Appendix C

present and future value concepts

# Student Learning Objectives and Related Assignment Materials

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| **Student Learning Objectives** | **Mini-Exercises** | **Exercises** | **Coached Problem** | **Problems (Groups  A & B)** |
| Not applicable | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 | 1, 2, 3, 4, 5, 6, 7 | 1, 2, 3, 4 | A1, A2, A3, A4, B1, B2, B3, B4 |

# Overview

# This appendix explains the time value of money concept, demonstrates present and future value computations using tables, Excel, and a financial calculator app, and applies present value computations to three common accounting settings.

# Synopsis of Chapter Revisions

* Reduced emphasis on tables and greater emphasis on Excel
* New introduction of online and mobile apps to compute present and future values (includes bond pricing and market interest rate computations)
* Significantly enhanced the quantity and quality of end-of-chapter material, with greater emphasis on Excel and financial calculator app

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| Appendix Outline | Teaching Notes |
| I. Present and Future Value Concepts |  |
| A. The concepts of present value (PV) and future value (FV) are based on the time value of money. |  |
| B. The **time value of money** is the idea that, quite simply, money received today is worth more than money to be received one year from today (or at any other future date), because it can be used to earn interest. |  |
| II. Future Value of a Single Amount |  |
| A. **Future value**—How much money you will have in the future as a result of investing a certain amount in the present. |  |
| B. To solve future value problems, you need to know: |  |
| 1. Amount to be invested.  2. Interest rate (*i*) the amount will earn.  3. Number of periods (*n*) in which the amount will earn interest. | * Supplemental Enrichment Activity #1 |
| C. Future value concept is based on compound interest, which means that the amount of interest for each period is calculated using the principal amount plus any interest not paid out in prior periods. |  |
| D. Example: On January 1, 2016, you deposit $1,000 in a savings account at 10% annual interest, compounded annually. What will the savings account balance be at December 31, 2018? |  |
| E. Use one of the following approaches: |  |
| 1. Table—Referring to Table C.1, Future Value of $1, use the interest rate (I = 10%) and number of periods (n = 3) to determine the value of 1.33100, and multiply by $1,000 to get the future value of $1,331. |  |
| 2. Excel—Enter the following: =FV(i, n, FV pmt, PV) in any cell; replace the i with the interest rate (expressed as a decimal), n with the number of interest periods, FV pmt with the number 0, and PV with the amount invested today (expressed as a negative number with no commas) to get =FV(0.10, 3, 0, -1000), click “Enter,” and the Excel cell will show $1,331.00. |  |
| 3. Financial calculator app—Using the free TMV app made by Bishinew Inc., leave the “Mode” selection at its default (End), enter the present value invested today as a negative number, enter the number 0 in the payment field, leave the Future Value field blank, enter the annual interest rate as a whole number, enter the number of interest periods, select the applicable compounding frequency (annually), click the FV button to the right of that empty field, and the future value (1,331.00) will appear in the Future Value field. |  |

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| Appendix Outline | Teaching Notes |
| III. Present Value of a Single Amount |  |
| A. The **present value** of a single amount is the worth to you today of receiving that amount sometime in the future. | * Supplemental Enrichment Activity #1 |
| B. Example: On January 1, 2016, you have the opportunity to invest in a financial instrument that would pay you $1,000 in 3 years. At an interest rate of 10% per year, how much is the $1,000 payment worth to you on January 1, 2016? |  |
| C. Use one of the following approaches: |  |
| 1. Table—Referring to Table C.2, Present Value of $1, use the interest rate (I = 10%) and number of periods (n = 3) to determine the value of 0.75131, and multiply by $1,000 to get the present value of $751.31. |  |
| 2. Excel—Enter the following: =PV(i, n, PV pmt, FV) in any cell; replace the i with the interest rate (expressed as a decimal), n with the number of interest periods, PV pmt with the number 0, and FV with the amount to be received in the future (expressed as a negative number with no commas) to get =PV(0.10, 3, 0, -1000), click “Enter,” and the Excel cell will show $751.31. |  |
| 3 Financial calculator app—Using the TMV app, leave the “Mode” selection at its default (End), leave the Present Value field blank, enter the number 0 in the Payment field, enter the Future Value as a negative number, enter the annual interest rate as a whole number, enter the number of interest periods, and select the compounding frequency (annually), click the PV button to the right of that empty field, and (751.31) will appear in the Present Value field. |  |
| IV. Future Value of an Annuity |  |
| A **Annuity**—A series of consecutive payments characterized by: | * Supplemental Enrichment Activity #1 |
| 1. An equal dollar amount each interest period.  2. Interest periods of equal length.  3. An equal interest rate each interest period. |  |
| B. Example: At the end of each year for three years, you deposit $1,000 in a savings account at an interest rate of 10% per year. You make the first payment on December 31, 2016. How much is the $1,000 payment worth to you on December 31, 2018? | *Note that the third payment earns no interest because it was made on the day the account balance is computed.* |
| C. Use one of the following approaches: |  |
| 1. Table—Refer to Table C.3, Future Value of an Annuity of $1. Using the interest rate (I = 10%) and number of periods (n = 3), determine the value of 3.31000, and multiply it by $1,000 to get the future value of $3,310. |  |

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| Appendix Outline | Teaching Notes |
| 2. Excel—Enter the following: =FV(i, n, PV pmt, FV) in any cell; replace the i with the interest rate (expressed as a decimal), n with the number of interest periods, PV pmt with the amount of the annuity payment (expressed as a negative number with no commas), and PV as the number 0 to get =FV(0.10, 3, -1000,0), click “Enter,” and the Excel cell will show $3,310.00. |  |
| 3 Financial calculator app—Using the TMV app, leave the “Mode” selection at its default (End), enter the number 0 in the Present Value field, enter the annuity amount in the Payment field (as a negative number), leave the Future Value field blank, enter the annual interest rate as a whole number, enter the number of interest periods, select the compounding frequency (annually), click the FV button to the right of that empty field, and the future value (3,310.00) will appear in the Future Value field. |  |
| V. Present Value of an Annuity |  |
| A. Example: You receive $1,000 cash on each December 31, 2016, 2017, and 2018. How much would the sum of these three $1,000 future amounts be worth on January 1, 2016, assuming an interest rate of 10% per year? | * Supplemental Enrichment Activity #1 |
| B. Use one of the following approaches: |  |
| 1. Table—Refer to Table C.4, Present Value of an Annuity of $1. Using the interest rate (I = 10%) and number of periods (n = 3), determine the value of 2.48685 and multiply it by $1,000 to get the present value of $2,486.85. |  |
| 2. Excel—Enter the following: =PV(i, n, FV pmt) in any cell; replace the i with the interest rate (expressed as a decimal), n with the number of interest periods, and PV pmt with the amount of the annuity payment (expressed as a negative number with no commas) to get =PV(0.10, 3, -1000), click “Enter,” and the Excel cell will show $2,486.85. |  |
| 3. Financial calculator app—Using the TMV app, leave the “Mode” selection at its default (End), leave the Present Value field blank, enter the annuity amount in the Payment field (as a negative number), enter the number 0 in the Future Value field, enter the annual interest rate as a whole number, enter the number of interest periods, select annual compounding, click the PV button to the right of that empty field, and the present value (2,486.85) will appear in the Present Value field. |  |

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| Appendix Outline | Teaching Notes |
| VI. Interest Rates and Interest Periods |  |
| A. When interest periods are less than a year, the values of *n* and *i* must be restated to be consistent with the length of the interest period. |  |
| B. Example: 12% interest compounded annually for 5 years requires the use of *n* = 5 and *i* = 12%. If the compounding is quarterly, however, the interest period is one quarter of a year (four periods per year), and the quarterly interest rate is one quarter of the annual rate (3% per quarter). Therefore, 12% compounded quarterly for 5 years requires use of *n* = 20 and *i* = 3%. |  |
| VII. Accounting Applications of Present Values |  |
| A. Case A—Present Value of a Single Amount |  |
| B. Case B—Present Value of an Annuity |  |
| C. Case C—Present Value of a Single Amount and an Annuity (Bond Pricing) |  |

# Supplemental Enrichment Activity

Note: This activity would be suitable for individual or group activities.

1. Handout C–1

Use Handout C–1 for an in-class activity designed to review present and future value concepts. Solution: The solution follows the handout master.

# HANDOUT C–1

# PRESENT AND FUTURE VALUES

All interest rates are annual. Round each answer to the nearest cent.

1. What is the future value of $12,000 after ten years, assuming 9% interest?
2. What is the future value of $7,500 after five years, assuming 12% interest?
3. What is the present value of $3,000 received 5 years from now, assuming 20% interest?
4. What is the present value of $3,000 received 5 years from now, assuming 5% interest, compounded quarterly?
5. What is the future value of an annuity of $12,000 after ten years, assuming 9% interest?
6. What is the future value of an annuity of $7,500 after five years, assuming 12% interest?
7. What is the present value of a $50,000 annuity received over 20 years, assuming 9% interest?
8. What is the present value of a $4,000 annuity received over 5 years, assuming 20% interest?

# HANDOUT C–1 SOLUTION

# PRESENT AND FUTURE VALUES

All interest rates are annual. Round each answer to the nearest cent.

1. What is the future value of $12,000 after ten years, assuming 9% interest?

***n* = 10; *i* = 9%; Payments = $12,000 each**

**Future value of $1 factor from Table C.1 = 2.36736**

**2.36736 × $12,000 = $28,408.32**

1. What is the future value of $7,500 after five years, assuming 12% interest?

***n* = 5; *i* = 12%; Payments = $7,500 each**

**Future value factor of $1 from Table C.1 = 1.76234**

**1.76234 × $7,500 = $13,217.55**

1. What is the present value of $3,000 received 5 years from now, assuming 20% interest?

***n* =5; *i* = 20%; Present Value = $3,000**

**Present value factor of $1 from Table C.2 = 0.40188  
0.40188 × $3,000 = $1,205.64**

1. What is the present value of $3,000 received 5 years from now, assuming 5% interest, compounded quarterly?

***n* =20 (or 5 years × 4 payment periods per year); *i* = 5%; Future Value = $3,000**

**Present value factor of $1 from Table C.2 = 0.37689  
0.37689 × $3,000 = $1,130.67**

1. What is the future value of an annuity of $12,000 after ten years, assuming 9% interest?

***n* =10; *i* = 9%; Payments = $12,000 each**

**Future value of annuity of $1 factor from Table C.3 = 15.19293  
15.19293 × $12,000 = $182,315.16**

1. What is the future value of an annuity of $7,500 after five years, assuming 12% interest?

***n* =5; *i* = 12%; Payments = $7,500 each**

**Future value factor of annuity of $1 from Table C.3 = 6.35285  
6.35285 × $7,500 = $47,646.38**

1. What is the present value of a $50,000 annuity received over 20 years, assuming 9% interest?

***n* =20; *i* = 9%; Payments = $50,000 each**

**Present value factor of annuity of $1 from Table C.4 = 9.12855  
9.12855 × $50,000 = $456,427.50**

1. What is the present value of a $4,000 annuity received over 5 years, assuming 20% interest?

***n* =5; *i* = 20%; Payments = $4,000 each**

**Present value factor of annuity of $1 from Table C.4 = 2.99061**

**2.99061 × $4,000 = $11,962.44**