UNIVERSITY OF ROCHESTER

William E. Simon Graduate School of Business Administration

FIN 411 | **Professor G. William Schwert**
Investments | Spring 1996

Case #3 -- Analysis of Options & Futures Prices: due May 6, 1996

The listings below from the April 16, 1996 *Wall Street Journal* (based on closing prices for April 15) show put and call option quotations for five stocks (Kodak, IBM, Microsoft, Netscape, and Xerox), and the S&P 500 portfolio. Use these data to answer the following questions:

(a) Are there any obvious profit opportunities (violations of boundary conditions) available in buying or selling Kodak, IBM, Microsoft, Netscape, or Xerox call options? If so, explain what you would have to do to "make money." If not, explain why you concluded that there were no arbitrage opportunities.

(b) Use the Excel spreadsheet discussed in class, OPTIONS.XLS (also available on the FIN411 directory of the Simon School fileserver) to analyze the call and put option prices for three of the individual stocks (your choice) and the S&P 500 portfolio.

- How do the market prices for the call options compare with the Black-Scholes model prices? Can you explain any differences that you see?[1]

- Estimate the implied variance of these four securities. Explain how you calculated this variance. Is the variance rate the same for a given security for different time horizons? (e.g., May and July? or July and October?) *Why or why not?* Is the variance rate implied by the "long-term options" (e.g., January 1997 for Kodak or January 1997 or 1998 for IBM, etc.) the same as for the shorter term options? *Why or why not?*

- The next ex-dividend dates for Kodak are May 27, August 26, and October 28 (with dividend payments of $0.40). The next ex-dividend dates for IBM are May 6, August 12, and November 11 (with dividend payments of $0.25). The next ex-dividend dates for Xerox May 27, August 26, and October 28 (with dividend payments of $0.87). The current dividend yield on the S&P portfolio is about 2.80% per annum. How, if at all, will this affect your analysis of the value of the call option contracts you studied in parts (a) and (b)? Explain.

[1] An Excel spreadsheet on the fileserver, **F411C3.XLS**, contains daily prices and dividend payments to Kodak, IBM, Microsoft, Netscape, Xerox, and the S&P 500 from January 1995 through April 15, 1996. You might find these data to be useful.

LISTED OPTIONS QUOTATIONS

Monday, April 15, 1996

Composite volume and close for actively traded equity and LEAPS, or long-term options, with results for the corresponding put or call contract. Volume figures are unofficial. Open interest is total outstanding for all exchanges and reflects previous trading day. Close when possible is shown for the underlying stock on primary market. **CB**-Chicago Board Options Exchange. **AM**-American Stock Exchange. **PB**-Philadelphia Stock Exchange. **PC**-Pacific Stock Exchange. **NY**-New York Stock Exchange. **XC**-Composite. **p**-Put.

Option/Strike		Exp.	-Call- Vol.	-Call- Last	-Put- Vol.	-Put- Last
EKodak	65	Apr	25	5	55	3/16
69¾	70	Apr	197	1¼	512	1½
69¾	70	May	109	2½	211	2½
69¾	70	Jul	22	4	51	3⅝
69¾	70	Oct	54	5⅜	...	...
69¾	75	Apr	20	1/16	78	5⅜
69¾	75	May	130	⅞	...	...
I B M	105	Apr	246	9⅝	2172	7/16
114	105	May	588	11	915	1 15/16
114	105	Jul	7	14¼	179	3½
114	110	Apr	1222	5⅜	1693	1 3/16
114	110	May	390	7⅞	688	3⅜
114	110	Jul	103	10¾	80	5⅜
114	115	Apr	4814	2⅜	1141	3⅛
114	115	May	2362	5⅛	467	5⅝
114	115	Jul	590	8	25	7¾
114	115	Oct	593	11⅛	5	10
114	120	Apr	3369	⅞	1509	6⅝
114	120	May	2673	3	25	9
114	120	Jul	360	5¾	25	10¾
114	120	Oct	46	8½	4	12⅝
114	125	Apr	1481	5/16	28	11
114	125	May	635	1 13/16	...	...
114	125	Jul	387	4⅛	20	13⅝
Micsft	95	Apr	86	8⅞	338	⅜
103 33/64	95	May	39	10¼	1101	1⅜
103 33/64	95	Jul	...	...	48	3⅛
103 33/64	100	Apr	1003	4½	700	13/16
103 33/64	100	May	397	6½	30	2⅞
103 33/64	100	Jul	218	9½	140	4¾
103 33/64	105	Apr	2473	1 7/16	45	3
103 33/64	105	May	469	3⅞	11	4⅞
103 33/64	105	Jul	47	6⅞	...	...
103 33/64	110	Apr	443	5/16	25	7¼
103 33/64	110	May	197	2	...	...
103 33/64	110	Jul	105	4¾	...	...
Netscpe	50	Apr	515	3½	511	7/16
52⅝	50	May	57	6	52	3¼
52⅝	55	Apr	188	11/16	29	2⅝
52⅝	55	May	169	3⅝	150	5⅝
52⅝	55	Oct	46	9⅝	...	...
52⅝	60	Apr	86	⅛	...	...
52⅝	60	May	78	2	...	...
52⅝	60	Jul	75	5	...	...
Xerox	125	Apr	40	5¾	5	⅜
130⅞	125	May	49	8¼	...	...
130⅞	125	Jul	485	10½	2	6¼
130⅞	130	Apr	178	1½	5	1⅜
130⅞	130	May	64	5½	10	4⅞
130⅞	130	Jul	53	9⅛	5	7⅝
130⅞	135	Apr	9	¼	67	5⅝
130⅞	135	May	13	2⅞	55	8½

RANGES FOR UNDERLYING INDEXES

Monday, April 15, 1996

	High	Low	Close	Net Chg.	From Dec. 31	% Chg.
S&P 500 -A.M.(SPX)	642.49	636.71	642.49	+ 5.78	+ 26.56	+ 4.3

S & P 500 INDEX-AM(SPX)

Strike		Vol.	Last	Net Chg.	Open Int.
Apr	600p	127	3/16	− 3/16	10,942
May	600p	447	2⅜	− 1	11,789
Jun	600c	55	50	+ 2¾	20,352
Jun	600p	390	5⅝	− 1	33,782
Apr	620p	7,868	7/16	− 13/16	19,814
May	620p	997	4½	− 1¾	6,887
Jun	620c	5	33⅝	+ 4⅜	6,588
Jun	620p	253	8½	− 2⅞	13,881
Apr	630c	716	13¾	+ 3¾	5,691
Apr	630p	4,770	¾	− 1¾	14,376
May	630c	56	19½	+ 2	134
May	630p	1,002	6¾	− 2¼	4,863
Jun	630c	36	26	+ 2⅛	2,971
Jun	630p	1,028	11½	− 2	11,153
Apr	640c	5,526	5⅜	+ 1⅞	13,910
Apr	640p	5,533	2¾	− 3¾	24,042
May	640c	412	13¼	+ 2¼	8,729
May	640p	3,231	9½	− 3¼	8,056
Jun	640c	260	19¾	+ 2⅝	11,363
Jun	640p	356	14⅛	− 3⅛	20,990
Apr	645c	1,679	2⅝	+ 1 1/16	9,408
Apr	645p	376	5	− 4⅛	7,306
May	645c	1,618	10⅜	+ 1⅝	19,510
May	645p	641	12	− 2¾	2,135
Jun	645c	30	16¾	+ 2½	17,190
Jun	645p	21	17¼	− 4¾	19,598
Apr	650c	2,001	⅞	+ 3/16	27,525
Apr	650p	1,920	8	− 6⅝	24,556
May	650c	57	7¾	+ 1½	2,741
May	650p	264	14⅝	− 3⅝	4,370
Jun	650c	348	13⅝	+ 1⅝	36,684
Jun	650p	102	18½	− 3	33,933
Apr	660c	433	⅛	...	12,907
Apr	660p	20	17⅝	− 6⅝	4,171
May	660c	104	3¾	+ ¾	6,758
May	660p	4	22½	− 3½	2,952
Jun	660c	252	9⅛	+ 1⅛	3,917
Jun	660p	10	24	− 5	5,403
Apr	680c	5	1/16	...	8,271
May	680c	3,035	⅝	...	16,269
Jun	680c	112	3	+ ⅜	3,277
Jun	680p	25	40½	− 2	15,052

LONG TERM OPTIONS

S & P 500 INDEX – CB

Dec 96	55c	2	10¾	+ 1	1012
Dec 97	55p	80	1¼	− ¼	7771
Dec 98	55p	20	1¾	− ⅛	746
Dec 96	60p	313	1½	...	9679
Dec 97	60p	10	2⅜	− 1/16	12175
Dec 98	60p	5	2¾	+ ⅛	2503
Dec 96	65c	10	3½	− ⅝	185
Dec 96	65p	10	3¼	...	1837
Dec 97	65p	10	3⅝	...	5326
Dec 98	65p	2	4	+ ⅛	3993
Dec 96	70c	20	15/16	+ ¼	31
Dec 96	70p	225	5½	− 1¼	1900
Dec 97	70p	330	5½	− ¾	1996
Dec 98	70p	341	5⅞	− ⅛	5119

Option/Strike		Exp.	-Call- Vol.	-Call- Last	-Put- Vol.	-Put- Last
EKodak	70	Jan 97	1	7	1051	5⅜
IBM	100	Jan 97	83	21⅛	345	4⅞
114	100	Jan 98	322	28⅜	6	7
114	110	Jan 97	103	15⅝	18	8¾
114	120	Jan 97	79	11	...	...
114	120	Jan 98	410	18	...	...
114	130	Jan 97	45	7⅜	...	...
114	140	Jan 98	46	10⅞	...	...
Micsft	40	Jan 97	50	64½	...	...
103 33/64	75	Jan 98	...	...	50	2⅞
	90	Jan 97	4	20¼	87	4⅜

The listings below from the April 16, 1996 *Wall Street Journal* (based on closing prices for April 15) show quotations for the futures contracts on 91-day Treasury bills and on the S&P 500 index. Explain how you might use the data on Treasury bill yields and futures prices for Treasury bills and for the S&P 500 portfolio to "make money."

- Based on these data, are there any apparent profit opportunities in trading Treasury bill futures? If so, what position would you take? If not, why not?
- Based on these data, are there any apparent profit opportunities in trading S&P futures? If so, what position would you take? If not, why not?

You may find it useful to take advantage of the spreadsheet FUTURES.XLS that was discussed in class (which is also available on FIN411 directory of the Simon School fileserver). You should do this assignment in groups and prepare a concise report that explains your analysis and findings. Neat, coherent presentation of high-quality analysis is the goal of this assignment. Do not include lots of computer output (although you may copy small portions of output that include relevant statistics).

FUTURES PRICES

Monday, April 15, 1996

Open Interest Reflects Previous Trading Day.

Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest

TREASURY BILLS (CME)-$1 mil.; pts. of 100%

	Open	High	Low	Settle	Chg	Discount Settle	Discount Chg	Open Interest
June	95.01	95.06	95.01	95.05	+ .05	4.95	– .05	9,250
Sept	94.83	94.89	94.83	94.88	+ .05	5.12	– .05	3,801
Dec	94.58	94.68	94.58	94.68	+ .09	5.32	– .09	717

Est vol 1,348; vol Fr 419; open int 13,768, +43.

INDEX

S&P 500 INDEX (CME) $500 times index

	Open	High	Low	Settle	Chg	High	Low	Open Interest
June	643.00	645.95	640.95	645.80	+ 5.20	673.20	553.95	175,882
Sept	648.50	651.40	646.40	651.30	+ 5.30	677.80	559.70	5,341
Dec	655.00	656.70	652.00	656.80	+ 5.35	681.80	612.70	2,713
Mr97	663.25	663.50	662.30	662.60	+ 5.00	681.20	656.80	161

Est vol 60,712; vol Fr 74,979; open int 184,037, –304.
Indx prelim High 642.48; Low 636.71; Close 642.48+5.77

TREASURY BILLS

Maturity	Days to Mat.	Bid	Asked	Chg.	Ask Yld.
Apr 18 '96	1	5.22	5.12	–0.01	5.21
Apr 25 '96	8	5.16	5.06	–0.06	5.15
May 02 '96	15	5.06	4.96	+0.02	5.05
May 09 '96	22	4.84	4.74	–0.02	4.83
May 16 '96	29	4.84	4.80	–0.05	4.90
May 23 '96	36	4.84	4.80	–0.04	4.90
May 30 '96	43	4.87	4.83	–0.05	4.94
Jun 06 '96	50	4.86	4.82	–0.05	4.93
Jun 13 '96	57	4.85	4.83	–0.04	4.95
Jun 20 '96	64	4.85	4.83	–0.05	4.95
Jun 27 '96	71	4.87	4.85	–0.05	4.98
Jul 05 '96	79	4.90	4.88	–0.06	5.02
Jul 11 '96	85	4.87	4.85	–0.07	4.99
Jul 18 '96	92	4.84	4.82	–0.07	4.96
Jul 25 '96	99	4.90	4.88	–0.04	5.03
Aug 01 '96	106	4.90	4.88	–0.06	5.03
Aug 08 '96	113	4.92	4.90	–0.05	5.06
Aug 15 '96	120	4.95	4.93	–0.03	5.10
Aug 22 '96	127	4.95	4.93	–0.05	5.10
Aug 29 '96	134	4.92	4.90	–0.06	5.07
Sep 05 '96	141	4.96	4.94	–0.06	5.11
Sep 12 '96	148	4.93	4.91	–0.05	5.08
Sep 19 '96	155	4.99	4.97	–0.04	5.16
Sep 26 '96	162	4.94	4.92	–0.04	5.10
Oct 03 '96	169	5.01	4.99	–0.06	5.18
Oct 10 '96	176	5.01	4.99	–0.06	5.19
Oct 17 '96	183	5.02	5.00	–0.05	5.22
Nov 14 '96	211	5.05	5.03	–0.06	5.25
Dec 12 '96	239	5.07	5.05	–0.05	5.28
Jan 09 '97	267	5.09	5.07	–0.04	5.31
Feb 06 '97	295	5.11	5.09	–0.05	5.35
Mar 06 '97	323	5.14	5.12	–0.05	5.38
Apr 03 '97	351	5.17	5.15	–0.06	5.43