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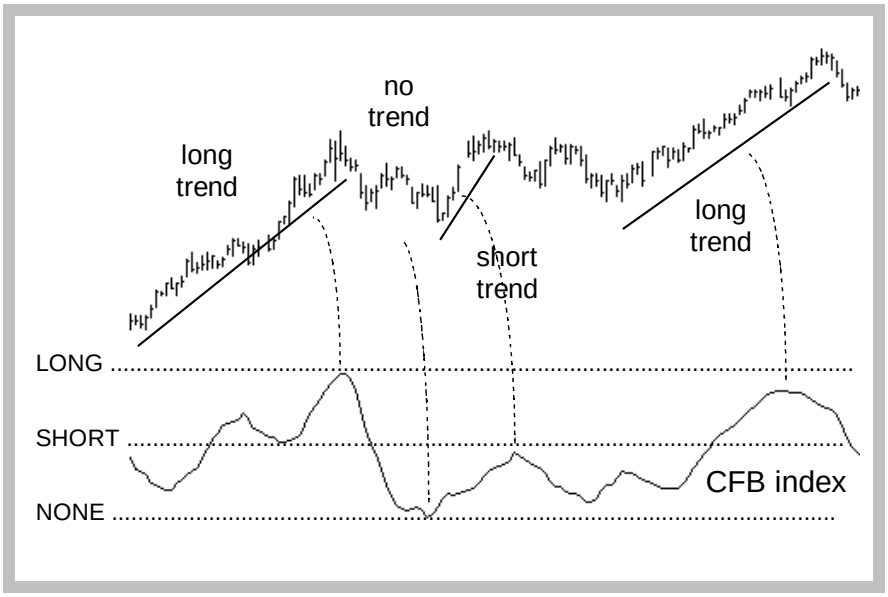
JURIK RESEARCH

CFB 1.0

Composite Fractal Behavior Index

Add-In Tool for Microsoft Excel for Windows®



USER'S GUIDE

 PO 2379 Aptos, CA 831-688-5893; fax 831-688-8947

Requirements

Our tools run inside

- Microsoft 5.0c, under Windows 3.1, 3.11, 95, or NT
- Microsoft Excel 7 and 97 under Win 95 and NT

Installation

1. Using either the Window's Program Manager or Explorer, go to the floppy disk and run JRS_XL.EXE
   It will request a password. Press OK. The installer will give you a computer identification number. Write it down.
2. Get your installation password from Jurik Research Software. Call 323-258-4860 (USA) , fax 323-258-0598
   or
   E-mail to nfsmith@anet.net. Either way, give your full name, mailing address and computer identification number. You will then be given a password.
3. Rerun JRS_XL.EXE, this time entering the password. The installer will verify your password. When approved, it will install documentation and demonstration files into a user specified directory and the tool(s) into your EXCEL \ XLSTART subdirectory. Read messages in all windows -- they are important. Scroll down if necessary.
4. Start Excel. The tool(s) will be ready to run from the DATA command menu.

Notes

In the installed directory, you will find the following files ...

1. LEGALESE.TXT Legal notices and warranties.
2. ORDRFORM.HLP A printable order form for all products we sell.
3. CATALOG.HLP An online catalog of all products we sell.

In each installed "xxx_DEMO" subdirectory, you will find the following files ...

1. All the necessary demonstration XLS files.
2. A new VBA module, showing how to control a tool using Excel's Visual Basic.

Passwords

If you upgrade to a new computer, you will need a new password to install these tools. If you want to run them on additional computers, you will need additional passwords. Call Jurik Research Software (323-258-4860) for details.

Why Use CFB ?

To measure the market's trending time frame without cycles!

CFB is an index that reveals the market's trending time frame, ideal for creating adaptive window sizes of various technical indicators.

All around you mechanisms adjust themselves to their environment. From simple thermostats that react to air temperature to computer chips in modern cars that respond to changes in engine temperature, r.p.m.'s, torque, and throttle position. It was only a matter of time before fast desktop computers applied the mathematics of self-adjustment to systems that trade the financial markets.

Unlike basic systems with fixed formulas, an adaptive system adjusts its own equations. For example, start with a basic channel breakout system that uses the highest closing price of the last N bars as a threshold for detecting breakouts on the up side. An adaptive and improved version of this system would adjust N according to market conditions, such as momentum, price volatility or acceleration.

Since many systems are based directly or indirectly on cycles, another useful measure of market condition is the periodic **length** of a price chart's **dominant cycle**, (DC), that cycle with the greatest influence on price action.

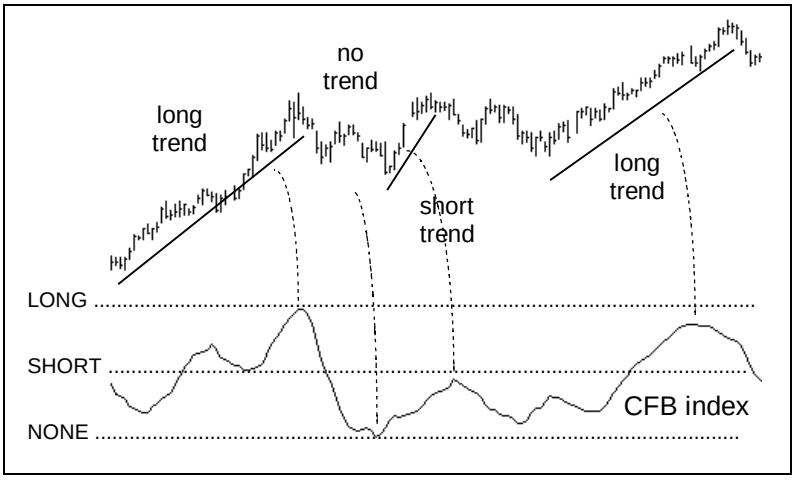
The utility of this new DC measure was noted by author Murray Ruggiero in the January '96 issue of Futures Magazine. In it, Mr. Ruggiero used it to adaptively adjust the value of N in a channel breakout system. He then simulation-traded 15 years of D-Mark futures in order to compare its performance to a similar system that had a fixed optimal value of N. The adaptive version produced 20% more profit!

This DC index utilized the popular MESA algorithm (a formulation by John Ehlers adapted from Burg's maximum entropy algorithm, MEM). Unfortunately, the DC approach is problematic when the market has no real dominant cycle momentum. Therefore, we replaced the DC index with a proprietary indicator that does not presuppose the presence of market cycles. It's called **CFB** (Composite Fractal Behavior) and it works well whether or not the market is cyclic.

CFB examines price action for a particular fractal pattern, categorizes them by size, and then outputs a composite fractal size index. This index is smooth, timely and accurate.

Essentially, **CFB** reveals the length of the market's trending action time frame. Long trending activity produces a large **CFB** index and short choppy action produces a small index value. Investors have found many uses for **CFB**, all related to scaling other existing technical indicators adaptively, on a bar-to-bar basis.

Now you can also benefit from the powerful information CFB produces.



How to Activate CFB

THE COMPOSITE FRACTAL BEHAVIOR INDEX

MENU COMMAND

If you installed CFB into the EXCEL/XLSTART subdirectory, then when you start Excel, CFB is automatically loaded and ready for use. It is accessed by the "CFB" command in the DATA menu.

DEMO

The best way to see how the tool works is to follow an example. All instructions for the demo will be written in italic format.

In Excel, go to the directory where your documentation and demonstration XLS files were installed. Open file CFB_DEMO.XLS. If you are using Excel 5 or 7, use the SAVE AS command to save the file back onto your hard drive. Give it the new filename CFB_DEM5.XLS and specify it as a Microsoft Excel Workbook in the dialog field "Save File As Type".

Column 1 of the spreadsheet file contains 253 consecutive days of 30 year T-Bond futures closing prices. In this demo, you will create a 24-bar wide CFB index and a 48-bar wide CFB index.

SELECTING THE DATA

Select all the cells in the column containing the time series to be sampled.

NOTE: Do not begin data time series in row 1. Row 1 is to be reserved for a text description (label) of the data. If you do not want to use a text description of the data column, then leave the cell in row 1 of this column blank.

In file CFB_DEMO.XLS, click on the first reference data cell (row 6, column 1) to highlight it. Include all the remaining data in the time series. You can easily do this by pressing CTRL-SHIFT-DOWN ARROW.

FIND THE TOOL

Bring up the tool dialog box by selecting the "CFB" command in the DATA menu.

DIALOG BOX

As shown in figure 1, the dialog has three data entry fields, and two groups of modifying options: Span and Output. When you select the time series data before calling CFB, the first field will automatically be filled in. The user may move forward from field to field by pressing the TAB key and backward by pressing the SHIFT-TAB keys.

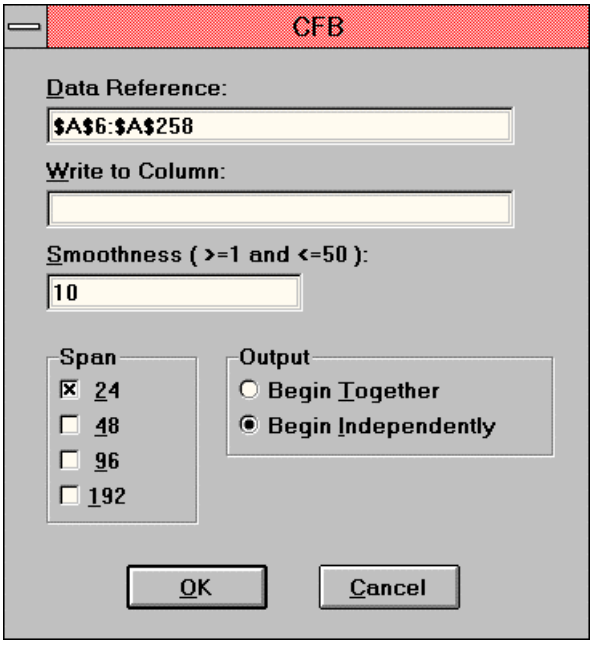


FIGURE 2 CFB's dialog box

DATA REFERENCE

This field designates the region of cells in one column. The dialog's default for this field is to use the most recently selected (highlighted) region of cells during your current session with Excel. If only a single cell was most recently highlighted, then CFB defaults to the prior run's Data Reference. The user may change the designated region of cells to any other region as follows:

1) activate the dialog's field by clicking the mouse on the "Data Reference" field or press the TAB key until the field becomes highlighted, and

2) modify its contents by either typing in the region description or by highlighting a new region on the spreadsheet with your mouse.

For your demo, bring up the tool dialog box by selecting the "CFB" command in the DATA menu. Then press the TAB key until the dialog's "Data Reference" field is highlighted. Select the cell containing the first number of the time series (row 6, column 1). Select the rest of the data in the column by pressing CTRL-SHIFT-DOWN ARROW on the keyboard. Now all the cells in the "T-Bond" time series should be highlighted.

WRITE TO COLUMN

This field designates the column that CFB will write to. If only a single cell was most recently selected, it defaults to using whatever column was designated, the last time CFB was executed during your current session with Excel. Otherwise, it defaults to being blank. The user may change the designated column to any other column as follows:

1) activate the dialog's field by clicking the "Write to Column" field or by pressing the TAB key until the field becomes highlighted, and

2) select, with a mouse click, any cell(s) in the column you wish to designate.

For your demo, ...
*Press the TAB key until the dialog's "*Write to Column*" field is highlighted. Select any cell in column 3 of the spreadsheet. This tells the tool that you want its output to begin in column 3.*

SMOOTHNESS

This field specifies the smoothness level of CFB's output. Larger values produce smoother curves. Typical smoothness values lay between 6 and 16. The full permissible range is any integer from 2 to 50.

For your demo, let's use the smoothness default value of 10.

SPAN

CFB measures the purity of fractals of various sizes. You must select the largest size fractal that CFB may consider. The choices are 24, 48, 96, and 192 bars wide. If you select more than one choice, CFB will produce a separate index for each selection.

The selection involves performance tradeoffs: although larger sizes of Span will enable CFB to discover longer patterns in the data, this induces a penalty of additional lag, thereby adding some delay to CFB's timing. You need to determine the optimal setting that's best for you.

For your demo, ...

- *Mouse click on both 24 and 48 in the Span grouping.*

DEAD ZONE

Note that CFB will leave as blank a block of cells at the top of each output column range. This "dead zone" gets larger for increasing values of Span. The size of the dead zone for CFB is automatically calculated using the formula:

$$Dead\_Zone = Span\ Size + 6$$

For example, the "dead zone" of a 48-bar wide CFB index would be the first 48 + 6 = 54 output cells.

If you have selected multiple Span values, CFB defaults to applying a dead-zone for each output column separately.

In your demo recall that Span = 24 and 48, therefore CFB will default to giving the two output columns dead-zones sizes of 30 and 54.

OUTPUT

If you prefer to have all multiple output columns have the same dead-zone size, then select "Begin Together". All dead-zones will be set equal to the largest value.

In your demo, selecting "Begin Together" causes both dead-zone sizes to be 54.

INITIATING CFB

After you have made your selections, press the OK button.

RETURNING HOME

After CFB has finished, you may want to return to the top left-hand corner of the spreadsheet. An easy way is to press CTRL-HOME on the keyboard.

For your demo, the CFB 24 index is the red line in the second chart, and the CFB 48 index is the blue line.

AUTOMATIC TITLES

When CFB writes data out to the specified output column, it also gives a title to that column. The title is placed in the first row of that column.

The title is composed of three parts:

1. The title word found in the first row of the reference data column,
2. an underscore "_" followed by the Span value used,
3. an underscore "_" followed by the Smoothness value used.

If no label is used in row 1 of the input reference column, then the title format is the same as above with the exception that the first part is replaced by "col" followed by the column number of the input column. An example would be "col7_24_10".

For the demo, the title "T-BOND" is in row 1 of the reference data column, Span = 24 and 48, and smoothness = 10. Therefore, the two output columns will be automatically titled "T-Bond_24_10" and "T-bond_48_10".

Sample CFB Trading System

In CFB_SYS1.XLS we have provided a sample trading system which demonstrates one possible method for utilizing the CFB in a trading system.

Overview of System

Making money when a financial instrument's price meanders within a narrow trading range is not likely, but you can profit by jumping in when trends start. How do you know when a trend has started? It occurs when the price breaks through one of the bounds of a trading range; this is called "breaking out of the channel." You'll see how to define the channel boundaries later.

The sample system is essentially a channel breakout system. Such systems are designed to provide buy signals when price moves beyond the upper bound of a trading range and short signals when price moves below the channel's lower bound. The sample system, once it's in the market, is always long or short. Of course, more complex systems can be devised, and this one is only intended to be a learning tool.

How the CFB is Used

Because CFB measures trend duration, it can be used to help to define a channel. For instance, if the current trend duration is 4 bars, you could simply say that the upper boundary of the channel is defined as the highest high in the last 4 bars; conversely, the lower boundary of the channel would be the lowest low during the last 4 bars.

Because the CFB values for a particular market (eg. oil, corn, IBM, S&P, ...) will tend to lie within a range that will differ from other markets, it is inadvisable to simply use the raw CFB value as the lookback period in which to find the highest highs and lowest lows. The sample system uses a more complex method instead.

Because different markets exhibit different characteristics, a system needs to be optimized for each market. In particular, it is necessary to determine the optimum lookback periods to be used to define the breakout channels. Often these channels are not symmetrical. In the case of the sample system, we found that the optimum range of lookback periods ran from 7 to 12 days. Thus we set up our system such that the actual lookback periods used to create channel boundaries fell within that range.

In order to arrive at a lookback period, it's first necessary to determine what range the observed CFB values will cover. In the sample system, the CFB span value was set to 24, so *possible* values include the range from 0 to 24, but the *actual* values observed range from 3.82 to 19.51. In our example, there are formulas (Note: Formulas are active in row 35, and they may be copied down to the bottom of the spreadsheet. They were stored as values to save on disk space.) in columns H and I which determine the maximum and minimum values of the CFB observed to date. Essentially, the logic in the formulas says that the maximum value must be *at least* slightly more than half the possible range; we use 12.01 as the floor maximum. If the current CFB exceeds any prior value of CFB, it becomes the maximum. Otherwise, the maximum remains as the highest value observed previously. The logic used to determine the minimum value of the range is essentially the same, only it seeks the minimum. The highest minimum value cannot be more than half the possible range.

In column J a formula calculates the fraction that the current value of CFB is relative to the observed range; for instance, if today's CFB is 9, and the range varies from 3 to 13, then the fraction is (9-3)/(13-3) = 0.6.

To arrive at a lookback period, the ratio of the current CFB value relative to its observed range is applied to the ideal range, 7 to 12. The formulas for this are in column K, and they round down to the nearest integer.

Once the lookback periods are determined, creating the channel boundaries is quite straightforward. Formulas in columns L and M use the lookback periods determined in column K to find the highest highs and lowest lows during those lookback periods. The actual channel boundaries are calculated in columns N and O. The Upper Channel is determined by the following algorithm: if today's high is higher than the previous Upper Channel, then it becomes the Upper Channel boundary. Otherwise, the Upper Channel is defined as the average of yesterday's Upper Channel value and today's highest high during the lookback period (determined in column L). The logic in column O is essentially the converse.

Trading Results

Columns P through U contain formulas which determine when to trade and how much profit and loss result.

All trades are entered with either BUY or SELL stops placed at the end of each day, to be used the next trading day. Stops are placed at channel boundaries, BUY stops at the upper boundary, SELL stops at the lower boundary. On the long side, trades are executed at the Channel boundary, or at the opening price if the Open has gapped above the Upper Channel boundary. Likewise, on the short side, trades are executed at the Channel boundary, or at the opening price if the Open has gapped below the Lower Channel boundary.

The user is encouraged to examine the formulas in these columns; the logic they follow will become quite evident upon examination. For TradeStation users, the code for this channel breakout system is provided below.

Note that commissions and slippage of $70 per trade are applied to each closing transaction.

NOTICE

DO NOT USE THIS SYSTEM TO TRADE REAL MONEY!

The trading formulas in CFB_SYS1.XLS are for demonstration purposes only. It does not have important features, e.g. money management, typical of real trading systems. Without such features, you may lose substantial equity trading the market.

```
{
------------------------------------------------------------------------
System:   CFB  CHANNEL  BREAKOUT

Purpose:  This is an example of a breakout system based on the CFB
index. Superimpose this indicator over any price chart (subplot #1).
The default input parameters are for ILLUSTRATION PURPOSES ONLY.

Notes:    Depth is typically between 0 and 26.
          Smooth is typically between 7 and 12.

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cod without express written permission from Jurik Research, Aptos,
Calif.  95003
------------------------------------------------------------------------
------------------------------------------------------------------------
}
```

```
inputs: Depth1(20), { lookback depth associated with min CFB output   }
        Depth2(1),  { lookback depth associated with max CFB output   }
        Smooth(8);  { smoothness of CFB curve                         }

vars: ratio    (0),      { % location of CFB in current range    }
      HH       (H),      { high channel boundary                 }
      LL       (L),      { low channel boundary                  }
      Depth    (0),      { lookback depth                        }
      CFB_out  (0),      { CFB output                            }
      max_out  (19),     { maximum fractal length to date        }
      min_out  (18);     { minimum  fractal length to date       }

{ get fractal_length }
CFB_out = JRC_Fractal24 ( H+L , Smooth ) ;

{ adjust max length }
if CFB_out > max_out
     then max_out = CFB_out

{ adjust min length }
else if CFB_out < min_out
     then min_out = CFB_out;

if   currentbar > 1 then begin

{ ratio varies from 0 to 1    }
     ratio = (CFB_out - min_out ) / (max_out - min_out );

{ depth varies from Depth1 to Depth2}
     depth = Depth1 + ratio * (Depth2 - Depth1) ;

{ adjust high channel boundary}
     if H > HH[1]   then HH = H
                    else HH = ( HH[1] + highest ( H , Depth ) ) / 2 ;

{ adjust low channel boundary }
     if L < LL[1]   then LL = L
                    else LL = ( LL[1] + lowest ( L , Depth ) ) / 2 ;

{ buy when price breaks up    }
     buy at HH stop;

{ sell when price breaks down }
     sell at LL stop;

     end;
```

Calling CFB
from
Excel's Visual Basic for Applications

The following information is for advanced users who want to maximize the power of CFB by incorporating it within either user-defined subroutines or functions.

CFB may be called from Excel's Visual Basic for Applications (VBA). This powerful capability can be used to...

- search for optimal SMOOTH and SPAN parameter values
- create numerous columns of different SPAN and SMOOTH values
- automate CFB's operation as part of an automated trading system

The following pages provide instructions on how to embed CFB in an Excel VBA subroutine.

INTRODUCTION

In your CFB installation directory (eg. C:\JRS\CFB_DEMO) the workbook CFB_VBA.XLS contains a working example of how to use Excel's VBA to operate CFB automatically. It contains one spreadsheet and one VBA module sheet.

The VBA routine will make CFB produce two columns (using span values 24 and 48) for each of two different data columns (Coffee and T-Bonds). The code makes CFB write to columns 4 through 7 (D through G). For each input column, there will be two output columns using SPAN values 24 and 48.

You can run this example by executing the menu command TOOLS / MACRO... and selecting the VBA subroutine named "**CFBCall**".

CFBCall assumes the following:

1. There is data in the region A5:B261, in a worksheet named "data" in an open Excel 5 workbook named "CFB_VBA.XLS".
2. The two input data columns have titles in the first row.
3. Both the workbook containing input data for CFB and the workbook set up to receive output from CFB are currently open in Excel. In this example, workbook CFB_VBA.XLS will serve for both input and output.
4. The path to your XLSTART subdirectory is D:\msoffice\excel\xlstart. If this is not true for your system, you MUST edit the code accordingly. This will enable the "register" command to find the file JRS_XL.DLL.

INPUT CALLING PARAMETERS

The VBA code for CFB has 5 input parameters. In this exmaple,

Input 1: Input reference range for coffee is r5c1:r261c1 in sheet "Data", and for D-Mark it is r5c2:r261c2 in sheet "Data".

Input 2: Output column number is appended as a text string to range "Data!r1c"

Input 3: SMOOTHNESS is a constant value 10.

Input 4: SPAN value for CFB calculations. It is converted to a text string.

- SPAN must be either 24, 48, 96, or 192. In this demo, value will be 24 and 48.

Input 5: SPAN2 value for Dead_Zone calculation. It is converted to a text string.

- SPAN2 must be either 24, 48, 96, or 192.
- Actual dead_zone size is 6 more than SPAN2.
- In this demo, we want the data in all 4 output columns to start in the same row. Since the largest SPAN we plan to use is 48, we let SPAN2 = 48.
- Dead_zone size will then be 6 + SPAN2 = 6 + 48 = 54.

```
'
' CFB_Loop Macro
' Demonstration code for using CFB
'
'
Sub CFBCall()
    Dim CFBFunc As Long             'Identifier for CFB_func registration
    Dim smoothness As Integer       'SMOOTHNESS factor
    Dim in_colnum As Integer        'input column number
    Dim out_colnum As Integer       'output column number
    Dim span1 As Integer            'SPAN for CFB calculations
    Dim span2 As Integer            'SPAN for dead_zone calculation
    Dim CFB_SPAN(1 To 4) As Integer 'holds the 4 legal SPAN values
    Dim k As Integer                'loop counter

    CFB_SPAN(1) = 24
    CFB_SPAN(2) = 48
    CFB_SPAN(3) = 96
    CFB_SPAN(4) = 192

    Application.ScreenUpdating = False
    CFBFunc = ExecuteExcel4Macro _
      ("register(""D:\MSOFFICE\EXCEL\XLSTART\JRS_XL32.xll"",""CFB_func"",""JRRJJJ"")")

    '*** For Excel v5.0 or a Windows 3.1 environment, use the following line
    '
    'CFBFunc = ExecuteExcel4Macro _
    ' ("register(""C:\EXCEL5\XLSTART\JRS_XL.xll"",""CFB_func"",""IRRIII"")")


    ' Loop through COFFEE and D-MARK and calculate two CFB's for each

    smoothness = 10
    span2 = 48
    For in_colnum = 1 To 2
        For k = 1 To 2
            out_colnum = 2 * in_colnum + k + 1
            span1 = CFB_SPAN(k)
            ExecuteExcel4Macro ("call(" & CFBFunc & _
                ", [CFB_VBA.XLS]Data!r5c" & LTrim(Str(in_colnum)) & ":r261c" &
                          LTrim(Str(in_colnum)) & _
                ", [CFB_VBA.XLS]Data!r1c" & LTrim(Str(out_colnum)) & _
                ", " & LTrim(Str(smoothness)) & _
                ", " & LTrim(Str(span1)) & _
                ", " & LTrim(Str(span2)) & ")")
            Next k
        Next in_colnum

    ExecuteExcel4Macro ("UNregister(" & CFBFunc & ")")
End Sub
```

Excel VBA code calling CFB in a double nested loop

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