
I almost
MISSED
the ERRORS

I was learning about Monte Carlo simulations from a book written by a professor of geneticist. He had under his belt a couple of books on Excel and programming as well as biology textbooks, so he appeared to be an authoritative source.

I took it for granted that I had followed his examples exactly.

One simulation concerned

exchange rates

and **profitability.**

Here's the basic setup.

It's a simple profitability setup.

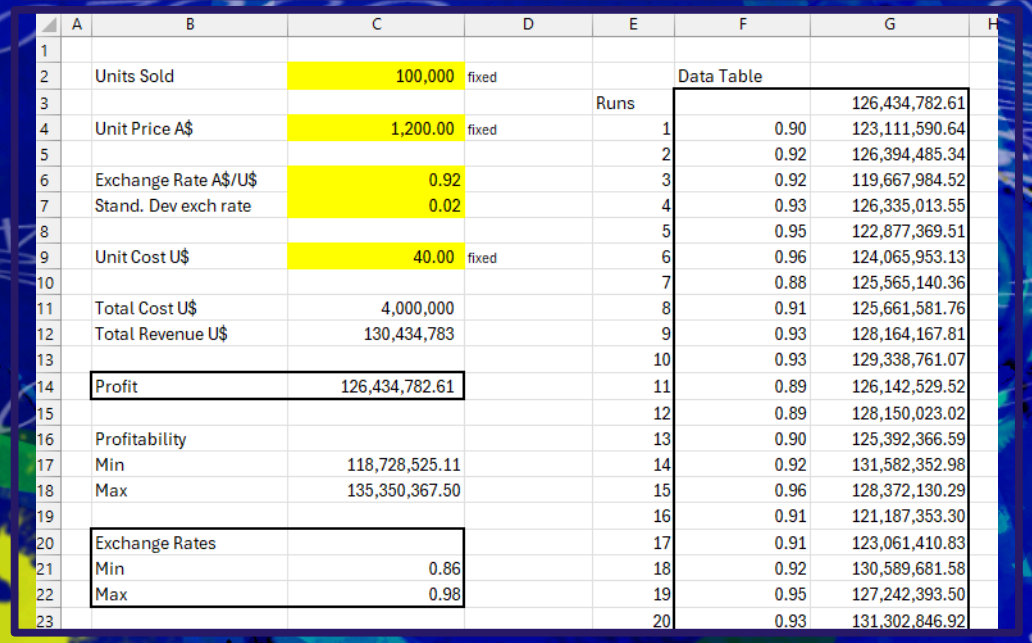
Yellow highlights = hard coded numbers.

Fixed = non-changing variables

	A	B	C	D
1				
2		Units Sold	100,000	fixed
3				
4		Unit Price A$	1,200.00	fixed
5				
6		Exchange Rate A$/U$	0.92	
7		Stand. Dev exch rate	0.02	
8				
9		Unit Cost U$	40.00	fixed
10				
11		Total Cost U$	4,000,000	
12		Total Revenue U$	130,434,783	
13				
14		Profit	126,434,782.61	
15				

As I understand it, Monte Carlo is a process of running hundreds or thousands of simulations of random and uncertain situations to answer the question of what is the most likely range of outcomes.

In this example, the exchange rate is to be the random factor using RAND function and 1000 simulations are run to find the likely range of profitability.



	B	C	D	E	F	G
2	Units Sold	100,000	fixed		Data Table	
3				Runs		126,434,782.61
4	Unit Price A$	1,200.00	fixed	1	0.90	123,111,590.64
5				2	0.92	126,394,485.34
6	Exchange Rate A$/U$	0.92		3	0.92	119,667,984.52
7	Stand. Dev exch rate	0.02		4	0.93	126,335,013.55
8				5	0.95	122,877,369.51
9	Unit Cost U$	40.00	fixed	6	0.96	124,065,953.13
10				7	0.88	125,565,140.36
11	Total Cost U$	4,000,000		8	0.91	125,661,581.76
12	Total Revenue U$	130,434,783		9	0.93	128,164,167.81
13				10	0.93	129,338,761.07
14	Profit	126,434,782.61		11	0.89	126,142,529.52
15				12	0.89	128,150,023.02
16	Profitability			13	0.90	125,392,366.59
17	Min	118,728,525.11		14	0.92	131,582,352.98
18	Max	135,350,367.50		15	0.96	128,372,130.29
19				16	0.91	121,187,353.30
20	Exchange Rates			17	0.91	123,061,410.83
21	Min	0.86		18	0.92	130,589,681.58
22	Max	0.98		19	0.95	127,242,393.50
23				20	0.93	131,302,846.92

The data table in the image on the left is a simulation containing 1000 rows with random exchange rates in column F and profitability in column G.

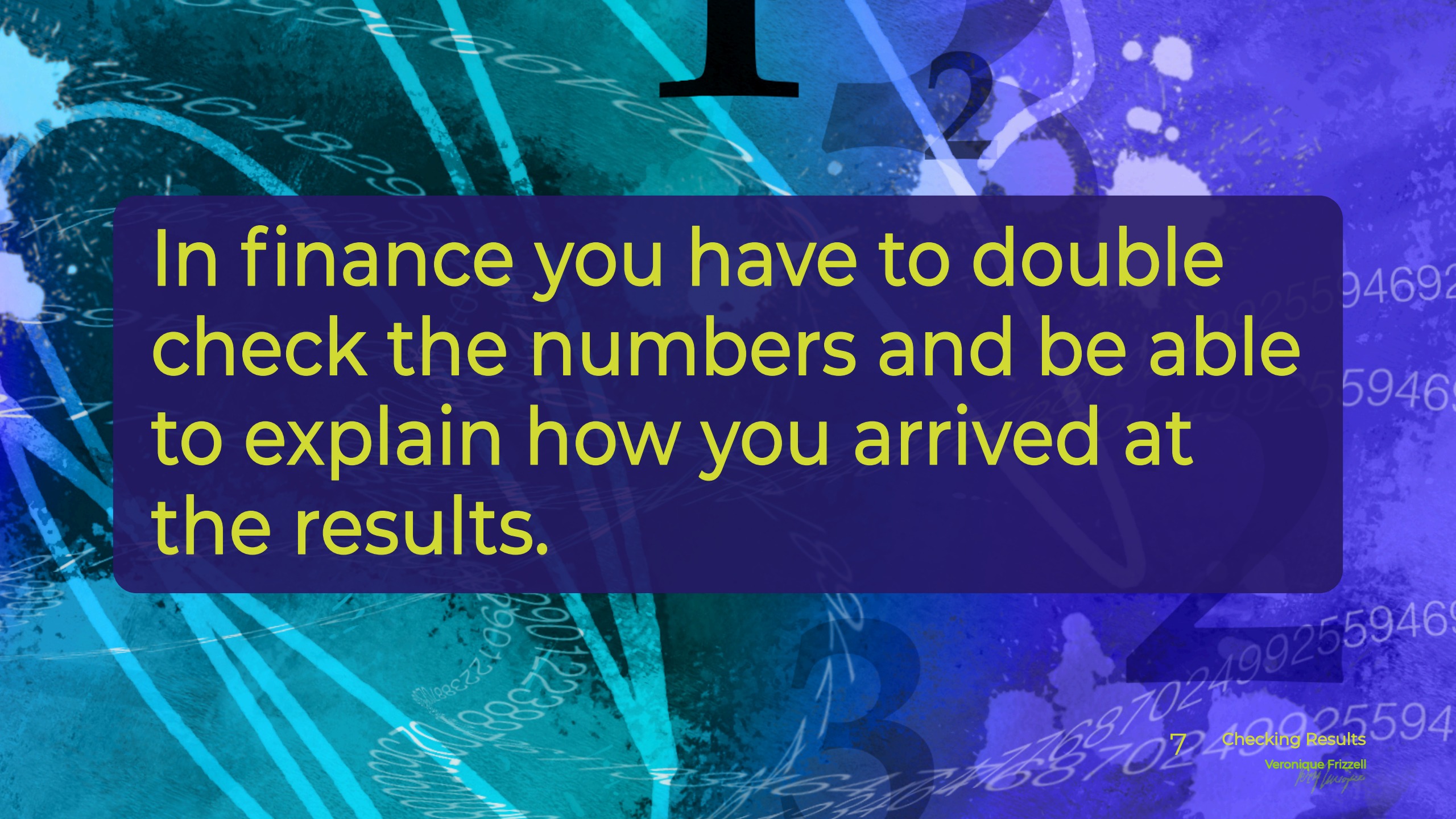
I'm mimicking the setup in the book.

I thought

GOOD, I'm

DONE.

But then my finance persona kicked in.



In finance you have to double check the numbers and be able to explain how you arrived at the results.

	E	F	G	H
		Data Table		
	Runs		126,434,782.61	
	1	0.90	123,111,590.64	
	2	0.92	126,394,485.34	
	3	0.92	119,667,984.52	
	4	0.93	126,335,013.55	
	5	0.95	122,877,369.51	
	6	0.96	124,065,953.13	
	7	0.88	125,565,140.36	
	8	0.91	125,661,581.76	
	9	0.93	128,164,167.81	
	10	0.93	129,338,761.07	
	11	0.89	126,142,529.52	
	12	0.89	128,150,023.02	
	13	0.90	125,392,366.59	
	14	0.92	131,582,352.98	
	15	0.96	128,372,130.29	
	16	0.91	121,187,353.30	
	17	0.91	123,061,410.83	
	18	0.92	130,589,681.58	
	19	0.95	127,242,393.50	
	20	0.93	131,302,846.92	
	21	0.92	131,280,681.30	
	22	0.94	126,754,740.03	
	23	0.90	128,151,842.18	
	24	0.89	124,119,865.49	
	25	0.91	122,781,150.11	
	26	0.90	125,527,281.04	
	27	0.91	124,208,057.04	
	28	0.87	129,060,738.95	
	29	0.93	130,220,911.26	
	30	0.94	131,316,072.33	
	31	0.90	128,797,857.02	
	32	0.92	128,455,708.55	

So, something looks FISHY

Why are there different profitability numbers for the same exchange rate?

E	F	G	H	M
970	0.90	123,976,137.60		
971	0.88	123,555,772.34		
972	0.93	124,156,303.46		
973	0.91	123,250,071.96		
974	0.90	123,381,213.16		
975	0.93	127,182,059.48		
976	0.95	127,453,934.00		
977	0.89	124,646,147.84		
978	0.90	124,652,681.42		
979	0.95	129,123,981.40		
980	0.91	130,421,200.62		
981	0.93	125,917,444.09		
982	0.93	126,893,730.90		
983	0.95	124,575,868.48		
984	0.91	129,091,421.96		
985	0.93	126,809,190.92		
986	0.90	123,576,984.40		
987	0.91	127,367,499.10		
988	0.93	126,401,324.73		
989	0.89	132,070,608.95		
990	0.91	121,808,084.66		
991	0.92	129,399,535.89		
992	0.91	125,877,487.87		
993	0.93	124,225,615.00		
994	0.92	128,996,926.63		
995	0.93	127,288,512.45		
996	0.94	127,054,178.61		
997	0.90	128,304,584.72		
998	0.92	128,919,192.23		
999	0.90	128,315,082.53		
1000	0.89	124,706,114.95		

I can EXPLAIN *that*

by REALIZING

that exchange rate .93
could be .92956... or .93187...
or whatever.

	Data Table	
Runs		126,434,782.61
1	0.90	123,111,590.64
2	0.92	126,394,485.34
3	0.92	119,667,984.52
4	0.93	126,335,013.55
5	0.95	122,877,369.51
6	0.96	124,065,953.13
7	0.88	125,565,140.36
8	0.91	125,661,581.76
9	0.93	128,164,167.81
10	0.93	129,338,761.07
11	0.89	126,142,529.52
12	0.89	128,150,023.02
13	0.90	125,392,366.59
14	0.92	131,582,352.98
15	0.96	128,372,130.29
16	0.91	121,187,353.30
17	0.91	123,061,410.83
18	0.92	130,589,681.58
19	0.95	127,242,393.50
20	0.93	131,302,846.92
21	0.92	131,280,681.30
22	0.94	126,754,740.03
23	0.90	128,151,842.18
24	0.89	124,119,865.49
25	0.91	122,781,150.11
26	0.90	125,527,281.04
27	0.91	124,208,057.04
28	0.87	129,060,738.95
29	0.93	130,220,911.26
30	0.94	131,316,072.33
31	0.90	128,797,857.02

BUT STILL

We have .89, .93 and .94, just to select a few exchange rates, all ending up with a profitability of around $126K+ and yet, we also have .93 and .94 with profitability around $131K+.

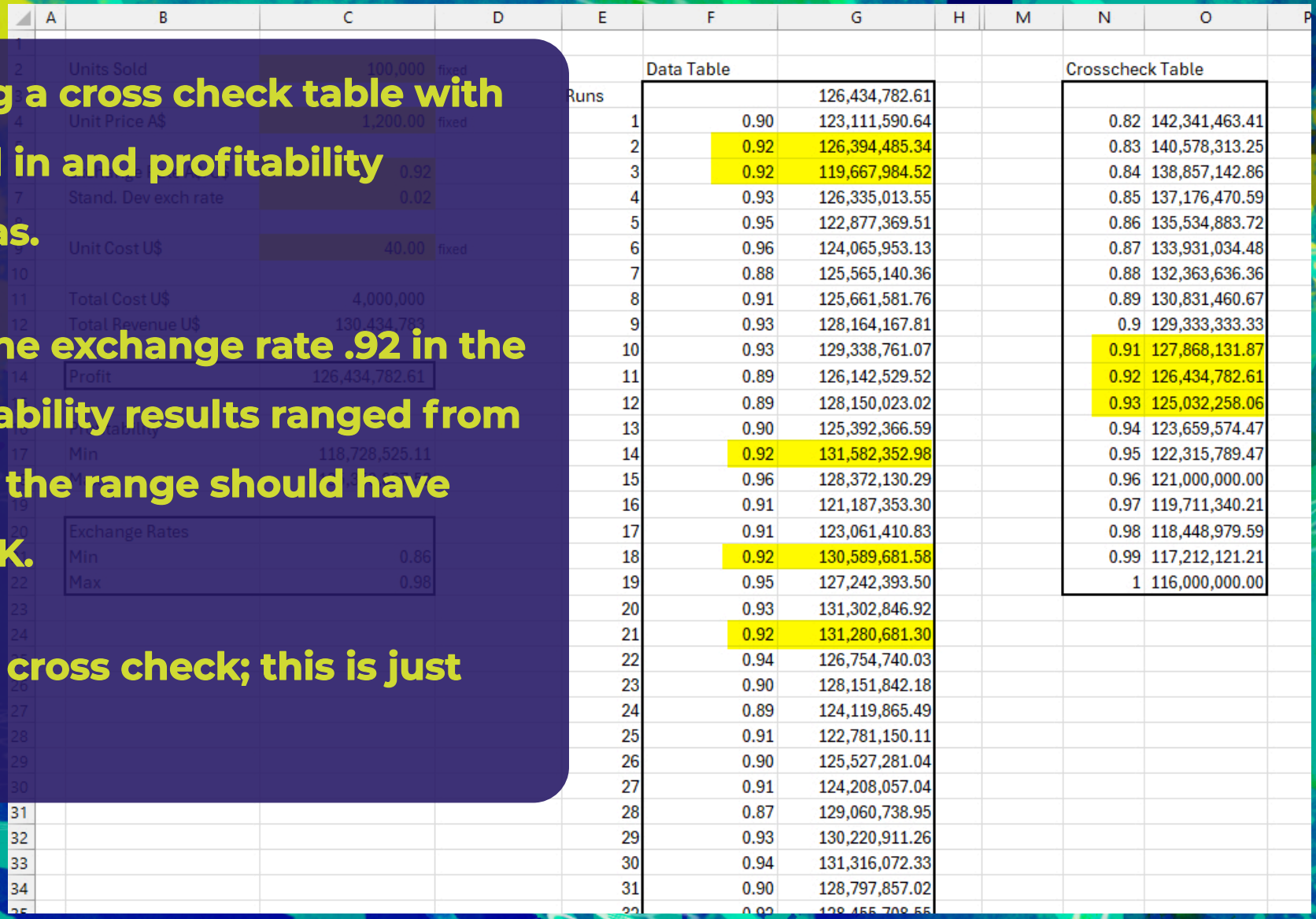
This is a simple profitability formula; numbers shouldn't jump around like that.


THAT
is
why
you double check your numbers.

I ended up developing a cross check table with exchange rates keyed in and profitability calculated via formulas.

As you can see with the exchange rate .92 in the Data Table, the profitability results ranged from $119K to $131.5K when the range should have centered around $126K.

There's many ways to cross check; this is just one way.



2	Units Sold	100,000	fixed									
4	Unit Price A$	1,200.00	fixed									
7	Stand. Dev exch rate	0.02										
9	Unit Cost U$	40.00	fixed									
11	Total Cost U$	4,000,000										
12	Total Revenue U$	130,434,783										
14	Profit	126,434,782.61										
17	Min	118,728,525.11										
20	Exchange Rates											
21	Min	0.86										
22	Max	0.98										

	Data Table		Crosscheck Table	
Runs		126,434,782.61		
1	0.90	123,111,590.64	0.82	142,341,463.41
2	0.92	126,394,485.34	0.83	140,578,313.25
3	0.92	119,667,984.52	0.84	138,857,142.86
4	0.93	126,335,013.55	0.85	137,176,470.59
5	0.95	122,877,369.51	0.86	135,534,883.72
6	0.96	124,065,953.13	0.87	133,931,034.48
7	0.88	125,565,140.36	0.88	132,363,636.36
8	0.91	125,661,581.76	0.89	130,831,460.67
9	0.93	128,164,167.81	0.9	129,333,333.33
10	0.93	129,338,761.07	0.91	127,868,131.87
11	0.89	126,142,529.52	0.92	126,434,782.61
12	0.89	128,150,023.02	0.93	125,032,258.06
13	0.90	125,392,366.59	0.94	123,659,574.47
14	0.92	131,582,352.98	0.95	122,315,789.47
15	0.96	128,372,130.29	0.96	121,000,000.00
16	0.91	121,187,353.30	0.97	119,711,340.21
17	0.91	123,061,410.83	0.98	118,448,979.59
18	0.92	130,589,681.58	0.99	117,212,121.21
19	0.95	127,242,393.50	1	116,000,000.00
20	0.93	131,302,846.92		
21	0.92	131,280,681.30		
22	0.94	126,754,740.03		
23	0.90	128,151,842.18		
24	0.89	124,119,865.49		
25	0.91	122,781,150.11		
26	0.90	125,527,281.04		
27	0.91	124,208,057.04		
28	0.87	129,060,738.95		
29	0.93	130,220,911.26		
30	0.94	131,316,072.33		
31	0.90	128,797,857.02		

BOTTOM LINE

Whether you are learning something from a book, a professor or even AI, always scrutinize the results.

Here's another approach using XLOOKUPs (columns K & L) to eliminate the eyeballing effort.

It turns out most of the runs' profitability appear incorrect (x = problematic).

So, at present time, I'm not going to use RAND in data tables.

	E	F	G	H	I	J	K	L	M	N	O	P
		Data Table								Crosscheck Table		
	Runs		126,434,782.61			x = problematic	Next smaller -1	Next larger 1				
	1	0.90	130,825,484.92		0.897		130,831,460.67	129,333,333.33		0.82	142,341,463.41	
	2	0.94	122,089,814.95		0.939	x	125,032,258.06	123,659,574.47		0.83	140,578,313.25	
	3	0.90	126,116,362.91		0.899	x	130,831,460.67	129,333,333.33		0.84	138,857,142.86	
	4	0.92	129,848,293.59		0.924	x	126,434,782.61	125,032,258.06		0.85	137,176,470.59	
	5	0.94	132,689,533.80		0.944	x	123,659,574.47	122,315,789.47		0.86	135,534,883.72	
	6	0.93	124,918,683.50		0.929	x	126,434,782.61	125,032,258.06		0.87	133,931,034.48	
	7	0.97	127,117,569.35		0.970	x	119,711,340.21	118,448,979.59		0.88	132,363,636.36	
	8	0.92	126,668,155.95		0.920		127,868,131.87	126,434,782.61		0.89	130,831,460.67	
	9	0.89	123,720,659.60		0.891	x	130,831,460.67	129,333,333.33		0.9	129,333,333.33	
	10	0.90	132,729,029.84		0.899	x	130,831,460.67	129,333,333.33		0.91	127,868,131.87	
	11	0.92	124,057,248.90		0.919	x	127,868,131.87	126,434,782.61		0.92	126,434,782.61	
	12	0.90	129,148,325.60		0.897	x	130,831,460.67	129,333,333.33		0.93	125,032,258.06	
	13	0.89	133,698,118.93		0.888	x	132,363,636.36	130,831,460.67		0.94	123,659,574.47	
	14	0.91	123,827,686.47		0.914	x	127,868,131.87	126,434,782.61		0.95	122,315,789.47	
	15	0.95	131,437,872.64		0.948	x	123,659,574.47	122,315,789.47		0.96	121,000,000.00	
	16	0.92	122,230,474.01		0.918	x	127,868,131.87	126,434,782.61		0.97	119,711,340.21	
	17	0.92	126,909,532.24		0.921	x	126,434,782.61	125,032,258.06		0.98	118,448,979.59	
	18	0.91	122,671,398.82		0.914	x	127,868,131.87	126,434,782.61		0.99	117,212,121.21	
	19	0.92	127,068,521.28		0.923	x	126,434,782.61	125,032,258.06		1	116,000,000.00	
	20	0.90	129,567,358.89		0.903	x	129,333,333.33	127,868,131.87				
	21	0.91	122,936,912.78		0.910	x	127,868,131.87	126,434,782.61				
	22	0.92	125,918,654.91		0.920	x	127,868,131.87	126,434,782.61				
	23	0.91	126,228,602.48		0.911	x	127,868,131.87	126,434,782.61				
	24	0.91	125,852,590.06		0.913	x	127,868,131.87	126,434,782.61				
	25	0.94	123,631,565.92		0.936	x	125,032,258.06	123,659,574.47				
	26	0.89	127,775,787.57		0.887	x	132,363,636.36	130,831,460.67				
	27	0.92	127,276,143.02		0.920		127,868,131.87	126,434,782.61				
	28	0.91	131,269,321.37		0.907	x	129,333,333.33	127,868,131.87				
	29	0.94	123,314,230.77		0.943		123,659,574.47	122,315,789.47				
	30	0.96	131,079,298.55		0.958	x	122,315,789.47	121,000,000.00				
	31	0.93	126,057,598.21		0.926		126,434,782.61	125,032,258.06				
	32	0.91	125,615,642.75		0.909	x	129,333,333.33	127,868,131.87				

I hope this example impresses upon you the importance of double checking your numbers. I almost let it go because I trusted the prof.

If there is something unclear, you can connect with me on LinkedIn by clicking on the More button at

https://www.linkedin.com/in/veroniquefrizzell/