

Principles Of Finance

Chapter 3

Time Value Of Money



Honda Motor Company is considering offering a 2,300 rebate on its minivan, lowering the vehicle's price from \$32,000 to \$29,700. The marketing group estimates that this rebate will increase sales over the next year from 43,000 to 58,000 vehicles. Suppose Honda's profit margin with the rebate is \$7,100 per vehicle. If the change in sales is the only consequence of this decision, what are its costs and benefits? Is it a good idea? **Hint: View this question in terms of incremental profits.**

Cost = Loss per vehicle * Vehicles that would have sold without rebate

Benefit = Profit per Vehicle * Additional Vehicle sold

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The cost of the rebate is that Honda will make less on the vehicles it would have sold:

$$\text{Cost} = (\$32,000 - \$29,700) * 43,000 = \$98.9 \text{ million}$$

The benefit of the rebate is that Honda will sell more vehicles and earn a profit on each additional vehicle sold:

$$\text{Benefit} = \$7,100 * (58,000 - 43,000) = \$106.5 \text{ million}$$

Is it a good idea?

Offering the rebate does look attractive

You are an international shrimp trader. A food producer in the Czech Republic offers to pay you 2.6 million Czech koruna today in exchange for a year's supply of frozen shrimp. Your Thai supplier will provide you with the same supply for 3.3 million Thai baht today. If the current competitive market exchange rates are 26.20 koruna per dollar and 41.60 baht per dollar, what is the value of this exchange to you?

Thai Supplier's Offer in Dollars = Price in THB / Exchange Rate THB \$

Czech Producer's Offer in Dollars = Price in CZK / Exchange Rate CZK \$

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the cost of the Thai supplier's offer in dollars:

$$\text{Thai supplier's offer in Dollars} = 3,300,000 \text{ THB} / 41.60 \text{ THB } \$ = \$79,326.92$$

the price of the Czech producer's offer in dollars:

$$\text{Czech producer's offer in dollars} = 2,600,000 \text{ CZK} / 26.20 \text{ CZK } \$ = \$99,236.64$$

the profit you would make:

$$(\$99,236.64 - \$79,326.92) = \$19,909.72$$

Suppose your employer offers you a choice between a \$5,300 bonus and 100 shares of the company's stock. Whichever one you choose will be awarded today. The stock is currently trading at \$65.00 per share.

- a. **If you receive the stock bonus and you are free to trade it, which form of the bonus should you choose? What is its value?**
- b. **Suppose that if you receive the stock bonus, you are required to hold it for at least one year. What can you say about the value of the stock bonus now? What will your decision depend on?**

Value of the stock bonus today = Number of shares * Price per share

Suppose your employer offers you a choice between a \$5,300 bonus and 100 shares of the company's stock. Whichever one you choose will be awarded today. The stock is currently trading at \$65.00 per share.

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- b. Suppose that if you receive the stock bonus, you are required to hold it for at least one year. What can you say about the value of the stock bonus now? What will your decision depend on?**

If you are free to trade the stock. The value of the stock bonus today:

$$\text{Value of the stock bonus today} = 100 * \$65.00 = \$6,500$$

The value of the cash bonus:

$$\text{Value of the cash bonus today} = \$5,300$$

Which bonus should you choose?

You should choose the stock bonus.

Suppose your employer offers you a choice between a \$5,300 bonus and 100 shares of the company's stock. Whichever one you choose will be awarded today. The stock is currently trading at \$65.00 per share.

- a. If you receive the stock bonus and you are free to trade it, which form of the bonus should you choose? What is its value?**
- b. Suppose that if you receive the stock bonus, you are required to hold it for at least one year. What can you say about the value of the stock bonus now? What will your decision depend on?**

A. The stock's value will depend on what you expect it to be worth in one year. As well as how you feel about the risk involved. There is no clear-cut answer to which alternative is best. Because taking the stock today and having to hold it for a year involves risk.

B. Because you could buy the stock today for \$6,500 if you wanted to, the value of the stock bonus cannot be more than \$6,500. But if you are not allowed to sell the company's stock for the next year, its value to you could be less than \$6,500.

C. You might decide that it is better to take the \$5,300 in cash than wait for the uncertain value of the stock in one year. This would be especially true if you believed you could invest the \$5,300 today in another equally risky asset that would be worth more than \$6,500 in one year.

Suppose Big Bank offers an interest rate of 8.5% on both savings and loans, and Bank Enn offers an interest rate of 9.0% on both savings and loans.

- a. **What profit opportunity is available?**
- b. **Which bank would experience a surge in the demand for loans? Which bank would receive a surge in deposits?**
- c. **What would you expect to happen to the interest rates the two banks are offering?**

a. What profit opportunity is available?

- A. Take a loan from Big Bank at 9.0% and save the money in Big Bank at 8.5%.
- B. Take a loan from Big Bank at 8.5% and save the money in Bank Enn at 9.0%.
- C. Take a loan from Bank Enn at 9.0% and save the money in Big Bank at 8.5%.
- D. Save at both banks.

Suppose Big Bank offers an interest rate of 8.5% on both savings and loans, and Bank Enn offers an interest rate of 9.0% on both savings and loans.

- a. **What profit opportunity is available?**
- b. **Which bank would experience a surge in the demand for loans? Which bank would receive a surge in deposits?**
- c. **What would you expect to happen to the interest rates the two banks are offering?**

b. Which bank would experience a surge in the demand for loans? Which bank would receive a surge in deposits?

- A. Big Bank would experience a surge in deposits, while Bank Enn would receive a surge in loans.
- B. Big Bank would experience a surge in the demand for loans, while Bank Enn would receive a surge in deposits.
- C. Big Bank would experience a surge in the demand for deposits, as will Bank Enn.
- D. Big Bank would experience a surge in the demand for loans, as will Bank Enn.

Suppose Big Bank offers an interest rate of 8.5% on both savings and loans, and Bank Enn offers an interest rate of 9.0% on both savings and loans.

- a. **What profit opportunity is available?**
- b. **Which bank would experience a surge in the demand for loans? Which bank would receive a surge in deposits?**
- c. **What would you expect to happen to the interest rates the two banks are offering?**

c. What would you expect to happen to the interest rates the two banks are offering?

- A. Both banks would decrease their interest rates.
- B. Big Bank would increase its interest rate and Bank Enn would decrease its rate.
- C. Big Bank would decrease the interest rate and Bank Enn would increase its rate.
- D. Both banks would increase their interest rates.



Bubba is a shrimp farmer. In an ironic twist, Bubba is allergic to shellfish, so he cannot eat shrimp. Each day he has a one-ton supply of shrimp. The market price of shrimp is \$10,700 per ton.

- a. **What is the value of a ton of shrimp to him?**
- b. **Would this value change if he were not allergic to shrimp? Why or why not?**

a. What is the value of a ton of shrimp to him?

- A. The value of a tonne of shrimp to Bubba is less than \$10,700 because shrimp is a perishable item.
- B. The value of a tonne of shrimp to Bubba is more than \$10,700 because he can wait for the market price to go up.
- C. The value of a tonne of shrimp to Bubba is less than \$10,700 because Bubba is allergic to shellfish.
- D. The value of a tonne of shrimp to Bubba is \$10,700 because that is the market price.

b. Would this value change if he were not allergic to shrimp? Why or why not?

- A. No. Even if he isn't allergic to shrimp, he can't eat a ton of it.
- B. Yes. If he is not allergic to shrimp, then he may prefer to eat the shrimp instead of selling it.
- C. Yes. If he is allergic to shrimp, he puts a low value on it, but if he is not allergic to shrimp, he values it highly.
- D. No. As long as he can buy or sell shrimp at \$10,700 per ton, his personal preference or use for shrimp is irrelevant to the value of the shrimp.

Brett has almond orchards, but he is sick of almonds and prefers to eat walnuts instead. The owner of the walnut orchard next door has offered to swap this year's crop with him. Assume he produces 1,060 tons of almonds and his neighbour produces 805 tons of walnuts. If the market price of almonds is \$111 per ton and the market price of walnuts is \$121 per ton:

a. Should he make the exchange?

b. Does it matter whether he prefers almonds or walnuts? Why or why not?

The market value = Quantity in tons * Price per ton

The market value of the almond crop = $1,060 * \$111 = \$117,660$

The market value of the walnuts crop = $805 * \$121 = \$97,405$

Should he make the exchange?

No

Does it matter whether he prefers almonds or walnuts? Why or why not?

No, His preference is irrelevant to the value of the crops.

You have \$1,300 and a bank is offering 6.5% interest on deposits. If you deposit the money in the bank, how much will you have in one year?

$$FV = PV * (1 + r)^n$$

$$FV = \$1,300 * (1 + 6.5\%) = \$1,384.50$$

You expect to have \$13,000 in one year. A bank is offering loans at 6.5% interest per year. How much can you borrow today?

$$PV = FV / (1 + r)^n$$

$$PV = \$13,000 / (1 + 6.5\%) = \$12,206.57$$



Due to your good credit, your bank reduces the interest rate on your \$15,000 loans from 11% to 8% per year. Thanks to the change, how much will you save in interest this year?

$$\text{Interest saved} = \text{Interest paid (original)} - \text{Interest paid (new)}$$

find the amount of interest paid on the loan at the original rate and at the new rate:

$$\text{Interest paid} = \text{Loan amount} * \text{Interest rate}$$

$$\text{Interest paid (original)} = \$15,000 * 0.11 = \$1,650$$

$$\text{Interest paid (new)} = \$15,000 * 0.08 = \$1,200$$

the amount in interest you will save this year:

$$\text{Interest saved} = \$1,650 - \$1,200 = \$450$$

What is the discount factor that is equivalent to a 12% discount rate ?

$$\text{Discount factor} = 1 / (1 + \text{Interest rate})$$

$$\text{Discount factor} = 1 / (1 + 0.12) = 0.8929$$

If your discount factor is 0.9346, what is your discount rate ?

$$\text{Discount rate} = (1 / \text{Discount factor}) - 1$$

$$\text{Discount rate} = (1 / 0.9346) - 1 = 7\%$$

You plan to borrow \$2,000 from a bank. In exchange for \$2,000 today, you promise to pay \$2,140 in one year. What does the cash flow timeline look like from your perspective? What does it look like from the bank's perspective?

What does the cash flow timeline look like from your perspective?

- A.**

0		1
	—————	
\$2,000		- \$2,140
- B.**

0		1
	—————	
- \$2,140		\$2,000
- C.**

0		1
	—————	
\$2,140		- \$2,000
- D.**

0		1
	—————	
- \$2,000		\$2,140

You plan to borrow \$2,000 from a bank. In exchange for \$2,000 today, you promise to pay \$2,140 in one year. What does the cash flow timeline look like from your perspective? What does it look like from the bank's perspective?

What does it look like from the bank's perspective?

- A.**

0	1
-----	-----
-\$2,000	\$2,140
- B.**

0	1
-----	-----
\$2,140	-\$2,000
- C.**

0	1
-----	-----
\$2,000	-\$2,140
- D.**

0	1
-----	-----
-\$2,140	\$2,000



Suppose the interest rate is 5.0%.

- a. Having \$700 today is equivalent to having what amount in one year?
- b. Having \$700 in one year is equivalent to having what amount today?
- c. Which would you prefer, \$700 today or \$700 in one year? Does your answer depend on when you need the money? Why or why not?

- a. Having \$700 today is equivalent to having what amount in one year?

$$FV = C * (1 + r)^n$$

$$FV = \$700 * (1 + 0.050) = \$735.00$$

- b. Having \$700 in one year is equivalent to having what amount today?

$$PV = C / (1 + r)^n$$

$$PV = \$700 / (1 + 0.050) = \$666.67$$

Suppose you invest \$1,200 in account paying 9% interest per year.

- a. What is the balance in the account after 5 years? How much of this balance corresponds to “ interest on interest “?
- b. What is the balance in account after 36 years? How much of this balance corresponds to “ interest on interest “?

- a. What is the balance in the account after 5 years?

$$FV = PV * (1 + r) ^ n$$

$$FV = 1,200 * (1 + 0.09) ^ 5 = \$1,846.35$$

How much of this balance corresponds to “ interest on interest “?

$$FV = PV * r * n + PV$$

$$FV = \$1,200 * 9\% * 5 + 1,200 = \$1,740.00$$

$$\text{Interest on interest} = FV (\text{compounded interest}) - FV (\text{simple interest})$$

$$\text{Interest on interest} = \$1,846.35 - \$1,740.00 = \$106.34$$

Suppose you invest \$1,200 in account paying 9% interest per year.

- a. What is the balance in the account after 5 years? How much of this balance corresponds to “ interest on interest “?
- b. What is the balance in account after 36 years? How much of this balance corresponds to “ interest on interest “?

b. What is the balance in the account after 36 years?

$$FV = 1,200 * (1 + 0.09) ^ 36 = \$26,701.47$$

How much of this balance corresponds to “ interest on interest “?

$$FV = \$1,200 * 9\% * 36 + 1,200 = \$5,088.00$$

$$\text{Interest on interest} = \$26,701.47 - \$5,088.00 = \$21,613.47$$

Your brother has offered to give you either \$80,000 today or \$160,000 in 7 years. If the interest rate is 3% per year, which option is preferable?

the present value of a lump:

$$PV = C / (1 + r)^n$$

$$PV = \$160,000 / (1 + 0.03)^7 = \$130,095$$

Which option is preferable?

Take the future amount because its present value is greater than the present amount offered.

Your bank pays 2.7% interest per year. You put \$1,300 in the bank today and \$600 more in the bank in one year. How much will you have in the bank in two years?

The future value of the first investment:

$$FV = \$1,300 * (1 + 0.027) ^ 2 = \$1,371.15$$

The future value of the second investment:

$$FV = \$600 * (1 + 0.027) = \$616.20$$

Which option is preferable?

$$FV = \$1,371.15 + \$616.20 = \$1,987.35$$

Your grandfather put some money into an account for you on the day you were born. You are now 18 years old and are allowed to withdraw the money. The account currently has \$11,000 in it and pays an interest rate of 13%.

- a. How much money would be in the account if you left the money there until your 25th birthday?
- b. What if you left the money until your 65th birthday?
- c. How much money did your grandfather originally put into the account?

$$FV = \$11,000 * (1 + 0.13)^7 = \$25,879$$

$$FV = \$11,000 * (1 + 0.13)^47 = \$3,436,209$$

$$PV = \$11,000 / (1 + 0.13)^18$$