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Webinar

Spreadsheets, Python and Financial Data

Felix Zumstein, May 2020

Agenda

1. Introduction
2. Spreadsheets in the age of blockchain and AI
3. Demo: Eikon with Excel and Python

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1. Introduction

Our Mission

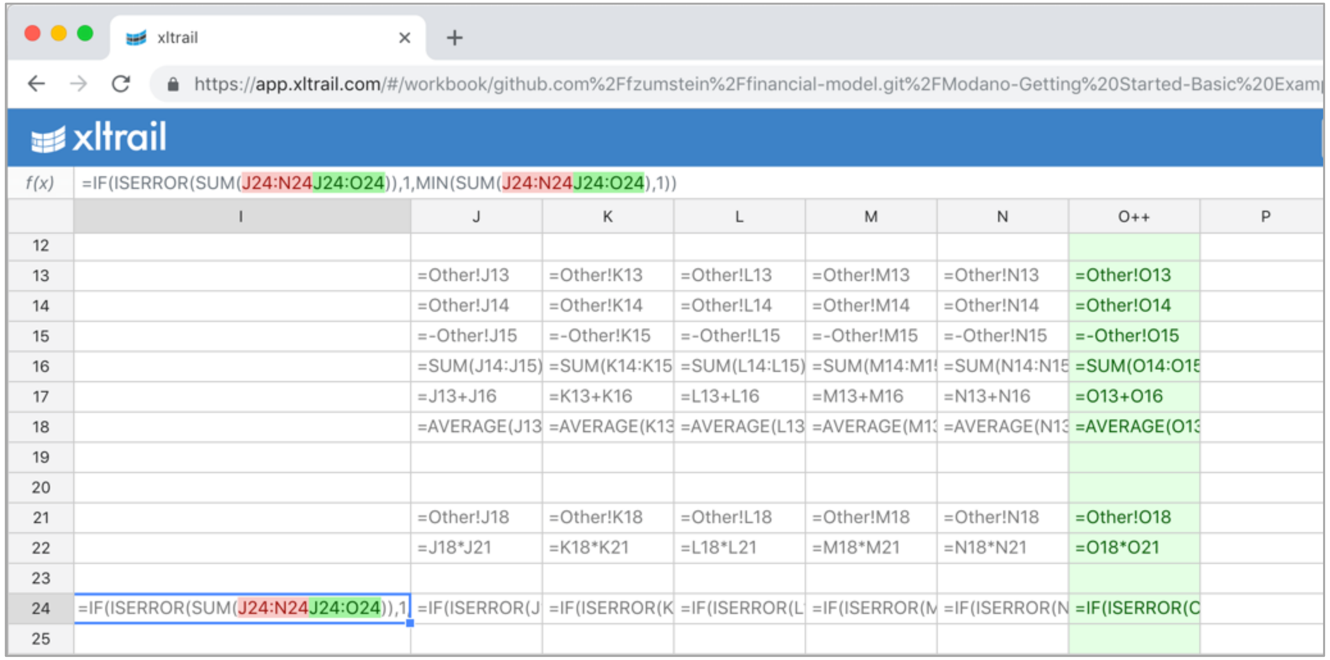
Provide innovative solutions to de-risk Excel spreadsheets

xlwings

xlwings

- Python for Excel
- Scripts, UDFs, Macros, REST API
- Windows & Mac
- Free & open-source
- xlwings PRO

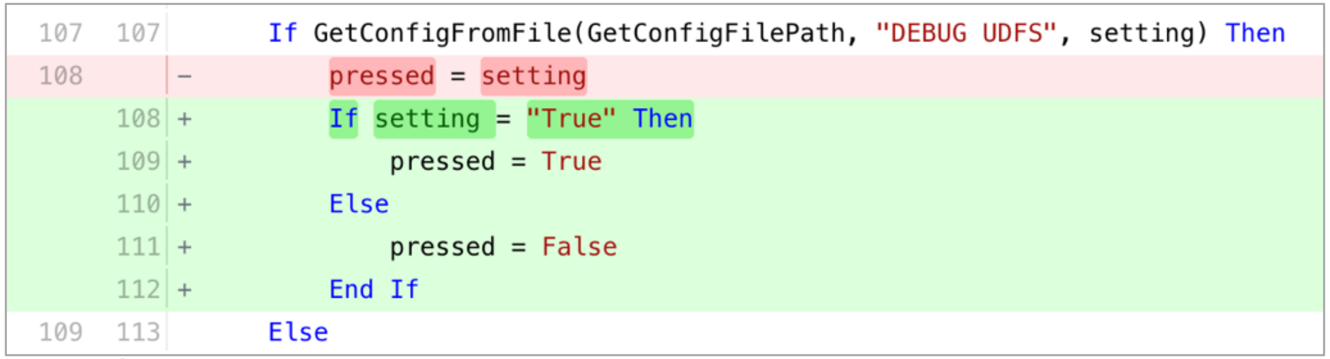
xltrail



xltrail
https://app.xltrail.com/#/workbook/github.com%2Ffzumstein%2Ffinancial-model.git%2FModano-Getting%20Started-Basic%20Exam
xltrail

f(x) =IF(ISERROR(SUM(J24:N24J24:O24)),1,MIN(SUM(J24:N24J24:O24),1))

	I	J	K	L	M	N	O++	P
12								
13		=Other!J13	=Other!K13	=Other!L13	=Other!M13	=Other!N13	=Other!O13	
14		=Other!J14	=Other!K14	=Other!L14	=Other!M14	=Other!N14	=Other!O14	
15		=-Other!J15	=-Other!K15	=-Other!L15	=-Other!M15	=-Other!N15	=-Other!O15	
16		=SUM(J14:J15)	=SUM(K14:K15	=SUM(L14:L15)	=SUM(M14:M1	=SUM(N14:N1	=SUM(O14:O1	
17		=J13+J16	=K13+K16	=L13+L16	=M13+M16	=N13+N16	=O13+O16	
18		=AVERAGE(J13	=AVERAGE(K1	=AVERAGE(L13	=AVERAGE(M1	=AVERAGE(N1	=AVERAGE(O1	
19								
20								
21		=Other!J18	=Other!K18	=Other!L18	=Other!M18	=Other!N18	=Other!O18	
22		=J18*J21	=K18*K21	=L18*L21	=M18*M21	=N18*N21	=O18*O21	
23								
24	=IF(ISERROR(SUM(J24:N24J24:O24)),1	=IF(ISERROR(J	=IF(ISERROR(K	=IF(ISERROR(L	=IF(ISERROR(M	=IF(ISERROR(N	=IF(ISERROR(C	
25								



```
         If GetConfigFromFile(GetConfigFilePath, "DEBUG UDFS", setting) Then
-            pressed = setting
+            If setting = "True" Then
+                pressed = True
+            Else
+                pressed = False
+            End If
         Else
```

- Audit Trial for Excel
- Version control with or without Git
- Tracks formulas and VBA code
- Will soon track: Power queries, names ranges

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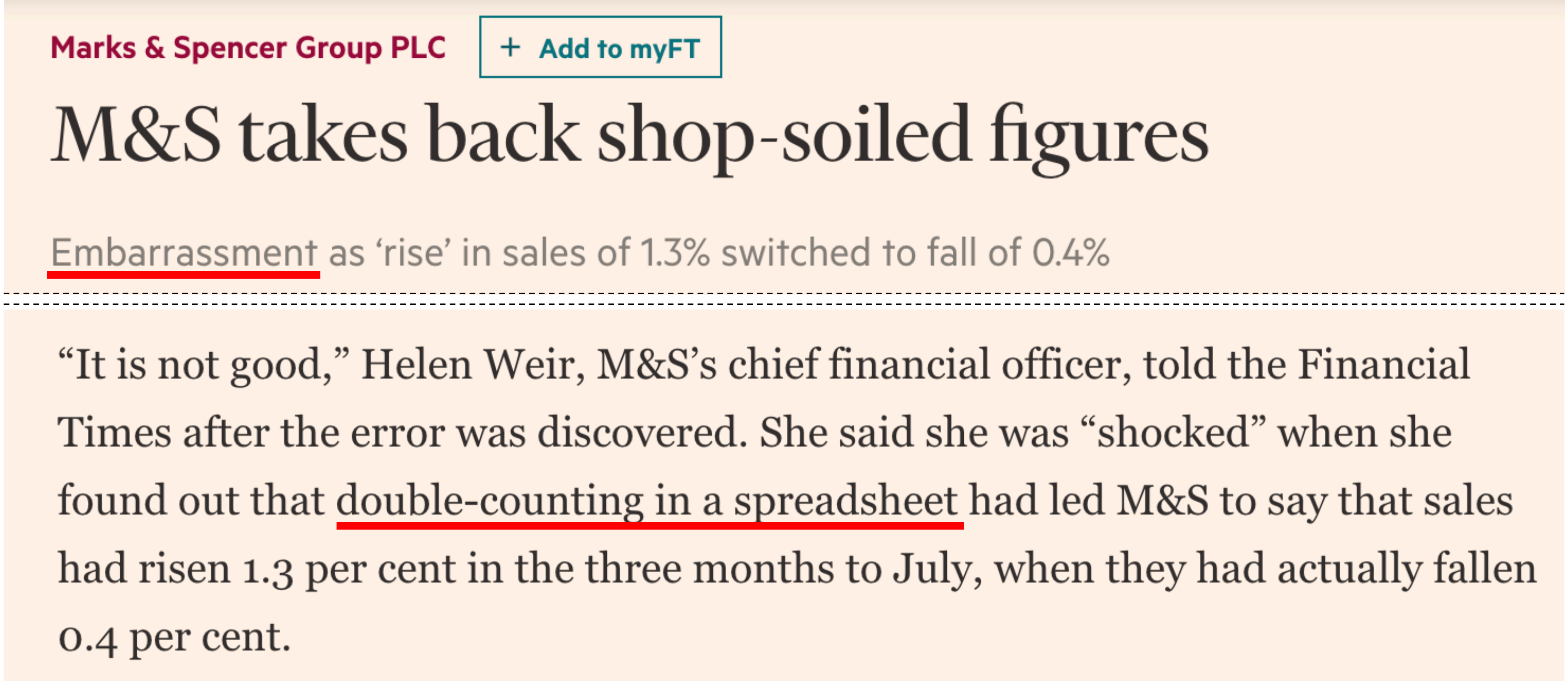
2. Spreadsheets in the age of blockchain and AI

Marks and Spencer 2016 Q1 report



Marks & Spencer Group PLC

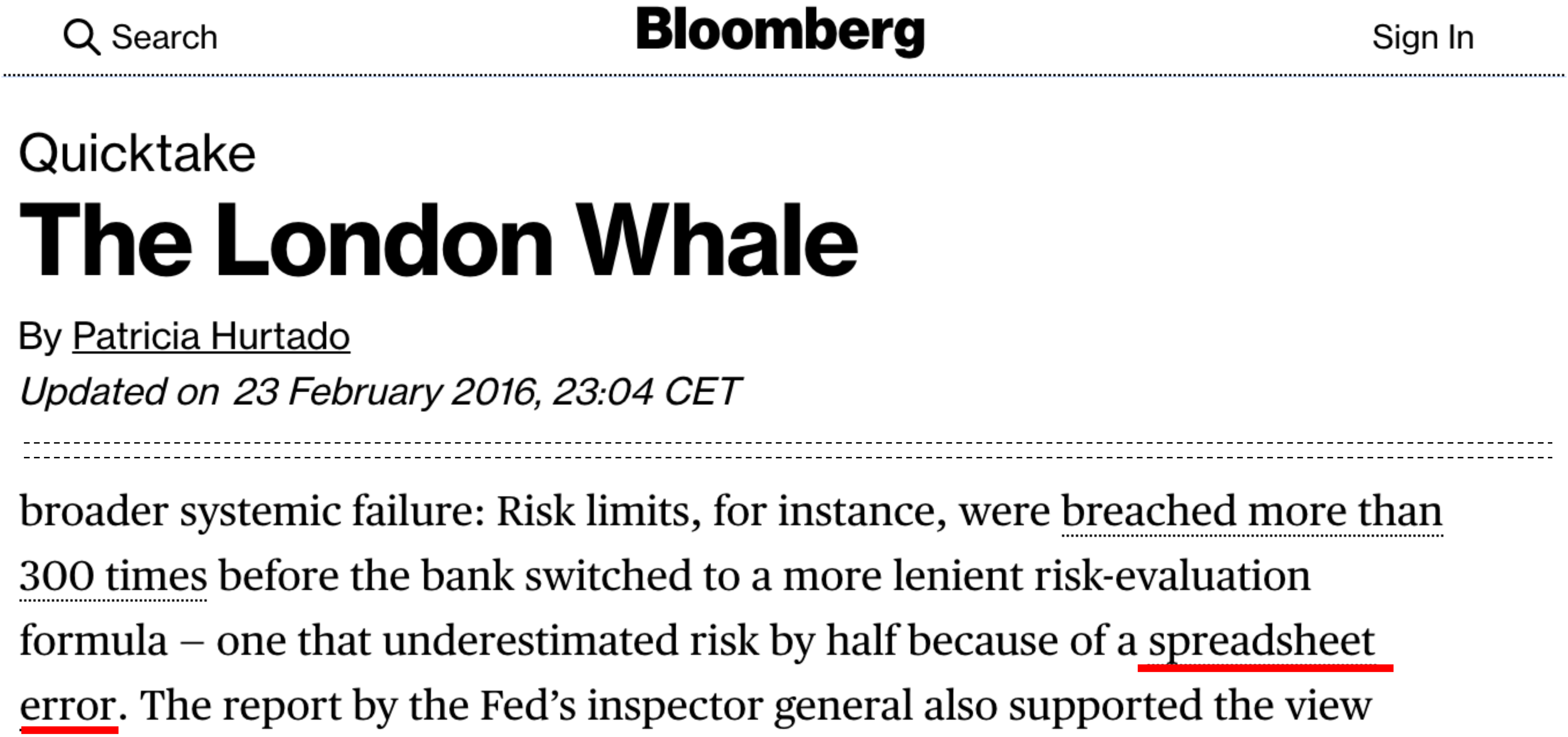
M&S takes back shop-soiled figures

Embarrassment as ‘rise’ in sales of 1.3% switched to fall of 0.4%

“It is not good,” Helen Weir, M&S’s chief financial officer, told the Financial Times after the error was discovered. She said she was “shocked” when she found out that double-counting in a spreadsheet had led M&S to say that sales had risen 1.3 per cent in the three months to July, when they had actually fallen 0.4 per cent.

Source: https://www.ft.com/content/1fc57f26-4467-11e6-9b66-0712b3873ae1 (7/7/2016)

The London Whale



Quicktake

The London Whale

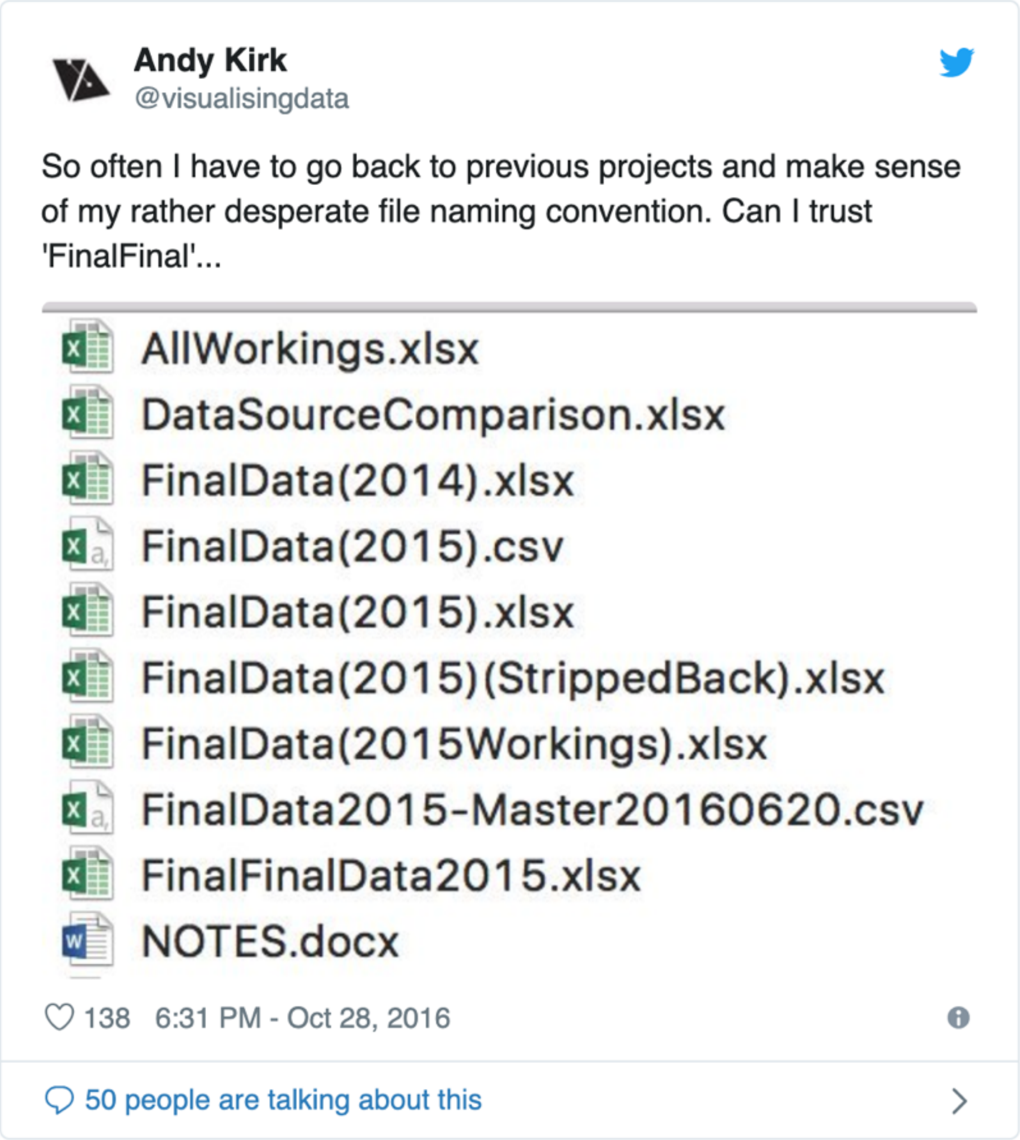
By Patricia Hurtado

Updated on 23 February 2016, 23:04 CET

broader systemic failure: Risk limits, for instance, were breached more than 300 times before the bank switched to a more lenient risk-evaluation formula – one that underestimated risk by half because of a spreadsheet error. The report by the Fed's inspector general also supported the view

Source: https://www.bloomberg.com/quicktake/the-london-whale (2/23/2016)

Look familiar? Part I



Andy Kirk
@visualisingdata

So often I have to go back to previous projects and make sense of my rather desperate file naming convention. Can I trust 'FinalFinal'...

AllWorkings.xlsx
DataSourceComparison.xlsx
FinalData(2014).xlsx
FinalData(2015).csv
FinalData(2015).xlsx
FinalData(2015)(StrippedBack).xlsx
FinalData(2015Workings).xlsx
FinalData2015-Master20160620.csv
FinalFinalData2015.xlsx
NOTES.docx

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Look familiar? Part II

```
=OFFSET('Appendix 4 -
Odds'!$B$3,ROW(INDEX('Appendix 4 -
Odds'!$B$3:$AH$35,MATCH(I12,'Appendix 4 -
Odds'!$B$3:$B$35,0),1))-
3,COLUMN(INDEX('Appendix 4 -
Odds'!$B$3:$AH$35,,MATCH(I13,'Appendix 4 -
Odds'!$B$3:$AH$3,0),1))-2)+INDEX('Round Robin
Predictions'!$C$4:$O$36,MATCH(I12, 'Round
Robin Predictions'!$D$4:$D$36,0),3)-
INDEX('Round Robin
Predictions'!$C$4:$O$36,MATCH(I13, 'Round
Robin Predictions'!$D$4:$D$36,0),3)
```

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Source: https://techcommunity.microsoft.com/t5/Excel-Blog/How-We-Built-our-Soccer-Tournament-Predictor-in-Excel/ba-p/199802

Our interpretation

1) Excel = code, so treat it as such!
2) Migrating away from Excel is not always possible.

3. Demo

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1. Interactive use with Jupyter notebook
2. UDF: Correlation matrix
3. Reporting
4. Macro: Monte Carlo simulation
5. Automated tests

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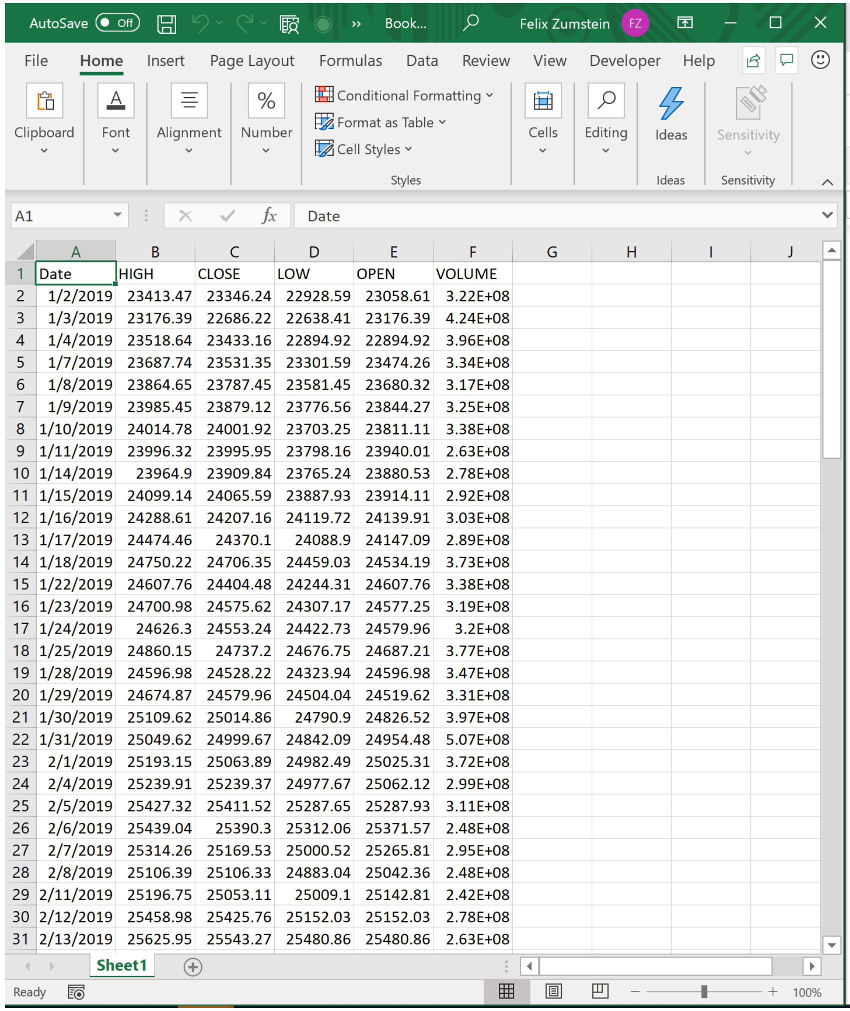
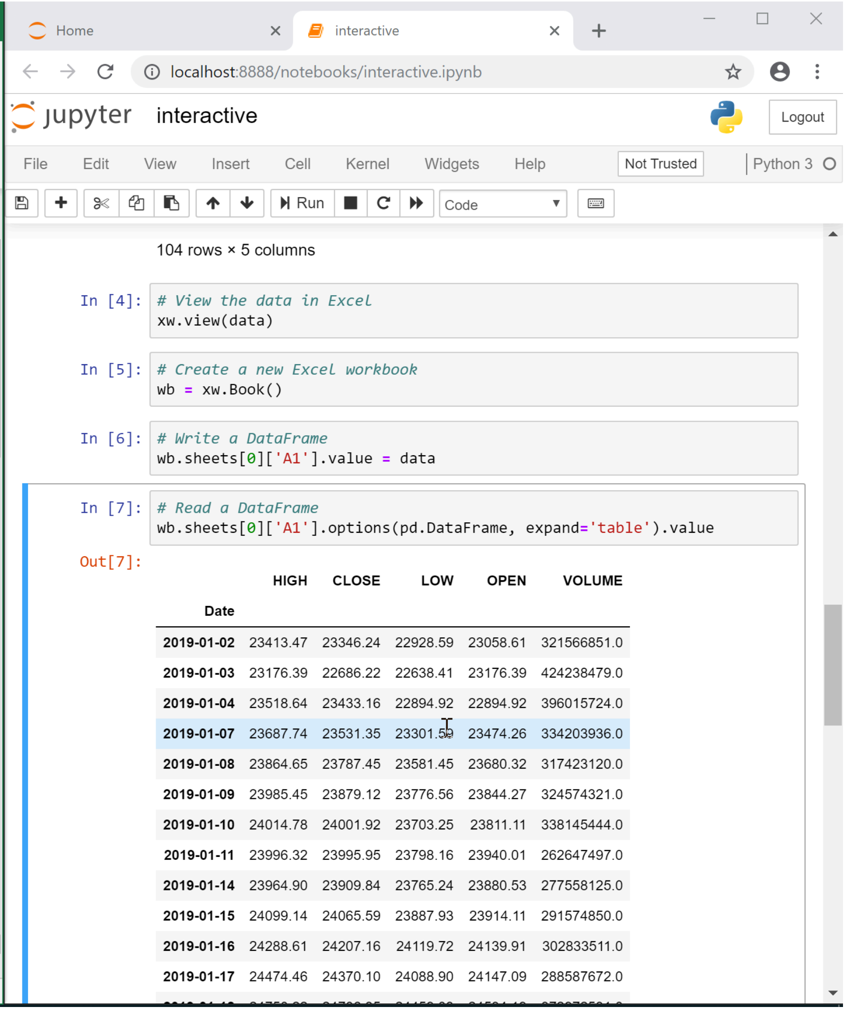
1. Interactive: Jupyter notebook



Date	HIGH	CLOSE	LOW	OPEN	VOLUME
1/2/2019	23413.47	23346.24	22928.59	23058.61	3.22E+08
1/3/2019	23176.39	22686.22	22638.41	23176.39	4.24E+08
1/4/2019	23518.64	23433.16	22894.92	22894.92	3.96E+08
1/7/2019	23687.74	23531.35	23301.59	23474.26	3.34E+08
1/8/2019	23864.65	23787.45	23581.45	23680.32	3.17E+08
1/9/2019	23985.45	23879.12	23776.56	23844.27	3.25E+08
1/10/2019	24014.78	24001.92	23703.25	23811.11	3.38E+08
1/11/2019	23996.32	23995.95	23798.16	23940.01	2.63E+08
1/14/2019	23964.9	23909.84	23765.24	23880.53	2.78E+08
1/15/2019	24099.14	24065.59	23887.93	23914.11	2.92E+08
1/16/2019	24288.61	24207.16	24119.72	24139.91	3.03E+08
1/17/2019	24474.46	24370.1	24088.9	24147.09	2.89E+08
1/18/2019	24750.22	24706.35	24459.03	24534.19	3.73E+08
1/22/2019	24607.76	24404.48	24244.31	24607.76	3.38E+08
1/23/2019	24700.98	24575.62	24307.17	24577.25	3.19E+08
1/24/2019	24626.3	24553.24	24422.73	24579.96	3.2E+08
1/25/2019	24860.15	24737.2	24676.75	24687.21	3.77E+08
1/28/2019	24596.98	24528.22	24323.94	24596.98	3.47E+08
1/29/2019	24674.87	24579.96	24504.04	24519.62	3.31E+08
1/30/2019	25109.62	25014.86	24790.9	24826.52	3.97E+08
1/31/2019	25049.62	24999.67	24842.09	24954.48	5.07E+08
2/1/2019	25193.15	25063.89	24982.49	25025.31	3.72E+08
2/4/2019	25239.91	25239.37	24977.67	25062.12	2.99E+08
2/5/2019	25427.32	25411.52	25287.65	25287.93	3.11E+08
2/6/2019	25439.04	25390.3	25312.06	25371.57	2.48E+08
2/7/2019	25314.26	25169.53	25000.52	25265.81	2.95E+08
2/8/2019	25106.39	25106.33	24883.04	25042.36	2.48E+08
2/11/2019	25196.75	25053.11	25009.1	25142.81	2.42E+08
2/12/2019	25458.98	25425.76	25152.03	25152.03	2.78E+08
2/13/2019	25625.95	25543.27	25480.86	25480.86	2.63E+08



104 rows × 5 columns

```
In [4]: # View the data in Excel
        xw.view(data)
```

```
In [5]: # Create a new Excel workbook
        wb = xw.Book()
```

```
In [6]: # Write a DataFrame
        wb.sheets[0]['A1'].value = data
```

```
In [7]: # Read a DataFrame
        wb.sheets[0]['A1'].options(pd.DataFrame, expand='table').value
```

Out[7]:

	HIGH	CLOSE	LOW	OPEN	VOLUME
Date					
2019-01-02	23413.47	23346.24	22928.59	23058.61	321566851.0
2019-01-03	23176.39	22686.22	22638.41	23176.39	424238479.0
2019-01-04	23518.64	23433.16	22894.92	22894.92	396015724.0
2019-01-07	23687.74	23531.35	23301.59	23474.26	334203936.0
2019-01-08	23864.65	23787.45	23581.45	23680.32	317423120.0
2019-01-09	23985.45	23879.12	23776.56	23844.27	324574321.0
2019-01-10	24014.78	24001.92	23703.25	23811.11	338145444.0
2019-01-11	23996.32	23995.95	23798.16	23940.01	262647497.0
2019-01-14	23964.90	23909.84	23765.24	23880.53	277558125.0
2019-01-15	24099.14	24065.59	23887.93	23914.11	291574850.0
2019-01-16	24288.61	24207.16	24119.72	24139.91	302833511.0
2019-01-17	24474.46	24370.10	24088.90	24147.09	288587672.0

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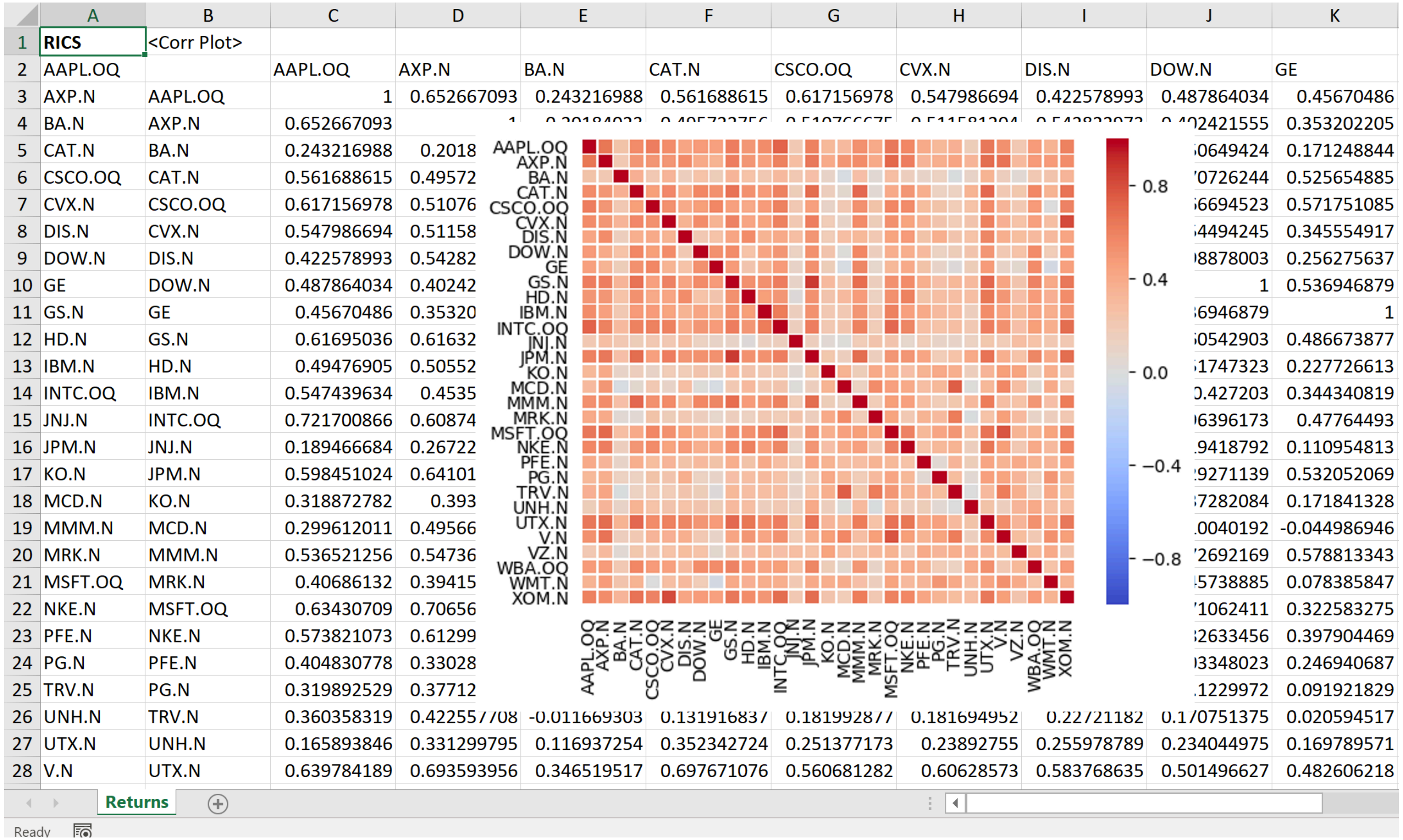
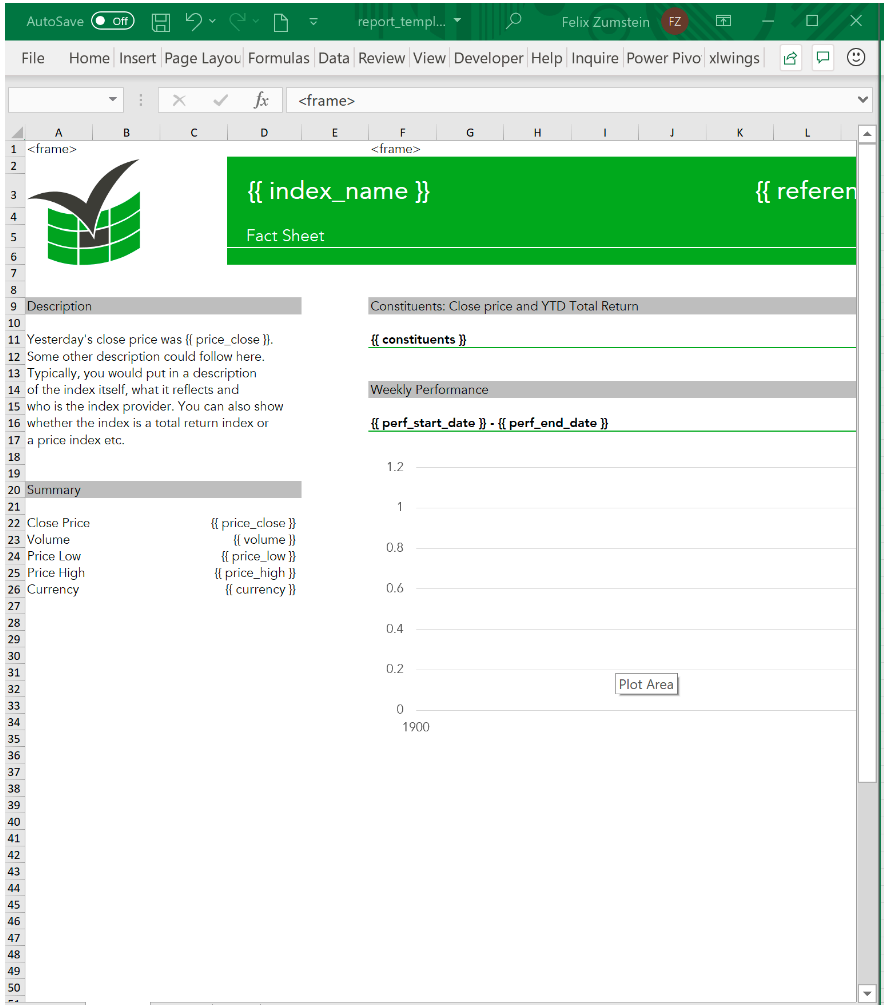
2. UDF: Correlation matrix



	A	B	C	D	E	F	G	H	I	J	K
1	**RICS**	<Corr Plot>									
2	AAPL.OQ		AAPL.OQ	AXP.N	BA.N	CAT.N	CSCO.OQ	CVX.N	DIS.N	DOW.N	GE
3	AXP.N	AAPL.OQ	1	0.652667093	0.243216988	0.561688615	0.617156978	0.547986694	0.422578993	0.487864034	0.45670486
4	BA.N	AXP.N	0.652667093	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2421555	0.353202205
5	CAT.N	BA.N	0.243216988	0.2018						0649424	0.171248844
6	CSCO.OQ	CAT.N	0.561688615	0.49572						0726244	0.525654885
7	CVX.N	CSCO.OQ	0.617156978	0.51076						6694523	0.571751085
8	DIS.N	CVX.N	0.547986694	0.51158						4494245	0.345554917
9	DOW.N	DIS.N	0.422578993	0.54282						8878003	0.256275637
10	GE	DOW.N	0.487864034	0.40242						1	0.536946879
11	GS.N	GE	0.45670486	0.35320						6946879	1
12	HD.N	GS.N	0.61695036	0.61632						0542903	0.486673877
13	IBM.N	HD.N	0.49476905	0.50552						1747323	0.227726613
14	INTC.OQ	IBM.N	0.547439634	0.4535						0.427203	0.344340819
15	JNJ.N	INTC.OQ	0.721700866	0.60874						6396173	0.47764493
16	JPM.N	JNJ.N	0.189466684	0.26722						.9418792	0.110954813
17	KO.N	JPM.N	0.598451024	0.64101						9271139	0.532052069
18	MCD.N	KO.N	0.318872782	0.393						7282084	0.171841328
19	MMM.N	MCD.N	0.299612011	0.49566						.0040192	-0.044986946
20	MRK.N	MMM.N	0.536521256	0.54736						2692169	0.578813343
21	MSFT.OQ	MRK.N	0.40686132	0.39415						5738885	0.078385847
22	NKE.N	MSFT.OQ	0.63430709	0.70656						1062411	0.322583275
23	PFE.N	NKE.N	0.573821073	0.61299						2633456	0.397904469
24	PG.N	PFE.N	0.404830778	0.33028						3348023	0.246940687
25	TRV.N	PG.N	0.319892529	0.37712						.1229972	0.091921829
26	UNH.N	TRV.N	0.360358319	0.422557708	-0.011669303	0.131916837	0.181992877	0.181694952	0.22721182	0.170751375	0.020594517
27	UTX.N	UNH.N	0.165893846	0.331299795	0.116937254	0.352342724	0.251377173	0.23892755	0.255978789	0.234044975	0.169789571
28	V.N	UTX.N	0.639784189	0.693593956	0.346519517	0.697671076	0.560681282	0.60628573	0.583768635	0.501496627	0.482606218

3. Reporting: xlwings PRO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report_templ...
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File Home Insert Page Layou Formulas Data Review View Developer Help Inquire Power Pivo xlwings
<frame>
Plot Area
1.2
1
0.8
0.6
0.4
0.2
0
1900

<frame>

<frame>

{{ index_name }}

{{ referen

Fact Sheet

Description

Yesterday's close price was {{ price_close }}.
Some other description could follow here.
Typically, you would put in a description
of the index itself, what it reflects and
who is the index provider. You can also show
whether the index is a total return index or
a price index etc.

Summary

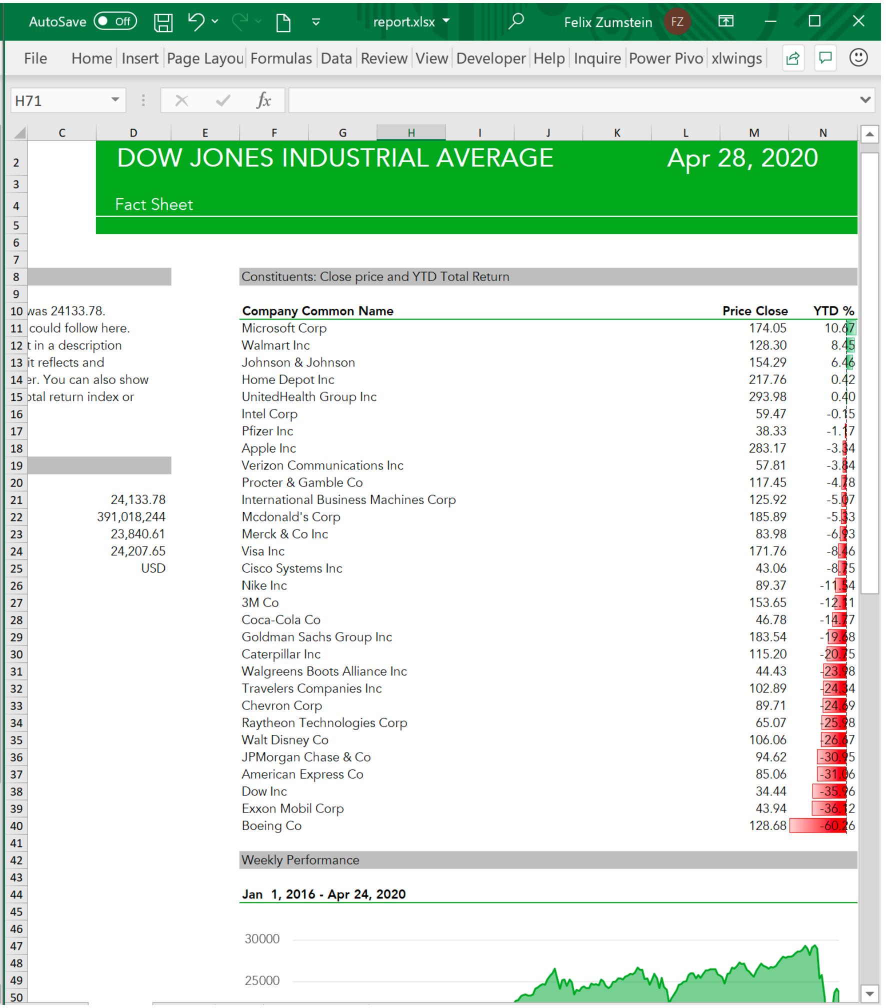
Close Price	{{ price_close }}
Volume	{{ volume }}
Price Low	{{ price_low }}
Price High	{{ price_high }}
Currency	{{ currency }}

Constituents: Close price and YTD Total Return

{{ constituents }}

Weekly Performance

{{ perf_start_date }} - {{ perf_end_date }}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report.xlsx
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H71
30000
25000

DOW JONES INDUSTRIAL AVERAGE

Apr 28, 2020

Fact Sheet

was 24133.78.
could follow here.
t in a description
it reflects and
er. You can also show
otal return index or

24,133.78
391,018,244
23,840.61
24,207.65
USD

Constituents: Close price and YTD Total Return

Company Common Name	Price Close	YTD %
Microsoft Corp	174.05	10.67
Walmart Inc	128.30	8.45
Johnson & Johnson	154.29	6.46
Home Depot Inc	217.76	0.42
UnitedHealth Group Inc	293.98	0.40
Intel Corp	59.47	-0.15
Pfizer Inc	38.33	-1.17
Apple Inc	283.17	-3.34
Verizon Communications Inc	57.81	-3.84
Procter & Gamble Co	117.45	-4.78
International Business Machines Corp	125.92	-5.07
Mcdonald's Corp	185.89	-5.33
Merck & Co Inc	83.98	-6.93
Visa Inc	171.76	-8.46
Cisco Systems Inc	43.06	-8.75
Nike Inc	89.37	-11.54
3M Co	153.65	-12.11
Coca-Cola Co	46.78	-14.77
Goldman Sachs Group Inc	183.54	-19.68
Caterpillar Inc	115.20	-20.75
Walgreens Boots Alliance Inc	44.43	-23.98
Travelers Companies Inc	102.89	-24.34
Chevron Corp	89.71	-24.69
Raytheon Technologies Corp	65.07	-25.98
Walt Disney Co	106.06	-26.67
JPMorgan Chase & Co	94.62	-30.95
American Express Co	85.06	-31.06
Dow Inc	34.44	-35.96
Exxon Mobil Corp	43.94	-36.12
Boeing Co	128.68	-60.26

Weekly Performance

Jan 1, 2016 - Apr 24, 2020

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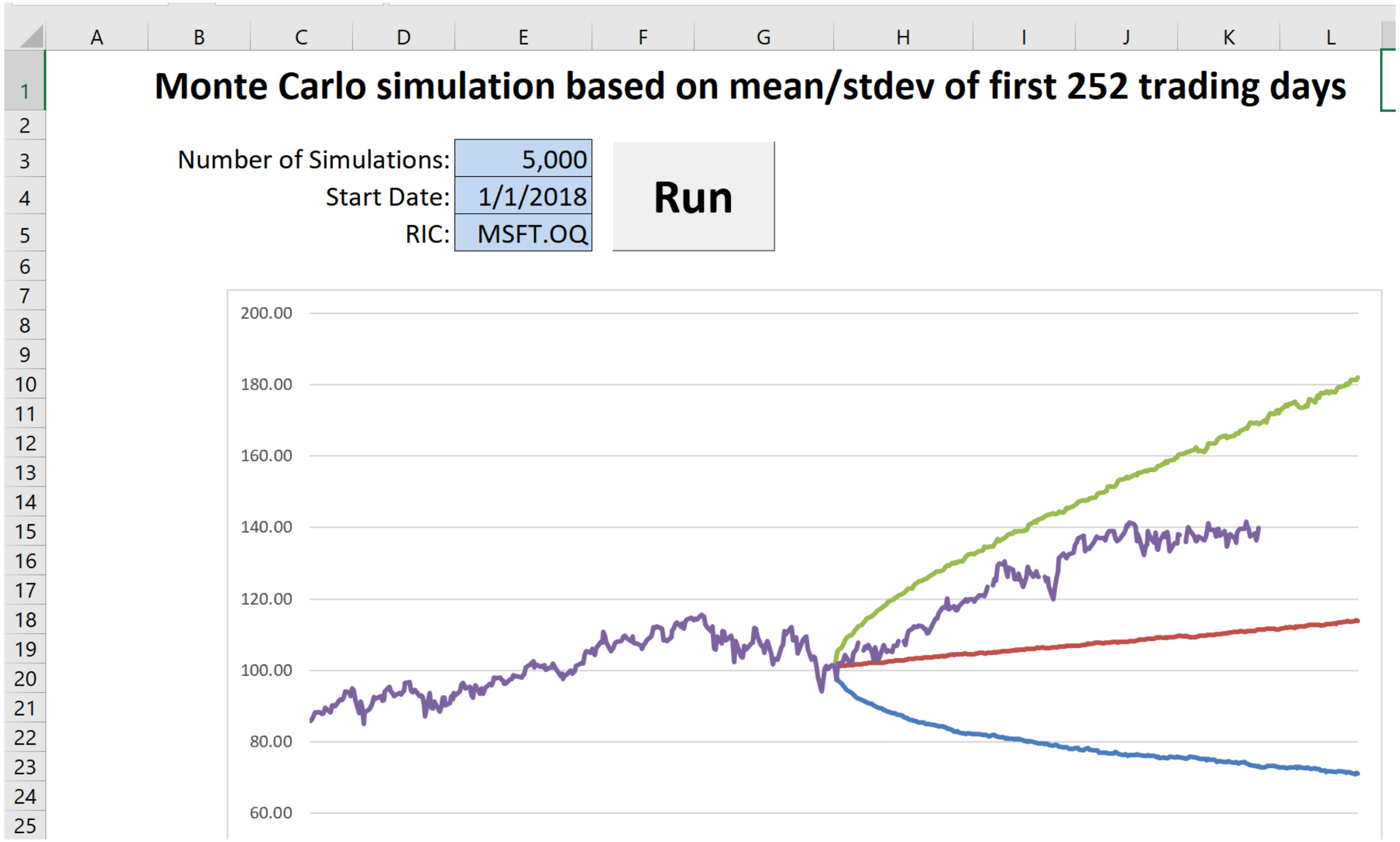
4. Macro: Monte Carlo simulation



Monte Carlo simulation based on mean/stdev of first 252 trading days

Number of Simulations: 5,000

Start Date: 1/1/2018

RIC: MSFT.OQ

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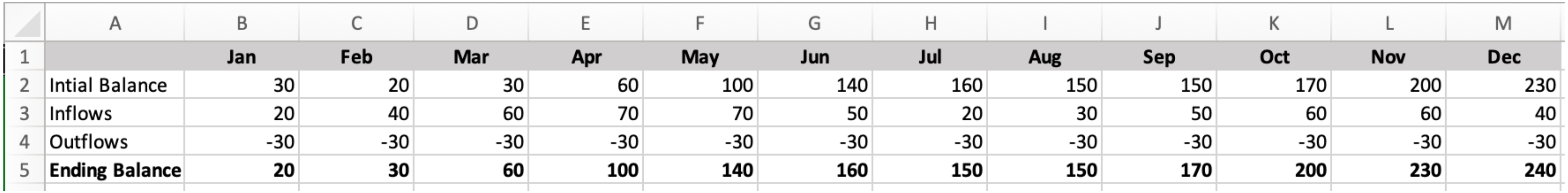
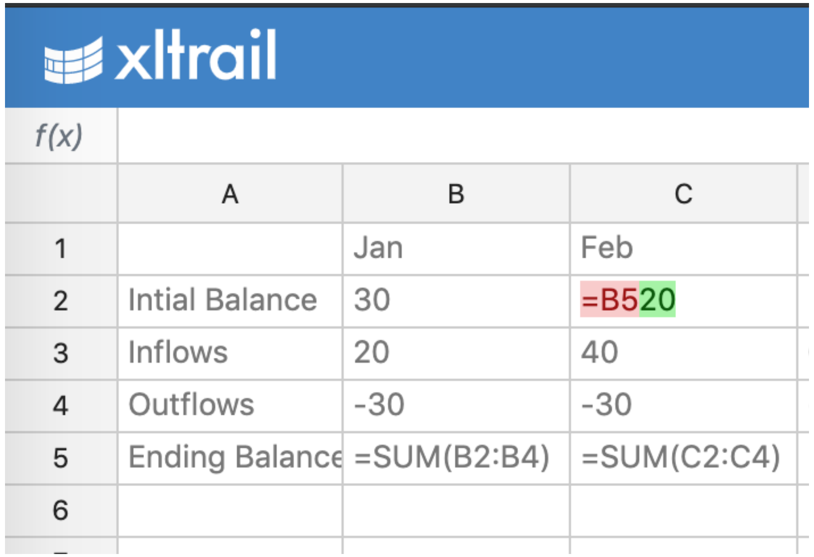
5. Automated testing



	A	B	C	D	E	F	G	H	I	J	K	L	M
1		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2	Intial Balance	30	20	30	60	100	140	160	150	150	170	200	230
3	Inflows	20	40	60	70	70	50	20	30	50	60	60	40
4	Outflows	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
5	**Ending Balance**	**20**	**30**	**60**	**100**	**140**	**160**	**150**	**150**	**170**	**200**	**230**	**240**

```python
def test_cash_flow_formula_integrity(book):
    sheet = book.sheets[0]
    sheet['start_value'].value = 100
    sheet['inflows'].value = 10
    sheet['outflows'].value = -5
    assert sheet['end_value'].value == 160
```



	A	B	C
1		Jan	Feb
2	Intial Balance	30	=B520
3	Inflows	20	40
4	Outflows	-30	-30
5	Ending Balance	=SUM(B2:B4)	=SUM(C2:C4)
6			

Thank You

Contact:
felix.zumstein@xlwings.org

https://www.linkedin.com/in/felix-zumstein