Impact of the opening of Shenzhen-Hong Kong Stock Connect on the relationship between exchange rate and stock price

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Abstract: Shenzhen-Hong Kong Stock Connect formally opened on December 5, 2016. Whether the correlation between the exchange rate and the stock price will be affected before or after its opening will affect not only the formulation of China's capital market and foreign exchange market policies but also the decisions made by investors significantly. This paper firstly introduces the theoretical basis of the correlation and cointegration between exchange rate and stock price ,and the empirical analysis of the exchange rate between Hong Kong dollar and Shenzhen stock index before and after the opening of Shenzhen-Hong Kong Stock Connect, and finally concludes that the opening of Shenzhen-Hong Kong Stock Connect, The relationship between the exchange rate and the exchange rate changed from a positive correlation to a negative correlation and the correlation decreased. Before the opening up, under the 5% confidence level, there was no cointegration between the exchange rate and the stock price, after opening, cointegration appears however.
Key words: Shenzhen-Hong Kong Stock Connect, exchange rates, stock prices, relevance, cointegration

1 INTRODUCTION

Shenzhen-Hong Kong Stock Connect refers to the stocks listed on the counterparty exchanges allowed by the Shenzhen Stock Exchange and the Hong Kong Stock Exchange under the trading rules of the two places. On December 5, 2016, Shenzhen-Hong Kong Stock Connect officially opened. The implementation of Shenzhen-Hong Kong Stock Connect will help to attract foreign capital into the A-share market, improve the valuation system with significant differences between A-shares and overseas markets, and further enhance the vitality of the A-share market. Hong Kong stock market is one of the most mature overseas markets. After Shenzhen-Hong Kong Stock Connect fully opens up the channels for A-shares and H-shares, it will be more conducive to the introduction of overseas institutional investors and gradually changes the market structure led by retail investors, and form long-term investment philosophy. However, the exchange rate, as one of the leverage that affects the capital market, has a significant impact on the capital market. At present, the academic research on the correlation and cointegration of exchange rates and stock prices has not yet reflected the impact brought by the opening of Shenzhen-Hong Kong Stock Connect. Therefore, this paper will use the time series analysis model to compare the exchange rate with the share price Relevance and cointegration changes, and then draw conclusions.

2 THEORETICAL ANALYSIS

At present, there are mainly two kinds of theoretical analysis models that are widely used, the traffic-oriented model of exchange rate determination, and the stock-oriented model.

(1). Traffic-oriented model

The traffic-oriented model points out that the price changes of exchange rate will have a significant impact on the international trade of a country, thereby affecting the cash flow and profitability of domestic companies and ultimately the changes in the domestic stock market. At the same time, the changes in exchange rate can cause changes in the prices of assets and liabilities of domestic firms abroad, causing changes in the prices of domestic firms.

This is mainly reflected in two aspects: firstly, from accounting factors, fluctuation in exchange rates will affect the company's financial assets and liabilities, which affects the future cash flow, thus affecting the stock price; and the second from the economic factors, exchange rate fluctuations will affect the company's International trade business, thus affecting the stock price.

(2). Stock-oriented model

The stock guidance model focuses on the impact of capital markets on exchange rates. The model argues that the change of stock price will cause the international capital flow and the change of money supply and demand, and the fluctuation of exchange rate will also be affected by the relationship between money supply and demand. At the same time, it is pointed out that the exchange rate, like other commodities on the market, is decided by its supply and demand.

(3). Metrology model

Based on the above two theories of classical model theory, the relationship between exchange rate and stock price can be described as:

$$R_t = \beta_{0i} + \beta_{1i} s + \varepsilon_{it}$$

Among them, R_t is stock returns, s is the nominal exchange rate changes, ε_{it} _it is the residual. Therefore, by calculating the coefficient values before and after the opening of Shenzhen-Hong Kong Stock Connect in the above formula and analyzing the coherence of the residuals, the influence of Shenzhen-Hong Kong Stock Connect on exchange rate and stock price correlation can be obtained. Meanwhile, the stock return data can be replaced by the share price. According to the stock price method of discounted cash flow, there is a functional relationship between the stock price and the return rate, which is reduced to a linear relationship here. Therefore, the above formula is transformed into：

$$p_t = \beta_{0i} + \beta_{1i} s + \varepsilon_{it}$$

Therefore, the model can be used to select the corresponding stock price and exchange rate for correlation analysis. On this basis, using the methods of sequence stability and unit root test to analyze the stability of the original sequence and the residual sequence, the cointegration between the stock price and the exchange rate can be obtained.

3 EMPIRICAL ANALYSIS

(1). Data selection and preprocessing

Since Shenzhen-Hong Kong directly contacts with Hong Kong and mainland China, involving foreign exchange for the Hong Kong dollar, this paper chooses the China yuan against the Hong Kong dollar (CNY / HKD) exchange rate daily opening price as a sample exchange rate. For the stock price, choosing the broader market index compared with the selection of stocks has a better macroeconomic significance, thus this article selects Shenzhen Component Index (399001) as the stock price data sample. In order to avoid the accidental impact of the stock market turmoil on the correlation between the two stocks in 2015, we select the data of all trading days between January 1, 2016 and November 30, 2016 as the data sample before the opening of Shenzhen-Hong Kong Stock Connect. Data for all trading days between January 1 and November 30, 2017 will be used as the data sample for the Shenzhen-Hong Kong Stock Connect. In addition, due to the more foreign exchange trading days, this article uses the stock trading day as the basis to screen the foreign exchange data corresponding to the trading day.

(2). Correlation analysis

Firstly, the correlation analysis between the two will be conducted. Before the Shenzhen-Hong Kong Stock Connect, the correlation coefficient R^2 between the two was 0.57. After opening, the correlation coefficient R^2 between the two was 0.37.

Secondly, the linear regression equation between exchange rate and stock price was established before and after the opening of Shenzhen-Hong Kong Stock Connect. The regression results using the least square method yielded the following results:

$$\hat{p}_1 = -6791.89 + 15072.06 * s$$

$$\hat{p}_2 = 27146.75 - 14283.9 * s$$

Among them , p^_1 and p^_2 respectively represent the predicted stock prices before and after the opening of Shenzhen-Hong Kong Stock Connect, s represents the exchange rate.

Therefore, from the correlation analysis, we can conclude that the opening of Shenzhen-Hong Kong Stock Connect makes the relationship between Shenzhen Component Index and the exchange rate change from a positive correlation to a negative one. Moreover, the correlation coefficient is not high, which proves that the correlation between the stock price and the exchange rate in the Shen Zhen stock market is relatively low. After the Shenzhen-Hong Kong Stock Connect, the relevance is further reduced.

(3).Cointegration analysis

Cointegration examines the interrelationship between two non-stationary time series. Therefore, we firstly need to test whether the stock price and exchange rate series are stable before and after the opening of Shenzhen-Hong Kong Stock Connect. Using the ADF test method, set the confidence level to 5% and the test result to be：

	StockPrice0	ExchangeRate0	StockPrice1	ExchangeRate1
T_test	-1.466	-0.699	-2.252	-2.391

Among them, the '0' is on behalf of before the Shenzhen-Hong Kong Stock opening the '1' on behalf of Shenzhen-Hong Kong opening. The condition of passing the test is that T_test is less than -2.87 (5% confidence level), and the original hypothesis of no stationary sequence can not be rejected. Therefore, both the stock price and the exchange rate sequence before and after the opening of Shenzhen-Hong Kong Stock Connect are non-stationary sequences. The cointegration of two sequences can be established by regression equation to find the residual to test the residual sequence is stable, if stable, then the residual sequence is stable, there is cointegration between the two, otherwise there is no cointegration.

Use the following formula to calculate the residual before and after the Shenzhen-Hong Kong SAR opened two residual sequences:

ε = p^-p

Using the Stationary Test of the ADF, the unit root of the residual sequence was obtained with a 5% confidence level to obtain the following results:

	Residual0	Residual1

T_test	-2.427	-3.209

Therefore, at a 5% confidence level, the residual sequence is non-stationary prior to the opening of Shenzhen-Hong Kong Stock Connect, so there is no cointegration between the stock price and the exchange rate. On the contrary, after the Shenzhen-Hong Kong Stock Connect, the residual sequence is stable Sequence, there is cointegration.

4 CONCLUSION AND SUGGESTION

(1) Conclusion

After empirical analysis, Shenzhen-Hong Kong Stock Connect has a significant impact on the correlation and cointegration between the stock price and the exchange rate. Relevance, before the opening of the Shenzhen-Hong Kong Stock Connect, the stock price and the exchange rate showed a relatively weak positive correlation. As Shenzhen-Hong Kong Stock Connect opened, the stock price and the exchange rate showed a negative correlation and their correlation further decreased. In terms of cointegration, under a 5% confidence level, there was no cointegration between the stock price and the exchange rate before the Shenzhen-Hong Kong Stock Connect. The opening of the Shenzhen-Hong Kong Stock Connect made the cointegration between the two.

Therefore, the stock market of our country is less effective and the stock price can not fully reflect all the information. As a policy factor, Shenzhen-Hong Kong Stock Connect still has a significant impact on the stock price and the exchange rate. In addition, the exchange rate system in our country can not effectively control the impact of foreign capital on the domestic capital market. The stock price and the exchange rate appear cointegration. The fluctuation of the exchange rate will cause the stock market turmoil and adversely affect the economic development of our country.

(2) Suggestion

Further improve China's exchange rate system. In recent days, the short-term sharp fluctuations in the exchange rate of our country have been closely linked to the sharp concussion of the U.S. dollar. And Hong Kong dollar pegs to U.S. dollar. To keep the exchange rate relatively stable in our country, we should reduce the weight of the U.S. dollar in a basket of currencies to a certain extent, thus reduce the unfavorable Influence on China 's International Trade and Stock Market Caused by Shock.

Accelerate the market-oriented exchange rate while strengthening foreign exchange risk management. At present, the exchange rate system in our country makes the exchange rate still not fully determined by the demand and supply of the foreign exchange market for our currency, which is not conducive to the domestic foreign exchange market being in line with international standards. Accelerate the marketization of China's exchange rate so that China's exchange rate will follow the guidance of market supply and demand more and more and reduce the government's intervention in the foreign exchange market so that the foreign exchange market can fully play its regulatory role.

Strengthen the stock market supervision, standardize the information disclosure system. In order to safeguard the legitimate rights and interests of market participants and the sound development of the stock market, regulators should further standardize the information disclosure system of the stock market and prevent some bad companies from drilling holes. In addition, regulators should vigorously punish the listed companies and underwriters to provide false information to ensure the accuracy of information disclosure, thereby strengthening the supervision of the stock market.

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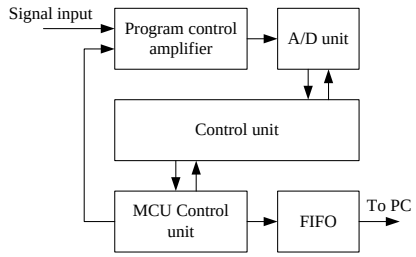

Figure 1 The system block diagram

2. SIGNAL ACQUISITION

The voltage pulse sequence signal is amplified linearly to 0-2V for A/D sampling. For small amplitude and wide bandwidth, the requirement of the amplifier is relatively high, the low noise and broadband is considered.

(1) The design of programmable amplifier

Programmable amplifier is the key to detect, its ation. The first stage is 10 times fixed amplification, and the DG508 is selected, which is controlled by MCU to realize programmed amplification with 8 levels. The principle block diagram of the amplifier is shown in figure 2.

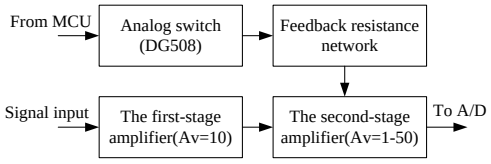

Figure 2 The principle block diagram of the Programmable amplifier

(2) The design of A/D acquisition circuit

According to the design requirements for the sampling rate 20MSPS and the resolution 10Bit, analog digital converter AD9224 is selected, whose sampling rate is 40 MSPS and resolution is 12bit, it possess on-chip high performance sample and hold amplifier and reference voltage. Under single + 5V power supply, power consumption is only 376mW. Signal to noise ratio and distortion is + 0.7dB, it have a signal overflow indicator and can directly output data by the binary[2].So form, so in AD9224, the reference n in figure 3. The clock of Ad9224 is obtained by FPGA dividing, 12 bit parallel data are read into the FPGA on each clock falling edge [3].

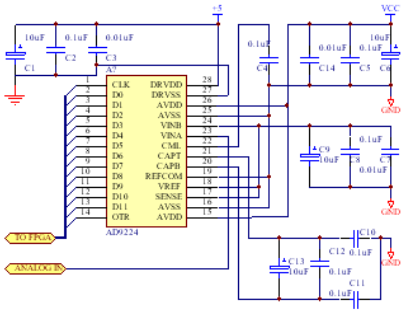

Figure 3 circuit scheme of AD9224

(v_{i3}, v_{i4}) respectively. v_i and v_o can be regarded as linear relation in each segment, and the equation can be written as

$$v_o = Kv_i + B \tag{1}$$

where K and B can be calculated according to the boundary value. The compensation equation is obtained by taking the (v_{i3}, v_{i4}) section as an example.

$$v_o = \frac{v_{o2} - v_{o1}}{v_{i2} - v_{i1}} v_i + \frac{v_{i2}v_{o1} - v_{i1}v_{o2}}{v_{i2} - v_{i1}} \tag{2}$$

This compensation method is simple and the calculation is small, and it is suitable for the occasion where the nonlinear error is small.

(2) Quantitative compensation

The quantization error is caused by the discontinuity of sampling, as shown in figure 6.This error can be compensated by the Lagrange interpolation method.

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