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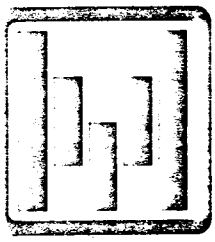

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The Use of Price-Volume Crossover Patterns in Technical Analysis

S. Kris Kaufman and Marc Chaikin

Abstract: Background and Methods. The routine use of price-volume crossover signals as a means of forecasting future stock or commodity price movement has been gaining popularity lately due to the availability of software to simplify the analysis. In this study we tested 24 unique crossover patterns and identified their forecasting performance. Crossovers are classed by both pattern and the elapsed time for the pattern to develop. For each pattern, we analyzed how much better one could forecast price direction 5, 10, 15, and 20 days in the future, given that the elapsed time for the cross to develop spanned the same number of days. We used approximately one hundred and twenty five thousand days of daily stock and commodity data bundled together in our evaluation. At least 100 occurrences for each crossover pattern were used in the analysis.

Results: The results suggest that several patterns are significant and could be used to improve a stock or commodity price forecast. The most negative cross within the test window was II-B, which occurs when price drops on decreasing volume, rises on light volume and then drops again on increasing volume. It was interesting that the converse pattern

TITLE: Price-Volume Crossover Derivations

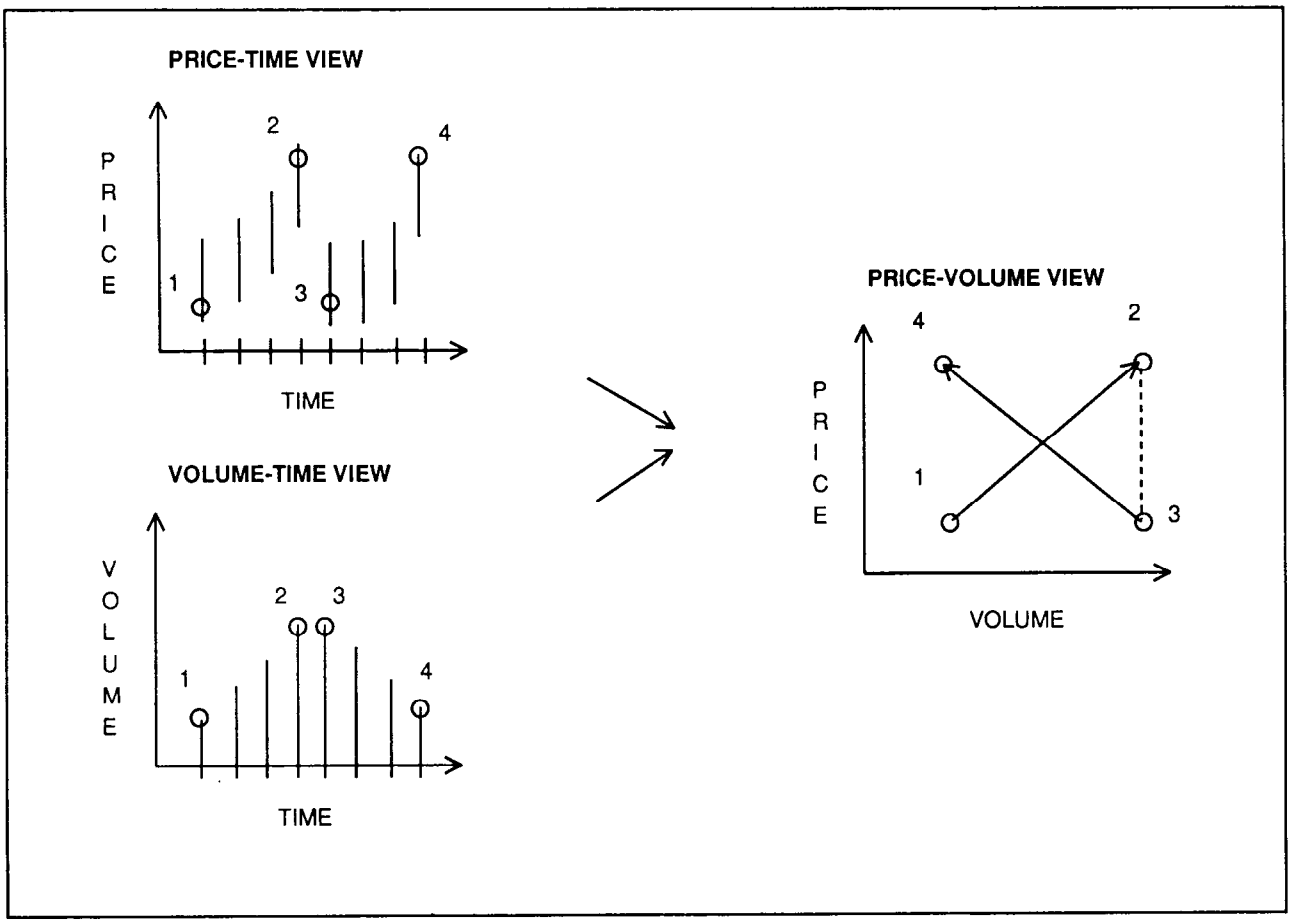

Figure 1: DERIVATION OF PRICE-VOLUME CROSSOVER

I-B is not as bullish as II-B is bearish. The I-B results show that you will generally move up immediately after the cross, only to fall later. The utility of this technique is its ease of use by computer and the integration of price and volume which is achieved.

Introduction

Market technicians usually study time-based charts in order to identify price and volume patterns. There is a large body of technical knowledge about the combinations of price and volume behavior that lead certain types of market price action [Pring et al.]. The price-volume chart provides a different way of viewing the data. In fact, the two major reasons for using this view are that it leads to a single indicator integrating price and volume and the data can be easily tracked by computer. The identification of these patterns on the price-volume chart has been linked to the crossing of two price-volume lines. Ben Crocker, for one, has long been a proponent of price-volume charting and has studied some of the basic patterns as well as pattern groupings. In this study we will test each of the 24 basic single cross patterns on four time periods using very diverse stock and commodity data.

Crossover Patterns

The price-volume view is formed by plotting the closing price on a vertical axis versus volume on a horizontal axis (*Figure 1*). Each day a new point is added and then connected to the previous days point by drawing a line. For this discussion we will refer to the "final" segment as the most recent price-volume line. The "initial" segment is the one which occurred further back in the past and is crossed by the final segment. Crossover patterns are

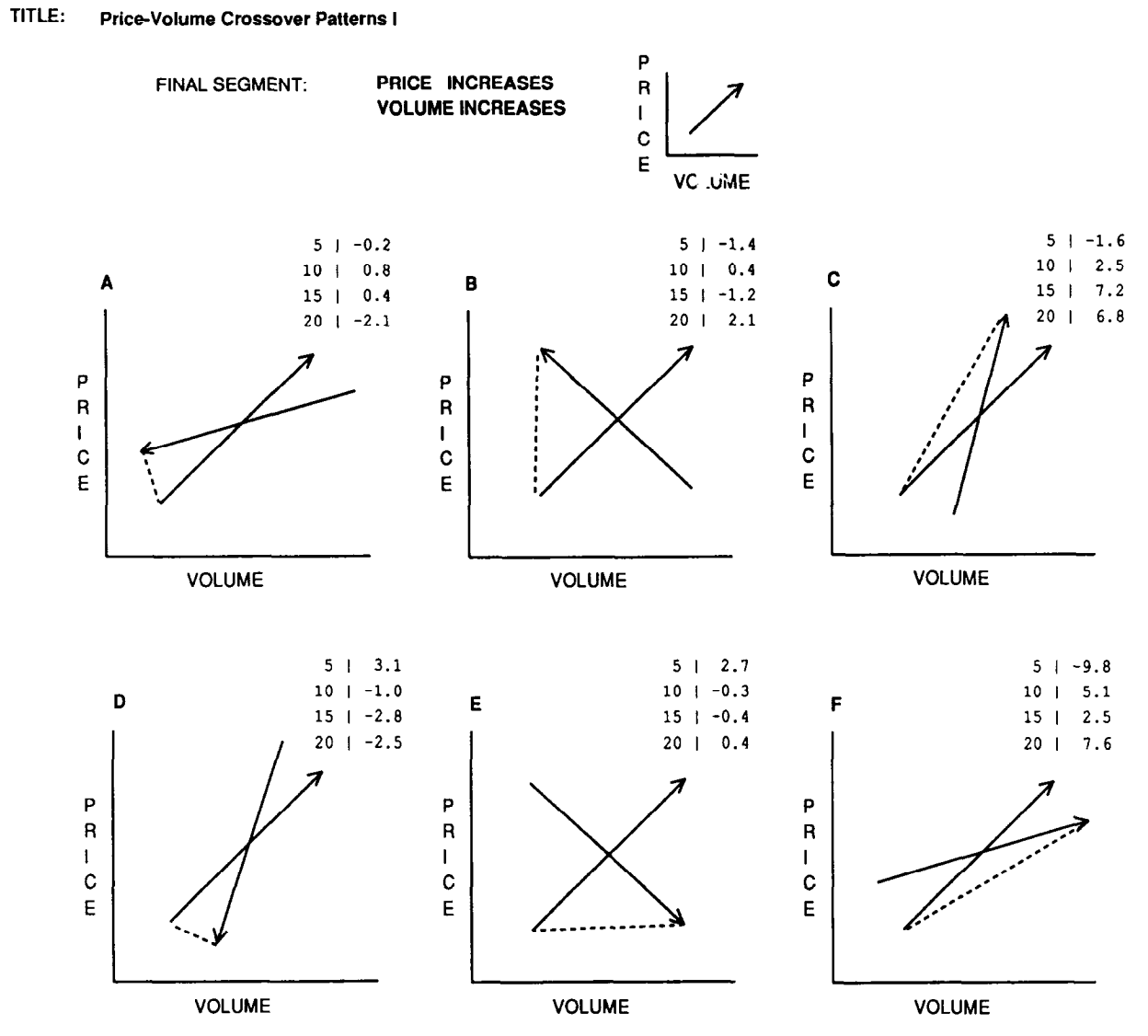

Figure 2

classified by the direction of the initial and final segments, and by the elapsed time between them. The pattern shown in figure 1 shows price rising on increased volume (1 to 2), then declining with the same level of volume (2 to 3), before finally rising on decreasing volume (3 to 4) to complete the pattern. The dashed line indicates that an unknown number of days may have elapsed between the initial and final segments. There are 24 patterns in all (*Figures 2* through *5*). The patterns have been divided into four groups based on the direction of the final segment. Each of the figures shows one of the four final segment possibilities with all possible initial segment choices.

Analysis

The best way to judge the benefit of using crossover signals is to analyze the actual price action following a certain crossover. Within a particular time frame, more than one crossover pattern may complete. They have different initial segments with the same final segment, but they still occur together in terms of the evaluation. We have chosen a simple least-squares approach to solve for the relative importance of the crossovers. This approach neatly separates each pattern by assigning it a weight as part of a linear sum. *Figure 6* shows the least-squares matrix equation Aij * Wj = Bi, where the A's are zeros or ones depending on whether one of the 24 crossovers occurred within the analysis window, the W's are the unknown pattern weights, and the B's are the answers to what happened next in the market. If the market went up after 5 days (or any fixed number), a plus one is entered. Otherwise, a minus one is used. Since we have so much data (roughly 125,000 days), the problem is very well constrained. The re-

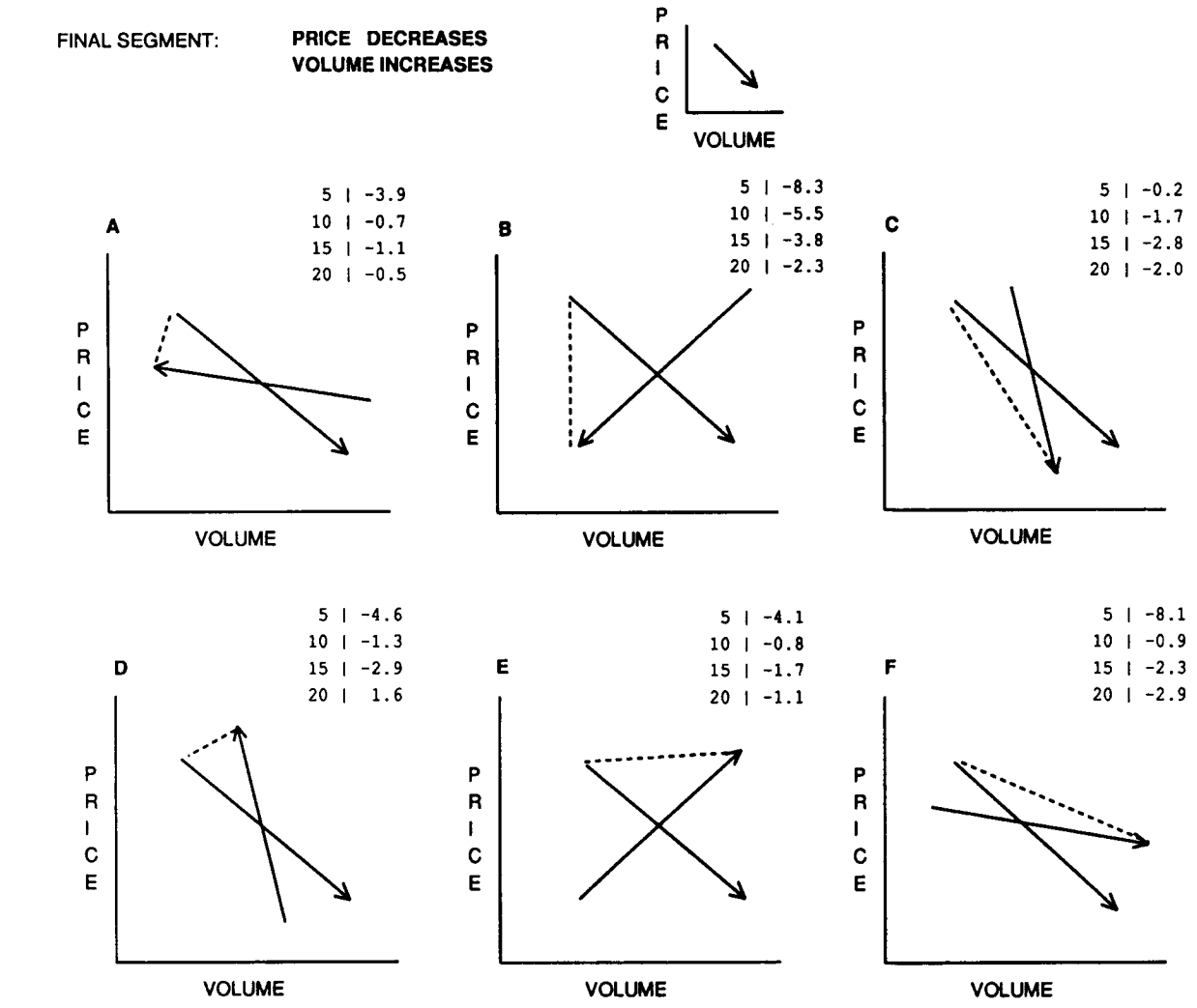

Figure 3

sulting weights will tell us whether a pattern is bearish ($W < 0$) or bullish. Also note that we added a constant term to the weighted sum model to pick up any price trend bias over the whole data set. This turned out to be positive 1 to 2% which is due to the 80's bull market.

The equation was solved for four cases. All crossovers occurring within 5 days coupled with the resulting price behavior 5 days out, and the same for 10, 15, and 20 days. The results are shown in the upper right hand corner of each pattern on figures 2 through 5. The weights may be interpreted as an average percentage deviation from the random case. In other words a 5.2 weight indicates that the pattern predicted higher prices about 5% better than random. When the weights flip-flop between positive and negative without any clear pattern, the crossover has little or no significance in forecasting.

In evaluating the results it is apparent that all patterns with the same final segment do not have the same forecasting utility (see *Figure 7*). One might expect that days following a move higher on increasing volume (figure 2 patterns) would always be more positive, independent of the crossover. Our results show that patterns I-C and I-F predict very negative price action 5-days out, before turning and becoming very positive later. Other members of that group, including I-A, I-B, and I-C show no clear pattern, while I-D is positive early and negative late, the opposite of I-C and I-F. Group II however, does show universally negative behavior, but there are two patterns which are much more negative than the rest. *Table 1* is a summary of the significant results.

Discussion

The results suggest that several of the price-

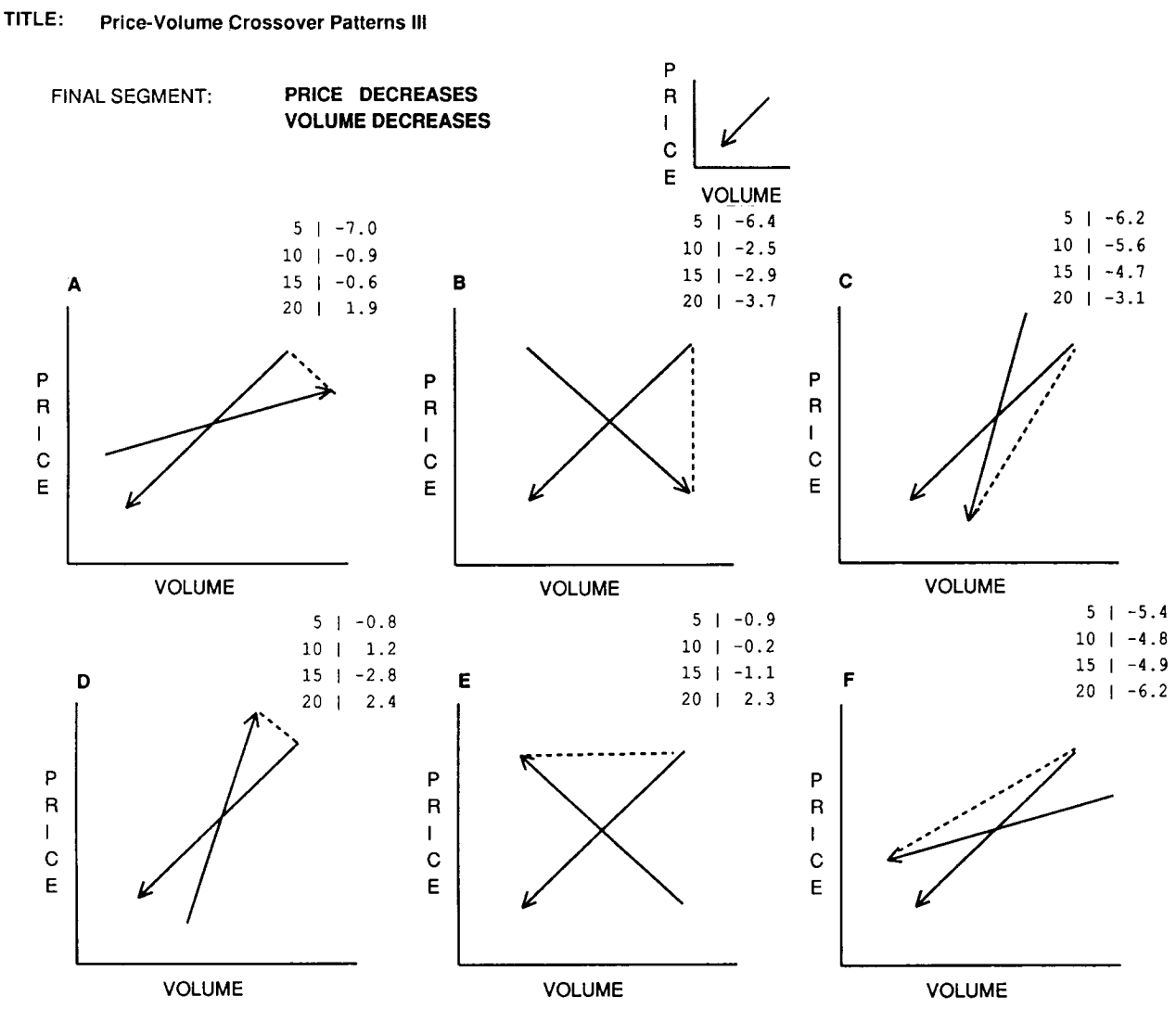

Figure 4

volume crossover patterns are significant and could be used to improve a stock or commodity price forecast by generally +/− 5%. It is interesting to note that down moves are much more easily forecast using price-volume patterns than up moves. Also, the group II pattern results suggest that any time one sees a price drop on heavy volume, a hasty exit is in order.

The most negative cross within the test window was II-B, which occurs when price drops on decreasing volume, rises on light volume and then drops again on increasing volume. It was very interesting to note that the converse pattern I-B is not as bullish as II-B is bearish. The I-B results show that you will generally move up immediately after the cross, only to fall later.

The use of the price-volume crossover technique is a practical way of integrating two charts into one for analysis. Since a computer can easily be programmed to pick out these patterns, this indicator should continue to gain in popularity over time. Further study should be devoted to combining crossover patterns with other technical indicators, analyzing weekly and monthly data, and also to special sequences of these patterns.

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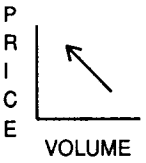
Crocker, Benjamin B., *The Computerized Investor,* The Crocker Report, 320 West California Blvd., Pasadena, CA 91105, Volume IX.

Pring, Martin, *Technical Analysis Explained,* McGraw-Hill, Second Edition, 1985.

TITLE: **Price-Volume Crossover Patterns IV**

FINAL SEGMENT: **PRICE INCREASES**
VOLUME DECREASES



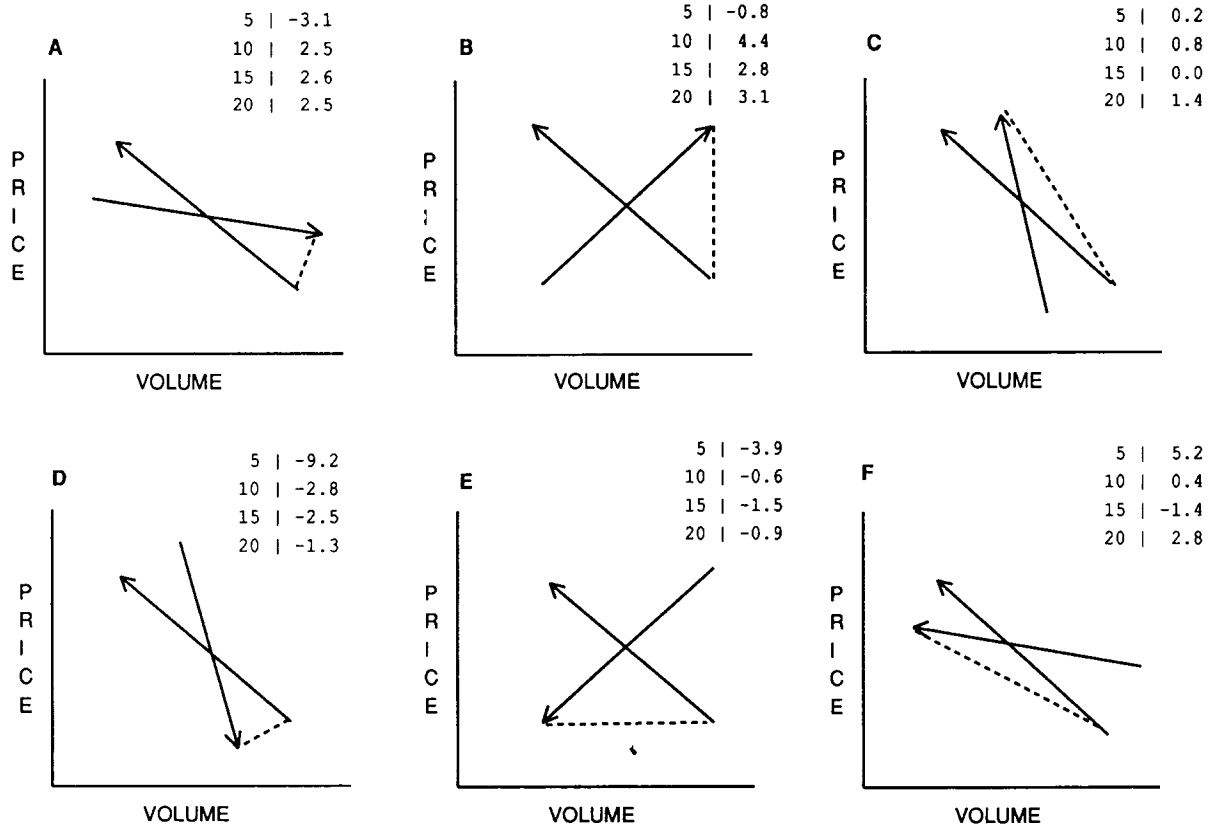


Figure 5

TITLE: Crossover Evaluation using Least-Squares

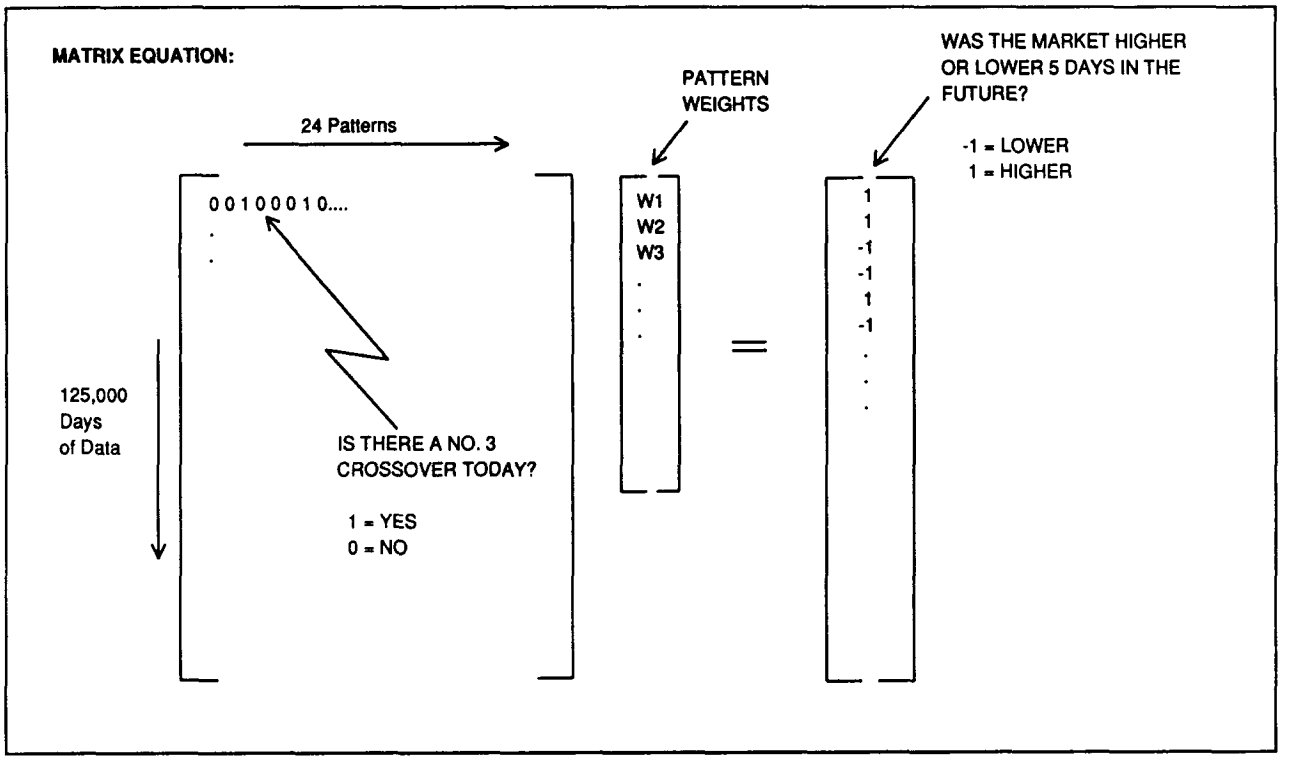


Figure 6: LEAST-SQUARES EQUATION TO SOLVE FOR CROSSOVER WEIGHTING

TITLE: Crossover Pattern Evaluation

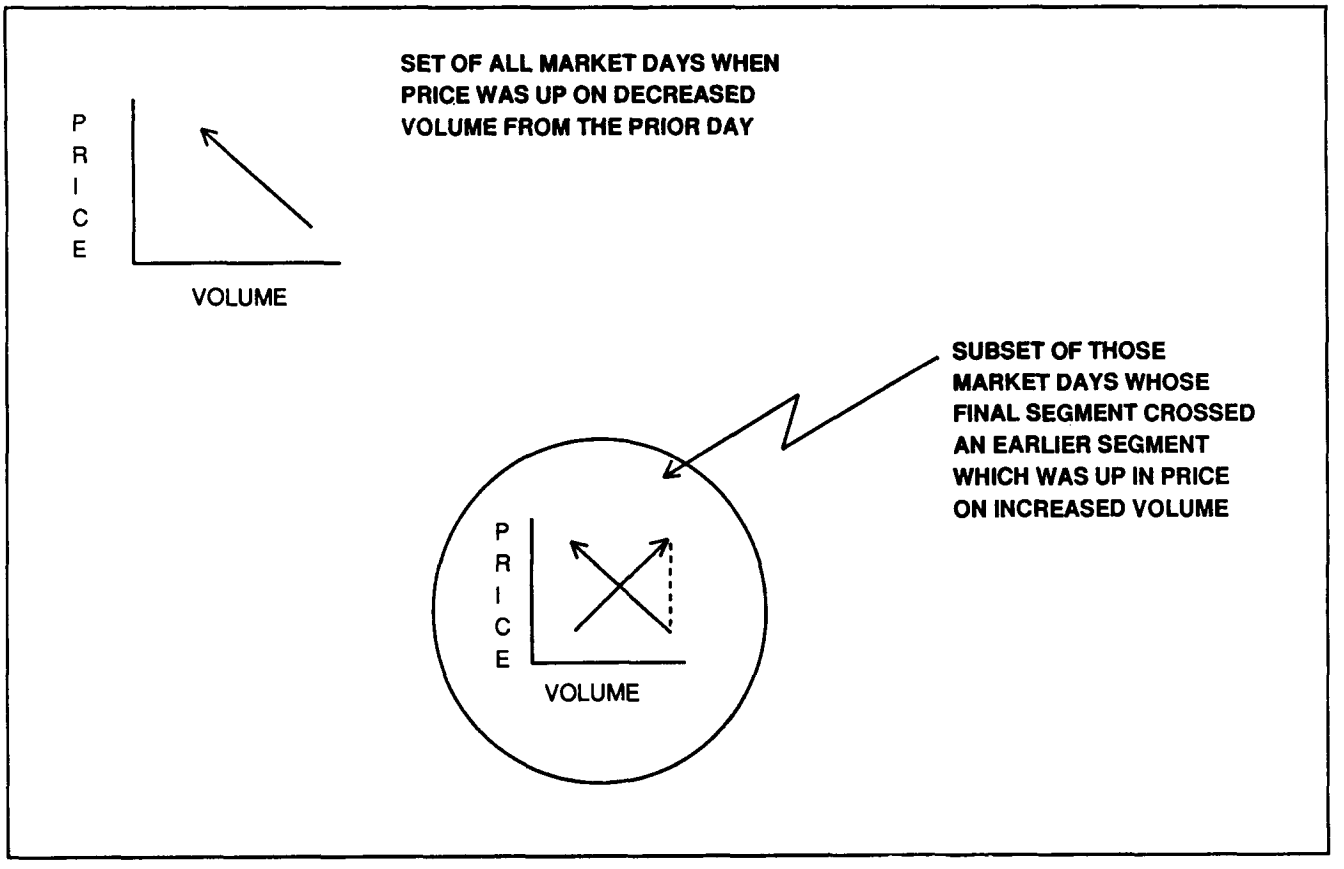


Figure 7: PATTERN EVALUATION: HOW DIFFERENT ARE CROSSOVER CASES FROM THE NORM ?

TABLE 1

Pattern	Description	Price Action Early	Price Action Late
I-C	Price is up strongly on increased volume followed later by price up less with more volume.	DOWN	UP
I-D	Price is down strongly on slightly decreased volume followed later by price moving up strongly with increasing volume.	UP	DOWN
I-F	Price is up somewhat on greatly increased volume followed later by price up more on less volume	DOWN	UP
II (all)	Price decreases on increasing volume. Note that II-B and II-F are very negative patterns within the group.	DOWN	DOWN
III-A	Price is up slightly on large volume increase followed later by a strong price decrease on decreased volume.	DOWN	UP
III-B	Price moves down on increased volume followed by price drop on decreased volume.	DOWN	DOWN
III-C	Price is down strongly on slightly lower volume followed later by smaller decline on much lower volume.	DOWN	DOWN
III-F	Price is down slightly on much lower volume followed by greater decline on slightly decreased volume.	DOWN	DOWN
IV-A	Price is down slightly on increased volume followed by a higher price on decreased volume.	DOWN	UP
IV-B	Price increases on increased volume followed by a price increase on decreasing volume	—	UP
IV-D	Price decreases strongly on slightly higher volume followed by a rising price on much lower volume.	DOWN	DOWN

Kris Kaufman is a senior geophysicist with a leading oil exploration software company and president of Parallax Financial Research. Parallax publishes the PRECISION TURN *trend change indicator quarterly and provides computer research and consulting services to several Wall Street firms.*

Marc Chaikin graduated from Brown University with a degree in Finance. He was the head of the Options Department at Tucker Anthony for five years. Later Marc joined Drexel Burnham Lambert and for five years he worked with technically oriented traders and investors. Two years ago he, along with his partner Bob Brogan, formed Bomar Securities, L.P., a technical research boutique with a computer-based product which gives buy-side portfolio managers and block trading desks quick and easy access to technical data. Marc is a frequent guest analyst on FNN, is often quoted in Investor's Daily *and recently wrote an article for* Wall Street Computer Review's *July issue titled "Technical Analysis Systems: A User's Perspective".*