I. Introduction

What is Macroeconomics?

*The study of the structure and performance of the aggregate economy

Different Schools of Thought

Economists often disagree on how to analyze or study the Economy

Major schools of thought in Economics include:

Classical, Keynesian, Austrian, Neo-Classical, New Keynesian, Monetarist, Marxian, Ecological, Feminist, and more

Common Questions

* What influences economic growth?

* What affects unemployment?

* Why does the economy fluctuate?

* How do government policies affect the economy?

* Are some groups affected differently than others?

Goals

1. To analyze the effects of potential government policies

2. To monitor the economy and make optimal decisions at the individual level

Two Broad Types of Analysis

*Theoretical

*Empirical

Model Evaluation

1. Are the assumptions realistic?

2. Is it understandable and manageable enough to be used in studying problems?

3. Does it have implications that can be tested using available data?

4. When the implications and the data are compared, are they consistent?

Normative vs Positive Statements

Positive economics: what are the effects of a policy?

Normative economics: should a policy be implemented?

*Normative statements are about value judgments

*This course focuses on positive economics, learning a variety of tools to analyze economy and make predictions

*With the analysis you create using these tools, you and others will make normative judgments

*It is important to think about the normative implications of your analysis

Key Variables & Terms

GDP
Capital good
Depreciation
Value added
Intermediate goods and services
Final goods and services
National income accounting
Income-expenditure identity
GNP
Current Account
Private disposable income
Savings
Wealth
Budget deficit
Stock
Flow
Price index
GDP deflator
CPI

Nominal
Real
Inflation
Interest rates
Expected real interest rate
Use-of-saving identity
Net foreign assets
Net factor payments from abroad
Net exports
National saving
Fundamental identity of national
Income accounting
Consumption

II. Measurement & Accounting

Remember some common questions asked in macroeconomics:

e.g., What influences economic growth? What affects unemployment?

In order to answer these, and other questions, it is important to have good measures – accurate & consistent data.

System of National Accounts (SNA)

*Used to compile accurate and systematic measures of aggregate economic activity of a nation or jurisdictional area.

*Sets up standardized measurement of macroeconomic variables based on a set of accounting principals.

*One of the common macroeconomic measures generated using the System of National Accounts is GDP.

"Economic growth in Canada is forecast to pick up gradually and average 2¼% over the projection." (Source: Bank of Canada Monetary Policy Report, October 2024)

What growth are they referencing?

*GDP is one of the most commonly cited measures of economic activity

*changes in GDP are frequently used as a yardstick for growth.

GDP (Gross Domestic Product): the market value[§] of all final goods and services produced in an economy during a fixed period of time.

[§]market value: the value of good(s) at market prices.

How is GDP calculated?

Three Ways to Measure GDP

1. The Product Approach

Sum all final goods and services produced in the economy at their market value.

Note: final output excludes intermediate production to avoid double counting.

Intermediate goods and services: those used up in the production of final goods and services within a fixed period of time.

Value added (of a producer): the value of it's output minus the value of it's inputs purchased from other producers.

Example:

Imagine an economy produced one pizza and that pizza is purchased within the year. The pizza parlour buys flour from a mill for $5 and sells the pizza for $25. The flour mill bought wheat from the farmer for $3 to make the flour.

$25 -Pizza
$5 -Flour
$3 -Wheat

Because Pizza is the only final product, GDP=$25.
(If you came up with GDP=$33, you would be double counting intermediate goods/services and GDP would be incorrect.)

Alternative Calculation:

Value Added (Product) Approach

25-5=20 from pizza parlour
5-3=2 from flour mill
3-0=3 from farmer

Summing all value added in the economy gives us the same thing: GDP=3+2+20=25

2. The Expenditure Approach

sum all final goods and services purchased in the economy

Pizza example:

GDP=total spending=1pizza=$25

Detailed Expenditure Approach

Personal Consumption Expenditure (C)
- Durable goods
- Semi-durable goods
- Nondurable goods
- Services

Investment (I)
- Residential Construction
- Nonresidential Construction, Machinery & Equipment
- Intellectual Property Products (IPP)
- Business Inventory Investment

Government Expenditures (G)
- Government Purchases of Goods and Services
- Government Investment

Net exports (NX)
- exports – imports

Statistical Discrepancy

Income Expenditure Identity:

$$\boxed{GDP = C + I + G + NX}$$

3. The Income Approach

Sum all income received by workers, the government and firms (wages, taxes, and profits)

Pizza Economy Example:

*Pizza parlour pays a wage of $5 to it's one employee, pays $5 to the mill for flour, and pays $5 in taxes.

*Mill pays an employee $1.75, pays $3 to the farmer for wheat, and pays $0.25 to government in taxes.

*Farmer pays $0.05 tax. So....

parlour profits = sales-wages-inputs(flour)-taxes
= $25 - $5 - $5 - $5
= *$10*

flour mill profits = sales-wages-inputs(wheat)-taxes
= $5 - $1.75 - $3 - $0.25
= *$0*

farm profits = sales - taxes
= $3 - $0.05
= *$2.95*

GDP using the income approach is:

wages: \$5.00 + \$1.75=\$6.75
taxes: \$5.00 + \$0.25 + \$0.05=\$5.30
profits: \$10.00 + 0 + \$2.95 = \$12.95

GDP = \$6.75 + \$5.30 + \$12.95 = \$25.00

Detailed Income Approach

Labour Income
Corporate Profits
Interest and Investment Income
Unincorporated Business Income
(total=net national income at factor cost)

Indirect Taxes less Subsidies
(total=net national income at market prices)

Capital Consumption Allowances/Depreciation

Statistical Discrepancy

Fundamental Identity of National Income Accounting:

Total Production = Total Expenditure = Total Income

This is true by definition

No matter which approach we use, product, income or expenditure, we have the same GDP

Each method for measuring GDP gives us a different perspective on which components contribute the most to an economy's production activities within a given time frame

Issues of Measurement: GDP

Does anyone have any concerns with these measurements of production?

Questions you might ask:
-is GDP comparable across countries?
-does it measure progress accurately?
-what about costs of resources?
-what about costs of pollution (dirty air, water, etc.)?
-do these GDP measures adequately capture quality or value?
-what about happiness?
-should GDP include home production?
-what about unpaid child care?

Some economists argue in favour of the commodification of goods and services for which markets may be missing

Others have argued against commodification of household production.

GDP measures "value", but how accurate is the total value if half of it is omitted from the equation? And what if the unmeasured portion grows faster/slower than the measured portion?

Economists are concerned about the adequacy of our measures of GDP, and this has led to a series of studies and some alternative (satellite) systems which have begun addressing many of the concerns listed here.

Further Elements of SNA

GNP (Gross National Product): the total market value of production by all of the national factors of production

What is the difference between GDP and GNP?

NFP (Net Factor Payments): income earned abroad by Canadian factors minus income earned in Canada by foreign factors.

GNP = GDP + NFP

Saving Identities & Formulas

Saving = current income - current spending

Yd = private disposable income
= the income that households have to spend
= income received from all sources, less taxes
= GDP + NFP + TR + INT – T
where INT is interest on government debt, TR is net transfers, and T is Tax

Yd = Y + NFP + TR + INT – T

Private Saving:

Spvt = private disposable income – consumption

Spvt = Yd – C
= (Y + NFP + TR + INT – T) – C

Government Saving:

Sgovt = net gov't income – gov't purchases
Sgovt = (T – TR – INT) – G

if Sgovt<0 then gov't has a budget deficit

National Saving:

$$
\begin{aligned}
S &= S_{pvt} + S_{govt} \\
&= (Y + NFP - T + TR + INT - C) + (T - TR - INT - G)
\end{aligned}
$$

$$S = Y + NFP - C - G$$

National Saving = total income – total spending of economy

Recall that **Y = GDP = C + I + G + NX**, so...

S = Y + NFP – C – G

S = (C + I + G + NX) + NFP – C – G

$\boxed{\mathbf{S = I + NX + NFP}}$

International Components in Savings

CA (Current Account): payments received from abroad less payments made to foreign countries by the domestic economy

CA = NX + NFP

so

S = I + CA

Now we have

S = Spvt + Sgovt = I + CA

so

$$\boxed{\textbf{Spvt = I + (- Sgovt) + CA}}$$

This is the uses-of-saving identity

Saving Vs Wealth (Measurement Type)

Flow Variable: calculated over (within) a period of time

Stock Variable: calculated at point in time

Wealth: the difference between an agent's assets & liabilities

National Wealth
= total wealth of all residents of a country
= domestic physical assets + net foreign assets

net foreign assets
= foreign financial & physical assets – foreign liabilities

Further Measurement Issues

Real versus Nominal Variables

Nominal Variable: a variable measured in terms of current market values

Real Variable: a variable measured in terms of a base unit

Accounting for Inflation

Inflation rate: percentage increase in the price level over a specific period of time

$$\pi_{t+1} = \frac{P_{t+1} - P_t}{P_t} = \frac{\Delta P}{P_t}$$

Where

π is the inflation rate

P_{t+1} is the price level in period t+1 and

P_t is the price level in period t

How is inflation measured?

Price index: measure of the average level of prices for some specified set of goods and services relative to the prices in a specified base year.

Three Commonly Used Indices:

1. **GDP deflator**: price index that measures the overall level of prices of goods & services included in GDP.

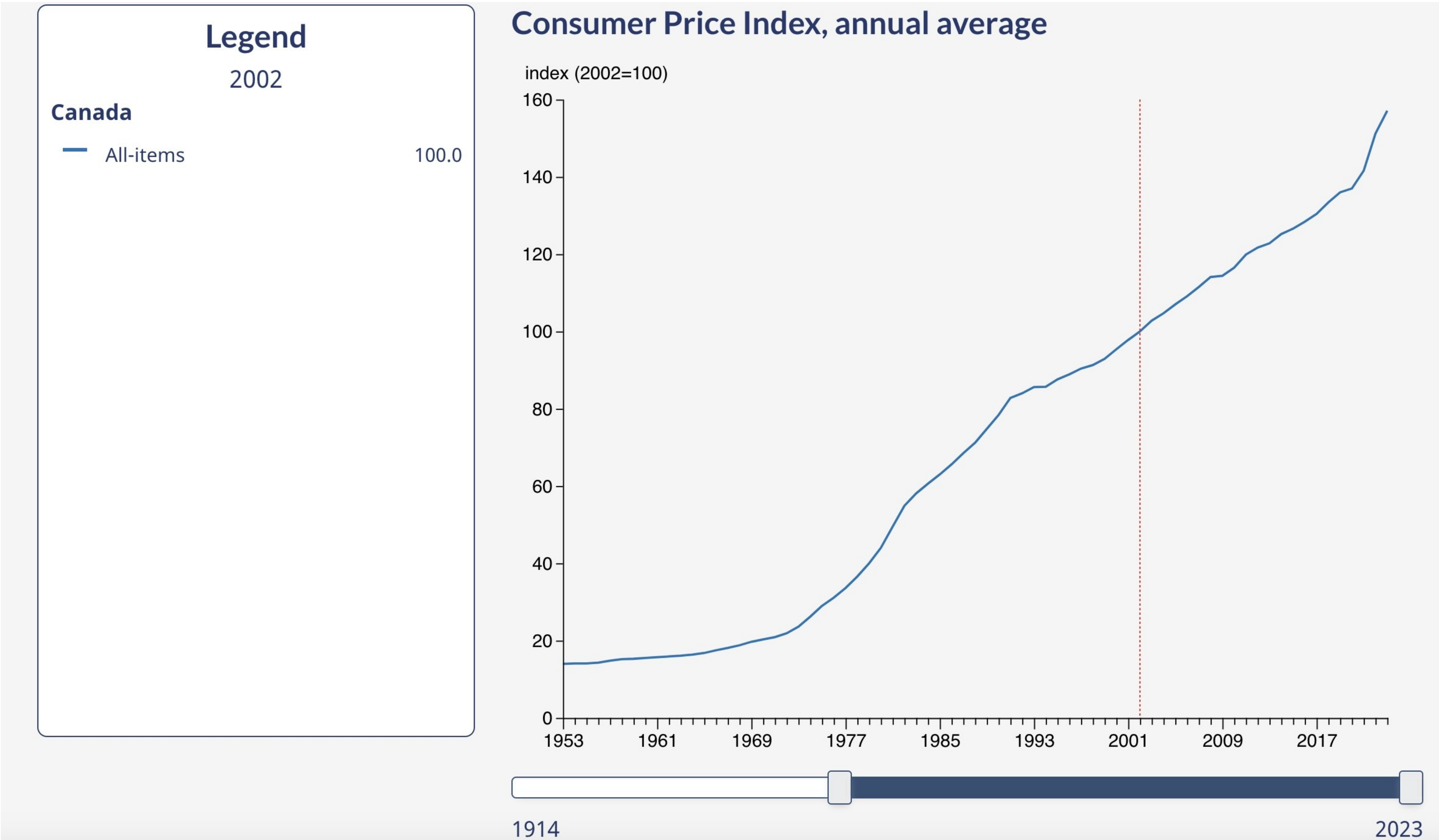
GDP deflator = nominal GDP/ real GDP

Example: Real GDP Calculation with GDP deflator

Suppose we have the following two product, two year economy

Product	*Quantity Year 1*	*Quantity Year 2*	*Price Year 1*	*Price Year 2*
e-Bicycles	10	30	$5,000	$3,000
Cars	100	150	$10,000	$12,000

2. **CPI (Consumer Price Index)**: measures changes in prices of subset of consumer goods, a fixed "basket" of goods, relative to a base reference period



Source: Statistics Canada's Consumer Price Index Data Visualization Tool, Price Trends 1914 to today, using Table 18-10-0005-01 Consumer Price Index, annual average, not seasonally adjusted, accessed at https://www150.statcan.gc.ca/n1/pub/71-607-x/2018016/cpilg-ipcgl-eng.htm

3. **Chain Fisher Volume Index**: a combination index which changes the base price and chains across time.

2001 Statistics Canada began to used chain Fisher volume indexes.

The fisher volume index process is as follows:

1. Calculate Fixed Weighted or *Laspeyres Volume Index*. This index covers a 1 year change with prices fixed at the earlier of the two years.

$$\textbf{Laspeyres index} = \frac{\text{GDP in year t+1 at year t prices}}{\text{GDP in year t at year t prices}}$$

2. Calculate Current Weighted or *Paasche Volume Index*. This index covers a 1 year change with prices fixed at the later (most current) of the two years.

$$\textbf{Paasche index} = \frac{\text{GDP in year t+1 at year t+1 prices}}{\text{GDP in year t at year t+1 prices}}$$

3. Calculate the Fisher Volume Index. This is the geometric mean of the previous two.

Fisher Volume index= $[(\text{Laspeyres index})(\text{Paasche index})]^{1/2}$

The chained fisher volume index (for a difference of more than1 year) is determined by multiplying subsequent indexes.

Ex/ for year 3 it is: (year 1 to 2)×(year 2 to 3).

These indexes give the real growth of GDP between the periods indicated, and as such Real GDP in subsequent periods should be calculated by multiplying the chain Fisher index by the initial (base) year GDP (previous periods are the product of the base year GDP and the inverse of the chain fisher index).

Issues with Consumer Price Indexes & “real” GDP

1. Basket becomes outdated
2. Goods may have not existed then & do now
3. Historical measures of real GDP often have to be recalculated for any comparison

Exercise:

1. Download annual nominal & real GDP from Statistics Canada over multiple years

(Table number, 36-10-0222-01, formerly CANSIM 384-0038)

2. Plot these series across time using software of your choice. What do you observe?

3. Now try this for another country of your choice (use the World Bank Data Bank). What do you observe?

Interest Rates

Interest rate: rate of return promised by a borrower to a lender

Nominal interest rate (i): the rate which is agreed upon between the borrower & lender

Real interest rate (r): the rate at which the real value of the asset (loan value) increases over time

The relationship between nominal and real interest rates can be characterized by

$$(1 + r) = \frac{(1 + i)}{(1 + \pi)}$$

When nominal interest rates and inflation are typically low, real interest rates can be approximated by

$$r \approx i - \pi$$

If we are in a period of high inflation and low constant interest rates, is it better to borrow or to lend?

Since we typically don't know what inflation will be until the next period is realized, we need to use expected values

The expected real interest rate is approximated by the nominal interest rate minus expected rate of inflation

$i - \pi^e$

III. Economic Frameworks

Basic Graphing - Review

We frequently graph in Economics

Often, our graphs our two dimensional – describing relationship(s) between two variables

Generally, what we are graphing is the theories of our models (we are graphing the algebraic expressions of the behavioural relationships between these two variables), e.g. wage and labour supply, or wage and labour demand, or price and consumption demand

Lets suppose our theory suggests that as the price of Carrots rises, we demand fewer carrots (our Carrot demand decreases).

That is the theory expressed in words. We might then say: demand for carrots is a function of the price of carrots.

Algebraically we might write: $C^D = f(P_C)$

where C^D is the quantity of carrots demanded, P_c is the price of carrots, and f is an unspecified function

To simplify, we might assume that f is a linear function, representing a linear relationship that looks something like: $C^D = f(P_C) = a + b^* P_C$

Our theory suggests that the relationship between carrot demand and price is negative
But how do we graph it?

Since Economists typically put price on the vertical axis, we should transform this consumption demand equation to isolate price on the left hand side

$C^D = a + b*P_C$

or

(exchange left and right sides)

$a + b*P_C = C^D$

so (then subtract a from both sides)

$b*P_C = -a + C^D$

(divide both sides by b)

$$P_c = \overset{+}{\frac{-a}{b}} + \overset{-}{\frac{1}{b}} C^D$$

Now we map this equation graphically.

$$P_c = \frac{-a}{b} + \frac{1}{b}C^D$$

intercept slope

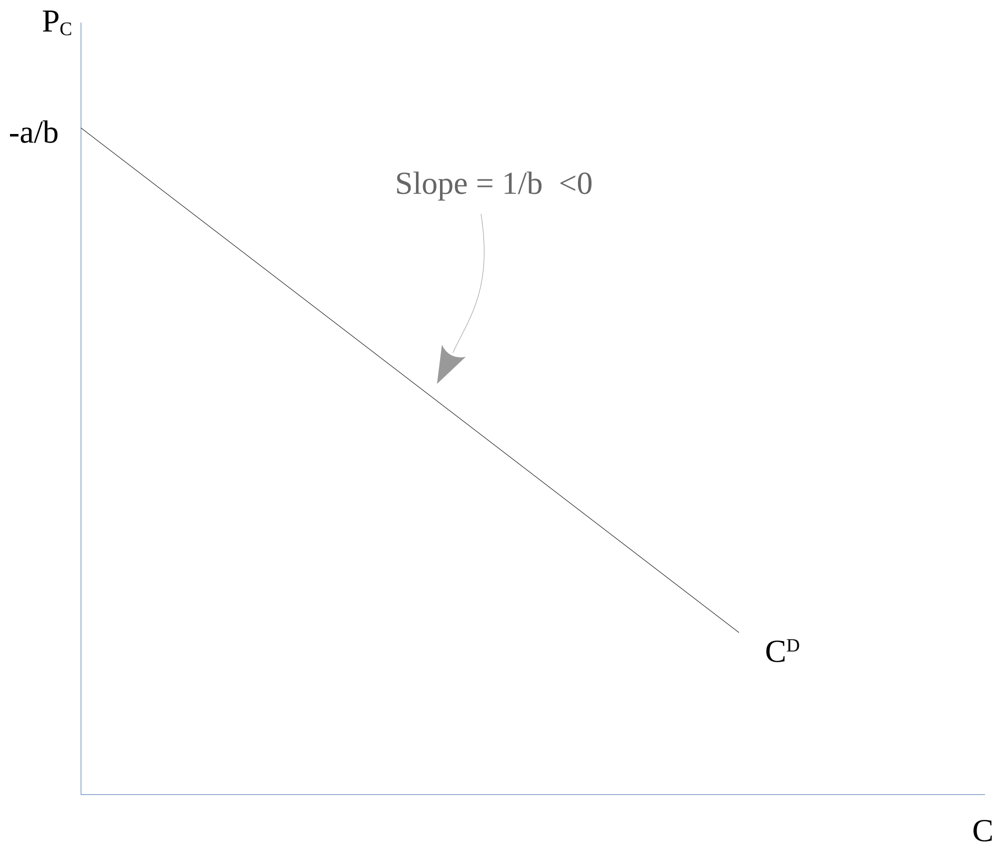
When mapping a linear equation into a cartesian plane, keep in mind that whatever is pre-multiplying by C (the horizontal variable) is the slope of this line.

(Recall, slope is rise/run. The change in P given a change in C)

So the slope is 1/b, a negative number since b<0

Whatever is <u>not</u> multiplied by our horizontal variable (C) is the vertical intercept (the value when C is set to 0). If b<0 then the intercept will be positive as long as a>0. (We could assume a>0 because prices are generally not negative)

Graphically, our theory on the relationship between C and P_C (as expressed in our equation) should look something like this:



Try a slightly more complicated example:

Suppose that theory suggests higher levels of Annual Income lead to higher numbers of pets (because pets are good, and if you have more money, you can afford to care for more)

Lets also suppose that kids love pets, and parents want kids to be happy, so the more kids you have, the more pets you have as well.

Our theories could be represented in the equation:

Pets = a + b*Kids + c*Income

where Pets is number of pets, Kids is number of kids, Income is Annual Income, and theory suggests both b and c are positive

As Pets is our outcome, and we've isolated it on the LHS, that means we're thinking of mapping our equation with Pets on the vertical axis. We have two variables on the RHS, so which goes on the horizontal axis?

The variable of primary interest should be on the horizontal axis. So if our primary interest is the relationship between Income and Pets (and/or if the only reason we include kids is to ensure we are controlling for all other factors that might confound the effect of Income on number of Pets purchased), then Income is on the Horizontal axis.

Is the relationship between Income and Pets linear according to our equation?

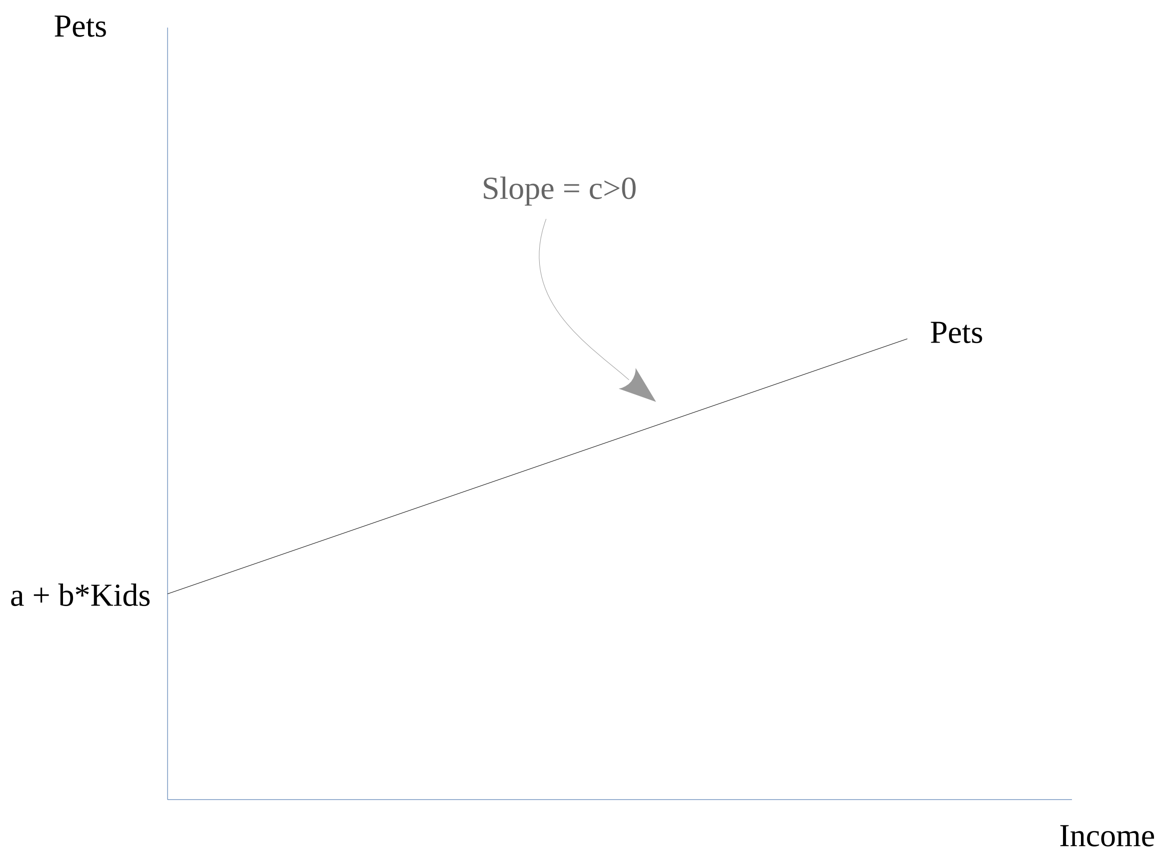
What is the slope?

What is the vertical intercept?

Since you can't have negative pets, even if income is zero. The intercept should be positive.

So a+b*Kids>0

Our line Pets = a + b*Kids + c*Income will have a positive intercept and be upward sloping, so should look something like this:



This line is in a fixed position given a particular number of kids, e.g. if kids=1, then the intercept is a+b.

What if kids=2? Then the intercept is a+2b. So when we have variables in our intercept, these variables act as shift factors in our lines.

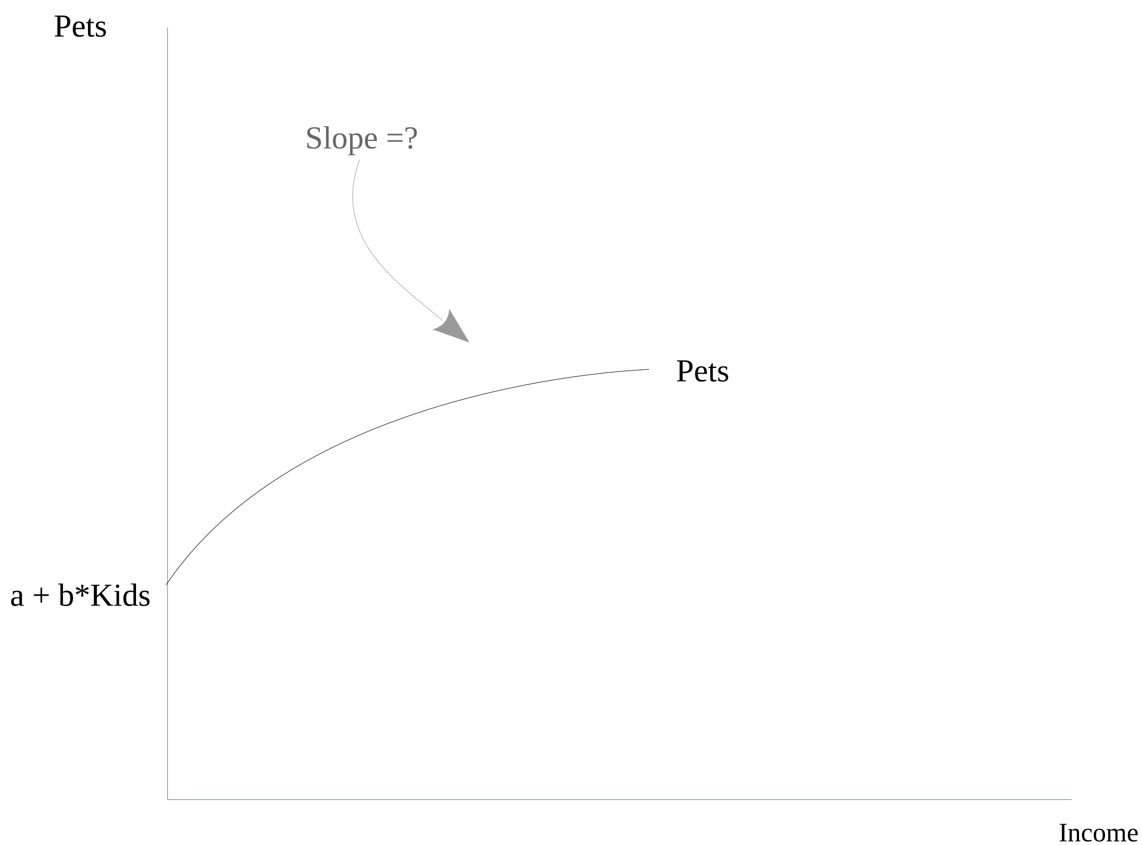
Note: we frequently have non-linear relationships

The major difference with non-linear relationships is that the slope of the curve is not constant – but changes depending on the value of the horizontal variable.

E.g., the relationship between Income and Pets may be non-linear. It is possible that as Income increases, Pets will increase but at a decreasing rate. This relationship might be better depicted as:

Pets = a + b*Kids + c*ln(Income)

Our curve Pets = a + b*Kids + c*ln(Income) will still have a positive intercept (a+bKids), but will increase at a decreasing rate like this:



The slope: the increase in pets given an increase in Income, is c/income (the first order partial of c*ln(income) with respect to income.

$$\text{Slope} = \frac{\partial\,\text{Pets}(.)}{\partial\,\text{Income}} \;=\; \frac{\partial\left(a + b * \text{Kids} + c * \ln(\text{Income})\right)}{\partial\,\text{Income}} \;=\; c\,\frac{1}{\text{Income}}$$

This slope is the slope of the line tangent to our curve at any specific income

We can roughly approximate the slope at any given income level by taking a one unit changing the value of income, calculating the change in value of Pets. Then divide the calculated change in the value of Pets by the change in the value of Income (1) . This approximation method uses the change in the value of the vertical variable (rise) over the change in the value of the horizontal variable (the run), linearly.

In addition to graphing theoretical relationships, we also graph data, and sometimes observable patterns in raw data motivate and/or inspire the theories we present.

e.g. Among a set of countries it was observed that countries with lower initial income experienced higher subsequent growth. Motivates *convergence theory*

See figure 1 of NBER working paper 2419: https://www.nber.org/system/files/working_papers/w2419/w2419.pdf

Note figure 2 - relationship no longer clear

These figures contained scatter plots, but there are many ways to graph data: ex/ scatter, line graph, bar chart, pie chart

Choose best graph type for what you want to highlight

Comparing across regions, bar graphs might be most appropriate, e.g., https://www150.statcan.gc.ca/n1/daily-quotidien/230830/cg-b002-eng.htm

If you are looking at weights or components adding to 100% pie charts are popular. See page 5 of https://www.bankofcanadamuseum.ca/wp-content/uploads/2024/05/charts_answer_key.pdf

Obtaining Data

When looking for data, be aware of the type of data you will be using: e.g., cross section (multiple entities at one point in time), time series (one entity across multiple periods of time), panel (multiple entities across multiple points of time) & pooled cross section (multiple entities at one point in time, pooled with another set of entities at a different point in time)

When seeking data it is important to consider whether the data you decide to use is appropriate for your model. Also, be sure to apply the techniques appropriate for your data and model

Primary sources of aggregate data include: National Statistical Agencies and Government Affiliated Organizations (e.g. Statistics Canada, Bank of Canada, BEA, FRED and many more), Research University/Institution organized data repositories (e.g., Pen World Tables), International Organization data repositories (e.g. World Bank, UN, IMF, OECD)

These latter usually source their data from the national statistical agencies. Be careful & aware of definitions & practices that may vary across country.

Modelling Concepts

Model: a disciplined framework to represent theories, test hypotheses, and to evaluate choice/policy outcomes

Models are based on theories about how the economy functions and how agents in the economy behave

Economic models are typically depicted using mathematical and/or statistical expressions

Economic models are constructed to represent the economy (or parts of the economy) in a simplified way

Moreover, economic models are designed specifically to enable us to test hypotheses about economic behaviour and economic relationships

Economists usually classify economic analyses into two broad categories: Theoretical and Empirical

However both Theoretical and Empirical analyses are based on theory; both formalize theory with models, and both test hypotheses

Theoretical analysis typically employs mathematical expressions to formalize economic theory (through a set of algebraic equations governing behaviour, constraints, economic structures and institutional rules). Solutions to these models are then used to make predictions that we can test (testable predictions).

Empirical analysis is also founded on theory but is focused on using data as well as mathematical and statistical techniques to test hypotheses generated by economic theory and estimate the magnitude of relationships

Any study may contain both Theoretical *and* Empirical analysis

Indeed, most empirical analysis contains some theoretical component. And many theoretical papers include some empirical or quantitative component

Economic analyses often following a common pattern:

1. Describe the research question and what motivates this question (what are you trying to answer and why?)

2. Explain the theoretical framework in which you will aim to answer this question (& test the hypotheses). This step includes explaining (in words) your theory on the underlying behaviours, constraints and economic structure

3. Formalize the theory mathematically and/or statistically

Typically, you would construct a set of algebraic expressions to characterize the behaviours, constraints and structures and institutional rules in/of the economy

These sets of equations are used to construct predictions (e.g. predictions of relationships between variables which help to answer our research questions) which can then be tested against/using data.

In an empirical framework, you would present statistical equation(s).

Often, empirical analysis is conducted on a reduced form solution to a structural model.
4. Calibrate or Estimate the model to obtain quantitative estimates and test hypothesis using the data.

5. Interpret the outcomes of the model & calibration/estimation with respect to your research question. What can you say in response to your question? What caveats do you need to state regarding the limitations of your work?

Simple example:

1. Research question and Motivation
We want to understand the relationship between job training and wage level.
Question: Is job training associated with a higher wage level?
The motivation is that if training programs improve wages, it may be a good policy to fund them nationally, so that wage level rises & households earn more.

2. Theoretical framework: Economic theory suggests that training (like other forms of human capital) improves the productivity of workers, so each unit of

labour will have a higher marginal product. If we are operating in a perfectly competitive market, profit maximizing firms will pay workers their marginal product. Using a market clearing framework we predict that additional training will increase the marginal product of labour, increase labour demand at any given wage, and increase both equilibrium wage and employment.

3. Formalize the theory (this is a very simple linear example of labour demand & supply curves, derived from the underlying behavioural relationships –we'll discuss the underlying utility and profit maximization decisions later as they are often the first thing presented to formalize & characterize underlying behaviour)

Max Utility → $N^S = a + b\text{Wage}$

Max Profit → $N^D = d + g\text{Wage} + k\text{Training}$

What does the model predict is the equilibrium relationship between Training & Wage?

We can solve the system of equations to obtain the predicted equilibrium relationship

Market clearing condition: $N^S = N^D$

$$a + bWage = d + gWage + kTraining$$

$$\rightarrow \quad Wage = \frac{(d-a)}{(b-g)} + \frac{k}{(b-g)} Training$$

$$Wage = \alpha + \beta \, Training$$

In an empirical framework, you would present statistical equation(s) by denoting the uncertainty (with an error term), and the data type that would be used to estimate the relationship (with a subscript).

$$Wage_c = \alpha + \beta \, Training_c + u_c$$

Where c represents country, and u is the error term.

4. In a theoretical analysis you might discuss the qualitative predictions and calibrate a-k to generate quantitative predictions (some theoretical papers also

contain estimation). In an empirical analysis, you might use data and statistical methods to obtain an estimate of β. Learn about these techniques in advanced Economic Theory and Econometrics courses

5. Interpretations, Caveats and Limitations: You can make a statement about what your model suggests the relationship to be, and policy implications thereof

Here, you might use some of the model evaluation criteria to help frame the caveats and limitations (Are there assumptions that aren't realistic, and does that impact the results? Is the model understandable and manageable? Are the data reasonable to test the assumptions? Is the model consistent with the data?), we might note some of the concerns that arise via our model evaluations –this model is limited by the assumptions of our perfectly competitive market clearing framework. Are these limitations likely to be major issues? More on Caveats and Limitations of Economic Analysis will be discussed in advanced courses. In particular, <u>correlation</u> does not imply <u>causation</u>. (So finding that higher training correlates with higher wages, does not imply that training causes wage increases).

Note, you may hear the terms structural and reduced form used frequently in economics. You will not be tested on this terminology in 102, but it is good to introduce the terms now so that you begin to become familiar with them.

Structural Model: the set of algebraic expressions that represent the economic theory (the underlying behaviours, constraints, and institutional rules). Structural parameters refer to the parameters that characterize those structural relationships.

Reduced form: characterizes the relationship without detailing the specific components of the relationship between variables. Usually does not have direct behavioural interpretation. Reduced form solutions typically isolate the predicted outcome of interest on the left hand side

Throughout this course we will illustrate concepts using simple examples, often employing a basic market clearing, perfectly competitive markets framework. But there are a multitude of different types of models, which may be more/less appropriate depending on the context/question.

There are several broad classes of models and choices you can make when designing your model.

We typically classify models according to regularities they are designed to explain, or the type of market we face

Examples of commonly used model classifications are:

Treatment of Information
e.g. full information vs missing or asymmetric information

Time Dimension
e.g. static vs dynamic

Treatment of State Dependency
e.g. deterministic vs stochastic

Type of Agent(s)
e.g. representative agent vs more than one type of agent

Scope
e.g. Partial vs General Equilibrium

Market Functionality
e.g. market clearing vs non-clearing models

Which class of models would be more appropriate to study business cycle or recession duration, Static or Dynamic?

Modern macroeconomic models are frequently Dynamic models

Macroeconomic models are also frequently designed with Stochastic and General Equilibrium frameworks

Many non-equilibrium, non-market clearing models are also popular – e.g. search & matching models

A once popular way to introduce macroeconomic modelling to 1st and 2nd year students was to use the IS-LM model (this GE model is presented in many text books). However, many macroeconomists have concerns about the basic IS-LM, and its usefulness given that it is not a dynamic model, & given its treatment of some markets/ behaviours. We won't cover IS-LM in this course

Model Elements

Variable: refers to an item (e.g. price, interest rates, consumption, investment, GDP) that can take on different possible values

Variables represent both the inputs to models, and the outputs from models

Two broad types of variables:

Endogenous: determined within the model

Exogenous: determined outside of the model

Parameters: characterize the strength and direction of relationships between variables. (the a, b, g's and α, β, ɣ's)

In theoretical analysis, parameters are sometimes calibrated, but they can also be estimated, as they are in empirical analysis

Estimation is conducted by applying the model to data, to determine (and test) the predicted relationship between variables

Building Macroeconomic models

Macroeconomic models are built by incorporating several components of the economy (components that are important for understanding the relationship between the variables of interest, and the behaviours that govern those relationships. The components can comprise models in & of themselves)

Components of economic models are often framed in relation to **markets** (e.g., labour, goods, financial, etc.), market **participants** (e.g., buyers, sellers, regulators), &or **outcomes** (e.g., prices, quantities, aggregates, and distributions)

We typically aim to predict outcomes by modelling the behaviour of the **participants** (e.g., sellers' supply, buyers' demand)

In order to do that, we need to understand their preferences/ objectives, as well as the environment and constraints in which they function (in which they make decisions)

Production processes or production functions are a key component that helps us understand firms' supply decision (how much they wish to sell in the goods market), but also firms' demand for inputs (e.g. labour and capital) in their respective markets

Factors of production: inputs such as capital, labour, raw materials, land and energy utilized by the producers in the economy

How much of each factor do firms want?

Aggregate Production Function (Basic Example)

$Y=A\times F(K,N)$

where

Y=real output produced

A=a multiplicative productivity effect

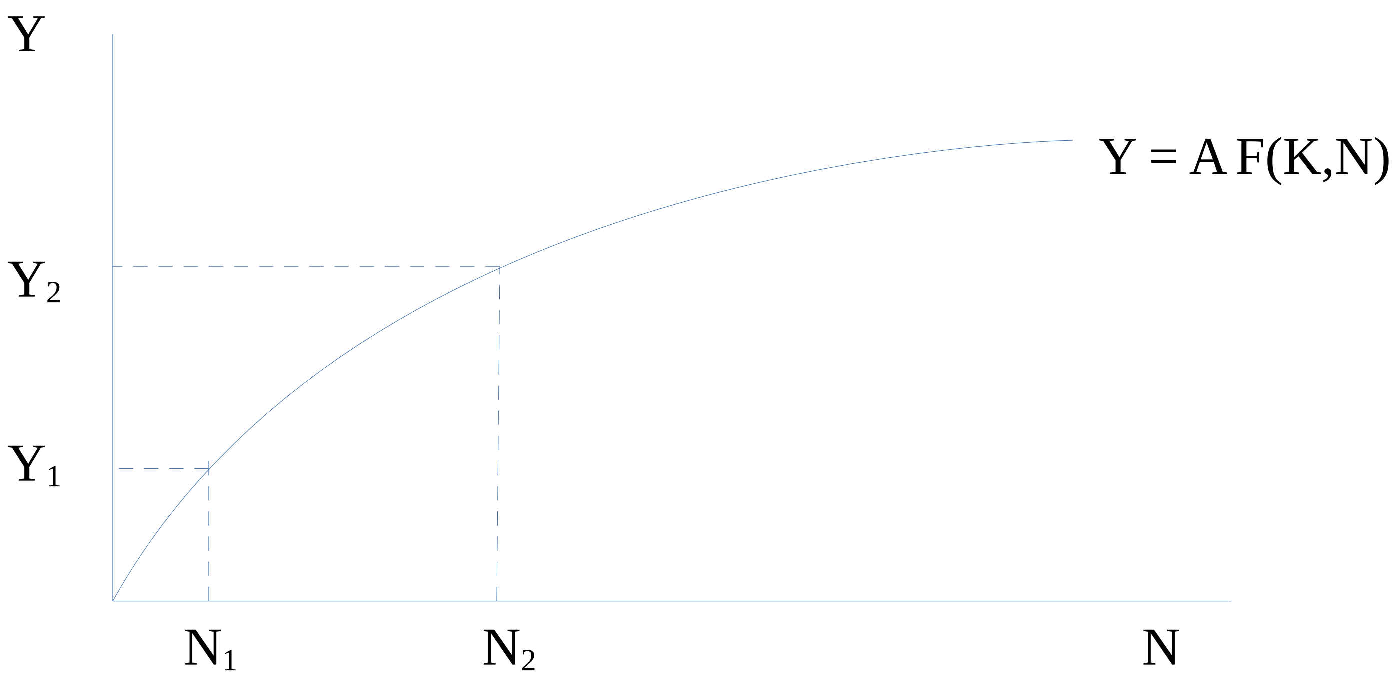
K=quantity of capital used

N=the number of workers employed

F=a function specifying how much output is derived from given quantities of input K & N

*Given the production function above, we can graph changes in output due to changes in one, or the other of the inputs

Ex/ Graph of Production at various N, holding K&A fixed



Firms objective: Profit Maximization

Profit maxing quantities of N & K determined by:

*Marginal Product of Labour (MPN)

=the increase in output resulting from a one unit increase in labour

$=\Delta Y/\Delta N$

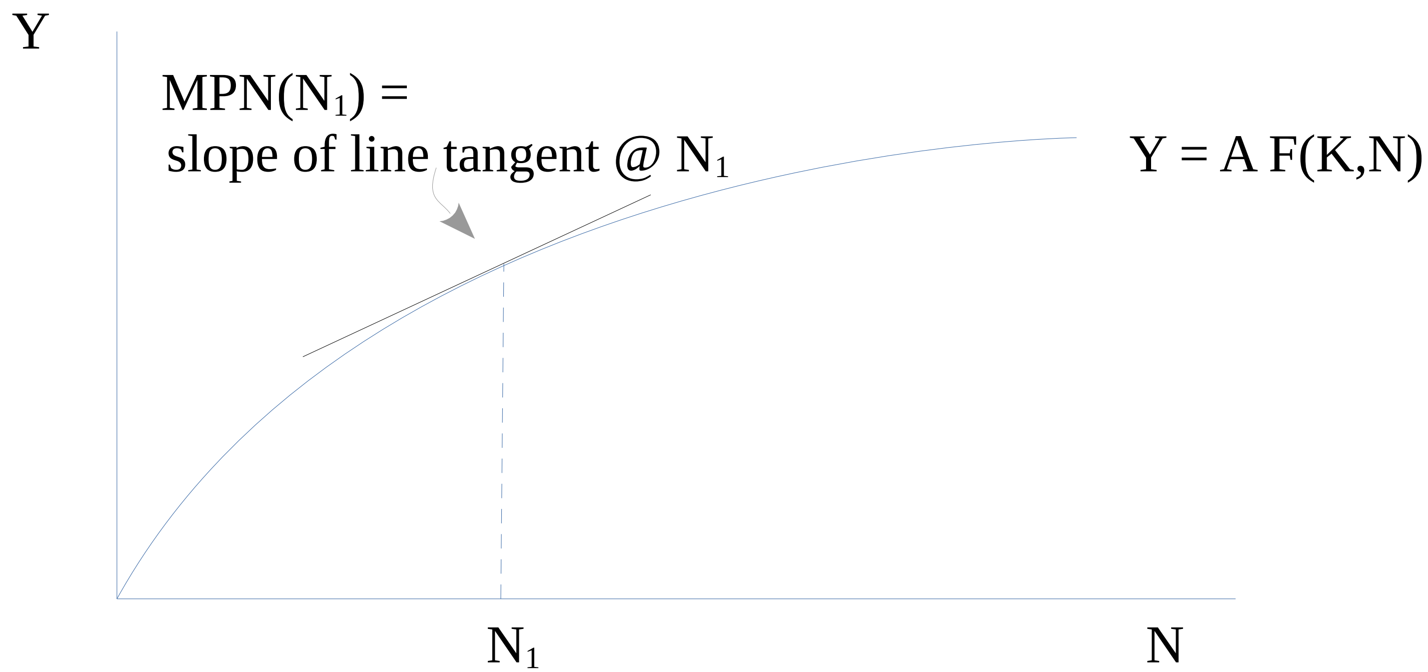
*Marginal Product of Capital (MPK)

=the increase in output resulting from a one unit increase in capital

$=\Delta Y/\Delta K$

*Relative Prices

Production



TFP – Total Factor Productivity

A is generally calculated using the "known" factors of Y and F(K,N)

if $Y=A \times F(K,N)$ then $A=\frac{Y}{F(K,N)}$

The level of A is important in firms' decision making, and factor markets, because it influences MPK and MPN

Example of a basic production function:

$A \times F(K,N) = A\,K^{0.3}N^{0.7}$

Note: The form of this function is called Cobb-Douglas

$Y=AK^{\alpha}N^{1-\alpha}$ where $0< \alpha <1$

α = capital owners' share of income from production

$1-\alpha$ = labour owners' share of income from production

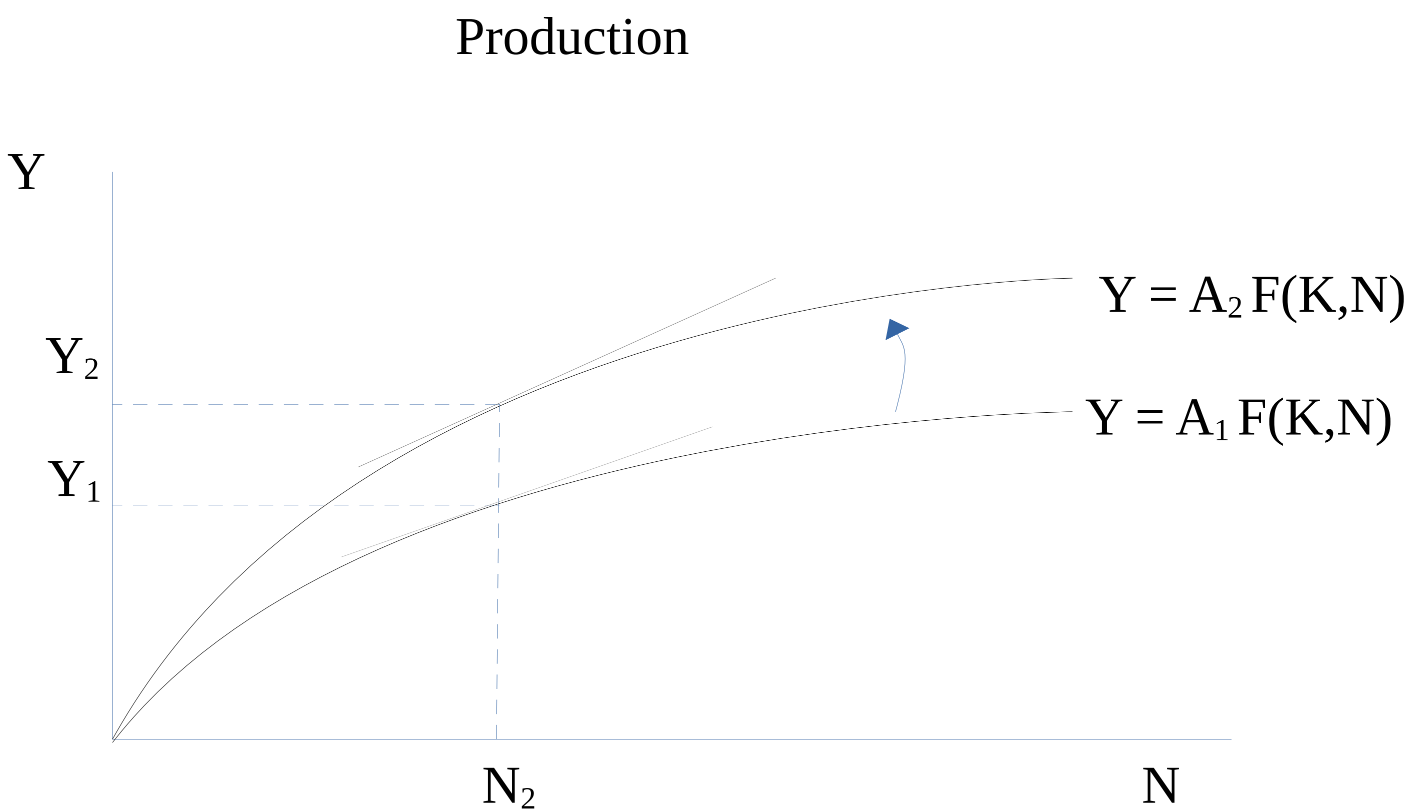
Productivity growth: the percentage change in TFP (A) from one period to the next.

*Changes in A are known as supply shocks or productivity shocks

*Positive supply shocks increases the amount of output that can be produced for given quantities of labour and capital. (& vice versa)

*Changes in A are important for predicting changes in factor markets and understanding & predicting aggregate outcomes

Ex/ positive supply shock on production



IV. Labour Market, Employment & Unemployment

The Labour Market is another common element in macroeconomic modelling, one that enables us to investigate Employment and Unemployment outcomes, as well as the impact of Labour Market shifts on broader Macroeconomic outcomes

The labour market is often modelled in and of itself, but it can also be included as a part of a larger general equilibrium macroeconomic model

There are many ways to model the labour market, we'll begin with a simple market clearing framework

Common Assumptions

1. All workers are identical
2. Firms are perfectly competitive
3. Firm’s goal is to maximize profits

Simple Market Clearing Model Example:

<u>Labour Demand</u>

How do firms determine how many workers to hire?

* To determine how many workers to hire, firms need to compare the costs and benefits of hiring an additional worker

What are the benefits of hiring on more worker?

$$MPN \times P = \mathbf{MRPN}$$

MRPN is Marginal Revenue Product of Labour

What is the cost of hiring an added worker?

$$\mathbf{W}$$

nominal wage: the wage that is paid to worker

Hiring Rule (Profit Maximizing Decision)

firm will continue to hire so long as MRPN $\geq$ W

Firms maximize profits by hiring until

MRPN = W

How do we know this maximizes profits?

Profits = revenue – costs = P x Q – N x W

Q is quantity produced by the production process, e.g., A*F(K,N)

Profit is maximized where the first order partial derivative of the profit function w.r.t. N equals zero

That is:

$$\begin{aligned} P*MPN - W &= 0 \\ P*MPN &= W \\ MRPN &= W \end{aligned}$$

Note also that W=Marginal Cost, and MRPN is Marginal Benefit, so profit maximization occurs where MB=MC

So our hiring rule is derived from profit maximization. Note that MRPN and W are in nominal terms

What is the hiring rule in real terms?

$$\mathbf{MPN = w}$$

where

$$\mathbf{w = \frac{W}{P} = \text{real wage}}$$

real wage: nominal wage divided by price level

Economic models often discuss outcomes in real terms

Labour demand can be written as function of real wages in a complex or simple way, e.g. $N^D=f(w)$ where $f'(w)<0$

Labour Demand Curve

Labour demand curve: the amount of workers a firm will wish to hire at given wages

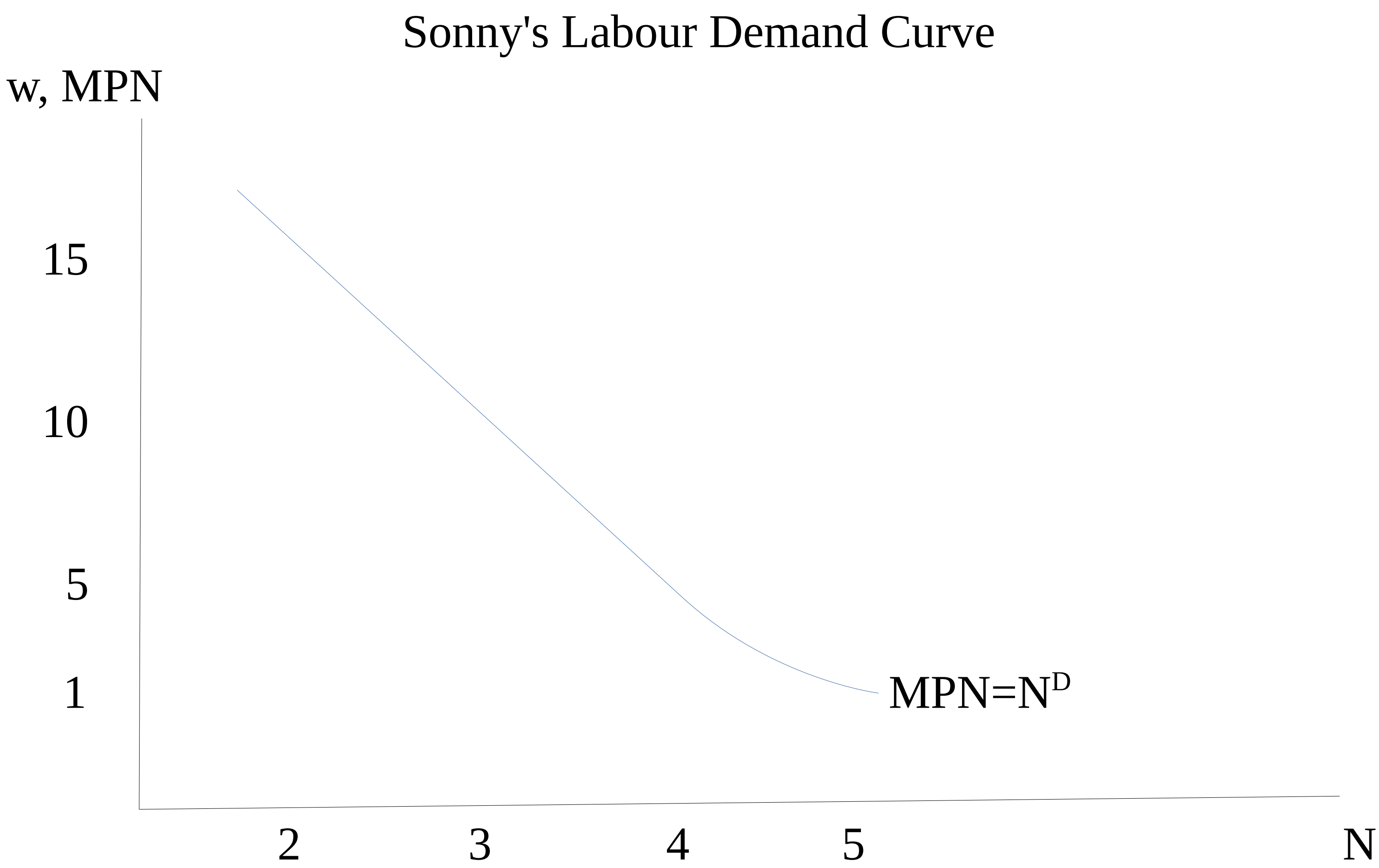
Ex/ Suppose Sonny's hamburger joint faces the following MPN schedule, and let P=1:

# workers	Hamburgers Produced	MPN
1	10	10
2	25	15
3	35	10
4	40	5
5	41	1

How many workers will Sonny's want to hire if wage is $10?

What if wage drops to $5?

Because demand is determined where MPN=w, Sonny's labour demand curve is MPN (whenever it is decreasing):



Note: we could characterize Sonny's linear portion of their demand curve as $N^D=5 - w/5$ (or as we graph it: $w=25 - 5N^D$)

Aggregate Labour Demand: the sum of all labour demands of all firms in the economy

e.g. 100 firms like Sonny's would mean an aggregate labour demand of $N^D=500-20w$ (or as we graph it $w=25-N^D/20$). Of course, a more complex function would incorporate more depending on the research question e.g. $N^D=f(A,K,w)$

Some Factors that Shift Labour Demand Curve

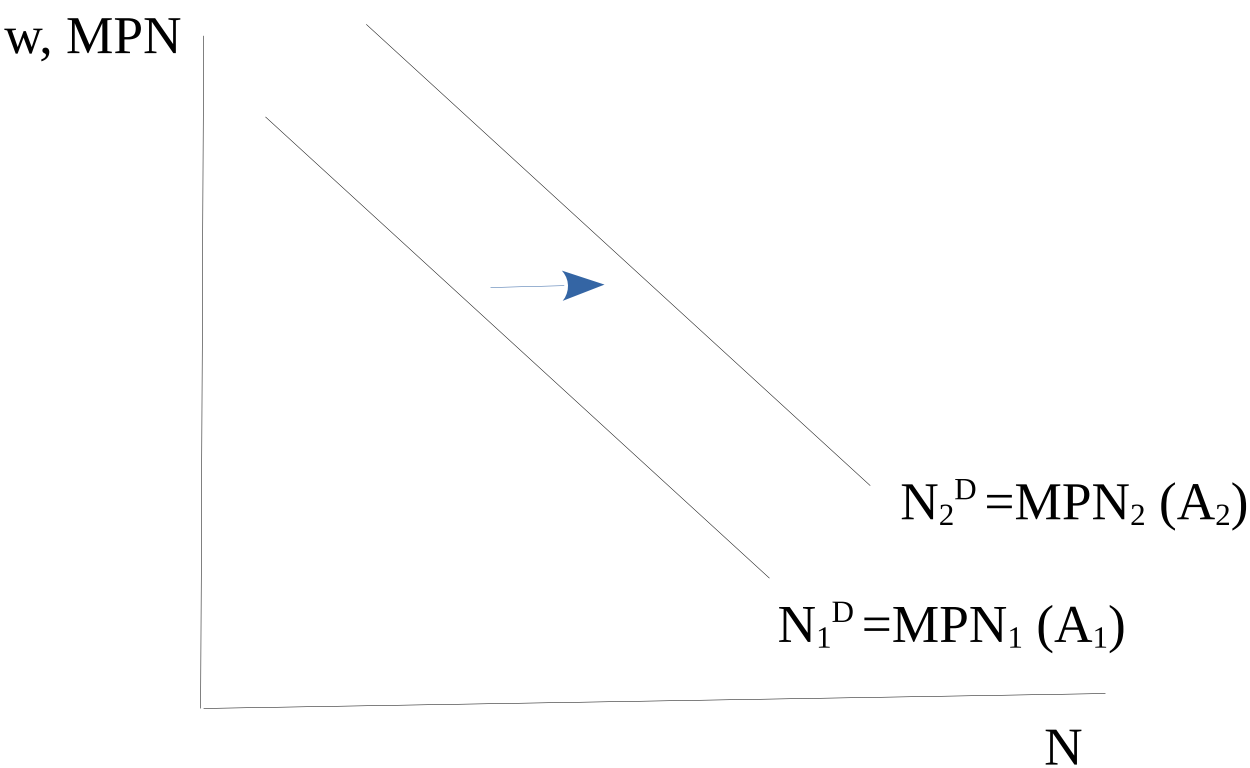
1. Beneficial productivity shock

2. Higher capital stock

How do you show these changes graphically?

ex/ increase in labour demand due to rise in A:

Aggregate Labour Demand Curve



Labour Supply

Labour Supply: labour the worker is willing to supply

One way to determine labour supply to use a simple labour-leisure decision framework, where individual or household labour supply decisions are based on the tradeoff of between consumption and leisure (more hours of leisure means fewer hours of work and less consumption possible due to lower total income). Workers choose leisure (labour) that maximizes utility subject to their budget constraint

→ solution gives us labour supply as a function of wage

We'll simplify – and just depict the resulting (general) relationship:

As wages rise, worker is willing to supply more labour

Labour supply could be depicted by a complex/simple function, e.g. $N^S=f(w)$ where $f'(w)>0$

as an example: $N^S=w/2$

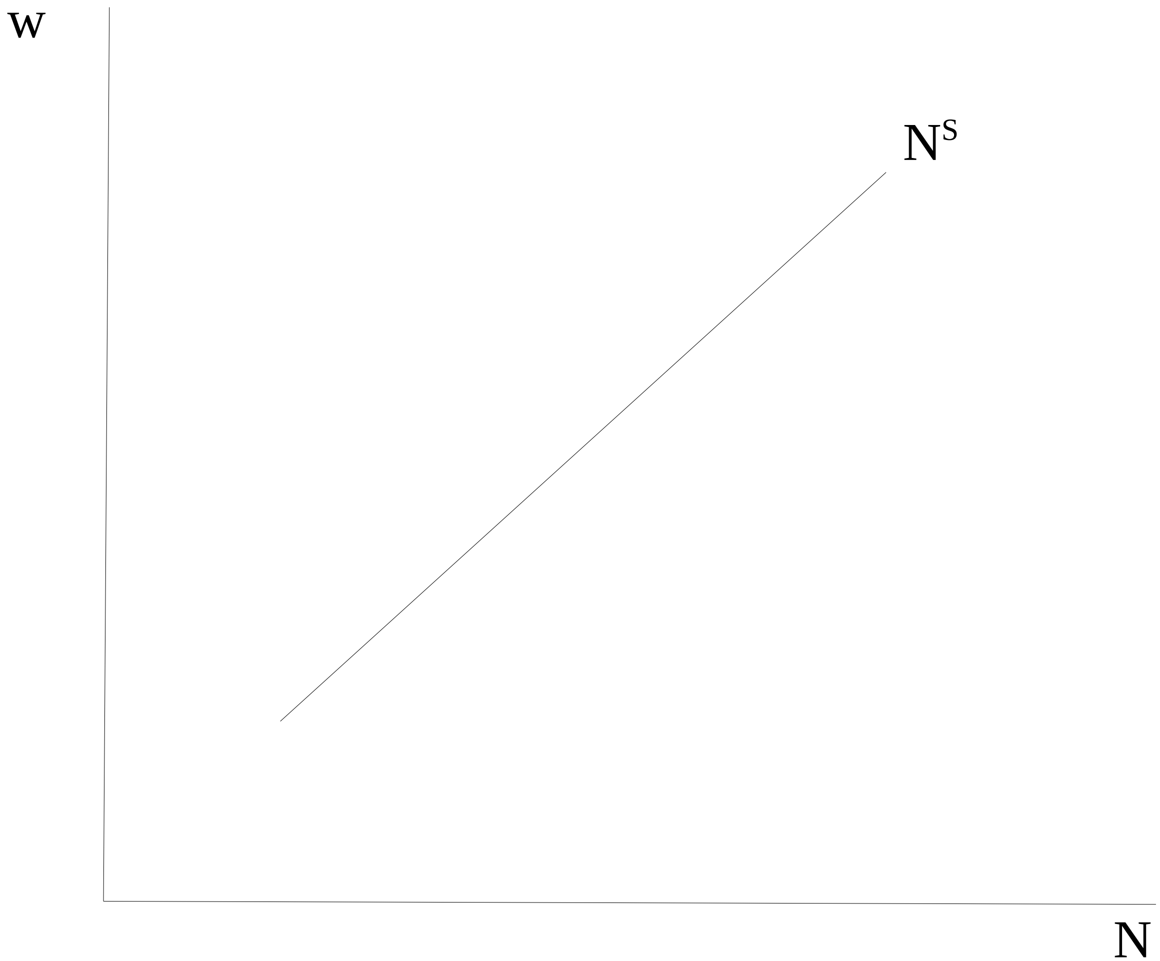
Labour Supply Curve

Labour Supply Curve: the labour the worker is willing to supply at given wages

Aggregate Labour Supply: sum of all individual labour supply

Aggregate Labour Supply curve: sum of all labour that workers are willing to supply given at wages

Labour Supply Curve (aggregate)



Factors that Shift Labour Supply Curve

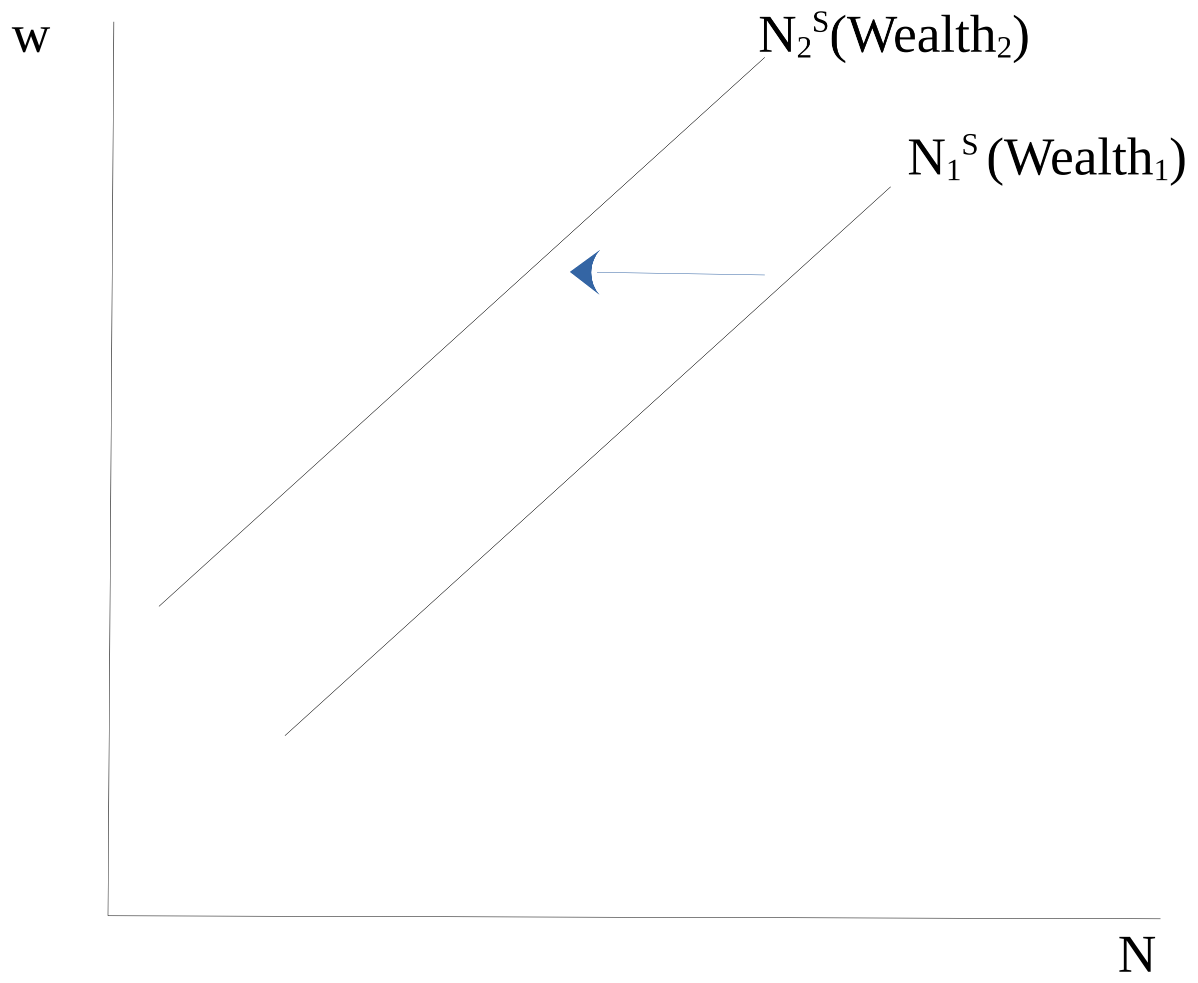
1. Wealth: increase in wealth will decrease the labour supply

2. Expected future real wage: increase in $E[w^f]$ will decrease the labour supply

3. Population: increase in population will increase labour supply

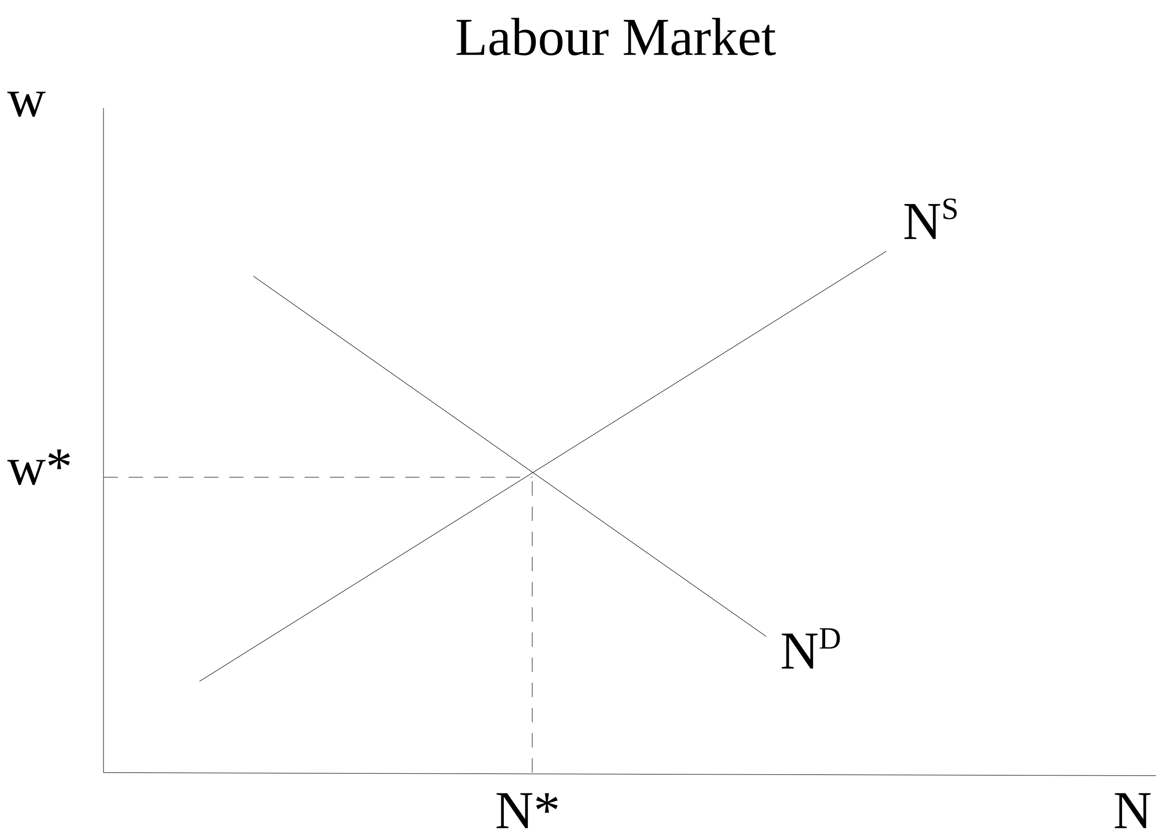
4. Participation rate: Increase in LFP will boost labour supply

Ex/ increase in Wealth



Labour Market Equilibrium

In this simple, market clearing, labour market example, equilibrium occurs when $N^D = N^S$



Labour Market Equilibrium and Potential Output

What the economy actually produces is typically called output (or national output or national income or actual output), and is denoted by Y

Full Employment Output (or Potential Output): is a measure of what the economy would produce if all resources were fully employed, sometimes denoted by Y^*, $\bar{Y}$ or FE

Full-Employment level of employment: the equilibrium level of employment, N (or N^*, or $\bar{N}$)

The simple market clearing labour model is useful in that it can be used to predict wage changes under a variety of demand and supply shifts.

However, there are aspects of the labour market that this simple model fails to capture. For example, unemployment dynamics. This model predicts zero unemployment at equilibrium, always

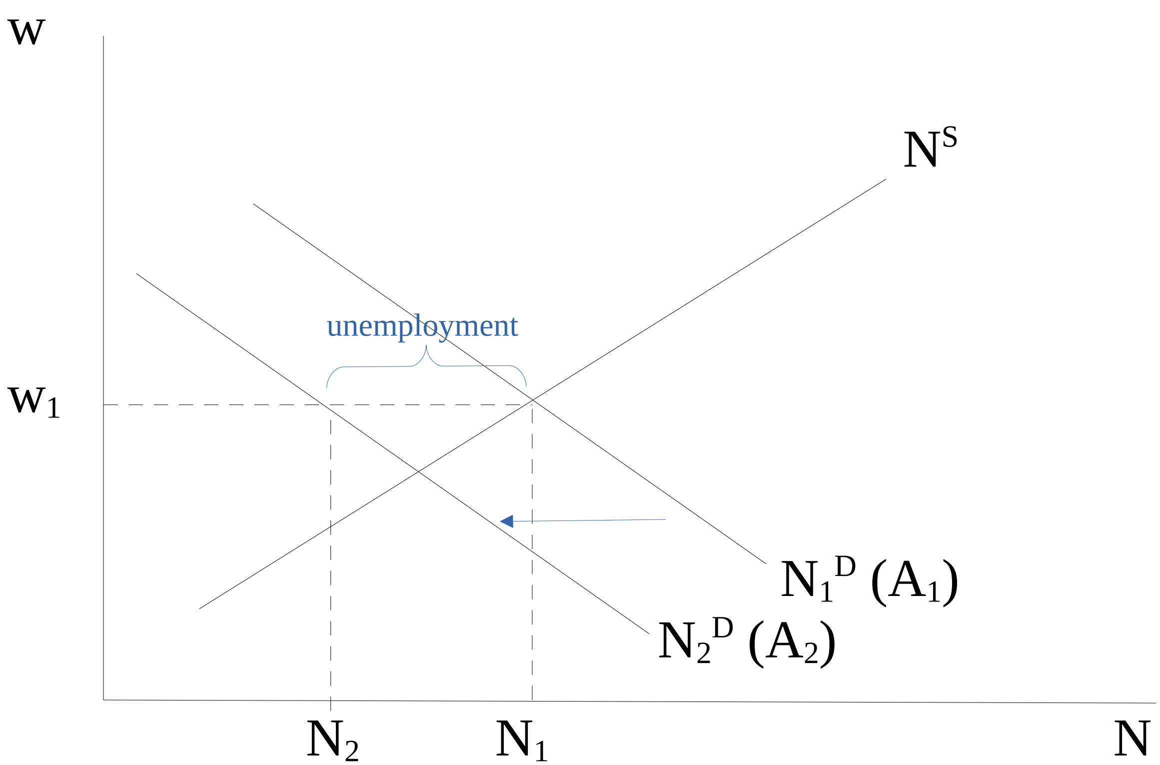
Alternative frameworks have been modelled which do generate unemployment dynamics

Two examples: sticky wage models, & models with friction (including search, search & matching models)

Sticky wage models

Can be graphed similar to our market clearing model, but wages “stick” and do not adjust quickly to clear the market

ex/ Negative productivity shock reduces MPN, lower N^D



Why would wages be sticky?

Institutional Factors: Wage floors and/or negotiated contracts might keep wages above market clearing levels

Some firms may set wages above market clearing levels, firms may reduce worker turnover, attract & retain better workers, and increase worker effort. Efficiency wage theory suggests productivity gains with above market wages

Sticky wage models theoretically could have wage stuck at w* on occasion, which would mean zero unemployment

However, models with friction (e.g. Search or Search and Matching models) will always generate some unemployment

Search & Matching Framework

It takes time for a worker to find a job. Someone who is looking for work must send out resumes, interview, and perhaps repeat the process if they don’t match with a job the first time. Likewise, it takes time for a firm to hire a worker: posting job advertisements and screening candidates

Moreover, even after a worker has been matched with a job, that match may end at some point (the worker may quit, the firm may go under and the job no longer exist) – and the worker will need to search for a new job.

Because it takes time to match workers with jobs, and because matches do not last forever, there will always be workers (and firms) searching. So there will always exist some unemployment

These are not market clearing models, so how do we solve them?

Rather than solving for an equilibrium point, we solve for a steady state where flows in = flows out

Flows into Employment are determined by the number of matches, which depends on market conditions (ex/ # of firms searching, # of workers searching, and how easy it is to search). Search & matching models often specify a matching function: # matches formed = $M(U,V)$ where U is number unemployed, and V is number of vacancies (job postings)

Flows out of Employment are determined by the rate of match dissolution (e.g. quits & job ends). The rate of match dissolution is often represented by a fixed parameter, δ. Thus, # of matches dissolved is δE, where E is # employed

So a steady state would be solved by setting: $M(U,V) = \delta E$

& by the free entry condition in which firms will continue to enter the market (post jobs) as long as there are gains to be made, pushing the expected value of posting a job to zero

(In these models, wage is often solved using a bargaining framework, where the gains from a match are split between firm and worker according to their relative bargaining power)

Typically, we solve for wage, then set the steady state flows in=flows out, then set that in the free entry condition & solve for E*. U=Labour Force-E

What do these models predict with a negative technology shock?

A drop in A reduces productivity of the match, so it reduces the expected value of posting a job

Fewer firms post jobs, reducing matching rate, decreasing the steady state level of Employment and increasing the steady state level of Unemployment

Conversely, if technology advanced and A rose, match productivity would go up, increasing the value of posting a job, so more firms would enter market (post jobs), increasing the matching rate, reducing Unemployment

Unemployment

Key Labour Market Terms/Measures

Employed: worked full-time or part-time during past week

Unemployed: without work during past week and actively looked for work during past 4 weeks. Excludes full-time students

Not in the Labour Force: not working during past week, and not looking for work in past 4 weeks

Labour Force (LF) = Employed + Unemployed

Participation Rate = Labour Force/working age population

Unemployment Rate (R4)= Unemployed/Labour Force

Employment Ratio (Rate) = Employed/working age population

Types of Unemployment

1. Frictional
Workers are unemployed briefly when changing jobs

2. Structural
Longer term unemployment which may result from poor capabilities, or from changes in economy that shift demand from one industry/skill/area to another

3. Cyclical
Occurs as the economy fluctuates around full-employment level

Natural Rate of Unemployment: unemployment due to frictional and structural causes

Issues in Measuring Unemployment

Discouraged workers: people become discouraged by not finding a job and stop searching

Underemployment: people may be able to find part time, but wish to work full time

Long-Term Unemployment: people unable to find jobs for longer periods of time

Some Measures of Unemployment

R1: Proportion of LF out of work for 1 year or more

R2: Proportion of LF out of work for 3 months or more

R3: Unemployment Rate per U.S. definition

R4: Official Unemployment Rate

R5: Includes discouraged workers

R7: Includes involuntary part-time workers

Exercise:

1. Graph R1, R4, and R7 for Canada over time.

2. How do they differ?

3. If your research question is about Unemployment over business cycles, which measure(s) would be appropriate?

4. Which measure(s) would you choose to explore policy impacts on short and long run unemployment rates?

Some factors that can influence changes in unemployment

1. Participation rate changes

2. Structural changes in the economy

3. Policy Changes that influence incentives

4. Hysteresis

    *skills and mis-match

    *insider/outsider theory

V. Consumption, Saving & Investment

Consumption & Saving

Desired Consumption (C^D): aggregate quantity of goods and services that households want to consume given disposable income and other factors

Desired National Saving (S^D): the level of national saving that occurs when aggregate consumption is at its desired level

Relationship between Saving & Consumption

What we don't spend, we save, so the decision of how many goods to purchase is also the saving decision.

$$S = \underline{Y + NFP} - C - G$$

so, if we know C, we also know S

A simplified version would be to look at a closed economy (no interaction with other countries)

A closed economy implies that NX=0 and NFP=0

$Y + NFP \rightarrow Y$ where $Y = C + I + G + NX \rightarrow Y = C + I + G$

$S = Y - C - G$

$S^D = Y - C^D - G$

What motivates our Spending and Consumption decisions?

Consumption Smoothing

What is saving for?

Why do people borrow (dissave)?

Consumption-Smoothing: borrowing and saving in order to have a relatively even pattern of consumption over time.

Changes that Affect Saving

1. Changes in the real interest rate, r
   Rise in r will lower current consumption & increase current saving

Two types of effect:

Substitution Effect: lower current C^D & raise future consumption (increase S^D)

Income Effect: raise current C^D (decrease S^D) for a saver, decrease current C^D (increase S^D) for a borrower

2. Change in Current Income, Y

A rise in current income (Y) will lead to an increase in C^D, but part of increase in Y will be saved as well

Marginal Propensity to Consume (MPC): the fraction of current income that a population (person) desires to consume in the current period

3. Changes in Expected Future Income, Y^f

   A rise in expected future income lowers current S^D & increase current C^D

4. Changes in Wealth

   An increase in wealth increases current C^D, decreases current S^D

5. Changes in Fiscal Policy (G, t, T)

   A. Increase in G reduces S^D because $S^D = Y - C^D - G$

   B. Increase in t (tax rate) decreases S^D because increase in t lowers after tax real interest rates, lowering returns to S

   expected after-tax real interest rate: $r_{a-t} = (1-t)*i - \pi^e$

C. Increase in T (lump sum taxes) increases S^D & C^D falls

When T rises, Yd falls, so C^D falls, & $S^D=Y-C^D-G$ rises if Ricardian Equivalence does not hold

Ricardian Equivalence: response to change in tax is independent of the timing of the tax. If R.E. holds, then consumers believe that a tax hike today will be followed by a tax cut tomorrow, and they will smooth their consumption

D. Increase G financed by T, with no RE, decreases both S^D & C^D because higher T reduces C^D, but not by full amount of increase in T, so G rises by more than C^D drops, therefore $S^D = Y - C^D - G$ falls

Saving Demand Curve

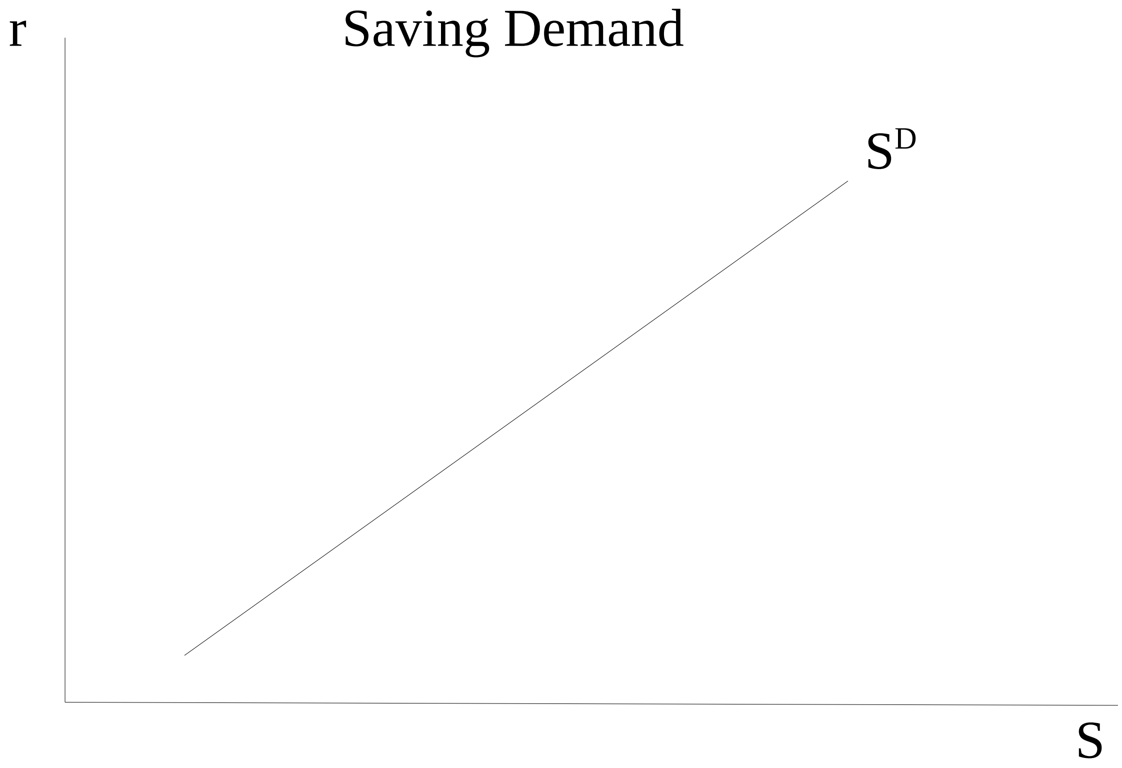
We can discipline our thinking around Saving behaviour. In this course, we are keeping things very simple; So you can consider a simple graphical representation with a

Saving Demand Curve: shows the relationship between saving demand (S^D) & real interest rates (r)

How you model this curve will depend on the assumptions and simplifications that you make.
Could be complex/simple equation, e.g. $S^D=F(r, Y, G, T, etc)$, or $S^D=F(r)$

If Saving increases in r (as discussed above) then the S^D curve will be upward sloping, so $F'(r)>0$

Saving Demand

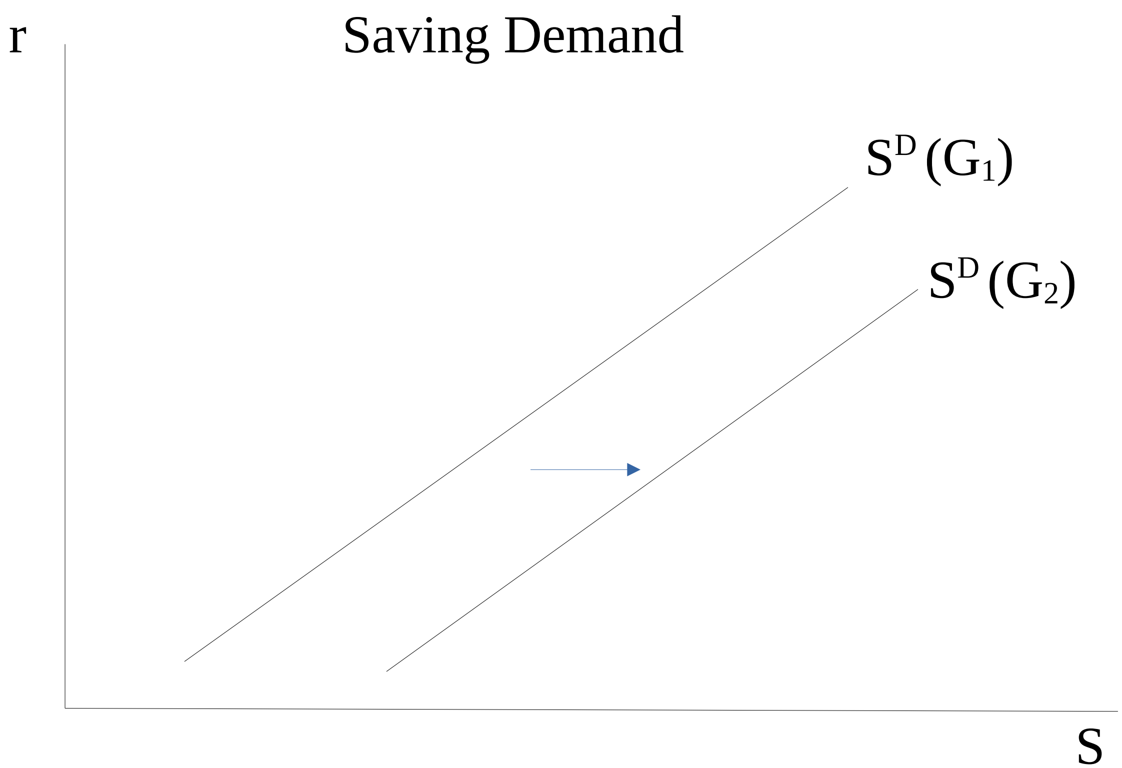


Saving is sometimes depicted as invariant to r, what would that curve look like?

Factors that affect National Saving

Factor	Saving	Consumption
Expected real interest rate, r, increases	*rises*	*falls*
Current output, Y, increases		
Expected future output, Y^f, increases		
Wealth increases		
Government purchases, G, increases		
Tax on interest, t, increases		
Lump Sum Taxes, T, increase		

Change in r moves along the curve, change in other factors shift the curve
ex/ Drop in Government Spending, increases saving demand



Investment

Investment: purchase or construction of capital goods
Investment

The decision of how much to invest depends on expectations about the economy's future

How does firms determine investment?

How is the optimal level of capital goods determined?

Again, we typically assume firms' decisions are based on profit maximization

Therefore, the investment decision will depend on costs and benefits

Terms & Measures of Costs & Benefits

Desired Capital Stock: amount of capital that allows firms to earn the largest expected profit

What is the value of a unit of capital? **MPK^f**

What is the cost of a unit of capital?

Consider the following restaurant example:

Suppose that Vijay's Restaurant in Kitchener is thinking of purchasing a new tandoori oven, so they can produce more tandoori paneer in the future.

Say tandoori ovens can be purchased at $5,000 per cubic metre in real terms

The oven becomes less efficient over time: it produces 5% fewer tandoori meals/year

Vijay's can borrow money from the bank in order to purchase this oven. The expected real interest rate is 3% per year

What is the cost of a unit of capital for Vijays?

User Cost of Capital: the expected real cost of using a unit of capital for a specified period of time.

$uc = r \times p_k + d \times p_k = (r + d) \times p_k$

Where

r=the expected real interest rate

d=the rate of depreciation of capital

p_k=the real price of capital goods

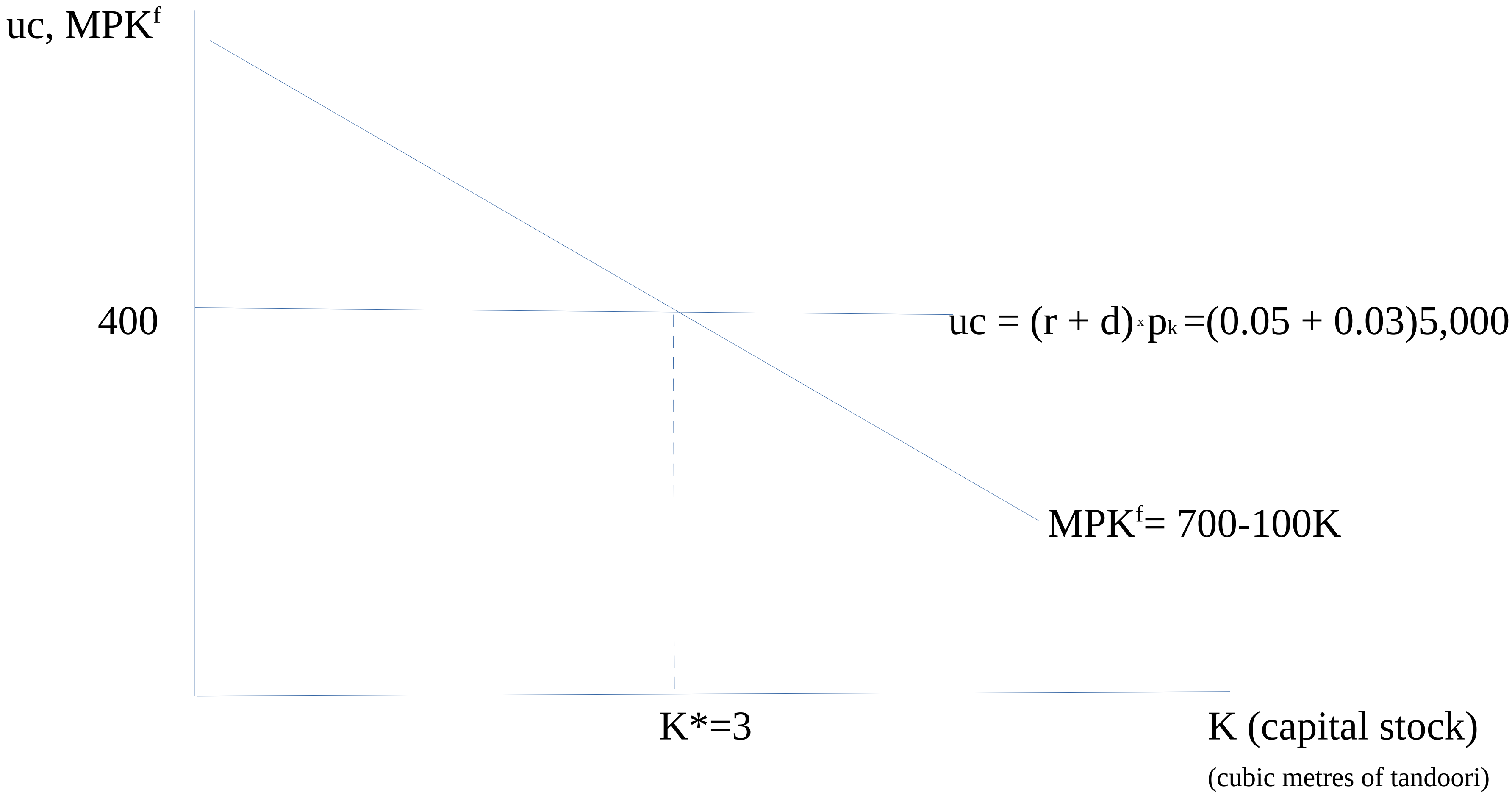
Determining Desired Capital Stock

Desired capital stock is that amount of capital at which the $MPK^f = UC$

If Vijay's $MPK^f = 700 - 100K$, what is Vijay's desired capital stock?

The desired capital stock is the intersection of the UC and MPK^f curves

Vijay's Desired Capital Stock



Factors that Affect Desired Capital Stock

1. A change in the real interest rate, r

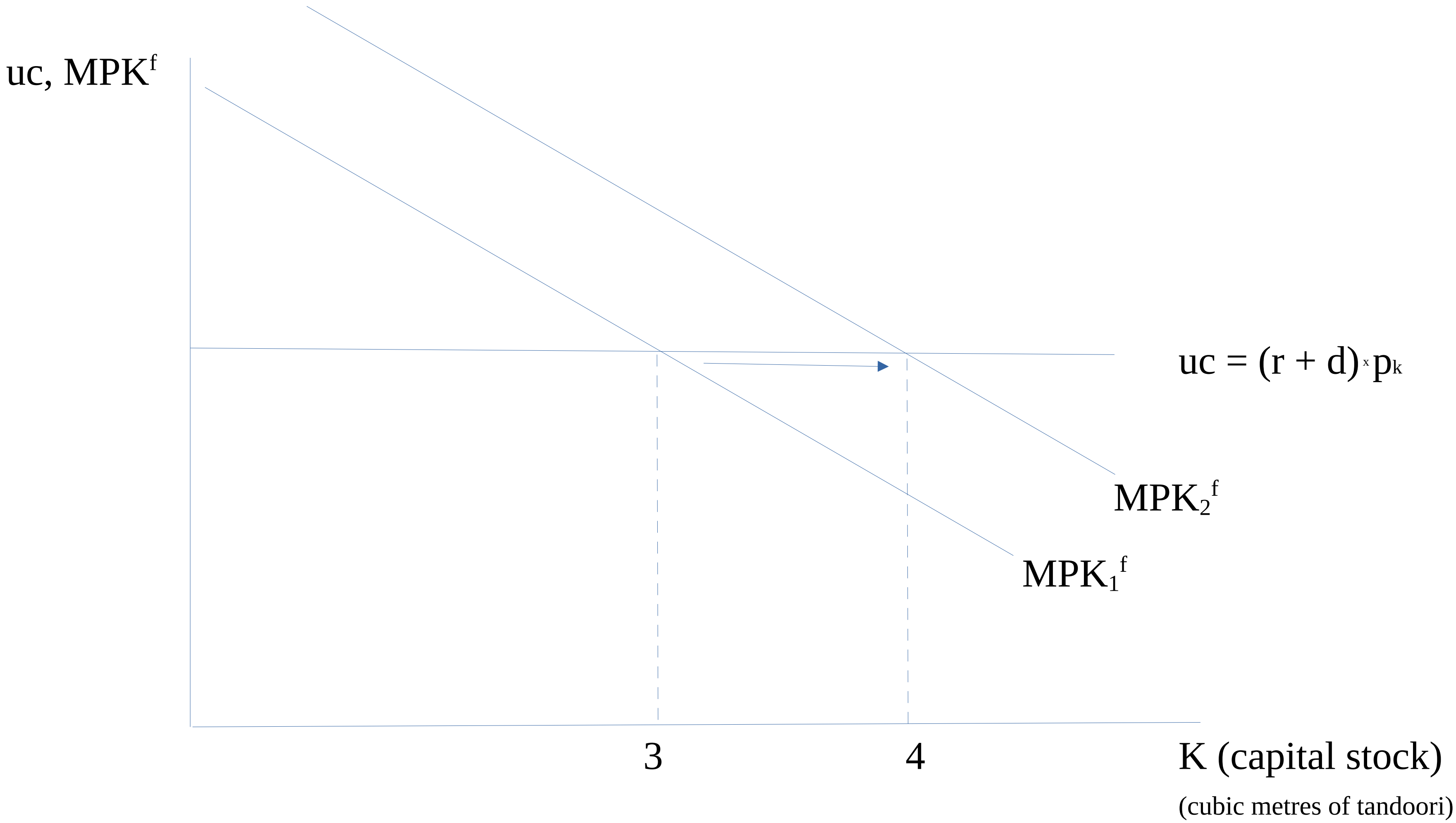
2. A change in MPK^f

3. A change in the effective tax rate on capital, τ

4. A change in any other factor that affects UC

ex/ Increase in MPK^f : desired capital stock will rise

Vijay's Desired Capital Stock



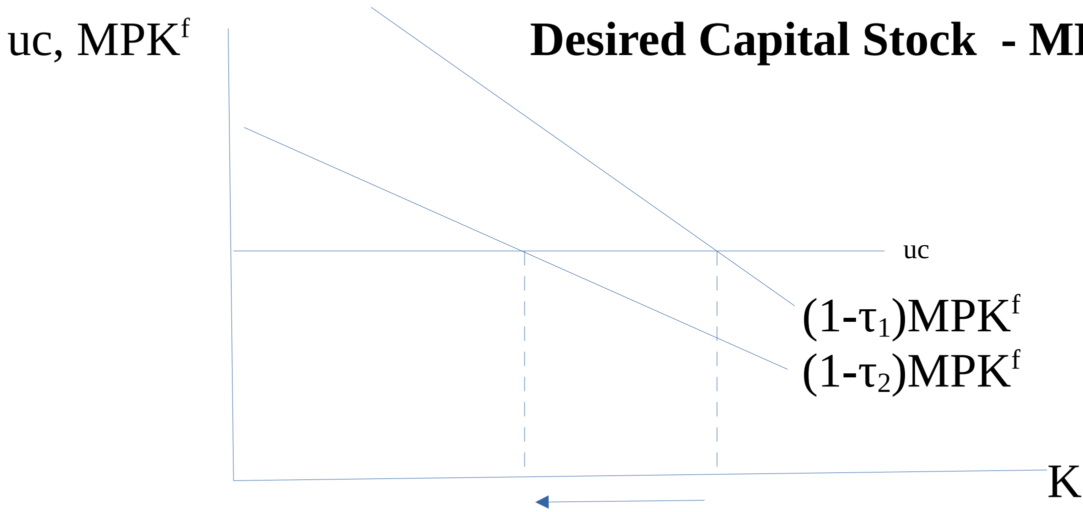
ex/ Increase in the effective tax rate: desired capital stock falls

$uc=(1-\tau)MPK^f$

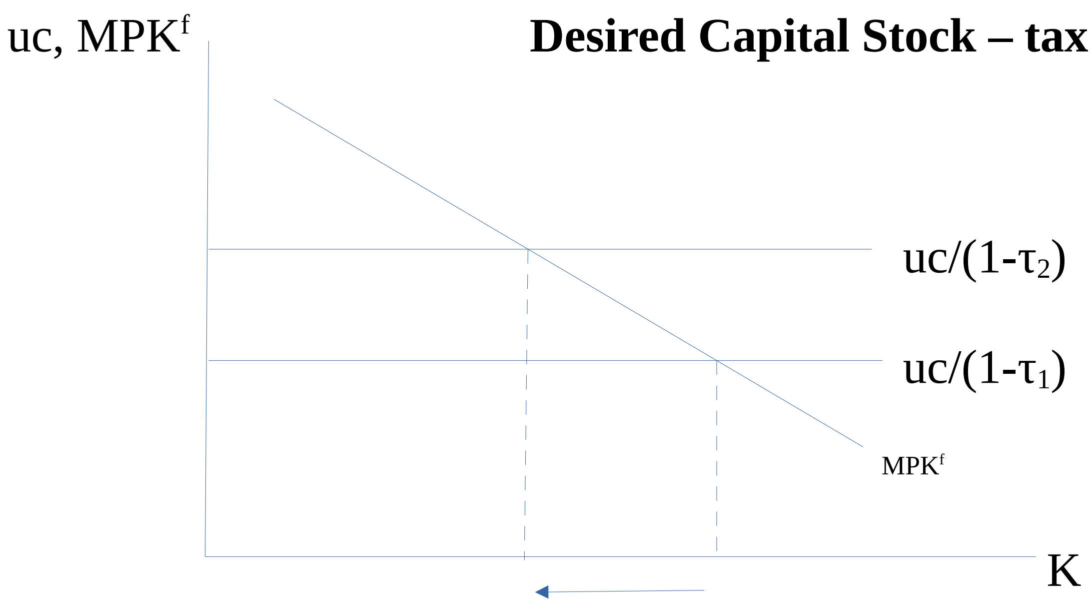
so the tax adjusted user cost of capital is:

$uc/(1-\tau)=MPK^f$

Desired Capital Stock - MPK Perspective



Desired Capital Stock – tax adjusted UC perspective



How are Investment and Desired Capital Stock Related?

Gross Investment: total purchase or construction of new capital goods within a year, $\mathbf{I_t}$

Depreciation: reduction in capital stock over the year due to wear and tear, $\mathbf{dK_t}$

Current Capital Stock: amount of current capital stock, $\mathbf{K_t}$

Desired Capital Stock: amount of capital stock you wish to have next period, $\mathbf{K_{t+1}}$

Investment Demand

$I_t = K_{t+1} - K_t + dK_t$

let K^*=desired capital stock= K_{t+1}

$\mathbf{I^d = K^* - K_t + dK_t}$

So, a firm's demand investment demand (demand for capital) has two parts:

1. net increase in capital stock over the year, $K^* - K_t$,

and

2. investment to replace worn out capital, dK_t

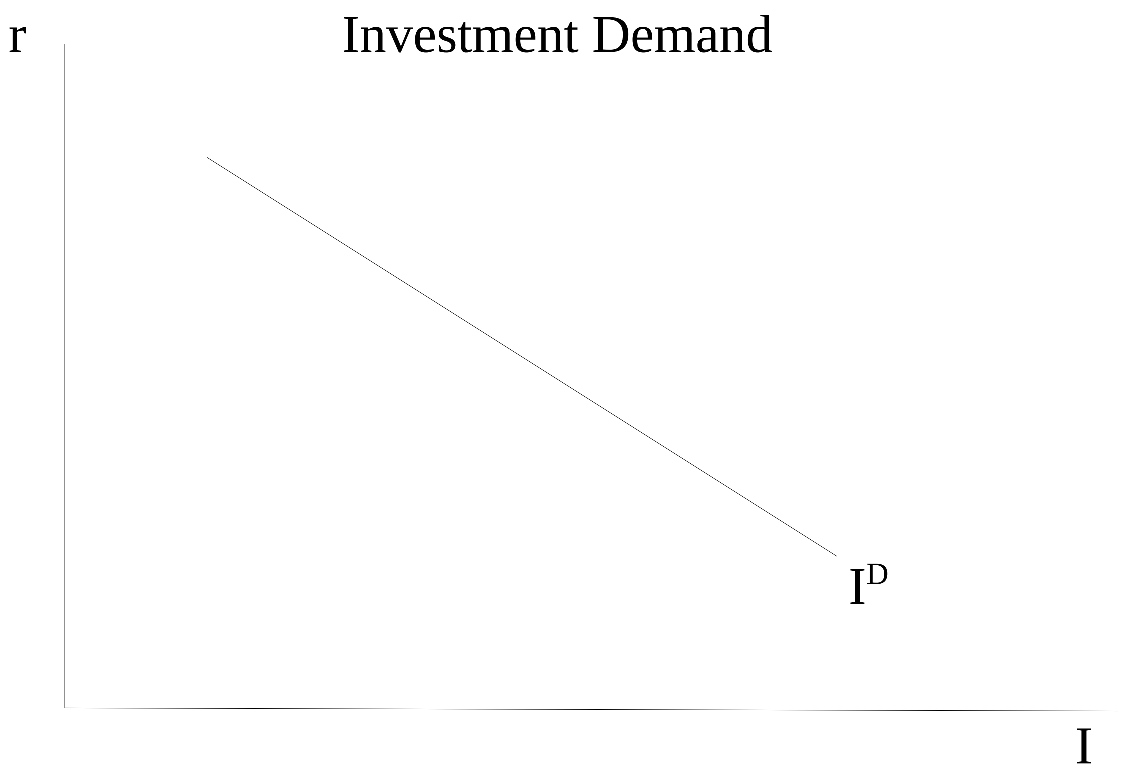
Given the I^d equation, what would the investment demand curve look like?

Recall K^* is determined at $uc = MPK^f$

An increase in r raises uc which decreases K^*

So we have a negative relationship between r and I^d

Investment Demand Curve



Factors affecting Investment Demand

(complete the study sheet, explain)

Factor	I^d
Expected real interest rate, r, increases	*falls*
MPK^f rises	
Tax rate, τ, rises	
Depreciation, d, rises	
Price of capital, P_k, rises	
Destruction of current capital stock, K_t	

Goods Market Equilibrium

*So far, we have determined demand for Consumer & Capital goods (C,K)

*How is equilibrium output determined? What is the goods market equilibrium? $Q^d = Q^s$

Y is the quantity supplied in any given period
C^d is quantity of consumer goods demanded
I^d is the quantity of Capital goods demanded
G is government demand for consumer & capital goods

So, in a closed economy, $Q^d = Q^s$ is: $Y = C^d + I^d + G$
(In an open economy, NX^d is included on the demand side, the RHS)

we can rearrange this equation to obtain:

$Y\text{-}C^d\text{-}G = I^d$

or

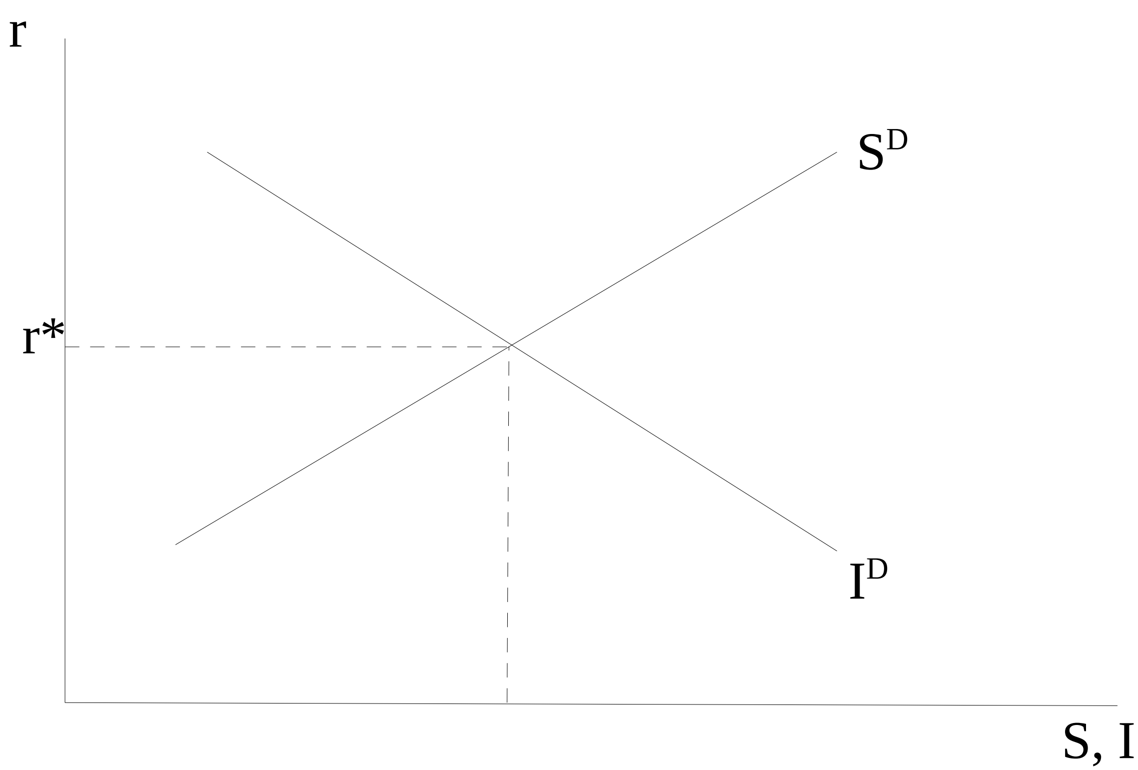
$S^d = I^d$

$$
\begin{aligned}
S &= Y - C - G \\
&= C + I + G - C - G \\
&= I
\end{aligned}
$$

In an open economy, NX would be included in Y but not subtracted out of saving, so open economy version is:

$S = Y - C - G = C + I + G + NX - C - G = I + NX$

*Goods market equilibrium often mapped against real interest rate, r



As you may note, this is one of many ways we can graph the goods market.

VI. Money and Inflation

Money: a medium of exchange
(any asset accepted as payment)

The most familiar form of money is currency
(dollars, yen, pesos, euros)

Another form of money is chequing accounts

Why is money important?

1. medium of exchange
2. unit of account
3. it stores value

Assets with these characteristics may be termed as money, and because of these characteristics, money has a value

Bank of Canada Definitions

M1+ (gross): Currency outside banks+chequable deposits
+ continuity adjustment

M1++ (gross): M1+(gross) + all non-chequable notice deposits other than fixed-term deposits (less interbank non-chequable notice deposits)

M2 & M3 are broader, & include items like term deposits, shares at credit unions & caisses populares, life insurance company individual annuities, mutual funds, foreign currency held by domestic residents, & continuity adjustment

Demand for Money

How do people determine how much money they want to hold?

Portfolio Allocation Decision: The decision of which assets, and how much of each asset to hold out of total wealth.

Wealth: aggregate of all asset holdings (wealth=monetary+non-money assets)

Money Demand: Quantity of monetary assets that people choose to hold in their portfolios.

Demand for money determined by costs & benefits

Cost: ~0 return on monetary assets

Benefits: highly liquid (ability to consume immediately) & typically lower risk

Key Factors affecting Money Demand

1. Interest rates
2. Price Level
3. Real Income
4. Wealth
5. Payment Technology
6. Liquidity of other Assets
7. Risk

Money Demand Function

$M^d = \overset{+}{P} \times L(\overset{+}{Y}, \overset{-}{i})$

= aggregate money demand (nominal)

P = price level

Y = real income (or output)

i = nominal interest rate on non-monetary assets

L = function relating real money demand to Y & i

What about inflation?

Remember that $r = i - \pi^e$ thus, $i = r + \pi^e$

So our money demand equation is:

$$M^D = P \times L(Y, r+\pi^e)$$

In real terms (divide both sides by P)

$$\frac{M^D}{P} = \frac{L\left(Y,\ r+\pi^e\right)}{P}$$

$L(\overset{+}{Y},\ \overset{-}{r}+\overset{-}{\pi}^e)$ = real money demand function

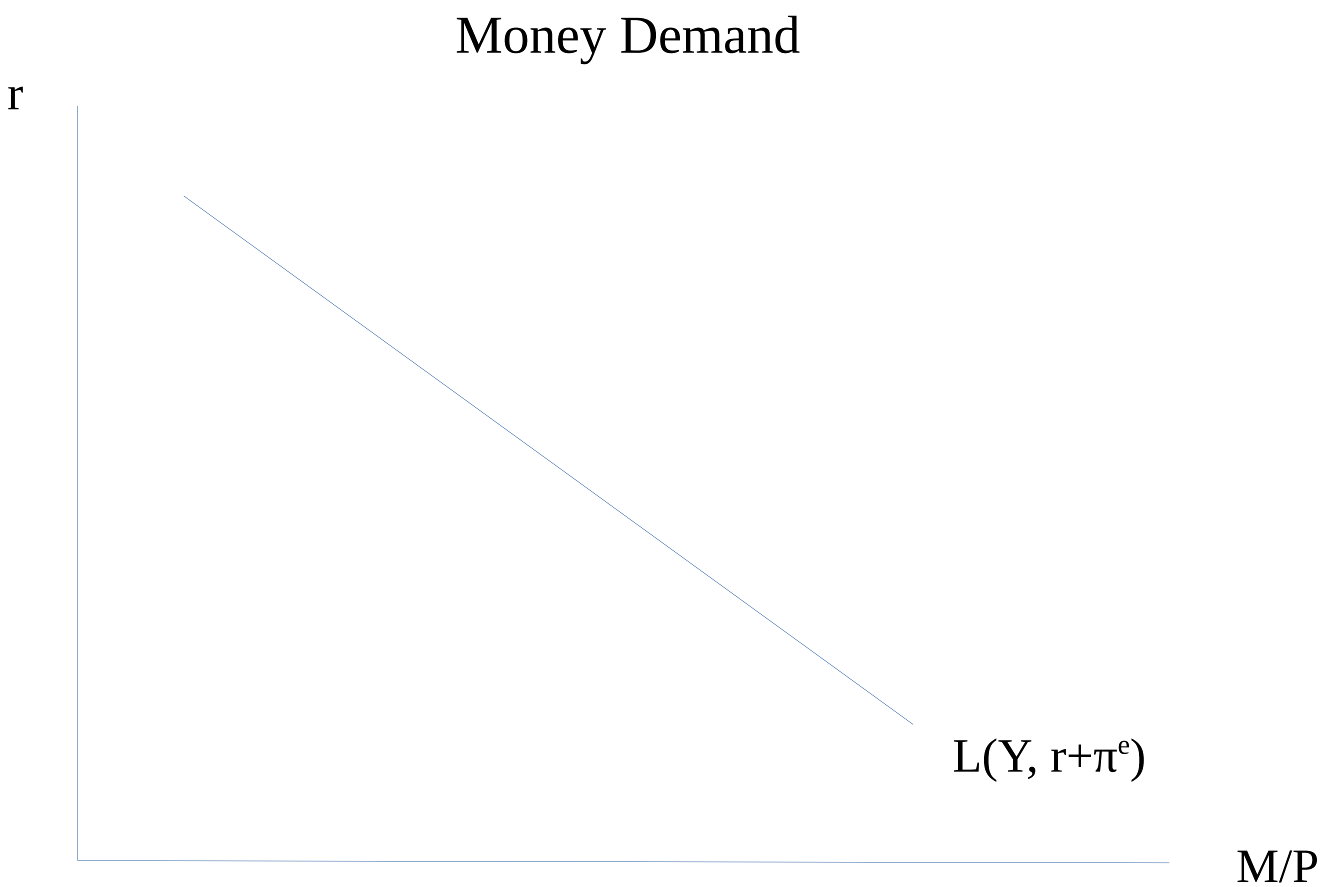
L(.) is a function that defines the relationship between real money demand and real interest rates

Money Demand Curve

Money Demand Curve shows us the relationship between real money demand and real interest rates, M^D/P and r

*as r falls, real money demand rises, so our curve should be downward sloping

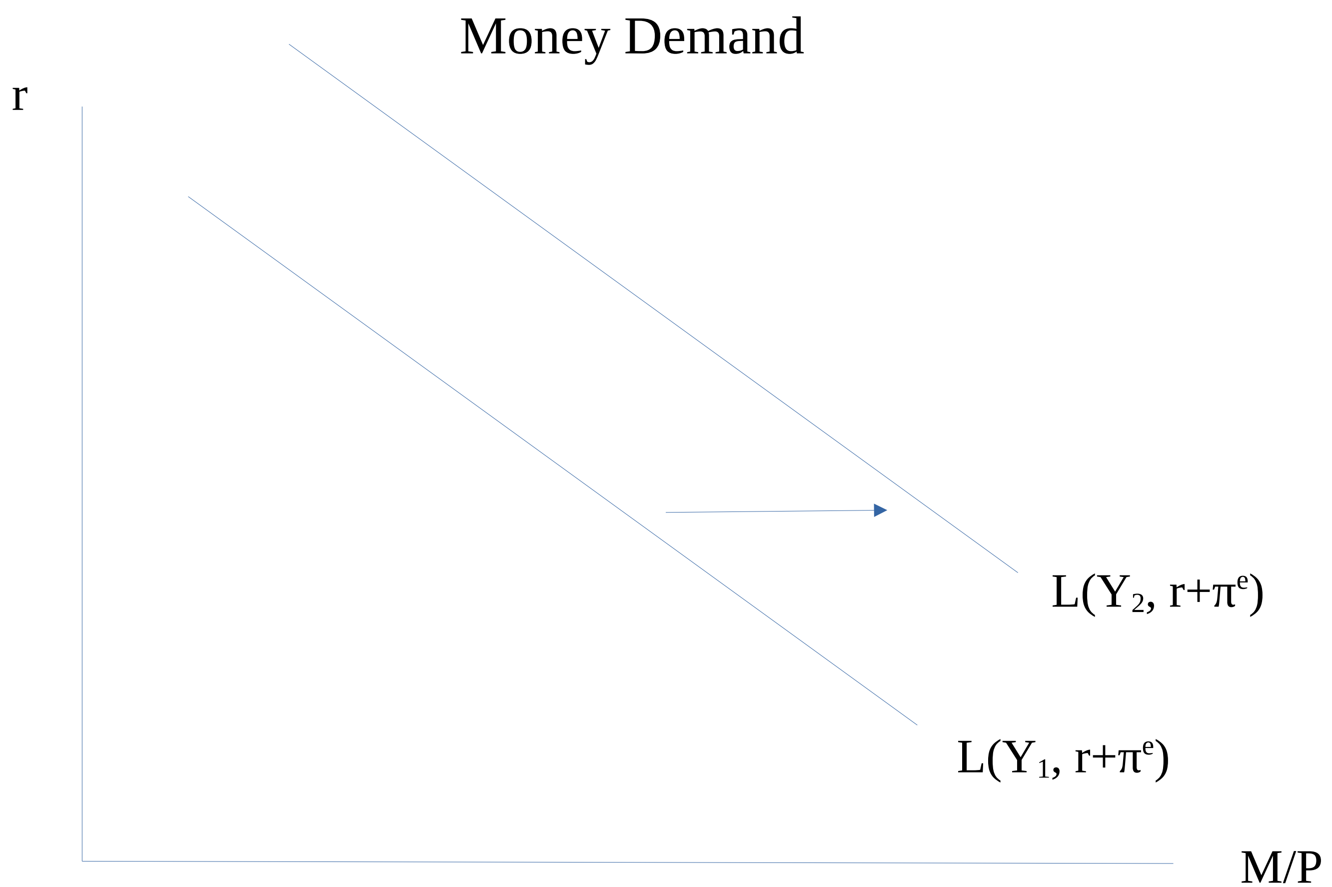
Holding all else constant, the relationship between r and real money demand is



Factors that affect Money Demand

Variable (rise in)	**Effect on Money Demand**
r	
π^e	
i^m	
P	
Y	
Wealth	
Payment Techonology	
Liquidity (of other assets)	
Risk (of other assets)	

ex/ Increase in Y will increase money demand



Quantity of Money (Money Supply)

In Fiat money systems, the government influences money supply via monetary policy

But money supply is also influenced by depository institutions and the public

How do these groups influence money supply?

First we need a basic understanding of how the monetary system works

Monetary System

This system may be better understood using balance sheets

Start with a simple case: all currency economy (no deposits)
with 1,000,000 in currency

Central Bank balance sheet (ex 1/ All cash holdings)

Assets	**Liabilities**
Goods 1,000,000 dollars	Currency 1,000,000 dollars

The liabilities of the bank are the dollars

The Central Bank's promise is that goods that can be purchased back by the public with dollars

Some Terms and Definitions:

monetary base: BASE = liabilities of central bank that are usable as money

System of private banks: banks willing to keep client money in safe

Bank reserves: liquid assets held by banks to meet demands for withdrawals or to pay cheques on depositor accounts

fractional reserve banking: keep<100% of deposits in vault

reserve–deposit ratio: $res = \dfrac{reserves}{deposits}$

ex/ suppose a bank wishes to have 20% reserve deposit ratio

If the bank loans out 80% of deposits to business (who then deposit these funds in bank), will they have res=20%?

Bank’s balance sheet (ex 2/ fractional reserves, part 1)

Assets	**Liabilities**
Currency (Reserves) 1,000,000 dollars	Deposits 1,000,000 + 800,000 dollars
Loans 800,000 dollars	
Total 1,800,000 dollars	Total 1,800,000 dollars

Res = 1,000,000/1,800,000 = ~.56 or 56%

To obtain a reserve-deposit ratio of 20%, the banks want to lend out more money (and businesses again deposit, and banks lend out more money) until such time as res=20%

Multiple expansion of loans & deposits: process in which fractional reserve banking increases economy's loans & deposits

Bank's balance sheet (ex 2/ fractional reserves, res=.2)

Assets	**Liabilities**
Currency (Reserves) 1,000,000 dollars	Deposits 5,000,000 dollars
Loans 4,000,000 dollars	
Total 5,000,000 dollars	Total 5,000,000 dollars

Res = 1,000,000/5,000,000 = .2 or 20% & no further expansion occurs

(The central bank balance sheet remains the same, as there is still only $1,000,000 currency in circulation)

In this example:

Money supply,	M	= 5,000,000
Monetary base,	BASE	= 1,000,000
Bank Deposits,	DEP	= 5,000,000
Reserves,	RES	= 1,000,000
reserve-deposit ratio,	res	= 0.2

Note: in fractional reserve system, where the public holds no currency (only uses deposits), M=DEP so, Bank reserves must equal the dollars distributed by the Central Bank: res*DEP = BASE = RES. This will not be the case if the public holds some currency.

Fractional reserve system if public keeps some currency:

M = CU + DEP

BASE = CU+RES

$$\frac{\mathbf{M}}{\mathbf{Base}} = \frac{(\mathbf{cu} + 1)}{(\mathbf{cu} + \mathbf{res})}$$

$\mathbf{res} = \dfrac{\mathbf{RES}}{\mathbf{DEP}}$ (under fractional reserves, res*DEP≠ BASE)

CU: currency holding of public

$\mathbf{cu} = \dfrac{\mathbf{CU}}{\mathbf{DEP}}$ = currency-deposit ratio

$$\textbf{Money Multiplier} = \frac{\mathbf{M}}{\mathbf{BASE}}$$

= dollars of money supply that can be created per base dollar

How can households, firms and bank decisions influence money supply?

Given the simple example of a fractional reserve system, we can see that:

Households and firms influence the money supply by deciding how much currency to hold versus deposits

Banks influence money supply by deciding how much to hold in reserves relative to deposits

How can Central Banks influence Money Supply?

One way in which Central Banks can influence Money supply is via Open Market operations

Open Market Purchase: Increases M by increasing BASE – print currency and buy securities

Open Market Sale: Decreases M by decreasing BASE – sell securities, keep currency

But Central Banks have other means of influencing Money Supply (and of achieving their primary goal of economic and financial well-being)

For example, consider:
Each day people buy/sell many items. In one day you may have $1,000 cheque going from CIBC to Royal Bank, and 900 cheque going from Royal Bank to CIBC. Rather than sending 1000 over then receiving 900 back. CIBC simply transfers 100 to Royal Bank at end of day - a NET TRANSFER

To make transfers easy, banks hold balances at the Bank of Canada (settlement balances) If a bank has a larger balance than it needs at end of day, it lends some of it's reserves to another bank & charges an interest rate

Overnight Rate, i_{ON}: rate of interest on loan over one night

charged on loan over one night

Bank of Canada targets the overnight rate

How do overnight rate targets affect Money Supply?

Lower i_{ON} → increases M

Higher i_{ON} → decreases M

Open market operations reinforce the targeted overnight rate and provide liquidity to support settlement and the financial system

How does the Bank of Canada bring about the targeted Overnight Rate?

Prior to 2020 used a corridor system (target rate in the middle of the operating band), Post 2020 use a floor system (target rate at the bottom of the operating band)

Floor system: offering an amount of settlement funds (in the form of deposits) such that the overnight rate trades at their target rate (the deposit rate=the target rate)

Lower i_{ON} ($\uparrow$ Reserves $\rightarrow$ $\uparrow$ Base) $\rightarrow$ increases M
Higher i_{ON} ($\downarrow$ Reserves $\rightarrow$ $\downarrow$ Base) $\rightarrow$ decreases M

While Central Banks do influence Money Supply, the Bank of Canada’s Monetary Policy framework centres primarily on an <u>inflation control target</u>

The Bank of Canada’s inflation target is 2%

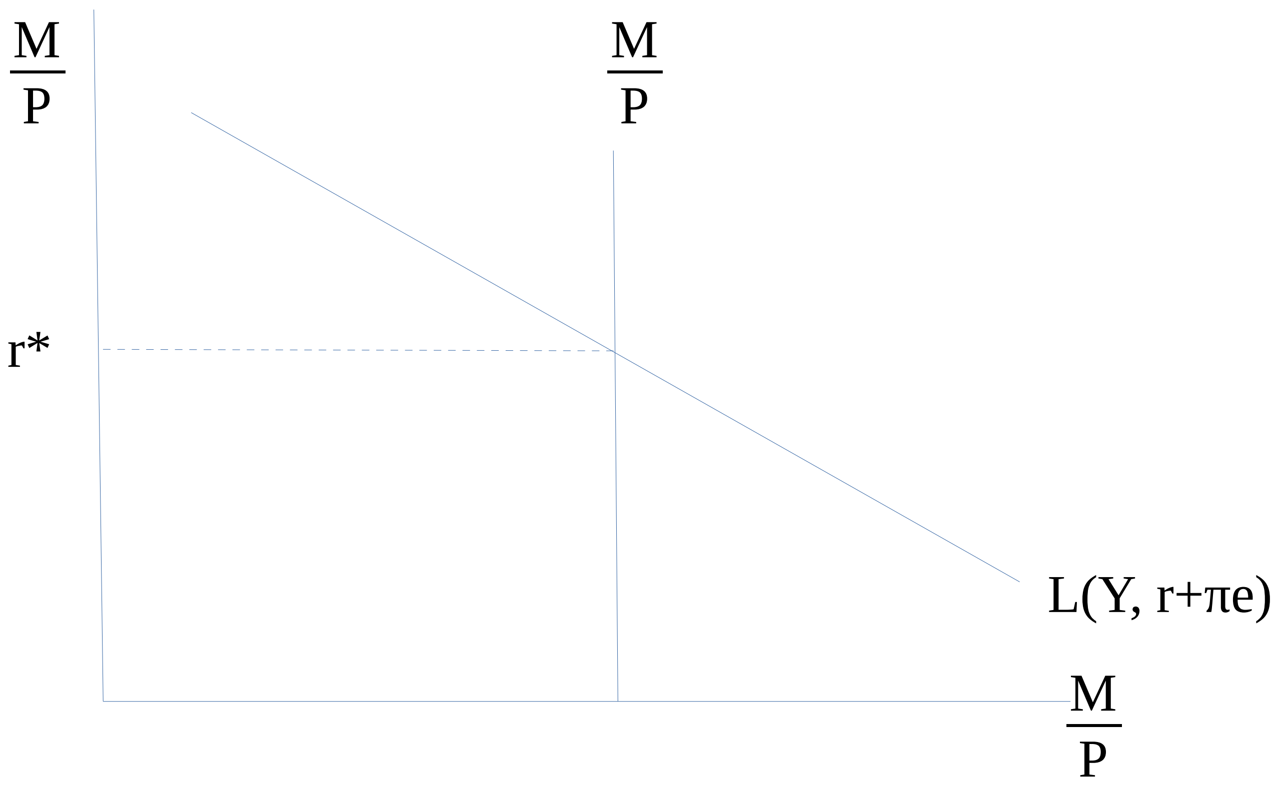
We will discuss the goals, targets and tools of Monetary Policy in more detail in section XIII

Note that the monetary system is considerably more complex than our simple example balance sheets indicate, for one, the central bank's balance sheet will reflect more than just "goods" and "currency," see page 72 of the Bank of Canada's 2023 Annual Report

However, the discussion above should provide a basis for understanding the monetary system and the roles played by the Public, depository institutions, and the Central Bank

That said, we can construct a simple model by assuming a fixed level of money supply, set exogenously

Graphical Depiction of Equilibrium

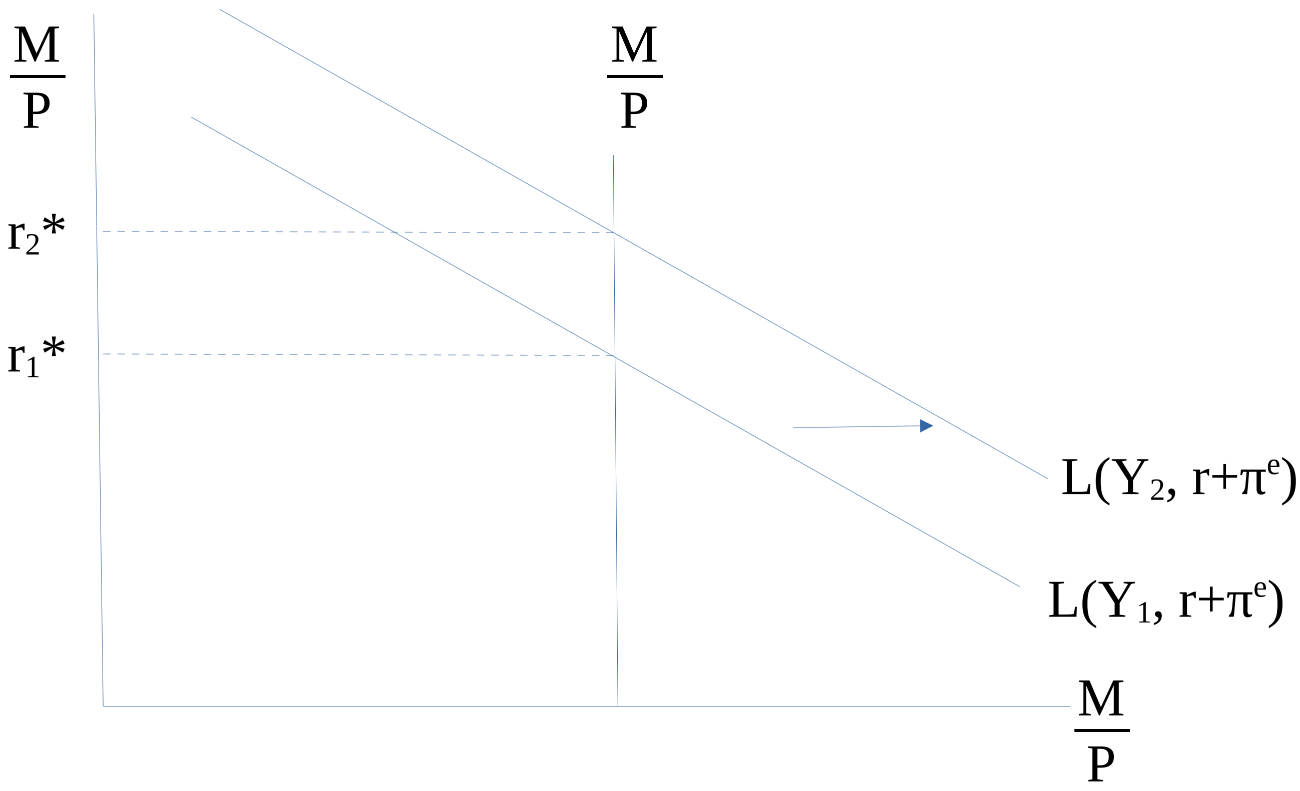


What affects Equilibrium?

*anything that shifts the money demand

*anything that influences monetary policy or price.

Ex/ increase in Y, increases money demand



Money Supply and Inflation

There is a long history of thought on the relationship between money supply and inflation

In a simple market clearing model

$$\frac{M}{P} = L\left(Y, r + \pi^e\right) \quad \text{so then } P = \frac{1}{L\left(Y, r + \pi^e\right)} M$$

or $M = P * L(Y, r + \pi^e)$, similar to Quantity Theory of Money, $M \times V = P \times Y$, V=velocity

Since inflation is $(P_{t+1} - P_t)/P_t$, inflation can be calculated as:

$$\frac{\Delta P}{P} = \frac{\Delta M}{M} - \frac{\Delta L(.)}{L} \quad \text{so inflation would rise with M}$$

Theoretical and empirical study on the relationship between Money (Monetary Policy) and inflation continues, but from the perspective of inflation targeting, the Bank of Canada's premise is easily understood:

In period of slow economic growth (or negative growth), inflation may fall below 2%. The central bank could lower the overnight rate (M rises), then interest rates fall – motivating people to consume more, providing a boost to the economy, and keeping inflation up closer to 2%. In a period of heated economic growth, inflation may rise. The central bank could reduce the overnight rate (M falls), interest rise – motivating people to consume less, slowing the economy and slowing inflation.

Costs of Inflation

1. Perfectly Anticipated Inflation
   * Shoe Leather Costs
   * Menu Costs
2. Unanticipated Inflation (costs of 1, plus)
   * Increased risk (decreases utility)
   * Increased costs of information gathering
3. Hyper Inflation (costs of 2, plus)
   * Reduced ability to collect tax & provide public goods
   * Decrease market efficiency

Because of these costs, governments often want to intervene and try to rein in inflation, but must do so carefully in order to unbalance the economy in other direction (recessionary)

Costs of Unemployment

*loss of output

*personal costs

Unemployment & inflation: 'twin evils' of macroeconomics

Is there a trade-off between unemployment & inflation?

Okun's law: a 1% point departure from FE employment yields a 2% point departure from FE output

Phillips curve: models relationship between unemployment and inflation

Historically observed that as one rises, the other often falls, but not always, and recently little relationship is apparent

Some debate as to whether the Phillips curve, even modified versions (e.g. Expectations Augmented Phillips curve – which takes into account expected inflation), are still useful, or whether there is no longer a strong relationship between unemployment and inflation

VI. Trends, Cycles and Inequality

Business Cycles & Fluctuations

Economies experience many short run fluctuations, sometimes expanding, sometimes declining, with irregular timing

Business cycle: the process of expansion, decline (and recovery) of aggregate economic activity.

Business Cycle Terminology

Aggregate Economic Activity (AEA): all components of all parts of the economy

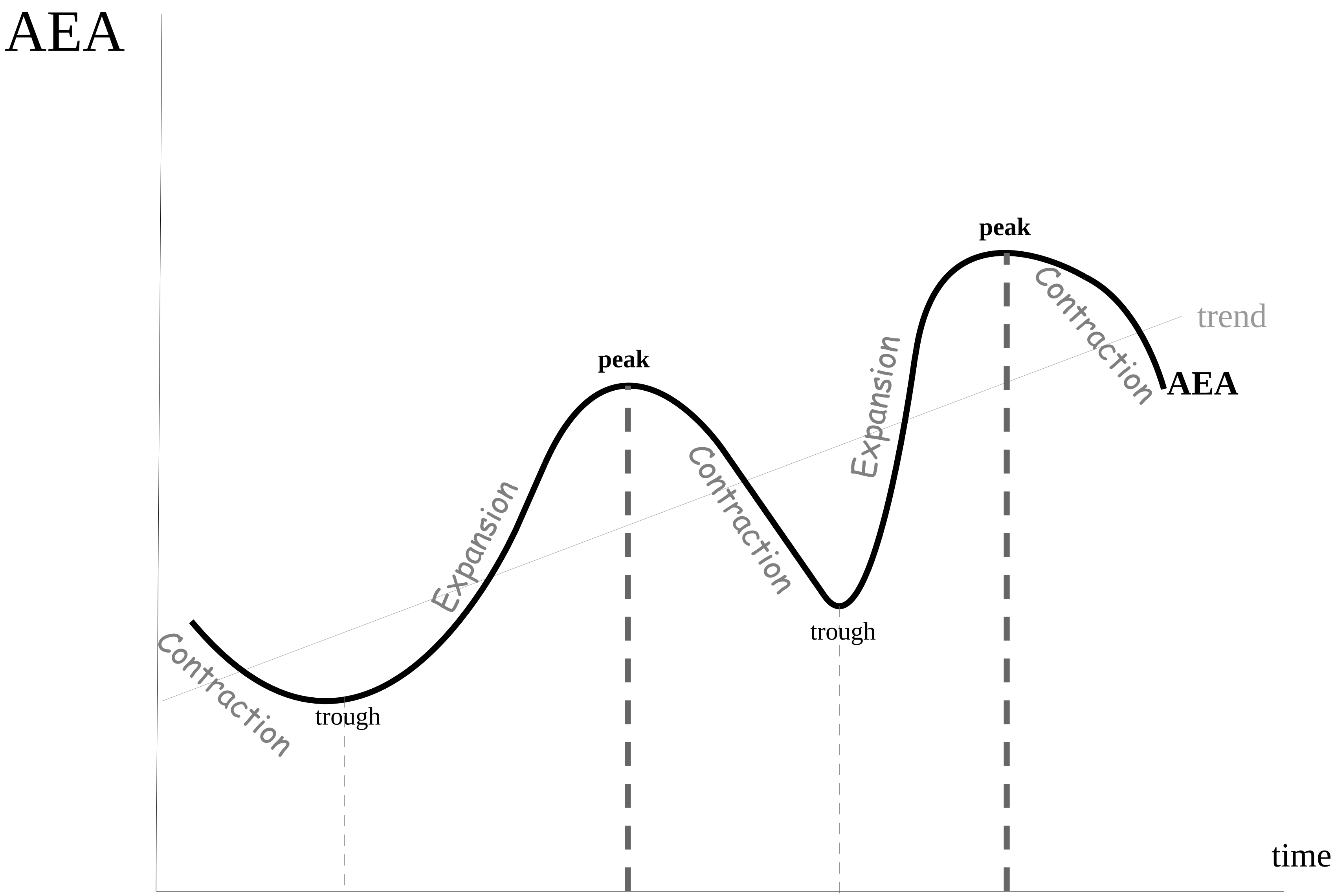
Expansion (boom): growth of AEA

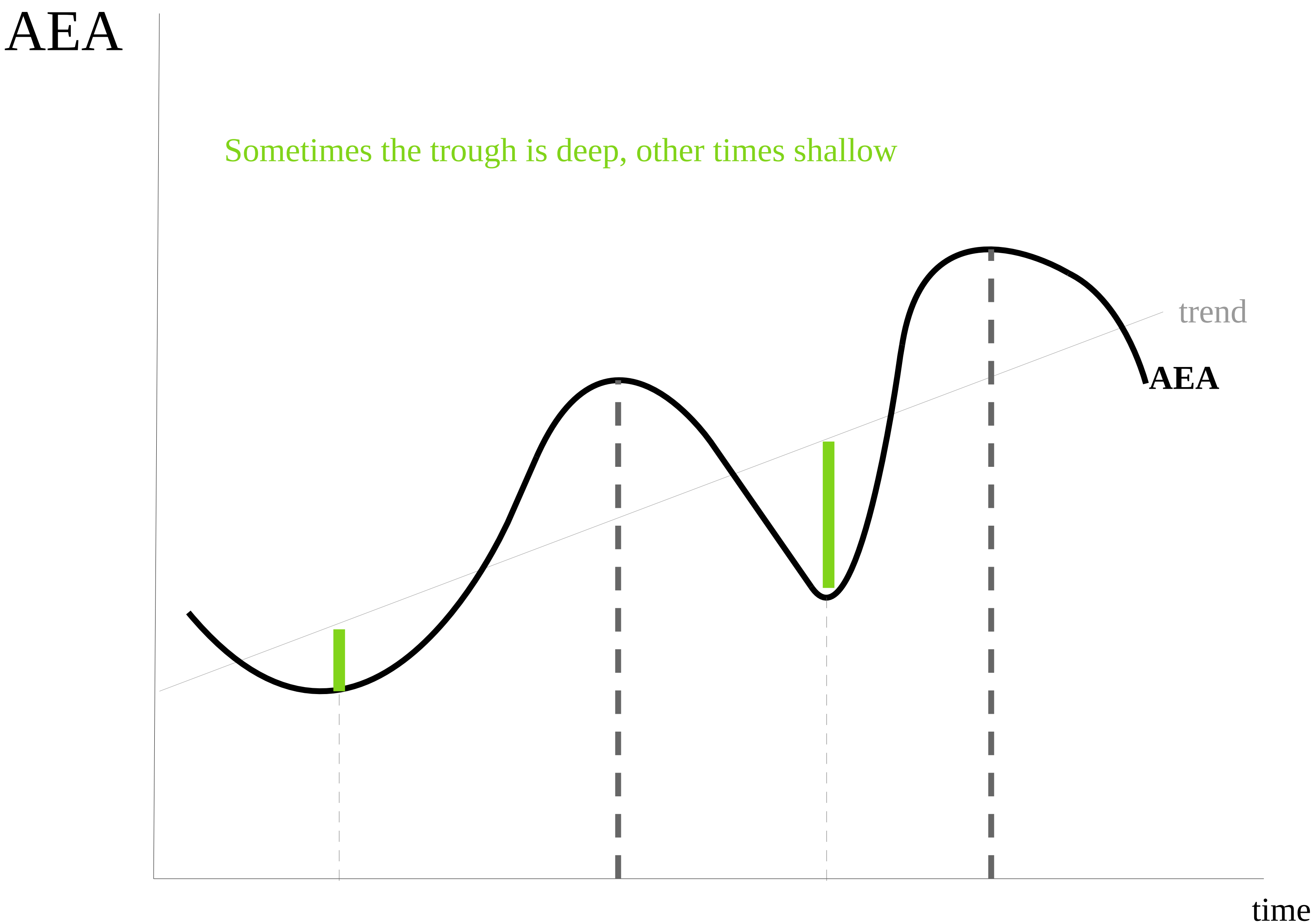
Contraction (recession/depression): decrease of AEA

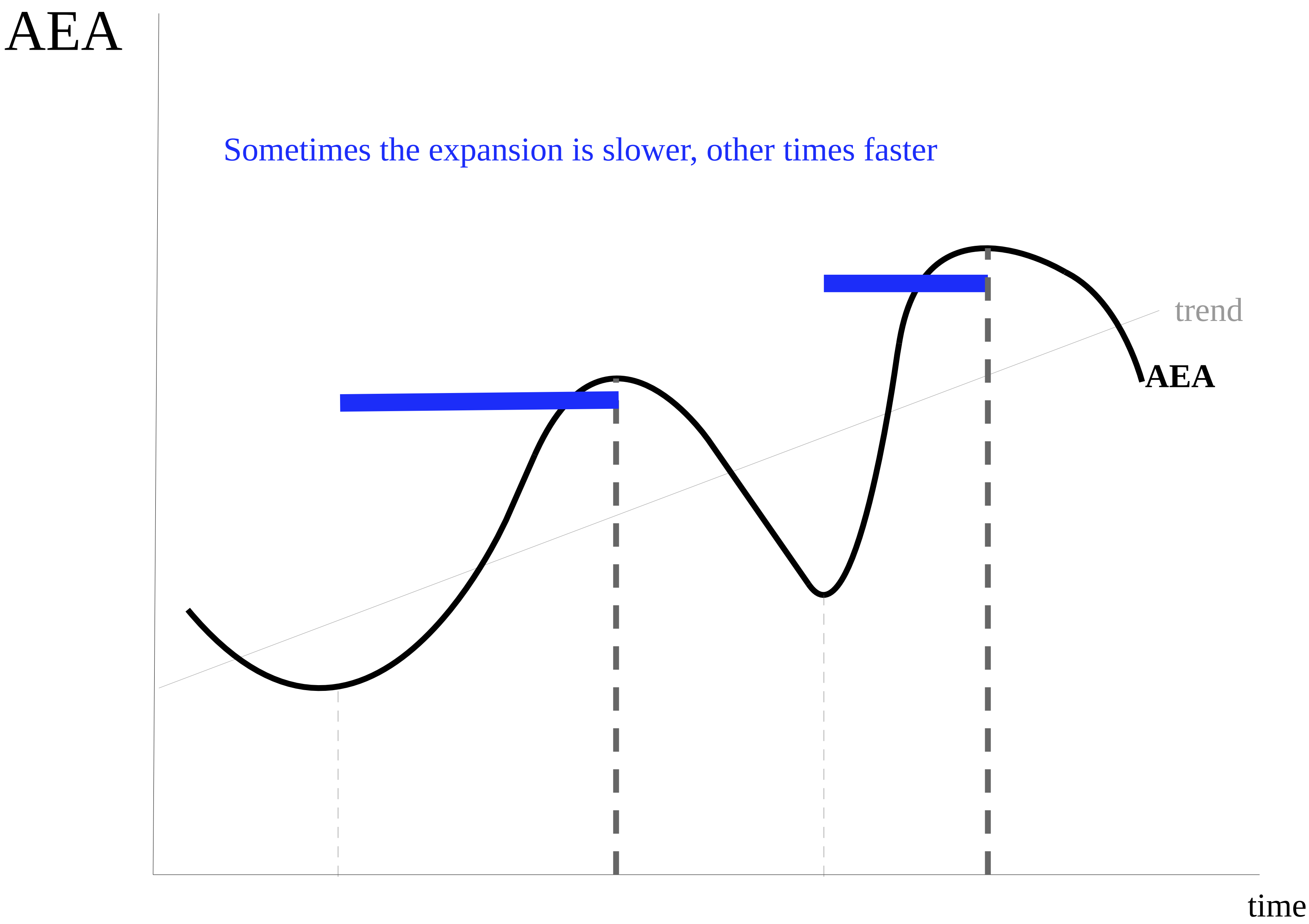
Trough: low point of contraction

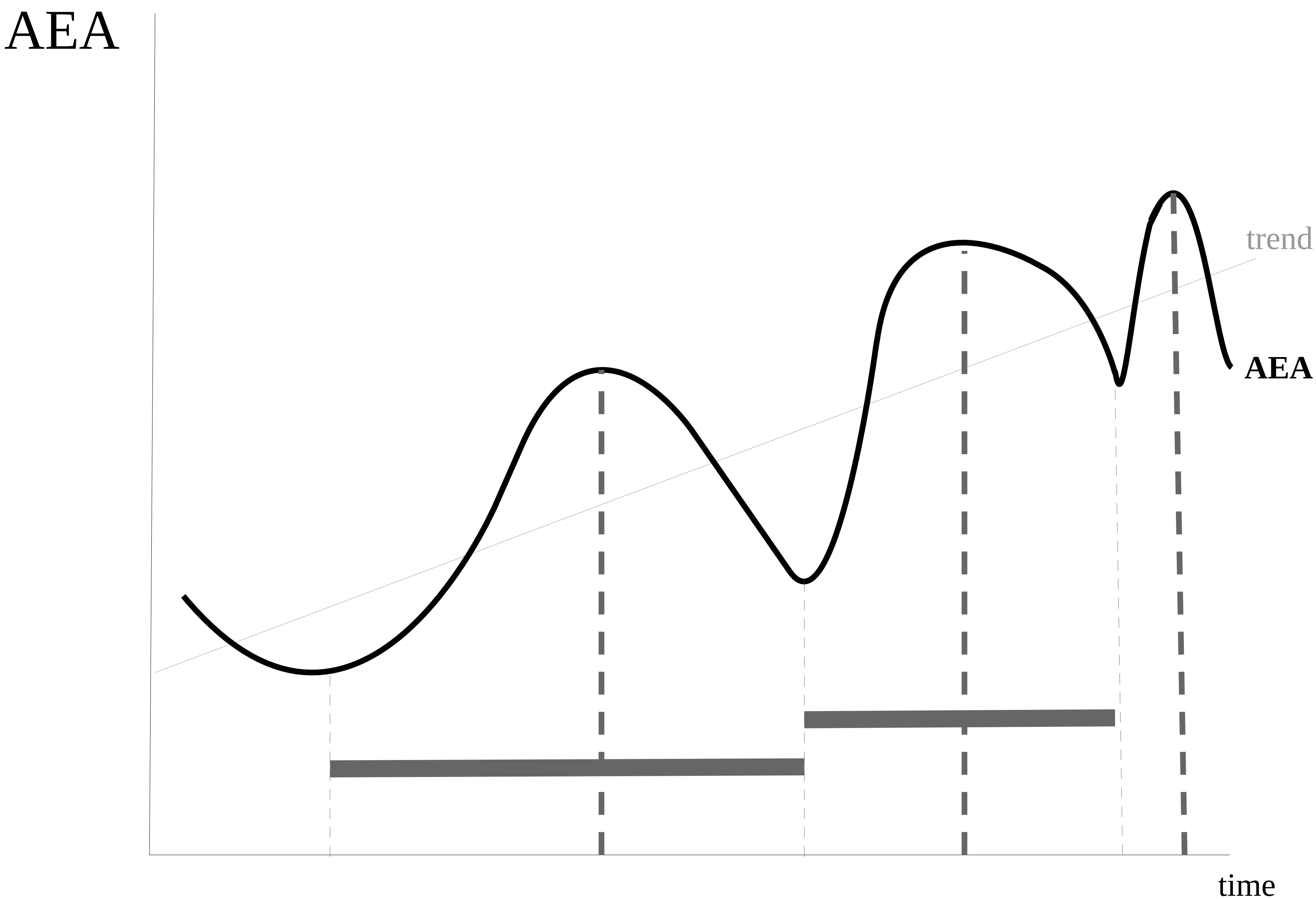
Peak: high point of expansion

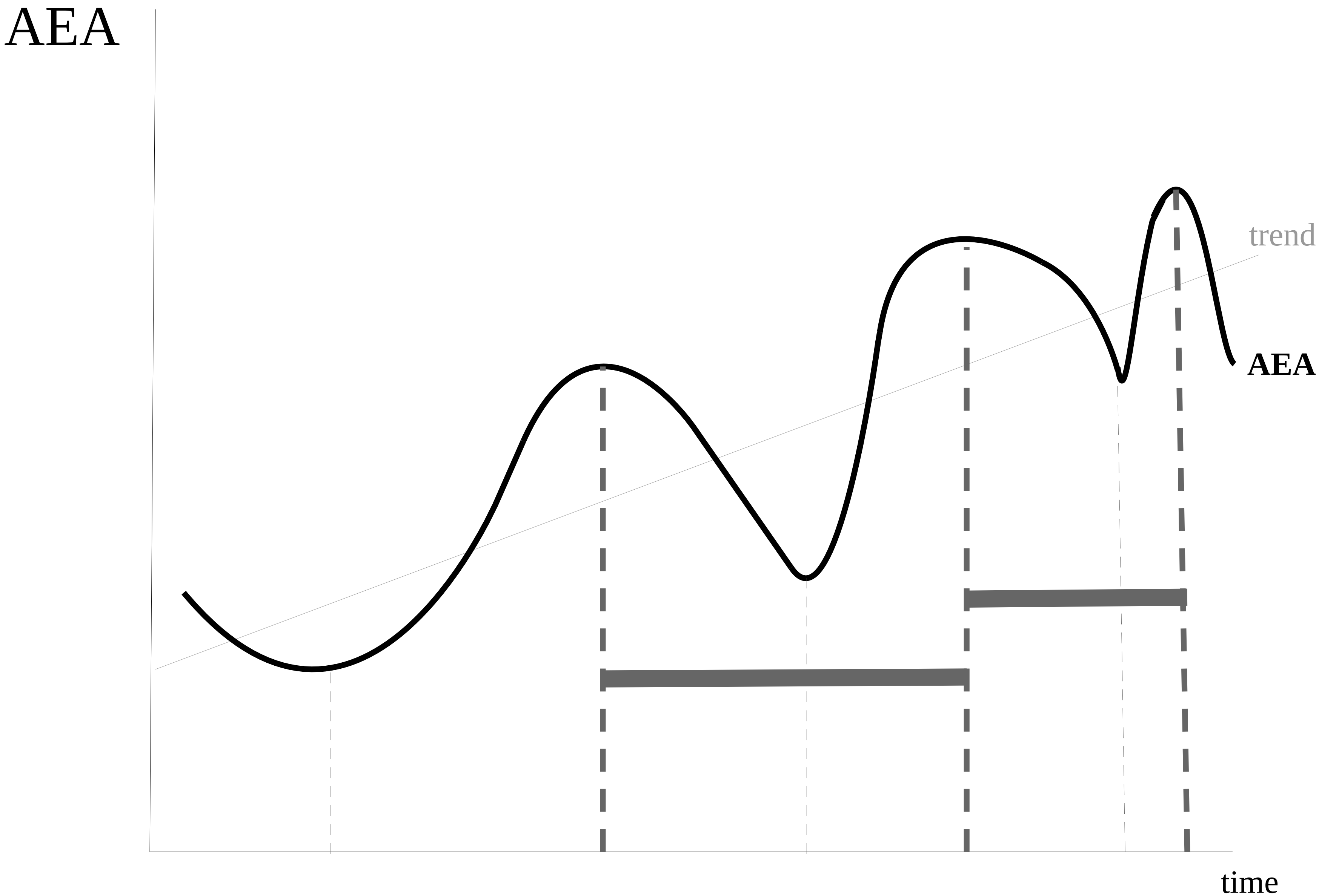
Business cycles are typically measured peak to peak or trough to trough


AEA
peak
peak
trend
AEA
Contraction
Expansion
Contraction
Expansion
Contraction
trough
trough
time


AEA
Sometimes the trough is deep, other times shallow
trend
AEA
time


AEA
Sometimes the expansion is slower, other times faster
trend
AEA
time


AEA
trend
AEA
time


AEA
trend
AEA
time

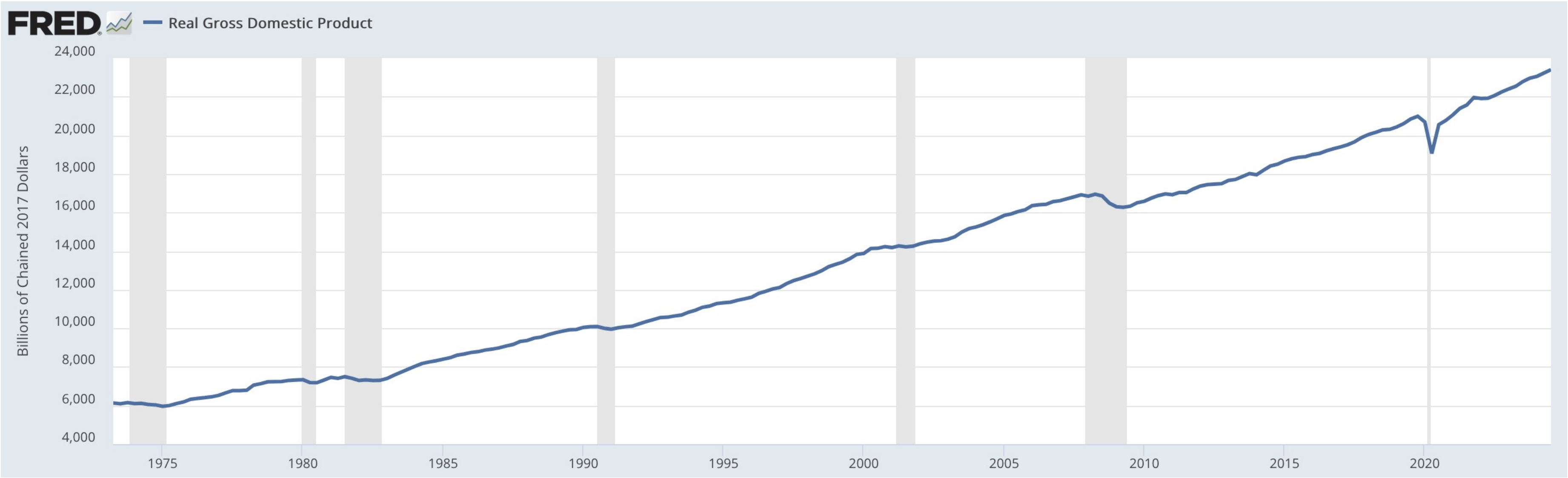
Recession: an economic downturn of large magnitude (significant decline in AEA), duration (multiple quarters) and scope (effects widespread across economy)

There are no set measures that are universally used to define a recession. Experts are sometimes divided as to whether a downturn should be classified as a recession or not

Recessions may also be classified in terms of severity. How researchers classify recessions can differ across studies

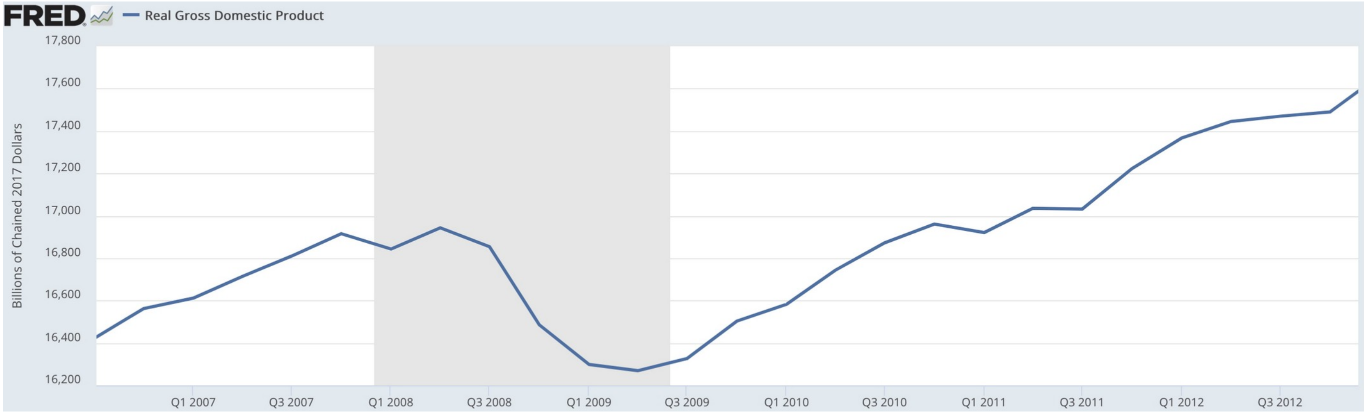
The term recession is often only used after we are well in it, otherwise BoC and government officials usually refer to risk of recession, or risk of overheated economy

How recessions are defined has implications for how we build our models to try to understand and even predict recessions. For more discussion on business cycle determination, see links provided on LEARN



Source: U.S. Bureau of Economic Analysis, Real Gross Domestic Product [GDPC1], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPC1, December 28, 2024.

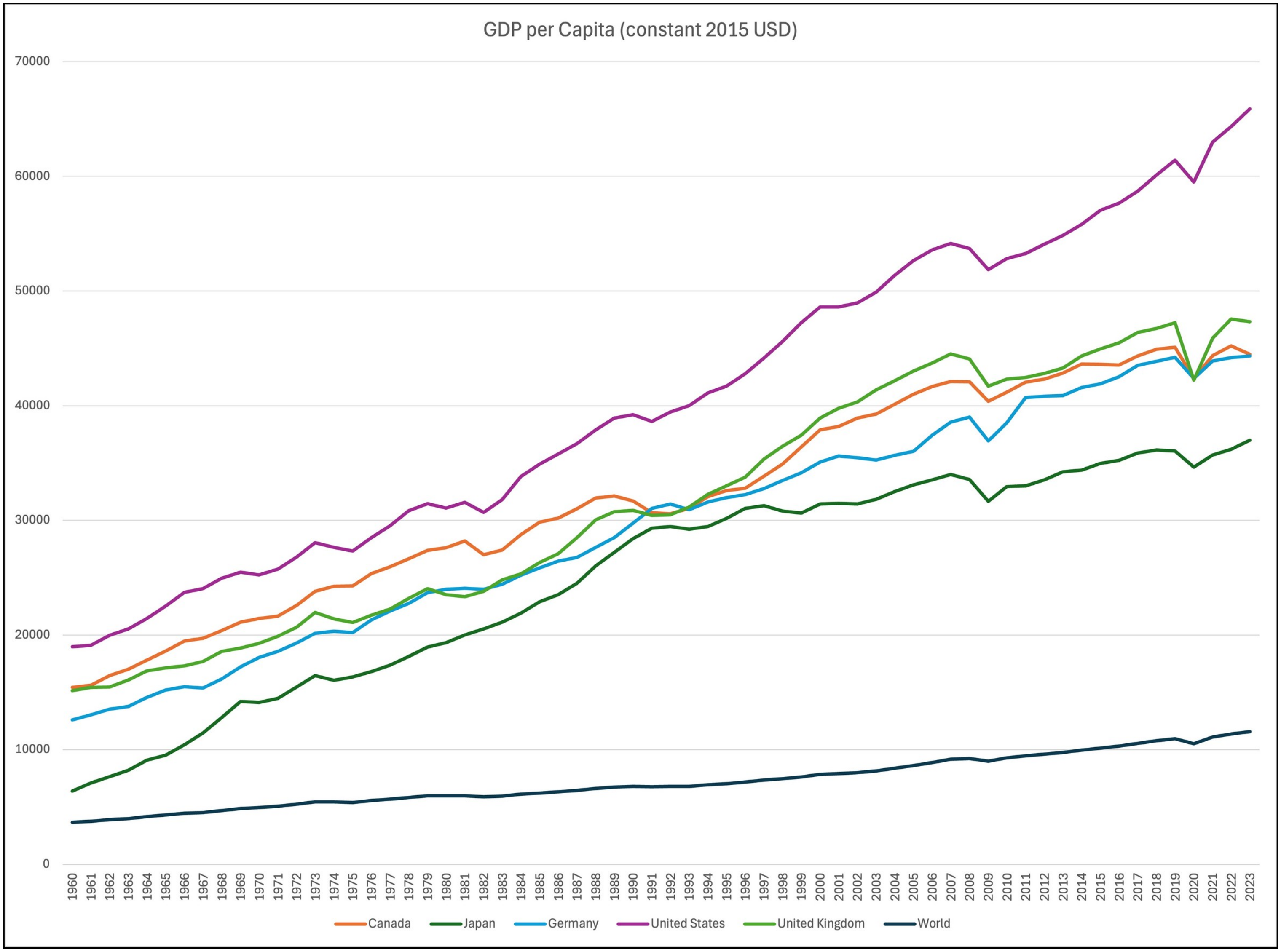
Zoom in 2008-2012:



Canadian Recessions vs US Recessions

Canada		US	
Peak	*Trough*	*Peak*	*Trough*
2020 – Feb	2020 – Apr	2020 – Feb	2020 – Apr
2008 – Oct	2009 – May	2007 – Dec	2009 – Jun
		2001 – Mar	2001 – Nov
1990 – Mar	1992 – May	1990 – Jul	1991 – Mar
1981 – Jun	1982 – Oct	1981 – Jul	1982 – Nov
		1980 – Jan	1980 – Jul
1974 – Oct	1975 – Mar	1973 – Nov	1975 – Mar
		1969 – Dec	1970 – Nov
1960 – Mar	1961 – Mar	1960 – Apr	1961 – Feb
1957 – Mar	1958 – Jan	1957 – Aug	1958 – Apr
1953 – Jul	1954 – Jul	1953 – Jul	1954 – May
1951 – Apr	1951 – Dec		
1947 – Aug	1948 – Mar	1948 – Nov	1949 – Oct
		1945 – Feb	1945 – Oct
1937 – Nov	1938 – Jun	1937 – May	1938 – Jun
1929 – Apr	1933 – Feb	1929 – Aug	1933 – Mar

Sources: CD Howe Commentary No.366, FRED dates for recession bars.



Source: World Bank [Data Bank,](#) World Development Indicators (data sources from individual country statistical agencies)
Note: Not all countries experience same presence, timing or depth of economic downturns and upswings

Business Cycles are recurrent and movements are persistent

Recurrent: business cycles will occur repeatedly in the same pattern (expansion, peak, recession, trough)

Persistent: each component of the business cycle represents movement that continues for some period of time

Co-movement: variables that predictably move in the same (or opposite) direction as AEA in the business cycle

Procyclical: variable moving same direction as AEA

Countercyclical: variable moving opposite direction as AEA

Acyclical: having no discernible co-movement with AEA

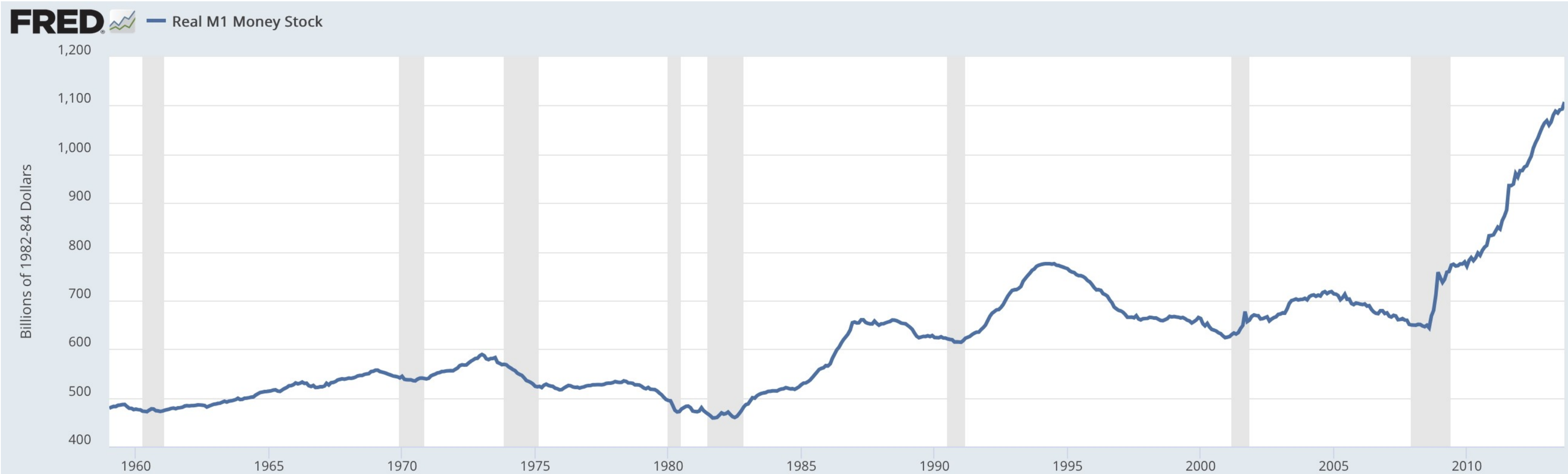
Timing of variable movement is characterized by variables tending to move after/at/in-advance-of AEA in business cycle

Leading Variable: variable that tends to move before AEA

Lagging Variable: variable that tends to peak/trough after AEA

Coincidence Variable: a variable that tends to peak and trough at the same time as AEA

With this information, can we predict when a recession will occur?



source: Federal Reserve Bank of St. Louis, Real M1 Money Stock [M1REAL], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/M1REAL, December 29, 2024.

Components of AEA

1. Production

2. Expenditure

3. Employment, Unemployment, Labour Productivity

4. Money Growth and Inflation

5. Financial Variables

Key Questions

1. What causes business cycles? Are they made in isolation?

2. Do business cycles affect long term economic growth?

3. How should the government respond to business cycles?

4. Are business cycles changing over time?

We have not constructed a GE model, but with the components we have constructed so far, we can start to think about predicting what would happen in the event of a temporary drop in A (negative supply shock)

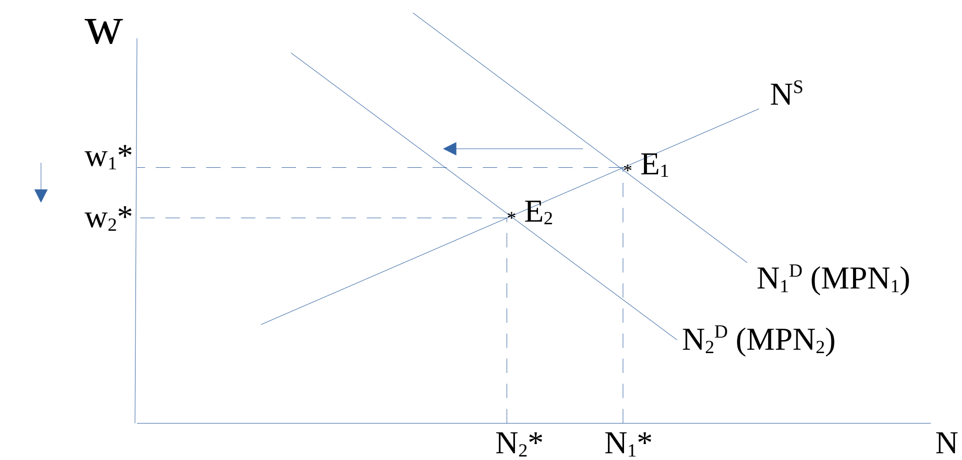
Ex/ Temporary increase in energy prices reduces A (fall from A_1 to A_2) reduces MPN, therefore labour demand decreases. Market clearing wage and employment would drop.

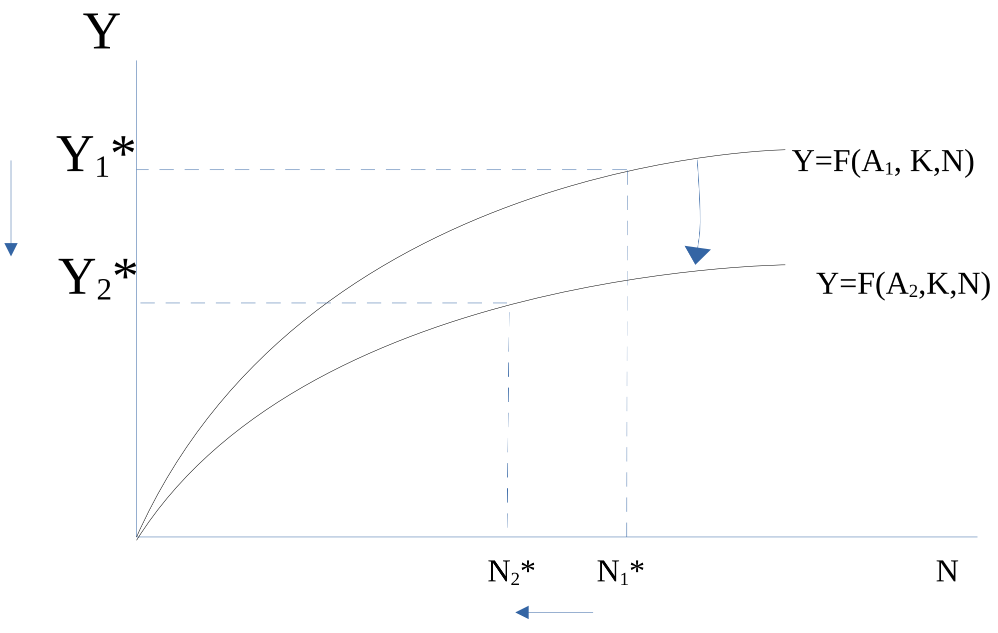
With a reduced A and lower N* then FE would fall (recall FE=Y*=AF(K,N*)

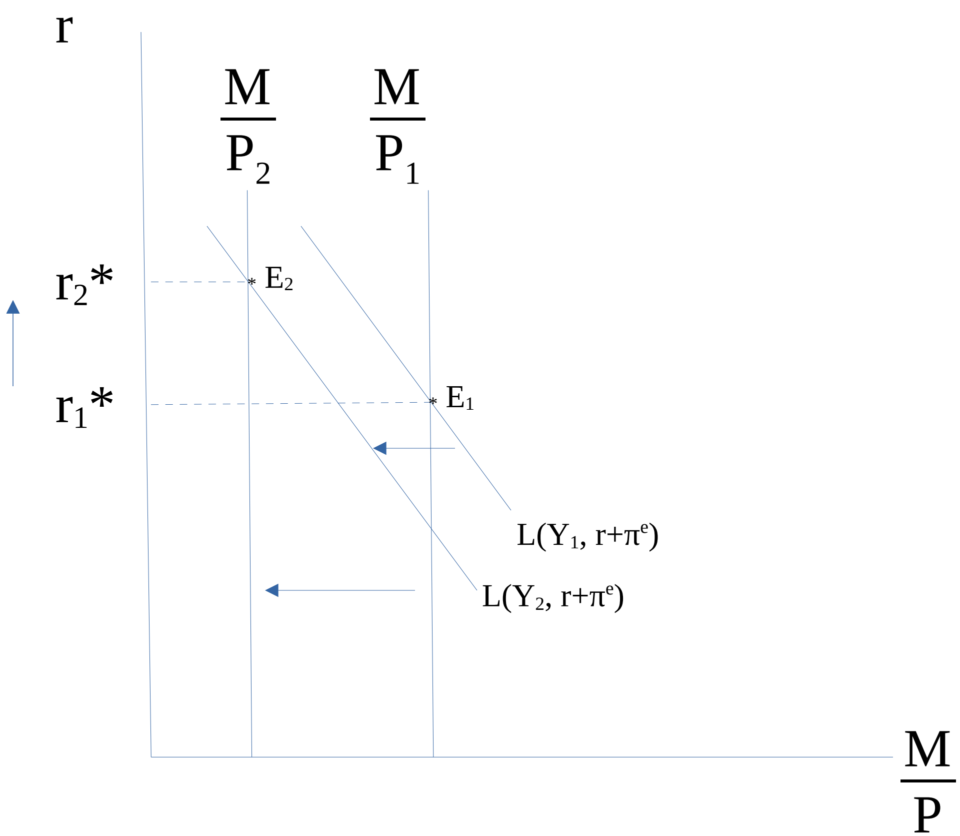
Investment demand unchanged because shock is temporary (MPK^f & K* unchanged)

Consumption demand fall somewhat (tempered by MPC).
Note: If consumption demand doesn't fall much, then aggregate demand in the economy will exceed Y*, putting upward pressure on prices – until Demand=Supply S=Y-C-G (Y falls by more than C), so S falls resulting in a higher market clearing r

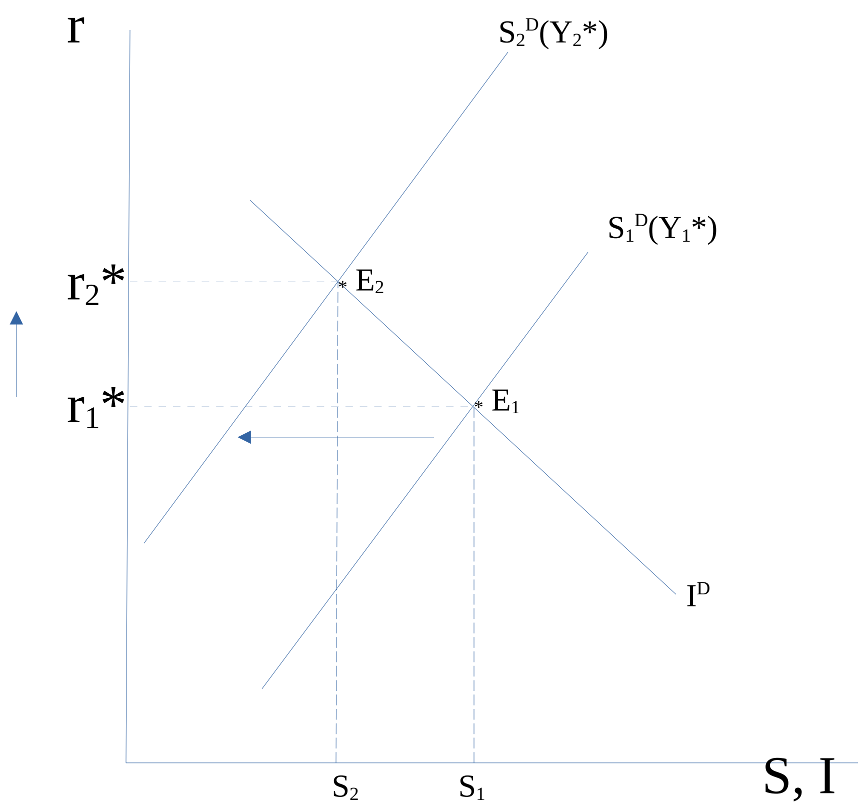
Graphically:







r
M / P2
M / P1
r2*
E2
r1*
E1
L(Y1, r+πe)
L(Y2, r+πe)
M / P



r
S2D(Y2*)
S1D(Y1*)
r2*
E2
r1*
E1
ID
S2
S1
S, I

Real Business Cycle (RBC) theory focuses on **supply shocks** driving business cycles, early RBC models had many predictions similar to the above simplified example

Major criticisms:

1. Reliance on productivity shocks, which are unknown
2. Prediction of money neutrality
3. Prediction of zero unemployment

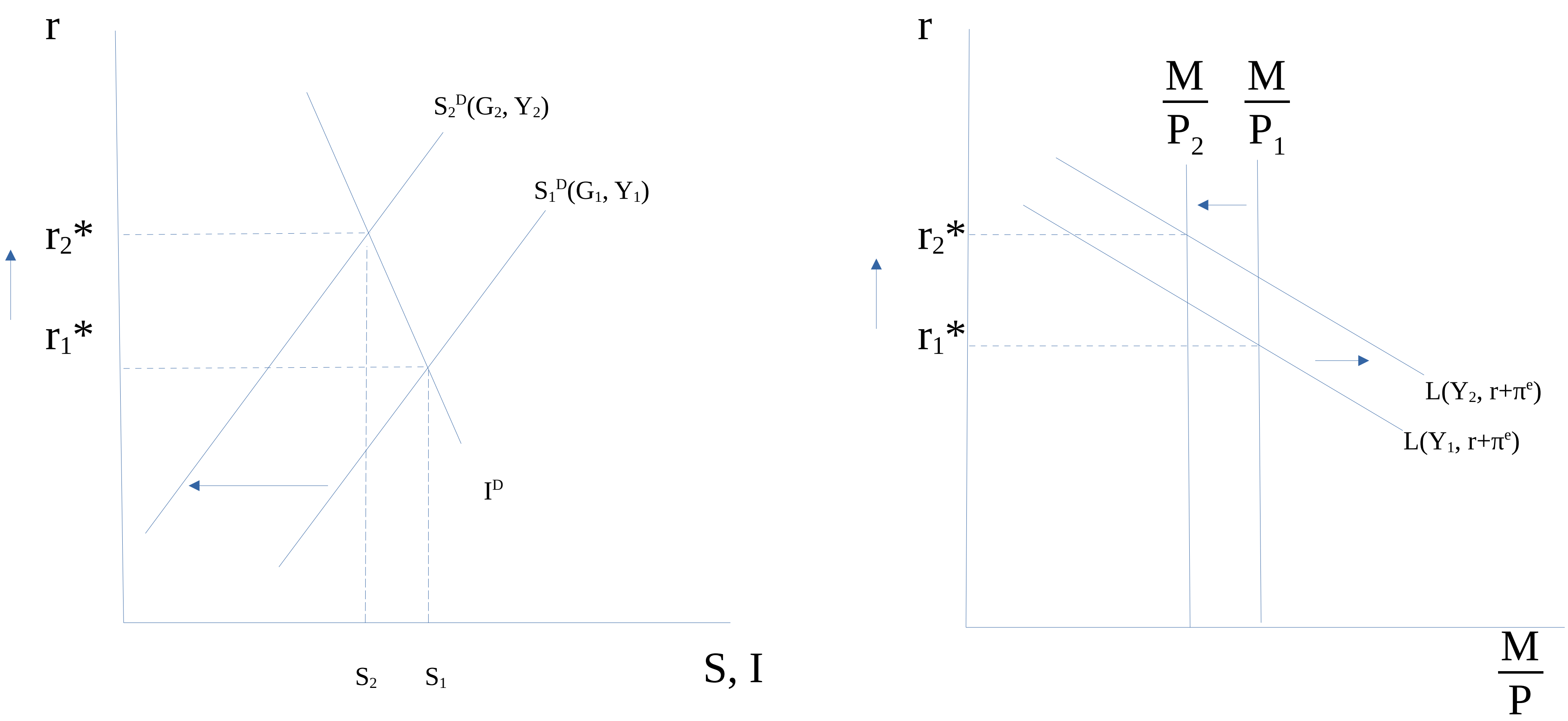
Business cycles could be caused by **demand shocks**: the recession/boom would represent a short run disequilibrium position (not all markets in equilibrium) with price stickiness and wage rigidity

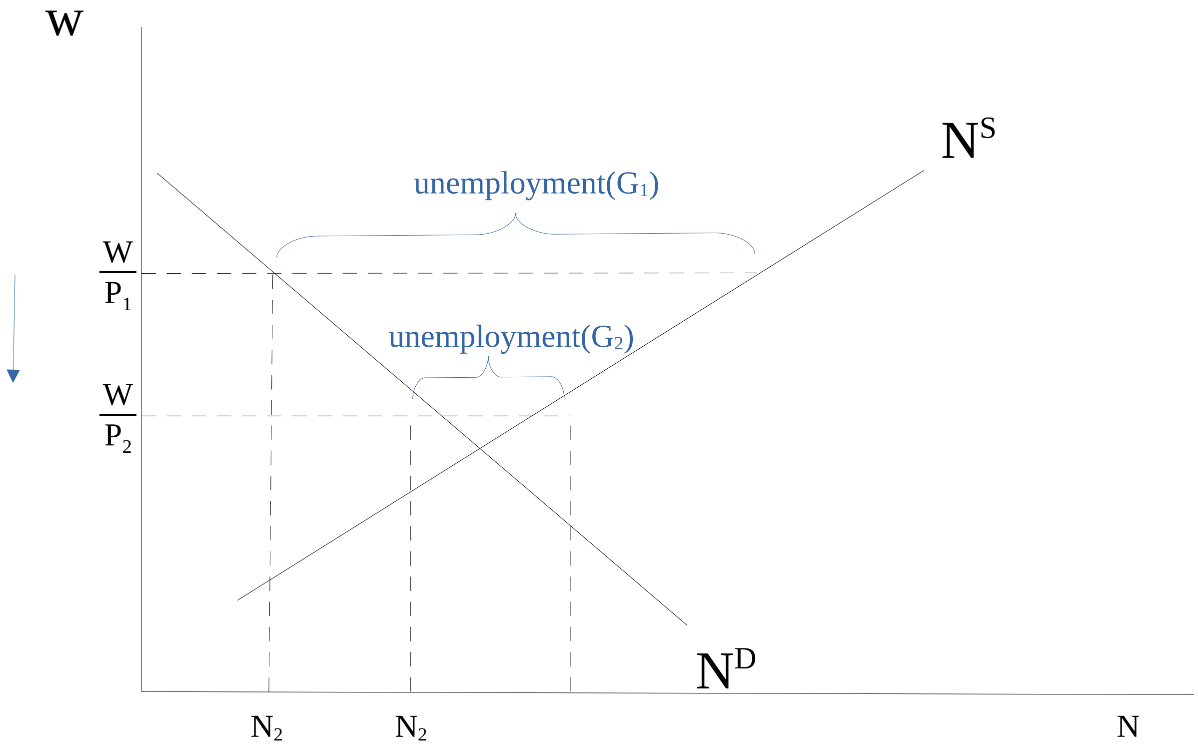
We talked about reasons for wage rigidity, what about sticky prices? What could generate price stickiness?

1. menu costs

2. monopolistic competition

e.g. Increase in Government Spending, decreases Saving demand ($S^D = Y - C^D - G$)





Price adjusts partially, assume nominal wage rigidity such that nominal wage unchanged

Predicts:

*Pro-cyclical Employment, counter-cyclical Unemployment

*Money is not neutral

Drawbacks:

*predicts countercyclical wages

*can exist zero unemployment

Long Run Trends & Growth

* Empirically we observe economies growing across time

Country (selected subset)	**Real GDP Growth 2023 (%)**
Canada	1.2
Argentina	-1.6
Bangladesh	5.8
Bhutan	5.2 (2022)
Burundi	2.7
China	5.2
Costa Rica	5.1
India	8.2
Iran	5.0
Japan	1.7
Mexico	3.2
Netherlands	0.1
Spain	2.7
Saudi Arabia	-0.8
Ukraine	5.3
Russian Federation	3.6
USA	2.9

source: World Bank, accessed January 26, 2025 at https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG

Strong economic growth is generally assumed to improve our wellbeing, and therefore policies which promote growth are often supported

How should we measure growth?

Growth is typically measured using GDP, with all of the concerns and drawbacks of using GDP (from section II being applicable)

When assessing growth, additional measurement dimensions should be considered:

*Growth vs growth net of population change (per capita growth)

*Distribution of growth

Exercise

1. Download annual Real GDP and Population from Statistics Canada (Table numbers 36-10-0222-01 and 17-10-0005-01)

2. Plot Real GDP and Real GDP per Capita across time. What do you observe?

3. Repeat steps 1 and 2 for any other country of your choice. What do you observe?

4. Compare the population growth rates for Canada and the country you selected in step 3. What do you observe?

Models of Growth

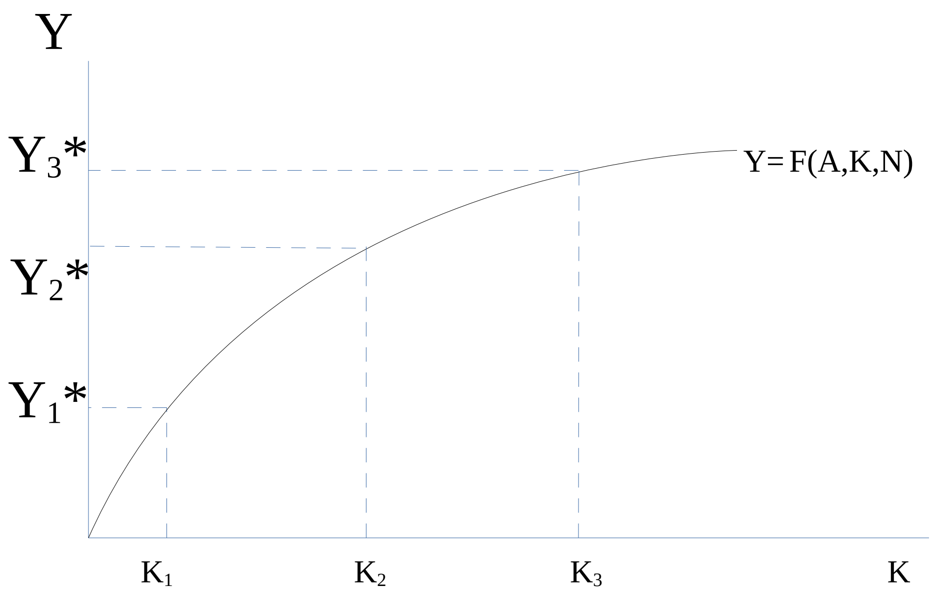
In our simple aggregate model, there are three terms which determine Y. Lets use a general function Y=F(A, K, N)

Therefore there are three elements which influence growth

1. Increases in N: as the population or employment level increases, the economy can produce more goods. Therefore population growth is generally associated with GDP growth

However, as we are often interested in growth per person, we tend to focus on some variant of growth of output per person or output per worker

2. Increases in K: yield increases in Y, and are a key focus of research on economic growth.



Greater capital stock means higher output, but diminishing returns mean that the higher the current level of K, the smaller the MPK (the smaller the increase in Y, and therefore subsequent increases in K)

*Thus, countries with relatively lower levels of capital (and lower levels of GDP), are predicted to have higher growth

*Simple models of growth predict an economy will converge to a steady state (balanced) growth

Economies well below that steady state will exhibit faster growth, where growth would slow as the economy converges to the balanced growth path: convergence theory

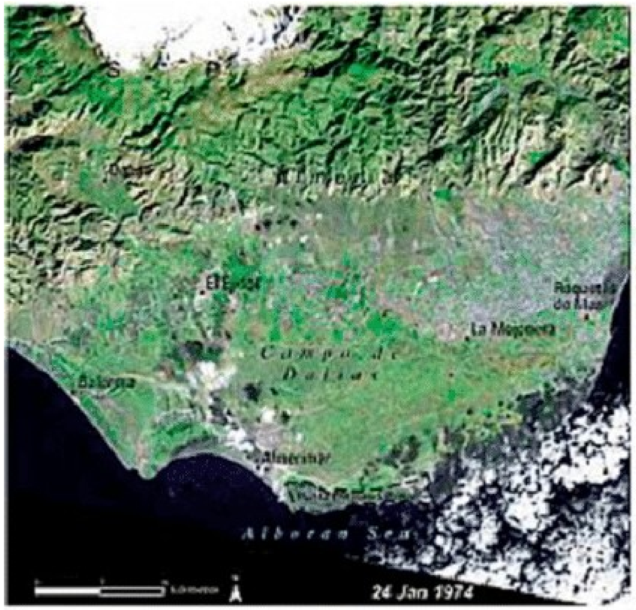
The steady state amount of capital could change if the saving rate of the economy changes, and increase short term growth, but the economy will still converge to the same balanced growth path

3. Increases in A: also yield increases in Y

If we construct a more complex example where A is not simply taken as given (exogenous), but is instead produced by the economy then the economy may or may not converge to a balanced growth path

There are many variants of growth models including: models with production functions that account for limited and diminishing resources, models that take into account human capital, models that do not assume CRS, models with more than one type of agent

Some of these models do not converge to a steady state


El Ejido
La Mojonera
Balerma
Alboran Sea
24 Jan 1974

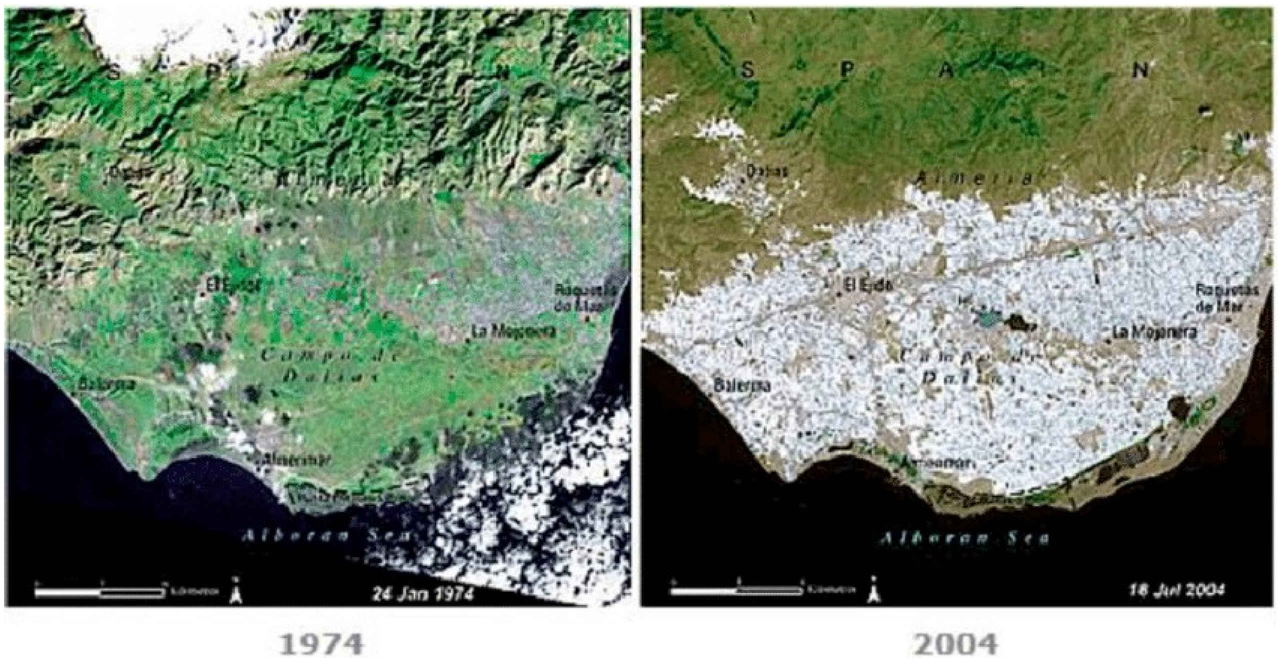
1974


Dalias
Almeria
El Ejido
Roquetas de Mar
La Mojonera
Balerma
Alboran Sea
18 Jul 2004

2004

Technology, Growth & Inequality

*Technological change may be important to positive growth of GDP per worker



Source: History of Controlled Environment Horticulture: Greenhouses - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Growth-of-the-greenhouse-industry-in-the-Almeria-region-of-Spain-during-30-years-between_fig3_358267715 [accessed 1 Feb 2025] See also https://geographyfieldwork.com/AlmeriaClimateChange.htm

What happens when firms adopt new technology?

While technological change is important to growth, it involves the obsolescence of some existing capital, and structural change which adversely affects some markets and participants more than others

Growth is measured increases at an aggregate level, but there are both benefits and drawbacks

Benefits include: increasing real GDP of an economy, with associated potential well-being improvements

Drawbacks can include: structural unemployment and the associated human losses (see text), obsolescence of capital, potential un-sustainability & environmental degradation, potential decreases in well-being, and increasing inequality

Growth for whom? Can economies experience growth without increasing inequality?

Do lower levels of inequality slow growth?

Some research suggests that high levels of inequality reduce growth in countries with low GDP, but increase growth in high GDP countries. Others find a negative impact on growth, and still others find that there is a level of inequality/equality at which growth may be impinged

Do we need growth?

Inequality & Poverty

Generally speaking **poverty** is seen as deprivation of resources. Which resources, and how much, are a subject of discussion

Moreover, dimensions of poverty can include deprivation of means and ability to not only maintain a specific living standard, but also to participate politically and socially

Although Poverty may be viewed as an “absolute” line of deprivation, when we consider the greater dimensionality of poverty it is clearly a relative measure

In Canada, the official measure of poverty is the Market Based Measure. MBM: amount of income required to buy a basket of goods/services to meet basic needs for basic living standard (including healthy food, shelter, transportation, clothes, and goods and services that permit engagement in the community), adjusted for location and family size

MBM threshold, 2020, large urban areas in Ontario

Single person household	$23,153
Four Person Family	$46,306

Source: https://www12.statcan.gc.ca/census-recensement/2021/ref/dict/tab/index-eng.cfm?ID=t2_2

If family income>threshold, family is above poverty line

This measure is focused on income; however, policy makers recognize the importance of education, wealth, and other factors that influence the opportunities to maintain a reasonable standard of living and participation over the long term, and not just consider immediate deprivation

Inequality (differences)

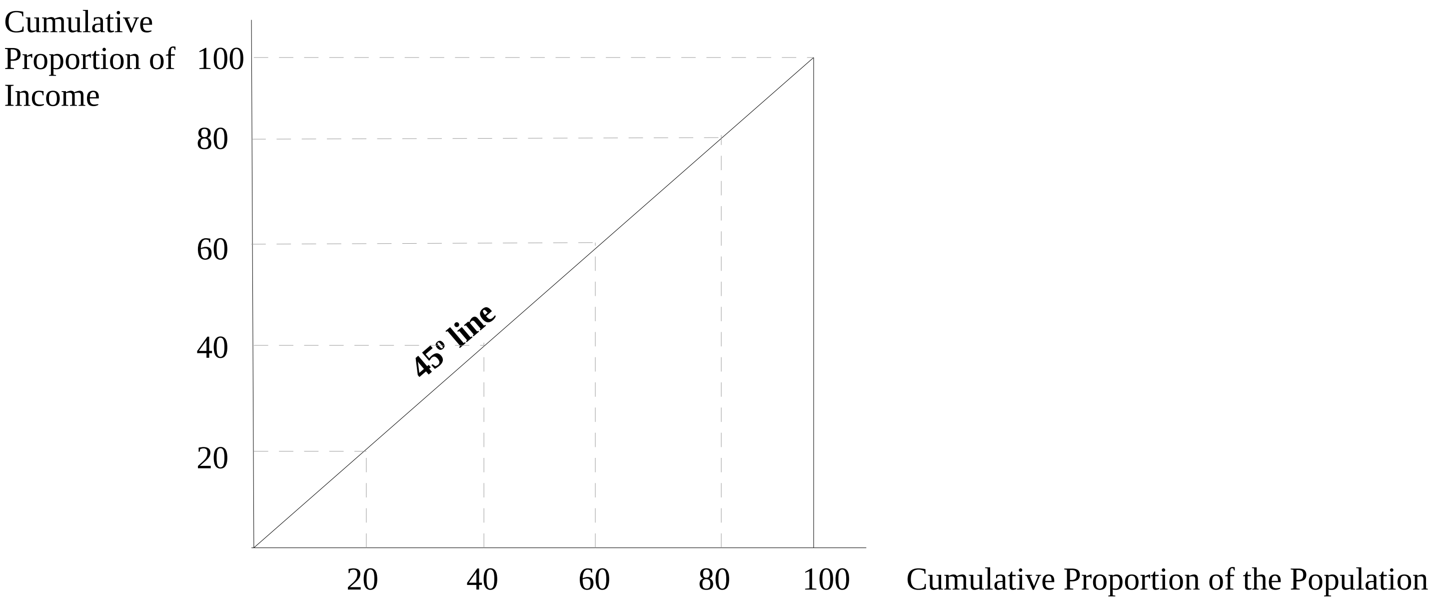
Measures of inequality are explicitly relative

Commonly cited measures of income inequality include

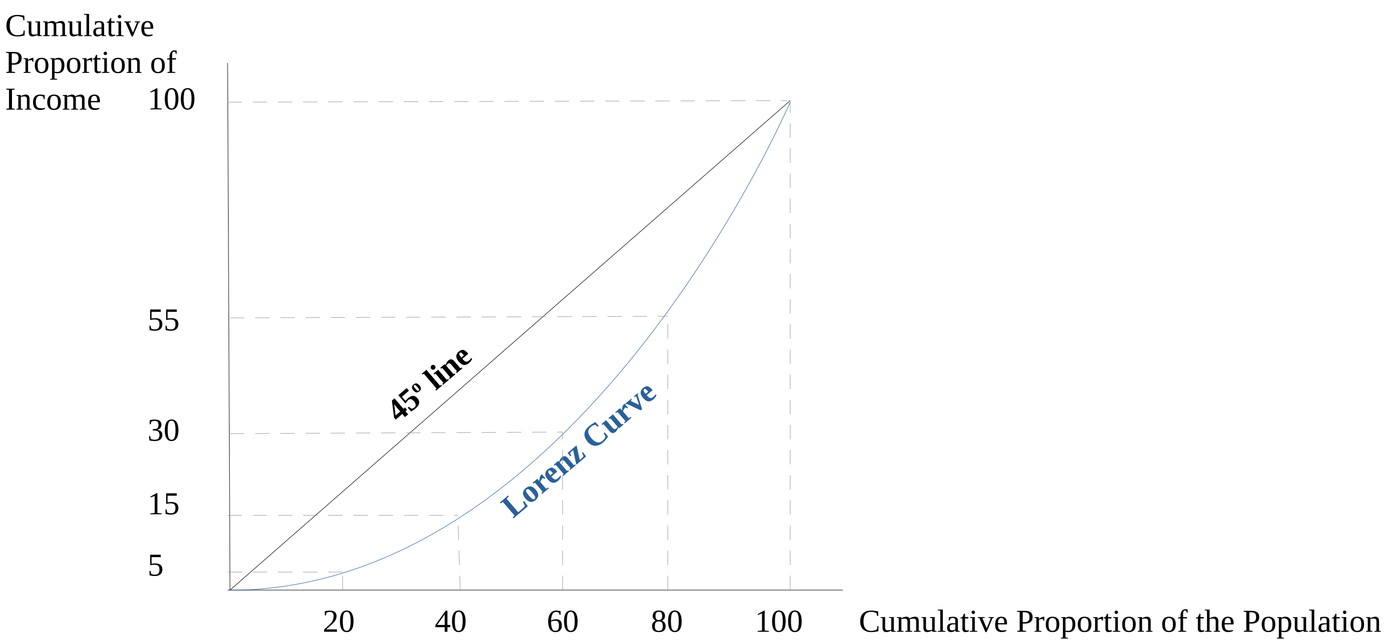
Gini index: a measure of inequality which increases in the share of total income held by the higher earners. Hence, Lower Ginis imply greater equality

Specifically, the Gini is the ratio of ‘the area between the 45^{o} line and the Lorenz curve’ to ‘the area below the 45^{o} line’, where the Lorenz curve represents the cumulative share of income held by the cumulative share of earners

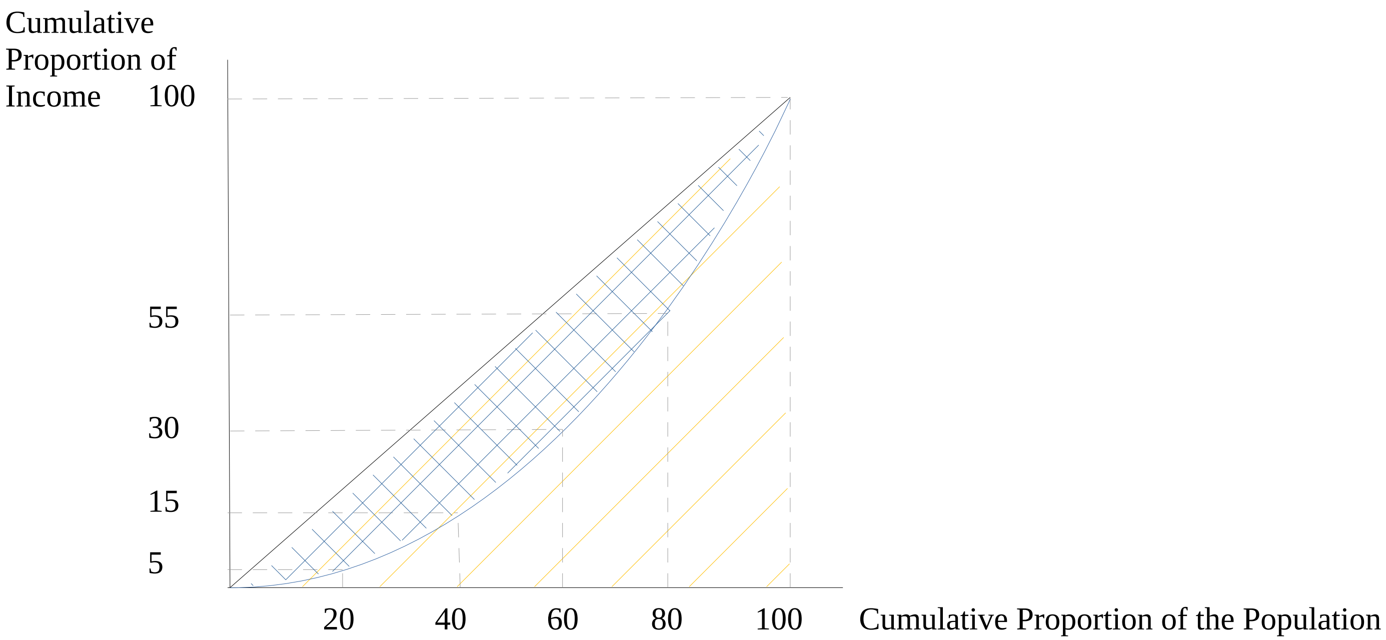
Ex/ Suppose everyone has the same income, so then the bottom 20% earned 20% of all income...up to the top 20% earning 20%. Then each group has an exactly equal share of total income, and the Lorenz curve would equal the 45 line and the gini would be zero.



Now suppose the bottom 20% earned 5% of all income, the next 20% earned 10% of all income (cumulate to 15%) the next 20% earned 15% (cumulating to 30%), the next 20% earned 25% (cumulating to 55%), and the top 20% earned 45% (cumulating to 100%) of all income (Show the Lorenz curve graphically, with bars adding up each 20% group). The Gini in this case would be 0.38



The Gini is 0.38 (The blue checked area divided by the yellow lined area)



Gini is an intuitive measure that summarizes inequality with a single value, but different distributions can generate the same (or similar) Ginis

Generalized entropy indices (e.g. Theil): are weighted ratios of incomes to the mean. A measure of distance from equality. Higher values mean greater inequality

These indices are invariant to population size, scale of income, additively decomposable & rank preserving, but are less intuitive than the Gini, and are not directly comparable across populations with different sizes or group structures

Decile ratios: can be constructed for various decile comparisons, and can be presented in log form, or as share, limit, or average ratios e.g. average income earned by the top decile divided by the average income earned by the bottom decile (90-10) is a common ratio

These indices are also intuitive, but do not use all information (e.g. inequalities in other percentiles)

Inequality indices may be applied to any number of variables, but the most common is income

Other common inequalities measured are wage, wealth and consumption

Consumption inequality may give a better summary of welfare inequality, because that is the end result of wage, income (total vs labour) and wealth differences (income alone may hide differences in wealth or wage that might help smooth consumption during negative shocks)

However, consumption may also involve greater choice, and looking at differences/distributions across multiple dimensions can provide a better understanding of the sources and outcomes of inequality

Poverty vs Inequality

One might argue that some level of inequality is necessary to motivate effort (e.g. efficiency wages would not be effective without wage differences)

Poverty (or a deprivation measure) may be a simpler measure to use when assessing whether policy intervention is needed

However, some research suggests that inequality can have very negative health and wellbeing implications for the population. Therefore, policy intervention on inequality may be particularly important as well

Exercise:

1. Access Statistics Canada's table 11-10-0134-01 and download the Gini coefficients for total income and after tax income for all levels of geography from the earliest to the most current date. Graph these two measures for Canada across time. What do you observe about the Gini for total income vs after-tax income?

2. Compare Gini trends for each of the provinces/regions available. What do you observe?
(is it important to use both measures? why/why not?)

3. Go to Canada's Quality of Life Framework website https://www160.statcan.gc.ca/index-eng.htm At the bottom of the main page are a series of indicators. 5. Browse through the measures. What do you observe?

4. Click on the Health Adjusted Life Expectancy measure. Is it always increasing? What would happen to average life expectancy if infant mortality rates fell, but the average age at death for individuals over 60 remained constant?

5. Download data on the percentage of the Canadian population in low income (Table: 11-10-0136-01) using the market base measure with 2018 base. What do you notice about the data availability? What do you notice about trends

VII. Monetary and Fiscal Policy

Monetary Policy

Monetary Policy typically has an overarching goal of maintaining a stable economy to promote the current and future wellbeing of the people living and working in the economy

Inflation Targeting is one of the most prevalent ways in which Central Banks try to achieve this overarching goal

The Bank of Canada's Monetary Policy framework centres primarily on flexible inflation targeting

If inflation is high/rising, Central Bank can raise i_{ON}, which influences the prime rate and thus the rates paid by firms and consumers. Higher interest rates → borrowing more expensive → Consumption & Investment demand fall → inflation slows

If inflation is low/falling, the Central Bank can lower i_{ON}, depressing interest rates, making borrowing less expensive, boosting Consumption and Investment demand, bolstering prices

The Bank of Canada’s current inflation target is 2%

A target that is too low may risk contracting the economy

A target that is too high may risk economic instability

Targets that change frequently run the risk of increasing uncertainty & confusion, and decreasing credibility

Additional tools may be used by Central Banks:

Quantitative Easing (QE): tool to influence longer-term interest rates

Central Bank buys government bonds, increasing their price and lowering their returns. The Central Bank's payment for bonds increases settlement balances (reserves)

Quantitative Tightening pulls back from QE, either by selling bonds or allowing them to mature

Financial Regulation: aimed to increase public confidence in banking and financial systems

Monetary Policy may not always be the most effective option, particularly with respect to combatting recessions

Considerations for the effectiveness of Monetary Policy

Lags - difficult to determine best policy and to assess policy effectiveness because there is a lag between implementing the policy and it's effects on the economy

Credibility – to reduce inflation without generating a recession, the bank's policies must be credible (believed)

Approaches to Monetary Policy

1. Rules Approach: set an automatic simple rule that governs monetary policy

ex/ Taylor Rule: $i_{ON} = \pi + 0.02 + 0.5y + 0.5(\pi - 0.02)$

where i_{ON} = nominal overnight rate
π = rate of inflation from previous 4 quarters
$y = (Y-FE)/FE$ = percentage deviation from FE output

2. Discretion – react to economic shocks as best able

Why use rules rather than discretion?

*Lags make it difficult to predict outcomes & timing

*Rules improve credibility, increasing policy effectiveness

Why use discretion rather than rules?

*Economic system too complex for a simple rule

*Improving forecasts → can improve policy

Fiscal Policy

Government Expenditure: G + TR + INT

Government Revenue: T

When revenue>expenditure, the government has a surplus

surplus = T-G-TR-INT

deficit= G+TR+INT-T

Fiscal Policy: changing G, T or tax rates

Potential Benefits/Drawbacks Fiscal Policy

Benefits

1. increase aggregate demand

2. capital formation

3. influence saving, investment & labour

Drawbacks

1. Deficits

2. inflexible mechanism

3. lags

4. inflation

5. distortions which lead to inefficiencies

Automatic-Stabilizer: budgetary provisions which allow G and T to rise/fall automatically with economic fluctuation (ex/ with GDP)

Examples of Automatic Stabilizers include Employment Insurance and Taxes

Is the deficit a “bad” thing?

Is the deficit a burden on future generations?

Seignorage– method of raising money (to pay for gov't spending) via printing money

Quantitative Effects of G on Y

Multiplier: change in total output resulting from a one unit change in spending

$$\Delta Y/\Delta G = 1/(c+i)(\beta_{LM} + \beta_{IS})$$

How is the multiplier determined for an economy? By processing the effects through all markets and the feedback loops

If the model is specified by a series of equations for each behavioural and market component, then you would plug the change in G into the equations that contain it, and calculate the final net change in Y

Examples of policy that may lower Unemployment & Inflation

Some policies to reduce Unemployment

*job training programs

*Reform EI

*Reduce market interference

*Monetary and fiscal policy (Keynesian)

Some policies to decrease Inflation

*Monetary Policy

*Direct wage/price controls (Keynesian)

Lucas Critique: when you introduce a policy, you change people’s behaviour, so if you are not modelling behaviours your predictions could be inaccurate

Cold Turkey vs Gradual style policies: fast vs slow approach

IX. International Economic Concepts, Exchange Rates & Balance of Payments

Balance of Payments Accounting

Balance of Payments Accounts: that part of the National Accounts that record international trade and investment

Major Components of BoP

1. Current Account

2. Capital (& Financial) Account

Current Account (CA): measures the country's exports and imports of currently produced goods and services as well as net transfer payments between countries.

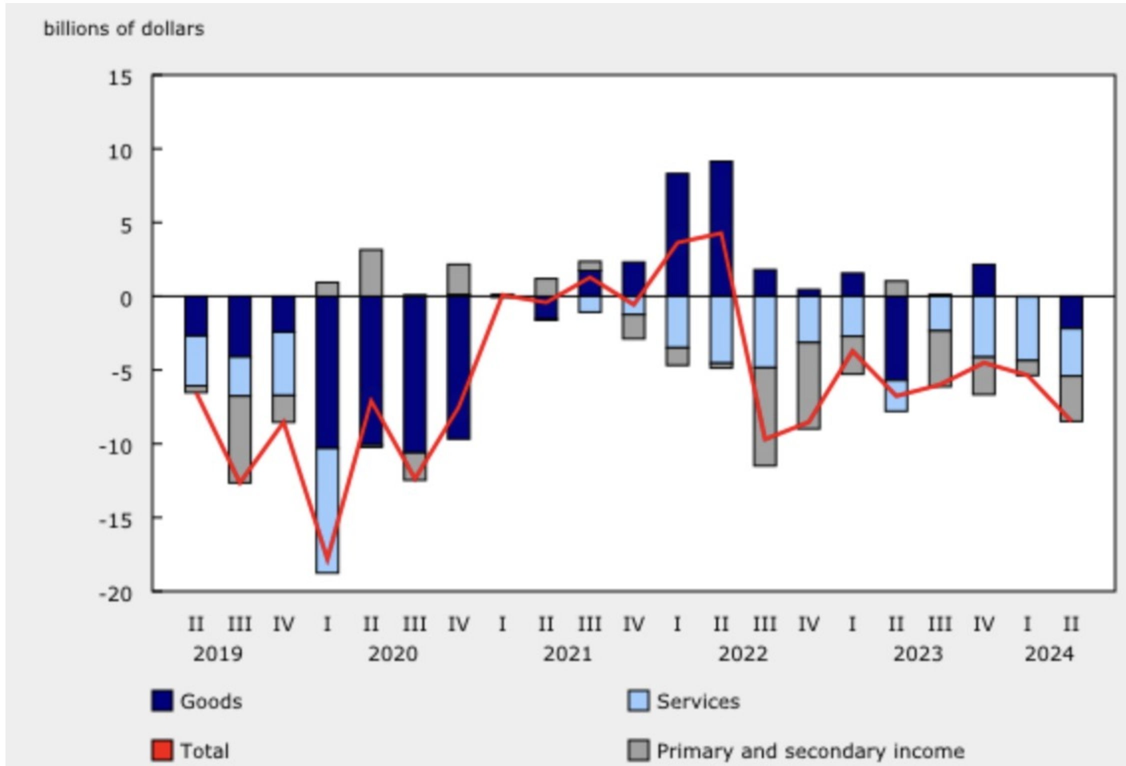
CA = NX +NFP

Current Account Balance:

sum of all credits – sum of all debits

Tells us whether or not the country is producing more than it is spending, or vice versa

Canada’s Current Account Balance Components over Time



Note(s): Data are seasonally adjusted.

Source(s): Table 36-10-0018-01.

Source: Statistics Canada Daily, Current Account Balances https://www150.statcan.gc.ca/n1/daily-quotidien/240829/cg-a001-png-eng.htm

The Capital (& Financial) Account (KA): records trade between countries in existing assets

financial or capital inflow

financial outflow

Among a country's stock of financial assets are its Official reserve assets

Official reserve assets: assets other than domestic money or securities that can be used in making international payment

Official settlements balance: net increase in a country's official reserve assets

Capital Account Balance:
value of capital inflows – value of capital outflows

Each period, we must have:

$$CA + KA = 0$$

The balance of payments accounting system is designed so that this identity is true by definition

But, in practice (in data) $KA+CA \neq 0$

Why?

Goods Market Equilibrium in Open Economy

A key element of an open economy is that a country's spending doesn't have to equal it's production

$Y \neq C + I + G$

$Y = C + I + G + NX$

Rather than assuming NX=0 (as we did in the closed economy), we let NX enter our analysis

Recall that national savings = Y+NFP-C-G

so

$$
\begin{aligned}
S &= GNP - C - G \\
&= C + I + G + NX + NFP - C - G \\
&= I + NX + NFP \\
&= I + CA
\end{aligned}
$$

So for the goods market to be in eq'm, we must have:

$S^D = I^D + CA$

if we assume NFP=0 to simplify the analysis

$S^D = I^D + NX$ is goods market equilibrium

Note that this is equivalent to:

$Y = C^D + I^D + G + NX$

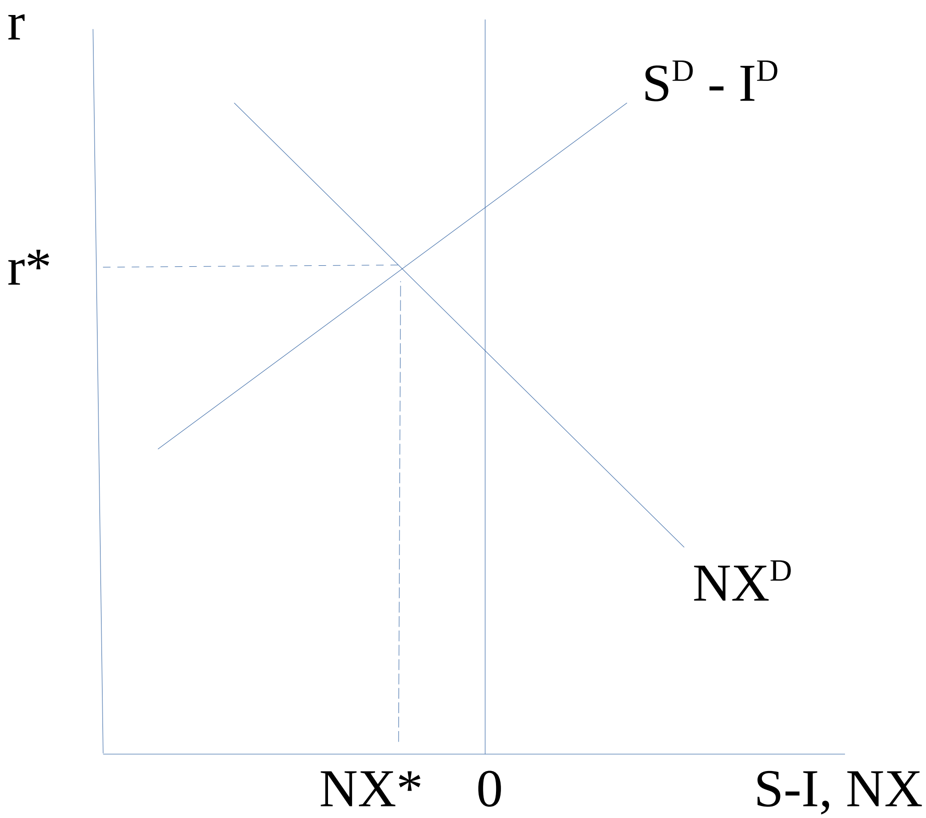
We can rewrite our equilibrium equation:

$S^D = I^D + NX$

as

$NX = S^D - I^D$

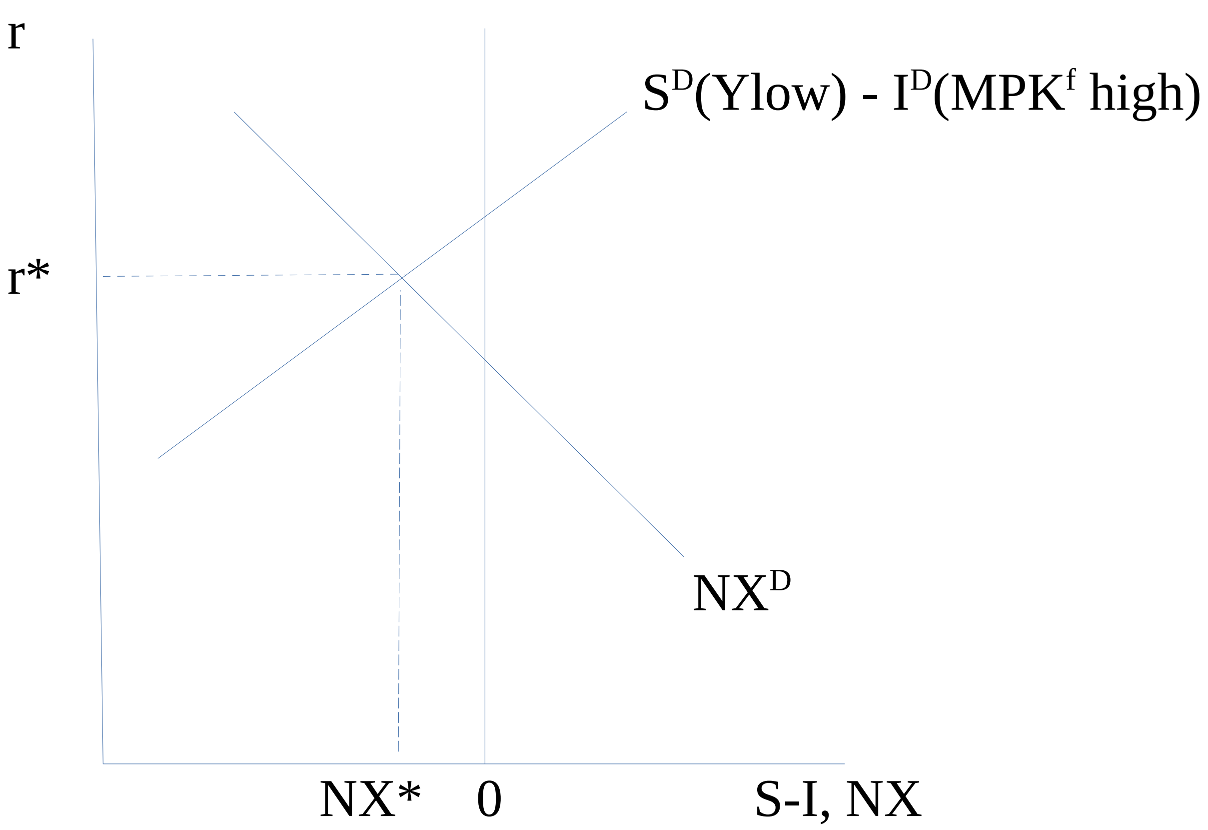
so in our simple open economy, our goods market equilibrium is given by NX equals the difference between saving & investment


r
r*
S^D - I^D
NX^D
NX*
0
S-I, NX

Small open economies: shocks in and decisions of small economies have small impact on the rest of the world

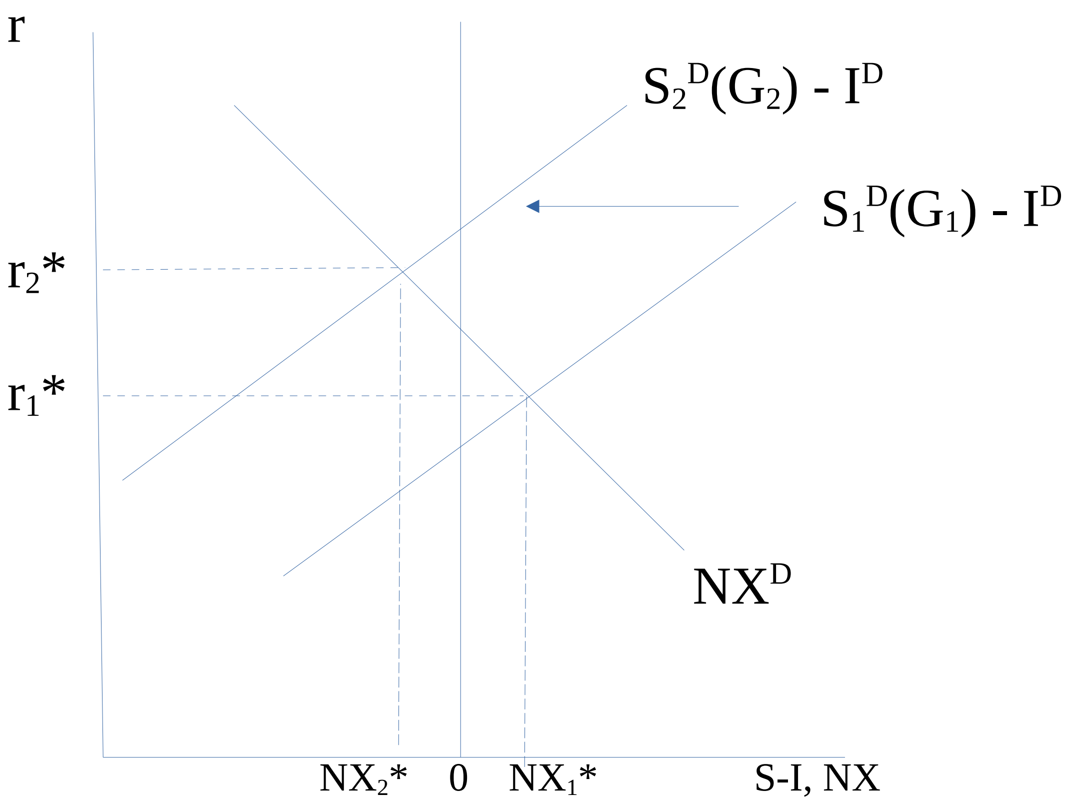
Large open economies: shocks in and decisions of this economy have a large impact on the rest of the world

Why have some lower income countries borrowed so much?



Why were some countries (e.g. Mexico) unable to meet their debt payments in the early 90s?

Twin Deficits: both Gov't budget deficit & CA deficit typically rise with expansionary fiscal policy



Foreign Exchange Markets

Nominal Exchange Rate: amount of foreign currency obtainable by one unit of domestic currency

ex/ December 13, 2024, the nominal exchange rate between the USD and the Canadian dollar was e_{nom}= 0.70 USD per Canadian Dollar
(with one Canadian dollar, I can buy 0.70 of a US dollar)

This is the Canadian nominal exchange rate (price of a Cdn $ in terms of USD)

Bank of Canada daily exchange rate look-up tool provides nominal exchange rates for other countries (price of other countries currencies), with the Canadian nominal exchange rate sometimes presented as well.

Real Exchange Rate: number of foreign goods one would get in exchange for one domestic good.

$$e = e_{nom} \frac{P}{P_{for}}$$

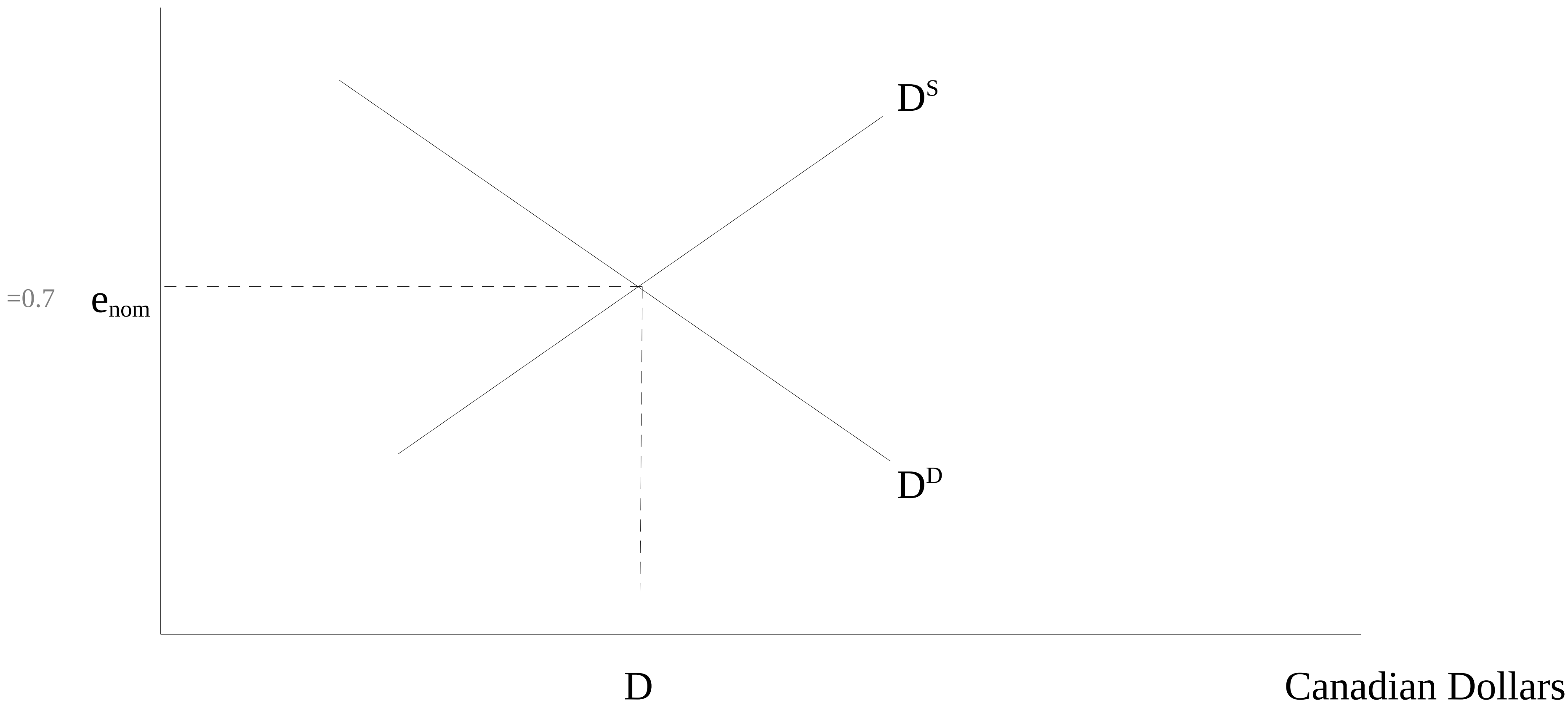
ex/ Suppose I wish to take my Canadian money, convert it into USD, and buy apples in the US. Let the price of an apple be $1.3 in the US, and $2 in Canada, and the exchange rate 0.7. If I have $2 Canadian, I can either buy one apple in Canada, or I can convert my money to USD I get $1.4 US, with this I can buy 1.167 apples. So the real exchange rate is 1.167

Nominal depreciation: when the nominal exchange rate falls

Nominal Appreciation: when the nominal exchange rate rises

Determining Exchange Rates

Foreign Exchange Market – Canadian Dollars



Purchasing Power Parity

If goods can be readily exchanged between countries, then the prices of these goods will equalize, such that if I can afford 1 apple in Canada I can afford 1 apple in US

Purchasing Power Parity (PPP): similar foreign and domestic goods should have the same price in terms of the same currency, so we should see $e=1$

If e=1 then

$$1 = e_{nom} \frac{P}{P_{for}}$$

So

$$P = \frac{P_{for}}{e_{nom}}$$

and

$$e_{nom} = \frac{P_{for}}{P}$$

Thus, PPP is equivalent to stating that the nominal exchange rate is simply the ratio of price levels

Is PPP true?

Why might it fail?

1. Different goods/services across countries

2. Transportation costs and legal barriers

While PPP doesn't tend to hold in RL, prices of goods follow each other closely across countries across time. A relative purchasing power parity appears to holds

Relationship Between NX & e

1. How do exchange rates affect NX?

If you were going to import a good from another country, would you do it where your dollar was worth more or less?

2. How do NX affect exchange rates?

What if the world increases demand for Canadian maple syrup?

We'd see an increase in demand for Canadian dollars. An increased demand for Canadian dollars causes the nominal exchange rate to increase.

Factors That Affect the Exchange Rate

1.world demand for Canadian goods

2. foreign Y

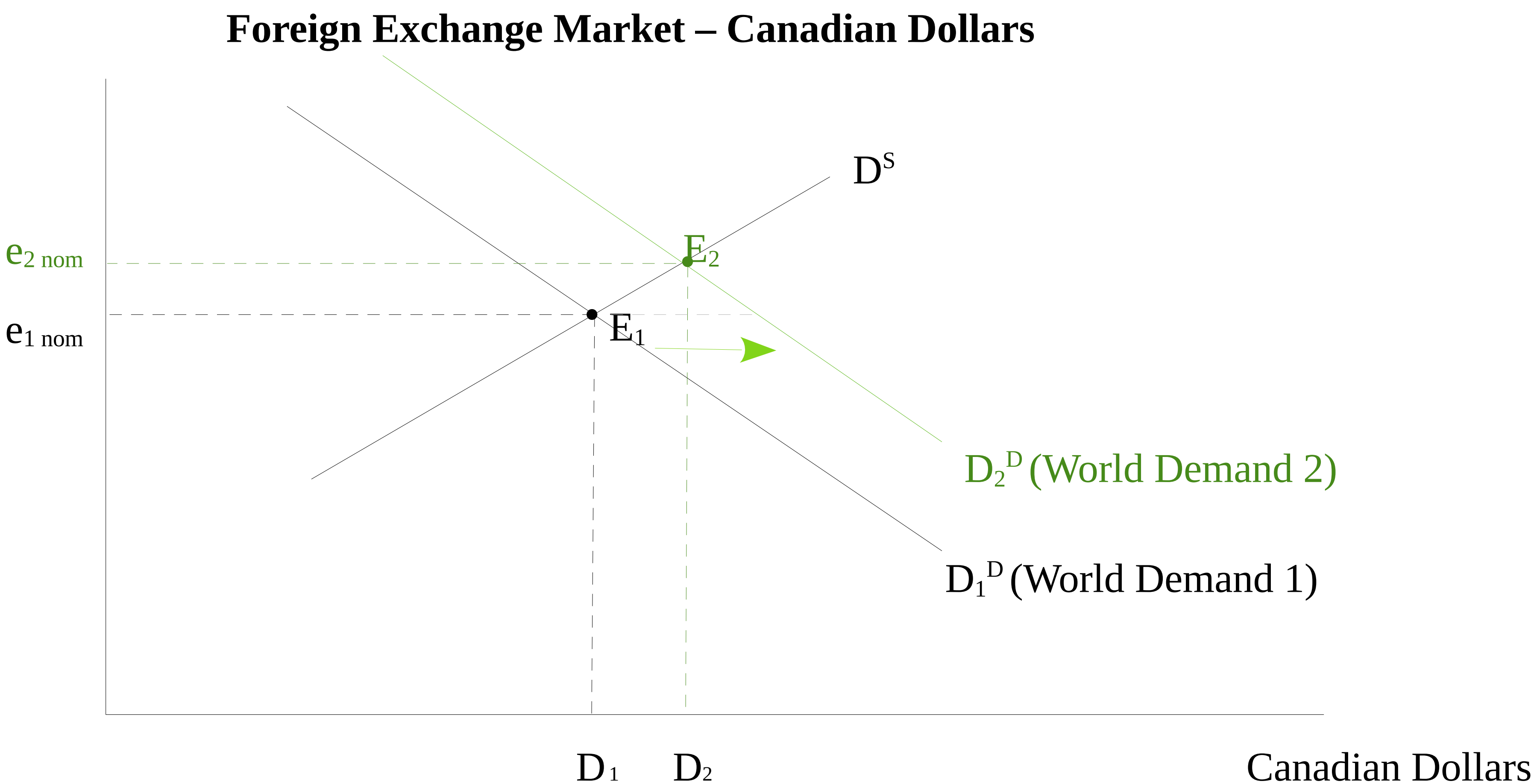
3. Y

4. foreign real interest rate

5. domestic interest rate

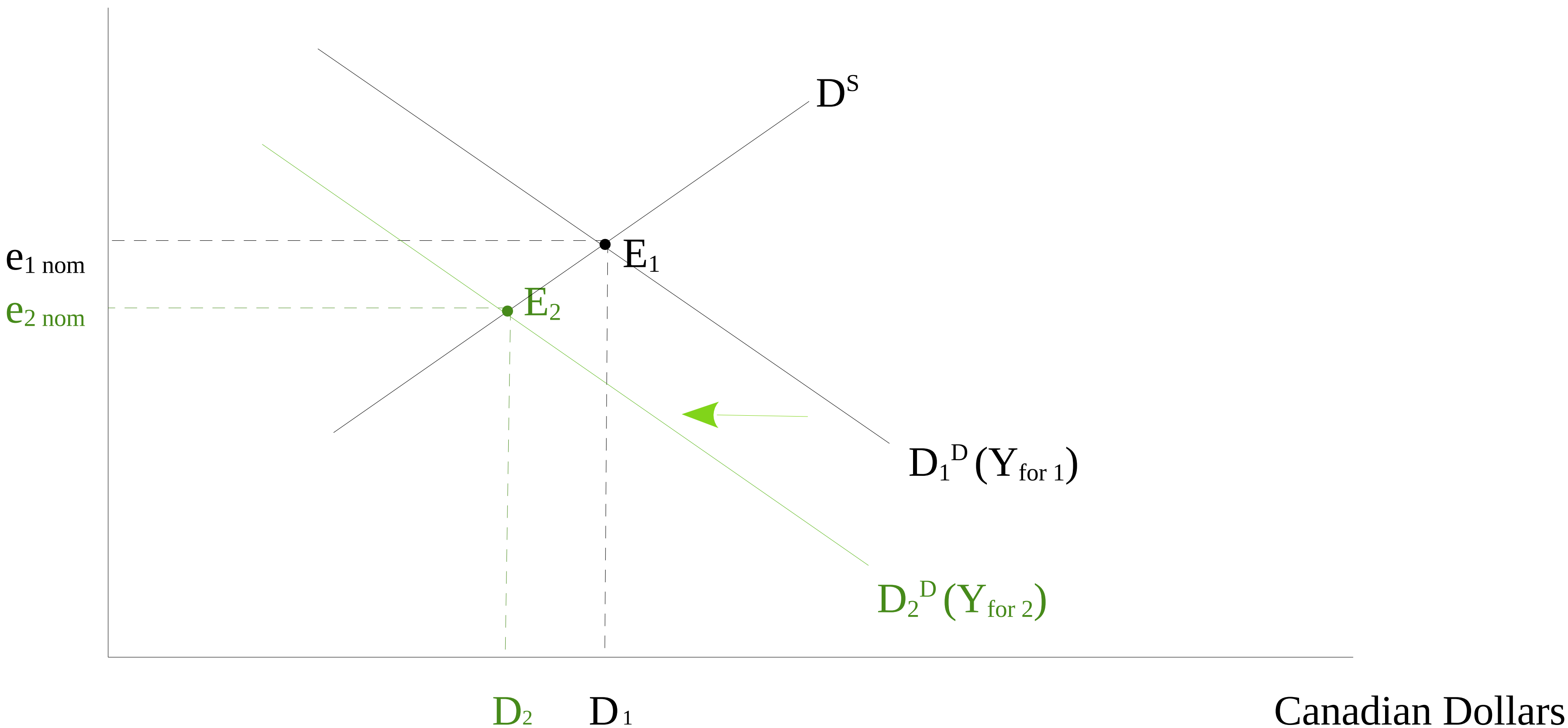
6. Direct intervention

ex/ increase in world demand for Canadian Maple Syrup



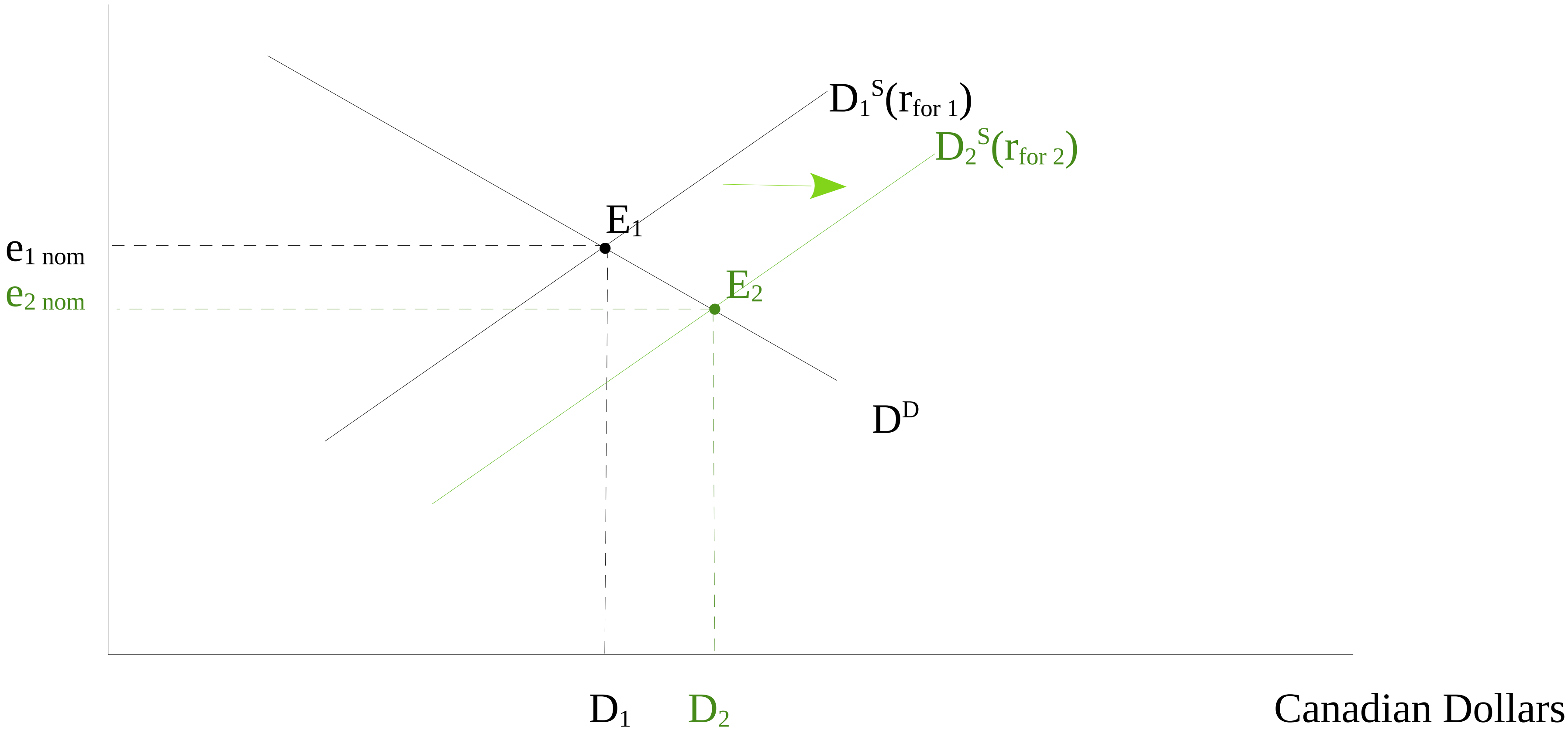
ex/ decrease in foreign Y

Foreign Exchange Market – Canadian Dollars



ex/ increase in foreign r

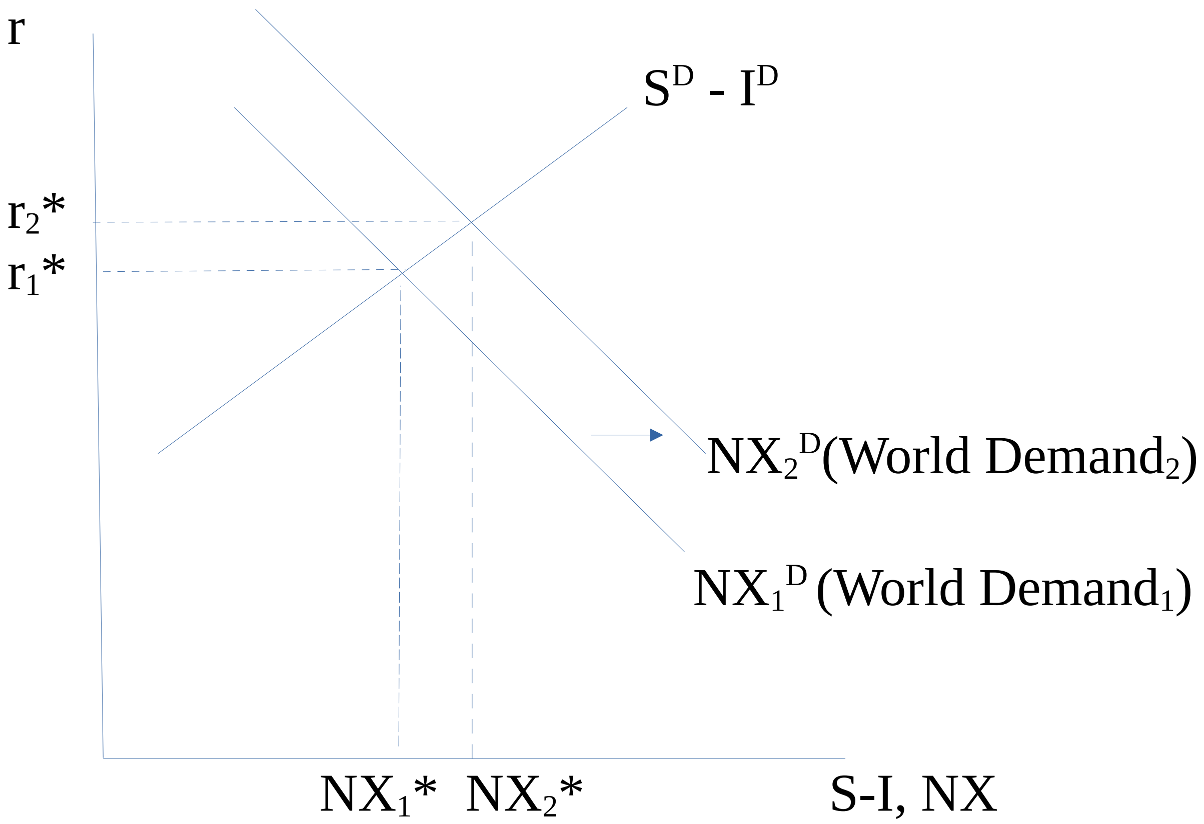
Foreign Exchange Market – Canadian Dollars



Factors that Affect NX

1. World demand for domestic goods
2. Foreign real interest rate
3. Domestic real interest rate
4. Foreign output
5. Domestic output

ex/ Increase in world demand for Canadian Maple Syrup



Factors that Affect e & NX

Increase in Factor	Causes e_{nom} to...	Causes NX to...
Y_{for}	Rise (shifts D^D right)	Rise (shifts NX right)
Y		
r_{for}		
r		
World Demand for Canadian Goods		

Business Cycle Transmission

A boom/recession in a foreign country can be transmitted to small open economy via NX

Policy Effectiveness in an Open Economy scenario: is now more complex and sometimes less effective

With fiscal policy, we have potential Twin Deficits

With Monetary policy, we need to understand the impact on exchange rate markets (see upcoming slides)

International policy and the implications of trade wars add another layer of complexity

For example, increasing tariffs increase government revenues but (like all taxes) distort markets resulting in deadweight loss

Exchange Rate Regimes

Fixed Exchange Rate: nominal exchange rate set by government in agreement with other countries

Flexible Exchange Rate: exchange rate is determined by the market

Fixed Exchange Rate Regime Terminology

fundamental value of exchange rate: what the exchange rate would be if determined by market

overvalued exchange rate: if fixed official rate is above the fundamental value (what the market would pay)

One concern in a fixed exchange rate system is potential outcomes when exchange rate is significantly overvalued for prolonged periods

speculative run: financial investors rush to sell off assets held in overvalued currency

Options for maintaining fixed rate system in event of overvaluation:

1. Change the official rate

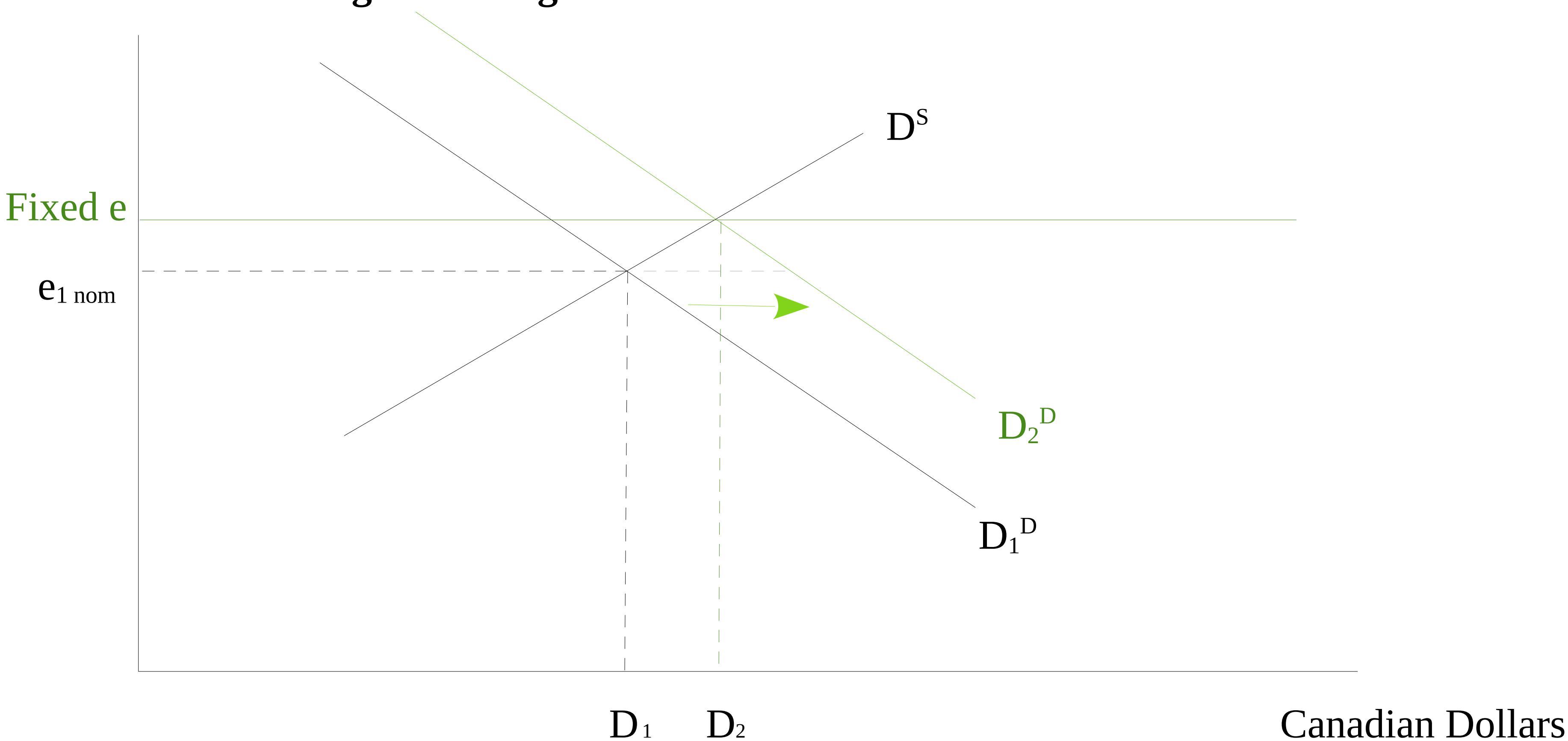
2. Restrict international trade or foreign exchange

3. Intervene in foreign exchange market (buy own currency)

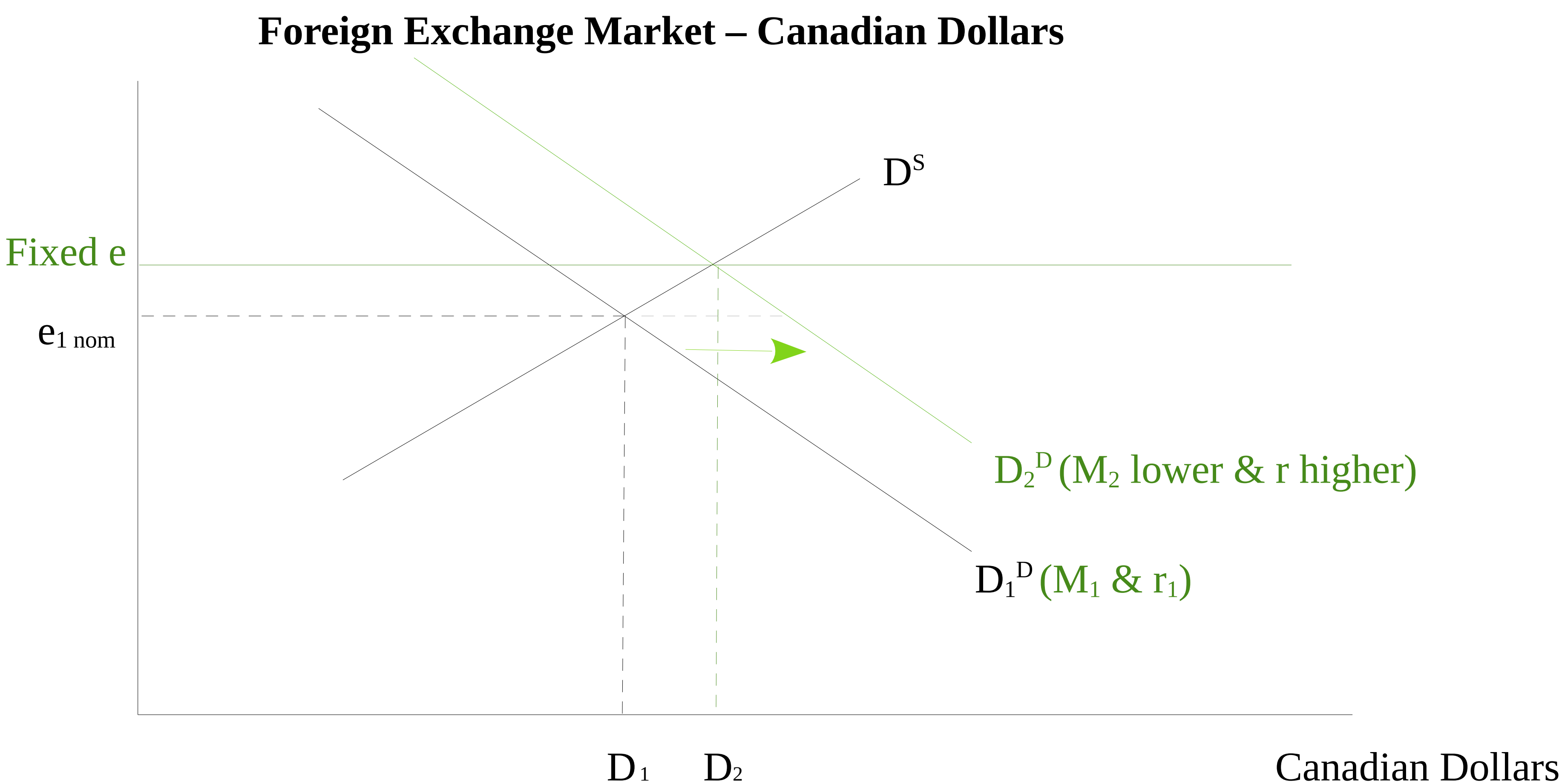
4. Monetary policy

ex / Intervening in foreign exchange market by buying domestic currency using reserve assets (artificially increasing demand for Canadian dollars)

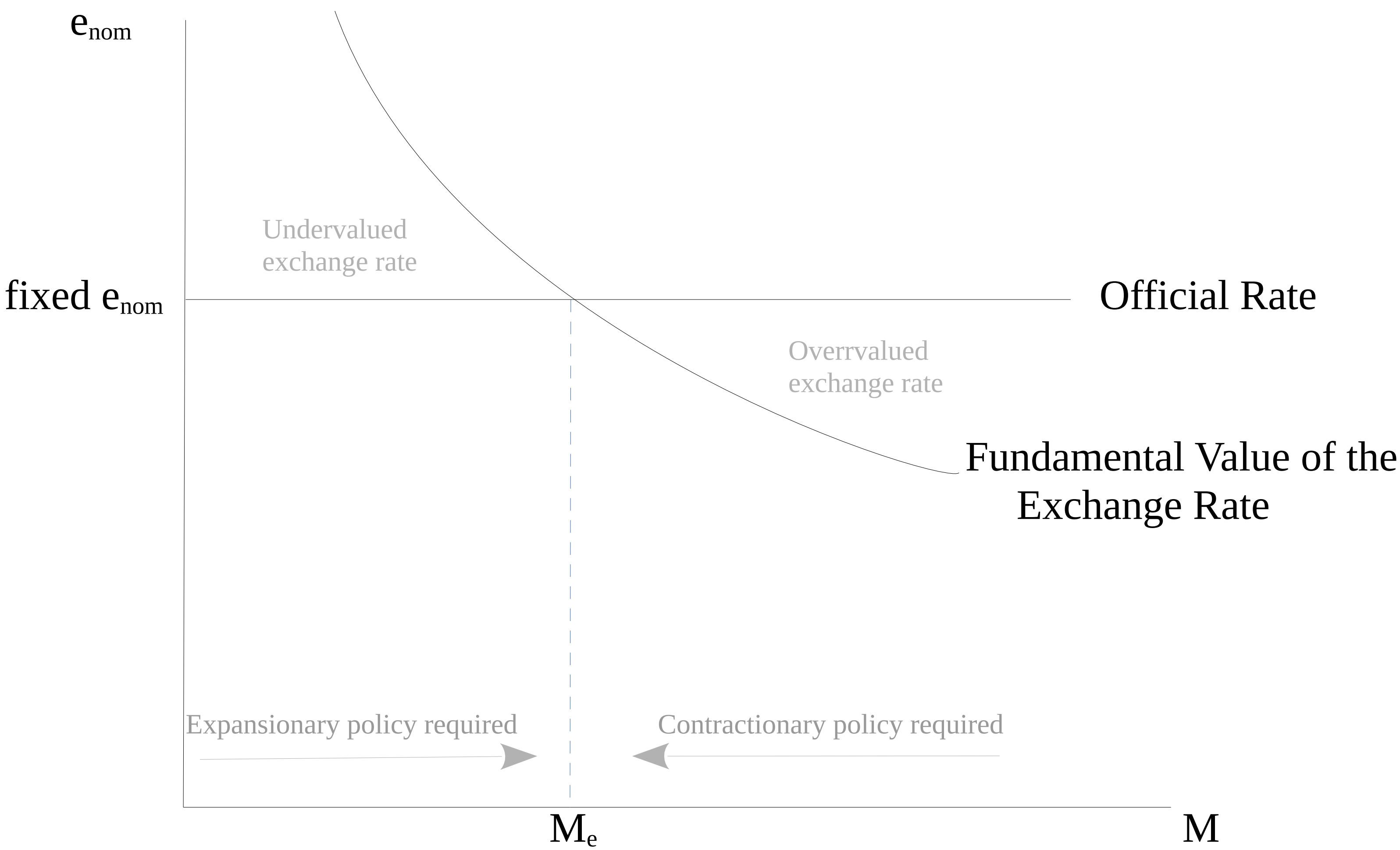
Foreign Exchange Market – Canadian Dollars



ex / Contractionary monetary policy increases r, people want to invest in Canadian assets, increasing demand for Canadian dollars



Fundamental Value and Monetary Policy



Issues and Complications with use of Monetary Policy to influence exchange rates:

1. Contractionary monetary policy cools economy and Monetary policy can’t then be used to combat recession

2. Expansionary policy heats economy and can spur inflation

3. To maintain high/low e_{nom}, requires continued contractionary/expansionary monetary policy

example of issue #2:

If the US were to embark upon an expansionary monetary policy, it's exchange rate would fall, and the Canadian-US exchange rate would rise.

This would will shift the fundamental value of Canada’s exchange rate up, and if Canada were maintaining a fixed exchange rate regime, then our exchange rate would now be undervalued.

If Canada wanted to keep the fixed exchange rate, it would have to use an expansionary monetary policy (inflationary)

It occurred in precisely this manner in the 60s/70s. During Bretton Woods (fixed regime in 60s-70s) US had expansionary Monetary policy (to keep interest rates low during expansionary fiscal policy).

USD becoming overvalued. Wanted others to do the same (exp. Monetary policy) to maintain fixed rates (otherwise US would have to combat overvaluation by selling official reserves), but Germany, for one, didn't want to have the inflation that an expansionary monetary policy would generate. To meet exchange rate peg, Germany demanded that US sell gold and buy USD (meet peg by selling official reserve assets). US refused because they feared huge loss of reserves and Bretton Woods system ended as countries chose to go flexible rather than following the US’s expansionary policy. (Canada wanted to avoid inflation caused by growth of M).

example of issue #3/

The original European Monetary System set up fixed exchange rates between member nations.

Germany had tight monetary policy in 1992. To maintain the fixed rate, the UK would also have to follow a tight monetary policy, but because UK was in recession the UK wanted to avoid the tight policy.

The alternative was devaluing the Pound. As everyone knew a devaluation would be needed, there was a speculative run on the Pound, and the Bank of England lost a lot trying to maintain the fixed rate, so decided to give up and go flexible.

Why would countries want to implement a Fixed Exchange Rate regime?

Pros & Cons of Fixed Versus Floating

Pros of Fixed rates (cons of floating):

1. Stability
2. Disciplines monetary policy

Cons of Fixed rates (pros of floating):

1. Instability, potential speculative runs
2. Restriction of international trade or exchange
3. Loss of reserves
4. Ties up monetary policy

Currency Union: group of countries agree to share a common currency

Additional benefits:
* Speculative runs no longer occur with single currency
* Cost of trading goods lower with a single currency

Additional concerns:
* Loss of individual national control over monetary policy