

MEASUREMENT OF PROPERTY INVESTMENT RETURNS - PART 2

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Summary Measures of Historical Investment Returns

- **Arithmetic mean**
 - This is a popular and simple way to estimate the expected return for a future individual year.

$$AM = \frac{\sum_{i=1}^n HPY}{n}$$

- Where HPY = Holding period yield

Summary Measures of Historical Returns

- **Geometric mean is expressed as:**

$$GM = \left[\prod_{i=1}^n HPR \right]^{1/n}$$

- **Where $HPR = 1 + HPY$**
- **The geometric average will be less than the arithmetic average unless all the returns are equal**

Example 1

Year	Returns
1	0.05
2	-0.03
3	0.12

- **Calculate:**
 - the arithmetic mean of the returns
 - the geometric mean of the returns
- **Show how an investment of R100m in Year 1 would grow over time.**

Example 1 (Answer)

- **Arithmetic mean:**
 - **AM = $[0.05 + (-0.03) + 0.12] / 3$**
 - **AM = 0.047 = 4.7%**
- **Geometric mean:**
 - **GM = $[1.05 * 0.97 * 1.12]^{1/3} - 1$**
 - **GM = 0.04486 = 4.5%**

Calculating Ending Market Values

- To show how an investment would grow over time, we can use the following formula:

$$EMV_n = EMV_{n-1}(1 + HPY_n)$$

- **Where:**
 - EMV_n = *Value of the investment in a particular year*
 - EMV_{n-1} = *Value of the investment in the previous year*
 - HPY_n = *Return earned on the investment in a particular year*
- **Note that this is the process used to create indexes to track the performance of different investments, assets, portfolios or even markets.**

Deriving Returns From Ending Market Values

- To derive the implied returns given a range of Ending Market Values, you can use the formula below:

$$HPY_n = \frac{EMV_n}{EMV_{n-1}} - 1$$

- **Where:**

- EMV_n = Value of the investment in a particular year
- EMV_{n-1} = Value of the investment in the previous year
- HPY_n = Return earned on the investment in a particular year

Example 2

Year	Return
2004	0.15
2005	0.20
2006	0.25
2007	-0.10
2008	0.12
2009	0.18
2010	0.22

- **Given the property return data shown here, calculate:**
 - the arithmetic mean of the returns
 - The geometric mean of the returns
- **Show how an investment of R500m in 2004 would grow over the years.**

Example 2 (Answer)

Geometric mean v. Arithmetic mean

Year		HPY	HPR
2004		0.1500	1.1500
2005		0.2000	1.2000
2006		0.2500	1.2500
2007		-0.1000	0.9000
2008		0.1200	1.1200
2009		0.1800	1.1800
2010		0.2200	1.2200
$\sum r_i =$		1.0200	
$n =$		7	
Arithmetic mean =	$\sum \text{HPY}_i / n =$	14.57%	
Arithmetic Mean using excel =	average(HPY ₁ :HPY _n) =	14.57%	
Product =	$\prod \text{HPR} =$		2.5032
Geometric Mean =	$(\prod \text{HPR})^{1/n} =$		14.01%
Geometric Mean using excel =	geomean(HPR ₁ ,HPR _n)-1=		14.01%

Example 3

Year	Returns (HPY)
2015	7
2016	11
2017	4
2018	6
2019	9
2020	8.5
2021	5

- **Based on this data, calculate:**
 - the arithmetic mean of the returns
 - The geometric mean of the returns
 - Show how an investment of R100m at the end of 2015 would have grown over the years. Produce a graph using these figures.

Example 4

- You wish to compare the performance of the South Africa and UK direct property markets. You have been provided with the total returns data for the two markets. The data is linked below:

[IPD-SA and UK](#)

- Using this data, calculate the arithmetic mean and geometric mean for the two direct property markets.
- Show how an investment of R100m in UK and South Africa real estate grow over years?
- Graph the returns and the ending market/portfolio values over the period.

Geometric v. Arithmetic Mean

- **The arithmetic average is overly optimistic for long horizons**
- **The geometric average is overly pessimistic for short horizons**
- **So, the answer depends on the planning period under consideration:**
 - **15 – 20 years or less: use the arithmetic**
 - **20 – 40 years or so: split the difference between them**
 - **40 + years: use the geometric**

QUESTIONS



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