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Technical Analysis and Market Efficiency in the Live Hog Futures Market

John W. Hales and Marvin L. Hayenga*

Three technical analysis tools—relative strength index (RSI), dual moving average and directional movement indicator—are applied to 1987-92 live hog futures market behavior to determine whether profitable trading rules could be devised which would continue to be profitable out-of-sample. A wide range of critical signaling points for each method is evaluated in conjunction with nine stop loss levels. The relative strength index is the only technique found to perform profitably and consistently. Out-of-sample performance of the best 1987-88 RSI trading rules is profitable, and the general performance of RSI trading rules is positively correlated over two year blocks during 1987-92. Dual moving average and directional movement indicator trading rules did not perform well in live hog futures.

Introduction

Technical analysis as a forecasting tool for futures prices has been widely criticized and, in some cases, supported in the academic literature. It is in common use by the public and frequently cited in the press and market commentaries as having some short term impact on future price movements. Charts are often provided as a market analysis tool by market quotation services such as Data Transmission Network, Farm Broadcast Partners and other vendors. Periodicals like *Technical Analysis of Stocks and Commodities* and *Futures* offer regular articles on the use of technical analysis in forecasting prices. Market advisory services frequently cite technical indicators when giving clients marketing advice. Many college courses in agricultural marketing at least provide an introduction to technical analysis. It is a large component of the market analysis done by many large commodity trading funds. If technical analysis has no value, many of the resources dedicated to market analysis are wasted.

This research investigates the effectiveness of three technical indicators of futures price direction applied to the live hog futures market at the Chicago Mercantile Exchange for the period 1987 to 1992. The types of indicators used are the Relative Strength Index (RSI), a Directional Movement Index (DMI) and a Dual Moving Average (DMA). The DMI and DMA methods assume that prices are trending. Both attempt to identify the direction of a price trend and assume that the identified trend will continue. In contrast, the RSI is often used as a predictor of market turning points. In this conventional role for RSI, prices are assumed to oscillate between relatively high and relatively low values and the RSI indicates an "overbought" or "oversold" condition when its value is relatively high or low. But, RSI could also be used as a trend indicator (TRSI). With TRSI, it is assumed price trends continue, while ORSI assumes price trends reverse in the future.

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The effectiveness of these technical analysis tools is analyzed over a six year period by postulating a wide range of critical signalling points in conjunction with a nine stop loss levels as "general trading rules" for each technique. Several performance measures are then calculated and evaluated for each six year period. The level of profitability and persistence over the six year period is analyzed for each technical analysis procedure, to ascertain whether the performance of any particular method which may work well for a short period of time (e.g. the backward optimization employed by many technical analysts) is likely to be persistent, or whether relative performance over several short periods of time is random. This appears to be a key test for the potential longer term usefulness of any technical analysis procedure. In addition, the highest profit trading rule in 1987-1988 is determined for each technical analysis tool at each stop loss level, and the subsequent out of sample profitability is evaluated.

Relevant Literature

Efficient market theory suggests that no technical analysis procedure will be effective if the market is weak form efficient, fully reflecting past publicly available price information. If the market is efficient with respect to past prices, there is no reason to expect the market to go either up or down in the future, based on the information contained in those prices. While some technical analysis methods may use other market information like volume and open interest figures, the four methods investigated here depend only on past price information that is readily available from the futures exchanges, brokers, newspapers, radio, television and electronic data information vendors.

The efficient markets hypothesis (EMH) formalized by Fama (1970) and explained by Marshall (1989) refers to a market's efficiency defined in terms of the speed and accuracy with which new information is processed into price changes. The current price should accurately reflect current information, and subsequent price changes should be random. According to this criterion, the market is considered efficient with respect to a particular class of information. In the weak form, the market is efficient with respect to all past price history including volume and open interest information. If that market is weak form inefficient, then it is also semi-strong (all public information) and strong form (all public and private information) inefficient, since the weak form is a subset of the other two. Jensen (1978) modified the concept of efficiency, proposing that a market should be considered efficient if information could not be used to forecast price to the extent that profits exceeded transaction costs, and that definition is used in this study.

Delong et al. (1990) proposed that a positive feedback model might explain price behavior (and allow for the presence of a trend in price). In this model, rational speculators buy ahead of noise demand knowing that there are "noise traders" who will buy on market strength and sell on market weakness, irrespective of market fundamental supply and demand information. This noise demand could be caused by traders using technical trend following systems, execution of stop loss or market orders around round numbers or technically obvious prices such as old highs and lows or the liquidation of positions due to margin calls on large price movements. A "follow the herd" mentality and the lack of immediate arbitrage by rational investors on the basis of fundamental information might be explained by risk aversion for the short term. When the stock

market crashed in 1987, there was no obvious change in market information that might have caused a drop in stock prices of 20% in one day. This would appear to be an example of positive feedback behavior in prices. The rational use of information external to the market might have implied buying any small dip immediately, yet information from the market itself may have prevented this immediate arbitrage. A fear that the market knew something that the individual trader did not, and outright fear and panic might have changed an individual's perception of the distribution of price given the information available. This type of behavior makes more plausible the existence of a trend exploitable by technical analysis, or the existence of an "overbought" or "oversold" condition exploitable by an RSI used as an oscillator (depending on the length of time that the positive feedback behavior influences prices). The concept of being "overbought" or "oversold" implies a reversal in trend toward an equilibrium price in the future. Predicting a continuation of trend implies that price has not reached an equilibrium based on the information that is known today. Neither idea fits with the immediate arbitrage assumed with an informationally efficient market.

Romer (1993) suggested that individual investors may have uncertainty about the quality of information possessed by others. They may look to the actions of other investors to adjust their own perception of value. Also, because of a great dispersion of information among investors, the individual incentive to trade on that information may be small due to transaction costs. In either case, the individual chooses not to trade immediately. Romer's theory allows for the rational use of information, but the full extent of the information is revealed by the market's action rather than being immediately reflected in price. Under this scenario, if a market failed to respond to negative fundamental news, an individual trader might conclude that other traders had better quality information of a positive nature and thus adjust his valuation according to the trading behavior of the market. In this case the news would be reflected in price changes over time and could account for some trend in price in the absence of new information. Either the positive feedback/noise model or Romer's model could account for the presence of an exploitable trend in an otherwise efficient market and thus allow for the potential success of price trend forecasting models based on past prices that do not immediately reflect all information.

Repeatable profits refute the efficient markets hypothesis by definition. At issue is whether those profits are repeatable. Tomek and Querin (1984, p.22) warned of the possible presence of systematic components within a randomly generated price series due to chance. "The speculator clearly should be skeptical of claims that technical analysis of past prices can successfully forecast forthcoming prices." Profitable patterns can be found within historical futures price series. Some futures industry publications carry advertisements for trading systems claiming up to 90% profitable trades in a particular price history. Of course an implication that this performance will carry over into the future is doubtful to say the least. The prices of such systems seem well under the discounted present value of all of the future profits of a 90% successful system. It seems more plausible that the possessor of such a successful system would use it privately, rather than publicizing it and risking the inevitable arbitrage that a relatively efficient (if not totally efficient) market would bring. The key question is how any system will perform in forecasting future prices, not explaining past prices. It has been noted by Granger (1979) and others that publications about trading rules may be biased towards negative conclusions. "If such a (foolproof) strategy were found, it would hardly be made public, even by an academic."

There have been a number of academic articles published regarding the profitability of trading systems based on past price information. Pruit, Tse and White (1992 pp. 55-56) studied a composite technical analysis based trading system called CRISMA. It utilized a Relative Strength, Moving Average and a cumulative volume component and generated a risk adjusted return of 6.13% to 35.65% for stocks and 12.05% to 28.72% return per round turn for stock options in the January 1976 to December 1985 period. A subsequent study of the January 1986 through December 1990 period showed a risk adjusted return of 22.28% to 26.45%, before transaction costs. They stated: "We believe a finding of continued success for the CRISMA system would provide important and convincing new evidence concerning the (in)efficiency of the securities markets and the ability of investors to "beat the market" by employing complex technical trading strategies." Two of the technical analysis components used in their study on stocks and options are evaluated in this live hog futures study- a relative strength and moving average indicator.

Irwin and Uhrig (1984) evaluated 4 technical trading systems over 8 different commodities with all of the systems showing substantial profits for the 1961 to 1981 period. Live hog futures were among one of the futures markets analyzed utilizing a channel system, moving average, dual moving average and a directional indicator system. Taylor (1985) studied the autocorrelation in futures prices and found evidence to reject the random walk hypothesis. He stated that "Market efficiency might perhaps be refuted by finding the profit potential of a trading rule based on past prices." His later study (1992) compared filter, channel and moving average technical trading rules to an ARIMA time series forecast for currency futures during the December 1981 to November 1987 time period. All of the trading rules were profitable and the profits were too large to be explained by a time-varying premium, thus implying inefficient pricing. Nefci and Policano (1984, p. 465) did a study on a moving average and slope method of forecasting futures prices, finding that the moving average had some predictive power in the RMSE sense but that the slope method gave mixed results. "If futures markets are efficient, then the existence of traders who use technical analysis is certainly an anomaly."

Lukac, Brorsen and Irwin (1988) tested 12 different technical trading systems with 12 different commodities from 1978 to 1984. Live hog futures were not considered. Seven of the systems generated significant gross returns while four systems generated significant net and risk adjusted returns. The authors felt that a disequilibrium model provided a better description of short run futures price movements than did a random walk model. The disequilibrium model allows a slower than instantaneous adjustment to new information shocks due possibly to information costs, transaction costs or risk aversion. Channel systems, momentum oscillators, moving averages and systems with trailing stops were all used in their study.

A 1987 survey showed that 15 out of 19 futures fund advisory groups did optimize their technical trading systems based on past prices. Lukac and Brorsen (1989, pp. 55-65) evaluated the usefulness of historical optimization of parameters for technical trading systems. They optimized the parameters for a DMI and channel system in 15 markets. Lukac and Brorsen concluded that historical optimization was of limited use with the random selection of parameters performing as well. Their two technical systems were significantly profitable over their diversified 15 market portfolio. Lukac and Brorsen state that "These results reject the random walk for commodity prices."