

Module 9: Taxation and inequality

Learning Goal for Module 9

Taxation and measures to mitigate inequality/poverty represent an area of expanded government scope. This module will reveal how taxes operate, especially personal income taxes, and how changes to the tax rates affect income inequality.

By the end of this Module, you will understand:

- Marginal and average tax rates
- How to create a tax schedule
- How to use VLOOKUP in tax calculations
- Tax burden and tax revenues
- The measurement of inequality
- How varying tax rates affects inequality

1. Introduction

Taxation is as old as the state. In early agrarian societies, kings (and a few queens) applied taxes (the value of the land), salt, grains and then in the twentieth century, income. Medieval kings taxed lords, who in turn taxed peasants to raise funds for the machinery of the state and to fight domestic and foreign wars. Often taxation followed few predictable rules, as local chieftains simply took what they wanted. The constraint on excess taxation was that peasants needed enough to survive and plant crops for the next year.

The Magna Carta (1215), a foundation document of western democracy, focused on limiting the taxation power of the king, but it was not based on the complaints of the serfs, but nobles who wished to limit the power of the King to take. Taxation by the English king on the 13 colonies was major trigger for the American Revolution (1776).

With industrialization, governments have applied taxes to wages, company revenues, land values, and then, as a more recent addition, to prices in the form of retail sales taxes. Most recently, governments have taxed payrolls and value added (such as the GST) on consumer goods.

Taxes have three roles in the modern mixed-market economy. First, they raise revenue to support an array of health, education, and infrastructure programming. Second, taxes help redistribute income from those with higher to those with lower incomes. Finally, government uses taxation to penalize certain behaviour, such as the carbon tax.

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Definitions

- **Tax base** is the *reference* for calculating the tax. Most common tax bases include income, price, profit, consumption, capital gains, and wealth (property).
- **Tax rate** is the percentage or ratio of tax total (income, profits, wealth...).
- **Deductions/exemptions** are parts of the tax base not taxed.
- **Proportional taxes** increase at a fixed rate of income.
 - *Example: Sales taxes are a fixed percentage of the price of a product.*
- **Progressive taxes** increase with the reference. Tax rate increases with increases in the tax base.
 - *Example: Many countries use a progressive income tax as part of their anti-poverty strategies.*
- **Regressive taxes** fall with the reference. Tax rate decreases with increases in the tax base.
 - *Example: Sales taxes are proportional with the price of the product, but when one examines the amount of the tax paid as a percentage of income, it is often the case that, for low-income households, the percentage of income devoted to sales taxes is higher than for those with higher incomes.*

2. Some important taxes

Income, sales, and wealth taxes form the base for much of government revenues. Note that governments also receive revenue from fees, fines, royalties, and payments from investments.

2.1. Income taxes

Personal income tax may be *flat* (same absolute value for all income levels), *proportionate* (same percentage of income for all income levels), or *progressive* (rate increases with income). Often, governments allow an *initial exemption* level and various deductions or credits.

- **Deductions** reduce taxable income, and therefore reduces the tax payable (education tuition is often deductible).
- **Credits** reduce the tax owing; governments use them as a more direct way to encourage certain behaviours. Most credits are non-refundable, which means the credit can only eliminate tax owing. Some credits are refundable, which means the credit will result in the government paying taxpayers, even after tax payable is zero.
- **Taxable benefits** are goods and services that are not income but which do add to the economic welfare of the individual. For example, some governments have deemed airline flight miles earned while working as a taxable benefit and tax filers must include it in gross income.
- **Negative income tax** pays an amount proportionate to the extent to which earnings fall short of the threshold.

Most income taxes in the developed world are *progressive*, as discussed later in this Module.

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2.2. Consumption and excise (sales) taxes

Consumers pay consumption taxes, comprising sales and value-added taxes, at the point of final sale. These taxes typically apply to all goods and services, except where government chooses not to levy the tax as part of broader social policy, such as basic food items as part of anti-poverty policy.

- **Sales taxes** occur as a percentage price at the retail level or at the wholesale level, for all commodities.
- **Value-added taxes** fall on differences between the price and the unit cost of materials (raw and intermediate goods but not wages). The GST is supposed to be a value-added tax, but consumers experience it as a sales tax. The seller remits revenues based on the calculation of value added.

Value added is the difference between the price of a product and its cost of production. Price is determined by willingness to pay, which the firm tries to boost through product performance and advertising.

Government imposes an excise tax on a specific commodity or service not so much to raise revenue but to control consumption of items judged to be socially harmful. These taxes often occur for business transactions and intermediate goods.

- **Sin taxes** increase the effective price to control use (tobacco and alcohol). Often these goods/services have low elasticities of demand, which can serve as a source of steadily increasing revenue since the tax does not really reduce consumption, so its imposition can be cynical.
- **Steering taxes** increase the price of a good/service to discourage use. It's aimed at changing the behaviour of the taxpayer. Examples include carbon tax on fossil fuels, sugar taxes to try to discourage consumption (such as taxes on soft drinks), and the **Tobin tax**, a proposed tax on international financial transactions to discourage sudden transfers of financial investment across international borders. Steering taxes and sin taxes overlap.

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2.3. Other taxes and concepts

Wealth and corporate taxes

- **Capital gains taxes** are levied on the increase in value of an asset (art, land...).
- **Land (property) taxes** apply to the total value of the property and are an important way that cities finance their activities.
- **Corporate income taxes** target *earnings, profits, or net income*, which typically equals total sales less costs (wages, rent, supplies, etc.).
- **Dividend taxes** fall on the dividend paid to shareholders and are often at a lower rate than income, which is why some professionals (doctors) become corporations. The corporation accepts the revenue, and the owner (doctor) runs expenses through the corporation, paying tax on the net, or paying themselves using dividends.

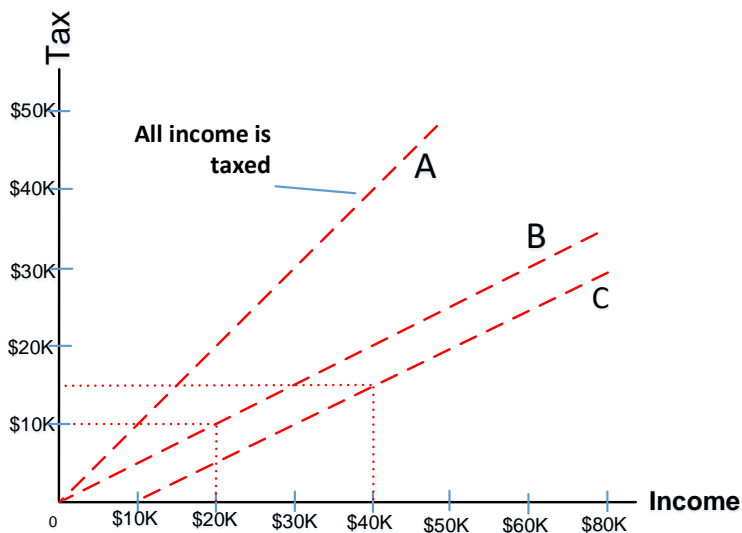
Miscellaneous tax concepts

- **Tariffs** are taxes imposed by a government on goods entering a country.
- **Poll taxes** are a fixed tax paid by each person. Also known as a head tax – uncommon.
- **Fees/tolls** for services, such as water, have become common to hide taxes.
- **Direct taxes** fall on the individual or business.
- **Indirect taxes** typically apply to business settings where the tax results in a price increase paid by consumers or a reduction in wages and prices for inputs. The ability to shift the tax depends on the elasticity of demand.
- **Pigouvian tax** (after the economist A.C. Pigou) are imposed on the production of goods or services whose production/consumption creates negative externalities. The tax indirectly reduces production/consumption of those goods and services, thereby reducing negative externalities.

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3. Average and marginal tax rates

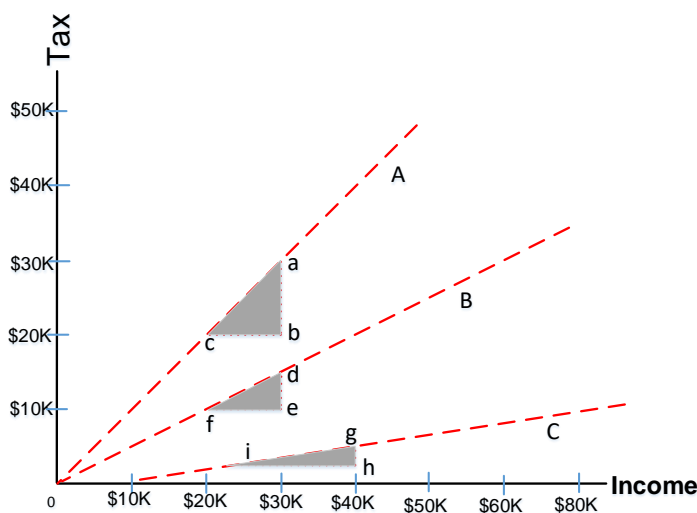
Income taxes are the most important source of government revenue. For proportional tax regimes, everyone pays a fixed percentage of taxable income. Most income tax environments have a range of deductions, the most important of which is the basic personal exemption, which in Canada (2022) is about \$13,000. Other exemptions include dependent children, medical expenses, work expenses, etc. Income tax uses *taxable income = gross income less deductions* as the basis for the tax.



- An **average tax** of 100% has the state taking all income as tax.
- **A:** 100% is the maximum theoretical rate (45° line).
- This formula calculated the average income tax and has the designation as the *effective rate*:
- $$\text{Average Tax} = \text{Tax} / (\text{Taxable Income})$$
- **B:** A 50% tax with no deduction means there is a \$20K tax owing on an income of \$40K.
- **C:** If we create a \$10K deduction, the tax on \$40K becomes \$15K and the average tax rate $\$15K / \$40K = 37.5\%$.
- The effect of a deduction is to lower the average tax rate.

Figure 1: Average tax

The marginal tax is the tax levied on the “last dollar” of taxable income. For proportional tax regimes, average and marginal tax rates are equal. For progressive tax systems, the marginal and average tax rates diverge, with the marginal tax rate increasing as income rises.



- This formula defines the marginal tax rate:
- $$\frac{\Delta \text{Tax}}{\Delta \text{Income}}$$
- A: Marginal rate is $\frac{ab}{cb}$
 - B: Marginal rate is $\frac{de}{fe}$
 - C: Marginal rate is $\frac{gh}{ih}$
- The marginal tax rate may be higher, equal, or lower than the average tax rate.
(Note ΔTax is the “change in Tax”)

Figure 2: Marginal tax rates

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3.1. Progressive income tax

An important question in taxation is at what level the tax becomes so high that citizens adjust their incomes (by working less), hide income (offshore), fail to declare income, or just refuse to pay (tax revolt). Obviously, at 100% tax rates, no one would work.

The two ideas behind the progressive income tax are the declining marginal utility of income and vertical equity. If horizontal equity is treating equals equally, then vertical equity argues that it is fair to treat unequals differently. A flat tax imposes the same tax on everyone, which clearly imposes higher burdens on low-income households. A proportional tax, where everyone pays the same percentage (constant marginal and average rates that are equal) of tax income, is better in terms of burden on low-income households. A progressive income tax increases the marginal rate for increasing income ranges (tax brackets).

The progressive income tax typically has two notable features:

- an exemption for a policy-defined income (in **Error! Reference source not found.**, \$20,000); and
- sets of proportional taxes that increase with income. This has the effect of increasing the “marginal” rate in fixed steps.

Usually, the tax schedule has at least two or three “marginal proportionate” levels. The 100% taxation rate (tax = income) shows a situation where government taxes all income. After the 0% tax level (for the \$20k basic deduction), the three proportional rates are:

- 12.5% (between \$20K and \$60K) (\$5k tax for a \$40K income range) C
- 25% (between from \$60K and \$100K) (\$10K tax for a \$40K income range) B
- 37.5% (between from \$100K and \$140K) (\$15K tax for a \$40K income range) C

The top marginal tax rate in Canada is just over 50%

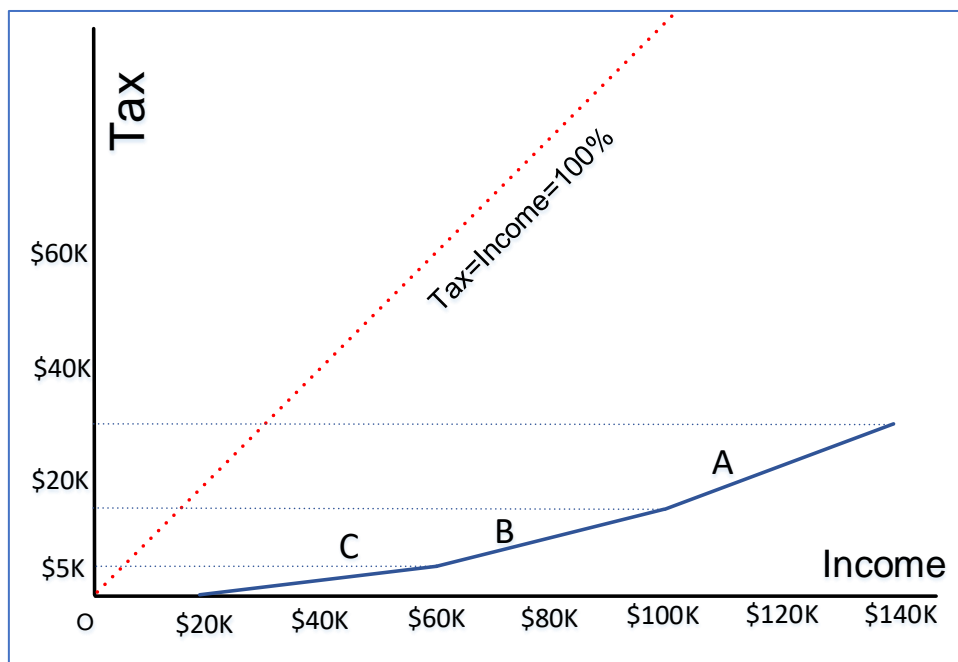


Figure 3: Progressive income tax

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- **Example 1:** An individual with a \$100K income pays no tax on the first \$20,000, 16.7% tax on the income between \$20K and \$80K, and 50% on the income between \$80K and \$100K, for a total tax of $.167 \cdot 60K + .5 \cdot \$20K$ or \$20,020.
- The **average tax rate** is $20,020/100,000$ or close to 20%; the **marginal rate** on the last dollar (the dollar between \$99,999 and \$100,000) is 50%.
- **Example 2:** An individual with an income of \$70K pays no tax on the first \$20K, and 16.7% on the income between \$20K and \$70K for a total tax of $.167 \cdot \$50K$ or \$8.35K. The **average tax rate** is $8,350/70,000$ or 11.9%. The marginal tax on the last dollar earned (between \$69,999 and \$70,000) is 16.7%.

This table shows the development of a basic income tax calculator.

It has a basic deduction and two brackets

- \$4,001 – \$15,999
- \$16,000 up

The lower tax rate starts at the deduction (\$4,001) and extends to the second bracket at \$16,000 (total income of \$20,000). Net incomes more than \$16,000 have taxes at the higher rate.

Deduction	\$4,000
First marginal rate	.2
Second marginal rate	.25
Cut-off for second marginal rate	\$16,000
Total income	\$30,000
Taxable income	\$26,000
Tax due	\$5,700
After-tax income	\$24,300

[Tax Calculator 1.xlsx](#)

[Video: Tax Calculator 1](#)

[Video: Tax Calculator 2](#)

See

[Tax Calculator 2.xlsx](#)

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4. Lookup functions and tax

While powerful, the =IF statement has limits, especially for repetitive tasks with dynamic data – data that update. Excel has series of “lookup” functions that compute a value in a cell dependent on information from a table in the same sheet, another sheet, or even a workbook. These include =VLOOKUP, =HLOOKUP, and =XLOOKUP. Additional functions include =INDEX and =MATCH.

Lookup functions share the same structure, where =VLOOKUP searches for information vertically in a column, =HLOOKUP searches horizontally in a row, and =XLOOKUP searches in an array. Each lookup function has the same structure and resembles scanning a menu in a restaurant; if the menu is conventional, the items and prices run vertically and, as you scan down the options, you look across at the price. You are looking up vertically. If the menu is on a ribbon, with items across and prices immediately below, you are performing a horizontal lookup. A new function =XLOOKUP in Microsoft 365 can replace both VLOOKUP and HLOOKUP.

It is useful to know all three lookup functions, as you may encounter all of these in your work. The following three videos explain VLOOKUP, which remains an important data management tool and shows XLOOKUP in a personal tax setting.

VLOOKUP 1.xlsx

Video: VLOOKUP 1

Video: VLOOKUP 2

See

VLOOKUP 2.xlsx

The XLOOKUP function has the following structure: =XLOOKUP(lookup_value, lookup_array, return_array, [if not found], [match_mode], [search_mode]), where

- lookup-value (What are you looking for?)
- lookup-array (Where are you looking?)
- return-array (Destination of lookup)
- [if not found] (Text if match not found, #NA if this is blank. *Optional field.*)
- [match-mode] (Specifies the match type; 0 for exact match and if not found #NA, -1 for exact match and if not found return the next smaller item, 1 for exact match and return the next larger item, and 2 for a wild card; *,?, and ~ are wild card characters in the lookup value. *Optional field.*)
- [search-mode] 1 start at the first item, -1 start at the last item, 2 for binary search where lookup-array is in ascending order, -2 for binary search where lookup-array is in descending order. *Optional field.*)

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Examples (from Excel 365 Help)

Example 1 is a simple XLOOKUP.

Example 1 uses XLOOKUP to look up a country name in a range, and then return its telephone country code. It includes the **lookup_value** (cell F2), **lookup_array** (range B2:B11), and **return_array** (range D2:D11) arguments. It doesn't include the **match_mode** argument, as XLOOKUP produces an exact match by default.

	A	B	C	D	E	F	G
1		Country	Abr	Prefix		What is the dial code?	
2		China	CN	+86		Brazil	+55
3		India	IN	+91			
4		United States	US	+1			
5		Indonesia	ID	+62			
6		Brazil	BR	+55			
7		Pakistan	PK	+92			
8		Nigeria	NG	+234			
9		Bangladesh	BD	+880			
10		Russia	RU	+7			
11		Mexico	MX	+52			

Example 2 looks up employee information based on an **employee ID** number. Unlike VLOOKUP, XLOOKUP can return an array with multiple items, so a single formula can return both employee name and department from cells C5:D14.

	A	B	C	D
1		Emp ID	Employee Name	Department
2		8389	Dianne Pugh	Finance
3				
4		Emp ID	Employee Name	Department
5		4390	Ned Lanning	Marketing
6		8604	Margo Hendrix	Sales
7		8389	Dianne Pugh	Finance
8		4937	Earlene McCarty	Accounting
9		8299	Mia Arnold	Operations
10		2643	Jorge Fellows	Executive
11		5243	Rose Winters	Sales
12		9693	Carmela Hahn	Finance
13		1636	Delia Cochran	Accounting
14		6703	Marguerite Cervantes	Marketing

Example 2 shows how XLOOKUP can return two fields.

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Example 4 shows all fields activated to return the tax rate for the income in E2.

Video: HLOOKUP - Tax

See.

HLOOKUP-TAX.xlsx

Example 4 looks in column C for the personal income entered in cell E2, and finds a matching tax rate in column B. It sets the **if_not_found** argument to return 0 (zero) if nothing is found. The **match_mode** argument is set to 1, which means the function will look for an exact match, and if it can't find one, it returns the next larger item. Finally, the **search_mode** argument is set to 1, which means the function will search from the first item to the last.

	A	B	C	D	E	F
1		Tax Rate	Max Income		Income	Tax Rate
2		10%	\$9,700		\$46,523	24%
3		22%	\$39,475			
4		24%	\$84,200			
5		32%	\$160,726			
6		35%	\$204,100			
7		37%	\$510,300			

Formula bar: `=XLOOKUP(E2,C2:C7,B2:B7,0,1,1)`

5. Poverty and inequality

Poverty is simple in concept but difficult to measure. It has both absolute and relative dimensions, as well as objective and relative perspectives.

- *Example A:* When we are young students, we are often poor in the sense that we have just enough money to cover essentials. We incur debt willingly under the expectation that deferring consumption will result in higher income and well-being in the future. Poverty is transitory and a step toward a better life. Often, we recall these as the “happiest” days of our lives.
- *Example B:* A young person who is poor, unemployed or in a low wage job, and has no skills may see little prospect for change. Poverty is permanent and grinding.

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Poverty and income inequality connect in complex ways. A society where everyone has low income (Case 1) may be more socially tranquil than a society marked with extreme inequality (Case 2) where even the lowest paid person has a higher income than anyone in Case 3. The politics of envy and perceived injustice weave through the concepts of poverty.

Measurement of poverty and inequality always rests on objective measures. Subjective measures of whether people are: happy or sad; generous or envious; and, optimistic or pessimistic. While part of the poverty/inequality experience, these emotional states are not open to easy measurement. Increasingly economists are

Two formal approaches exist to the measurement of poverty – relative and absolute:

- **Relative measures** use two steps:
 - Define a reference point in the distribution of income.
 - Use some point between 0 and that reference to define the numbers in poverty.
 Examples include low-income measures (**LIM**) and low-income cut-offs (**LICO**).
- **Absolute measures** identify the minimum set of goods and services judged as essential to life and include Market Basket Measures (**MBM**), the Basic Needs Index (**BNI**), and the Human Poverty Index (**HPI**).

5.1. Relative measures of poverty

We start with a lognormal income distribution, showing the mean and median. Recall the median is a common reference that divides the population in half. Many measures, such as a LICO, set some reference poverty line, which is a percentage of the median income. Finally, some reference for complete deprivation may be set.

Derived from an expenditure survey and then compared to an income survey, LICOs are set at the point where the family in question spends 20% more of its income than the average family on food, clothing, and shelter (matched by family size, composition, and region).

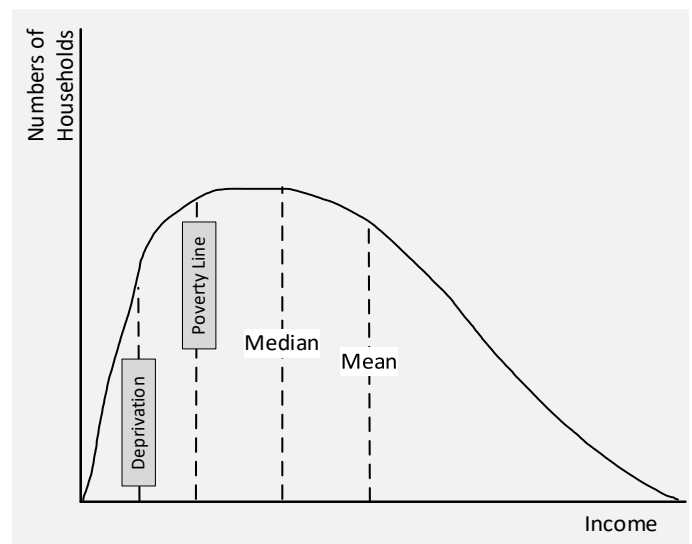


Figure 4: Central tendency and inequality

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LICOs based on *after-tax* rather than *before-tax* income result in lower measures of poverty. LICOs vary by size of city/region since they are affected by local cost of living, The choice of 20% more than the average is arbitrary, which is why Statistics Canada states that [LICOs are not poverty measures](#); however, this remains a common shorthand measure used by anti-poverty activists and academics.

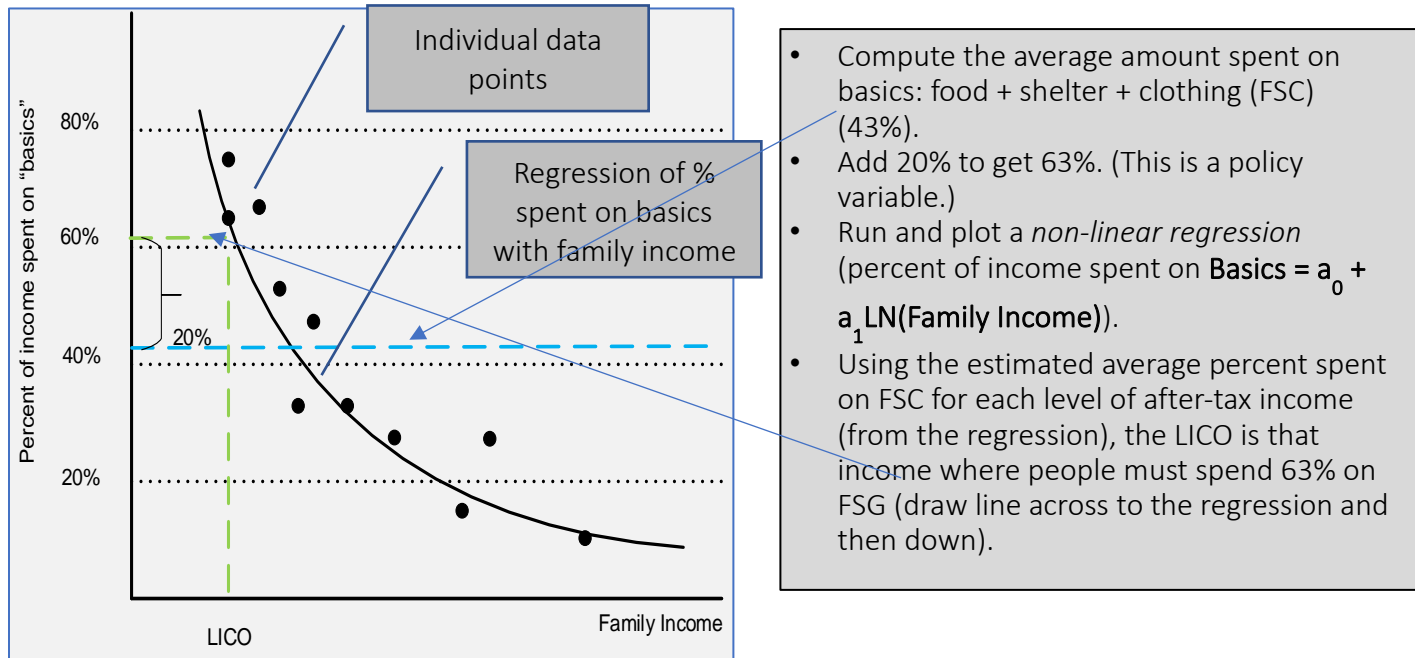


Figure 5: Low-income cut-offs

The **LIM** has become more popular, especially for international comparisons. The LIM is a fixed percentage (50%) of median adjusted household income. “Adjusted” indicates the measure for household sizes and reflects the fact that a household's needs increase as the number of members increases, but at a decreasing rate. The LIM uses a household survey to estimate median income by household size (number of adults plus a weighted sum of children by age).

Several options exist for calculating LIMs for households

- Market income (LIM-MI)
- Before-tax income (LIM-BT)
- After-tax income (LIM-AT)

Unlike the LICO, LIMs are both derived and applied using a single income survey. They are not related to the size of city or region, but they do vary by household size. LIM is a measure of inequality not poverty.

If all Canadian families received an additional \$10,000 income (by helicopter), the incidence and depth of poverty remain unchanged using the LIM. The LIM is insensitive to the business cycle, meaning that it has low fluctuations during recession or economic expansion.

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5.2. Absolute measures of poverty

Poverty is determined by calculating the cost of “basic necessities.” An individual is poor if..

- they lack items that maintain long-term *physical* well-being; and
- these items are part of the minimum acceptable standard within the community.

Some advocate for an absolute measure of poverty as a more realistic representation of the true numbers of poverty.

Basic needs index is a snapshot for physical survival, not the essentials needed to escape poverty in the short and long terms. The exclusion of certain goods is problematic, since children without access to internet, in this time, are clearly educationally disadvantaged. This measure always shows fewer in poverty:

- In 2004, the LICO measure showed 15.8% in poverty.
- The basic needs measure (with needs defined as a minimum level for physical survival) showed that only 4.9% of Canadians lived in poverty in 2004.

MBMs estimate the cost of purchasing a pre-determined “basket” of goods and services deemed to represent the standard of consumption for a reference family of two adults and two children. These measures include the costs of food, clothing, shelter, transportation, and other goods and services calculated for different regions across Canada. The MBM represents the cost of a basket that includes a nutritious diet, clothing and footwear, shelter, transportation, and other necessary goods and services (such as personal care items or household supplies).

A household in poverty lacks the disposable income needed to purchase this basket, where *disposable family income* is income from all sources less

- expenses such as childcare,
- medically prescribed, non-insured healthcare,
- personal income taxes and the personal portion of payroll taxes (such as payments to the Canada/Quebec Pension Plan),
- alimony and child support payments, and
- all mandatory payroll deductions for employer-sponsored pension plans, union dues, employment insurance, worker’s compensation, and supplementary (non-government) health plans.

Where should we draw the line at what to include for the minimum basket? Some say just subsistence (basic food, shelter, and clothing); others say that people need resources such as Wi-Fi, laptops, and accessible transportation just to maintain their position. During the pandemic, many children, especially from low-income households could not access on-line learning, further exacerbating their poverty.

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5.3. Economic inequality

Several perspectives exist on economic disparity, including wealth, income, and consumption.

Example: A professional may have low wealth and low income as student, low wealth, and high earnings at the beginning of their career, and high wealth and low earnings after retirement.

The distinction between measures of inequality (current snapshot at a point in time) and the determinants of inequality is important.

Many interpretations exist on measures of inequality

- *Dispersion of hourly wages among full-time (or full-time equivalent) workers*
- *Wage dispersion among workers* – e.g., annual wages, including wages from part-time work or work during only part of the year
- *Individual earnings inequality among all workers* – includes the self-employed
- *Individual earnings inequality among the entire working-age population* – includes those who are inactive (e.g., students, unemployed, early pensioners, etc.)
- *Household earnings inequality* – includes the earnings of all household members
- *Household market income inequality* – includes incomes from capital (dividends, profit, rent), savings, and private transfers (inheritance)
- *Household disposable income inequality* – includes public (government) cash transfers received (e.g., welfare) and direct taxes paid (income and sales taxes)
- *Household adjusted disposable income inequality* – includes publicly (government) provided services

5.4. Lorenz curves

The most common measure depends on the Lorenz curve and its derivative, the Gini coefficient. The Lorenz curve starts by collecting income (or wealth or any other indicator of economic well-being) from administrative or survey data, grouping the income data into categories, creating a frequency distribution of income, and then plotting the cumulative percentage of households against the cumulative percentage of income.

See

[Lorenz Calculator.xlsx](#)

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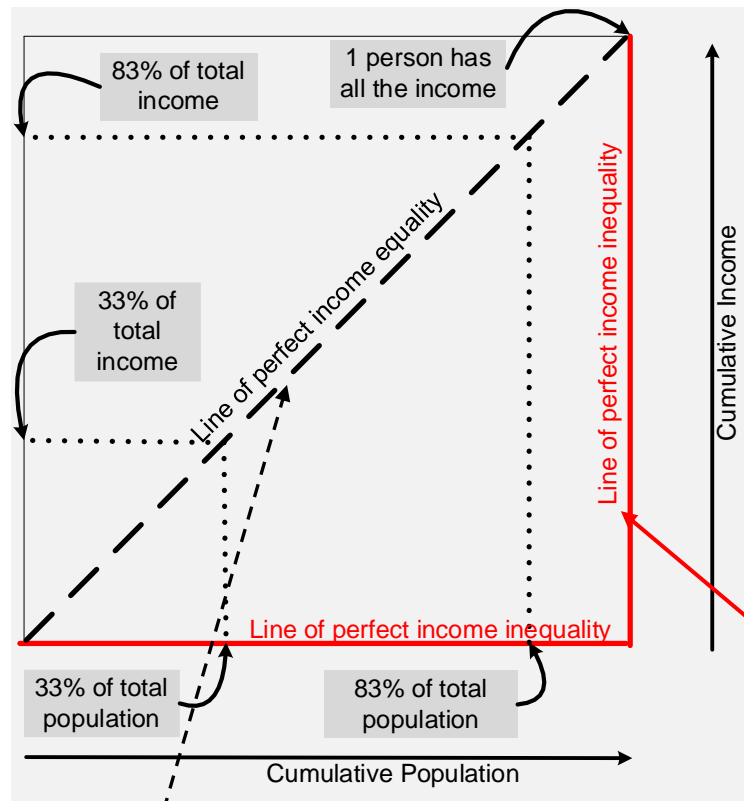


Figure 6: Perfect equality and perfect inequality

The dashed line shows everyone having an equal share of income, wealth, cows, iPads, or whatever.

- A Lorenz curve supports statements like "The bottom 10% of all households have 4% of the total income."
- A society where everyone has that same income has perfect equality.
 - 1% of the population has 1% of the total income.
 - 23% of the population has 23% of the total income.
 - etc.
- In this case, the bottom x% of society would always have x% of the income, as shown by the straight-line $y = x$, called the "line of perfect equality."

The red line shows one person having all the income, wealth, cows, iPads, or whatever.

- ### Steps to constructing the Lorenz curve
1. Sort the income into ascending order.
 2. Calculate the proportion of total income owned by everyone.
 3. Calculate the cumulative proportion of income and the cumulative proportion of population.
 4. Plot the line of equality (45°).
 5. Plot the cumulative proportion of income against the cumulative proportion of population.

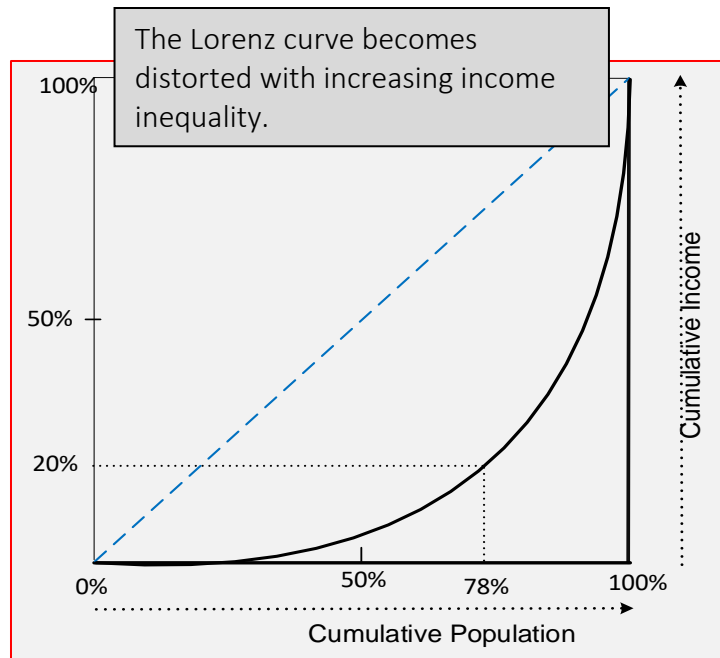


Figure 7: Lorenz curve

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5.5. Gini coefficient

The Gini coefficient is the most common measure of inequality. A Gini coefficient value of zero (Area A = 0) represents perfect equality (all values are the same when everyone has the same income). A Gini coefficient of one (Area A = Area A+B) represents maximum inequality among values, such as when one person has everything, and all others have none. Sometimes, a value greater than one may occur when some have negative incomes or wealth. One can also imagine situations when comparing two societies where their Lorenz curves cross, and the same Gini may be associated with different states of inequality. While these are theoretically possible, their practical significance is low.

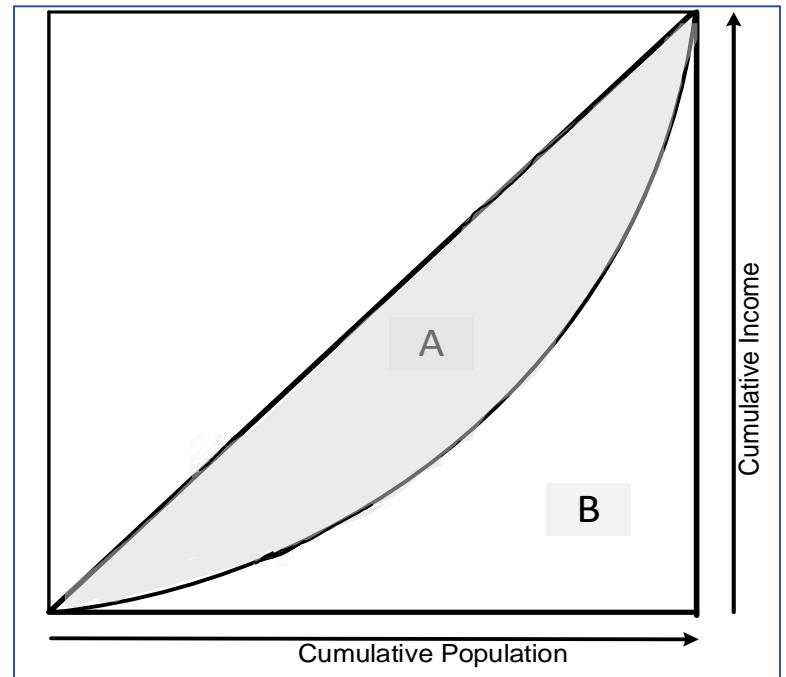


Figure 8: Gini coefficient

We can create approximate values of the Gini using geometry, which we can then translate into Excel.

You may need to read this a few times and remember your high school geometry.

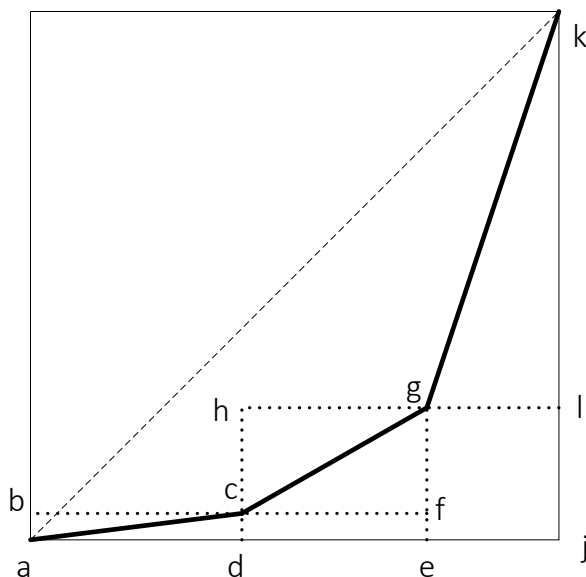


Figure 9: Calculating the Gini

Imagine a society of three people...

- The Lorenz curve appears at the left.
- Rather than a smooth line, the Lorenz “curve” is a series of line segments.
- The task is to compute the area between $acgk$ and the axes (aj and jk) and take this area from the triangle ajk . Then divide the result by the area ajk .
- We start with adc . Since $aj = 100\% = jk$, we set this to 1.
- Since the area of a triangle is $(\text{base} \cdot \text{height})/2$, and the base is 1 and height is 1, the area of $ajk = .5$.
- The area $acgkj$ comprises a series of triangles and rectangles.
- The calculation of the GINI is $[ajk - (acd + dejc + cfgh + e jlg + g l k)] / ajk$

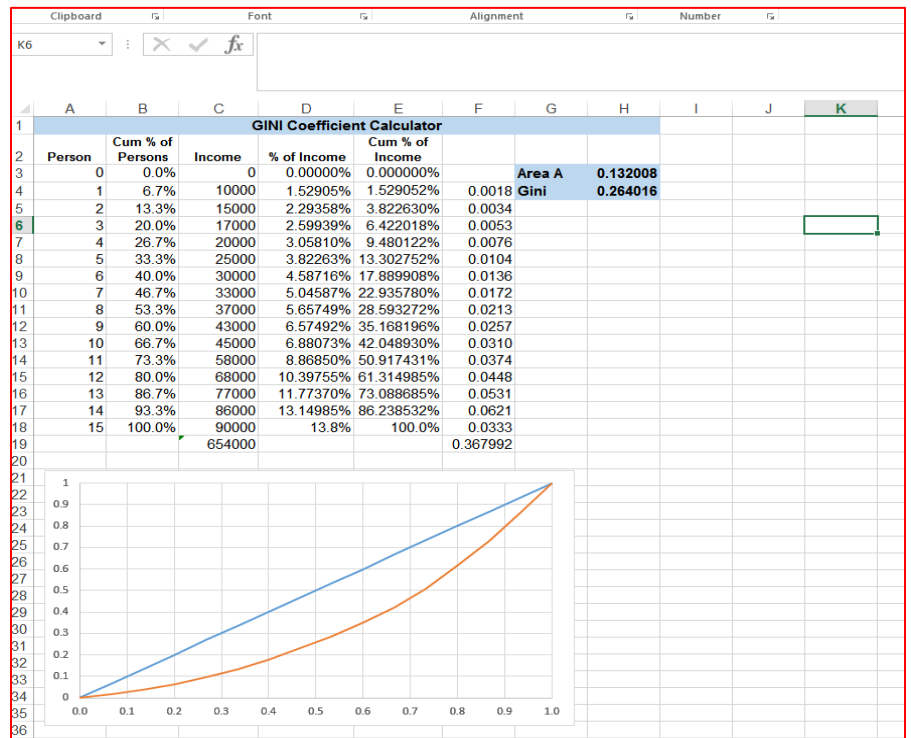
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Video: Gini Lorenz

See

Gini Calculator.xlsx

and study the code needed to create the Gini.



6. Summary

In this Module, taxation of incomes uses nested IF, VLOOKUP, and XLOOKUP to calculate taxes and tax tables. The “LOOKUP” functions are important data management tools when data updates.

Excel can measure depth and incidence of poverty as well as unequal distribution of income, wealth, and any other measure of economic well-being.

This Module has much of the important insights and learning in the exercises and videos. For example, given an income distribution, how does changing the tax rates affect the Gini coefficient? Study the exercises with worked answers and attempt to replicate the answers to the exercise without the solutions process.

Module 9: Taxation and inequality

Annex: Key Excel functions and formulas

Function	Example	Explanation
VLOOKUP(lookup-value, table-array, col-index- num, TRUE/FALSE)	=VLOOKUP(B3,B2:E7,2,FALSE)	Looks for the value in B3, from the second column of the array B2:E7. FALSE requires an exact match.
HLOOKUP (lookup-value, table-array, row-index_ num, TRUE/FALSE)	=HLOOKUP(B3,B2:E7,2,FALSE)	This is the same as VLOOKUP but uses a row index.
XLOOKUP(lookup-value, lookup-array, return-array, <i>if-not-found</i> , <i>match-mode</i> , <i>search-mode</i>)	=XLOOKUP(B4,A7:A17,C7:C13,,-1)	This searches two columns for the value in B4. The next two arguments are not used (for this example), and the search mode is for an exact match or the next smaller value.
Note in the description of the function (col 1) spaces appear to increase readability. These must not appear in the specification of the function as shown in the examples.		