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In This Issue

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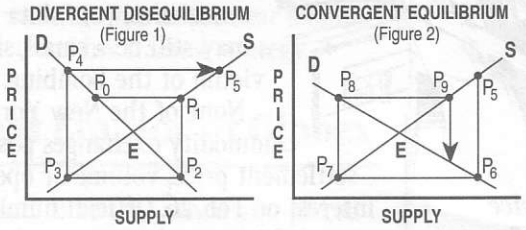
How to Combine Neural Networks & Fuzzy Logic Techniques to Trade More Sensibly

The February 1993 CSI Technical Journal introduced neural networks to our readers and caused such great interest we thought we would carry the ideas a step further in this two-part article. We made the point that input preparation represents probably 90% of the work required to form the neural network into a formidable predictive tool. But what preparation should be performed to feed the network, and how would fuzzy logic be integrated into a neural network?



In disequilibrium (figure 1), supply and demand curves which illustrate the cobweb model are positioned such that price and supply aggravate further disparity. As market forces influence the supply and demand curves to change their slope (figure 2), the process stabilizes to the equilibrium price and supply E. The elapsed time from P_0 to P_1 and from P_1 to P_2, etc. depends on the economic and physical forces that control price and supply. The elapsed period could be measured in hours, weeks or years.

There are many affordable neural network training algorithms in the software arena. What these algorithms do for you is accept your numerous inputs and prepare various outputs that minimize prediction error. What goes on in the inner hidden layers is taken care of by the algorithm, but the software requires the user supply certain quantitative direction. The number of hidden layers to be considered is one of many inputs.

Input preparation for a neural network is not a simple matter. The ability to predict the future price of a given market absolutely requires a thorough understanding of the forces which affect the market. The reduction of raw data into a form suitable for the neural network processing algorithm is normally left as an exercise for the analyst. The user should be aware of such things as cyclical lead time of various inputs on the demand for a product. This then can be translated into a cause-and-effect price discovery for the dependent variable you wish to predict.

I'm not sure who originated the idea, but the cobweb theorem in agricultural economics helps to explain how lags in production translate into future prices. Knowing the cyclic lag relationship of dependent variable price versus the supply of a required raw material should be helpful to any neural network analysis. For example, a low corn price in one period may prompt increased hog production in another, which will translate to a low price for pork bellies or live hogs in another. The converse is also true. Knowing the frequency response and introducing the data appropriately should make your network a more powerful predictor.

Transformations

Last month we introduced some ideas on transformation which also apply to neural network analysis. The

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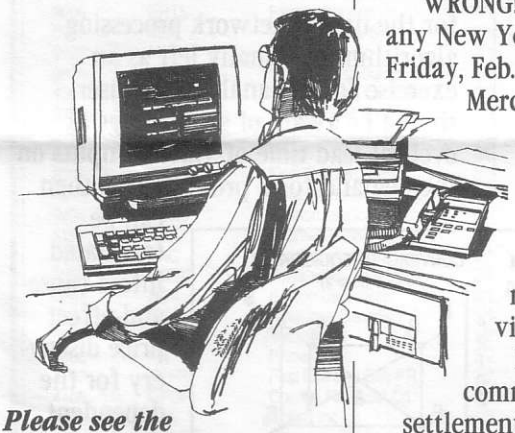
World Trade Center Bombing
How it affects your data base



Please see the Ask Customer Service column on page 4 for details on correcting your files.

As many CSI customers in New York are still struggling to return to normalcy after the bombing of the World Trade Center, subscribers in other locations are back to business as usual. We can sympathize, empathize and try to help, but fortunately, most of us weren't affected, right?

WRONG! Anyone who has updated any New York commodity data for Friday, Feb. 26 and/or New York Mercantile (NYMEX) exchange data for Monday, March 1 may have received incomplete or invalid data. If you haven't taken corrective measures, your data base may still be a small, silent victim of the bombing.

None of the New York commodity exchanges posted a settlement price, volume or open interest on Feb. 26. Official numbers straggled in over the next week, making it impossible for us to report them all before March 5. We are told that at least one data vendor reported 100% erroneous volume and open interest for Friday. We chose instead to report zeros for figures that were unavailable.

Brief trading sessions were held Monday, March 1 at all the New York exchanges, but after Monday's session, the NYMEX retroactively declared March 1 a holiday. The official record for the NYMEX combines all statistics from Monday's session with data from Friday, Feb. 26. All other New York exchanges have maintained separate records for these two sessions.

We initially quoted separate prices for Monday's trading at the NYMEX, but later revised our data base to match the exchange's official records. Our records now show trading for Feb. 26 and March 1 as a single session which took place on the 26th. March 1 appears as a holiday for NYMEX only. All records for the short session at the NYMEX on March 1 have been deleted from the CSI host computer. There was no viable alternative to this because the exchange released only one set of volume and open interest reports for the combined period.

As of March 5, all figures for Feb. 26 and March 1 are believed to be correct in the CSI data base. We urge all our subscribers who follow New York commodities to declare March 1st a holiday for NYMEX on your data base and recollect Feb. 26 through March 2nd to assure the integrity of your data files. ✦

How to Combine Neural Networks...
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idea is to take some form of a variable and replace the variable with the transformed result. The transformations will produce curvilinear relationships for your model without introducing additional freedom-restricting control parameters in the process.

Model building has often been a process which requires making assumptions about linearity. A neural network through simulation and transformation, can solve complex curvilinear problems with often very superior performance.

The types of transformations that should be tried require replacing any variable x with the inverse of x, the root of x, x to a power, the exponential of x, or the logarithm of x to name a few. Another step would replace x_t with x_{t-N} or the quantity

$$1/(N+1) \sum_{n=0}^{N} x_{t-n}$$

where t is the current time, small n is an index and N represents the value of x, N periods ago, etc. The latter transformations are candidate lead-time adjustments.

The Train-Test Cycle

Another consideration involving network development is the interaction between network training and network testing. Typically, a network is trained over a period of months or

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Seasonal Index Update

As many successful traders know, CSI's exclusive Seasonal Indices offer a unique way to combine seasonal information on commodities with daily chart analysis. A seasonal index rating has been calculated for most popular commodities for each of the average 251 trading days per year to help promote a better understanding of price movement. The seasonal index repeats itself year after year with the same wave form, permitting a glimpse of what might be expected in the future. Some of these indices are virtually mirror images of the recent past, while others reflect only subtle seasonal effects. The general wave form tends to prevail all of the time.

We recalculate the Seasonal Indices so that recent pricing information can be included. The subtle changes inherent in the revisions do not invalidate previous index data, but they may enhance market insight and could be useful as a neural network input. We are preparing a revision of Seasonal Index data (code 62) for release on April 12. It has been about a year since we last revised these values.

Beginning April 12, daily users of Seasonal Indices will notice a slight change in index values. As time goes by, you will find many subtle differences in overall seasonal patterns, which are brought about by the infusion of new price data. The revised Seasonal Indices will be identified as code 62 - the same as the original. The new data will update current Seasonal Index files with no problem. If you are currently collecting Seasonal Index data, you may continue to update existing files with the newly-revised indices or you may purchase a replacement history package for exact data blending.

Anyone who has already purchased Seasonal Index history from CSI may request a two-year history of replacement data for $5.00 per commodity. First-time purchasers of Seasonal Index data pay the same rates as for Perpetual Contract® data according to the CSI History Data Price Schedule. A 36-month minimum order applies to each commodity. When more than three years of history are ordered on a given commodity, the price goes down to $1.00 for each additional year.

Seasonal indices can be ordered as history and/or updated each day from CSI. We recommend starting with a complete history and updating that history on a daily basis. These indices are best studied along with a minimum of two years of Perpetual Contract data and with actual contract delivery months. The user should allow sufficient remaining time on the near months to implement his trading strategy. ✦

Caveat Emptor at Globex

It used to be that when you placed a market order - no matter how bad your fill - you still came out with a price somewhere within the range reached on the trading floor. This is not necessarily so if you use the CBT and CME's GLOBEX system, where overnight trading is thin and prices can diverge drastically from those in the pit.

GLOBEX was basically conceived to compete with overseas markets by providing 24-hour service. It's a great idea, but given GLOBEX's current low-volume environment, it may be difficult to match orders. If you're not careful, you may end up with a disastrous fill. Here is an isolated example of an unfortunate trading experience via GLOBEX:

On Friday, Feb. 5, the March '93 Eurodollar contract closed at 96.71. The following Monday on the trading floor, it opened at 96.67 and closed at 96.68. Monday's trading range for all contracts was a modest .03 to .05 points.

In between Friday's and Monday's floor sessions, the nighttime GLOBEX session played havoc with the trading

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For more information on Seasonal Indices, see your QuickTrieve® User's Manual or contact CSI marketing to receive a free brochure.

The GLOBEX concept is very promising and we hope it will prosper. Only time will tell if overnight trading will survive and end the low-volume limbo.

Ask Customer Service

Since the explosion at the World Trade Center on Feb. 26, we have had many calls from subscribers asking how to handle the inevitable data problems. This is a recap of the most crucial questions, along with answers from our Customer Service staff.

Please read the "Bombing" article on page 2 which explains how the exchanges handled the crisis at the World Trade Center and how their actions affect your data base, before reading the "Ask Customer Service" questions.

Q. *How can I tell if my data base was affected by the World Trade Center bombing?*

A. If you collected any Feb. 26 commodity data for the affected exchanges (COMEX, NYFE, NYMEX, or CSCE (sugar only)), you probably received incomplete data. All prices for NYMEX commodities on March 1 have been declared invalid. If you update NYMEX commodities or if you updated data from the other affected exchanges between Feb. 26 and March 5, you should proceed with the steps described below. The New York Stock Exchange on Wall Street was not affected, only those New York commodity exchanges listed.

Q. *I understand that the New York Mercantile Exchange (NYMEX) has officially combined trading activity for March 1 with summary trading information for Feb. 26 and declared March 1 a holiday. I collected NYMEX prices from CSI on March 1. How should I get rid of them?*

A. When the exchange retroactively declared a holiday, they created a bit if a clerical problem for all of us. If you update any commodities from the NYMEX (light crude oil, sour crude oil, unleaded gasoline, heating oil, liquified propane, platinum and palladium), you must code Monday, March 1, 1993 as a holiday for each NYMEX contract you are updating. This is done through QuickManager's® Editor Subsystem (E on the QuickManager menu). Select A - Edit a contract data file from the editor subsystem menu. You'll be offered a list of available data files for editing. Select one of your NYMEX contracts. Data for the last date updated will be displayed. Replace the date with 930301. This will bring up your record for March 1. Press <ENTER> to reach the Day of Week field. Replace the 1 (for Monday) with 9 (for holiday). Press <Esc> to exit. Do this for each of your contracts that trades at the NYMEX for March 1, 1993. The NYMEX data held in your files for this date will now by disregarded by any software recognizing CSI's holiday-coding convention.

Q. *Now that the New York commodity exchanges have released official prices, volume and open interest for Feb. 26 and March 1, how should I revise my data base?*

A. Use your CSI downloader (QuickTrieve or Trade Data Manager™) to retrieve data for Feb. 26 through March 2. (You may need Tuesday's data to correct Monday's or Friday's volume and open interest.) Proceed as you would for a standard daily update. We recommend the calendar method for updates when QuickTrieve version 4.03 or 4.04 is used. This provides easy access of all three days in a single call. Others should make a call for each day, being sure to collect and distribute Friday, Feb. 26 first, then Monday, March 1 and finally Tuesday, March 2. Before picking up any data, users of NYMEX contracts should make Monday a holiday as described above.

Q. *Why can't I just pick up your electronic correction file to fix my files?*

A. You could, but the large number of revisions makes it more efficient to pick up your own portfolio again. Also the correction file can't change the Day of Week status for Monday's NYMEX contracts to a holiday. You must do this yourself. ✦

How to Combine Neural Networks...
(continued from page 2)

years and another later virgin period is used for testing the model to determine if its predictive power remained intact. If a developer rejects a trained network and experiments with several additional forms of network design by repeating the training and testing cycle, he has inadvertently made the test period a part of the training period.

This procedural defect in neural network development is also common in other areas of model building. The analyst must be aware of the fallacy of adopting a repetitive training-testing practice in any sort of model development. ✦

(Fuzzy Logic & other matters addressed next month)

Bob Pelletier

Caveat Emptor at Globex...
(continued from page 3)

range. On Sunday night or Monday morning, GLOBEX reported a trade at 96.56 - - down .15 ($375 per contract) from Friday's close. Twelve contracts were traded at this GLOBEX opening price. The next trade was 12 contracts at 96.69. The first two trades in this session were .13 points ($325 per contract) apart!

Our point is that during GLOBEX's nighttime session, someone executed a trade substantially under the daytime range. There is little recourse in such an event, as the exchange's only responsibility is to assure the trades are executed in accordance with orders.

What can you do to avoid such problems? First and foremost, let the buyer (and seller) beware. Careful order placement is essential. Discuss with your broker ways to make sure your trades will be protected from GLOBEX price swings. Then make sure your wishes are implemented every time. ✦

Holiday NEWS

CSI will be closed for voice communication on Friday, April 9. The host computer will be operational for updates throughout the Easter weekend and Customer Service will be open as usual on Saturday, April 10.