

## Applying The Noise Channel System to IBM 5min Bars

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In a previous article on the German Mark, we showed how the application of a simple channel breakout system, with a small improvement to minimize whipsaws due to random market trading noise, could be used to develop a daily system to buy and sell Deutschmark futures. Here we will use a variation of that previously developed *Noise Channel* system to create a system to trade IBM on an intraday basis using IBM 5 minute bar data.

IBM is one of the premier computer corporations in the world and is a major factor in the movement of the Dow Jones and S&P 500 indices. Although IBM is traded on all regional exchanges the lion's share and real market of IBM is traded on the NYSE.

### Data Discussion

Here we will use 5 minute bar prices of IBM from 2/21/2001 to 4/06/2001. IBM pays dividends on a quarterly basis, usually on the dividend *payable dates* of March 10<sup>th</sup>, June 10<sup>th</sup>, September 10<sup>th</sup>, and December 10<sup>th</sup>. On the dividend Ex dates (approximately one month before the payable date) the price of the stock is adjusted down by the value of the dividend. Thus over a year IBM has a small downward bias in price by the amount of the yearly dividend. If you were a holder of IBM then you would receive those dividends in cash and the small downward bias over the year would be made up by the cash dividends you received. However in developing a system using IBM prices, those prices are not adjusted for the dividend payments. This non-dividend adjustment creates a small distortion in parameter selection and walk forward results. Since no dividends were paid in the data sample we are using, no adjustment need be made. If the intraday time period were to fall on a dividend xdate then an adjustment would have to be made to avoid distortion in the intraday optimization parameters.

### The Noise Channel System.

The system that we will use here is fairly simple and effective and has been in the public domain for many years. As a matter of fact it is my guess that 98% of the "*secret*" stock and commodity trading system are already in the public domain...that is they've been published in books, magazines, etc. The only value a "*secret*" vendor usually adds is some minor variation to these published systems. No matter whether a system is "*secret*" or not the important point of any system is how well it will perform on data it has not been optimized on, that is *out-of-sample* data. Without *out-of-sample* testing it's nothing more than a "hope and a prayer" to believe that system performance in the future will be anywhere near the optimized performance.

Intraday data has a high noise content. What this means is that there are many random price movements that look like they are significant but turn out to be false alarms. Without some kind of filter, the losses created by the buy and sells signals generated by the random price movements could completely overwhelm the system. In order to help filter out the random signals, we will add a noise filter, with the symbol  $x_0$ , to the well known channel breakout system.

The Noise Channel Breakout System is defined as follows:

### Buy Rule:

**If** IBM crosses above the highest high price of IBM of the last *nhi* bars by an amount greater than or equal to *xo*, **then** buy IBM at market. In addition, when short, and when calculating the highest high price (*hhp*), that *hhp* cannot be higher than the previously calculated *hhp* as the *nhi* lookback period moves forward and previous highs are dropped out of the lookback window. In other words when short the *hhp* can only stay the same or go lower...it cannot go higher.

**Sell Rule:**

If IBM crosses below the lowest low price of IBM of last *nlo* days minus by an amount of greater than or equal to *xo*, **then** sell IBM at market. In addition, when long and when calculating the lowest low price (*llp*), that *llp* cannot be lower than the previous calculated *llp* as the *nlo* lookback period moves forward and previous lows are dropped out of the lookback window.

**Exit Rule**

Close the IBM position 5 minutes before the New York Stock Exchange close (no trades will be carried overnight).

**Walk Forward Optimization**

Walk forward optimization will be used here because of the changing nature of intraday markets for individual stocks.. Intraday price dynamics are constantly changing due to current economic surprises, events and trader sentiment. Also the time of year changes the nature of intraday markets, such as the seasons, holidays, vacation time, etc. As such, optimizations on intraday data performed 3 months ago may no longer be representative of today's intraday price dynamics.

The walk forward procedure will be applied as follows. A period of 4 weeks from the start of the IBM 5 minute bar data, February 21<sup>st</sup>, 2001 through March 23<sup>rd</sup>, 2001, is chosen and system parameter values are found through optimization on this intraday data segment. The parameter values found are then applied to the out-of-sample 5 minute intraday bar data following the test segment which in this case is March 26<sup>th</sup>, 2001 to March 30<sup>th</sup>, 2001. This process is repeated by moving the test data window forward one week to February 28<sup>th</sup>, 2001 through March 30<sup>th</sup>, 2001, and again finding the parameters values through optimization on this new data test window. The parameter values found are then applied to the next out-of-sample 5 minute intraday bar data following this new test window data which in this case is April 2<sup>nd</sup>, 2001 to April 6<sup>th</sup>, 2001.

Why a 4 week intraday data test segment? Why not 2 weeks or 3 months? Well the answer is that there is no correct ratio of test data needed to produce good one week intraday out-of-sample results. By experimenting with different window lengths, the four to one ratio seemed to work well. In walk forward testing enough data is needed to model most of the price dynamics that will be encountered in the out-of-sample segment, but not so much data that when the price dynamics start to change they are swamped by the weight of distant past data price dynamics that no longer are valid. An important unspoken point in walk forward testing is that if you can not get good results in the out-of-sample segments, then the price dynamics cannot be modeled with the system. This means that real time performance will be random using the model. Traders observe this type of random performance (that is it looks great on paper but falls apart in real time) when trying systems based on curve fitting or anecdotal "proof" (looking at 3 or 4 successful cases only) without any out-of-sample testing.

## Finding The System Parameters Using Walk Forward Optimization

There are three system parameters to find *nhi*, *nlo*, and *xo*. The best parameters will be defined as those values that give the best Net Profits with the minimum drawdown and minimum largest losing trades. In addition, the results should be stable, e.g. the profits, wins, and drawdowns should not change by much as the parameters move by a small amount away from their optimum values. Also in choosing the “best” parameters, I considered only those parameters sets whose maximum consecutive losses were 4 or less. Optimization is defined as the search for the parameter values that give the best results as defined above. It should be noted that in this stage of system development, the only thing indicated by the optimum values that are found in the test portion is that the data has been *curve fitted* as best it can with this system. Without further testing on out-of-sample data there is no way to tell if the system will work in the future.

It is not well known, but almost any real time series or even a random time series defined over a fixed number of bars can be curve fitted rather easily. The performance results and the statistical measurements that validate this performance of the curve fit will look excellent giving the false illusion of future profitability. However, the truth is that these excellent performance and associated statistics on the test section in no way validate how the system will perform on data it has not been optimized on. Only *out-of-sample* testing, that is testing on data the parameters were not derived on, can determine if the parameters found in the test section have captured the price dynamics. Despite these facts, many market pundits still make the unproven claim that statistics generated from the optimized buy and sell trades in the test section have value in predicting whether or not the system will perform well in the future without the need for any out-of-sample validation. Nothing could be farther from the truth! The only thing the statistics from the test section tell you is how well you have curve fitted the data in the test section. As a matter of fact, using optimization, it’s almost impossible not to get an excellent fit with excellent statistical results.

## Results

Figure 1 presents a table of the test window selected optimum parameters for the IBM 5min data series.

Start Date	End Date	nhi	nlo	xo
02/21/01	03/23/01	8	4	1
02/28/01	03/30/01	8	4	1

**Figure 1 Optimum Parameter Values For Test Data Segments**

Figures 2a and 2b presents the performance summary of the test windows using the optimum parameters for the test windows shown in Figure 1.

Figure 3 presents the combined performance summary of the two out-of-sample data segment from 3/26/01 to 4/06/01. This performance represents what would have happened in *real time* if one used the parameters found in the test sections. Slippage, and commissions are not included.

Figure 4 presents a specialized percentage trade by trade summary from 3/26/01 to 4/06/01. Note that the trades from 3/26/01 to 4/06/01 are the out-of-sample trades generated from the optimized parameters from the two test sections of 2/21/01 to 3/23/01 and 2/28/01 to 3/30/01.

The in sample trades were generated by the curve fit and are not of interest here.

Figures 5A through 5D present the 5 minute bar charts of IBM with the Noise Channel superimposed and all the buy and sell signals from the trade by trade summary of Figure 4 indicated on the charts.

### **Discussion of System Performance**

As can be observed from the test sample Performance summary in Figures 2a, 2b and the out-of-sample performance summary of Figure 3, the out-of-sample performance was better than the test sample performance with respect to average winning and losing trades, drawdowns and profit factor. This better performance in the out-of-sample section could have been due to chance but does indicate that 4 weeks of test data was enough to capture the intraday price dynamics of IBM.

Observing the out-of-sample trade by trade summary of Figure 4, we can see that the system did better on short trades than it did on long trades. This could indicate a negative bias for the system and will have to be investigated further. On the other hand, given the current Bear Market environment the ability to cash in on the short side is of value. There were no big winners or big losers indicating steady returns. Average wins were 2.4 times average losses in the out-of-sample section.

In observing the charts we can see that the system did very well in catching every major intraday trend of IBM. As can be seen from the charts, the system constraint of not carrying positions overnight eliminated many negative opening surprises. Overall the Noise Channel system did a good job in minimizing the losses due to the inevitable whipsaws that will occur in any trading system and maximizing the profits from the major intraday trend moves of IBM.

In order to use this system in real time trading, at least ten more test and out-of-sample windows would have to be examined to make sure that the above results above were not due to pure chance.

### **References:**

Meyers, Dennis [1998], "The Noise Channel Breakout system", *Stocks & Commodities*, Volume 16: April.

Meyers, Dennis [2000], "Hoodwinked by Randomness", *Futures*, Volume 26: December 2000.

### **Info on Dennis Meyers**

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**Figure 2a Test Window Performance Summary for IBM Noise Channel System IBM-5 min bars  
02/21/2001 - 03/23/2001**

Noise Channel System IBM 5 min bars 02/21/2001 - 03/23/2001  
Performance Statistics based upon Buying and Selling 1000 shares of IBM

Performance Summary: All Trades

Total net profit	\$ 13890.000	Open position P/L	\$ 0.000
Gross profit	\$ 39260.000	Gross loss	\$-25370.000
Total # of trades	48	Percent profitable	54%
Number winning trades	26	Number losing trades	22
Largest winning trade	\$ 5940.000	Largest losing trade	\$ -2060.000
Average winning trade	\$ 1510.000	Average losing trade	\$ -1153.182
Ratio avg win/avg loss	1.309	Avg trade(win & loss)	\$ 289.375
Max consec. winners	4	Max consec. losers	3
Avg # bars in winners	39	Avg # bars in losers	21
Max intraday drawdown	\$ -8470.000		
Profit factor	1.547	Max # contracts held	1

Performance Summary: Long Trades

Total net profit	\$ 230.000	Open position P/L	\$ 0.000
Gross profit	\$ 13770.000	Gross loss	\$-13540.000
Total # of trades	23	Percent profitable	43%
Number winning trades	10	Number losing trades	13
Largest winning trade	\$ 5940.000	Largest losing trade	\$ -2060.000
Average winning trade	\$ 1377.000	Average losing trade	\$ -1041.538
Ratio avg win/avg loss	1.322	Avg trade(win & loss)	\$ 10.000
Max consec. winners	3	Max consec. losers	5
Avg # bars in winners	32	Avg # bars in losers	15
Max intraday drawdown	\$-10780.000		
Profit factor	1.017	Max # contracts held	1

Performance Summary: Short Trades

Total net profit	\$ 13660.000	Open position P/L	\$ 0.000
Gross profit	\$ 25490.000	Gross loss	\$-11830.000
Total # of trades	25	Percent profitable	64%
Number winning trades	16	Number losing trades	9
Largest winning trade	\$ 4320.000	Largest losing trade	\$ -1840.000
Average winning trade	\$ 1593.125	Average losing trade	\$ -1314.444
Ratio avg win/avg loss	1.212	Avg trade(win & loss)	\$ 546.400
Max consec. winners	5	Max consec. losers	3
Avg # bars in winners	43	Avg # bars in losers	28
Max intraday drawdown	\$ -5080.000		
Profit factor	2.155	Max # contracts held	1

**Figure 2b Test Window Performance Summary for IBM Noise Channel System IBM-5 min bars  
02/28/2001 - 03/30/2001**

Noise Channel System IBM 5 min bars 02/28/2001 - 03/30/2001  
Performance Statistics based upon Buying and Selling 1000 shares of IBM

Performance Summary: All Trades

Total net profit	\$ 10490.000	Open position P/L	\$ 0.000
Gross profit	\$ 35500.000	Gross loss	\$-25010.000
Total # of trades	47	Percent profitable	47%
Number winning trades	22	Number losing trades	25
Largest winning trade	\$ 5940.000	Largest losing trade	\$ -1840.000
Average winning trade	\$ 1613.636	Average losing trade	\$ -1000.400
Ratio avg win/avg loss	1.613	Avg trade(win & loss)	\$ 223.191
Max consec. winners	3	Max consec. losers	3
Avg # bars in winners	39	Avg # bars in losers	26
Max intraday drawdown	\$ -9660.000		
Profit factor	1.419	Max # contracts held	1

Performance Summary: Long Trades

Total net profit	\$ 1090.000	Open position P/L	\$ 0.000
Gross profit	\$ 14220.000	Gross loss	\$-13130.000
Total # of trades	22	Percent profitable	36%
Number winning trades	8	Number losing trades	14
Largest winning trade	\$ 5940.000	Largest losing trade	\$ -1680.000
Average winning trade	\$ 1777.500	Average losing trade	\$ -937.857
Ratio avg win/avg loss	1.895	Avg trade(win & loss)	\$ 49.545
Max consec. winners	3	Max consec. losers	5
Avg # bars in winners	34	Avg # bars in losers	21
Max intraday drawdown	\$-10780.000		
Profit factor	1.083	Max # contracts held	1

Performance Summary: Short Trades

Total net profit	\$ 9400.000	Open position P/L	\$ 0.000
Gross profit	\$ 21280.000	Gross loss	\$-11880.000
Total # of trades	25	Percent profitable	56%
Number winning trades	14	Number losing trades	11
Largest winning trade	\$ 4320.000	Largest losing trade	\$ -1840.000
Average winning trade	\$ 1520.000	Average losing trade	\$ -1080.000
Ratio avg win/avg loss	1.407	Avg trade(win & loss)	\$ 376.000
Max consec. winners	5	Max consec. losers	4
Avg # bars in winners	42	Avg # bars in losers	32
Max intraday drawdown	\$ -6840.000		
Profit factor	1.791	Max # contracts held	1

### Figure 3 Combined Walk Forward Out-Of-Sample Performance Summary for IBM Noise Channel System IBM-5 min bars 03/26/2001 - 04/06/2001

Noise Channel System IBM 5 min bars Combined Out-Of-Sample 03/26/2001 - 04/06/2001  
Performance Statistics based upon Buying and Selling 1000 shares of IBM

#### Performance Summary: All Trades

Total net profit	\$ 8390.000	Open position P/L	\$ 0.000
Gross profit	\$ 14460.000	Gross loss	\$ -6070.000
Total # of trades	16	Percent profitable	50%
Number winning trades	8	Number losing trades	8
Largest winning trade	\$ 4000.000	Largest losing trade	\$ -1350.000
Average winning trade	\$ 1807.500	Average losing trade	\$ -758.750
Ratio avg win/avg loss	2.382	Avg trade(win & loss)	\$ 524.375
Max consec. winners	5	Max consec. losers	3
Avg # bars in winners	54	Avg # bars in losers	37
Max intraday drawdown	\$ -4480.000		
Profit factor	2.382	Max # contracts held	1

#### Performance Summary: Long Trades

Total net profit	\$ 2530.000	Open position P/L	\$ 0.000
Gross profit	\$ 6470.000	Gross loss	\$ -3940.000
Total # of trades	7	Percent profitable	43%
Number winning trades	3	Number losing trades	4
Largest winning trade	\$ 4000.000	Largest losing trade	\$ -1350.000
Average winning trade	\$ 2156.667	Average losing trade	\$ -985.000
Ratio avg win/avg loss	2.190	Avg trade(win & loss)	\$ 361.429
Max consec. winners	2	Max consec. losers	3
Avg # bars in winners	64	Avg # bars in losers	31
Max intraday drawdown	\$ -4930.000		
Profit factor	1.642	Max # contracts held	1

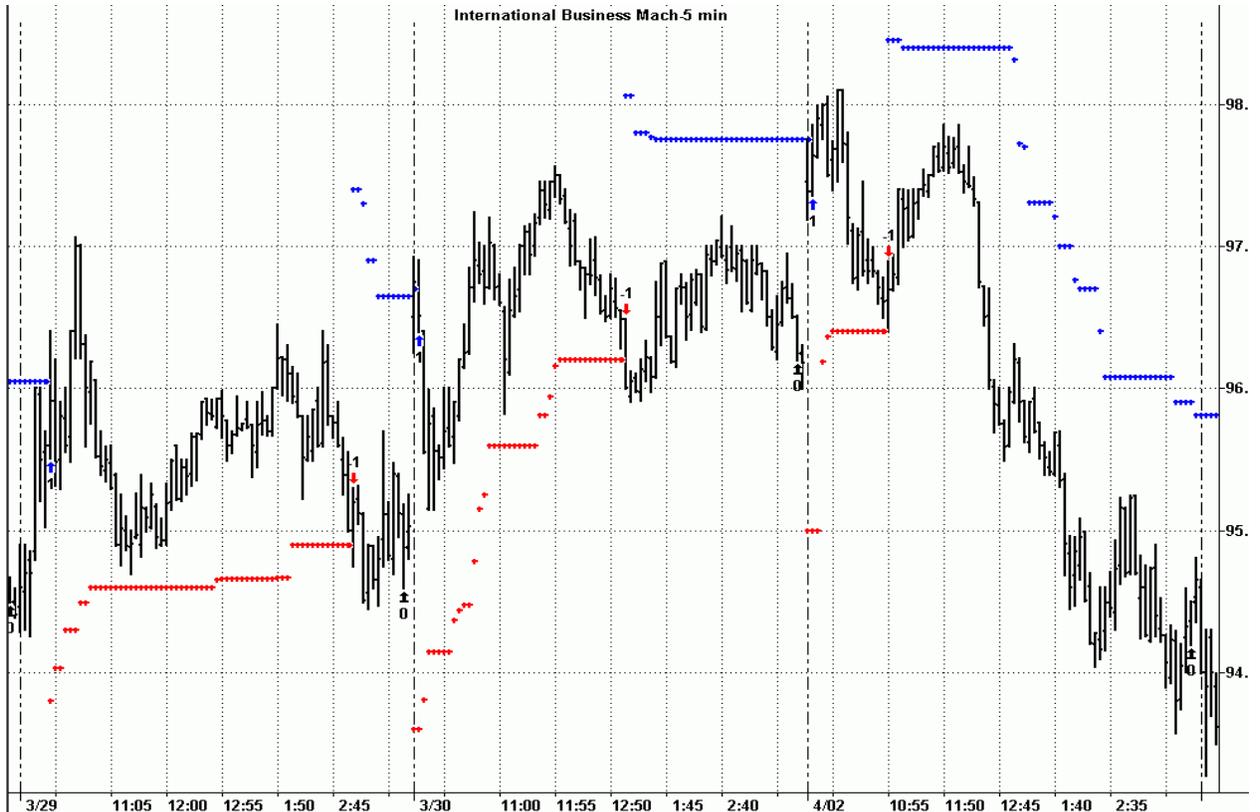
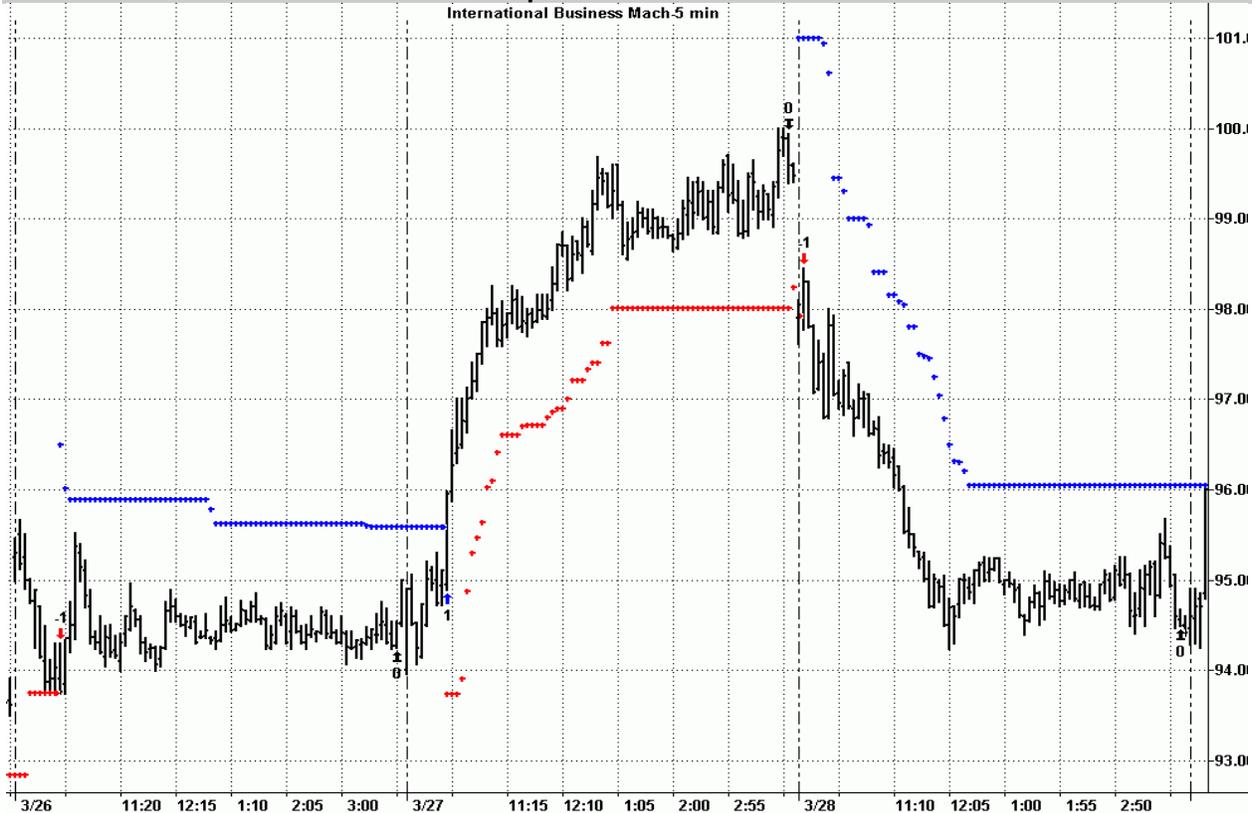
#### Performance Summary: Short Trades

Total net profit	\$ 5860.000	Open position P/L	\$ 0.000
Gross profit	\$ 7990.000	Gross loss	\$ -2130.000
Total # of trades	9	Percent profitable	56%
Number winning trades	5	Number losing trades	4
Largest winning trade	\$ 3420.000	Largest losing trade	\$ -940.000
Average winning trade	\$ 1598.000	Average losing trade	\$ -532.500
Ratio avg win/avg loss	3.001	Avg trade(win & loss)	\$ 651.111
Max consec. winners	3	Max consec. losers	2
Avg # bars in winners	48	Avg # bars in losers	42
Max intraday drawdown	\$ -3140.000		
Profit factor	3.751	Max # contracts held	1

**FIGURE 4 Out-Of-Sample Trade By Trade Summary**  
**IBM 5min Noise Channel System Trade Size = 1000 Shares 03/26/2001 to 04/06/2001**

Entry Date	Entry Time		Entry Price	Exit Date	Exit Time	Exit Price	Bars InTrd	Trade \$P&L	Trade %P&L	Trade Max\$Pft	Time	Trade Max\$DD	Time
03/26/01	1020	Sell	93.75	03/26/01	1555	94.52	67	(770)	-0.82%	0	1020	(1,620)	1035
03/27/01	1015	Buy	95.59	03/27/01	1555	99.59	68	4,000	4.18%	4,300	1550	0	1015
03/28/01	940	Sell	97.92	03/28/01	1555	94.50	75	3,420	3.49%	3,420	1200	(380)	940
03/29/01	1005	Buy	96.05	03/29/01	1505	94.90	60	(1,150)	-1.20%	950	1030	(1,160)	1120
03/29/01	1505	Sell	94.90	03/29/01	1555	94.88	10	20	0.02%	390	1515	(500)	1545
03/30/01	940	Buy	96.70	03/30/01	1305	96.20	41	(500)	-0.52%	800	1155	(1,190)	1000
03/30/01	1305	Sell	96.20	03/30/01	1555	96.25	34	(50)	-0.05%	220	1315	(840)	1435
04/02/01	940	Buy	97.75	04/02/01	1055	96.40	15	(1,350)	-1.38%	350	1005	(1,350)	1055
04/02/01	1055	Sell	96.40	04/02/01	1555	94.50	60	1,900	1.97%	2,600	1540	(1,300)	1140
04/03/01	1000	Sell	93.00	04/03/01	1555	90.50	71	2,500	2.69%	2,740	1540	0	1000
04/04/01	945	Buy	92.00	04/04/01	1350	92.00	49	0	0.00%	1,900	1120	(1,890)	1030
04/04/01	1350	Sell	92.00	04/04/01	1555	91.85	25	150	0.16%	380	1400	(500)	1420
04/05/01	940	Buy	95.68	04/05/01	1555	98.15	75	2,470	2.58%	3,040	1525	(10)	940
04/06/01	940	Sell	97.30	04/06/01	1155	98.24	27	(940)	-0.97%	550	1115	(940)	1155
04/06/01	1155	Buy	98.24	04/06/01	1235	97.30	8	(940)	-0.96%	1,660	1205	(940)	1235
04/06/01	1235	Sell	97.30	04/06/01	1555	97.67	40	(370)	-0.38%	300	1235	(1,960)	1355

**FIGURE 5 IBM 5min Noise Channel System Chart  
Out-Of-Sample 03/26/2001 to 04/06/2001**



**FIGURE 5 IBM 5min Noise Channel System Chart  
Out-Of-Sample 03/26/2001 to 04/06/2001**

