PERFORMANCE PERSPECTIVES

with David Spaulding

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MORE ON THE IRR

During our recent Asia Forum Chapter meeting in Singapore, we discussed the merits of money-weighting and the IRR. As I often do, I showed an example where an investor lost money but had a positive time-weighted return. It might be fun to construct another example, for a one year period, where an investor makes monthly cash flows. We have three scenarios:

#1 Each month in which there's a positive return, the investor adds money; each month in which there's a negative return, the investor withdrawals money (the "lucky" or "premoni-tion" approach)

#2 Each month in which there's a positive return, the investor withdrawals money; each month in which there's a negative return, the investor adds money (the "unlucky" or "chase the re-turns" approach)

#3 No cash flows.

An excerpt of the spreadsheet is in Table 1; the full spreadsheet is shown in Table 2.

	Cash Flow Dates	1/1/15	2/1/15	[illegible]	11/1/15	12/1/15		
	Starting Value =	$1,000,000						
Scenario #1		Jan	Feb		Nov	Dec	Year	Gain/Loss
	Monthly Cash Flows	$10,000	-$10,000	[illegible]	$60,000	-$60,000	0	
	Start of Month Value	$1,010,000	$1,012,120	[illegible]	$1,069,768	$1,076,094		
	End of Month Value	$1,022,120	$1,001,999	[illegible]	$1,136,094	$1,011,528		$11,528
	Monthly Returns	1.20%	-1.00%	[illegible]	6.20%	-6.00%	0.25%	
Scenario #2		Jan	Feb		Nov	Dec	Year	Gain/Loss
	Monthly Cash Flows	-$10,000	$10,000	[illegible]	-$60,000	$60,000	0	
	Start of Month Value	$990,000	$1,011,880	[illegible]	$938,642	$1,056,837		
	End of Month Value	$1,001,880	$1,001,761	[illegible]	$996,837	$993,427		-$6,573
	Monthly Returns	1.20%	-1.00%	[illegible]	6.20%	-6.00%	0.25%	
Scenario #3		Jan	Feb		Nov	Dec	Year	Gain/Loss
	Monthly Cash Flows	$0	$0	[illegible]	$0	$0	$0	
	Start of Month Value	$1,000,000	$1,012,000	[illegible]	$1,004,205	$1,066,466		
	End of Month Value	$1,012,000	$1,001,880	[illegible]	$1,066,466	$1,002,478		$2,478
	Monthly Returns	1.20%	-1.00%	[illegible]	6.20%	-6.00%	0.25%	

Table 1

All cash flows occur on the first of the month, and are therefore included in that month's starting value. We begin with $1 million. The cash flows are paired in values, alternate between positive and negative, and cancel each other out for the year.

Because the returns are time-weighted, each scenario gets the same return: 0.25 percent.[1] However, there's a fairly significant difference in the gain/loss for each scenario:

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– Rodolfo Vanzini

Contribution Fundamentals
– David Spaulding, DPS, CIPM

#1 +$11,528
#2 −6,573
#3 +2,478.

The Scenario #1 investor benefits from adding money just at the right time, and taking money out *just at the right time*, while the Scenario #2 investor had a case of "bad luck" with their monthly flows, doing the opposite of what they should have.

If this were a mutual fund, the fund would report the return of 0.25%, and that would, of course, be correct. However, each investor gets a different experience, save for the third.[2]

Many mutual funds today offer "personal rates of return." These are typically based on the internal rate of return, and capture the cash flow decisions of the investor.

Table 3[3] provides the internal rates of return for the three scenarios. These returns capture the effect of the cash flows.

From the investor's perspective, these returns will probably make more sense, as they reflect *their experience*; i.e., tying their cash flow decisions into the return results. The first investor obtained a higher return than the fund, itself, because of the advantageous cash flows; the second didn't do as well, because of the poor cash flow timing; and the third got the same result, because there were no flows.

Cash Flow Dates	1/1/15	2/1/15	3/1/15	4/1/15	5/1/15	6/1/15	7/1/15	8/1/15	9/1/15	10/1/15	11/1/15	12/1/15		
Starting Value =	$1,000,000													
Scenario #1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Gain/Loss
Monthly Cash Flows	$10,000	-$10,000	$20,000	-$20,000	$30,000	-$30,000	$40,000	-$40,000	$50,000	-$50,000	$60,000	-$60,000	0	
Start of Month Value	$1,010,000	$1,012,120	$1,021,999	$1,024,483	$1,033,993	$1,037,081	$1,045,968	$1,049,899	$1,057,903	$1,062,914	$1,069,768	$1,076,094		
End of Month Value	$1,022,120	$1,001,999	$1,044,483	$1,003,993	$1,067,081	$1,005,968	$1,089,899	$1,007,903	$1,112,914	$1,009,768	$1,136,094	$1,011,528		$11,528
Monthly Returns	1.20%	-1.00%	2.20%	-2.00%	3.20%	-3.00%	4.20%	-4.00%	5.20%	-5.00%	6.20%	-6.00%	0.25%	

Scenario #2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Gain/Loss
Monthly Cash Flows	-$10,000	$10,000	-$20,000	$20,000	-$30,000	$30,000	-$40,000	$40,000	-$50,000	$50,000	-$60,000	$60,000	0	
Start of Month Value	$990,000	$1,011,880	$981,761	$1,023,360	$972,893	$1,034,025	$963,005	$1,043,451	$951,713	$1,051,202	$938,642	$1,056,837		
End of Month Value	$1,001,880	$1,001,761	$1,003,360	$1,002,893	$1,004,025	$1,003,005	$1,003,451	$1,001,713	$1,001,202	$998,642	$996,837	$993,427		-$6,573
Monthly Returns	1.20%	-1.00%	2.20%	-2.00%	3.20%	-3.00%	4.20%	-4.00%	5.20%	-5.00%	6.20%	-6.00%	0.25%	

Scenario #3	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Gain/Loss
Monthly Cash Flows	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Start of Month Value	$1,000,000	$1,012,000	$1,001,880	$1,023,921	$1,003,443	$1,035,553	$1,004,487	$1,046,675	$1,004,808	$1,057,058	$1,004,205	$1,066,466		
End of Month Value	$1,012,000	$1,001,880	$1,023,921	$1,003,443	$1,035,553	$1,004,487	$1,046,675	$1,004,808	$1,057,058	$1,004,205	$1,066,466	$1,002,478		$2,478
Monthly Returns	1.20%	-1.00%	2.20%	-2.00%	3.20%	-3.00%	4.20%	-4.00%	5.20%	-5.00%	6.20%	-6.00%	0.25%	

Table 2

Please don't misinterpret the message: time-weighting is clearly the appropriate return to explain how the manager did. It's hopefully clear that they performed in an identical fashion in each scenario; the only differences are the cash flows. The IRR (money-weighting) provides perfor-mance from a different perspective: that of the investor. It, too, has value, and should be incorpo-rated into the reporting.

1 Because with time-weighting, we eliminate the impact of cash flows.

2 With no cash flows, they should get the same result as the fund itself.

3 I used Excel's XIRR function to derive the result. The first column of dollar values represent the flows as we might expect (that is, positive for inflows and negative for out). However, Excel expects the signs to be reversed, so that's what I did in each scenario's second column of dollar values. .

Scenario #1			Scenario #2			Scenario #3		
1/1/15	$1,000,000	-$1,000,000	1/1/15	$1,000,000	-$1,000,000	1/1/15	$1,000,000	-$1,000,000
1/1/15	$10,000	-$10,000	1/1/15	-$10,000	$10,000	1/1/15	$0	$0
2/1/15	-$10,000	$10,000	2/1/15	$10,000	-$10,000	2/1/15	$0	$0
3/1/15	$20,000	-$20,000	3/1/15	-$20,000	$20,000	3/1/15	$0	$0
4/1/15	-$20,000	$20,000	4/1/15	$20,000	-$20,000	4/1/15	$0	$0
5/1/15	$30,000	-$30,000	5/1/15	-$30,000	$30,000	5/1/15	$0	$0
6/1/15	-$30,000	$30,000	6/1/15	$30,000	-$30,000	6/1/15	$0	$0
7/1/15	$40,000	-$40,000	7/1/15	-$40,000	$40,000	7/1/15	$0	$0
8/1/15	-$40,000	$40,000	8/1/15	$40,000	-$40,000	8/1/15	$0	$0
9/1/15	$50,000	-$50,000	9/1/15	-$50,000	$50,000	9/1/15	$0	$0
10/1/15	-$50,000	$50,000	10/1/15	$50,000	-$50,000	10/1/15	$0	$0
11/1/15	$60,000	-$60,000	11/1/15	-$60,000	$60,000	11/1/15	$0	$0
12/1/15	-$60,000	$60,000	12/1/15	$60,000	-$60,000	12/1/15	$0	$0
12/31/15	$1,011,528	$1,011,528	12/31/15	$993,427	$993,427	12/31/15	$1,002,478	$1,002,478
IRR for Scenario #1		1.14%	IRR for Scenario #2		-0.67%	IRR for Scenario #3		0.25%

Table 3

EXPANDED ROLE FOR THE IRR IN THE GIPS STANDARDS

For some time I've been aware that there is a GIPS subcommittee working on expanding the role of the IRR within GIPS. Not being part of that committee, I have no knowledge of what they're doing, considering, planning. At September's annual GIPS conference, we learned that a draft guidance statement is planned for 2017. I look forward to discovering, along with you, what's proposed.

For quite some time (roughly 15 years), I've advocated having a very simple rule: if the manager controls the cash flows, they must report the IRR. Today, its mandated in a limited number of cases. For example, for private equity closed end funds: why not open end funds, too? If the manager controls the flows, we want the flows to count in the return: simple!

Many years ago I worked with an asset manager who acted just like a private equity manager with one exception: they invested in public equity: they established closed-end funds, they sought a "committed capital" amount for each client, they controlled the cash flows. They argued that they should be reporting IRR: I fully agreed. I prepared a rather detailed letter to the folks in charge, but failed to convince them. To me, *if it looks like a duck, walks like a duck, and sounds like a duck*, it's a duck! Granted, it's not private equity, but who cares?

I am aware that I've had "friends of the IRR" involved with the highest levels of GIPS for some time; hopefully, they'll be able to convince the others that it's time to get the mandated use of the IRR much clearer within the Standards.

PUZZLE TIME

October puzzle

Last month we had the "4 Hats for 4 Gentlemen" puzzle:

- (The host of a restaurant holds 4 hats in the coat room..)
- After dinner, 4 gentlemen go to get their hats.
- What is the probability that ALL four gentlemen (each) randomly receives the wrong hat?

I got this from the *Math: An Integral Part of Happiness* page of Facebook.

I'll confess that I tried something that gave me what turned out to be the wrong answer. What I found intriguing was a formula I was not familiar with: derangements.[4]

From Wikipedia we find that "In combinatorial mathematics, a derangement is a permutation of the elements of a set, such that no element appears in its original position."[5]

Derangements are given by what's called "subfactorial numbers," which is the expression !n. You may be familiar with factorial numbers, which are shown in the form n!. E.g., 4! Is 4 × 3 × 2 × 1.

The general form of the subfactorial formula is:

$$!n \equiv n!\left(1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}+\ldots+(-1)^n\frac{1}{n!}\right)=n!\sum_{k=0}^{n}\frac{(-1)^k}{k!}$$

The formula for subfactorial, where n = 4 is:

$$!4 = 4!\left(1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}+\frac{1}{4}!\right)$$

We can use the "FACT" formula in Excel; our answer is 9. And so, there are nine possible ways for the four gentlemen to pick the wrong hat. But, that's not what we want to know. We want the probability of this occurring. And so, we need to know the total number of options or permuta-tions, and here we can use the PERMUT formula in Excel: our answer is 24.[6] And so, the answer to the problem is 9 ÷ 24 or 37.5 percent.

4 See http://oeis.org/wiki/Number_of_derangements.

5 See https://en.wikipedia.org/wiki/Derangement. More can be found here: https://www.artofproblemsolving.com/wiki/index.php?title=Derangement

6 This answer can also be found from 4! (4 × 3 × 2 × 1 = 24).

KEEP THOSE CARDS & LETTERS COMING

We appreciate the emails we receive regarding our newsletter. Mostly, we hear positive feedback while at other times, we hear opposition to what we suggest. That's fine. We can take it. And more important, we encourage the dialogue. We see this newsletter as one way to communicate ideas and want to hear your thoughts.

Hans Braker offered the following solution:

The solution to the puzzle is 3/8 (being the simplification of 9/24 resulting from counting).

It is a fun puzzle. It involves a lot of smart counting. The main issue is that, once two hats are distributed, the position of the third hat implies where the fourth hat goes. That can be seen from the fact that it is not possible to give precisely three gentlemen their own hats. Once three received their own hats, then the fourth one must also receive his own hat.

The smart counting seems easiest by naming the gentlemen Mr. Red, Mr. Black, Mr. White and Mr. Blue, corresponding with their own hats.

There are in total 24 ways to distribute the hats: four for Mr. Red, then three for Mr. Black, two for Mr. White and the remaining hat goes to Mr. Blue.

Now how can we distribute the hats in such a way that nobody gets the right hat?

Suppose first that Mr. Red receives the black hat. Then the red hat can be given to Mr. Black, Mr. White or Mr. Blue. These are three possibilities. After the black and red hat are distributed,, the white and blue hat remain to be given to the two remaining gentlemen. These two hats can both be given to the incorrect person in only one way, because either Mr. White or Mr. Blue (or both) still need to receive their hats. But they can not be given their own hat, so they must receive the other hat.

- *So if Mr. Red receives the black hat, there are three ways to distribute the remaining three hats.*
- *If Mr. Red receives the white hat, there are also three ways to distribute the other hats.*
- *If Mr. Red receives the blue hat, there are again three ways.*

So there are in total nine ways to distribute all four hats to the incorrect persons.

The probability is thus 9/24 = 3/8.

As a check, it is nice to see if we can find all probabilities.

- *Of course Prob(4 correct hats) = 1/24.*
- *We already saw Prob(3 correct hats) = 0.*
- *It is not difficult to see that Prob (2 correct hats) = 6/24. Starting from the situation that all hats are correctly distributed, the situation of having two gentlemen with correct hats aris-es only if two of the gentlemen switch their hats. This can be done in only six ways: (Mr. Red <> Mr. Black), (Mr. Red <> Mr. White), (Mr. Red <> Mr. Blue), (Mr. Black <> Mr. White), (Mr. Black <> Mr. Blue), (Mr. White <> Mr. Blue).*
- *It is easy to see that Prob(1 correct hat) = 8/24. If Mr. Red gets the red hat, then the black hat must be given to either Mr. White or Mr. Blue. If Mr. White gets the black hat, then Mr. Black must get the blue one and Mr. Blue the white one. If Mr. Blue gets the black hat, then Mr. Black must get the white one and Mr. White the blue one. Therefore, with each correct hat correspond only two ways of distributing the other three hats incorrectly. So the total number of solutions here is 8: 4 correct hats with each 2 ways for the other three hats.*

- *We showed above that Prob(0 correct hats) = 9/24.*
- *Total is (1 + 6 + 8 + 9)/24 = 24/24.*

The probability of "not getting your own hat" is increasing, where the largest probability is that none of the gentlemen gets his own hat. This is more or less what you would expect. But the probability that one of the gentlemen receives his own hat is almost as large.

Tom Stapleton and Anthony Howland also got it correct.

And speaking of Hans Braker, we missed his contribution for September:

The solution is that you need to fold 42 times.

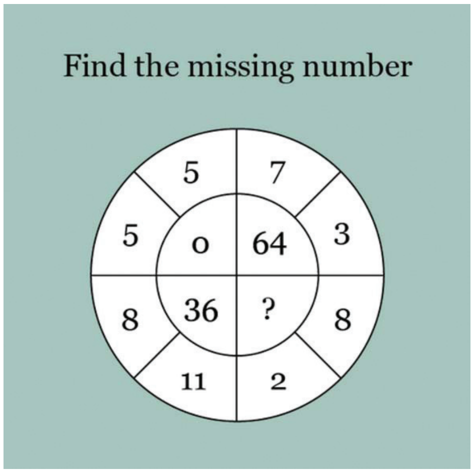
How to find the solution:

- *0.1 mm = 0.01 cm = 0.0001 m*
- *384.000 km = 384.000.000 m*
- *No folds: thickness 0.0001 m*
- *1 fold: 2 x 0.0001 m*
- *2 folds: 4 x 0.0001 m*
- *n folds: 2^n x 0.0001 m*
- *So we need to find the value of n for which 2^n x 0.0001 >= 384.000.000, or 2^n >= 3.840.000.000.000*
- *That means n >= 2log(3.840.000.000.000) or n>= 41.8*
- *Therefore n needs to be 42.*
- *After 42 times folding, the distance is 2^42 x 0.0001 m = 440.000 km which brings the folded paper beyond the moon. After 41 foldings, it is more than halfway.*

Hans also mentioned that Excel has a formula called "LOG" to which you can add the ground number: LOG(x,2) gives you 2log(x). Therefore in Excel you can immediately find LOG(3840000000000,2) = 41.8.)

Thanks, Hans! And sorry for overlooking your earlier response.

<u>November puzzle</u>[7]



7 Source: Math: An Integral Part of Happiness (Facebook).

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DATE	EVENT	LOCATION
December 6-7	Fundamentals of Performance Measurement	New Brunswick, NJ (USA)
December 8-9	Performance Measurement Attribution	New Brunswick, NJ (USA)
February 14-15, 2017	Fundamentals of Performance Measurement	Chicago, IL (USA)
February 16-17, 2017	Performance Measurement Attribution	Chicago, IL (USA)
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