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THC Co-integration March 28 2010

Feature Article	**THC Co-integration: A New Methodology for Price Discovery**
THC Decisions™	**Treasury Analytics: Co-integration**

The 5 year on-the-run (OTR), 2.5% 3/31/2015, price dropped significantly as a result of the previous day's auction, and in reflection, raises questions about the reaction of the 5 year June futures contract during the same time frame. Of particular interest is whether the futures and cash prices moved in tandem. If not, it is important to determine the market forces that drove the basis, and whether any trading opportunities resulted. On the assumption trading opportunities exist in volatile markets, THC cointegration possibly offers a new methodology of price discovery, which in turn, could be useful for an intra-day basis trade.

The OTR/Futures basis trade is complex. Futures prices are tied to a basket of deliverable bonds, particularly the cheapest-to-deliver bond (CTD) and its associated delivery option. This relationship is defined on a "net basis", which is the spread between the futures and the CTD, adjusted for the cost to carry and the conversion ratio. These bonds, in turn, trade with the OTR based on the standard bond basis. Cointegration identifies all the moving parts that correlate to basis movements between the OTR and the futures.

OTR/Futures Basis Trading on March 25, 2010

Figure 1 depicts the relative values of the cash instruments. Specifically, it shows the co-movements of the OTR prices, the CTD market and model prices at 5 minute intervals on 3/25, beginning at 4:18 am and concluding around midnight on the same day, EDT. The CTD is 2.375 8/3/14 and has a conversion ratio of 0.868053. In comparing the OTR prices (blue line) and the CTD market price (red line), we can see that the CTD is priced higher than the OTR for its shorter maturity, and the spread changes and particularly tightens between 12:00pm and 8:00pm. This pattern can be attributed to the variations in the cheap/rich values of the CTD (the gap between the green and red lines) and the yield curve movements. Richness is defined as the market value net of the model value. Negative richness is called cheapness. Figure 1 shows the market is trading the CTD cheap relative to the OTR curve, since the model price (green) is higher than the market price. In general, off-the-runs tend to trade cheaper than the OTRs.

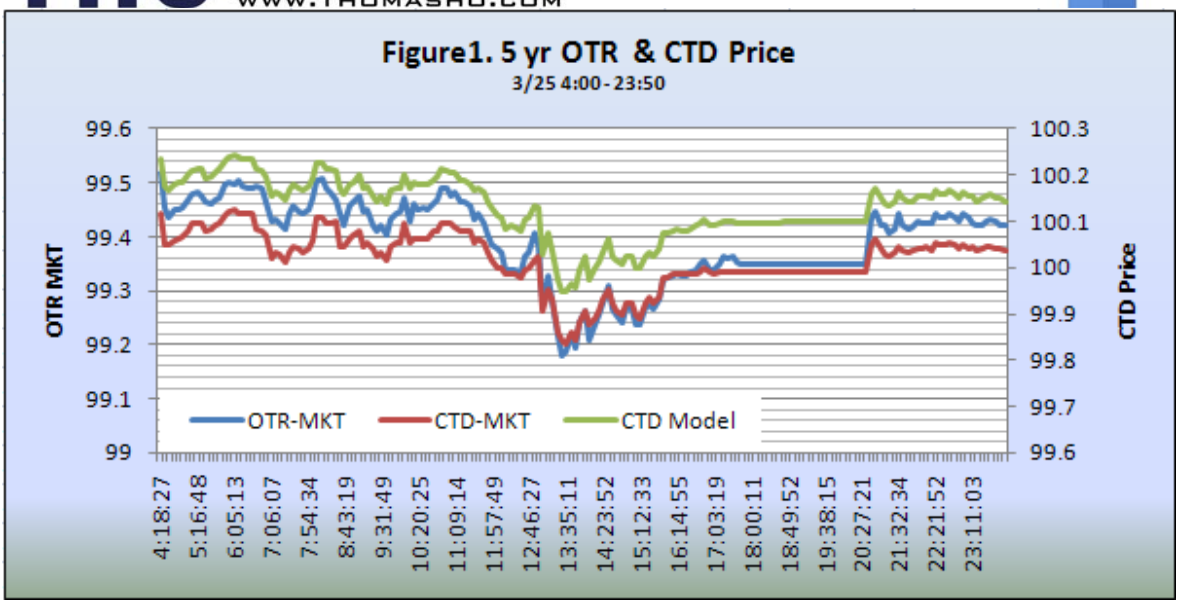


Figure 2, "Value Attribution", below depicts the futures value relative to that of the CTD using the net basis. The net basis is the forward price of the CTD net of the futures price, adjusted by the conversion factor, and its value is attributed to the delivery option value and the futures cheap/rich relative to the CTD. As trading commenced in the US at 6:29 am, the net basis (red line) widened significantly, becoming negative. The widening was explained primarily by the richness of the futures relative to the CTD (yellow bars) with minimal effect from the option value (grey bars). That is, the futures price did not fall as much relative to the CTD. This comovement is particularly pronounced around 6:15pm. The richness of the futures stayed on that level for the rest of the day, albeit in numerous variations.

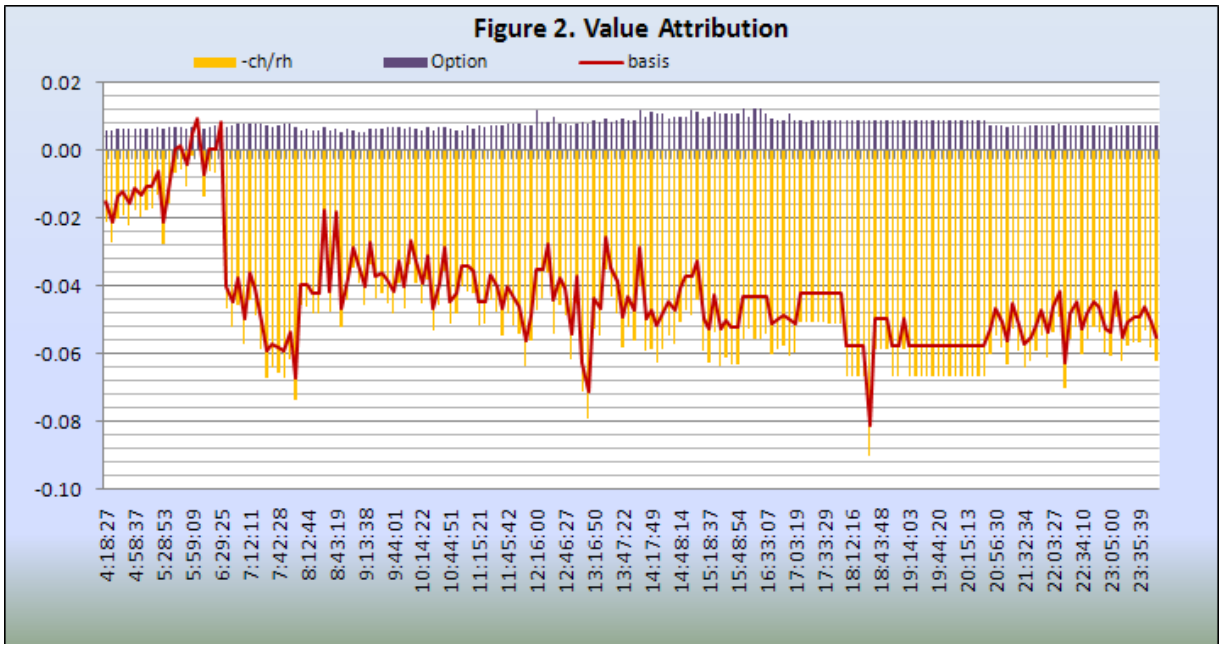


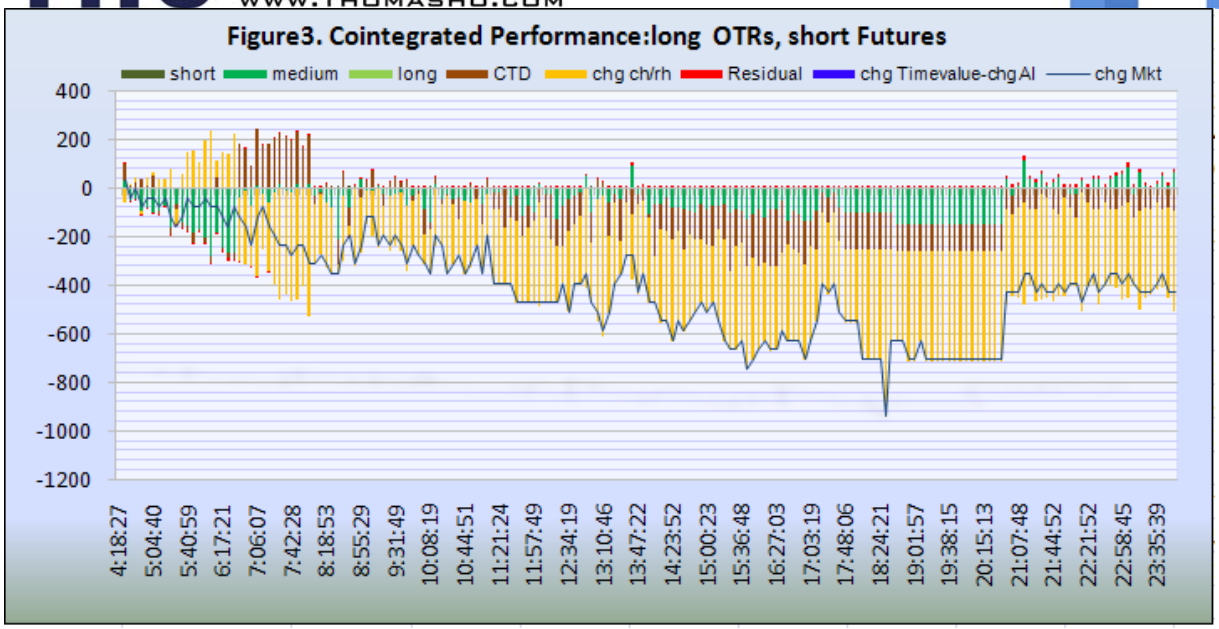
Figure 3 below combines the results of Figures 1 and 2 into a "cointegration analysis", a coherent view of all the risk factors driving the basis movements. Consider a 5 year OTR-Futures basis trade, with $1MM long in the OTR and $1MM short in the June contract. Now consider the profit and loss of the basis position (blue line) in Figure 3. Profit and loss (P/L) was neutral at the outset of the position. We should think of the blue line as an "index" which tracks the momentum and level of the basis position throughout the day. The color bars indicated in the model depict the driving forces or components behind the basis P/L in their entirety.

The first component is the yield curve movement. Yield curve shifts will affect OTR, CTD and futures. The net effect of the basis trade is depicted by the green bars. The short term rate movements (<2 years), the medium term (2 ~ 10 years) and the long term (> 10 years) are represented by dark green, green and light green respectively. This component is often called the "tail risk" of a basis trade.

The second component is the change in the cheap/rich of the CTD. If all components are held constant as the CTD gets cheaper, futures would lower in price relative to the OTR. As a result, the basis would nudge to profit (leading to a rise of the blue line). The cheap/rich movements of the CTD result in the basis trade P/L, as depicted by the brown bars. (To be more precise, "CTD" is the probability weighted basket of deliverable bonds because there is a probability of switching the CTD over time.)

Finally, the third component is the change in the cheap/rich of the futures relative to the CTD. The contribution of this component to the P/L is depicted by the yellow bars.

Figure 3 shows the futures cheap/rich, as depicted in Figure 2, does not explain all the factors behind the OTR/futures basis trading. Figure 3 shows the richness of the futures (yellow bar) led to the losses of the basis trade (blue line). In addition, the CTD cheap/rich (brown bar) also contributed to the losses. While the losses were cut by the close of the US session (17:33), the losses increased again in the evening. By 9:00pm EDT, trading accelerated again, and this resulted in trimming back the richness of the futures. The cointegration shows that the tightening of the spread between the OTR and CTD from 12:00pm to 8:00pm as depicted in Figure 1 also contributed the losses of the basis trade, as depicted by the significant green and brown bars during that period.



Conclusions

THC cointegration is clearly a powerful tool that provides a real-time breakdown of trading strategy P/L into its various components. For example, as the basis value fell, the cointegration demonstrated the tail risk from the yield curve movement was not the driving force behind the basis P/L. The fall was primarily driven by futures trading rich against the CTD. Later in the day, the CTD also traded rich versus the OTR. Given this comprehensive real time depiction of the market movement, the cheap/rich signals for price discovery are definitely more useful.

It is logical to consider whether futures markets figured the cash market over-reacted to over-selling OTR, or if the OTR led the futures market. Traders can use the market information to draw their own conclusions, however. To the extent the traders cannot decide on market direction, then the cointegration results appear to suggest the cheap/rich should mean revert. If the richness were to tighten the following day, the basis trade would be profitable.

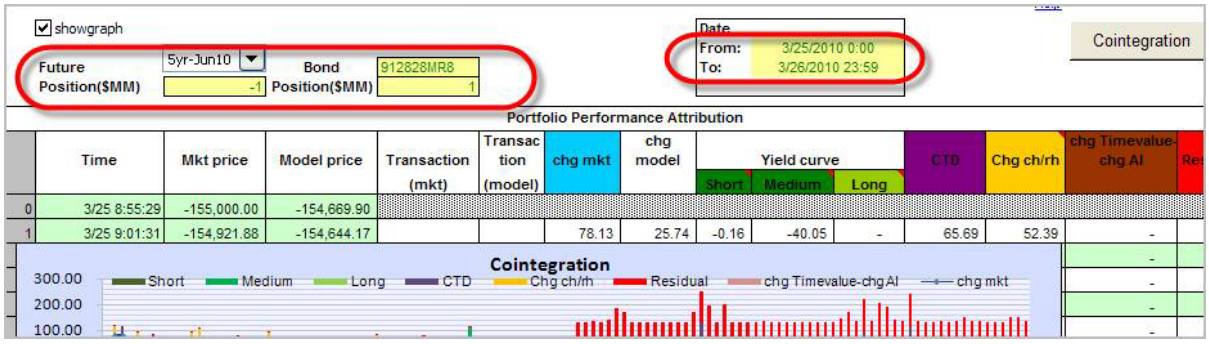
The results also reveal, that while the market is relatively illiquid during the evening (or during the Asian trading session), the profit potential remains. For example, when the market opened the next morning, the market basis adjusted upward significantly.

Note that the cointegration method has broad applications. It can be used for any trade. For example, traders can apply cointegration to both June and September contracts to see the impact of the combined effect in a calendar trade, or market momentum in all the risk drivers can be depicted for the butterfly trades. Hedgers can use this tool to identify the most cost effective hedging strategies by choosing the optimal hedging instruments among the OTR and futures. Using the tool this way enables traders to make tradeoffs between minimizing tail risks and incurring higher trading costs.

Often, cointegration is defined as an econometric model identifying the correlation structure of multiple time-series of data. THC cointegration does not rely on an econometric method. Instead, we use financial modeling to determine the time series; valuation of futures contracts, cash bonds, and interest rate options. In this basis trade, the time series are the components of the P/L: interest rate returns, futures cheap/rich and CTD cheap/rich. This approach is not data fitting. In contrast, the validity of the approach relies on the accuracy and the robustness of the valuation models. For this reason, THC cointegration can be used in many trading applications and in a consistent fashion across multiple trading strategies, trading desks, and relating trading strategies to risk management and portfolio management of an organization.

THC Decisions™ Treasury Analytics

THC Decisions ™ offers the cointegration tool for traders. The CTD and Futures cheap/rich time series trends are depicted in the "Bias Chart", where traders can monitor the mean reversion dynamics of the market trends. The cointegration of the basis trade can be continually monitored by "Cointegration." Traders can select the basis trade and the commencement time. The results will be continually presented graphically and numerically at a user specified time interval, for example five minute intervals. The figure below provides a snap shot of the screen.



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