ACE 427
Spring 2010

Lecture 12

Commodity Price Forecasting and Market Efficiency

by
Professor Scott H. Irwin

Required Readings:

Schwager, J.D. "Ch. 1: Charts: Forecasting Tool or Folklore?" *Schwager on Futures: Fundamental Analysis*, New York, NY: John Wiley and Sons, 1995.

Two Basic Approaches to Commodity Price Forecasting

Fundamental Analysis

- Definition: An assessment of _____ based on the underlying _____ and _____ factors and the changes in those relationships

- Goal: Estimate _____ and compare to _____

  - Bullish: Value > Price

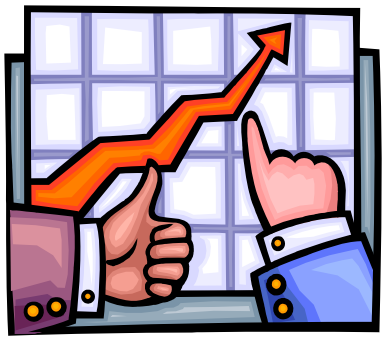
  - Bearish: Value < Price

  - Focus on "fundamentals" of supply and demand, such as crop size, export demand, consumer income

  - Subjective judgment to sophisticated statistical models

Technical Analysis

- A forecasting method for price movements using _____
- Generally based only on patterns in prices
- Typically based on _____ arguments
- Goal: Determine "trend" in past prices and project this into the future



Technical analysis includes a variety of forecasting techniques

- _____ analysis
- _____recognition analysis
- _____ indicators
- Seasonal tendencies
- _____ analysis
- Computerized _____

Market Efficiency

Nothing more than the application of _____ competition to the determination of ____ over _____

<u>Key:</u> With sufficient competition, price in an efficient market will never be higher or lower than the "true" equilibrium value

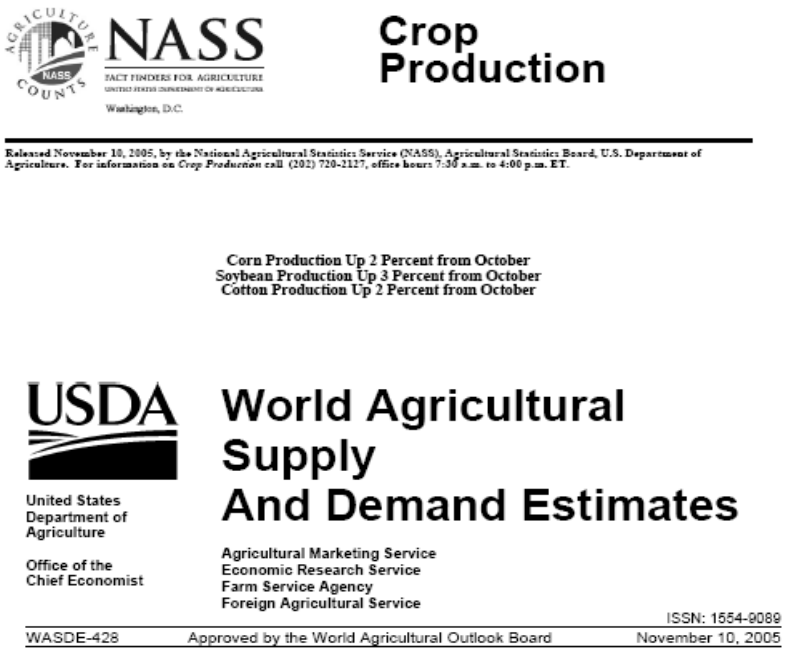
Two sources of _____ in efficient markets:

1. Temporary

- Small, short-term price movements due to _____ supply-demand _____ between buyers and sellers
- _____ effect through time
- Occurs over very _____ time intervals, typically by the minute or, at most, the hour

2. New information

- New data on _____ factors, such as crop size, exports, etc.



NASS
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Washington, D.C.

Crop Production

Released November 10, 2005, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture. For information on *Crop Production* call (202) 720-2127, office hours 7:30 a.m. to 4:00 p.m. ET.

Corn Production Up 2 Percent from October
Soybean Production Up 3 Percent from October
Cotton Production Up 2 Percent from October

USDA
United States Department of Agriculture
Office of the Chief Economist

World Agricultural Supply And Demand Estimates

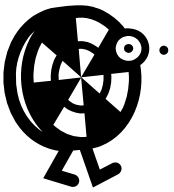
Agricultural Marketing Service
Economic Research Service
Farm Service Agency
Foreign Agricultural Service

ISSN: 1554-9089

WASDE-428 | Approved by the World Agricultural Outlook Board | November 10, 2005

- New information changes _____ price
- _____ in content, timing and importance
- If it is not unpredictable, then it _____ be ____ information!

Bottom Line: Equilibrium price is a _____ because market information changes



- Prices respond _____ to bullish new information
- Prices respond _____ to bearish new information
- Arrival of new information must be _____, if not, information is not new
- Implies _____ must be _____

Coin Flipping Experiment

1. Start graph at $5.00/bu.
2. Flip coin one time
   - heads: daily high up 10 cents from previous close
   - tails: daily low down 10 cents from previous close
3. Setting the close
   - heads: market closes at high of daily range
   - tails: market closes at low of daily range
4. Generate 30 “days” (one flip/day)

Fun with random numbers:

http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/bookapplets/chapter1/HTSimulation/HTSimulation.html

Random Walks and Commodity Prices

Price _____ in an efficient market from day to day are _____

- Behave as if generated by _____
- Called a _____ by statisticians
- Analogy to the path of a drunk walking home from a bar (I am not making that up!)

After the fact, _____ and _____ may appear

- No _____ power whatsoever
- Purely _____ information
- Similar to "patterns" in _____
- Outcome of a _____

A Warning

- Do not interpret the coin-flipping exercise as proving that commodity prices follow a random walk

- Market efficiency is a theory that may or may not describe the movement of actual prices

Formal Definitions of the Efficient Market Hypothesis

Working (1949, p. 160) provided an early version of the hypothesis:

> *If it is possible under any given combination of circumstances to predict future price changes and have the predictions fulfilled, it follows that the market expectations must have been defective; ideal market expectations would have taken full account of the information which permitted successful prediction of the price change*

In later work (Working, 1962, p. 446), he revised his definition of a perfect futures market to

> *... one in which the market price would constitute at all times the best estimate that could be made, from currently available information, of what the price would be at the delivery date of the futures contracts*

This definition of a perfect futures market is in essence identical to the famous definition of an efficient market given by Fama (1970, p. 383):

> *A market in which prices always 'fully reflect' available information is called 'efficient'*

Since Fama's survey study was published, this definition of an efficient market has long served as the standard definition

A more practical definition of an efficient market is given by Jensen (1978, p. 96) who wrote

> *A market is efficient with respect to information set θ_t if it is impossible to make economic profits by trading on the basis of information set θ_t*

Since the _____ are risk-adjusted returns after deducting transaction costs, Jensen's definition implies that market efficiency may be tested by considering the _____ of trading strategies based on the particular information set considered

Degrees of Market Efficiency

Markets may differ in the level of _____, and hence, efficiency

Weak-form efficiency:

- Current prices reflect all information that is contained in the _____
- Past prices are of _____ in forecasting future prices
- Everyone has free access to past prices, hence, they are not _____

Semi-strong form efficiency:

- Current prices not only reflect all information contained in historical prices, but also reflect all _____ about a commodity
- Public information, such as a USDA crop report, is not useful in forecasting

- When public information is released, prices react _____ to incorporate the information in prices

Strong-form efficiency:

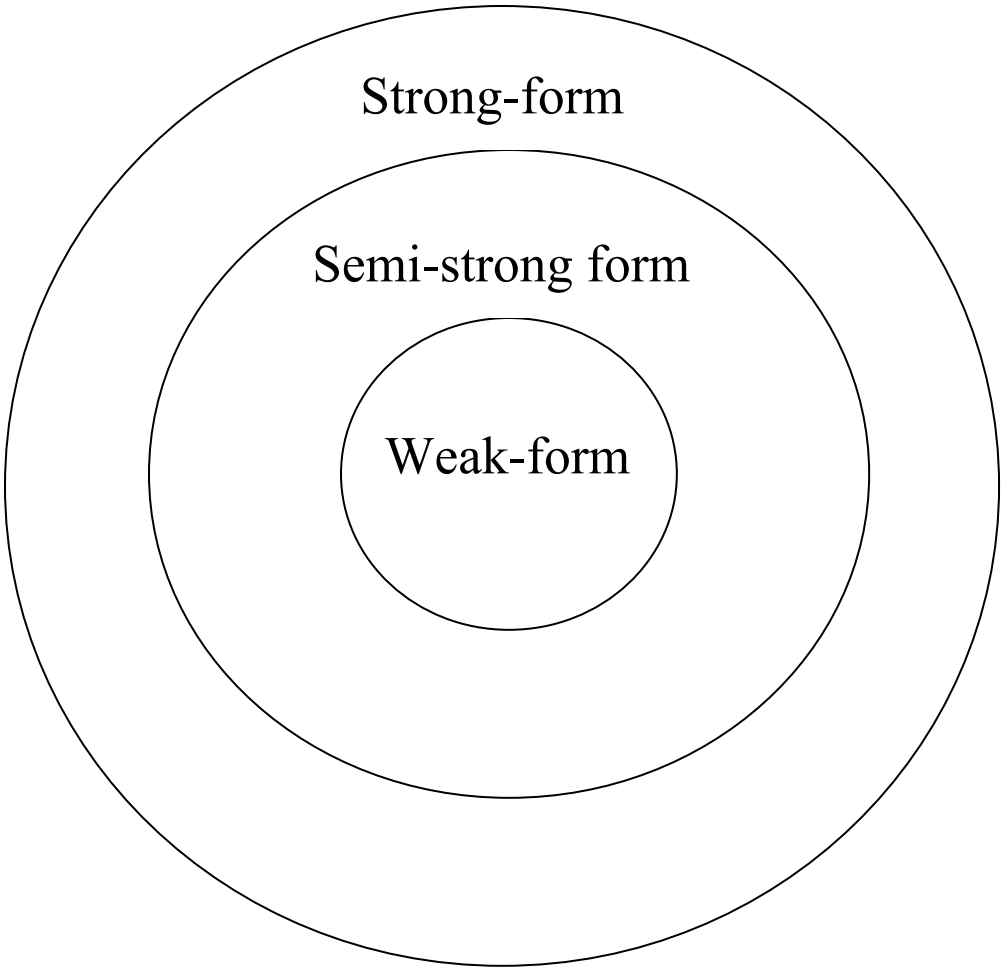
- Current prices not only reflect all information contained in historical prices, but also reflect all _____ available knowledge about a commodity

- _____ information cannot be used to trade profitably

- Private information _____ into the public sphere quickly

- Private information also revealed by traders' actions

Different levels of market efficiency



Market Efficiency and Price Forecasting

Startling and controversial implications:

- Current price is an _____ estimate (best guess) of the price in the future
- If strong-form efficiency holds, impossible to _____
- Prices follow a _____ from period-to-period
- Prices react _____ and _____ at all times to _____
  - If prices do not change instantly in response to new information, then _____ profit opportunities exist
  - Such opportunities quickly _____ in a market with many well-financed and intelligent participants
  - Sometimes termed the _____ nature of profitable opportunities in efficient markets

Wheat futures prices on 4/20/2007

Wheat Futures (W)

Delayed 10 minute data as of April 20, 2007 15:20 CDT

07Jul settle: 07/ 13 Click to see Wheat Product Calendar Dates

Quotes | Settlement | Daily Vol | Time & Sales | Volatility | Historical Data | Spreads

Open Auction | Electronic | Combinations | Real-Time Quotes

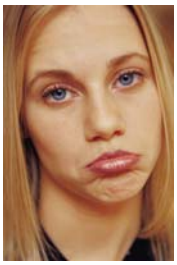
Exp	Last 1 Last 2	Net Chg	Open	High	Low	Close	Settle	Prev Settle	Hi/ Lo Limit
07May	502'0 13:21 503'0 13:21	+6'0	498'0 500'0 9:33	503'0 13:14	491'0 9:57	501'0 503'0 13:21	502'0	496'0	532'0 472'0
07Jul	514'6 13:20 516'0 13:20	+7'0	508'0 514'0 9:33	516'0 13:15	503'0 9:59	513'4 516'0 13:20	514'6	507'6	544'6 484'6
07Sep	516'6 13:21 516'4 13:21	+7'0	517'0 9:33	517'4 13:14	507'0 9:59	517'0 516'4 13:21	516'6	509'6	546'6 486'6
07Dec	521'0 13:18 522'0 13:18	+6'4	514'0 515'0 9:30	522'0 13:15	511'0 9:59	520'0 522'0 13:18	521'0	514'4	551'0 491'0
08Mar	524'4 13:21	+6'4	520'0 9:40	524'4 13:21	515'0 10:00	524'4 13:21	524'4	518'0	554'4 494'4
08May	517'0 13:21	+4'0				517'0 13:21	517'0	513'0	547'0 487'0
08Jul	493'0 13:21 495'0 13:21	Unch	495'0 9:44	495'0 9:44	487'0 13:06	491'0 495'0 13:21	493'0	493'0	523'0 463'0
08Dec	499'0 13:22	-1'0	502'0 10:53	502'0 10:53	499'0 13:05	499'0 13:22	499'0	500'0	529'0 469'0
09Jul	490'4 13:22 491'0 13:22	-3'4	482'0 12:55	491'0 13:22	482'0 12:55	490'0 491'0 13:22	490'4	494'0	520'4 460'4

Table generated April 20, 2007 15:20 CDT = Chart = Option

It is important to understand what market efficiency does not imply:

- Does not imply that prices _____ aimlessly and are _____ from supply and demand information
- Just the opposite is true: prices _____ track known _____ on supply and demand
- Since new information about supply and demand changes randomly, so must prices

Implications for fundamental analysis



- Useless in a strong-form efficient market because _____ always _____ fundamental _____
- Only useful if market is weak- or semi-strong-form efficient
- _____ price forecasts must be based on:
  - Valuable _____ information
  - _____ to analyze _____ information (a better than average forecasting model)

Implications for technical analysis

- Any "patterns" or "trends" in past prices are an _____ and are _____ for predicting the future
- Like trying to predict the sequence of lottery numbers from past lottery numbers
- Like trying to predict the sequence of numbers from a roulette wheel from recent winning numbers
- _____ to consistently use technical analysis to make _____ forecasts of price _____ or _____

The Great Debate: What Works in Practice?

This is a very hard question!

We will review both sides of the argument

Fundamentalists

Market efficiency logic is appealing to a fundamentalist

_____ must be right!

- Usually somewhat fuzzy about the _____ of market efficiency
- Uncomfortable discussing problems market efficiency causes for them

Fundamentalists love to throw rocks at technical analysts (elves)

Chartist-technicians are in about as low repute as ESP investigators because they usually have holes in their shoes and no record of reproducible worth.

---Paul Samuelson, Nobel Laureate in Economics

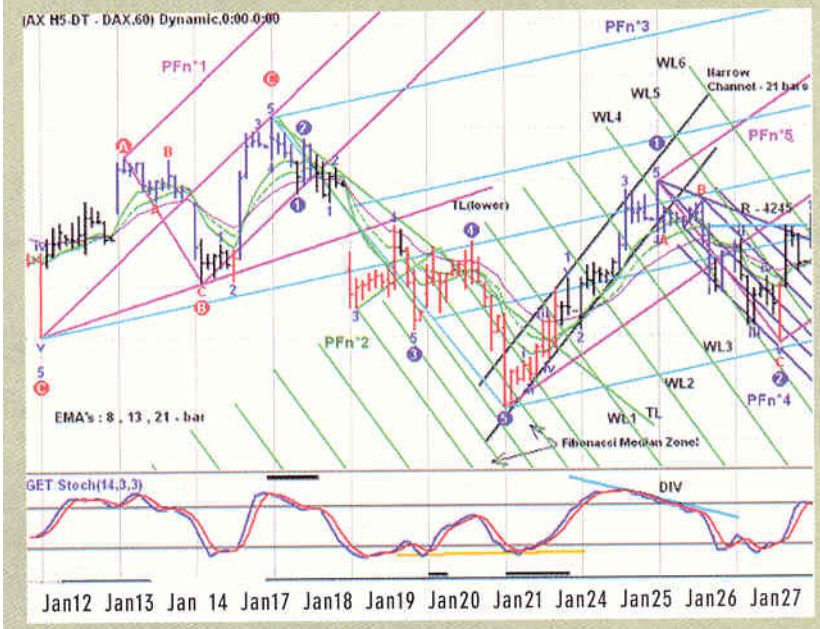
STICK A FORK IN IT

Here we can see how multiple pitchfork applications can work together on a single 60-minute Dax chart.

Source: eSignal

DOWN THE PIKE

The downward price bounce from ML provides the anchor of the second pitchfork, as well as that of the downward impulse pattern (waves 1 through 5), sliding along its own pitchfork handle. As soon as we get a pitchfork swing such as this, we are equipped to evaluate the upcoming move.



Source: eSignal

Just, R. E. and G. C. Rausser. "Commodity Price Forecasting with Large-Scale Econometric Models and the Futures Market." ***American Journal of Agricultural Economics*** **63(1981):197-208.**

Obtained forecasts from 3 major commercial firms and the USDA over July 1976 – December 1978

- Forecasts based on large-scale _____ models of the _____ sector
- Wheat, corn, cotton, soybeans, soybean meal and oil, hogs, fed cattle
- Compared _____ to _____ for relevant markets

Average _____ in terms of accuracy across all comparisons (1 = most accurate):

Futures market	2.75
Doanes	3.17
Wharton	3.19
Chase	3.27
USDA	4.19

Results _____ market analysts as well as agricultural economists in universities

Authors concluded that (p. 203):

> *...econometric models do a poorer job of including all relevant exogenous forces, forecasting them, and transforming them into price forecasts than the aggregate intelligence of the futures market*

Since publication of Just and Rausser's study, the basic finding that it is _____ for fundamental _____ or fundamental _____ to "beat the market" in terms of _____ generally has been confirmed in a number of studies

University outlook forecasts for hogs and cattle:

> Bessler, D. A., and J. A. Brandt. "An Analysis of Forecasts of Livestock Prices." *Journal of Economic Behavior and Organization* 18(1992): 249-263. (University actually better for cattle)

USDA hog and cattle forecasts vs. hog and cattle futures markets:

> Irwin, S. H., M. E. Gerlow, and T.-R. Liu. "The Forecasting Performance of Livestock Futures Prices: A Comparison to USDA Expert Predictions." *Journal of Futures Markets* 14(1994): 861-875.

Econometric model forecasts vs. wheat futures prices:

> Kastens, T. L., and T. C. Schroeder. "Efficiency Tests of July Kansas City Wheat Futures." *Journal of Agricultural and Resource Economics* 21(1996): 187-198.

Expert forecasts for pork and beef:

> Kastens, T.L., T.C. Schroeder, and R. Plain. "Evaluation of Extension and USDA Price and Production Forecasts." *Journal of Agricultural and Resource Economics,* 23(1998):244-261.

For a review of this literature see:

Tomek, W. "Commodity Futures Prices as Forecasts." *Review of Agricultural Economics*. 19(Spring/Summer 1997): 23-44.

Zulauf, C. R., and S. H. Irwin. "Market Efficiency and Marketing to Enhance Income of Crop Farmers." *Review of Agricultural Economics* 20(1998): 308-331.

Technical analysts

Two _____ explanations usually offered in defense of technical analysis:

- Works because so many people _____
- Works because it takes advantage of natural _____ in people (e.g. waves of irrational optimism and pessimism)

More _____ explanations have been offered in the finance and economics literature in recent years

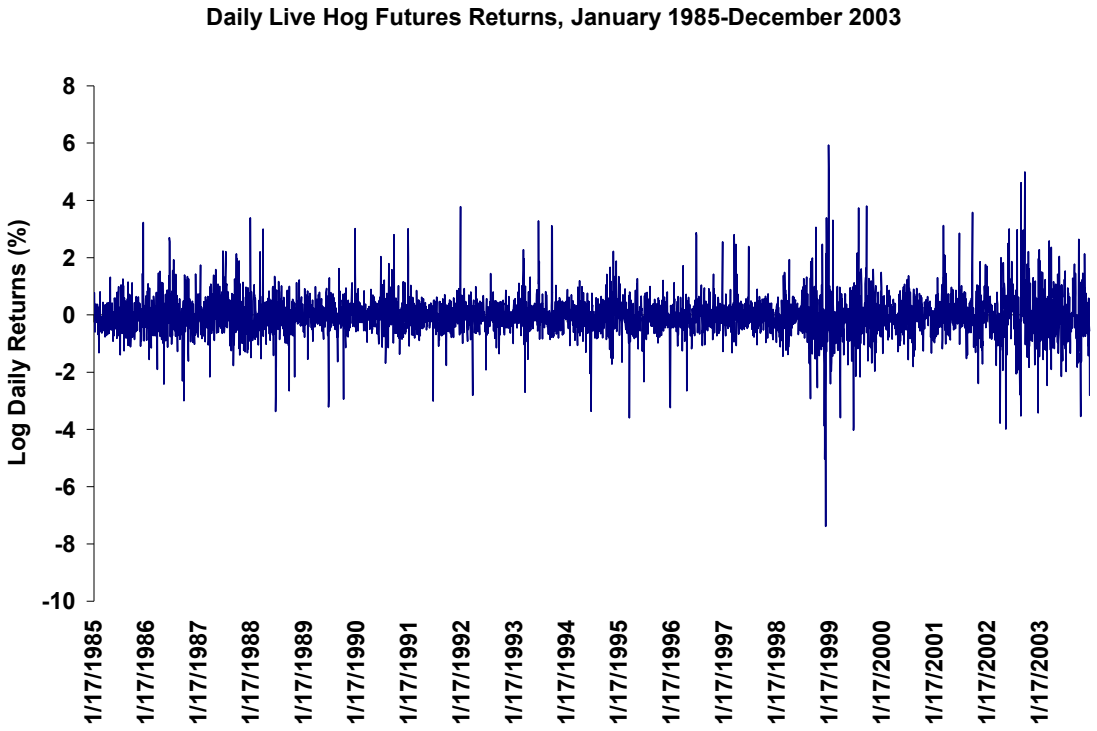
Price may adjust _____ to _____ due to:

- Noise
- Market frictions
- Market power
- Trader sentiments
- Herding behavior
- Chaotic dynamics

_____ allows technical methods to profit

Two basic approaches to testing validity of technical analysis

- _____ properties of futures prices
- _____of technical trading rules or systems


Daily Live Hog Futures Returns, January 1985-December 2003
Log Daily Returns (%)
8
6
4
2
0
-2
-4
-6
-8
-10
1/17/1985
1/17/1986
1/17/1987
1/17/1988
1/17/1989
1/17/1990
1/17/1991
1/17/1992
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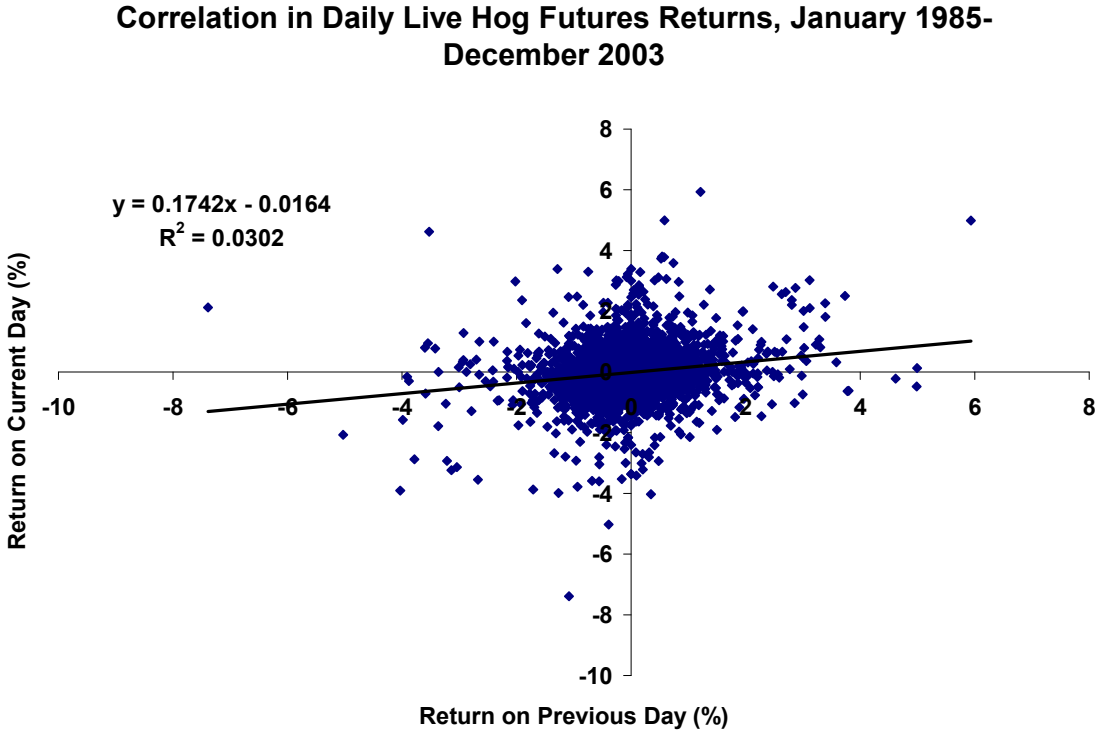

Correlation in Daily Live Hog Futures Returns, January 1985-December 2003
y = 0.1742x - 0.0164
R2 = 0.0302
Return on Current Day (%)
Return on Previous Day (%)
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-8
-6
-4
-2
0
2
4
6
8

Park, Cheol Ho and Scott H. Irwin. "The Profitability of Technical Analysis: A Review." AgMAS Project Research Report 2004-04, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, October 2004.
[http://www.farmdoc.uiuc.edu/agmas/reports/index.html]

- Report comprehensively _____ empirical studies on the _____ of technical analysis

- Discusses the _____ and _____ of technical trading profits across markets and over time

- Empirical studies surveyed include those that tested technical trading systems, trading rules formulated by genetic algorithms or some statistical models (e.g., ARIMA), and chart patterns that can be represented algebraically

- The majority of the studies were collected from academic journals published from _____ to the present and recent working papers

The profitability of technical trading strategies in modern studies (1988-2004)

Studies	The number of studies			Net profit range (Out-of-sample period)	Comments
	Positive	Mixed	Negative		
A. Stock markets					• For the Dow Jones Industrial Average (DJIA) data, which was most frequently tested in the literature, results varied considerably depending on the testing procedure adopted. In general, technical trading strategies were profitable until the late 1980s. However, technical trading strategies were no longer economically profitable thereafter. • Overall, variable-moving average rules showed a quite reliable performance for the stock market over time. • For several non-US stock markets (e.g., Mexico, Taiwan, and Thailand), moving average rules generated large annual net profits of 10% to 30% until the mid-1990s.
Standard	1	0	3	1.1%[a] (1968-88)	
Model-based Bootstrap	7	2	3		
Genetic programming	2	1	3		
Reality Check	0	1	1		
Chart patterns	5	0	1		
Nonlinear	3	0	1		
Others	8	1	0		
Sub-total	24	5	12		
B. Currency markets					• Many studies investigated major foreign currency futures contracts traded on the CME, i.e., the Deutsche mark, Japanese yen, British pound, and Swiss franc. • For major currencies, a wide variety of technical trading strategies, such as moving average, channel, filter, and genetically formulated trading rules, consistently generated economic profits until the early 1990s. • Several recent studies confirmed the result, but also reported that technical trading profits have declined or disappeared since the early 1990s, except for the yen market.
Standard	7	3	3	5%-10% (1976-91)	
Model-based bootstrap	6	0	1		
Genetic programming	3	0	1		
Reality Check	1	0	0		
Chart patterns	2	0	3		
Nonlinear	3	0	0		
Others	3	1	1		
Sub-total	25	4	9		
C. Futures markets					• Technical trading strategies generated economic profits in futures markets from the late 1970s through the mid-1980s. In particular, technical trading strategies were consistently profitable in most currency futures markets, while they appeared to be unprofitable in livestock futures markets. • Channel rules and moving average rules were the most consistent profitable strategies. • After the mid-1980s, the profitability of technical trading strategies for overall futures markets were not investigated comprehensively yet.
Standard	5	0	1	4%-6% (1976-86)	
Model-based bootstrap	1	0	1		
Genetic programming	0	1	0		
Others	1	0	1		
Sub-total	7	1	3		
Total	58	10	24		

Park, Cheol-Ho and Scott H. Irwin. "The Profitability of Technical Trading Rules in US Futures Markets: A Data Mining Free Test," Working Paper, 2005.

Goal of determining whether _____ have been truly profitable in _____

Study replicates Lukac, Brorsen, and Irwin's (1988) trading model on a _____

12 futures markets weighted towards agricultural and natural resource commodities (commodities: corn, soybeans, cattle, pork bellies, sugar, cocoa and lumber; metals: copper and silver; financials: British pound, Deutsche mark and US treasury bills).

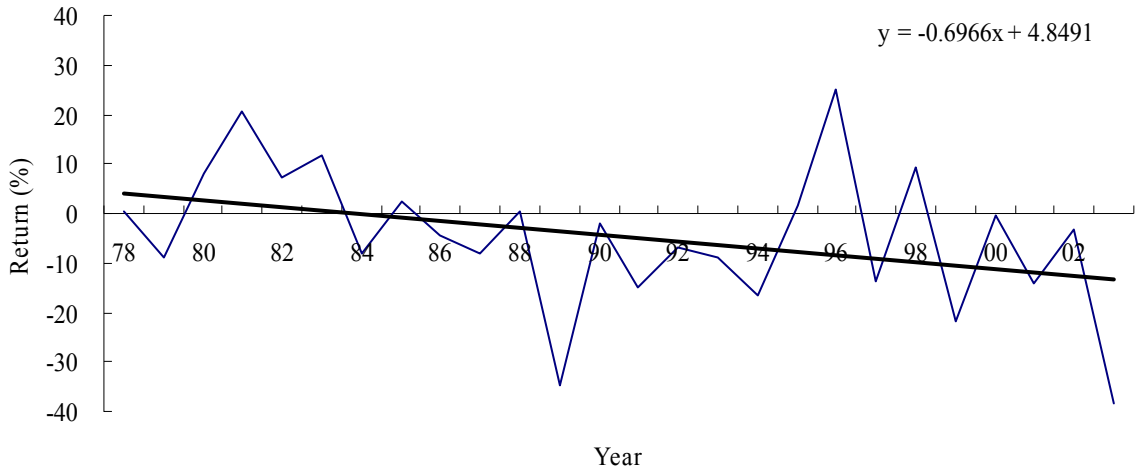
The original framework is duplicated as closely as possible by preserving all the _____ assumptions in Lukac, Brorsen, and Irwin's work, such as trading systems, markets, in-sample optimization length, transaction costs, rollover dates, and other important assumptions

Table 1. Lukac, Brorsen, and Irwin's Trading Systems Categorized by System Type, Number of Parameters, and Time of Trading.

Trading Systems	System Type	Number of Parameters	Time of Trading[a]
Simple Moving Average with Percentage Price Band (MAB)	Moving average	2	Open
Dual Moving Average Crossover (DMC)	Moving average	2	Open
Outside Price Channel (CHL)	Price channel	1	Close
L-S-O Price Channel (LSO)	Price channel	2	Close/Stop
M-II Price Channel (MII)	Price channel	1	Close
Directional Indicator (DRI)	Momentum oscillator	2	Open
Range Quotient (RNQ)	Momentum oscillator	2	Open
Reference Deviation (REF)	Momentum oscillator	2	Open
Directional Movement (DRM)	Momentum oscillator	1	Stop
Alexander's Filter Rule (ALX)	Filter	1	Close
Parabolic Time/Price (PAR)	Filter	1	Stop
Directional Parabolic (DRP)	Combination system	2	Stop

Figure 1. Portfolio Annual Mean Net Returns for Corn (a) and British Pound (b) Using 12 Trading Systems, 1978-2003.

(a)



(b)

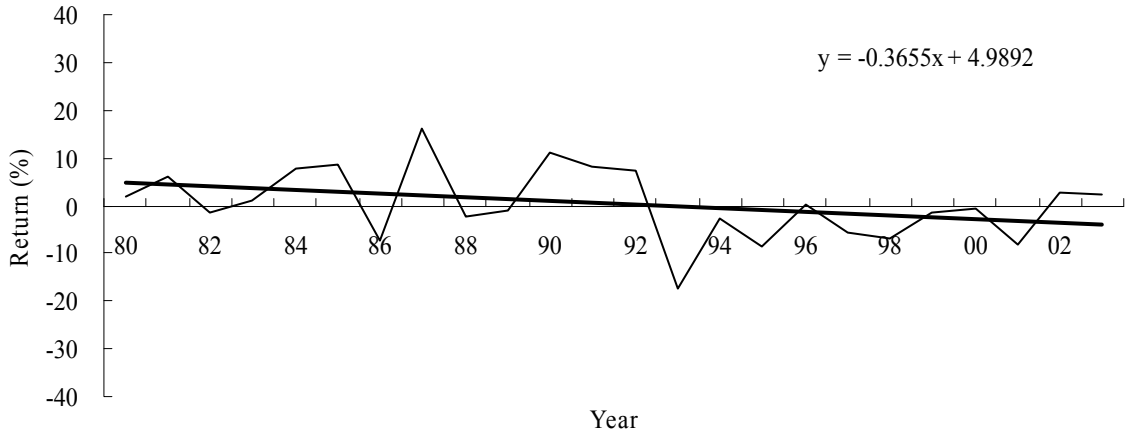
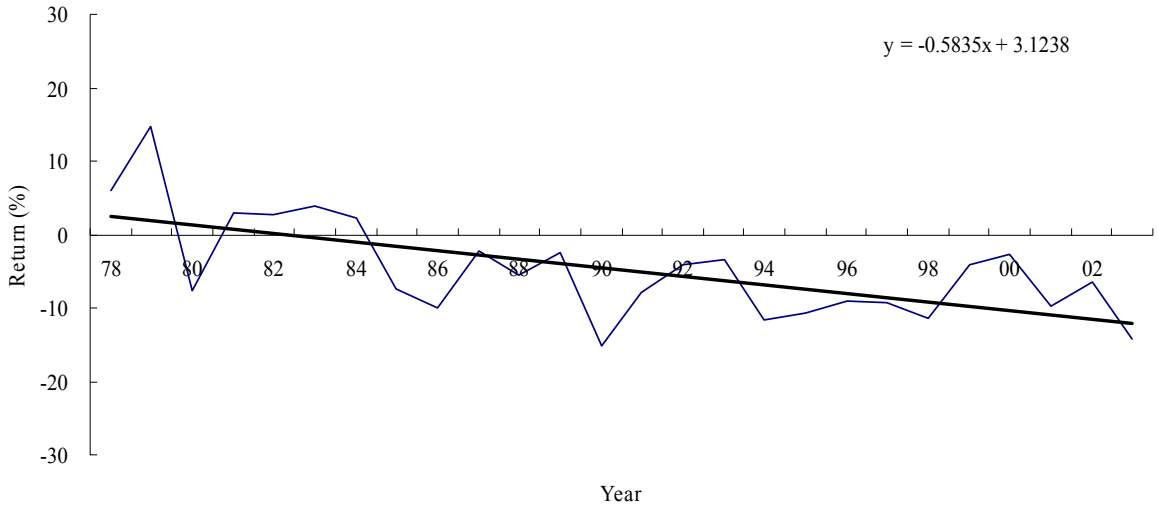


Figure 2. Annual Mean Net Returns of the DMC (a) and the CHL (b) System across 12 Futures Markets, 1978-2003.

(a)



(b)

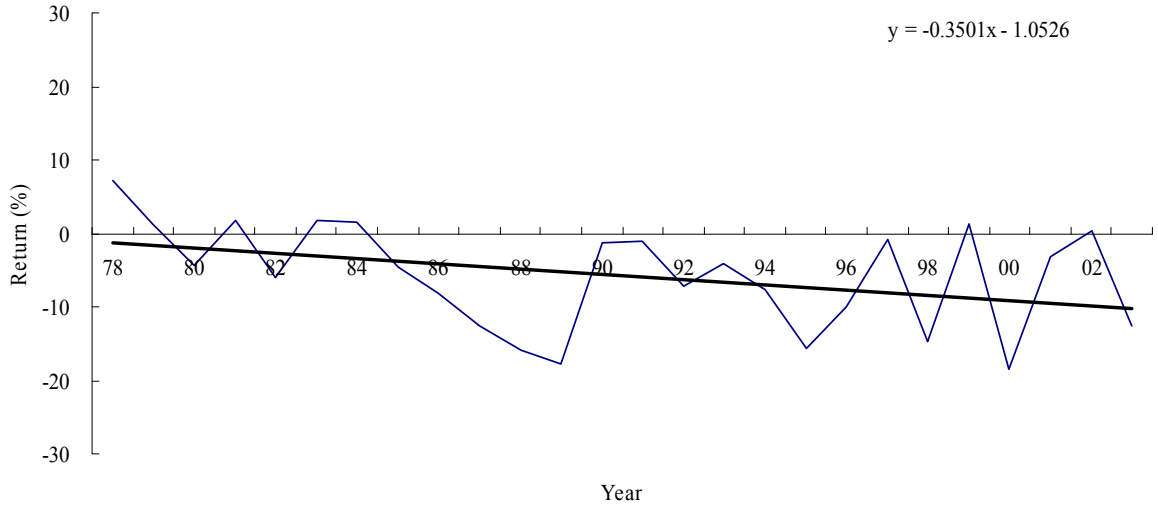
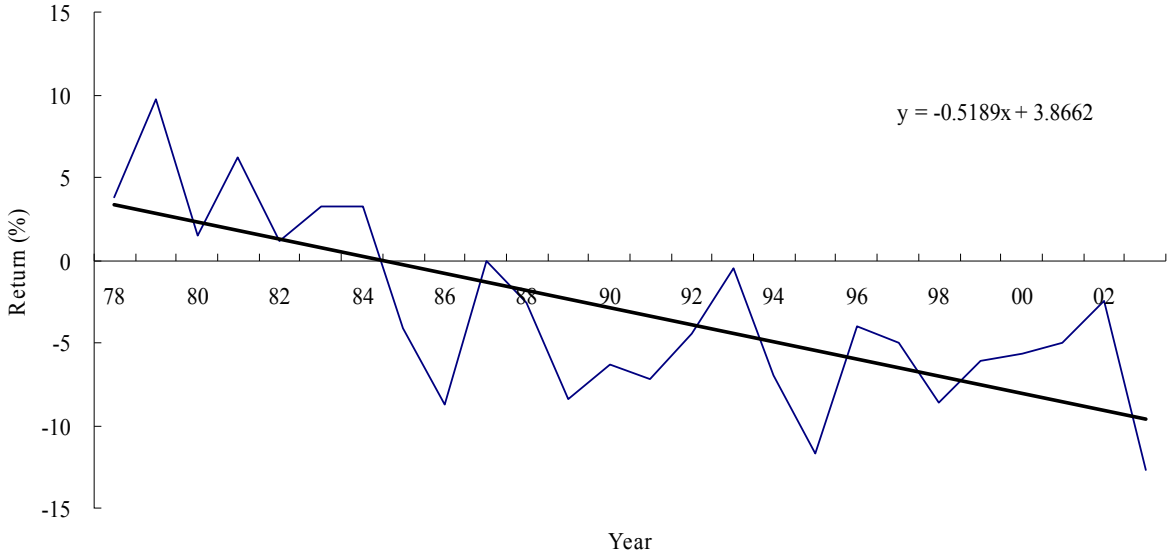


Figure 3. Portfolio Annual Mean Net Returns for an Equally-Weighted Portfolio of 12 Futures Markets Using 12 Trading Systems, 1978-2003.



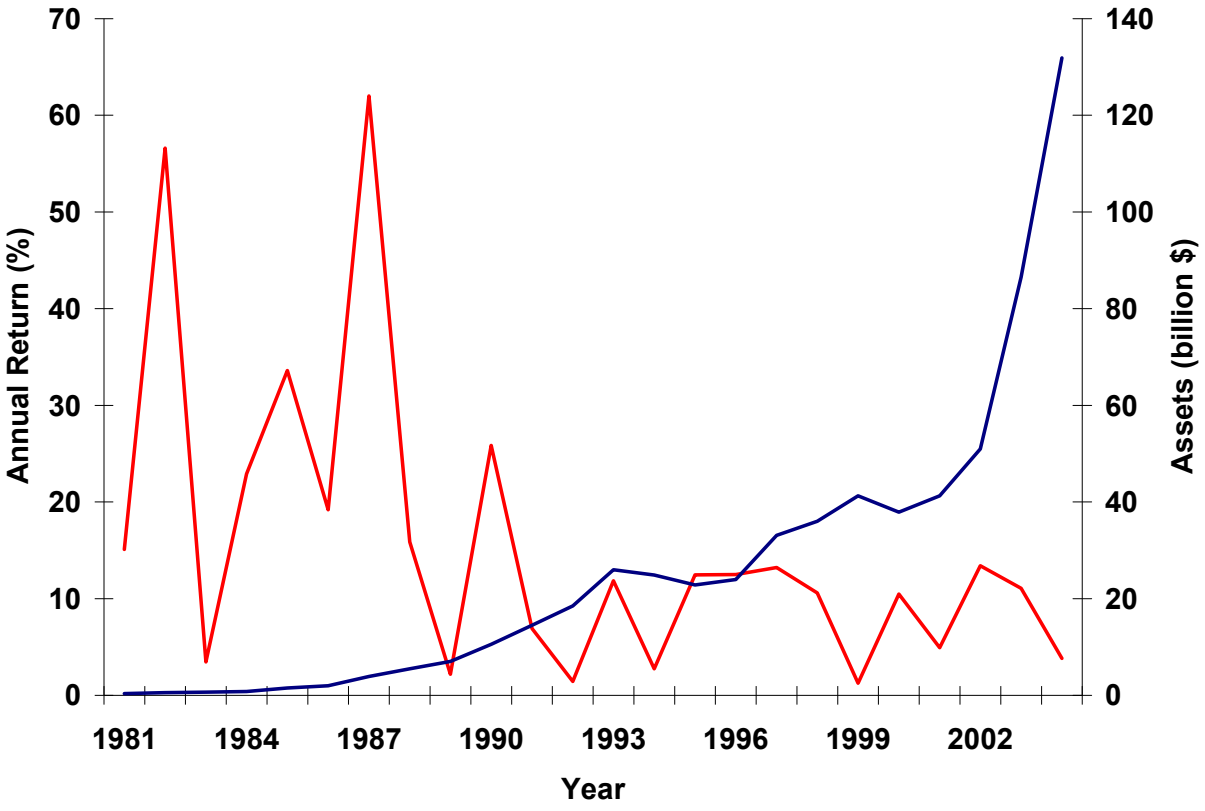
Park and Irwin suggest three possible explanations about the _____ of technical trading profits in the 1985-2003 period:

(1) _____ bias (or selection bias)

(2) _____ in futures markets

(3) _____ nature of technical trading strategies

Annual Net Returns and Total Assets of Commodity Trading Advisors (CTAs), 1981-2004



Sources: Center for International Securities and Derivatives Markets (CISDM), The University of Massachusetts, Amherst; The Barclay Group

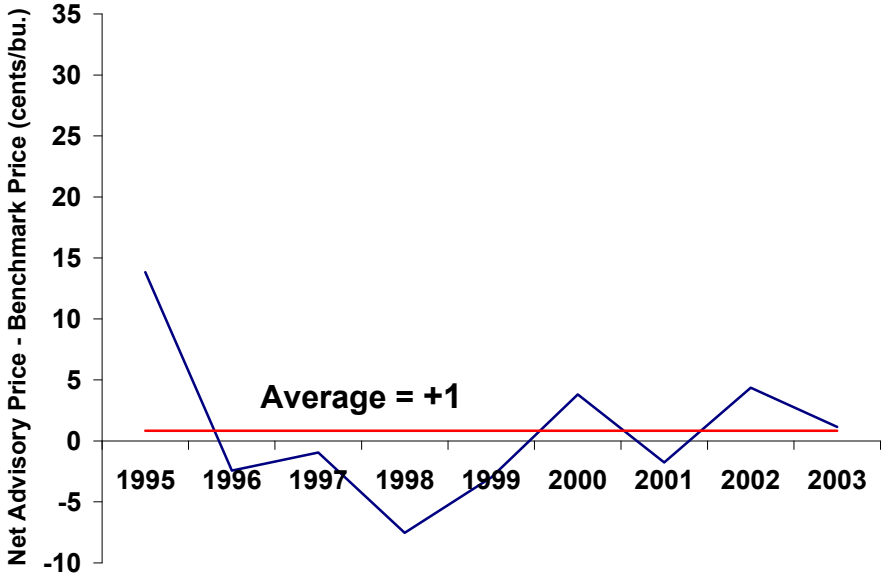
Typical Argument about the Actual Use of Technical Analysis

Technical analysis is the key to correct timing of buy and sell decisions in commodity futures markets. The technical dimensions of the market do not dominate the fundamental supply-demand dimensions, and no sustained technical pattern will develop that is contrary to the emerging and underlying supply-demand balance. But the discovered price can and will move and trace out technical patterns, as the market seeks to discover the price that balances the forces of supply and demand. Within the limits to those price moves, technical analysis can be an important guide the timing of pricing actions.

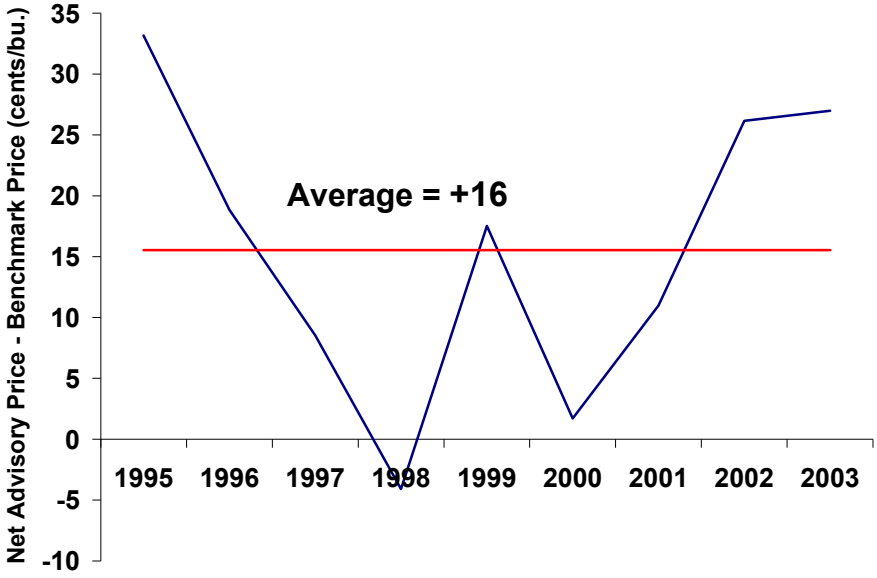
---Purcell and Koontz, *Agricultural Futures and Options, Principles and Strategies*

Difference between Advisory Service Performance and 24-Month Market Benchmark, 1995-2003 Crop Years

Corn:



Soybeans:



Summary

Best approach may depend on _____

- Fundamental analysis seems to work best when market structure and trends are within _____
- Technical analysis appears to work best when there are _____ in market structure, i.e. high inflation

Debate is almost "theological" in nature!

"I haven't met a rich technician. Excluding, of course, technicians who sell their services and make a lot of money"

---Jim Rogers in *Market Wizards*

"I always laugh at people who say, 'I've never met a rich technician.' I love that! It is such an arrogant, nonsensical response. I used fundamentals for nine years and got rich as a technician."

---Marty Schwartz in *Market Wizards*

"…most people in the grain industry other than fundamental analysts have concluded that the market prices have little to do with supply and demand, but more on the technical movements of the markets themselves. I have become a much better marketer since I have sworn off fundamental analysis. I think farmers would be better served with a more in-depth discussion of technical analysis and the effect of funds in the market."

---Illinois farmer, summer 2005

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Tuesday, December 13 • 9:00 am – 4:00 pm

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Drawing on material from his new book of interviews with traders, *Entries & Exits: Visits to 17 Trading Rooms* (scheduled for release in 2006), noted trader and psychiatrist **Dr. Alexander Elder** will delve into the minds and trades of successful traders by analyzing specific winning and losing trades, and revealing exactly how the pros make their buy and sell decisions.

$295 per person before November 23, **$395 per person** on or after November 23.
(Includes refreshments; one-hour lunch break on your own, 12:00 pm – 1:00 pm.)

Saturday, December 17 • 9:00 am – 5:00 pm Post-Conference Event

Market Wizard Linda Raschke Explains How to Become a Consistently Profitable Trading Machine

Market wizard **Linda Raschke** will help you master the tools that will allow you to become a totally self-reliant trader, free from external opinions and distractions. She will share with you the best trading ideas she learned as a floor trader, along with the more sophisticated strategies resulting from her own years of research and now used by her hedge fund.

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Confirmed Speakers:

Murray Ruggiero
Contributing Editor
Futures Magazine
The Complete Guide to Building a Successful Mechanical System Trading Plan

Oliver L. Velez
President
Pristine Capital Management
Momentum Trading: How to Maximize Potential Profits from Every Trade

David Vomund
Chief Analyst
AIQ Systems
Indicator Effectiveness Testing and System Creation

Daniel Gramza
President
Gramza Capital Management, Inc.
Live Trading of CME E-mini Futures at the Opening Bell

Didier Perennez
Founder, President, and CEO
Lunchtimetrading.com
The Last Hour of Trading and the Morning After

Price Headley
Founder and Chief Analyst
BigTrends.com
How to Find Big Trends in Options

Carolyn Boroden
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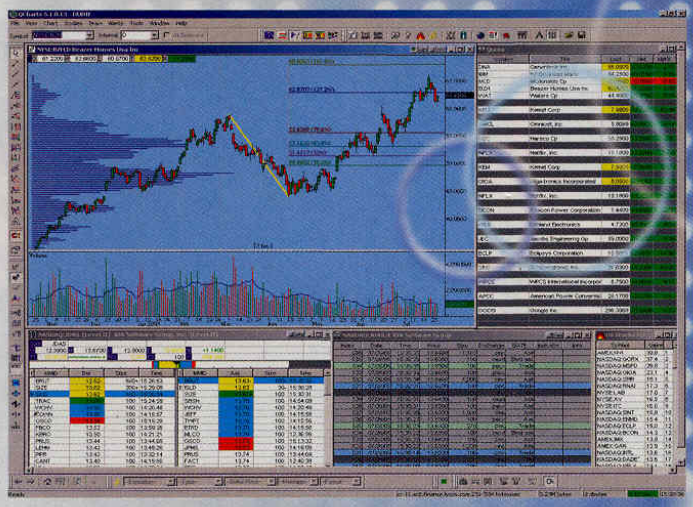

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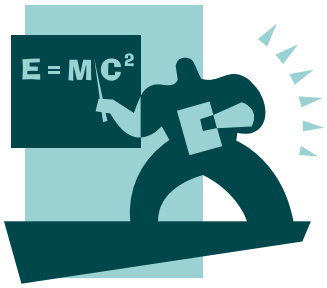

Most academics are _____ of the efficient market hypothesis

> *Despite decades of dredging the data, and the popularity of media reports that purport to explain where markets are going, trading rules that reliably survive transactions costs and do not implicitly expose the investor to risk have not yet been reliably demonstrated*
>
> ---Cochrane (2001, p. 25)

However, substantial _____ has erupted in recent years within academics and financial markets for several reasons

- Rise of _____ concepts
- Driven by evidence from _____ studies that people have a disturbingly large number of _____ (cognitive) biases
- Stock market _____ in the last decade

Other major boom and bust episodes in the past

- Dutch tulip mania in the 17th century
- John Law's Mississippi Land Company in the 18th century
- Florida land boom of the 1920s
- Stock market boom and bust of the 1920s and 1930s
- Real estate boom and bust of the 21st century????

Some excellent popular books on the topic:

Belsky, Gary and Thomas Gilovich. *Why Smart People Make Big Money Mistakes-and How to Correct Them: Lessons from the New Science of Behavioral Economics.* Simon & Schuster: New York, 1999.

Malkiel, Burton G. *A Random Walk Down Wall Street: Completely Updated and Revised Eighth Edition.* W.W. Norton & Company: New York, 2004.

Paulos, John Allen. *A Mathematician Plays the Stock Market.* Basic Books: New York, 2003.

Schwager, Jack D. *Market Wizards: Interviews with Top Traders.* Harper and Row, Publishers: New York, 1990.

Taleb, Nassim Nicholas. *Fooled by Randomness: The Hidden Role of Chance in the Markets and in Life.* Texere: New York, 2001

Final Thought

There is a weird _____ at the heart of the efficient market hypothesis

> *In summary, if the Efficient Market Hypothesis is true, most investors won't believe it, and if it's false, most investors will believe it. Alternatively stated, the Efficient Market Hypothesis is true if and only if a majority believes it to be false*
>
> ---Paulos (2003, p.189)