

The Analysis of the Characteristics and the Reasons of China Treasury Bond Futures

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Abstract

Treasury bond futures basis is one of the core indicators of futures market operation quality. Identifying characteristics and causes of futures basis from an objective respect are of realistic significance for correctly understanding and improving the treasury bond futures market. Based on the analysis of China's treasury bond futures basis, the article summarizes the main factors affecting treasury bond futures basis, elaborates the market impact of characteristics of treasury bond futures spread, and then offers a proposal to improve the treasury bond futures market.

Keywords: Treasury Bond Futures, Basis, Characteristics

1. Introduction

Treasury bond futures is one of widespread basic interest rate derivatives. On September 6th 2013, the issuance of the five-year treasury bond futures created a new era of risk management of interest in China.

China had carried out the practice of treasury bond futures in the last century. Its efficiency has drawn the attention of the market since treasury bond futures were issued.

Yan Xiong and Zhongchao Li (2014), Yan Xiong and Wei Wang, Jialiang Shi and Feng Xie (2015) studied the efficiency in the treasury bond futures market from the delivery of options, the cost of transactions, the discovery of price and the function of hedge respectively and found valuable research results.

Basis is one of the core indicators of the fitting degree of spot price of treasury bond futures, and basis risk is also one of the key issue of the efficiency of hedge of treasury bond futures. Therefore, understanding the characteristics and influencing factors of treasury bond futures from an objective perspective is significant for understanding the

operation and evaluating the efficiency of the China's treasury bond futures market.

1.1 The Basic Characteristics of China's Treasury Bond Futures

China five-year treasury bond futures deliveries treasury bonds range from 4 to 7 years of the remaining terms for the purposes of preventing them from the delivery risk and expanding the scope of the delivery of treasury bonds.

1.2 Characteristic 1

Treasury bond Futures has a steady trend generally, close to the mature market level

Until the end of December 31st 2014, the common technical document (CTD) average basis of the main contract of the treasury bond futures is ¥-0.068, the maximum close basis is ¥0.50, and the minimum close basis is ¥-0.62(See picture 1).

Compared to the US market, China treasury bond futures has two characteristics; the first is the generally steady trend of the treasury bond futures, close to the mature market.

From September 3rd 2014 to October 22nd 2014, the average close price of the US five-year treasury bond futures is 0.24 dollars. The average close price of the main contract is ¥-0.068 from the issuance of China treasury bond futures.

The second characteristic is the "sawtooth" sharps of China and the US treasury bond futures generally, but the directions are opposite.

The level of basis of the US treasury bond futures was in a higher situation at the time of becoming the main

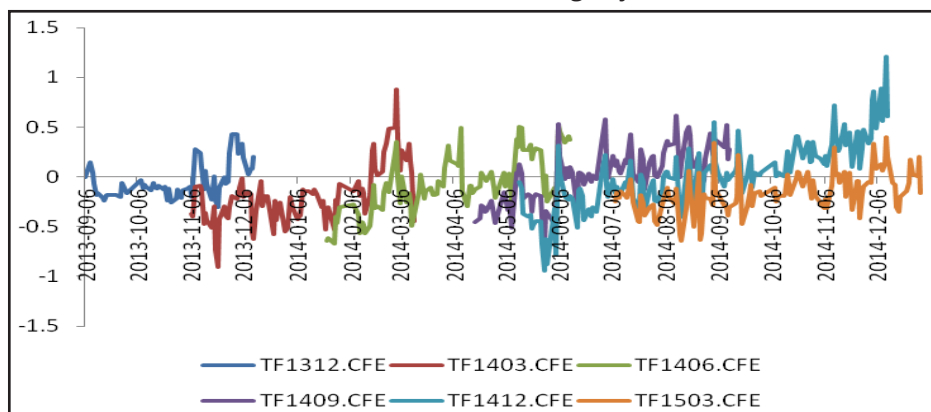
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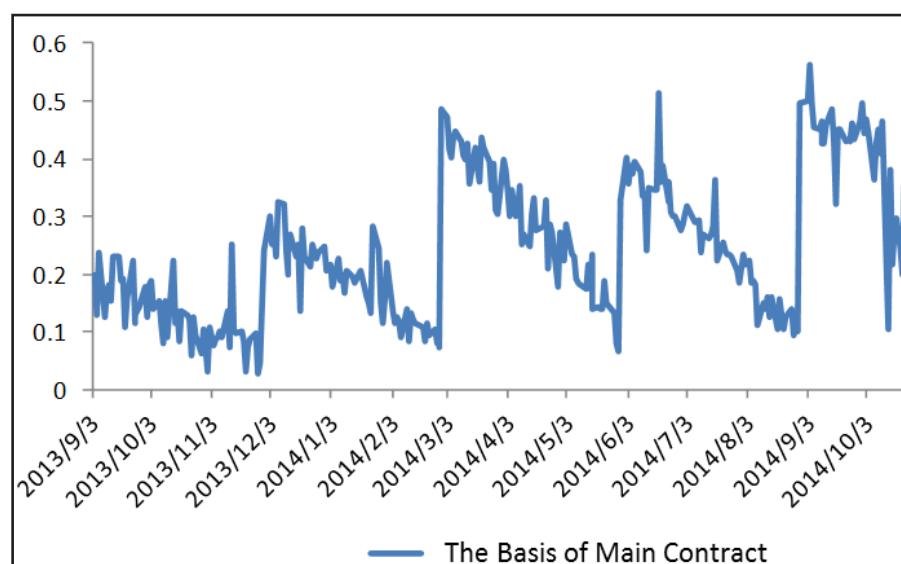
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contract, and declined later, near the end close to zero. The convergence process is relatively smooth (See picture 2).

The basis of China treasury bond futures is negative at the time of becoming the main contract, turned positive gradually, reached to a peak in the vicinity of the last trading day.



Picture 1: The Statistical Chart of the Basis of Active CTD of Main Contract of Treasury bond Futures



Picture 2: The Statistical Chart of the Basis of Main Contract of the US 5-year Treasury bond Futures

1.3 Characteristic 2

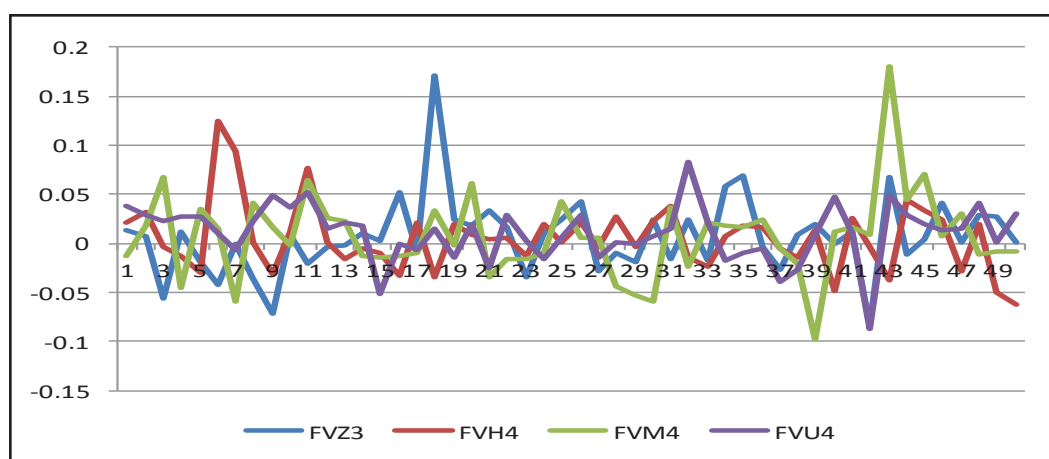
The net basis of treasury bond futures is generally less than zero, as close to the delivery month, the net basis turned to be positive, in the vicinity of the last trading day reached its peak.

Net basis of treasury bond futures means that basis of treasury bond futures deducts the held proceeds. Concerning the cost of financing, net basis is the index more accurate than basis to reflect the fitting degree of treasury bond futures.

From the experience of The US market, the US 5-year treasury bond futures' average net basis was \$0.011, the maximum net basis was \$0.0088, the minimum net basis was \$-0.02.

After the handover of the main contract, the net basis of treasury bond futures turned to be positive, but the increase is limited.

Set FVZ3 Contract as example, before the handover of the main contract, the net basis of this contract is \$-0.002, after the handover of the main contract, the net basis of this contract was \$0.009, the difference is \$0.01.



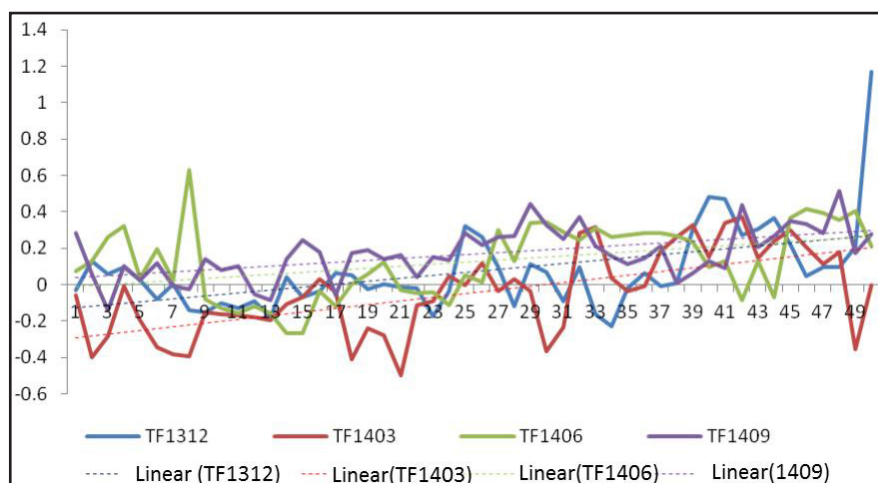
Note: the statistical interval is the last 50 trading days of treasury bond futures trading days

Picture 3: The Statistical Chart of the Net Basis of the US five-year Treasury Bond Futures

Since getting listed, China treasury bond futures' net basis is negative overall, with the approaching of the delivery month, the net basis turned to be positive, in the vicinity of the last trading day it reached its peak.

Specifically, the average net basis of active CTD is \$-0.055 in the general months. The average net basis was

\$0.180 between the handover of the main contract and a month before the delivery month, compared to the general months, the net basis was increased about \$0.331, and \$0.151 compared to the previous months.(See Picture 4)



Note: the statistic interval is the last 50 trading days of treasury bond futures trading days

Picture 4: the Trend Chart of the Treasury Bond Futures' Net Basis

1.4 Characteristic 3

The cheapest active CTD of net basis and the cheaper active CTD of net basis are almost found to be same, but significantly higher than the net basis of CTD in theory.

Since the treasury bond futures got listed, the cheapest active CTD and the cheaper active CTD, the average

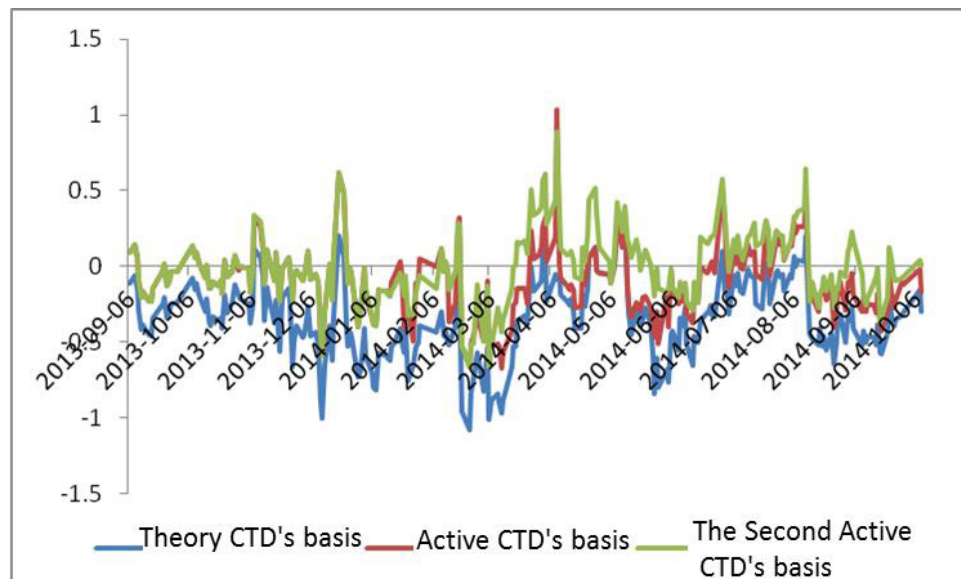
trading amount of 130015 and 130020 reached respectively ¥295 billion and ¥393 billion.

As investors can arbitrage to use the cheapest active CTD and cheaper active CTD flexibly, the net basis of the two treasury bonds are almost the same.

As we can see in Picture 2, the average net basis of the cheapest active CTD is ¥-0.082¥ and the cheaper active CTD is ¥0.045, the difference is ¥0.127.

However, the cheapest active CTD was significantly higher than the net basis of the CTD in theory. Since the treasury

bond futures got listed, the average net basis of CTD in theory is ¥-0.348, which is ¥0.266 lower than the average net basis of the cheaper active CTD(See Picture 5).



Picture 5: The Net Basis of CTD in Theory, Active CTD and the Second Active CTD

1.5 Characteristic 4

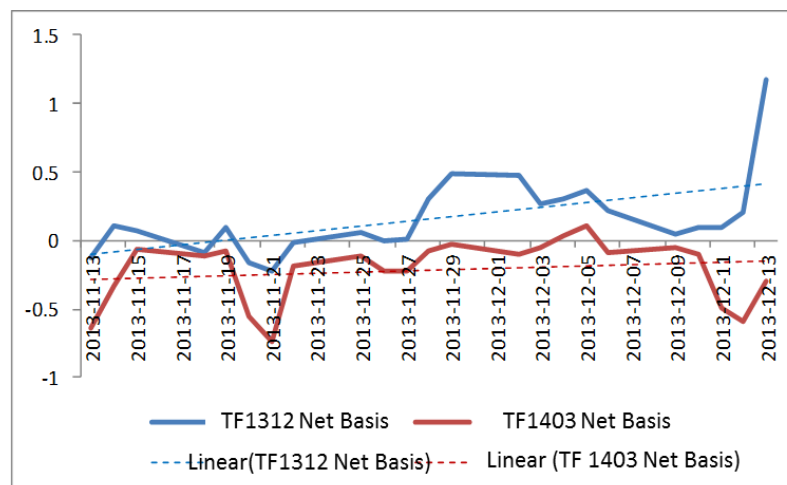
In the handover process of main contract, the price variance of the recent month and the near month contracts was expanded and presented the trend of trumpet overall.

In the course of the handover of the treasury bond futures contracts, the price difference between the recent month and the near month reflected the cost of warehouse shift in the market.

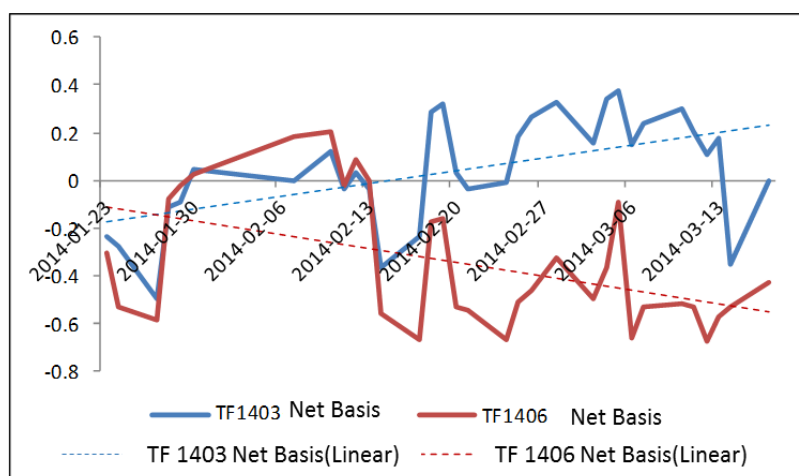
All these are shown from Picture 6 to Picture 10, in the process of the handover of treasury bond futures contracts,

the net basis in the recent month expanded its negative trend, resulting in the expand of price difference between the recent month contract and the near recent month contract, which reflected a trend of trumpet.

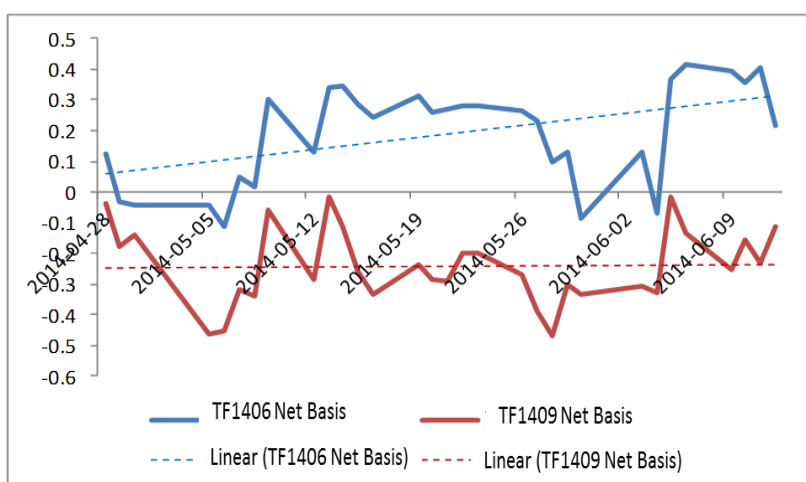
It means that treasury bond futures exist ¥0.3–¥0.5 cost of warehouse shift, that is, the average cost of one piece of ¥3000–¥5000. Set the handover of TF1312 to TF1403 as an example, the net basis of TF1312 contract is higher from ¥-0.018 to ¥0.311. the net basis of TF1403 contract is higher from ¥-0.018 to ¥0.150, the average difference is ¥0.38.



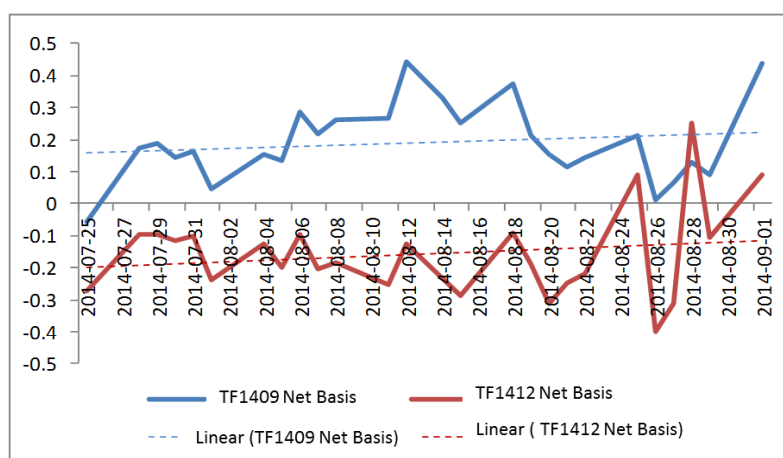
Picture 6: The Net Basis Change of the Handover from TF1312 to TF1403



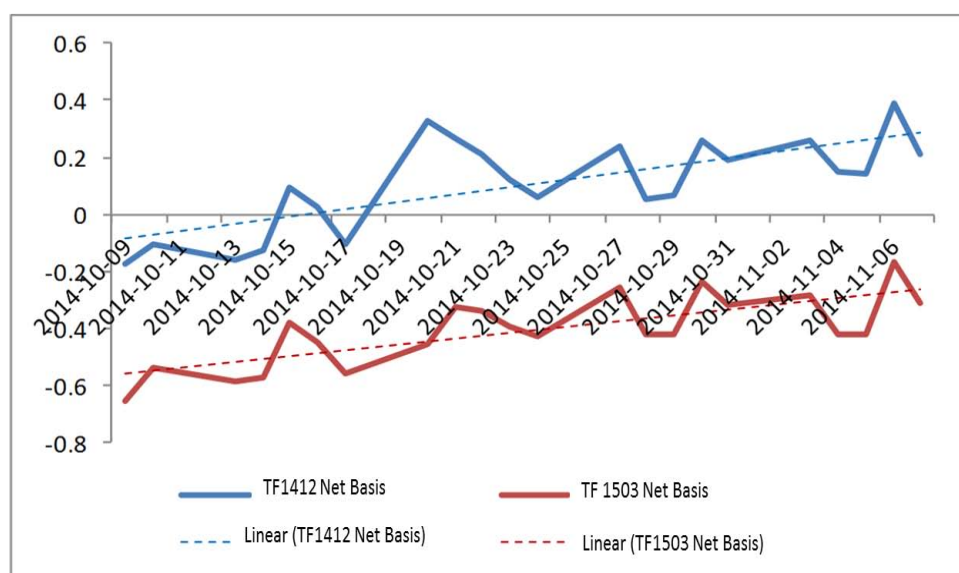
Picture 7: The Net Basis Changes of the Handover from TF1403 To TF1406



Picture 8: The Net Basis Changes of the Handover from TF1406 to TF1409



Picture 9: The Net Basis Change of the Handover from TF1409 to TF1412



Picture 10: The Net Basis Change of the Handover from TF1412 to TF1503

2. The Main Factors Which Influence the Basis of Treasury Bond Futures

2.1 Factor 1

The repo market interest rate from high to low and yields holding treasury bonds from negative to positive drive the basis of treasury bond futures from negative to positive

According to the non-risk arbitrage price theory, under the equilibrium conditions, investors who choose to hold bonds bull or will hold the bonds continuous through the repurchase transaction rollover to the last trading day of treasury bond futures, should get the same return.

Therefore, the treasury bond futures price is the sum of the spot price of the bond and the income of the period of holding treasury bonds. Among them, the yields holding the treasury bond is the cost of the bond interest income minus the cost of the use of bond repurchase transactions into the capital. Due to the bond interest income which can be accurately calculated according to the coupon rate, so bond futures basis can be reflected by repo market interest rates.

From the operation condition of China treasury bond futures market, since 5-year treasury bond futures listed,

inter-bank market repo rate is the cause of guiding national debt futures price change, and change of treasury bond futures basis is not the cause of guiding inter-bank repo market interest rates change.

Exchange market repurchase interest rate and bond futures base do not exist to guide the relationship.

In 2013, the bond market twice suffered the liquidity shortage, the interest rate rise of the money shortage phenomenon, thus raising the repo market interest rates.

As shown in Picture 11, September to December 2013, the inter-bank market 7-day repo fixed rate is at an average of 4.57%, higher than active CTD coupon rate, the repurchase financing of CTD bond will get negative holding gains.

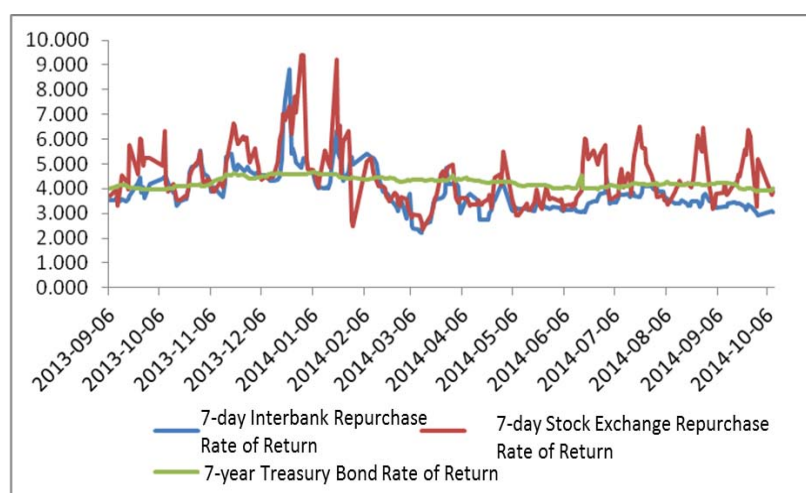
Since 2014, with the inter-bank market liquidity improved, the inter-bank repo market interest rates have fallen sharply, the seven-day repurchase rate average was only 3.66% below active CTD coupon rate, the use of repurchase financing of active CTD will have positive holding gains.

Affected by this, the average bond futures basis is negative in the second half of 2013, the basis of treasury bond futures is positive in the first half of 2014.

Null Hypothesis	F-Statistic	P-value	Conclusion
FR007 does not Granger Cause BASIS	3.44583	0.0334	FR007 Cause BASIS
BASIS does not Granger Cause FR007	1.39014	0.251	BASIS does not Cause FR007
FRGC007 does not Granger Cause BASIS	1.65841	0.1925	FRGC007 does not Cause BASIS
BASIS does not Granger Cause FRGC007	0.46923	0.626	BASIS does not Cause FRGC007

Note: This is the optimal value for repeated screening.

Picture 1: Grainger Causality Test



Picture 11: Repurchase Interest Rates and Bond Yields

2.2 Factor

The market is expected to achieve bond yields downward expectations gradually, driven by bond futures net basis gradually narrowed

Treasury bond futures reflect market expectations of future prices for bonds, treasury bond futures price is affected not only by the effect of treasury stock price, but also by the market expectations, the latter is often the most important factor in the impact on net treasury bond futures basis.

At present, China is at a stage of economic growth shift, structural adjustment pains and pre-stimulus-policy-digestion period is three imposed there, greater market operation risks and adjustments are more often, the economy is facing the downward pressure.

Therefore, despite China inter-bank market repo rate meted a sharp rise in 2013, the market for interest rate

cuts, quasi expected drop exists for a long time, bond futures net basis trend to some extent reflects the market expectations.

Treasury bond futures net basis by the initial listing ¥0.14 all the way down, to March 2014 reduced to ¥0.67, to its lowest level since the listing of Treasury futures market.

Thereafter, with the People's Bank has implemented a directional drop quasi, medium-term lending facility (MLF), interest rate cuts and other monetary policy operations, market of interest rate cuts, drop quasi expected gradually realized, treasury bond futures net basis gradually narrowed.

At present, treasury bond futures net basis is close to zero, shows what the market generally felt so that the current level of interest rates are close to market equilibrium interest rate level.

2.3 Factor 3

The cheapest active CTD and the cheaper active CTD markets' liquidity is active, two net basis are almost equal; theory of CTD market liquidity inadequate, the net basis was significantly lower than that of the other bonds

Under equilibrium conditions, treasury bond futures price is the sum of the treasury bonds spot prices and the income of the period of holdings of treasury bonds. Treasury bond futures net basis is close to zero, the difference of two delivery basis should be equal to the cost of transaction in the spot market.

The cheapest active CTD and the cheaper active CTD, for example, because two bonds can be conveniently used for arbitrage, the cheapest active CTD and the cheaper active net basis of CTD were close to zero, the difference and spot market transaction costs are the same.

Since treasury bond futures were listed, with the improvement of treasury stock market liquidity, the average price difference of the cheapest active CTD from 4–5 percentage points declined to 1 point after listing, corresponding to 7-year treasury bond spot price from ¥0.2–¥0.3 down to ¥0.05 after the listing; the cheapest active CTD net basis and the cheaper active net basis of CTD differ only in ¥0.12, with bilateral trade cost of spot market becoming equal.

For the theory of CTD, although the theory has higher futures prices and implied repo rate (IRR), but because the market liquidity is weak, investors can hardly be used to market arbitrage, resulting in net basis of an average of ¥-0.348, exists greater arbitrage space.

But under the effect of arbitrage trading mechanism, the theory of CTD net basis and the cheapest active CTD net basis are becoming smaller and smaller, from ¥0.14 in the fourth quarter of 2013 down to ¥0.11 in fourth quarter of 2014.

2.4 Factor 4

The structure of bond futures investors is relatively simple, to a certain extent, increases the treasury bond futures long shift warehouse costs and delivery costs

At present, the short of treasury bond futures are institutional investors who have good bases in the spot market like securities companies, with the delivery month approaching, these investors can choose the physical delivery or transfer. The bulls of the treasury bond futures are full of private institutions, individual investors.

It is difficult for these investors to enter the stock market, as participating in the delivery of treasury bonds futures, not only need to pay a lot of cash, but also difficult to sell in the spot market after receipt of the Treasury bonds. Therefore, along with the coming of the delivery month, the bulls of treasury bond futures, such as private institutions, individual investors will be the preferred choice in front of the treasury bonds futures delivery by closing or switching positions, thus to a certain extent, increased the near month contract short power.

Affected by this, last month treasury bond futures contract net basis gets gradually regularized, far month contract net basis showed a negative trend to expand, which eventually led to the near month contract net basis and far month contract net basis's *trumpet* trend. After entering the delivery month, with the decline in market liquidity, coupled by the Treasury bond futures delivery threshold and other factors constraints, treasury bond futures arbitrage power is inadequate, bond futures contracts in recent months net basis to further expand.

3. The Impact of the Characteristic of the Price Difference of the Treasury Bond Futures

(1) Timely reflecting the monetary policy information, and promote the market interest rates by the short end to the long end conduction

At present, China's monetary policy operation is by the number of type tone control to the price regulation of the main transition, to the treasury bond market as a platform for open market operations, so as to realize the market interest rate by the short end to the long end of the conduction and by the currency market to the capital market transmission is one of the key points.

Since the treasury bond futures listed, treasury bond futures basis by the inter-bank repo market interest rates to guide, but do not boost inter-bank repo market interest rates; treasury bond futures and treasury bond stock market is closely linked, closer to the mature market level.

These phenomena show that the central bank open market operations affected the repo market interest rates, 7-day repurchase market interest rates affect the government bond futures pricing, then through the treasury bonds futures arbitrage trading mechanism gets transmitted to long-term treasury bonds spot pricing, so as to promote the market interest rate by the short point to the long of the rapid conduction.

(2) To promote the improvement of market liquidity, and revitalize the stock of treasury bonds

For a long time, being restricted by the cost of information collection, liquidity and other factors, the bond secondary market transacted traditionally new issued bonds, issued for a period of more than 1 year of debt have almost no transactions.

Treasury bond futures and the spot linkage are closely interlinked, the spot market price to find, then price, and then correct, to promote the improvement of the spot market pricing efficiency.

At the same time, the treasury bond futures theory CTD net basis was significantly lower than that of the other active CTD net basis, which means investors to buy bonds theory CTD spot, sell of treasury bonds futures exist larger arbitrage space, activate market demand for old bonds, to revitalize the stock of national debt.

Treasury bond futures since listing were carried out five times physical delivery, in the TF1412 contract delivery, the size of the old bonds delivery reached ¥2.91 trillion, compared with the contract of TF1312 increased ¥2 trillion; old bonds accounted for the proportion of deliverable bonds reached 96.1%, compared with TF1312 contract improve 75.2%.

(3) To decrease the hedging efficiency of treasury bond futures, and impact the function of treasury bond futures

Basis risk is the main risk faced by the treasury bond futures hedging management. Since the treasury bond futures listed, despite the overall stable value of treasury bond futures basis, net basis fluctuation amplitude is large, especially along with the coming of the delivery month,

treasury bond futures net basis fast from negative to positive, increase the treasury bond futures long hedging cost, reduce bond futures hedging efficiency, impact the function of treasury bond futures.

(4) Time to handover the main contract in advance, from the end of the month before delivery to the beginning of a month in advance to the delivery month, the main contract active period shortened

From the market experience in the US, the handover of treasury bond futures contract generally occurs in the delivery month before a month at the end of the month, the main contract active period remained about 3 months, before and after the two main contract time difference does not exceed 2 trading days.

Since the Treasury bond futures listed, due to the treasury bond futures bulls facing higher shift warehouse cost, as far as possible to reduce shift positions cost, treasury bond futures bulls will be as much as possible ahead of time shift positions, resulting in the handover time of the main contract will continue to advance.

Since the Treasury bond futures listed, the handover time of the main contract by listed for the initial delivery months ago a month late in advance to the delivery month before a month early, recently increased to delivery month before two months at the end of the month, relatively early listing ahead of nearly a month's time. Due to the main contract handover time compared to the previous main contract handover time was relatively early, bond futures contract ACTIVE period has been shortened, a week compared to a contract active period.

Picture 2 Statistics on the Handover Time of the Main Contract of the Intermediate Term Treasury Bond Futures in the US and China

The Expiration Month of the contract	USA	China	
		Handover Time	The days advanced the handover time of last main contract
Dec,2013	27th Nov 2014	27th Nov 2013	
Mar,2014	27th Feb 2014	20th Feb 2014	5 Working Days
Jun,2014	29th May 2014	14th May 2014	5 Working Days
Sep,2014	28th Aug 2014	13rd Aug 2014	1 Working Day
Dec,2014	-	4th Nov 2014	6 Working Days

4. Conclusions and Suggestions

Since the Treasury futures listed, market linkage is good, bond futures basis trend is stable, close to the mature market level.

In this paper, our study found:

(1) The inter-bank market repo rate is the main influencing factor of the treasury bond holding gains, thereby affecting the treasury bonds futures basis.

Since 2014, repo market interest rate moved from high to low, holding Treasury yields turned from negative to positive, driven by the treasury bonds futures basis on the whole from negative to positive.

This means that the central bank's open market operations affect the repo market interest rate, the 7-day repo market interest rates affect the bond futures pricing. Treasury bond futures in a timely manner to reflect the monetary policy information, and then through the treasury bonds futures arbitrage mechanism is transmitted to long-term treasury bonds spot pricing, so as to promote the market interest rate by the short to the long through the rapid conduction.

(2) Treasury bond futures reflect market expectations. Since 2014, with the central bank's gradual actions of directing down quasi, interest rates and other monetary policy, market on treasury bond yields down is expected to gradually rise realize, driving treasury bond futures net basis gradually narrowed.

(3) Under the effect of the market arbitrage mechanism, the cheapest active CTD and the cheaper active CTD net basis is quite cheap. Theory CTD exist greater arbitrage space, in the effect of the market arbitrage mechanism, theory CTD take part in delivery of scale expansion, improves the proportion of the delivery of the scale of treasury bonds, and promotes the improvement of the old bond market liquidity, to revitalizing the stock of national debt has a positive effect.

(4) Being restricted by investor structure and other factors, in the process of the main contract handover, differences between the near month contract net basis with that of the next near month contract net basis has expanded, treasury bond futures bulls bear higher shift warehouse cost, storage cost to about ¥0.3. Affected by this, treasury bond futures contract's handover time continues to advance, from before delivery month for the initial listing a month late in advance to the delivery month before a month early, recently increased to delivery month before two months at the end of the month, relatively early listing ahead of nearly a month's time.

In order to further improve the treasury bond futures market and promote coordinated development of treasury bond futures market and the spot market, it is suggested that:

(1) To improve the design of treasury bond futures contracts and rules, facilitate investors in participating , improve the liquidity of treasury bond futures market.

The steps taken at present by China Financial Futures Exchange are; take adjustment to position limits, improve the large position reporting, adjust the margin trading and daily price fluctuation limits such as market optimization measures that are more likely to cancel delivery doorsill, and execute the seller hands delivery mode, etc. These measures can facilitate investor participation, has an important role to promote the improvement of government bond futures market liquidity.

It is recommended to further optimize the treasury bonds futures delivery system, as soon as possible to carry out treasury bond futures delivery versus payment (DVP) settlement way, decrease transit cost of capital, to facilitate investors to participate in; further optimize the hedging and arbitrage trading system, facilitate investors to carry out delivery month hedging and arbitrage trading, providing high cut monthly treasury bond futures market liquidity and price efficiency.

(2) To accelerate the commercial banks, insurance companies and other financial institutions involved in Treasury bond futures market process and promote a greater degree of securities companies and fund companies to participate in government bond futures market, and in the construction of diversified treasury bond futures market.

On the one hand, these steps can further bring closer the connection between the treasury bond futures and inter-bank repo market interest rates, on the other hand can enrich the treasury bonds futures investor structure, promote balanced development of treasury bond futures market, improve the liquidity of treasury bond futures market, to reduce the national debt futures shift warehouse storage costs, and promote the functions of the treasury bonds futures market.

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