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Improve Your Trading through Correlation Analysis

CSI's Correlation Studies give our customers the rare chance to either arrange a risk-averse, truly diversified portfolio or to get an edge in "pair trading" by gauging how markets are likely to move in relation to each other. These studies allow the trader to participate in golden opportunities for profitable trading and wealth building.

As you may already know, correlation is a measure of the statistical relationship between any two time series. The subjects of our Correlation Studies can be any tradable investments such as two commodities, two stocks, a stock and an index or perhaps a stock and a commodity — always tracked as pairs.

In our world economy, every market coexists with all other markets, and each market responds in its own way to various stimuli. Whether the relationship between market elements (more precisely, pairs of markets) is causal, complementary, parallel or reciprocal, their relationship can be quantified and plainly expressed as a "correlation coefficient." This shows the level of association between the members of the pair over an extended period of time in numerical probability terms. The corresponding Z-score, a statis-

tical derivative that is an integral part of the Correlation Studies, tips the trader off to future market direction.

Correlation analysis can stand on its own for trade timing and selection, or it can act as a wonderful supplement to any form of analysis that may be supplied by CSI or third party trading software. It provides instant insight into likely future market direction for either or both members for any market pair. In doing so, it can confirm or reject buy and sell recommendations.

Every evening immediately after the exchanges close, CSI's computers calculate the statistical level of correlation for each and every pair of markets in the massive CSI database. CSI covers over 100,000 world stocks and nearly every futures market traded. A host of different time periods are studied to enhance the comprehensiveness of the result.

This exercise takes about three hours on multiple high-speed computers to complete, but traders usually have at least 12 hours to comprehend the analytical results before the next trading session begins. A thorough screening of results allows customers to orient their trading focus and benefit from likely directional movement for the most promising of the many millions of pairs that are analyzed. Computer speed, depth of coverage and longevity of data reserves are three keys to the production of this amazing resource. Flawless CSI data seals the integrity of the correlation database.

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Improve Your Trading...

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Description of Color coding	
From 1.0 To 0.8	High correlation
From 0.8 To 0.7	Moderate correlation
From 0.7 To 0.3	Marginal correlation
From 0.3 To 0.2	Low correlation
From 0.2 To -0.2	Minimal correlation
From -0.2 To -0.3	Low correlation
From -0.3 To -0.7	Marginal correlation
From -0.7 To -0.8	Moderate correlation
From -0.8 To -1.0	High correlation

Figure 1

vs.	C	CL	LH	BK	MER	MSFT
C	1.000	-0.085	0.454	-0.279	-0.123	-0.356
CL	-0.085	1.000	0.263	0.616	0.798	0.505
LH	0.454	0.263	1.000	-0.078	0.110	-0.120
BK	-0.279	0.616	-0.078	1.000	0.885	0.893
MER	-0.123	0.798	0.110	0.885	1.000	0.775
MSFT	-0.356	0.505	-0.120	0.893	0.775	1.000

Figure 2

Understanding Correlation Coefficients

As mentioned above, the relationship between markets can be stated as a correlation coefficient, which is an important subject of this newsletter. There are two parts to the correlation coefficient — the sign and the magnitude. The magnitude is an absolute value that ranges from zero (0) to one (1). It denotes the strength of the relationship. The sign (positive or negative) indicates the direction of the relationship.

A value of +1.0 represents perfect positive correlation, meaning the two members of a given pair move up or down together in perfect uni-

son. If two markets move in exactly opposite directions with equal force, then they have a perfect negative correlation (-1). The closer to +1, the more strongly positive is the relationship and the more likely it is that the markets will move together. The closer the coefficient is to -1, the more negative the relationship and the more likely it is that the pair will consistently and reliably move apart. The closer to zero (0), the more likely is market independence. The correlation coefficient fluctuates depending upon the current strength of the relationship.

See the “Description of Color coding,” Figure 1, above for a guide to determining the strength of the association between pairs of markets. Positive and negative situations are equally powerful to the trader. These levels should be viewed as

probabilities, which are essentially the percentage likelihood that a pair will move together or apart into the future.

Using Correlation To Balance A Portfolio

The CSI Correlation Studies can be your expert guide to balancing (diversifying) your portfolio and guarding against coincident losses in ongoing trading activity. Independence, which is gained through a diversified portfolio, is tremendously important because of the outstanding implications of independent action.

If you are following the recommendations of any trading system or market advisory service that doesn't consider the ramifications of market interrelationships, you may benefit substantially by screening potential trades through the Correlation Studies. Otherwise, you may be faced with synchronized losses that can easily drive the best of traders from the market.

For example, great weather or even a change in government policies could cause a glut or economic tidal wave that might send all grain prices tumbling. This could be devastating to the trader who is long the entire grain complex. Your hard-earned investment capital could be lost like beads on a broken string, tumbling down together despite your best efforts to staunch the flow. Don't let this happen to you. Check out the correlation levels between all pairs of proposed market positions before adding an intolerable level of risk to your trading.

CSI's Correlation software can analyze your portfolio of tradable products to virtually guaranty independence of market movement. As shown in Figure 1, at the middle of the spectrum between strongly positive and strongly negative market correlations are independent mar-

kets with “minimal to low” relationships. Only market pairs with this characteristic should populate your active trading account if it includes anything other than a carefully selected pair trade. More on pair trading later.

To rate the diversification of your portfolio, go to the CSI website at www.csidata.com and click “Market Correlation Studies” at the top of the page. Near the top of the screen is a series of tabbed pages. The four tabs to the right are used for in-depth intermarket correlation analysis. Click the “Portfolio” tab to examine your mix of markets. When prompted to Login, enter the User ID and password provided to you by CSI, or call CSI Marketing and obtain a 3-day FREE trial for CSI’s Correlation Studies.

After logging in, simply enter the commodity symbols of your proposed portfolio into the “Commodities” entry box and stock symbols into the “Stocks” entry box on the “Portfolio” tab. Click [View] and a color-coded matrix displays showing the correlation coefficient for every pair in the combined lists. (See Figure 2 on page 2.) This matrix is interpreted using the key on page 2 in Figure 1. Of course, each market will show a perfect correlation (1.0) with itself. These self-to-self comparison cells are colored white to avoid confusion. Unless you are engaging in specialized pair trading, which is discussed later, then all elements of your portfolio should have correlation levels of 0 to perhaps +/- .3 (green to aqua). It is recommended that you divest yourself of those positions that don’t fit the minimal-to-low range. This will help you avoid potentially devastating coincident losses when correlated markets move together.

Pair Trading

Pair trading involves a systematic procedure in which pairs of corre-

lated markets are pitted against each other and traded together for profit. The same analysis can also determine if a single member of the pair is appropriate to trade in a given direction. In seeking out correlated markets for this type of exercise, the trader might be tempted to look to those markets with the very highest correlation coefficients between .9 and 1.0. These are the best of the best, right? They are the most correlated markets, but they do not necessarily represent the most promising trading opportunities. Perfectly and near-perfectly correlated pairs don’t oscillate on a regular basis, so few, if any, pair trading opportunities exist for them. However, many markets that are linked by industry, market segment, substitutability and other factors exhibit a moderate-to-high degree of correlation, and may prove to be viable opportunities for capturing short-term profits when they stray from their normal relationships. These typically exhibit correlation levels in the .7 to .9 range.

Introducing Z-Scores

To help you find suitable market pairs, the CSI host computer calculates a value that quantifies the profit opportunities for correlated markets. This value, called a “Z-score,” is a dimensionless quantity that is derived by subtracting the sample mean from a raw score and then dividing the difference by the sample standard deviation. The Z-score represents the number of standard deviations between the raw score and the mean. It demonstrates how a given market is performing relative to its own norm. The Z-score may be positive or negative, depending upon whether the raw score is respectively above or below the mean.

Our commodity Z-scores are based on normalized Perpetual Contract®

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CSI's software is uniquely designed to help customers avoid coincident losses by following market products which rise and fall simultaneously to benefit from known negatively correlated market pair relationships. Be sure to read the forthcoming November CSI Technical Journal. It describes a new and novel CSI product that protects customers and promotes profitable trading.

Improve Your Trading...

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Wheat on CBT(Floor Trading Only)

Symbol: W , Csinum: 21

vs.

Soybeans on CBT(Floor Trading Only)

Symbol: S , Csinum: 17

# of Years Back	Time Frame Start Date	Rank Correlation
2 Years	20050912	0.775
5 Years	20020912	0.620
10 Years	19970912	0.808
15 Years	19920912	0.766
20 Years	19870912	0.691
25 Years	19820912	0.721
30 Years	19770912	0.727
35 Years	19720912	0.628
40 Years	19670912	0.750

End of history for market symbols



data, whereas raw market statistics are used to calculate Z-scores for stocks and indexes. When correlated pairs are selected for analysis, the CSI host computer processes the individual Z-scores of both markets to produce a single, combined Z-score for the pair, which shows how the pair is performing relative to its norm. The cumulative daily values are called the “Signal Line” in the CSI Market Correlation Studies

because the pattern generated can be used to develop trading signals.

Signal Line Z-scores measure how far apart a pair of markets may be throughout a common period of history and at an ending point in time. They help the trader find those pairs that have tellingly fallen out-of-sync with their normal relationship and may represent good trading opportunities.

A particular forte of the Correlation Studies is the ability to help you assure that you are positioned in the market in the correct direction through pair analysis. This is due to the fact that prices tend to react to external conditions and then return to normal relationship patterns rather quickly. When relationships change, the sensitive correlation indicator and corresponding Z-scores pick up on that change and expose otherwise hidden trading opportunities.

Suppose you are a Soybean trader and you have noticed a rise in the price of Wheat. To determine if Soybeans and Wheat are correlated, enter the Correlation Studies as described above, but this time select the “One vs. One” tab on the right side of the screen.

To test the Soybeans and Wheat relationship, simply enter “S” (for Soybeans) and “W” (for Wheat) into

the “One vs. One” form. The results screen will tell you that, yes, Wheat and Soybeans are correlated, with a 15-year correlation coefficient of +.766. (See result screen at left.) This means that they typically track together about 76% of the time.

Scroll down to the Z-score chart of these two moderately correlated futures markets. An example is on page 5. The chart demonstrates that Soybeans have been rising, but not to the degree that Wheat has risen. Such a scenario is a tip-off that Soybeans are likely to rise more, following Wheat’s lead. What if there had been no rise in Soybeans to match the observed rise in Wheat? This might indicate a good time to simply wait. When both markets’ Z-scores trend up and your hunch or your broker suggests buying the lagging market, you could do so with added confidence, thanks to the knowledge that the higher market may be leading the way for the lower one’s advance.

Use the graphic presentations in the Correlation Studies to verify that the market you propose to trade is moving in tandem with other markets that are heavily correlated over time. If the heavily correlated markets you discover are moving up, your target market will likely move up. On the other hand, if you display a market that is negatively correlated with the market you plan to trade, your chosen market is likely move in the opposite direction. With the correlation studies, you will have a good idea whether long or short positions are likely to yield a profit. Perhaps the most valuable service of the Correlation Studies is to get you positioned in the markets in the right direction.

Charts showing Z-scores of correlated markets tend to oscillate. Although they generally move together, their relationship swings

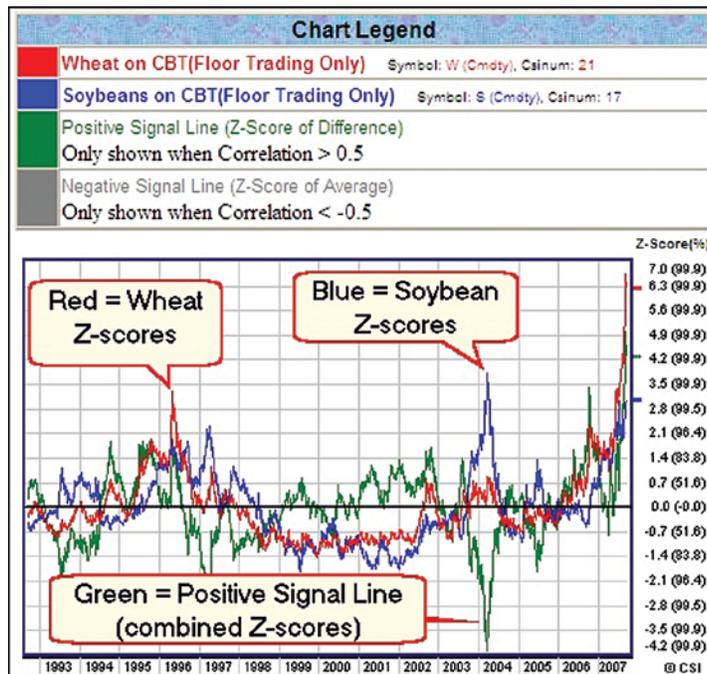
as they switch positions as follower and leader. You can use this added insight in interpreting the current relationship between the two. If the recent Z-Score trend has been divergent, then the tendency to perform together may be weaker than at other times. If the trend is moving toward greater conformity, then this indicator confirms a high likelihood that the two markets will move in the same direction and with similar robustness.

The above graph shows three sets of Z-scores. The blue is the normalized value of Soybeans, the red is the normalized value of CBT Wheat and the green is the difference of the two. (If these had been negatively correlated markets, the Signal Line would have been gray — and subject to different interpretation.) The green Signal line illuminates the fluctuations in the relationship between the pair. It is used for selecting and timing trades.

Finding Spread Trades

If you scroll down to the “Possible Entry Rules” shown below the Z-score chart, you will find that the Signal Line Z-score (derived from subtracting the blue market from the red) could indicate significant spread or pair trading opportunities. These unfold as markets that normally trade together get back in sync with their normal relationship.

This example, although not a



current trading recommendation, suggests selling the red and buying the blue in this positively correlated pair, AFTER the Signal line becomes a confirming indicator by breaking through your chosen significance threshold in a move toward zero (0). This situation is so far beyond the normal range with a Z-score of 4.2, it would definitely bear watching before launching a spread trade.

Scrolling further down the screen will bring you to various other pieces of critical information. One such data set involves “Position Sizing.” This table tells you how many contracts or shares should be taken in each of the opposing positions to produce a balanced spread. Farther down the web page, you will see price charts for the two series. If one or both is a commodity, Perpetual Contract® Data price charts will display as needed. These are smoothed continuous series showing the approximate value of liquid futures contracts. You can also see the numerical values of specific futures

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The scale on the right includes both the Z-score and the implied normal probability for your convenience. Z-Scores allow CSI to chart both series from a common scale and derive meaningful information about daily price variations. If these markets had traded in currencies other than the U.S. dollar, their values would have been automatically converted and the same comparison would be possible. In this chart, the terminal Z-score value is a whopping +4.2 sigma, a very highly significant dispersion.

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CSI can be relied upon to deliver accurate data that is hundreds of percent cleaner than any other source. Ask why Google, Yahoo!, and Microsoft provide CSI data to their site visitors. Ask for a FREE reprint of a comprehensive study conducted by Futures magazine for the details on how CSI data is superior to all other competitive services. You may be surprised to learn that no internationally known data banking firms met CSI's high standards of accuracy when all were scientifically evaluated.

contracts by clicking the chart and then clicking the “more details” link.

Combining Studies

In much the way you might use the Correlation Studies to support your own hunches, this type of analysis can also be useful when applied in conjunction with trading systems. We suggest you enter any trading recommendation into CSI's Correlation product to determine if the recommendation is supported with correlation analysis. As an example, suppose your trading system suggests you become a seller of Wheat. To confirm this advice, use CSI's Correlation Studies' “One vs. All” feature, by selecting this tab from the top of the Correlation Study screen.

Enter “W” (commodity) as your selected market. There are several user-defined parameters, including Z-score filtering values, time period to present and others, that allow you to fine-tune the scanning and filtering exercise. The defaults generally work well, but feel free to change them. Click the question mark [?] button next to any prompt for a complete explanation of your options and their consequences. Click [View] to begin the analysis.

You'll experience a brief wait for results as the CSI host computer applies your filtering parameters to the recently updated CSI Correlation database. Coefficients have already been calculated for all possible pairings offline and behind-the-scenes, so processing an individual query can be done rather quickly. The results screen will be a list of markets that are correlated with Wheat. Click on any market shown there (such as Soybeans) to view the full correlation details.

An examination of the statistical relationship and “Possible Entry Rules” for the Wheat/Soybean pair will typically have either Soybeans

as the buy side and Wheat on the sell side of a possible spread, or the reverse, depending upon the current market conditions. If CSI's Correlation analysis suggests selling Soybeans and simultaneously buying Wheat, consider it a rejection of the advice to short Wheat at this time. There is very little chance such a trade would be profitable. On the other hand, agreement between systems should add to your confidence in the trading signal. A simple exercise like this can make you thousands of dollars or save you that much from losses not taken.

Finding Golden Opportunities

The above examples focus on pre-conceived trading ideas, but one of the benefits of using the Correlation Studies is that it lets you find opportunities you may not have considered — perhaps not in your wildest dreams! To find unknown pair trading opportunities, select the “All vs. All” tab at the right of the CSI Correlation Study screen on the csidata.com website. This lets you scan hundreds of thousands of markets to find correlated pairs from the universe of possibilities.

You can choose to scan Commodities, Stocks, or Commodities and Stocks. The most unusual possibilities can be found by scanning both. Adjust the scanning parameters as desired, and then click [View] to begin the analysis.

The “All vs. All” results will reveal those markets that are most correlated, presented as columns of symbols and market names (read across to see market pairs) and the corresponding correlation ranks and Z-scores. Initially, they are sorted by highest correlation. You'll do well to scroll down to markets in the .90 to .70 correlation range (either positive or negative). These are the markets

that are likely to yield profits as their relationships naturally oscillate.

Being highly correlated doesn't automatically mean that any two markets currently offer salient trading opportunities. The trick is to find correlated pairs that have strayed from their normal relationship, as indicated by those wonderful Z-scores. Click on pairs with high Z-scores to hone in on promising pairs of temporarily non-synchronous markets.

Because of the tendency of correlated markets to move up or down together, Z-score spikes of greater than +/-2 could indicate extremes in the relationship that may be noteworthy trading opportunities. A Z-score of +/-2 (representing a 2 sigma difference) is typically a 95% confidence event. A Z-score of +/-3 suggests a 99% confidence in the association (or disassociation) between the market pair. The higher the Z-score, the closer the result would be to certainty. Z-scores higher in magnitude than +/-3 are quite rare, but they do happen.

The Z-score chart that displays is the same as shown on page 5 for the "One vs. One" analysis discussed earlier. Use the "Possible Trade Rules," "Position Sizing" and other suggestions that can help you make the right trading choices. It is important to explore the markets beyond this chart to try to 1) discern that they truly have a relationship (that their movement isn't coincidental) and 2) understand the market forces causing their similar movement or estrangement.

With trillions of pairs examined daily, a few real winners may be uncovered each day. This is CSI's exciting discovery that helps you find hidden gems. Get into the action with us! You will be amazed at what we can find for you when you explore CSI's historical database with this unrivaled tool.

We did our homework so you, the trader, can take advantage of processes unknown and undiscovered by the balance of the trading community. It would be impossible to reproduce this product without benefit of the massive, accurate CSI database, the pure muscle of our robust computational equipment and the expertise of our team of brilliant software engineers. Only CSI subscribers can experience this synthesis of power and reap the rewards of reliable profits. ♦

Bob Pelletier

NOTICE:

As of September 19, 2007, the cash price (CSI Delivery Month code 54) for the CME currency cross rates reflects a 23 1/2 hour time frame, 5 p.m. until 4:30 p.m. Eastern time the following day. Previously the cash price for CME currencies was from 8 a.m. until 3 p.m. Eastern time.

Compatibility Corner

Compatibility Corner is an occasional series that introduces our customers to programs that run on quality CSI data and to investment-related services that may be of interest. We at CSI are pleased to be among the preferred data vendors for many third-party investment programs and welcome the opportunity to pass along these notices when space allows. This month we will highlight a new addition to our "Compatible Software Supplier" list, Tradecision* by Alyuda Research and an update of One Day at a Time* by our venerable old friend Welles Wilder.

Tradecision is a professional trading software application for charting, technical analysis and creation of trading systems. With Tradecision, traders can successfully combine technical analysis with artificial intelligence in any market, in any time frame. Alyuda Research, the maker of Tradecision, is an internationally recognized provider of technical analysis and neural network software for companies and individuals. Founded in 2001, Alyuda demonstrates its commitment to innovation and a dedication to its customers by developing high-end solutions with an exceptionally high quality service. The wide range of the company's products includes two premium-quality trading software applications: Tradecision and AmpleSight (www.amplesight.com). For more information, visit www.alyuda.com and www.tradecision.com.

The Delta Society's One Day at a Time software has been updated! It includes the systems detailed in Welles Wilder's landmark book "New Concepts in Technical Trading Systems," and a recent revamp adds Fibonacci Studies, a five-wave Elliott Wave study and the Adam Projection. Many use the software to solve for the Intermediate, Medium, and Long term solutions talked about in Wilder's book, "The Delta Phenomenon." Learn more about this and other products offered by the Delta Society at www.deltasociety.com.

*This is not a CSI product. CSI does not endorse or stand behind the products of outside firms.