

Using SAS® as a Definitive Tool in Stock Market Analysis

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ABSTRACT

The "truth" of the stock market is that price movement of equities is controlled by the forces of supply and demand. Since the data of supply and demand is readily available in terms of daily summaries of stock price movements and since the data is voluminous, SAS® software is a fine choice as a tool to apply definitive measures to recent price history. Given the price ranges and the trading volume from day to day, this simple program can derive relative strong areas of both supply and demand in relation to the current price. This summary can be acted upon in terms of whether to buy, sell, or hold.

INTRODUCTION

The purpose of this paper is to demonstrate a simple SAS program effectively noting areas of supply and demand given daily price information from the stock market. It is left to the reader to apply further analysis in terms of portfolio management.

FIRST AND FOREMOST

I have read far more than my fair share of books on the stock market over the years. Of all the advice offered, precious little stems from the only truthful data stemming from the markets – the price and volume of the actual buying and selling. Any advice, wisdom, or so-called "truth" from a study of the stock market not taking into account the fundamentals of supply and demand is merely conjecture.

Complex theories abound as to the driving force in a free market. Every person involved can and will have a unique perspective on what constitutes a fair market value on a given equity. Attempting to keep ahead of the rationale of all the participants in a market as vast as the stock market is a daunting task to say the least. However, the study of their actual decisions is far more manageable as the price and volume of each transaction is recorded. The grouping of these transactions forms the greater picture of supply and demand.

It is the most basic economic theory of supply and demand that holds the most power when studying the stock market. Supply equates to those willing to sell at the current price and demand equates to those willing to buy. The truth is that prices simply cannot rise unless the forces of demand are stronger than the forces of supply.

SAS® software is a tool primarily used to make definitive statements about data. The group of transactions over time of a given equity in the stock market make up data from which definitive statements can be made. This is because this data represents the only pure truth derived from this equity. These are the actual decisions being made by the myriad of buyers and sellers. This is not their rationale, reasoning, or emotional state. These are the real decisions based on fear, greed, or hope. This data can be transformed into areas of supply and demand – the truth of the markets.

For example, witness an equity trading at about the same price for quite a few days. Suddenly the price jumps and continues to rise at a steady pace. Some time later, this trending up in price slows and the price suddenly drops back to the price level seen during the first observation. During the initial time when the trading was constricted to a tight price range, it is clear the forces of supply and demand are equal. The buyers cannot buy enough to overcome demand and the sellers cannot sell enough to

overcome supply. The price jump verifies the buyers have eventually won. Either their forces increased or the sellers diminished. As the price topped out and dropped back down the conclusion drawn is that the buyers lost their steam and supply had overcome demand. As the price approached the area of first consolidation it is known that this was an area of previous demand. If recent price history shows more demand below than supply overhead, the price is likely to succumb to the forces of demand and again rise. Given a program to effectively evaluate areas of previous supply and demand, the investor can make insightful decisions on where to buy and sell.

A MATTER OF PERSPECTIVE

After acceptance of supply and demand as the reason for price movement, the next lesson is one of perspective. Prices in the stock market bounce around quite a bit in a short period of time. What is one transaction among all taking place during the day? It is the same as the daily activity compared to the full history of the equity. Perspective must be respected. Volatility can be more readily accounted as the volume of source data increases. The stock market churns out a great volume of data. It is no secret that SAS is a great tool when dealing with large volumes of data.

The transaction data stemming from the equities of the stock market has normally already been summarized up to a particular time frame. The most common example is the daily summary for a stock. The record containing the daily summary of a stock during a trading day contains the opening, closing, high, and low price of the day as well as the overall trading volume in number of shares. This simple data provides the best means for assessing the current status of a stock in terms of whether it has been moving up, down, or sideways. This data is often displayed in the form of a stock market chart showing the price action over a period of time. For those not adept at reading stock market charts, a clear assessment of the current state of the stock can be derived using simple logic.

In the most simple of terms, a relatively constant demand greater than supply will manifest itself in a stock chart showing an upward trend over time. A stock chart showing a downward-sloping trend is evidence of a relatively constant supply of sellers exerting more pressure than the relatively constant demand from the buyers. A chart showing no clear trend is the norm showing the battle between supply and demand with no clear victor.

Again, perspective is imperative before proceeding. The 'current state' of a stock is only applicable in the time frame of note. Given only three days worth of data where the stock has gone up in price each day, it is easy to derive that the stock is trending up but it is folly to act upon such information without considering the larger time frame. As noted before, the larger the sampling of data, the more definitive the derived conclusion from that data. If during the previous month or year that stock had fallen rather precipitously in price, that three-day rally may have been nothing more than a temporary reprieve from another price decline. The conclusions derived can only apply in terms of the time frame examined.

Given stock market equity transaction data, sufficient sample size is itself a matter of perspective. This perspective depends on the level of attention paid to the stock market itself. For the investor who pays attention to equities of interest on a daily basis, the correct time perspective is in terms of days and therefore the sample size should be at least a few months of recent daily price action. For the active trader who monitors the stock market

whenever it is open, the correct time perspective should be intra-day. They might require a sufficient sample size of hourly history data or perhaps even minute-by-minute if they are so keen as to focus this level of attention. For our purposes, we will focus on the most common time perspective – that of daily transaction data.

THE SAS APPLICATION

The SAS program presented is nothing more than a simple tool categorizing the previous daily price history of a stock to note areas of supply and demand given the current price. In terms of stock market price action, previous price congestion areas below the current price are known as support as they offer buoyancy to the price should it fall. Previous price congestion areas above the current price are known as resistance as the price should meet resistance to further upward movement given all the transactions which have occurred at a higher price. A stock with a recent price history where the relative support exceeds the relative resistance is likely to continue to rise as the forces of demand are stronger than the forces of supply. A stock with a recent price history where the relative resistance exceeds the relative support is likely to continue to fall in price as the sellers hold a stronger influence than the buyers.

The key is relative measures. No program (SAS or otherwise) is ever going to be developed to provide specific and accurate buy and sell recommendations given recent price measures. The stock market cannot be modeled as each moment is unique with a constantly changing array of participants and motives. However, you can take note of recent activity and act accordingly. Although previous price action is no guarantee of future price action, utilizing a tool such as the SAS program presented here does provide a concise and definitive statement in the ever-changing story of supply and demand.

The input parameters to the program consist of the name of the data set containing the daily transaction summary of the stock of note and a parameter noting the number of divisions requested. The name of the input data set also functions in the title of the reports and is assumed to be the name of the equity from which the transaction data emulates. Web sites such as the finance page at Yahoo provide historical price summary data in the form of a spreadsheet which can be easily loaded into a SAS data set. The fields available from Yahoo are the transaction date, the open, high, low, and closing price for the day as well as the total trading volume for the day. These fields are the standard daily stock summary fields.

The second program parameter (named 'parts' in the code) represents the level of dissection of recent price action. The default value is to break recent price action into ten equal parts. The minimum breakdown is two equal parts and the maximum breakdown is 100 equal parts. The higher the number for this parameter, the tighter the focus on support and resistance levels in recent price action. A tighter focus is not necessarily a good thing as support and resistance levels rarely conform to exact prices, but rather ranges within the overall price range. A good guideline is to match this parameter the level of risk management followed by the investor.

```

/*****
* Mike Tangedal Summer 2003
*
* Support Resistance macro (supres)
* - This macro identifies the support and
* resistance areas in a daily stock market
* transaction file and displays this
* information in a simple report
* Input Parameters
* - parts: Number of specified equal

```

```

* regions covering the entire price range
* of the specified stock.
* Allowable range is from 2-100 and default
* range is 10
* - indset: Name of the input data set
* containing the daily stock transaction
* data.
* Required fields are date, high, low,
* close, and volume
*****/
%macro supres(parts=10,indset=qqq);
* Minimum allowable # of partitions is 2;
  %if &parts < 2 %then %let parts=2;
  * Maximum # of partitions is 100;
  %else %if &parts > 100
    %then %let parts=100;

```

ASSESSMENT OF SOURCE DATA

The first section of the program traverses the input data set to determine the price range of the recent price data. From this is calculated the minimum transaction price from the data set as well as the maximum transaction price. The 'break' is calculated as the price range divided by the number of 'parts' specified by the user. Also derived is the minimum trading volume.

One can easily surmise that the 'break' can evaluate to quite a wide price range if the number of 'parts' specified is small and the evaluated equity's price has varied quite a bit of late. Tightening up this range to a more manageable level is a function of risk management as noted before. For example, given a stock which has ranged from \$40 a share to \$60 a share in recent months, setting the 'parts' parameter to the default value of 10 would result in each 'break' being \$2 wide (as the range of \$20 (\$60 - \$40) divided by 10 equals \$2). For the investor who is willing to risk price fluctuations of up to \$2 without concern, this setting would be fine. However, if the level of attention the investor was willing to devote to the stock activity was such that adjustments of \$1 a share could be acted upon, then the 'parts' parameter would be set to a higher value of 20. The 'parts' parameter is positively correlated with degree of risk management with the investor as well as level of interest in price action.

```

**** read input data set to determine
overall price range and trading volume;
data _null_;
  set &indset
    (keep = high low volume) end=last;
  low = low * 100;
  high = high * 100;
  retain minprice maxprice minvol;
  if _n_ = 1 then do;
    minprice = low;
    maxprice = high;
    minvol = volume;
  end;
  else do;
    minprice = min(minprice,low);
    maxprice = max(maxprice,high);
    minvol = min(minvol,volume);
  end;
  if last then do;
    minprice = floor(minprice);
    minvol = round(minvol);
    break = round(
      (maxprice-minprice)/&parts,1);
    call symput
      ('minprice',put(minprice,8.));
    call symput('break',put(break,3.));
    call symput('minvol',put(minvol,8.));
  end;

```

```
run;
```

MOST RECENT INFORMATION FIRST

After the range of the recent price action is derived, the next step in the process is to ensure the data is sorted from the most recent date back to the earliest date of note. Recent price action holds more influence than older price action.

```
**** sorting is required to place most
recent date first;
proc sort data = &indset;
by descending date;
run;
```

DETERMINE SUPPORT AND RESISTANCE LEVELS

The next step is to create a data set summarizing recent price action to create a definitive picture of support and resistance levels at the latest equity price. This is done through evaluating each day's price action and updating each variable in the arrays set up to cover each calculated price range. A stock trading heavily at a certain price would contribute more relative focused influence than a stock trading lightly over a wide price range.

'Relative influence' is a subjective term and must be applied within context just as any assessment of stock price action must be taken within context. The assumption here is that a trading volume five times that of previous trading volume at a particular price will exude five times the amount of influence in later price action. All other influences being equal, since five times the number of buyers and sellers came to agreement at that particular price vs. prices relatively above or below, it should be expected that price will hold significant influence in the near future.

The other major assumption here is that trading volume is equally spread across the daily price range. This is simply not true in most cases as trading volume near the opening price and closing price are historically higher than other times during the trading day. Although the transactions during the day were most likely not evenly dispersed across this price range, this assumption will not cause undue influence given a sufficient sample size. Exceptionally volatile equities would not fit under this assumption.

The 'relative influence' within each calculated price range is a function of daily price action, trading volume, and days in the past. The relative trading volume is divided by the number of price ranges punctured by the daily price action. Since the influence of historical data diminishes on roughly a logarithmic scale, the 'relative influence' is adjusted by the number of days in the past from the latest date. This is set to the degree that daily information from one year in the past exhibits half the influence on current daily price information.

```
**** calculate relative support/resistance
for each equal price range;
data results
(keep=enddate closeprice range_low
range_high significance category
adjvol pctchange);
set &indset end=last;
** latest reported date and latest price
are retained from first observation;
retain enddate closeprice;
if _n_ = 1 then do;
format enddate date9.;
enddate = date;
closeprice = close;
end;
**** prices are multiplied by 100 to
adjust for dollars and cents;
low = low * 100;
```

```
high = high * 100;
**** variables initialized to be
calculated for each price range;
length category $10;
array break(&parts);
array bottom(&parts);
array top(&parts);
**** volume is adjusted against minimum
trading volume seen;
adjvol = volume / &minvol;
**** the number of price ranges penetrated
by each daily price activity is calculated;
rangecnt = 0;
**** the count of each day into the past
is maintained to adjust the significance
of that days price action accordingly;
retain daycount 0;
**** for each price range, the minimum and
maximum price are calculated;
do i = 1 to &parts;
bottom{i} = &minprice + ((i-1)*&break);
top{i} = &minprice + (i*&break);
**** if the daily price range exceeds
the calculated price ranges,
the count is accumulated;
if high ge bottom{i} and low le top{i}
then rangecnt + 1;
end;
**** the volume is further adjusted to
account for each price range
penetrated;
adjvol = adjvol / rangecnt;
**** for each price range the influence is
calculated as adjusted volume
multiplied by the significance of that
day;
do i = 1 to &parts;
if high ge bottom{i} and low le top{i}
then break{i} +
(adjvol * exp(-0.0025 * daycount));
end;
**** for each day back into history, the
significance is adjusted accordingly;
daycount + 1;
**** upon completion of calculating the
significance of each day, a data set is
created for reporting purposes;
if last then do;
minbreak = break{1};
**** adjust significance to relative
numbers;
do i = 2 to &parts;
minbreak = min(break{i},minbreak);
end;
do i = 1 to &parts;
range_low = bottom{i}/100;
range_high = top{i}/100;
significance = break{i}/minbreak;
**** percent change is shown to
identify peaks in relative
support/resistance;
if i = 1 then pctchange = 0;
else pctchange =
(abs(significance
-(break{i-1}/minbreak))
/ (break{i-1}/minbreak));
**** Category is set to Support if
current price is above the price
range and set to Resistance if the
current price is below the price
```

```

range;
if closeprice > range_high then
  category = 'Support';
else if range_low le closeprice le
  range_high then
  category = 'Within';
else category = 'Resistance';
output;
end;
end;
run;

```

REPORT RESULTS

The resulting report is purposely simple. An overly sophisticated presentation of the results may focus attention on the one most obvious result and not the summary as a whole. The summary as a whole lists the ending date and the closing price for the stock data provided. Then listed are all calculated price ranges along with Significance, Percent Change, and Category. Significance is defined as a relative measure of that calculated price range within the price history of the data. The minimum value is always 1. Therefore a value of 2.5 means that 2.5 times as many buy and sell transactions occurred within that price range than the minimum. A value of 5.0 would mean twice as many transactions occurred than a value of 2.5. The percent change is relative to each successive Significance value. A significant jump in percent change from one price range to the next equates to a potential line of support/resistance. Category is set to 'Resistance' if the closing price is below the price range of note, 'Support' if the closing price is above the price range of note, and 'Within' if the closing price is within the price range of note.

```

title "Support and resistance results based
on daily data from &indset";
title2 "Calculated price range of &break
cents";
proc print data = results noobs label;
  by enddate closeprice;
  id enddate closeprice;
  format closeprice range_low range_high
    dollar6.2
    significance 5.2 pctchange percent9.1;
  var range_low range_high significance
    pctchange category;
  label range_low = 'Range Low'
    range_high = 'Range High'
    significance = 'Significance'
    pctchange = 'Percent Change'
    category = 'Category'
    enddate = 'Ending Date'
    closeprice = 'Closing Price';
run;
proc datasets nolist;
  delete results;
  quit;
title;
footnote;
&mend;

```

CONCLUSION

Creating this table from a list of daily transactions from a particular stock will not provide a definitive answer as to whether to buy, sell, or hold a stock. However, it certainly can be used to validate actions taken and more importantly – actions not taken. For example, if in consideration to purchase an equity this program is run on the latest daily transaction data and the results show the Resistance levels with higher Significance levels than the current Significance level and also higher than the Significance levels just below, then obviously a more prudent action would be to not purchase the stock at that time. The

levels of resistance are much higher than the levels of support. The recent selling pressure has exceeded the recent buying pressure. Unless assurances are known that this has changed, one should conclude the selling pressure would continue should the price move up.

Conversely, a lack of Resistance is not necessarily a green light to buy an equity. For example, if the execution of this program shows a report with no resistance at all, it is known that the current price must be near the high price for the daily range provided. If the Support levels below the current price are relatively high compared with all the other Significance levels, then a decision to buy might be warranted as the combination of significant support with no resistance equal higher prices. However, if the Support levels below the current price are relatively low compared to all the other Significance levels, then caution is warranted. When buying pressure diminishes, prices are more susceptible to fall.

Support and Resistance are simple concepts presented in a simplified manner in the resulting report from this program. However, proper interpretation of Supply and Demand levels is anything but simple. The level of Supply must be taken within the context of the level of Demand. The level of Demand must be assessed within the level of Supply. Both Supply and Demand levels from an individual stock should be assessed within the overall context of the state of the overall stock market. This SAS program can certainly be used as a tool to effectively assess the current state of a stock for the given time frame without the need for conjecture of outside opinion.

CONTACT INFORMATION

If you would like a copy of the code or would like to challenge my allegiance to support and resistance being the only 'truth' of the markets, your comments and questions are valued and encouraged. Contact

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