

Price and Earnings Momentum

Objectives: The objective of this assignment is to introduce some of the more popular momentum indicators used in sales and trading. More specifically, this exercise is designed to have you learn how to:

- Use moving averages and relative strength, two price momentum indicators
- Test if technical trading systems are more profitable than a buy-and-hold strategy
- Determine whether earnings surprises are statistically significant

I. Technical Trading Systems: Moving Averages and Relative Strength Indicators

Technical analysis assumes that past prices contain information about future prices. Thus, technicians try to discover trends and patterns in past prices, which can be related to an anticipated pattern in future prices.

A. Single Moving Average (MA) System

A moving average is used to smooth out erratic movements in past prices thereby revealing only more pronounced trends and patterns in prices. To implement this strategy, average the *closing* prices P over the past n (say $n=200$) days. For example,

$$MA(200) = \frac{1}{200} (P_T + P_{T-1} + P_{T-2} + P_{T-3} + \dots + P_{T-200})$$

This 200-day moving average is updated each day, by eliminating the price 200 days back from the moving average calculation, and adding the current price.

Trading Strategy: Since the moving average lags the market, it will be above (below) the price in a bear (bull) market. Consequently, the decision strategy is to

- Buy when the *closing price* crosses above its moving average
- Sell when the *closing price* crosses below its moving average

Length(T) of the Moving Average: The larger T is, the more false starts are likely and sluggishness in reacting to developing trends increases. Traders typically use a 200-day moving average not only for individual stocks but also for the overall market. The smaller T is, the more sensitive it is to the start of new price trends but the greater the likelihood of giving false signals during non-directional but volatile price movements.

Calculating Profits Using a Moving Average

To calculate profits using a moving average system, recall that the decision rule in a single moving average system is to buy if the price crosses above its moving average. Conversely, if the price falls below its moving average, then a sell is indicated. To determine when there is a “crossing”, we subtract the price from its moving average. When this difference changes from positive to negative then a **sell** is indicated while if the difference changes from negative to positive, then a **buy** is indicated. In excel, this can be modeled using an IF statement.

Profit Calculation Example using a Single Moving Average: We shall use the Microsoft data to illustrate our profit calculations.

Date	Microsoft Price	MA(6)	Price - MA(6)	MA(6) Decision	MvgAvg Profit
91.07	24.50			Initial Buy	
91.08	28.42				
91.09	29.67				
91.10	31.29				
91.11	32.42				
91.12	37.08	30.56	6.52		
92.01	40.00	33.15	6.85		
92.02	41.17	35.27	5.90		
92.03	39.50	36.91	2.59		
92.04	36.75	37.82	-1.07	Sell	12.25
92.05	40.33	39.14	1.19	Buy	
92.06	35.00	38.79	-3.79	Sell	-5.33
92.07	36.50	38.21	-1.71		
92.08	37.13	37.54	-.40		
92.09	40.25	37.66	2.59	Buy	
92.10	44.38	38.93	5.45		
92.11	46.56	39.97	6.59		
92.12	42.69	41.25	1.44		
93.01	43.25	42.38	.87		
93.02	41.69	43.14	-1.45	Sell	1.44
93.03	46.25	44.14	2.11	Buy	
93.04	42.75	43.87	-1.12	Sell	-3.50
93.05	46.31	43.82	2.49	Buy	
93.06	44.00	44.04	-.04	Sell	-2.31
93.07	37.00	43.00	-6.00		
93.08	37.56	42.31	-4.75		
93.09	41.25	41.48	-.23		
93.10	40.06	41.03	-.97		
93.11	40.00	39.98	.02	Buy	
93.12	40.31	39.36	.95		
94.01	42.56	40.29	2.27		

Date	Microsoft Price	MA(6)	Price - MA(6)	MA(6) Decision	MvgAvg Profit
94.02	41.25	40.91	.34		
94.03	42.38	41.09	1.29		
94.04	46.25	42.13	4.13		
94.05	53.75	44.42	9.33		
94.06	51.63	46.30	5.33		
94.07	51.50	47.79	3.71		
94.08	58.13	50.61	7.52		
94.09	56.13	52.90	3.23		
94.10	63.00	55.69	7.31		
94.11	62.88	57.21	5.67		
94.12	61.13	58.80	2.34		
95.01	59.38	60.11	-.73	Sell	19.38
95.02	63.00	60.92	2.08	Buy	
95.03	71.13	63.42	7.71		
95.04	81.75	66.55	15.21		
95.05	84.69	70.18	14.51		
95.06	90.38	75.06	15.33		
95.07	90.50	80.24	10.26		
95.08	92.50	85.16	7.34		
95.09	90.50	88.39	2.11		
95.10	100.00	91.43	8.57		
95.11	87.13	91.84	-4.71	Sell	24.13
95.12	87.75	91.40	-3.65		
96.01	92.50	91.73	.77	Buy	
96.02	98.69	92.76	5.93		
96.03	103.13	94.87	8.26		
96.04	113.25	97.08	16.18		
96.05	118.75	102.35	16.41		
96.06	120.13	107.74	12.39		
Total Profit					46.06

Column 1 - Gives the year and month e.g. 91.07 is July 1991

Column 2 - Reports the actual price of Microsoft

Column 3 - Is the 6 month moving average, MA(6), of Microsoft

Column 4 - Is the difference between Column 2 and Column 3 e.g. the extent to which Microsoft's price exceeds its 6-month moving average

Column 5 - Gives the decision as to when to buy and when to sell (or sell short). In this illustration, we will assume that we will purchase Microsoft at the beginning of our time series. Hence, the **Initial Buy** decision. If we look at Column 4 (Price - MA(6)), we obtain our first signal to sell on April 1992 since the difference is negative which means that $Price - MA(6) < 0$ which in

turn means that $\text{Price} < \text{MA}(6)$ Microsoft's price falls below its 6 month moving average. In the next month, $\text{Price} - \text{MA}(6)$ reverses its sign, which indicates a buy, e.g. price exceeds or crosses above its 6 month moving average. Note: we only buy (+) or sell (-) when there is a sign change.

Column 6 - Reports the profits from using a 6-month single moving average. Recall that we initially purchased the stock on July 1991 at \$24.50 a share. The stock was sold on April 1992 at \$36.75 a share. The total profit on this trade from buying long was \$12.25 a share (\$36.75 - \$24.50). We next purchased the stock in the next month at \$40.33 and then according to our mechanical trading rule, sold it in the succeeding month for \$35 a share for a loss of -\$5.33 (\$35 - \$40.33). The same logic process is used in calculating all trades. If we sum up the profits from all of our trades, the total profit from using a 6 month single moving average from July 1991 until November 1995 (the date of our last sell signal) is \$46.06.

Question: How does the performance of the 6-month single moving average compare to a buy and hold strategy?

If we purchase Microsoft in July 1991 at \$24.50 a share, hold it until November 1995 the date of our last sell signal, this results in a total profit of \$62.63 a share (\$87.13 - \$24.50) for the buy and hold strategy. Consequently, in this example, the buy and hold strategy yields higher profits relative to using a 6-month single moving average even though the latter is a profitable strategy.

II. Relative Strength

Technical analysts believe that if a stock or an industry group such as semiconductors is outperforming the market on a *relative performance* basis (e.g. either with respect to price, price-earnings, or returns), it will continue to do so until some major event causes a reversal. Thus, it is an indicator of continued momentum e.g. strong (weak) industries get stronger (weaker). Hence, technicians calculate weekly or monthly relative strength ratios and plot these ratios over time. Mathematically,

$$\text{Industry Relative Strength Ratio}_t = \frac{\text{S \& P Industry Index}_t}{\text{Stock Market Index}_t \text{ such as S \& P500}_t}$$

$$\text{Relative Strength Ratio for a Stock}_t = \frac{\text{Stock Price}_t}{\text{Stock Market Index}_t \text{ such as S \& P500}_t}$$

From a technical perspective,

1. The plotting indicates whether the industry has kept pace with, exceeded or lagged the overall market as proxied by the S&P Industrials.
2. A change in the relative price or relative price-earnings of an industry often will indicate that that industry requires new or additional basic research.
3. Technicians have observed that industries, which have high relative strength and earn high returns in bull markets tend to do the opposite in bear markets. During a general market decline therefore, any industry, which resists this decline, may indicate future leadership.

The following trading strategy is utilized in conjunction with a relative strength system:

- Buy when the relative strength ratio for a stock is increasing over time (relative wealth >1) since the stock is outperforming the market... is exhibiting "relative strength".
- Sell when the relative strength ratio for a stock is decreasing over time (relative wealth <1) since the stock is underperforming the market.

Example: To calculate relative strength ratios based on prices, we use the following data for Microsoft. The market index used is the S&P500 and the industry index is the S&P Computer Software (SPCS). For illustrative purposes, we have chosen monthly data.

Date	MSFT Price	S&P500 Index	SPCS	RS Raw			RS Scaled		
				msft/ SP500	msft/ SPCS	SPCS/ SP500	msft/ SP500	msft/ SPCS	SPCS/ SP500
7/91	24.50	387.81	75.24	.0632	.3256	.1940	1.00	1.00	1.00
8/91	28.42	395.43	78.47	.0719	.3622	.1984	1.14	1.11	1.02
9/91	29.67	387.86	78.46	.0765	.3782	.2023	1.21	1.16	1.04
10/91	31.29	392.45	80.35	.0797	.3894	.2047	1.26	1.20	1.06
11/91	32.42	375.22	75.87	.0864	.4273	.2022	1.37	1.31	1.04
12/91	37.08	417.09	91.64	.0889	.4046	.2197	1.41	1.24	1.13
1/92	40.00	408.78	94.31	.0979	.4241	.2307	1.55	1.30	1.19
2/92	41.17	412.70	98.47	.0998	.4181	.2386	1.58	1.28	1.23
3/92	39.50	403.69	91.85	.0978	.4300	.2275	1.55	1.32	1.17
4/92	36.75	414.95	89.99	.0886	.4084	.2169	1.40	1.25	1.12
5/92	40.33	415.35	90.18	.0971	.4472	.2171	1.54	1.37	1.12
6/92	35.00	408.14	84.30	.0858	.4152	.2065	1.36	1.28	1.06
7/92	36.50	424.22	90.92	.0860	.4015	.2143	1.36	1.23	1.10
8/92	37.13	414.03	86.32	.0897	.4301	.2085	1.42	1.32	1.07
9/92	40.25	417.80	95.86	.0963	.4199	.2294	1.52	1.29	1.18

Date	MSFT Price	S&P500 Index	SPCS	RS Raw			RS Scaled		
				msft/ SP500	msft/ SPCS	SPCS/ SP500	msft/ SP500	msft/ SPCS	SPCS/ SP500
10/92	44.38	418.68	102.11	.1060	.4346	.2439	1.68	1.33	1.26
11/92	46.56	431.35	105.78	.1079	.4402	.2452	1.71	1.35	1.26
12/92	42.69	435.71	107.87	.0980	.3958	.2476	1.55	1.22	1.28
1/93	43.25	438.78	117.00	.0986	.3697	.2666	1.56	1.14	1.37
2/93	41.69	443.38	116.59	.0940	.3576	.2630	1.49	1.10	1.36
3/93	46.25	451.67	120.82	.1024	.3828	.2675	1.62	1.18	1.38
4/93	42.75	440.19	113.31	.0971	.3773	.2574	1.54	1.16	1.33
5/93	46.31	450.19	120.39	.1029	.3847	.2674	1.63	1.18	1.38
6/93	44.00	450.53	123.72	.0977	.3556	.2746	1.55	1.09	1.42
7/93	37.00	448.13	117.27	.0826	.3155	.2617	1.31	.97	1.35
8/93	37.56	463.56	118.75	.0810	.3163	.2562	1.28	.97	1.32
9/93	41.25	458.93	126.87	.0899	.3251	.2764	1.42	1.00	1.42
10/93	40.06	467.83	134.81	.0856	.2972	.2882	1.36	.91	1.49
11/93	40.00	461.79	141.41	.0866	.2829	.3062	1.37	.87	1.58
12/93	40.31	466.45	137.15	.0864	.2939	.2940	1.37	.90	1.52
1/94	42.56	481.61	141.59	.0884	.3006	.2940	1.40	.92	1.52
2/94	41.25	467.14	148.77	.0883	.2773	.3185	1.40	.85	1.64
3/94	42.38	445.76	135.05	.0951	.3138	.3030	1.50	.96	1.56
4/94	46.25	450.91	132.75	.1026	.3484	.2944	1.62	1.07	1.52
5/94	53.75	456.51	143.86	.1177	.3736	.3151	1.86	1.15	1.62
6/94	51.63	444.27	139.59	.1162	.3699	.3142	1.84	1.14	1.62
7/94	51.50	458.26	138.72	.1124	.3713	.3027	1.78	1.14	1.56
8/94	58.13	475.50	151.61	.1223	.3834	.3188	1.94	1.18	1.64
9/94	56.13	462.71	150.30	.1213	.3735	.3248	1.92	1.15	1.67
10/94	63.00	472.35	165.40	.1334	.3809	.3502	2.11	1.17	1.80
11/94	62.88	453.69	161.96	.1386	.3882	.3570	2.19	1.19	1.84
12/94	61.13	459.27	161.72	.1331	.3780	.3521	2.11	1.16	1.81
1/95	59.38	470.42	160.35	.1262	.3703	.3409	2.00	1.14	1.76
2/95	63.00	487.39	173.33	.1293	.3635	.3556	2.05	1.12	1.83
3/95	71.13	500.71	181.79	.1421	.3913	.3631	2.25	1.20	1.87
4/95	81.75	514.71	196.55	.1588	.4159	.3819	2.51	1.28	1.97
5/95	84.69	533.40	201.59	.1588	.4201	.3779	2.51	1.29	1.95
6/95	90.38	544.75	217.34	.1659	.4158	.3990	2.63	1.28	2.06
7/95	90.50	562.06	222.66	.1610	.4064	.3961	2.55	1.25	2.04
8/95	92.50	561.88	222.56	.1646	.4156	.3961	2.61	1.28	2.04
9/95	90.50	584.41	219.95	.1549	.4115	.3764	2.45	1.26	1.94
10/95	100.00	581.50	240.07	.1720	.4165	.4128	2.72	1.28	2.13
11/95	87.13	605.37	238.40	.1439	.3655	.3938	2.28	1.12	2.03
12/95	87.75	615.93	226.89	.1425	.3868	.3684	2.26	1.19	1.90
1/96	92.50	636.02	243.80	.1454	.3794	.3833	2.30	1.17	1.98
2/96	98.69	640.43	252.50	.1541	.3909	.3943	2.44	1.20	2.03
3/96	103.13	645.50	256.71	.1598	.4017	.3977	2.53	1.23	2.05

Note: We have 2 sets of relative strength (RS) ratios - RS Raw and RS Scaled. RS raw = the appropriate price or index relative to the appropriate index. For example,

$$RS1_{11/30/94} = \text{Microsoft Price/S\&P500} = 62.88/453.69 = .1386$$

$$RS2_{11/30/94} = \text{Microsoft Price/S\&P Computer Software} = 62.88/161.96 = .3882$$

$$RS3_{11/30/94} = \text{S\&P Computer Software/S\&P500} = 161.96/453.69 = .3570$$

The RS Scaled simply normalizes the RS Raw by the initial ratio or first data point in the series. Since we are using 7/31/91 as our start date, the initial ratios are

$$RS1_{7/31/91} = \text{Microsoft Price/S\&P500} = 24.50/387.81 = .0632$$

$$RS2_{7/31/91} = \text{Microsoft Price/S\&P Computer Software} = 24.50/75.24 = .3256$$

$$RS3_{7/31/91} = \text{S\&P Computer Software/S\&P500} = 75.24/387.81 = .1940$$

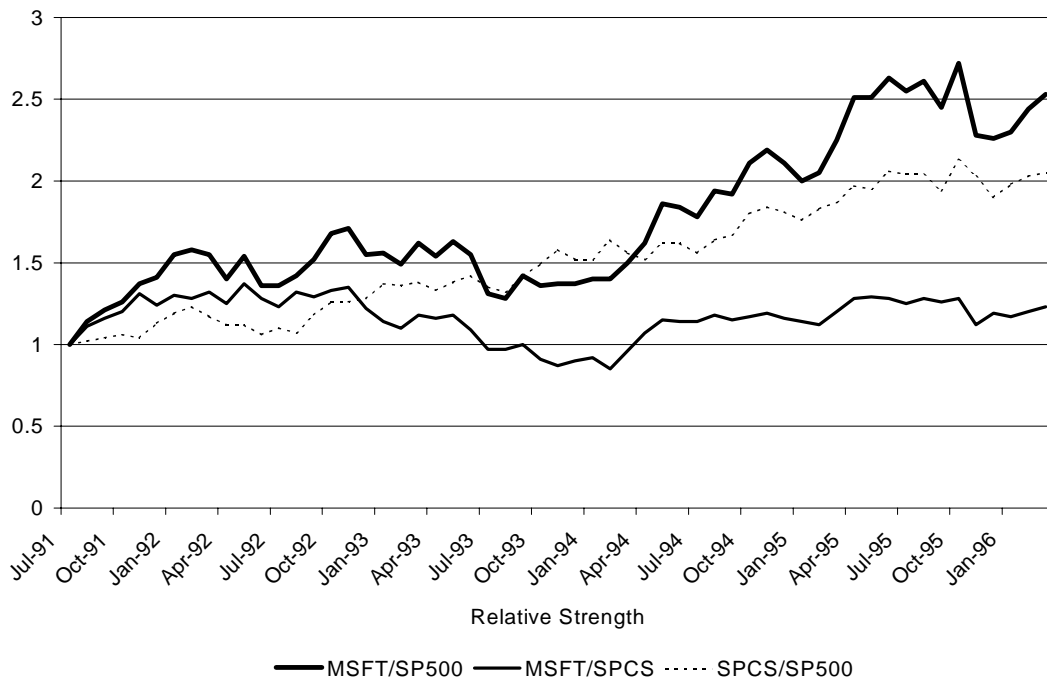
Every RS Raw ratio is divided by these initial ratios. For example,

$$RS1^*_{11/30/94} = RS1_{11/30/94} / RS1_{7/31/91} = .1386/.0632 = 2.19$$

$$RS2^*_{11/30/94} = RS2_{11/30/94} / RS2_{7/31/91} = .3882/.3256 = 1.19$$

$$RS3^*_{11/30/94} = RS3_{11/30/94} / RS3_{7/31/91} = .3570/.1940 = 1.84$$

To really see the relative strength of Microsoft, we graph the preceding numbers.



Brief Analysis of Charts: Over the 7/91 to 3/96 period, The relative price performance of Microsoft, exceeded the price performance of the computer software industry and the S&P500 as well. It appears that the stock is a continued hold (or buy) in the short run.

III. Standardized Unexpected Earnings (Earnings Surprise Model)¹

Theory: Efficient capital markets assume that security prices quickly adjust to new information such as earnings announcements as soon as it becomes publicly available. This rapid adjustment of prices to new information is predicated on frictionless trading, instantaneous availability of information to all investors, and all investors processing this information in a similar manner from a pricing standpoint. In the real world, however, where there are

- trading costs, and delays in (information) transmission and differences in interpretation and evaluation of information, the process of adjustment to new information is less clear-cut.
- New information can be described as unexpected information. If everyone expects a company to report \$1.00 per share earnings in the next quarter and it actually reports the \$1.00, little new information has been added. No major revision of expectations would be called for. On the other hand, if earnings of \$.50 or \$2.00 were reported this would be unexpected information and clearly would call for a revision of probability beliefs about the future.

Studies by Latane and Jones (1977), pp. 1457 among others suggest that favorable information contained in quarterly earning announcements is not instantaneously reflected in stock prices. In addition to this, these studies find that a significant relationship exists between the size of the unexpected earnings performance and the post-announcement stock price changes.

For example, Rendleman, Jones, and Latane (1982) find evidence that large SUEs (standardized unexpected earnings) are accompanied by significant abnormal stock price changes as revealed in Figure 1 of their study which is shown on the next page.

What Figure 1 Shows:

- adjustments occur both before and after the announcement dates of earnings
- ability of SUE to discriminate among over- and under-performing stocks
- adjustment of stock prices to unexpected earnings continues after the announcement of quarterly earnings

¹This discussion is based on the work of Henry Latane. These include Henry A. Latane and Charles Jones, December 1977, "Standardized Unexpected Earnings-A Progress Report," *Journal of Finance* 32(5): 1457-1465; Henry Latane and Charles Jones, June 1979, "Standardized Unexpected Earnings: 1971-1977," *Journal of Finance* 34(3): 717-724; and Richard Rendleman, Charles Jones, and Henry Latane, November 1982, "Empirical Anomalies Based on Unexpected Earnings and the Importance of Risk Adjustments," *Journal of Financial Economics* 10(3): 269-287.

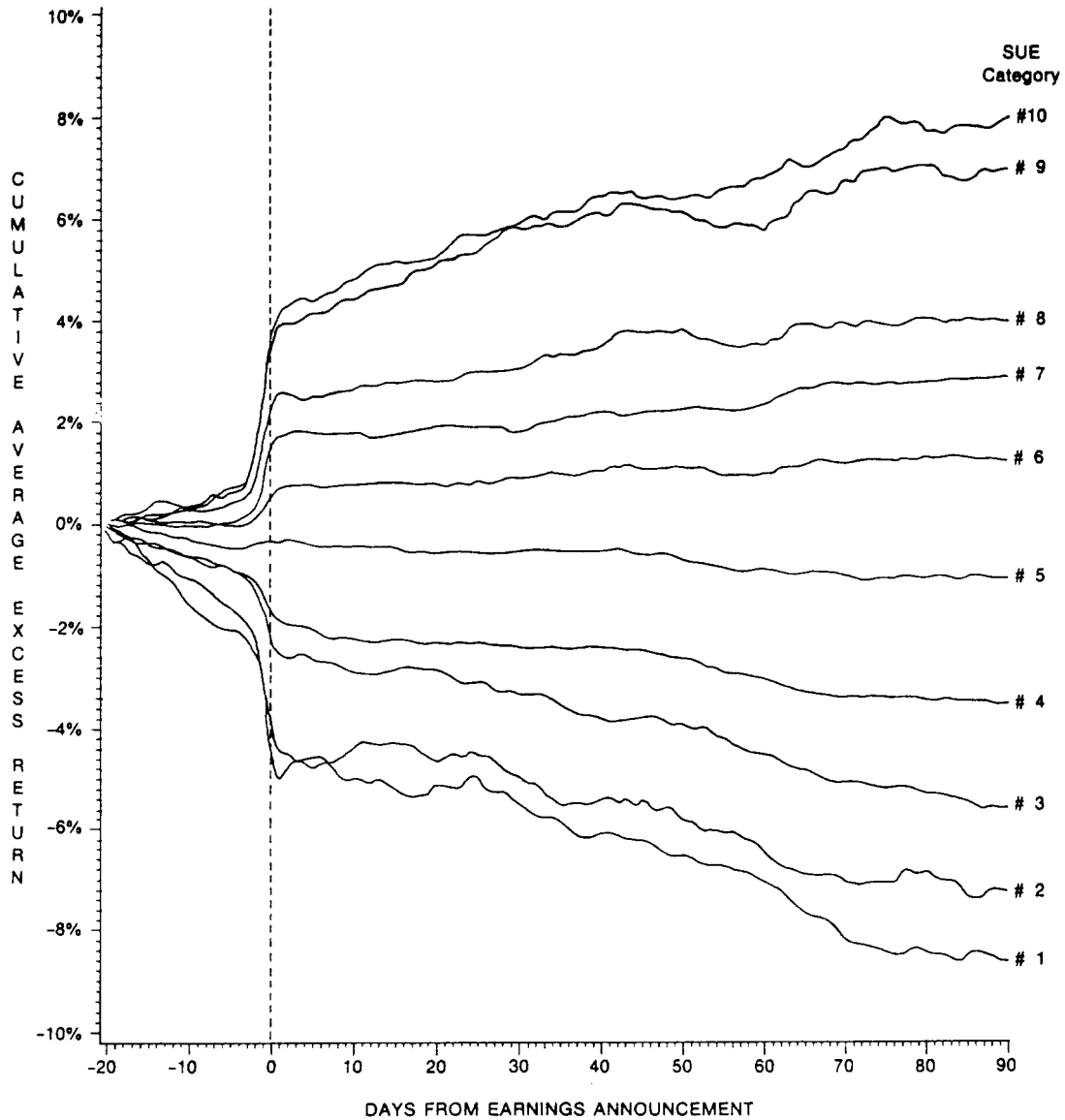


Fig. 1. Cumulative excess returns averaged over the 36 quarter period 1971. 3–1980.2 for 10 SUE categories ranging from the most negative SUE category (#1, $SUE \leq -4.0$) to the most positive SUE category (#10, $SUE > +4.0$). The sample size ranges from a minimum of 618 companies (1971.3) to a maximum of 1496 in 1980.1 (see table 1 for additional details on sample size). Day 0 on the horizontal axis is the announcement date of earnings.

All stocks in their sample are grouped into one of 10 SUE Categories:

Category	SUE	Category	SUE
1	$SUE < -4.0$	6	$0.0 < SUE < 1.0$
2	$-4.0 < SUE < -3.0$	7	$1.0 < SUE < 2.0$
3	$-3.0 < SUE < -2.0$	8	$2.0 < SUE < 3.0$
4	$-2.0 < SUE < -1.0$	9	$3.0 < SUE < 4.0$
5	$-1.0 < SUE < 0.0$	10	$+4.0 < SUE$

The authors found that for

Highest SUE categories 9 and 10: of the total response in stock returns over the period extending 20 days before the announcement of earnings to 90 days after the announcement,

Partition of Return	Time Period
31%	occurred before the day of the announcement
18%	occurred on the day of the announcement
51%	occurred after the day of announcement.

Lowest SUE categories (#1 and #2), the response averaged:

Partition of Return	Time Period
40%	prior to the day of the announcement
15%	on the day of the announcement
45%	after the day of announcement.

Latane and Jones (1979) found that the price adjustment process is much more rapid for stocks which analysts follow closely. Consequently, while the efficient market hypothesis may hold for stocks which many analysts follow, the market is not so efficient for other stocks.

Technique: Several ways exist to use earnings surprises to predict stock returns. The first set of ways involves *standardizing* unexpected earnings while the second method simply uses unexpected earnings. Both techniques are the most effective in the days preceding or on the actual announcement of quarterly earnings per share (EPS). We shall discuss the former method.

Standardized Unexpected Earnings: The difference between the actual and expected earnings for a particular quarter is normalized by the standard deviation of the earnings to obtain a z-score known as the standardized unexpected earnings (SUE). Mathematically,

$$SUE = \frac{\text{Reported EPS}_t - \text{Expected EPS}_t}{\text{Standard Deviation of EPS}} = \frac{X - \bar{X}}{\sigma} = Z \text{ Score}$$

Obtaining Earnings Estimates: There are several ways to obtain earnings estimates.

- *Earnings Estimate Services:* Services such as First Call which can be obtained from America Online, I/B/E/S, Nelson's, Standard & Poor's Outlook Report, and Zacks from Bloomberg or the Internet provide consensus earnings estimates through gathers the estimates of several investment analyst who follow each stock. These services also report the latest revisions in earnings expectations for each stock. Following are the earnings estimates for Coca-Cola obtained from First Call vis-a-vis America Online.

FIRST CALL EARNINGS ESTIMATES

KO Coca Cola Co. 06/10/96
 Industry: Soft Drinks SIC: 2080
 Latest Price: \$46.75 1996 P/E: 33.6
 Analyst Recommendation: 2.5

	QTR Jun 96	QTR Sep 96	FY Dec 96	FY Dec 97
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CURRENT MEAN EPS	0.42	0.38	1.39	1.63
Number of Brokers	18	16	19	20
Median	0.42	0.38	1.39	1.65
Standard Deviation	0.01	0.01	0.02	0.03
Current High	0.44	0.40	1.43	1.68
Current Low	0.41	0.37	1.35	1.55
Year Ago EPS	0.36A	0.32A	1.19A	1.39
Current vs. Year Ago Change	17%	19%	17%	17%
Report Date	wk/Jul 22	wk/Oct 21	wk/Jan 27	-

	EARNINGS ESTIMATE REVISION MOMENTUM			
Up Revisions last 7 days	0	0	0	0
Up Revisions last 30 days	0	0	0	0
Down Revisions last 7 days	0	0	0	0
Down Revisions last 30 days	1	1	1	0

	EARNINGS ESTIMATES CONSENSUS TRENDS			
Current Mean	0.42	0.38	1.39	1.63
7-days ago Mean	0.42	0.38	1.39	1.63
30-days ago Mean	0.42	0.38	1.39	1.63
60-days ago Mean	0.42	0.38	1.39	1.64
90-days ago Mean	0.42	0.38	1.39	1.64

The preceding information shows that the expected EPS for the second quarter of 1996 is \$.42 per share. We further observe that analysts in general (except for one analyst) have not revised earnings estimates either up or down.

Based on the deviation in expected analysts' estimates of EPS, $\sigma^*_{EPS} = .01$

Thus, the formula that we use in conjunction with the EPS announcement for the 2nd quarter of 1996 for Coca-Cola (KO) is

$$SUE^* = \frac{.42 - .42}{.01} = 0$$

Since the reported EPS for the second quarter of 96 was \$.42 (announced on July 15, 1996), it follows that SUE = 0. Since SUE = 0, we would recommend a **hold**. There is no "surprise" since the actual quarterly EPS is equal to the expected quarterly EPS.

THE key issue: Whether the reported EPS is statistically different from the predicted EPS and also how statistically different is it e.g. what's the significance level?

Our Focal Company: International Gaming Technology (IGT).

International Game Technology (www.igt.com) is the #1 designer and manufacturer of slot machines (it controls about 75% of the US market), and it also produces video gaming, player tracking, and accounting systems. Products include reel-type slot machines (Vision Series, S-Plus), video gaming machines (Players Edge-Plus, Game King), video gaming terminals for government-sponsored lotteries, and progressive jackpot slot-machine networks (MegaJackpots) that link slot machines from several casinos to increase jackpot payoffs. IGT provides gaming products in every significant legalized gaming jurisdiction in the world. International clients account for more than a quarter of its sales.



It has tightened its stranglehold on the gaming machines business through its recently announced intention to buy Anchor Gaming ([SLOT:NYSE](http://SLOT.NYSE)) for around \$1.23 billion at IGT's current stock price. But wild cards exist. IGT readily admits it won't be able to grow as fast as it has over the past 12 months. The big question, is whether this deceleration will be greater than expected. The other issue is IGT's dwindling cash flows arising from an increase in its inventory and receivables.

Class Assignment: Download the spreadsheet labeled IGT2001.xls from my website and do all your work on this spreadsheet. This is an *individual* assignment. Although you can discuss this case with your classmates, you are responsible for doing the case yourself. Students caught cheating will be given an F on this assignment.

1. The stock market crash, known as "Black Monday", occurred on October 19, 1987. The 1987 stock market crash occurred on "Black Monday" -- October 19, 1987 -- when the Dow Jones Industrial Average fell from 2246 to 1738, losing 22.6% of its total value. From the close of trading on Tuesday, October 13, to the close of trading on Monday, October 19, the Dow fell by almost one third, indicating a loss in value of all outstanding United States stocks of approximately one trillion dollars. This crash marked the end of a five-year "bull" market that had seen the Dow average rise from 776.92 points in August 1982 to a high of 2,722.42 points in August 1987. Fortunately, the market soon recovered after the crash. By September 1989, the Dow had regained all it had lost in the crash.

- a. Using a 150-day moving average, would you have been able to get out of the market before Black Monday? What date in October of 1997 should you have gotten out of the market? Please answer the same questions if a 200-day moving average was used in lieu of a 150-day moving average.
- b. Using a 150-day moving average, when would you have gotten back into the market after the crash of October 1987? If you had used a 200-day moving average instead of a 150-day moving average, when would you have gotten back into the market after the crash of October 1987?

Hint: To make your life easier, you should use a series of IF statements. The first IF statement sets up a dummy variable of 1 or 0 where 1 = buy and 0 = sell e.g., =IF(B152>C152,1,0). The next IF statement, set up in another column of your worksheet, use your first IF statement and assigns a BUY or SELL decision e.g., =IF(E153<E152,"Sell",IF(E153>E152,"Buy",""))).

c. Based on either the MA(150) or MA(200) should you be invested in the S&P500 a.k.a. the market or waiting on the sidelines to buy into the market as of July 2001? **Note:** your “call”/investment decision is based on the most current /recent crossing e.g. the last crossing.

2. Graph the 150-day moving average (MA(150)) of the S&P500 and the actual S&P500 on a graph from January 4, 1993. Graph the 200-day moving average (MA(200)) of the S&P500 and the actual S&P500 on a graph from January 4, 1993.

3. Calculate the profits associated with using the MA(150) strategy starting from November 20, 1986 (date of your first investment decision) assuming that you purchased 100 shares of the S&P500². In addition to this, calculate the profits associated with using the MA(200) strategy starting from November 20, 1986. Finally, calculate the profits associated with a buy and hold strategy wherein you buy the S&P500 on November 20, 1986 and sell it on September 29, 2000. In calculating profits, assume that an investor buys or sells when the MA indicates a buy or sell. After a stock is sold, the investor sits on the sidelines until the next buy signal occurs. No short sales are allowed. A portion of the profit table for the MA(150) strategy follows (I included this example to be sure that you are on the right track):

	150-Day	S&P500	MA(150)	MA(150)
Date	Decision	Close	Profits	Profits on 100 Shares
20-Nov-86	Buy	242.05		
31-Dec-86	Sell	242.17	0.12	12.00
			
24-May-01	Buy	1293.17		
25-May-01	Sell	1277.89	-15.28	-1528.00
		Profit		

Which strategy is the most profitable: using an MA(150), MA(200), or using a buy and hold strategy?

4. Calculate the profits associated with using the MA(150) strategy starting from January 15, 1991 (date of your first investment decision) assuming that you purchased 100 shares of International Gaming Technology (IGT). In addition to this, calculate the profits associated with using the MA(200) strategy starting from January 15, 1991. Finally, calculate the profits associated with a buy and hold

²Note: This isn't an unrealistic assumption since you could purchase a proxy of the S&P500 such as the Vanguard 500.

strategy wherein you buy IGT on January 15, 1991 and sell it on July 20, 2001. A portion of the profit table for the MA(200) strategy follows (I included this example to be sure that you are on the right track):

	200-Day	IGT	MA(200)	MA(200)
Date	Decision	Close	Profits per Share	Profits on 100 Shares
15-Jan-91	Buy	1.9856		
4-Nov-93	Sell	31.4935	29.51	2,950.79
.....				
14-Mar-00	Buy	19		
20-Jul-01	Sell	53.69	<u>34.69</u>	<u>3,469.00</u>
		Profit		

Which strategy is the most profitable: using an MA(150), MA(200), or using a buy and hold strategy?

5. Calculate the relative strength index for IGT using the data provided in the worksheet labeled "RelStrength". Graph the relative strength index. Is there ever a time when IGT underperformed the S&P500 (relative strength ratio is less than one)? Following is a portion of the table that I want you to construct.

	IGT	S&P500	IGT/	RS
Date	Close	Close	S&P500	Scaled
Mar-90	1.8051	339.94	0.00531	1.00
Apr-90	1.9706	330.8	0.00596	1.12
May-90	2.0157	361.23	0.00558	1.05
.....				
May-01	61.45	1255.8	0.04893	9.22
Jun-01	62.75	1224.4	0.05125	9.65

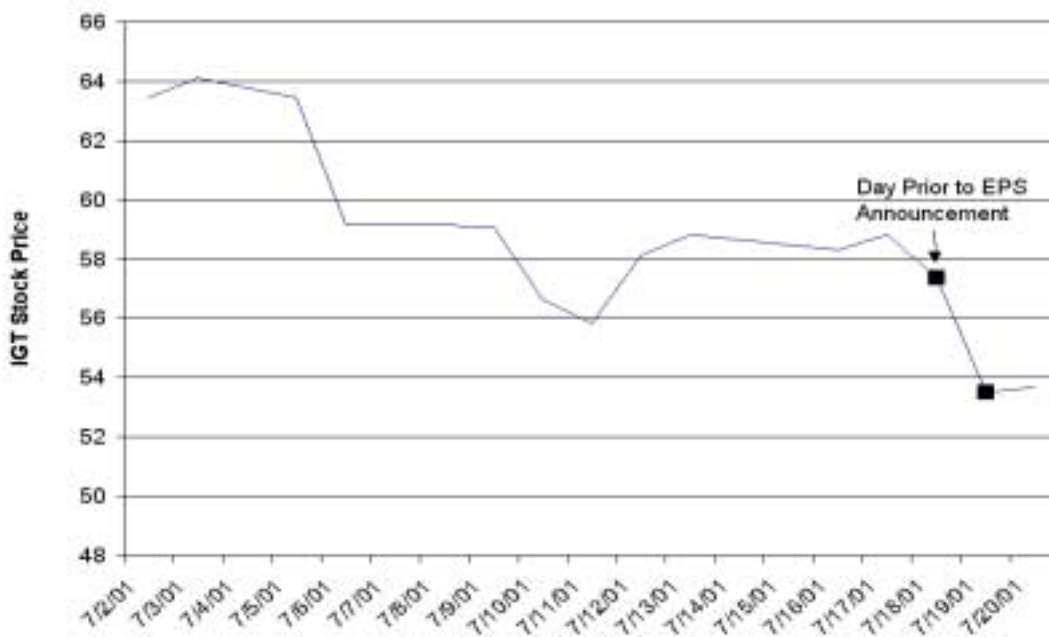
6. Some technical analysts use the relative strength index in conjunction with a moving average of the relative strength index. In essence, the relative strength index is analogous to the closing stock price. The decision criterion is to buy (sell) the stock when the stock's relative strength index crosses above (below) the moving average of the relative strength index. Using the relative strength index that you calculated in question 5, calculate a 12-month moving average of this relative strength index. A portion of the moving average is shown on the right. Next, calculate the profits based on this strategy. Assume that you sell the stock in July 2001. Compare this strategy to a simple buy and hold strategy wherein the stock is purchased

	IGT/	IGT/
Date	S&P500	S&P500
Mar-90	0.00531	MA(12)
Apr-90	0.00596	
May-90	0.00558	
Jun-90	0.00542	
Jul-90	0.00625	
Aug-90	0.00644	
Sep-90	0.00531	
Oct-90	0.00455	
Nov-90	0.00551	
Dec-90	0.00610	
Jan-91	0.00717	
Feb-91	0.00799	0.00597
Mar-91	0.00922	0.00629
Apr-91	0.01154	0.00676

in February of 1991 and sold in June 2001. A portion of the table of profits based on the moving average of the relative strength index is given below.

	Investment	IGT	MA(RS)	MA(RS)	Buy and
Date	Decision	Close	Profit	Profit per 100 Shares	Hold 100 Shares
Feb-91	Buy	2.9333			
Nov-93	Sell	29.201	26.268	2,626.76	
				
Mar-00	Buy	21.688			
Jun-01	Sell	62.75	41.063	4,106.25	XXXXXX
		Profit	XX.XX	XXXXXX	XXXXXX

7. On Thursday, July 19th, 2001, International Gaming Technology (IGT) announced net income per diluted share for the quarter ended June 30, 2001 of \$.73 before the market opened. This beat both the consensus EPS estimate of \$.70 and the whisper number of \$.72 yet the stock fell on this news.



Using the worksheet labeled “SUE” calculate the Standardized Unexpected Earnings together with the data in the worksheets labeled “IGT EPS” and “IGT Earnings Whisper” to calculate the Standardized Unexpected Earnings. Use the standard deviation of analyst estimates in calculating both SUEs. To determine whether these Z-scores (SUEs) are statistically significant, use the NORMDIST function in Excel. NORMDIST returns the normal cumulative distribution for the specified mean and standard deviation. The significance level is 1 – NORMDIST.

Syntax

NORMDIST(x,mean,standard_dev,cumulative)

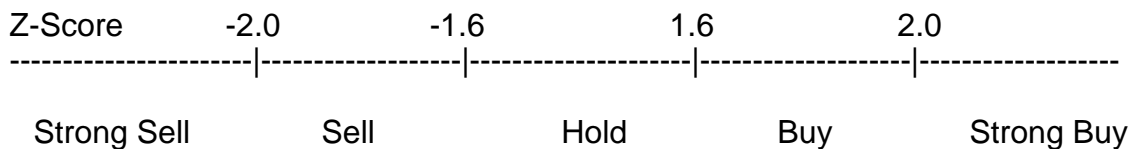
Where x = actual earnings per share for the quarter

Mean = either the analyst estimate of EPS or the earnings whisper of EPS

Standard deviation = standard deviation of analyst estimate of EPS

Cumulative = set this to TRUE

Based on either SUE, was the EPS announced expected or unexpected? Use a 5% level of significance. Using the following decision rule:



determine whether International Gaming Technology (IGT) is a strong sell, sell, hold, buy, or strong buy.

Please turn in a hard copy of the spreadsheet together with your disk containing the spreadsheet with all the appropriate calculations.