

BA285/E285 INTERNATIONAL FINANCE: STUDENT PROJECT #4

Beating the Hang Seng

International Finance

November 25, 1997

Summary

The strategy we tried to develop involved placing varying amounts of money in the Hang Seng index via a mutual fund which invests in Hong Kong on days when the S&P 500 rose. Buying the mutual fund just after the close of the market in New York would allow us to invest at the closing price of the same day in Hong Kong (which would have closed some twelve hours earlier). We could thus take advantage of any rise in the index that occurred at the opening of the Hong Kong market following the New York close, should we find that moves in the S&P 500 were correlated with the following day's move in the Hang Seng. ✓

Reviewing data from 1990 through November 17, 1997, we found statistically significant correlation between movements in the Standard & Poors 500 benchmark index and next-day movements in the Hang Seng benchmark index. The correlation was particularly large when the S&P index experienced positive movements of two standard deviations and higher.

We used data from January 1, 1990 through the end of 1996 to develop a model for investing in the Hang Seng index at the previous day's price (possible using mutual funds), varying the amount invested on the size of the move in the S&P 500 that day. We then applied the model to data from January 1, 1997 through November 17 as an objective. We found that while a straight investment in the Hang Seng index during this 10.5 month period would have resulted in a return of -23.2% (-26.1% annualized return), while our method would have returned 38.7% (45.3% annualized, not including interest earned). We have therefore scrapped our post-graduation jobs and will monitor our computer program trading scheme full time.

Data and Analysis

We chose to do our study on the Hang Seng index mainly because the Hong Kong dollar is tied to the US dollar, at least for now. The strategy really depends on the time difference, and being able to buy mutual funds before the market opens in Hong Kong, so there are a number of markets where a similar strategy could work if correlations exist. However, with a fluctuating currency, there is an added degree of noise thrown in, and we therefore decided to look exclusively at Hong Kong.

We began by examining the returns from the S&P 500 and the Hang Seng index from January 1, 1990 through December 31, 1996. We used percentage changes rather than absolute changes, as the percentage changes would not necessarily have a tendency to grow larger over time, making it possible to compare data directly over the entire time period. We thought that this amount of data (seven years) was sufficient, and that going back any further would not have added much. In addition, if correlations between the S&P and the following day's Hang Seng shift over time, it is possible that including data from earlier dates would actually make our results less relevant to the present. We decided to develop our model using this data, and then to test it using the data from 1997. Naturally testing the model on data that was used to develop the model would tend to prove the model correct, and would make us far less confident about the robustness of our results, and we wanted to avoid this problem.

We removed from the data all dates where either the US or the Hong Kong stock markets were closed, because the direct relationship between the moves could be

obscured by other information by the delay. We did retain values over the weekend (S&P Friday moves and Hang Seng moves the following Monday).

For the following tests we used all the data, as it was not to be used directly in determining our trading model, only to analyze the data. We examined the autocorrelation of both the S&P and Hang Seng indices for the time period in question, and found them to be close to zero (0.0308 for the US and 0.0007 for Hong Kong). This confirmed that both indices are indeed moving as a random walk as expected. We also looked at the scatterplot of both indices' returns over time, and found that to be random and without pattern. Drawing the histogram of both the S&P returns and the Hang Seng returns showed that the returns were normally distributed (see histograms).

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We then looked at the correlations between the S&P and the following day Hang Seng moves. The correlation for all the data, negative and positive moves, was 0.361. For only the positive data, the correlation was 0.301. A one standard deviation move in the S&P was equivalent to a 0.78% move, and we found that the correlation increased as the size of the S&P move increased. The correlation between the two indices for moves of greater than two standard deviations was 0.686, and for moves of greater than three standard deviations the correlation coefficient was 0.810. Most of the correlation was in fact due to the high correlation at the extreme end, as the correlation for moves of between two and three standard deviations only was 0.244.

Our strategy was to use only the positive moves in the S&P 500, because it is not possible to short mutual funds, and thus we would have no way to take advantage of downward moves in the S&P and corresponding downward moves in the Hang Seng. We therefore decided to run a regression on only the positive S&P 500 returns. At this point,

because the results would have a direct impact on the trading strategy we developed, we used only data from 1990 to 1996, leaving the 1997 data to test our results. We used the S&P percent change as the independent variable, and the following day Hang Seng percent change as the dependent variable, using only the positive returns of the S&P, to create a line predicting the Hang Seng move following a given S&P 500 move. The regression data is attached. The intercept was statistically equal to zero (t-statistic was 1.11), and the x coefficient was 0.629, giving us the slope of the line. The x coefficient was statistically significant (not equal to zero) as the t-statistic was 7.33. The R-squared for the regression was 0.056, which is not large, but we thought explaining anything at all about the Hang Seng move may be good enough to form a trading strategy.

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We found the residuals to be normally distributed around the regression line, and the standard error of the residuals was 0.0127. Because they were normally distributed, using this standard error and the regression line we were able to determine the percent chance that the move in Hong Kong would be positive following a given move in the S&P 500. For example, if the regression line predicted a move in Hong Kong of 0.0127, we would be about 84% sure that the actual Hang Seng move would be greater than zero from the area under the curve of a normal distribution curve. In other words, the area under the tail of the curve would represent a negative Hang Seng return, and the number of standard errors from zero that our predicted return is would tell us the degree of certainty that the Hang Seng move would be positive. With a two standard error move predicted in Hong Kong, we would be 97.7% certain the actual move would be positive, etc. For every point along the regression line we were able to determine the exact degree of certainty that the actual Hang Seng move would be positive.

We used this degree of certainty to determine the amount we would commit to the Hang Seng index following a positive S&P 500 move. Clearly for smaller moves, less would be committed. In our model we decided we would begin with a specific amount (we used \$1000), and risk a percentage of this amount corresponding to the degree of certainty that the actual Hang Seng move would at least be positive. At the close of trading in Hong Kong, or when the mutual fund allowed it, we would sell the mutual fund and put the money back in a money market account where it would safely earn interest, as would the remainder of the amount not committed. We were looking only at positive moves in the S&P 500, and in theory after a very small positive move we would be about 50% sure the Hang Seng move would also be positive. However, we didn't want to bet half of our total amount on this, so we scaled our percentages so that 50% certainty was equal to a bet of 0 and 100% certainty (impossible, of course) would result in a 100% bet. Even with a large amount committed, we could be fairly comfortable because we know that a large percentage drop is rare, and even if the move in Hong Kong was negative, most of our money would be returned to us.

Application of Model to 1997 Market Movements

Starting with our notional \$1000, we used our regression line to predict the Hang Seng moves following positive S&P 500 moves from January 1, 1997 through November 17. Based on the strategy described above, we committed different amounts to a hypothetical mutual fund that precisely tracks the Hang Seng index, and then compared the returns from this strategy over the period to investing the same \$1000 in the Hang

Seng index for the same period. Even if the returns were the same, it is possible that our strategy would be less volatile, and thus preferable to a simple investment in the Hang Seng index.

As it turned out, the Hang Seng index fell by some 23.2% during the 10.5 months we used, or an annual rate of -26.1%. Our strategy, on the other hand, had a positive return of 38.7%, or 45.3% annualized. This assumes that our notional rises and falls by the amount gained or lost on a particular day. This makes the total gain comparable to an investment in the index, since if the index rises 1% two days in a row, the dollar gain is greater the second day. Note that we did not include dividends that would have been received by an investor in the Hang Seng mutual fund, but likewise the figure for our strategy does not include returns from interest income received on days we do not invest in the mutual fund, or on the amount not invested in the mutual fund on the days we do invest. If we include an estimate of the interest earned assuming a 5% return in a money market fund, the return using our strategy rises to 42.6%, or 50.1% annualized.

To compare the relative riskiness of the straight investment in the Hang Seng index and our strategy, we looked at the standard deviations of the percent changes of the two over the period. If our strategy had a much higher standard deviation, we would be concerned that the riskiness outweighed the benefits of the higher returns. However, the standard deviation of the Hang Seng index was 0.0259 for the period, and the standard deviation for our strategy was only 0.0147, making it considerably less risky.

How About S&P?

Conclusion and Future Research

While our analysis found arbitrage opportunities between the US and Hong Kong markets, the opportunities persist only in limited circumstances. Mutual funds are the only way to exploit the predictive outcome of US market moves on Hong Kong. Expectations of Hong Kong reactions to a US market move cause Hong Kong prices to rise to higher opening levels, such that it would not be possible to purchase securities at the previous day's closing price as trading started. Using our strategy in practice requires that we find a mutual fund that matches the Hang Seng index closely and is a no load fund (loads would create transaction costs that would kill us). It has also come to our attention that at least some mutual funds use "fair value" pricing rather than net asset value (NAV) pricing on certain days when a large move is expected in the foreign market the fund invests in. Instead of looking at the fund's closing asset prices, they incorporate other information such as futures to determine the mutual fund share price. This could have the effect of negating any positive jump we expect based on moves in the S&P 500, as we would in effect be unable to buy at the previous day's closing prices. Funds that use fair value pricing state the fact in the prospectus, and we would try to avoid such funds. The SEC is currently reviewing whether fair value pricing is legal or not.

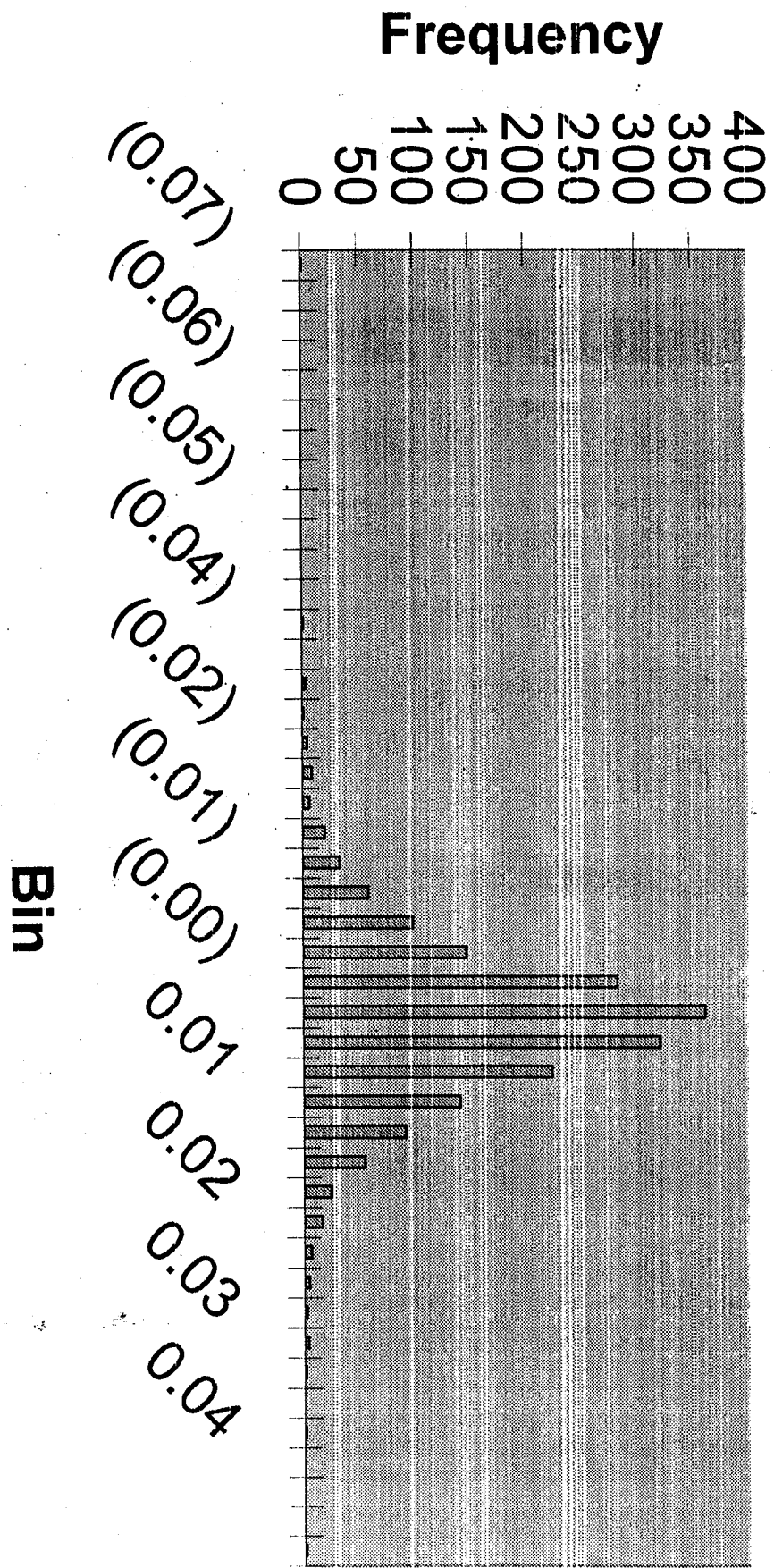
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We would also want to test our strategy on more than one time period. It is clear from looking from the results of our test that a large part of our gain came on one day when the Hang Seng rose by more than 18% (it is also worth noting that our strategy committed nearly the full amount on that day, however, and we were able to take advantage of the gain). We might not be able to expect the same magnitude of gains in periods of lower volatility. We would want to go back to some earlier year, for example

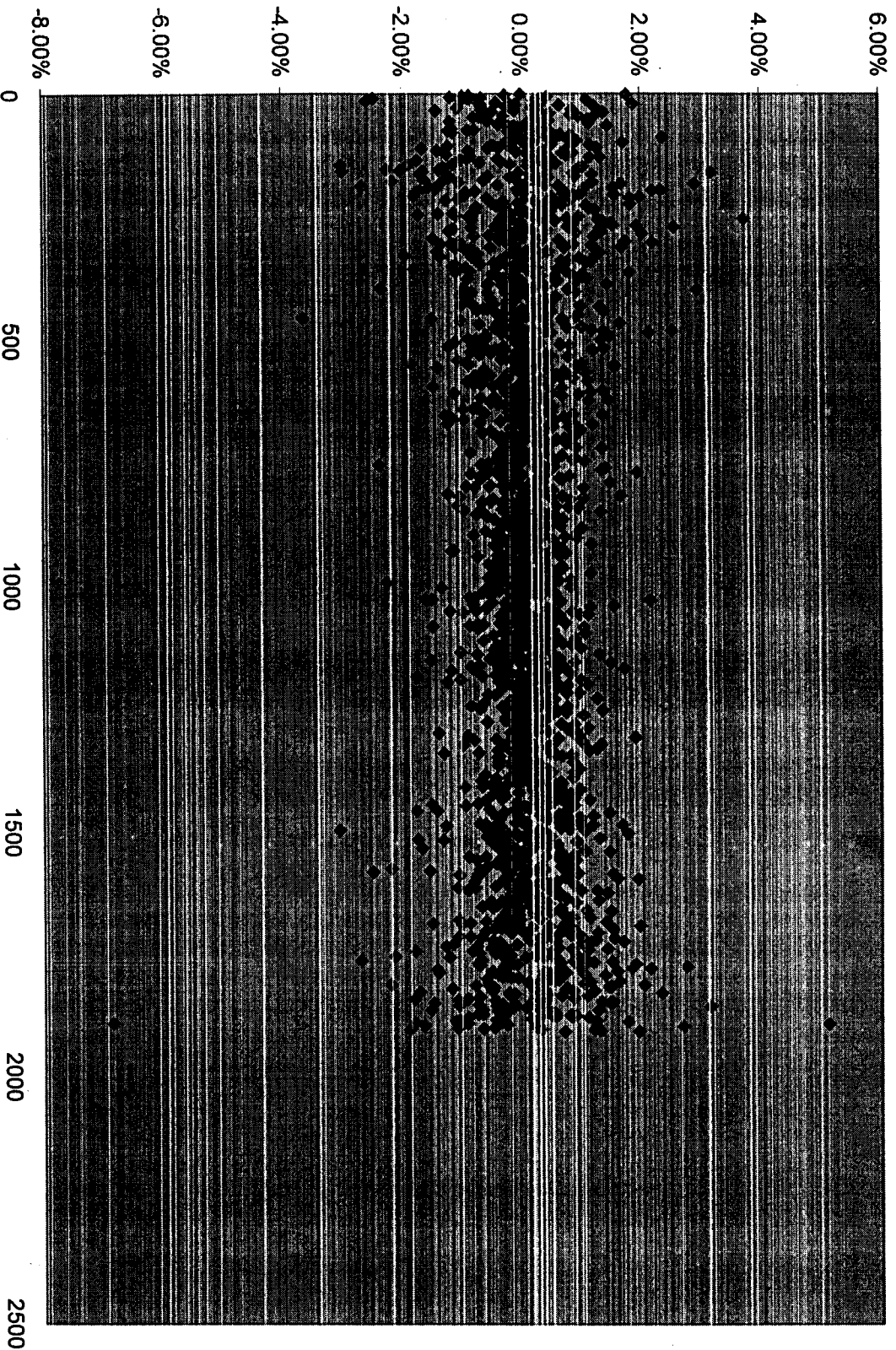
1985, run the regression on the data from 1985 through 1991, and see how our strategy would have done in 1992. We would then shift this forward, using data from 1986 through 1992, and see how we would have done in 1993. We would continue this analysis to the present, and if the strategy proved as effective in other years as in 1997, we would feel quite confident that it could truly be traded upon for profit.

We plan to perform the above analysis, and it will be interesting to see how our strategy does in years when the Hang Seng rises dramatically. We also plan to research various no-load mutual funds and determine how well they track the Hang Seng index. Once we have done these two things, if all appears to be in order, we will set up a computer program to determine our trades and commit some money to it. The results of that, of course, are the ones that count.

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Histogram of US Returns 1990-1997

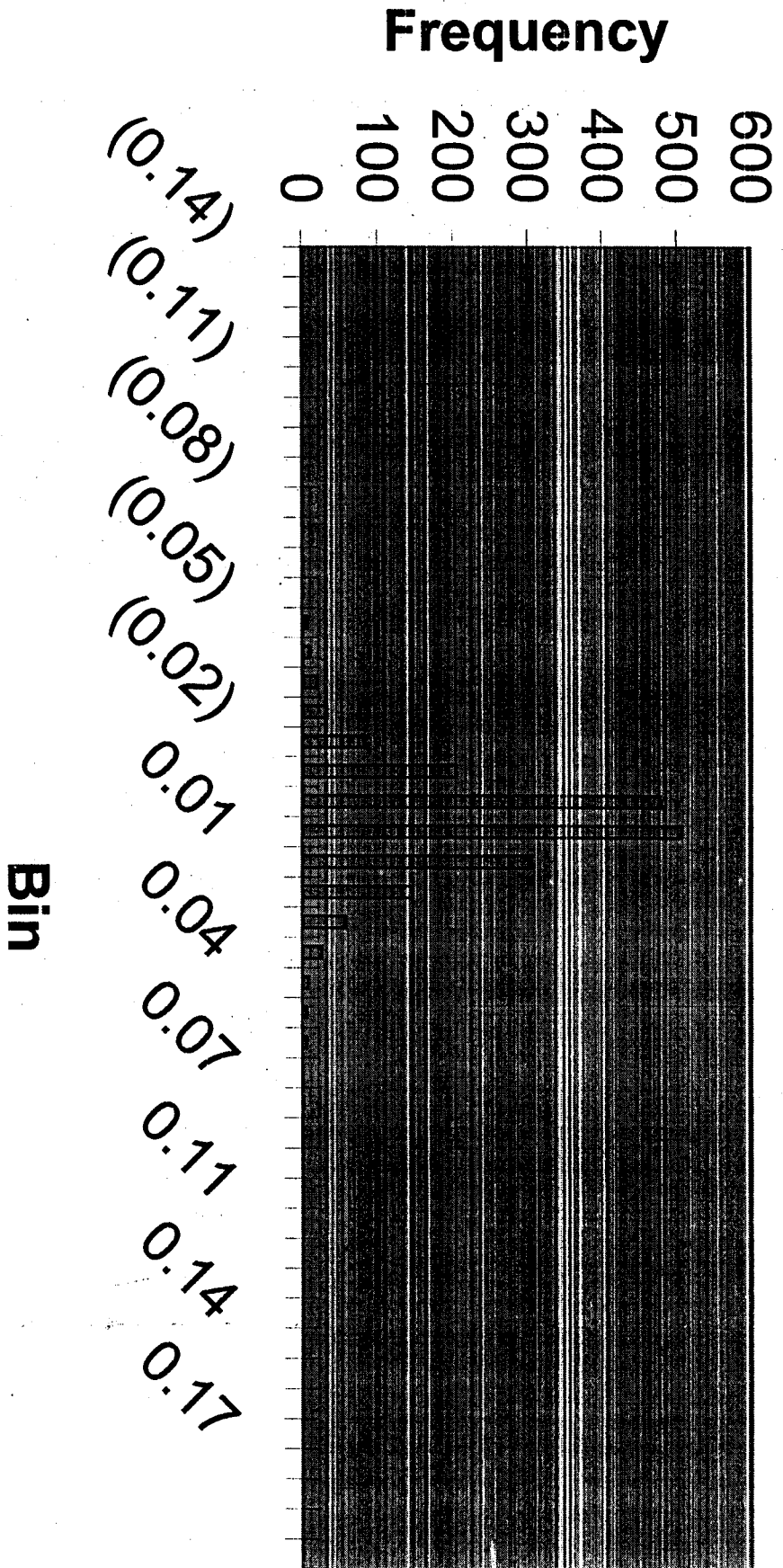




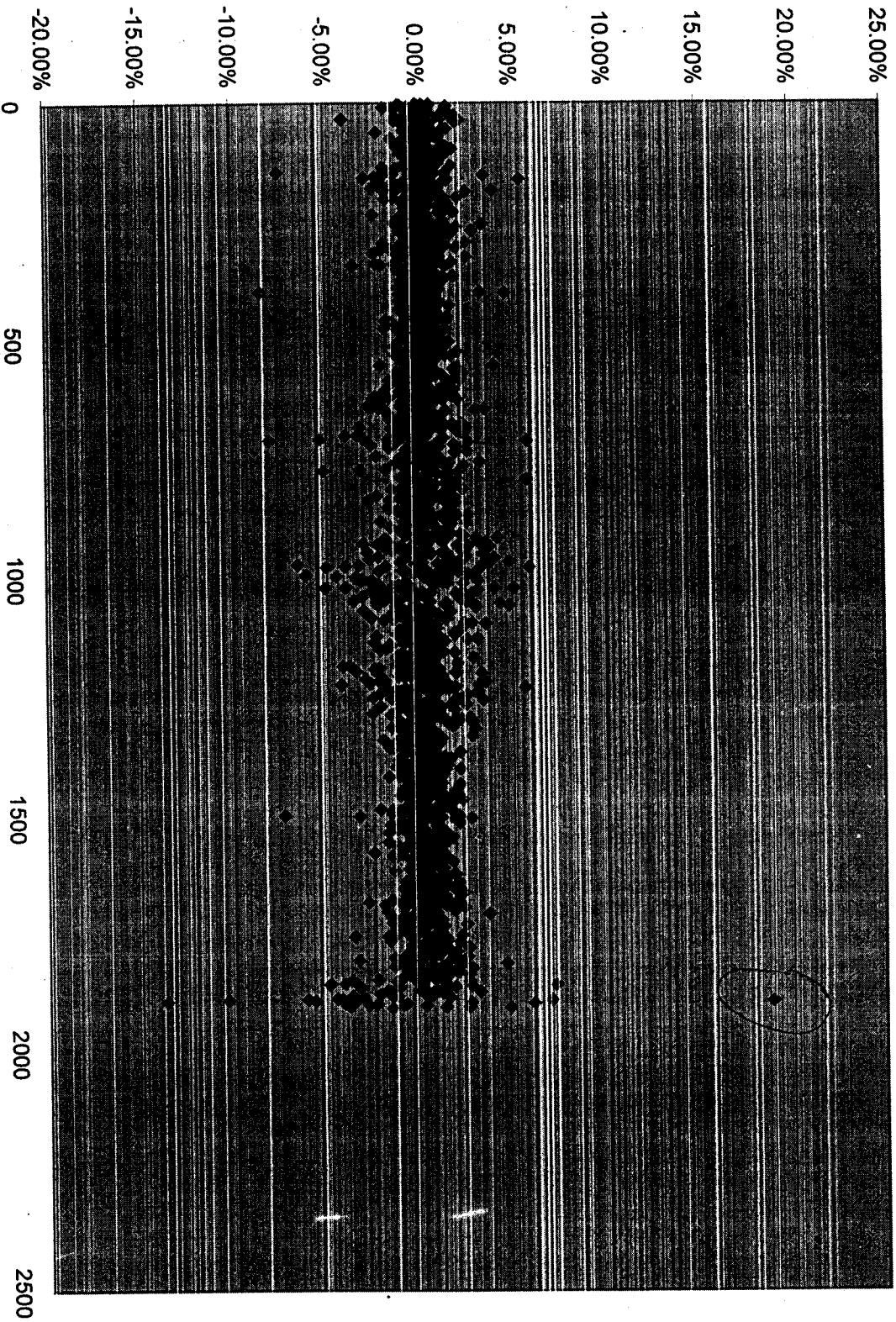
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Histogram of Hong Kong Returns 1990-1997

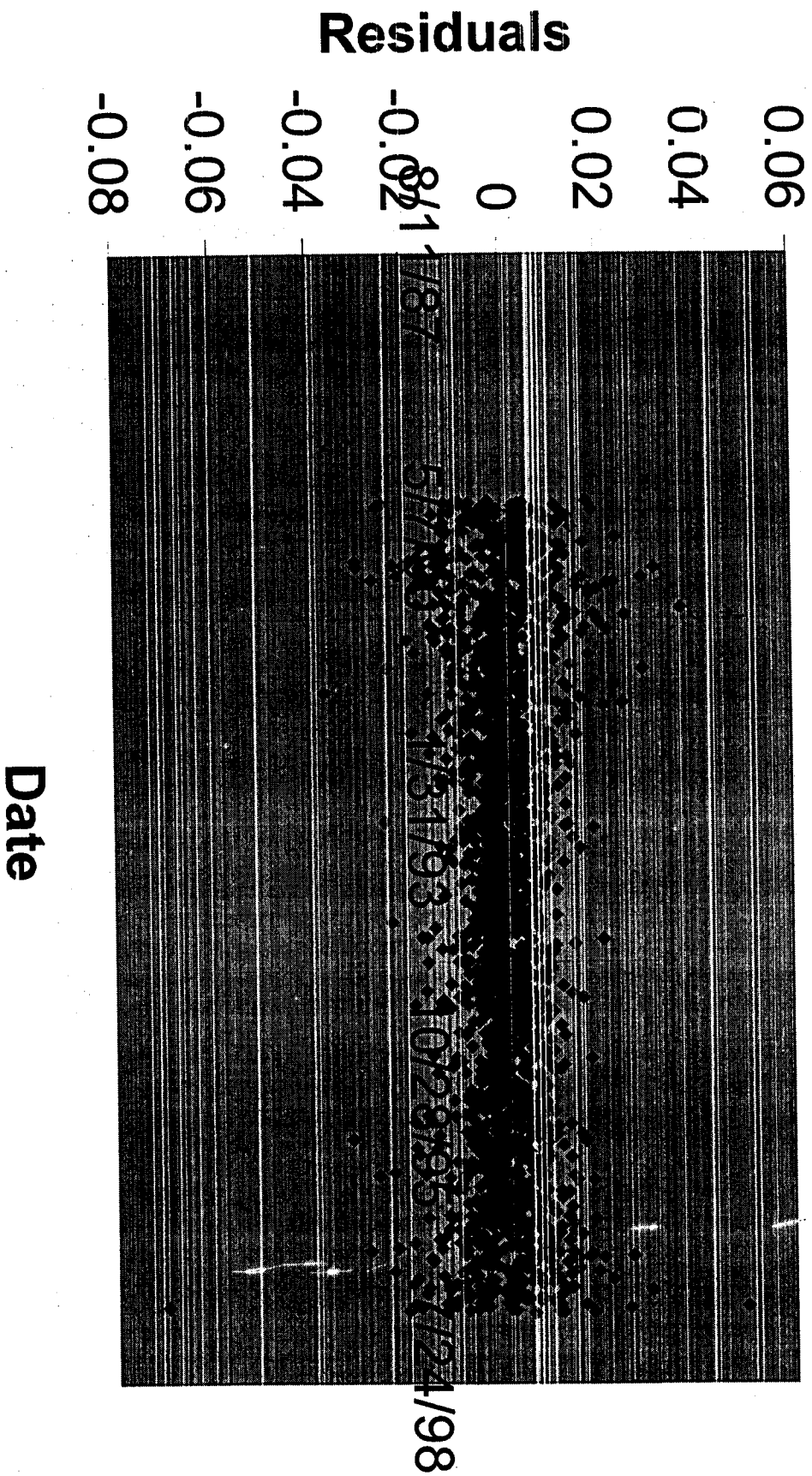


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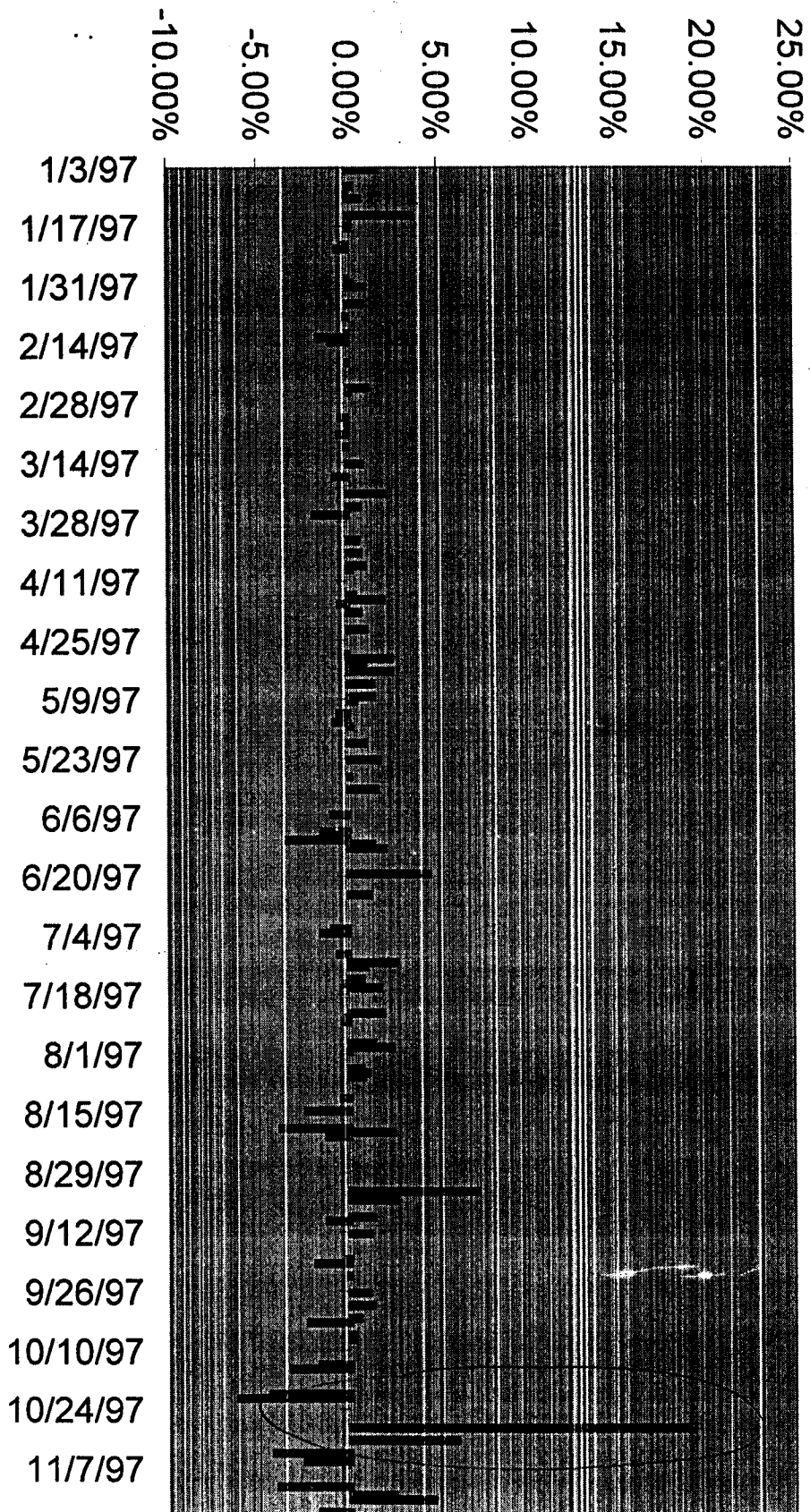
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Regression Residual Plot

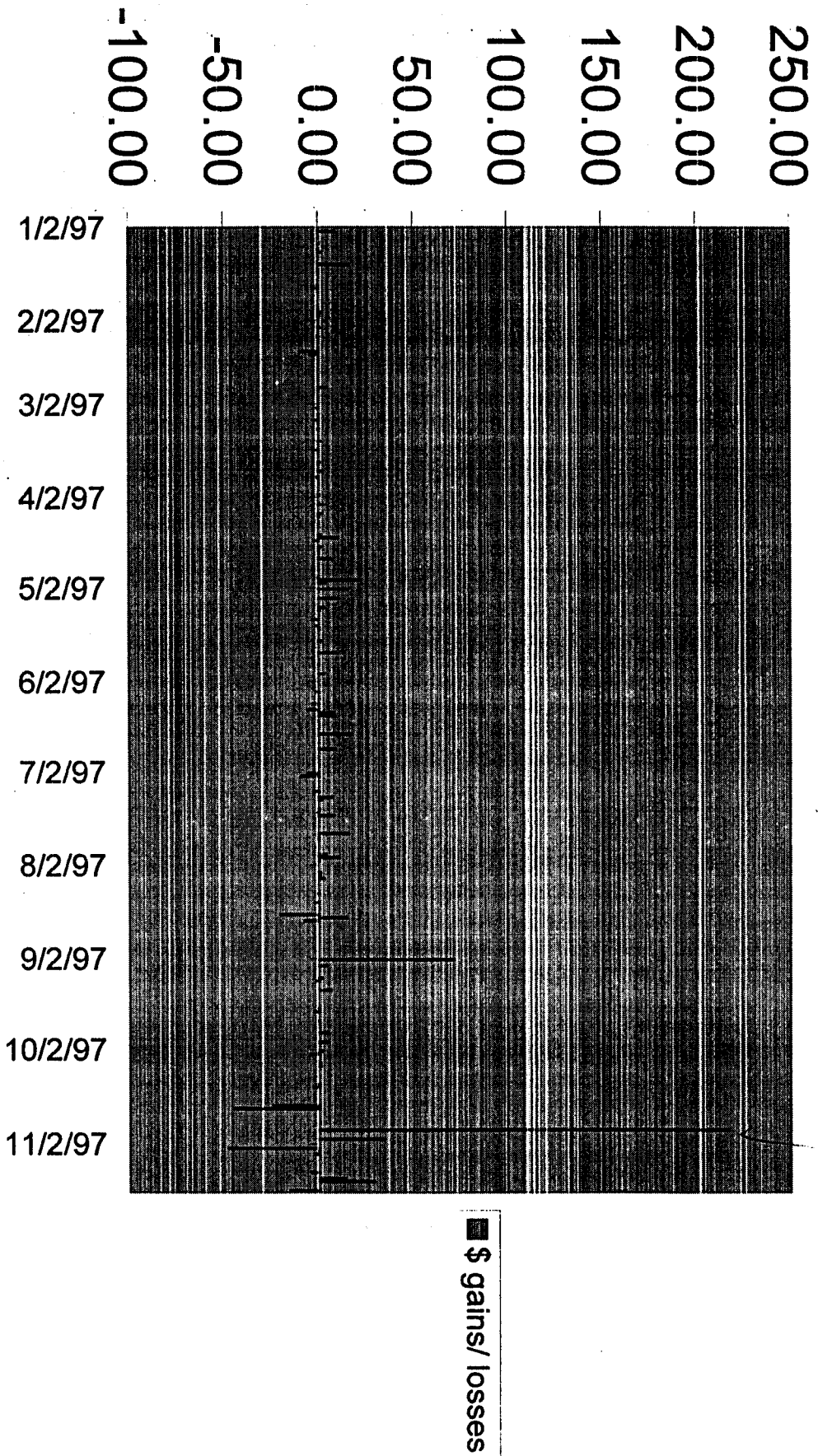


Return On Investment (our strategy)

Daily Non-Zero Gains/(Losses)



\$ gains / losses (our strategy)



- 1997 returns from our model and the Hang Seng

Date	US %chg	HK+1 %chg	Predicted HK move	HK sliders	% of total bet amount	model gain	our model	int. amount	int. earned	wkend int	%chg our model	HK index return
1/2/97	-0.50%	0.15%	-0.32%	-0.25	0	0.00	1000	1000	0.134	16.62	0.000	1001.47
1/3/97	1.50%	1.67%	0.94%	0.74	0.516	516.00	1008.63	484.00	0.065		0.009	1018.21
1/6/97	-0.05%	-0.18%	-0.03%	-0.03	0	0.00	1008.35	1000.00	0.134		0.001	1016.41
1/7/97	0.75%	0.26%	0.47%	0.37	0.274	276.36	1009.36	723.64	0.097		0.000	1019.05
1/8/97	-0.64%	-1.91%	-0.40%	-0.32	0	0.00	1009.35	1000.00	0.134		0.000	999.60
1/9/97	0.86%	-0.05%	0.54%	0.43	0.31	312.90	1009.19	687.10	0.092		0.000	999.10
1/10/97	0.62%	0.74%	0.39%	0.30	0.236	238.17	1010.95	761.83	0.102		0.002	1006.50
1/13/97	0.00%	0.04%	0.00%	0.00	0	0.00	1010.95	1000.00	0.134		0.000	1006.85
1/14/97	1.23%	3.55%	0.77%	0.61	0.452	456.95	1027.20	543.05	0.073		0.016	1047.51
1/15/97	-0.22%	0.47%	-0.14%	-0.11	0	0.00	1027.20	1000.00	0.134		0.000	1047.51
1/16/97	0.33%	0.19%	0.21%	0.16	0.12	123.26	1027.43	876.74	0.117		0.000	1049.45
1/17/97	0.83%	0.09%	0.52%	0.41	0.31	318.50	1027.71	681.50	0.091		0.000	1050.35
1/20/97	0.07%	-0.98%	0.04%	0.03	0	0.00	1027.71	1000.00	0.134		0.000	1040.09
1/21/97	0.78%	-0.29%	0.49%	0.38	0.274	281.59	1028.89	718.41	0.096		-0.001	1037.06
1/22/97	0.45%	-0.60%	0.28%	0.22	0.16	164.30	1028.90	835.70	0.112		-0.001	1030.82
1/23/97	-1.10%	-1.70%	-0.69%	-0.55	0	0.00	1028.90	1000.00	0.134		0.000	1013.34
1/24/97	-0.91%	-0.63%	-0.57%	-0.45	0	0.00	1028.90	1000.00	0.134		0.000	1006.93
1/27/97	-0.71%	0.02%	-0.45%	-0.35	0	0.00	1028.90	1000.00	0.134		0.000	1015.14
1/29/97	0.98%	0.02%	0.62%	0.48	0.348	357.01	1025.98	642.99	0.086		0.000	1015.36
1/30/97	1.51%	0.25%	0.95%	0.75	0.516	525.40	1027.31	470.60	0.063		0.001	1017.91
1/31/97	0.25%	0.97%	0.16%	0.13	0.08	82.16	1028.10	917.62	0.123		0.001	1027.79
2/3/97	0.07%	0.72%	0.05%	0.04	0	0.00	1028.10	1000.00	0.134		0.000	1035.23
2/4/97	0.32%	0.83%	0.20%	0.16	0.12	123.37	1029.12	876.63	0.117		0.001	1043.80
2/7/97	1.21%	-0.12%	0.76%	0.60	0.418	430.17	1028.59	569.83	0.076		0.001	1042.50
2/10/97	-0.52%	-1.39%	-0.33%	-0.26	0	0.00	1028.59	1000.00	0.134		0.000	1028.03
2/11/97	0.53%	0.08%	0.33%	0.26	0.2	205.72	1028.72	794.28	0.106		0.000	1028.67
2/12/97	1.67%	-0.95%	1.05%	0.83	0.576	592.54	1018.84	407.46	0.054		-0.010	1011.66
2/13/97	1.13%	-0.96%	0.71%	0.56	0.418	425.91	1014.92	574.09	0.077		0.000	1001.98
2/14/97	-0.41%	0.24%	-0.26%	-0.20	0	0.00	1014.84	1000.00	0.134		0.000	1004.38
2/18/97	0.97%	0.03%	0.61%	0.48	0.348	353.17	1014.93	646.83	0.086		0.000	1004.64
2/19/97	-0.47%	2.33%	-0.29%	-0.23	0	0.00	1014.93	1000.00	0.134		0.000	1028.02
2/20/97	-1.19%	0.25%	-0.75%	-0.59	0	0.00	1014.93	1000.00	0.134		0.000	1030.59
2/21/97	-0.13%	-0.51%	-0.08%	-0.06	0	0.00	1014.93	1000.00	0.134		0.000	1025.28
2/24/97	1.06%	1.08%	0.67%	0.53	0.384	389.73	1019.15	610.27	0.082		0.004	1036.37
2/25/97	0.22%	0.16%	0.14%	0.11	0.08	81.53	1019.28	918.47	0.123		0.000	1038.02
2/26/97	-0.79%	0.04%	-0.50%	-0.39	0	0.00	1019.28	1000.00	0.134		0.000	1027.05
2/27/97	-1.32%	-1.89%	-0.83%	-0.65	0	0.00	1019.28	1000.00	0.134		0.000	1033.37
2/28/97	-0.53%	0.81%	-0.34%	-0.26	0	0.00	1019.28	1000.00	0.134		0.000	1033.99
3/3/97	0.57%	-0.42%	0.36%	0.28	0.2	203.86	1018.41	796.14	0.106		0.000	1030.99
3/4/97	-0.55%	-0.29%	-0.34%	-0.27	0	0.00	1018.41	1000.00	0.134		0.000	1027.97
3/5/97	1.40%	0.04%	0.88%	0.69	0.484	492.91	1018.62	507.09	0.068		0.000	1028.40
3/6/97	-0.43%	-0.59%	-0.27%	-0.21	0	0.00	1018.62	1000.00	0.134		0.000	1022.35
3/7/97	0.80%	0.51%	0.51%	0.40	0.274	279.10	1017.18	720.90	0.096		-0.001	1017.09
3/10/97	-0.12%	-1.00%	0.68%	0.53	0.384	390.60	1016.70	609.40	0.081		0.000	1005.62
3/11/97	1.08%	-1.00%	0.18%	-0.14	0	0.00	1016.70	1000.00	0.134		0.000	1005.82
3/12/97	-0.87%	-1.54%	-0.55%	-0.43	0	0.00	1016.70	1000.00	0.134		0.000	990.13
3/13/97	-1.83%	-1.40%	-1.15%	-0.90	0	0.00	1016.70	1000.00	0.134		0.000	976.29
3/14/97	0.46%	0.80%	0.29%	0.23	0.16	162.67	1018.00	837.33	0.112		0.001	984.11
3/17/97	0.32%	0.70%	0.20%	0.16	0.12	122.16	1017.15	877.84	0.117		-0.001	977.24
3/18/97	-0.76%	-0.76%	-0.48%	-0.38	0	0.00	1017.15	1000.00	0.134		0.000	969.77

3/19/97	-0.49%	-1.42%	-0.31%	-0.24	0	0.00	0.00	1017.15	1000.00	0.134	0.000	956.04
3/20/97	-0.40%	0.14%	-0.25%	-0.20	0	0.00	0.00	1017.15	1000.00	0.134	0.000	957.34
3/21/97	0.19%	2.08%	0.12%	0.09	0.04	40.69	0.85	1017.99	959.31	0.128	0.001	977.26
3/24/97	0.87%	0.65%	0.54%	0.43	0.31	315.58	2.06	1020.06	684.42	0.091	0.002	983.65
3/25/97	-0.23%	-0.44%	-0.14%	-0.11	0	0.00	0.00	1020.06	1000.00	0.134	0.000	979.35
3/26/97	0.18%	-1.89%	0.11%	0.09	0.04	40.80	-0.77	1019.28	959.20	0.128	-0.001	960.79
3/31/97	-2.17%	-3.67%	-1.36%	-1.07	0	0.00	0.00	1019.28	1000.00	0.134	0.000	925.52
4/1/97	0.33%	0.51%	0.21%	0.16	0.12	122.31	0.63	1019.91	877.69	0.117	0.001	930.28
4/2/97	-1.25%	-0.67%	-0.79%	-0.62	0	0.00	0.00	1019.91	1000.00	0.134	0.000	924.06
4/3/97	0.03%	1.24%	0.02%	0.01	0	0.00	0.00	1019.91	1000.00	0.134	0.000	935.52
4/4/97	1.01%	0.68%	0.64%	0.50	0.384	391.65	2.67	1022.58	608.35	0.081	0.003	941.90
4/5/97	0.56%	0.90%	0.36%	0.28	0.2	204.52	1.84	1024.43	795.48	0.106	0.002	950.39
4/7/97	0.52%	0.23%	0.23%	0.26	0.2	204.89	0.46	1024.89	795.11	0.106	0.000	952.54
4/8/97	-0.72%	-0.55%	-0.46%	-0.36	0	0.00	0.00	1024.89	1000.00	0.134	0.000	947.33
4/9/97	-0.30%	-1.28%	-0.19%	-0.15	0	0.00	0.00	1024.89	1000.00	0.134	0.000	959.43
4/10/97	-2.73%	-1.76%	-1.72%	-1.35	0	0.00	0.00	1024.89	1000.00	0.134	0.000	942.52
4/11/97	0.82%	0.38%	0.52%	0.41	0.31	317.72	1.19	1026.08	682.28	0.091	0.001	946.05
4/14/97	1.48%	1.94%	0.93%	0.73	0.516	529.46	10.27	1036.35	470.54	0.063	0.010	964.39
4/15/97	1.17%	-0.52%	0.73%	0.58	0.418	433.19	-2.24	1034.11	566.81	0.076	-0.002	959.40
4/16/97	-0.23%	0.20%	-0.15%	-0.11	0	0.00	0.00	1034.11	1000.00	0.134	0.000	961.32
4/17/97	0.60%	0.68%	0.38%	0.30	0.2	206.82	1.40	1035.51	793.18	0.106	0.001	967.82
4/18/97	-0.78%	-0.36%	-0.49%	-0.39	0	0.00	0.00	1035.51	1000.00	0.134	0.000	964.36
4/21/97	1.87%	1.00%	1.18%	0.93	0.632	654.44	6.56	1042.07	345.56	0.046	0.006	974.03
4/22/97	-0.13%	0.16%	0.08%	0.06	0	0.00	0.00	1042.07	1000.00	0.134	0.000	975.55
4/23/97	0.32%	0.64%	-0.20%	-0.16	0	0.00	0.00	1042.07	1000.00	0.134	0.000	959.33
4/24/97	-0.75%	-0.28%	-0.47%	-0.37	0	0.00	0.00	1042.07	1000.00	0.134	0.000	966.60
4/25/97	0.99%	-0.08%	0.62%	0.49	0.348	362.64	-0.28	1041.79	637.36	0.085	0.000	965.86
4/28/97	2.73%	2.40%	1.72%	1.35	0.824	858.44	20.63	1062.43	141.56	0.019	0.020	989.07
4/29/97	0.92%	0.91%	0.58%	0.45	0.348	369.72	3.37	1055.79	630.26	0.084	0.003	998.08
4/30/97	-0.35%	0.47%	-0.22%	-0.17	0	0.00	0.00	1065.42	1000.00	0.134	0.000	1002.75
5/1/97	1.81%	2.43%	1.14%	0.90	0.604	643.74	15.63	1081.79	356.26	0.048	0.015	1027.10
5/2/97	2.12%	1.34%	1.34%	1.05	0.706	763.48	10.26	1091.68	236.52	0.032	0.009	1040.89
5/5/97	-0.30%	0.20%	-0.19%	-0.15	0	0.00	0.00	1091.68	1000.00	0.134	0.000	1042.93
5/6/97	-1.47%	0.99%	-0.92%	-0.73	0	0.00	0.00	1091.68	1000.00	0.134	0.000	1053.23
5/7/97	0.57%	1.39%	0.36%	0.28	0.2	218.34	3.03	1094.71	781.66	0.104	0.003	1067.83
5/9/97	0.55%	0.41%	0.35%	0.27	0.2	218.94	0.9c	1095.60	781.06	0.104	0.001	1072.20
5/12/97	-1.56%	-0.58%	0.98%	0.77	0.546	598.20	-3.48	1092.12	401.80	0.054	-0.003	1085.97
5/14/97	0.35%	-0.79%	-0.34%	-0.27	0	0.00	0.00	1092.12	1000.00	0.134	0.000	1084.91
5/15/97	0.70%	0.15%	0.44%	0.35	0.236	257.50	0.38	1091.46	742.50	0.099	0.000	1077.92
5/16/97	-1.44%	0.33%	-0.91%	-0.71	0	0.00	0.00	1091.46	1000.00	0.134	0.000	1081.48
5/19/97	0.47%	0.90%	0.27%	0.21	0.16	174.63	1.58	1093.04	825.37	0.110	0.001	1091.24
5/20/97	1.01%	0.00%	0.63%	0.50	0.348	380.38	-0.02	1093.02	619.62	0.083	0.000	1091.19
5/21/97	-0.27%	-0.17%	-0.17%	-0.14	0	0.00	0.00	1093.02	1000.00	0.134	0.000	1098.39
5/22/97	-0.44%	0.84%	-0.28%	-0.22	0	0.00	0.00	1093.02	1000.00	0.134	0.000	1098.56
5/23/97	1.36%	1.70%	0.86%	0.67	0.484	529.02	8.97	1101.99	470.98	0.063	0.008	1117.19
5/27/97	0.37%	0.11%	0.20%	0.16	0.12	132.24	0.15	1102.14	867.76	0.116	0.000	1118.44
5/28/97	-0.29%	-0.95%	-0.19%	-0.15	0	0.00	0.00	1102.14	1000.00	0.134	0.000	1107.69
5/29/97	-0.37%	2.37%	-0.23%	-0.18	0	0.00	0.00	1102.14	1000.00	0.134	0.000	1133.91
5/30/97	0.50%	1.56%	0.31%	0.25	0.16	176.34	2.79	1104.93	823.66	0.110	0.003	1151.82
5/29/97	-0.23%	-1.54%	-0.14%	-0.11	0	0.00	0.00	1104.93	1000.00	0.134	0.000	1134.09
6/2/97	-0.10%	-0.48%	-0.07%	-0.05	0	0.00	0.00	1104.93	1000.00	0.134	0.000	1139.58
6/4/97	-0.64%	-0.24%	-0.40%	-0.31	0	0.00	0.00	1104.93	1000.00	0.134	0.000	1136.81
6/5/97	0.40%	-0.95%	0.25%	0.20	0.12	132.59	-1.26	1103.67	867.41	0.116	-0.001	1126.02

6/9/97	0.57%	-1.47%	0.36%	0.28	0.2	220.73	-3.24	1100.42	779.27	0.104	-0.003	1109.47
6/10/97	0.27%	-0.13%	0.17%	0.14	0.08	88.03	-0.11	1100.31	911.97	0.122	0.000	1108.07
6/11/97	0.50%	-3.45%	0.31%	0.25	0.16	176.05	-6.07	1094.24	823.95	0.110	-0.006	1089.87
6/12/97	1.60%	1.35%	1.01%	0.79	0.546	597.46	8.06	1102.32	402.54	0.054	0.007	1084.33
6/13/97	1.11%	2.00%	0.70%	0.55	0.384	423.29	8.46	1110.78	576.71	0.077	0.008	1106.00
6/16/97	0.07%	-0.61%	0.04%	0.03	0	0.00	0.00	1110.78	1000.00	0.134	0.000	1099.28
6/17/97	0.06%	-0.72%	0.04%	0.03	0	0.00	0.00	1110.78	1000.00	0.134	0.000	1091.35
6/18/97	1.00%	4.47%	0.63%	-0.30	0	0.00	0.00	1110.78	1000.00	0.082	0.016	1164.38
6/19/97	1.00%	2.13%	0.05%	0.50	0.348	386.55	17.26	1128.04	613.45	0.134	0.000	1154.15
6/20/97	-2.23%	-0.88%	0.05%	0.04	0	0.00	0.00	1128.04	1000.00	0.134	0.000	1144.14
6/23/97	2.02%	-0.87%	-1.41%	1.11	0	0.00	0.00	1136.72	257.75	0.034	0.008	1157.51
6/24/97	2.02%	-1.17%	-1.27%	1.00	0	742.25	8.68	1136.72	1000.00	0.134	0.000	1162.35
6/25/97	-0.82%	0.42%	-0.52%	-0.41	0	0.00	0.00	1136.72	1000.00	0.134	0.000	1167.64
6/26/97	-0.60%	0.45%	-0.38%	-0.30	0	0.00	-5.44	1131.27	413.45	0.055	-0.005	1156.80
7/2/97	1.46%	-0.93%	0.92%	0.72	0.516	586.55	-5.02	1122.25	416.26	0.056	-0.006	1136.32
7/3/97	1.43%	-1.55%	0.90%	0.71	0.516	563.74	-9.02	1122.25	1000.00	0.134	0.000	1133.83
7/7/97	-0.51%	-0.45%	-0.32%	-0.25	0	0.00	-1.84	1120.41	692.50	0.093	-0.002	1127.05
7/8/97	0.72%	-0.60%	0.45%	0.36	0.274	307.50	0.00	1120.41	1000.00	0.134	0.000	1137.43
7/9/97	-1.22%	0.92%	-0.77%	-0.60	0	0.00	6.88	1127.29	735.58	0.098	0.006	1167.02
7/10/97	0.69%	2.60%	0.43%	0.34	0.236	264.42	1.29	1128.58	864.73	0.116	0.001	1178.19
7/11/97	0.32%	0.96%	0.20%	0.16	0.12	135.27	0.34	1128.92	954.86	0.128	0.000	1187.10
7/14/97	0.19%	0.76%	0.12%	0.09	0.04	45.14	-0.82	1128.10	690.67	0.092	-0.001	1183.94
7/15/97	0.80%	-0.27%	0.51%	0.40	0.274	399.33	7.95	1136.05	528.45	0.071	0.007	1203.89
7/15/97	1.17%	1.69%	0.74%	0.58	0.418	471.55	0.00	1136.05	1000.00	0.134	0.009	1193.48
7/17/97	0.53%	0.87%	-0.33%	-0.25	0	0.00	0.00	1136.05	1000.00	0.134	0.000	1190.86
7/18/97	-1.75%	-0.22%	-1.10%	-0.87	0	0.00	0.00	1136.05	1000.00	0.134	0.000	1184.00
7/21/97	-0.26%	-0.58%	-0.16%	-0.13	0	827.04	15.64	1151.68	172.96	0.023	0.014	1206.39
7/23/97	2.30%	1.89%	1.45%	1.14	0.728	92.13	-0.17	1151.68	907.87	0.121	0.000	1204.12
7/24/97	0.28%	-0.19%	0.17%	0.14	0.08	138.18	-0.45	1151.06	861.82	0.115	0.000	1200.20
7/24/97	0.40%	-0.33%	0.25%	0.20	0.12	0.00	0.00	1151.06	1000.00	0.134	0.000	1200.85
7/24/97	-0.16%	0.05%	-0.10%	-0.08	0	0.00	0.00	1151.06	1000.00	0.134	0.000	1200.85
7/25/97	0.62%	1.34%	0.67%	0.53	0.384	443.40	3.64	1154.70	728.35	0.097	0.003	1225.12
7/28/97	-0.25%	0.67%	0.39%	0.31	0.236	271.65	10.61	1165.31	556.60	0.074	0.009	1254.44
7/29/97	1.06%	2.39%	0.67%	0.53	0.384	443.40	0.08	1165.39	906.78	0.121	0.000	1255.47
7/30/97	0.21%	0.08%	0.13%	0.10	0.08	93.22	0.00	1165.39	1000.00	0.134	0.000	1246.30
7/31/97	-0.75%	-0.73%	-0.47%	-0.37	0	0.00	0.00	1165.39	1000.00	0.134	0.000	1246.30
8/1/97	0.33%	0.69%	0.21%	0.17	0.12	139.85	0.96	1166.35	860.15	0.115	0.001	1254.88
8/1/97	0.22%	1.04%	0.14%	0.11	0.08	93.31	0.97	1167.32	906.69	0.121	0.002	1267.92
8/5/97	0.83%	0.80%	0.80%	0.41	0.31	361.87	2.88	1170.20	638.13	0.085	0.002	1278.01
8/6/97	-0.95%	-0.15%	-0.60%	-0.47	0	0.00	0.00	1170.20	1000.00	0.134	0.000	1276.04
8/7/97	-1.86%	-1.12%	-1.17%	-0.92	0	0.00	0.00	1170.20	1000.00	0.134	0.000	1261.70
8/8/97	0.37%	-0.47%	0.23%	0.18	0.12	140.42	-0.66	1169.54	859.58	0.115	-0.001	1255.80
8/11/97	-1.12%	0.67%	-0.70%	-0.55	0	0.00	0.00	1169.54	1000.00	0.134	0.000	1263.42
8/12/97	-0.49%	0.09%	-0.31%	-0.24	0	0.00	0.00	1169.54	1000.00	0.134	0.000	1264.56
8/13/97	0.30%	-2.43%	0.19%	0.15	0.08	93.56	-2.27	1167.27	906.44	0.121	-0.002	1233.83
8/14/97	1.30%	-3.85%	0.82%	0.64	0.452	527.60	-20.31	1146.96	472.40	0.063	-0.017	1186.34
8/18/97	1.48%	2.44%	0.93%	0.73	0.516	591.83	14.47	1161.43	408.17	0.085	0.013	1215.34
8/19/97	1.44%	-1.27%	0.91%	0.71	0.516	599.30	-7.62	1153.81	400.70	0.054	-0.007	1199.89
8/20/97	-1.52%	-1.43%	-0.96%	-0.75	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1182.70
8/21/97	-0.16%	1.10%	-0.10%	-0.08	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1195.66
8/22/97	-0.37%	-0.33%	-0.23%	-0.18	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1191.70
8/25/97	-0.78%	-0.03%	-0.49%	-0.38	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1190.68
8/26/97	0.07%	-4.23%	0.05%	0.04	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1140.26
8/27/97	-1.10%	-4.98%	-0.69%	-0.54	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1083.47

8/29/97	-0.46%	-5.02%	-0.29%	-0.23	0	0.00	0.00	1153.81	1000.00	0.134	0.000	1029.08
9/2/97	3.13%	7.13%	1.97%	1.55	0.866	999.20	71.19	1225.00	0.80	0.000	0.062	1102.41
9/3/97	0.03%	-3.50%	0.02%	0.01	0	0.00	0.00	1225.00	1000.00	0.134	0.000	1063.83
9/4/97	0.32%	2.57%	0.20%	0.16	0.12	147.00	3.77	1228.77	853.00	0.114	0.003	1091.13
9/5/97	-0.20%	1.67%	-0.12%	-0.10	0	0.00	0.00	1228.77	1000.00	0.134	0.000	1109.34
9/8/97	0.23%	1.28%	0.15%	0.11	0.08	98.30	1.26	1230.04	901.70	0.121	0.001	1123.56
9/9/97	0.26%	-1.28%	0.16%	0.13	0.08	98.40	-1.25	1228.78	901.60	0.121	-0.001	1109.26
9/10/97	-1.56%	-3.36%	-0.98%	-0.77	0	0.00	0.00	1228.78	1000.00	0.134	0.000	1072.01
9/11/97	-0.70%	1.13%	-0.44%	-0.35	0	0.00	0.00	1228.78	1000.00	0.134	0.000	1084.16
9/12/97	1.24%	1.11%	0.78%	0.61	0.452	555.41	6.15	1234.93	444.59	0.059	0.005	1096.16
9/15/97	-0.45%	-1.50%	-0.28%	-0.22	0	0.00	0.00	1234.93	1000.00	0.134	0.000	1079.72
9/17/97	-0.28%	0.06%	-0.18%	-0.14	0	0.00	0.00	1234.93	1000.00	0.134	0.000	1080.34
9/18/97	0.45%	-0.24%	0.29%	0.23	0.16	197.59	0.00	1234.45	802.41	0.107	0.000	1077.69
9/19/97	0.34%	-1.92%	0.21%	0.17	0.12	148.13	-2.84	1231.60	851.87	0.114	-0.002	1057.01
9/22/97	0.52%	-0.10%	0.33%	0.26	0.26	246.32	-0.24	1231.36	753.68	0.101	0.000	1055.98
9/23/97	-0.37%	0.79%	-0.22%	-0.18	0	0.00	0.00	1231.36	1000.00	0.134	0.000	1054.30
9/24/97	-0.78%	3.04%	-0.48%	-0.39	0	0.00	0.00	1231.36	1000.00	0.134	0.000	1096.61
9/25/97	-0.70%	0.51%	-0.44%	-0.34	0	0.00	0.00	1231.36	1000.00	0.134	0.000	1102.17
9/28/97	0.78%	1.04%	0.48%	0.39	0.274	337.39	3.52	1234.88	662.61	0.089	0.003	1113.67
9/29/97	0.86%	1.24%	0.54%	0.43	0.31	382.81	4.76	1239.65	617.19	0.083	0.004	1127.53
10/2/97	0.53%	0.62%	0.33%	0.26	0.2	247.93	1.30	1240.94	752.07	0.101	0.001	1133.43
10/3/97	0.48%	-2.32%	0.30%	0.24	0.16	198.55	-4.61	1236.33	801.45	0.107	-0.004	1107.11
10/6/97	0.78%	0.23%	0.50%	0.39	0.274	338.76	0.78	1237.11	661.24	0.088	0.001	1109.66
10/7/97	1.07%	0.19%	0.67%	0.53	0.384	475.05	0.89	1238.00	524.95	0.070	0.001	1111.74
10/8/97	-0.94%	3.81%	-0.59%	-0.47	0	0.00	0.00	1238.00	1000.00	0.134	0.000	1059.37
10/10/97	-0.38%	-1.40%	-0.22%	-0.19	0	0.00	0.00	1238.00	1000.00	0.134	0.000	1054.37
10/13/97	0.12%	-1.68%	0.07%	0.06	0.04	49.52	-0.83	1237.17	950.48	0.127	-0.001	1036.67
10/14/97	0.23%	-3.27%	0.14%	0.11	0.08	98.97	-3.24	1233.94	901.03	0.120	-0.003	1002.78
10/15/97	-0.47%	1.37%	-0.30%	-0.23	0	0.00	0.00	1233.94	1000.00	0.134	0.000	1016.49
10/16/97	-1.09%	0.25%	-0.66%	-0.54	0	0.00	0.00	1233.94	1000.00	0.134	0.000	1019.02
10/17/97	-1.16%	-4.63%	-0.73%	-0.57	0	0.00	0.00	1233.94	1000.00	0.134	0.000	971.81
10/20/97	1.21%	-4.38%	0.76%	0.60	0.452	557.74	-24.41	1209.52	442.26	0.059	-0.020	929.27
10/21/97	1.74%	-6.17%	1.10%	0.86	0.604	730.55	-45.08	1164.44	269.45	0.036	0.000	871.93
10/22/97	-0.39%	-10.41%	-0.25%	-0.19	0	0.00	0.00	1164.44	1000.00	0.134	0.000	781.16
10/23/97	-1.84%	6.89%	-1.16%	-0.91	0	0.00	0.00	1164.44	1000.00	0.134	0.000	834.96
10/24/97	-0.95%	-6.80%	-0.60%	-0.47	0	0.00	0.00	1164.44	1000.00	0.134	0.000	786.55
10/27/97	-6.87%	-13.70%	-4.32%	-3.40	0	0.00	0.00	1164.44	1000.00	0.134	0.000	678.79
10/28/97	5.12%	18.82%	3.22%	2.53	0.988	1150.47	216.56	1381.00	-150.47	-0.020	0.186	806.56
10/29/97	-1.68%	2.62%	-0.18%	-0.14	0	0.00	0.00	1381.00	1000.00	0.134	0.000	776.41
10/30/97	-1.68%	2.62%	-1.06%	-0.83	0	0.00	0.00	1381.00	1000.00	0.134	0.000	795.96
10/31/97	1.21%	5.94%	0.76%	0.60	0.418	577.26	34.30	1415.31	422.74	0.057	0.025	843.26
11/3/97	2.86%	-4.21%	1.66%	1.32	0.806	1140.74	-48.07	1367.23	-140.74	-0.019	-0.034	807.72
11/4/97	0.19%	-0.92%	0.12%	0.09	0.04	54.69	-0.50	1366.73	945.31	0.126	0.000	800.30
11/5/97	0.21%	2.52%	0.13%	0.11	0.08	109.34	-2.76	1363.98	890.66	0.119	-0.002	780.13
11/6/97	-0.50%	-2.96%	-0.32%	-0.25	0	0.00	0.00	1363.98	1000.00	0.134	0.000	757.05
11/7/97	-1.12%	-1.11%	-0.71%	-0.56	0	0.00	0.00	1363.98	1000.00	0.134	0.000	748.69
11/10/97	-0.69%	0.11%	-0.43%	-0.34	0	0.00	0.00	1363.98	1000.00	0.134	0.000	749.53
11/11/97	0.29%	-3.96%	0.16%	0.14	0.08	109.12	0.00	1359.65	890.88	0.119	-0.003	719.85
11/12/97	-1.93%	1.17%	-1.21%	-0.95	0	0.00	-4.32	1359.65	1000.00	0.134	0.000	728.30
11/13/97	1.18%	2.43%	0.74%	0.58	0.418	568.34	13.83	1373.48	431.66	0.058	0.010	746.03
11/14/97	1.28%	4.64%	0.80%	0.63	0.452	620.82	28.83	1402.32	379.18	0.051	0.021	780.67
11/17/97	1.92%	-1.68%	1.21%	0.95	0.658	922.72	-15.46	1386.86	77.28	0.010	-0.011	767.59
							386.86			22.962		-232.41

stddev

10.5 month return

38.7%

avg.

avg.

22.962

16.62

10.5 month return annualized	38.7% 45.3%	
10.5 month return with interest annualized		42.6% 50.1%
Hang Seng return annualized	-23.2% -26.1%	

Std. Dev for our model	0.0147
Std. Dev for Hang Seng	0.0259

Tom & Jeff -

(111)

NICELY DONE. THIS PAPER IS GREAT FLOW. I HOPE YOU'LL KEEP ME APPRISED OF YOUR RESULTS MOVING FORWARD

SOME SPECIFIC COMMENTS:

- ① THERE IS A SENSE IN WHICH OUT-OF-SAMPLE HERE IS NOT AS IT SEEMS: WE KNEW GOING IN THAT THAT FATEFUL DAY IN OCTOBER WOULD BE A WIND FOR YOU. YOU MIGHT HAVE PRESENTED 97 RESULTS WITHOUT THAT DAY IN JUST FOR COMPARISON.
- ② I LIKE YOUR IDEA OF BACK-TESTING ON OTHER YEARS
- ③ BE AWARE: SOME MUTUAL FUNDS THAT DON'T CHARGE TO GET IN WILL CHARGE TO GET OUT IF YOUR HOLDING PERIOD IS TOO SHORT.
- ④ YOU SHOULD HAVE PROVIDED AN ESTIMATE OF THE AVERAGE SHARE OF YOUR PORTFOLIO IN CASH OVER THE PERIOD. EVEN AT 100% YOU WOULD HAVE DONE MUCH BETTER THAN THE HANG SENG IN THIS SAMPLE.
- ⑤ YOU MIGHT THINK ABOUT WHETHER YOUR β DIFFERS ACROSS DAYS (E.G., SMALLER OVER WEEKENDS)

SUPER JOE
RICH