ECO402: Intermediate Macroeconomics

Tour of the World

History of Macroeconomics

Math and Economic Review

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Covers Chapters 1 & 24

Last Revised: May 12, 2020

1 What is Macroeconomics?

- Why do some countries experience more economic growth than other countries?
- How have countries like South Korea and Singapore grown so much faster than other Asian countries?
- Why are some countries like Venezuela experiencing high inflation? Does the U.S. experience inflation? How can a the central bank of a country combat inflation?
- How can fall in housing prices lead to recessions? What role do financial markets play in influencing episodes of booms and recessions?
- What policies can be used and have been used to reduce the severity and frequency of recessions?
- What effects can a negative exogenous shock like the COVID-19 have on the economy?

The study of macroeconomics answers these questions, and many other related questions on the relationships between aggregate economic variables. Macroeconomics is a branch of economics that studies the behavior of the economy as a whole.

1.1 Keynesian Economics

Historians of economic thought generally agree that modern macroeconomics began with John Maynard Keynes's book *The General Theory of Employment, Interest and Money* in 1936.

In 1935, John Maynard Keynes wrote to George Bernard Shaw: "I believe myself to be writing a book on economic theory which will largely revolutionise – not, I suppose, at once but in the course of the next ten years – the way the world thinks about its economic problems." - *The Guardian*, Feb 26, 2016

And it did! He wrote *The General Theory* at a time when most economists of business cycle theory (what macroeconomics was known as back then) could not explain the mechanics of the Great Depression that began in 1929. His book was better able to theorize the macroeconomics behind the economic catastrophe, and as a result, his insights dominated macroeconomic theory for decades after its publication.

Even without using mathematical models and graphs, Keynes provided the building blocks of modern macroeconomics. He argued that **effective demand** or what we now refer to as **aggregate demand** is what determines economic output in the short run. In addition, he also introduced:

- The link between consumption and income, and the concept of a multiplier that explains how smaller shocks to aggregate demand amplifies into large shifts in output in the economy.
- The concept of liquidity preference, or the demand for money, which explains how monetary policy can affect interest rates and aggregate demand.
- The importance of expectations for macroeconomic variables like consumption and how shifts in expectations (or the animal spirits) can lead to shifts in demand and output.

1.2 Neoclassical Synthesis

Subsequently, after Keynes, economists tried to corroborate his writing into mathematical models, known as the Neoclassical Synthesis. One of these models is the IS-LM model, developed by John Hicks and Alvin Hansen, which will be covered later in this course.

Keynes's work also focused on consumption and investment behavior, as did subsequent macroeconomists. Franco Modigliani and Milton Friedman independently developed a theory of consumption decisions over time. James Tobin and Dale Jorgensen developed a theory of investment where investment decisions depended upon the present value of profits.

Another key development following Keynes was the development of growth theory. Post the second world war, many countries devastated by war began to grow rapidly. Robert Solow developed a theory of the determinants of growth which was able to explain why these countries were experiencing such rapid growth. This theory will be covered later in the course.

1.3 Rational Expectations

By the 1970's macroeconomics appeared to be a successful field as we lived in a time of unparalleled global prosperity. However, by the mid-1970's many countries began to experience a combination of high inflation and high unemployment. This was a novel phenomenon at the time which existing macroeconomic theories of the day could not explain. This phenomenon was later coined as *stagflation*. Later on, economists were convinced that stagflation was a result of supply-side shocks to the economy.

Robert Lucas and Thomas Sargent argued that the economics profession greatly underestimated the role of expectations in driving macroeconomic phenomena. They developed the theory of rational expectations. Rational expectations says that agents in the economy make rational forecasts about future economic variables based on the set of information they had.

An implication of this theory, known as the Lucas Critique, says that we cannot assume that macroeconomic relationships will continue to behave the same way if fiscal or monetary policy changes. All agents in the economy will take these changes into account and adjust their behavior.

1.4 New Classical and Real Business Cycle Theory

To combat this Robert Lucas said that macroeconomic models should come from explicit micro-foundations of economic behavior. Thus, the real business cycle models were devel-

oped: consumers made decisions to maximize lifetime utility and firms made decisions to maximize profits. The major results were that there was not much fiscal or monetary policy could do and the government should be focused on promoting innovation and other long-run structural policies.

1.5 New Keynesian Economics

New Keynesian models were developed in response to the real business cycle models. They featured micro-foundations like real business cycle models, but these models incorporated nominal rigidities such as menu costs and described how decisions that do not matter much at the individual level (change prices or wages) lead to large aggregate effects (slow adjustment of the price level, and shifts in aggregate demand that have a large effect on output). This allowed for a role for fiscal and monetary policy to stabilize the economy in the short-run. More advanced models, like the one developed by former Federal Reserve Chairman Ben Bernanke and Mark Gertler, also incorporated financial frictions.

1.6 New Growth Theory

After being somewhat unpopular in the 1970s, growth theory made a comeback in the 1980s. Two leading economists, Robert Lucas and Paul Romer, led the discussion of the effects of research and development (R&D) on technological progress and the association between technological progress and unemployment. Other important contributions were made by Phillipe Aghion and Peter Howitt who worked on the "institutions" being an importance determinant of growth by affecting the rate of technological progress.

2 The Great Recession

From 2000-2007 overall the global economy experienced sustained expansion. This can be seen in Figure (1) which shows real GDP growth rates from 2000-2016 in advanced countries and Figure (2) which shows real GDP growth rates in the BRICS nations. In 2007, however the expansion began to come to an end. Housing prices started to decline in the U.S. and in other advanced economies. Back then, it was believed by some that it was enough for the Federal Reserve to lower interest rates to sustain aggregate demand. However, others believed that cutting interest rates would not be enough and that the US may go through a short recession. Although some economists claim they saw the Great Recession coming, the general consensus among economists is that it was unexpected or that the recession was expected to have been less severe.

As housing prices continued to decline a financial crisis began to emerge: many of the mortgages given out during the expansion were of poor quality. Even worse banks had packaged these bad mortgages into securities[1] and sold those securities to other banks and investors. These securities were often repackaged into new securities and on and on. Not being able to assess the quality of these esoteric securities banks became reluctant to lend to each other for fear the other bank would not be able to pay back the loan. The crisis hit full swing when Lehman brothers declared bankruptcy on September 15, 2008. Since all the banks in the banking sector were essentially linked, there were many other banks that risked failing with Lehman. This was the financial apocalypse![2]

Following Lehman Brothers bankruptcy stock prices began to collapse as well. Now with both the value of houses declining and stock prices collapsing households began to cut consumption. Due to uncertainty about the future firms cut back on investment. Due to

[1] Financial instruments

[2] The full explanation of the crisis is beyond the scope of this course and it is more complicated than the one given here. I strongly urge those interested to register for EC370, Money and Banking, which should give a more full explanation of the causes.

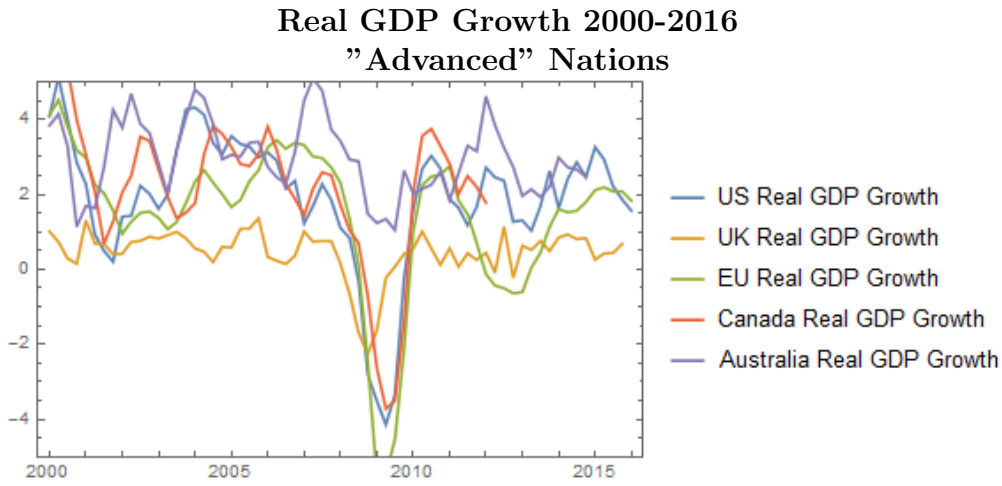

Figure 1: Real GDP growth from 2000-2016 for four "Advanced" nations and the Euro Area.
Source: Federal Reserve Economic Data

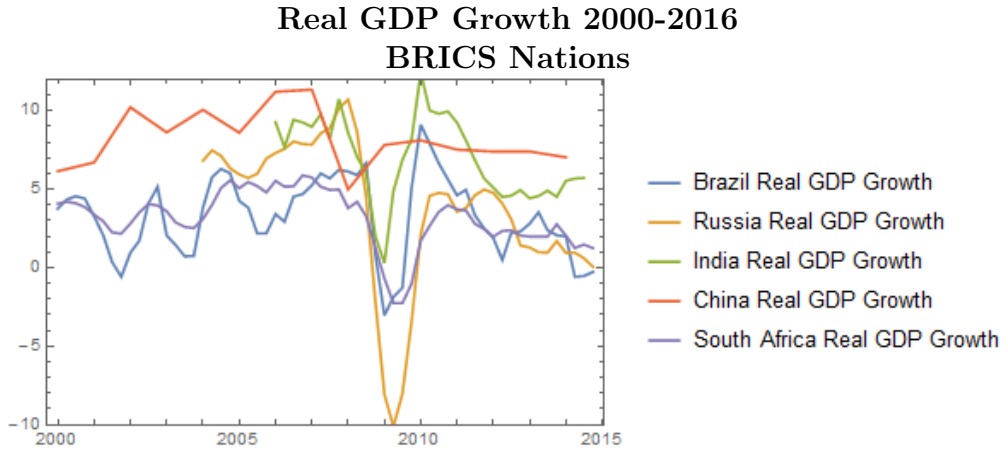

Figure 2: Real GDP growth from 2000-2016 for the five BRICS nations.
Source: Federal Reserve Economic Data

Figure 3: Ratio of workers looking for a job to total job openings. Shaded regions represent recessions.

the drop in home prices fewer new homes were built. Despite the Fed cutting interest rates to zero and the U.S government decreasing taxes and increasing spending aggregate demand decreased and output followed.

Things have slowly but steadily improved since the crisis began, but there were real human costs associated with the recession. The unemployment rate went from 4.6% in 2007 to 9.6% in 2010. The graph below illuminates just how bad things were for the unlucky workers who lost their job during the recession. During 2009, the ratio of job seekers to job openings peaked at 7. In normal times this ratio is somewhere between 1 and 2.

In October 2016 the unemployment rate was 4.9% so in some respects the economy seemed to be doing really well. But at the same time inflation is still falling short of the Federal Reserve's target of 2%. How can the economy be so sick, yet so strong?[3] That is a difficult question.

[3]Borrowed from Gene Belcher

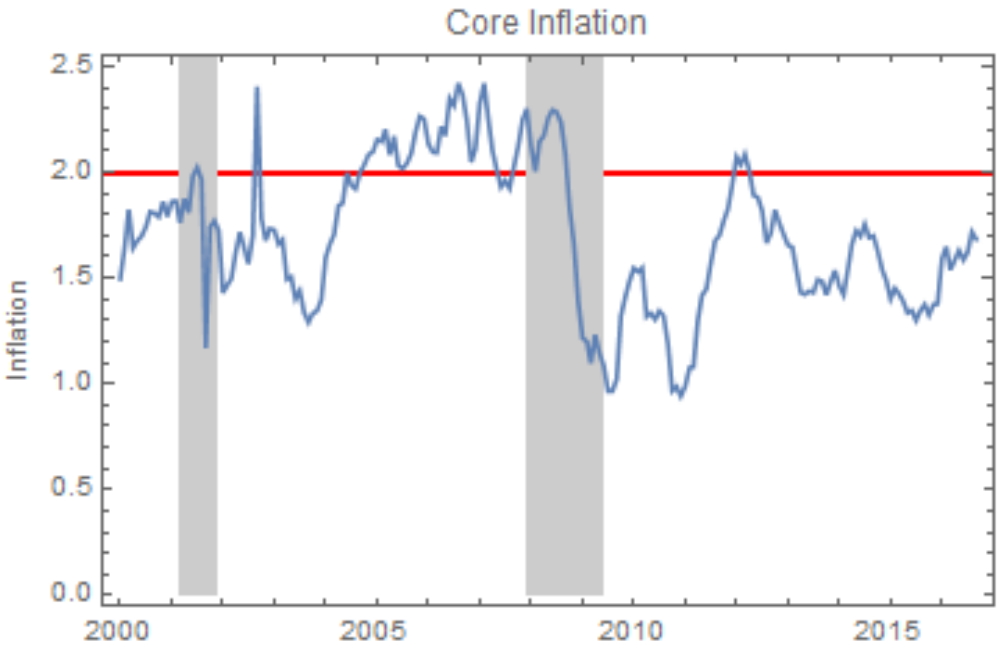

Figure 4: Core Inflation 2000-2016. Shaded regions represent recessions.

3 Key Macroeconomic Variables of Interest

The first variable economists often look at to determine the health of an economy is its Gross Domestic Product (GDP) or total output. The second is GDP per capita.

Gross Domestic Product (GDP): A measure of the total output of a country.

GDP Per Capita: Total output averaged over a country's population.

Assignment: Look up current GDP per capita for the United States, Canada, the United Kingdom, Russia, Turkey, Japan, Vietnam, Mexico, etc. (Use FRED)

But output can only tell us so much about the health of an economy. After output economists will usually look at the following three basic variables:

- **Output Growth** - the rate of change of output
- **Unemployment Rate** - the proportion of workers who do not have a job but are actively seeking employment to the entire labor force.
- **Inflation Rate** - the rate at which the average price of goods is changing.

Discussion: What are some shortcomings of the five economic variables discussed so far?

4 Math and Economics Review

Throughout this course understanding of concepts covered in previous courses you have taken will be essential to your success.

4.1 Equilibrium

Economic equilibrium: A state in which two economic forces are in balance. The most common example is of equilibrium between supply and demand in a market.

What does it mean for supply and demand to be balanced? The supply curve represents the minimum price firm(s) would need to accept in order to produce and sell a given quantity of that good. The supply curve is actually derived from adding up the individual marginal cost curves of firms in the market. Each point on the supply curve represents a point where firms are maximizing their profits. Similarly, each point on the demand curve gives the highest price a consumer would be willing to pay for a given quantity of the good. The market demand curve is the summation of the individual demand curves, which come from consumers maximizing their utility. That is the force associated with demand.

When supply and demand are in equilibrium (quantity supplied equals the quantity demanded), we have reached a price and quantity where consumers are maximizing their utility and firms are maximizing their profits. Therefore, the market "clears"!. In the definition, "A state" is referring to this equilibrium.

An equilibrium usually but not always involves a price and a quantity. In some cases, the price is just the aggregate price level or wage level (labor market) and in other cases it is an interest rate.

4.2 Steady State

There will be occasions where we'll be dealing with another equilibrium concept called **steady state** equilibrium. This concept is applicable when we're dealing with dynamic economic systems - systems that are changing over time. The steady state occurs when the detrended variables are not changing over time[4].

For example the suppose that we're interested in some economic variable x_t, the t here means that it's the value of x at time period t. For example x_1 is the value of x in period 1. To keep things simple let's suppose that the evolution of x_t is given by:

$$x_t = a + bx_{t-1}.$$

This says that the value of x today is determined by some constant value a and a constant b times the value of x in the previous period. The steady state is a value of x such $x_t = x_{t-1} = x$. If this is true then our equation becomes:

$$x = a + bx$$

Solving this equation for x gives us $x = (1 - b)^{-1}a$.

4.3 Endogenous vs Exogenous

We will be talking about **endogenous variables** and **exogenous variables** a lot in this course. Endogenous variables are variables that are determined within the model. Exogenous variables are variables determined outside the model that affect the endogenous variables.

You've already seen endogenous variables in your earlier economics coursework. Price and quantity are the endogenous variables in the simple supply and demand models that you covered in your introductory microeconomics classes. The equilibrium value of P and Q are determined by equilibrium between supply and demand.

[4]Variables have a trend when they're always growing every period.

You've also already seen exogenous variables in that same model. Recall talking about the factors that shift demand - income, the price of other good, preferences etc these are all exogenous variables. The model does not determine their value, but they ultimately play a role in determining price and quantity. The same goes for variables that shift the supply curve like factor prices and technology.

4.4 Solving Systems of Two Linear Equations

A portion of this course will involving solving algebraically for equilibrium. This will require you to solve a system of two linear equations with two unknown variables. In general these systems will look like:

$$y = m_1 x + b_1$$
$$y = m_2 x + b_2$$

The equations we'll encounter will be messier and the variables we're solving for will not be x and y, but in general the best method for solving these systems is to substitute for one of the variables in these equations. This is because equilibrium means that both equations hold true, the first y must equal the second y. As a result:

$$m_1 x + b_1 = m_2 x + b_2$$
$$(m_1 - m_2)x = b_2 - b_1$$
$$x = \frac{b_2 - b_1}{m_1 - m_2}$$

Now that we've found the equilibrium value of x we can plug it back into one of the two equations to find y:

$$y = m_1 \frac{b_2 - b_1}{m_1 - m_2} + b_1$$
$$y = \frac{m_1 b_2 - m_2 b_1}{m_1 - m_2}$$

It is important that you understand how to solve simultaneous linear equations. Here is a link: Click here!. The substitution method is more applicable to all cases.

4.5 Exponents

During this course we will also occasionally need to algebraically manipulate exponents. This should not be too difficult if you understand the properties of exponents.

$$x^a x^b = x^{a+b}$$
$$x^{-1} = \frac{1}{x}$$
$$x^{-a} = \frac{1}{x^a}$$
$$(x^a)^b = x^{ab}$$
$$\sqrt{x} = x^{1/2}$$
$$\sqrt[n]{x} = x^{1/n}$$

4.6 Functions

We will also be dealing with abstract functions during this course. A **function** F maps its input value x into an output value $F(x)$. Many times we'll also denote the relationship between a functions input and its output with either a $+$ or $-$ to indicate whether there is a positive or negative relationship between the value of the input and output. This is the sign of the **(partial) derivative** of the function.

We can also have functions of multiple variables which map multiple input values, say x and y, into a single output value $F(x, y)$.

As an example suppose that $F(x, y) = \ln x + e^{-y}$. As x grows larger holding y constant F grows larger, so it has a positive relationship. On the other hand as y grows larger holding x constant F gets smaller and smaller so it has a negative relationship.

It would be helpful to have knowledge on differentiation and specifically partial derivatives for this course. Click here for help!

5 Questions

1. Robert Lucas and Thomas Sargent focused on the importance of expectations in determining economic variables. (**T**/F)

2. Stagflation is the combination of high inflation and unemployment. (**T**/F)

3. Ben Bernanke in addition to being a former Federal Reserve Chairman was among the scholars who developed an extension of the New Keynesian model which incorporated financial frictions. (**T**/F)

4. Suppose that Supply is given as $Q_s = 100 + 4P$ and demand is given as $Q_d = 400 - 2P$. What is the market equilibrium?

   Equilibrium occurs when $Q_s = Q_d$, which means that:

$$100 + 4P = 400 - 2P$$

$$6P = 300$$

$$P = 50$$

   If $P = 50$ then $Q = 300$.

5. What is the steady state value for a process y that has the following law of motion:

$$y_t^a = y_{t-1}^b c$$

In steady state $y_t = y_{t-1} = y$:

$$\begin{aligned} y^a &= y^b c \\ y^{a-b} &= c \\ y &= c^{\frac{1}{a-b}} \end{aligned}$$

6. Suppose we have the following function:

$$G(x, y) = x^2 + y^{-2}$$

What is the sign of the relationship between G and x and y respectively.

G increases when x increases and it decreases when y increases, holding the opposite variable constant in each case.

6 Further Readings (And Listenings)

Blanchard and Johnson Chapters 1 & 25

Joe Stiglitz: The Book of Jobs (Vanity Fair January 2012)

This American Life: The Giant Pool of Money (2008)