

Consumer Borrowing

Lecture 3

Background

- While so much attention has been devoted to wealth and wealth management, most people carry debt.
 - Need to look at both sides of the balance sheet
- Consumer borrowing:
 - People increasingly start their working life in debt (student debt, car loans, credit card debt)
 - Debt carries much higher interest rate than assets
 - Opportunities to borrow have grown tremendously and have become very profitable fields
 - At the macro level as well, the financial crisis had to do with debt

Some facts

- Student loans have grown to more than \$1.5 trillion in the US.
 - 45% of Americans age 18-34 have student loan debt.
 - Source: 2015 National Financial Capability Study
- Sub-prime mortgages exploded and then imploded over a short time period.
- About half of credit card holders carry a balance.
 - FINRA Financial Capability Study (several waves)
- Borrowing has increased also against retirement accounts.
 - Of each dollar put in, 50 cents leaked out during the financial crisis.
 - Source: Sabelhaus, J. et al. "Changes in U.S. Family Finances from 2007 to 2010: Evidence from the Survey of Consumer Finances." *Federal Reserve Bulletin*, 2012.
- High-cost methods of borrowing have become common among many Americans.

Consumer borrowing

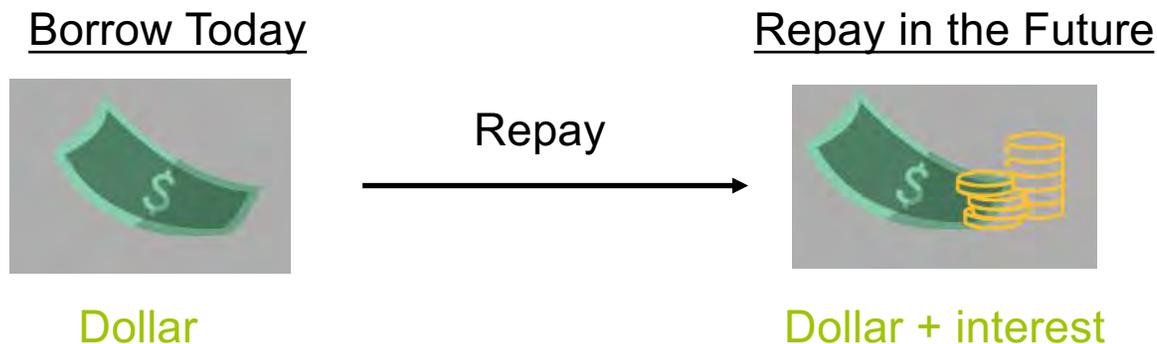
There are many reasons why consumers borrow.

- To **finance an education** with a student loan.
- To **buy a home** with a mortgage loan.
- To **finance home improvements** with a home equity loan.
- To **buy a car** with an auto loan.
- To **finance consumption** with a credit card, home equity line of credit, or a personal loan.
- To **fund a business** with a credit card, home equity line of credit, or business loan.
- To **finance an investment** with a margin loan.

The cost of borrowing

The **interest rate** is the **price of money**.

- When you borrow money today, you must not only return it in the future, but you must also pay interest. Interest is the cost of borrowing.

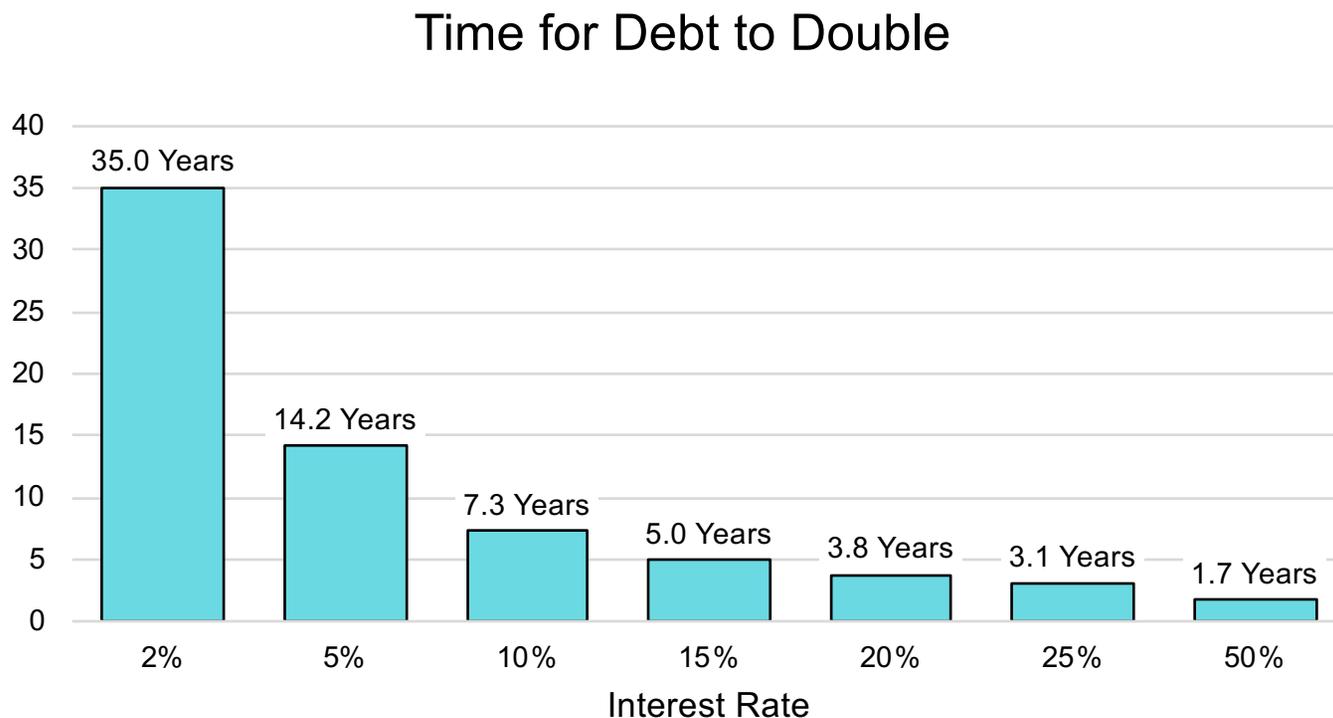


- The higher the interest rate, the higher the cost of borrowing, and the more you will ultimately pay. So **pay attention to the interest rate** when you borrow.

Interest and debt growth

We learned about interest compounding and saw that debt can grow quickly with a high interest rate.

Let's see how long it takes for debt to double at different interest rates.



Installment Loans

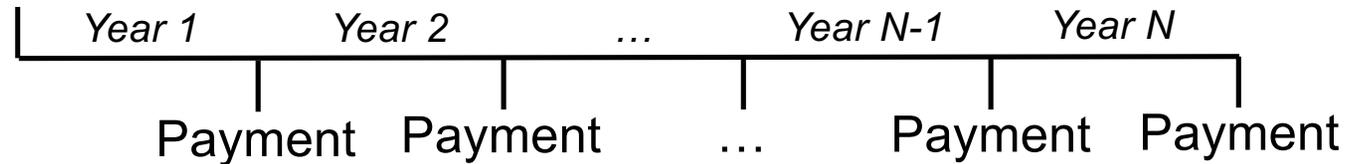


Installment loans

In an **installment loan**, a borrower must repay the loan in fixed payments according to a set schedule.

- An installment loan that requires annual payments for N years will have the following cash flow structure:

Borrowed Amount



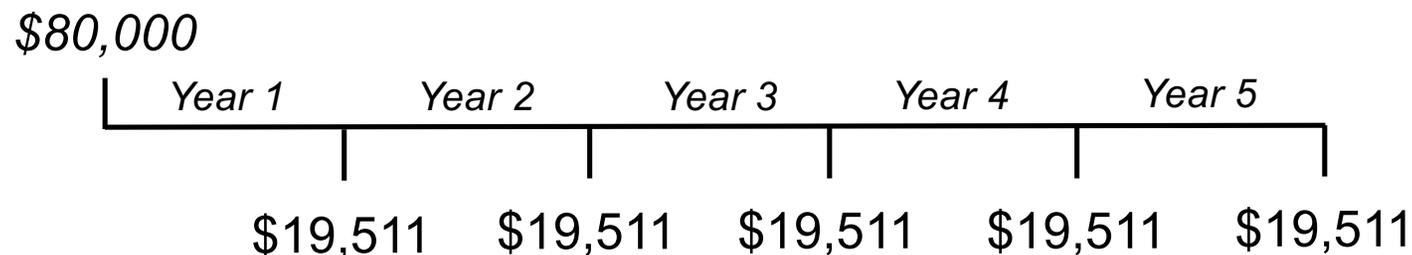
- The payment will be the same each year. After the N^{th} payment, the loan will be fully repaid.
- Mortgages, student loans, auto loans, and personal loans are all common types of installment loans.

Auto loans

Auto loans are a good example of installment loans.

Imagine that you borrow \$80,000 to buy a fancy car. You take out a 5-year auto loan with an interest rate of 7% that requires annual payments.

You must make payments of \$19,511 a year for the next 5 years:



Auto loans are **collateralized** loans – this means if you don't make your payments, the lender can take your car!



Calculate a fixed payment

The payment on an installment loan can be calculated using the TVM function on a financial calculator.

For example, the five-year auto loan in the previous example had the following structure:

PV= \$80,000	PMT=?	PMT=?	PMT=?	PMT=?	PMT=?, FV=0
	Year 1	Year 2	Year 3	Year 4	Year 5

Interest Rate = 7%, Frequency = 1

The present value is the borrowed amount of \$80,000. The final value is zero because no extra payment is required at the end of the five years. The annual interest rate is 7% and the loan requires one payment per year.

The only missing TVM variable is the payment (PMT), which we can calculate with a finance calculator.

Interest on installment loans

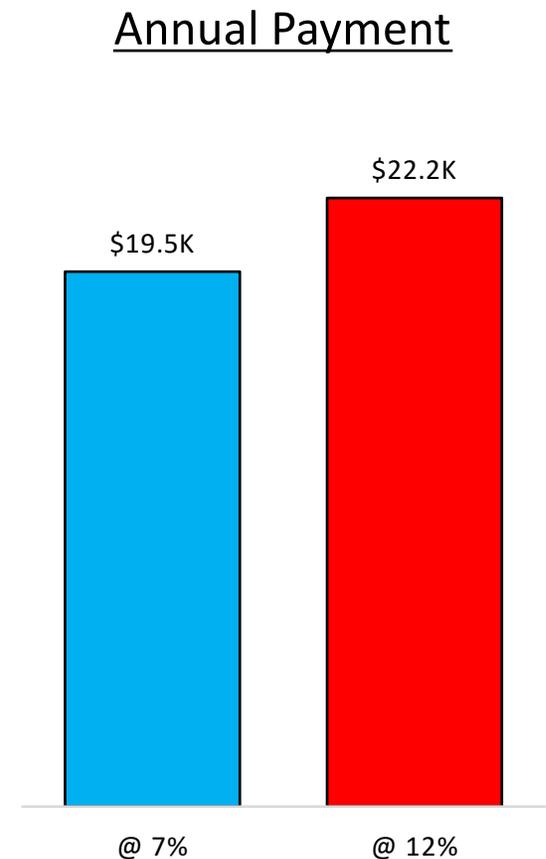
The balance on an installment loan won't grow over time, but a higher interest rate is still costly: a **higher interest rate** on an installment loan results in a **higher fixed payment**.

Let's compare the fixed payment on the 7% five-year auto loan with a 12% loan.

A 7% loan requires payments of \$19,511.

A 12% loan requires payments of \$22,193.

The 12% loan costs about \$2,700 more each year!



Interest on installment loans

And a higher interest rate and higher fixed payment implies a **higher total interest expense** over the life of the loan.

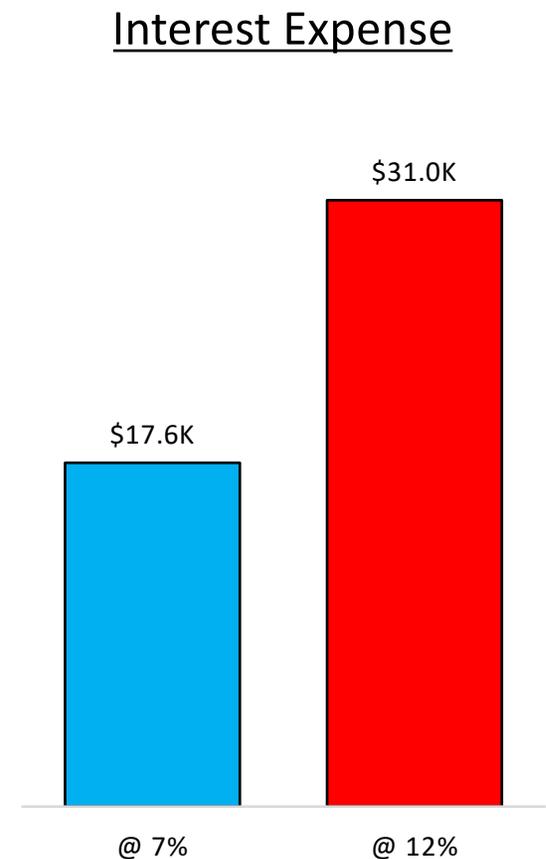
Let's compare the total interest expense on a 7% loan to a 12% loan.

The 7% loan requires total payments of:

$$5 * \$19,511 = \$97,555$$

\$80,000 is the principal. The remaining \$17,555 is the interest expense.

The interest expense on the 12% loan is \$30,965. **This is almost twice as much interest!**



Loan Amortization



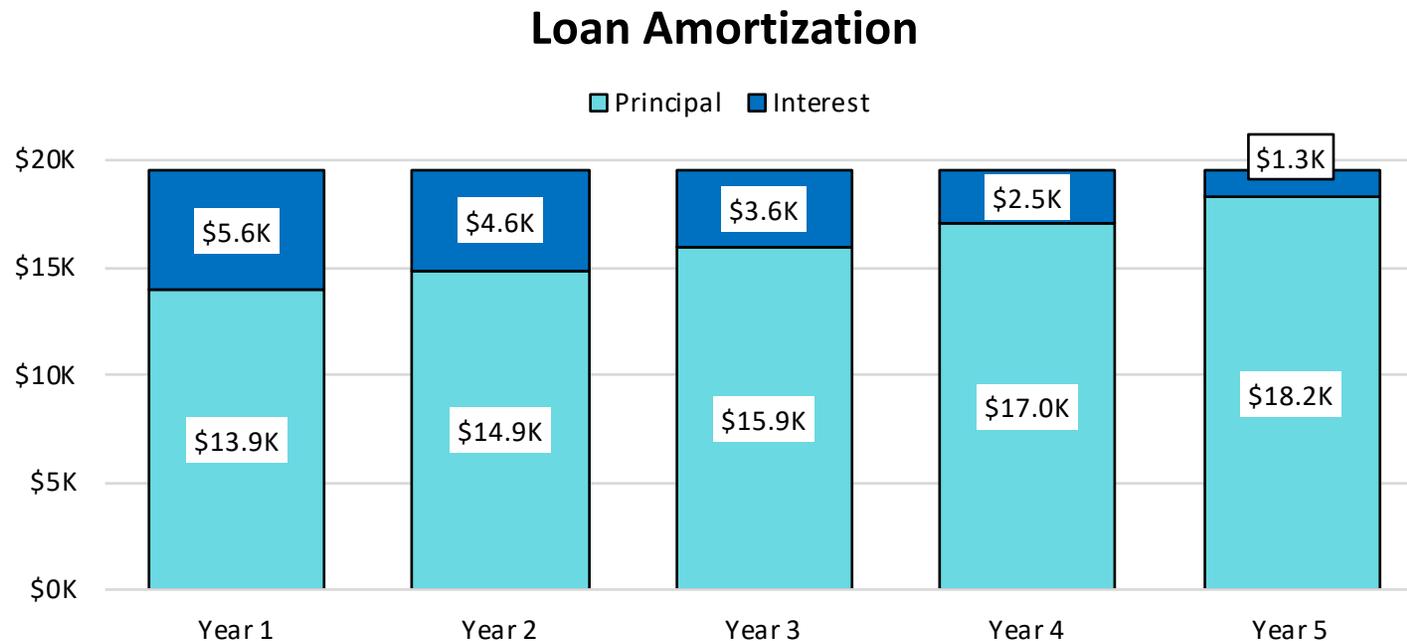
Loan amortization

When a loan is repaid in installments, the loan **balance** (the amount still owed at a given time, i.e. the **principal**) is gradually reduced over time.

- This is known as **amortization**.
- When a balance is amortized, a portion of each payment is used to repay the interest accrued on the balance between payments.
- The remainder is used to reduce the balance.
- As the balance shrinks, the interest owed in each subsequent period will decline, and a larger portion of the payment will be used to reduce the principal.

Loan amortization

The following chart shows the principal and interest payments for the 7% auto loan discussed earlier.



The payment is \$19.5K each year, but the interest payment declines while the principal payment increases.

Loan amortization

Let's see how this works.

- The beginning balance is \$80K and the interest rate is 7%. Therefore, the interest payment for the first year is \$5.6K.

$$0.07 * \$80,000 = \$5,600$$

- Since the full payment is \$19.5K, the principal portion of the payment is \$13.9K.

$$\$19,511 - \$5,600 = \$13,911$$

- The balance is reduced by this principal payment and becomes \$66.1K.

$$\$80,000 - \$13,911 = \$66,089$$

Loan amortization

Because the balance is smaller going into the second year, the interest payment will be smaller.

- The balance at the beginning of the second year is now \$66.1K, and so the interest expense falls to \$4.6K.

$$0.07 * \$66,089 = \$4,626$$

- The principal portion of the payment increases to \$14.9K

$$\$19,511 - \$4,626 = \$14,885$$

- And the balance is reduced to \$51,204. This process continues with the interest payment declining each year and the principal payment increasing. In the fifth year, the principal payment completely pays the remaining balance.

Implications of loan amortization

What are the implications?

- How much of the loan have you paid back after a few installments?
- What happens if T is high, such as 30 years?
- Is it always better to have a high T ?
- Can you borrow the entire amount you need to say buy a car, a house, a household appliance? If yes, which interest rate are you likely to get?

APR and Monthly Payments



APR and monthly payments

Consumer loans generally require **monthly** payments and interest is calculated monthly using an **annual percent rate (APR)**.

- Interest is compounded *monthly* on loans with monthly payments. The interest rate used is a **monthly interest rate**.
- The **annual percent rate (APR)** is the monthly interest rate multiplied by twelve (the number of months in a year).
- For example, if the interest rate was *2% per month*, the APR would be $12 * 2\% = 24\%$.
- The *Truth in Lending Act* requires that all consumer loan interest must be expressed as an APR.

APR and monthly payments

The APR can be used to compute the monthly interest expense each month.

If you maintain a \$20,000 balance on a loan that charges an 18% APR, you will have to pay \$300 in interest every month.

The monthly interest rate is the APR divided by twelve, or 1.5%:

$$r_m = \frac{APR}{12} = \frac{18\%}{12} = 1.5\%$$

So the monthly interest expense will be \$300:

$$0.015 * \$20,000 = \$300$$

Over the course of a year, this is $12 * \$300 = \$3,600$, or 18% of your \$20,000 balance (note that 18% is the APR).

Calculating a monthly payment

You can use a financial calculator to compute a monthly payment. Just set the payments per year to 12 and enter the APR as the interest rate.

If you borrow \$80,000 to purchase a car using a five-year auto loan with a 7% APR, your monthly payment will be \$1,584.

<i>Time Value of Money</i>	
P/Y	12
PV	\$80,000
N	60
FV	\$0
I/Y	7%
PMT=	-\$1,584.10

Your financial calculator will automatically convert the APR into a monthly interest rate for you. But you must change the number of payments to 60 for the number of monthly payments in five years.

Student Loans



Student loans

Over the last two decades, the amount of money students borrow to finance their education has increased.

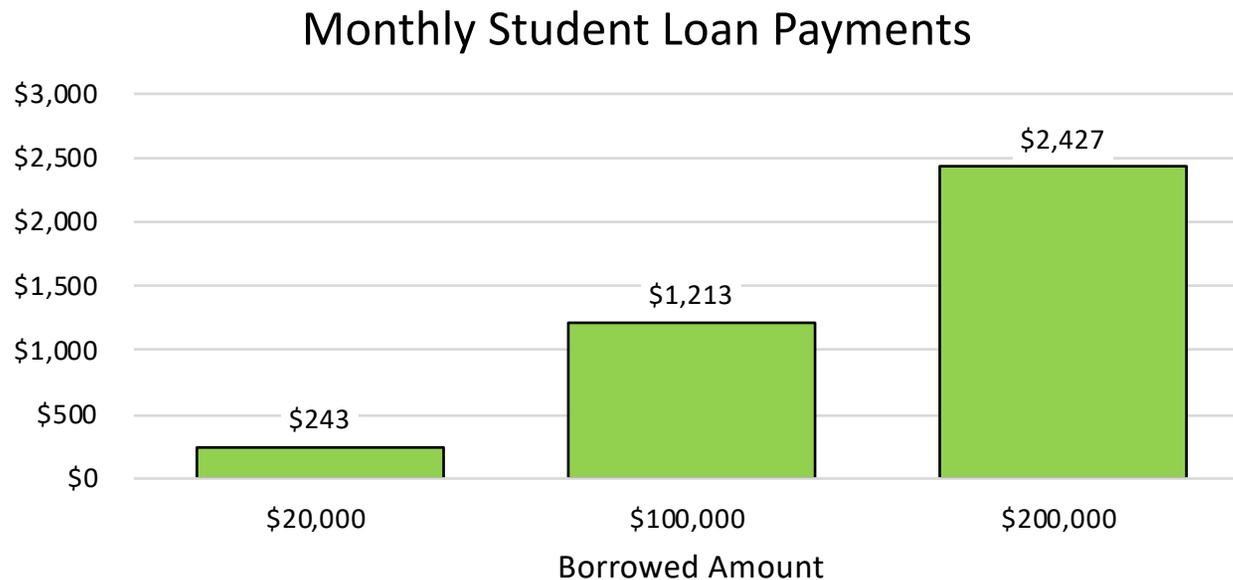
According to data from the 2015 National Financial Capability Study

- 45% of Americans age 18-34 have student loan debt.
- Nearly 1 in 5 of American student loan holders do not know how their monthly payments are determined.
- More than half (53%) of American borrowers said that they would make a change if they could go through the process of taking out loans all over again.

How expensive is student debt?

Student loan payments

- If you saved \$180,000 of the \$200,000 needed for your child's college education, and they have to **borrow the remaining \$20,000** with a 10-year student loan charging an 8% APR, their **monthly payment will be \$243.**
- If you only save half of the \$200,000 and they **borrow \$100,000**, their **monthly payment will be \$1,213.**
- If they **borrow the full \$200,000**, their **monthly payment will be \$2,427!**



Student loan payments

Monthly student loan payments can be easily calculated using a financial calculator.

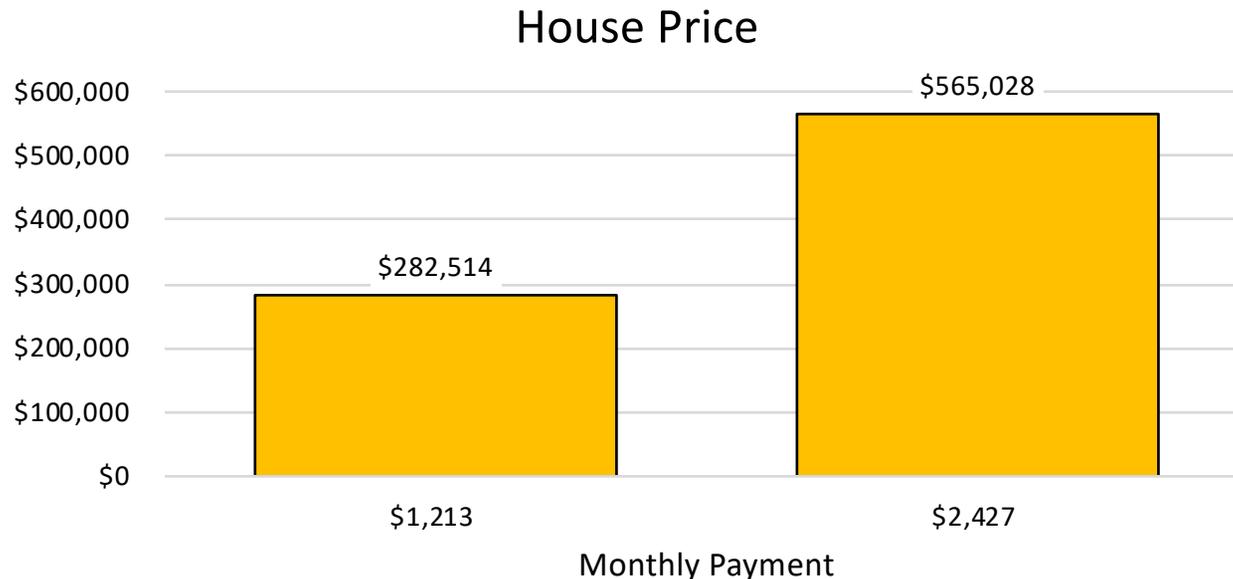
Consider the ten-year student loan with an 8% APR. The monthly payment for the three different amounts can be calculated as noted (note that there are 120 months in ten years):

<i>Time Value of Money</i>	
P/Y	12
N	120
I/Y	8%
FV	\$0
PV	\$20,000
PMT=	-\$243
PV	\$100,000
PMT=	-\$1,213
PV	\$200,000
PMT=	-\$2,427

Student loans versus mortgages

Let's put these payments into perspective.

- A \$1,213 monthly payment could pay the mortgage bill on a \$283,000 house!
- And a \$2,427 monthly payment could pay the mortgage bill on a \$565,000 house!



Not saving for a child's college education means they may have to decide between a degree or a house or postpone buying a house.

Student loans and subsidized interest

Federal student loans, such as **Perkins loans**, provide an interesting case of consumer borrowing for analysis because of their unique characteristics:

- Perkins loans have a nine-month **grace period**, over which no interest accrues and no payment is due.
- The interest on a Perkins loan is **subsidized** while the student is still in school.
- Therefore, students aren't responsible for making any payments or accruing any interest until nine-months after they graduate.

Because of these features, students are effectively able to push their payments further into the future, and because of the **time value of money**, this has value. We will now quantify that value.

Student loans and subsidized interest

Ex.

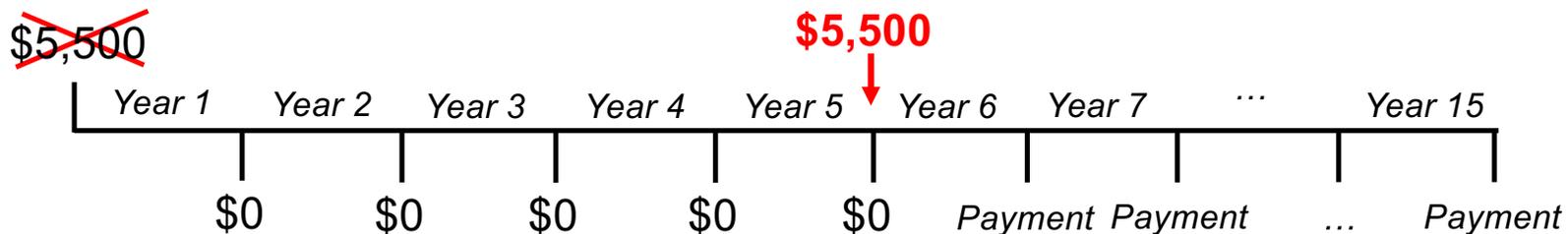
A student borrows **\$5,500 using a Perkins loan with an APR of 5%** during her freshman year of college.

Because of the subsidized interest and grace period on the loan, **interest will not accrue on the loan over the following four years while the student is in school and for another during the grace period. The student will be required to repay the loan over ten years in annual installments beginning with a payment at the end of the sixth year** (in reality, like most consumer loans, Perkins loans require monthly payments, but for simplicity, we assume that all payments are annual and occur at the end of the year for this example. We also assume the payments start after a year, not 9 months).

Calculate the implied APR incurred by the student if the student repays the loan according to schedule.

Student loans and subsidized interest

Ans. No payment is due during the first five years. After that, ten equal payments are due:



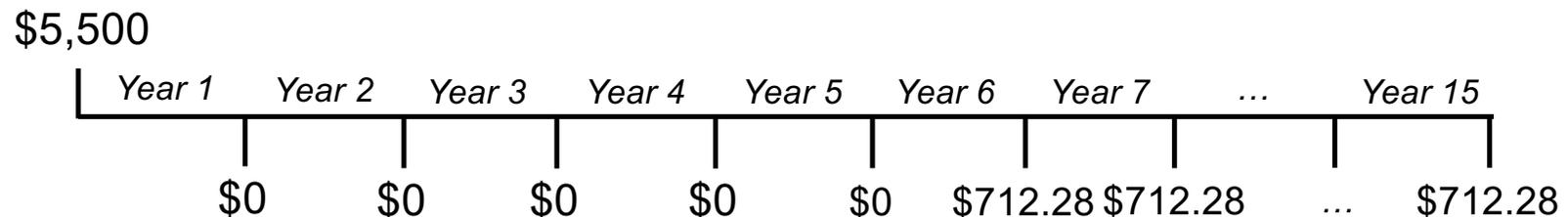
Because of the **subsidized interest**, no interest accrues over the first five years. Therefore, the payments are calculated as if the loan is taken out at the start of the sixth year. Use a financial calculator to find the annual payment:

<i>Time Value of Money</i>	
P/Y	1
PV	\$5,500
FV	\$0
N	10
I/Y	5%
PMT=	-\$712.28

Student loans and subsidized interest

Ans. (continued)

With ten payments of \$712.28, the cash flows are:



While the payments were calculated *as if* the payments started as soon as the loan was disbursed, in fact, there was a five-year lag. The effect is that the implied interest rate on the loan is lower than the stated 5% APR.

This is once again **the time value of money** at work. Delaying payments to the future has financial value, and in this problem, we **quantified that financial value.**

CF₀	\$5,500
C01	\$0
F01	5
C02	-\$712.28
F02	10
IRR=	2.52%

Credit Cards



Credit Cards: 2015 National Financial Capability Survey (NFCS)

In the past 12 months...	Total	18-34	35-54	55+
I always paid credit cards in full	52%	54%	44%	59%
In some months, I carried over a balance and was charged interest	47%	46%	56%	40%
In some months, I paid the minimum payment only	32%	43%	38%	20%
In some months, I was charged a fee for late payment	14%	21%	15%	6%
In some months, I was charged a fee for exceeding my credit line	8%	14%	8%	3%
In some months, I used the cards for a cash advance	11%	17%	11%	7%

Source: [2015 NFCS by FINRA Investor Education Foundation](#)

Credit cards

Unlike most consumer loans, a credit card loan is not an installment loan but a **revolving loan, or line of credit.**

- In a **revolving loan or line of credit**, the borrower does not borrow a fixed amount, but rather has the right to borrow incrementally over time up to some **credit limit**.
- The interest rate is applied to whatever balance is outstanding in a month to find the **interest expense** due in the following month.
- Typically, credit cards and other lines of credit require a **minimum monthly payment**, and this is often just the interest expense.



Credit cards (simplified payment)

Here's an example:

- Joy has a credit card that carries a 24% APR with a \$5,000 credit limit. This month, she has a balance of \$2,000 on her card.
- Next month, she must pay \$40 in interest (a 24% APR corresponds to a 2% monthly interest rate): $0.02 * \$2,000 = \40 .
- If she makes a payment of \$240, the \$40 will pay the interest and the remaining \$200 will reduce her balance to \$1,800. She will then owe \$36 in interest the next month: $0.02 * \$1,800 = \36 .
- If Joy then uses her credit card to buy a new \$1,000 bike, her balance will increase to \$2,800. She will then owe \$56 in interest the next month: $0.02 * \$2,800 = \56 .
- Joy must pay at least the interest expense each month. She may use her credit card to make purchases as long as her balance does not exceed her credit limit of \$5,000.

Making the minimum payment

Let's figure out how long it takes to pay off a credit card.

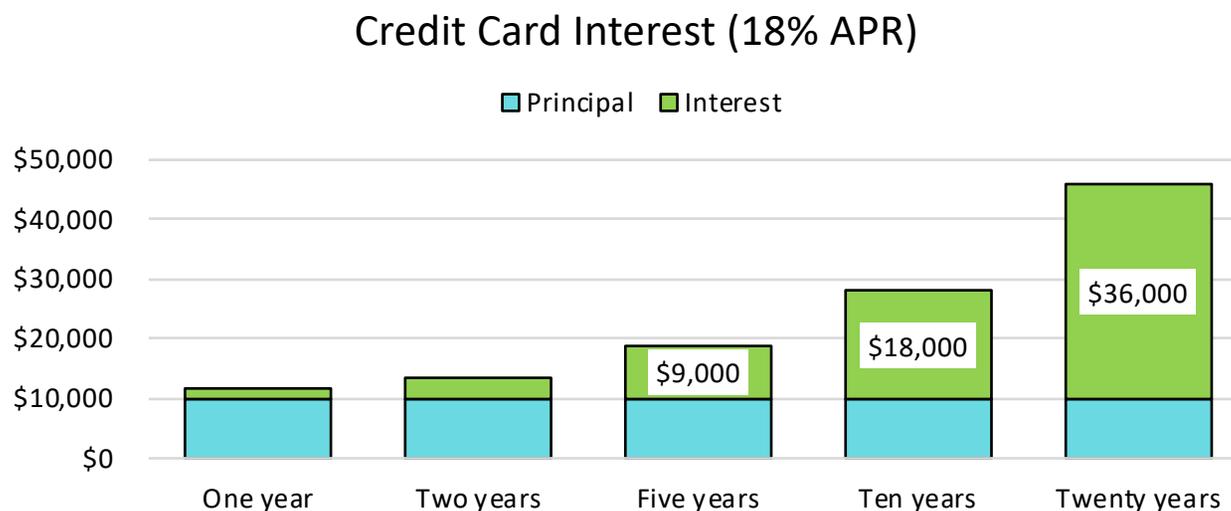
You have a \$10,000 balance on your credit card with a 18% APR. If you make the minimum payment of \$150 each month, how long will it take you to pay off your credit card?

Making the minimum payment

With a \$10,000 balance on a credit card with a 18% APR (1.5% monthly), the monthly interest expense is \$150: $1.5\% * \$10,000 = \150

If you only pay the \$150 minimum, the full \$150 will go toward the interest and \$0 will be left to amortize the balance. You will be required to pay \$150 until you make extra payments to reduce the principal.

Over a year, that's \$1,800 in interest. Over 5 years, it's \$9,000, and in 20 it's \$36,000. This is much more than the original borrowed amount \$10,000 (which you still have to repay)!

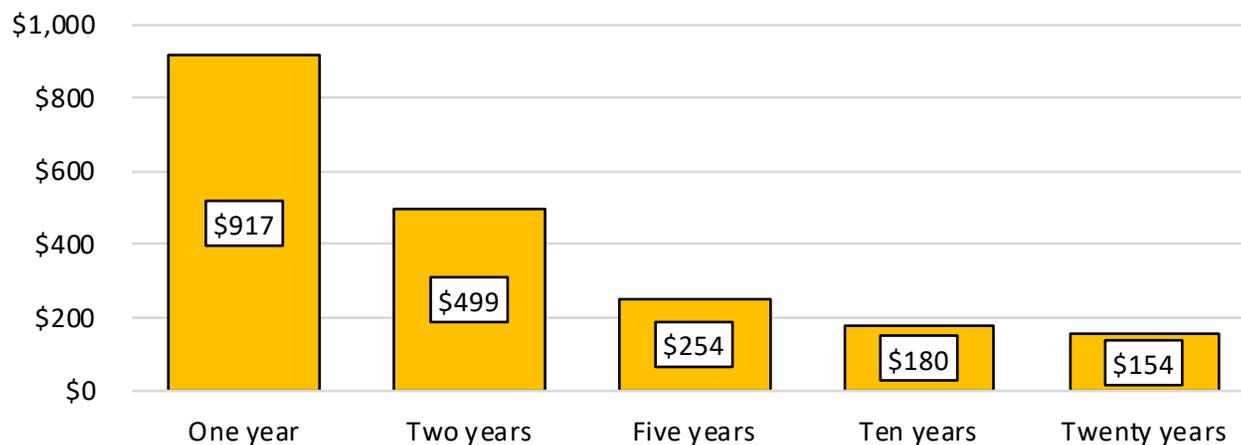


Paying off your credit card

“So how do I pay off my credit card in 10 years? In 5?”

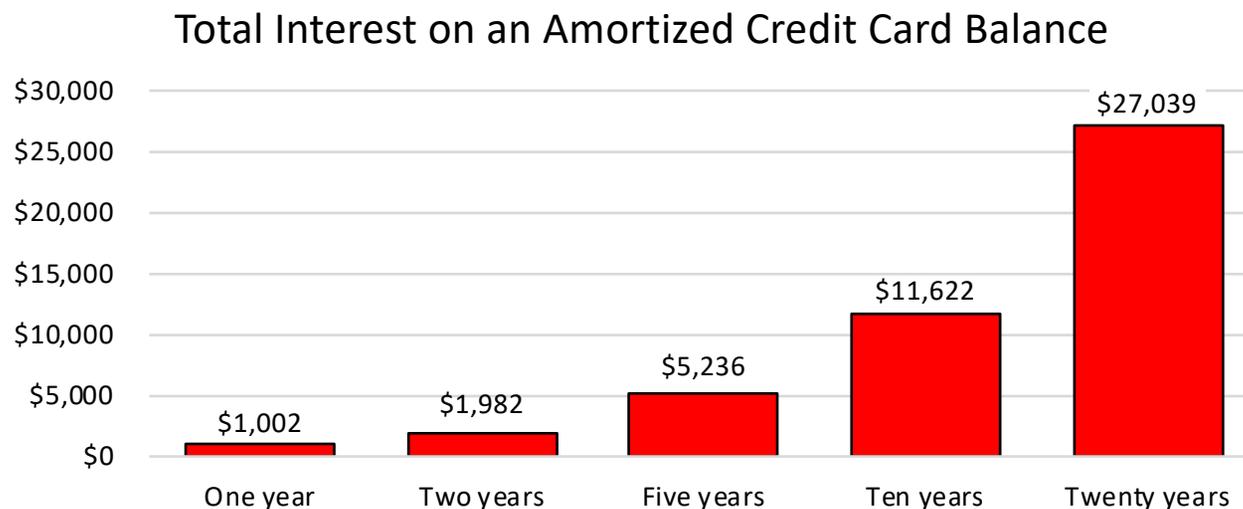
- If you carry a large balance on your credit card, it may be difficult to pay it off all at once.
- To pay it off gradually over time, treat it like a regular installment loan and calculate the monthly fixed payment required to amortize it over a certain number of years.
- For a \$10,000 balance on a credit card with a 18% APR, \$254 monthly payments will pay it off in five years, and \$180 payments will pay it off in ten years.

Payment to Amortize a Credit Card Balance



Paying off your credit card

- By taking longer to pay off your credit card, you can make smaller monthly payments. But because you must make more payments, your total interest expense will be higher.
- If you amortize a \$10,000 balance on a credit card with an 18% APR in five years, it will take 60 monthly payments of \$253.93. Your total interest expense will be about \$5,236.
- If you amortize the same balance over ten years, your required monthly payment will decrease to \$180, but you must make 120 of them. Your total interest expense will increase to about \$11,600.



Paying off your credit card

The monthly payment needed to amortize a credit card balance can be easily calculated using a financial calculator.

To find the monthly payment needed to amortize the \$10,000 balance on a credit card charging a 18% APR in five years (60 months) from the problem above:

<i>Time Value of Money</i>	
P/Y	12
PV	\$10,000
N	60
FV	\$0
I/Y	18%
PMT=	-\$253.93

This will require total payments of $60 * \$253.93 = \$15,235.8$. The first \$10,000 of this will repay the balance. The remaining \$5,236 is the total interest expense.

High-Cost Borrowing



High-Cost Borrowing

2015 National Financial Capability Study

Many Americans use high-cost borrowing—26% have used at least one alternative (non-bank) borrowing method in the past 5 years:

- Pay-day loans
- Pawn shops
- Auto title loans
- Rent-to-own store



Payday loans

A **payday loan** is a type of unsecured short-term loan that is generally marketed toward consumers with poor or nonexistent credit histories.

Consider the following example: Jeff borrows \$100 from a payday lender for five days, with an agreement to repay the \$100 plus \$1.50 per day in fees.

After five days, Jeff owes the original \$100 plus \$7.50 in fees:

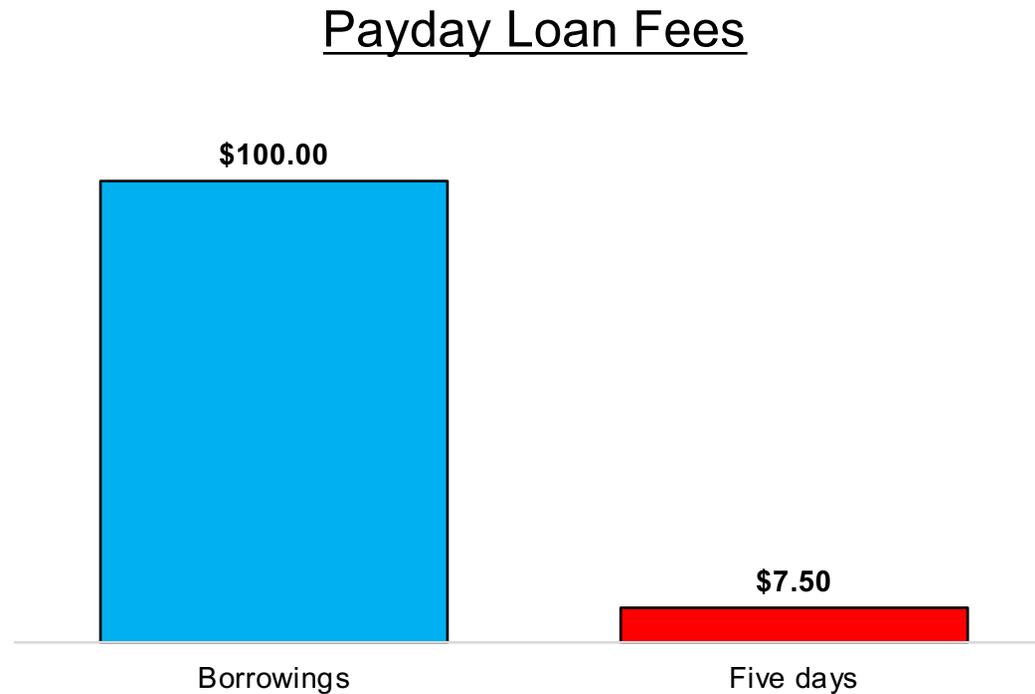
$$5 * \$1.50 = \$7.50$$

The daily interest rate on this loan is 1.5%. With 365 days in a year, this corresponds to an APR of 547.5%. This is a very high rate!

$$365 * 1.5\% = 547.5\%$$

Payday loans

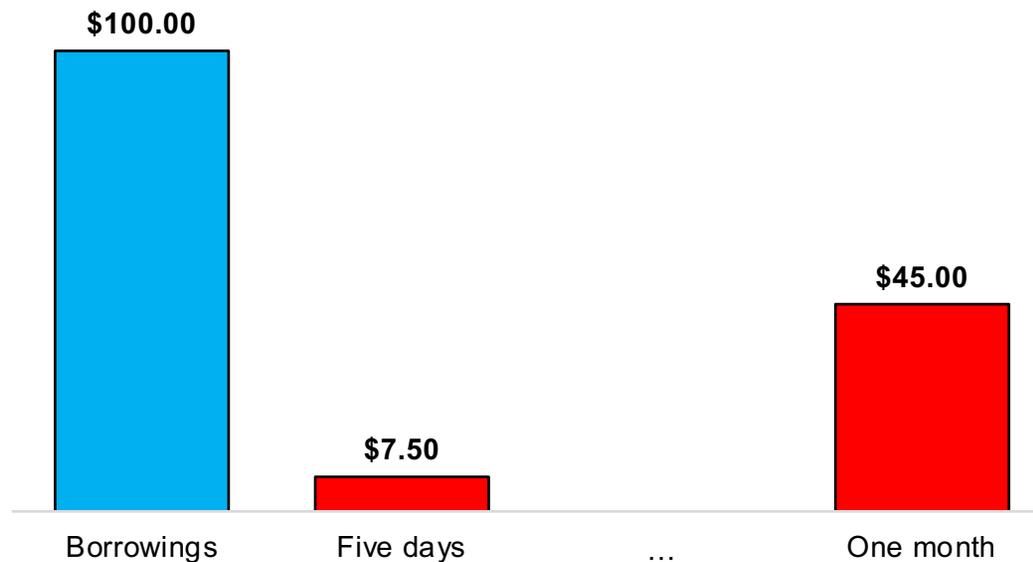
A \$7.50 fee to borrow \$100 until pay day might be manageable...



Payday loans

But payday loan borrowers often **roll over** their debt into new loans as they become due, incurring more fees.

Payday Loan Fees



(Note that after 30 days, the fees accumulate to $30 * \$1.50 = \$45.$)

Payday loans

Until they soon pay more in fees than they originally borrowed!

Payday Loan Fees



(After 365 days, the fees accumulate to to $365 * \$1.50 = \547.40)

Inside a payday loan shop

This podcast, produced by *NPR's Planet Money*, described how “payday” lenders work.

[Inside a Payday Loan Shop](#)

Auto title loans

An **auto title loan** requires that the borrower offer their vehicle as **collateral** so that if they default, the lender may repossess and sell the vehicle to pay down the debt. In addition to high interest rates, **high fees** – including processing and origination fees – are imposed on auto title borrowers.

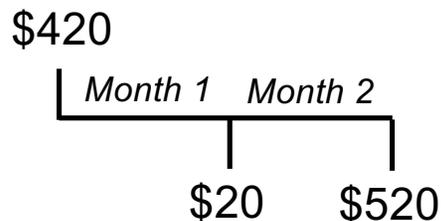
Consider a borrower who takes out a two-month \$500 auto title loan at a monthly APR of 48%, where interest is due at the end of each month and the \$500 principal must be repaid at the end of the second month. At the time of borrowing, the lender requires \$80 in fees. What is the implicit APR on the loan after considering the fee?

Auto title loans

Ans.

Each month, the borrower must repay $\frac{0.48}{12} * \$500 = \20 in interest. At the end of the second month, the borrower must repay \$500. At origination, the borrower receives \$500, but must immediately pay \$80 in fees, so only receives \$420 on net.

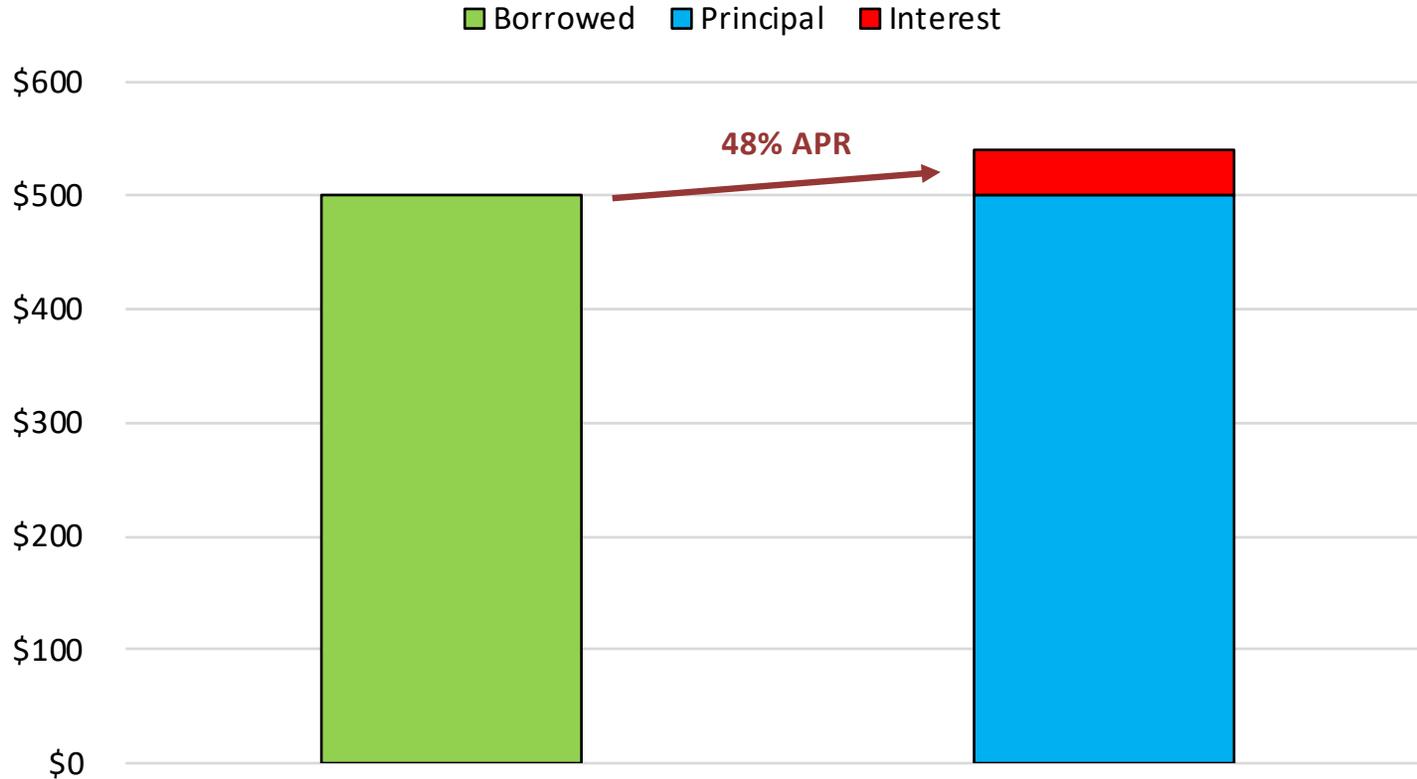
The APR implied by these cash flows is 164%. This is much higher than the (already high) advertised APR of 48%!



<i>Time Value of Money</i>	
P/Y	12
PMT	-\$20
N	2
FV	-\$500
PV	\$420
I/Y=	164%

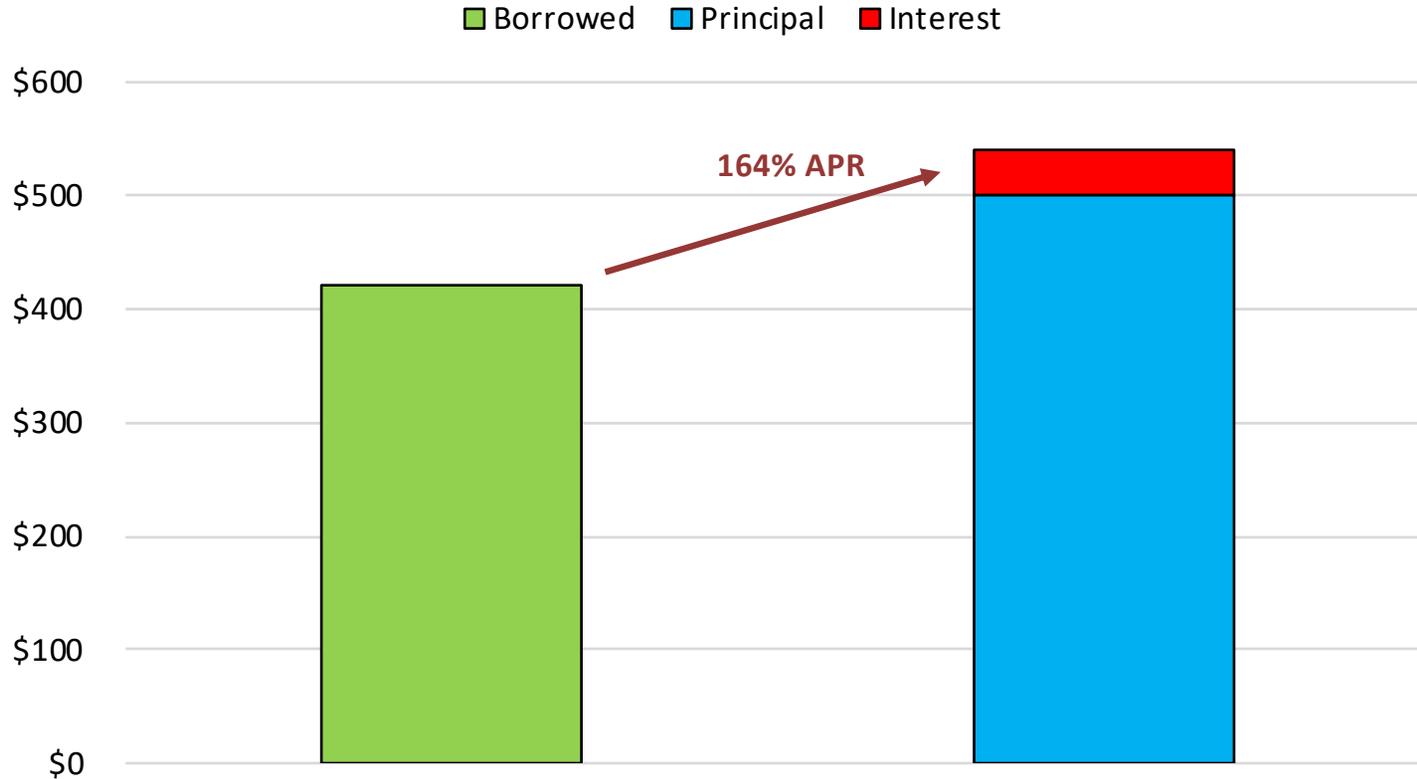
Auto title loans

Without fees, the APR on auto title loans is high...



Auto title loans

But with fees, it's much higher. **Fees matter!**

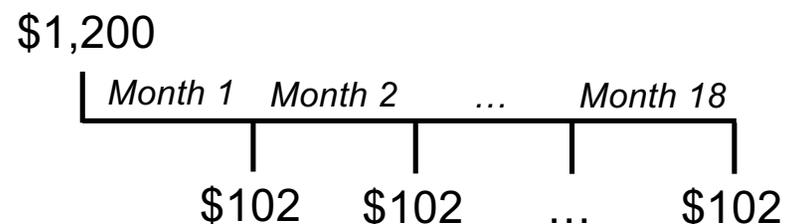


Rent-to-own

While **rent-to-own** stores may not appear to be lenders, they are economically equivalent in function. And many charge high implicit interest rates.

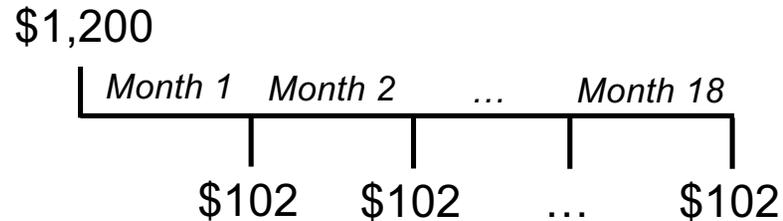
Consider the following example: A popular rent-to-own furniture store gives buyers the option to either purchase a sofa outright for \$1,200 or to rent-to-own by making 18 “convenient” monthly payments of \$102.

Effectively, the renter “borrows” the \$1,200 from the store and uses it to buy the \$1,200 couch today. The renter must then repay the “loan” in monthly installments. The cash flow diagram for this transaction is:



Rent-to-own

The cash flow diagram for rent-to-own is:



Using a financial calculator, we can solve for the implied interest rate offered by this transaction:

<i>Time Value of Money</i>	
P/Y	12
PV	\$1,200
N	18
PMT	-\$102
FV	\$0
<hr/>	
I/Y=	59%

This corresponds to borrowing at an APR of 59%.

Rent-to-own

Compare the implicit monthly interest payments required with this rent-to-own option...

Interest Payments: Rent-to-own

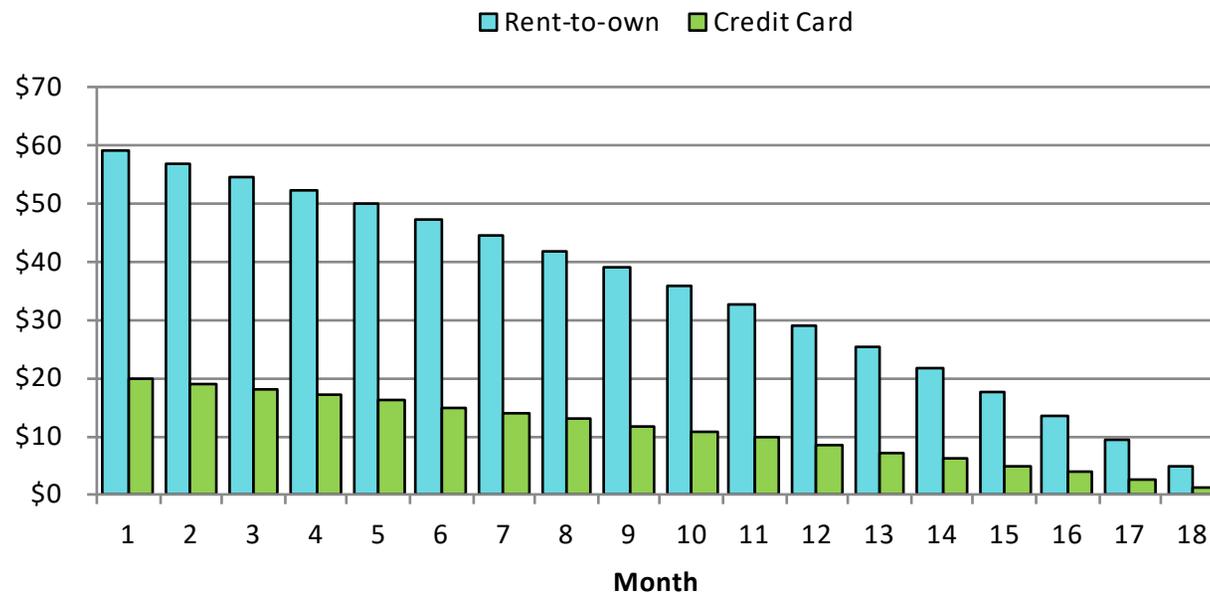


Rent-to-own

To the interest payments on a credit card with a 20% APR.

Rent-to-own is like borrowing using the worst credit card!

Interest Payments: Rent-to-own vs. Credit Card



Today we learned...

- ✓ Consumer borrowing
- ✓ Installment loans
- ✓ Loan amortization
- ✓ APR and monthly payments
- ✓ Student loans
- ✓ Credit cards
- ✓ High-cost methods of borrowing