



Financial Planning

- Why Bother about a good job?
- How will you live when you retire?



Research Paper Guide

Art of Graphs

ECE 694 – April 11, 2024

Gerhard Klimeck, Purdue University



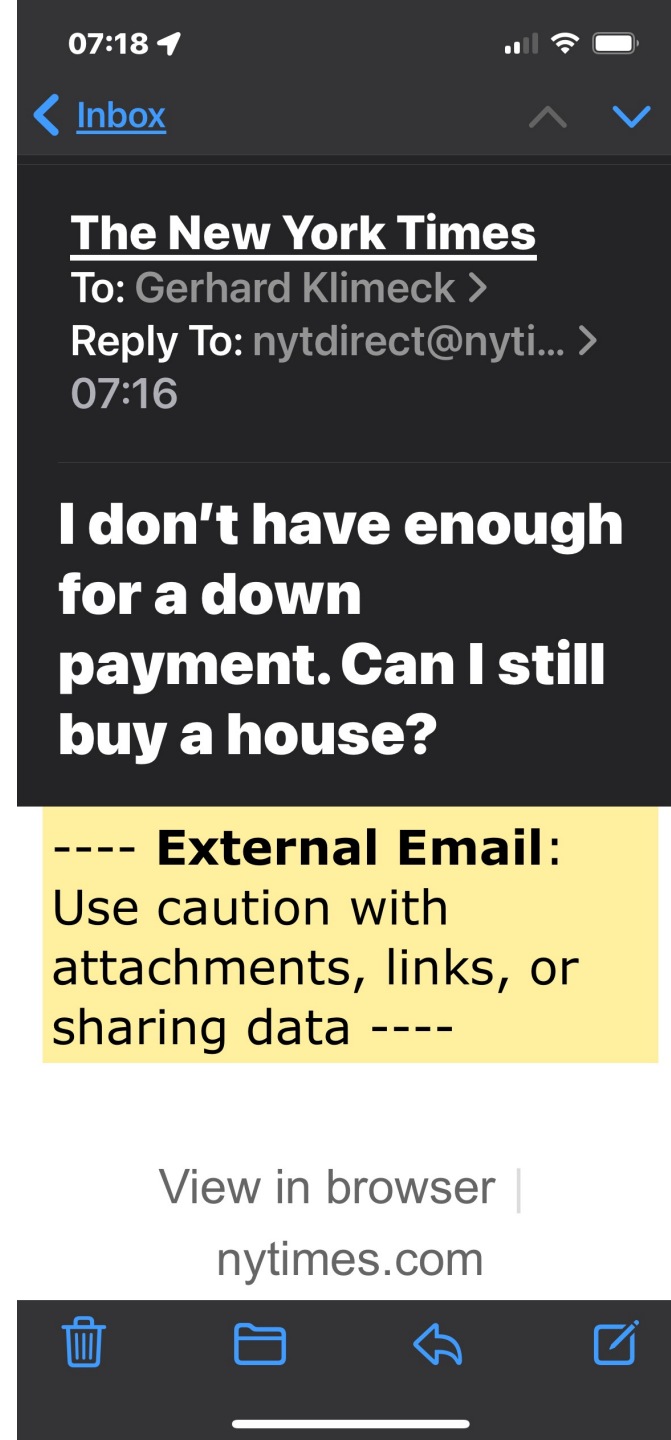
Some Financial Aspects of Life after Grad School

- Buying a House in the US
- How much money “should” you save?
 - For retirement?
 - For other expenses?
 - Buying a house?
- Personal perspective on retirement planning
- Compensation packages



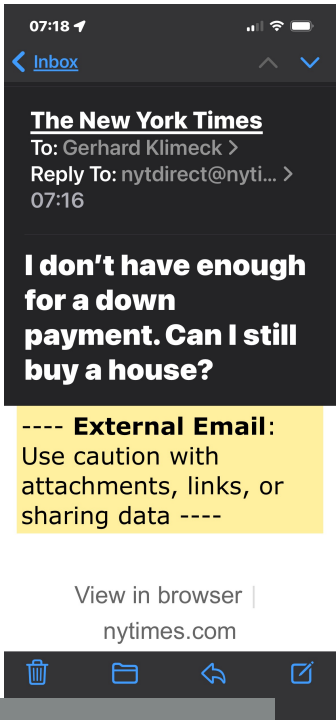
Buying a House in the US

- Coincidentally –
my NY Times news feed this morning (4/12/2024)



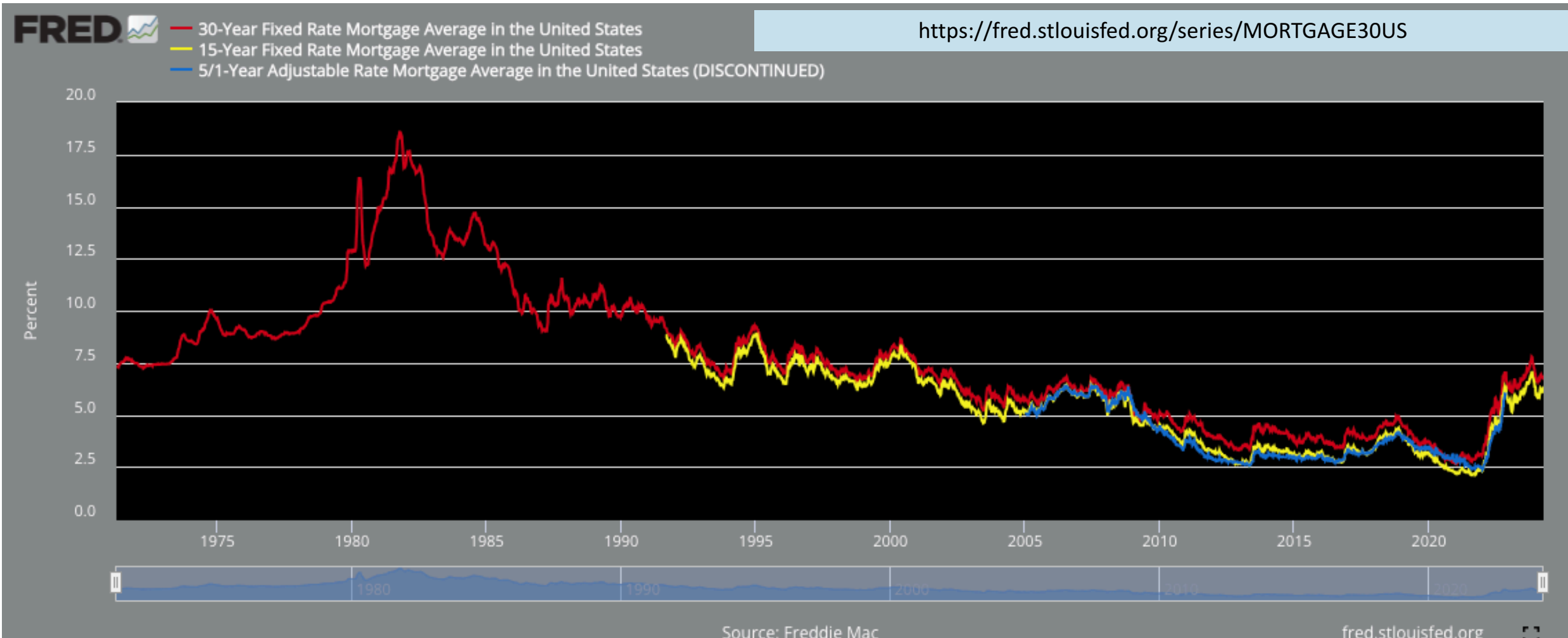
Buying a House in the US

- Housing costs (rent or own) should be less than 30% of income
- Considered worthwhile when you live at a place for 5+ years
 - There is a commission cost of buying and selling of 5% -paid for by seller
- You need 20% of a down payment for the house
 - If you do not have that you will need to buy PMI – Primary Mortgage Insurance that will cover the bank against a potential job loss etc.
- Getting the right Mortgage
 - 30 year mortgages are typical – but there is mostly interest payment for the first 10+ years
 - Consider 15-year mortgage
 - If your time horizon is short, consider an ARM – adjustable rate mortgage
 - Interest locked in for 5 or 7 years and then can be adjusted annually
- Property taxes can be high for certain states – 1-2% of house value
 - 2% on a \$600k house is \$12k per year or \$1k per month!



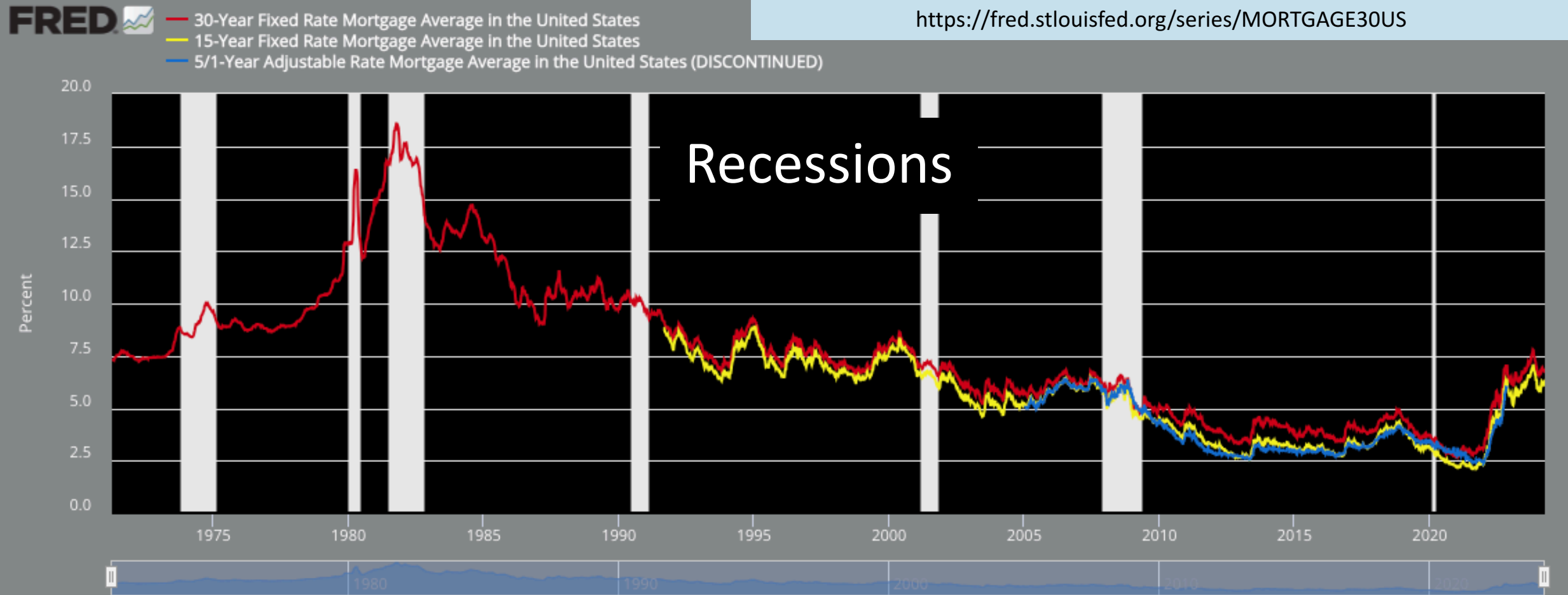
Mortgages

- Mortgage rates (Interest Rates) vary over time!



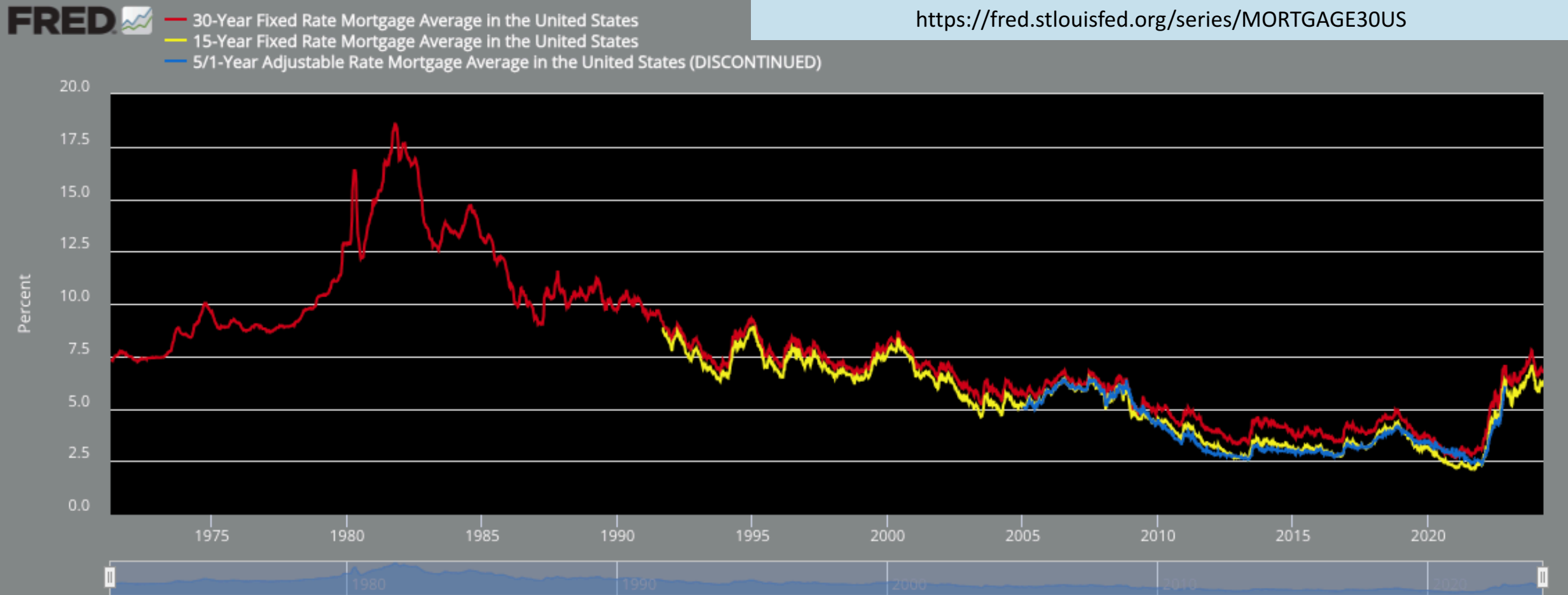
Mortgages

- Mortgage rates (Interest Rates) vary over time!
 - They are linked to the overall economy – recessions
 - They are loosely linked to federal interest rates / treasury notes.



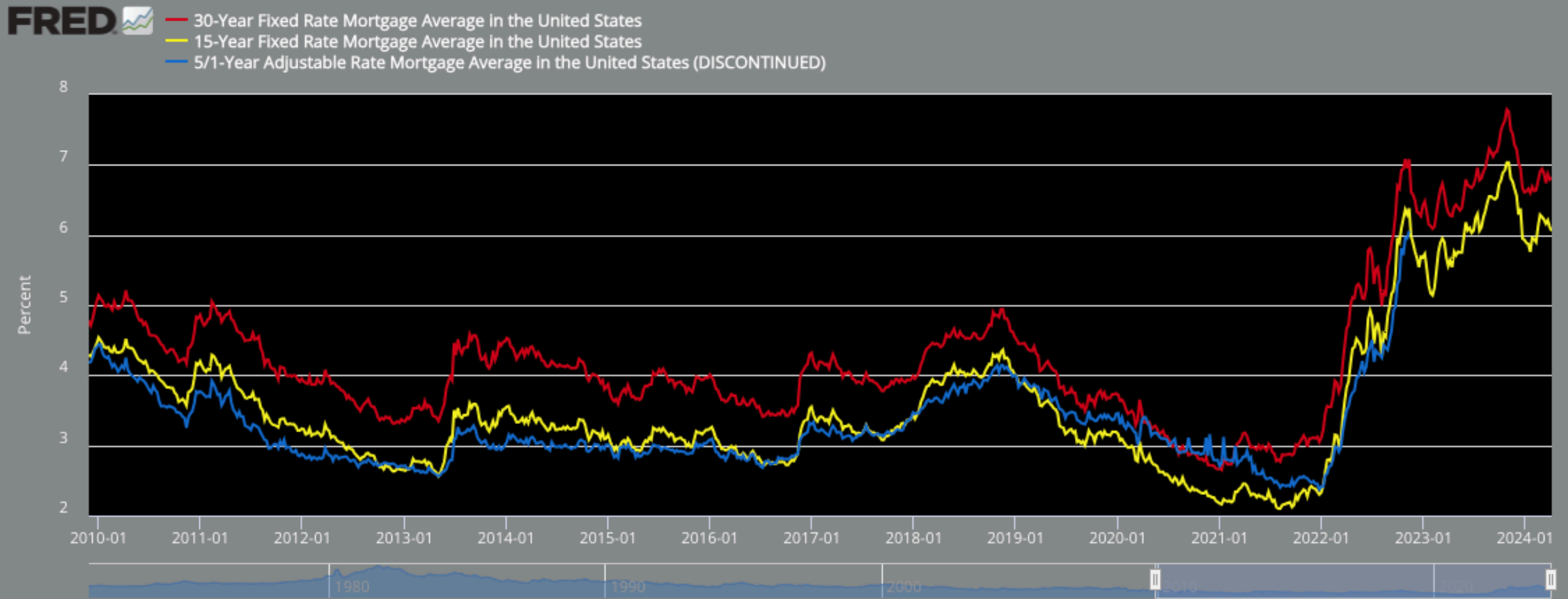
Mortgages

- Mortgage rates (Interest Rates) vary over time!
 - There are different mortgage rates for different products.
 - Yes, they are products that are sold...



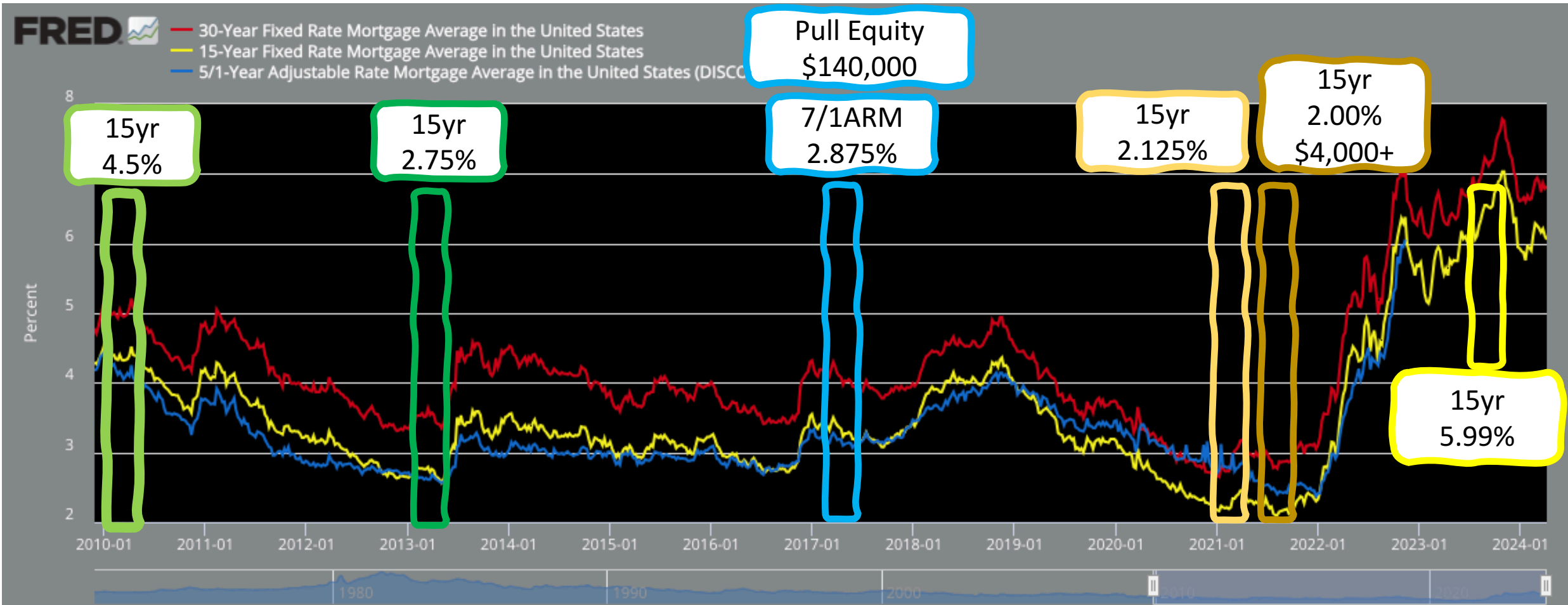
Mortgages

- Mortgage rates (Interest Rates) vary over time!
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 - Yes, they are products that are sold...



Mortgages

- Here are my personal “recent” experiences in mortgages
 - 5 mortgages for the same home in less than 10 years (different reasons)
 - Bought another home recently 2023.



Mortgages

Apr 9, 2024

Loan amount

\$400K

Down payment

20%

State

Indiana

Credit score

780 - 799

5 / 6 ARM

7.603%

30-yr fixed

7.031%

15-yr fixed

6.759%

+ Add loan type to compare

History

8.00%

7.50%

7.00%

6.50%

6.00%

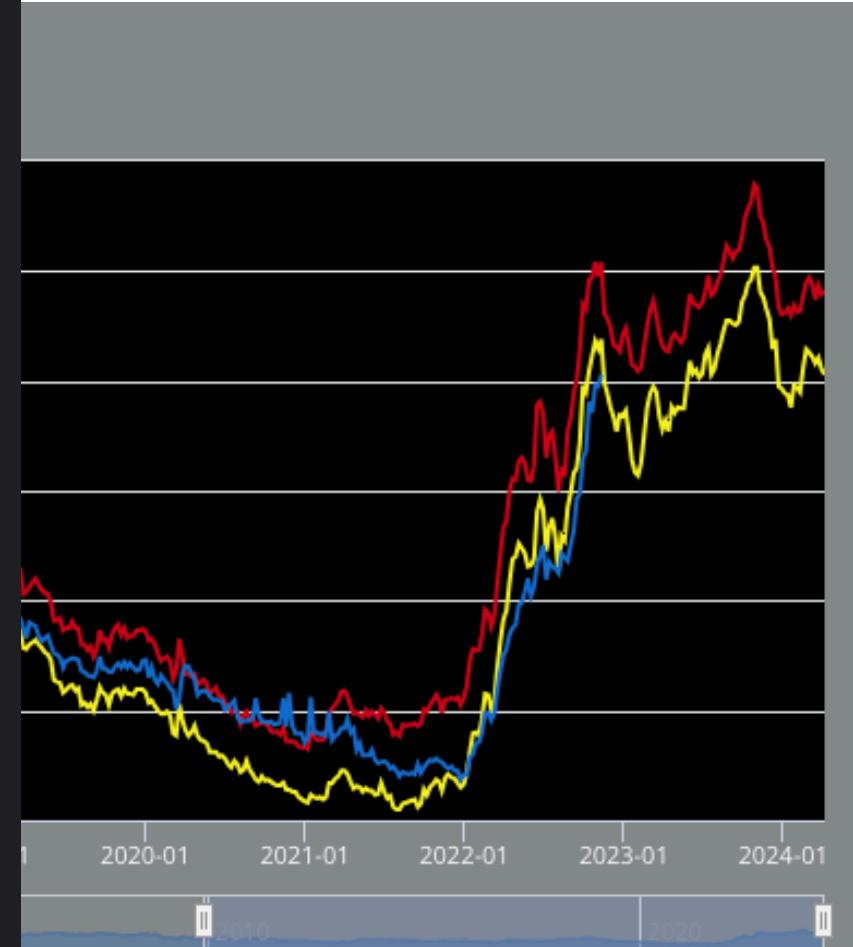
Jan 30

Feb 14

Mar 1

Mar 18

Apr 4

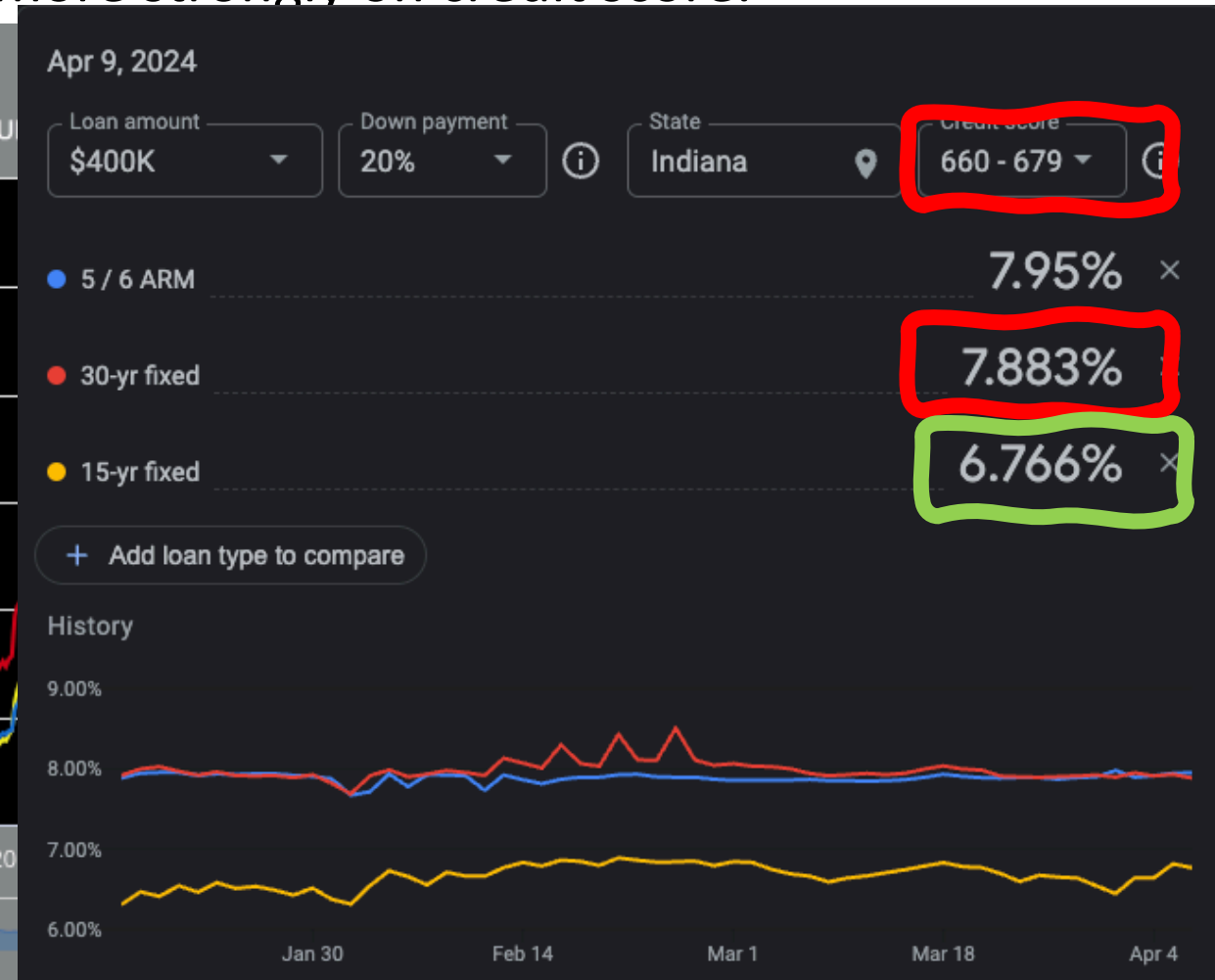


Source: Freddie Mac

fred.stlouisfed.org

Mortgages

- Mortgage rates depend on your credit score!
 - Score needs to be >660 for most lenders or >700
 - 30-year mortgage seems to depend more strongly on credit score.



Mortgages

- Mortgage rates...
 - Literally fluctuate from one day to the next!



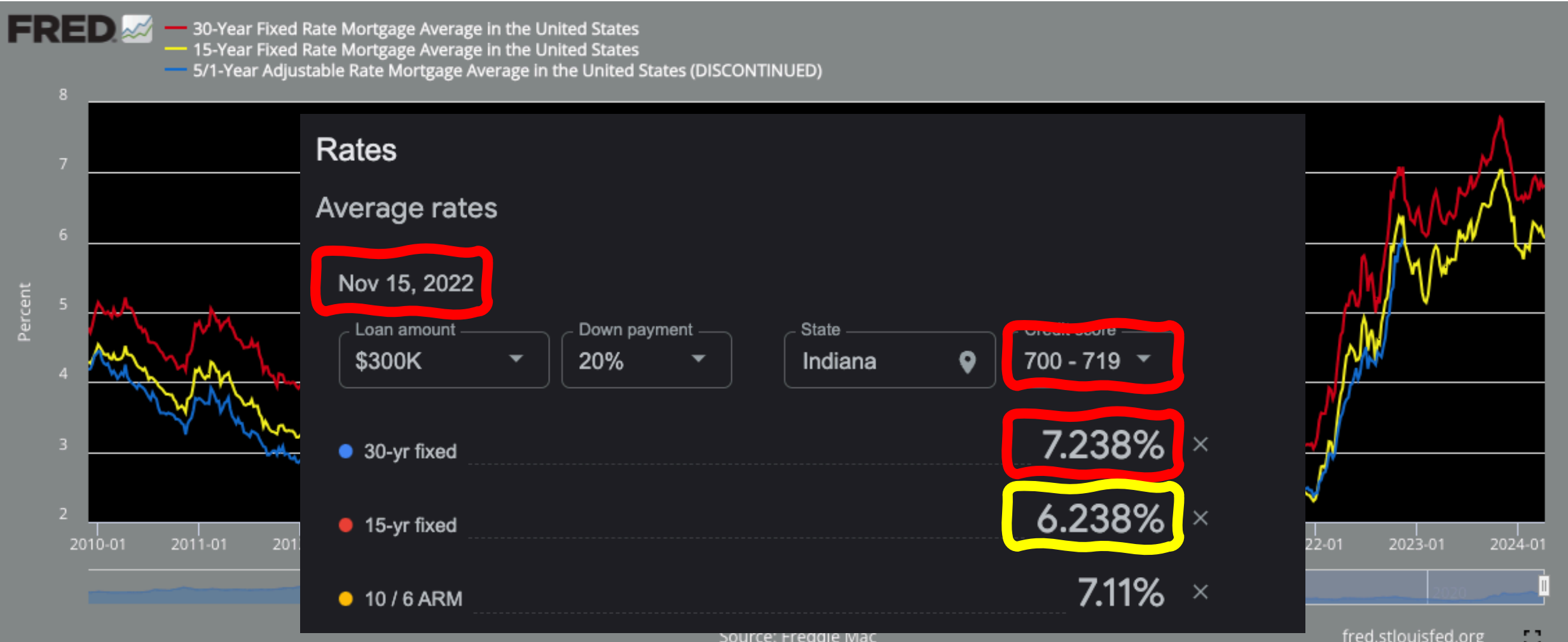
Mortgages

- Mortgage rates...
 - Literally fluctuate from one day to the next!
 - Depend on the downpayment!



Mortgages

- Let's say you want to buy a house for \$500k
 - You have a 20% down payment => \$100k
 - You need a mortgage of \$400k



• <https://www.calculator.net/amortization-calculator.html>

• \$400k, 30 year 7.25%

Amortization Calculator

Rates
Average rates
Nov 15, 2022

Loan amount: \$300K
Down payment: 20%
State: Indiana
Credit score: 700 - 719

- 30-yr fixed: 7.238%
- 15-yr fixed: 6.238%
- 10 / 6 ARM: 7.11%

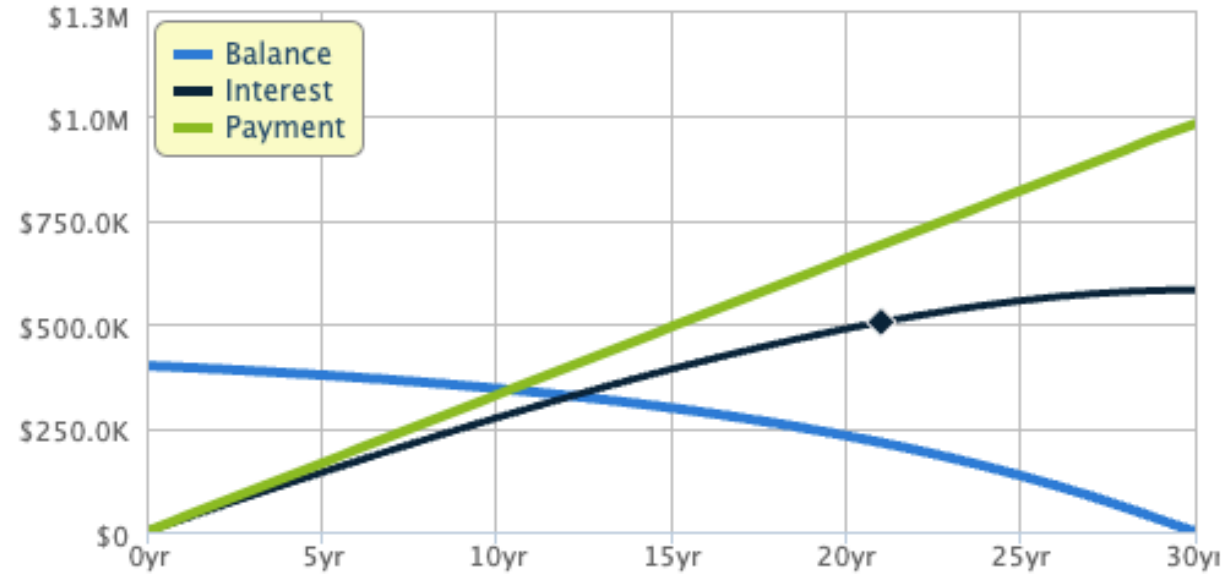
Loan Amount: \$400000
Loan Term: 30 years
Interest Rate (APR): 7.25 %

Calculate

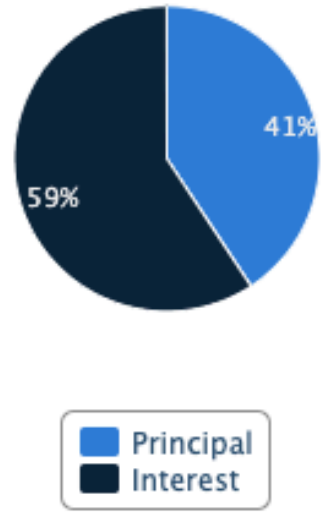
Monthly Pay: \$2,728.71

Total of 360 Loan Payments: \$982,333.84
Total Interest: \$582,333.84

Loan Amortization Graph



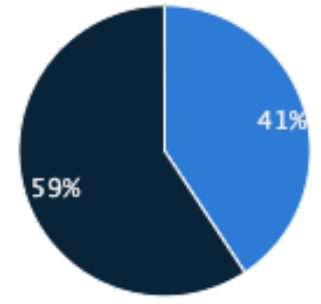
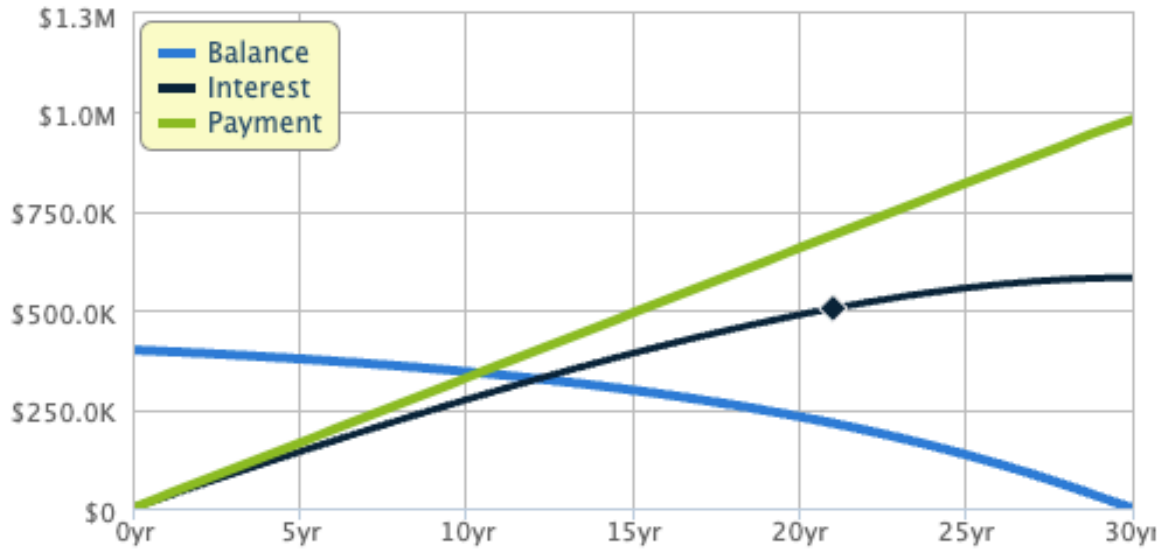
Payment Breakdown



Loan Amortization Graph

Payment Breakdown

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Annual Amortization Schedule

	Annual Schedule	Monthly Schedule		
	Beginning Balance	Interest	Principal	Ending Balance
1	\$400,000.00	\$28,873.03	\$3,871.49	\$396,128.57
2	\$396,128.57	\$28,592.84	\$4,167.83	\$391,960.74
3	\$391,966.95	\$28,270.89	\$4,473.63	\$387,493.38
4	\$387,493.38	\$27,935.54	\$4,808.98	\$382,684.48
5	\$382,684.48	\$27,575.07	\$5,169.45	\$377,515.11
6	\$377,515.11	\$27,187.60	\$5,556.92	\$371,958.25
7	\$371,958.25	\$26,771.09	\$5,973.43	\$365,984.86
8	\$365,984.86	\$26,323.33	\$6,421.19	\$359,563.72
9	\$359,563.72	\$25,841.98	\$6,902.54	\$352,661.26
10	\$352,661.26	\$25,324.61	\$7,419.91	\$345,241.40

- 30 year Mortgage: you pay “rent” to the bank for over 21 years
- 21 years of paying more interest than principal

• <https://www.calculator.net/amortization-calculator.html>

• \$400k, 30 year 7.25%

Loan Amount	\$400000
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Interest Rate (APR)	7.25 %

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• \$400k, 15 year 6.25%

Amortization Calculator

Loan Amount	\$400000
Loan Term	15 years
Interest Rate (APR)	6.25 %

Monthly Pay: \$3,429.69

Total of 180 Loan Payments \$617,344.46

Total Interest \$217,344.46

Rates

Average rates

Nov 15, 2022

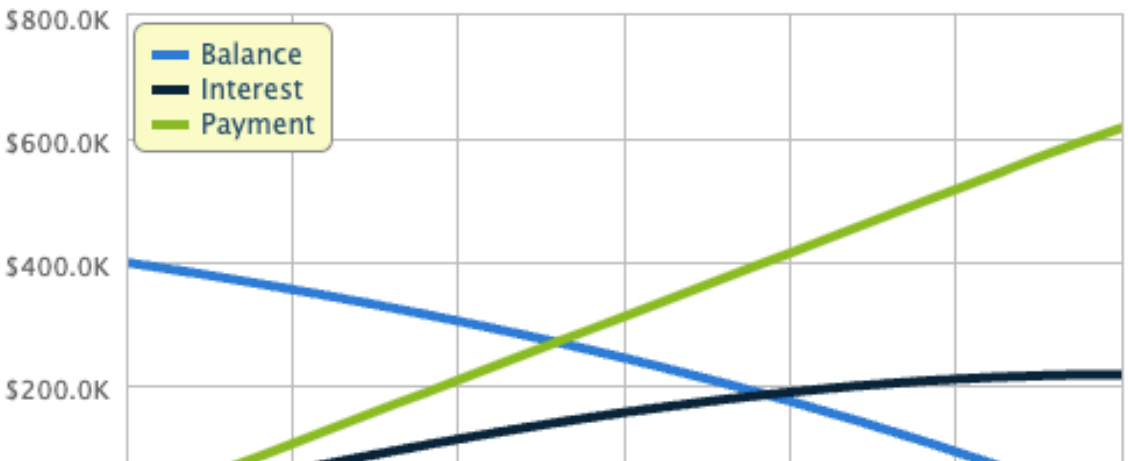
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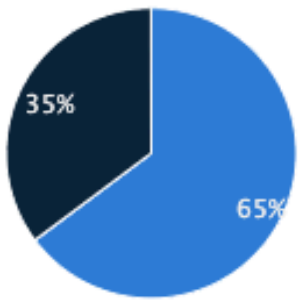
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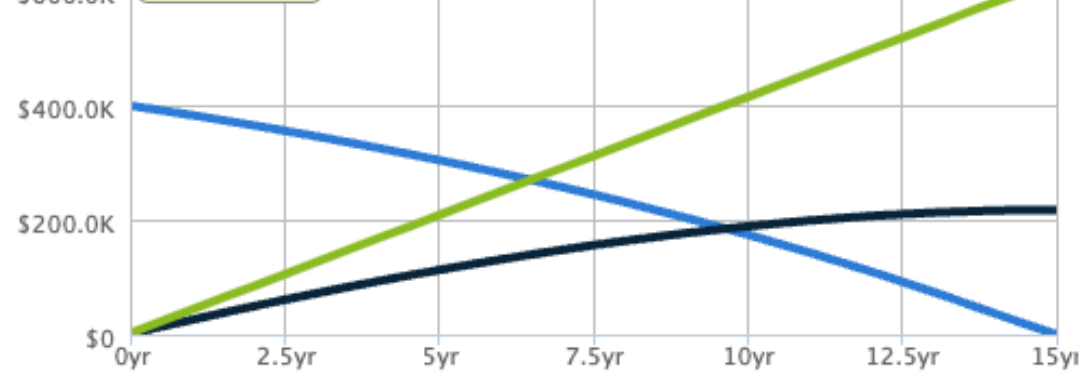
Loan Amortization Graph



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Principal Interest

- \$400k, 15 year 6.25%

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Annual Amortization Schedule

	Beginning Balance	Interest	Principal	Ending Balance
1	\$400,000.00	\$24,529.04	\$16,627.24	\$383,372.76
2	\$383,372.76	\$23,499.89	\$17,398.89	\$365,973.87
3	\$365,976.03	\$22,321.27	\$18,835.01	\$346,841.01
4	\$346,841.01	\$21,109.77	\$20,046.51	\$326,794.49
5	\$326,794.49	\$19,820.35	\$21,335.93	\$305,458.54
6	\$305,458.54	\$18,447.99	\$22,708.29	\$282,750.23
7	\$282,750.23	\$16,987.77	\$24,162.26	\$258,587.96
8	\$258,587.96	\$15,432.81	\$25,695.14	\$232,892.82
9	\$232,892.82	\$13,778.01	\$27,316.81	\$205,576.01
10	\$205,576.01	\$12,017.37	\$29,029.44	\$176,546.57
11	\$176,546.57	\$10,142.81	\$30,886.69	\$145,659.88
12	\$145,659.88	\$8,148.33	\$32,888.36	\$112,771.55
13	\$112,771.55	\$6,024.87	\$35,131.41	\$77,187.33
14	\$77,187.33	\$3,765.17	\$37,594.44	\$39,592.89
15	\$39,796.20	\$1,360.11	\$39,796.17	\$0.00

- 30 year Mortgage: you pay “rent” to the bank for over 21 years

- 21 years of paying more interest than principal

- 15 year Mortgage: you pay “rent” to the bank for over 4.5 years

- 4.5 years of paying more interest than principal

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• 4.5 years of paying more interest than principal

What if you do NOT have the Downpayment?

• <https://www.calculator.net/amortization-calculator.html>

• \$400k, 30 year 7.25%

Loan Amount	<input type="text" value="\$400000"/>
Loan Term	<input type="text" value="30"/> years
Interest Rate (APR)	<input type="text" value="7.25"/> %

Monthly Pay: \$2,728.71

Total of 360 Loan Payments \$982,333.84

Total Interest \$582,333.84

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Loan Amount	<input type="text" value="\$400000"/>
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Interest Rate (APR)	<input type="text" value="6.25"/> %

Monthly Pay: \$3,429.69

Total of 180 Loan Payments \$617,344.46

Total Interest \$217,344.46

• \$500k, 30 year 7.25%

Loan Amount	<input type="text" value="\$500000"/>
Loan Term	<input type="text" value="30"/> years
Interest Rate (APR)	<input type="text" value="7.25"/> %

Monthly Pay: \$3,410.88

Total of 360 Loan Payments \$1,227,917.30

Total Interest \$727,917.30

+ \$504 PMI
= \$3914 total

• \$500k, 15 year 6.25%

Loan Amount	<input type="text" value="\$500000"/>
Loan Term	<input type="text" value="15"/> years
Interest Rate (APR)	<input type="text" value="6.25"/> %

Monthly Pay: \$4,287.11

Total of 180 Loan Payments \$771,680.58

Total Interest \$271,680.58

+ \$504 PMI
= \$4791 total

What if you do NOT have the Downpayment?

- <https://www.calculator.net/amortization-calculator.html>

- \$400k, 30 year 7.25%

Loan Amount	<input type="text" value="\$400000"/>
Loan Term	<input type="text" value="30"/> years
Interest Rate (APR)	<input type="text" value="7.25"/> %

Monthly Pay: \$2,728.71

Total of 360 Loan Payments \$982,333.84
 Total Interest \$582,333.84

Average annual PMI premium	Your credit score	Annual average premium as a percentage of original loan amount
	660-679	1.54%
	680-699	1.21%
	700-719	0.99%
	720-739	0.87%

0.46

0.46

0.30

0.30

0.30

+ \$504 PMI
 = \$3914 total

+ \$504 PMI
 = \$4791 total

Loan Term	<input type="text" value="30"/> years
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Total of 360 Loan Payments \$711,680.58
 Total Interest \$271,680.58

Some Financial Aspects of Life after Grad School

- Buying a house
- How much money “should” you save?
 - For retirement?
 - Buying a house?
 - For other expenses?
- Personal perspective on retirement planning
- Compensation packages



How do you get to \$100k down payment?

How Much Money do you need for Retirement?

Back of the envelope calculation:

- Desire annual retirement income: \$100k
- Typical conservative return APR 5%
- $\$100k / 5\% = \$2M$

=> Need \$2M to retire

How How to you get \$2M for retirement?

[Excel Retirement Planner](#)

Some Financial Aspects of Life after Grad School

- Buying a house
- How much money “should” you save?
 - For retirement?
 - Buying a house? (take a loan against 401K)
 - For other expenses?
- Personal perspective on retirement planning
- Compensation packages



Compensation Packages – Salary is not everything

- ESPP – Employee Stock Purchase Plan
 - Purchase company stock at a discounted price

Sell stock < 2 years from offering start or < 1 year from purchase



\$14 - \$12 tax basis in stock = \$2 capital gains
Sale results in \$3 ordinary income + \$2 capital gains

Compensation Packages – Salary is not everything

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 - Purchase company stock at a discounted price
- ESOP – Employee stock option plans
 - Options – Opportunity to buy Stock in the future for today's price
 - No money invested until options are due



At the due date
you can buy Options for \$9 and sell on the same date for \$14
There is no money tied down / invested until the due date

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- Contributions to Retirement Accounts (401k, 403b, etc)
 - Can range from employer to employer 4-15%
 - Might require matching contributions on your part



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 - Can range from employer to employer 4-15%
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- Medical insurance (worth \$15k - \$30k per year)
- Medical Savings accounts
 - Pay medical expenses from a pre-tax account
- Subsidized Employee activities – clubs, health centers
 - GK: Texas Instruments Scuba Club and Soccer Arena rentals



At the due date
you can buy Options for \$9 and sell on the same date for \$14
There is no money tied down / invested until the due date



Financial Planning

- Why Bother about a good job?
- How will you live when you retire?



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Thank You!

Almost done with the semester.
I hope you enjoy the semester so far