

Teaching Students the Effects of Closing Costs on Mortgages

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Abstract

The concept of the time value of money is a cornerstone of undergraduate business education, yet a significant gap exists between textbook knowledge and practical applications in the home mortgage market. While most standard introductory finance texts cover amortized loans, they frequently provide insufficient detail regarding how mortgage Annual Percentage Rates (APRs) are determined and the specific role that closing costs play in these calculations. This paper addresses this pedagogical deficiency by providing a comprehensive guide for teaching the effects of closing costs on mortgages. Through detailed numerical examples and financial calculator applications, the paper demonstrates the step-by-step determination of APR. Furthermore, it explores the impact of early loan repayment, showing how shorter durations increase the effective interest cost to the borrower. The paper allows educators to integrate these materials into existing finance curricula to better prepare graduates for their personal and professional lives.

Keywords: Time Value of Money, Mortgage, APR, Closing Costs, Finance Education, Housing Affordability.

1. Introduction

The time value of money concept is generally introduced in the very first university junior-level finance class or a lower-level financial literacy course. This concept is crucial not just to finance majors but also to other business or non-business disciplines because the finance knowledge and problem-solving skills students gain will be beneficial to both their professional and personal lives. Amortized loans such as mortgages and auto loans in the U.S. are usually real-world applications examined in textbooks used for such finance classes (see, e.g., Berk, DeMarzo, & Harford, 2022; Brigham & Houston, 2022a, 2022b; Ross, Westerfield, & Jordan, 2023). Students will eventually realize these examples are extremely relevant and useful as some of them may be planning to purchase cars and even first homes after they graduate.

Purchasing a home, especially for first-time buyers, is typically a complicated process. It involves multiple steps including but not limited to finding the right home a buyer can afford, making an offer, inspection and appraisal of the property, and closing the process. One of the potentially confusing issues is a mortgage interest rate and its Annual Percentage Rate (APR) which is generally *higher* than the interest rate due to the mortgage closing costs. In a typical finance textbook that discusses amortized loans such as mortgages will demonstrate how monthly payments and total interest payments are calculated. Unfortunately, when a potential buyer or college graduate refers to these textbooks to learn exactly how a mortgage APR is calculated and the closing costs affect their mortgages, they may be surprised to find that most textbooks emphasize the difference between APR and EAR (Effective Annual Rate) instead. In this context, APR (also called a stated or quoted or nominal interest rate) is calculated as the periodic interest rate multiplied by the number of periods in a year, hence ignoring the periodic compounding effect. Conversely, the EAR does consider this periodic compounding effect, representing the actual interest rate a borrower is paying.

Some textbooks (see Ross et al., 2023) do mention that lenders are required by federal law to report the APR on mortgages which is an annual interest rate that includes certain fees and charges and therefore is higher than the mortgage stated interest rate. However, equations are generally not provided to show exactly how this APR is determined and the exact role of closing costs play in the mortgage is not discussed either. Of course, a potential buyer can ask the lending agent about the APR, utilize AI such as Gemini, Copilot and ChatGPT, or refer to real estate textbooks. This paper attempts to bridge the gap between the time-value-of-money knowledge students learn in class and the practical needs of a purchasing a house, especially their first houses. It provides instructors a brief guide to teach students how a mortgage APR is determined and explain how certain closing costs affect the APR, monthly mortgage payments, and affordability.

The remainder of the paper is as follows. First, we will discuss the three major types of mortgage closing costs and who are usually responsible for them. Next, we will examine the equation used to determine the mortgage payments and then demonstrate how the same equation can also be applied to calculate the mortgage APR that incorporates the additional financing fees. We will also visit a mortgage-related website to demonstrate how lenders report APRs. Then, we will explain how these closing costs actually affect the mortgage payments and housing affordability. That follows by a discussion of how paying off a mortgage early will increase the mortgage APR. We will also discuss how educators can integrate these materials into their curriculum designs. The last section concludes this paper.

2. Mortgage Closing Costs

There are three major types of closing costs: statutory costs, third-party charges, and additional financing fees (see, e.g., Brueggeman, Fisher, & Yates, 2024).

2.1 Statutory Costs

Fees such as recording charges for deeds and mortgages are levied by local government agencies at the time of closing. The borrower is responsible for these costs which are paid for the services provided by governmental agencies. As a result, these costs do not provide income to the lender and hence have no impact on the borrowing cost.

2.2 Third-Party Charges

These include expenses for services such as legal fees, appraisals, inspections, escrow account, and title insurance. These expenses, typically paid by the borrower, are collected by the lender at closing who in turn pays out to third parties. Again, similar to the statutory costs, these charges are not additional income to the lender and hence do not affect the borrowing cost.

2.3 Additional Financing Costs

Closing costs that *do* impact the cost of borrowing are additional financing costs levied by the lender for services related to approving and underwriting the loan. These expenses cover services related to loan application processing, loan documentation and amortization schedules. These fees are sometimes itemized individually and sometimes grouped under the administration fee with the loan origination charges. Another significant borrowing cost is the loan discount points which can be considered as prepaid interest the borrower pays upfront to the lender in return for a *lower* interest rate over the life of the loan. One point equals one percentage of the loan amount.

3. Mortgage Monthly Payments and APR

The Truth in Lending Act (TILA), which was enacted by the Congress in 1968, is implemented by Regulation Z (see Regulation Z of the Federal Reserve Board, 12 C.F.R., sec. 226, as amended) requires lenders to make mandatory disclosure of the cost of mortgage credit when advising the terms of a mortgage (see, e.g., Siedel & Aalberts, 2006). The APR is the most distinct disclosure because it measures the total cost of credit that incorporates both the interest rate and finance charges considered under TILA and is expressed as an annual percentage rate. Hence the APR presents borrowers a standardized figure to compare the true cost of different loan programs.

3.1 Determination of APR

The following *three* steps can be used to determine the APR. The monthly mortgage payment is first calculated by a present value of an annuity equation. Suppose:

L = the loan's principal or original amount borrowed;

i = the loan's nominal interest rate;

N = the term of the loan; and

PMT = the monthly payment. Hence, the monthly payments are:

$$PMT = L \frac{1}{\frac{1}{\frac{i}{12}} - \frac{1}{\frac{i}{12} \left(1 + \frac{i}{12}\right)^{12N}}}. \quad (1)$$

Second, the Amount Financed (AF) is obtained by deducting the Finance Charges (FC) from the original loan amount. Therefore, AF equals $L - FC$. Last, we solve for the interest rate (APR) that equates the present value of the PMTs to the Amount Financed by the same present value equation (see, Brueggeman et al., 2024, P. 246):

$$AF = L - FC = PMT \left[\frac{1}{\frac{APR}{12}} - \frac{1}{\frac{APR}{12} \left(1 + \frac{APR}{12}\right)^{12N}} \right]. \quad (2)$$

This approach is in essence a determination of the internal rate of return (IRR) which is the lender's rate of return over the term of the loan that includes both the mortgage interest rate and Finance Charges.

3.2 Numerical Example of APR Determination and Lender Website Disclosures

Consider a borrower is purchasing a \$500,000 home (a primary residence) in the Las Vegas area with a 20% down payment and an excellent credit score. A popular website a borrower could utilize to compare mortgage lenders is bankrate.com. Figure 1 shows five different lenders' advertisements of their interest rates and APRs for a 30-year mortgage with monthly payments and fixed interest rates as of February 6, 2026.

Mortgage type

ZIP code

Purchase price

Down payment
 %

Credit score

Loan term
☒ 30 yr fixed ☐ 20 yr fixed
☐ 15 yr fixed ☐ 10 yr fixed

[Show more](#)

Show FHA loans

Showing results for: Single-family home, 30 year fixed and 5 year ARM mortgages with all points options.
 The listings that appear on this page are from companies from which this website receives compensation.

Sort by

Key terms explained

Lender	Rate	APR	Mo. payment	as of February 6, 2025
VALLEY WEST MORTGAGE NMLS #65506 State Lic: 2118 ★★★★★ 4.9 (56)	5.375%	5.526%	\$2,240	Next
Upfront costs: \$6,659 8 year cost: \$168,074				
FIRST FEDERAL BANK MORTGAGE LENDERS NMLS #408902 ★★★★★ 5.0 (109)	5.375%	5.567%	\$2,240	Next
Upfront costs: \$8,415 8 year cost: \$169,830				
Sage HOME LOANS CORPORATION NMLS #3304 ★★★★★ 4.8 (706)	5.375%	5.568%	\$2,240	Next
Upfront costs: \$8,474 8 year cost: \$184,903				

Figure 1. Bankrate.com Lender Advertisement

<https://www.bankrate.com/mortgages/mortgage-rates/?disablePre=1&mortgageType=Purchase...>

We examine only the first four programs since they all offered a 5.375% interest rate but with different APRs. Rather than solving manually for the monthly payment and APR with equations (1) and (2), respectively, we can easily compute them with the use of a financial calculator such as the *Texas Instruments BAII Plus* (the Time Value of Money keys). For the monthly payment at 5.375% interest rate, we enter 360 as N as there are 360 (or 12 x 30) payments, 0.44792 as I/Y because the monthly interest rate is 5.375%/12, and last the loan amount \$400,000 as PV:

	N	I/Y	PV	PMT	FV
Enter	360	0.44792	-400,000		0
Compute (CPT)				2,239.88	

The payment (PMT) is exactly what the lenders listed (after rounding).

To calculate the APR, we first determine the Amount Financed (AF) and then enter it as the PV. For instance, the fees or upfront costs the first lender charges is \$6,659. Hence, AF is \$393,341 (\$400,000 – \$6,659). The remaining steps are:

	N	I/Y	PV	PMT	FV
Enter	360		-393,341	2,239.88	0
Compute (CPT)					0.4605

The resulting monthly rate 0.4605% is multiplied by 12 to reach an APR of 5.526%, which is exactly what is listed by the lender. The other three APRs can also be confirmed with identical calculations.

Furthermore, we can also use the same calculator's Cash Flow (CF) keys to determine the APR with the IRR method:

CF0 -393,341 Enter
 C01 2,239.98 Enter F01 360 Enter
 Compute (CPT) IRR 0.4065

Again, the answer is a monthly rate. Hence the IRR is 5.526% which is identical to the previous method. So, the first lender offered the lowest APR. That is, the APR allows the borrower to compare easily the true cost of different loan offerings. Table 1 summarizes the first four loan offerings:

Table 1. Lender Disclosures on bankrate.com

Lender	Interest Rate	Payment	Upfront Cost/Fees	Points (%)	Points (\$)	Amount Financed	APR
Valley West Mortgage	5.375%	\$2,240	\$6,659	1.146%	\$4,584	\$393,341	5.526%
First Federal Bank	5.375%	\$2,240	\$8,415	1.805%	\$7,220	\$391,585	5.567%
Sage	5.375%	\$2,240	\$8,474	1.745%	\$6,980	\$391,526	5.568%
Mutual Omaha	5.375%	\$2,240	\$8,826	1.647%	\$6,588	\$391,174	5.577%

4. Impact of Closing Costs on Mortgage Payments and Affordability

The first home purchase in the U.S. is considered the most expensive purchase for many people, especially when the median home price across the nation as of December 2025 is roughly at \$405,000 whereas the median household income for 2025 is around \$84,000. With the average mortgage interest rate hovering around 6.15% in February 2026, affordability remains challenging for typical first-time buyers.

The above APR calculation which is governed by the TILA explicitly implies that the closing costs are deducted from the original loan amount and therefore reducing the amount available. In reality, how does a borrower actually pay for the closing costs? This netting the closing costs from the proceeds, however, is almost impossible in a typical home purchase because a loan is confined by the home's appraised value, in other words, lenders have extremely strict Loan-to-Value (LTV) limits. Netting the costs from the loan requires the borrower to obtain a larger loan, resulting in a higher LTV than allowed. By the same token, rolling in (or adding) the closing costs to the loan also yields a larger loan and therefore exceeds the allowed LTV.

Paying the closing costs upfront with a borrower's own funds is the most straightforward method. Alternatively, a borrower may be able to use a lender credit to cover the costs in exchange for a higher interest rate, resulting in a larger monthly payments and hence, a higher APR. Either method of paying the closing costs makes housing less affordable because the first method reduces a borrower's funds availability while the second increases monthly mortgage payments.

5. Early Repayment and APR

The APR calculation assumes the closing costs are amortized over the life of a mortgage if they were additional interest. But what if a borrower decides to pay off the mortgage before maturity? The effective interest cost of the mortgage will further *increase* because the closing costs are now spreading over a shorter period. For example, suppose the borrower chooses the first lender in Table 1 and repays the loan after *five* years. The effective interest cost can be determined as follows.

First, we need to find out what the remaining loan balance is after five years or immediately after the 60th payment is made. The remaining loan balance (RLB) is just a present value of the remaining 300 payments:

$$\begin{aligned}
 \text{RLB} &= \text{PMT} \frac{1}{\frac{1}{12} - \frac{1}{12} \left(1 + \frac{i}{12}\right)^{300}} \\
 &= 2,239.88 \frac{1}{\frac{0.05375}{12} - \frac{0.05375}{12} \left(1 + \frac{0.05375}{12}\right)^{300}}
 \end{aligned} \tag{3}$$

With the aid of the calculator, the equation can be easily solved:

	N	I/Y	PV	PMT	FV
Enter	300	0.44792		-2,239.88	0
Compute (CPT)			369,222.72		

That is, RLB is \$369,222.72. Then, we solve for the effective interest cost (EIC) that equates the Amount Financed to the present value of the 60 PMTs *plus* the present value of the remaining loan balance (see, Brueggeman et al., 2024, P. 98):

$$AF = L - FC = PMT \left[\frac{1}{\frac{EIC}{12}} - \frac{1}{\frac{EIC}{12} \left(1 + \frac{EIC}{12} \right)^{60}} \right] + LRB \left[\frac{1}{\left(1 + \frac{EIC}{12} \right)^{60}} \right]. \quad (4)$$

EIC can be easily found by using the financial calculator again:

	N	I/Y	PV	PMT	FV
Enter	60		-393,341	2,239.88	369,222.72
Compute (CPT)		0.4811			

Hence, EIC is 0.4811% x 12 or 5.7732% which is higher than the APR (5.526%).

Again, we can also use the IRR method with the calculator's (CF) keys to determine the EIC:

CF0 -393,341 Enter
 C01 2,239.98 Enter F01 59 Enter
 C02 371,462.70 Enter F02 1 Enter

Compute (CPT) IRR 0.4811

Note that we enter 59, not 60, for 2,239.98 because the last cash flow is the last payment (60th) plus the remaining balance (369,222.72). So, we have the same EIC 5.7732% (0.4811% x 12) as above.

6. Discussion

Unless business (non-real estate major) students refer to real estate specialized textbooks or seek AI assistance, they will not fully comprehend how lenders determine APR. Most finance textbooks focus on the EAR vs. APR distinction regarding periodic compounding rather than the impact of closing costs. Instructors should consider including these materials as auxiliary notes. By bridging the gap between curriculum and real-world application, educators can better prepare students for the most expensive purchase of their lives.

7. Concluding Remark

Home purchase, especially for first time buyers, is a challenging process. Not to mention that it is usually the most expensive purchase for many people in the U.S. A mortgage APR is critical to a mortgage borrower because it measures the true cost since it incorporates both the interest rate and finance charges a lender levies. Yet, non-real estate business university graduates, including finance majors, may feel frustrated because they believe they should have learned about how a mortgage APR is determined by lenders. This paper attempts to build a gap between finance curriculum and real world knowledge and provide finance instructors and textbook authors a simple guideline to teach students the effect of closing costs on mortgages.

8. Disclosure – AI-assisted editing disclosure

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References

- Berk, L., DeMarzo, P., & Harford, J. (2022). *Fundamentals of Corporate Finance* (6th ed.). New York, NY: Pearson.
- Brigham, E. F., & Houston, J. F. (2022a). *Fundamentals of Financial Management* (16th ed.). Boston, MA: Cengage.
- Brigham, E. F., & Houston, J. F. (2022b). *Fundamentals of Financial Management: Concise* (11th ed.). Boston, MA: Cengage.
- Brueggeman, W. B., Fisher, F. D., & Yates, S. (2024). *Real Estate Finance & Investments* (4th ed.). New York, NY: McGraw-Hill.
- Ross, S. A., Westerfield, R. W., & Jordan, B. D. (2023). *Essentials of Corporate Finance* (11th ed.). New York, NY: McGraw Hill.
- Siedel, G. J., & Aalberts, R. J. (2006). *Real Estate Law* (6th ed.). Mason, OH: Thomson/West.