

USER MANUAL

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INTRODUCTION TO OUR SERVICE

Optima Investment Research provides daily fundamental and technical research focusing on the international financial markets with complete analysis of the interest rate, currency and stock index markets. In addition, Optima provides tabular technical data for the U.S. agricultural markets and the international financial markets. In total, subscribers have access to over 100 pages of fresh information each trading day. That is over 200 screens for the on-line electronic system version)

Optima has been providing respected analysis to the futures industry since 1983. Our research has received a reputation as being among the best in the industry and we are dedicated to bringing our subscribers the most reliable and useful information available.

Our goal is to provide subscribers with the information that is necessary for successfully understanding and trading the markets. Our research distills the flood of information that emerges each day from the U.S. and international financial markets. Market professionals of all types find our research to be very useful for supporting their trading decisions and for helping them be conversant with their customers regarding current market activity. Our client base includes many independent traders, virtually every major brokerage firm and U.S. bank, and many European and Asian banks and financial institutions.

Optima does not provide specific trading recommendations. Instead, we provide an objective view of the markets that allows our subscribers to draw their own conclusions regarding trading decisions. This makes our research valuable to a wide range of market participants. Our clients vary widely in trading styles and in time horizons -- from the scalper on the exchange floor who has a very short-term speculative outlook to the money manager who has a long-term investment outlook.

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We encourage calls from our subscribers if they have questions or comments about the content of the material or need further explanations of particular topics. Because we do not provide specific trading recommendations, however, we do not take telephone calls from subscribers seeking trading advice.

Optima does not trade customer money or manage commodity pools, although our officers and employees may trade for their own accounts.

Subscribers to Optima are entitled to receive a free copy of Optima's booklet *Interpreting Technical Indicators*. This booklet provides a clear explanation of how to use the major technical indicators and contains an annotated bibliography of technical analysis books. Subscribers may call Optima for a copy.

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1 SERVICES AVAILABLE

Optima's daily research is published in two basic sections: Fundamental Analysis and Technical Analysis.

Fundamental Analysis

The Fundamental Analysis covers the U.S. and international markets. It provides a three to four page analysis of the news and events that will be affecting the financial markets during the upcoming session. It also includes a schedule of the major reports and other significant events that are due out during the day and shows the market expectations for the key reports. This analysis is described in more detail in Section 2.

Included with a subscription to the Fundamental Analysis section is the Morning International Report. This report is a survey of overnight Far Eastern and European market activity and includes the morning U.S. market calls. It is sent out about 6:15 AM central time every U.S. trading day.

Technical Analysis

The Technical Analysis is published in six different "Technical Pictures".

- *T-Bonds*
- *T-Notes*
- *Eurodollars*
- *Stock Indexes*
- *Forex*
- *German Markets*

Each Technical Picture includes technical commentary, support/resistance levels, retracements & trendline intersections. Each of the Technical Pictures also includes the relevant Technical Indicator Tables which show the moving averages, Pivot Points, RSI, oscillators, momentum, stochastics & historical volatility data for all the actively traded futures contracts and financial cash markets. Some of the Technical Pictures also include tables covering Volatility, Price Range Probability, Theoretical Options, Currency Futures/Cash Equivalents, and other information. The analysis and tables are described in more detail in Sections 3 through 8.

Service Packages

A typical package from Optima contains the fundamental analysis (including the International Morning Report) and one or more technical pictures from the list above. Clients can also mix and match the various services to produce a customized package.

2 FUNDAMENTAL ANALYSIS

Optima's Fundamental Analysis section analyzes the key economic events impacting the U.S. and international financial markets. It is typically about three to four pages in length (10-12 computer screens). The purpose is to provide a fundamental framework for understanding the markets and to help identify the key bullish/bearish factors that will determine the market direction that day.

The general order of the topics is:

- *Market factors for the day*
- *Discussion of specific events impacting the markets*
- *U.S. credit market comments*
- *Fed policy and open market activity*
- *U.S. stock market comments*
- *Energy market comments*
- *Forex comments*
- *International news and market activity*

Optima places a very high priority on fundamental analysis. Some market participants, in fact, use only fundamental analysis to assess market direction. At the very least, fundamental analysis tells the trader when important events are scheduled and how the market should react to those events. If the market does not react to a new fundamental event in the expected way, then the market may be indicating that an opposite underlying market trend is in force.

Many books on technical analysis suggest that it is impossible to know all the fundamentals and therefore a trader should ignore the fundamentals and trade exclusively on technical analysis. Those books also argue that all the fundamentals are reflected in the technical behavior of the market and that technical analysis is therefore the only necessary tool for trading the markets.

That advice, however, does a disservice to those who want to gain as much knowledge as possible about the markets and want to use all the available tools for trading the markets. Fundamental analysis is an important tool for determining intrinsic market value and is the primary kind of analysis that drives a market on a long-term basis.

Fundamental analysis and technical analysis can ideally be used as complementary tools. For example, a trader may wait to initiate a trade until both the fundamental and the technical pictures are in agreement so that both are signalling the same trend. A trader may also use fundamental analysis to decide upon a bullish/bearish/neutral stance toward the market and then use technical analysis as a tool for determining the timing of particular trades.

3 TECHNICAL ANALYSIS

General Approach

Optima's general approach to technical analysis is to use the technical tools that have stood the test of time. We therefore place heavy emphasis on chart patterns, moving averages, moving average oscillators, RSI, and volume/open interest. We specialize in providing support/resistance levels that are useful for order placement and assessment of market direction. See Optima's booklet *Interpreting Technical Indicators* for further details.

Optima's technical analysis is objective and based on observable facts. We do the legwork, make observations and provide ideas, but we leave the final trading decisions up to the subscriber. This approach makes our analysis appealing to those traders who have their own opinions on the markets and who are only looking for support in analyzing the market. This approach also allows Optima's analysis to appeal to a wider range of subscribers who have different time frames and trading horizons.

Content of Technical Pictures

Optima's service includes five separate Technical Pictures, each containing analysis of a particular market or market sector. The individual Technical Pictures are:

- T-Bonds
- T-Notes
- Eurodollars/T-bills
- Stock Indexes
- Forex

Each of the Technical Pictures is broken down into sections as follows:

Commentary This section discusses the previous day's price activity and how that activity may affect the price action during the upcoming session. The discussion covers such matters as significant new highs or lows; moving average, RSI and oscillator changes; significant price patterns; changes in volume and open interest; and an identification of the short, intermediate and long-term trends.

Support/Resistance Levels This section contains a list of what we believe will be the primary support and resistance levels for the upcoming session.

Retracements & Trendlines This section describes the important major price moves and identifies the significant retracement levels. It also contains the important trendlines and identifies the trendline price for the upcoming session.

Technical Indicator Tables Each data table covers six contracts. For each contract we identify the previous session's high, low and close plus technical indicators such as the pivot point, moving averages, oscillators, RSI and Stochastics.

Volatility/Probability Ranges This section includes two tables: (1) the "Volatility Summary Table" which gives implied volatility and historical volatility statistics, and (2) the "Probable Range Table" which provides the market's estimate of future price movement based on the current implied volatility level.

Cash Price Information

Some of the analyses include cash prices because Optima believes that watching the cash markets is very important for assessing market direction, particularly for identifying support/resistance levels. We therefore identify the key cash prices for the T-bond, currency and stock index markets as of 3 PM New York time since that is the time the futures markets close. We then calculate the approximate corresponding futures price levels for the related contracts. These futures price levels are only approximate, however, because of the possibility that the cash-futures basis (i.e., the difference between the cash and futures price) will change during the upcoming session.

Special Stock Market Information

The Stock Technical picture includes some additional information. It also has a section covering breadth and sentiment indicators. We use several popular technical analysis indicators including the (1) advance/decline line, (2) overbought/oversold indicator (the 10-day exponential moving average of the advance/decline line), (3) call-put volume and ratio, and (4) TRIN. Please refer to Optima's booklet *Interpreting Technical Indicators* for further information.

The Stock Technical picture has another small section regarding the fair value premium for the S&P futures. It shows for example:

S&P 500 FUTURES-CASH PREMIUMS											
09/29	3:00/ 3:15PM CHNG	PREV 3 PM PREM	PREM @ ED	EURO RATE	PREM @ TB	TB RATE	PREM ED&TB AVG	ED&TB AVG	DIVIDEND POINTS	DTE	
SPZ92	0.50	0.25	0.21	3.14%	-0.14	2.76%	0.04	2.95%	2.67	79	
SPH93	0.45	0.4	0.63	3.19%	-0.07	2.84%	0.28	3.02%	5.70	170	

Notes: EDZ & TBZ apply for SPZ. EDH & TBH apply for SPH.

Included above is (1) the change in the S&P 500 futures contracts from the NYSE cash market close until the futures close for the most recent session, (2) the observed futures premium at the most recent session's NYSE close, (3) the theoretical futures premiums for the current day's session based on the Eurodollar rate, the T-bill rate and the average Eurodollar and T-bill rate, (4) the total dividends payable on all S&P 500 stocks through the particular futures contract's expiration date (expressed in dividend points), and (5) the number of days to the futures contract's expiration (DTE). The theoretical premium is calculated using the formula discussed in Appendix 2. The fair value premium provides an idea of when program traders are likely to enter the market.

On another note regarding the Stock Technical Picture, Optima uses the theoretical high/low for the Dow Jones Industrials Average as opposed to the real-time high/low. The theoretical high/low for the Dow is calculated by combining the highs and lows of all the stocks in the Average, whenever those highs/lows may have occurred during the day. The real-time high/low for the Dow is simply the highest and lowest that the Average itself actually traded during the day on a real-time basis. While the real-time high/low for the Dow is the more accurate measure of market behavior, the theoretical high/low is used almost exclusively throughout the financial industry for quotes and charts. Optima uses the more widely used theoretical value unless otherwise noted.

4 TECHNICAL INDICATOR TABLES

Optima's tabular Technical Indicator Tables contain the most popular technical indicator data for the most widely watched contracts. Those contracts are listed across the top of the table. The tables are issued for all actively traded futures and cash contracts.

Following is a brief description of the items on the Technical Indicator Table. For a more thorough discussion of these indicators, please refer to Optima's booklet *Interpreting Technical Indicators*. The examples below refer to Table 1 which is a sample Technical Indicator Table.

High, Low, Settle, Change, % Change

The high, low & settlement values are for the session that took place on the date shown at the top of the table, that would be the most recent trading session. A daily percent-change figure is given on some tables and that allows the trader to compare a contract's percentage movement with other contracts in the same complex (e.g., among various stock index contracts or among various currencies). In addition to the one-day percentage changes, the cash currency technical table also provides the percentage changes over various periods of time so that the strength of the currencies over longer periods can be directly compared with each other.

Pivot Analysis

Pivot Point analysis is used extensively on the exchange floors in Chicago. The Pivot value (P in the following formulas) is the average of the day's high, low and settlement prices. R1 & R2 are two resistance levels above the Pivot Point and S1 & S2 are two support levels below the Pivot Point. The formulas are:

$$R2 = P + H - L$$

$$R1 = (2 \times P) - L$$

$$\text{Pivot} = (H+L+S)/3$$

$$S1 = (2 \times P) - H$$

$$S2 = P - H + L$$

Moving Averages

These are simple moving averages based on settlement prices for the number of trading sessions included.

TECHNICAL INDICATORS - T-bonds, T-notes, Munis							Update as of: 091189
Contract	:	USU89	USZ89	BHY	TYZ89	FVZ89	MBZ89
	:			8-1/8 Bond			
High:		97-24	97-23	100-23	98-26	99-40	93-14
Low:		97-16	97-15	100-14	98-19	99-26	93-01
Settle:		97-23	97-22	100-19	98-26	99-39	93-06
Change:		+0-03	+0-03	+0-04	+0-06	+0-15	+0-03
Pivot	R2:	97-29	97-28	100-28	98-31	99-49	93-20
Analysis	R1:	97-26	97-25	100-23	98-28	99-44	93-13
	Pivot:	97-21	97-20	100-19	98-24	99-35	93-07
	S1:	97-18	97-17	100-14	98-21	99-30	93-00
	S2:	97-13	97-12	100-10	98-17	99-21	92-26
Moving	3 Day:	97-17	97-16	100-12	98-20	99-25	93-03
Averages	4 Day:	97-14	97-13	100-11	98-19	99-22	93-00
	5 Day:	97-10	97-09	100-08	98-18	99-20	92-30
	9 Day:	96-30	96-30	99-27	98-13	99-11	92-20
	10 Day:	96-27	96-27	99-24	98-11	99-09	92-18
	18 Day:	96-24	96-23	99-20	98-11	99-08	92-14
	20 Day:	96-22	96-22	99-18	98-10	99-07	92-14
	30 Day:	97-11	97-09	N/A	99-00	99-42	93-01
	60 Day:	97-08	97-04	N/A	99-01	99-58	93-16
	100 Day:	95-04	95-00	N/A	97-18	N/A	92-22
	200 Day:	91-28	91-25	N/A	N/A	N/A	N/A
Contract	5-D:	97-14	97-13	100-11	98-19	99-22	93-00
crosses MA	10-D:	96-30	96-30	99-27	98-13	99-11	92-20
today at	20-D:	96-23	96-23	99-20	98-11	99-08	92-14
price of:	30-D:	97-08	97-07	N/A	98-29	99-37	92-31
Moving Avg	3-9:	0-18	0-18	0-17	0-07	0-14	0-16
Difference	5-20:	0-20	0-20	0-22	0-08	0-12	0-16
Oscillators	9-18:	0-06	0-06	0-08	0-03	0-03	0-06
	18-30:	-0-19	-0-18	0-00	-0-21	-0-34	-0-19
Price today	3-9:	95-04	95-04	98-07	97-22	98-26	91-13
cause MA Osc	5-20:	93-02	93-03	95-24	96-30	97-62	89-12
zero xover	9-18:	91-23	91-28	93-24	95-23	97-08	87-13
Momentum	1-10 Day:	+1-07	+1-06	+1-07	+0-20	+0-39	+0-31
(Settle	1-20 Day:	+0-21	+0-23	+0-14	-0-13	-0-01	+0-06
- prev.	1-30 Day:	-1-09	-1-04	N/A	-1-31	-2-00	-1-23
x-day	1-100 Day:	+8-00	+8-01	N/A	+5-16	N/A	+3-17
settle)	1-200 Day:	+10-25	+11-02	N/A	N/A	N/A	N/A
RSI	9-Day RSI:	63.5	63.7	60.2	57.2	58.1	64.1
Prev	9-Day RSI:	62.2	62.4	58.7	53.0	51.8	62.2
Close today for	80:	99-27	99-24	103-22	100-31	101-06	94-15
new 9-RSI of:	20:	92-05	92-06	94-11	95-10	96-41	89-19
Simulated	+3 Unit:	83.2	83.4	79.7	83.5	86.1	87.4
9-Day RSI	+2 Unit:	79.5	79.8	75.8	79.2	82.2	83.9
for settle+1	Unit:	73.7	74.0	69.9	72.0	75.0	77.8
today of:	-1 Unit:	45.6	45.6	45.6	37.4	34.7	39.8
	-2 Unit:	35.6	35.5	36.6	27.8	24.8	28.8
	-3 Unit:	29.2	29.0	30.7	22.1	19.2	22.6
Stochastics	9-Day Range Raw K:	98.6	98.6	94.3	100.0	98.6	85.2
3-Day EMA	K: %K:	89.8	89.5	85.3	86.7	85.6	83.3
3-Day EMA	%K: %D:	77.2	77.1	73.7	73.5	71.6	73.4
Price today for	%K & %D xover :	96-23	96-23	99-20	98-01	98-62	92-22
	%K,%D at xover :	77.2	77.1	73.7	73.5	71.6	73.4
Historical	10 Day:	6.1%	6.0%	6.7%	4.6%	3.6%	3.8%
Volatility	20 Day:	7.7%	7.6%	9.7%	6.3%	4.6%	5.1%
	30 Day:	9.2%	9.1%	N/A	6.7%	5.6%	6.3%
	60 Day:	8.5%	8.4%	N/A	6.1%	4.9%	5.9%
	100 Day:	9.4%	9.2%	N/A	6.9%	N/A	6.8%
	200 Day:	9.0%	8.9%	N/A	N/A	N/A	N/A
Notes:							
Simulated RSI 1 Unit equals: 1-00 points for all contracts.							
Cash 30-year T-bond H/L/C covers 24 hours of trading beginning in Tokyo, with the close as the NY 3PM quote.							
(c) Optima Investment Research, Inc. 312-427-3616							

Table 1. Sample Technical Indicator Table

Contract Crosses Moving Average

This is the price at which a contract will cross above or below a particular moving average in the upcoming session. Mathematically, the price shown in this section is simply the new settlement price that will cause that price and the particular moving average to be equal. One must look at whether the price in the previous session was above or below the particular moving average to see whether the cross-over price will result in the contract making an upward or a downward crossover.

For example in Table 1, the following situation applies: (1) Sep T-bonds (USU89) settled +0-03 at 97-23, (2) the settlement price is 12 ticks above the 30-day moving average of 97-11, and (3) the price shown for "Contract crosses MA at price of:" is 97-08. This means that Sep T-bonds would have to settle in the current session below 97-08 (i.e., down more than 15 ticks) in order for the Sep bond contract to cross below its 30-day moving average.

Moving Average Difference Oscillators

The formula for a moving average difference oscillator is the shorter-term average minus the longer-term average. The value of the moving average difference oscillator is that it smooths out the price movement and can be indicative of underlying trends.

For some contracts, such as T-bonds, the oscillator value shown in the table may not be the same value that would result if one were to simply subtract the two moving averages shown on the same table. The apparent discrepancy is caused by rounding because Optima calculates the oscillators using the more precise decimal value of the moving average rather than the rounded value in 32nds as it is shown in the Moving Average section of the table.

Moving Average Oscillator Zero Crossover

The value shown in the table is the settlement price for the upcoming session that will cause the moving average difference oscillator to cross its zero level which occurs, of course, when the short-term moving average crosses its longer-term moving average. Mathematically, the value shown is actually the new price settlement that will cause the Moving Average Difference Oscillator to equal zero, or alternatively, the price settlement that will cause the short-term and long-term moving averages to be equal. One must note whether the oscillator was above or below zero in the previous session to see whether the oscillator would be making an upward or a downward crossover.

For example, in Table 1 the following situation applies: (1) Sep T-bonds in the previous session settled +0-03 at 97-23, (2) the 3-9 day "Moving average difference oscillator" equals +0-18 (meaning the 3-day average is 18 ticks above the 9-day average), and (3) the "Price today to cause MA Osc zero crossover" is 95-04. This means that a settlement in the upcoming session below 95-04 will be necessary to push the 3-day moving average down below the 9-day average, thus causing the 3-9 day oscillator to cross below zero from its previous level of +0-18.

Momentum

Momentum = Current settlement - n-session previous settlement

9-Day RSI

Values shown include both the current RSI and the previous session's RSI so that one can see how much the RSI moved.

The "Close today for new RSI of 80 or 20" is the price at which the instrument would have to settle in the upcoming session in order to produce a new RSI value of either 80 (overbought) or 20 (oversold) .

The "Simulated 9-day RSI for settlement today of" is the value the RSI would become if the instrument were to settle +3, +2, +1, -1, -2, or -3 units up or down in the upcoming session. The value of one unit for a particular instrument is identified at the bottom of the report.

Stochastics

Raw K refers to the percentile level at which the settlement occurred relative to the range seen over the past nine sessions, with zero as the bottom of the scale and 100 as the top of the scale. "%K" is the 3-day exponential moving average of Raw K. "%D" is the 3-day exponential moving average of %K.

"Price today for %K & %D xover" is the price at which the instrument would have to settle in the upcoming session in order to make the %K and the %D lines cross one another. "Price today for %K,%D at xover" is the value of both %K and %D when that cross-over occurs. The %K & %D cross-over will always occur at the previous session's %D value simply because of the way the stochastic formula works.

Historic Volatility

Historic volatility is a measure of the variability of the range of closing prices seen over a past period of time. To say it another way, historic volatility is essentially the standard deviation of closing prices over a period of time. A wide range of closing prices results in a higher standard deviation and thus in a higher historic volatility. Thus, a financial instrument with an historic volatility of 20% would have been closing over a much broader range than did a similar instrument with an historic volatility of only 10%.

For a more detailed explanation of historic volatility, see Section 5 following.

5 VOLATILITY SUMMARY TABLES

Optima's Volatility Summary Tables provide a summary of key volatility information for particular options contracts. The tables cover all of the actively traded options on futures contracts, including the financial markets, energy markets and agricultural markets. A sample of a table is shown in Table 2.

The data in the table is divided into two basic types: (1) average implied volatility data for the call and put options combined, and (2) historical volatility data for the underlying contract.

Implied Volatility

Implied volatility is a measure of what the market expects the volatility of a particular contract to be in the future. The implied volatility for a particular option expiration series is calculated by taking the average of the three nearest-the-money calls and the three nearest-the-money puts. The options model is the standard Black Scholes model modified for options on futures.

Historical Volatility

Historic volatility is a measure of the volatility over a past period of time. Historic volatility is of primary concern to options traders who must constantly assess the volatility of the underlying instrument and the premiums that the options market is reflecting. Historical volatility always refers to the underlying instrument and not to the options on the underlying instrument.

Historical volatility can also be used as a tool by traders who are trading only the underlying instrument. Quantifying the volatility in a market can affect a trader's perception of how far the market can move and thus provides some help in making price projections and placing orders. High volatility can also sometimes indicate a trend reversal as heavy buying/selling comes into the market and causes sharp price reversals. Some traders try to avoid markets with high volatility and instead look for quieter markets which nevertheless have a clear trend.

Historical volatility is defined as the standard deviation of the "price returns" over a given number of sessions, multiplied by a factor to produce an annualized volatility level. A "price return" is simply the natural log of the percentage price changes or $\ln [P_t / P_{(t-1)}]$.

A volatile market has a larger standard deviation and thus a higher historical volatility value. Conversely, a market with small fluctuations has a small standard deviation and a low historical volatility value.

The general formula for historic volatility is:

$$n\text{-session Hist. Vol.} = \sqrt{252} * \sqrt{\frac{\sum(R_t - \bar{R})^2}{(n-1)}}$$

Where:

R_t (compounded price returns) = $\ln [P_t / P_{(t-1)}]$ where P_t
is the settlement price in period t

$\bar{R} = \frac{\sum(R_t)}{n}$ which is the average of the price returns

252 = the number of trading days in a year

$n = t - 1$ i.e., an n-day historical volatility.

t = total number of prices used. Because it takes 1 additional session to produce the required number of price changes (n), t must always equal 1 day more than the term of historical volatility (n) being calculated. For example, t would equal 11 days for a 10-day historical volatility.

There are several different parameters in the historical volatility formula which can produce different, but still correct, volatility values. This is why no two information services are likely to produce exactly the same historical volatility figure. The parameters are: (1) trading sessions in a year (Optima uses 252), (2) the degrees of freedom (Optima uses one degree of freedom) which refers to the "1" in the n-1 portion of the volatility formula, and (3) the number of sessions used to calculate an n-session historical volatility (Optima uses $t = n+1$ sessions to produce n price changes). Optima follows the most widely used conventions.

Volatility Summary - Currency Futures

Update as of: 050189

Contract	JYM89	DMM89	SFM89	BPM89	CDM89	ADM89
Price High:	.7530	.5327	.5976	1.6784	.8403	.7853
Low:	.7502	.5307	.5940	1.6722	.8394	.7836
Settle:	.7511	.5313	.5954	1.6730	.8402	.7840
Change:	-.0064	-.0025	-.0035	-.0066	-.0004	-.0032
Implied Volatility	8.7	9.0	9.3	8.7	4.8	11.2
Change from Prev:	+1.1	+6	+3	+5	-.1	-.6
from 5-days:	+1.4	+9	+5	+3	-.2	-.6
10-days:	+7	+3	+1	-.2	-.1	+4
20-days:	-.3	-.4	-.4	-.8	+2	-1.2
Implied Volatility High/Low Ranges :						
over 5-days High:	8.7	9.0	9.3	8.7	5.5	12.0
Avg:	7.5	8.4	8.9	8.4	5.1	11.7
Low:	6.9	8.0	8.6	8.2	4.8	11.2
10-days High:	8.7	9.0	9.4	8.9	5.5	12.4
Avg:	7.5	8.3	9.0	8.5	5.1	11.9
Low:	6.9	8.0	8.6	8.2	4.8	11.2
20-days High:	8.7	9.1	9.7	9.4	5.5	12.9
Avg:	8.0	8.5	9.2	8.8	5.0	11.8
Low:	6.9	8.0	8.6	8.2	4.7	10.8
60-days High:	9.4	11.2	11.1	11.1	5.9	N/A
Avg:	8.4	9.6	9.9	9.8	5.1	N/A
Low:	6.9	8.0	8.6	8.2	4.5	N/A
100-days High:	N/A	N/A	N/A	N/A	6.4	N/A
Avg:	N/A	N/A	N/A	N/A	5.5	N/A
Low:	N/A	N/A	N/A	N/A	4.5	N/A
Historical 10 Day Volatility	9.5%	8.1%	10.3%	5.5%	4.1%	8.9%
20 Day:	8.3%	6.9%	10.1%	7.0%	3.8%	12.9%
30 Day:	8.1%	7.0%	10.1%	7.7%	3.7%	11.5%
60 Day:	8.7%	7.4%	9.9%	8.9%	4.0%	16.8%
100 Day:	9.2%	9.5%	11.1%	9.6%	4.2%	N/A
200 Day:	9.3%	N/A	N/A	N/A	6.1%	N/A
20-day Hist. Vol	8.3	6.9	10.1	7.0	3.8	12.9
Change from Prev:	+3	-.5	-.5	+1	-.1	-.2
from 5-days:	+6	-.1	+2	-1.2	+7	-.9
10-days:	+7	+4	-.1	-1.7	+1	+1
20-day Hist. Vol Moving Avgs						
5-day:	7.9	7.1	10.0	6.8	3.4	13.1
10-day:	8.1	7.0	10.1	7.6	3.3	13.4
20-day:	8.1	6.9	10.1	8.2	3.5	14.1
60-day:	8.8	8.0	10.4	9.2	4.0	16.8

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Table 2. Sample Volatility Summary Table

6 PRICE RANGE PROBABILITY TABLES

Optima's Price Range Probability Tables provide the settlement price range extremes for futures contracts based on the market's implied volatility level. The settlement price ranges therefore represent the market's opinion on likely price movement rather than the opinion of any one individual or an estimate based on historical data. This table essentially reduces the annualized implied volatility level to a shorter and more meaningful time frame.

For an example, refer to Table 3. For USH90, "Today's Range Probability" for a 68% degree of probability is 99-15 to 100-13. This means that the implied volatility level of 7.49% (which is shown near the top of the column) suggests that there is a 68% probability that USH will settle today within that 99-15/100-13 range, i.e., within a +/-15 tick range (a one standard deviation move) on either side of the latest underlying settlement of 99-30 which is shown at the top. This assumes, of course, that the market is correct in its estimate of implied volatility.

The tables show the price ranges for three different confidence intervals: 68% (one standard deviation), 95% (two standard deviations) and 99% (three standard deviations). [For a thorough discussion of the concepts of standard deviation and volatility see Sheldon Natenberg's book, *Option Volatility and Pricing Strategies*, Chapter 4 and Appendix B.] The tables also show the settlement price ranges for a given number of sessions out into the future. The price probability ranges become wider and more accurate as the time frame gets longer, simply because the law of averages has more time to work. For example, in the above example, a one standard deviation move for the current day is 15 ticks, whereas on a 10-session time frame, a one standard deviation move is 1-16/32 points.

It should be noted that the price ranges shown in the tables refer only to the contract's final settlement price, not to the daily highs and lows which can be more extreme. This is because the implied volatility level used in calculating the tables is based on the price settlement, not on the intra-day volatility as reflected in daily high and low.

There are several ways to use the information in this table. Option traders can use this information to gauge the likelihood that a contract will move to particular strike prices or position break-even levels. Traders of the underlying futures contract can use this information to obtain an objective market opinion as to the size of possible near-term price moves. This allows the trader to obtain reasonable price movement expectations and therefore be able to identify better trade entry and exit points

For example, an option trader can look at the sample table and see that for USH90 the market believes there is only about a 2.5% probability that a March 106 Call will be in the money as of its expiration. To come to this conclusion, notice in the "To expiration" section near the bottom of the page that the top of the range to expiration for a 95% confidence level is 105-29, very close to the 106 strike price. A 95% confidence level that the market will remain within that range is the same as saying there is a 5% chance the settlement will be outside that range. Because 5% refers to a breakout on both the upside and the downside in combination, one must divide 5% by 2 (obtaining 2.5%) to identify the probability of only an upside breakout. The option trader, however, may be very bullish and believe that there is a much better chance of the 106 call being in the money within the 58 days to expiration. The option trader thus believes that the 106 calls are underpriced and that they represent a good buy.

The same calculations can be made for other time frames and price levels simply by interpolating between the values given on the table. The tables thus allow a trader to identify the market's opinion, as reflected in implied volatility, of the probability that a particular price level will be reached within a given time period.

A trader of the underlying futures contract can use the information in the tables as a guide for assessing the probability that a specific price objective will be met. For example, a trader might be trying to establish a reasonable upside objective for a long position taken today with a planned time frame of about 20 sessions. The trader could look on the sample table for USH90 and see that for 20 sessions out, the market is 95% certain (two standard deviations) that the settlement price will remain between 95-23 and 104-05, i.e., within a 4-06/32 point range (which is two times the one standard deviation value of 2-03/32) on either side of the latest settlement of 99-30 for an overall range of 8-12/32 points. This allows the trader to see that the market believes that there is only a 2.5% chance for a rally of more than 4-06/32 points (i.e., above 104-05) within the next 20 sessions. In other words, the market seriously doubts that such a price objective will be met. The trader may agree or disagree with that assessment but the trader at least obtains an objective and quantifiable market opinion on the likelihood that a long position taken today will meet a 4-06/32 point upside objective within the next 20 sessions.

As a note on rounding, if one actually adds or subtracts the 2-03/32 point standard deviation for the "20-sessions out" set of values from the latest settlement price on the sample table, one will see that some of the price ranges appear to be one tick off. All the numbers shown, however, are accurate to the nearest 1/32nd. Small apparent one-tick discrepancies arise from the necessity of rounding the final answer to the nearest 1/32nd. The calculations are actually done using the more accurate decimal figures.

The price range tables also can be used to place stops. Such stops would be close-only stops since the current discussion is limited to settlement ranges, not to intra-day high/low extremes. In Table 3, for example, a one-standard-deviation move for the USH90 contract on the current day is 15 ticks. This means the market is saying that there is a 68% probability (one standard deviation) that the contract will settle today within a range of +/-15 ticks and a 95% probability (two standard deviations) that the contract will settle within a +/- 30 tick range. Thus, for example, if a trader would like to have only a 2.5% probability of having his or her stop activated (the upside or downside probability at a 95% confidence level), then the trader should place the stop 30 ticks (two standard deviations) away from the latest settlement.

The same theory applies to time frames beyond one day. For example, a trader with a time frame of 10 sessions could place a stop one standard deviation away from the market and have a 16% chance that the stop will be activated (the upside probability outside a 68% confidence level). On the sample table, this translates to a 1-16/32 point price move (one standard deviation) which means the close-only stop should be placed either above 101-14 or below 98-14. Using this theory to place stops provides an objective, market-based method for assessing the probability that one's stop will be activated.

One should be careful using the tables on short time frames, however, because implied volatility is keyed more to the situation at expiration than to the next several days. In addition, the calculations have less statistical validity as the time frame becomes shorter. For example, the current implied volatility might not fully reflect the fact that a very big report is being released during the upcoming session that could easily cause a temporary extreme spike.

PRICE RANGE PROBABILITIES - INTEREST RATES & STOCKS Update as of: 122189

Contract:	USH90	TYH90	MBH90	EDH90	TBH90	SPH90
Underlying Settle:	99-30	100-29	94-19	92.18	93.34	349.45
Change:	-0-07	-0-03	-0-05	-.01	+.00	+1.60
ImpliedVolatility:	7.49%	5.36%	9.21%	13.86%	18.79%	16.51%
Change:	-.08	+.02	-.06	-.41	+.16	+.08
Today's Range	68% H: 100-13 L: 99-15	101-08 100-18	95-05 94-01	92.25 92.11	93.42 93.26	353.10 345.80
Probabil.	95% H: 100-28 L: 99-00	101-19 100-07	95-22 93-16	92.32 92.04	93.50 93.18	356.70 342.20
	99% H: 101-11 L: 98-17	101-30 99-28	96-08 92-30	92.38 91.98	93.58 93.10	360.35 338.55
1 Std Deviation:	0-15	0-11	0-18	.07	.08	3.65
5-Sessions Out	68% H: 101-00 L: 98-28	101-21 100-05	95-26 93-12	92.33 92.03	93.52 93.16	357.55 341.35
	95% H: 102-01 L: 97-27	102-14 99-12	97-02 92-04	92.49 91.87	93.69 92.99	356.70 333.20
	99% H: 103-03 L: 96-25	103-06 98-20	98-09 90-29	92.64 91.72	93.87 92.81	373.80 325.10
1 Std Deviation:	1-02	0-24	1-07	.15	.18	8.10
10-Sessions Out	68% H: 101-14 L: 98-14	101-31 99-27	96-11 92-27	92.40 91.96	93.59 93.09	360.95 337.95
	95% H: 102-29 L: 96-31	103-02 98-24	98-02 91-04	92.61 91.75	93.84 92.84	372.45 326.45
	99% H: 104-13 L: 95-15	104-04 97-22	99-26 89-12	92.83 91.53	94.09 92.59	383.90 315.00
1 Std Deviation:	1-16	1-02	1-24	.22	.25	11.50
20-Sessions Out	68% H: 102-01 L: 97-27	102-14 99-12	97-02 92-04	92.49 91.87	93.69 92.99	365.70 333.20
	95% H: 104-05 L: 95-23	103-30 97-28	99-16 89-22	92.79 91.57	94.05 92.63	381.95 316.95
	99% H: 106-08 L: 93-20	105-15 96-11	101-31 87-07	93.10 91.26	94.40 92.28	398.20 300.70
1 Std Deviation:	2-03	1-17	2-15	.31	.35	16.25
60-Sessions Out	68% H: N/A L: N/A	N/A N/A	N/A N/A	92.71 91.65	N/A N/A	377.60 321.30
	95% H: N/A L: N/A	N/A N/A	N/A N/A	93.24 91.12	N/A N/A	405.75 293.15
	99% H: N/A L: N/A	N/A N/A	N/A N/A	93.77 90.59	N/A N/A	433.90 265.00
1 Std Deviation:	N/A	N/A	N/A	.53	N/A	28.15
To expiration	68% H: 102-29 L: 96-31	103-02 98-24	98-02 91-04	92.72 91.64	93.84 92.84	377.45 321.45
	95% H: 105-29 L: 93-31	105-07 96-19	101-17 87-21	93.25 91.11	94.34 92.34	405.45 293.45
	99% H: 108-28 L: 91-00	107-12 94-14	105-00 84-06	93.79 90.57	94.84 91.84	433.45 265.45
1 Std Deviation:	2-31	2-05	3-15	.54	.50	28.00
Date of Expiration	021790	021790	021790	032090	021790	031790
Days to Expiration	58	58	58	89	58	86

Note: Price ranges reflect the probability (1,2,3 standard deviations) that the price will settle within that range over the given number of sessions out. Calculation brings annualized implied volatility in to a shorter, more-immediate time frame.

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Table 3. Sample Price Range Probability Table

Sigma Boundary Charts

Optima's new Sigma Boundary charts show the market's best estimate of the boundary of expected closing prices within a 68% probability (1 standard deviation). The "sigma" refers to the Greek letter that is usually applied to a standard deviation value. The beauty of this chart is that it represents "market generated" information. In other words, the chart represents the consensus estimate of options traders as to the likely boundaries of price movement over the near-term. Option traders may be wrong, but the boundary represents the "fair value" of price movement over the near-term. The chart thus takes a market-consensus statistic and puts it into a graphic that can be used to better assess market price structure.

Optima has shown this data in tabular form for some time in the "Probable Range Tables." Now, we are extending the tabular data to graphic form. We have also made the upper and lower boundaries more exact by using the log-normal formula. We are in the process of changing the name of the "Probable Range" data to the "Sigma Boundaries" because of some confusion that occurred with the old name. The current "Probable Range" tables will soon be reorganized.

The first step in creating the sigma boundary is to calculate the current implied volatility for a particular options contract. The implied volatility figure contains the market's best estimate of how far prices are likely to move through the expiration of the options contract. If implied volatility is high, then the boundary will be wide. On the other hand, if implied volatility is low, then the boundary will be narrow. The boundary will widen and narrow from day to day as implied volatility changes.

The first step is to bring implied volatility down from an annualized figure to a 1 day level. To do this, we basically multiply the volatility times $1 / \text{SQRT}(252)$ or 252 trading days. The formula for this is:

$$1\text{-Day Std Deviation} = \text{Settlement} \times \text{Implied Vol} \times \left(\frac{1}{\sqrt{252}}\right)$$

The meaning of the 1-day standard deviation is that there is a 68% chance (i.e., plus/minus 1 standard deviation under a normal distribution) that the market today will close within the boundary of a 1 standard deviation either up or down. If the 1-day standard deviation for bonds is 20 ticks, for example, then there is a 68% chance (about 2/3) that the market today will close plus/minus 20 ticks or less. Under 2 standard deviations, there is a 95% chance that the market will close within the boundary of plus/minus 40 ticks or 1-08/32 points. Under 3 standard deviations, there is a 99% chance that the market will close plus/minus 60 ticks or 1-28/32 points.

Chart 4. Sigma Boundary Charts

The Sigma Boundary is then extended from the 1-day level out to expiration for the 1 standard deviation level. At expiration, the formulas for the upper and lower boundaries are:

$$\text{Upper } 1 \sigma \text{ Boundary at Expiration} = \text{Settle} \times e^{\text{Impl Vol} \times \sqrt{t}}$$

$$\text{Lower } 1 \sigma \text{ Boundary at Expiration} = \text{Settle} \times e^{-(\text{Impl Vol} \times \sqrt{t})}$$

where t = calendar days to option expiration / 365

Optima's Sigma Boundary Charts are useful in several different ways. First, the breakeven point for a volatility trade is a 1 standard deviation move in prices through expiration. Optima's chart therefore allows an options trader to assess the size of this movement in graphic terms.

Second, a trader can also use the sigma boundaries to assess whether the market is simply moving sideways in a random, consolidation fashion, or whether a sharp breakout of the sigma boundary is perhaps signalling the start of a new trend that is beyond the likelihood of a normal distribution. A trader can also use the sigma boundaries to help set stops and reasonable objectives for trading profits.

References for Price Range Probability Tables **Section**

Bookstaber, Richard M., *Option Pricing & Investment Practices*, Probus Publishing, Chicago, 1987 (especially "Volatility Estimation", pp 75-83).

Hull, Robert W., "Using Basic Statistics for Stops", *Technical Analysis of Stocks and Commodities*, July 1986, pp 22-28.

Natenberg, Sheldon, *Option Volatility and Pricing Strategies: Advanced Techniques for Professionals*, Probus Publishing, Chicago, 1988 (especially Chapter 4 and pp 74-75).

Natenberg, Sheldon, *Advanced Options Manual*, LIT America, 1989.

7 THEORETICAL OPTIONS TABLES

The Theoretical Options Tables provide theoretical option prices and corresponding deltas for a range of underlying prices and for several different implied volatility assumptions. These tables provide a variety of information and are useful for obtaining option prices, implied volatility levels, deltas, gammas and vegas.

The inputs for these tables are: (1) underlying price, (2) implied volatility assumption, (3) interest rate assumption, and (4) days to option expiration. The outputs are (1) theoretical option price, and (2) delta. The options model is the standard Black Scholes model modified for futures.

See Table 4 for a sample Theoretical Options Table for June 1990 T-bond options. The underlying prices run down the left side of the table, while the theoretical option prices and deltas are found below the relevant strike prices which are across the top of the table.

The prices for the underlying instrument and the options are expressed in the regular units in which they trade. Since the underlying price and the option normally trade in the same units, there is usually no room for confusion. For CBT T-bonds and T-notes, however, the underlying price is expressed in 32nds whereas the option price is expressed in 64ths.

Deltas

The delta refers to how fast the option price moves relative to the price movement in the underlying instrument. The delta is expressed in percentage terms. For example, a delta of 50 for a T-bond call means that the call will rise only 50% as fast as the underlying price rises, or will fall 50% as fast as the underlying price falls. For T-bonds, the call will therefore rise only $4/64$ ($2/32$) points when the underlying future rises by $4/32$ points.

A negative delta means that the option price will decline when the underlying price rises and vice versa. Puts have negative deltas since the put will decline in price as the price of the underlying instrument rises.

Delta values change as the underlying price changes and as the implied volatility level changes. Optima's tables can be used to see how the delta will change under a variety of different situations. For example, in Table 5, note how the delta for a 92 Call changes from 39 to 50 as the underlying price moves from 91-00 to 92-00. The change in delta for a 1-point move in the underlying price happens to be the definition of gamma, which means that a trader can use these tables to calculate the gamma for a position. In the example just cited, the gamma for the 92 Call for a 1-point move from 91-00 to 92-00 is 11, i.e., the delta of 50 at a price of 92-00 minus the delta of 39 at a price of 91-00.

JUN 90 T-Bond Options
 Evaluation date: 3/20/90 Expiration: 5/19/90 #Days:60
 Interest Rate: 8.25%

	88				90				92			
	Call		Put		Call		Put		Call		Put	
91-00 @ 9.00%	3-18	82	0-20	-17	1-55	62	0-56	-37	0-57	39	1-56	-60
@ 9.50%	3-21	81	0-23	-18	1-59	61	0-60	-38	0-61	39	1-60	-60
@10.00%	3-24	79	0-27	-20	2-00	61	1-01	-38	1-02	40	2-01	-59
91-04 @ 9.00%	3-24	83	0-19	-16	1-60	63	0-53	-36	0-60	40	1-51	-59
@ 9.50%	3-27	82	0-22	-17	2-00	63	0-57	-36	1-00	41	1-56	-58
@10.00%	3-30	80	0-25	-19	2-05	62	0-62	-37	1-05	41	1-60	-58
91-08 @ 9.00%	3-31	84	0-18	-15	2-01	65	0-50	-34	0-63	41	1-47	-58
@ 9.50%	3-34	83	0-21	-16	2-05	64	0-55	-35	1-04	42	1-51	-57
@10.00%	3-37	81	0-24	-18	2-10	63	0-59	-36	1-08	42	1-56	-57
91-12 @ 9.00%	3-38	85	0-17	-14	2-06	66	0-48	-33	1-03	43	1-42	-56
@ 9.50%	3-40	83	0-19	-16	2-11	65	0-52	-34	1-07	43	1-47	-56
@10.00%	3-43	82	0-22	-17	2-15	65	0-56	-34	1-12	44	1-51	-55
91-16 @ 9.00%	3-44	85	0-15	-14	2-12	68	0-45	-31	1-06	44	1-38	-55
@ 9.50%	3-47	84	0-18	-15	2-16	67	0-49	-32	1-11	45	1-42	-54
@10.00%	3-50	83	0-21	-16	2-20	66	0-53	-33	1-15	45	1-47	-54
91-20 @ 9.00%	3-51	86	0-14	-13	2-17	69	0-43	-30	1-10	46	1-33	-53
@ 9.50%	3-54	85	0-17	-14	2-21	68	0-47	-31	1-14	46	1-38	-53
@10.00%	3-57	84	0-20	-15	2-25	67	0-51	-32	1-19	46	1-43	-53
91-24 @ 9.00%	3-58	87	0-13	-12	2-23	70	0-40	-29	1-13	47	1-29	-52
@ 9.50%	3-61	86	0-16	-13	2-27	69	0-44	-30	1-18	47	1-34	-52
@10.00%	3-63	85	0-18	-14	2-31	68	0-48	-31	1-23	48	1-39	-51
91-28 @ 9.00%	4-01	88	0-12	-11	2-28	71	0-38	-28	1-17	49	1-25	-50
@ 9.50%	4-03	87	0-15	-12	2-32	70	0-42	-29	1-22	49	1-30	-50
@10.00%	4-06	85	0-17	-14	2-36	70	0-46	-29	1-27	49	1-35	-50
92-00 @ 9.00%	4-08	89	0-11	-10	2-34	73	0-36	-26	1-21	50	1-21	-49
@ 9.50%	4-10	87	0-14	-12	2-38	72	0-40	-27	1-26	50	1-26	-49
@10.00%	4-13	86	0-16	-13	2-42	71	0-44	-28	1-31	50	1-31	-49

Table 5. Sample Theoretical Options Table

The delta value can be used in several different ways. The delta value of a position defines how long or short a trader is when buying/selling an option. For example, if a trader is long a call with a delta of 50, then the trader is effectively long 50% of an underlying contract.

The delta also tells a trader how many futures contracts must be bought/sold to hedge an options position and make it "delta neutral". This is why the delta is sometimes called the "hedge ratio" or "hedge factor". For example, if a call has a delta of 50, then one future would be bought/sold against two options contracts to produce a delta-neutral position. A delta neutral position is one in which the trader is betting on a change in implied volatility because a small change in the price of the underlying instrument will not affect the value of the overall position.

Option Spread Positions

One can easily assess option spread positions with Optima's tables by simply combining the individual theoretical option prices and by adding the relevant deltas. As an example in Table 5, consider a "90 straddle" (i.e., long one 90 Call and long one 90 Put) with the assumptions of an underlying June T-bond price of 91-00 and an implied volatility of 10.0%. The straddle should be trading at a price of about 3-01/64 points, that is, the call price of 2-00/64 plus the put price of 1-01/64. The 90 straddle position with those assumptions would have a combined delta of +23, that is, the call delta of 61 plus the put delta of -38.

Implied Volatility

Optima's tables express the theoretical option prices for several different implied volatility assumptions. This allows a trader to see how a change in implied volatility will affect the option price. The trader also can take an actual option price and compare it to the various theoretical prices to get a ballpark figure on the market's current implied volatility level.

The change in the option price for a 1% change in implied volatility is the definition of vega (or kappa), which means the tables can be used to obtain vega values and assess how vega changes over different underlying price assumptions. For example, in Table 5, consider the 92 Call at an underlying June T-bond price of 91-00. The theoretical option price at a 9.00% implied volatility is 0-57/64, and the option price at a 10.00% implied volatility is 1-02/64. This produces a vega of 9/64, that is, 1-02/64 minus 57/64.

8 T-BOND PRICE-YIELD RANGE TABLE

Optima issues a new Cash T-bond Price-Yield Range Table on the first business day of each month. Subscribers should therefore save the table for reference purposes during the month. The values on the table are accurate throughout the month. Another new table is issued during the month if a new benchmark bond or note is auctioned.

The T-bond Price-Yield Table shows the price-yield equivalents for the benchmark 30-year Treasury bond. This table shows the cash T-bond prices that correspond to particular yield levels for that bond, and vice versa.

Table 6 is a sample Price-Yield Range Table for the cash 6-1/4% T-bond of 8/15/23. The table shows that for a 6.000% yield the price would be 103-15/32. The table could be used in the opposite way by looking at the price of 96-28/32 the yield would be 6.488%

The T-bond market often finds support/resistance when the benchmark 30-year T-bond hits major psychological levels such as 8.50% or 9.00%. The table thus shows the cash T-bond prices that correspond to those important yield levels.

When the cash T-bond market finds support/resistance at these key yield levels, it is necessary not only to know the relevant cash T-bond price but also the corresponding T-bond futures price. It is possible to estimate beforehand where the futures will be trading simply by assuming that the futures-cash basis will remain constant from the previous sessions settlement. Please see Appendix 1: The Treasury Bond Basis for further information on this subject.

The price-yield equivalents are calculated using the industry-standard formula for government bonds. The tables assume a settlement date for the bond transaction as the 15th of the month and thereby provides a price-yield relationship that is accurate throughout the entire month.

Yield	Price (32nd)	Price (32nd)	Yield	Price (32nd)	Yield
3.500%	150-26	94-12	6.687%	100-00	6.250%
3.625%	147-25	94-16	6.677%	100-04	6.241%
3.750%	144-25	94-20	6.667%	100-08	6.231%
3.875%	141-29	94-24	6.656%	100-12	6.222%
4.000%	139-03	94-28	6.646%	100-16	6.213%
4.125%	136-12	95-00	6.636%	100-20	6.204%
4.250%	133-23	95-04	6.626%	100-24	6.195%
4.375%	131-05	95-08	6.616%	100-28	6.185%
4.500%	128-21	95-12	6.606%	101-00	6.176%
4.625%	126-07	95-16	6.596%	101-04	6.167%
4.750%	123-27	95-20	6.586%	101-08	6.158%
4.875%	121-18	95-24	6.576%	101-12	6.149%
5.000%	119-10	95-28	6.566%	101-16	6.140%
5.125%	117-05	96-00	6.557%	101-20	6.131%
5.250%	115-01	96-04	6.547%	101-24	6.122%
5.375%	112-31	96-08	6.537%	101-28	6.113%
5.500%	110-31	96-12	6.527%	102-00	6.104%
5.625%	109-00	96-16	6.517%	102-04	6.095%
5.750%	107-03	96-20	6.507%	102-08	6.086%
5.875%	105-08	96-24	6.498%	102-12	6.077%
6.000%	103-15	96-28	6.488%	102-16	6.068%
6.125%	101-23	97-00	6.478%	102-20	6.059%
6.250%	100-00	97-04	6.468%	102-24	6.050%
6.375%	98-11	97-08	6.459%	102-28	6.041%
6.500%	96-23	97-12	6.449%	103-00	6.032%
6.625%	95-05	97-16	6.439%	103-04	6.024%
6.750%	93-19	97-20	6.430%	103-08	6.015%
6.875%	92-03	97-24	6.420%	103-12	6.006%
7.000%	90-21	97-28	6.410%	103-16	5.997%
7.125%	89-07	98-00	6.401%	103-20	5.988%
7.250%	87-27	98-04	6.391%	103-24	5.980%
7.375%	86-15	98-08	6.382%	103-28	5.971%
7.500%	85-05	98-12	6.372%	104-00	5.962%
7.625%	83-28	98-16	6.363%	104-04	5.953%
7.750%	82-20	98-20	6.353%	104-08	5.945%
7.875%	81-13	98-24	6.344%	104-12	5.936%
8.000%	80-07	98-28	6.334%	104-16	5.927%
8.125%	79-01	99-00	6.325%	104-20	5.919%
8.250%	77-29	99-04	6.315%	104-24	5.910%
8.375%	76-25	99-08	6.306%	104-28	5.901%
8.500%	75-23	99-12	6.297%	105-00	5.893%
8.625%	74-21	99-16	6.287%	105-04	5.884%
8.750%	73-20	99-20	6.278%	105-08	5.876%
8.875%	72-19	99-24	6.268%	105-12	5.867%
9.000%	71-20	99-28	6.259%	105-16	5.858%

Settlement Date: 8/15/93 (Note: All yields and prices shown reflect calculations for settlement dates 2-weeks prior and 2-weeks after the assumed settlement date).

Table 6. Price-Yield Range Table for Cash 6-1/4% T-bond of 8/15/23

9 VOLATILITY CONES

Investors and speculators constantly face the issue of whether implied volatility is "high" or "low." The volatility cone and the volatility cheapness index represent ways to answer this question. These concepts were originally developed by Galen Burghardt (currently at Dean Witter) and have since been extended by others.

The main idea of the volatility cone is to overlay implied volatility on a shaded backdrop representing the "history" of historical volatility for particular weeks to expiration. Historical volatility is a measure of how volatile a futures contract has been in the past. With this benchmark, one can gain an idea of whether implied volatility is trading on a rich or cheap basis.

Traders often assess the richness/cheapness of implied volatility by overlaying it on the 20-day historical volatility (or some other n-day volatility). However, this is only a correct view if there are 20 days left to expiration on the options contract. The volatility cone corrects this problem by ensuring that implied volatility is being matched up with the distribution of historical volatilities that corresponds to the correct number of days to expiration of the options contract.

The volatility cheapness index is a method of assigning an index value to a particular level of implied volatility. The index varies from 0 to 100, with 50 being a neutral or average implied volatility measure.

The index simply represents the percentile of the current implied volatility level compared with the "history" of historical volatilities at that particular week-to-expiration. In other words, if the implied volatility is currently trading right on the median of the past historical volatilities, then the volatility cheapest index will be 50. If the implied volatility level is such that 25% of the historical volatility observations are below the current implied volatility level, then the index will be 25. If 75% of the historical volatility observations are below the current implied volatility level, then the index will be 75. If the implied volatility is trading at or below the lowest historical volatility ever observed for the particular week-to-expiration, then the volatility cheapness index is 0.

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Chart 7. Volatility Cone

APPENDIX 1:

TREASURY BOND BASIS

The T-bond Cash-Futures basis is defined as:

$$\text{Basis} = \text{Cash T-bond Price} - (\text{Futures Price} * \text{Conversion Factor})$$

Optima's T-bond Technical Picture each day has a data line which shows the basis for the benchmark cash 30-year T-bond versus the lead T-bond futures month, along with its change from the previous session. For example:

$$\text{Basis Data: Cash 8-1/2\% bond} - (\text{USM})(1.0563)$$

The cash price used in that calculation is 98-15 which was the price observed at the time the futures settled. The futures price is the 92-03 settlement of the June T-bond. The basis, therefore, is calculated as follows:

$$\text{Basis} = 98-15/32 - (92-03/32 * 1.0563)$$

The calculation is done in decimal form and then converted back into 32nds.

$$\text{Basis} = (98.46875) - (92.09375 * 1.0563) = 1.190 \text{ (or } 38/32)$$

It is necessary to multiply the futures price by a conversion factor to adjust for the difference between the coupon rate and maturity date of the cash T-bond and the delivery date of the T-bond futures contract. The CBOT's T-bond futures contract is always defined as having an 8% coupon and a maturity of longer than 15 years. The conversion factors for other cash instruments versus other futures are available from the CBOT's economic analysis department.

The cash futures basis for T-bonds, like other financial instruments, is primarily a function of carrying costs. The T-bond basis also changes, however, when there is a change in the cash T-bond that is the cheapest to deliver on the futures contract.

There is an excellent explanation of the T-bond basis in the book *The Treasury Bond Basis* written by Galen Burghardt, Morton Lane and John Papa (Probus Publishing, Chicago, 1989).

APPENDIX 2:

STOCK INDEX FUTURES AND FAIR VALUE PREMIUM

The fair value premium for a stock index futures contract is defined simply as the theoretical futures price minus the cash index price. The fair value premium shows how far the futures contract should be trading above or below the cash index given expected dividend income for the stocks in the S&P 500, the days to expiration for the futures contract and the short-term interest rate. If the future's price moves too far above or below the fair value premium band, then one can expect index arbitragers to begin executing trades which will bring the cash and the futures prices back into line.

In order to calculate the fair value premium, it is first necessary to calculate the theoretical S&P 500 futures price. Optima uses the standard theoretical futures valuation formula to compute the S&P 500 theoretical futures price. This formula is explained in detail in the Chicago Board of Trade's pamphlet entitled *CBOT Financial Update* or in the *Journal of Futures Markets*, (Jan 1983, Vol 3, No 1), in an article entitled "The Pricing of Stock Index Futures", by Bradford Cornell and Kenneth R. French.

The formula is as follows:

$$F = (s * e^{rt}) - D$$

where:

F = Theoretical Futures Price

s = Spot Index Price

e = 2.7183 which is the Natural Exponential Function

r = short-term interest rate

t = number of days to futures expiration/360

D = dividends, expressed in index points, for stocks going ex-dividend prior to futures expiration.

For example, assume:

- a cash S&P 500 index price of 352.00
- a short-term interest rate of 4.50%
- 65 days until futures contract expiration
- dividend income of 2.17738 S&P 500 index points through the futures contract expiration date.

Using that data the theoretical futures price is calculated as follows:

$$\text{Theo. futures price} = [(352.00)(2.7182)^{(.0450 \times 65 / 360)}] - (2.17738) = 352.69 \text{ points}$$

The fair value premium is then calculated as follows:

$$\text{Fair value premium} = \text{Theoretical Futures Price of } 352.69 \text{ minus Cash Price of } 352.00 = 0.69 \text{ points.}$$

If strong buying in the futures market pushes the futures prices higher relative to the cash index so that the actual premium moves to 2.19 points, for example, which is 1.50 points above the fair value premium of 0.69 points, one would expect arbitragers to initiate buy programs in which they buy the cash stocks and sell equal amounts of the futures. This type of index arbitrage performs the function of keeping the futures and cash prices in line and provides liquidity to the markets.

Optima computes the S&P fair value premium on a daily basis for the front two S&P futures contracts. Optima uses the interest assumptions of the Eurodollar rate, the T-bill rate, and the average of the Eurodollar and T-bill rates. Optima uses these three different rates to allow the user to see how different rates affect the premium.

Optima maintains a data base of the daily dividend payments expected on an S&P 500 stock portfolio. This data base is updated weekly and is used to derive the value of dividends for stocks going ex-dividend prior to expiration.

APPENDIX 3

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