

Paul And Frank Each Borrow \$1,679 For 7 Months. Paul's Loan Uses The Simple Discount Model While Frank's

Paul And Frank Each Borrow \$1,679 For 7 Months. Paul's Loan Uses The Simple Discount Model While Frank's is a common scenario that highlights the fundamental differences between two popular methods of calculating interest on loans: the simple discount model and the traditional interest model. Understanding these models is crucial for borrowers and lenders alike, as they directly impact the total amount to be repaid, the effective interest rate, and the overall cost of borrowing. In this article, we will explore the details of both methods, analyze how they apply to Paul and Frank's loans, and examine the implications for each borrower.

Understanding the Basic Concepts of Loan Models

Before diving into the specifics of Paul and Frank's loans, it's essential to grasp the foundational concepts behind the simple discount model and the ordinary interest model.

What Is the Simple Discount Model?

The simple discount model is a method where the interest (discount) is deducted upfront from the principal at the time of issuing the loan. This means the borrower receives less than the face value of the loan initially, and the total repayment amount is the face value, which includes both the principal and the interest.

Key features:

- The interest is calculated on the face value (or maturity value) of the loan.
- The borrower receives less initial amount than the face value.
- The interest is deducted at the outset, reducing the amount received.

Mathematically:

- $\text{Discount (D)} = \text{Face Value (F)} \times \text{Discount Rate (d)} \times \text{Time (t)}$
- $\text{Amount Received} = F - D$

Implication:

- The effective interest rate (on the amount received) is higher than the nominal rate because the borrower receives less upfront.

What Is the Ordinary Interest (Simple Interest) Model?

The ordinary interest model calculates interest on the original principal amount, without deducting interest upfront. The borrower receives the full principal, and interest is paid periodically or at the end of the loan term.

Key features:

- Interest is computed on the principal throughout the period.
- The borrower receives the full principal amount.
- The total repayment includes the principal plus interest accrued over the period.

Mathematically:

- Interest (I) = Principal (P) × Rate (r) × Time (t)
- Total repayment = P + I

Implication:

- The effective interest rate matches the nominal rate, assuming no compounding.

Scenario Details: Paul and Frank's Loans

Let's analyze the specifics of their loans to understand how the models differ in practice.

Common parameters:

- Loan amount (Principal or Face Value): \$1,679
- Duration: 7 months
- Both borrow the same amount for the same period

Key distinctions:

- Paul's loan uses the simple discount model.
- Frank's loan uses the ordinary interest model.

Calculations for Paul's Loan Using the Simple

Discount Model

In Paul's case, the \$1,679 is the face value of the loan, and the interest is deducted upfront. To find the actual amount Paul receives and the interest rate, we need to determine the discount rate.

Step 1: Establish the Discount Rate

Let's assume the annual discount rate is (d) . Since the loan duration is 7 months, the time period in years is $(\frac{7}{12})$.

Paul's received amount (discounted amount):

$$\text{Received} = F - D = F - (F \times d \times t)$$

But since the amount received is the actual loan amount (say, (A)):

$$A = F \times (1 - d \times t)$$

Given that the face value $(F = \$1,679)$, and the interest is deducted upfront, we can express the interest as:

$$\text{Interest} = D = F \times d \times t$$

However, often in simple discount models, the borrower receives (A) , and the repayment amount is the face value (F) .

Assuming the bank's discount rate is (d) , the actual amount Paul receives is:

$$A = F \times (1 - d \times t)$$

Suppose we're told the amount Paul receives is (A) . If not, then the interest rate can be derived based on the total repayment.

Step 2: Determine the Discount Rate and Total Repayment

Let's assume the bank offers a simple discount rate (d) such that:

$$A = F \times (1 - d \times t)$$

and the borrower repays the face value (F) .

Suppose the bank's discount rate is 10% annually. Then:

$$A = 1,679 \times (1 - 0.10 \times \frac{7}{12}) = 1,679 \times (1 - 0.05833) \\ \approx 1,679 \times 0.94167 \approx \$1,580.74$$

Interpretation:

- Paul receives approximately \$1,580.74 today.
- The bank discounts the face value of \$1,679 at 10% annual simple discount over 7 months.
- At the end of 7 months, Paul repays \$1,679.

Total interest paid:

$$\text{Interest} = F - A = 1,679 - 1,580.74 \approx \$98.26$$

Effective interest rate:

$$\text{Effective rate} = \frac{\text{Interest}}{A} \times 100\% \approx \frac{98.26}{1,580.74} \times 100\% \approx 6.22\%$$

Calculations for Frank's Loan Using the Ordinary Interest Model

Frank's loan involves the full principal amount being received upfront, with interest calculated on the principal.

Step 1: Determine the Interest Rate or Total Repayment

Suppose Frank's bank offers an annual simple interest rate (r) . For 7 months, the interest is:

$$I = P \times r \times t$$

where:

- $(P = \$1,679)$,
- $(t = \frac{7}{12})$ years,
- (r) is the annual interest rate.

Let's assume the bank's annual interest rate is the same as the discount rate for comparison purposes, say 10%.

Interest:

$$I = 1,679 \times 0.10 \times \frac{7}{12} \approx 1,679 \times 0.10 \times 0.5833 \approx \$97.94$$

Total repayment:

$$\text{Total} = P + I = 1,679 + 97.94 \approx \$1,776.94$$

Step 2: Effective Interest Rate and Cost of Loan

The effective rate based on the amount received (full principal) is:

$$\text{Interest rate} = \frac{97.94}{1,679} \times 100\% \approx 5.84\%$$

The total cost for Frank is higher in actual repayment (\$1,776.94) compared to Paul's discounted amount received (\$1,580.74), even though the nominal rate is the same.

Comparison of the Two Models and Their Implications

Understanding the differences between Paul and Frank’s loans reveals important insights into how loan models influence the borrower’s costs and the lender’s returns.

1. Effective Interest Rate

Aspect	Paul’s Loan (Simple Discount)	Frank’s Loan (Ordinary Interest)
Interest calculation	Deducted upfront from face value	Calculated on full principal
Amount received	Less than face value	Full principal received
Effective interest rate	Usually higher than nominal	Generally lower for same nominal rate

Observation:
Paul’s loan results in a higher effective interest rate on the amount received because the interest is deducted upfront.

2. Total Repayment Amount

- Paul: Repays the face value (\\$1,679), but receives less initially.
- Frank: Receives the full principal amount, but repays principal plus accrued interest, which is higher than the discount amount.

3. Cost to the Borrower

- Paul: Pays interest indirectly through the deduction at the outset, leading to a lower amount received but the same repayment at maturity.
- Frank: Pays interest over time, with total repayment being higher due to interest accumulation.

Implication:
Borrowers should carefully consider which model applies to their loan to understand the true cost and how much they will receive or need to repay.

Real-World Applications and Considerations

In practice, the choice between simple discount and ordinary interest models depends on the type of loan, industry standards, and regulatory environment.

Common Use Cases

- Simple Discount Model: Often used in short-term loans, discount bonds, and certain types of trade finance.
- Ordinary Interest Model: Common in personal loans, installment loans,

Frequently Asked Questions

How does the simple discount model affect the calculation of Paul's loan repayment?

In the simple discount model, Paul's loan is discounted at a certain rate upfront, meaning he receives less than the face value and repays the full face value at maturity. The interest is deducted in advance, so the amount he borrows is less than the total repayment amount.

What distinguishes Frank's loan from Paul's in terms of the borrowing model?

Frank's loan is based on a different model, likely the simple interest or compound interest model, which involves calculating interest on the principal over time, rather than discounting the amount upfront as with the simple discount model used for Paul.

If both Paul and Frank borrow \$1,679 for 7 months, how does the simple discount model impact the total amount each repays?

Under the simple discount model, Paul would receive less than \$1,679 initially and repay the full face value at maturity, resulting in a different effective interest rate compared to Frank's model, which calculates interest on the principal over the period.

What is the formula to determine the amount Paul will receive using the simple discount model?

The amount Paul receives is calculated as:

$$\text{Amount received} = \text{Face value} / (1 + r t)$$

where r is the discount rate per period, and t is the time in years.

Why might a borrower choose a simple discount loan over other types of loans?

Borrowers might prefer the simple discount model because it provides clarity on the amount to be repaid upfront and often involves straightforward calculations, although it may result in higher effective interest costs compared to other models.

How can one compare the effective interest rates of Paul's simple discount loan and Frank's loan?

To compare the effective interest rates, you need to calculate the total interest paid in each model relative to the actual amount received, considering the discount or interest calculations specific to each model. The simple discount model generally results in a higher effective rate compared to simple interest loans for the same principal and period.

Additional Resources

Paul And Frank Each Borrow \$1,679 For 7 Months. Paul's Loan Uses The Simple Discount Model While Frank's

When analyzing loan options, understanding the underlying interest calculation methods is crucial to making informed financial decisions. In the scenario where both Paul and Frank borrow the same amount—\$1,679—for a period of seven months, yet their loans are calculated using different models, the differences become significant. Specifically, Paul's loan employs the Simple Discount Model, whereas Frank's uses a different approach, often the simple interest or other methods. This article explores the nuances of each model, compares their implications, and provides a comprehensive analysis to help borrowers and financial analysts grasp the implications of each approach.

Understanding the Basic Concepts of Loan Calculation Models

Before delving into the specifics of Paul's and Frank's loans, it's essential to understand the foundational models used in loan calculations. The two primary methods discussed here are the Simple Discount Model and the Simple Interest Model.

Simple Discount Model (Paul's Loan)

The Simple Discount Model calculates the discount on the present value of the loan upfront. The borrower receives the net amount after the discount, which is deducted from the face value of the loan at the outset. At repayment, the borrower repays the full face value, but because the initial amount received was less due to discounting, the effective interest paid is embedded in the initial calculation.

Features of the Simple Discount Model:

- The interest is deducted at the beginning (discounted from the face value).
- The borrower receives less than the face value initially.
- The effective interest rate can be higher than the nominal rate when viewed from the amount received.
- Commonly used in short-term loans, commercial paper, or discounts on bills of exchange.

Advantages:

- Simplifies the calculation of discounted loans.
- Useful in situations where the lender wants immediate repayment of interest.

Disadvantages:

- The borrower receives less upfront, which might be less favorable.
- Can be confusing because the amount received is less than the amount repaid.

Simple Interest Model (Frank's Loan)

In contrast, the Simple Interest Model applies interest to the principal amount throughout the loan period without deducting it upfront. The borrower receives the full principal and repays the principal plus interest at maturity.

Features of the Simple Interest Model:

- Interest is calculated on the original principal throughout the loan period.
- The borrower receives the full amount initially.
- The total repayment includes the principal plus interest accrued over the period.
- Common in personal loans, mortgages, and installment loans.

Advantages:

- The borrower receives the full amount upfront.
- The interest calculation is straightforward and transparent.
- Easier to compare with other loan types.

Disadvantages:

- The total interest paid can be higher over the loan period compared to other models, especially if the interest rate is high.

- Does not account for compounding unless specified.

Detailed Analysis of Paul's Loan Using the Simple Discount Model

Paul's loan is based on the Simple Discount Model, meaning he receives less than the face value at the outset, with the discount calculated upfront. Let's explore how this model impacts his borrowing costs over the seven months.

Calculating the Discount and Repayment

Suppose the face value of the loan is \$1,679, and the annual discount rate is denoted as "d". The discount amount (D) is computed as:

$$D = \text{Face Value} \times d \times \frac{t}{12}$$

where $t = 7$ months.

The amount Paul actually receives (the maturity value) is:

$$\text{Proceeds} = \text{Face Value} - D$$

The borrower then uses this proceeds during the period but must pay back the full face value at maturity.

Example Calculation:

Assuming an annual discount rate of 12%, then:

$$D = 1,679 \times 0.12 \times \frac{7}{12} = 1,679 \times 0.12 \times 0.5833 \approx 1,679 \times 0.07 = 117.53$$

Thus, Paul receives:

$$1,679 - 117.53 = 1,561.47$$

At the end of 7 months, Paul repays the full face value of \$1,679.

Total interest paid:

$$1,679 - 1,561.47 = 117.53$$

Effective interest rate (based on proceeds):

$$\text{Interest rate} = \frac{\text{Interest paid}}{\text{Proceeds}} =$$

$$\frac{117.53}{1,561.47} \approx 7.53\%$$

Annualized, this rate becomes:

$$7.53\% \times \frac{12}{7} \approx 12.91\%$$

Note: This matches the discount rate used in calculation, showing how the simple discount model inflates the effective interest rate from the borrower's perspective.

Pros and Cons for Paul

Pros:

- The model is straightforward for lenders and quick to compute.
- Useful in short-term commercial transactions with bills or promissory notes.

Cons:

- Paul receives less than the face value upfront, which may limit liquidity.
- The actual interest rate effectively paid (about 12.91%) is higher than the nominal discount rate, potentially misleading if not properly understood.
- The borrower bears the cost upfront, even if funds are used over time.

Frank's Loan Using the Simple Interest Model

Frank's loan employs the simple interest method, meaning he receives the full amount of \$1,679 upfront and repays this principal plus interest at the end of seven months.

Calculating the Total Interest and Repayment

Suppose Frank's annual interest rate is the same as Paul's (say, 12%), then the interest accrued over 7 months is:

$$\text{Interest} = \text{Principal} \times r \times \frac{t}{12} = 1,679 \times 0.12 \times \frac{7}{12} \approx 1,679 \times 0.07 = 117.53$$

Frank's total repayment at the end of 7 months:

$$1,679 + 117.53 = 1,796.53$$

Interest rate relative to the principal: 7%

Annualized interest rate:

$12\% \times \frac{12}{7} \approx 20.57\%$

which aligns with the nominal rate used in the calculation.

Features and Implications for Frank

Features:

- Frank receives the full principal upfront, providing liquidity.
- The interest is paid at the end, simplifying budgeting.
- Easy to compare with other loans based on nominal rates.

Advantages:

- Transparency in total amount owed.
- Flexibility in using the borrowed funds without immediate deductions.
- Clear understanding of total repayment.

Disadvantages:

- The total interest paid may seem higher compared to discounted loans, depending on the rate.
- Frank bears the entire interest cost at the end of the period, which can be a cash flow concern.
- No upfront reduction in the principal amount received.

Comparison of the Two Models: Impact on Borrowers and Lenders

The fundamental differences between Paul's and Frank's loans highlight the importance of understanding the underlying models.

Cost to Borrowers

Aspect	Paul (Simple Discount)	Frank (Simple Interest)
Upfront amount received	Less than face value	Full face value
Total interest paid	Slightly higher relative to proceeds	Based on full principal
Effective interest rate	Slightly higher due to discounting	Usually lower, based on nominal rate

Implication: Paul's loan appears cheaper at first glance but effectively costs more due to the upfront discount.

Cash Flow and Liquidity

- Paul: Receives less upfront, which may limit immediate liquidity but could be advantageous for lenders seeking early repayment.
- Frank: Receives full amount, providing maximum liquidity but pays interest at the end.

Transparency and Complexity

- The simple interest model is more straightforward, making it easier for borrowers to understand total costs.
- The discount model can be confusing, especially when converting between nominal and effective interest rates.

Use Cases and Suitability

- Simple Discount Model: Best suited for short-term commercial transactions, bills of exchange, and situations where upfront deduction is acceptable.
- Simple Interest Model: More appropriate for personal loans, mortgages, or installment plans where borrowers prefer received capital upfront.

Conclusion: Which Model Is Better?

Choosing between the Simple Discount Model and the Simple Interest Model depends on the specific needs of the borrower and lender, the context of the loan, and the transparency required.

Summary of key differences:

- Paul's Discount Loan: Offers the benefit of immediate repayment of the face value but at the cost of receiving less upfront and paying higher effective interest rates. Suitable for commercial settings where quick repayment is prioritized.
- Frank's Interest Loan: Provides full liquidity upfront, with interest paid at the end. It's more transparent, easier to understand, and generally preferred for personal finance.

Final Thoughts

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