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**Time Series Transformations
 (Converting Raw Data into Profit Opportunities)**

The naval operations officer reading images on his sonar display is actually viewing mathematically transformed data. Each blip on the sonar screen has been filtered and screened to capture the valuable information and ignore the superfluous. Like the naval officer, the modern investor can use mathematical filters and screening methods to identify obstacles and formations in market data. It can be shown that certain mathematical manipulations, when applied to raw market data, can reveal hidden directional market forces.

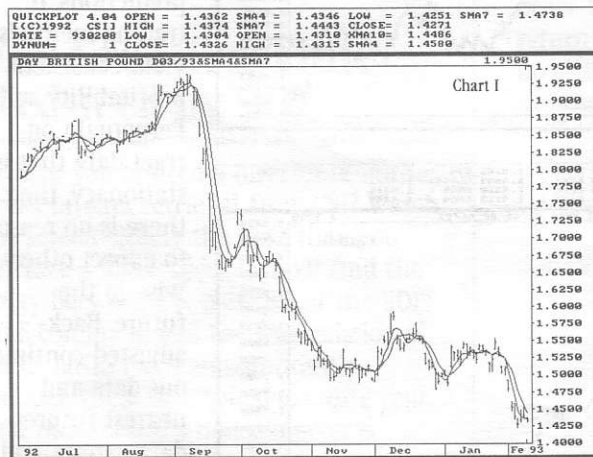
In sonar signal processing, a field in which I was involved for many years, we were able to transform raw detected signals from a target into useful information. The transformation took what appeared to be garbled random noise and produced viable targets with finite characteristics. These included the target's size or classification, range or distance, velocity, acceleration and direction or heading.

Using properly selected frequencies, filtering and noise cancellation and/or suppression techniques (all of which have corollaries with simple moving averages), a high degree of sophistica-

tion in target detection and classification has been achieved. With today's sonar systems, the Navy most likely can not only classify a target submarine, but identify its type and country of origin.

The methods used in military applications are not unlike the ideas I

would like to introduce to you. Raw market data is often used without transformation to identify significant directional market movement. A pair of simple moving averages on



raw futures data can measure momentum and temporary price direction. This is done by examining the direction of crossover of the shorter moving average from above or from below the longer period average. (Please see Chart I, which displays raw data for the March '93 British Pound with a four- and seven-day moving average.) This admittedly crude form of technical analysis is used by many traders as their exclusive source of determining future market direction. The analyst who first transforms raw data into stationary data and then applies differential smoothing techniques has a much greater chance of deriving

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Time Series Transformations...

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profitable trading signals.

Transforming raw data into stationary data

Regular readers of this Journal are not so easily fooled. They know, because we insist that they know, that

Perpetual Contract® data is stationary. Stationarity is required of any stochastic series where there is a need for consistency and repeatability in predictions. If trading methods yield consistent profitability with Perpetual Contract data that is stationary, then there is no reason to expect otherwise in the future. Back-adjusted continuous data and nearest futures data cannot and should not be used because of the apparent absence of stationarity.

We do not recommend using non-stationary data because it is not likely to perform for you.

Perpetual Contract data focuses on a constant-forward period of perhaps 91 days. It represents a time-weighted average of the two contracts that lie before and after the 91-day-forward target date. This time-weighted interpolation of price produces a slight smoothing that tends to reduce volatility and stabilize price behavior. Chart II shows a #46 Perpetual Contract series of the British Pound with a five-day exponential moving average superim-

posed. The significance of the exponential average is explained below.

This first level of necessary data transformation occurs when converting raw futures data into a stationary Perpetual Contract series. Once this is done, the pair of moving average calculations should then be applied to the smoothed series. A careful examination should reveal fewer crossovers in time and less false alarms of long-to-short and short-to-long directional market changes.

Transforming and enhancing stationary data through differential smoothing

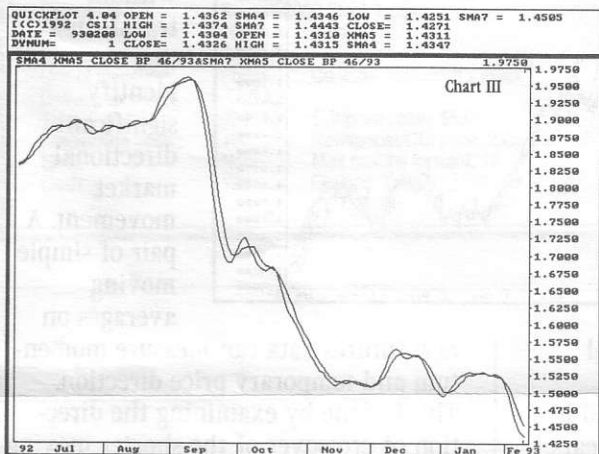
A second level of data transformation would be obtained by smoothing the Perpetual Contract data. In doing so, one can adopt an exponential smoothing approach giving the heaviest weight to data for the most current readings. Please note the relationship of the exponentially smoothed curve superimposed over the Perpetual Contract data in Chart II. For the sophisticated analyst, the exponential smoothing should be replaced by a differential smoothing approach. In either event the object is to transform the stationary data such that the number of crossovers of a momentum-measuring device are minimized.

The approach used for the final transformation must also minimize the lag time consumed to implement trades. This is a critical fine-tuning process. Acting too soon may produce a disappointing reversal and acting too late could trim most or all of the profit opportunity from the trade.

Transforming differential data into trading signals

The final step in the stationary/differential smoothing process is to apply your favorite indicator. It must be done such that the number of trade positions is minimized and the level of

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Stock Prices Slashed

Each day the CSI host computer updates prices on over 6,000 stocks. The stock data base covers NYSE, AMEX and NASDAQ trading with timely, accurate prices.

Despite the quality of our stock-reporting service, this extensive data base is woefully under-utilized. Only a small percentage of CSI subscribers include stocks in their daily update portfolios. We would like to change that percentage by making our stock offering more attractive to stock market investors.

We have slashed the prices for daily updates of stocks by 60%, making them very affordable to all. Users of our Custom Portfolio Service can now receive ten stocks for the price of every one futures contract! Prices now start at around \$11 per month for a prepaid portfolio of up-to 50 stocks. Six hundred and forty stocks of your choice can be updated for about \$35 monthly using a "Prepaid Custom Portfolio."

Contact CSI marketing for pricing details on the above and use QuickTrieve's® or Trade Data Manager's™ electronic ordering system to add or delete stocks as desired. ♦

QT 4.04 Delivered

All orders for QuickTrieve 4.04, which includes the information-rich 1993 alert calendar have been filled. Customers have expressed their appreciation of the helpful benefits of the trading calendar. In addition to holidays and important dates for traders from the U.S., this version includes a wealth of international information. We contacted the commodity exchanges of about 20 countries to compile the information on their trading holidays.

Such holidays as Whit Monday, Ascension Day, Queen Beatrix Day, Boxing Day, Epiphany, Corpus Christi,

All Saints Day, Remembrance Day, Bastille Day, Ching Ming Day, Dragon Boat Day, Moon Festival Day, Respect for the Aged Day, Emperor's Day, Hari Raya Puassa Day and dozens more are carefully identified by the celebrating country where trading is suspended.

If you haven't yet ordered your copy of QT v. 4.04, consider getting one today, before the 1993 calendar becomes history. The upgrade price is \$29, inclusive of the '93 alert calendar and domestic P&H. If you bought v. 4.04 before the end of '92 and would like the '93 alert calendar, you may purchase a new copy for \$10, which covers postage and handling. ♦

File Creation Time Reduced by 90%

Have you noticed a difference in the speed of data retrieval from CSI? Watch the screen closely the next time you retrieve a daily update. You'll find the delay between the issuance of the EDIT FILE command and the transmission of DATA LINES has been significantly reduced. The time required to create your data file on the CSI host computer is probably about 10% of what you experienced at the beginning of the year.

By the time you receive this Journal, we hope to have this change effective for all CSI subscribers. Our schedule is to initially support Tymnet users. Those who dial direct or use Telenet will be supported very soon thereafter.

In the past, file creation consumed a large percentage of overall data retrieval time. Since this is no longer the case, transmission time should be reduced for most users.

This is just one of many enhancements scheduled for the CSI Data Retrieval service in the next few months. QuickTrieve users can expect a similar enhancement in the speed of history file creation shortly. We'll keep you posted on our progress. ♦

CSI Catalog Now Available

We have published a catalog describing the scope and longevity of CSI data products along with a complete pricing summary. If you would like a copy, please complete the order form on page 5 and return it to CSI. There is no charge for the catalog.

Ask Customer Service

Each month in this column the Customer Service Staff addresses a topic that may be of interest to all. This month they'll present some common questions and answers about retrieving duplicate days with Quicktrieve.

Q. *QuickTrieve's multiple-day collection calendar still shows the last holiday as a date that is available from CSI. Every time I retrieve "all uncollected days," the program tries to pick up the holiday again. How can I change the update status?*

A. QuickTrieve keeps track of collected days in a file called CDATES, which is automatically amended with each access. Since you can never pick up data for a holiday, these dates are always listed as uncollected. Erasing CDATES from your QuickTrieve directory with DOS will solve the problem. Simply change to the \QUICK directory and type: ERASE CDATES. The next time you start QuickTrieve, you will be asked the last day updated. Enter the correct date. A new CDATES file will be created, which will list all previous dates as "collected." QuickTrieve will then stop trying to retrieve the missing holiday.

Q. *I ordered some history on a new contract without adding it to my portfolio. By the time I realized it wasn't being updated, a few days were missing from the file. My problem - when I try to re-collect those days through QuickTrieve's multiple days collection calendar, they are shown as "collected" and I can't get to them. Any suggestions?*

A. Although the calendar shows these days are collected, you can retrieve them again by selecting them with the cursor keys and pressing <Enter>. The selected days will blink. When all desired days are blinking, press <F2> to begin collection. Another alternative is to use QuickTrieve's single-day collection feature to pick up each missing day individually. If you use an older QuickTrieve (prior to version 4.04), consider the "full week" option to retrieve five days at a time.

Q. *If I re-collect my custom portfolio to pick up a little history on a new item I have added, will I be charged extra?*

A. Quite possibly. You are allowed 26 updates during a billing cycle (typically 21 trading days) without incurring extra charges. If your retrieval has been going smoothly, you can probably get a few duplicate days without paying for them. Keep in mind that the extra-access surcharges are based on portfolio size and number of extra accesses. Network users pay six cents per contract per day and those who dial direct pay five cents per contract per day for more than 26 updates. At these rates, it may be marginally cheaper to order history. Since you pay only for each update that exceeds the 26 limit, the extra charge will be insignificant in many cases. By the way, a full-week collection counts as five updates.

Q. *I sometimes bypass QuickTrieve's collection calendar and select the individual days I want to update from the menu. I realize that in doing so, I may be retrieving a day I have already collected. If I collect a date that I have retrieved with QuickTrieve before, will my data files be damaged?*

A. No. A unique feature of the CSI data format is that we map out file space in advance, so each day has its own spot on your data disk. If a duplicate date is retrieved, the latest update simply overwrites the previous entry with no ill effects. Similarly, if a day is skipped, it may be filled-in retroactively.

Since too many redundant collections can result in higher bills, we recommend consulting and using the calendar method of retrieval on a regular basis. This is a fast, easy way to retrieve one day or many, without skipping dates or duplicating efforts. Use the other collection methods for special situations when duplicate updates are desired. ♦

Time Series Transformations..

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realized return is maximized. You will find this task much easier on the newly transformed data than on your original raw market data.

Chart III shows four- and seven-day moving averages applied to the exponential series of chart II. We could have selected any other indicator for this purpose. Please notice the incidence of crossover versus the heavier incidence in Chart I. Through this demonstration, it is easy to see that by applying some simple transformations, one can avoid overtrading, reduce costs and improve profits.

The example in Chart III uses only closing prices. Greater profits may be realized by smoothing stationary highs and lows or factoring in a small delta price on the averages that will reduce false signals. Space limitations in our Journal restrict the detail we can

present, so further refinements will be left to the reader. This may sound self serving, but we believe the key factor in deriving profits from time series transformations is achieving stationarity. You want repeatability of the simulated past to unfold in the real future. We believe this first step is critical.

And so, like the naval officer, the astute financial analyst can discern the unseen through mathematics. The simple steps of transforming raw data into stationary data, applying differential smoothing techniques and deriving trading signals should result in improved trading results. The raw data may uncover no more than a school of fish, whereas the transformed series might trap the image of a truly coveted target. ♦

Bob Pelletier

Feedback on Neural Network Article

Many users have commented favorably on our presentation last month covering Neural Networks. New subscribers may receive a free copy by asking for it when they order. We feel this is an exciting and worthwhile topic, so we don't want to leave anyone out.



CSI Software Product Summary

- QuickTrieve®/QuickManager®** - To retrieve, manage & edit data; includes Alert Calendar: Unrestricted use \$99, Daily data user \$39 and 4.04 Upgrade \$25
- QuickPlot®/QuickStudy®** - Charting & analysis software (requires QT/QM) \$156 Currently on sale @ \$99
- Trade Data Manager™** - Macintosh downloader & accounting program; includes 1st month of updates \$99
- Trading System Performance Evaluator™ (TSPE)** - Computes your system's capital requirements \$199
- Trader's Money Manager™** - Introductory price \$499 (includes TSPE)
- TraDesk™** - Traders' complete accounting system-(price varies with number of accounts) Starting @ \$399/Unrestricted use \$299/Daily data user or 12-month lease starting @ \$22/Mo.
- Seasonal Index Value Pack** - Ten years of history for 33 popular commodities \$444
- Daily Updates** - Starting at \$10.80 per month
- CSI News Journal** - Aug. 1990 to present \$35/Yr. or \$5/Reprint
- CSI Mailing List** - \$200/1,000 names (CSI users omitted)
- CSI Product Catalog** - Free

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All prices subject to change without notice.