PART C

*14.4 Mortgage Loans: Additional Topics

A mortgage loan sometimes involves costs in addition to interest charges. In this section you will learn how to incorporate these additional costs into an overall effective cost of borrowing. This is the best figure to use when comparison shopping for a mortgage loan.

A mortgage loan represents an investment of funds by the lender. Most mortgage contracts can be sold by the lender to another investor at any time during the term of the mortgage. This section explains how to determine the fair market value of a mortgage contract. This topic is also relevant to real estate transactions in which the vendor provides mortgage financing at a below-market interest rate.

The Effective Cost of Borrowing

Some mortgage lenders, particularly individual investors, use the services of a mortgage broker. The broker finds a party in need of mortgage financing, determines the party's financial condition and creditworthiness, and conducts the negotiations. All or a substantial portion of the broker's remuneration for these services may be deducted from the principal amount of any loan that is advanced. Consequently, the borrower receives *less* than the face value or **gross amount** of the mortgage loan, but must repay the full gross amount over the amortization period. The amount retained to compensate the broker is variously called the brokerage fee, bonus, placement fee, commission, finder's fee, or discount.[6]

A brokerage fee or bonus represents a cost of borrowing in addition to the interest charges. Particularly from the borrower's point of view, it is desirable to combine the interest charges and brokerage fee in some measure of the overall "true" cost of borrowing.[7] These costs must be combined in a way that takes into account the time value of money. Borrowers can then use this measure to compare alternative loans from various mortgage lenders.

[6] A mortgage loan in which an amount, by whatever name, is retained by the broker or lender, is called a *bonused mortgage*. Who do you think chose this name—mortgage brokers or borrowers?

[7] Mortgage lenders routinely require an official land survey, an official appraisal of the property's market value, and a title search of the property. Most mortgages make provision for the lender to directly pay the survey and appraisal costs, legal fees, and other disbursements, and to deduct them from the loan proceeds. These are not considered a cost of borrowing in the same sense as interest and brokerage fees. A prudent purchaser of real estate will incur most of these expenses even if a mortgage loan is not required. Therefore, these other charges are not included when you calculate the "true" cost of borrowing.

Most provinces in Canada have passed legislation requiring disclosure of the impact of brokerage fees on the cost of borrowing. The most common requirement is for the disclosure of an effective annual interest rate that impounds the brokerage fee. We can gain an insight into how to calculate this effective interest rate by taking the following view. The borrower initially receives net or "useful" loan proceeds of only

Net amount of the loan = (Gross amount of the loan) − (Brokerage fee)

The effective interest rate we want is the interest rate on a no-fee loan in which the *same* payments reduce a

Beginning balance = *Net amount* of the brokered mortgage loan

to an

Ending balance = End-of-term balance of the brokered mortgage loan

Therefore,

Effective Cost of Borrowing

The effective or "true" cost of borrowing for a brokered mortgage loan is the annually compounded discount rate that makes

Net amount of the loan = (*PV* of payments) + (*PV* of end-of-term balance)

This definition of the effective cost of borrowing implies a two-step procedure for obtaining it.

1. Determine the nominal annual rate, j, or the interest rate per payment interval, i, that satisfies

   Net amount of the loan = (*PV* of payments) + (*PV* of end-of-term balance)

2. Calculate the effective annual interest rate using $f = (1 + i)^m - 1$ where m is the number of compoundings in a year (which in this context equals the number of payments in a year).

Example 14.4A CALCULATING THE "TRUE" OR EFFECTIVE COST OF BORROWING

A mortgage broker arranged a $50,000 gross mortgage loan at .75% compounded semiannually. The loan has a five-year term with monthly payments based on a 20-year amortization. A brokerage fee of $3767.45 was deducted from the gross amount. What is the borrower's effective annual cost of borrowing (over the five-year term)?

Solution

The borrower receives only

$$\$50{,}000 - \$3767.45 = \$46{,}232.55$$

but must make payments that pay off $50,000 over the 20-year amortization period. The brokerage fee of $3767.45 is viewed, for the purpose of this calculation, as a "front-end" interest charge. Before we can begin the two-step procedure described above for calculating the effective cost of borrowing, we need to determine the mortgage payments and the end-of-term balance.

Only the financial calculator solution will be presented. In all, there will be four steps in the solution.

Step1: Calculate the payment size.
Step 2: Calculate the balance at the end of the five-year term.
Step 3: Calculate the nominal interest rate that makes the net amount actually received ($46,232.55) equal to the combined present value of 60 payments and the balance owed (from Step 2) at the end of the five-year term.
Step 4: Convert the nominal rate from Step 3 to the effective annual rate.

Step 1:
240 N
7.75 I/Y
50000 PV
0 FV
P/Y 12 ENTER
C/Y 2 ENTER
CPT PMT
Ans: −406.71

Step 2:
Same *I/Y, PV, P/Y, C/Y*
60 N
406.71 +/− PMT
CPT FV
Ans: −43,531.85

Step 3:
Same *N, FV, PMT*
Same *P/Y, C/Y*
46232.55 PV
CPT I/Y
Ans: 9.8384
Since $P/Y = 12$ and $C/Y = 2$, then $I/Y =$ 9.834% compounded semiannually.

Step 4: The periodic rate corresponding to 9.834% compounded semiannually is

$$\frac{9.8384\%}{2} = 4.9192\% \text{ per half year}$$

Hence,
$$f = (1 + i)^m - 1 = 1.049192^2 - 1 = 0.100804 = 10.08\%$$

The impact of the brokerage fee is to make the effective interest rate for the overall cost of borrowing 10.08% (compared to

$$f = 1.03875^2 - 1 = 0.0790 = 7.90\%$$

for the quoted interest rate of 7.75% compounded semiannually).

Example 14.4B DETERMINING WHICH MORTGAGE LOAN HAS THE LOWER "TRUE" COST OF BORROWING

William intends to raise $50,000 for his business by obtaining a second mortgage loan secured by his home. He is considering two alternatives. A mortgage broker will approve a $52,000 face value loan at 8.5% compounded semiannually but will retain a $2000 commission. A credit union will grant a $50,000 loan at 9.5% compounded semiannually with no other fees. Both loans would have a five-year term and require monthly payments based upon a 15-year amortization. Which loan is a better deal for William?

Solution

Clearly, William should not simply choose the loan with the lower interest rate because that would ignore the $2000 commission. Furthermore, William should not necessarily select the loan with the lower payments because when the loans are renewed after five years, their balances will not be equal. The best decision criterion is to choose the loan with the lower effective rate of interest (including any brokerage fee).

For the credit union loan, the cost of borrowing is just the interest rate. The effective annual interest rate is

$$f = (1 + i)^m - 1 = 1.0475^2 - 1 = 0.097256 = 9.73\%$$

For the loan from the broker, the commission or brokerage fee is also a cost of borrowing. The $2000 front-end commission cost must be combined with the actual interest costs and expressed as an effective rate of interest for the five-year term. To determine this rate, we will:

Step 1: Calculate the payments on the brokered loan.
Step 2: Calculate the balance on the brokered loan at the end of the five-year term.
Step 3: Calculate the nominal interest rate that makes the combined present value of 60 payments and the balance in Step 2 equal to the net amount of the loan ($52,000 − $2000 = $50,000).
Step 4: Convert the nominal rate from Step 3 to the effective annual rate.

Step 1:
180 N
8.5 I/Y
52000 PV
0 FV
P/Y 12 ENTER
C/Y 2 ENTER
CPT PMT
Ans: −507.60

Step 2:
Same *I/Y, PV, P/Y, C/Y*
60 N
507.60 +/− PMT
CPT FV
Ans: −41,200.84

Step 3:
Same *N, FV, PMT*
Same *P/Y, C/Y*
50000 PV
CPT I/Y
Ans: 9.5992
Since $P/Y = 12$ and $C/Y = 2$, then $I/Y =$ 9.5992% compounded semiannually.

Step 4: The periodic rate corresponding to 9.5992% compounded semiannually is

$$\frac{9.5992\%}{2} = 4.7996\% \text{ per half year}$$

Hence,
$$f = (1 + i)^m - 1 = 1.047996^2 - 1 = 0.09830 = 9.83\%$$

The credit union loan is the better choice for William because the effective annual cost of the mortgage loan from the credit union is

$$9.83\% - 9.73\% = 0.10\% \text{ lower.}$$

POINT of Interest

BEWARE! Financial Quicksand!

"Psst! Hey buddy—need a loan? OK, here's duh deal. Duh boss lends yuh $25 grand. Yuh make monthly payments for 25 years. Oh ya, a couple udder t'ings. A year from now yuh owe us almost $30 grand. Seven years from now, yuh still owe us more than 25 big ones. Wha' da yuh say?"

You can get a deal like this from your local loan shark. Or, if you prefer more refined English, you can probably find a registered mortgage broker offering similar loans in your city. The data in the following table were extracted from a mail flyer distributed by a store-front lender[8] in a mid-size Canadian city. Some cells are left blank for you to calculate the missing amounts later.

Gross amount of loan	Net amount of loan	Monthly payment
$30,400	$25,000	$186.68
?	50,000	357.40
?	75,000	525.04
113,000	100,000	?
139,500	125,000	?

[8] The author's fondness for the current shape of his knee-caps precludes naming names!

The monthly payment in every case is based on an interest rate of 5.5% compounded monthly, a 25-year amortization, and the *gross amount* of the loan. The rate of 5.5% compounded monthly was, if anything, lower than mortgage rates offered at the time by mainstream lenders. However, the term of the loan was only one year, after which the borrower would face market rates.

Actually, only the net amount of the loan (which was called the "cash advance") and the monthly payment were shown on the front of the flyer. To find the gross amount, you had to look on the back panel (just where the tiny print all but disappeared against the background of the lender's logo) and squint really hard. The amount retained for brokerage and other charges in each case is shocking.

Questions:

1. Do the calculations to determine the missing amounts in the table.
2. What will be the balance on each loan at the end of the one-year term?
3. In each case, what is the borrower's effective annual cost of borrowing (for the one-year term)?
4. Even though the borrower will likely pay a higher interest rate upon renewal in one year, assume for the moment that the interest rate and monthly payment will not change. In each case, how long from the date of the original loan will it take the borrower to reduce the balance owed to the original *net* amount of the loan? (Now you understand the choice of title for this Point of Interest!)

Valuation of Mortgages

A mortgage loan represents an investment by the lender in the form of a loan to the borrower. The mortgage contract specifies the stream of future payments to which the lender is entitled. If they are received as scheduled, the lender's rate of return will be the rate of interest charged on the loan.

The original lender can sell his legal interest in the mortgage contract to another investor without the consent of the borrower. This might be done, for example, if the lender needs to raise a substantial amount of cash before the expiry of the current term of the mortgage. The central question for both the original lender and the new investor is: What price should be paid for the right to receive the remaining payments?

Suppose there are two years remaining in the five-year term of a mortgage loan. Also suppose that interest rates in general have *risen* over the past three years. If the new investor pays an amount equal to the current principal balance, her rate of return on investment will equal the contractual interest rate on the mortgage loan. Since the prevailing interest rate is now higher than that contractual rate, she will prefer the alternative of making a new loan at the prevailing market rate. Consequently, the owner of the existing mortgage must expect to receive a price lower than the outstanding balance on the mortgage. The price must be low enough that the remaining scheduled payments provide a rate of return to the purchaser equal to the *prevailing* rate on new two-year-term mortgages. Then investors will be indifferent between the alternatives of buying the existing mortgage or making a new loan.

To determine the value of an existing mortgage, we again turn to the Valuation Principle (presented in Section 7.2) for guidance. The fair market value of an investment is the present value of the expected payments discounted at the *prevailing*

market rate of return. Adapting the Valuation Principle to the specific case of mortgage valuation,

$$\begin{pmatrix}\text{Fair market value}\\ \text{of a mortgage}\end{pmatrix} = \begin{pmatrix}\text{Present value of the}\\ \text{payments remaining}\\ \text{in the current term}\end{pmatrix} + \begin{pmatrix}\text{Present value of the}\\ \text{principal balance}\\ \text{at the end of the term}\end{pmatrix}$$

TIP

The Different Roles of the Contractual Interest Rate and the Market Interest Rate

The *contractual* rate of interest on the mortgage loan is used to calculate the size of the payments and the loan's balance at any point. The *prevailing market* rate is used as the discount rate for calculating the mortgage's fair market value at any later date.

Example 14.4C CALCULATING THE FAIR MARKET VALUE OF A MORTGAGE LOAN PARTWAY THROUGH ITS TERM

A $65,000 mortgage loan was made three years ago at 7% compounded semiannually. The monthly payments for the first five-year term were based on a 20-year amortization. What price can the lender expect to receive from the sale of the mortgage if the current rate on new mortgage loans for a two-year term is:

a. 8% compounded semiannually?

b. 7% compounded semiannually?

c. 6% compounded semiannually?

Solution

The fair market value of the mortgage is the present value of the 24 payments remaining in the five-year term *plus* the present value of the principal balance due at the end of the term. The discount rate used should be the prevailing rate of return required on similar investments in the capital markets. From the point of view of an investor, the existing mortgage has two years remaining in its term. The purchase of the existing mortgage must provide a rate of return equal to the rate on new two-year term mortgage loans.

Part (a) requires three steps. Only Step 3 needs to be repeated for parts (b) and (c).

Step 1: Calculate the size of the monthly payment.

Step 2: Calculate the principal balance after five years.

Step 3: Calculate the combined present value of the remaining 24 payments and the balance from Step 2. The discount rate should be the current market rate on new two-year-term mortgages.

a.

Step 1:

240 N
7 I/Y
65000 PV
0 FV
P/Y 12 ENTER
C/Y 2 ENTER
CPT PMT

Ans: −500.05

Step 2:

Same *I/Y, PV, P/Y, C/Y*

60 N
500.05 +/− PMT
CPT FV

Ans: −55,981.35

Step 3:

Same *PMT, FV, P/Y, C/Y*

24 N
8 I/Y
CPT FV

Ans: −58,924.00

b.

Step 3:
Same *N, PMT, FV, P/Y, C/Y*
7 I/Y
CPT FV
Ans: 59,964.49

c.

Step 3:
Same *N, PMT, FV, P/Y, C/Y*
6 I/Y
CPT FV
Ans: 61,029.72

The price that the lender can expect to receive for the mortgage is:

a. $58,924.00 **b.** $59,964.49 **c.** $61,029.72

Note: If you calculate the balance owed on the mortgage at the time of sale (after 36 payments), you will obtain $59,964.49. Compare this balance to the market prices calculated above. The comparison provides examples of the following three general cases.

1. When the prevailing market return *equals* the contractual rate on the mortgage, the fair market value is the *actual* principal balance currently owed on the mortgage (part **b**).
2. When the prevailing market return is *greater* than the contractual rate, investors pay *less* than the principal balance in order to obtain the higher rate of return (part **a**).
3. When the prevailing market return is *less* than the contractual rate, investors will pay *more* than the principal balance owed and still earn the competitive rate of return (part **c**).

Vendor Take-Back Mortgage

The prospective purchaser of a property may propose to buy the property with a cash down payment and with the balance of the purchase price set up as a loan payable by the purchaser to the vendor. The loan would normally be secured by a mortgage on the property. A mortgage arising in this way is called a **vendor take-back mortgage**.

On a vendor take-back mortgage, it is common for the borrower to try to negotiate an interest rate that is below the current market rate. A below-market rate confers a financial benefit to the buyer at the expense of the vendor. (If the vendor were instead to receive the full purchase price in cash, he could invest the money by granting another mortgage loan at the higher current market rate.) The value of the financial benefit to the purchaser of the property is the difference between the *face* value and the *fair market* value of the vendor take-back mortgage.

Example 14.4D CALCULATING THE EQUIVALENT CASH PRICE ON A PROPERTY SALE THAT INCLUDES A VENDOR TAKE-BACK MORTGAGE

A house is listed for $225,000. A potential purchaser makes a "full price" offer of $225,000 subject to the vendor taking back a $150,000 mortgage at 5.5% compounded semiannually. Monthly payments would be based on a 25-year amortization. The prevailing market rate for mortgages with terms of five years and longer is 6.5% compounded semiannually. To the nearest dollar, calculate the equivalent cash value of the offer if the term of the vendor take-back mortgage is:

a. 25 years. **b.** 5 years.

Solution

The equivalent cash value of the offer is the cash price that would put the vendor in the same economic position as the actual offer. Since the vendor could sell the proposed mortgage for its fair market value, the

equivalent cash value of the offer is the down payment of $75,000 plus the fair market value of the vendor take-back mortgage. The steps for obtaining the mortgage's fair market value are:

Step 1: Calculate the payments on the vendor take-back mortgage loan.

Step 2: Calculate the balance owed at the end of the mortgage's term.

Step 3: Calculate the combined present value of the mortgage payments during the term and the balance payable at the end of the term. Use the prevailing market rate as the discount rate.

a. In Step 2, we will assume the final payment is equal to the others and the balance after 25 years is $0. (The error in Step 3 resulting from these assumptions will be only a few cents.)

Step 1:

300 N
5.5 I/Y
150000 PV
0 FV
P/Y 12 ENTER
C/Y 2 ENTER
CPT PMT

Ans: −915.59

Step 2:
Since the term equals the amortization period in Part (a), the balance at the end of the term will be $0.

Step 3:
Same *N, PMT, FV, P/Y, C/Y*

6.5 I/Y
915.59 +/− PMT
CPT FV

Ans: 136,691.17

The equivalent cash value of the offer is $75,000 + $136,691 = $211,691.

b. **Step 1:** The monthly payment is the same as in part (a).

Step 2:
Same *PMT, P/Y, C/Y*

60 N
5.5 I/Y
150000 PV
CPT FV

Ans: −133,781.06

Step 3:
Same *N, PMT, FV, P/Y, C/Y*

6.5 I/Y
CPT FV

Ans: 144,052.88

The equivalent cash value of the offer is $75,000 + $144,053 = $219,053.

EXERCISE 14.4

Answers to the odd-numbered problems are at the end of the book.

Problems 1 through 6 concern the effective cost of borrowing when a mortgage loan involves brokerage fees.

•1. The Gills have arranged a second mortgage loan with a face value of $21,500 at an interest rate of 13.5% compounded monthly. The face value is to be fully amortized by equal monthly payments over a five-year period. The Gills received only $20,000 of the face value, the difference being a bonus retained by the lender. What is the actual cost of borrowing, including the bonus, expressed as an effective interest rate?

•2. A mortgage loan having a face value of $63,000 is arranged by a mortgage broker. From this face value, the broker deducted her fee of $3000. The mortgage is written at a contract rate of 8% compounded semiannually for a

five-year term. Monthly payments are calculated on a 25-year amortization. What is the annual cost of borrowing, including the brokerage fee, expressed as an effective interest rate?

•**3.** A borrower has arranged a $105,000 face value, bonused mortgage loan with a broker at an interest rate of 10.8% compounded semiannually. Monthly payments are based on a 15-year amortization. A $5000 placement fee will be retained by the broker. What is the effective annual cost of the funds actually advanced to the borrower if the contractual interest rate is for:

a. A five-year term?

b. A 10-year term?

c. The entire 15-year amortization period?

•**4.** A local mortgage broker has arranged a mortgage loan with a face value of $77,500, which included a finder's fee of $2500. The loan is to be amortized by monthly payments over 20 years at 12% compounded semiannually. What is the actual cost of borrowing, expressed as an effective annual rate, if the contractual interest rate is for:

a. A three-year term?

b. A seven-year term?

c. The entire 20-year amortization period?

•**5.** A borrower has the choice between two mortgage loans. Both are to be amortized by monthly payments over 10 years. A mortgage broker will charge a fee of $2200 for an $82,200 face value loan at 10.25% compounded semiannually. A trust company will grant an $80,000 loan (with no other fees) at 10.75% compounded semiannually. Determine which loan has the lower effective annual cost of borrowing if the contractual interest rates are for:

a. A five-year term.

b. The entire 10-year amortization period.

•**6.** Calculate the effective annual cost of borrowing for each of the following three financing alternatives. All interest rates are for a seven-year term and all mortgages use a 20-year amortization to calculate the monthly payments. Bank B will lend $90,000 at 10.75% compounded semiannually. Credit union C will lend $90,000 at 10.5% compounded monthly. Mortgage broker M will lend $93,000 at 10.25% compounded semiannually but will retain $3000 as a brokerage fee.

Problems 7 through 16 require the calculation of the fair market value of mortgage loans.

•**7.** The vendor of a residential property accepted a $40,000 take-back mortgage to facilitate the sale. The agreement calls for quarterly payments to amortize the loan over 10 years at an interest rate of 7% compounded semiannually. What was the cash value (or fair market value) of the mortgage at the time of the sale if the market interest rate on 10-year term mortgages was:

a. 10.5% compounded semiannually?

b. 9% compounded semiannually?

•**8.** The vendor of a property agrees to take back a $55,000 mortgage at a rate of 7.5% compounded semiannually with monthly payments of $500 for a two-year term. Calculate the market value of the mortgage if financial institutions are charging 9.5% compounded semiannually on two-year term mortgages.

•9. A mortgagee wishes to sell his interest in a closed mortgage contract that was written 21 months ago. The original loan was for $60,000 at 12% compounded semiannually for a five-year term. Monthly payments are being made on a 20-year amortization schedule. What price can the mortgagee reasonably expect to receive if the current semiannually compounded interest rate on three- and four-year term mortgages is:

a. 11%? **b.** 12%? **c.** 13%?

•10. An investor is considering the purchase of an existing closed mortgage that was written 20 months ago to secure a $45,000 loan at 10% compounded semiannually paying $500 per month for a four-year term. What price should the investor pay for the mortgage if she requires a semiannually compounded rate of return on investment of:

a. 11%? **b.** 10%? **c.** 9%?

•11. A property is listed for $175,000. A potential purchaser makes an offer of $170,000, consisting of $75,000 cash and a $95,000 mortgage back to the vendor bearing interest at 8% compounded semiannually with monthly payments for a 10-year term and a 10-year amortization. Calculate the equivalent cash value of the offer if 10-year mortgage rates in the market are at 10.25% compounded semiannually.

•12. What is the equivalent cash value of the offer in Problem 11 if the vendor financing arrangement is for the same 10-year amortization but with:

a. A five-year term? **b.** A one-year term?

•13. The owner of a property listed at $145,000 is considering two offers. Offer C is for $140,000 cash. Offer M is for $50,000 cash and a mortgage back to the vendor for $100,000 at a rate of 8% compounded semiannually and payments of $750 per month for the five-year term. If current five-year rates are 10.25% compounded semiannually, what is the cash equivalent value of M's offer?

•14. You are interested in purchasing a house listed for $180,000. The owner seems quite determined to stay at the asking price, but you think that the true market value is $165,000. It may be that the owner would accept an offer whose nominal value is the psychologically important $180,000 figure but whose cash value is close to your $165,000 figure. What would be the cash value of the following offer if prevailing long-term mortgage rates are 10.5% compounded semiannually? The offer is for the "full" price of $180,000, consisting of $60,000 down and the balance by a $120,000 mortgage in favour of the vendor. Base monthly payments on a 20-year term, a 20-year amortization, and an interest rate of 8.5% compounded semiannually.

•15. The Phams are almost two years into the first five-year term of a 25-year $80,000 mortgage loan at 10.5% compounded semiannually. Interest rates on three-year term mortgage loans are now 9% compounded semiannually. A job transfer necessitates the sale of the Phams' home. To prepay the closed mortgage, the mortgage contract requires that the Phams pay a penalty equal to the greater of:

a. Three months' interest on the balance.

b. The difference between the fair market value of the mortgage and the balance.

What would be the amount of the penalty if they pay out the balance at the time of the twenty-fourth payment?

•16. A $75,000 mortgage loan at 9% compounded semiannually has a five-year term and a 25-year amortization. Prepayment of the loan at any time within the first five years leads to a penalty equal to the greater of:

a. Three months' interest on the balance.

b. The difference between the fair market value of the mortgage and the balance.

What would be the amount of the penalty if the balance was paid out just after the nineteenth monthly payment and the prevailing rate on three- and four-year-term mortgages was 8% compounded semiannually?