A Day Trading Strategy: The Gap System

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Trading stocks on days when they have a massive opening gap

- One casually observes that a stock opening up or down several times its average daily price movement tends to be actively traded early in the day and move in big intraday trends.

- We hypothesize the following:

  1. Since the gap is due to an "information innovation", i.e. an unexpected and dramatic stock-specific event, the opening price is likely to be "wrong".

  2. The larger the opening gap, the greater the uncertainty in the opening price and the greater the chance of it being "wrong".

  3. The market then adjusts *by trending* to the "right" price over the course of the day.

  4. The increased liquidity demands amplify the trends much more than on no-gap days, allowing them to be traded profitably.

- Using trading strategies as statistical diagnostics, we study the post-gap price behavior of several hundred large cap stocks. We determine if post-gap prices tend to travel in the direction of the gap or counter to it.

Do post-gap prices follow the gap or counter it?

- The simplest strategy is to buy a stock when it gapped up and short it when it gapped down. This assumes that the market tends to underreact to the information that produced the gap.

- The following *Follow Gap At Open* strategy is backtested using 1-minute bars on 231 large cap stocks from 7/3/2002 to 2/17/2005:

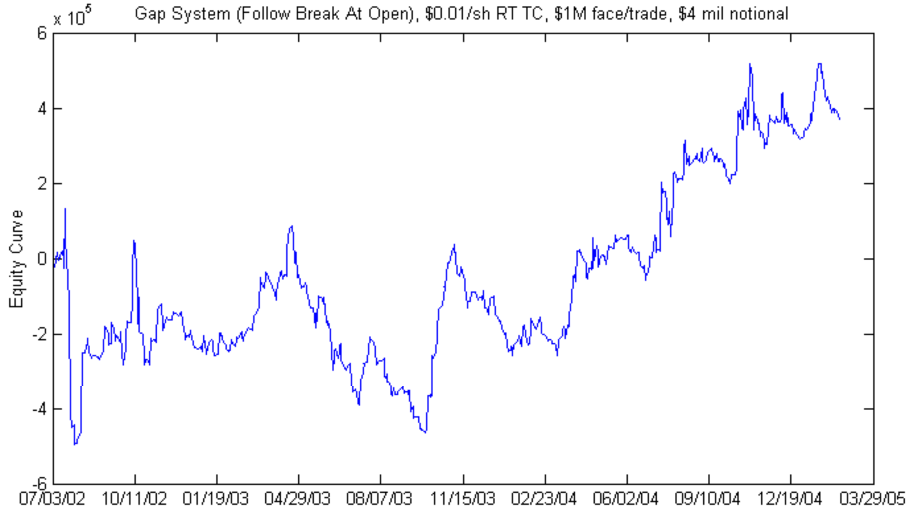
  Long strategy:

  If the difference between the opening price and the previous day's close is greater than 2.75 times the exponential average of the absolute daily close-to-close changes (with a 0.01 smoothing factor), then buy 1 minute after the opening. Sell out the position if the price breaks a 15-minute low.

  Short strategy:

  If the difference between the opening price and the previous day's close is less than -2.75 times the exponential average of the absolute daily close-to-close changes (with a 0.01 smoothing factor), then sell short 1 minute after the opening. Buy to cover the position if the price breaks a 15-minute high.

  Only one trade is permitted on any given day.



Gap System (Follow Break At Open)	
Mean gross profit per 2 shares traded	$0.033
Mean gross profit per share per round turn (long trades only)	$0.021
Mean gross profit per share per round turn (short trades only)	$0.045
Mean trade duration (minutes)	31
Max trade duration (minutes)	167
Success rate (gross profit)	44%
Success rate (long trades, gross profit)	48%
Success rate (short trades, gross profit)	45%
Win/loss ratio (gross)	1.1

The direction of the opening gap is not a good trading signal

- The *Follow Gap At Open* strategy is neither profitable nor consistent enough to be traded in practice. The $0.033 gross profit per round turn may not be viable after slippage costs.

- Although prices do follow the opening gap more often than not, the direction of the gap on its own is not a good trading signal.

Gap System (Follow Break At Open), $0.01/sh RT TC, $1M face/trade, $4M notional, DayTrac								
	1M	3M	6M	9M	12M	24M	36M	
min	-4.39	-6.33	-9.23	-5.73	-5.67	11.59	0	
max	11.55	7.43	12.99	18.03	17.26	18.46	0	
std	3.34	4.29	5.05	6.6	7.07	2.41	0	
r/r	0.16	0.66	1.72	2.25	3.21	28.96	0	
%pos	0.5	0.68	0.8	0.68	0.84	1	0	
%neg	0.5	0.32	0.2	0.32	0.16	0	0	
avg+	2.89	4.13	5.16	8.69	8.33	14.24	0	
avg-	-1.84	-3.64	-2.93	-3.04	-2.97		0	
avg	0.52	1.63	3.54	4.96	6.54	14.24	0	
Annual:								
2002	-5.26							
2003	1.71							
2004	12.12							
2005	1.19							
CARR	8.37							
R/R	0.71							
skew	1.23							
STD	11.86							
5 worst drawdowns:								
	DD	Begin	End	Dur(M)	Recovery			
1	-10.46	20030429	20030930	8	2			
2	-5.48	20031031	20040430	9	4			
3	-4.98	20041029	20041129	2	0			
4	-2.44	20021127	20030226	5	3			
5	-1.19	20040528	20040630	2	2			
Avg DD:	-4.91							

The *Follow Gap Breakout from Opening Range* Strategy

- **The key to trading opening gaps is to define an *opening range.***
- The market heuristic is that in the first few minutes after a gap opening, market participants sort out the direction in which the stock price will move.
- The opening range is the bracket formed by the highest and lowest prices transacted during these few minutes.
- A decisive breakout from the opening range determines the direction of adjustment to the "right price" given the information innovation that caused the opening gap.

The opening range helps filter out false reversals and false follow throughs after the opening gap.

The opening range dramatically improves trading of opening gaps

- The *Follow Gap Breakout from Opening Range Strategy* incorporates the opening range as described below:

  The opening range is defined to be the highest and lowest prices observed in the first 10 minutes of the trading session.

  Long strategy:

  If the difference between the opening price and the previous day's close is greater than 2.75 times the exponential average of the absolute daily close-to-close changes (with a 0.01 smoothing factor), then wait for the opening range to be established and buy on a stop price equal to the high of the opening range. If a position is established, sell it out if the price breaks a 15-minute low.

  Short strategy:

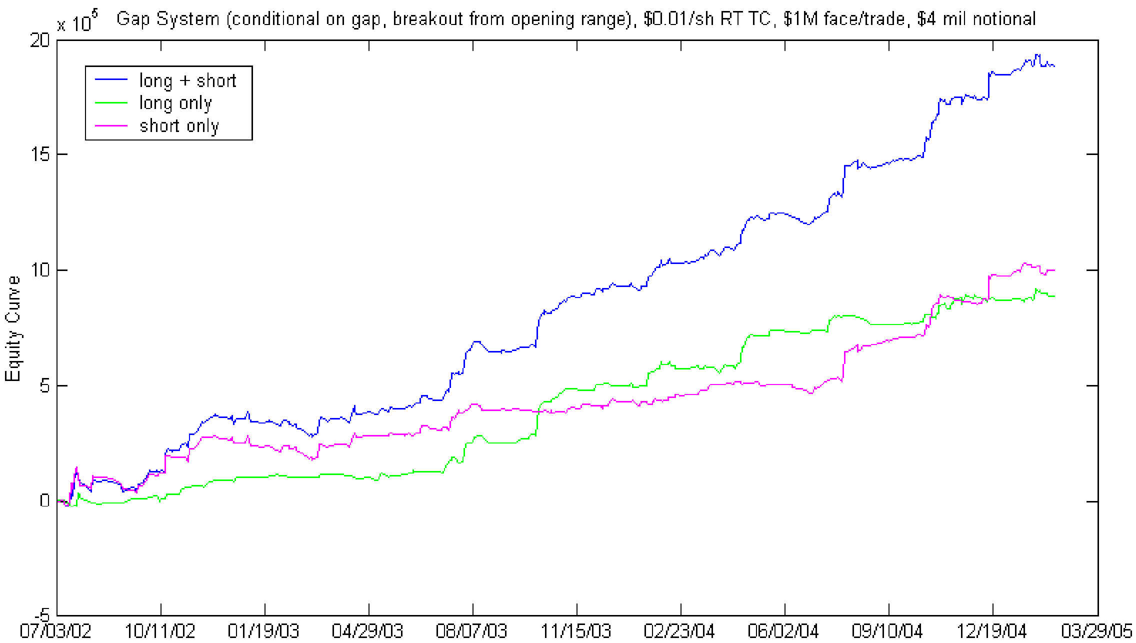
  If the difference between the opening price and the previous day's close is less than -2.75 times the exponential average of the absolute daily close-to-close changes (with a 0.01 smoothing factor), then wait for the opening range to be established and sell short on a stop price equal to the low of the opening range. If a position is estabished, buy to cover it if the price breaks a 15-minute high.

  At most one trade is permitted on any given day.

- **The idea is that a breakout from the opening range in the same direction as the opening gap confirms the trading signal.**

The opening range dramatically improves trading of opening gaps

- The *Follow Gap Breakout from Opening Range Strategy* has an admirable success rate (insofar as it is a trend following strategy) and a very high win/loss ratio:



Gap System (follow gap, breakout from opening range)	
Mean gross profit per round turn	$0.107
Mean gross profit per share per round turn (long trades only)	$0.100
Mean gross profit per share per round turn (short trades only)	$0.115
Mean trade duration (minutes)	28
Max trade duration (minutes)	149
Success rate (gross profit)	50%
Success rate (long trades, gross profit)	54%
Success rate (short trades, gross profit)	49%
Win/loss ratio (gross)	2.0
Average # trades per day (for 231 stocks)	2

A gross profit of $0.11 per share is likely to be viable after slippage costs.

The opening range dramatically improves trading of opening gaps

- A gross profit of $0.11 per share is exciting because of the fabulous advantages of day trades:
    1. No overnight/gap risk
    2. No need to finance positions means extra return from not having to pay the debit/credit spread
    3. Practically infinite intraday leverage
    4. P/L is clean since there are no dividends and other accruals.

Gap System (follow gap, breakout from OR), $0.01/sh RT TC, $1M face/trade, $4 mil notional								
	1M	3M	6M	9M	12M	24M	36M	
min	-1.25	-1.4	0.95	7.19	13.45	33.81	0	
max	6.59	9.2	15.41	19.54	22.85	39.89	0	
std	1.99	2.38	3.47	3.57	3.21	2.51	0	
r/r	0.75	3.39	6.43	11.64	20.24	71.55	0	
%pos	0.77	0.93	1	1	1	1	0	
%neg	0.23	0.07	0	0	0	0	0	
avg+	2.1	5.06	9.12	13.86	18.77	36.63	0	
avg-	-0.47	-0.7					0	
avg	1.5	4.65	9.12	13.86	18.77	36.63	0	
Annual:								
2002	8.85	half year return						
2003	14.42							
2004	22.81							
2005	0.79							
CARR	17.51							
R/R	2.56							
skew	1.09							
STD	6.83							
5 worst drawdowns:								
	DD	Begin	End	Dur(M)	Recovery			
1	-1.4	20021129	20030331	6	3			
2	-1.25	20050131	20050131	0	0			
Avg DD:	-1.32							

A high Sharpe ratio and low drawdowns are hallmarks of this strategy.

Opening range without conditioning on gap does not work

- As a control, we backtest a strategy that trades the breakout from the opening range every day without conditioning on the occurrence of an opening gap.

- The strategy is as follows:

  The opening range is defined as the highest and lowest prices observed in the first 10 minutes of the trading session.

  Long strategy:

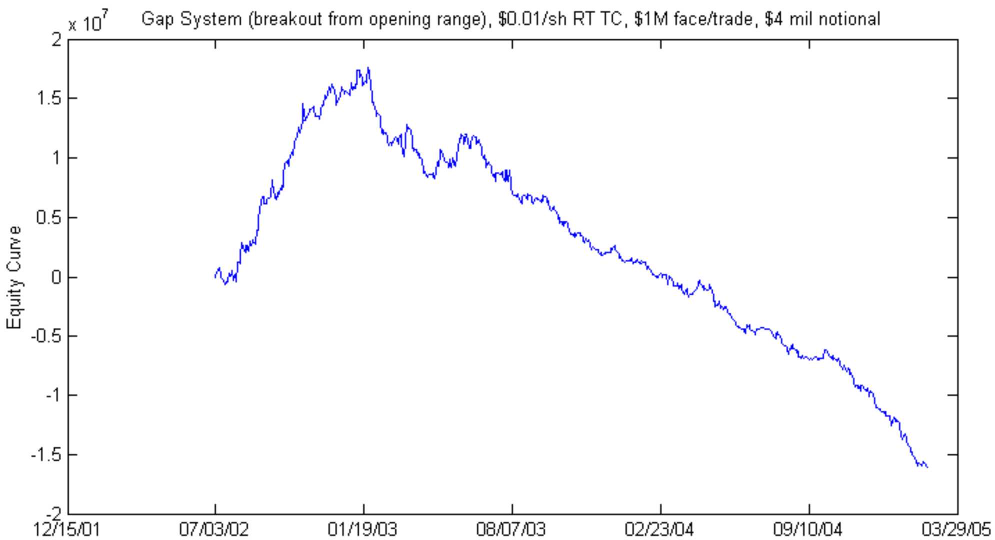
  Wait for the opening range to be established and buy on a stop price equal to the high of the opening range. If a position is established, sell it out the position if the price breaks a 15-minute low.

  Short strategy:

  Wait for the opening range to be established and sell short on a stop price equal to the low of the opening range. If a position is estabished, buy to cover it if the price breaks a 15-minute high.

  At most one trade is permitted on any given day.

- This strategy is not profitable after assumed transaction costs. This attests to the efficacy of the dual conditon of gapping and breaking out of the opening range.



Gap System (breakout from opening range, no gap condition)	
Mean gross profit per 2 shares traded	$0.013
Mean gross profit per share per round turn (long trades only)	$0.010
Mean gross profit per share per round turn (short trades only)	$0.015
Mean trade duration (minutes)	24
Max trade duration (minutes)	223
Success rate (gross profit)	39%
Success rate (long trades, gross profit)	38%
Success rate (short trades, gross profit)	39%
Win/loss ratio (gross)	1.1
Average # trades per day (for 231 stocks)	311

The *Counter Gap Breakout from Opening Range* Strategy

- A breakout from the opening range in the direction opposite to that of the opening gap can sometimes be a good reversal signal.

- This *Counter Gap Breakout from Opening Range Strategy* is as follows:

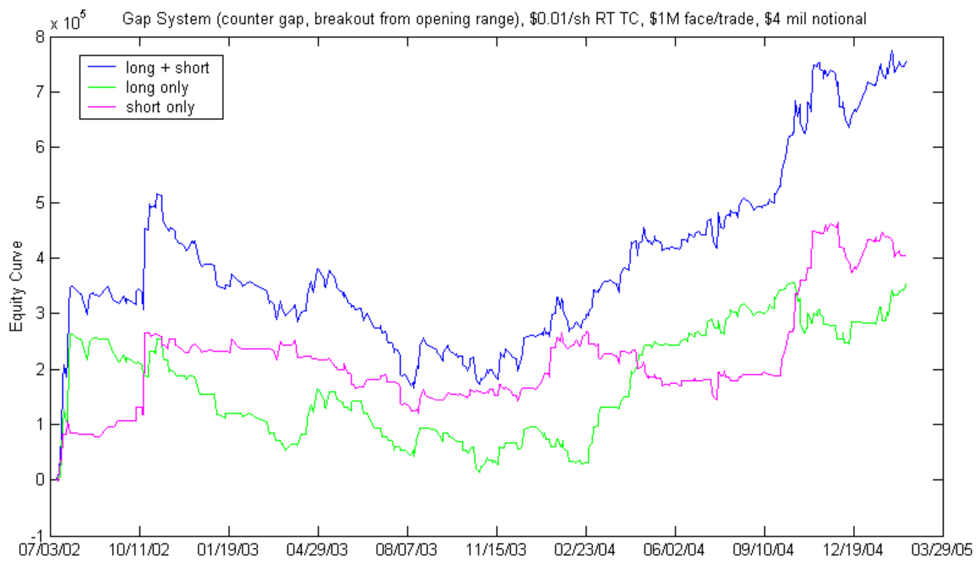
The opening range is defined to be the highest and lowest prices observed in the first 10 minutes of the trading session.

Long strategy:

If the difference between the opening price and the previous day's close is greater than 2.75 times the exponential average of the absolute daily close-to-close changes (with a 0.01 smoothing factor), then wait for the opening range to be established and sell short on a stop price equal to the low of the opening range. If a position is established, buy it to cover if the price breaks a 15-minute high.

Short strategy:

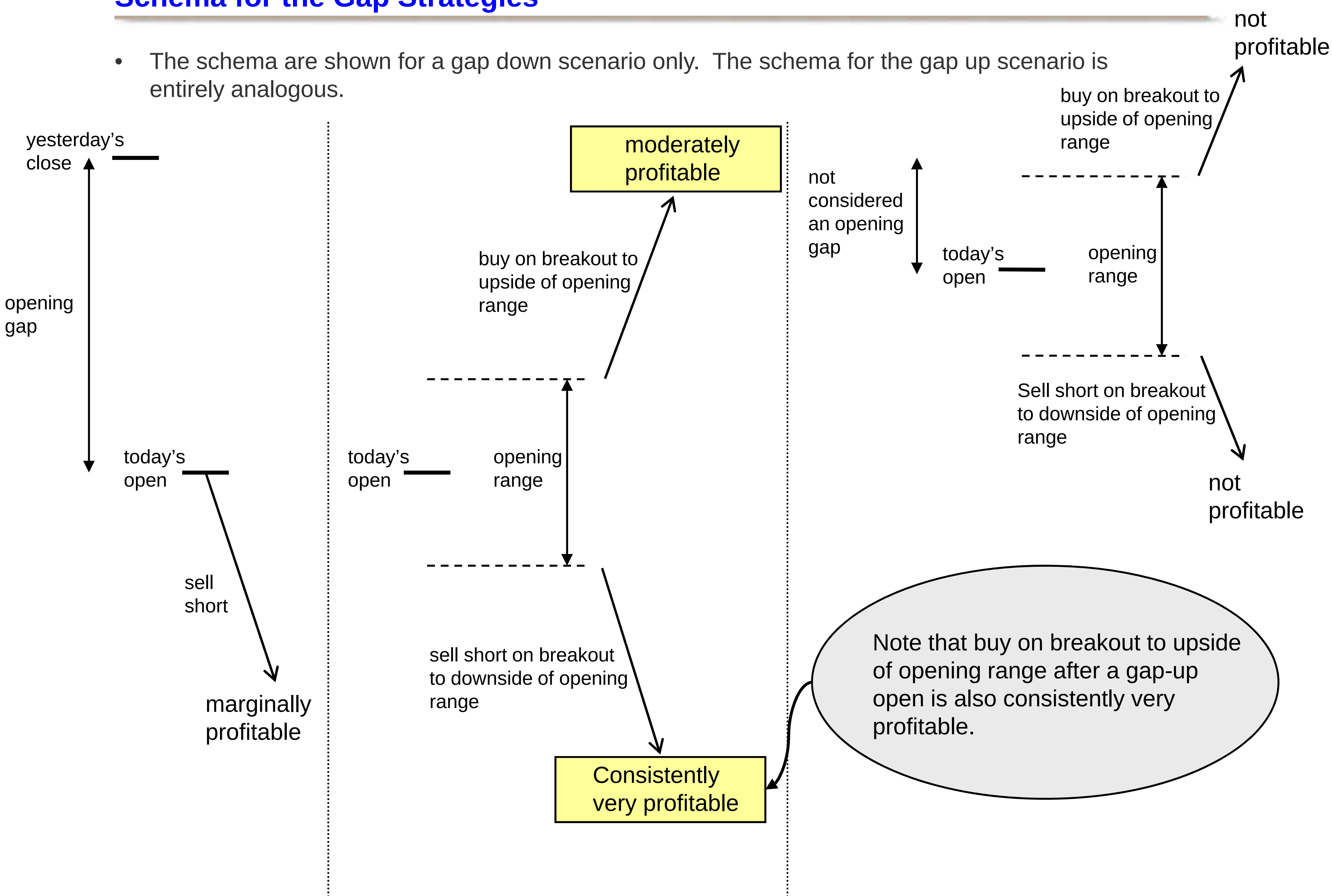
If the difference between the opening price and the previous day's close is less than -2.75 times the exponential average of the absolute daily close-to-close changes (with a 0.01 smoothing factor), then wait for the opening range to be established and buy on a stop price equal to the high of the opening range. If a position is estabished, sell it out if the price breaks a 15-minute low.



Gap System (counter gap, breakout from opening range)	
Mean gross profit per round turn	$0.057
Mean gross profit per share per round turn (long trades only)	$0.057
Mean gross profit per share per round turn (short trades only)	$0.056
Mean trade duration (minutes)	26
Max trade duration (minutes)	139
Success rate (gross profit)	44%
Success rate (long trades, gross profit)	41%
Success rate (short trades, gross profit)	45%
Win/loss ratio (gross)	1.4
Average # trades per day (for 231 stocks)	2

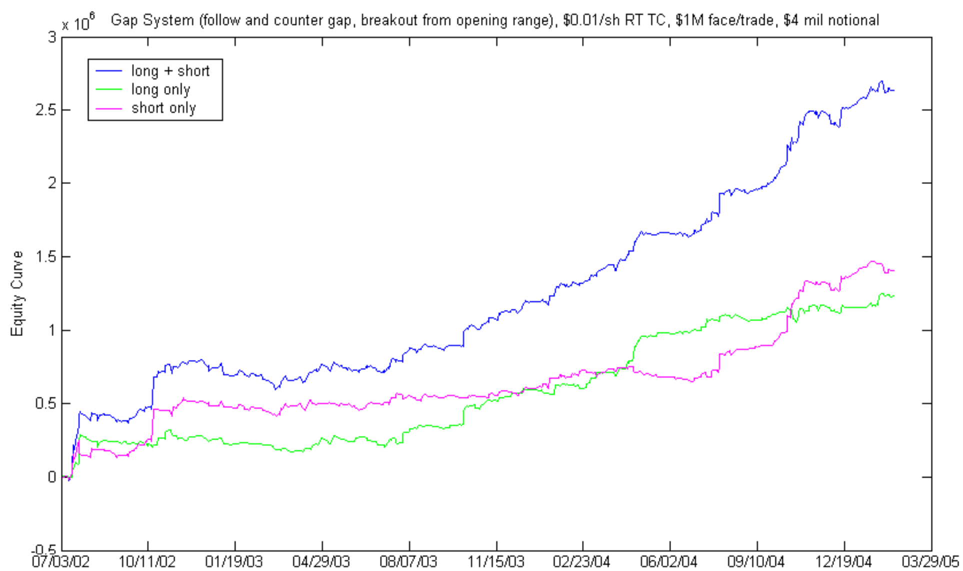
Schema for the Gap Strategies

- The schema are shown for a gap down scenario only. The schema for the gap up scenario is entirely analogous.



Increase profits by combining Follow Gap and Counter Gap strategies

- The *Follow Gap Breakout from Opening Range* and the *Counter Gap Breakout from Opening Range* strategies are *not* logical opposites (the fact that one makes money does not mean the other will lose money).
- Combining both strategies increases profits because the number of trading opportunities per day increases.



Gap System (follow and counter gap, breakout from opening range)	
Mean gross profit per round turn	**$0.080**
Mean gross profit per share per round turn (long trades only)	**$0.078**
Mean gross profit per share per round turn (short trades only)	**$0.083**
Mean trade duration (minutes)	**27**
Max trade duration (minutes)	**149**
Success rate (gross profit)	**47%**
Success rate (long trades, gross profit)	**47%**
Success rate (short trades, gross profit)	**47%**
Win/loss ratio (gross)	**1.7**
Average # trades per day (for 231 stocks)	**3**

Gap System (follow and counter gap, breakout from OR), $0.01/sh RT TC, $1M face/trade, $4

	1M	3M	6M	9M	12M	24M	36M	
min	-1.66	-3.33	-1.24	1.78	6.97	37.97	0	
max	9.65	13.58	20.85	28.37	34.66	50.27	0	
std	2.77	4.14	6.55	8.4	9.41	4.72	0	
r/r	0.67	2.33	4.09	5.84	8.15	45.3	0	
%pos	0.73	0.89	0.92	1	1	1	0	
%neg	0.27	0.11	0.08	0	0	0	0	
avg+	2.8	6.51	11.95	16.35	22.14	43.62	0	
avg-	-0.75	-2.36	-0.77				0	
avg	1.85	5.56	10.94	16.35	22.14	43.62	0	
Annual:								
2002	18.59	half year return						
2003	11.13							
2004	32.98							
2005	3.09							
CARR	21.46							
R/R	2.26							
skew	1.24							
STD	9.52							
5 worst drawdowns:								
	DD	Begin	End	Dur(M)	Recovery			
1	-3.33	20021129	20030630	11	7			
2	-1.66	20050131	20050131	0	0			
Avg DD:	-2.5							

Minimizing slippage is key to success of the Gap Strategies

- The Gap Strategies are truly statistical strategies, since gaps only occur sparingly on any given stock, but there are on average about 1 gap per 100 stocks per day.

- It is hard to judge whether the strategy works when it is tested only it on one stock. When it is applied to many stocks, one gets a statistically steady stream of profits even though the trading jumps from stock to stock.

- While the Gap Strategies are simple, their implementation must be sophisticated since minimizing slippage is the key to their success.

- I surmise that by tracking tick-by-tick prices, it is possible to discern very short term liquidity flows on the scale of seconds. This information can be used to improve the execution of stop orders.