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**Larry Schrenk, Instructor**

**Problem Set: Interest Rates**

**(Solutions Below)**

**Percentages and Basis Points**

1. Express 1% as a decimal and in basis points.
2. Express 0.0025 as a percentage integer and in basis points.
3. Express 15 basis points as a percentage integer and a decimal.

**Compound Rates**

1. If $100 grows to $500 in 5 years, what is the annual compound rate of interest?
2. If $11.15 grows to $30.34 in 7 years, what is the annual compound rate of interest?

**Holding Period Return**

1. If a stock price is $102.78 in June and $120.56 one month later, what is the holding period return?
2. If a stock price is $45.00 in May and $43.55 one month later, what is the holding period return?
3. Find the monthly holding period returns, the quarterly holding period returns, and the annual holding period return:

|  |  |
| --- | --- |
| Month | Price |
| December | $99.76 |
| January | $101.56 |
| February | $105.67 |
| March | $110.55 |
| April | $102.77 |
| May | $107.45 |

**Annual Percentage Rate (APR)**

1. If a stock price is $103.45 in June and $105.11 one month later, what is the APR?
2. If a stock price is $45.00 in May and $43.55 one month later, what is the APR?
3. If the APR (based on monthly data) is 15.6%, what is the EAR?
4. If the APR (based on quarterly data) is 12.5%, what is the EAR?
5. If the EAR is 17.8%, what is the APR (based on weekly data)?

**Effective Annual Return (EAR)**

1. If a stock price is $102.78 in June and $120.56 one month later, what is the EAR?
2. If a stock price is $45.00 in May and $43.55 one month later, what is the EAR?
3. Find the monthly EAR and the quarterly EAR (this is the same data as about, so you can begin with those results:

|  |  |
| --- | --- |
| Month | Price |
| December | $99.76 |
| January | $101.56 |
| February | $105.67 |
| March | $110.55 |
| April | $102.77 |
| May | $107.45 |

**Annual and Non-Annual Rate Conversions**

1. If the monthly return is 2.1%, find the daily (365 days in a year), weekly, quarterly, semi-annual and annual returns.
2. If the weekly return is 0.6%, find the daily (365 days in a year), monthly, quarterly, semi-annual and annual returns.
3. If the annual return is 10.1%, find the daily (365 days in a year), weekly, monthly, quarterly, and semi-annual returns.
4. If the daily return is 5 basis points (365 days in a year), find the weekly, monthly, quarterly, semi-annual, and annual returns.

**Continuous Time Rates**

1. If the annual return is 2.1%, find the continuous time return.
2. If the weekly return is 0.6%, find the continuous time return.
3. If the quarterly return is 3.4%, find the continuous time return.
4. If the monthly return is 1.1%, find the continuous time return.
5. If the daily return is 4 basis points, find the continuous time return.
6. If the continuous time return is 10%, find the annual return.
7. If the continuous time return is 11.8%, find the monthly return.
8. If the continuous time return is 9.1%, find the weekly return.
9. If the continuous time return is 4.5%, find the quarterly return.
10. If the continuous time return is 11.2%, find the semi-annual return.

**Arithmetic Average versus Geometric Average**

1. Find the arithmetic and geometric averages for the following series:

|  |
| --- |
| 10.1% |
| 11.3% |
| 14.0% |
| 12.3% |
| 15.7% |
| 10.4% |

1. Find the arithmetic and geometric averages for the following series:

|  |
| --- |
| 0.163 |
| 0.123 |
| 0.130 |
| 0.141 |
| 0.120 |
| 0.091 |

**Solutions**

**Percentages and Basis Points**

1. Express 1% as a decimal and in basis points.

1% = 0.01 = **100 basis points**

1. Express 0.0025 as a percentage integer and in basis points.

0.0025 = **0.25% = 25 basis points**

1. Express 15 basis points as a percentage integer and a decimal.

15 basis points = **0.15% = 0.0015**

**Compound Rates**

1. If $100 grows to $500 in 5 years, what is the annual compound rate of interest?

P/Y = 1; N = 5; I/Y = **37.97**; PV = -100; PMT = 0; FV = 500

1. If $11.15 grows to $30.34 in 7 years, what is the annual compound rate of interest?

P/Y = 1; N = 7; I/Y = **15.37**; PV = 11.15; PMT = 0; FV = 30.34

**Holding Period Return**

1. If a stock price is $102.78 in June and $120.56 one month later, what is the holding period return?

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P/Y = 1; N = 1; I/Y = **17.30**; PV = -120.56; PMT = 0; FV = 102.78

1. If a stock price is $45.00 in May and $43.55 one month later, what is the holding period return?

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P/Y = 1; N = 1; I/Y = **-3.22**; PV = -45.00; PMT = 0; FV = 43.55

1. Find the monthly holding period returns:

|  |  |
| --- | --- |
| Month | Price |
| December | $99.76 |
| January | $101.56 |
| February | $105.67 |
| March | $110.55 |
| April | $102.77 |
| May | $107.45 |

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**Annual Percentage Rate (APR)**

1. If a stock price is $103.45 in June and $105.11 one month later, what is the APR?

****

1. If a stock price is $45.00 in May and $43.55 one month later, what is the APR?

****

1. If the APR (based on monthly data) is 15.6%, what is the EAR?

****

NOTE: Your calculator may have a function to convert APR to EAR.

1. If the APR (based on quarterly data) is 12.5%, what is the EAR?

****

1. If the EAR is 17.8%, what is the APR (based on weekly data)?

****

NOTE: Your calculator may have a function to convert EAR to APR.

**Effective Annual Return (EAR)**

1. If a stock price is $102.78 in June and $120.56 one month later, what is the EAR?

****

1. If a stock price is $45.00 in May and $43.55 one month later, what is the EAR?

****

1. Find the monthly EAR (this is the same data as about, so you can begin with those results):

|  |  |
| --- | --- |
| Month | Price |
| December | $99.76 |
| January | $101.56 |
| February | $105.67 |
| March | $110.55 |
| April | $102.77 |
| May | $107.45 |

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**Annual and Non-Annual Rate Conversions**

1. If the monthly return is 2.1%, find the daily (365 days in a year), weekly, quarterly, semi-annual and annual returns.

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1. If the weekly return is 0.6%, find the daily (365 days in a year), monthly, quarterly, semi-annual and annual returns.

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1. If the annual return is 10.1%, find the daily (365 days in a year), weekly, monthly, quarterly, and semi-annual returns.

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1. If the daily return is 5 basis points (365 days in a year), find the weekly, monthly, quarterly, semi-annual, and annual returns.

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**Continuous Time**

*NOTE: When converting a non-annual rate to a continuous time rate, first find the EAR, then the continuous time rate.*

1. 1. If the annual return is 2.1%, find the continuous time return.



1. 2. If the weekly return is 0.6%, find the continuous time return.



1. 3. If the quarterly return is 3.4%, find the continuous time return.



1. 4. If the monthly return is 1.1%, find the continuous time return.



1. 5. If the daily return is 4 basis points, find the continuous time return.



1. 6. If the continuous time return is 10%, find the annual return.



1. 7. If the continuous time return is 11.8%, find the monthly return.



1. 8. If the continuous time return is 9.1%, find the weekly return.



1. 9. If the continuous time return is 4.5%, find the quarterly return.



1. 10. If the continuous time return is 11.2%, find the semi-annual return.



**Arithmetic Average versus Geometric Average**

1. 1. Find the arithmetic and geometric averages for the following series:

|  |
| --- |
| 10.1% |
| 11.3% |
| 14.0% |
| 12.3% |
| 15.7% |
| 10.4% |



1. 2. Find the arithmetic and geometric averages for the following series:

|  |
| --- |
| 0.163 |
| 0.123 |
| 0.130 |
| 0.141 |
| 0.120 |
| 0.091 |

