XMIM Analyst Guide

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Table of Contents

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This document was written with the intention of fusing trading theory with application by using analytical tools manipulating a time-series database. This guide offers step-by-step instructions on how to turn popular trading ideas into computer-driven models. The author assumes that the reader has a general financial knowledge base as well as a fundamental understanding of the XMIM software.

Pairs Trading

"Pairs Trading" is a type of arbitrage that first became popular about 20 years ago. Its methodology focuses around finding pairs of instruments that are similar in all aspects, both qualitative and quantitative. Rather than spending days sifting through 10K's trying to locate matches, most Pairs Traders have developed computer models which measure quantitative relationships to find pairs. Once a pair is determined, and the relationship quantified, the trader uses a hedge trade by going long one instrument and short the other as they deviate from their expected course. The trades will offset each other for the most part and the trader will decide which to weigh more heavily to realize the gains (some companies have made a lot of money off of the small differences by investing immense amounts of money.) The further they deviate, the higher the probability that they will snap back, the greater the propensity for gain, assuming that the pair was chosen accurately. Each system for picking pairs differentiate from one another on some level, wherein lies the creativity and mathematical knowledge of the analyst. Where to start?

Correlations

Correlations are one of the basis measurements for locating pairs. Without diving too deep into the mathematics, a correlation measures the degree to which prices move together based on a specified time range. The calculation returns a value between -1 and 1 (1 being perfectly positively correlated, -1 being perfectly negatively correlated, and 0 having no price correlation.) For example, if XMIM returns the value .75, then the two instruments move in the same direction about 75% of the time. If XMIM returns -.70, then the two instrument prices move in opposite directions 70% of the time.

```
SHOW
  1: 180 day correlation of YHOO and SUNW
WHEN
   Date is within 5 years
```

The above query will return the moving 180 day[1] correlation of Yahoo! and Sun Microsystems. In other words, XMIM will calculate the 180 correlation every day for the last 5 years for the two data series.

1 "180 days" is traditionally taught as a standard time frame for measuring a correlation. Again, it is important to note that measurement time frames will vary dependant upon the goals of the trader or his/her beliefs about market movements.

Once the analyst has discerned a pair, he can then use the ORDER screen in XMIM to back-test a particular trading scenario. It might look something like this:

```
1: ORDER
     1.1: Buy 1000 contracts of YHOO
   WHEN
       Date is after 1990
     AND
       180 day correlation of YHOO and SUNW crosses below 0.3
   EXIT
       Date is 1 week after entry_date
```

In plain terms, the above query uses the historical (moving) 180 day correlation of YHOO and SUNW as the sole buy and sell signal. It is a simple example and makes the assumption that SUNW and YHOO have been identified as a pair. The query simultaneously goes long 1000 shares of YHOO and short 1000 shares of SUNW when the correlation moves below 30%[2]. The pairs-trade allows for one week of corrective price action and then exits both trades.

XMIM can also be used to locate a highly correlated pair. For example, you can pick a single equity and then ask XMIM to search all the S&P Groups for the top 5 highest correlated groups. The way you would do this is to first define a variable equal to the entire subset of the S&P Groups and then put that variable in the correlation function.

```
LET
  SPgroups = TopRelation:Indices:S&P500Groups
TOP 5  180 day correlation of SPgroups and SUNW
SHOW
  1: 180 day correlation of SPgroups and SUNW
WHEN
  Date is SUNW last_data_day
```

We defined our variable "Spgroups" in the LET statement as all the S&P500Groups in the database. Then we told it to only return the TOP 5 highest correlations. In the SHOW statement, we want to see the correlations, and only on the most recent measurement which is the WHEN statement. XMIM will then, in a matter of seconds, rip through the correlation calculations for Sun Microsystems and 118 S&P Groups! The first answer we get (the highest correlated match) as you might have guessed is TECH.COMP that is the High-Tech Composite in the technology sector at a current 92% correlation:

```
Let variable values:
SPgroups=TECH.COMP
TOP 1 Using 0.921
      Date   Day          1

01/10/2002   Thu     0.9212

             Avg     0.9212
          AvgPos     0.9212
          AvgNeg        NaN
          PctPos   100.0000
          PctNeg     0.0000
         Maximum     0.9212
         Minimum     0.9212
          StdDev        NaN
           ZStat        NaN
```

2 The theory behind this signal is based on the belief that YHOO and SUNW have, or should have, a high historical correlation. If that correlation were to drop below a certain level, that could preclude the need for corrective price action in these two stocks.

```
        Variance        NaN
1 Occurrence
```

An important note to make here is that you are looking at the most current 180 day correlation which is only the most current measurement. It has no regard for the variance, standard deviation, or average of the historical moving correlation. If you wanted to see what the correlation looks like for the last 2 years instead of just the most current instance, you can run the query below:

```
SHOW
  1: 180 day correlation of TECH.COMP and SUNW
WHEN
  Date is within 2 years
      Avg     0.7905
   AvgPos     0.8219
   AvgNeg    -0.0433
   PctPos    96.3671
   PctNeg     3.6329
  Maximum     0.9706
  Minimum    -0.0735
   StdDev     0.2892
    ZStat     2.7333
 Variance     0.0836
523 Occurrences
```

You will notice that the average (Avg) of the moving 180 day correlation is significantly lower due to the fact that the user is taking into account 523 data points as opposed to just 1. It turns out that the two series are still at an 80% correlation with a small standard deviation therefore leaving the match still valid.

Exploring Historical Price Volatility

Volatility can be measured in a number of ways. The most common methods include standard deviation, variance, a day range (High – Low) and historical volatility calculations. Bollinger bands are one way to measure price volatility that incorporates the visual aspects of channels while having the versatility of moving averages. The bands are basically a group of moving averages set a defined number of standard deviations apart. The general theory is that prices will tend to stay within the bands until higher price volatility takes over, at which point, they may violate either the high or low band. This violation can be used as a signal for price movement.

Bollinger Bands

Three arguments are required to calculate a Bollinger band. The first is the instrument (an equity or future contract of choice). The second is the number of days over which to calculate the curve. As a rule of thumb, keep the number of days between 20 and 250. Anything under 20 days tends to be too reactive and anything over 1 year is generally too smooth. 180 days is a good starting point and is generally what is used in technical analysis texts. The third argument is the number of standard deviations that should generally be kept between

0.5 and 2.5. Anything under 0.5 will generate signals on low volatility and anything over 2.5 is probably too rare.[3] The greater the number of standard deviations used, the smaller the frequency distribution and the more volatile the security must be to reach one of the bands. Bollinger bands expand (i.e. the gap between the high and low band increases) during times of high volatility and contract during low price volatility. The query below shows a graph of Home Depot stock with 75 day Bollinger bands set at 1 standard deviation:

```
SHOW
  1: bollinger_high ( HD, 75 days, 1 )
  2: bollinger_low ( HD, 75 days, 1 )
  3: HD
WHEN
  Date is within 1 year
```

You can then translate this into a signal by asking XMIM what happens to Home Depot 1 week later when the daily price closes beneath its Bollinger low band in the last year.

```
 SHOW
     1: percent_move from today to 1 week later  of HD
   WHEN
       Date is within 1 year
     AND
       HD crosses below bollinger_low ( HD, 75 days, 1 )[4]
      Date   Day          1

02/22/2001   Thu     3.7500
03/14/2001   Wed    -0.2883
03/20/2001   Tue     3.5995
04/11/2001   Wed     9.9036
08/29/2001   Wed    -2.1489
10/04/2001   Thu     9.9770
10/29/2001   Mon     7.5867

             Avg     4.6257
          AvgPos     6.9634
          AvgNeg    -1.2186
          PctPos    71.4286
          PctNeg    28.5714
         Maximum     9.9770
         Minimum    -2.1489
          StdDev     4.7806
           ZStat     0.9676
        Variance    22.8540
7 Occurrences
```

While this type of query can have many different applications, when used alone, it does not account for the amount of time that the price spends below/above the Bollinger band. In other words, just because the price drops below a certain level, doesn't mean that it won't stay below that level. A much more interesting application of XMIM allows the analyst to measure the number of days, historically, that HD has been below its Bollinger low band. Then, based on the number of days HD has been down below that band, shows the reaction for the following week.

On a theoretical level, you are taking into account not only that the price has dropped below a particular level, but also the time that the price continues to trade under that level. XMIM will loop through all combinations

3 The range recommendations are mentioned for relative purposes, using daily data. They are not intended to set hard, fast rules for Bollinger bands. There are trading scenarios that will require more extreme values for standard deviation and number of days especially when using tick data.

4 HD is the stock ticker for Home Depot

of days down and return the week later moves for each. For example, when HD was down below its 75 day Bollinger low band for 4 days, it is up 92% of the time the following week (please see the following page.)

In the example below: the variable “sumit” basically loops through and sums up the number of days in a row that the price of “theSec” has been below the Bollinger band and records them. The variable “theNumb” tells XMIM the number of days to loop through. I set it to no more than 20 days because the occurrences of the price lingering below the Bollinger band longer than that are too sparse. 20 days is probably an over-estimation as the number of occurrences normally starts dwindling into the single digits around 15. Again, this will completely depend on the standard deviation you are using and the number of days you specify for the moving average.

```
LET
     theSec = HD

   LET
     ATTR mark = IF
                     theSec is less than bollinger_low ( theSec, 75 days, 1 )
                 THEN 1
                 ENDIF

   LET
     ATTR sumit = IF
                      mark is DEFINED
                    AND
                    1 day later
                      mark is not DEFINED
                  THEN sum from previous {
                         mark is not DEFINED }  to today of mark
                  ENDIF

   LET
     ATTR theNumb = 1 TO 20 BY 1

   SHOW
     1: sumit
     2: percent_move from today to 1 week later  of theSec
   WHEN
       sumit is exactly theNumb
theNumb = 4.000000

      Date   Day          1          2

11/01/1990   Thu     4.0000     4.2917
03/11/1992   Wed     4.0000     6.7346
04/29/1992   Wed     4.0000     2.8282
08/09/1994   Tue     4.0000    10.2485
05/19/1995   Fri     4.0000     1.5625
06/09/1995   Fri     4.0000    -1.2158
09/01/1995   Fri     4.0000     5.3125
09/15/1995   Fri     4.0000     1.5723
12/31/1996   Tue     4.0000     2.4938
08/10/1999   Tue     4.0000    11.3687
03/08/2000   Wed     4.0000     8.5714
10/09/2001   Tue     4.0000     9.8153

             Avg     4.0000     5.2986
          AvgPos     4.0000     5.8909
          AvgNeg        NaN    -1.2158
          PctPos   100.0000    91.6667
          PctNeg     0.0000     8.3333
```

```
 Maximum     4.0000    11.3687
 Minimum     4.0000    -1.2158
  StdDev     0.0000     4.0428
   ZStat        NaN     1.3106
Variance     0.0000    16.3442
```

12 Occurrences[5]

This technique gives the XMIM user more insight into the reaction of a security using a dynamic rather than a static signal. In other words, you can measure the duration of a signal through time instead of just one instance. This query can be augmented to use Bollinger high bands or other types of signals like moving average crossovers, correlations or spreads. For example, measure the number of days that a spread crosses above a certain level and show the following price reaction. You can also execute it using intra-day data and change "theNumb" to fractional instead of whole number increments thereby compiling answers on an hourly or even minute basis.

5 Answers are abbreviated