Calendar Spreads In China Stock Index Futures

Why Are Calendar Spreads So Important To This New Market?

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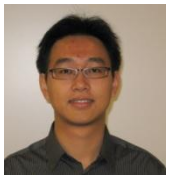

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Abstract (http://ssrn.com/abstract=1820583)

The successful functioning of global stock index futures markets depends heavily upon the efficient execution of two essential recurring transactions: calendar spreads and stock index arbitrage. In the final weeks preceding a futures expiration calendar transactions dominate order flow in a dramatic fashion making economical execution of critical importance for the health of the market. As frequent and familiar as calendar spread orders are there is surprisingly little written about these essential futures transactions. For China's CSI 300 futures there is no literature at all. Using recent CSI 300 futures data this article seeks to address the central characteristics of calendar spreads and the important uses for this transaction type in China's newest futures market. Establishing the legitimacy of this type of order in CSI 300 futures along with suitable margin controls is essential to ensuring the willingness of both domestic and foreign investors to seek participation in China's important growing capital market.

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Introduction

The successful functioning of global stock index futures markets depends heavily upon the efficient execution of two essential recurring transactions: calendar spreads and stock index arbitrage. At this point in the development of China's new CSI 300 futures market index arbitrage is highly inefficient at best and often impossible. Because calendar spreads are not yet recognized as a legitimate order type for China futures brokers to accept, investors seeking position changes between calendar months are not assured of fair pricing. Using recent CSI 300 futures data this article seeks to address the central characteristics of calendar spreads and the important uses for this transaction type in China's newest futures market. Establishing the legitimacy of this type of order in CSI 300 futures along with suitable margin controls is essential to ensuring the willingness of both domestic and foreign investors to seek participation in China's important growing capital market.

Origins and Classification of Calendar Spread Orders

Calendar spread orders in global futures markets originate from investor requests to execute the simultaneous purchase of a futures contract expiring in one month and the sale of a second contract expiring in a different calendar month with the two orders to be filled at a specified price difference (spread) between the contracts. They are primarily a natural outcome of trading and investing strategies whose completion does not end on a standardized contract expiration date. Such transactions arise as a consequence of the finite lifetimes for futures contracts, a property that periodically forces both long term and short term investors to exchange contracts with differing expiration dates.

In mature global futures markets where there is a balance of institutional, retail and arbitrage participants there will often occur periods of time when the volume of market transactions is dominated by calendar spread orders from such market participants. As frequent and familiar as calendar spread orders are there is surprisingly little written about these essential futures transactions. For China's CSI 300 futures there is no literature at all. For foreign investors in China's stock market, understanding more about calendar spreads in these new contracts becomes important not only for institutional firms seeking to hedge but also for hedge funds seeking short term profits . Assessing the risk of calendar spreads relative to outright futures positions is also important for regulators and exchanges who must set appropriate margin levels if such orders are to be officially recognized.

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Calendar spread orders can be transacted intramarket (within the same market) or intermarket (between markets). The analysis in this paper deals strictly with intramarket transactions. Intramarket spreads have the same commodity or asset underlying each contract while intermarket spreads involve two different commodities or assets. Such spreads, whether intramarket or intermarket, originate from both hedgers and from speculators and can require several different combinations of opening and closing transactions (see Figure 1).

Certain hedgers, for example, may have a strategy of maintaining a short futures position on an asset over a fixed hedging horizon. In such cases there will be a need to roll the futures position over to the next term contract as the future already in place approaches expiration. Such a rollover can be accomplished by placing two separate futures orders or, more simply, by placing a single order to be executed at a specified price difference or spread. Placing two separate orders subjects the hedger to the risk of transactions taking place at unequal times and at a net price difference that degrades returns. Controlling this pricing risk during executions through a single spread order enables the hedger to manage that same risk. In either case the hedger places a closing transaction of the near term contract and an opening transaction for the next term contract.

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Traders and speculators on the other hand, can create calendar spreads using two opening transactions. The purchase and sale of contracts in two different months creates an opportunity to obtain a profit when the spread widens or narrows. Such spread positions can be used effectively when the market participant has a strong view on the future direction of the price spread.

Figure 1 - Intramarket Calendar Spread Orders

Intramarket Calendar Spread Orders	Near Term Contract	Next Term Contract	Typical User
Rollover A Long Position	Closing Sale	Opening Purchase	Hedger
Rollover A Short Position	Closing Purchase	Opening Sale	Hedger
Buy A New Calendar Spread	Opening Sale	Opening Purchase	Speculator
Sell (Offset) An Existing Calendar Spread	Closing Purchase	Closing Sale	Speculator
Sell A New Calendar Spread (Reverse Calendar Spread)	Opening Purchase	Opening Sale	Speculator
Buy (Offset) An Existing Reverse Calendar Spread	Closing Sale	Closing Purchase	Speculator

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Calculating The Calendar Spread Fair Value

A long hedger in futures will prefer to roll over a long position at a spread price not to exceed fair value while a short hedger will seek to roll over at a spread not priced below fair value. Systematically failing to execute at a fair value for the spread will adversely affect investment performance by degrading the hedger's returns. Therefore setting a calendar spread order as a limit order based upon the spread's fair value price makes sense for both types of hedgers.

The Fair Value of a Calendar Spread is given by the following formula.

$$\text{Calendar Spread Fair Value} = FV2 - FV1 \quad (1)$$

where

FV1 = Fair value of near term contract
FV2 = Fair value of next term contract

The fair value for the near term CSI 300 contract is given by

$$FV1 = Io \times [\, 1 + (r1 - d1) \times n1/365 \,] \quad (2)$$

where
Io = level of the CSI 300 index stated in index points
r1 = interest rate for borrowing matched to the expiration date of the near term contract
d1 = dividend yield on the CSI 300 calculated to the expiration date of the near term contract
n1 = number of days to the expiration date of the near term contract
t1 = n1 / 365

Similarly the fair value equation for the next term contract is FV2 with related definitions.

So the calendar spread fair value is:

$$\text{FV Calendar Spread} = (Io / 365) [\, (n1\, d1 - n2\, d2) + (n2\, r2 - n1\, r1) \,]$$

Or

$$\text{FV Calendar Spread} = Io [\, (d1 \times t1 - d2 \times t2) + (r2 \times t2 - r1 \times t1) \,] \quad (3)$$

Appearing in Figure 2 are the fair value and market value of the September-October 2010 CSI 300 calendar spread. Throughout the life of the October 2010 contract the market price of the calendar spread consistently traded below its fair value. Such behavior of the spread would have benefitted Qualified Foreign Institutional Investors (QFIIs) and Qualified Domestic Institutional Investors (QDIIs) seeking to create synthetic index funds (see Reference 1). Such institutional investors could have sold their September contracts and replaced them with October contracts at a very cheap price, thereby adding incremental return to their portfolios.

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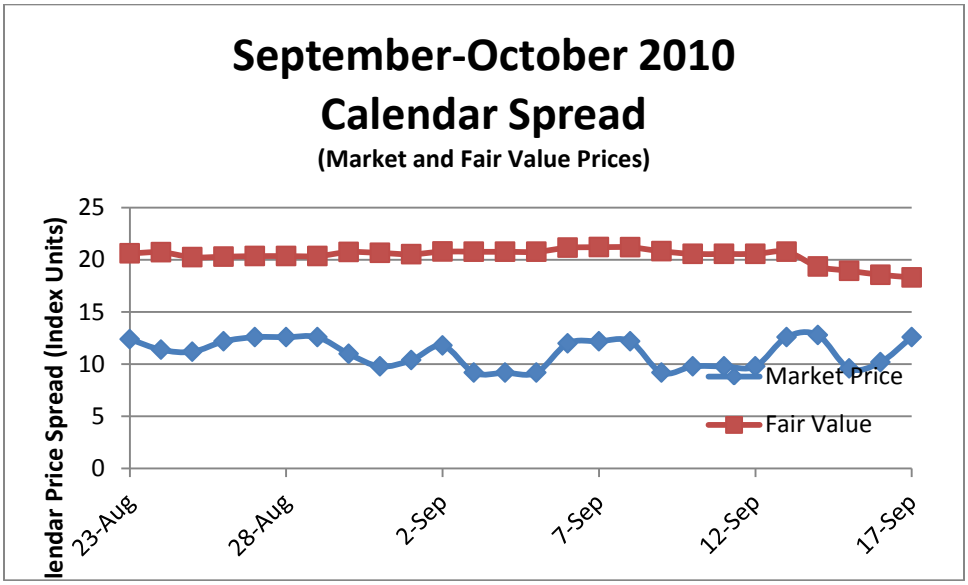
Figure 2 - Market and Fair Value Prices for September-October 2010 CSI 300 Calendar Spread



Source: Authors' Calculations

Figure 3 displays the calculated results on May 24, 2010 for the fair value price of the CSI 300 June-July 2010 calendar spread. As small changes are made in each of the pricing variables affecting the calendar spread, a percentage change in the spread's fair value is calculated and displayed. Rising interest rates and rising dividend yields change the spread in opposite directions. A decrease in the time to contract expiration also decreased the spread value although this would have reversed if the difference in dividend yields, d1 - d2, had been negative. The results are typical for most calendar spreads.

Figure 3 - June / July 2010 CSI 300 Calendar Spread Sensitivities

June-July 2010 Calendar Spread Sensitivities

CSI 300 June July 2010 Calendar Spread	No Change	Pricing Variables						
		Io	r1	r2	d1	d2	n1	n2
Market Level	24-May-10	2873.47	6.00%	6.10%	5.50%	4.32%	26	53
Change in Variable	None	Up 1 Index Point	Up 1 bp	Up 1 bp	Up 1 bp	Up 1 bp	Down 1 day	Down 1 day
New Variable Level	Unchanged	2874.47	6.01%	6.11%	5.51%	4.33%	25	52
Revised Fair Value F1	2874.49	2875.49	2874.51	2874.49	2874.47	2874.49	2874.45	2874.45
Revised Fair Value F2	2880.90	2881.90	2880.90	2880.94	2880.90	2880.86	2880.76	2880.76
Calendar Spread	6.40	6.41	6.38	6.45	6.42	6.36	6.30	6.30
% Change in Spread Fair Value	0.00%	0.03%	-0.32%	0.65%	0.32%	-0.65%	-1.57%	-1.57%

Source: Authors' Calculations

Setting Calendar Spread Margins

Futures initial margins, sometimes called performance bonds, are normally set by global futures exchanges using a Value-At-Risk methodology in which the maximum potential loss for a contract is calculated based upon the standard deviation of price movements. Today as many as fifty registered global exchanges and clearing organizations utilize the SPAN (Standard Portfolio Analysis of Risk) system to set margin rates. SPAN was developed originally in 1988 by the Chicago Mercantile Exchange and is now offers a sophisticated approach to margin setting.

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Since calendar spread orders for CSI 300 futures are not yet recognized by the China Financial Futures Exchange (CFFEX) no spread margin has yet been set . An estimate of this margin requirement, however, can be made as follows. Knowing the initial margin that applies to a single outright futures position (a minimum of 12% for a CSI 300 future) and the standard deviations of the price changes for both the outright future and for a calendar spread, regulators can estimate the margin for calendar spreads as

$$\text{Calendar Spread Margin} = \text{Outright Margin} \times \frac{\text{(standard deviation of calendar spread price changes)}}{\text{(standard deviation of outright price changes)}}$$
$$= \text{Outright Margin} \times \text{Risk Ratio}$$

Using closing price data from the May through October 2010 contracts, the Risk Ratio (ratio of standard deviations for calendar spread price changes to outright futures price changes) was found to be approximately 10.9% (see Figure 4). On average the results suggest the minimum initial margin on a calendar spread for the period studied should be approximately 1.3% as follows:

$$\text{Calendar Spread Initial Margin Estimate} = 12\% \text{ minimum} \times 10.9\% = 1.3\% \qquad (4)$$

However, the observed gradual decline in the Risk Ratio from May to October suggests a lower margin requirement is likely to be appropriate. In the US market the initial margin for a calendar spread on the S&P 500 contract (0.67%) is about half this amount while the initial margin for an outright contract is about 10%. The Risk Ratio for in the period from April 2010 through October 2010 was calculated for CSI 300 calendar spreads and found to decline significantly over this period (see Figure 4). The estimated margin for these calendar spreads declined accordingly and is potentially a sign of a maturing market. To set the calendar spread margin correctly will require far more accuracy in the collection of pricing data for the Risk Ratio. In particular, prices of futures and the level of the index must be captured at the same point in time if a SPAN calculation is to be accurate and reliable. Nevertheless the estimated margins for the second half of 2010 appear to be converging to a level consistent with the more mature S&P 500 futures.

Figure 4 - Estimated Minimum Margin Requirements for CSI 300 Calendar Spreads

CSI 300 2010 Calendar Spreads	Risk Ratio*	Calendar Spread Margin**
May-June	**20.7%**	**2.5%**
June-July	**15.7%**	**1.9%**
July-August	**6.8%**	**0.8%**
August-September	**6.2%**	**0.7%**
September-October	**5.1%**	**0.6%**
Average for CSI 300	**10.9%**	**1.3%**
S&P 500 Futures		**0.7%**

***Standard Deviation of Calendar Spread Price Changes to Standard Deviation of Futures Price Changes**

**** Estimate As % of Outright Futures Margin**

Source: Author's Calculations From CFFEX Data

" To attract and retain professional global market participants, and to facilitate retail investment strategies, history suggests China's regulators and the China Financial Futures Exchange will want soon to support

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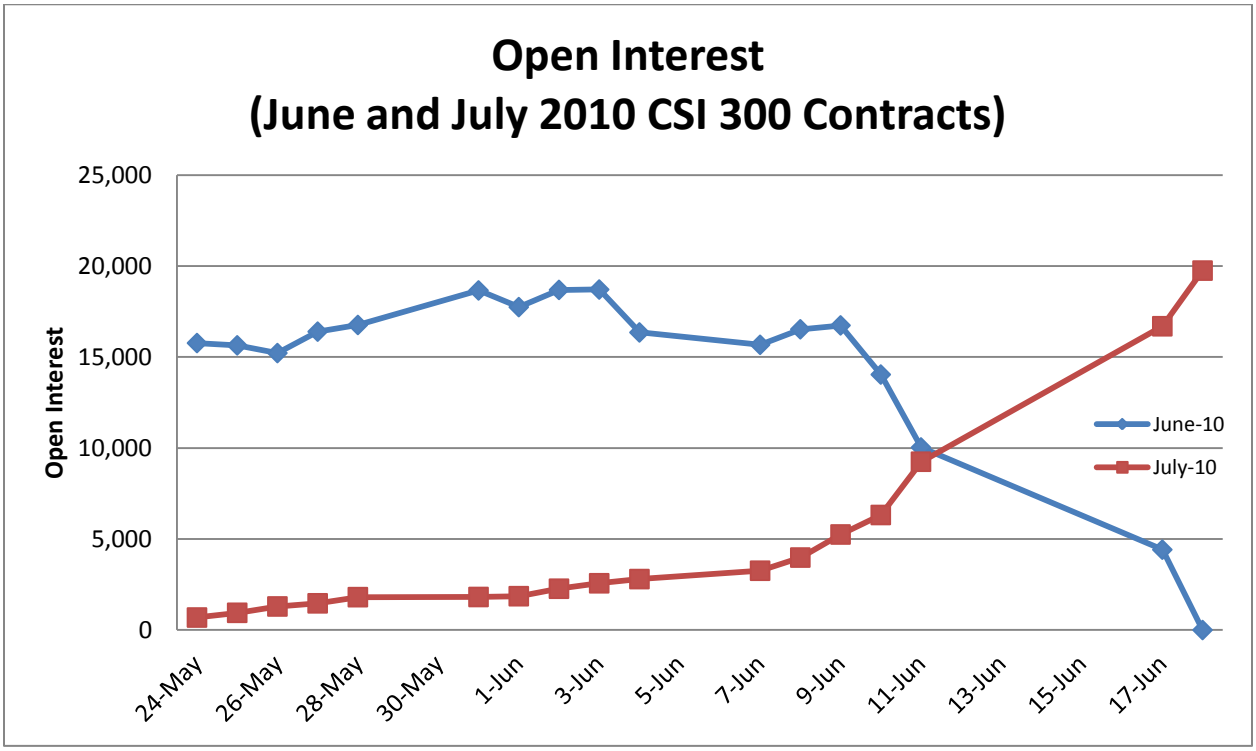
the proper recognition of calendar spread orders together with their associated suitable margin requirements."

Calendar Transaction Frequency and Execution Costs

Because futures trading volume and its associated liquidity are typically largest in the contract nearest to expiration and decline steeply with successive contract maturities, calendar transactions normally involve only the nearest and next term contracts. In CSI 300 futures this means calendar transactions will be typically between successive calendar months but not executed as single spread orders. As the expiration of the near term contract approaches the trading volume and open interest in the next term contract rise dramatically to support rollover transactions (see Figure 5). In the final weeks preceding a futures expiration calendar transactions dominate order flow in a dramatic fashion making economical execution of critical importance for the health of the market.

Figure 5 - Open Interest Changes For June & July 2010 CSI 300 Contracts



Source: CFFEX Data

" In the final weeks preceding a futures expiration calendar transactions dominate order flow in a dramatic fashion making economical execution of critical importance for the health of the market."

Execution costs in global stock index futures markets are normally well below the costs to buy and sell stocks and China markets provide no exception. CSI 300 index futures execution costs are in the range of one basis point (0.01%) to buy or sell where half of this cost is broker commissions while the balance is a charge by the CFFEX. For CSI 300 calendar transactions not executed as a spread, then, the execution costs will simply be double this amount or 2 basis points (0.02%). In many mature futures markets an additional advantage of executing calendar transactions as a single spread order is that commissions are even lower than for two such single orders.

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For China stocks, on the other hand, there is a commission between 0.2% and 0.3% of stock price , a transfer fee of 1 RMB per thousand shares on the Shanghai exchange and a stamp duty of 0.1% for share sales. With these stock costs being so high relative to futures, institutional participants will find the use of futures contracts provide an attractive way both to contain market risks and to create new investment strategies.

Futures also provide additional advantages when compared with stock purchases. Included among these advantages are the absence of custody charges for holding purchased stock, a smaller bid-ask spread and no stamp taxes or additional fees beyond that charged by the CFFEX. Such characteristics make it very attractive to acquire stock index exposure through long futures positions rather than through direct share purchases. Knowledge of this advantage has encouraged the development of synthetic index funds in other global futures markets. These synthetic funds consist only of cash holdings plus futures contracts (see Reference 1). Such funds are simple to administer, low in execution costs and offer the potential for superior investment returns. Establishing and maintaining such funds, however, depends on the ability of the institutional sponsor to execute economically attractive calendar transactions as spread orders.

Market Participants and Their Motivations

Two important futures market participants are likely to employ calendar spreads either to implement strategies having an investment horizon longer than that of the near term contract or to capture short term profits as prices move. The first class of participants would typically include hedgers such as QFIIs and QDIIs, independent money managers, arbitrageurs, pension and mutual funds. The second class of participants is representative of speculators and includes individuals, hedge funds and traders (Figure 6). The difference between these two classes lies primarily in their capacity and willingness to own market risk. This risk capacity is reflected in the strategies preferred by participants in each of the two classes of market participants.

Bona Fide Hedging Strategies

Hedgers in the futures markets can be long or short hedgers. Short hedgers typically own the asset underlying the futures contract in physical form and seek to offset price declines in their assets though short futures positions. Long hedgers, on the other hand, seek to acquire the underlying asset in connection with their ongoing investment activity and so use the futures contracts as an anticipatory hedge in advance of acquiring an asset amount equal to the long futures purchased. Hedgers which either own the underlying asset or own its currency equivalent in cash are classified by regulators as so-called bona fide hedgers. Having such a designation entitles these hedgers to the benefit of lower initial margin requirements.

Each type of bona fide hedger has a periodic need to execute calendar spread orders. For long hedgers this need arises as a futures expiration date is approached creating a need to replace an existing long position in the near term contract with an equivalent size position in the next term contract. For short hedgers a similar need exists only from an existing short futures position.

> Long Hedger Example:
> A CSI 300 index fund manager holds RMB 20 million in CSI 300 June 2010 futures together with RMB 20 million in cash. The combination is economically equivalent to owning RMB 20 million in a CSI 300 index fund of stocks. In the days just prior to the expiration of the June contract the manager will need to close out the existing June contracts and reestablish a new position in the July 2010 contract on a one-for-one basis. To accomplish this the manager should enter a calendar spread order for the closing sale of the June contracts and the opening purchase of July contracts at a specified price difference, or spread. The manager would seek to execute the spread at a level at or below the spread fair value.
>
> Short Hedger Example:
> A QFII manager has a RMB 50 million portfolio of stocks having a broad exposure to China A shares. In late July 2010 the manager fears a market decline in the next 6 months and sells

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RMB 50 million of CSI 300 August futures. As the expiration date of these contracts is approached the manager must switch the hedge into September 2010 contracts. This would be done by entering orders to execute calendar spreads, buying to close the August 2010 futures and selling to open the September 2010 futures at a specified price difference. The manager would seek to execute the spread at a level at or above the spread fair value.

Whether a bona fide hedger is long or short futures there is a need to execute spread orders at economical levels that do not degrade returns. As long as calendar spread orders remain unrecognized in CSI 300 futures the substitution of a new contract for one expiring will remain inefficient and risky.

Figure 6 - Calendar Spread Market Participants

Calendar Spread Participants	Motivation	Transaction Horizon	Typical User
Long Hedgers	**Acquire a price now as protection against a price rise**	**Longer term**	**Synthetic Index Fund Managers, QFIIs, QDIIs**
Short Hedgers	**Acquire a price now as protection against a price decline**	**Longer term**	**QFIIs, QDIIs, Money Managers**
Speculators	**Acquire a price spread in anticipation of a favorable change**	**Short term**	**Individuals, Traders, Hedge Funds**

During trading days in an expiration month large trading volumes and changes in open interest appear as investors establish positions in the contract for the next month.(Figure 1). These significant changes often distort futures closing and settlement prices so that actual market level executions for calendar spreads become difficult to discern . To avoid such data aberrations futures prices used to compute realistic calendar spreads were typically limited in this research to dates prior to the first day of the expiration month. Such a caution is consistent with the approach to data analysis taken by other authors (see Reference 2).

Speculator Strategies

Speculators, the second class of participants in calendar spreads, are often defined by regulators as any party that is not a bona fide hedger. Such parties have no commercial reason for acquiring or disposing of the asset underlying the futures contract. Instead, this class of investors seeks to make a short term profit by simultaneously taking a long and short position in the futures in anticipation of a movement in the pricing difference between the two contracts. In this case the risk of price spread differences is assumed knowingly. Examples of speculators include individuals, professional traders and hedge funds each taking futures positions that will profit directly from a rise or fall of the index. It is typically the case that speculators and hedgers act on opposite sides of transactions as risk is assumed by one party and shed by the other. Successful futures markets depend on both types of market participants.

As an example of how speculators use calendar spreads consider the following. A speculator observing a price difference between the near and next term contracts can profit by taking simultaneous long and short opening positions and waiting for a favorable change in the spread. To acquire the position the speculator night instruct a futures broker to sell a near term and buy a next term contract at a specified spread. Such calendar spreads are not typically held by speculators for a long period of time. Assuming the spread is under its fair value and that the spread shortly widens, the speculator can then reverse out of the spread, closing both contracts and realizing a profit.

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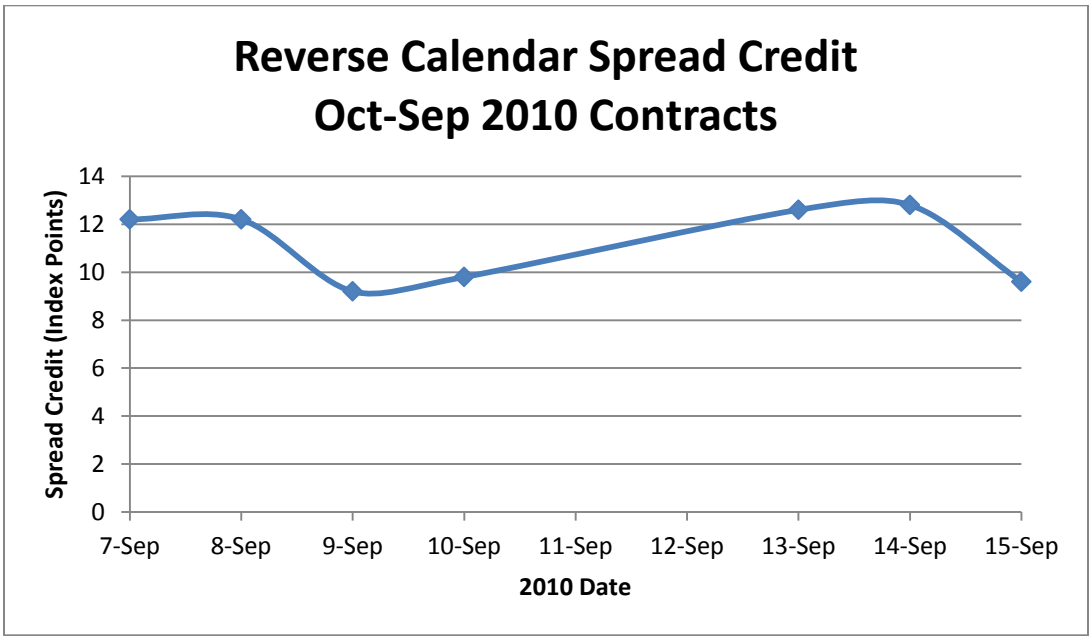
As a second example consider the use of a reverse calendar spread (Figure 7). A trader sells a new September - October reverse calendar spread on September 7, 2010 and unwinds it on September 15, 2010 prior to the September expiration. The trader would first execute an opening purchase of the September contract and an opening sale of the October contract. Based upon closing prices for CSI 300 futures contracts the net credit for this position based upon September 7, 2010 closing prices would have been 12.20 index points. On September 15, 2010 the calendar spread would be offset by executing a closing sale of the September contract and a closing purchase of the October contract. Using market data for this transaction on September 15, 2010 (Figure 7) the spread would be unwound at a debit of 9.60 for a net profit of 2.60 index points (RMB 780) before commissions. The annualized return would have been 4.5%. Only initial margin would have been posted with the exchange prior to placing the order.

Figure 7 - Reverse Calendar Spread on Oct-Sep 2010 Contracts



Source: CFFEX Data

Sell a Reverse Calendar Spread on		7-Sep-10
Order	**Contract**	**Closing Price**
SO	Oct-10	3008.8
BO	Sep-10	-2996.6
Credit on	7-Sep-10	12.2

Unwind Reverse Calendar Spread on		15-Sep-10
Order	**Contract**	**Closing Price**
BC	Oct-10	-2929.6
SC	Sep-10	2920
Debit on	15-Sep-10	-9.60

Net Results for Reverse Calendar Spread

Spread Profit (Index Points) **2.6**

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Spread Profit (RMB)	**780**
Annualized Return	**4.5%**

Source: Authors' Calculations From CFFEX Data

As a third example consider the calendar spread as a transaction on a forward interest rate. Because three month calendar spreads contain an implied three month forward interest rate it is possible in some futures markets to trade calendar spreads against forward rate agreements or futures contracts containing forward rates. In the US market, for example, the calendar spread implied forward rate can be calculated from a market-observed spread and compared with the three month forward rate embedded in a Eurodollar contract. If the difference in these rates is high and thought to narrow, the calendar spread could be sold and Eurodollar futures sold to hedge. A narrowing of the interest rate differential produces a profit when the hedge is offset.

The presence of a forward rate in a calendar spread can be seen as follows:

$$\text{Fair Value Calendar Spread} = Io\ [\ (d1 \times t1 - d2 \times t2) + (r2 \times t2 - r1 \times t1)\ ] \quad (5)$$

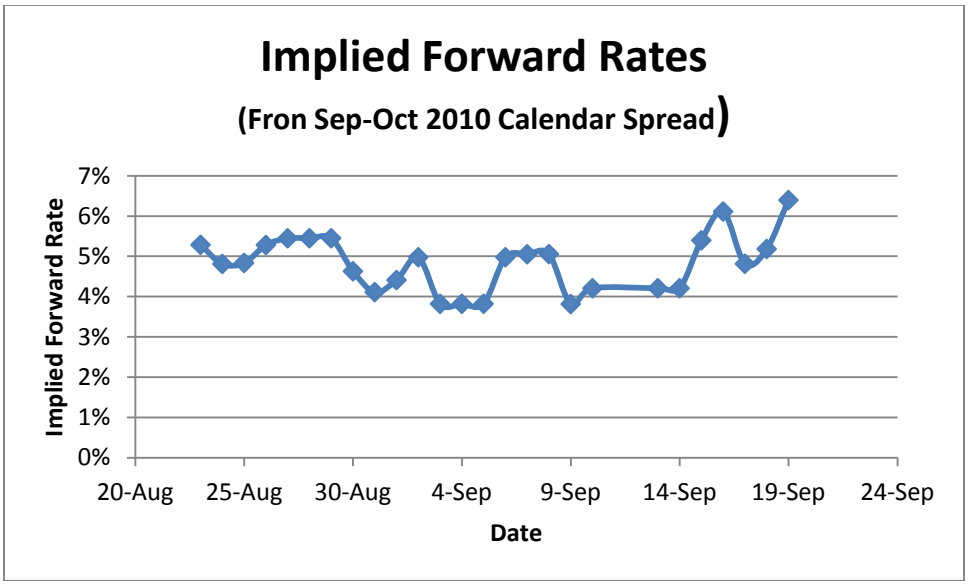
which can be rewritten as

$$\text{FV Calendar Spread} = Io\ [\ (d1 \times t1 - d2 \times t2) + rf \times tf \times (1 + r1 \times t1)\ ] \quad (6)$$

where rf = forward rate for a period tf = (t2 - t1) in length

The implied forward rate for the September-October 2010 CSI 300 calendar spread is computed and displayed in Figure 8.

Figure 8 - Implied Forward Rate From Sep-Oct 2010 Calendar Spread



Source: Authors' Calculations From CFFEX Data

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Final Comments

Calendar transactions in China's new CSI 300 futures are not presently executed as a single order based upon a pricing spread. This is not the case in most global futures markets where spread orders are officially recognized and essential to the economical implementation of both retail and institutional investment strategies. Allowing spread transactions in futures markets has proved a critical practice by futures exchanges seeking to provide needed liquidity and price stability. Both to attract and retain professional global market participants and to facilitate retail investment strategies, history suggests China's regulators and the China Financial Futures Exchange will want soon to support the proper recognition of calendar spread orders together with their associated suitable margin requirements.

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