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Chapter 12

Finance 300

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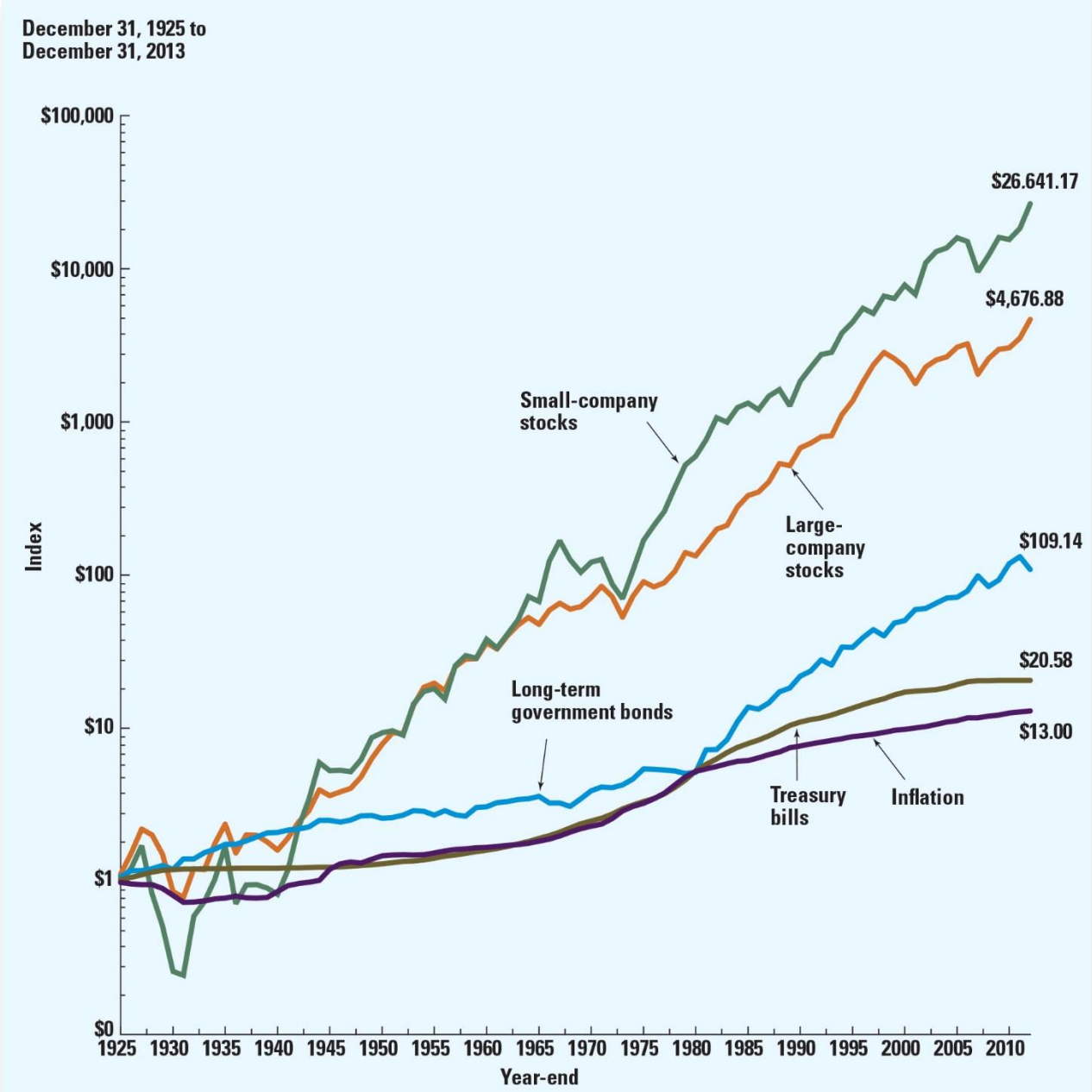
Risk and return

Risk, Return and Financial Markets

- Lessons from capital market history
  - There is a reward for bearing risk
  - The greater the potential reward, the greater the risk
  - This is called the risk-return trade-off
- How should we measure risk and return?


December 31, 1925 to
December 31, 2013
$100,000
$10,000
$1,000
$100
$10
$1
$0
Index
$26.641.17
$4,676.88
$109.14
$20.58
$13.00
Small-company stocks
Large-company stocks
Long-term government bonds
Treasury bills
Inflation
1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010
Year-end

Historical Record

Highest returns to lowest returns

1) Small cap
2) Large cap
3) Long-term government bonds
4) Treasury bills
5) Inflation

Why wouldn’t you just buy Small cap stocks?

Answer: RISK!

Dollar & Percent Returns

- Total dollar return = the return on an investment measured in dollars
  - $ Return = Dividends + Capital Gains
  - Capital Gains = Price received – Price paid
- Total percent return = the return on an investment measured as a percentage of the original investment.
  - % Return = $ Return/$ Invested

Example: Calculating Total Dollar and Total Percent Returns

- You invest in a stock with a share price of $25.
- After one year, the stock price per share is $35
- Each share paid a $2 dividend
- What was your total return?

	Dollars	Percent
Dividend	$2.00	$2/25 = 8%
Capital Gain	$35 - $25 = $10	$10/25= 40 %
Total Return	$2 + $10 = $12	$12/$25 = 48%

Percent Return

Dividend Yield ➡ $$DY = \frac{D_{t+1}}{P_t}$$

Capital Gains Yield ➡ $$CGY = \frac{P_{t+1} - P_t}{P_t}$$

$$\%\,\text{Return} = DY + CGY$$

$$\%\,\text{Return} = \frac{D_{t+1} + P_{t+1} - P_t}{P_t}$$

Practice Problems

1. One year ago, Neal purchased 3,600 shares of Franklin stock for $101,124. Today, he sold those shares for $26.60 a share. What is the total return on this investment if the dividend yield is 1.7 percent?

Historical Average Returns

- Historical Average Return = simple, or arithmetic average

$$\text{Historical Average Return} = \frac{\sum_{i=1}^{T} \text{yearly return}}{T}$$

- Using the data in Table 12.1:
  - Sum the returns for large-company stocks from 1926 through 2010, you get about 1,012/85 years = 11.9%.
- *Your best guess about the size of the return for a year selected at random is 11.9%.*

Average Returns: The First Lesson

1926 - 2010

Investment	Average Return
Large-company stocks	12.1%
Small-company stocks	16.9
Long-term corporate bonds	6.3
Long-term government bonds	5.9
U.S. Treasury bills	3.5
Inflation	3.0

What is the average return?

- A: -6, 8, 12, -15, 6

- B: -1, 2, -1, 1, 4

Risk Premium

The excess return required from an investment in a risky asset over that required from a risk free investment.

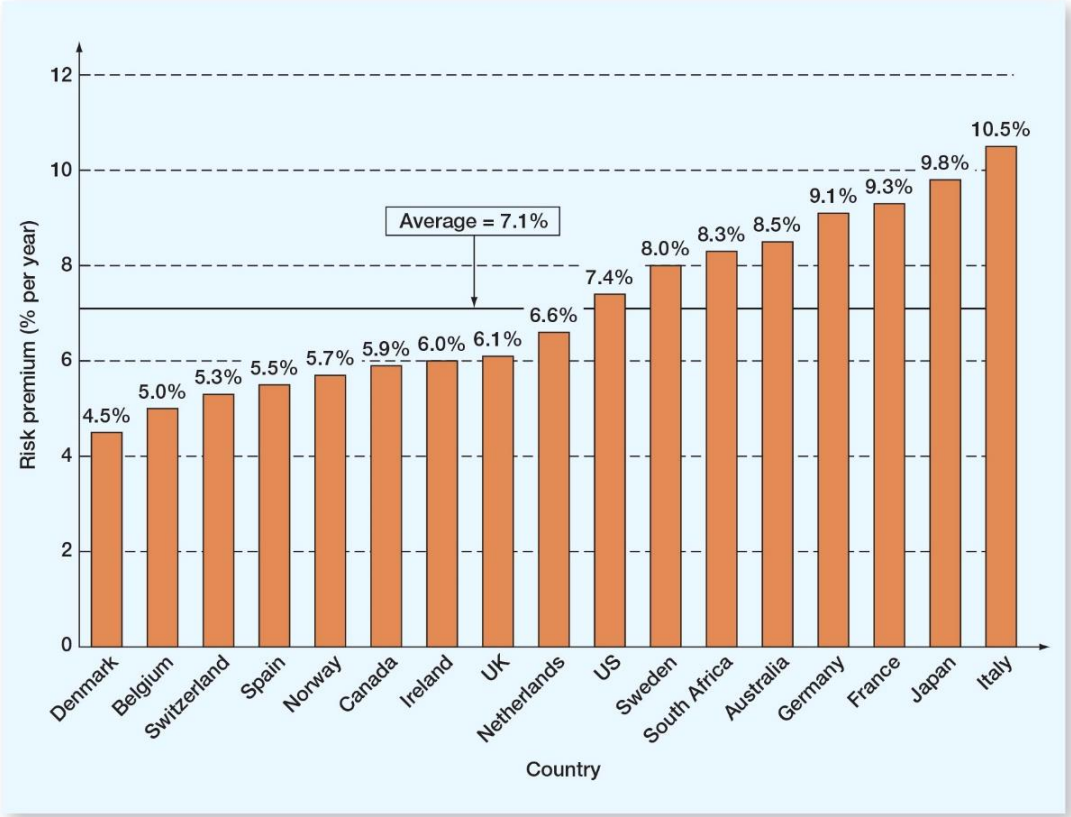
- The additional return for taking on the risk.

Investment	Average Return	Risk Premium
Large-company stocks	12.1%	8.6%
Small-company stocks	16.9	13.4
Long-term corporate bonds	6.3	2.8
Long-term government bonds	5.9	2.4
U.S. Treasury bills	3.5	.0

U.S. Treasury bill is considered risk-free return

Historical Average risk premiums

FIGURE 12.13 Stock Market Risk Premiums for 17 Countries: 1900–2005



SOURCE: Based on information in Elroy Dimson, Paul Marsh, and Michael Staunton, "The Worldwide Equity Premium: A Smaller Puzzle," in *Handbook of the Equity Risk Premium*, Rajnish Mehra, ed. (Elsevier: 2007).

First Lesson Takeaway

Risky assets, on average, earn a risk premium.

- Large company stocks have a historical average risk premium of 8.6%

What determines size of risk premium?

Return Variability Review

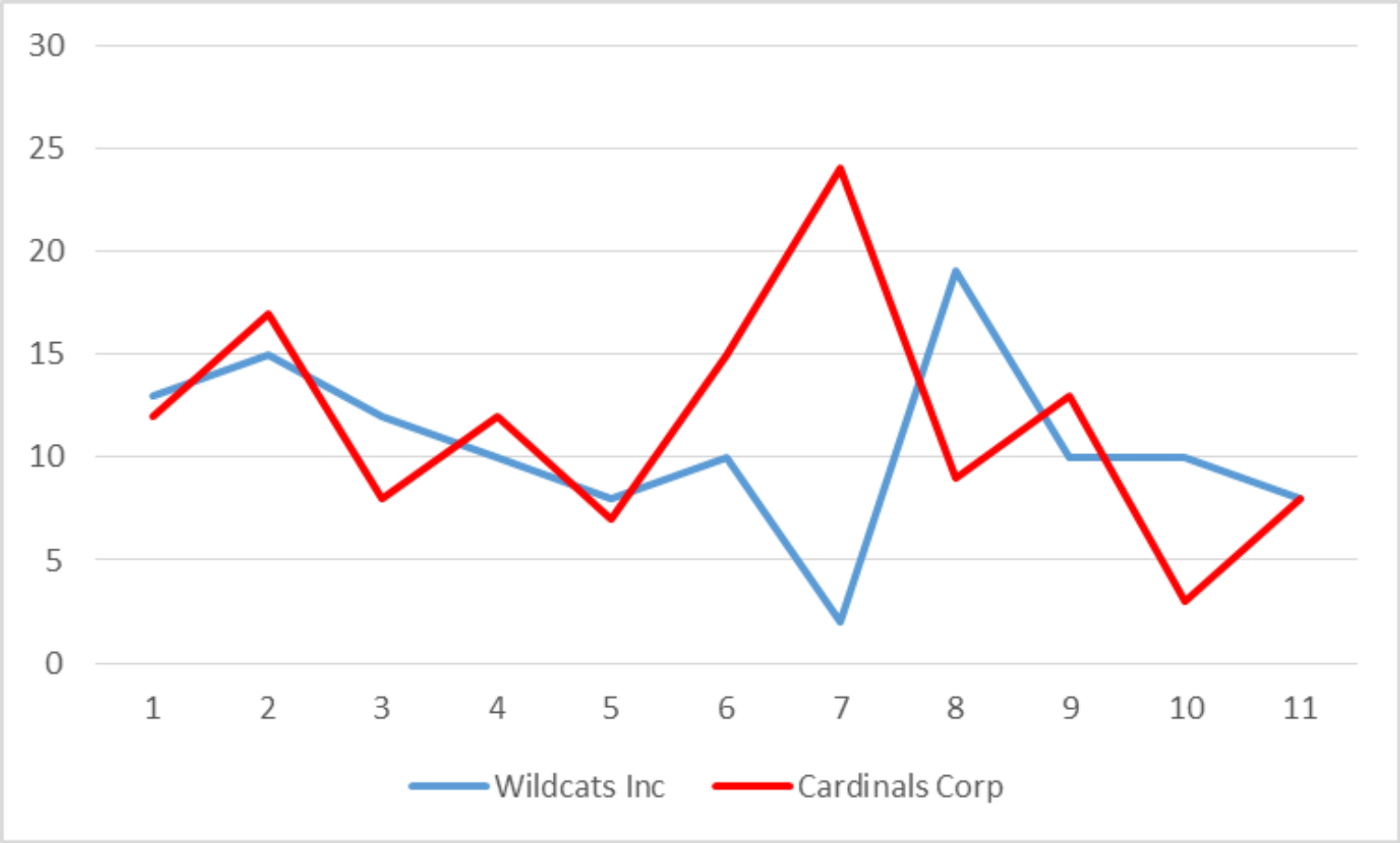
- Variance or σ^2
  - Common measure of return dispersion

- Standard deviation or σ
  - Sometimes called *volatility*
  - Same "units" as the average

	Wildcats Inc.	Cardinals Corp.
	13	12
	15	17
	12	8
	10	12
	8	7
	10	15
	2	24
	19	9
	10	13
	10	3
	8	8
Average return	10.6	11.6

	Wildcats Inc.	Cardinals Corp.
	13	12
	15	17
	12	8
	10	12
	8	7
	10	15
	2	24
	19	9
	10	13
	10	3
	8	8
Average return	10.6	11.6
Standard Deviation	4.3	5.7

Graphical representation of volatility



Points in 2016 Playoffs in last 9 games.	Steph Curry	LeBron James
	40	27
	29	24
	26	21
	28	24
	24	23
	19	24
	31	29
	31	23
	36	33
Average Points/game	29.33	25.33
Standard Deviation	6.25	3.71

Return Variability:

The Statistical Tools for Historical Returns

- Return variance: ("T" =number of returns)

$$\mathbf{VAR(R)} = \boldsymbol{\sigma}^2 = \frac{\sum_{i=1}^{T}\left(R_i - \overline{R}\right)^2}{T-1}$$

- Standard Deviation:

$$\mathbf{SD(R)} = \boldsymbol{\sigma} = \sqrt{\mathbf{VAR(R)}}$$

What is the average return?

- A: -6, 8, 12, -15, 6
  - Average = 1

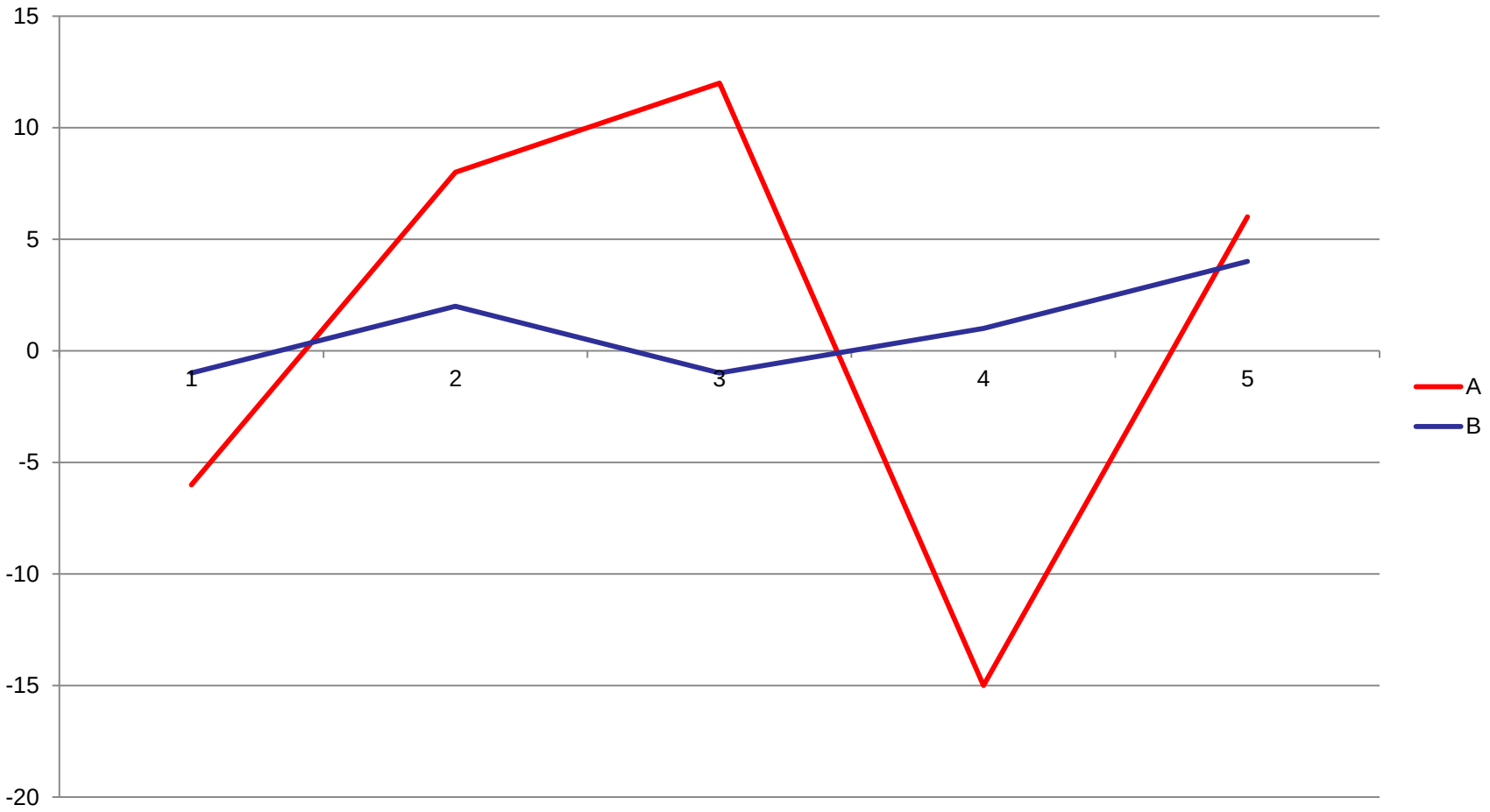
- B: -1, 2, -1, 1, 4
  - Average = 1

Which has higher variance?

- A: -6, 8, 12, -15, 6

- B: -1, 2, -1, 1, 4

Graphical representation of volatility



Example: Calculating Historical Variance and Standard Deviation

- Using data for large-company stocks:

(1)	(2)	(3)	(4)	(5)
Year	Return	Average Return:	Difference: (2) - (3)	Squared: (4) x (4)
1926	11.14	11.48	-0.34	0.12
1927	37.13	11.48	25.65	657.82
1928	43.31	11.48	31.83	1013.02
1929	-8.91	11.48	-20.39	415.83
1930	-25.26	11.48	-36.74	1349.97
Sum:	57.41		Sum:	3436.77

Average:	11.48

Variance:	859.19

Standard Deviation:	29.31

Practice Problems

1. A stock has yielded returns of 6 percent, 11 percent, 14 percent, and -2 percent over the past 4 years, respectively. What is the standard deviation of these returns?

Arithmetic vs. Geometric Mean

- If you invest in a hedge fund that loses 20% the first year, but makes 20% the second year, are you back to even?

Arithmetic vs. Geometric Mean

- If you invest in a hedge fund that loses 20% the first year, but makes 20% the second year, are you back to even?
- NO
- Start with $100
- After year 1, you have $80

  = 100*(1-.20)
- After year 2, you have $96

  = 80*(1+.20)

Arithmetic vs. Geometric Mean

- If you invest in a hedge fund that loses 20% the first year, but makes 20% the second year, are you back to even?
- NO
- Start with $100
- After year 1, you have $80

  = 100*(1-.20)
- After year 2, you have $96

  = 80*(1+.20)

Example 2

Suppose you invest $100 and it falls 50% in year one but gain 100% in year 2.

Year 0: 100

Year 1: 100 x (1 + -0.5) = 50

Year2: 50 x (1 + 1) = 100

Arithmetic vs. Geometric Mean

- Arithmetic average:
  - Return earned in an average period over multiple periods
  - Answers the question: "What was your return in an *average year* over a particular period?"

- Geometric average:
  - Average compound return per period over multiple periods
  - Answers the question: "What was your *average compound return per year* over a particular period?"

- Geometric average < arithmetic average unless all the returns are equal

Geometric Average Return: Formula

Equation 12.4

$$GAR = \left[(1+R_1)\times(1+R_2)\times\ldots\times(1+R_{T)}\right]^{1/T} - 1$$

Where:

R_i = return in each period

T = number of periods

Geometric Average Return

$$GAR = \left[\prod_{i=1}^{T} (1 + R_i) \right]^{1/T} - 1$$

Where:

Π = Product (like Σ for sum)

T = Number of periods in sample

R_i = Actual return in each period

Practice Problems Ch. 12

3. You purchased 1,300 shares of LKL stock 5 years ago and have earned annual returns of 7.1 percent, 11.2 percent, 3.6 percent, -4.7 percent and 11.8 percent. What is your arithmetic average return?

4. What is the geometric return?

Example: Calculating a Geometric Average Return

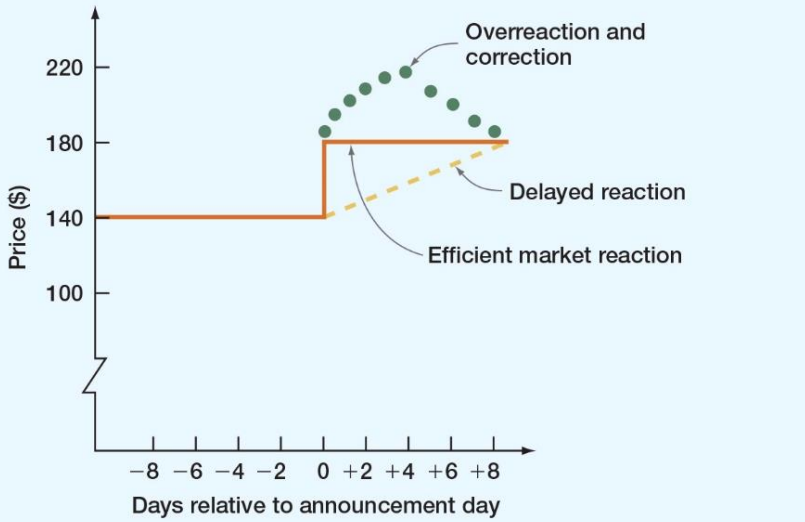
Year	Percent Return	One Plus Return	Compounded Return:
1926	11.14	1.1114	1.1114
1927	37.13	1.3713	1.5241
1928	43.31	1.4331	2.1841
1929	-8.91	0.9109	1.9895
1930	-25.26	0.7474	1.4870
		(1.4870)^(1/5):	1.0826

Geometric Average Return: 8.26%

Capital Market Efficiency

A market in which security prices reflect available information.

- If true, cannot earn abnormal or excess returns.



Efficient market reaction: The price instantaneously adjusts to and fully reflects new information; there is no tendency for subsequent increases and decreases to occur.
Delayed reaction: The price partially adjusts to the new information; eight days elapse before the price completely reflects the new information.
Overreaction: The price overadjusts to the new information; it overshoots the new price and subsequently corrects.

Efficient Market Hypothesis

The hypothesis that actual capital markets are efficient.

- *Idea is competition among investors drives information into prices and thus the market becomes more and more efficient.*
- *Stocks are all priced correctly*

Short story on EMH

A student and a finance professor are walking down the hall when they both see a $20 bill on the ground. The student bends down to pick it up.

The professor shakes their head slowly with a look of disappointment. And says…

“Don’t bother, If it were really there, someone else would have picked it up already”

Forms of Market Efficiency

1. Strong form: all information of every kind is reflected in the stock prices. Including public and private

2. Semi-strong form: all public information is reflected in stock prices.

3. Weak form: Prices reflect all past trading information such as prices and volume

Capital Market History and Market Efficiency

- No simple way to “beat” the market
- Identifying mispriced stocks is very difficult (impossible)
- Prices do respond rapidly to information
- Very difficult to predict future stock prices