EFS02: Lecture Summary

Overview

- This lecture primarily focuses on building a strategy back-testing framework for basic quantitative and systematic ideas using spreadsheet software like Microsoft Excel.
- Excel is a quick and effective way to do hypothesis testing of a trading idea.
- We demonstrate the objective of the lecture using a breakout strategy based on ATR. Towards the end of the lecture, we covered how we can use data tables in Excel to optimize variables.

Excel Terminologies and Functions:

- Cell Range: A cell range is a combination of cells with one or more rows and columns. The range can be determined by using a colon (:) between cell references or by selecting the rows and columns manually. Refer to the examples below:

Date	Open	H
2021-03-29	12950.5	
2021-03-30	12904.0	
2021-03-31	12970.3	
2021-04-01	13268.9	
2021-04-05	13434.0	
2021-04-06	13567.2	
2021-04-07	13553.9	
2021-04-08	13730.7	
2021-04-09	13709.7	
2021-04-12	13792.7	
2021-04-13	13874.6	
2021-04-14	13988.9	
2021-04-15	13934.9	
2021-04-16	14036.0	
2021-04-19	13970.8	
2021-04-20	13892.0	
2021-04-21	13768.9	
2021-04-22	13920.9	
2021-04-23	13794.5	
2021-04-26	13954.9	
2021-04-27	14048.1	
2021-04-28	13953.6	
2021-04-29	14063.9	
2021-04-30	13857.8	
	=B2:B25	

The above example shows a cell range with a single column and multiple rows.

Date	Open	High
2021-03-29	12950.5	13013.5
2021-03-30	12904.0	12929.5
2021-03-31	12970.3	13167.1
2021-04-01	13268.9	13333.4
2021-04-05	13434.0	13623.6
2021-04-06	13567.2	13660.3
2021-04-07	13553.9	13648.8
2021-04-08	13730.7	13763.2
2021-04-09	13709.7	13849.3
2021-04-12	13792.7	13839.4
2021-04-13	13874.6	14002.5
2021-04-14	13988.9	13990.5
2021-04-15	13934.9	14040.1
2021-04-16	14036.0	14050.4
2021-04-19	13970.8	14025.6
2021-04-20	13892.0	13934.9
2021-04-21	13768.9	13939.7
2021-04-22	13920.9	13954.0
2021-04-23	13794.5	13989.4
2021-04-26	13954.9	14039.4
2021-04-27	14048.1	14048.3
2021-04-28	13953.6	13992.1
2021-04-29	14063.9	14073.5
2021-04-30	13857.8	13969.2
	=b2:c22	

Here, we see an example of multiple columns and multiple rows cell range.

Date	Open	
2021-03-29	12950.5	
2021-03-30	12904.0	
2021-03-31	12970.3	
2021-04-01	13268.9	
2021-04-05	13434.0	
2021-04-06	13567.2	
2021-04-07	13553.9	
2021-04-08	13730.7	
2021-04-09	13709.7	
2021-04-12	13792.7	
2021-04-13	13874.6	
2021-04-14	13988.9	
2021-04-15	13934.9	
2021-04-16	14036.0	
2021-04-19	13970.8	
2021-04-20	13892.0	
2021-04-21	13768.9	
2021-04-22	13920.9	
2021-04-23	13794.5	
2021-04-26	13954.9	
2021-04-27	14048.1	
2021-04-28	13953.6	
2021-04-29	14063.9	
2021-04-30	13857.8	

328941.8 ×

=SUM(B2:B25)

The above-mentioned snapshot shows how we can use a cell range in a function.

Functions:

"AND": It is a function under the logical category. If all the conditions satisfy to be TRUE, it returns TRUE else FALSE. Syntax:
=AND(*Cond1,Cond2*) returns *TRUE or FALSE*

"OR": It is a function under the logical category. If either of the conditions satisfies to be TRUE, it returns TRUE else FALSE. Syntax:
=OR(*Cond1,Cond2*) returns *TRUE or FALSE*

"SUM": It is a function under the math category. It returns the sum total of all the values passed to it. It is defined as
=SUM(*Num1,Num2...*) returns *Num1+Num2+....* **OR**
=SUM(*Cell Range*) returns *Sum of all the cells in Cell Range*

"COUNT": It is a function under the math category. It returns the count of the values given as parameters. It is defined as
=COUNT(*Num1,Num2...*) returns *Count of Num1, Num2,....*
=COUNT(*Cell Range*) returns *Count of all the cells in Cell Range*

"IF": It is a function under the Logical category. It takes logical condition/s and their respective outcomes. Based on the evaluation of the logical condition/s, the output is produced. Syntax:
=IF(*Cond,value_if_true,value_if_False*) returns *value_if_true or value_if_False*

"SUMIF": It is a function under the math category. It is defined as
=SUMIF(*Cell Range, condition*) returns *Sum of all the cell in Cell Range which meets the given criteria*

"COUNTIF": It is a function under the math category. It is defined as
=COUNTIF(*Cell Range, Criteria*) returns *Count of all the cells in Cell Range which meets the given criteria*

"INDEX": It is a function under the Lookup and reference category. It is defined as
=INDEX(*Cell*) returns *Content in the given cell*
=INDEX(*Cell Range,row,column*) returns *Content in the cell(row,col)*

Refer to the strategy in the lecture:
It is a break-out strategy with logic as:

1. Initiate a new buy trade if the price goes above 'x' candles high
2. Initiate a new sell trade if the price goes below 'y' candles low
3. Exit trade when:
    a. Price goes against us by 'a' times ATR (Average True Range)
    b. Price goes in our favour by 'b' times ATR (Average True Range)
4. Only take one position at a time. Ignore new signals if there is an ongoing trade.
5. Fixed position size of 1 'quantity'.
6. Average True Range(ATR) is calculated as shown below:

$$\text{True Range (TR): MAX(H-L, H-PCC, PCC-L)}$$

$$ATR(i) = \frac{ATR(i-1)*(n-1)+TR(i)}{n}$$

$$ATR(1) = \text{Average of previous 'n' TRs}$$

Where,
- PCC: Previous Candle Close
- H: High
- L: Low

We have historical data of the instrument as:

S No.	Date	OPEN	HIGH	LOW	LAST_PRICE
1	1/10/18 9:15	10599.8!	10609.4(	10598.0!	10607.35
2	1/10/18 9:16	10607.3!	10610.4(	10601.7(	10607.55
3	1/10/18 9:17	10607.5!	10611.0!	10598.5(	10608.55
4	1/10/18 9:18	10609.0!	10615.8(	10606.9!	10611.45
5	1/10/18 9:19	10611.5(	10614.6!	10603.6!	10604.80
6	1/10/18 9:20	10604.9(	10608.9!	10601.9!	10605.90
7	1/10/18 9:21	10606.1!	10613.2!	10597.5(	10599.30
8	1/10/18 9:22	10599.8!	10605.4!	10594.3!	10597.95
9	1/10/18 9:23	10598.4(	10602.9(	10589.2!	10591.60
10	1/10/18 9:24	10591.8!	10593.4(	10586.9!	10591.30
11	1/10/18 9:25	10591.1!	10593.6!	10584.0!	10591.90
12	1/10/18 9:26	10591.6(	10599.5!	10586.2!	10594.00

To develop the model, we require some parameters. These parameters will be used in the calculations of the strategy as follows:
1. Initiate a new buy trade if the price goes above 'x' candles high -- (Parameter 'x')
2. Initiate a new sell trade if the price goes below 'y' candles low -- (Parameter 'y')
3. Exit trade when:
   a. Price goes against us by 'a' times ATR (Average True Range) -- (Parameter 'a')
   b. Price goes in our favour by 'b' times ATR (Average True Range) -- (Parameter 'b')

B	C	D
Input Parameters		
Buy Candles	2	x
Sell Candles	3	y
Stop Loss (SL)	1	a
Take Profit (TP)	2	b
ATR (n)	20	n

- To develop the strategy, we need to calculate few columns as follows:
  - **"x candle high"**=MAX(INDEX(col_high_range,(sr_no-x),last_high_cell)

- **"y candle low"**=if(sr_no<=y,"",MIN(INDEX(col_low_range,(sr_no-y),last_low_cell))
- **"TR"**=MAX((last_high-last_low),(last_high-prev_close),(prev_close-last_low))
- **ATR(1)**: Average of n TRs(Note: ATR(1) is the first value of ATR in the timeseries)
- **ATR(n)**: (Prev_value_ATR*(n-1)+Curr_TR)/n
- **"Signal"**: if(col_high>"x candle high","buy", if("col_low"<"y candle low","sell",""))
- Don't calculate the "Signal" if any of the base parameters are null.
- **"Signal"**: if(OR("x candle high"="",
                            "y candle low"="",
                            "TR"="",
                            "ATR"=""),
                    "",
                    if(col_high>"x candle high","buy",
                                    if("col_low"<"y candle low",
                                    "sell","")))

- **"Signal Price"**: if("Signal"="Buy","x candle high",if("Signal"="Sell","y candle low",""))
- **Possible Status of the trade are:**
  - No Trade
  - Buy Trade
  - Sell Trade
  - SL
  - TP
- **"Status":** if(OR("Prev_Status"="","Prev_Status"="SL","Prev_Status"="TP"),"Signal", if("Prev_Status"="Buy",if("Low"<"SL Price","SL",if("High">"TP Price","TP","Prev_Status")),if("Prev_Status"="Sell",if("High">"SL Price","TP",if("Low"<"TP Price","TP","Prev_Status"))
- **"Entry Price"**: if("Status"="Prev_Status","Prev Entry Price",if(or(Status="Buy",Status="Sell"),"Signal_Prie",""))
- **"ATR Rep"**: if("Status"="Prev_Status","ATR Rep",if(or(Status="Buy",Status="Sell"),"ATR",""))
- **"P&L"**: if(AND("Prev_Status"="buy","Status"="SL"),
                        "SL Price"- "Entry Price",
            If(AND("Prev_Status"="buy","Status"="TP"),
                    "TP Price"- "Entry Price",
            If(AND("Prev_Status"="sell","Status"="TP"),
                    -"TP Price"+ "Entry Price",
            If(AND("Prev_Status"="sell","Status"="SL"),
                    -"SL Price"+ "Entry Price", ""))))