac{N-1}{N+1} \right) + X_n * \left(\frac{2}{N+1} \right)$$

$$EMA_N(X_n) = \frac{2X_n + (N-1)EMA_N(X_{N-1})}{N+1}$$

where N stands for the day N, EMA_N stands for the EMA of day N, X_n means the close price of day N and N is a positive integer. Plus, EMA1 = X1. Therefore, we can obtain the 12-day EMA (EMA12) and 26-day EMA (EMA26) by this formula.

2. Then we calculate MACD: it equals to EMA12 - EMA26.

A positive MACD with a price higher than MA5 indicate that the price embraces an upward trend. Therefore, the team would make a transaction when there is a positive MACD of a futures contract, and its price is higher than MA5. Below is the implementation structure of the futures portfolio construction rules:

1. Calculate the MACD of different futures contracts and find the contracts with a price higher than MA5.
2. Rank the candidates by MACD.
3. Choose the top 10 contracts to buy in with equal weight strategy and clear our position every day.

3.3.2 Data Description

The team collects 5-year daily historical data of futures contracts in Zhengzhou Commodity Exchange (ZZCE), including open price, intraday high price, intraday low price and close price. The sample period from March 2016 to March 2021. The team uses the following link for gathering data: http://www.czce.com.cn.

3.3.3 Backtest Evaluation

In the 5-year back-test on commodities trading, the strategy does good jobs in capturing the underlying price movements most of the time. The performance is as Fig. 3 (Table 7).
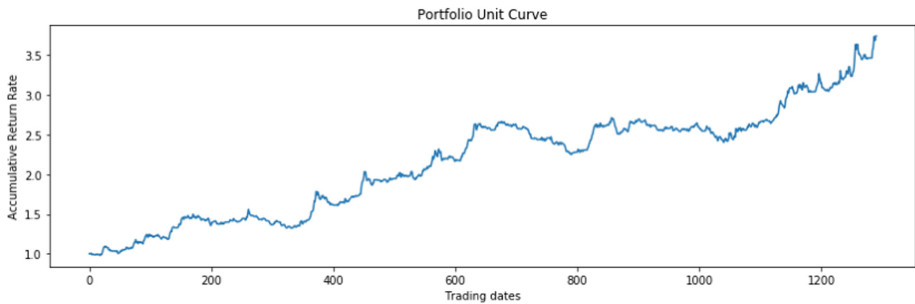

Fig. 3. Systematic Commodities Trading Portfolio Unit ValueIt reaches a return of 268% on the 5-year scale. As the most widely used asset in China's momentum trading, the futures market can be seen to have a good backtest performance. Moreover, it contributes a more significant proportion of revenue to the final transaction composition. In terms of volatility, futures strategies also have a relatively stable performance. Below chart shows more detailed results of the evaluation.

Table 7. Systematic Forex Trading Performance Analysis

Annualized Return	53.76%
Maximum Drawdown	15.52%
Annualized volatility	40.17%
Sharp Ratio	1.26

3.3.4 Conclusion

The performance of the futures trading strategy is outstanding, which seems unrealistic. The primary reason is the lack of consideration of transaction costs. Futures trading yields lots of transaction costs where various factors contribute to the complicated components, and one of the characteristics of futures trading is the costly transaction fee. For simplicity and feasibility of this strategy exploration, we decide to neglect this factor. Such neglection contributes significantly to the exceptional performance; yet it does not jeopardize the feasibility of this strategy.

3.4 Derivatives Trading

3.4.1 Rules

The team chooses MACD in implied volatility as the primary indicator to determine the portfolio breakdown. MACD is a significant signal to measure the changing trend of implied volatility which can help our team select options with potential profits. The followings are detailed models:

$$\text{Today EMA}(12)$$

$$= \text{The mean of the IV of the past 12 days}$$

$$\text{Today EMA}(26)$$

$$= \text{The mean of the IV of the past 26 days}$$

$$\text{MACD(Difference, DIF)}$$

$$= \text{EMA}(12) - \text{EMA}(26) \text{DEA} = \text{The arithmetic average for the past one month's DIF}$$

When the option's DIF and DEA are all greater than 0, the indicators show us that the option's implied volatility is expected to increase in the future, which means that the option's future price will increase, we choose to long this option. When the option's DIF and DEA are all smaller than 0, the indicators show us that the option's implied volatility is expected to decrease in the future, which means that the option's price will fall. Hence, we choose to short this option. The weight of each option in the portfolio should follow the Delta-neutral principle:

$$w_1 \times \text{Delta}_1 + w_2 \times \text{Delta}_2 + \cdots + w_n \times \text{Delta}_n = 0$$

where Delta_i denotes the Delta value of the i-th option.

3.4.2 Data Description

Our option data comes from some databases like the Wind terminal. We retrieve those on option prices, daily open prices, daily close price, and implied volatility from the Wind database for all kinds of Chinese i-th stockndex options. The universe contains the SSE 50 index ETF option, CSI300 index ETF option, CSI 300 index option during our sample period from March 2016 to March 2021. We do a filtration of data based on the below principle:

1. Options quotes violate no-arbitrage conditions;
2. Bid price is zero or less than the ask price;
3. Implied volatility is less than 3% or greater than 200%;
4. Open interest equals zero;
5. Time to maturity is less than 10 days or greater than 365 days.

We finally narrow down our universe to be the Chinese market index options. It differs from the choices of the HKEC stock options as in the section of discretionary trading in order to study the practical implementation of the strategy in China.

3.4.3 Backtest Evaluation

The annualized rate of return of the option's MACD strategy is only 0.9%, which is even far lower than the risk-free rate of 2.9%, and changes in net worth have extremely high volatility (Fig. 4).

These indicators represent the ineffectiveness of option trading strategies. After studying each trading day's positions and overall strategy, we believe that there are several reasons. First of all, the number of assets in the option asset pool is too small. Due to the minimal options market in mainland China, there are only three types: the HS300 Index, the HS50 ETF, and the HS300 ETF.

Furthermore, the trading volume of each option is also at a relatively low level, which leads to a high degree of repetition of our asset types in the trading cycle, and we cannot better diversify investment risks. The detailed performance is listed as Table 8.
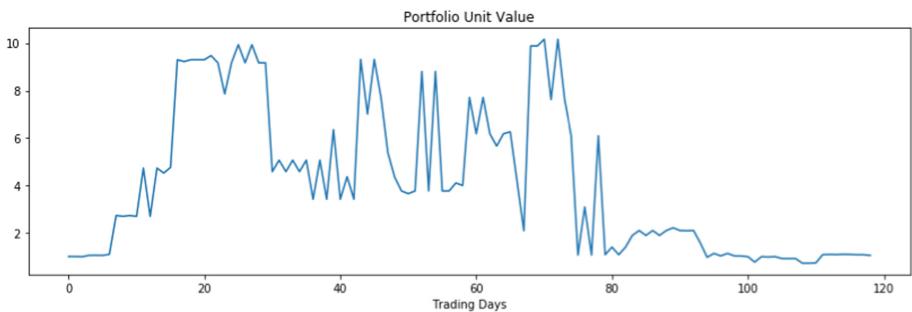

Fig. 4. Systematic Derivatives Trading Portfolio Unit Value

Table 8. Systematic Derivatives Trading Performance Analysis

Annualized Return	1.01%
Maximum Drawdown	96.88%
Annualized volatility	59.60
Sharp Ratio	−0.00033

3.4.4 Conclusions

Compared with Hong Kong stocks and U.S. stocks, China's derivatives market still has more room for improvement in terms of the degree of development and perfection. Secondly, in the basic model, we did not set the stop-profit and stop-loss conditions, which resulted in large fluctuations in the overall net value, resulting in more significant investment risks. Finally, it is the treatment of the date of exercise. As options approach the exercise period, there will be a small trading volume, and the price fluctuation ratio is large, but the base is small. In the backtest, we did not filter and restrict this condition, which led to purchasing this option contract on some days, and abnormal gains or losses occurred.

3.5 Multi-class Portfolio Construction

The team assigns weights among different asset classes based on risk-parity principle. The process of determining corresponding weights is by solving the system of equation below

$$\begin{cases} W_1 + W_2 + W_3 = 1 \\ W_i / W_j = \sigma_j / \sigma_i \end{cases}$$

where W_i denotes the weight for the i-th asset class and the ratio between weights equal the ratio between reciprocal of standard deviation of price returns on a fixed interval.

During back-testing, the team implements the risk-parity principle as follows:

1. On each trading day, calculate the standard deviation of the historical 5-day data till most recent trading day for each of the asset portfolio.
2. Solve the linear system to generate corresponding weights for each asset class.
3. Construct the weighted portfolio combining all asset classes to complete the overall portfolio selection on that trading day.

Above parts give rules for the construction and selection of the portfolio. The next subsection is a presentation of the portfolio evaluation.

3.5.1 Performance and Evaluation

Below is the back-testing evaluation for systematic trading on the 5-year interval from 2016–03-21 to 2021–03-19. The team records the accumulative unit value curve on the interval (Fig. 5).
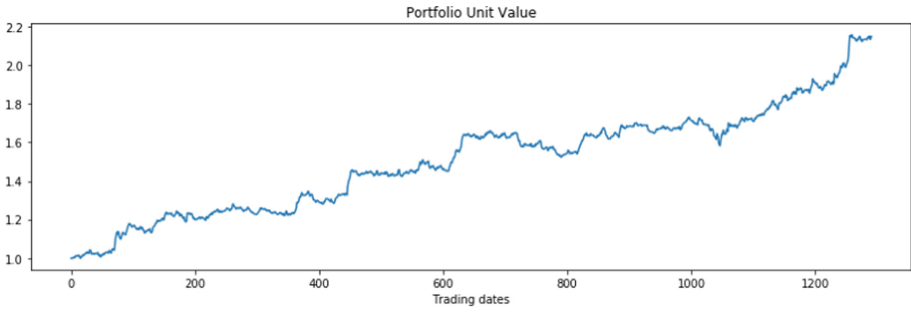
Fig. 5. Systematic Trading Overall Portfolio Unit Value

Table 9. Systematic Trading Overall Performance Analysis

Annualized Return	22.99%
Maximum Drawdown	8.6%
Annualized volatility	14.97%
Sharp Ratio	1.34

This portfolio achieves a 5-year 140% return in the universe of Chinese derivatives market. Among all portfolios, the Forex class and commodities class account for the majority, while the derivatives are always modest in weights as a result of risk-parity strategy. A significant feature of this portfolio is the breakdown of different asset classes: Forex and futures account for the majority, while option trading only spares a share of smaller than 0.1% due to its high volatility. This observation is reasonable since the risk-parity principle aims at reducing the overall volatility at the cost of a smaller return. Below chart shows more detailed results of the evaluation (Table 9).

4   Advanced Models

4.1   Forex Trading: Momentum Detection of Forward Rate Anomaly

Baillie and Chang has raised up a momentum trading strategy that exploits characteristics of uncovered interest rate parity [1]. It uses price returns and forward returns to look for large disparity from the assumption of uncovered interest rate parity

$$E_t \Delta s_{t+1} = i_t^* - i_t = f_t - s_t$$

where the second equation comes from covered interest rate parity, a virtual identity assumed to hold. Baillie and Chang uses a standard test of uncovered interest rate parity has been to estimate the regression [1]:

$$\Delta s_{t+1} = \alpha + \beta(f_t - s_t) + u_{t+1}$$

under uncovered interest rate parity, the null hypothesis is $\alpha = 0, \beta = 1$ while $\{u_t\}$ is an uncorrelated series of error terms. According to Baillie and Chang, the forward premium anomaly is the "widespread finding" of a negative slope coefficient, meaning that investors would demand higher interest rates on currencies expected to fall in value [1].

The signals for trading is generated by a combination of uncovered interest rate parity and forward premium using logistic smooth transition regression model [1]:

$$\Delta s_{t+1} = [\alpha_1 + \beta_1(f_t - s_t)](1 - G(z_t; \gamma, c)) + [\alpha_2 + \beta_2(f_t - s_t)]G(z_t; \gamma, c) + u_{t+1}$$

$$G(z_t; \gamma, c) = (1 + \exp(-\gamma(z_t - c)/\sigma_{z_t}))^{-1}$$

$$z_t = \min\left\{i_t^Y, i_t^Z\right\} - i_t^X$$

where f is the forward rate, s is the spot rate, G is taken as the logistic function; z_t is the interest rate differential among fundamental currency candidates. It can be construed as a weighted average between measurements of uncovered risk parity (α_1, β_1) and detection of forward premium anomaly (α_2, β_2). Based on this LSTR model, the implementation of the trading strategy is:

1. Select 30-day historical data for forward and spot prices of currency pairs till last trading day after data processing; select candidates for the fundamental currency (for example, CNY, USD and JPY).
2. Apply the logistic smooth transition regression model on data above for each fundamental currency and transition variable as defined above.
3. Evaluate transition functions: select the candidate with transition function G closest to 1 as the fundamental currency, denote as X.
4. Calculate Δs_{t+1} of each currency pair with respect to X and rank them. Construct a long-short neutral portfolio via selecting currencies with longing highest, positive Δs_{t+1} and shorting currencies with lowest, negative Δs_{t+1}.

This trading strategy is regarded as a combination of the carry style and the momentum style. It primarily relies on momentum tracking and trend following to predict future exchange rate differentials and gain profits. Statistical regression methods calculate underlying momentums for indexes like the synergetic change in spot and forward rates to detect forward rate anomaly. Moreover, it allows comparisons between different fundamental currencies, thus broadening the universe, making the strategy more robust and flexible than single-numeraire strategies.

4.2   Commodities Trading: Pivot Points

One of the advanced models for momentum commodities trading is pivot point trading. In a market, yesterday's price can give us some hints about today's price trend to some extent. Most of the time, the price moves in a relatively stable range, but sometimes a considerable amount of money is put into the market, there may be a broader range of

price changes. Therefore, we can combine some prices by some rules to construct some indicators to help us see if there would be any hint for price changing. The pivot point is calculated via:

$$P = \frac{prehigh + prelow + preclose}{3}$$

Trading decisions are made based on the pivot with the introduction of more indicators. According to Tian et al., the pivot point system determines the price support or resistance zone [5]. Hence, we need to divide the prices into two kinds of prices. One is support price, meaning that this price line would support today's price, and the price is hard to fall below the price line. The other one is resistance price, like a barrier that hinders price increasing. Therefore, we can set 3 support prices and 3 resistance prices, and the formulas are below:

$$R1 = 2P - prelow$$

$$S1 = 2P - prehigh$$

$$R2 = P + (R1 - S1)$$

$$S2 = P - (R1 - S1)$$

$$R3 = prehigh - 2 * (prelow - P)$$

$$S3 = prelow - 2 * (prehigh - P)$$

The above indicators characterize the trend of commodity prices: if today's open price is higher than P, there is likely to be an upward trend today; if today's open price is lower than P, there is likely a downward trend today.

It leads to the following trading decisions. When the price is increasing and reaching R1, we decide to have a long position. Then, if the price breaks R2 upward, we would continue to increase the long position. If the price continues to grow and break R3 upward, it predicts that the price would receive greater resistance, resulting in a clearance of the long position and get a short position.

Adversely, if the price drops down to the S1, we decide to have a short position. Then, if the price drops down S2, we would extend the short position. If the price continues to decrease and break down the S3, we decide to buy a long position where the price embraces a greater supporting force that makes it less likely to drop.

In conclusion, this strategy is flexible in allocating portfolio long-short positions and prompting the market change in commodities trading.

4.3 Derivatives Trading: Implied Volatility Spreads and Skews

Implied volatility is a significant characteristic of options. Bali and Hovakimian have introduced an options trading model by detecting option volatility spread (Bali and

Hovakimian 2009); Xing et al. have also proposed the concept of volatility skew in options trading [4]. Liu et al. devise an integrated model by considering both volatility spreads and volatility skews. The model aims at selecting "winners" and "losers" by the two volatility indexes to construct portfolios [7].

According to Cremers and Weinbaum, the calculation of the IV spread as the weighted average on an "open-interest" basis of the difference in IVs between call and put options on the same underlying stock with the same strike price and expiration date [3]. Precisely, according to Liu et al., the implied volatility spread for the i-th stock at date t is calculated as follows [7]:

$$\text{IV\_Spread}_{i,t} = \sum_{j=1}^{N_{i,t}} w_{j,t}^i (IV_{j,t}^{i,call} - IV_{j,t}^{i,put})$$

The parameters above are (we follow the notations from Liu et al. (2020)):

1. $N_{i,t}$: the number of call-put option pairs of i-th stock at date t;
2. $w_{j,t}^i$: the weight measured as the proportion of the open interests of the j-th paired options to the total open interests of the tradable option pairs of i-th stock at date t;
3. $IV_{j,t}^{i,call}$ and $IV_{j,t}^{i,put}$: the IVs of the call and put of the j-th paired options of i-th stock at date t, respectively.

Apart from IV spread, we also introduce the idea of IV skew. Xing et al. (2010) measures the IV skew as the difference between the implied volatilities of OTM puts and ATM calls. The definitions for OTM put option and ATM call option are given as follows:

$$\text{PutorCallwithStrikeK,}$$

$$\text{StockPriceS(t)} \begin{cases} OTM \ 0.80 \leq \frac{K}{S(t)} \leq 0.95 \\ ATM \ 0.95 \leq \frac{K}{S(t)} \leq 1.05 \end{cases}$$

According to Xing et al. (2010), the IV skew for the i-th stock at date t is calculated as follows:

$$\text{IV\_Skew}_{i,t} = \sum_{j=1}^{N_{i,t}^{OTMP}} w_{j,t}^{i,OTMP} IV_{j,t}^{i,OTMP} - \sum_{j=1}^{N_{i,t}^{ATMC}} w_{j,t}^{i,ATMC} IV_{j,t}^{i,ATMC}$$

where we follow the notations from Liu et al. [4]:

1. $N_{i,t}^{OTMP}$ ($N_{i,t}^{ATMC}$) is the number of eligible OTM put (ATM call) options of i-th stock at date t;
2. $w_{j,t}^{i,OTMP}$ ($w_{j,t}^{i,ATMC}$) is the weight of the j-th OTM put (ATM call), which is the proportion of open interest of the j-th OTM put (ATM call) options to the total open interest of eligible OTM put (ATM call) options of the i-th stock at date t;

3. $IV_{j,t}^{i,OTMP}(IV_{j,t}^{i,ATMC})$ is the IV of the j-th OTM put (ATM call) options of the i-th stock at date t.

The calculations above identify the options into the following classes:

1. Early-stage winners: options with high IV spreads or low IV skews;
2. Early-stage losers: options with low IV spreads or high IV skews.

Based on above classifications, the model constructs a robust portfolio via a combination of longing early-stage winners and shorting early-stage losers. According to Liu et al., such strategy based on volatility spread and skew exhibit price continuation and reversal, hence would be a complicated yet effective momentum strategy (Liu et al. 2020).

5 Conclusions

5.1 Summary

In Sect. 2, the discretionary trading from March to April shows decent results using fundamental indexes. Those indexes, RSI, MA5, and implied volatility, are fundamental but straightforward indicators to predict future trends for different asset classes. Having a good capture of the indicators will help the design and implementation of the systematic trading strategies.

In Sect. 3, our models for systematic trading have relatively good performance in both the Forex and commodities markets. The performance might deviate from reality: there are many restrictions not taken into account. Despite such deviation, the performance still proves its feasibility in the Chinese market. It allows us to optimize asset selection and risk diversification when conducting momentum trading so that the strategy has stable returns. The poor performance of options trading strategies is due to the reasons we analyzed before. Due to its incompleteness and inferior liquidity, it is challenging to implement momentum strategies and diversify risks effectively. The manifestation of this defect is that in the final risk parity portfolio, the asset ratio of options is meager. However, we can see that in the final overall trading strategy, the adequate proportion of foreign exchange and futures has significantly increased the return of Forex and decreased the volatility of commodities. It proves that our use of a risk-parity portfolio is reasonable.

Section 4 examines different momentum strategies more advanced than the basic models and systematic trading strategies. Having more factors and more robust methods for processing and analyzing data, those models might do a better job at predicting trends and making excellent trading decisions. The team plans to integrate the advanced model into systematic trading in future work. Also, since those models proved effective only in foreign markets, their feasibility in the Chinese financial market requires future verification.

On the whole, momentum trading strategies designed by the team have divergent performance across different sectors of the Chinese financial market; one can expect better results under the strengthening and broadening of the market. Current Experimental

results and models have many fallacies; after fallacy repair and integration of insights from advanced models, the strategies would prove more robust and realistic. It also holds for the bigger picture: though limited with many constraints, momentum trading will undoubtedly play a more profound role in the future of China's financial market.

5.2 Recommendation

Lots of evidence and papers have illustrated that the momentum signals affect the market, from the stocks market to the options market. Price change could happen every moment, and the investors who do not have a particular trading strategy may face uncontrolled loss and miss some good trading opportunities. A momentum strategy, especially a systematic one, is a decent trading strategy helping us to make trading decisions by using different indicators to analyze historical data and predicting future trends for the underlying assets. This characteristic prevents investors from making trading decisions from personal bias that might lead to trading fallacies.

In the Chinese market, there is a lack of knowledge about investing for most individual investors. One feature is that most individual investors make trading decisions by their feeling or intuition rather than analysis based on data. The momentum strategies help reduce wrong trading caused by subjective and intuitive factors. The team suggests Chinese investors apply momentum trading strategies based on fundamental momentum indicators as explored in the previous sections. For example, one can use RSI for Forex, a combination of MA5 and MACD for commodities, and a combination of implied volatility and MACD for derivatives in their discretionary trading. Chinese institutional investors (investment or portfolio allocation institutions) can take advantage of large data corpora to design and upgrade systematic trading based on momentum indicators or existing advanced models. Sufficient data and great algorithm power allow institutions to dig deeper into assets' momentum signals. Results in Sect. 3 have manifested great potentials for such trading, and Sect. 4 points out examples of institutions' upgrading momentum trading strategies. Hence, it is highly recommended for Chinese personal and institutional investors to apply the momentum trading strategy in China's financial market.

Moreover, as the Chinese market embraces more diversity and is more effective like Western ones, efficient momentum strategies will be more prepared for surging opportunities. Learning from sophisticated momentum strategies in the Western market, momentum trading in the Chinese financial derivatives market, although juvenile, has manifested its pleasantly growing potentials.

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