# Personal Taxes

Lecture 8

Personal taxes

Taxes are a pervasive part of life in most societies. Or, as Mark Twain liked to say:

The only two certainties in life are death and taxes!

Personal taxes

Understanding taxes is important because they affect consumers in a number of ways:

- The **income tax** reduces a consumer's **take-home pay** and constrains his or her budget. To budget effectively, one must understand how much income is available after taxes.

- Governments subsidize certain behaviors through **sales taxes** and **tax deductions**. Understanding these taxes is important for understanding the true cost of certain activities.

- **Capital gains** may be taxed differently from income, so it is important to understand such taxes to invest efficiently.

- Governments encourage retirement saving by allowing consumers to invest in **tax-advantaged retirement accounts**. Understanding these accounts helps consumers maximize their nest egg.

Personal taxes

Other Issues

- Is a Tax Refund Always a good thing?
  - No- it's an interest free loan to the Federal Government
  - The ideal situation is no refund, and no balance due

- This Presentation only deals with Federal Taxes, beware of State and Local Tax Issues
  - DC and Maryland- Homeowner and Renter's Credits
  - VA- Excise Taxes on your Car

Income Tax Rates

Marginal tax rates

In **marginal tax rate** systems (ex. the U.S. federal income tax), **taxable income** is divided into **tax brackets**, and any income falling within a bracket is taxed at that bracket's rate.

Below are the U.S. federal income tax brackets for an unmarried individual filer in 2018:

Income	Marginal Tax Rates
$0 - $9,525	10%
$9,526 - $38,700	12%
$38,701 - $82,500	22%
$82,501 - $157,500	24%
$157,501 - $200,000	32%
$200,001 - $500,000	35%
Over $500,000	37%

The lecture's examples will use 2018 marginal tax rates.

Marginal tax rates

The **U.S. income tax** is progressive. The tax rates get higher as income increases. This means you are taxed for each part of your income that moves through the brackets. You can see this below:

Income	Tax Due:
$0 - $9,525	**10% of taxable income**
$9,526 - $38,700	**$952.50 + 12% of the amount over $9,525**
$38,701 - $82,500	**$4,453.50 + 22% of the amount over $38,700**
$82,501 - $157,500	**$14,089.50 + 24% of the amount over $82,500**
$157,501 - $200,000	**$32,089.50 + 32% of the amount over $157,000**
$200,001 - $500,000	**$45,689.50 + 35% of the amount over $200,000**
Over $500,000	**$150,689.50 + 37% of the amount over $500,000**

Marginal tax rates

In a marginal tax rate system, if a filer falls within a certain bracket, all of their income is **not** subject to the tax rate in that bracket. Only the portion of a filer's income that falls within a bracket is taxed at that bracket's rate.

This is why it is referred to a **marginal** tax rate system. Each *marginal* dollar is taxed individually.

Ex. Joe Taxpayer has income of $250,000, all of which is taxable. He is subject to the marginal tax rate bracket in the previous slide. How much must Joe pay in taxes?

Ans. Joe's income must be broken up and assigned to the respective tax bracket and taxed accordingly…

Marginal tax rates

Ans. (continued)

The **first $9,525** of Joe's income is taxed at 10%, so he must pay **0.1*$9,525 = $952.50** on this first $9,525 of income.

Between $9,525 and $38,700, Joe has $29,175 of income that is taxed at a rate of 12%. He must pay **0.12*$29,175 = $3,501** on this $29,175.

Between $38,700 and $82,500, Joe has $43,800 of income that is taxed at a rate of 22%. He must pay **0.22*$43,800 = $9,636** on this $43,800.

Between $82,500 and $157,500, Joe has $75,000 of income that is taxed at a rate of 24%. He must pay **0.24*$75,000 = $18,000** on this $75,000.

Between $157,500 and $200,000, Joe has $42,500 of income that is taxed at a rate of 32%. He must pay **0.24*$42,500 = $13,600** on this $42,500.

The excess $250,000 - $200,000 = $50,000 is taxed at a rate of 35%. Joe must pay **0.35*$50,000 = $17,500.00** on this $50,000.

In total, Joe must pay $63,189.50:

$952.50 + $3,501 + $9,636 + $18,000 + $13,600 + $17,500 = $63,189.50

Marginal tax rates

**Ans. (continued)**

In one equation, this can be calculated as:
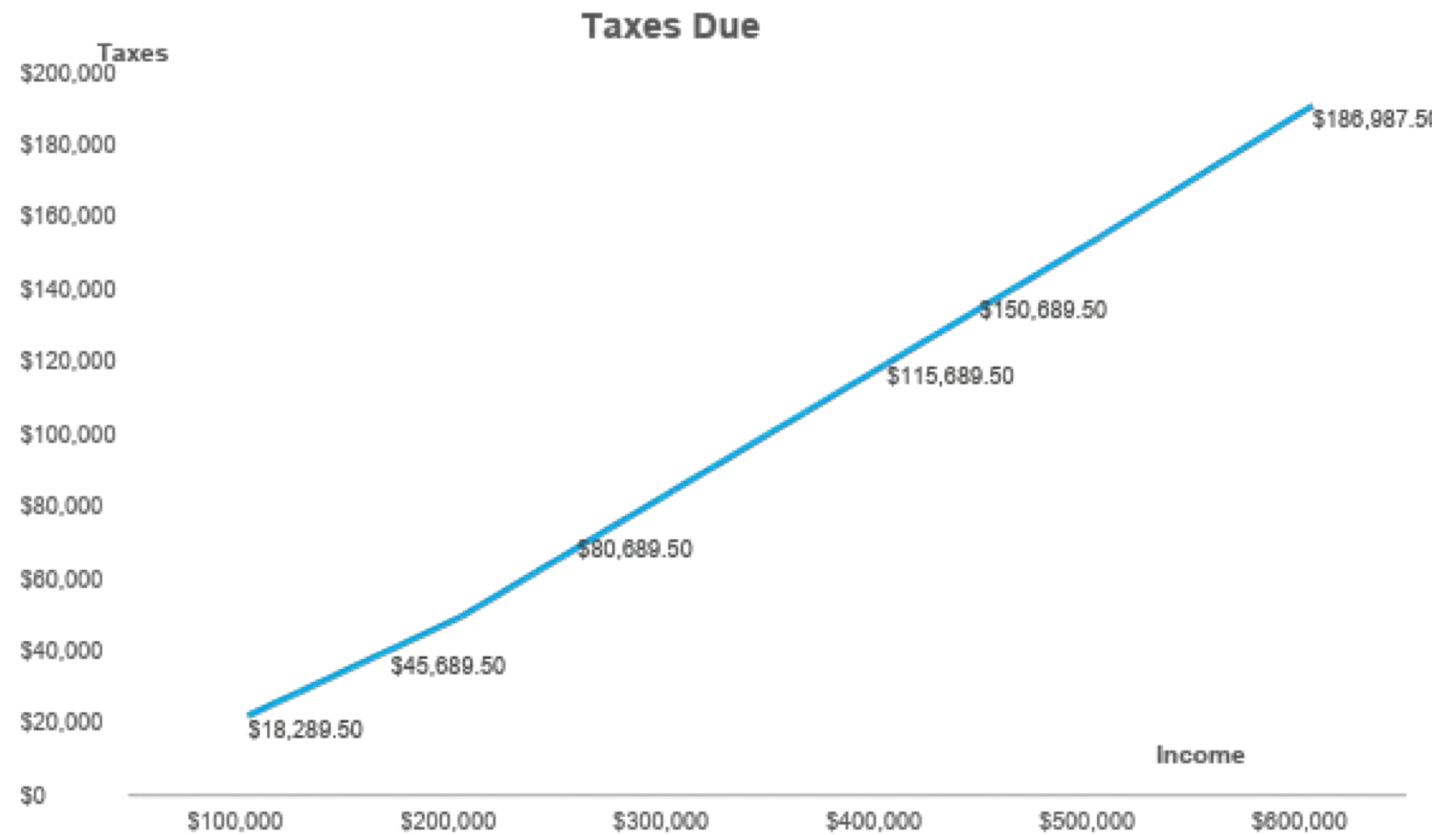
$$0.10 * \$9,525$$
$$+0.12 * (\$38,700 - \$9,525)$$
$$+0.22 * (\$82,500 - \$38,700)$$
$$+0.24 * (\$157,500 - \$82,500)$$
$$+0.32 * (\$200,000 - \$157,500)$$
$$+0.35 * (\$250,000 - \$200,000)$$
$$= \$63,189.50$$

This is considerably less than Joe would pay if the entire 35% was applied to the full $250,000:

$$0.35 * \$250,000 = \$87,500$$

Marginal tax rates

The following chart shows how the amount owed in taxes increases with a filer's income:

Taxes Due

Note: This chart is based on the tax brackets presented earlier and assumes no exemptions, deductions, or credits, which are discussed next.

Effective tax rate

The **effective tax rate** is the rate at which a filer pays taxes on his or her total income. It is calculated as:

$$Effective\ Tax\ Rate = \frac{Taxes\ Paid}{Income}$$

Ex. John Taxpayer from the last example has income of $250,000, all of which is taxable. He must pay $63,189.50 in taxes. What is John's effective tax rate?
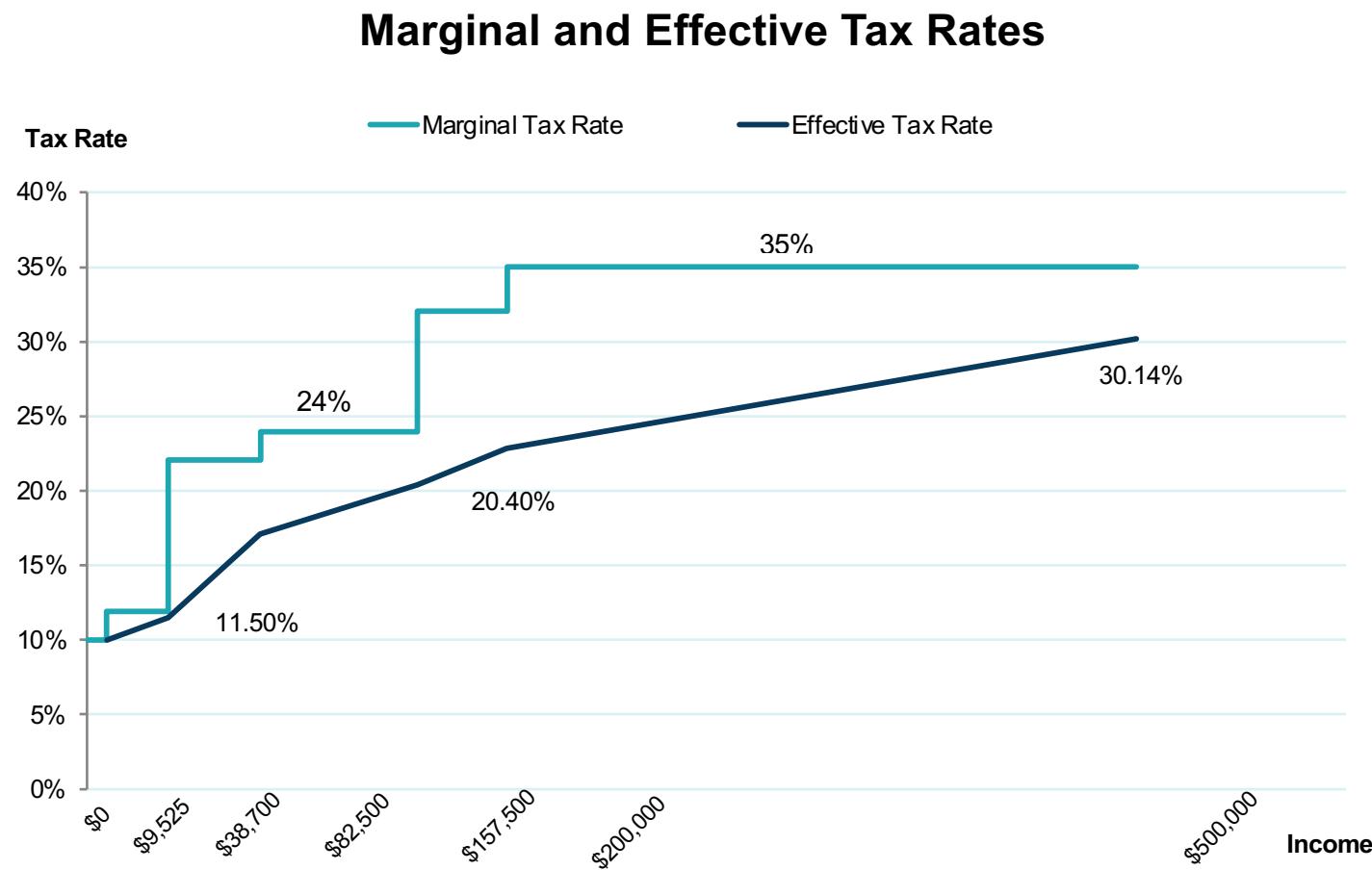
Ans. John's effective tax rate is 25.28%.

$$Effective\ Tax\ Rate = \frac{Taxes\ Paid}{Income} = \frac{\$63,189.50}{\$250,000} = 25.28\%$$

John must pay 25.28% of his income in taxes. This is much less than the 35% maximum marginal tax rate he is subject to.

Effective tax rate

The following chart shows the effective tax rate and marginal tax rates at different income levels:

Marginal and Effective Tax Rates

Note: This chart is based on the tax brackets presented earlier and assumes no exemptions, deductions, or credits, which are discussed next.

Deductions and Exemptions

Filing Status and Deductions

A taxpayer's **Filing Status** has a significant impact on which deductions they are/are not allowed to take

- Filing as **Single**, **Head of Household**, or **Married Filing Jointly** tends to be the most advantageous
  - **Head of Household:** pay to keep up a home for yourself and one or more qualifying children or relatives

- **Married Filing Separately** disqualifies a taxpayer from multiple credits, including credits related to childcare and education

Deductions, exemptions, and credits

A filer's **taxable income** may differ from his or her *total* income because of **exemptions** and **deductions**:

- Filers may automatically subtract **tax exemptions** from their taxable income. For 2017 taxes filed by April 2018, a filer may take one exemption for himself/herself and for each dependent one may claim, which is $4,150 for each exemption. But, with the new tax bill passed in 2018, this will no longer be the case (increase in standard deduction and doubling of child tax credit from $1,000 to $2,000).

- A **tax deduction** is a qualifying expense that may be deducted from a filer's taxable income. For example, mortgage interest and charitable donations may be deducted. Filers may **itemize** deductions by adding up all qualifying expenses and subtracting that amount, or they may take the **standard deduction**, which is a fixed amount ($6,350 for a single filer in 2017 taxes, $12,000 for a single filer in 2018 taxes).

- Additionally, taxes may be reduced directly by **tax credits**, which are applied to the final tax bill (not taxable income). Tax credits reduce your tax bill *dollar for dollar.*

Deductions and credits

This following example will use the 2018 tax schedule

Ex. Joe Taxpayer's twin sister, Jane Taxpayer, also earned $250,000 last year and is subject to the same tax brackets presented earlier.

Unlike Joe, however, Jane has a number of expenses she will itemize and deduct from her taxable income: $14,000 in mortgage interest (can currently deduct interest indebtedness up to $750,000), $5,000 in charitable donations, and $1,000 in other deductions.

Since Jane is filing her 2018 taxes (filing in 2019), she cannot receive for the personal exemption. However, if she chooses to not itemize, she can receive the $12,000 standard deduction.

Calculate Jane's taxable income, taxes owed, and effective tax rate knowing that she decides to itemize, as the standard deduction is less than what she can itemize.

Deductions and credits

Ans.

Jane may deduct her mortgage interest, charitable donations, and other qualifying expenses from her taxable income, reducing it to:

$$\$250,000 - \$14,000 - \$5,000 - \$1,000 = \$230,000$$

This her **taxable income** upon which her tax bill is calculated:

$$
\begin{aligned}
& 0.10 * \$9,525 \\
& +0.12 * (\$38,700 - \$9,525) \\
& +0.22 * (\$82,500 - \$38,700) \\
& +0.24 * (\$157,500 - \$82,500) \\
& +0.32 * (\$200,000 - \$157,500) \\
& +0.35 * (\mathbf{\$230,000} - \$200,000) \\
& = \$56,189.50
\end{aligned}
$$

This is much less than the $63,189.50 her brother is required to pay in taxes.

Deductions and credits

Ans. (continued)

Jane's effective tax rate is calculated as:

$$Effective\ Tax\ Rate = \frac{Taxes\ Paid}{Income} = \frac{\$56,189.50}{\$250,000} = 22.5\%$$

This is 2.78 percentage points less than her brother's effective tax rate of 25.28%.

Deductions can noticeably reduce one's tax burden!

The standard deduction

If, when itemized, deductions amount to less than the **standard deduction**, it is best to take the standard deduction.

Ex. Joe and Jane's little sister, Allison Taxpayer, recently graduated from college and earned $40,000 in her entry-level position. She is subject to the tax brackets presented earlier.

Allison paid $1,800 in student loan interest over the year* and made $200 worth of charitable donations, both of which may be deducted from her taxable income.

Should Allison itemize her deductions or take the $12,000 standard deduction?

For 2018, the maximum amount that you can deduct for interest paid on student loans remains $2,500. Phaseouts apply for taxpayers with modified adjusted gross income (MAGI) in excess of $65,000 and is completely phased out for taxpayers with MAGI of $80,000 or more

The standard deduction

Ans.

In total, Allison may itemize $1,800 + $200 = $2,000 in deductions. Because this is less than the $12,000 standard deduction, she will be better off if she takes the standard deduction. To measure, the difference, we may calculate her tax bill under both scenarios.

If she itemizes deductions, Allison's taxable income will be $40,000 - $2,000 = $38,000. Her tax bill will be $4,369.50:
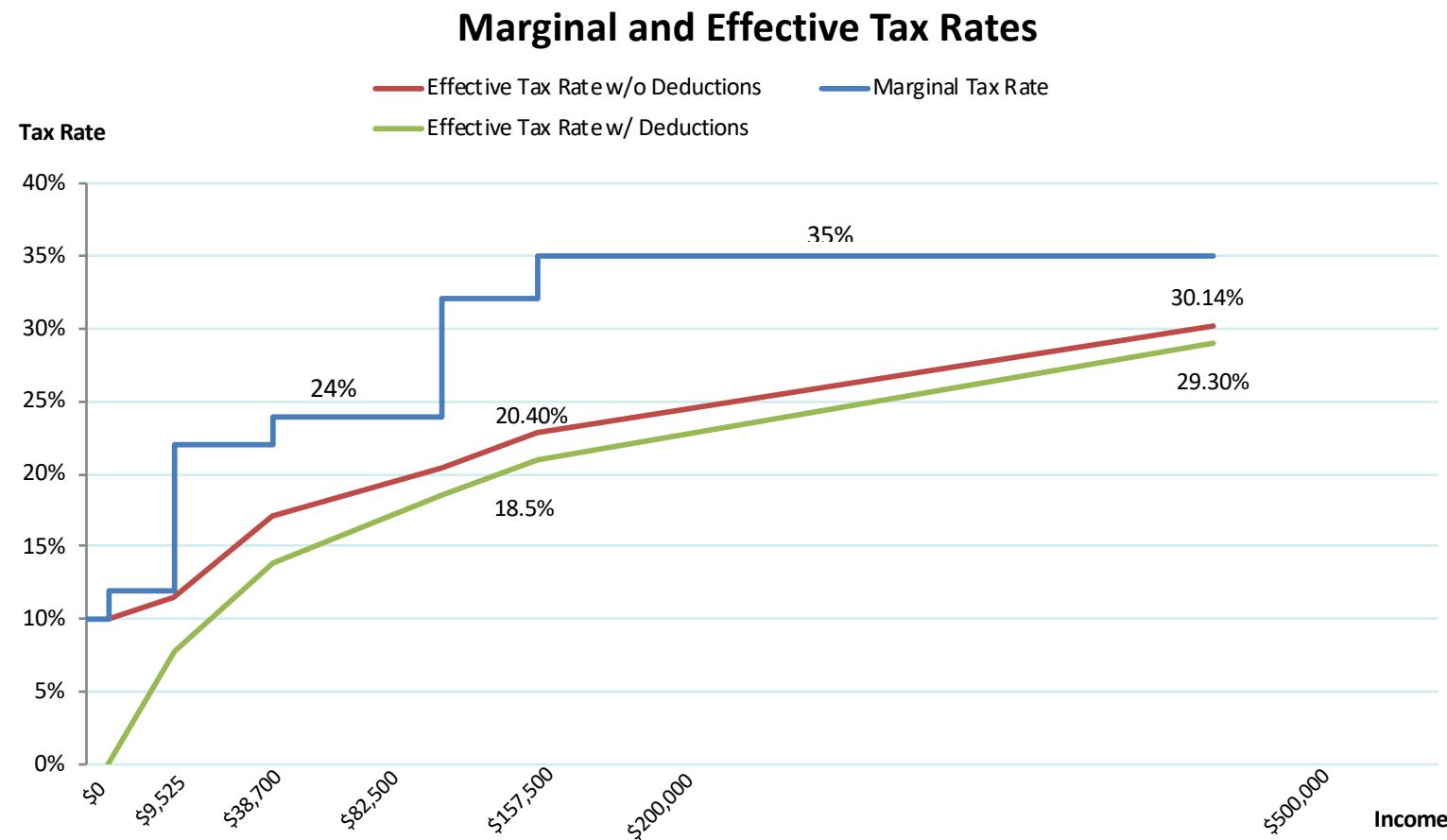
$$0.10 * \$9{,}525 + 0.12 * (\$38{,}000 - \$9{,}525) = \$4{,}369.50$$

If she instead takes the standard deduction, Allison's taxable income will be $40,000 - $12,000 = $28,000. Her tax bill will be $3,169.50:

$$0.10 * \$9{,}525 + 0.12 * (\$28{,}000 - \$9{,}525) = \$3{,}169.50$$

Deductions, exemptions, and credits

The following chart shows the effect of deductions on a filer's effective tax rate.

Marginal and Effective Tax Rates

— Effective Tax Rate w/o Deductions   — Marginal Tax Rate
— Effective Tax Rate w/ Deductions

Note: Assuming a $12,000 standard deduction.

Completing your W4

When you start a new job, your employer is required to give you a **W-4** to fill out. Pay attention to your withholding!

- Taking certain credits or itemizing deductions can lower the amount you should withhold
- Working multiple jobs or having a side business can increase the amount you should withhold

Completing your taxes

How do I complete my 2018 taxes?

There are a number of ways you can complete your 2018 return if you haven't already.

- Come visit **Community Tax Aid at GWU**
  - **DC/MD/VA returns:** Saturday 9:30 am-4:30 pm, Sunday 1-4 pm, Tuesday 6-8 pm
  - **Other states:** Thursday 6-8 pm

- **TurboTax** is generally **free** if you had income less than $34,000 in 2018
  - Federal and up to 2 states
- **MyFreeTaxes** is **free** for filers with income less than $66,000 in 2018
  - Federal and 3 states
  - Joint effort by United Way and H&R Block

After-tax Interest

After-tax interest rate

Because some forms of interest payments are tax deductible, the actual cost of financing such borrowing is reduced. Effectively, the **after-tax interest rate** the borrower pays is lower than the contractual interest rate.

Ex. Jane Taxpayer has a $350,000 mortgage upon which she pays an APR of 4%. Assuming she makes payments annually (in reality mortgage payments are monthly, but we assume annual payments for simplicity), she will pay $14,000 in mortgage interest:

$$0.04 * \$350,000 = \$14,000$$

Jane makes a salary of $250,00 and has additional deductions totaling $6,000. Earlier, we found that Jane pays a tax of $56,189.50 under these conditions.

Calculate the after-tax cost of Jane's mortgage interest and the after-tax interest rate on her mortgage.

After-tax interest rate

Ans.

Earlier, we found Jane's taxable income to be $230,000. Without the $14,000 mortgage interest deduction, her taxable income would be $244,000. In this case, her tax bill would be:

$$
\begin{aligned}
& 0.10 * \$9,525 \\
& +0.12 * (\$38,700 - \$9,525) \\
& +0.22 * (\$82,500 - \$38,700) \\
& +0.24 * (\$157,500 - \$82,500) \\
& +0.32 * (\$200,000 - \$157,500) \\
& +0.35 * (\mathbf{\$244,000} - \$200,000) \\
& = \$61,089.50
\end{aligned}
$$

So, while mortgage interest costs Jane $14,000, it also saves her $4,900 in taxes (the $61,089.50 without the deduction minus the $56,189.50 with the deduction). On net, mortgage interest costs Jane $9,380:

$$\$14,000 - \$4,900 = \$9,100$$

After-tax interest rate

Ans. (continued)

And the effective, after-tax interest rate on her mortgage is 2.68%:

$$\frac{\$9,100}{\$350,000} = 2.6\%$$

Note that the after-tax cost of $9,100 for Jane's mortgage interest can be found by reducing her interest payment by her marginal tax rate of 35%:
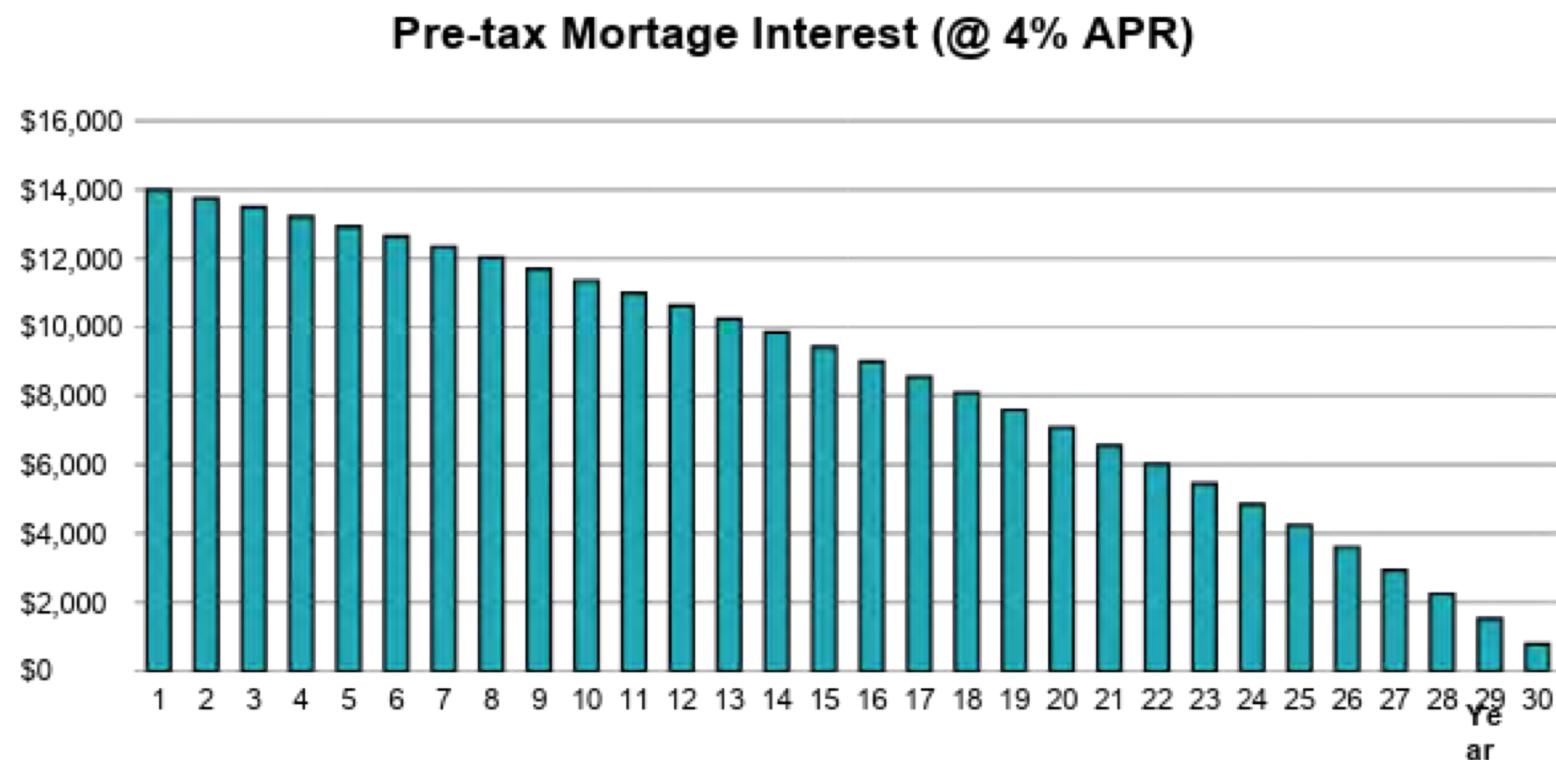
$$\$14,000 * (1 - 0.35) = \$9,100$$

Similarly, her after-tax interest rate can be easily found by reducing her 4% before-tax interest rate by her 35% marginal tax rate:

$$4\% * (1 - 0.35) = 2.6\%$$

After-tax interest rate
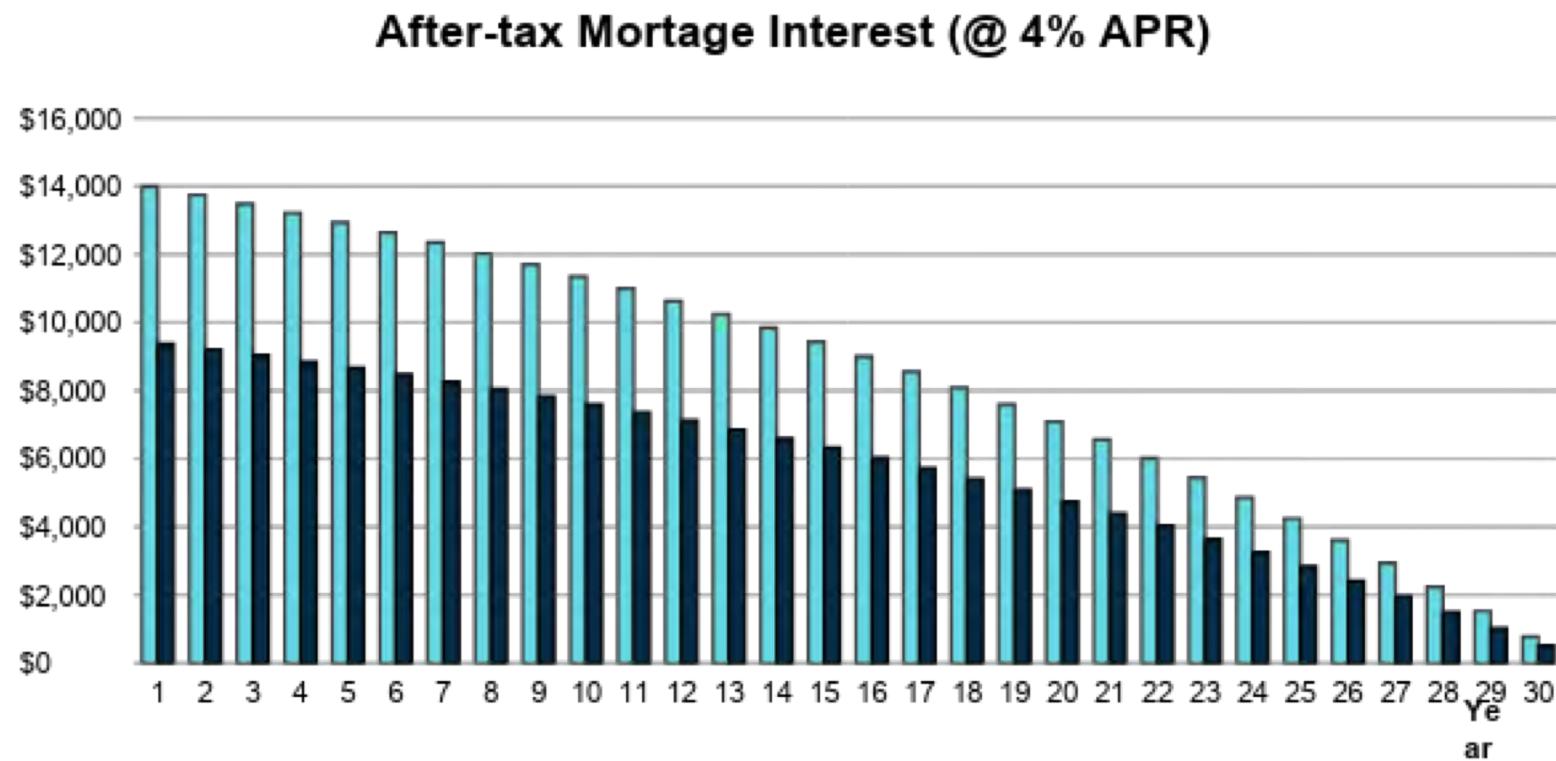
Taking advantage of the mortgage interest deduction is like taking payments on 4% APR loan…

Pre-tax Mortage Interest (@ 4% APR)

Author's calculations

After-tax interest rate

And reducing them to the to payments on 2.6% APR loan!

After-tax Mortage Interest (@ 4% APR)

Author's calculations

After-tax interest rate

In general, the **after-tax interest rate** for tax deductible borrowing is:

$$r_{After-tax} = r_{Pre-tax}(1 - T)$$

Where T is the borrower's marginal tax rate.

While this is a good guide, in reality, the calculation must be caveated by a couple of observations:

- If the amount of the deduction causes the borrower to cross a bracket threshold, the T should be a weighted average of straddled marginal rates.
- Because of the differences in timing between interest payments and tax refunds, the equation is not exact.
- A borrower must itemize deductions to reduce the tax rate.

After-tax interest rate

Ex. Allison Taxpayer, who was introduced earlier, has $30,000 in student loans at an APR of 6%. Assuming she makes payments annually, she will make interest payments of 0.06*$30,000 = $1,800 this year. Assume these interest payments are tax-deductible, but only if she itemizes her deductions.

Allison earns $40,000 per year. Because her itemized deductions don't exceed the $12,000 standard deduction, she takes the standard deduction.

What is the after-tax interest rate Allison pays on her student loans?

Ans. Because Allison does not itemize her deductions, she receives no tax benefit for her student loan interest payments.

Therefore her after-tax interest payment is equal to her $1,800 before-tax interest payment, and **her interest rate remains at 6% even after taxes.**

There is no tax benefit to borrowing if deductions are not itemized.

Capital Gains Taxes

Capital gains tax

Profits from buying and selling financial assets are subject to **capital gains taxes**.

- When an investor sells a financial asset, such as a stock, at a price higher than that at which it was purchased, the profit realized by the investor is a **capital gain**.

- Capital gains are subject to the **capital gains tax**.

- Note that other sources of income from financial assets, such as **dividend payments** on stocks or **coupon payments** from bonds are treated differently and may be taxed as **ordinary income** (or may not be; currently in the U.S., **qualified dividends** are taxed at the capital gains rate).

- In the U.S. taxes on capital gains are **deferred** and levied at a different rate depending on whether the capital gains are **long-term** or **short-term**. The following examples examine these features.

Capital gains tax

Long-term gains are taxed at rates of 0%, 15%, or 20%, depending on your tax bracket, while short-term gains are taxed as ordinary income.

Long-Term Capital Gains Rate	Single Taxpayers	Married Filing Jointly	Head of Household	Married Filing Separately
0%	Up to $38,600	Up to $77,200	Up to $51,700	Up to $38,600
15%	$38,600-$425,800	$77,200-$479,000	$51,700-$452,400	$38,600-$239,500
20%	Over $425,800	Over $479,000	Over $452,400	Over $239,500

Accrual tax

If capital gains are taxed each year that they are earned, whether **realized or unrealized**, the capital gains are subject to the **accrual tax formula**:

$$F = P[1 + r(1 - T)]^N$$

Where F is the ending, after-tax value of the investment, P is the original invested amount, r is the annual return, T is the tax rate, and the asset is held for N years.

Accrual tax

The following example demonstrates accrual taxation.

Ex. Jamie invests $10,000 in a stock portfolio that grows in value by 9% each year. The capital gains are subject to a 15% tax rate whether she sells them or not (whether they are unrealized or realized). Jamie sells all of her stock after 30 years. How much is her investment worth after 30 years?

Ans. The final value of Jamie's investment may be found using the accrual tax formula:

$$F = P[1 + r(1 - T)]^N = \$10,000[1 + 0.09(1 - 0.15)]^{30} = \$91,290$$

Naturally, taxes reduce the value of investments. Without taxes, Jamie's investment would have grown to $132,677.

Deferred tax

If capital gains are taxed only when the financial asset is sold, taxes are said to be **deferred**. In this case:

$$F = P[(1 + r)^N(1 - T) + T]$$

Note that this is mathematically equivalent to taxing only the capital gains:

$$F = P + [P(1 + r)^N - P](1 - T)$$

Original
Principal

Capital
Gains

Deferred tax

The following example demonstrates deferred taxation.

Ex. Mary invests $10,000 in a stock portfolio that grows in value by 9% each year. The capital gains are subject to a 15% tax rate when she sells all of her stock after 30 years. How much is Mary's investment worth after 30 years?

Ans. The final value of Mary's investment may be found using the **deferred** tax formula:
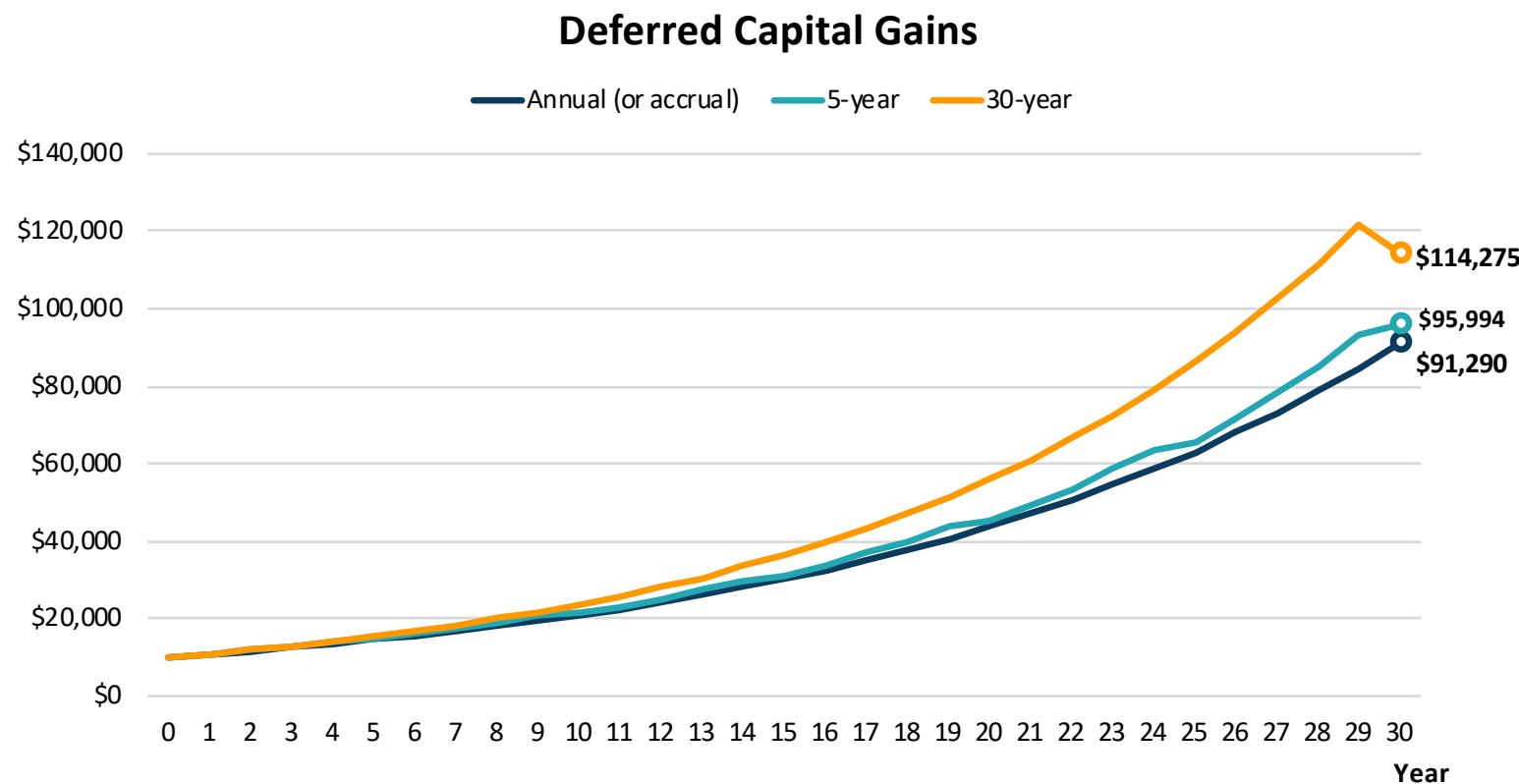
$$F = P[(1 + r)^N(1 - T) + T] = \$10{,}000[(1.09)^{30}(1 - 0.15) + 0.15] = \$114{,}275$$

Above, we found that Jamie, who invested the same amount with the same rate of return taxed at the same rate ended the 30 years with only $91,290. The difference is that Mary's taxes were **deferred** while Jamie's were not.

Deferred taxes on capital gains allow investments to grow larger because the full return is compounded each year. When taxes are levied in a year, the return is not compounded on the full before-tax return the next.

Deferred tax

The benefits of deferred taxation increase with the holding period. If portfolio turnover is high, taxes will decrease the long-run return.

Deferred Capital Gains

Annual (or accrual)   5-year   30-year

$114,275
$95,994
$91,290

Year

After-tax return

Taxes on capital gains reduce the effective return on an investment. The **after-tax return** on an investment is the effective, after-tax growth on an investment that satisfies the following:

$$F = P\left(1 + r_{after-tax}\right)^N$$

Solving for the after-tax return:

$$r_{after-tax} = \left(\frac{F}{P}\right)^{\frac{1}{N}} - 1$$

After-tax return with accrual taxes

Ex. In the example above, Jamie invested $10,000 in a stock portfolio that grew in value by 9% each year subject to a 15% accrual tax. After 30 years, the portfolio grew to an after-tax value of $91,290. Calculate Jamie's after-tax return.

Ans. Jamie's after-tax return can be calculated as:

$$r_{after-tax} = \left(\frac{F}{P}\right)^{\frac{1}{N}} - 1 = \left(\frac{\$91,290}{\$10,000}\right)^{\frac{1}{30}} - 1 = 7.65\%$$

Note that, in this case, this is simply the 9% return reduced by the 15% tax rate:

$$r_{after-tax} = 0.09 * (1 - 0.15) = 7.65\%$$

In general, this is true for *accrual* taxes only.

After-tax return with deferred taxes

Ex. In the example above, Mary invested $10,000 in a stock portfolio that grew in value by 9% each year subject to a 15% deferred tax. After 30 years, the portfolio grew to an after-tax value of $114,275. Calculate Mary's after-tax return. Compare this to the 7.65% after-tax return for an accrual tax.

Ans. The after-tax return is calculated with the after-tax return formula:
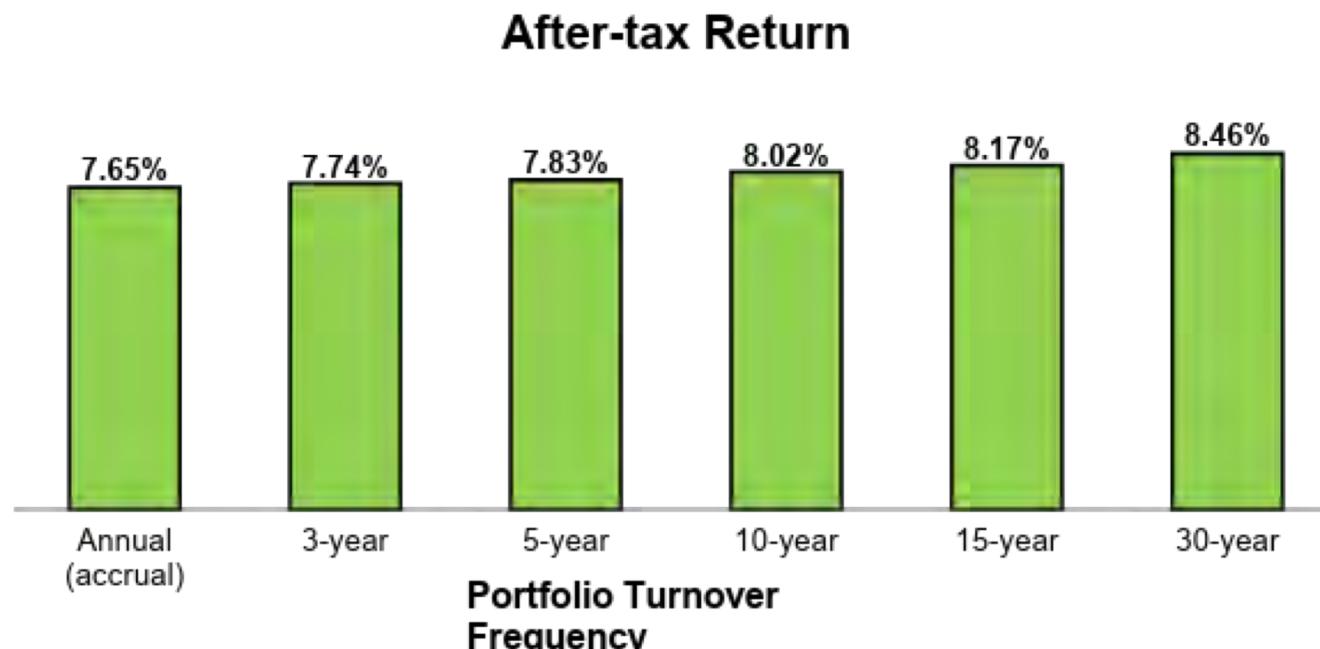
$$r_{after-tax} = \left(\frac{F}{P}\right)^{\frac{1}{N}} - 1 = \left(\frac{\$114,275}{\$10,000}\right)^{\frac{1}{30}} - 1 = 8.46\%$$

This is higher than the 7.65% after-tax return with an accrual tax at an equivalent rate. It is no longer the 9% return decreased by the 15% tax rate. In fact, the 9% is instead decreased by an **accrual-equivalent tax rate** 6%:

$$0.09 * (1 - 0.06) = 8.46\%$$
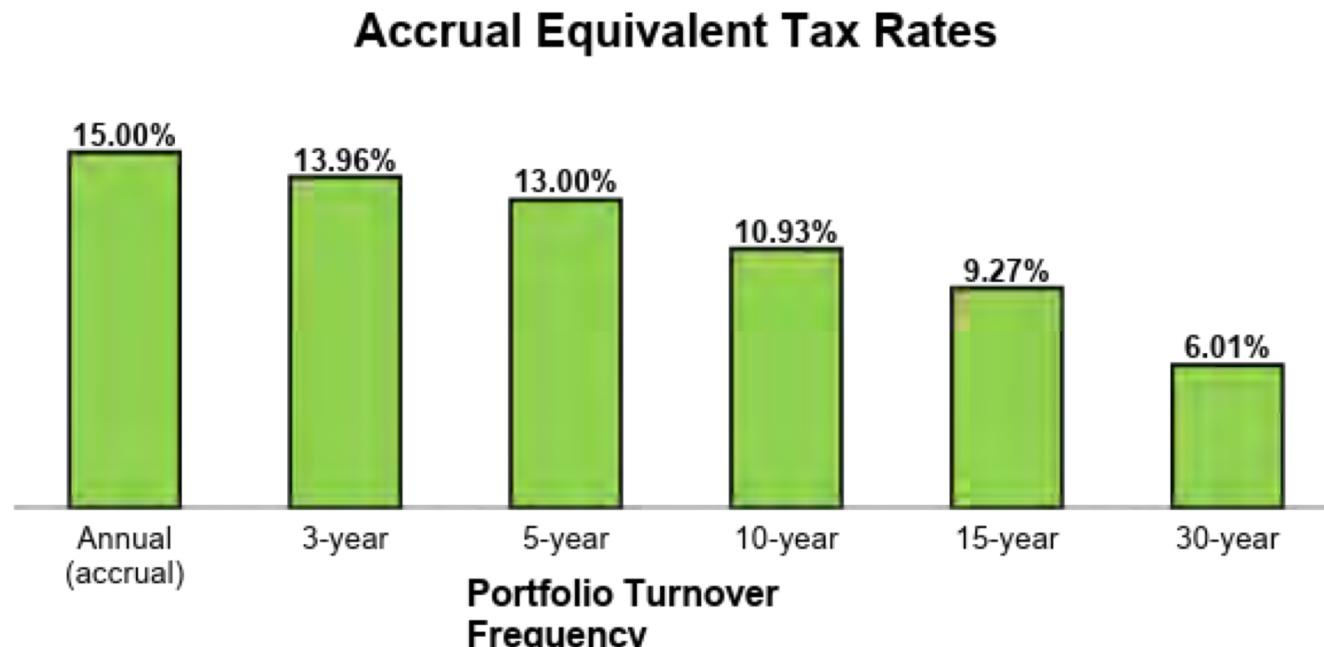
After-tax return on deferred taxes

By deferring capital gains taxes, an investor increases his or her **after-tax return**…

After-tax Return

7.65%	7.74%	7.83%	8.02%	8.17%	8.46%
Annual (accrual)	3-year	5-year	10-year	15-year	30-year

Portfolio Turnover Frequency

Accrual-equivalent tax rates

Which effectively reduces the implicit annual tax rate to a lower **accrual-equivalent tax rate**:

Accrual Equivalent Tax Rates

Portfolio Turnover Frequency	Rate
Annual (accrual)	15.00%
3-year	13.96%
5-year	13.00%
10-year	10.93%
15-year	9.27%
30-year	6.01%

Short- versus long-term capital gains

Further, the capital gains on stocks that are traded frequently are often taxed at a higher, **short-term capital gains tax rate:**

- In the U.S. capital gains on financial assets held longer than one year are taxed at the **long-term capital gains tax rate**, which is currently set at 15% (or 0% for those in the lowest marginal income tax brackets).

- Capital gains on financial assets held less than one year are taxed at the higher **short-term capital gains tax rate**, set at the investors marginal tax rate.

- Because short-term capital gains are realized annually, they are also effectively subject to an accrual tax, and no benefits from deferment will be realized.

Short- versus long-term capital gains

Ex. Sarah invests $10,000 in a stock portfolio that grows in value by 9% each year. She frequently trades and buys and sells each stock in her portfolio each year. Therefore, Sarah's returns are subject to the short-term capital gains tax rate, which is her 35% marginal income tax rate. How much is her portfolio worth after 30 years?

Ans. The final value of Sarah's investment may be found using the accrual tax formula with a capital gains tax rate of 35%:
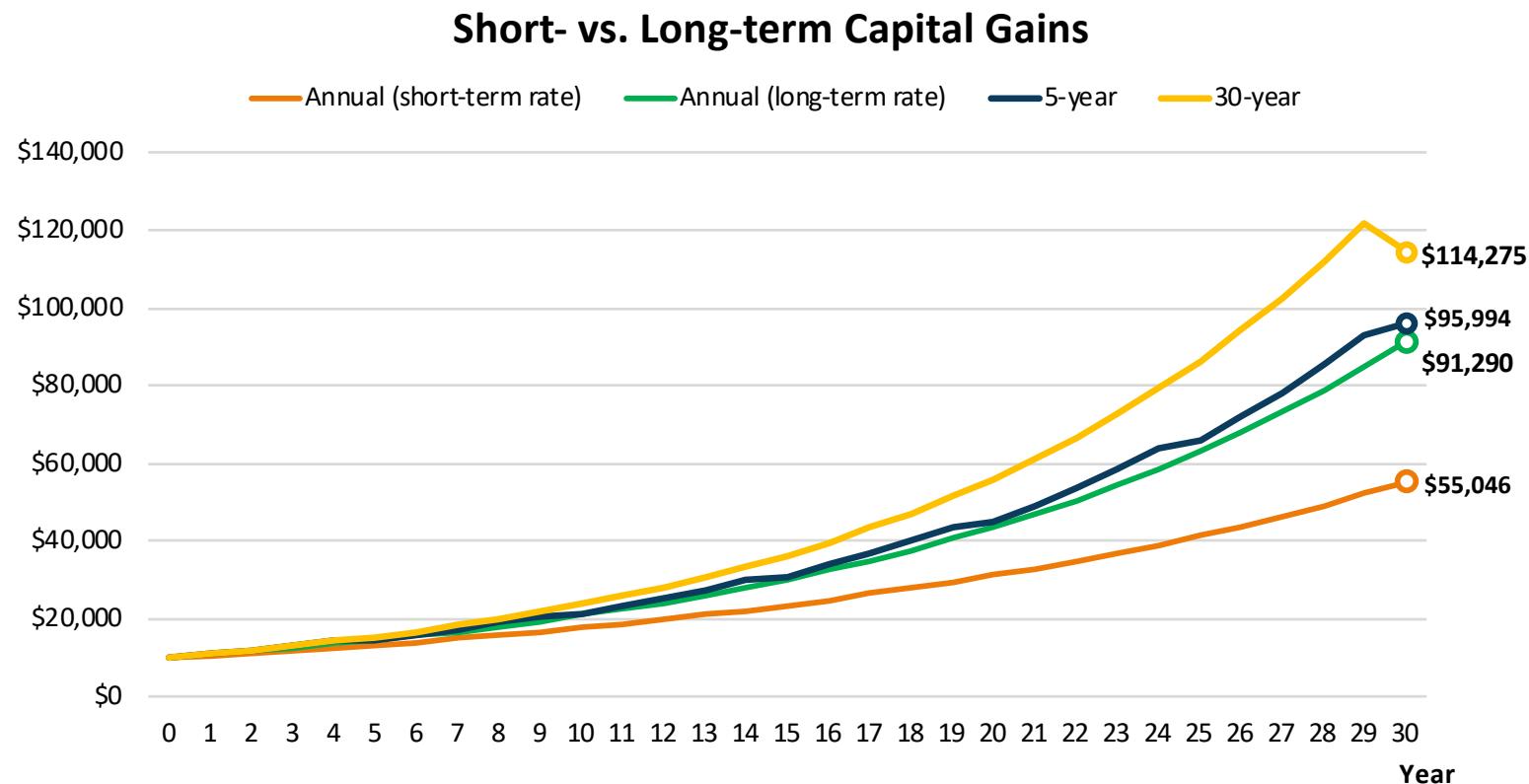
$$F = P[1 + r(1 - T)]^N = \$10{,}000[1 + 0.09(1 - 0.35)]^{30} = \$55{,}046$$

If she were instead taxed annually at the 15% capital gains tax rate, her portfolio would be worth $91,290, as we found for Jamie in the example above. *Remember though that long-term gains are not taxed annually*, and her portfolio would be worth (after-taxes) $114,275 in 30 years.

The short-term capital gains tax can do serious damage to a portfolio!

Short- versus long-term capital gains

Given the same return, a portfolio subject to short-term capital gains may only reach a fraction of the value of a portfolio held for the long-term:

Short- vs. Long-term Capital Gains

Legend: ——Annual (short-term rate) ——Annual (long-term rate) ——5-year ——30-year

- $114,275 (30-year)
- $95,994 (5-year)
- $91,290 (Annual long-term rate)
- $55,046 (Annual short-term rate)

Year

Taxes and high portfolio turnover

Capital gains tax treatment provides yet another reason to avoid high portfolio turnover:

- By trading frequently, an investor reduces, or even eliminates, the potential benefits from deferring capital gains taxes.

- Stocks bought and sold within less than a year are subject to a higher tax rate, which further reduces the after-tax return.

- When transaction costs are included, the picture becomes even bleaker for day traders…

There are many ways that frequent trading can *__decimate__* a portfolio!

Tax-advantaged Retirement Accounts

Tax-advantaged retirement accounts

Specific kinds of **retirement accounts** often receive beneficial tax treatment.

- **Tax-deferred** retirement accounts allow savers to contribute *pre-tax* income into a retirement account by *deducting* their contribution. Taxes on not only income and capital gains, but also the initial income, are deferred until withdrawal.

- Gains and income earned in **tax-exempt** retirement accounts are not taxed *at all*. However, the contributions are made *after-tax*, so tax is paid on the original contribution.

- 401(k)s are employer-sponsored **defined contribution** retirement plans. A traditional **401(k)** is tax-deferred. A **Roth 401(k)** is tax-exempt. Employers often match contributions made into an employee's 401(k).

- IRAs are individual retirement accounts not sponsored by any employer. A **traditional IRA** is tax-deferred. A **Roth IRA** is tax exempt.

Tax-advantaged retirement accounts

Video about the benefits of tax-advantaged retirement accounts

"How Tax-Advantaged Accounts Build Assets"

http://gflec.org/education/educational-videos/

IRA versus Roth IRA

The following example demonstrates the computation of returns on traditional IRAs and Roth IRAs.

Ex. A worker earns a salary of $60,000 and is subject to a flat income tax rate of 20% with no exemptions or deductions. After budgeting the worker determines he needs $44,000 of take-home pay and will contribute the remainder into his retirement account. If he makes a contribution into a traditional IRA, he will use the tax savings from the deduction to increase his contribution.

Assume the contribution is invested for 30 years and earns a average annual return of 9%. Assume also that the capital gains tax rate is 15% and that the worker's income tax rate remains at 20% in retirement.

Calculate the final value of the contribution when it is withdrawn in 30 years if the worker invests in (a) a mutual fund outside of any tax-advantaged retirement account , (b) a Roth IRA, or (c) a traditional IRA. (Note that withdrawals from both traditional IRAs and Roth IRAs are subject to ordinary income tax rates, regardless of whether they earn capital gains.)

IRA versus Roth IRA

Ans.

Without any deductions, the workers after-tax income is $60,000*(1-0.20) = $48,000. He can thus invest $48,000 - $44,000 = $4,000.

If the worker doesn't contribute into a tax-advantaged fund, his stock returns will be subject to the long-term capital gains tax:

$$F = P[(1+r)^N(1-T) + T] = \$4{,}000[(1.09)^{30}(1-0.15) + 0.15] = \$45{,}710$$

If the worker contributes to a Roth IRA, his balance will be tax exempt:

$$F = P(1+r)^N = \$4{,}000(1.09)^{30} = \$53{,}071$$

The tax advantages of a Roth IRA should be clear!

If the worker contributes to traditional IRA, he will realize a tax deduction…

IRA versus Roth IRA

Ans. (continued)

The *pre-tax* investment that will yield the same $44,000 disposable income is:

$$P_{Pre-tax} = \frac{P_{After-tax}}{1-T} = \frac{\$4,000}{1-0.20} = \$5,000$$

If the worker makes $5,000 contribution into a traditional IRA, he may deduct this from his taxable income and reduce it to $60,000 - $5,000 = $55,000. His after-tax disposable income is then $55,000*(1-0.20) = $44,000 as required.
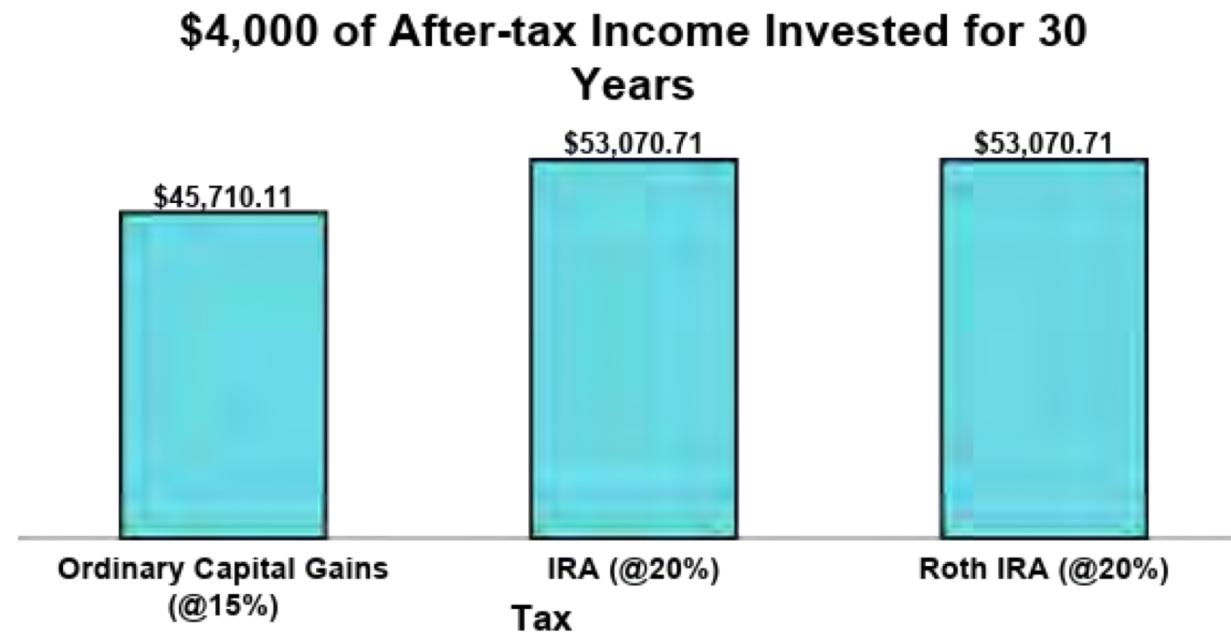
The taxes on this contribution and its gains will be deferred if invested into a traditional IRA:

$$F = P(1+r)^N(1-T) = \$5,000(1.09)^{30}(1-0.20) = \$53,071$$

This is the same as for the Roth IRA!

IRA versus Roth IRA

The following chart shows the final value for each case:

$4,000 of After-tax Income Invested for 30 Years

Ordinary Capital Gains (@15%)	IRA (@20%) Tax	Roth IRA (@20%)
$45,710.11	$53,070.71	$53,070.71

In this example, the ending value for a traditional IRA is the same as for a Roth IRA!

However, this may not always be the case…

IRA versus Roth IRA

In general, the final value of a qualifying contribution into an **IRA** can be calculated as:

$$F_{IRA} = P_{Pre-tax}(1 + r)^N(1 - T_F)$$

Where T_F is the investor's income tax rate *in retirement*.

The final value of a qualifying contribution into a **Roth IRA** is:

$$F_{Roth\ IRA} = P_{After-tax}(1 + r)^N = P_{Pre-tax}(1 - T_0)(1 + r)^N$$

Where T_0 is the investor's income tax rate *at the time of the contribution*.

Traditional 401(k)s and Roth 401(k)s behave similarly.

IRA versus Roth IRA

Using these two equations, we can determine when an IRA is better than a Roth IRA and vice versa.

$$F_{IRA} > F_{Roth\ IRA}$$
$$P_{Pre-tax}(1+r)^N(1-T_F) > P_{Pre-tax}(1-T_0)(1+r)^N$$
$$(1-T_F) > (1-T_0)$$
$$T_F < T_0$$

In other words, a traditional IRA is better than a Roth IRA when the saver's tax rate at retirement is less than their tax rate today!

Intuitively, this should make sense. Under a traditional IRA, all taxes occur at retirement. Under a Roth IRA, all taxes occur today. Maximize returns by picking the lowest tax rate!

IRA versus Roth IRA

Ex. Consider the same worker above, but assume he expects a **lower tax rate in retirement**.

The worker earns a salary of $60,000 today and is subject to a flat income tax rate of 20% with no exemptions or deductions. He will either contribute $4,000 of after-tax income into a Roth IRA or $5,000 of pre-tax income into an IRA, both of which will result in the $44,000 necessary to meet his budget.

Assume the contribution is invested for 30 years and earns a average annual return of 9%. Assume also that the worker's income tax will fall to **15% in retirement**.

Compare a contribution into a Roth IRA with one into a traditional IRA.

IRA versus Roth IRA

Ans.

As we saw above, if the worker contributes $4,000 to a Roth IRA, his withdrawal will be tax exempt:

$$F = P_{after-tax}(1+r)^N = \$4{,}000(1.09)^{30} = \$53{,}071$$

Note that $4,000 of after-tax dollars is a $5,000 *pre-tax* contribution because $5,000*(1-0.20) = $4,000.

If the worker contributes the $5,000 pre-tax contribution to traditional IRA, he will be taxed at the worker's 15% income tax rate during retirement:

$$F = P_{pre-tax}(1+r)^N(1-T_F) = \$5{,}000(1.09)^{30}(1-0.15) = \$56{,}388$$

He gets over $3,000 more at retirement for investing in a traditional IRA!

IRA versus Roth IRA

There are reasons why a saver's tax rate might change in the future, and they should be considered when deciding on the type of IRA (or 401(k)).

- If the saver is in a high-income period of his or her life, and all sources of income in retirement are expected to be lower, he or she will fall into a lower tax bracket at retirement. (+1 IRA)

- During retirement, the saver might move into a state with a lower income tax. (+1 IRA)

- If the saver lives in a country that has been consistently running a large deficit and may need to raise taxes in the future to balance the budget, the saver's tax rate may increase in retirement. (+1 Roth IRA)

IRA versus Roth IRA

And there are non-tax reasons why a traditional IRA may be better or worse than a Roth IRA.

- Traditional IRAs and Roth IRAs currently have the same contribution limit. However, because the Roth IRA's limit is *after-tax,* it is actually a higher *pre-tax* limit and so will shelter more investment income for savers contributing the limit.

- Eligibility requirements and withdrawal restrictions and penalties vary between the two account types. Other distinctions might also exist. Please take steps to understand all the differences before choosing between the two!

IRA versus Roth IRA tax shelter

Ex. Irene is deciding whether to contribute to an IRA or a Roth IRA. She plans on making the maximum contribution, which is $5,000 for either account type ($5,500 as of 2018, but the following examples will use $5,000).

Assume she is taxed at 20% and will be taxed at this rate throughout retirement. The capital-gains tax rate is 15%. For simplicity, assume there are no other exemptions or deductions (and no standard deduction).

If she invests for 30 years and earns an average return of 9%, is it better to invest in the IRA or the Roth IRA?

IRA versus Roth IRA tax shelter

Ans.

The Roth IRA contribution will be made with a $5,000 *after-tax* contribution and will grow to:

$$F_{Roth\,IRA} = P(1+r)^N = \$5,000 * 1.09^{30} = \$66,338$$

The $5,000 contribution in a traditional IRA will grow to:

$$F_{IRA} = P(1+r)^N(1-T_F) = \$5,000 * 1.09^{30} * (1-0.20) = \$53,071$$

This $5,000 contribution is tax-deductible and increases Irene's after-tax income by 0.20*$5,000 = $1,000. Unlike previous examples, however, this additional income may **not** be invested in her IRA account, because of the $5,000 limit. Instead, if it is invested in an ordinary investment account, it will grow to:

$$F_{CG} = P[(1+r)^N(1-T_{CG}) + T_{CG}] = \$1,000 * [1.09^{30} * 0.85 + 0.15] = \$11,428$$

Ans. (continued)

In total, if Irene invests $5,000 in a traditional IRA and the $1,000 tax benefit in an ordinary account, then at retirement she will have:

$$F_{IRA} + F_{CG} = \$53{,}071 + \$11{,}428 = \$64{,}499$$

This is less than the $66,338 she could get by making her $5,000 investment in a Roth IRA!

This differs from previous examples because of the contribution limit…

Ans. (continued)

In both cases, Irene contributes $5,000 of *after-tax* income, or $6,250 *pre-tax*:

$$\frac{\$5,000}{1 - 0.20} = \$6,250 \rightarrow \$6,250 * (1 - 0.20) = \$5,000$$

The Roth IRA shelters $5,000 of *after-tax* income, or $6,250 of *pre-tax* income.

The traditional IRA, however, only shelters $5,000 of *pre-tax* income. The remaining $1,250 is not sheltered, so is subject to taxes and reduced to $1,000:

$$\$1,250(1 - 0.20) = \$1,000$$

This $1,000 must then be contributed in a non-tax-advantaged account, and so this $1,250 never receives a tax benefit.

Taxes and Asset Allocation

Taxes and asset allocation

Investors that save beyond the limit on their tax-advantaged account should take care in deciding which assets to place within the tax-advantaged accounts.

- Assets that are not taxed, such as municipal bonds, should not be placed in a tax-advantaged account.

- Assets that pay taxable income regularly, such as dividends or coupon payments, should have priority in a in a tax-advantaged account because, outside of a tax-advantaged account, the tax is not deferred.

- Index funds or mutual funds that are actively traded or frequently rebalanced, such as small stock mutual funds, will realize capital gains frequently and so should have priority over funds that are not frequently rebalanced.

Today we learned…

Income tax rates

Deductions and exemptions

After-tax interest

Capital gains tax

Municipal bonds

Taxes and asset allocation