TOPICS IN MACROECONOMICS

Summary of selected topics from University of Washington course ECON 301 taught Fall 2016 by graduate student Mishita Mehra (MXM) compiled by Michael C. McGoodwin (MCM). Content last updated 2/6/2017

Table of Contents

INTRODUCTION AND PRELIMINARIES

I describe here some of the topics discussed in my first course in economics, or at least in its subdivision macroeconomics, or topics of interest that have some connection with the broad social science of economics. This one quarter course was taught by Mishita Mehra, a very knowledgeable graduate student who is nearing completion of her work toward a PhD. She is an enthusiastic instructor and will surely go far in her chosen area of macroeconomics research. I appreciate being allowed to sit in on her class and her ready willingness to help me get some of the concepts straight.

This is a discipline in which I have little formal background and only modest interest despite its importance in human interactions. Moreover, I have found this subject matter more than a little elusive and often difficult to grasp (compared, for instance, to astrophysics). It seems clear that macroeconomics is an evolving field in which there remains a substantial degree of controversy and disagreement regarding causality, how important variables evolve and respond to other factors, and which interventions are indicated for which conditions (according to the various economic schools of thought). I have not gotten very far along in understanding the full gamut of this subject. A better or more consistent textbook would probably have helped. Thus, please be indulgent of this presentation's shortcomings.

I have included some probably copyrighted material in this purely not-for-profit personal study aid. I hope that this would fall within fair usage for the betterment of macroeconomic comprehension for my few readers, and I have tried to be certain that all materials included are fully credited. I have often added emphasis not present in the original. Please go to the original sources which I have referenced to get the exact quote, should you wish to quote this document. If you are an author who wishes to have certain materials removed that I have included here, please advise.

Suggestions and corrections would be graciously accepted. Send email to this address (reformatted):
MCM at McGoodwin period NET

Textbook

Macroeconomics 7th edition (Student Value Edition: loose-leaf, about $190) by Olivier Blanchard, 2017, Pearson—hereafter referred to as *ME7*. This is a very costly textbook, at times confusing and frustrating in its imprecise and varying mathematical usage and notation, and presenting much to stumble over. A little more calculus would have added clarity. Too many simplifying assumptions are made for didactic purposes, only to become no longer operative in a later treatment.[1] Examples of confusing notation: Blanchard uses the expression $c_1(Y - T)$ as a standard math expression—c_1 times the difference of Y and T—whereas he uses C(Y - T) to indicate that C is an (undefined) function of the quantity (Y - T). (*ME7* p. 91) He also uses π(-1) to signify π_{t-1}, also a confusing and inconstant usage, and tends to include then drop subscripts with abandon.

The associated website MyEconLab[2] costs extra to use and I did not explore it. The lack of a free website offering supplemental information for this expensive textbook is unfortunate. However, the instructors receive extra materials which can be incorporated into lectures, and students should beg the instructors for these.

Course Catalog Description

"The material in this course further develops the material you studied in ECON 201 using a slightly more rigorous mathematical perspective (some calculus will also be used). The four key topics covered in this intermediate macroeconomics course are:

- Short-run fluctuations in output and policy implications of the short-run.
- Medium-run output determination in which output is subject to supply constraints.
- Long-run output determination and growth in a cross-country perspective.
- Output decisions in an open-economy framework."

---

[1] In his own defense, Blanchard states (*ME7* p. 393): "By now, you realize that the way to understand various macroeconomic mechanisms is to refine the basic model in one direction, and simplify it in others [i.e., by assuming some variables are constant, as one does when considering partial derivatives]… Keeping all the refinements would lead to a rich model (and this is what macro econometric models do), but would make for a terrible textbook. Things would become far too complicated." But alas, the textbook is just too confusing in its current incarnation.

[2] www.myeconlab.com

The course and textbook did not focus on or provide instruction in how to be a successful investor and get rich, and this summary is not an investment manual.

Resources and Links for Macroeconomics

American Economic Association
Angus Maddison Monitoring the World Economy (1820 - 1992) and extensions via the Maddison Project
Current Population Survey (of the US Census)
Federal Reserve Economic Data - St. Louis Fed (FRED)
Global Financial Stability Report (of the IMF)
Historical Statistics of the United States, Colonial Times to 1970
National Economic Trends, recent
National Bureau of Economic Research NBER
National Income and Product Accounts NIPA:
Concepts and Methods of the U.S. National Income and Product Accounts (Chapters 1–10 and 13) , February 2014, http://www.bea.gov/national/pdf/allchapters.pdf
2016 update: https://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf
Organisation for Economic Co-operation and Development (OECD)
Statistical Abstract of the United States (most recent is for 2011)
Survey of Current Business (SCB per BEA)
World Bank Open Data
World Economic Outlook Reports (of the IMF)
2016 Economic Report of the President[3]

Textbook Chapters and Assigned Readings

(Bold faced were assigned chapters. I have indicated my state of involvement with each chapter as follows.)

Introduction (Including Review)

- [Chapter 1]: A Tour of the World
  Discusses the crisis of 2007-2011; The impact on output in the USA, the Euro Area, and China, etc. Not assigned but reviewed. MCM RV completed.
- **Chapter 2**: A Tour of the Book
  Aggregate Output and calculating GDP, inflation and unemployment; Real vs. nominal GDP; Relationship between inflation, unemployment and output: Intro to Phillips Curve and Okun's Law; The conceptual timespans: Short run, Medium run, and Long run. MCM RV completed.

The Short Run

- **Chapter 3**: The Goods Market:
  Short run equilibrium in goods market using AE model [Aggregate Expenditure model]; Two equivalent equilibrium conditions: Production=Demand and Investment= Saving; Paradox of Saving. MCM RV completed.
- **Chapter 4**: Financial Markets I:
  Determining nominal interest rate via money market equilibrium- Money demand and supply; Relationship between bond prices and bond interest rates; Concept of OMOs [Open Market Operations]; More realistic determination of interest rates via demand and supply of Central Bank Money; The money multiplier; Liquidity trap. MCM RV completed.
- **Chapter 5**: Goods and Financial Markets- The IS-LM Model
  Deriving IS Curve from goods market equilibrium; LM Curve from financial market equilibrium; Factors that shift both the curves; Monetary and Fiscal policy in the IS-LM framework. MCM RV completed.
- [Chapter 6]: Financial Markets II. Not assigned. MCM RV completed.

The Medium Run

- **Chapter 7**: The Labor market
  Determination of wages: WS relation and PS relation; medium run equilibrium unemployment-

[3] also https://www.gpo.gov/fdsys/browse/collection.action?collectionCode=ERP

natural rate of unemployment; impact of changes in markups and other labor market conditions. MCM RV completed.

- **Chapter 8**: The Phillips Curve, the Natural Rate of unemployment, and Inflation
  Establish the relationship between real wage model, AS and Phillips Curve; Original PC vs. expectation-augmented PC; Forming Expectations; Natural Rate Hypothesis MCM RV completed.
- **Chapter 9**: Putting All Markets Together: From the Short to the Medium Run:
  The IS-LM Model with real interest rates; IS-LM-PC Model: Tying Together the IS-LM Model with Phillips Curve; Dynamic Effects of Shocks/policy changes : How economy adjusts from the short run to the medium-run equilibrium; Applications: 1) Zero lower bound and deflationary spiral 2) Fiscal consolidation 3) Effects of an oil price increase. MCM RV completed.

The Long Run

- **Chapter 10**: The Facts of Growth. MCM RV completed.
- **Chapter 11**: Saving, Capital Accumulation, and Output. MCM RV completed.
- [Chapter 12]. Technological Progress and Growth. Not assigned: MCM RV completed
- [Chapter 13]. Technological Progress: The Short, the Medium, and the Long Runs Not assigned: MCM RV completed

Expectations

- [Chapter 14]: Financial Markets and Expectations. Not assigned, omitted by MCM.
- [Chapter 15]: Expectations, Consumption, and Investment Not assigned, omitted by MCM.
- **Chapter 16**: Expectations, Output, and Policy. Brief coverage in course, omitted by MCM.

The Open Economy

- **Chapter 17**: Openness in Goods and Financial Markets MCM RV completed.
- **Chapter 18**: The Goods Market in an Open Economy MCM RV completed
- **Chapter 19**: Output, the Interest Rate, and the Exchange Rate (Exchange Rate Regimes)
- [Chapter 20]: Exchange Rate Regimes Not assigned or reviewed

Back to Policy

- [Chapter 21]: Should Policy Makers Be Restrained? Not assigned or reviewed
- [Chapter 22]: Fiscal Policy: A Summing Up Not assigned or reviewed
- [Chapter 23]: Monetary Policy: A Summing Up Not assigned or reviewed
- [**Chapter 24**]: Epilogue: The Story of Macroeconomics [briefly]. Not reviewed here.

Course Files Reviewed

Syllabus Econ 301 C-1 Mehra.pdf: MCM reviewed
Lecture 01.pptx; Instructor_Pearson_File_7e_PPT_01.pptx: MCM RV completed
Lecture 02.pdf; Instructor_Pearson_File_7e_PPT_02.pptx: MCM RV completed
Lecture 03.pdf: Instructor_Pearson_File_7e_PPT_03.pptx; MCM RV completed
Instructor_Pearson_File_7e_PPT_04.pptx: MCM RV completed
Instructor_Pearson_File_7e_PPT_05.v2.pptx: MCM RV completed
Instructor_Pearson_File_7e_PPT_06.pptx: MCM RV completed
Lecture Ch. 07.pdf; Instructor_Pearson_File_7e_PPT_07.v2.pptx: MCM RV completed
Lecture Ch. 08.pdf; Instructor_Pearson_File_7e_PPT_08.pptx: MCM RV completed
Lecture Ch. 09.pdf; Instructor_Pearson_File_7e_PPT_09.pptx: MCM RV completed
Lecture Ch. 10- Long-Run Growth.pdf; Instructor_Pearson_File_7e_PPT_10.pptx: MCM RV completed
Instructor_Pearson_File_7e_PPT_11.pptx: MCM RV completed
Instructor_Pearson_File_7e_PPT_12.pptx: MCM RV completed
Instructor_Pearson_File_7e_PPT_13.pptx: MCM RV completed
Instructor_Pearson_File_7e_PPT_14.pptx: brief MCM RV completed
Instructor_Pearson_File_7e_PPT_15.pptx: brief MCM RV completed
Instructor_Pearson_File_7e_PPT_16.pptx: brief MCM RV completed
Lecture Ch. 17.pdf; Instructor_Pearson_File_7e_PPT_17.v2.pptx: MCM RV completed
Lecture Ch. 18.pdf; Instructor_Pearson_File_7e_PPT_18.pptx: MCM RV completed
Lecture Ch. 19.pdf; Instructor_Pearson_File_7e_PPT_19.pptx: MCM RV completed
Remaining chapters and materials not reviewed.

TOPICS OF INTEREST

Much of the text herein consists of direct quotes from outside sources, which are always cited. I have tried to use quotation marks when appropriate, but have done so less when I am paraphrasing or extensively editing quoted material. My additions are usually in [square brackets]. Some unacknowledged modifications may be present, so check the cited sources before quoting any of these passages. Cross references to other entries in this section are shown in *italics*.

In general, I have not created a topic for every entity that is defined or discussed. Instead, I have incorporated many items into the text of one or more major topics. Subjects lacking their own topic can be found by searching on part or all of the exact phrase or the acronym sought. Thus to find out more about Personal Consumption Expenditures, search on PCE or Expenditures; to find Personal Consumption Expenditures Price Index search on PCEPI.

Blanchard introduces a number of functions in inexact algebraic terms. I have termed these functions, such as L(i) in M^d = $Y L(i), as **undefined functions** (though perhaps they are more exactly defined somewhere outside the textbook). In most cases, I have tried to indicate function arguments (single letter or composite) in red if an increase in the argument's value is said to decrease the value of its parent function rather than to increase it. Blanchard has chosen to indicate these with a minus sign placed below the argument. Function arguments which are positive in their effect on their function, such as Y_D in C = C(Y_D) are left as black. I may not have remembered to redden every negative-effect function argument, however.

A sequence of symbols such as ↑A → ↓B signifies that an increase in A causes (or is at least associated with) a decrease in B.

Here follow the selected topics, in alphabetical order. References in a topic within this summary to other topics are placed in *italics*.

A

Arbitrage: Riskless and Risky

The **Arbitrage Pricing Theory (APT) Model** was first described by Steven Ross in an article entitled "The Arbitrage Theory of Capital Asset Pricing", which appeared in the *Journal of Economic Theory* in December 1976. The APT Model contrasts with the more restrictive **Capital Asset Pricing Model**. The Arbitrage Pricing Theory assumes that each stock's (or asset's) return to the investor is influenced by several independent factors…[4]

Expected Return = rf + b1 × (factor 1) + b2 × (factor 2)… + bn × (factor n)

where rf = risk free interest rate
b's = coefficient giving sensitivity of the stock or security to each factor considered
factor's = the risk premium associated with each entity

For savvy investors (**arbitrageurs**), "**Arbitrage** is the simultaneous purchase and sale of an asset to profit from a difference in the price. It is a trade that profits by exploiting the price differences of identical or similar financial instruments on different markets or in different forms. Arbitrage exists as a result of market inefficiencies… [For instance,] in triangular arbitrage, a trader converts one currency to another at one bank, converts that second currency to another at a second bank, and finally converts the third currency back to the original at a third bank. The same bank would have the information efficiency to ensure all of its currency rates were aligned, requiring the use of different financial institutions for this strategy."[5] However, "In real life, arbitrage opportunities (if any) exist only for brief periods since most of the arbitrage trading has been taken over by **algorithm-based trading** in

[4] http://www.money-zine.com/investing/stocks/arbitrage-pricing-theory-or-apt/
[5] http://www.investopedia.com/terms/a/arbitrage.asp

matured markets. These algorithms are quick to spot and capture arbitrage opportunity, making it easy for human traders to keep track"[6]

Blanchard uses the term *arbitrage* somewhat differently. He defines it as "the proposition that the expected rates of return on two financial assets [such as 2 bonds having differing maturities] must be equal." Arbitrage is "also called **risky arbitrage** [when it incorporates a risk premium] to distinguish it from **riskless arbitrage**... Riskless arbitrage is "the proposition that the actual rates of return on two financial assets must be the same", ignoring risk, and according to the **expectations hypothesis** for future interest rates. (*ME7* p. 293-4 and p. G-1)

Riskless arbitrage can also be defined by the **simultaneity** of 2 transactions: "A risk-free transaction consisting of purchasing an asset at one price and simultaneously selling that same asset at a higher price, generating a profit on the difference."[7]

Arbitrage seems to me rather complex, with arbitrageurs somewhat exploitive and perhaps even parasitic, and one must be careful which definition is operative.

B

Balance of Payments Accounts

Balance of payments (BoP or BOP)

This important topic is discussed in *ME7* Ch. 17, p. 359-61, etc. The accounting is provided by the BEA (see *Bureau of Economic Analysis (BEA)*. Their most recent update is *U.S. International Transactions: Third Quarter 2016*, 15 Dec. 2016, hereafter termed the *2016 3Q BOP update*.[8] § The accounting for BOP is complex and I don't pretend to have mastered it.

"The **balance of payments (BOP)** is the method countries use to monitor all international monetary transactions at a specific period of time. Usually, the BOP is calculated every quarter and every calendar year. All trades conducted by both the private and public sectors are accounted for in the BOP in order to determine how much money is going in and out of a country. If a country has received money, this is known as a **credit**, and if a country has paid or given money, the transaction is counted as a **debit**. Theoretically, the **BOP should be zero**, meaning that assets (credits) and liabilities (debits) should balance, but in practice this is rarely the case. Thus, the BOP can tell the observer if a country has a deficit or a surplus and from which part of the economy the **[statistical] discrepancies** are stemming.

The BOP is divided into three main categories: the **current account**, the **capital account** and the **financial account**. Within these three categories are sub-divisions, each of which accounts for a different type of international monetary transaction."[9] ‡

The BOP accounting includes both **trade flows** and **financial flows**. Blanchard describes the Balance of Payments as being divided into *above the line* (the Current Account) versus *below the line* (the Capital Account), but this dichotomy neglects the splitting out of the Financial Account from the Capital Account by the IMF and BEA (discussed below), so that these *above/below the line* phrases are confusing and may no longer be appropriate. (*ME7* p. 359)

The Current Account

This tracks financial flows for
(1) trade balance, income received for foreign held entities,
(2) income paid to foreign residents for domestically held entities; and
(3) net transfers received (transfers of foreign aid, etc.)

---

[6] http://economictimes.indiatimes.com/definition/arbitrage
[7] http://www.investorwords.com/4300/riskless_arbitrage.html
[8] Main page: https://www.bea.gov/newsreleases/international/transactions/trnsnewsrelease.htm
BEA *U.S. International Transactions: Third Quarter 2016*, Full PDF with tables:
http://www.bea.gov/newsreleases/international/transactions/2016/pdf/trans316.pdf
including all quotes marked with §
[9] http://www.investopedia.com/articles/03/060403.asp including all quoted text in this topic marked with ‡

"The **current account** is used to mark the inflow and outflow of **goods and services** into a country. **Earnings on investments**, both public and private, are also put into the current account… Within the current account are **credits and debits** on the trade of merchandise, which includes goods such as **raw materials** and manufactured goods that are bought, sold or given away (possibly in the form of [foreign] aid). Services refer to receipts from tourism, transportation (like the levy that must be paid in Egypt when a ship passes through the Suez Canal), engineering, business service fees (from lawyers or management consulting, for example) and royalties from patents and copyrights. When combined, goods and services together make up a country's **balance of trade (BOT)**. The BOT is typically the biggest bulk of a country's **balance of payments** as it makes up **total imports and exports**. If a country has a **balance of trade deficit**, it imports more than it exports, and if it has a **balance of trade surplus**, it exports more than it imports.…

Receipts from income-generating assets [investments] such as **stocks** (in the form of **dividends** [from abroad]) are also recorded in the current account. The last component of the current account is **unilateral transfers**. These are credits that are mostly **worker's remittances**, which are salaries sent back into the home country of a national working abroad, as well as **foreign aid** that is directly received." ‡

Here are some recent facts in the *2016 3Q BOP update:*

"The current account consists of transactions between U.S. residents and nonresidents in goods, services, primary income, and secondary income.

The current-account balance is the difference between credits (exports and income receipts) and debits (imports and income payments) in the current account. The U.S. current account deficit decreased to $113.0 billion (preliminary) in the third quarter of 2016 from $118.3 billion (revised) in the second quarter of 2016, according to statistics released by the Bureau of Economic Analysis (BEA) [this is one fourth of a year's flow]. The deficit decreased to 2.4 percent of current-dollar gross domestic product (GDP) from 2.6 percent in the second quarter… The $5.3 billion decrease in the current account deficit reflected a $9.0 billion decrease in the deficit on goods that was partly offset by changes in the balances on secondary income, primary income, and services…

Exports of goods and services and income receipts increased $17.7 billion in the third quarter to $799.0 billion… Goods exports increased $15.7 billion to $375.9 billion, mostly reflecting increases in foods, feeds, and beverages, largely soybeans… Services exports increased $2.0 billion to $188.2 billion, mostly reflecting an increase in travel…

Imports of goods and services and income payments increased $12.4 billion to $912.0 billion… Goods imports increased $6.7 billion to $553.6 billion, mostly reflecting an increase in imports of industrial supplies and materials, primarily petroleum and products, nonferrous metals, and iron and steel products… Services imports increased $2.7 billion to $126.9 billion, mostly reflecting increases in charges for the use of intellectual property and travel.

Secondary income payments increased $2.0 billion to $72.0 billion, mostly reflecting an increase in U.S. government transfers…

Primary income payments increased $1.0 billion to $159.4 billion, mostly reflecting an increase in portfolio investment income payments…"[10] §

Blanchard states that our openness allows the US to run a trade deficit, and that each year that we have a trade deficit, the deficit must be made up for by **borrowing** from other countries or equivalently that net **foreign holdings of US assets** must increase by the amount of the deficit. (*ME7* p. 359-360).

Caution: Blanchard uses "**CA**" to represent the Current Account Balance (potentially confusing in view of the Capital Account (of the BOP) having the same acronym. Also, the Current Account (a table of data) is not the same as the Current Account Balance [a single number, see *Saving, Investment, and the Current Account Balance (CA)*].

The US current account trade deficit for 2015 was minus $462,965 million.[11]

The Capital Account

"The capital account is where all international capital transfers are recorded. This refers to the acquisition or disposal of non-financial assets (for example, a physical asset such as land) and non-produced assets, which are needed for production but have not been produced, like a mine used for

[10] https://www.bea.gov/newsreleases/international/transactions/2016/pdf/trans316_fax.pdf
[11] https://www.bea.gov/newsreleases/international/transactions/2016/pdf/trans316.pdf Table 1, line 101

the extraction of diamonds…

The capital account is broken down into the monetary flows branching from debt forgiveness, the transfer of goods, and financial assets by migrants leaving or entering a country, the transfer of ownership on fixed assets (assets such as equipment used in the production process to generate income), the transfer of funds received to the sale or acquisition of fixed assets, gift and inheritance taxes, death levies and, finally, uninsured damage to fixed assets." ‡

The *2016 3Q BOP update* provides no specific commentary on the capital account and minimal data. It defines the capital account as follows: "The **capital account** consists of **capital transfers** between residents and nonresidents and the cross-border acquisition and disposal of **non-produced non-financial assets**. Capital transfers include debt forgiveness and certain disaster-related nonlife insurance claims. Non-produced nonfinancial assets include **natural resources** [including **land**[12]] and contracts, leases, and licenses. Capital account transactions are distinguished from current account transactions in that **capital account transactions result in a change in the assets of one or both parties** to the transaction **without affecting the income or savings of either party** [at the time of the transaction]." §

It records capital flows from the rest of the world minus capital flows to the rest of the world.[13]

The Financial Account

"In the financial account, international monetary flows related to **investment in business, real estate, bonds and stocks** are documented. Also included are government-owned assets such as foreign reserves, gold, **special drawing rights (SDRs)**[14] held with the International Monetary Fund (IMF), private assets held abroad and direct foreign investment. Assets owned by foreigners, private and official, are also recorded in the financial account." ‡

The *2016 3Q BOP update* states:

"The financial account consists of transactions between U.S. residents and nonresidents for direct investment, portfolio investment, other investment, reserves, and financial derivatives other than reserves.

Net U.S. borrowing measured by financial-account transactions was $207.9 billion in the third quarter, an increase from net borrowing of $41.0 billion in the second quarter. A decrease in net U.S. acquisition of financial assets excluding financial derivatives was partly offset by a decrease in net U.S. incurrence of liabilities excluding financial derivatives and an increase in net lending in financial derivatives other than reserves…

Net U.S. acquisition of financial assets excluding financial derivatives decreased $292.0 billion in the third quarter to $31.5 billion…

Net U.S. incurrence of liabilities excluding financial derivatives decreased $115.9 billion to $251.5 billion…

Transactions in **financial derivatives** other than reserves reflected third-quarter net lending of $12.1 billion, a $9.2 billion increase from the second quarter." §

I have not yet determined how this and other BOP accounting relates to NIPA accounting. Financial accounts for the US are also summarized in the FRB's *Financial Accounts of the United States*, most recently their *Third Quarter 2016* update.[15] Blanchard omits a Financial Account separate from the Capital Account in describing the Balance of Payments.

Balancing the Accounts

"The **current account should be balanced against the combined-capital and financial accounts**; however … this rarely happens [exactly]. …With fluctuating exchange rates, the change in the value of money can add to **BOP discrepancies**. When there is a deficit in the current account, which is a

---

[12] https://www.imf.org/external/pubs/ft/bop/2014/pdf/BPM6_15F.pdf section 15.3

[13] Lecture Ch. 17.pdf

[14] **Special Drawing Rights SDR**: "The SDR is an international reserve asset, created by the IMF in 1969 to supplement its member countries' official reserves. As of March 2016, 204.1 billion SDRs (equivalent to about $285 billion) had been created and allocated to members. SDRs can be exchanged for freely usable currencies. The value of the SDR is based on a basket [i.e., a weighted average] of five major currencies—the U.S. dollar [USD], euro [EUR], the Chinese renminbi (RMB) [aka CNY = yuan], the Japanese yen [JPY], and pound sterling [GBP]—as of October 1, 2016." http://www.imf.org/external/np/exr/facts/sdr.htm

[15] https://www.federalreserve.gov/releases/z1/current/z1.pdf

balance of trade deficit, the difference can be borrowed or funded by the capital account.

If a country has a fixed asset abroad, this borrowed amount is marked as a capital account outflow. However, the sale of that fixed asset would be considered a current account inflow (earnings from investments). The current account deficit would thus be funded. When a country has a current account deficit that is financed by the capital account, the country is actually foregoing capital assets for more goods and services. If a country is borrowing money to fund its current account deficit, this would appear as an inflow of foreign capital in the BOP." ‡

The *2016 3Q BOP update* states:

"The statistical discrepancy is the difference between net acquisition of assets and net incurrence of liabilities in the financial account (including financial derivatives) less the difference between total credits and total debits recorded in the current and capital accounts…

The **statistical discrepancy** shifted to −$95.0 billion in the third quarter from +$77.3 billion in the second quarter." §

Blanchard states that the net capital flows (capital account balance or surplus) should equal the current account balance or deficit (*ME7* p. 360). However, this seems to neglect the financial account, an omission which appears to be explained by the following quote: "In macroeconomics and international finance, the **capital account** (also known as the **financial account**) is one of two primary components of the balance of payments, the other being the current account… The term 'capital account' is used with a narrower meaning by the International Monetary Fund (IMF) and affiliated sources [as well as by the BEA]. The IMF splits what the rest of the world calls the capital account into two top-level divisions: **financial account** and **capital account**, with by far the bulk of the transactions being recorded in its financial account."[16]

Liberalizing the Accounts

"The rise of global financial transactions and trade in the late-20th century spurred BOP and macroeconomic liberalization in many developing nations. With the advent of the emerging market economic boom—in which capital flows into these markets tripled from USD $50 million to $150 million from the late 1980s until the Asian crisis—developing countries were urged to lift restrictions on capital and financial-account transactions in order to take advantage of these capital inflows. Many of these countries had restrictive macroeconomic policies, by which regulations prevented foreign ownership of financial and non-financial assets. The regulations also limited the transfer of funds abroad.

With capital and financial account liberalization, capital markets began to grow, not only allowing a more transparent and sophisticated market for investors, but also giving rise to **foreign direct investment (FDI)**. For example, investments in the form of a new power station would bring a country greater exposure to new technologies and efficiency, eventually increasing the nation's overall GDP by allowing for greater volumes of production. Liberalization can also facilitate less risk by allowing greater diversification in various markets." ‡

Sample BOP Tables

Sample excerpts from the most recent BOP update tables follow (and quotes are provided above to give the flavor of the report): Line numbers in the original were consecutive—missing line numbers here indicate **lines that have been arbitrarily hidden by MCM to shorten the data displayed**. Several **columns have also been hidden**. See cited source to view the actual complete tables. §

[16] https://en.wikipedia.org/wiki/Capital_account

December 15, 2016

Table 1. U.S. International Transactions

[Millions of dollars]

Line		2014	2015	Seasonally adjusted 2016 II r	Seasonally adjusted 2016 III p
	Current account				
1	**Exports of goods and services and income receipts (credits)**	**3,338,757**	**3,172,693**	**781,364**	**799,047**
2	**Exports of goods and services**	**2,376,577**	**2,261,163**	**546,430**	**564,117**
3	**Goods**	**1,633,320**	**1,510,303**	**360,228**	**375,947**
4	General merchandise	1,610,368	1,488,639	356,152	370,115
5	Foods, feeds, and beverages	143,722	127,727	31,148	41,703
11	Net exports of goods under merchanting	299	259	50	53
12	Nonmonetary gold	22,654	21,405	4,025	5,779
13	**Services**	**743,257**	**750,860**	**186,203**	**188,170**
14	Maintenance and repair services n.i.e.	22,132	24,036	6,495	6,718
15	Transport	90,701	87,221	21,086	20,764
21	Other business services	128,817	134,648	34,976	35,051
22	Government goods and services n.i.e.	20,325	20,270	5,074	5,032
23	**Primary income receipts**	**821,807**	**782,915**	**202,619**	**202,825**
24	Investment income	815,123	775,846	200,820	201,021
25	Direct investment income	478,381	432,498	109,652	109,899
26	Portfolio investment income	304,984	311,619	81,031	80,967
29	Compensation of employees	6,684	7,069	1,799	1,804
30	**Secondary income (current transfer) receipts** [2]	**140,373**	**128,614**	**32,315**	**32,105**
31	**Imports of goods and services and income payments (debits)**	**3,730,817**	**3,635,658**	**899,635**	**912,004**
32	**Imports of goods and services**	**2,866,754**	**2,761,525**	**671,176**	**680,549**
33	**Goods**	**2,385,489**	**2,272,868**	**546,964**	**553,644**
34	General merchandise	2,370,025	2,260,279	541,456	548,088
35	Foods, feeds, and beverages	126,804	128,783	32,248	32,682
42	**Services**	**481,264**	**488,657**	**124,212**	**126,905**
43	Maintenance and repair services n.i.e.	7,521	8,996	2,059	2,037
44	Transport	94,160	97,050	24,199	24,192
51	Government goods and services n.i.e.	24,236	21,515	5,287	5,213
52	**Primary income payments**	**597,802**	**600,531**	**158,398**	**159,426**
53	Investment income	580,871	582,466	153,767	154,785
54	Direct investment income	189,375	167,103	45,581	44,748
55	Portfolio investment income	377,521	400,396	101,973	103,456
56	Other investment income	13,974	14,967	6,213	6,580
57	Compensation of employees	16,931	18,065	4,632	4,641
58	**Secondary income (current transfer) payments** [2]	**266,261**	**273,602**	**70,061**	**72,030**
	Capital account				
59	**Capital transfer receipts and other credits**	**0**	**0**	**0**	**0**
60	**Capital transfer payments and other debits**	**45**	**42**	**0**	**n.a.**

Table 1. U.S. International Transactions–Table Ends

[Millions of dollars]

Line		2014	2015	Seasonally adjusted 2016 II r	Seasonally adjusted 2016 III p
	Financial account				
61	**Net U.S. acquisition of financial assets excluding financial derivatives (net increase in assets / financial outflow (+))**	**823,343**	**225,398**	**323,426**	**31,451**
62	**Direct investment assets**	**343,441**	**348,646**	**106,273**	**87,513**
65	**Portfolio investment assets**	**582,688**	**153,968**	**146,397**	**-35,111**
70	**Other investment assets**	**-99,203**	**-270,924**	**70,566**	**-22,593**
75	**Reserve assets**	**-3,583**	**-6,292**	**189**	**1,642**
76	Monetary gold	0	0	0	0
77	Special drawing rights	23	9	(*)	2
83	Other claims	4	0	0	0
84	**Net U.S. incurrence of liabilities excluding financial derivatives (net increase in liabilities / financial inflow (+))**	**1,056,374**	**395,234**	**367,324**	**251,459**
85	**Direct investment liabilities**	**207,368**	**379,435**	**174,007**	**86,874**
88	**Portfolio investment liabilities**	**701,861**	**250,936**	**11,934**	**229,129**
93	**Other investment liabilities**	**147,145**	**-235,137**	**181,383**	**-64,544**
99	**Financial derivatives other than reserves, net transactions** [3]	**-54,347**	**-25,392**	**2,904**	**12,063**
	Statistical discrepancy				
100	**Statistical discrepancy** [4]	**104,727**	**267,780**	**77,278**	**-94,987**
	Balances				
101	**Balance on current account (line 1 less line 31)** [5]	**-392,060**	**-462,965**	**-118,271**	**-112,958**
107	**Balance on capital account (line 59 less line 60)** [5]	**-45**	**-42**	**0**	**0**
108	**Net lending (+) or net borrowing (-) from current- and capital-account transactions (line 101 plus line 107)** [6]	**-392,105**	**-463,007**	**-118,271**	**-112,958**
109	**Net lending (+) or net borrowing (-) from financial-account transactions (line 61 less line 84 plus line 99)** [6]	**-287,378**	**-195,227**	**-40,994**	**-207,945**

EXTRACTS OF DATA FROM THE ACTUAL TABLE (certain lines and columns have been hidden)

Bond Interest and Price

A $100 Bond (i.e., one paying $100 at maturity) costs $$P_B$ today. If so the actual interest paid is:

$$i = (\$100 - \$P_B)/ \$P_B$$ which is usually expressed as a percent

When $$P_B$ goes up, the interest rate i goes down: $\uparrow \$P_B \rightarrow \downarrow i$

Also, $$P_B = 100 / (1 + i)$

When i goes up, the price must go down: $\downarrow \$P_B \rightarrow \uparrow i$

The best estimate of bond interest is the Bond Equivalent Yield (BEY):[17]

$$BEY = ((F- P)/P) \times (365/d)$$

where F = Face (final) value
P = Price Paid (Ask price by seller)
d = number of days to maturity (e.g., 91 days to maturity out of 365 days per year)

Bureau of Economic Analysis (BEA)

"BEA strives to provide the most timely, relevant and accurate economic data to you, our users, to help promote a better understanding of the U.S. economy. These reliable and consistent measures of economic activity are essential to the informed decision making of policymakers, business leaders and every American household. The success of our statistical programs, in large part, is determined by your confidence in our data, and your suggestions for improving that data. As one of the world's leading statistical agencies, we are dedicated to staying on the cutting edge of the economy."[18]

"The Bureau of Economic Analysis (BEA) produces economic accounts statistics that enable government and business decision makers, researchers, and the American public to follow and understand the performance of the Nation's economy. The Bureau of Economic Analysis produces some of the Nation's most important economic statistics, including the gross domestic product (GDP) and the balance of payments. These statistics influence critical decisions made by policymakers, business leaders, households, and individuals that affect interest and exchange rates, tax and budget projections, business investment plans, and the allocation of over $300 billion in federal funds to states and local communities. BEA prepares national, regional, industry, and international economic accounts that present essential information on such issues as regional economic development, inter-industry relationships, and the Nation's position in the world economy. The National Income and Product Accounts (NIPAs) are the cornerstone of BEA's statistics, which feature the Nation's GDP statistics and related measures"[19]

"The Bureau of Economic Analysis (BEA) is a U.S. government agency that provides official macroeconomic and industry statistics including the gross domestic product of the United States. BEA is part of the United States Department of Commerce and is one of the principal agencies of the U.S. Federal Statistical System… BEA has about 500 employees and an annual budget of approximately $96.5 million."[20]

Bureau of Engraving and Printing (BEP)

"[BEP] is a government agency within the United States Department of the Treasury that designs and produces a variety of security products for the United States government, most notable of which is **Federal Reserve Notes** (**paper money**) for the Federal Reserve… . In addition to paper currency, the BEP produces **Treasury securities** [**Treasury bills, Treasury notes, Treasury bonds, and Treasury Inflation Protected Securities (TIPS)**]; military commissions and award certificates; invitations and admission cards; and many different types of identification cards, forms, and other special security documents for a variety of government agencies. The BEP does not produce coins—all coinage is produced by the **United States Mint**. With production facilities in Washington, DC, and Fort Worth,

[17] http://www.financeformulas.net/Bond_Equivalent_Yield.html
[18] https://www.bea.gov/about/director.htm
[19] https://www.commerce.gov/doc/bureau-economic-analysis#1/39/-77
[20] https://en.wikipedia.org/wiki/Bureau_of_Economic_Analysis

Texas, the Bureau of Engraving and Printing is the largest producer of government security documents in the United States."[21] The federal government no longer prints postage stamps.[22]

C

Capital and Capital Goods

This is a complex topic which I have not fully explored and can only touch on superficially. It seems that much confusion can be eliminated by qualifying any use of the bare word *capital* with a suitable clarifying modifier, such as *capital goods*, *human capital*, *financial capital*, *capital crime*, etc.

There are many definitions of capital. Adam Smith [1723 - 1790] defines **capital** as, "That part of a man's stock which he expects to afford him revenue". Capital is derived from the Latin word *caput* meaning head, as in "head of cattle". "The term 'stock" is derived from the Old English word for stump or tree trunk. It has been used to refer to all the **moveable property** of a farm since at least 1510… [By most definitions,] capital is distinct from land (or non-renewable resources) in that **capital can be increased by human labor**. At any given moment in time, total physical capital may be referred to as the **capital stock** (which is not to be confused with the capital stock of a business entity [i.e., the equity stock of the owners])…

In a fundamental sense, capital consists of **any produced thing that can enhance a person's power to perform economically useful work**—a stone or an arrow is capital for a caveman who can use it as a hunting instrument, and roads are capital for inhabitants of a city. "… Capital is **an input in the production function**. Homes and personal autos are not usually defined as capital but as durable goods because they are not used in a production of saleable goods and services… In Marxist political economy, capital is money used to buy something only in order to sell it again to realize a financial profit. For Marx [Karl Marx 1818 –1883], capital only exists within the process of economic exchange—it is wealth that grows out of the process of circulation itself, and for Marx it formed the basis of the economic system of capitalism. In more contemporary schools of economics, this form of capital is generally referred to as '**financial capital'**, and is distinguished from 'capital goods'."[23]

"Classical and neoclassical economics regard capital as one of the **factors of production** (alongside the other factors: land and labour, see *Factors of Production*). All other inputs to production are called **intangibles** in classical economics. This includes **organization**, **entrepreneurship**, **knowledge**, **goodwill**, or **management** (which some characterize as talent, social capital or instructional capital)…"[24]

Modern Types of capital are [some overlap may be present; the first item has been added by MCM for completeness]:

- "**Capital goods**, **real capital**, or **capital assets** are already-produced durable goods or any non-financial asset that is used in production of goods or services…" [E.g., computers, factory buildings, machinery, cattle. Real capital does not usually include land, and can be increased by human labor.]
- "**Financial capital**, which represents **obligations** [e.g., to pay back with interest], and is liquidated as money for trade, and owned by legal entities. It is in the form of **capital assets**, **traded** in **financial markets**. Its market value is not based on the historical accumulation of money invested but on the perception by the market of its expected revenues and of the risk entailed. [Financial capital can be construed as **funds available to acquire real capital**.]
- **Natural capital**, which is inherent in ecologies [i.e., naturally present in the environment or underground] and which increases the supply of human wealth, e.g. trees, veins of ore. "Natural capital is the world's stock of natural resources, which includes geology, soils, air, water and all living organisms. Natural capital assets provide people with a wide range of free

[21] https://en.wikipedia.org/wiki/Bureau_of_Engraving_and_Printing
[22] http://www.washingtonpost.com/wp-dyn/content/article/2005/06/12/AR2005061201253.html
[23] https://en.wikipedia.org/wiki/Capital_(economics) all quotes in the paragraph are from this source, except as noted
[24] ibid.

goods and services, often called **ecosystem services**, which underpin our economy and society and some of which even make human life possible." [25]

- **Social capital**, which in private enterprise is partly captured as **goodwill** or **brand value**, but is a more general concept of **inter-relationships between human beings having money-like value** that motivates actions in a similar fashion to paid compensation.
- **Instructional capital**, defined originally in academia as that aspect of teaching and knowledge transfer that is not inherent in individuals or social relationships but transferrable. Various theories use names like knowledge or intellectual capital to describe similar concepts but these are not strictly defined as in the academic definition and have no widely agreed accounting treatment.
- **Human capital**, a broad term that generally includes social, instructional and individual **human talent** in combination. It is used in technical economics to define balanced growth which is the goal of improving human capital as much as economic capital."[26] This topic is addressed in (*ME7* p. 234ff) in the discussion regarding factors affecting output per worker. He symbolizes the effect of human capital (investment in education, skills and training, etc.) as H/N in the production function. "[27] See also under *GDP Growth*.

"Capital refers to **financial assets** or the **financial value of assets**, such as cash and funds held in deposit accounts, as well as the **tangible machinery and production equipment** used in environments such as factories and other manufacturing facilities. Additionally, capital includes **facilities**, such as the **buildings** used for the production and storage of the manufactured goods. Materials used and consumed as part of the manufacturing process do not qualify… **While money is used simply to purchase goods and services for consumption, capital is more durable and is used to generate wealth through investment**. Examples of capital include automobiles [used in businesses], patents, software and brand names. All of these items are inputs that can be used to create wealth. Besides being used in production, **capital can be rented out** for a monthly or annual fee to create wealth, or it **can be sold** when it is no longer required… In order to qualify as capital, the **[capital] goods must provide an ongoing service to the business to create wealth**. Capital must be combined with labor, the work of individuals who exchange their time and skills for money, to create value. By investing in capital and foregoing current consumption, a business or individual can direct those efforts into future prosperity."[28]

Capital goods are "tangible assets such as buildings, machinery, equipment, vehicles and tools that an organization uses to produce goods or services in order to produce consumer goods and goods for other businesses. Manufacturers of automobiles, aircraft, and machinery fall within the capital goods sector because their products are used by companies involved in manufacturing, shipping and providing other services… Capital goods that a business does not consume within a single year of production cannot be entirely deducted as business expenses for the year of their purchase [i.e., *expensed*]. Instead, they must be **depreciated** over the course of their useful lives, with the business taking partial tax deductions spread over the years that the capital goods are in use. This is done through use of such accounting techniques as depreciation, amortization and depletion…

Capital goods are not necessarily fixed assets, such as machinery and manufacturing equipment. The industrial electronics industry produces a wide variety of devices which are capital goods. These range from small wire harness assemblies to air purifying respirators and high-resolution digital imaging systems. Capital goods are also produced for service businesses. Hair clippers used by hair stylists, paint used by painters, and musical instruments played by musicians are among the many types of capital goods purchased by service providers. **Core capital goods** are a class of capital goods which excludes aircraft and goods produced for the Defense Department, such as automatic rifles and military uniforms… This information is closely followed as a forward-looking indicator on the degree to which businesses plan to expand. **Durable goods** are products with an expected useful life of at least three years [and are not necessarily capital goods]."[29]

---

[25] https://en.wikipedia.org/wiki/Natural_capital
[26] https://en.wikipedia.org/wiki/Capital_(economics)
[27] ibid.
[28] http://www.investopedia.com/terms/c/capital.asp
[29] http://www.investopedia.com/terms/c/capitalgoods.asp

Capital goods "are economic goods (e.g. railways, ships, machinery, buildings) destined for use in production (as opposed to consumers' goods)."[30]

For **capital accounts**, see *National Income and Product Accounts NIPA*.

Central Bank

"A **central bank**, **reserve bank**, or **monetary authority** is an institution that manages a state's [i.e., country's] **currency**, **money supply**, and **interest rates**. Central banks also usually oversee the commercial banking system of their respective countries. In contrast to a commercial bank, a central bank possesses a monopoly on increasing the monetary base in the state, and usually also prints the national currency [though not in the US], which usually serves as the state's legal tender.

The primary function of a central bank is to control the nation's money supply (**monetary policy**), through active duties such as managing interest rates, setting the reserve requirement [for banks], and acting as a lender of last resort to the banking sector during times of bank insolvency or financial crisis. Central banks usually also have supervisory powers, intended to prevent bank runs and to reduce the risk that commercial banks and other financial institutions engage in reckless or fraudulent behavior. Central banks in most developed nations are institutionally designed to be independent from political interference. Still, limited control by the executive and legislative bodies usually exists"[31]

Central banks include the **US Federal Reserve banks** (Atlanta, Chicago, New York, St. Louis, San Francisco, etc.) and their several **branches**,[32] all under the **Federal Reserve Board** (FRB). Also are the foreign counterparts: Bank of Canada; Bank of Mexico; European Central Bank [Euro Area]; Bank of England; Banque de France; Deutsche Bundesbank; Sveriges Riksbank [Sweden]; Central Bank of the Russian Federation; People's Bank of China; etc.[33]

Regarding the **printing or creation of money**, "Despite being colloquially charged with running the printing press for dollar bills, the modern Federal Reserve no longer simply runs new paper bills off of a machine. Some real dollar printing does still occur (with the help of the U.S. Department of the Treasury), but the vast majority of the American money supply is **digitally debited and credited to major banks** [without printing these dollars as paper money]. The real money creation takes place after the banks loan out those new balances to the broader economy."[34] See also *Bureau of Engraving and Printing (BEP)*.

Consumer Price Index CPI

See *Inflation and Price Levels*.

Current Population Survey CPS

Operated by the US Census, "The Current Population Survey (CPS) is one of the oldest, largest, and most well-recognized surveys in the United States. It is immensely important, providing information on many of the things that define us as individuals and as a society—our work, our earnings, and our education. In addition to being the primary source of monthly labor force statistics, the CPS is used to collect data for a variety of other studies that keep the nation informed of the economic and social well-being of its people. This is done by adding a set of supplemental questions to the monthly basic CPS questions. Supplemental inquiries vary month to month and cover a wide variety of topics such as child support, volunteerism, health insurance coverage, and school enrollment. Supplements are usually conducted annually or biannually, but the frequency and recurrence of a supplement depend completely on what best meets the needs of the supplement's sponsor…

The CPS is administered by the Census Bureau using a probability selected sample of about 60,000 occupied households. The fieldwork is conducted during the calendar week that includes the 19th of the month. The questions refer to activities during the prior week.… Households from all 50 states and the District of Columbia are in the survey for 4 consecutive months, out for 8, and then return for another 4 months before leaving the sample permanently. This design ensures a high

---

[30] http://www.oed.com.offcampus.lib.washington.edu/view/Entry/27450?rskey=vKqIeS&result=2#eid224980164
[31] https://en.wikipedia.org/wiki/Central_bank
[32] https://en.wikipedia.org/wiki/List_of_Federal_Reserve_branches
[33] http://www.bis.org/cbanks.htm
[34] http://www.investopedia.com/articles/investing/081415/understanding-how-federal-reserve-creates-money.asp

degree of continuity from one month to the next (as well as over the year). The 4-8-4 sampling scheme has the added benefit of allowing the constant replenishment of the sample without excessive burden to respondents."[35]

The CPS is the primary source of information about unemployment. A sample of 2016 data from the CPS **Detailed Tables for Poverty** follows, representing Householders below the 100% poverty line. (Numbers in parentheses are footnotes in the CPS Poverty Tables Footnotes):[36]

Householder

	All people (1)			People in families (2)			People in unrelated subfamilies (3)			Unrelated individuals (4)		
All Races Below 100%	All income levels	Below 100% of poverty (5)	Percentage below 100% of poverty (6)	All income levels	Below 100% of poverty (5)	Percentage below 100% of poverty (6)	All income levels	Below 100% of poverty (5)	Percentage below 100% of poverty (6)	All income levels	Below 100% of poverty (5)	Percentage below 100% of poverty (6)
Householder (7)	125,834	16,624	13.2	82,199	8,589	10.4	(N/A)	(N/A)	(X)	43,635	8,035	18.4
Under 18 years	216	72	33.4	205	61	29.9	(N/A)	(N/A)	(X)	11	11	(B)
18 to 24 years	6,145	1,900	30.9	2,982	801	26.8	(N/A)	(N/A)	(X)	3,163	1,099	34.7
25 to 34 years	20,048	3,102	15.5	12,911	2,254	17.5	(N/A)	(N/A)	(X)	7,137	847	11.9
35 to 44 years	21,223	2,809	13.2	16,915	2,137	12.6	(N/A)	(N/A)	(X)	4,308	671	15.6
45 to 54 years	23,296	2,548	10.9	17,093	1,355	7.9	(N/A)	(N/A)	(X)	6,203	1,193	19.2
55 to 59 years	12,668	1,534	12.1	8,431	509	6.0	(N/A)	(N/A)	(X)	4,237	1,026	24.2
60 to 64 years	11,231	1,491	13.3	7,065	532	7.5	(N/A)	(N/A)	(X)	4,166	958	23.0
65 years and over	31,006	3,169	10.2	16,597	939	5.7	(N/A)	(N/A)	(X)	14,409	2,230	15.5
65+ and living alone (8)	13,563	2,095	15.4	(N/A)	(N/A)	(X)	(N/A)	(N/A)	(X)	13,563	2,095	15.4
Male	4,302	540	12.6	(N/A)	(N/A)	(X)	(N/A)	(N/A)	(X)	4,302	540	12.6
Female	9,261	1,555	16.8	(N/A)	(N/A)	(X)	(N/A)	(N/A)	(X)	9,261	1,555	16.8

D

Deflation

This term if not further qualified appears to apply to more than one phenomenon and is thus potentially ambiguous, the usage apparently model-dependent. It seems best to clarify which type of deflation is being referenced:

(1) **Price Deflation**: Blanchard defines deflation as "sustained decline in the price level", thus "negative inflation" (*ME7* p. 31 and glossary). This appears to be by far the most common use of the term.

"In economics, deflation is a decrease in the general price level of goods and services. Deflation occurs when the inflation rate falls below 0% (a negative inflation rate). Inflation reduces the real value of money over time; conversely, deflation increases the real value of money—the currency of a national or regional economy. This allows one to buy more goods and services than before with the same amount of money… Economists generally believe that deflation is a problem in a modern economy because it may increase the real value of debt, especially if the deflation was unexpected. Deflation may also aggravate recessions and lead to a deflationary spiral… Deflation is distinct from **disinflation**, a slow-down in the inflation rate, i.e. when inflation declines to a lower rate but is still positive… When prices are falling, consumers have an incentive to delay purchases and consumption until prices fall further, which in turn **reduces overall economic activity**… An answer to falling aggregate demand is **stimulus**, either from the central bank, by **expanding the money supply**, or by the fiscal authority to increase demand [via government spending], and to borrow at interest rates which are below those available to private entities… From a monetarist perspective, deflation is caused primarily by a reduction in the velocity of money and/or the amount of money supply per person [but several other causes are also discussed in this detailed article]…

A **deflationary spiral** is a situation where decreases in price [levels] lead to lower production,

---

[35] • https://www.census.gov/programs-surveys/cps/technical-documentation/methodology.html and
• 2016 Annual Social and Economic (ASEC) Supplement (reissued Nov. 7, 2016)
http://www2.census.gov/programs-surveys/cps/techdocs/cpsmar16.pdf and
• footnotes: https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-footnotes/cps-tables-footnotes.html

[36] I can no longer identify the exact source of this specific table.

which in turn leads to lower wages and demand, which leads to further decreases in price [levels]. … A deflationary spiral occurs when reductions in price lead to a **vicious circle**… In science, this effect is also known as a positive feedback loop."[37]

(2) **Monetary Deflation**: Deflation "is a **contraction in the supply of circulated money** within an economy, and therefore the opposite of inflation. In times of deflation, the purchasing power of currency and wages are higher than they otherwise would have been. This is distinct from but similar to price deflation, which is a general decrease in the price level, though the two terms are often mistaken for each other and used interchangeably… Monetary deflation can only be caused by a decrease in the supply of money or financial instruments redeemable in money. In modern times, the money supply is most influenced by central banks, such as the Federal Reserve. Periods of deflation most commonly occur after long periods of artificial monetary expansion… Following the Great Depression, when monetary deflation coincided with high unemployment and rising defaults, most economists believed deflation was per se an adverse phenomenon. Thereafter, most central banks adjusted monetary policy to promote consistent increases in the money supply, even if it promoted chronic price inflation and encouraged debtors to borrow too much… In recent times, economists increasingly challenge the old interpretations about deflation, especially after the 2004 study by economists Andrew Atkeson and Patrick Kehoe, "Deflation and Depression: Is There an Empirical Link?" After reviewing 17 countries across 180 years, Atkeson and Kehoe found 65 out of 73 deflation episodes with no economic downturn, while 21 out of 29 depressions had no deflation. There are now a wide range of opinions on the usefulness of deflation and price deflation."[38]

Demand for Goods, Equilibrium Goods Output, and I-S Curve

Much of this section ignores net exports NX.

The **goods market** is all of the buying and selling of **goods and services**. **Aggregate production/output of goods and services (and income) Y is measured by GDP**, defined as

GDP ≡ Y_t = C + I + G + (X-IM) + (Inventory Investment) = C + I + G + NX + Inv. Inv.

In the **short run** model of demand (*ME7* p. 50 ff), we make several assumptions (for now ignoring trade so that net exports NX = 0, ignore inflation, assume there are no supply constraints, assume Inventory Investment Inv. Inv. = 0).

We also assume that **at equilibrium in the goods market**:

Z (aggregate demand) = aggregate production/output/income Y (GDP), or
Z = Y

(If the goods market is out of equilibrium, inventory investments adjustments will take place until equilibrium occurs.)

Disposable income is defined as

Disposable income Y_D ≡ (Y - T) where Y = income and T = govt. taxes minus govt. transfers

Consumption is a function of disposable income, thus the **consumption function**

C = C(Y_D), for which ↑Y_D → ↑C.

Aggregate Demand theory holds that **Z = C + I + G + NX** = $(c_0 + c_1Y_D) + I + G = c_0 + c_1(Y - T) + I + G = Y$

where **c_0** is **autonomous consumption** and
c_1 is a simplifying constant termed the **marginal propensity to consume (MPC).**

Thus,

Output/income $Y = \left(\frac{1}{1-c_1}\right)[c_0 + \bar{I} + \bar{G} - c_1 T]$ (at goods market equilibrium)

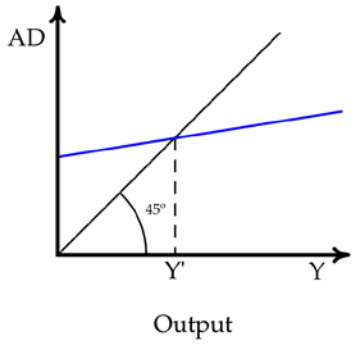
where
- the left term on the RHS is a **multiplier** which increases as c_1 approaches one
- the right term on the RHS is **autonomous spending**, which decreases with increasing c_1

(items with a macron are assumed here to be fixed or "exogenous")

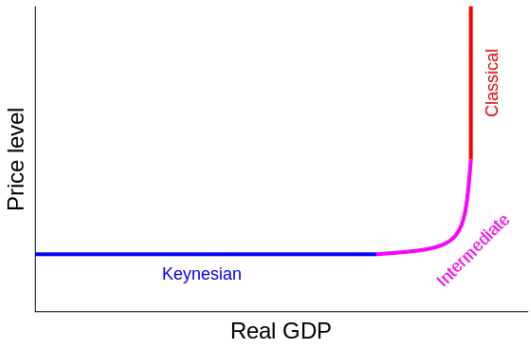
Note that the overall effect on Y with ↑c_1 seems uncertain, given the formula components.

[37] https://en.wikipedia.org/wiki/Deflation
[38] http://www.investopedia.com/terms/d/deflation.asp?lgl=no-infinite

The **Keynesian cross** (diagram to right) demonstrates the postulated relationship between **aggregate demand AD** (vertical axis) and real GDP (horizontal axis, expressed as **output**). The desired total spending (**aggregate expenditure AE** or **aggregate demand AD**) curve (shown in blue) is assumed be a rising line starting with a positive value, because consumers will have a larger demand with rising disposable income, and this ↑spending → ↑national output (GDP). This ↑AD is due to the positive relationship between consumption and consumers' disposable income in the consumption function. Aggregate demand may also rise due to ↑investment, while AD rise is reduced if imports and tax revenues rise with income. Equilibrium in the goods market (and, in this diagram) occurs where total demand, AD, equals the total amount of national output, Y = Y′ at the crossing point on the 45° line. Here, total demand equals total supply.[39]



Supply constraints are shown on the **Aggregate Supply curve** or **AS curve** [example diagrams below). This curve plots Price Level against Real GDP, and the changes in P are most apparent at high levels of GDP. In the left example, the curve is assumed to be flat in the Keynesian short run while vertical in the Classical longer run.[40] The right diagrams make explicit the distinction between the short run AS curve, which increases as Real GDP increases,[41] and the long run AS curve (which has a constant value located at the natural level of real GDP).[42] The following describes the **medium run AS curve (MRAS)**: "Medium run aggregate supply (MRAS) — As an interim between **SRAS [short run AS]** and **LRAS [long run AS**], the MRAS form slopes upward and reflects when capital as well as labor usage can change. More specifically, medium run aggregate supply is like this for three theoretical reasons, namely the Sticky-Wage Theory, the Sticky-Price Theory and the Misperception Theory. The position of the MRAS curve is affected by capital, labor, technology, and wage rate."[43]



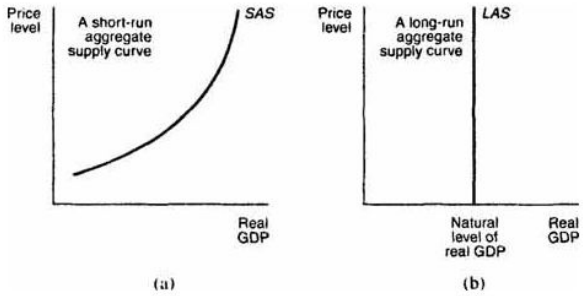


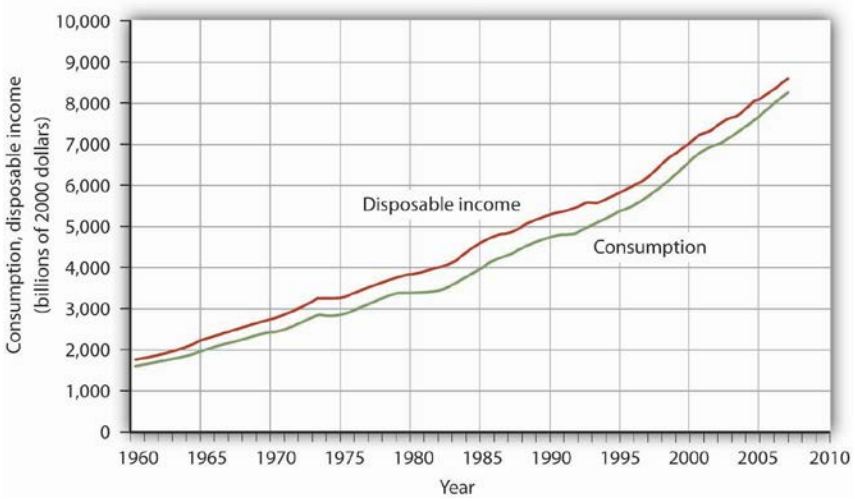
Figure 1 The aggregate supply curve

The term **Aggregate Expenditures AE** is also encountered. "[It is] defined as $AE = C + I_p + G + X_n$ [where C is consumption expenditure, I_p is planned investment and X_n is net exports (X - IM)]… Aggregate Expenditure is one of the methods to calculate [GDP], … an important measure of the growth of the economy, [which] is calculated through the Aggregate expenditure model also known as the Keynesian cross. AE is also used in the **Aggregate Demand-Aggregate Supply [AD-AS] Model** which advances the **Aggregate Expenditures Model** with the inclusion of Price changes…"[44]

Aggregate Consumption closely follows aggregate disposable income Y_D:[45]

---

[39] paraphrased from https://en.wikipedia.org/wiki/Keynesian_cross , includes diagram
[40] https://en.wikipedia.org/wiki/Aggregate_supply including left diagram
[41] http://www.freeeconhelp.com/2011/10/introduction-of-keynesian-short-run.html
[42] Rt. diagram : https://www.cliffsnotes.com/study-guides/economics/aggregate-demand-and-aggregate-supply/aggregate-supply-as-curve
[43] https://en.wikipedia.org/wiki/Aggregate_supply
[44] https://en.wikipedia.org/wiki/Aggregate_expenditure
[45] Lecture2.pdf

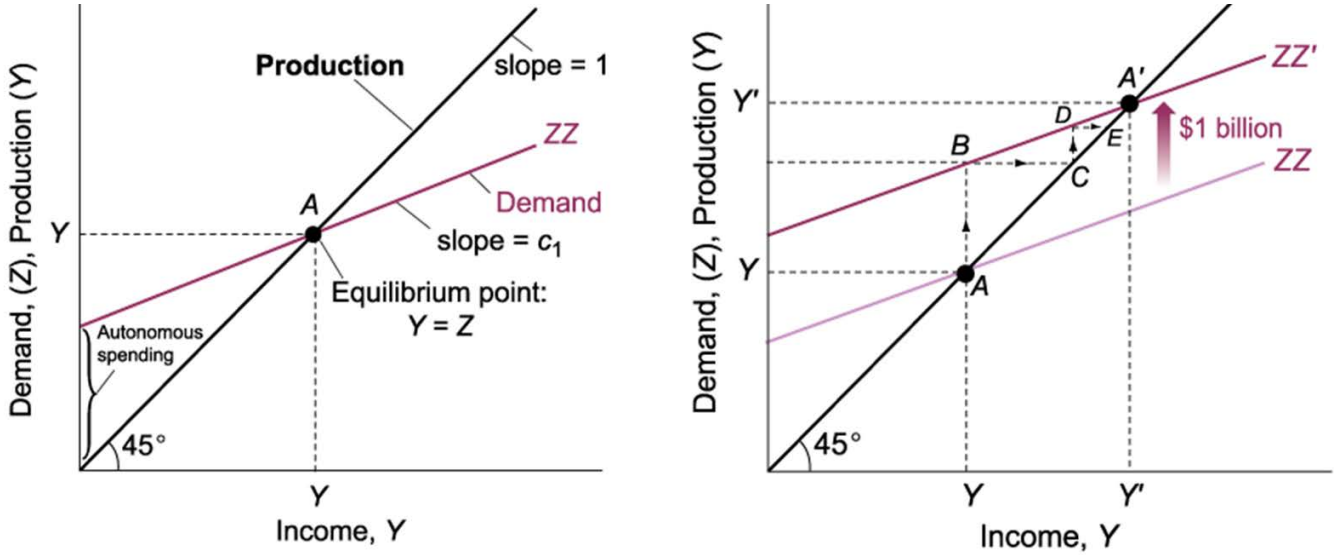


Production Y depends on demand, demand depends on income Y, income Y = production Y (according to the definitions of Account 1 of the NIPA). An increase in demand leads to an increase in production and income. A change in **autonomous consumption** $\Delta\mathbf{c_0}$ will change output by a proportionately greater % than the percent change in $\Delta\mathbf{c_0}$ (reaching a limit defined by the multiplier above).

The higher $\mathbf{c_1}$ is —the **marginal propensity to consume (MPC)**—the greater will be the multiplier effect $[1/(1 - c_1)]$. In the US, the propensity to consume c_1 is currently around 0.6, making the multiplier ≈ 2.5. If c_1 equals 0.6 and the multiplier is 2.5, an increase of consumption by $1 billion will increase output by ~2.5 x $1 billion = $2.5 billion.[46]

If autonomous consumption c_0 falls, the loss in autonomous spending $[c_0 + \bar{I} + \bar{G} - c_1 T]$ can sometimes be made up by adjustments in fiscal policy (↑G or ↓T or both).

The equilibrium condition in the goods market, and the effect of introducing an increase in autonomous spending c_0, are shown graphically according to this model as follows for a $\Delta\mathbf{c_0}$ of 1 billion (the demand curve ZZ may also be shown as curving, as shown later):[47]



The left diagram depicts the hypothesized equilibrium in the good market that occurs when the Demand curve ZZ crosses the Z = Y (45° identity) line at point A, at which point Z = Y. This crossing point is said to be the **Keynesian cross**.

An increase of autonomous spending (via ↑I, ↑G, or ↓T; see right diagram above) shifts the ZZ curve up to ZZ′ and thereby moves the equilibrium income Y at A to a higher value Y′ at A′, a change greater than the direct effect on autonomous spending (here, > 1 billion).

---

[46] *ME7* p. 57 and Instructor_Pearson_File_7e_PPT_03.pptx

[47] http://www2.hawaii.edu/~noy/300pp/03goods.ppt modified MCM

In actual conditions, the response to a perturbation is not instantaneous, and equilibrium at which Z = Y is attained only after the 3 to 12 months or so that seems to characterize the short run time scale.

According to Keynesian theory [John Maynard Keynes 1883 - 1946], equilibrium in the goods market may equivalently be said to be established when **Investment I = Total Saving** (where saving here is S by consumers + (T - G) by government). This is because at equilibrium:

$S \equiv Y_D - C = (Y - T) - C$ [S is Saving by consumers]
$Y = C + I + G$ [ignoring NX and Inv. Inv.=0 at equilibrium]
$Y - T - C = I + G - T$
but $Y - T - C$ is private saving S, so
$S = I + G - T$, or
$I = S + (T - G)$ where RHS is the total saving of consumers + government

The RHS [S + (T - G)] represents **total saving = private saving + public saving**
So Investment = Total Saving = S + (T - G)

The symbol S should always be regarded as private non-governmental saving. **Total saving** is given by S + (T - G), but has no single symbol. This is a little confusing in the text. The textbook avoids (and you should avoid) the use of the ambiguous word *Savings*.

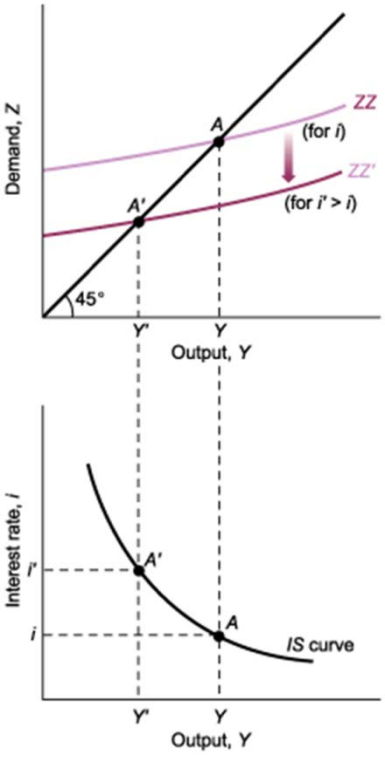
Public (government) saving ≡ (T - G) = taxes net of transfers less government spending. When public saving is positive, we have a **budget surplus**, and when negative a **budget deficit** (aka **dissaving**).

ME7 p. 61 derives the following (again ignoring net exports NX):
I = S + (T - G); i.e.,
Investment = Private saving + Public saving = Total saving

Thus at equilibrium in the goods market according to Keynes,[48]
Investment I = [Total] Saving
justifying the somewhat mysterious name of the so-called **IS Relation** or **I-S Relation**.

Blanchard states that this equation I = S + (T - G), which derives from the equilibrium condition Y=Z (again ignoring NX = X - IM), "gives us another way of thinking about equilibrium in the goods market… This way of looking at equilibrium explains why the equilibrium condition for the goods market is called the **IS relation,** which stands for '**investment equals saving**': .What firms want to invest must be equal to what people and the government want to save." (*ME7* p. 61)[49]

The diagrams[50] to the right illustrates the origin of the **IS Curve** (or **I-S Curve**), which despite the name typically plots interest i against output Y (thus, the lower of the two diagrams), rather than investment against saving S. The upper diagram shows how an increase in the interest rate (e.g., fed funds rate) from i to i′ causes the Demand curve ZZ (shown here as curving) to shift down, so that a new equilibrium value at A′ (where Demand Z = Production Y) at (Y′, i′) is seen, that is at a lower level of output. Summarizing, ↑i → ↓Y



The lower diagram plots all values of interest i and the resulting equilibrium output values Y. The IS curve shows decreasing i for increasing Y (↓i → ↑Y), and is concave upward (inexactly described as "downward sloping").

The IS curve will shift in response to changes in Taxes T, Government spending G, or Consumption C (graph not shown). For example, the IS curve is shifted to the left, so that output Y decreases ↓**Y** for a given level of i, as a result of ↑**T,** ↓**G**, and/or ↓consumer confidence → ↓**C** (*ME7* p. 93, graph not shown).

Changes in output adjust slowly to changes in the goods market (IS).

---

[48] http://www.economicsdiscussion.net/keynesian-economics/keynes-theory/saving-and-investment-equality-with-explanation-and-diagram/14397

[49] Blanchard causes confusion by calling the **IS relation** is that given by the equations presented in the extended IS-LM model (*ME7* p. 96 and 121 or even 335), whereas p. 61 he says it is the equation I=S + (T – G). "I = S + (T - G)" is the IS relation. (*ME7* p. 61)

[50] http://mysite.avemaria.edu/gmartinez/Courses/ECON301/PPoints/ECO_301_ch05.ppt

Because

$S = -c_0 + (1 - c_1)(Y - T)$,

it follows that $(1 - c_1)$ may be termed **the propensity to save**. We may again derive

Output/income $Y = \left(\frac{1}{1-c_1}\right)[c_0 + \bar{I} + \bar{G} - c_1 T]$

The government is limited in how much it can influence output. Changing G and T can be difficult (especially if there are a large public debt or deficit), foreign trade can complicated matters, and expectations can be important.

This leads to the **Paradox of Saving** (aka **Paradox of Thrift**) (a concept popularized by Keynes).[51] If consumers at a given level of disposable income decide to save more by decreasing c_0, the effect on S is uncertain: decreasing c_0 could increase saving S, or, because it leads to lower income Y, it might decrease saving S. In fact, according to theory, attempting to increase saving by decreasing c_0 will result in a decline in output, because

$\downarrow c_0 + c_1(Y - T \rightarrow \downarrow C$
$\downarrow C + I + G \rightarrow \downarrow Z$, and
$\downarrow Z \rightarrow \downarrow Y$.

and no change in saving in the short run, because

$I = S + (T - G)$ at equilibrium, and S cannot change when I, T, and G do not change.

Thus we have the **paradox of saving/savings**.[52]

An effort instead to decrease the budget deficit by raising taxes to increase public saving (T - G) would also lead to lower output but unchanged overall public + private saving $I = S + (T - G)$.

The Keynesian theory, which advocates that "the proper response to an economic recession is more spending, more risk-taking and less saving",[53] is not universally accepted by economists [and much of the above seems a bit mystical to me]. The lowering of output would occur in the short run, but in the medium or long run, other factors come into play and ↑saving rate is likely to lead over time to ↑saving S and ↑income Y.

Demand for Money, LM Curve, and IS-LM Model

Money is defined in *Money and Wealth*.

We opt to allocate our funds to money versus bonds etc. based on interest rates on bonds, the need for cash to settle transactions, etc.

Interest rates (e.g., on bonds) adjust nearly instantaneously to changes in the financial markets (LM).

The **demand for money** M^d is given by

$M^d = \$Y\ L(i)$

where $\$Y$ = nominal income (Y is equivalent to output), for which increases cause an increase in M^d

$L(i)$ = an unspecified function of nominal interest rate. When i increases, $L(i)$ decreases, so that decreases M^d also decreases.
The $L(i)$ or L symbol derives from **liquidity preference**.

Thus, a rising interest rate reduces demand for money (because more money is placed in bonds), so $\uparrow i \rightarrow \downarrow M^d$. A decreasing interest rate increases demand for money, because the value of holding bonds diminishes, so $\downarrow i \rightarrow \uparrow M^d$.

An increase in nominal income $Y (assuming a fixed money supply) leads to an increase in interest rate, so $\uparrow \$Y \rightarrow \uparrow i$. An increase in the supply of money M^S by the CB leads to a decrease in the interest rate, so $\uparrow M^d \rightarrow \downarrow i$. (*ME7* p. 73)

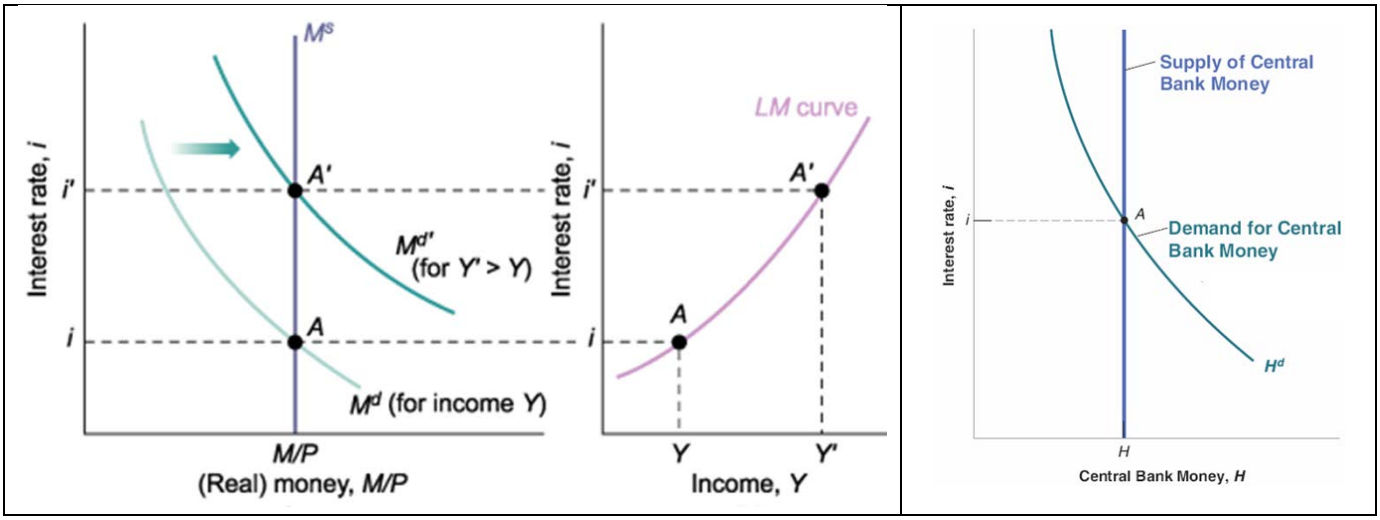
The Demand for Central Bank Money H^d also leads to an equilibrium at which Supply of CB Money H equals the Demand for CB Money, or $H^d = H$ (see right-most graph below). The value of H is fixed in the short run, whereas H^d is correlated with interest i: $\uparrow H^d \rightarrow \downarrow i$, $\downarrow H^d \rightarrow \uparrow i$. Blanchard derives this formula pertaining to CB money at equilibrium as follows: (*ME7* p. 79; see p. 86 for details.)

---

[51] https://en.wikipedia.org/wiki/Paradox_of_thrift
[52] *ME7* p. 63 and Lecture 02.pdf. Blanchard avoids the word *Savings*.
[53] http://www.investopedia.com/terms/p/paradox-of-thrift.asp

$$H^d = H = [c + \theta(1-c) \bullet \$Y \bullet L(i)]$$

where H = supply of CB money,
H^d = demand for high powered CB money (monetary base)
= H at equilibrium
θ = reserve ratio
c = fixed proportion of money that people hold in currency
$\$Y \bullet L(i) = M^d$ (money demand)



Blanchard refers to the equilibrium relationship

$$M/P = Y\ L(i)$$

as the **LM Relation** or **L-M Relationship** (*ME7* p. 95, and equation 5.3), where M/P = real money supply, Y = real income, and i = interest rate. (Note that the LM relation is not the same as the LM curve [middle graph above].) Here, the *L* of *LM* denotes **Liquidity preference** (related to i), and the *M* of *LM* denotes (real) money supply M^S. At equilibrium, $M^d = M^S$. "Since the demand for money [M^d] is directly related to an individual's preference for liquidity and this must be equal to the supply of money [M^S] in equilibrium, this relationship [formula just above] is known as the LM relationship."[54]

In the left graph above,[55] real money demand (M^d/P) is plotted against i, where P is price level such as CPI). The curve for (M^d/P) is seen to shift to the right with increasing values of Y (nominal income), so that the equilibrium value of real Money demand M^d shifts from M^d at A to $M^{d'}$ at A'. At equilibrium:

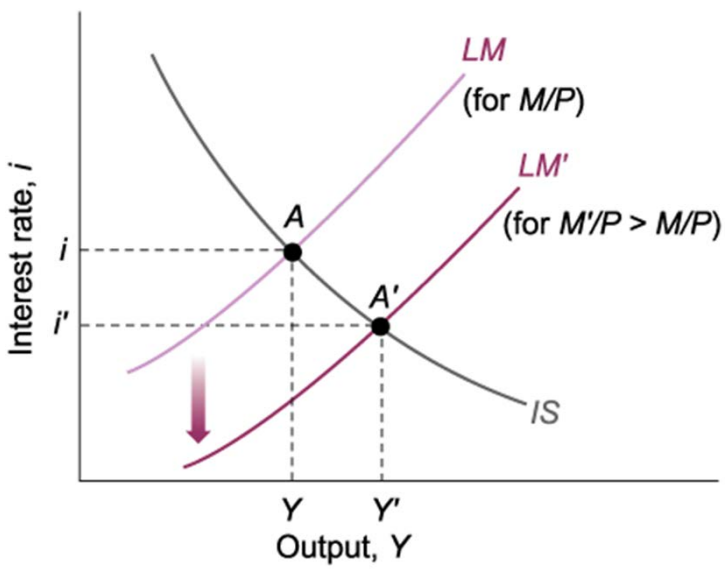
(1) Increasing nominal income Y causes increase in demand for money; also
(2) Increasing interest rate i when the real money supply M^S is fixed will increase money demand.

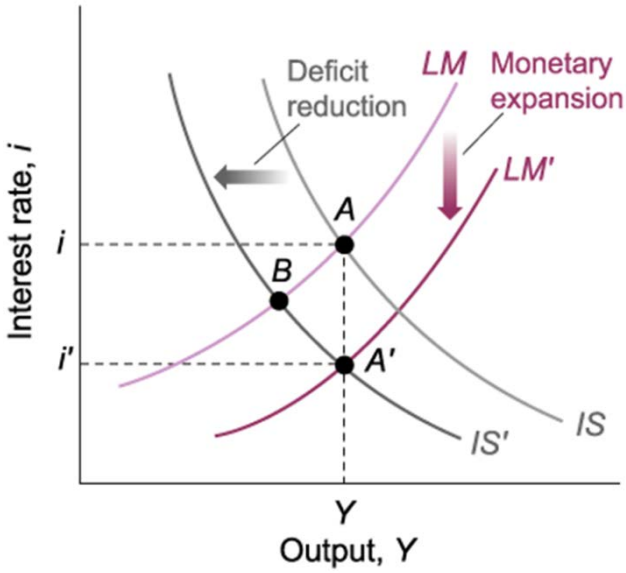
The **LM Curve** or **L-M Curve**, i.e., the **Liquidity preference** and **Money supply** curve (middle graph above), plots all values of interest rate i (here nominal interest, sometimes shown as real interest) against real income Y corresponding to the values from the LM relationship curves on the left. Increasing aggregate real income causes interest rate i to increase. The higher interest rates are necessary to discourage high demand for liquidity and encourage the shifting of wealth into bonds instead.[56] Note that the version of the LM curve depicted here corresponds to earlier Blanchard textbook editions (*ME6* and earlier); in contrast, the LM curve is depicted as a flat horizontal line (fixed value of ī) in *ME7*. (*ME7* p.96ff)

The **IS-LM Model** (**Investment-Saving—Liquidity preference-Money supply**) of John Hicks and Alvin Hansen combines equilibria in the goods market (IS Curve) and in the financial market. In the short run textbook analysis, the price level P is considered to be constant. In the medium and long run,

[54] Lecture 03
[55] http://mysite.avemaria.edu/gmartinez/Courses/ECON301/PPoints/ECO_301_ch05.ppt (right diagram)
[56] Lecture 03.

prices and wages adjust, which affects output, and supply constraints are introduced via the labor market.[57]





As noted above, in earlier Blanchard editions, the LM curve is depicted as a true curve (such as is shown in diagrams just above).[58] When there is a **monetary expansion** and ↓i (left diagram above), equilibrium output Y at A increases to Y′ at the new equilibrium point A′, and i decreases to i′ where the IS′ and LM′ curves intersect.

If deficit reduction ↑(T - G) is appropriately combined with just the right amount of monetary expansion ↓i, the deficit reduction might be achieved without any adverse effect on output (right diagram).

Performance of the IS-LM model: The IS-LM model proves to be a fairly good description of the **short run** (c. 2 years) but not for much longer.[59] The **actual empirical effects** of a 1% increase in the Federal Funds Rate led in the short run to:

- a decrease in production (output)
- a decrease in retail sales—these were below production, and inventories accumulated
- an decrease in employment and increase in unemployment
- little effect on the price level.

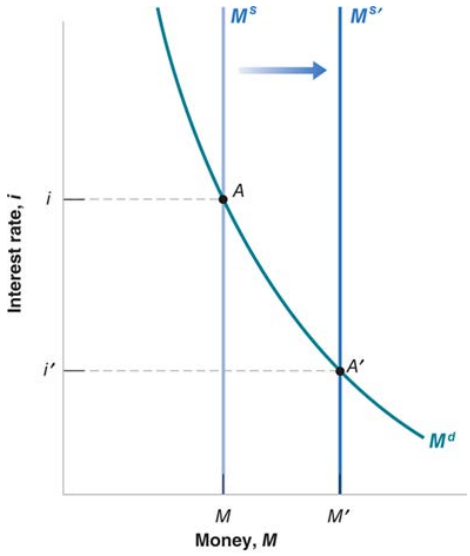
Another assessment states, "The IS–LM model occupies an awkward position in modern macroeconomics. It is still a workhorse of undergraduate teaching and still widely used by economists in developing intuition about short-run macroeconomic phenomena, including policy counterfactuals; see Colander (2004) for discussion of these roles. However, the model fails to accommodate the main features of modern macroeconomic theory, although modern dynamic models are sometimes interpreted as having IS–LM type features."[60]

According to Blanchard (*ME7* p. 95), the central bank controls the interest rate i and keeps it more or less fixed (as ī) at least in the short run, so the LM Curve under these conditions is envisioned to be a simple horizontal line (depicted further down in this topic). As income Y varies, ī remains at the value fixed by the CB.

[57] Lecture Ch. 07.
[58] http://mysite.avemaria.edu/gmartinez/Courses/ECON301/PPoints/ECO_301_ch05.ppt and *ME7* p. 102
[59] http://mysite.avemaria.edu/gmartinez/Courses/ECON301/PPoints/ECO_301_ch05.ppt and *ME7* p. 105
[60] http://www.dictionaryofeconomics.com.offcampus.lib.washington.edu/article?id=pde2008_I000303

Similar conclusions as above may be tentatively drawn from this version of the LM curve in the short term:

- ↑**money supply M^s** (**monetary expansion**) → ↓**interest rate i** , ↑**investment**, and ↑**output** [This is depicted in the graph immediately to right)[61]
- ↑**budget deficit** (**fiscal expansion** through ↓(T - G) shifts IS to the right but i remains constant, so there is ↑**output**.
- ↓**money supply M^s** (**monetary contraction** or **tightening**) → ↑**interest rate**, ↓**borrowing** and ↓**investment**, and ↓**output**
- ↓**budget deficit** (**fiscal contraction** or **fiscal consolidation** through ↑(T - G)) shifts IS to the left but i remains constant, so ↓**output**.
- A combination of a **monetary policy** change and **fiscal policy** change is called a **monetary-fiscal policy mix**. For instance, they can be combined in the same direction: **fiscal expansion** (↑G and/or ↓T) **plus monetary expansion** (lower i) can each → ↑**output**. (*ME7* p. 99) The two policies may also be combined in opposite directions (for example, **monetary expansion plus deficit reduction**, with the intent of keeping output constant while reducing the budget deficit, as is illustrated in the right diagram on the previous page above).



These changes exhibit a **dynamic** aspect in that the values continuously change during the short run period of observation.

The IS-LM model may be **extended** even in the short run to allow for
(1) nominal interest rate i vs. real interest rate r, [62]
(2) the "policy" interest rate $\bar{\imath}$ or $\bar{r}$ set by the CB vs. the interest rates actually charged to borrowers (which are of course higher). The macron signifies a rate set directly or indirectly by CB policy.
(3) risk premium adjustment of interest rates x, and
(4) expected inflation rate π^e. (see *Inflation and Price Levels*) [63]

The overall interest rate entering the LM equation is the actual real borrowing rate, which is (real interest [the nominal interest rate less expected inflation] plus the risk premium). Thus overall interest rate is (r + x), the real interest r plus risk premium x.

In contrast, the interest rate in the LM relationship is the real policy interest rate $\bar{r}$ set indirectly by monetary policy, thus

$$\text{LM real interest } r = \bar{\imath} - \pi^e = \bar{r}$$

This all gets pretty confusing!

"Although the central bank formally chooses the nominal [policy] interest rate $\bar{\imath}$, it can choose it in such a way to achieve the real [policy] interest rate $\bar{r}$ that it wants … Thus, we can think of the central bank as choosing the real policy rate [$\bar{r}$] directly." Then the IS-LM relations become:

IS Relation (extended) : $Y = C(Y - T) + I(Y, i - \pi^e + x) + G$

where i is the nominal interest rate

or simplifying because CB effectively sets real interest rate as well as nominal interest rate i_t

$$Y = C(Y - T) + I(Y, r + x) + G$$

where real borrowing rate interest is (r + x)[64]

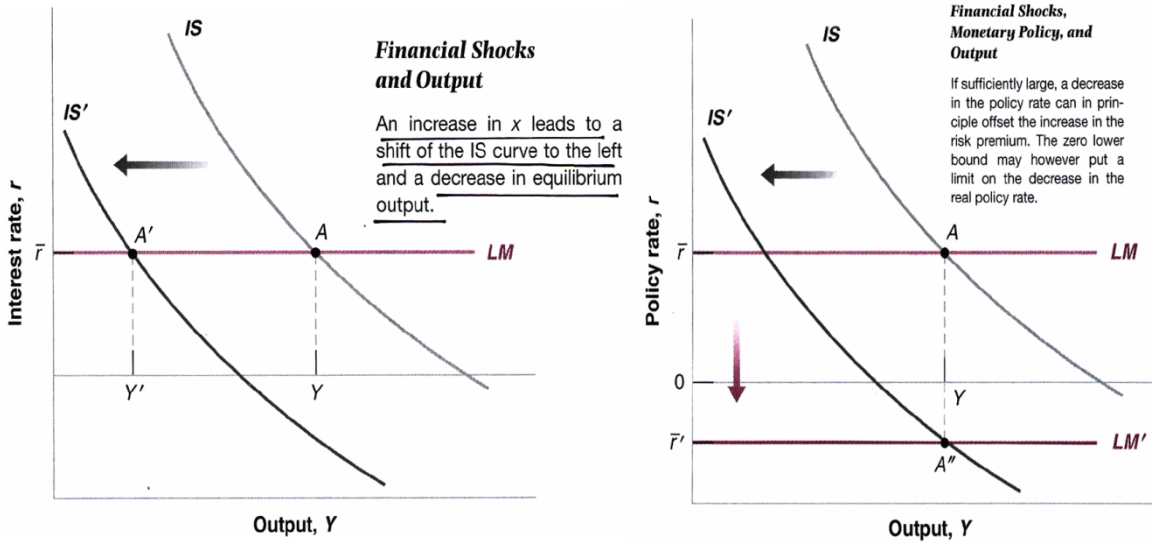
LM Relation: $r = \bar{r}$, where $\bar{r}$ is the real policy rate set indirectly by the fed.[65]

Here, C and I are shown in functional form, for which ↑(Y-T) → ↑C, and ↑(r + x) → ↓I.

---

[61] *ME7* p. 73 and Instructor_Pearson_File_7e_PPT_04.pptx
[62] see *Interest Rates, Real interest versus Nominal interest*, also ME7 p. 112-114
[63] *ME7* p. 121-2, including quoted text; also Instructor_Pearson_File_7e_PPT_06.pptx
[64] Blanchard causes confusion by calling the **IS relation** as given by the equations presented in the extended IS-LM model (*ME7* p. 96 and 121 or even 335), whereas p. 61 he says it is the equation I = S + (T - G). "I = S + (T - G)" is the IS relation. (*ME7* p. 61)
[65] However, *ME7* p. 121 says it is the "nominal" policy rate, an inconsistency which is a source of confusion

Representative extended IS-LM responses to shocks are depicted as follows:



Here (diagrams above) we see the horizontal line (*ME7* version) of the LM curve.[66] At intersection point A, there is an **equilibrium in the goods market (IS curve)** and in the **money market (LM curve)**.

The left graph above shows the effect of a **financial shock** [such as the Housing Market Crash of 2007 and subsequent Great Recession] in which risk premium x substantially increased while real policy rate r̄ is constant, leading to an IS curve shift to the left (due to the negative effect of x on I), and thus a decrease in equilibrium demand, with ↓output from Y to Y′. In the right diagram above, the reduction of output to Y′ is offset by a decrease in the policy rate to $\bar{r}'$ (here shown as a negative real policy rate), thus shifting to A″ on the IS′ curve and restoring output back to the original value of Y at least for a while.

Note that during a crisis like the Great Recession, the combined advanced economies, the combined other economies, and the world economies taken together all exhibited marked reductions in output growth rates by 2009, but they became negative only in the combined advanced economies (graph not shown).[67] Moreover, stock prices dipped substantially in the combined emerging economies, in the US, and in the euro area.

See also *Financial crisis of 2007–2008 (Great Recession), Precursors and Government Interventions*; and also *Leverage and Lending*.

Double-Entry Accounting System

This is a standard tool of the accounting profession, one that is utilized in the NIPA accounts and elsewhere to enhance the accuracy of data by entry at least twice and to provide other benefits.

"When accounting for [business] transactions, we record numbers in two accounts, where the **debit column is on the left** and the **credit column is on the right**.

A **debit** is an accounting entry that either increases an asset or expense account, or decreases a liability or equity account. It is positioned to the **left** in an accounting entry.

A **credit** is an accounting entry that either increases a liability or equity account, or decreases an asset or expense account. It is positioned to the **right** in an accounting entry....

Whenever you create an accounting transaction, at least two accounts are always impacted, with a debit entry being recorded against one account and a credit entry being recorded against the other [or sometimes the same] account. There is no upper limit to the number of accounts involved in a transaction - but the minimum is no less than two accounts. The totals of the debits and credits for any transaction must always equal each other, so that an accounting transaction is always said to be 'in balance'... Thus, the use of debits and credits in a two-column transaction recording format is the most essential of all controls over accounting accuracy.

There can be considerable confusion about the inherent meaning of a *debit* or a *credit*. For example, if you debit a cash account, then this means that the amount of cash on hand increases.

---

[66] Images adapted from *ME7* p. 122-3

[67] Instructor_Pearson_File_7e_PPT_01.pptx

However, if you debit an accounts payable account, this means that the amount of accounts payable liability decreases. These differences arise because debits and credits have different impacts across several broad types of accounts, which are:

Asset accounts. A debit increases the balance and a credit decreases the balance.
Liability accounts. A debit decreases the balance and a credit increases the balance.
Equity accounts. A debit decreases the balance and a credit increases the balance.

The reason for this seeming reversal of the use of debits and credits is caused by the underlying **accounting formula** upon which the entire structure of accounting transactions are built, which is:

Assets = Liabilities + [Shareholder's or Owner's] Equity

The **rules** governing the use of debits and credits are as follows:

• All accounts that normally contain a debit balance will increase in amount when a debit (left column) is added to them, and reduced when a credit (right column) is added to them. The types of accounts to which this rule applies are **expenses, assets, and dividends**.
• All accounts that normally contain a credit balance will increase in amount when a credit (right column) is added to them, and reduced when a debit (left column) is added to them. The types of accounts to which this rule applies are **liabilities, revenues, and equity**.
• The **total amount of debits must equal the total amount of credits in a transaction**. Otherwise, an accounting transaction is said to be unbalanced, and will not be accepted …

Debits and Credits in Common Accounting Transactions:

The following represent the more common business transactions:

• **Sale for cash**: Debit the cash account | Credit the revenue account
• **Sale on credit**: Debit the accounts receivable account | Credit the revenue account
• **Receive cash in payment of an account receivable**: Debit the cash account | Credit the accounts receivable account
• **Purchase supplies** from supplier for cash: Debit the supplies expense account | Credit the cash account
• **Purchase supplies** from supplier on credit: Debit the supplies expense account | Credit the accounts payable account
• **Purchase inventory** from supplier for cash: Debit the inventory account | Credit the cash account
• **Purchase inventory** from supplier on credit: Debit the inventory account | Credit the accounts payable account
• **Pay employees**: Debit the wages expense and payroll tax accounts | Credit the cash account
• **Take out a loan**: Debit cash account | Credit loans payable account
• **Repay a loan**: Debit loans payable account | Credit cash account"[68]

E

Economics: Definitions and Subdivisions

Per Merriam Webster, [69] **Economics** has several definitions:

1 a: "a social science concerned chiefly with description and analysis of the production, distribution, and consumption of goods and services… "

1 b: "economic theory, principles, or practices <sound economics>"

2: "economic aspect or significance <the economics of building a new stadium>"

3: "economic conditions <current economics>"

In greater detail, "**Economics** is a social science concerned with the **factors that determine the production, distribution, and consumption of goods and services**. The term *economics* comes from the Ancient Greek οἰκονομία from οἶκος (oikos, "house") and νόμος (nomos, "custom" or "law"), hence

[68] http://www.accountingtools.com/debits-and-credits
[69] http://www.merriam-webster.com/dictionary/economics

"rules of the house… [or, household management])". 'Political economy' was the earlier name for the subject, but economists in the late 19th century suggested *economics* as a shorter term for *economic science* to establish itself as a separate discipline outside of political science and other social sciences.

Economics focuses on the behavior and interactions of *economic agents* and how economies work. Consistent with this focus, primary textbooks often distinguish between microeconomics and macroeconomics. **Microeconomics** examines the behavior of basic elements in the economy, including individual agents and markets, their interactions, and the outcomes of interactions. Individual **agents** may include, for example, households, firms, buyers, and sellers. **Macroeconomics** analyzes the entire economy (meaning **aggregate production**, **consumption, saving,** and **investment**) and issues affecting it, including unemployment of resources (labour, capital, and land), inflation, economic growth, and the public policies that address these issues (monetary, fiscal, and other policies).

Other broad distinctions within economics include those between **positive economics**, describing 'what is', and **normative economics**, advocating 'what ought to be'; between **economic theory** and **applied economics**; between **rational** and **behavioral** economics; and between **mainstream** economics and **heterodox** economics.

Besides the traditional concern in production, distribution, and consumption in an economy, economic analysis may be applied throughout society, as in business, finance, health care, and government. Economic analyses may also be applied to such diverse subjects as **crime, education,** the **family, law, politics, religion, social institutions, war, science,** and the **environment**. Education, for example, requires time, effort, and expenses, plus the foregone income and experience, yet these losses can be weighed against future benefits education may bring to the agent or the economy. At the turn of the 21st century, the expanding domain of economics in the social sciences has been described as **economic imperialism**. The ultimate goal of economics is to improve the living conditions of people in their everyday life."[70]

Economics is "the *dismal science*, according to Thomas Carlyle, a 19th-century Scottish writer… The most concise, non-abusive definition is the study of how society uses its scarce resources."[71]

Economics includes **Econometrics**, "the application of **statistical** and **mathematical** theories in economics for the purpose of testing hypotheses and forecasting future trends. It takes economic **models**, tests them through **statistical trials** and then **compares** and contrasts the results against real-life examples. Econometrics can therefore be subdivided into two major categories: **theoretical** and **applied**."[72]

The **American Economic Association AEA** states, "Economics can actually be defined a few different ways: it's the study of **scarcity**, the study of how people use **resources**, or the study of **decision-making**. Economics often involves topics like **wealth**, finance, recessions, and banking, leading to the misconception that economics is all about money and the stock market. Actually, it's a much broader discipline that helps us understand historical trends, interpret today's headlines, and make predictions for coming decades… The study of **governments, industries, central banking**, and the **boom and bust of the business cycle** is called macroeconomics." The AEA publishes journals in Applied Economics and several other subdivision of Economics.[73]

Regarding **environmental economics** , see the next topic, *Environmental Economics*.

Environmental Economics

From my own perspective (i.e., MCM's), **environmental economics** is probably the most important branch of economics, though it receives grossly inadequate attention and favor. A one-sided and misleading definition can be found: "Environment economists perform studies to determine the theoretical or empirical effects of environmental policies on the economy."[74]

However, it is my opinion that the field is much better conceived as "an area of economics dealing with the relationship between the economy and the environment. Environmental economists study the economics of natural resources from both sides—their extraction and use, and the waste products

[70] https://en.wikipedia.org/wiki/Economics
[71] http://www.economist.com/economics-a-to-z/e#node-21529558
[72] http://www.investopedia.com/terms/e/econometrics.asp
[73] https://www.aeaweb.org/journals/ , etc.
[74] http://www.investopedia.com/terms/e/environmental-economics.asp

returned to the environment. They also study **how economic incentives hurt or help the environment**, and how they [economic incentives] can be used to create **sustainable policies and environmental solutions**."[75] The cited source describes the meager numbers of employment and salaries for environmental economists, organized by state.

The bottom line for me is the strongly held belief that society should analyze, compute, be aware of, publicize, and educate the populace on the short-term, long-term, and very-long-term environmental costs for all major human actions that have the potential to degrade the biosphere, or to non-renewably consume and thereby deplete natural resources. The persons, firms, or other agents that profit from actions causing environmental degradation and depletion of natural resources should pay the full economic costs, including long-term cleanup and remediation costs. Of course, the ultimate goal should be to prevent further degradation, depletion, and destruction of our precious biosphere.

Endogenous vs. Exogenous Variable

Endogenous variables depend on other variables in the model under consideration and actually "vary" in the model.

Exogenous variables are variables not explained by or dependent on other variables within the model under consideration, but are instead taken as "given" (i.e., constant), thus externally determined by forces outside the control of the model. Exogenous variables are indicated by Blanchard inconsistently, sometimes with a macron (straight overhead bar).

Exchange Rates: Nominal and Real

Published and ordinarily encountered exchange rates are **bilateral nominal exchange rates**, symbolized by Blanchard as **E** (and also called the **spot rate**). For many countries like the US, these rates are set in open, **flexible, freely floating forex**[76] = **FX** (foreign exchange) markets by currency traders.[77] In other countries, the government or other regulatory body such as the CB fixes ("**pegs**") a **fixed exchange rate** relative to another country's currency (or that of a weighted pool of countries). **Bilateral** signifies an exchange rate specifically between two countries.

Exchange rates may be defined and quoted in either of two ways (and this can definitely be a cause for confusion, especially when the exchange rate is close to 1):

- the price of current domestic currency in terms of [one unit of] the current foreign currency, for example, 0.15 US dollars (USD) per one Chinese yuan renminbi (CNY, sometimes RMB) as of 1/25/2017.[78] This is called "**dollars in terms of yuans**". This is the form preferred by Blanchard (*ME7* p. 353), and is shown as **E**.[79] In forex notation, this would be shown as CNY/USD (see below).

- the price of current foreign currency in terms of [one unit of] domestic currency, for example, = 6.88 Chinese yuans renminbi per one US dollar as of 1/25/2017). This is called "**yuans in terms of dollars**". By Blanchard's definition, this is **1/E**. In forex notation, this would be shown as USD/CNY

The definition of which currency is domestic vs. foreign of course depends on the trader's point of view, including the country in which he/she is currently located. Because of the potential for ambiguity and confusion, be certain you know which definitions you are encountering for nominal exchange rates.

---

[75] http://www.environmentalscience.org/career/environmental-economist

[76] **Forex (FX)** is the market in which currencies are traded. The forex market is the largest, most liquid market in the world, with average traded values that can be trillions of dollars per day. It includes all of the currencies in the world.
http://www.investopedia.com/terms/f/forex.asp?ad=dirN&qo=investopediaSiteSearch&qsrc=0&o=40186

[77] http://www.economicswebinstitute.org/glossary/exchrate.htm and https://www.forex.com

[78] https://www.google.com/finance?q=USDCNY

[79] To visit a foreign country, you will want to know how many dollars will be needed per unit foreign currency. But definitions vary: "Exchange rates are always represented in terms of the amount of foreign currency that can be purchased for one unit of domestic currency." http://www.sparknotes.com/economics/macro/trade/section3.rhtml

Investopedia states for **forex quotes** (forex is the largest market for trading currencies):

> "When a currency is quoted, it is done in relation to another currency, so that the value of one is reflected through the value of another. Therefore, if you are trying to determine the exchange rate between the U.S. dollar (USD) and the Japanese yen (JPY), the **forex quote** would look like this:
>
> **USD/JPY** = 119.50 (i.e., 1 USD to 119.50 JPY). (base currency/quote currency)
>
> This is referred to as a **currency pair**. The currency to the left of the slash or virgule is the **base currency**, while the currency to the right is called the **quote** or **counter currency**. The base currency (in this case, the U.S. dollar) is **always expressed as one unit** (in this case, 1 USD or US$ 1), and the quoted currency (in this case, the Japanese yen) is **what that one base unit is equivalent to in the other currency**. The forex quote means that US $1 = 119.50 Japanese yen (¥). In other words, US $1 can buy 119.50 Japanese yen and vice versa. The forex quote includes the currency abbreviations for the currencies in question."[80]

Another website shows an identical interpretation for the notation USD/JPY.[81] It appears to me that this notation using the slash symbol is unfortunate, because if the slash were interpreted in the customary way as a division to create a ratio, then

USD/JPY would = 1/119.5 = 0.008368 [$/ ¥], and
JPY/ USD would = 1/0.008368 = 119.5 [¥/$],

which are the exact opposite of the forex usage, namely

USD/JPY = 119.50 ¥/$ and
JPY/USD = 0.0084 $/¥.

Parenthetically, the Bloomberg cable channel shows the exchange rate as USD–JPY = 119.5, a less ambiguous notation which does not suggest division by using a slash.

The following diagram[82] shows the substantial fluctuations in the nominal exchange rate of US dollars needed to buy one euro (EUR/USD), over the previous 10 years. This is dollars in terms of euros. (The **euro** was introduced as a currency for the **euro area** or **eurozone** in 1999. All these terms appear in lower case, whereas **European Union (EU)** uses upper case.) The lead-up to the recent 6/23/2016 Brexit vote caused a sharp rise in the value of the US dollar relative to the euro, so fewer dollars are now needed to buy a euro. The notation EUR/USD as usual means the price in dollars for one euro.

A rise in this EUR/USD graph means that more dollars are required to buy one euro, so the dollar is **depreciating** (showing **depreciation**) in terms of the euro. Equivalently, the euro is **appreciating** (showing **appreciation**) in terms of the dollar.

---

[80] http://www.investopedia.com/university/forexmarket/forex2.asp
[81] http://www.xe.com/currencycharts/?from=USD&to=JPY&view=1D
[82] Diagram adapted by MCM from http://www.xe.com/currencycharts/?from=EUR&to=USD&view=10Y

A decline in this EUR/USD graph means that fewer dollars are required to buy one euro, so the dollar is **appreciating** in terms of the euro. Equivalently, the euro is **depreciating** in terms of the dollar.

For countries that use **fixed exchange rates** relative to a selected foreign currency or other standard, a **devaluation** of the country's currency is a decrease in the exchange rate ↓E, so the domestic currency has lower buying power or value in terms of the foreign currency. A **revaluation** is an increase in the exchange rate ↑E, so the domestic currency has higher buying power or value in terms of the foreign currency. (*ME7* p. 353) These also change with time, but in a more planned less erratic manner. The following graph depicts the fixed exchange rates that China has set for its currency yuan renminbi relative to one US dollar since 1982.[83]

This rate is apparently subject to small but rapid short term fluctuation in the markets. The following graph depicts one recent week of rate fluctuations of yuans per $1 (USD/CNY).[84]

In order to compare the purchasing power of a domestic currency in terms of a foreign currency, we need the **real exchange rate RER**, which is defined as follows:[85]

$$\varepsilon = {}^{EP}/_{P^*}$$

where

ε (epsilon) = real exchange rate RER, expressed as the price of a basket of domestic goods in terms of a basket of foreign goods
(e.g., Japanese Big Macs per U.S. Big Mac)

P = price of domestic goods in local currency (e.g., the US GDP Deflator,

[83] https://fred.stlouisfed.org/series/EXCHUS

[84] http://www.xe.com/currencycharts/?from=USD&to=CNY&view=1W

[85] CAUTION: I have also seen RER defined as ε = EP*/P, be sure to confirm which definition you are using. example: http://www3.nd.edu/~jstiver/FIN475/Lecture%20Slides/New%20Slides/PPP.ppt

or US domestic prices in dollars for a basket of goods & services,)
P* = price of foreign goods in foreign currency (e.g., eurozone GDP Deflator, or eurozone [foreign] prices in euros for a similar basket of goods & services)
E = exchange rate as defined above.

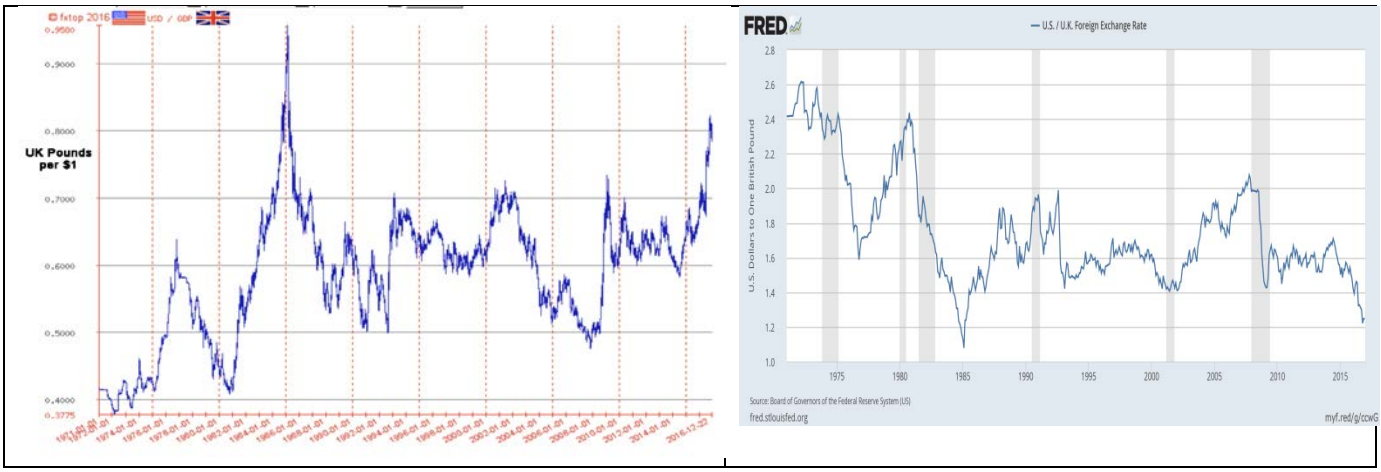
Note that for the USD/EUR example, EP is the price of US domestic goods converted to euros.

Units may be accounted as follows: (Yen per $) × ($ per unit U.S. goods) / (Yen per unit Japanese goods)[86]

The RER ε is an index with an arbitrary value, but a rise in ε (e.g., $[\varepsilon_t - \varepsilon_{(t-1)}]/\varepsilon_{(t-1)}$, expressed as a percent) is significant. For dollars vs. euros, if there is rise of 10% in $[\varepsilon_t - \varepsilon_{(t-1)}]/\varepsilon_{(t-1)}$, then US goods are now 10% more expensive (in the US purchased with dollars) relative to the same goods bought in the eurozone with euros. The result is likely to be ↓EX, ↑IM, and ↓NX for the US.

An increase in RER ε is a **real appreciation**, and signifies that the price of domestic goods in terms of foreign goods has increased. A decrease in RER ε is a **real depreciation**, and signifies that the price of domestic goods in terms of foreign goods has decreased.

In the following left graph,[87] the **nominal exchange rate** for 1971 to 2016 is shown for UK Pounds per 1 USD (USD/GBP), thus depicting the exchange rate from a UK perspective according to Blanchard's definition. In the right graph,[88] nominal exchange rate for 1971 to 2016 is shown now for US dollars per 1 UK Pound (GBP/USD), thus depicting the exchange rate from the perspective of a US inhabitant. These two graphs are the inverse of each other, though from different web sources and time periods. It is always helpful to indicate GB pounds per $1, US dollars per 1 GBP, etc.



In the top graph below, the red line again shows nominal exchange rate for 1971 to 2016 for dollars per 1 UK Pound (GBP/USD). (This choice might cause confusion for an unwary US reader—same applies for Blanchard's UK-centric graph *ME7* p. 354.)

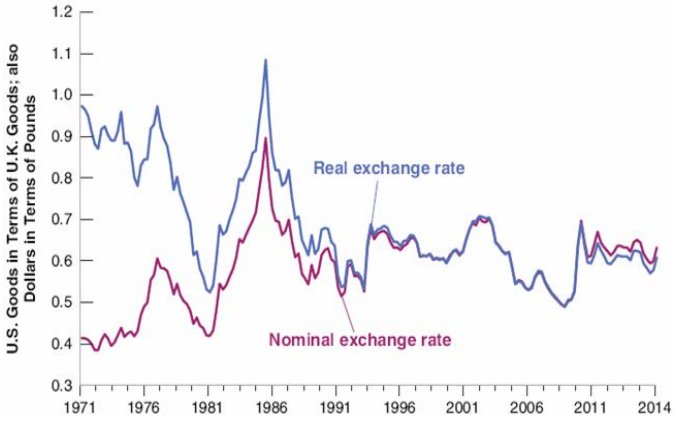
Real exchange rates are shown (top graph below) for US Goods in terms of UK goods (blue line).[89] The GDP Deflators used for the RER have been normalized to the same value for year 2000. The graphs show that since about 1991 the two exchange rates have moved largely in synchrony. The earlier discordant movement is attributable, according to Blanchard, to
• rising E in the 1970s so that "the dollar went up in terms of pounds" (the dollars appreciated and fewer were needed to buy one UK pound, see top right graph), and
• P/P* decreased but less so than ↑E (inflation in the US was lower than in the UK), causing a ↓ε, a "real depreciation in the price of domestic goods in terms of foreign goods". (*ME7* p. 356) Price levels tend to move slowly but exchange rates change rapidly, so RER fluctuates in the short term mainly due to changes of E.

In assessing how a country should view exchange rates, it should examine which countries it trades with the most. (The top 5 countries in total trade (X + IM) for the US are EU > Canada > China > Mexico >

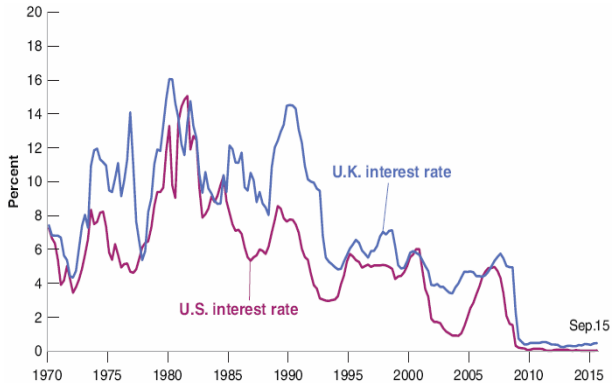
[86] http://www.jurgilas.net/fpdb/Econ%20219%20Spr05/02-09-2005.pdf
[87] http://fxtop.com/en/historical-exchange-rates-graph-zoom.php
[88] https://fred.stlouisfed.org/series/DEXUSUK
[89] Instructor_Pearson_File_7e_PPT_17.v2.pptx, *ME7* p. 356

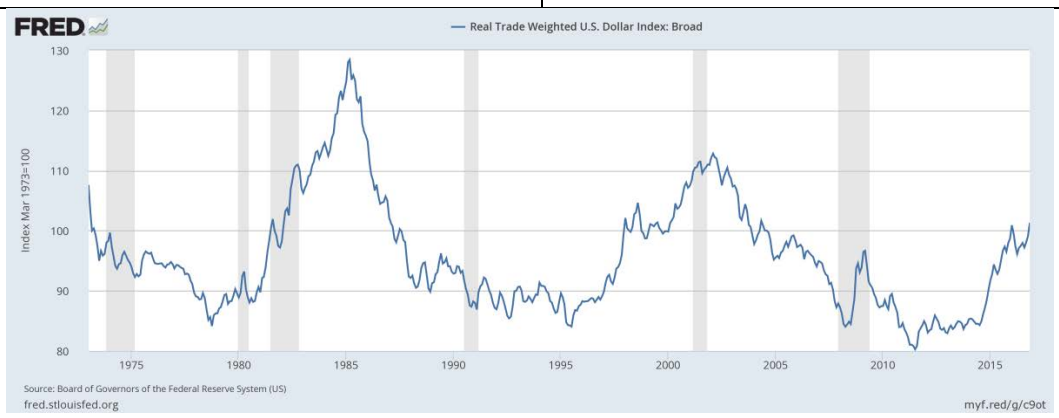
Japan).[90] We wish to develop a **multilateral real US exchange rate** (aka **real US exchange rate**, **US trade-weighted real exchange rate**, or **US effective real exchange rate**) with reference to the pool of our principle trading partners. Each country receives statistical weight in proportion to our quantity of trade with it, and the extent that it competes with us directly or indirectly. The lower graph depicts the desired broad multilateral real exchange rate for the US. Rising values represent appreciation of the US dollar, and two major peaks are apparent. (*ME7* p. 358) The

Comparison of Nominal and Real Exchange rates for USD and US Goods in terms of UK GBP and UK Goods



Three-Month Nominal Interest Rates in the US vs. the UK. These nominal interest rates have moved roughly together (with exceptions) over the period 1970 to 2015. US rates have nearly always been lower.[91]





U.S. Multilateral Real Exchange Rate, since 1973 ("Real Trade Weighted U.S. Dollar Index: Broad"[92])

The US multilateral real exchange rates index uses weighted contributions from these countries: "…the Euro Area, Canada, Japan, Mexico, China, United Kingdom, Taiwan, Korea, Singapore, Hong Kong, Malaysia, Brazil, Switzerland, Thailand, Philippines, Australia, Indonesia, India, Israel, Saudi Arabia, Russia, Sweden, Argentina, Venezuela, Chile and Colombia."

For additional discussion on exchange rates, see several other topics starting with *Exchange rates*.

Exchange Rates and Interest in Choosing Foreign vs. Domestic Bonds

Graphs comparing the US and UK nominal exchange rates and the US and UK nominal interest rates are shown above in *Exchange Rates: Nominal and Real*.

In an open economy with open financial markets, we may wish to choose between buying a foreign asset (for example, assume an interest-bearing UK one year bond) vs. a similar domestic asset (assume an interest-bearing US one year bond). An informed investor will want to compare not only the interest

[90] https://en.wikipedia.org/wiki/List_of_the_largest_trading_partners_of_the_United_States , also diagrams
[91] Instructor_Pearson_File_7e_PPT_17.v2.pptx
[92] https://fred.stlouisfed.org/series/TWEXBPA

rates but also the exchange rates and how they are expected to change (showing appreciating or depreciation). For now, we will ignore risks.

The domestic US bonds are expected to yield at maturity $\$(1 + i_t)$ per dollar invested, where i_t is the domestic US nominal interest rate.

The UK bond must be bought with dollars \$ converted to pounds £ at exchange rate E_t for dollars to pounds. At maturity, the UK bond will pay $E_t(1 + i_t^*)$ £ per \$ invested, where i_t^* is the interest rate paid in £ at maturity for the UK bond. To convert these realized £ back to \$, we must apply the expected inversed exchange rate at maturity, $1/E^e_{t+1}$.

The full set of transactions are expressed by the **uncovered interest parity relation UIRP** (also called simply the **interest parity condition**) (*ME7* p. 363):

where i_t = the interest rate paid in \$ at maturity for the US bond
i_t^* = the interest rate paid in £ at maturity for the UK bond
E^e_{t+1} = the expected exchange rate for \$ to £ at maturity.
$(1+i_t)$ = total \$ received (principal plus interest) per \$ invested.

The parity condition is *uncovered* in the sense that exposure to foreign exchange risk (unanticipated changes in exchange rates) is uninhibited or unprevented, whereas a *covered* parity condition would use a forward contract to *cover* (eliminate or prevent exposure to) exchange rate risk.[93]

For modest interest rates and currency depreciation/appreciation, this equation may be reduced to the following simplifying approximation:

$$i_t \approx i_t^* - \left(\frac{E^e_{t+1} - E_t}{E_t}\right)$$

This approximation may be summarized: the domestic interest rate [e.g., in \$] must approximately equal the foreign interest rate [e.g., in £], minus the expected appreciation rate of the domestic currency \$ relative to the foreign currency £ (or equivalently, minus the expected depreciation rate of the foreign currency £ relative to the domestic currency \$), in order for the investments to be comparable. If UK one-year bonds are currently paying 5% and US one-year bonds are paying 2%, and if you expect the £ to depreciate by less than 3% relative to the \$ (or even to appreciate), the UK one-year bond would be favored over the domestic. Note that a foreign bond may pay a high interest rate, yet still be an unfavorable investment if the foreign currency is depreciating rapidly in relation to the domestic currency. (*ME7* p. 363-4)

Exchange Rates, Output, and Interest Rate Interrelationships

This topic derives largely from *ME7* Chapter 19.

At equilibrium in the goods market, (*ME7* p. 392, as before, neglecting risk x):

$$Y = C(Y - T) + I(Y, r) + G - IM(Y, \varepsilon)/\varepsilon + X(Y^*, \varepsilon),$$

where Net Exports $NX = IM(Y, \varepsilon)/\varepsilon + X(Y^*, \varepsilon)$, so the equation may be simplified to (*ME7* p. 392)

$$Y = C(Y - T) + I(Y, r) + G + NX(Y, Y^*, \varepsilon)$$

For the short run considered here, P and P* are considered fixed (constant), so real exchange rate ε and nominal exchange rate E move together, and Blanchard chooses to simplify by setting $P/P^* = 1$ so $\varepsilon = EP/P^* = E$, and he assumes no inflation, so nominal interest i = real interest r. Thus,

$$Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, \varepsilon)$$

In the idealized equilibrium in the financial market, and again ignoring risks, domestic and foreign bonds must give the same expected rate of return (*ME7* p. 393, 363), so the interest parity condition holds:

$$(1 + i_t) = (1 + i_t^*)\left(\frac{E_t}{E^e_{t+1}}\right)$$

where the LHS term is domestic return at domestic interest rate i_t of domestic bonds and RHS terms is the expected return for holding foreign bonds. Here, i_t^* is foreign interest rate, E_t is current exchange

[93] https://en.wikipedia.org/wiki/Interest_rate_parity

rate, and E^e_{t+1} is future expected exchange rate. Simplifying by assuming that $E^e_{t+1} = \overline{E}^e$ is fixed and dropping t subscripts,

$$E = \frac{(1+i)}{(1+i^*)}\overline{E}^e \qquad \text{(eqn. 19.5)}$$

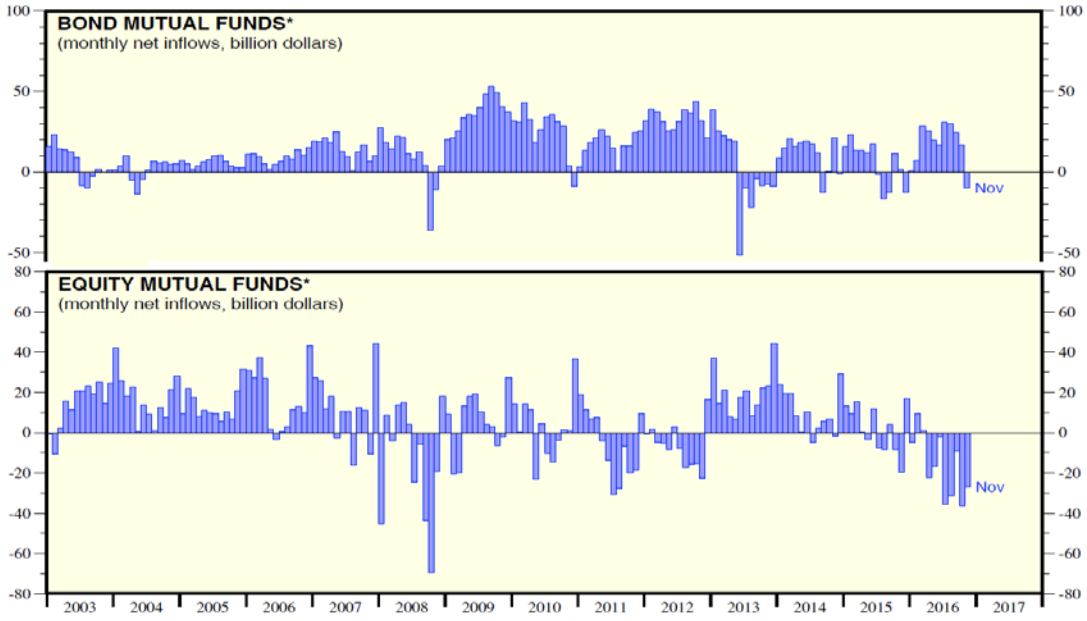
which tells us these important relations: (*ME7* p. 395):

↑i → ↑E (increased domestic interest increases E and causes appreciation of the domestic currency)

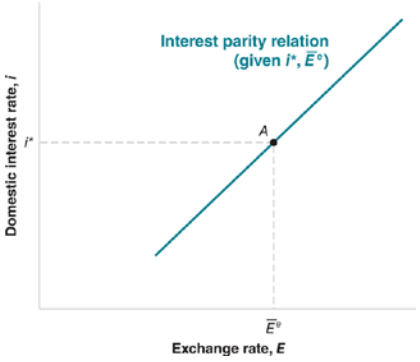
↑i* → ↓E (increased foreign interest decreases E and causes depreciation of the domestic currency)

$\uparrow\overline{E}^e$ → ↑E (increased expected exchange rate increases current exchange rate)

Investment inflows for domestic US bonds tend to be partly inverse in behavior compared to investment in domestic US equity funds, in that high equity inflows are often associated with low or negative bond inflows, and vice versa (diagrams follow, compare for instance years 2003 and 2016):[94]



For **emerging market countries**, in which foreign securities are purchased by foreigners, since 2008 there has been high volatility in their equities and bonds (in terms of dollar equivalent flows, see diagrams to follow below).[95] This phenomenon reflects greater perceived risk including liquidity risk. When uncertainty rises, emerging markets (such as Iceland and Ireland) are sometimes affected by **sudden stops**, the interest parity condition fails, and investors decide to sell all their assets in the emerging country, regardless of changes in interest rates or lack thereof, and take their funds home or move to more secure investments. At the time of the 2008 crisis, some US banks that invested in such foreign investments found themselves short of funds, and had to cut lending, adding to the propagation of the 2008 crisis. The US is seen as a relatively **safe haven** in times of crisis, and T-bills have become very popular, in particular because of their high liquidity and strong government guarantees. The high foreign demand for T-bills helps to explain how the US gets away with running a chronic trade deficit. Excess purchases of T-bills causes an upward pressure (appreciation) on the US dollar.



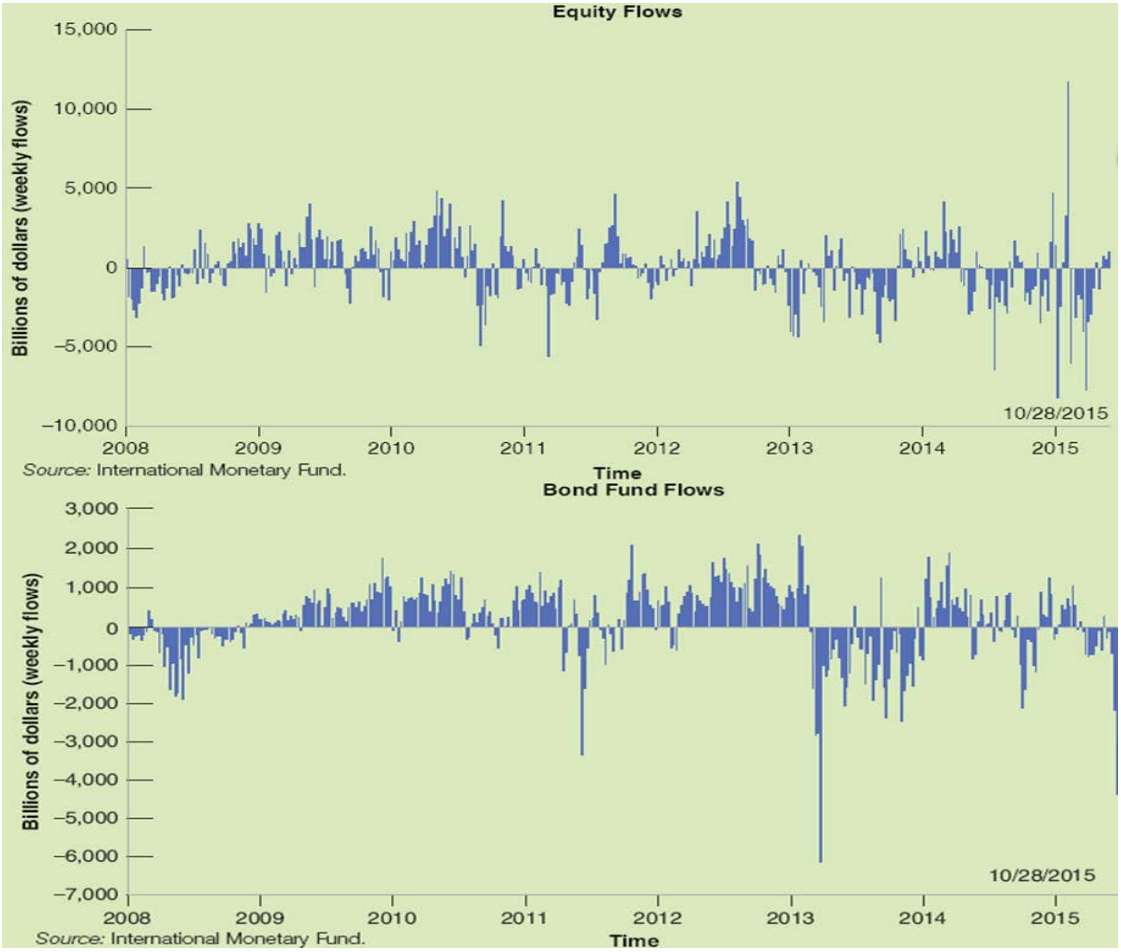
Consider a hypothetical US-Japan market. When E starts at 100 and the US interest rate rises from 2% to 5%, and Japan interest remains at 2%, and the expected future exchange rate is unchanged at 100, US bonds become attractive, and Japanese investors want to shift into US bonds. They sell yen, the US dollar appreciates by 3%, so that (by eqn. 19.5 above):

[94] www.yardeni.com/pub/icieqbnd.pdf , diagrams adapted by MCM

[95] Instructor_Pearson_File_7e_PPT_19.pptx and *ME7* p. 394-5, diagrams adapted MCM

E = (1.05/1.02) 100 ≈ 103.

Thus the current exchange rate has appreciated by 3%. This is because investors assume the dollar, which has appreciated by 3%, will depreciate by 3% back to its original level The expected rate of return in dollars from holding Japanese bonds is 2% (Japanese yen interest) + 3% (yen appreciation) = 5%. This is the same return as the US bond dollar return rate, reflecting a state of equilibrium in the financial market. In general, **an increase of domestic interest rate relative to the foreign interest rate increases demand for the domestic currency, and produces an appreciation of the domestic currency (more foreign units needed per $1)**.[96] This is reflected in the diagram to the right above, where exchange rate E signifies the number of foreign currency units needed to buy $1. When ↑E, the domestic currency $ appreciates.



Discussion in Chapter 19 of IS and LM model that includes NX is mostly omitted here, but final formula follows.[97]

$$\text{IS: } Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, \frac{1+i}{1+i^*}\overline{E}^e) \text{ and}$$

$$\text{LM: } i = \bar{i}$$

Applying these relations shows how interest rates and equilibrium output gives the implied exchange rate.

An increase in the domestic interest rate ↑i now has two effects:

The direct effect on investment I (causing ↓I), and

The secondary effect through the exchange rate (causing ↑E, an appreciation)

Thus, ↑i decreases demand directly and indirectly, causing ↓output Y.

The Effect of ↑Domestic interest rate i

[96] Instructor_Pearson_File_7e_PPT_19.pptx and *ME7* p. 397

[97] *ME7* p. 397 - 399, diagram from Instructor_Pearson_File_7e_PPT_19.pptx

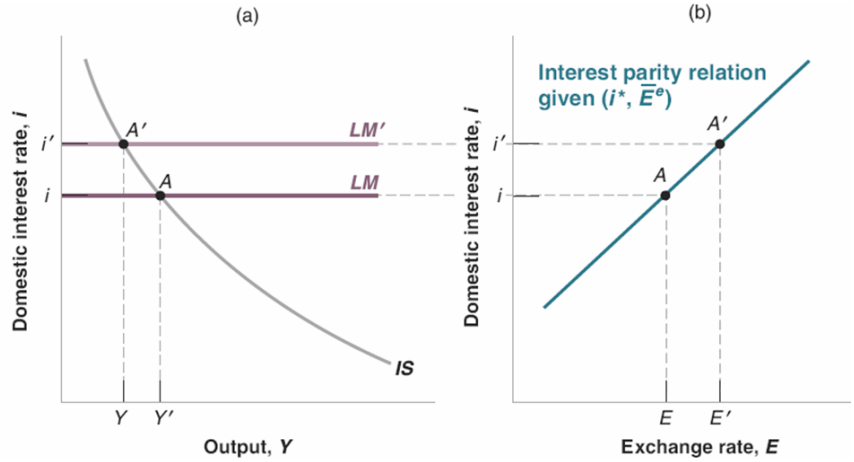
The upper diagrams[98] below show the effect of ↑domestic interest rate from i to i′. The LM curve shifts up. This causes ↓output Y to Y′ [sic, labelled incorrectly in diagram] and ↑E and thus appreciation of the domestic currency. (The US currency is now more attractive and attracts investors raising demand, causing its appreciation, an increase in the number of yen required to buy $1).

The Effect of ↑Government domestic spending G with no CB response

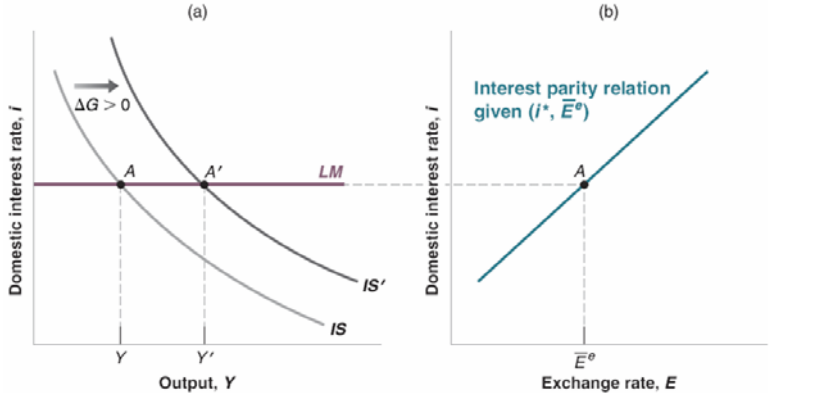
The middle diagrams[99] below show the effect of ↑government domestic spending. The IS curve shifts to the right. The LM curve does not change, and domestic interest rate i does not change, but ↑output from Y to Y′ and E is unchanged, thus no appreciation of the domestic currency. There is ↑Consumption, ↑Investment, ↑IM, ΔX = 0, and ↓NX. Thus ↑G → ↑budget deficit, accompanied by a deterioration of trade balance (↓NX).

↑Government domestic spending G with ↑Interest by CB

The lowermost diagrams[100] below show the effect of ↑government domestic spending with a response by CB to ↑i. The IS curve shifts to the right, as before. But the LM curve now is elevated, and domestic interest rate i rises. Output is increased from original Y but less so and only to Y″ < Y′. E rises to E″, so there is an appreciation of the domestic currency. In sum, there is ↑G, ↑Consumption, ΔInvestment is ambiguous, ↑IM, ↓X, and ΔNX is ambiguous. A worsening of budget deficit is present (↓[T-G]), but the effect on trade balance NX is unclear.



An increase in the interest rate leads to a decrease in output and an appreciation.

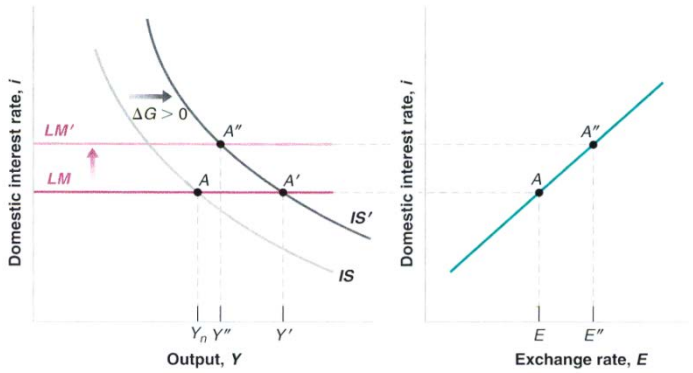


An increase in government spending leads to an increase in output. If the central bank keeps the interest rate unchanged, the exchange rate also remains unchanged.

[98] *ME7* p. 399, diagram from Instructor_Pearson_File_7e_PPT_19.pptx, diagram mislabeled, should have Y and Y′ reversed (Y′<Y)

[99] *ME7* p. 400, diagram from Instructor_Pearson_File_7e_PPT_19.pptx

[100] *ME7* p. 401 including diagram



The final open economy model discussed above is called the **Mundell-Fleming model**,[101] using the so-called **IS-LM-UIP model** or **diagram** (aka **IS-LM-BP** or **IS-LM-BoP model** or **diagram** (these are apparently the diagrams in the lowermost row above). As before, UIP = Uncovered Interest Parity, and BP = BoP = Balance of Payments. It is a short-run extension for the open economy of the short-run IS-LM model. "The Mundell–Fleming model has been used to argue that an economy cannot simultaneously maintain a fixed exchange rate, free capital movement, and an independent monetary policy."[102] The role of risk in affecting portfolio decisions should be incorporated into this model, along with the zero lower bound—these are omitted here as a simplification.

The Mundell-Fleming model successfully predicted much of the outcome of so-called **supply-side economics** of the early 1980s. "Supply-siders", supported by Pres. Reagan et al, argued that the economy would be beneficially stimulated if there were sustained and even increased government spending while personal and corporate taxes would be cut deeply to more optimal rates (according to the later discredited "**Laffer Curve**" hypothesis). These actions cut revenues, and the combination led to a steady rise in **large budget deficits** (to 5.6% of GDP in 1983, 4.5% in 1984.)

Major U.S. Macroeconomic Variables, 1980–1984

	1980	1981	1982	1983	1984
GDP growth (%)	−0.5	1.8	−2.2	3.9	6.2
Unemployment rate (%)	7.1	7.6	9.7	9.6	7.5
Inflation (CPI) (%)	12.5	8.9	3.8	3.8	3.9
Interest rate (real) (%)	11.5	14.0	10.6	8.6	9.6
	2.5	4.9	6.0	5.1	5.9
Real exchange rate	85	101	111	117	129
Trade surplus (% of GDP)	−0.5	−0.4	−0.6	−1.5	−2.7

Inflation: rate of change of the CPI. The nominal interest rate is the three-month T-bill rate. The real interest rate is equal to the nominal rate minus the forecast of inflation by DRI, a private forecasting firm. The real exchange rate is the trade-weighted real exchange rate, normalized so that 1973 = 100. A negative trade surplus is a trade deficit.

During this period, interest rates were high after Paul Volcker raised them in 1979 (nominal reaching 14% in 1981). The high interest rates led to dollar appreciation (real ε peaked in 1984) and a recession (-2.2% of GDP in 1982). Inflation was lowered successfully by 1982. Output decline and dollar appreciation together led to a worsening of the trade balance by 1983 (-1.5% of GDP, and -2.7% in 1984). Fiscal expansion (↑budget deficit) led to ↑output (+6.2% of GDP in 1984), higher interest rates, and more dollar appreciation peaking in 1984, worsening the trade deficit to -2.7% of GDP by 1984. The worsening of trade deficit and budget deficit persisted as major issues until the early 1990s.[103]

Fixed Exchange Rates

In the US, Canada, etc., exchange rates are allowed to float freely. Governments and CBs can set exchange rate **regimes** to fixed values or target **ranges** or **bands**, using monetary policy. Some **peg** their currency to the USD (US $) or French Franc (FF or ₣) or euro (€), or to a basket of currencies

[101] Named for Robert Mundell b. 1932, Marcus Fleming 1911 – 1976.
[102] https://en.wikipedia.org/wiki/Mundell%E2%80%93Fleming_model
[103] *ME7* p. 403, diagram from Instructor_Pearson_File_7e_PPT_19.pptx

with weighted components. Changes in "fixed" rates occur, but not as frequently as floating rates. A decrease in a fixed exchange rate is a **devaluation** of that currency, whereas an increase is a **revaluation**. Some use a **crawling peg**, or select a predetermined depreciation against the USD. Some use the rate determined (fixed) by that of the euro. (*ME7* p. 403-406)

Pegged exchange rates must satisfy the interest parity condition IPC. Under fixed exchange rates, the CB gives up monetary policy as a policy instrument—it is no longer an option. Fiscal policy is limited by inflation that would result and the inability to raise interest rates (their interest rate must always equal the foreign interest rate). Fixed exchange rates have the disadvantages of eliminating (1) a tool for correcting trade imbalances, and (2) control of policy rate.

Countries like those of the euro zone have adopted a common currency, because in the medium run price levels can adjust. Methods of responding to exchange rate crises are discussed in chapter 20, but I did not study this chapter.

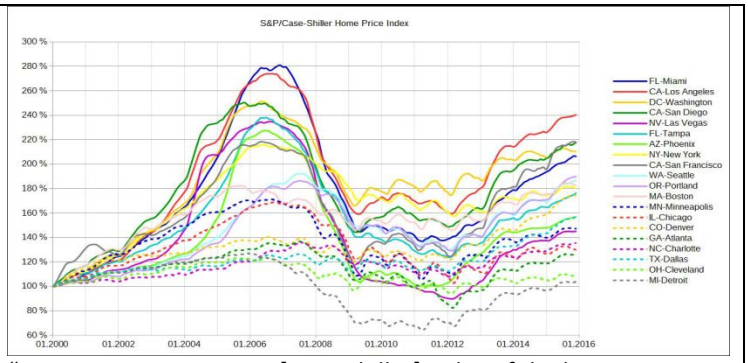
Expectations

This topic is covered in *ME7* Chapters 14-16, material which appears to be of considerable interest for instance to investors and consumers, but the course omitted any more than a token study of these and I have done the same. Perhaps I will return to these chapters at a later date.

Expectations play an essential role in macroeconomics and everyday actions. Decisions by people and firms depend on their expectations about future income, profits, interest rates, bond prices and yield curve (e.g., US Treasury yield curve rates), stock prices and dividends, fads and bubbles (such as the 2000's housing bubble preceding the Great Recession, the 1929 stocks bubble preceding the Great Depression, and the 1634 tulip bulb bubble, etc.), levels of risk, consumption and consumer spending, wealth, investment and saving, market volatility, output, and changes in monetary and fiscal policy, etc. (*ME7* p. 37, also Chapters 14-16, etc.) The methodology includes estimation of the **expected present discounted value** of a sequence of future payments, and the **present value of expected profits** (details omitted).

The following graphs depicts the recent US housing price bubble which immediately preceded the Great Recession (rightmost gray vertical band in left diagram). Seattle's bubble (light blue) was not as pronounced as for many other cities. The Case-Shiller indices track house prices for houses that have been sold more than once (so-called *repeat-sales*).

S&P/Case-Shiller U.S. National Home Price Index© (CSUSHPINSA). Jan. 1975 to Sept. 2016, Index Jan 2000=100, Not Seasonally Adjusted[104]



"SPCS20R is a composite [Case-Shiller] index of the home price index for 20 major Metropolitan Statistical Areas in the United States"[105]

"While **rational expectations** is often thought of as a school of economic thought, it is better regarded as a ubiquitous modeling technique used widely throughout economic… The theory of rational expectations was first proposed by John F. Muth of Indiana University in the early 1960s. He used the term to describe the many economic situations in which the outcome depends partly on what people expect to happen. The price of an agricultural commodity, for example, depends on how many acres farmers plant, which in turn depends on the price farmers expect to realize when they harvest

[104] https://fred.stlouisfed.org/series/CSUSHPINSA#0

[105] https://en.wikipedia.org/wiki/Case%E2%80%93Shiller_index , image prepared by Gandalf-tof

and sell their crops. As another example, the value of a currency and its rate of depreciation depend partly on what people expect that rate of depreciation to be. That is because people rush to desert a currency which they expect will lose value, thereby contributing to its actual loss in value. Similarly, the price of a stock or bond depends partly on what prospective buyers and sellers believe it will evolve to in the future…

The influences between expectations and outcomes flow both ways. In forming their expectations, people try to forecast what will actually occur. They have strong incentives to use forecasting rules that work well because higher "profits" accrue to someone who acts on the basis of better forecasts, whether that someone is a trader in the stock market or someone considering the purchase of a new car. And when people have to forecast a particular price over and over again, they tend to adjust their forecasting rules to eliminate avoidable errors. Thus, there is continual feedback from past outcomes to current expectations. Translation: in recurrent situations the way the future unfolds from the past tends to be stable, and people adjust their forecasts to conform to this stable pattern…

The concept of rational expectations asserts that outcomes do not differ systematically (i.e., regularly or predictably) from what people expected them to be. The concept is motivated by the same thinking that led Abraham Lincoln to assert, 'You can fool some of the people all of the time, and all of the people some of the time, but you cannot fool all of the people all of the time.' From the viewpoint of the rational expectations doctrine, Lincoln's statement gets things right. It does not deny that people often make forecasting errors, but it does suggest that errors will not persistently occur on one side or the other."[106]

"The **rational expectations theory** is an economic idea that the people make choices based on their rational outlook, available information and past experiences. The theory suggests that the current expectations in the economy are equivalent to what people think the future state of the economy will become. This contrasts with the idea that government policy influences people's decisions. …

In 2015, when Janet Yellen announced that the Federal Reserve would increase interest rates starting in 2016, the markets reacted negatively. [The] rational expectations theory subsequently trapped the Federal Reserve into making decisions that would take expectations of the economy into account, and Yellen soon backed off her initial decision to increase rates as many as four times in the coming years."[107]

Exports, Imports, and Balance of Trade

Symbol X ≡ Exports

Symbol IM ≡ Imports

Symbol NX ≡ (**X - IM)** ≡ Net Exports (a flow)

When X – IM > 0, there is a **trade surplus (positive balance of trade)**, whereas when X - IM < 0, there is a **trade deficit (positive negative of trade)**. (For more on BOT, see *Balance of Payments Accounts*.)

For example, "The U.S. Census Bureau and the U.S. Bureau of Economic Analysis, through the Department of Commerce, announced today that the goods and services deficit was $36.4 billion in September [2016], down $4.0 billion from $40.5 billion in August [2016], revised. September exports were $189.2 billion… September imports were $225.6 billion… The September figures show surpluses, in billions of dollars, with Hong Kong ($2.5), South and Central America ($1.8), United Kingdom ($0.9), Singapore ($0.7), and Brazil ($0.3). Deficits were recorded, in billions of dollars, with China ($26.9), European Union ($11.7), Japan ($5.4), Germany ($5.3), Mexico ($4.8), Italy ($2.8), India ($2.2), South Korea ($1.4), OPEC ($1.2), France ($0.8), Taiwan ($0.5), Canada ($0.4), and Saudi Arabia ($0.1)."[108]

Opinions seem to vary on the importance of not running a trade deficit. Contrasting examples:
(1) "… a deficit has been reported and growing in the United States for the past few decades, which has some economists worried. This means that large amounts of the U.S. dollar are being held by foreign nations, which may decide to sell at any time. A large increase in dollar sales can drive the value of

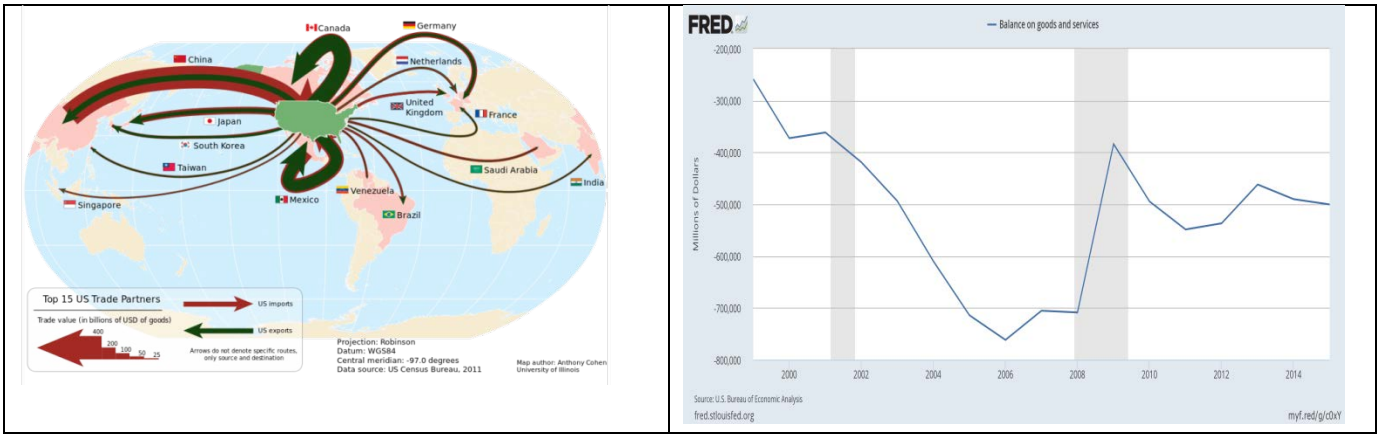
[106] http://www.econlib.org/library/Enc/RationalExpectations.html
[107] http://www.investopedia.com/terms/r/rationaltheoryofexpectations.asp
[108] http://www.bea.gov/newsreleases/international/trade/tradnewsrelease.htm

the currency down, making it more costly to purchase imports."[109]

(2) "But Mr. Trump's framing is in direct conflict with the view even of many economists who are sympathetic to the idea that current trade arrangements work to the detriment of American workers and want to see change. In the more widespread view among economists, trade deficits are not inherently good or bad; they can be either, depending on circumstances. The trade deficit is not a scorecard… What's more, eliminating the trade deficit would not, on its own, make America great again, as Mr. Trump promises. In fact, trying to eliminate the trade deficit could mean giving up some of the key levers of power that allow the United States to get its way in international politics… Getting rid of the trade deficit could very well make America less great. The reasons have to do with the global reserve currency, economic diplomacy and something called the Triffin dilemma."[110]

The US ratio of Exports to GDP is rather low at 12.6% in 2015, compared for example to Germany 49% or Netherlands 83%.[111]

Bidirectional trade with the US is shown in the following left diagram using 2011 data.[112] The width of the bands of red and black depict the relative amounts of imports and exports from/to a country.



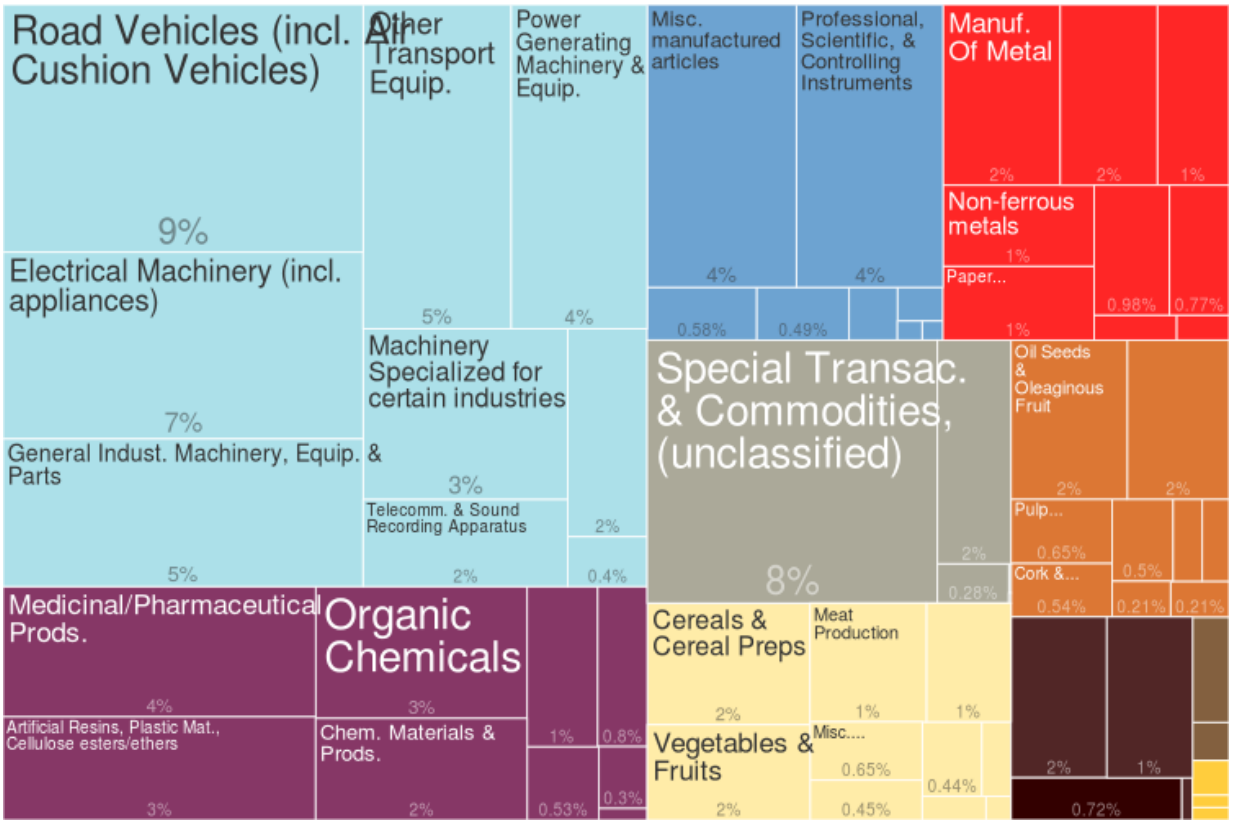
The 2015 **US Trade Balance** was $531,500 million USD.[113] FRED shows (in graph[114] above on right) that the US Balance on goods and services (IEABCGSA not seasonally adjusted) for 2015 was $500,400 million. I am unsure why these sources are discrepant.

Diagrams below using 2014 data—with regions colored by and proportional to categories of exports and imports—are from *The Atlas of Economic Complexity*. Some cells in this summary show unavoidable overlapping text not present in the original images on the website. On their website, the individual cells are interactive and show more detailed info—view these at Exports and Imports, respectively.

[109] http://www.investopedia.com/terms/t/trade_deficit.asp
[110] http://www.nytimes.com/2016/07/22/upshot/what-donald-trump-doesnt-understand-about-the-trade-deficit.html?_r=0
[111] http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS
[112] https://en.wikipedia.org/wiki/List_of_the_largest_trading_partners_of_the_United_States
[113] https://www.statista.com/statistics/220041/total-value-of-us-trade-balance-since-2000/
[114] https://fred.stlouisfed.org/series/IEABCGSA

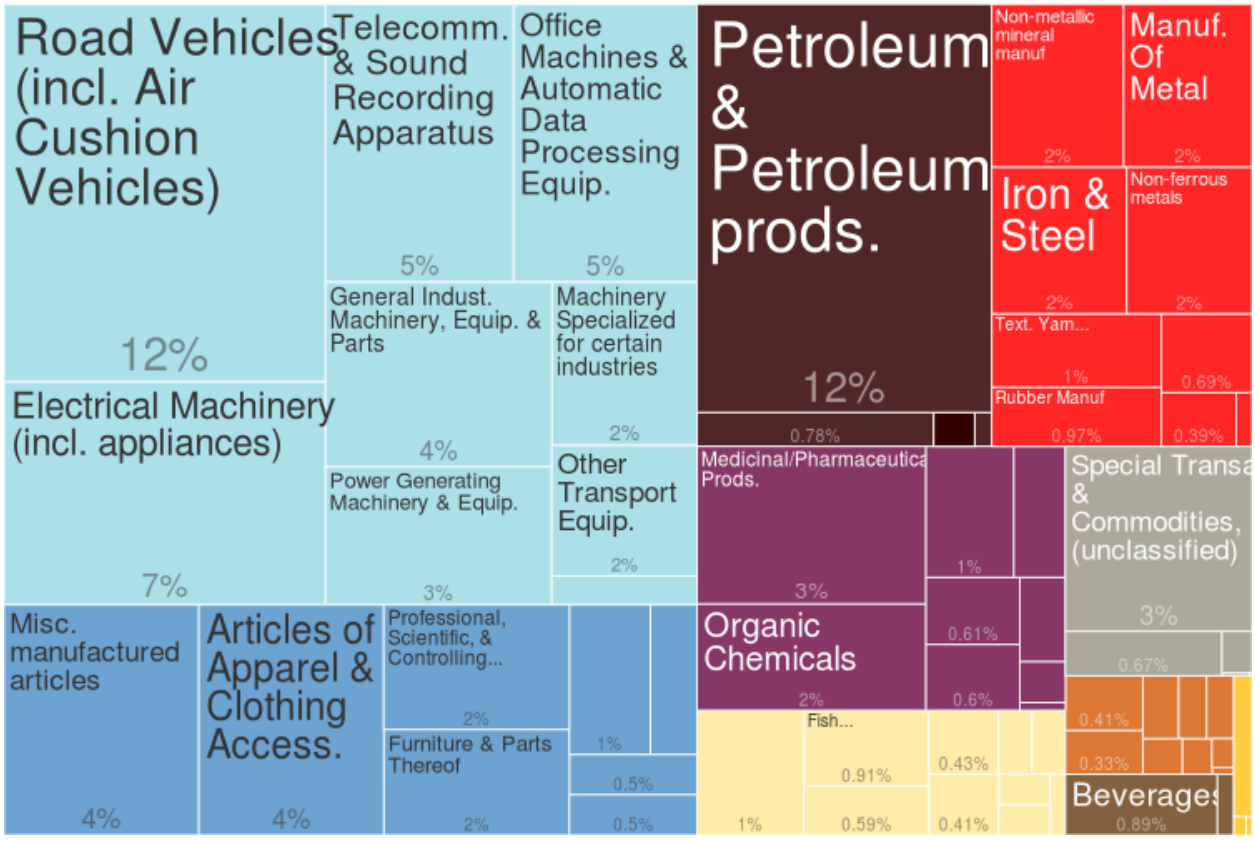
US Exports to Other Countries, 2014

$1.35T USD



US Imports from Other Countries, 2014

$2.08T USD



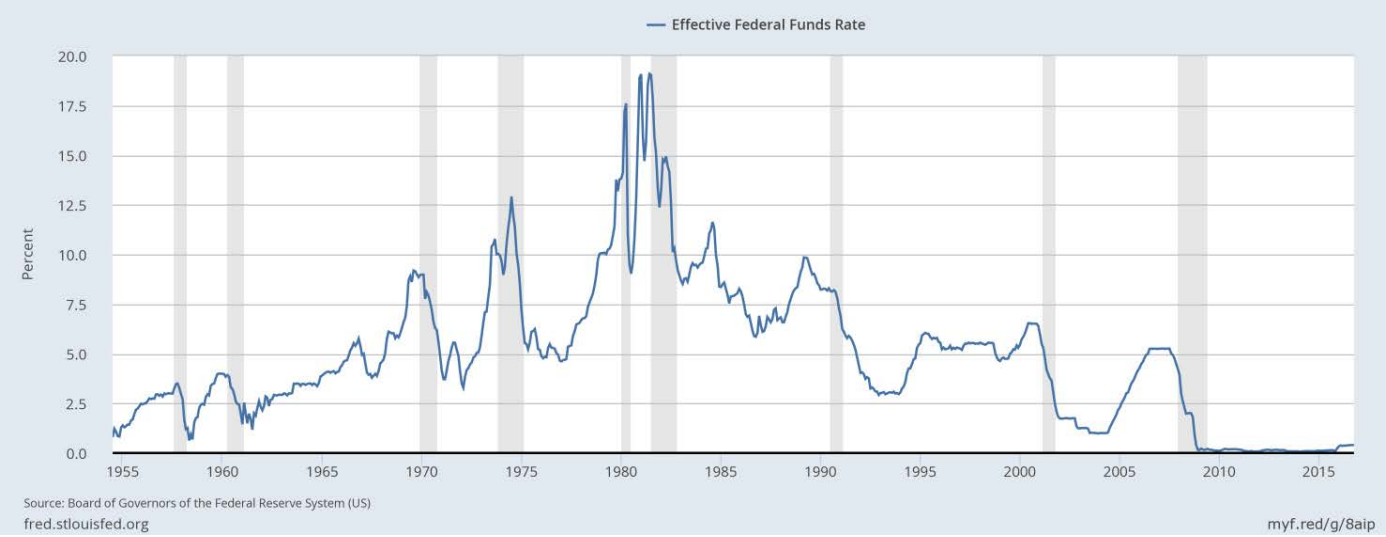
F

Factors of Production

Factors of production is an economic term that describes the inputs that are used in the production of goods or services in order to make an economic profit. The factors of production "include **land, labor, capital,** and **entrepreneurship**… A factor market is a marketplace for the services of a factor of production. A **factor market** facilitates the purchase and sale of services of factors of production, which are inputs like labor, capital, land and **raw materials** that are used by a firm to make a finished product. A factor market is distinct from the goods and services market, which is the market for finished products or services."[115]

The terms *good* or *goods* without qualification are apparently applied only to **final goods** (products for consumption). Products that are inputs as factors of production are sometimes termed **intermediate goods**, **producer goods**, or **semi-finished products**—these are not counted in a country's GDP (which is a measure only of finished goods and service).[116] Intermediate goods, such as certain chemicals or catalysts, may be used in the production of final goods yet not be found in the final product.

Federal Funds Rate versus the Federal Discount Rate



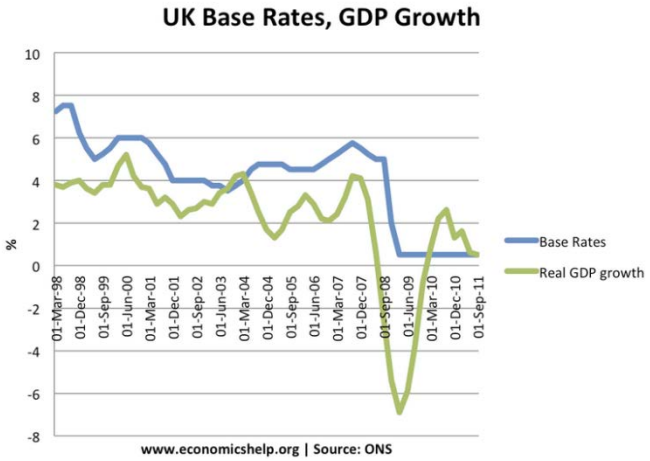
"The interest rate at which a depository institution lends funds maintained at the Federal Reserve to another depository institution overnight. The federal funds rate is generally only applicable to the most creditworthy institutions when they borrow and lend overnight funds to each other. The federal funds rate is one of the most influential interest rates in the U.S. economy, since it affects monetary and financial conditions, which in turn have a bearing on key aspects of the broad economy including employment, growth and inflation. The **Federal Open Market Committee** (FOMC), which is the Federal Reserve's primary monetary policymaking body, telegraphs its desired target for the federal funds rate through **open market operations**. Also known as the **fed funds rate**."[117] or the **policy rate** (because it is determined by monetary policy).

The graph above of Effective Federal Funds Rate (FEDFUNDS) is from FRED, and covers the period from 1954 to Oct. 2016.[118] In recent years, the fed funds rate has been near zero.

---

[115] http://www.investopedia.com/terms/f/factors-production.asp
[116] https://en.wikipedia.org/wiki/Final_good and https://en.wikipedia.org/wiki/Intermediate_good
[117] http://www.investopedia.com/terms/f/federalfundsrate.asp
[118] https://fred.stlouisfed.org/series/FEDFUNDS

The nominal fed funds rate cannot be decreased below 0% (this is the so-called **zero lower bound constraint**), so that a "**liquidity trap**" may arise when the fed funds rate is at or near zero. The adjacent graph demonstrates this phenomenon.[119] "In the UK, Base [nominal] interest rates were cut to 0.5% in March 2009. For a considerable time, the economy remained in recession [negative real GDP growth]. Helped by **quantitative easing** [the introduction of new money into the money supply by a central bank] and a devaluation in the Pound, there was a weak recovery in 2010. However, 2011 and 2012 saw a fall in the rate of economic growth. This period is a good example of a **liquidity trap**.". A liquidity trap occurs when low / zero [nominal] interest rates fail to stimulate consumer spending and monetary policy becomes ineffective. In this situation, an increase in the money supply could fail to increase spending because [nominal] interest rates can't fall further." Here, the base rate could not be further decreased, so that no effective remedy was available to prevent the real GDP recessionary (negative) spike in 2008 to 2010.



The **Federal Discount Rate** (at the **Federal Reserve Discount Window** program) is not the same as the fed funds rate, but is

"the interest rate set by the Federal Reserve on loans offered to eligible commercial banks or other depository institutions as a measure to reduce liquidity problems and the pressures of reserve requirements. The discount rate allows the federal reserve to control the supply of money and is used to assure stability in the financial markets… Depository institutions and commercials banks that are in generally sound financial condition are eligible to borrow from their regional Federal Reserve banks at a primary credit, or discount, rate… The federal discount rate is used as a tool to either stimulate (**expansionary monetary policy**) or rein in (**contractionary monetary policy**) the economy. A decrease in the discount rate makes it cheaper for commercial banks to borrow money, which results in an increase in available credit and lending activity throughout the economy. Conversely, a raised discount rate makes it more expensive for banks to borrow and thereby diminishes the money supply while retracting investment activity… It is determined by the **Federal Reserve's Board of Governors**, as opposed to the federal funds rate which is set by the **Federal Open Markets Committee (FOMC)**. The FOMC achieves the fed funds rate through the open sale and purchase of U.S. Treasuries, whereas the discount rate is reached solely through review by the Board of Governors."[120]

"**Primary credit** [through the Federal Discount Rate program] is available to generally sound depository institutions on a very short-term basis, typically overnight, at a rate **above** the Federal Open Market Committee's (FOMC) target rate for federal funds [i.e., the fed funds rate]. Depository institutions are not required to seek alternative sources of funds before requesting occasional advances of primary credit. The Federal Reserve expects that, given the above-market pricing of primary credit, institutions will use the **Discount Window** [the Federal Discount Rate service] as a backup rather than a regular source of funding… **Secondary credit** is available to depository institutions that are not eligible for primary credit. It is extended on a very short-term basis, typically overnight, at a rate that is **above the primary credit rate**. Secondary credit is available to meet backup liquidity needs when its use is consistent with a timely return to a reliance on market sources of funding or the orderly resolution of a troubled institution. Secondary credit may not be used to fund an expansion of the borrower's assets. The secondary credit program entails a higher level of Reserve Bank administration and oversight than the primary credit program… A Reserve Bank must have sufficient information about a borrower's financial condition and reasons for borrowing to

[119] http://econ.economicshelp.org/2009/10/liquidity-trap-explained.html
[120] http://www.investopedia.com/terms/f/federal_discount_rate.asp?lgl=no-infinite

ensure that an extension of secondary credit would be consistent with the purpose of the facility."[121]

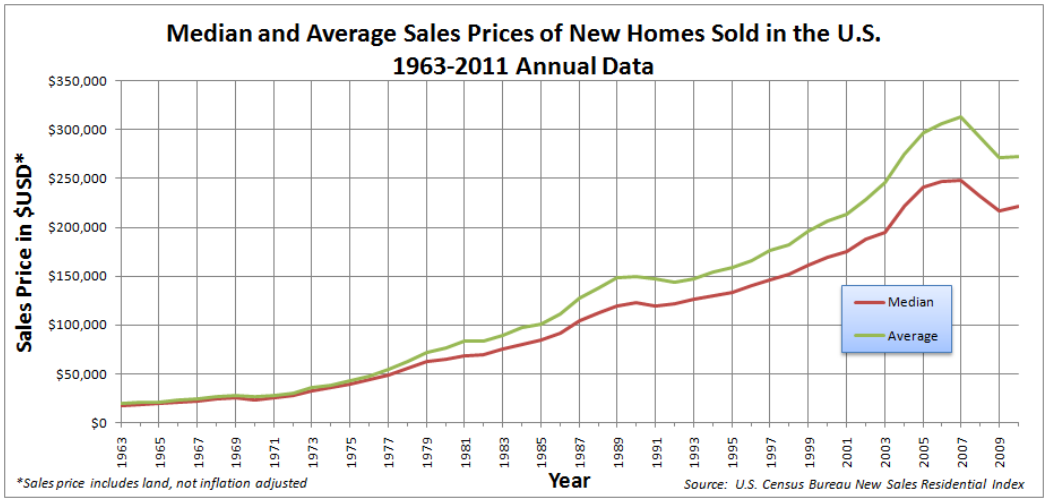
Comparison of interest rates 1/25/2017:[122]

	This week	Month ago	Year ago
WSJ Prime Rate[123]	3.75	3.75	3.50
Federal Discount Rate	1.25	1.25	1.00
Fed Funds Rate (Current target rate 0.50-0.75)	0.75	0.75	0.50

Financial crisis of 2007–2008 (Great Recession), Precursors and Government Interventions

This was the worst recession since the Great Depression, officially lasting from Dec. 2007 to June 2009, but having adverse effects lasting much longer.

It was preceded by the rise of the poorly regulated **US shadow banking system**, a marked rise or **boom in asset prices** and **easy credit**, and the bubble in housing c. 2003 – 2006 which **burst starting in 2006.** The following graph depicts this housing bubble (nominal prices for houses + land, not inflation adjusted).[124]



Homeowners began to default on their mortgages. The **structured investment vehicles** (**SIV**) were intended to diversify risk, and included various types of **securitization** (creation of securities based on a bundle of assets, such as loans or mortgages). **Mortgage-backed securities (MBS)** were a type of SIV that had risks that were very difficult to assess, and contained too many **subprime mortgages** that defaulted. **Collateralized debt obligations** (**CDO**) proved to be **junior securities** with lower payoff priority relative to more senior securities that had first claim on any returns. Ratings agencies failed to identify and downgrade SIVs that ultimately proved to be poor risks, and SIVs were used to avoid regulations. Some of these packaged investments came to be known as **toxic assets** which secondary investors shunned. The combination of **underestimation of risk**, **high bank leverage**, **illiquid assets**, and excessively **liquid liabilities** (arising from **wholesale funding** via banks borrowing from other banks), along with other factors above, resulted in a financial crisis. Assets had to be sold at fire sale prices. Consumer and business confidence plummeted, as did output (↓3.5% in 2009) and demand for goods. Borrowing became very expensive and/or nearly impossible. A variety of governmental palliative monetary and fiscal policies were adopted: increased FDIC insurance,

[121] https://www.frbdiscountwindow.org/en/Pages/General-Information/The-Discount-Window.aspx#ratesprimary
[122] http://www.bankrate.com/rates/interest-rates/prime-rate.aspx
[123] "the rate at which **banks** will lend money to their most-favored customers", same source as table
[124] https://en.wikipedia.org/wiki/Financial_crisis_of_2007%E2%80%932008

improved liquidity in the financial system, Troubled Asset Relief Program TARP, unconventional monetary policy, revised fiscal policy via the American Recovery and Reinvestment Act (tax reductions and spending increases), etc. (*ME7* p. 122-128) These governmental measures were not enough to avoid a major recession, but are thought by many to have been very helpful in preventing worse.

Major and prolonged reduction in business and consumer confidence during the Great Recession[125]

Financial Markets and the LM Relation

A financial market is "a market in which people trade financial securities, commodities, and other fungible items of value at low transaction costs and at prices that reflect supply and demand. Securities include stocks and bonds, and commodities include precious metals or agricultural products."[126] These determine the cost of funds for firms, households, and the government, and thus affect spending decisions. (*ME7* p. 67)

For LM Relation and LM Curve, see *Demand for Money, LM Curve, and IS-LM Model*.

Financial Wealth

Financial Wealth = the sum of all financial assets minus all financial liabilities. This is a stock variable (not a flow), which applies to a person, household, etc. Though we traditionally call many financial assets investments, economists prefer to call these **financial investments** to distinguish them from the agreed-upon economics **investments** (capital goods, plants, buildings, new houses and apartments, etc.).

Fiscal Policy

"In economics and political science, fiscal policy is the use of government revenue collection (mainly **taxes T**) and expenditures [**government spending G**] to influence the economy. According to Keynesian economics, when the government changes the levels of taxation and governments spending, it influences aggregate demand and the level of economic activity. Fiscal policy can be used to stabilize the economy over the course of the business cycle.

The two main instruments of fiscal policy are changes in the level [and] composition of taxation and government spending in various sectors. These changes can affect the following macroeconomic variables, amongst others, in an economy:

Aggregate demand and the level of economic activity;
[Saving] and investment in the economy
The distribution of income

Fiscal policy can be distinguished from monetary policy, in that fiscal policy deals with taxation and government spending and is often administered by an executive under laws of a legislature, whereas monetary policy deals with the money supply, lending rates and interest rates and is often administered by a central bank."[127]

---

[125] Instructor_Pearson_File_7e_PPT_06.pptx
[126] https://en.wikipedia.org/wiki/Financial_market
[127] https://en.wikipedia.org/wiki/Fiscal_policy

G

G20 or Group of Twenty

"The G20 (or G-20 or Group of Twenty) is an international forum for the governments and central bank governors from 20 major economies. It was founded in 1999 with the aim of studying, reviewing, and promoting high-level discussion of policy issues pertaining to the promotion of international financial stability. It seeks to address issues that go beyond the responsibilities of any one organization. The G20 heads of government or heads of state have periodically conferred at summits since their initial meeting in 2008, and the group also hosts separate meetings of finance ministers and central bank governors… The members include 19 individual countries—Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, South Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, United Kingdom and United States—along with the European Union (EU)."[128]

Great Depression

See *IS-LM-PC Model*

Gross Domestic Product (GDP)

GDP is the measure of a country's **aggregate output**. This important measure of total production of the economy and therefore economic health is also discussed elsewhere (e.g., *National Income and Product Accounts NIPA*; *GDP: Real vs. Nominal; Standard of Living and Purchasing Power Parity PPP*; and *GDP Growth*). This entry is partly paraphrased from various places in *ME7*.

(See *Demand for Goods, Equilibrium Goods Output, and I-S Curve* about Aggregate Expenditure AE.)

The Formula for nominal GDP (from the **product/output side**, see *ME7* Appendix 1 A-4 and here[129]) is given by:

GDP ≡ Y_t = C + I + G + (X - IM) + InvInv

where **Y_t** = **Gross Domestic Output/Product** at specified time
(subscript t indicates a stock determination at a specific time)

C = Personal (non-governmental) consumption expenditures
(a flow, durable and nondurable goods plus services)

I = Gross private [non-governmental] fixed Investment (a flow), consisting of
residential (new homes and apartments built)
non-residential: Structures, equipment, and software, etc.

G = Government purchases/spending
Federal (National Defense and Nondefense)
State and local governments

(**X – IM)** = Net Exports **NX** (a flow)
X = Exports (a flow)
IM = Imports (a flow)

InvInv = Inventory Investment (a flow)
(change in business inventories = goods produced less goods sold)

Simpler formulas for aggregate output are found in various places in the textbook, such as Y ≡ C + I + G + (Exports- Imports), but this represents a simplification from the full definition.

Consumption C and therefore demand for goods is said to reflect behavior in the short run according to the following simplified model: $C = c_0 + c_1 Y_D$. Here, c_1 is the **(marginal) propensity to consume**, which according to this formulation contributes a component to C that depends on the disposable income Y_D (personal income left over after paying personal current taxes,[130] and according to some definitions, certain other mandatory charges). The component c_0 is fixed consumption that is present even when disposable income $Y_D = 0$ (in which case it may require selling assets or borrowing to maintain). (*ME7* p. 51)

---

[128] https://en.wikipedia.org/wiki/G20

[129] http://www.bea.gov/national/pdf/nipa_primer.pdf *A Primer on GDP and the National Income and Product Accounts*

[130] http://www.bea.gov/newsreleases/national/pi/pinewsrelease.htm also, *ME7* p. 52

Investment I = Gross private [non-governmental] fixed Investment, which in constructing a short run demand model is taken as a given **exogenous variable**. (*ME7* p. 52)

Government spending G, along with **taxes T**, determines government demand for goods and services.

See *Demand and the Determination of Equilibrium Output* for modeling of short run demand.

GDP as calculated above represents the **expenditures approach**, namely the **final goods and services produced** in the economy during a specified period.

Nominal GDP is expressed in current dollars (using the value of dollars at the time of the measurement). Nominal GDP is also called **dollar GDP** or **GDP in current dollars**.

The following table (for 2014 to 2016, including advance estimates for 2016 Q4) is of **Nominal Current Dollars GDP** (product side) in seasonally adjusted annualized amounts (expressed as billions of nominal dollars). First estimate of full 2016 GDP is 18,567 US billions of dollars:[131]

Bureau of Economic Analysis

Table 1.1.5. Gross Domestic Product

[Billions of dollars] Seasonally adjusted at annual rates

Last Revised on: January 27, 2017 - Next Release Date February 28, 2017

Line		2014 I	2014 II	2014 III	2014 IV	2015 I	2015 II	2015 III	2015 IV	2016 I	2016 II	2016 III	2016 IV
1	**Gross domestic product**	**17,025.2**	**17,285.6**	**17,569.4**	**17,692.2**	**17,783.6**	**17,998.3**	**18,141.9**	**18,222.8**	**18,281.6**	**18,450.1**	**18,675.3**	**18,860.8**
2	**Personal consumption expenditures**	**11,636.1**	**11,800.6**	**11,941.0**	**12,075.8**	**12,098.9**	**12,240.2**	**12,356.9**	**12,438.8**	**12,498.0**	**12,692.7**	**12,832.2**	**12,980.4**
3	Goods	3,900.8	3,967.4	3,999.7	4,014.1	3,956.7	4,010.7	4,043.0	4,038.1	4,008.7	4,085.4	4,111.9	4,185.8
4	Durable goods	1,256.3	1,289.2	1,308.5	1,325.2	1,331.0	1,353.3	1,364.7	1,371.8	1,366.6	1,390.0	1,414.0	1,441.2
5	Nondurable goods	2,644.5	2,678.2	2,691.2	2,688.9	2,625.6	2,657.4	2,678.4	2,666.3	2,642.0	2,695.4	2,697.9	2,744.6
6	Services	7,735.3	7,833.2	7,941.3	8,061.7	8,142.2	8,229.5	8,313.9	8,400.6	8,489.3	8,607.3	8,720.3	8,794.6
7	**Gross private domestic investment**	**2,774.0**	**2,861.6**	**2,939.8**	**2,970.4**	**3,044.6**	**3,049.9**	**3,072.1**	**3,059.9**	**3,036.8**	**2,987.5**	**3,017.2**	**3,106.5**
8	Fixed investment	2,738.6	2,796.7	2,863.6	2,885.2	2,915.7	2,944.7	2,995.3	2,997.2	2,994.8	3,002.5	3,013.1	3,055.4
9	Nonresidential	2,194.5	2,235.5	2,287.5	2,286.3	2,297.6	2,304.9	2,331.5	2,311.3	2,292.4	2,304.7	2,313.8	2,333.2
10	Structures	518.1	531.8	532.4	540.4	519.8	512.9	508.5	487.8	486.0	487.3	500.5	497.1
11	Equipment	1,011.6	1,031.5	1,070.8	1,049.0	1,076.6	1,075.7	1,099.7	1,092.6	1,066.3	1,058.7	1,049.3	1,057.2
12	Intellectual property products	664.7	672.2	684.4	696.9	701.2	716.3	723.3	730.9	740.1	758.7	763.9	778.9
13	Residential	544.1	561.2	576.0	598.8	618.1	639.8	663.8	685.9	702.4	697.8	699.3	722.2
14	Change in private inventories	35.4	64.9	76.2	85.3	129.0	105.2	76.8	62.7	41.9	-15.0	4.1	51.1
15	**Net exports of goods and services**	**-508.4**	**-515.6**	**-485.6**	**-525.5**	**-534.7**	**-508.9**	**-523.4**	**-520.9**	**-507.4**	**-492.4**	**-460.0**	**-538.3**
16	Exports	2,339.1	2,388.4	2,394.7	2,379.0	2,287.8	2,298.6	2,259.1	2,211.7	2,179.0	2,209.7	2,276.3	2,263.7
17	Goods	1,593.5	1,629.8	1,637.3	1,611.8	1,519.8	1,530.0	1,495.6	1,448.3	1,410.9	1,437.2	1,495.4	1,473.5
18	Services	745.6	758.6	757.4	767.2	768.0	768.6	763.5	763.4	768.1	772.5	780.9	790.1
19	Imports	2,847.4	2,904.0	2,880.3	2,904.6	2,822.4	2,807.5	2,782.5	2,732.6	2,686.3	2,702.2	2,736.2	2,801.9
20	Goods	2,369.1	2,416.9	2,392.0	2,407.9	2,330.6	2,314.6	2,284.1	2,235.0	2,185.7	2,199.4	2,222.7	2,291.5
21	Services	478.3	487.1	488.3	496.7	491.8	493.0	498.4	497.7	500.7	502.7	513.5	510.4
22	**Government consumption expenditures and gross investment**	**3,123.6**	**3,139.0**	**3,174.2**	**3,171.4**	**3,174.7**	**3,217.2**	**3,236.3**	**3,245.0**	**3,254.3**	**3,262.3**	**3,285.9**	**3,312.1**
23	Federal	1,218.1	1,214.3	1,230.6	1,212.5	1,218.8	1,222.1	1,225.0	1,234.0	1,233.8	1,239.2	1,251.8	1,253.2
24	National defense	750.0	746.0	755.5	732.5	731.2	731.8	729.3	735.6	731.4	729.3	736.0	732.0
25	Nondefense	468.0	468.3	475.1	480.0	487.6	490.3	495.7	498.4	502.4	509.9	515.8	521.2
26	State and local	1,905.5	1,924.7	1,943.6	1,958.9	1,955.9	1,995.1	2,011.3	2,011.0	2,020.5	2,023.1	2,034.1	2,058.9

An alternative and equivalent formulation of GDP on the production side is the **Sum of Value Added in the Economy** during a given period (*ME7* p. 23; Lecture1.pptx). "In addition [to the expenditures approach], GDP can also be measured either as total sales less the value of intermediate inputs or as the sum of the 'value added' at each stage of the production process. The value-added approach to measuring GDP is central to the U.S. industry accounts and is used to analyze the industrial composition of U.S. output."[132]

Finally, GDP may be expressed with the **income approach**: "...Because the market price of a good or service will reflect all of the incomes earned and costs incurred in production, GDP can also be measured as the sum of these charges. This is known as the income approach and is used to examine the purchasing power of households and the financial status of business income."[133] (also *ME7* p. 24) "**Aggregate spending** and **aggregate income should be equal**, except for statistical discrepancy."[134]

---

[131] https://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&903=5 , see also https://www.bea.gov/newsreleases/national/gdp/2017/pdf/gdp4q16_adv.pdf

[132] http:// www.bea.gov/national/pdf/nipa_primer.pdf

[133] ibid.

[134] lecture1.pptx

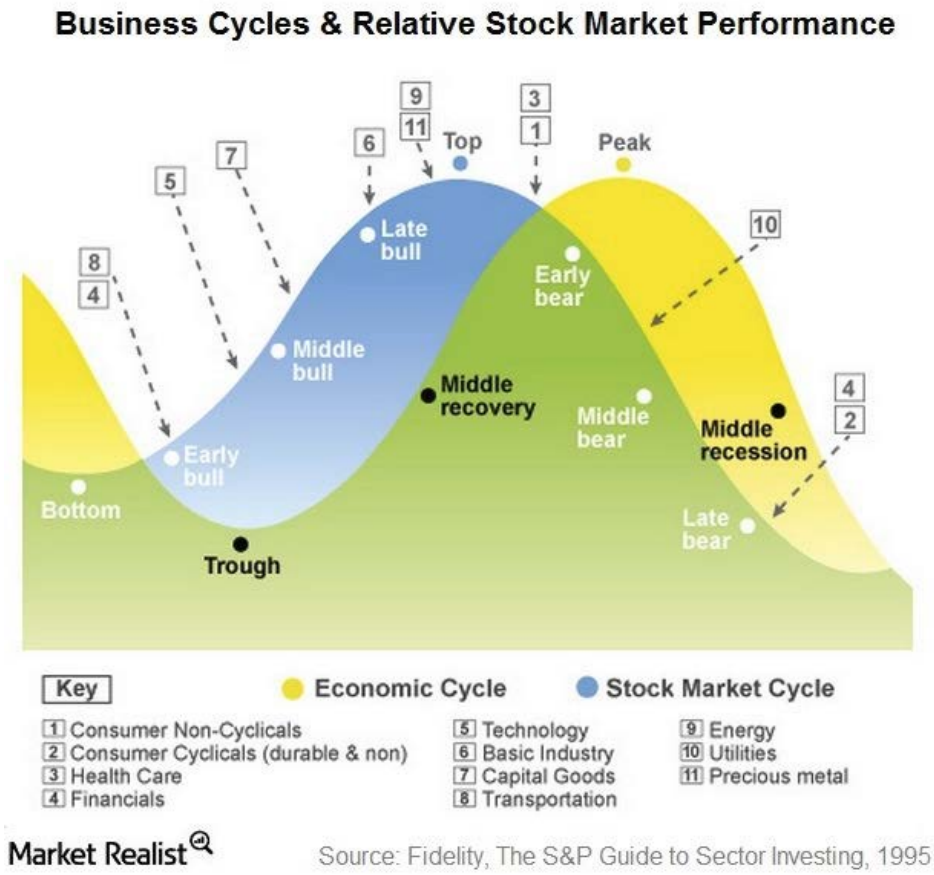
Discussion of **Real GDP** is found under *GDP: Real vs. Nominal*. Adjustment of Real GDP for Purchasing Power Parity (when comparing GDP among countries) is found under *Standard of Living and Purchasing Power Parity PPP*.

In the **short run** (from months to a few years), GDP changes are determined primarily by **Demand** for goods and services.

In the **medium run** (roughly a decade), GDP output changes are determined by **Supply factors** (how much the economy can produce), which depend on the level of technology, the capital stock, and the size and skill of the labor force.

In the **long run** (several to many decades), GDP output growth is determined by **innovation** and introduction of **new technologies**, increased **saving and capital stock**, improved **worker skills** through **education**; and **clear laws**, **governmental honesty**, and **low levels of corruption**.

GDP **output fluctuations** occur normally in so-called **business cycles**: periods of expansion alternating with recession which are superimposed on the long-term trend. The nonprofit NBER determines the official dates for phases of the business cycles.[135] The following diagram depicts an idealized business cycle and suggests that stock market cyclical peaks and troughs precede the corresponding economic business cycle peaks and troughs.[136]



Some of the business cycle fluctuations may be due to *shocks*. Major shocks can cause large perturbations in output than exceed normal business cycle fluctuations. Output is thus affected by shocks and their dynamic effects, called the **propagation mechanism**, as well as by normal business cycle fluctuations. Shocks can be hard to define, and there is controversy about delineating the "chain of causation".[137]

---

[135] http://www.nber.org/cycles.html (long term data dating back to 1854, but no cycle years past 2009 are included as of Dec. 11, 2016)

[136] http://marketrealist.com/2016/04/phase-business-cycle/

[137] *ME7* p. 192-3, Chap. 9, and Instructor_Pearson_File_7e_PPT_09.pptx

For some countries, exports may exceed GDP, because they may include intermediate goods not counted in GDP. (*ME7* p. 352)

GDP Deflator

This an index which reflects prices of all new goods and services—or at least a sample of these goods and services that is allowed to vary—and that are domestically produced within the country (not imported). It is a measure of price inflation/deflation with respect to a specific base year, for which the GDP deflator is set equal to 100. Conceptually, it is given for year t by (*ME7* p. 31)

$$P_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} = \frac{\$Y_t}{Y_t}$$

Thus Nominal GDP_t = GDP $deflator_t$ P_t multiplied by Real GDP_t. In other words, GDP $deflator_t$ is the factor by which Nominal GDP_t must be divided to yield Real GDP_t.

The absolute value of the GDP deflator index is arbitrary and depends on the base year (currently 2009), but its rate of change

$$\pi_t = (P_t - P_{t-1})/P_{t-1} ,$$

which is determined for a time interval between time t and earlier time (t-1), is a meaningful quantity.

"The rate of growth of nominal GDP is equal to the rate of inflation plus the rate of growth of real GDP." (*ME7* p. 31).

GDP deflator is currently expressed in **chained 2009 dollars**, and 2009 is termed the **base year** for which nominal and real GDP are taken to be equal and $P_t = 1.0$. (*ME7* p. 25, 42)

The exact formulas for these chained computations are quite complex and are shown in NIPA Guide Appendix 1.[138] Blanchard provides a simplified summary of the US BEA method:[139]

"1. Construct the rate of change of real GDP between two years in two different ways:

Using the price from year t as the set of common prices

Using the price from year t+1 as the set of common prices

2. Construct the rate of change of real GDP as the average of the these two [usually non-identical] rates of change

3. Construct an index of the level of real GDP by linking or chaining the constructed rates of change for each year

4. Multiply this index by nominal GDP to derive real GDP in chained dollars."

Note that **chaining** refers to successively multiplying the constructed weighted changes from one year to the next for each intervening year, as is often in other contexts notated mathematically by the upper case Greek symbol for pi (Π).

Chain-type (Chain type) measures have the following advantages:

"The chain-type indexes based on the Fisher formula have several advantages over the fixed-weighted indexes that BEA used before 1996:

● They produce percent changes in quantities and prices that are not affected by the choice of the reference period [**base year**].

● They eliminate the substitution bias in measures of real GDP growth that are derived using fixed-weighted indexes. This bias tends to cause an understatement of growth for periods before the reference year and an overstatement of growth for periods after the reference year.

● They eliminate the distortions of growth in components and in industries that result from the fixed-weighted indexes.

● They eliminate the anomalies that arise from using recent-period weights to measure periods in the past when a far different set of prices prevailed. For example, the prices of defense equipment in the 2000s are not appropriate for measuring the real changes in defense spending in the 1940s.

● They eliminate the inconvenience and confusion associated with BEA's previous practice of updating weights and years—and thereby rewriting economic history—about every 5 years."[140]

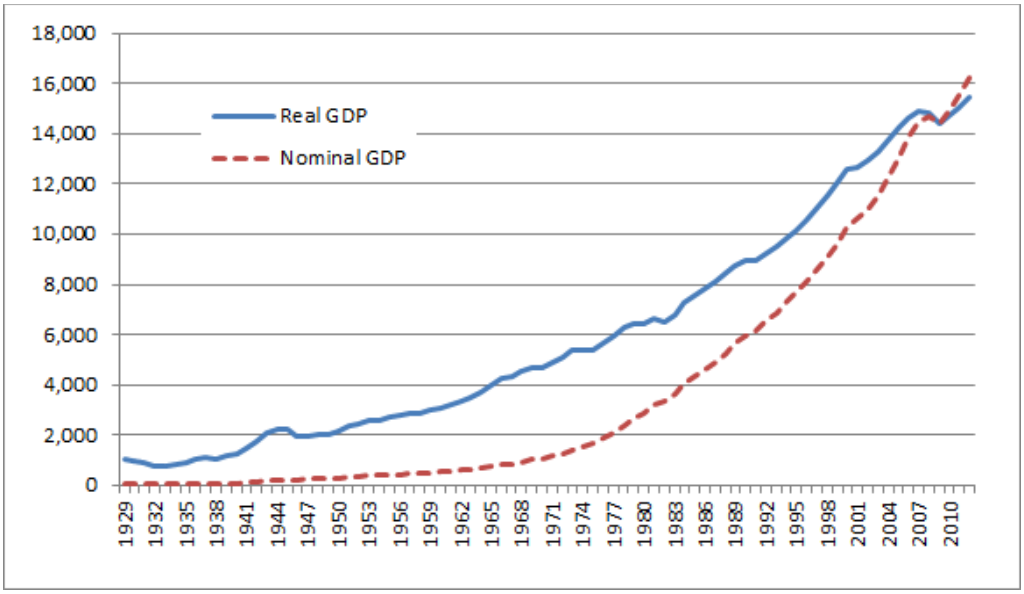
---

[138] https://www.bea.gov/national/pdf/nipaguid.pdf see Extra

[139] *ME7* p. 42 & Instructor_Pearson_File_7e_PPT_02.pptx

[140] *Concepts and Methods of the U.S. National Income and Product Accounts (Chapters 1–10 and 13)* , February 2014, http://www.bea.gov/national/pdf/allchapters.pdf (Chapter 4)

US Real vs. Nominal GDP since 1929 to c. 2012 are shown graphically as follows (in 2009 base year dollars):[141]



GDP deflator is further discussed at *Inflation and Price Levels*.

GDP Growth

Blanchard defines growth as [more or less] steady increase in aggregate output over some period of time. Growth is a key measure of economic health. Recession leads to gloom. Standard of living is closely related to GDP growth and thus growth is considered of great importance in the long run. See *Standard of Living and Purchasing Power Parity PPP*. [MCM: But we must ask, is GDP growth always good if it results in degradation of the biosphere in which we live?]

Sustained growth is not automatic—countries have risen, flourished, and declined. In the long span of history continuous growth is a mostly recent phenomenon which depends on technological progress. Poor countries may remain poor and show continued slow growth (such as we have seen for many of the African countries).

GDP Growth rate is more precisely specified as a change in GDP over a specified period of time, such as a year or a quarter (sometimes annualized and often seasonally adjusted). GDP is symbolized as Y, and its growth rate may be symbolized one or more of the following notations:

$$\text{GDP Growth Rate} = \frac{\Delta Y}{\Delta t} = \frac{dY}{dt} = \dot{Y}$$

However, there is little meaning to instantaneous GDP growth rate (except apparently in some models), and I would surmise that the delta expression is probably most appropriate for expressing growth over discrete time increments or periods.

If GDP growth rate is accelerating, this implies, using the meaning in physics and math of acceleration, namely that

$$\text{GDP Growth Rate acceleration} \implies \frac{\Delta(\Delta Y/\Delta t)}{\Delta t} = \frac{d^2Y}{dt^2} = \ddot{Y} > 0$$

where again the delta notation is probably more appropriate.

One might also express GDP growth rate as a partial derivative with respect to time, in the sense that GDP growth rate is a function of several variables besides time, such as capital K and employment N (labor force L).

The mathematical treatment of GDP growth as in the Solow model is discussed in detail here.[142]

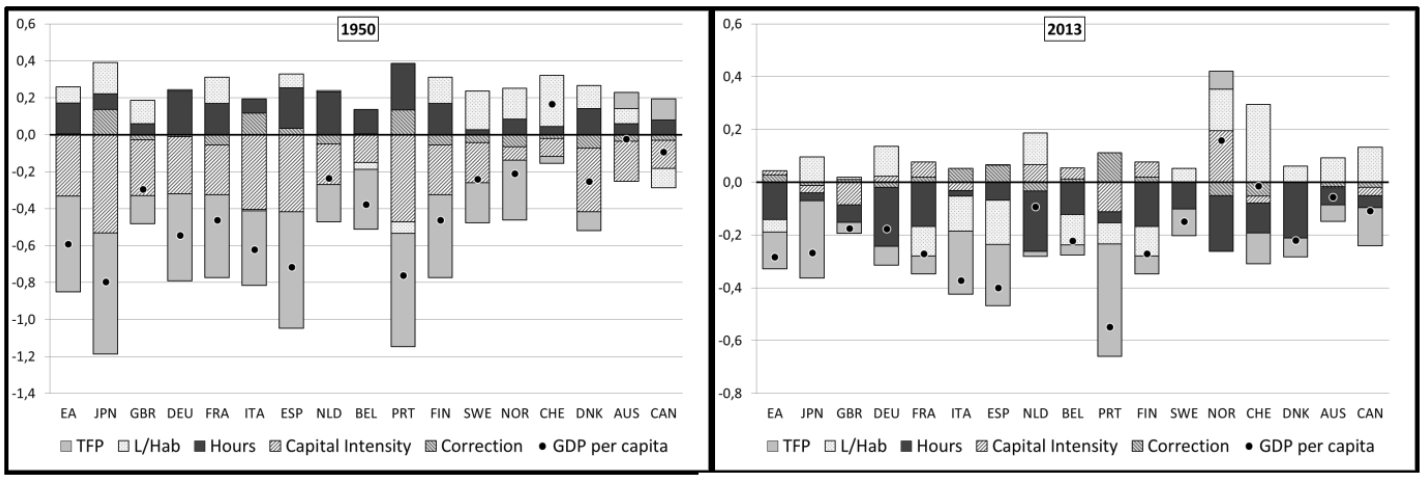
ME7 p. 203 presents data from US, UK, France, and Japan. The numbers show that **real annual output per person in constant 2005 PPP dollars** exhibits a substantial increase comparing 1950 to 2011 for

[141] http://www.ken-szulczyk.com/economics/economics_lesson_15.php
[142] http://www.reed.edu/economics/parker/s11/314/book/Ch03.pdf

all these countries, reflecting an improvement in the economic well-being. The **annual GDP PPP per capita growth rates** range from 2.0% for the US to 4.1% for Japan [mostly in the 1960s], again comparing 1950 to 2011.

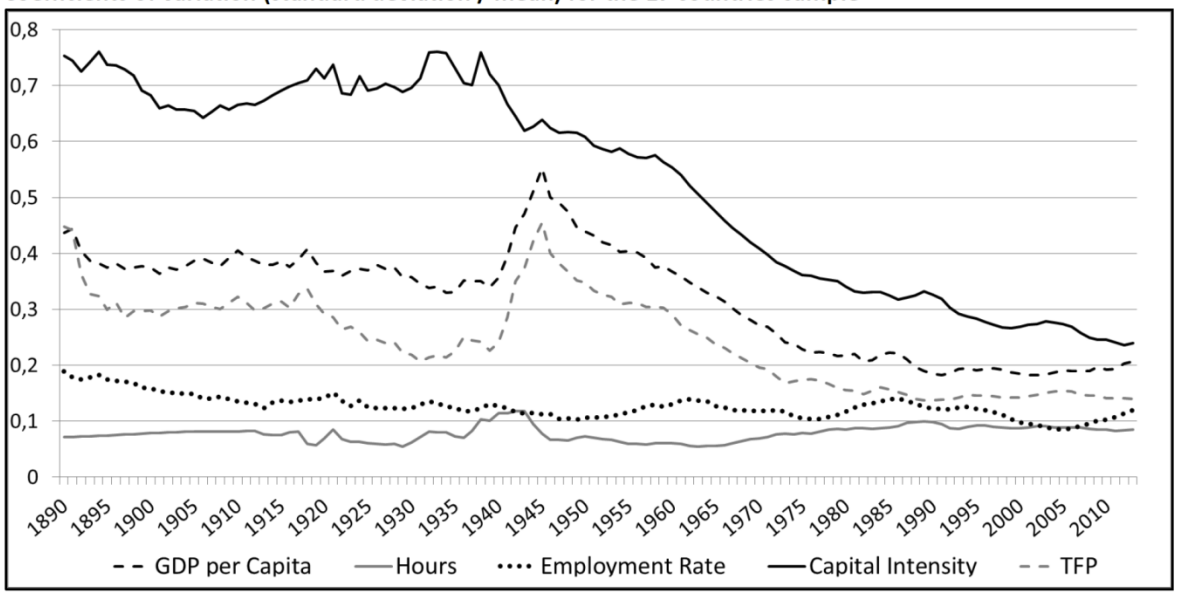
But for these 4 countries, regardless where they started from in 1950 (in real annual output per person in constant 2005 PPP dollars), by 2011 they were tending to **converge** to a similar value of **real annual output per person in constant 2005 PPP dollars** (ranging from ~29,600 for France to ~42,200 for the US).

A trend toward **convergence** of GDP in fact applies to the OECD countries in general, though these countries are essentially pre-selected as "economic winners". (*ME7* p. 206) For example, the following graphs depict a subset of 16 the OECD countries plus the USA, adapted from the paper cited.[143] It can be seen that the values of GDP per capita (converted to 2010 US dollars = 100 at purchasing power parity ppp), which are represented by the black dots, are more spread out in values in 1950 than in 2013. (The US is not included in these graphs except by comparison to level 0.0) More technical tests for convergence are also presented in this paper. For instance, the values of GDP per capita **coefficients of variation** (s.d. / mean), shown as the darkest dashed line in the bottom graph, trend after WWII toward a value of about 0.2. TFP = Total Factor Productivity; Capital Intensity = capital stock per hours worked; L/Hab = probably the average # of hours worked per capita.

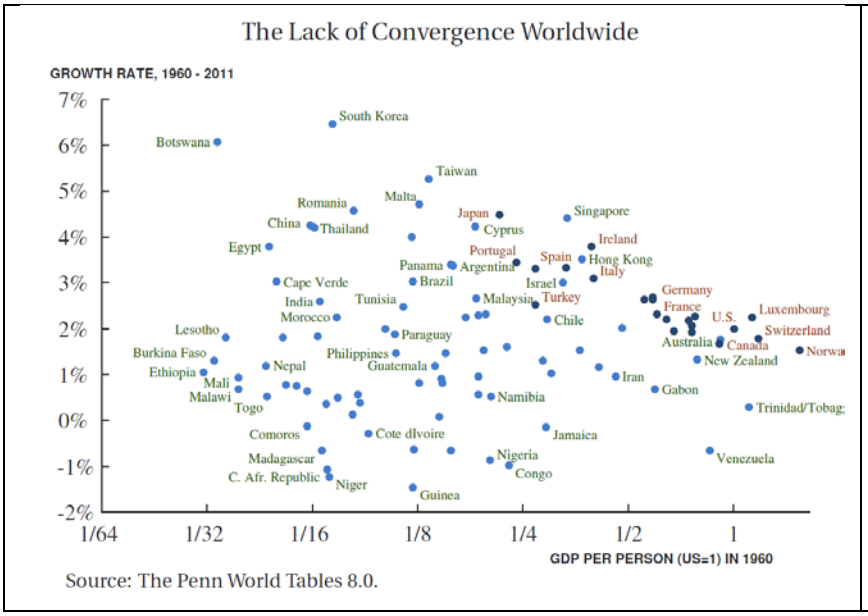


[143] Euro Area (EA), Japan (JPN), United Kingdom (GBR), Germany (DEU), France (FRA), Italy (ITA), Spain (ESP), The Netherlands (NLD), Belgium (BEL), Portugal (PRT), Finland (FIN), Sweden (SWE), Norway (NOR), Switzerland (CHE), Denmark (DNK), Australia (AUS), Canada (CAN). MCM has selected 2 of the graphs presented for the top pair. The bottom graph is adapted from the same source.
Bergeaud, A, Cette, G and Lecat, R, "GDP Per Capita in Advanced Countries Over the 20th Century" (April 1, 2015). *Banque de France Working Paper No. 549*. Available at SSRN: https://ssrn.com/abstract=2602267 .

Coefficients of variation (standard deviation / mean) for the 17 countries sample



Convergence toward US real GDP is also seen in the "four tigers": Singapore, Taiwan, Hong, Kong, and South Korea. However, there is less evidence of convergence of GDP growth rate when looking at a broader range of countries and comparing 1960 per capita PPP GDP with annual GDP PPP growth rate from 1960 to 2011 (see next diagram on left, also *ME7* p. 208).



THE WORLD FACTBOOK

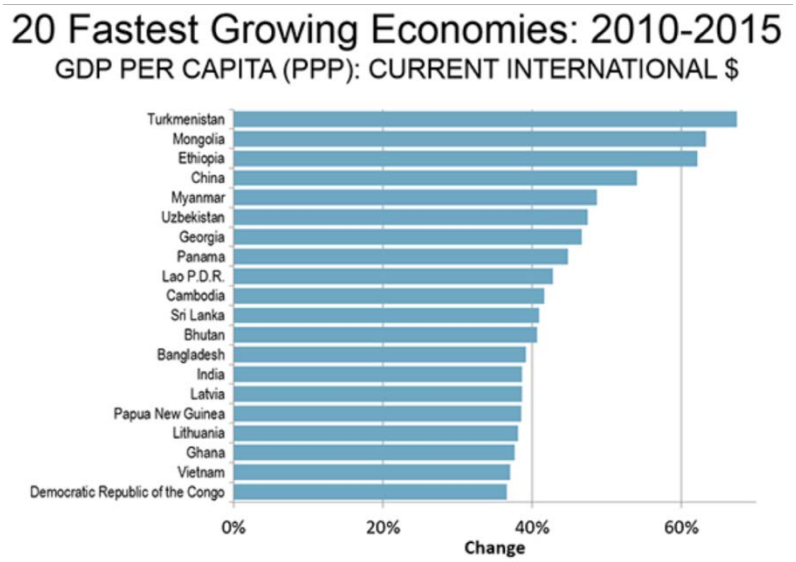
COUNTRY COMPARISON :: GDP - PER CAPITA (PPP)

GDP - per capita (PPP) compares GDP on a purchasing power parity basis divided by population as of 1 July for the same year.

RANK	COUNTRY	GDP - PER CAPITA (PPP)	DATE OF INFORMATION
1	QATAR	$132,900	2015 EST.
2	MACAU	$101,300	2015 EST.
3	LUXEMBOURG	$99,500	2015 EST.
4	LIECHTENSTEIN	$89,400	2009 EST.
5	BERMUDA	$85,700	2013 EST.
6	SINGAPORE	$85,400	2015 EST.
7	ISLE OF MAN	$83,100	2007 EST.
8	BRUNEI	$79,500	2015 EST.
9	MONACO	$78,700	2013 EST.
10	KUWAIT	$70,500	2015 EST.
11	NORWAY	$68,600	2015 EST.
12	UNITED ARAB EMIRATES	$67,200	2015 EST.
13	SINT MAARTEN	$66,800	2014 EST.
14	IRELAND	$65,800	2015 EST.
15	SAN MARINO	$63,800	2015 EST.
16	SWITZERLAND	$58,600	2015 EST.
17	JERSEY	$57,000	2005 EST.
18	HONG KONG	$56,900	2015 EST.
19	UNITED STATES	$56,100	2015 EST.

Real per capita GDP (PPP) is shown in the CIA data[144] (table to the right above) for the top 19 countries sorted in descending order. It is seen that the countries with the highest GDP per capita tend to be smaller wealthy countries, and that the US is 19th in the list, with Germany 28th, France 39th, UK 40th, and Japan 43rd (the latter four are not shown in the excerpt). German workers have about the same hourly productivity as US, but US workers work more hours, and therefore higher output per capita. (*ME7* p. 203) For a graph of real per capita US GDP in 2009 dollars extending from 1890 to 2015, see below and also under *GDP: Real vs. Nominal*.

[144] adapted MCM from
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html



Derived from International Monetary Fund, 2016.04

In contrast, recent 2010 – 2015 Real Growth *rate* as per capita GDP (PPP) Growth is shown in IMF data[145] (diagram to left), for several countries sorted in descending GDP order. The countries with highest growth tend to be small and/or developing countries (including China, India, and Vietnam), and the US is not in the top 20.

In the top row of the graphs to follow, [146] we look back at very long term per capita GDP in Western Europe as a whole (total of 30 countries), starting at 1 AD (1 CE) in ancient Roman times. The data source states that these values are expressed in 1990 International Geary-Khamis [PPP] dollars (Int$). (For more on this important metric, see *Standard of Living and Purchasing Power Parity PPP*.) Prior to 1500 was the stagnant growth era, the so-called **Malthusian Era** (or **Malthusian Trap**), with per capita real GDP less than 2000 Int$.[147] For the top right graph, we see a minimal steady rise in per capita GDP on a log scale beginning only about 1500, with a much higher growth rate beginning at about 1700. The scaling does not optimally display perturbations such as the Great Depression and WWII, and the Great Recession is not included in these graphs. The linear GDP scale graph on the left also shows the dramatic growth after about 1700.

The middle two graphs present the US per capita real GDP from 1870 to 2008 in Int$. On the left graph is a linear scale GDP axis whereas on the right is a log scale GDP axis. The overall trend of steadily rising growth and growth rate is apparent in the log scale graph which appears almost linear in shape. (To the extent it is a straight line, for any given time interval in years, US per capita real GDP increases in that interval by roughly the same multiple.) The linear scale axis GDP graph on the left show the gradually accelerating GDP in a concave-upward curve. The impact of the Great Depression and the surge in GDP during WWII are apparent in both graphs. The Great Recession is not included.

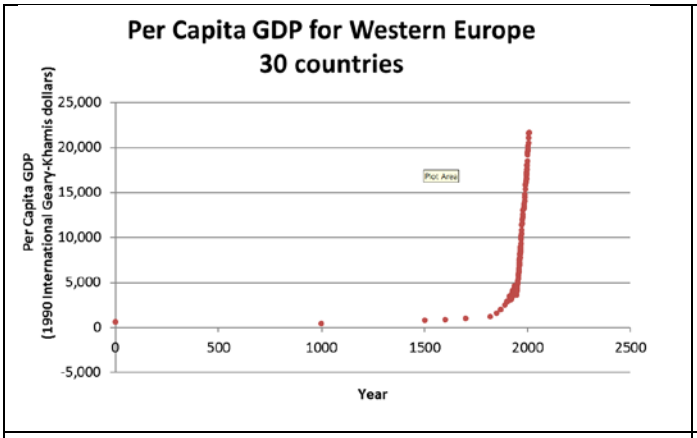
ME7 p. 207 states, "From the end of the Roman Empire to roughly year 1500, there was essentially no growth in output per person in Europe. Most workers were employed in agriculture in which there was little technological progress." The Blanchard comments appear consistent with the data graphed in the first 2 rows (to follow), and he provides a similar per capita GDP graph (final graph at bottom). The steep rise in US per capita GDP has been said to reflect the **force of compounding**. (*ME7* p. 205)

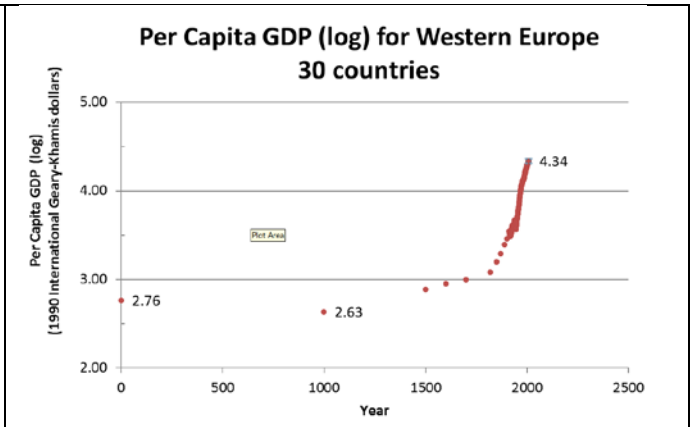
---

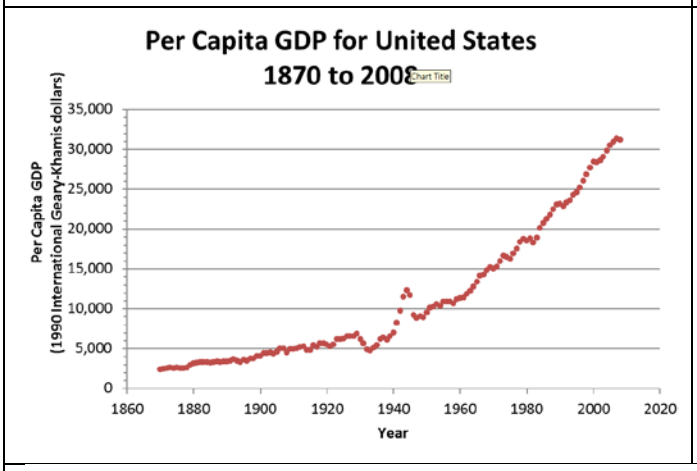
[145] adapted MCM from https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html

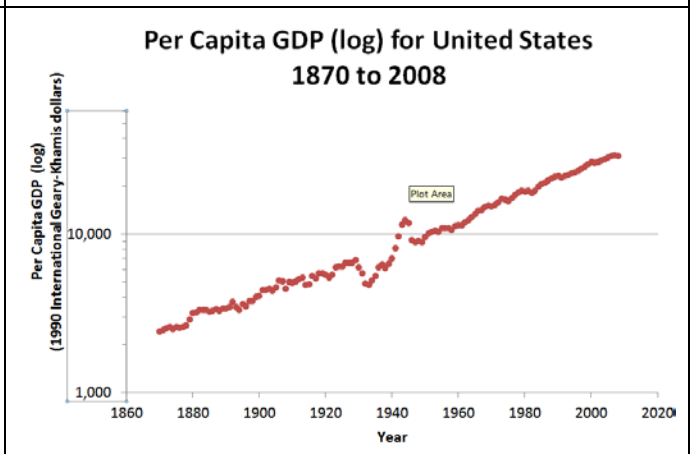
[146] The 4 graphs in top and middle rows were created in Excel by MCM using Excel data from www.ggdc.net/maddison/Historical_Statistics/horizontal-file_02-2010.xls

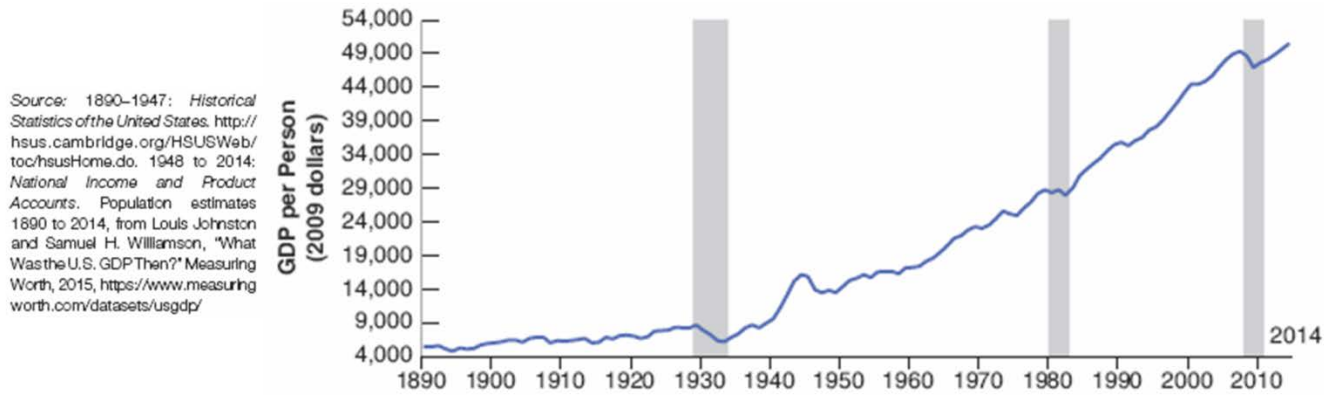
[147] [Thomas} Robert Malthus [1766 - 1834] observed that an increase in a nation's food production improved the well-being of the populace only temporarily, because it led to population growth, which in turn restored the original per capita production level. In other words, mankind had a propensity to utilize abundance for population growth rather than for improving the standard of living, a view that has become known as the "Malthusian trap" or the "Malthusian spectre". https://en.wikipedia.org/wiki/Thomas_Robert_Malthus











US per capita GDP in constant dollars 1890 to 2014[148]
Great Depression and Great Recession shown in grey
Over the time interval shown, real per capita GDP output has increased by a factor of about 9.

Growth theory was advanced by the work of **Robert M. Solow** [b. 1924] beginning with his influential 1956 article.[149] Solow postulates a functional relationship between capital K (machines, plants, office buildings, etc.), total labor N (number of workers in the economy), and aggregate output Y, namely

$$Y = F(K, N)$$

(Later, we will add in technological progress.)

[148] Instructor_Pearson_File_7e_PPT_10.pptx

[149] Robert M. Solow "A Contribution to the Theory of Economic Growth" , *The Quarterly Journal of Economics*, Vol. 70, No. 1. (Feb., 1956), pp. 65-94.

Here F, which he terms an **aggregate production function**, is understood (in Solow's article) to be net after depreciation of capital (though not apparently in Blanchard). If the population grows at a constant relative rate **n**, and in the absence of technological advancement, the rate of capital stock accumulation that must occur to keep available labor employed is given as the time derivative of capital:

$$\dot{K} = sF(K, N_0 e^{nt})$$

where **s** = **the fraction of output saved and to some extent invested**, also called the **saving rate**, $0 < s < 1$

Solow suggests that F satisfies the property of **constant returns to scale**, so that

$2Y = F(2K, 2N)$ or $xY = F(xK, xN)$, where x is a constant[150]

and also that increase in only one of the inputs by x will produce a smaller increase in Y than if K and N both increase by the same factor x, i.e.,

$2Y > F(K,2N)$

He also shows that the output to workers satisfies:

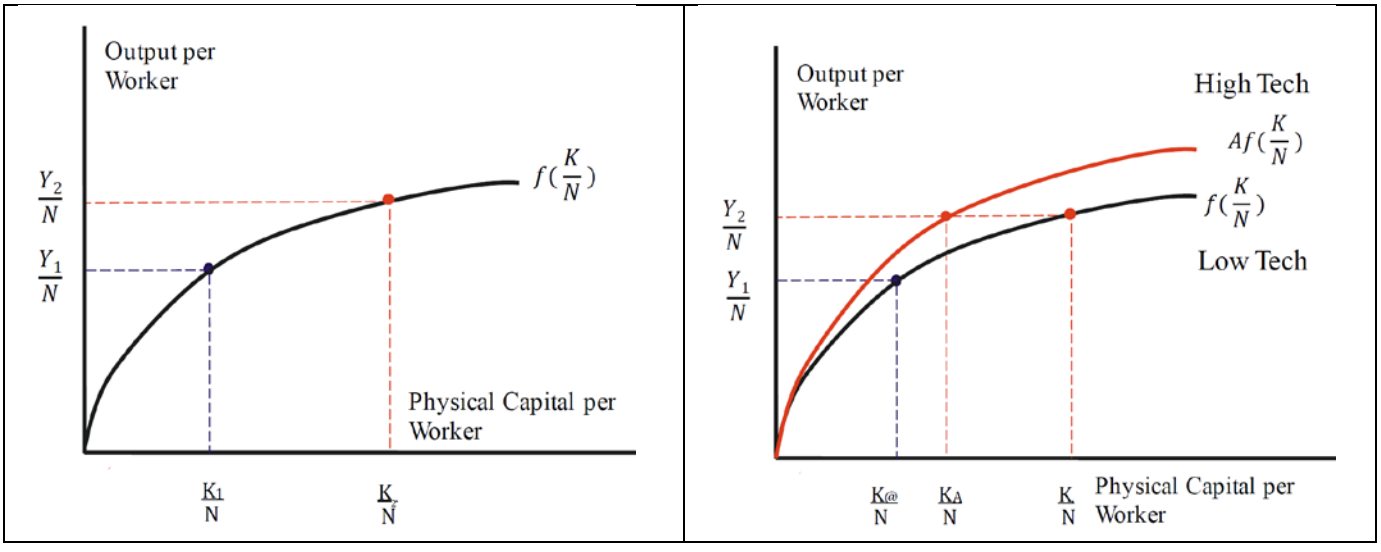
$Y_t/N = F(K_t/N, N/N) = F(K_t/N, 1) = f(K_t/N)$ (Eqn. 11.1)

where f is an unspecified function for which f increases when K_t/N increases.

As Y/N increases, $F(K_t/N,1)$ and $f(K_t/N)$ increase, but F and f exhibit diminishing returns as capital increases (aka **decreasing returns to capital** or **diminishing marginal productivity of capital**). (*ME7* p. 211) Output in fact tends to level out in asymptotic fashion as shown in the left diagram below.[151] Stated another way, the slope of the $f(K_t/N)$ gradually decreases as K_t/N decreases/

In addition, as the amount of labor increases, while capital does not change, there are **decreasing returns to labor**. (*ME7* p. 211) It makes sense that if there are only a few computers, increasing the number of employees that use them may not increase production much.

Output per worker Y/N will increase for a while as a result of rise in capital K/N, but by itself this rise **cannot sustain growth**, as a result of **decreasing returns to capital**. "At some stage, the economy will be unwilling or unable to save and invest enough to further increase capital." (*ME7* p. 212) Increases in technological capabilities and skills are the key to continued increase in output per worker (and the Af(K/N) curve shown in the right diagram).



[150] This **constant returns to scale** property is not entirely intuitive—consider Area = Length x Width, in which area will quadruple (not double) when each of the 2 arguments are doubled.

[151] Lecture Ch. 10.pdf, right and left diagrams, modified MCM, also *ME7* p. 211

Long term growth in output per worker will arise primarily from **technological advances**. In the diagram to the right above, the factor A represents these advances, which increase Y/N even when capital per worker K/N does not change.

The actual expression of the production function is controversial and ultimately empirical. The following forms are mentioned in *ME7*:

(1) $Y = \sqrt{K}\sqrt{N}$ (a special case of the Cobb-Douglas production fn that follows, for α=0.5) (*ME7* p. 214)

(2) **Cobb-Douglas Production Function**: $Y = K^{\alpha}N^{(1-\alpha)}$ where $0 < \alpha < 1$. (*ME7* p. 239)
or $Y = AK^{\alpha}N^{(1-\alpha)}$

where A = **Total factor productivity = TFP**, aka **multi-factor productivity**, a measure of an economy's long-term technological change or technological dynamism[152]

Human capital: Blanchard also incorporates per capita human capital H/N (*ME7* p. 234ff) in the discussion regarding factors affecting output per worker Y/N, so that the production function becomes

$$\frac{Y}{N} = f\left(\frac{K}{N}, \frac{H}{N}\right)$$

where an increase in either argument increases f.

Human capital consists in part of investment in **education.** US education overall costs 6.5% of GDP—not including opportunity losses—compared to 16% of GDP as investment in physical capital. However, only a fraction of higher education is investment important in increasing H/N. Also important are **training** (including **OJT**) and **skills acquisition**. All of these often have associated opportunity and/or other costs). These all can potentially enhance a worker's productivity and his/her ability to perform complex tasks, thus affecting the production function.

However, it is **difficult to compute the economic value** of such human capital, compared to physical capital factors such as factories, buildings, computers, software, etc. Human capital also deteriorates (depreciates), though not as fast as physical capital, especially if kept in active use. In general, though, Blanchard states, "Countries that save more or spend more on education can achieve substantially **higher steady-state levels of output per worker** (↑ **Y/N**) … [though they cannot sustain] permanently higher growth of output per worker [↑ ΔY/Δt]." (*ME7* p. 235, 236) Blanchard also discusses the controversy as to whether GDP growth can be sustained solely **endogenously** (i.e., solely from increases in physical and human capital)… The consensus for now is that permanently higher growth rate requires technological progress.

Another view of human capital: "Schooling, a computer training course, expenditures on medical care, and lectures on the virtues of punctuality and honesty are also capital. That is because they raise earnings, improve health, or add to a person's good habits over much of his lifetime. Therefore, economists regard expenditures on education, training, medical care, and so on as investments in **human capital**. They are called human capital because people cannot be separated from their knowledge, skills, health, or values in the way they can be separated from their financial and physical assets."[153]

A **higher saving rate S** leads to higher growth for some time but **cannot permanently increase the growth rate of output**. However, it can **sustain a higher level of output** and a **higher standard of living** and a **higher level of output per person Y/N**. (*ME7* p. 212) Over the long run, an economy's growth rate ΔY/Δt does not depend on the saving rate S. The US has a relatively low saving rate. There is more than one method of expressing this fact (see also table later to follow):

NIPA: "Personal Saving Rate" = ~6% of Disposable Income in 2015[154]
FRED: NIPA Gross Saving / Gross National Income = 18.6% in 2015[155]
ME7: "Saving / GDP", which has averaged "only 17%" since 1970[156]

---

[152] also https://en.wikipedia.org/wiki/Cobb%E2%80%93Douglas_production_function
[153] http://www.econlib.org/library/Enc/HumanCapital.html
[154] annual_nipa_revision_2016.pdf
[155] Gross saving as a percentage of gross national income (W206RC1A156NBEA) , https://fred.stlouisfed.org/series/W206RC1A156NBEA#0
[156] *ME7* p. 217

but the low saving rate does not cause low US economy growth. However, a higher saving rate in the US would lead to a higher level of output and thus a higher standard of living. (*ME7* p. 217)

Given the following simplifying assumptions:

(1) Closed economy without trade , so
Investment I = S + (T - G) where S = private saving and (T - G) = public saving.

(2) Public saving (T - G) = 0 so
I = S

(3) $S = sY_t$ (i.e., private saving is proportional to income), where $0 < s < 1$, so then in the long run, investment I = private saving S, so
$I_t = sY_t$

"The higher (lower) output is, the higher (lower) is saving and so the higher (lower) is investment."[157]

Although output per worker Y_t/N is a function of K_t/N, private saving S depends on s and income Y_t, so that I_t depends on s and Y_t.

In Blanchard (*ME7* p. 221), depreciation is represented by δ, so that in 1 unit of time,

$$K_{t+1} = (1 - \delta) K_t + I_t$$

and he derives

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = s\frac{Y_t}{N} - \delta\frac{K_t}{N}$$ (s is in lower case)

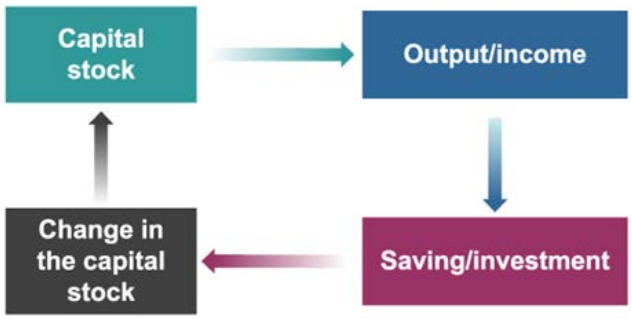
thus providing an expression for the change in capital stock per worker per unit of time.

Combining the two equations relating output and K/N:

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = sf\left(\frac{Y_t}{N}\right) - \delta\left(\frac{K_t}{N}\right)$$ (Eqn. 11.3)

In words, this states that the stock of capital per worker will increase over 1 year if investment during that year exceeds depreciation during that year (i.e., the difference is positive). (*ME7* p. 221)

Note that a circular relationship exists in the interactions between output/income and capital:[158]

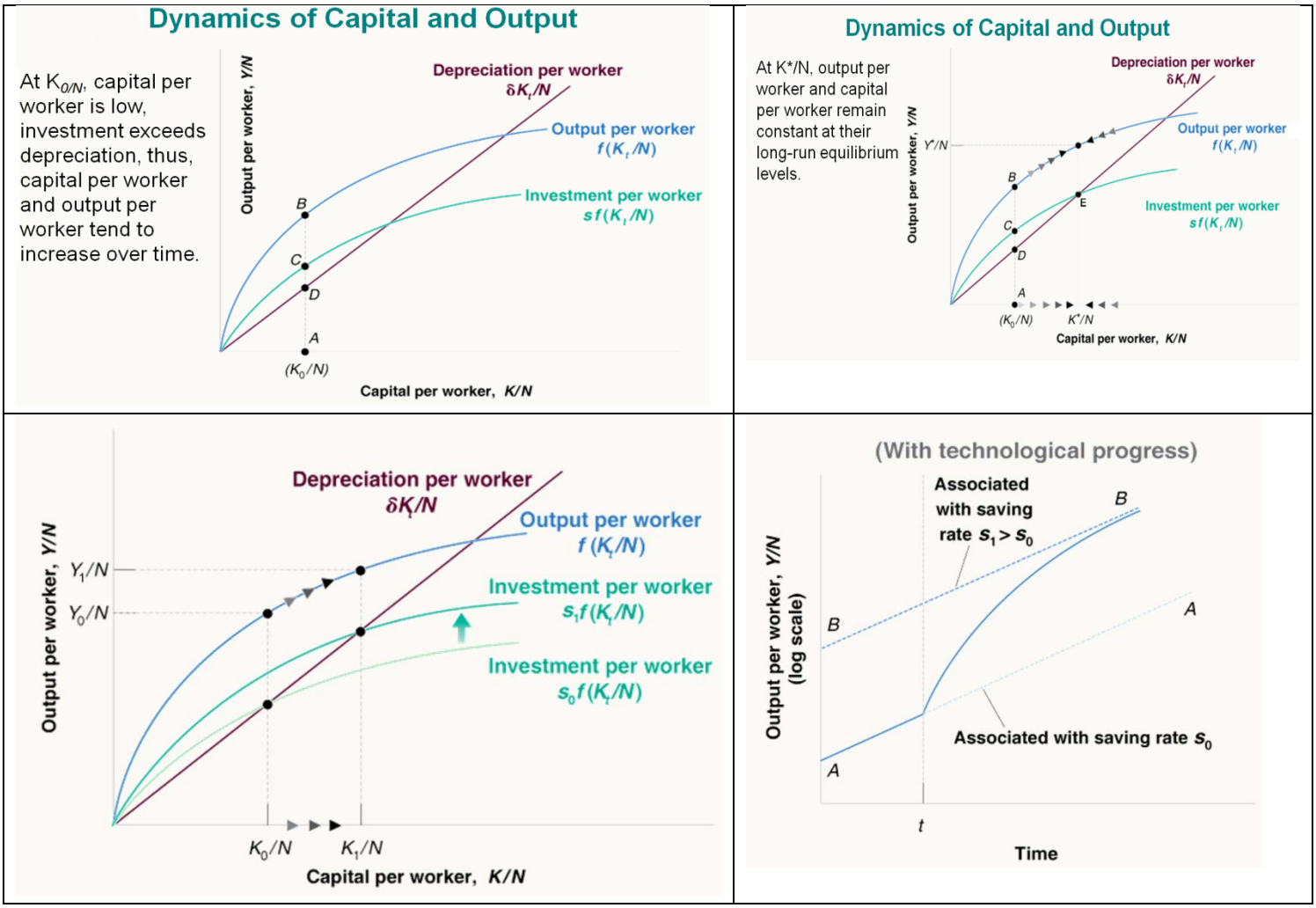


Some of the dynamical behaviors of Y output/income, K capital, N employment, s saving rate, and δ depreciation are summarized in diagrams and text to follow:[159]

[157] Instructor_Pearson_File_7e_PPT_10.pptx
[158] mysite.avemaria.edu/gmartinez/Courses/ECON301/PPoints/ECO_301_ch11.ppt
[159] www.sef.hku.hk/~kcfung/econ6022A/lecture%20notes/ch11_5e.ppt , images modified by MCM, quotes also from this source

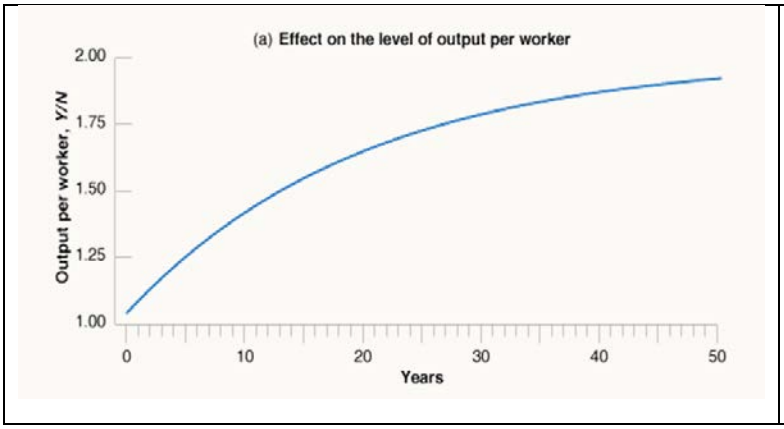
In the upper left diagram to follow, the proportionality of depreciation with K_t/N is shown as a straight maroon line. At K_0/N, investment for the upcoming period exceeds depreciation, so K/N and $Y/N = f(K_t/N)$ will increase in the upcoming year. Note that $0 < s < 1$, so $sf(K_t/N) < f(K_t/N)$ and is plotted as the lower green curve.

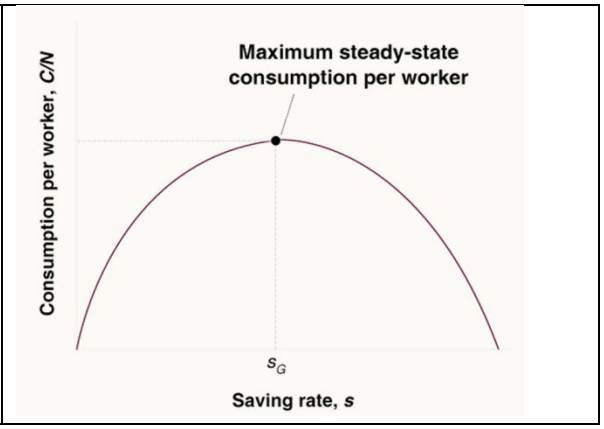
In the upper diagrams, the model suggests that K/N will increase from K_0/N to K*/N. At this **long-term equilibrium point** E, the annual investment/worker $sf(Kt/N)$ is equal to the depreciation rate $\delta K_t/N$. Therefore, no further growth in output per worker will occur if only capital K/N increases. When capital and output are low (as in France at the end of the capital-destroying WWII), investment exceeds depreciation, and capital increases. When capital K/N and output Y/N are high (beyond the long-term equilibrium point), investment is less than depreciation, and capital K/N decreases (also top row).



The lower left diagram above shows the effect of a country increasing its saving rate, from s_0 to s_1. The resulting investment per worker ($sf(K_t/N)$) will gradually rise and asymptotically approach the higher steady state value $s_1 f(K_t/N)$ at K_1/N, again where depreciation equals investment. The period of higher growth leading to asymptotic rise to a higher level of output Y/N is shown on the lower right diagram above (in this case, however, also assuming there is also technological progress contributing to a steady rise in output).

The long period during which the equilibrium level of output per worker rises following an increase in saving may stretch over many decades before it attains the higher equilibrium (left diagram to follow). The **steady state equilibrium output per worker** is given by $Y^*/N = s/\delta$, so that doubling s will double Y*/N. The **steady state equilibrium capital per worker** is given by $K^*/N = (s/\delta)^2$, so that doubling s will quadruple K*/N. (*ME7* p. 231) The graph shows that Y/N rises toward a fixed value, and correspondingly the growth rate of output declines toward zero (graph not shown). (Technological progress is not assumed for this particular diagram.)





An economy may have a high saving rate, leading to a high level of capital and high output, yet low consumption, and therefore a balance between saving and consumption is needed. "The level of capital associated with the value of the saving rate that yields the highest level of consumption in steady state is known as the **golden-rule level of capital**" (see right diagram immediately above; perhaps this might be termed the **Goldilocks level** of consumption). Steady state consumption C/N peaks at 2.5 when s = 1/2, assuming depreciation δ = 10%/year.

Clearly, the US could improve its saving rate from our current ~17% to as much as 50%. We may assume an increase in US saving rate from 17% to 50% or less → ↑capital per worker, ↑output growth rate per worker (for a while), ↑output per worker, and ↓consumption per worker (for a while) followed by ↑consumption later. The standard of living would gradually improve. (*ME7* p. 217, 233)

Although Blanchard in the earlier part of Chapter 11 defines saving rate s by S = sY (where S = private non-public saving rate, Y = income), in the last part of chapter 11 (*ME7* p. 233) he confusingly appears to be referring to the *Saving Rate* as defined for instance in the NIPA Guide[160] as follows:

$$\text{Saving Rate} = \frac{[\textbf{Net Saving} \text{ (Account 6)} + \textbf{Consumption of fixed capital} \text{ (Account 6)}] \equiv [\text{Gross Saving (Account 6)}]}{\textbf{Gross National Income GNI}}$$

This is not the same saving rate as the s used earlier in the chapter, nor is it the "**Personal saving** as a percentage of DPI ([Disposable personal income])" mentioned in the NIPA 2016 update and 5.8% in 2015.

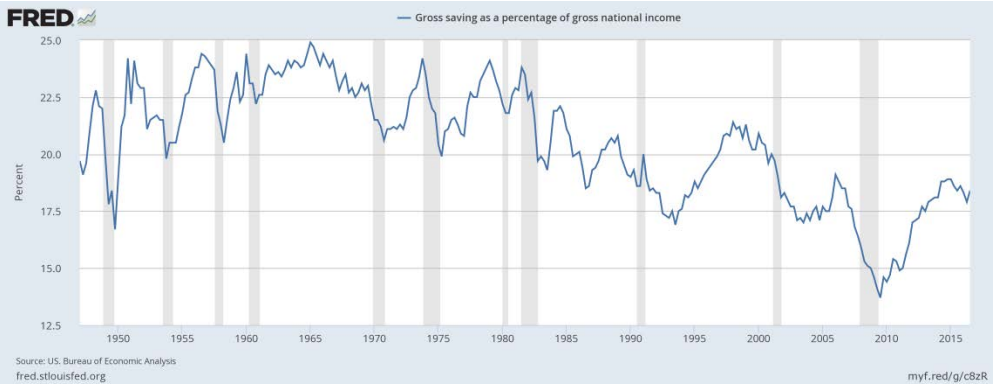
The following data from NIPA or FRED definitions (in billions of current dollars) are not entirely consistent, but Saving Rate per NIPA and FRED are quite close, perhaps differing because of adjustments:

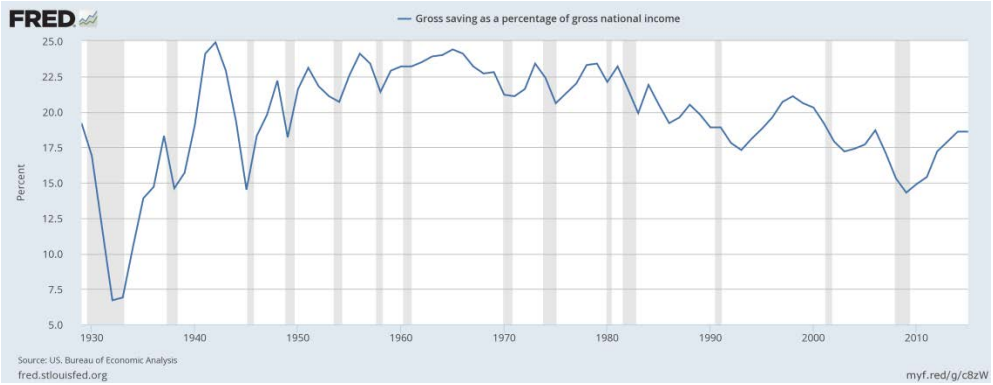
	1 yr. 2015	1 yr. 2014
Net Saving (per NIPA)	616	520
Consumption of Fixed Capital CFC (NIPA)	2831	2,747
Gross Saving: per annual_nipa_revision_2015.pdf & 2016	3447	3267
Gross National Income GNI (per same)	18,496	17,823
Saving rate (per data above)	18.6%	18.3%
Saving rate (per FRED W206RC1Q156SBEA)	**18.6%**	**18.7%**

The following graphs depict the progression of the US percent "saving rate". The top graph is computed for quarter-year intervals for 1947 to 2014 4Q. The bottom graph gives annual values for 1929 to 2015.[161] FRED terms this as "Gross saving as a percentage of gross national income"[162] and presumably uses the same relationship as defined in the NIPAs.

[160] Saving Rate: • https://www.bea.gov/national/pdf/nipaguid.pdf
or https://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf

[161] https://fred.stlouisfed.org/series/W206RC1A156NBEA#0





It is apparent that this US gross saving rate has been falling but is averaging around 17-18% in recent years. This compares unfavorably to many other countries:

Country	FRED 2015 as of 7/29/2016	Economy Watch 2015 as of 6/30/2016[163]	CIA: The World Factbook: Rank: Gross National Savings (2015 est.)[164] plus GDP Per Capita PPP in thousands on the right	
USA	18.6%	18.7%	94: 19.1%	GDPPCPPP: 56.1
Japan		25.3%	50: 25.3%	GDPPCPPP: 38.1
Germany		27.3%	41: 27.7%	GDPPCPPP: 47.0
China		46.0%	2: 47.9%	GDPPCPPP: 14.3

To sum, GDP Growth "comes from capital accumulation (a higher saving rate) and technological progress (the improvement in the state of technology)."[165]

The US Social Security system is not fully funded, has become a **pay-as-you-go system**, and is partly responsible for the low US saving rate. Contributions have exceeded benefits since the early 1980s. A move to a **fully funded system** will need to occur slowly. The non-partisan **Concord Coalition**, "a nationwide, non-partisan, grassroots organization advocating generationally responsible fiscal policy", has much to say about improving the Social Security system.[166]

---

[162] Gross saving as a percentage of gross national income (W206RC1Q156SBEA): https://fred.stlouisfed.org/series/W206RC1Q156SBEA

[163] http://www.economywatch.com/economic-statistics/economic-indicators/Gross_National_Savings_Percentage_of_GDP/

[164] https://www.cia.gov/library /publications/the-world-factbook/rankorder/2260rank.html

[165] Instructor_Pearson_File_7e_PPT_10.pptx

[166] http://www.concordcoalition.org/issue-page/social-security

GDP: Real vs. Nominal

For Nominal GDP, see also *Gross Domestic Product (GDP)*, including a table of nominal GDP values.

Real GDP (aka **GDP in terms of goods**, **GDP in constant dollars**, **GDP adjusted for inflation**, **GDP in chained 2009 dollars**, or **GDP in 2009 dollars**) is expressed in inflation-adjusted constant dollars. These are obtained by comparison of the purchasing power of current dollars to the purchasing power of dollars in a **base** or **reference year** (currently **chained 2009 dollars**), thus adjusting for price changes.[167] The calculation is complicated by the fact that the goods purchased may have evolved in capability and quality, so they are not always exactly comparable. (See also *Hedonic Pricing*).

Using *ME7* symbols, Real GDP Y_t is given by:

$Y_t = \$Y_t / P_t$,

where

$\$Y_t$ is nominal GDP (in current dollars) at time t

P_t is the **GDP Deflator**

Equivalently, Nominal GDP $\$Y_t = Y_t \bullet P_t$.

Annual 2016 US nominal (current dollars) GDP was 18,567 billion in current dollars, whereas real annual 2016 GDP was 16,660 in billions of chained 2009 dollars.[168]

Blanchard and others appear to imply Real GDP when the type of "GDP" is not specified,[169] especially when it is expressing growth.

Nominal GDP growth may appear impressive (as with Venezuela 2000 to 2010) but corrected for high inflation, real GDP may be nearly unchanged.[170]

[167] See *GDP Deflator* for more about the methodology, also Instructor_Pearson_File_7e_PPT_02.pptx
[168] https://www.bea.gov/newsreleases/national/gdp/2017/pdf/gdp4q16_adv.pdf
[169] *ME7* p. 26; Instructor_Pearson_File_7e_PPT_02.pptx
[170] lecture1.pptx

The next table lists the most recent % changes available (through 2016 4Q, 1st estimate) in Real (inflation-adjusted) GDP (i.e., GDP Growth). The data are also seasonally adjusted and expressed as annualized flow rates:[171]

Bureau of Economic Analysis

Table 1.1.1. Percent Change From Preceding Period in Real Gross Domestic Product

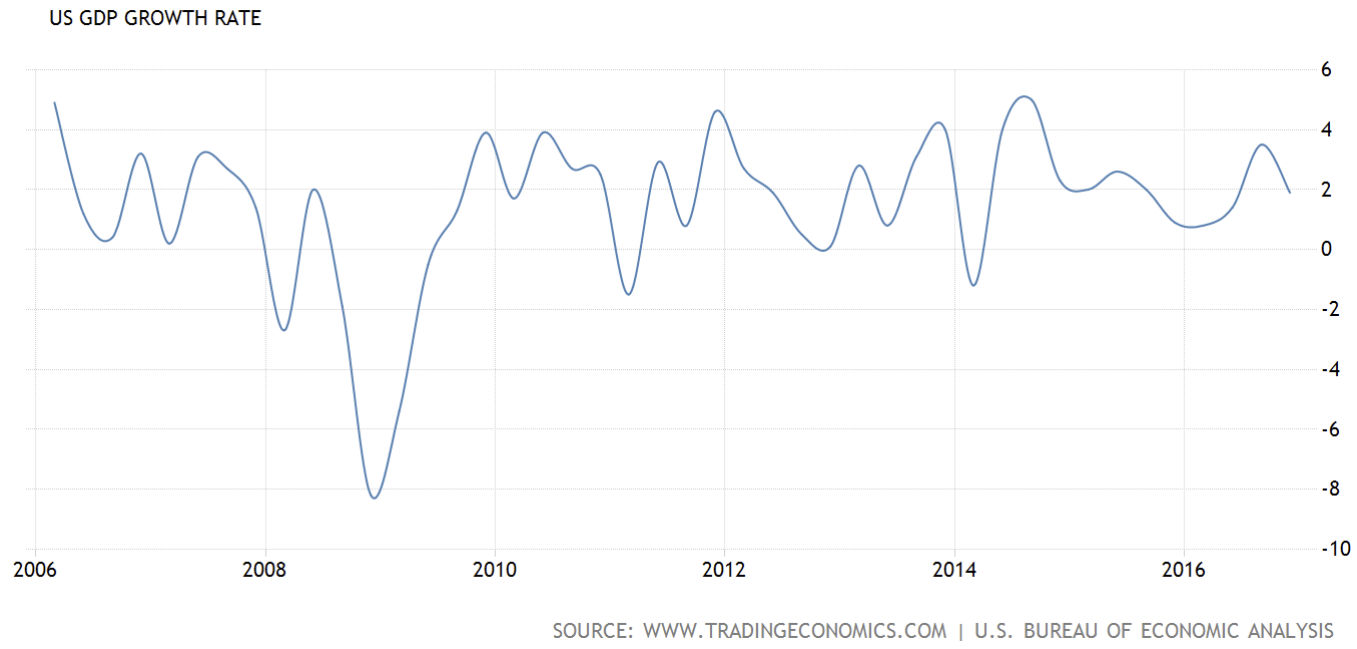
[Percent] Seasonally adjusted at annual rates

Last Revised on: January 27, 2017 - Next Release Date February 28, 2017

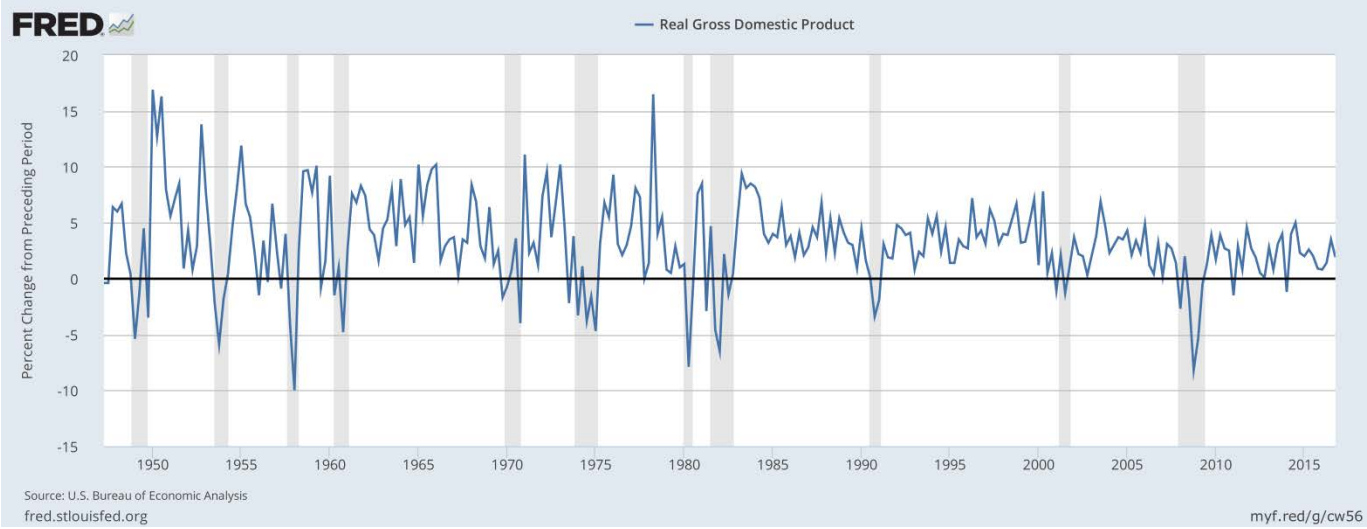
Line		2014 I	2014 II	2014 III	2014 IV	2015 I	2015 II	2015 III	2015 IV	2016 I	2016 II	2016 III	2016 IV
1	**Gross domestic product**	**-1.2**	**4.0**	**5.0**	**2.3**	**2.0**	**2.6**	**2.0**	**0.9**	**0.8**	**1.4**	**3.5**	**1.9**
2	**Personal consumption expenditures**	**1.9**	**3.8**	**3.7**	**4.6**	**2.4**	**2.9**	**2.7**	**2.3**	**1.6**	**4.3**	**3.0**	**2.5**
3	Goods	2.4	6.7	4.3	5.1	2.7	4.3	4.2	2.1	1.2	7.1	3.5	5.2
4	Durable goods	4.6	13.0	8.7	8.5	4.1	7.6	6.2	4.0	-0.6	9.8	11.6	10.9
5	Nondurable goods	1.4	3.8	2.3	3.5	1.9	2.7	3.2	1.2	2.1	5.7	-0.5	2.3
6	Services	1.7	2.3	3.4	4.3	2.3	2.2	2.0	2.3	1.9	3.0	2.7	1.3
7	**Gross private domestic investment**	**-6.6**	**11.2**	**8.9**	**2.6**	**9.9**	**1.0**	**2.0**	**-2.3**	**-3.3**	**-7.9**	**3.0**	**10.7**
8	Fixed investment	5.3	7.2	7.4	1.3	3.7	4.3	5.7	-0.2	-0.9	-1.1	0.1	4.2
9	Nonresidential	7.0	6.1	8.3	-1.1	1.3	1.6	3.9	-3.3	-3.4	1.0	1.4	2.4
10	Structures	25.1	7.4	-2.7	4.1	-12.3	-2.7	-4.3	-15.2	0.1	-2.1	12.0	-5.0
11	Equipment	0.3	6.5	15.2	-8.9	9.3	-0.3	9.1	-2.6	-9.5	-2.9	-4.5	3.1
12	Intellectual property products	4.9	4.5	7.1	7.8	0.8	8.0	2.1	4.6	3.7	9.0	3.2	6.4
13	Residential	-1.4	11.7	3.6	11.4	13.3	14.9	12.6	11.5	7.8	-7.7	-4.1	10.2
14	Change in private inventories	---	---	---	---	---	---	---	---	---	---	---	---
15	**Net exports of goods and services**	---	---	---	---	---	---	---	---	---	---	---	---
16	Exports	-2.7	8.7	2.1	4.5	-5.8	2.9	-2.8	-2.7	-0.7	1.8	10.0	-4.3
17	Goods	-7.3	10.7	4.4	3.8	-10.1	4.6	-3.1	-4.6	0.1	1.7	14.4	-6.9
18	Services	7.9	4.7	-2.8	6.0	3.8	-0.4	-2.3	1.0	-2.2	1.9	2.0	0.9
19	Imports	4.9	9.9	-1.2	11.2	5.6	2.9	1.1	0.7	-0.6	0.2	2.2	8.3
20	Goods	5.7	10.7	-1.4	11.7	6.8	3.4	-0.1	0.7	-1.3	0.0	0.5	10.9
21	Services	1.2	6.3	0.1	8.8	-0.2	0.2	6.9	0.7	2.5	1.1	9.8	-2.7
22	**Government consumption expenditures and gross investment**	**-1.0**	**0.1**	**2.5**	**-0.4**	**2.6**	**3.2**	**1.9**	**1.0**	**1.6**	**-1.7**	**0.8**	**1.2**
23	Federal	-0.2	-2.8	3.9	-6.0	1.9	0.2	1.0	3.8	-1.5	-0.4	2.4	-1.2
24	National defense	-5.0	-3.2	4.0	-11.6	-0.4	-0.5	-1.2	4.4	-3.2	-3.2	2.0	-3.6
25	Nondefense	8.3	-2.0	3.9	3.5	5.4	1.1	4.2	2.8	0.9	3.8	3.0	2.3
26	State and local	-1.5	2.0	1.6	3.3	3.0	5.1	2.5	-0.6	3.5	-2.5	-0.2	2.6
	Addendum:												
27	Gross domestic product, current dollars	0.6	6.3	6.7	2.8	2.1	4.9	3.2	1.8	1.3	3.7	5.0	4.0

[171] https://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&903=1 , also https://www.bea.gov/scb/ in the BEA's *Survey of Current Business*

The following graph shows smoothed real annualized GDP % growth rate for the past 10 years through 2016 4Q (1st estimate).[172]



The next graph shows % change in Real GDP on a quarterly basis and at seasonally adjusted annualized rates from 1947 to 2016 4Q (1st estimate). The shaded regions are periods of recession: [173]



The levels of Real GDP are often represented by Y_t. Real GDP Growth Rate may be represented as y_t[174] or g_y. Real GDP growth (i.e., % change) from 1947 to 2016 4Q is shown in the preceding graph. GDP Growth has been mostly positive, representing periods of **Expansion**.[175] **Recessions** represent periods of negative GDP growth, but for a more precise definition of recession, see *Recession*.

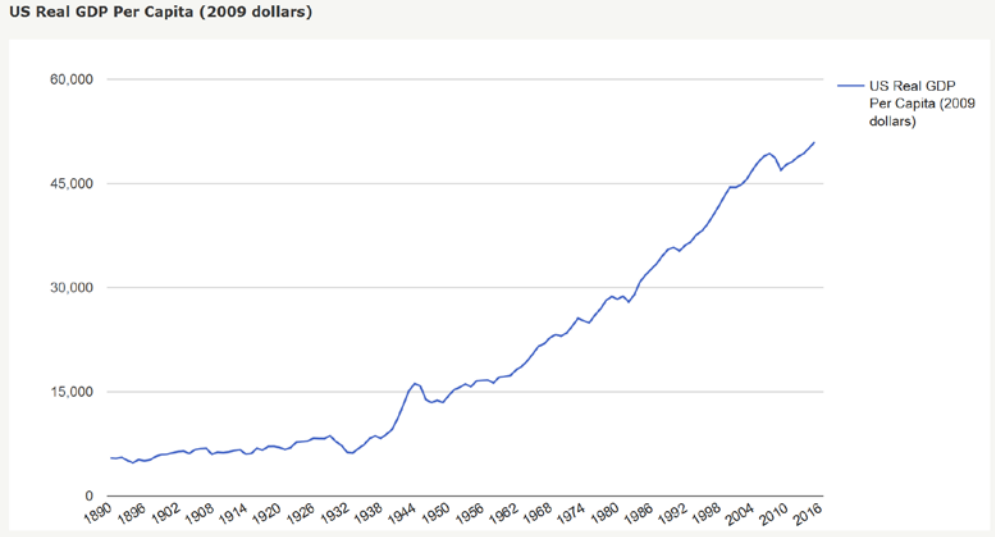
GDP growth as of time t is expressed typically in % as $100 \bullet (Y_t - Y_{t-1}) / Y_{t-1}$, annualized if the interval is not one year, often seasonally adjusted as well.

The **Great Recession of 2007-2009** is seen in the graph above (last grey band), as well as lesser recessions in 1958, 1973–75, and the early 1980's, etc.

---

[172] http://www.tradingeconomics.com/united-states/gdp-growth
[173] https://fred.stlouisfed.org/series/A191RL1Q225SBEA
[174] Lecture1.pptx
[175] http://www.tradingeconomics.com/united-states/gdp-growth

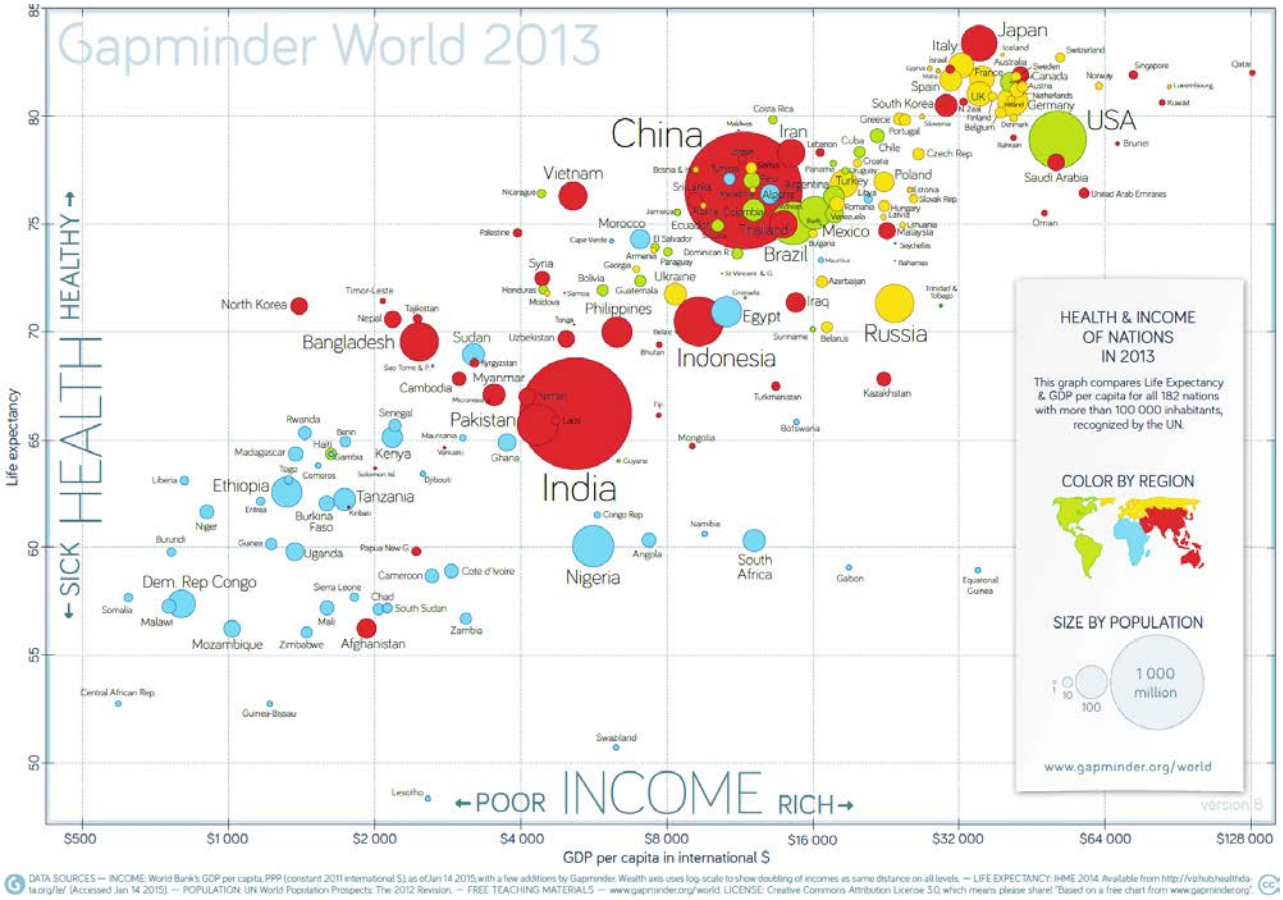
The historical view of real GDP per capita shows fairly steady long-term growth since 1890 with a comparatively modest dip in the Great Depression and WWII wartime rebound, and a boom and lesser dip in the recent Great Recession[176]



[176] https://www.measuringworth.com/graphs/graph_1.php
See also *ME7* p. 200 for similar graph.

Health versus Income, World 2013

The following graph[177] depicts the trend in improved health with increasing income. Circle size is proportional to population:



Hedonic Pricing

"The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes.

It can be used to estimate economic benefits or costs associated with:

- environmental quality, including air pollution, water pollution, or noise
- environmental amenities, such as aesthetic views or proximity to recreational sites

The basic premise of the hedonic pricing method is that the price of a marketed good is related to its characteristics, or the services it provides. For example, the price of a car reflects the characteristics of that car—transportation, comfort, style, luxury, fuel economy, etc. Therefore, we can value the individual characteristics of a car or other good by looking at how the price people are willing to pay for it changes when the characteristics change. The hedonic pricing method is most often used to value environmental amenities that affect the price of residential properties."[178]

[177] http://www.gapminder.org/posters/gapminder-world-2013/

[178] http://www.ecosystemvaluation.org/hedonic_pricing.htm also, *ME7* p. 27

Inflation and Price Levels

Inflation is a sustained rise in the general level of prices as expressed by a time-dependent measure of **Price Level**, $\mathbf{P_t}$. The **inflation rate** is the rate (usually given in %) at which the price level rises during a specified time interval, and is a positive rate for inflation. Inflation rate may thus be expressed in % as $\mathbf{100\ (P_t - P_{t-1})/P_{t-1}}$ for a specified time interval Δt, or $\mathbf{100}\ \Delta P_t/P_{t-1}$ for specified Δt.

Sustained decrease in Price Level [$100\ (P_t - P_{t-1})/P_{t-1} < 0$ for multiple intervals Δt] is called **Deflation** and corresponds to a negative rate of inflation. Price Level P_t is expressed as either (1) **GDP Deflator** (aka **implicit price deflator**, discussed more under *GDP Deflator*), or (2) **Consumer Price Index CPI**. (after *ME7* p. 31, etc.)

The GDP Deflator differs from the CPI in that

(1) **GDP Deflator** is an index which reflects prices of all new goods and services—or at least a sample of these goods and services that is allowed to vary—and that are domestically produced within the country (not imported). It is a measure of price inflation/deflation with respect to a specific base year, for which the GDP deflator is set equal to 100.

(2) CPI is an index that reflects the prices at a particular time of a representative basket of goods and services purchased by consumers (including some imported goods). The basket is fixed in content from year to year, whereas the CPI Deflator uses a varying sample. CPI is also set to 100 for some reference year or period, such as the period 1982–1984.[179]

Consumer Price Index (CPI): is a measure of price changes in consumer goods and services such as gasoline, food, clothing and automobiles. The CPI measures price change from the perspective of the **purchaser** or **consumer**. U.S. CPI data can be found at the Bureau of Labor Statistics.[180] It may be defined as

$$\mathrm{CPI}_t = \frac{\text{Price (in current period) of specified basket of goods and services in current dollars}}{\text{Price of the same goods and services in reference (base) period dollars}}$$

Currently, the reference period Price (for 1982 - 1984) is arbitrarily set at 100.

The items in the CPI include: [181]

"FOOD AND BEVERAGES (breakfast cereal, milk, coffee, chicken, wine, full service meals, snacks)

HOUSING (**rent** of primary residence, owners' equivalent rent, fuel oil, bedroom furniture)[182]

APPAREL (men's shirts and sweaters, women's dresses, jewelry)

TRANSPORTATION (new vehicles, airline fares, gasoline, motor vehicle insurance)

MEDICAL CARE (prescription drugs and medical supplies, **physicians' services**, eyeglasses and eye care, **hospital services**)

RECREATION (televisions, toys, pets and pet products, sports equipment, **admissions**);

EDUCATION AND COMMUNICATION (**college tuition**, postage, telephone services, computer software and accessories);

OTHER GOODS AND SERVICES (tobacco and smoking products, haircuts and other **personal services**, funeral expenses).

---

[179] https://ntueconomics.wordpress.com/2007/10/02/differences-between-gdp-deflator-and-consumer-price-index/ https://en.wikipedia.org/wiki/GDP_deflator
(note: http://www.econport.org/content/handbook/Inflation/Price-Index/CPI/Differences.html states this incorrectly)

[180] https://www.bls.gov/cpi/

[181] http://www.bls.gov/cpi/cpifaq.htm

[182] **CPI and Owned vs. Rented Housing**: "Housing units are not in the CPI market basket. Like most other economic series, the CPI views housing units as capital (or investment) goods and not as consumption items. Spending to purchase and improve houses and other housing units is investment and not consumption. **Shelter**, the service the housing units provide, is the relevant consumption item for the CPI. The cost of shelter for renter-occupied housing is **rent**. For an owner-occupied unit, the cost of shelter is the **implicit rent** that owner occupants would have to pay if they were renting their homes [called **Owners' equivalent rent of primary residence (OER)**]." www.bls.gov/cpi/cpifacnewrent.pdf

Also included within these major groups are various government-charged user fees, such as water and sewerage charges, auto registration fees, and vehicle tolls. In addition, the CPI includes taxes (such as **sales and excise taxes**) that are directly associated with the prices of specific goods and services.

The CPI **excludes taxes (such as income and Social Security taxes)** not directly associated with the purchase of consumer goods and services.... The CPI does not include financial investment items, such as stocks, bonds, real estate, and life insurance. (These items relate to saving and not to day-to-day consumption expenses.)"

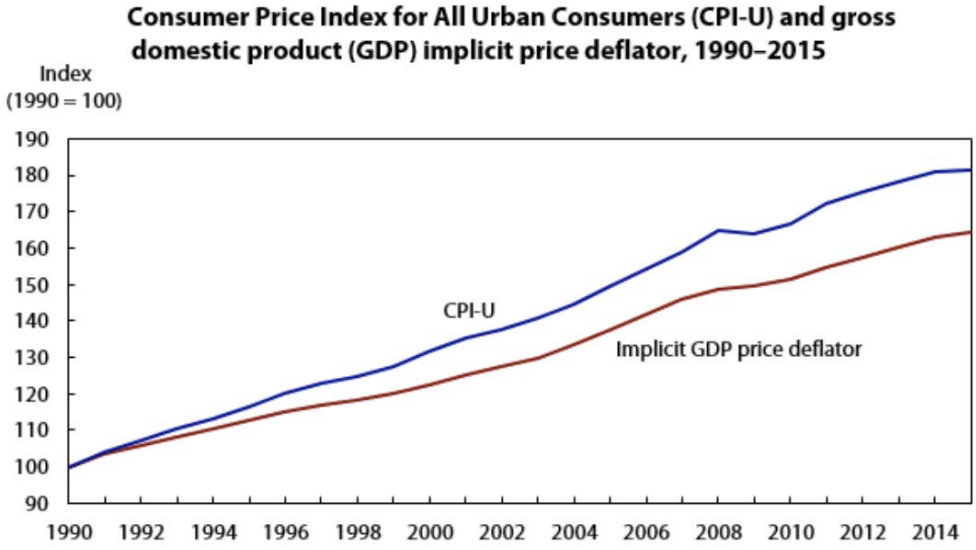
Producer Price Indexes (PPI) - A family of indexes that measure the average change over time in selling prices by **domestic producers** of goods and services. PPIs measure price change from the perspective of the seller. U.S. PPI data can be found at the Bureau of Labor Statistics...

In the long run, the various PPIs and the CPI show a similar rate of inflation. This is not the case in the short run, as PPIs often increase before the CPI. In general, investors follow the CPI more than the PPIs."[183]

The **time rate of change of price level is the rate of inflation**, given as a percent by[184]

$$\pi_t = 100\,(P_t - P_{t-1})/P_{t-1}$$, where t and t-1 represent times separated by a defined period.

The following graph from the Bureau of Labor Statistics compares the two indexes, starting in 1990 when they were both arbitrarily set to 100 for this comparison. "The change in the GDP implicit price deflator is roughly equal to the change in the GDP price index. As shown in [the figure], the GDP implicit price deflator has risen at a systematically lower rate than the CPI-U over time (2 percent annually for the GDP price index and implicit price deflator, versus 2.4 percent annually for the CPI-U [Consumer Price Index for All Urban Consumers]), in part because the CPI-U employs a Laspeyres aggregation while the GDP implicit price deflator employs a Fisher ideal aggregation."[185]

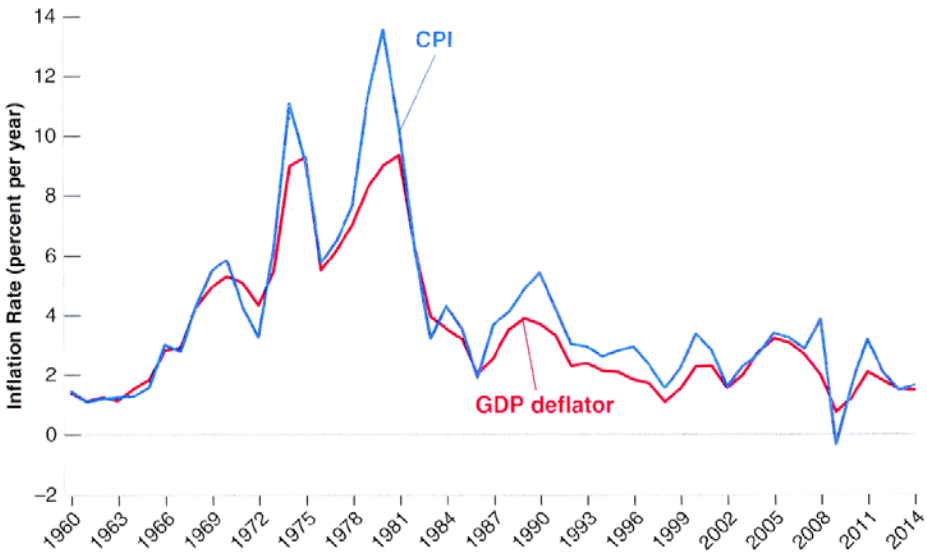


Source: U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis.

The year to year variation in CPI with respect to GDP Deflator, expressed as a percent difference, also shows close but imperfect correlation, with CPI (which includes some imported goods) rising faster than GDP deflator (which includes only goods produced in the US) in years in which the price of imported goods increases relative to the price of goods produced in the US. (*ME7* p. 31)

[183] http://www.investopedia.com/university/inflation/inflation2.asp
[184] Lecture1.pptx
[185] http://www.bls.gov/opub/mlr/2016/article/comparing-the-cpi-with-the-gdp-price-index-and-gdp-implicit-price-deflator.htm

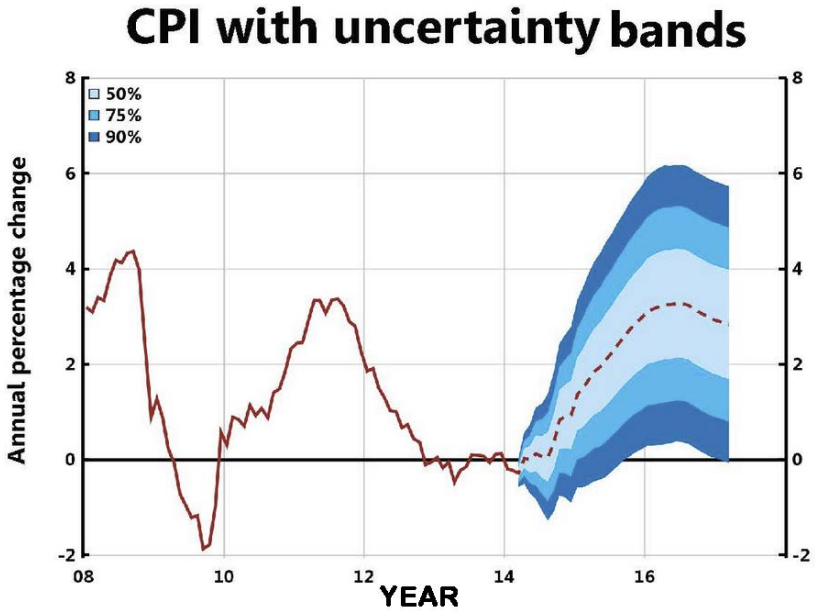
The following graph[186] compares the inflation rate as determined by the CPI vs. the GDP deflator. They appear to move in near-synchrony, but CPI has greater amplitude excursions and generally attains higher % values.



Expected future inflation rate over a designated period (current time t to future time t+1) is given in terms of prices levels by:

$$\pi^{e}_{t+1} = \frac{(P^{e}_{t+1} - P_t)}{P_t}$$

Estimating future inflation can be a very uncertain business. The following diagram depicts the increasingly wide bands of confidence limits applying to ~2.5 years of estimates of future inflation for Sweden, starting at the last known data point (start of 2014), based on the historical past forecasting errors of the Sveriges Riksbank (Sweden's CB).[187] The widest (dark blue) bands enclose the 90% confidence limits, so that a 10% chance exists that the true final value will lie outside these dark blue bands.



[186] Instructor_Pearson_File_7e_PPT_01.pptx

[187] http://newmonetarism.blogspot.com/2016_01_01_archive.html by Stephen Williamson, annotations revised by MCM.

Interest Rates, Real interest versus Nominal interest

This topic is also mentioned at several other locations. For foreign vs. domestic interest, see *Exchange Rates and Interest in Choosing Foreign vs. Domestic Bonds*.

Nominal interest i_t at time t is expressed as interest rate in current dollars (or other national currency). Typically, published interest rates are nominal. Interest i_t on a loan principal λ is typically specified at a starting time t and for a specified period, after which time period, a total of $\lambda (1+ i_t)$ principal plus interest will be owed.

Real interest r_t corrects nominal interest i_t for how the **current price level P_t** compares to the **expected price level P^e_{t+1}** prevailing after one time period into the future, specifically (*ME7* p. 113, see Eq. 6.4). Blanchard states and derives the following:

$$(1 + r_t) = (1 + i_t)\frac{P_t}{P^e_{t+1}} \qquad \text{Eqn. 6.1}$$

$$(1 + r_t) = \frac{(1 + i_t)}{(1 + \pi^e_{t+1})} \qquad \text{Eqn. 6.3}$$

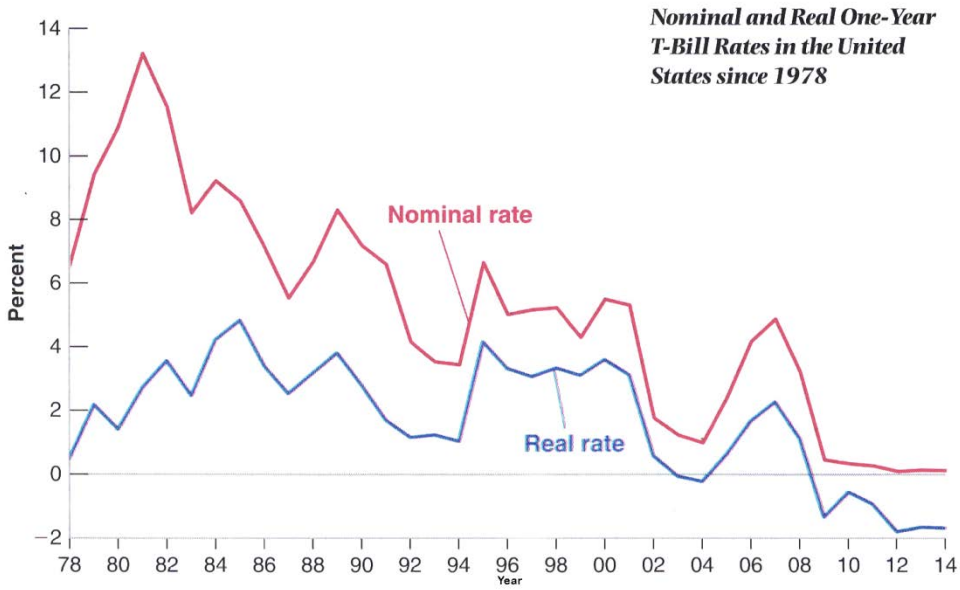
$$r_t \approx i_t - \pi^e_{t+1} \qquad \text{Eqn. 6.4}$$

The real interest rate $(i_t - \pi^e_{t+1})$ is based on **expected** inflation, so it is sometimes called the **ex-ante** ("**before the fact**") **real interest rate**.

The realized real interest rate $(i_t - \pi_{t+1})$ is called the **ex-post** ("**after the fact**") interest rate.

Because i_t cannot be less than 0 and to the extent that the right hand approximation is correct, the real interest rate, which may be negative, cannot be less than (i.e., no more negative) than the negative of expected (typically positive) inflation. (*ME7* p. 114, 115)

A representative graph comparing real interest and nominal interest follows. This is the one-year interest on T-Bills in the US 1978 to 2014:[188]



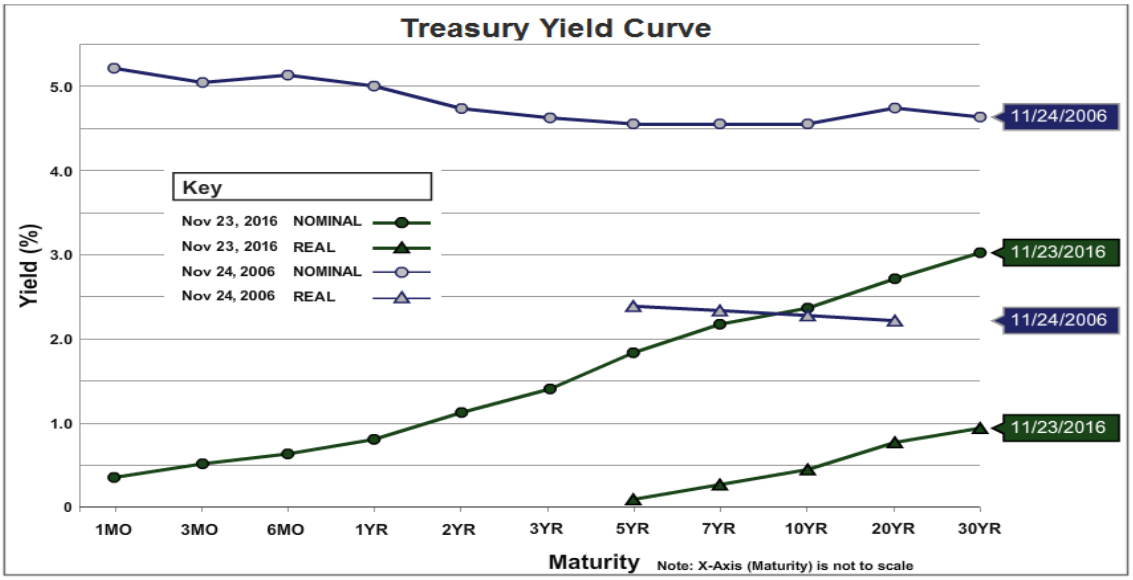
It can be seen that both nominal and real interest rates have declined, but the decline has been to lower percent with real interest. In recent years, nominal interest has been at or near zero, and real interest has been negative, in keeping with the relation $r_t \approx i_t - \pi^e_{t+1}$.

Interest rates for non-risk-free instruments must often build in a **risk premium** (plural: **risk premia**) to reward the lender (bond or stock purchaser, etc.) a higher interest rate or return that *may* compensate the **risk averse** investor for taking on the various causes of increased risk. Types of risk can include **default risk** or **credit risk** (including **business risk** for bonds or stocks), rising overall interest rates (**interest rate risk**), **inflationary risk**, **liquidity risk**, **call risk** and **reinvestment risk** (for bonds),

[188] adapted from *ME7* p. 115 and Instructor_Pearson_File_7e_PPT_06.pptx

currency/exchange rate risk, **social/political/legislative risk**, and other risk in stocks (**market risk** = **systematic risk**, **equity risk**), etc.[189]

As a graphical example of risk premiums for interest bearing securities, the **Treasury Yield Curves** are shown for 11/23/2016 and for 10 years earlier (11/24/2006) for **Treasury bills** (≤1 year maturity), **Treasury notes** (2, 3, 5, and 10 year maturities), and **Treasury bonds** (20 to 30 years).[190] Real yields are shown only for maturities of 5 or more years. These yield curves show how risk premiums were currently required 11/23/2016 on longer term treasury bills and bonds (compare solid circles to solid triangles), but that these market-determined yields vary with time substantially. (In fact, the nominal yield curve for 11/24/2006 show lower nominal yields for longer term bonds, a so-called **Inverted Yield Curve**,[191] sometimes an indicator of a pending recession, but in more recent years may result from high foreign demand.): [192]



The following graphs show Yields on 10-Year U.S. Government Treasury, versus AAA, and BBB Corporate Bonds, since 2000. The maturities on the corporate bonds are not specified. The risk premia is apparent for BBB rated bonds (in red) and AAA (in blue) compared to the lower risk 10-Year U.S. Government Treasury interest rate:[193]

[189] http://www.investopedia.com/exam-guide/finra-series-6/evaluation-customers/types-investment-risks.asp , also *ME7* p. 116

[190] https://en.wikipedia.org/wiki/United_States_Treasury_security (definitions of bill, note, and bond)

[191] http://www.investopedia.com/articles/basics/06/invertedyieldcurve.asp

[192] https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/Historic-Yield-Data-Visualization.aspx

[193] Instructor_Pearson_File_7e_PPT_06.pptx and *ME7* p. 117

International Monetary Fund (IMF)

An organization of 189 countries, "working to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world.... Created in 1945, the IMF is governed by and accountable to the 189 countries that make up its near-global membership."[194]

Investment

Investment definitions vary. In macroeconomics generally and *ME7* (p. G-5) specifically, the term refers to the purchase of new houses and apartments by people, and purchases of new capital goods (machines and plants etc.) by firms.

According to the NIPA 2016 update for GDP,[195] Investment is broken down into

- Gross private [i.e., non-governmental] domestic investment
  - Fixed investment
    - Nonresidential
      - Structures
      - Equipment
      - Intellectual Property, etc.
    - Residential [new houses and apartments etc.]
  - Change in Private Inventories
- Government consumption expenditures and gross investment ...

IS Curve (I-S Curve)

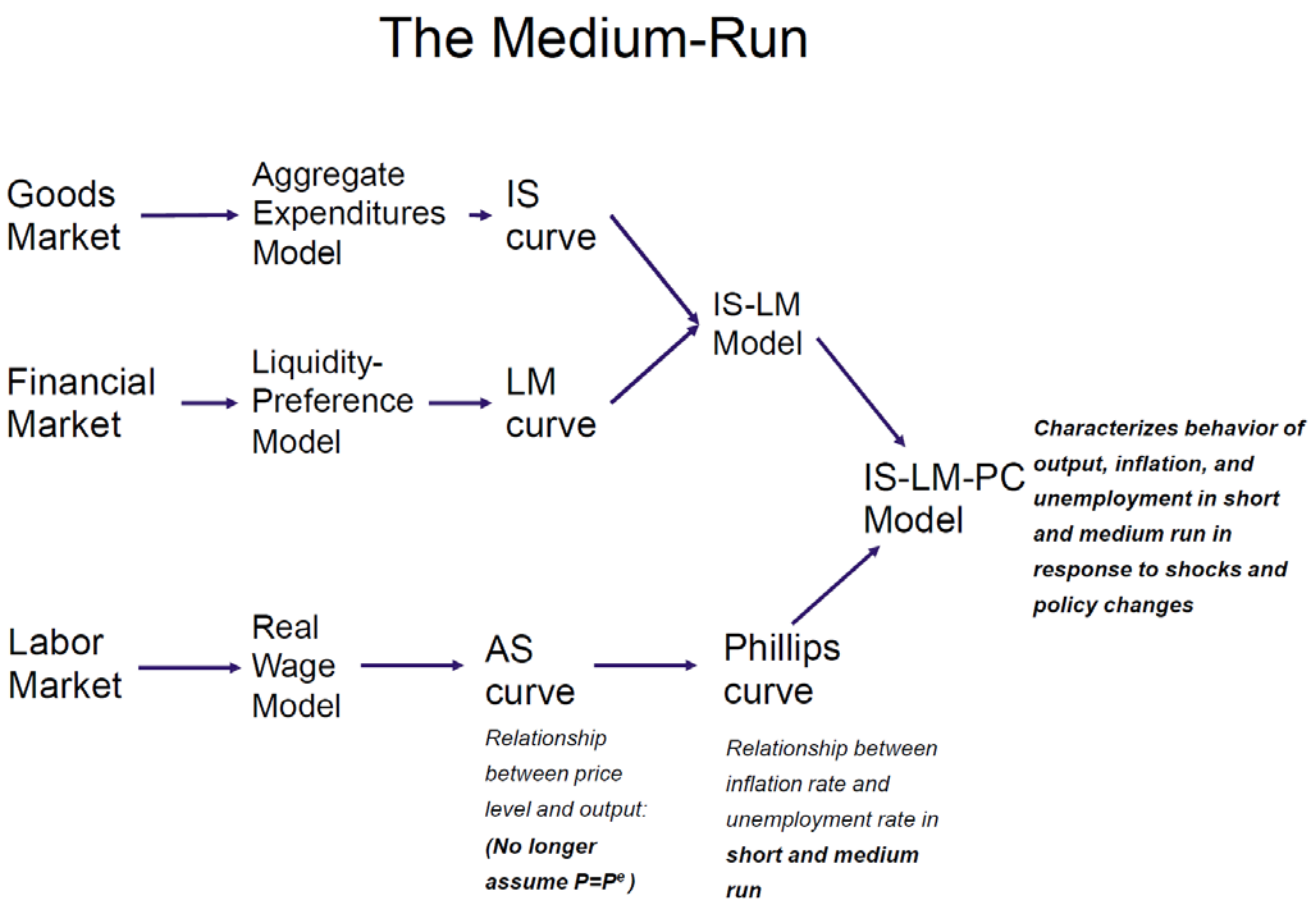
See *Demand for Goods, Equilibrium Goods Output, and I-S Curve*

[194] http://www.imf.org/external/about.htm
[195] http://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf

IS-LM-PC Model

"The IS-LM-PC model characterizes the behavior of output, inflation, and unemployment in short and medium run in response to shocks and policy changes."[196]

The following flow diagram[197] illustrates the relationships between
the IS Curve, LM Curve, and IS-LM Model (best in the short run); and
the AS curve (short and medium run), the Phillips Curve, and the IS-LM-PC model
(suitable for the short and medium run):



The **AS curve** (which relates price level P and output Y as real GDP) is discussed and illustrated under *Demand for Goods, Equilibrium Goods Output, and I-S Curve*, where it is noted to have short, medium, and long run formulations. As noted in the flow chart above, the AS curve relaxes the condition that $P = P^e$ that is imposed in the Real wage model (discussed in *Wage Determination and Natural Rate of Unemployment*).

The **AS curve or AS relation**, connecting P with Y, is given by:

$$P = P^e (1 + m) \bullet F(1 - Y/L, z)$$

Employment factors *z*, markup m, and labor force L provide the parameters which determine the equilibrium point for (P, Y) from the labor market.[198] Assuming the form $F(u , z) = 1 - \alpha u + z)$, where $W = P^e F(u , z)$ (*ME7* p. 159), the AS Curve becomes (*ME7* p. 159):

$$P = P^e (1 + m) \bullet (1 - \alpha u + z) \qquad \text{Eqn. 8.1}$$

Then (derivation not shown)

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t \qquad \text{Eqn. 8.3}$$

where π_t = current actual inflation rate
π_t^e = expected inflation rate.

---

[196] Lecture Ch. 08, quote shown in the flow diagram.
[197] Lecture Ch. 08
[198] Lecture Ch. 08

m = markup by firm, constant
z = employment benefits factor, constant
α = a parameter
u_t = current unemployment rate

Note that this equation 8.3 tells us that ↑π_t^e (**expected inflation)** → ↑π_t (**actual inflation**). ↑inflation → ↑nominal wages (WS, wage setting relation). ↑nominal wages → ↑Prices.

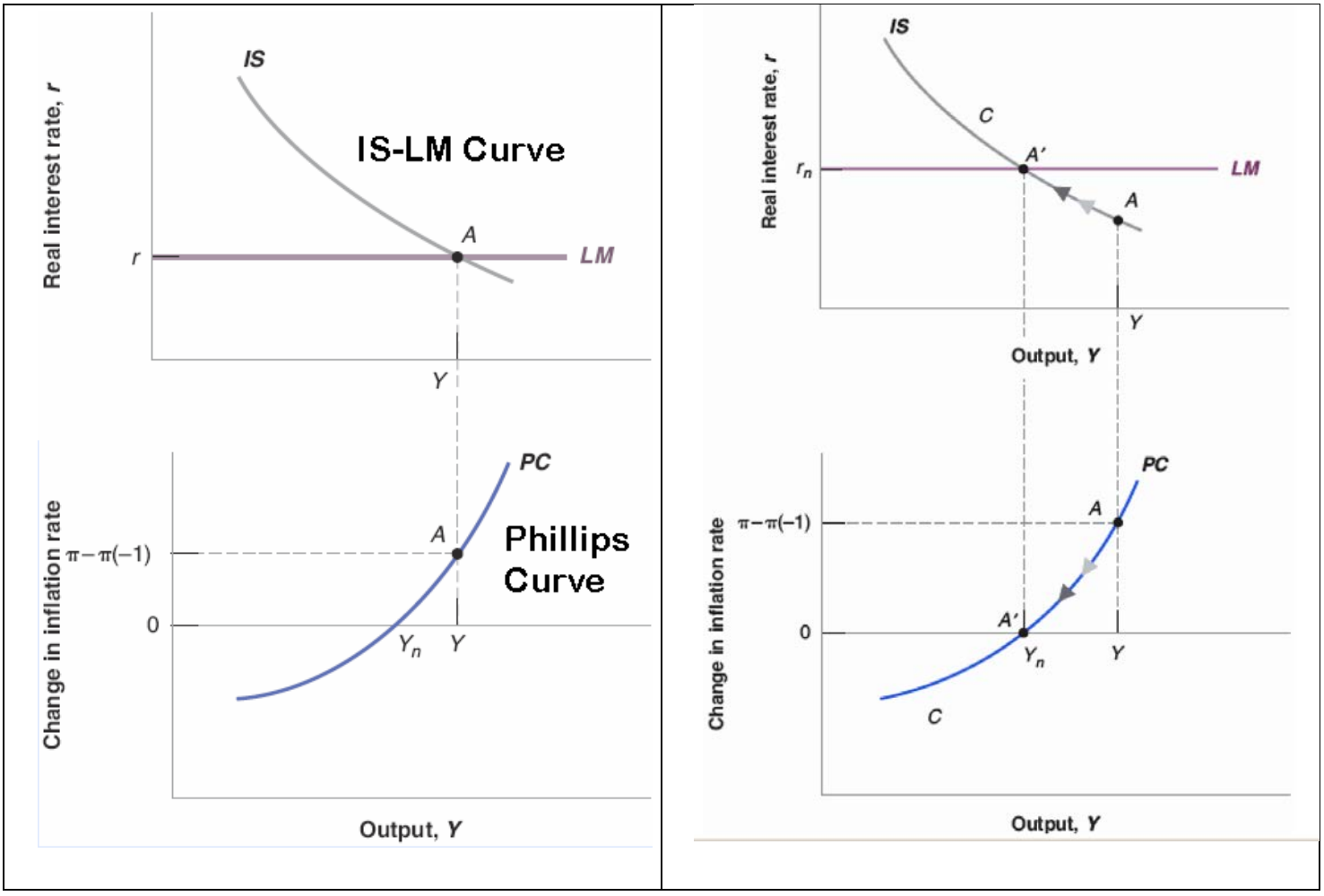
If expected inflation is a "given" (constant, not decreasing), ↑markup m or ↑employment factor z → ↑actual inflation π_t. Higher m seen before encourages firms to set prices higher. ↑z → ↑bargaining power of employees → ↑nominal W and ↑P and ↑π_t.

If expected inflation is a given (not increasing), ↑u_t (unemployment rate) → ↓nominal wages, ↓P, and ↓π_t (inflation).[199]

The negative relationship between change in the inflation rate and unemployment is shown in the revised (Expectations-Augmented) Phillips curve (see *Unemployment and Employment Rate* for details). Empirically, the best fit regression line for actual data relating inflation changes with unemployment for the years 2000 to 2014 is[200]

$$\pi_t = 4.726 - 0.3639u_t$$

with an R^2 of only 0.271 (graph is also shown in *Unemployment and Employment Rate*).



[199] Lecture Ch. 8 and *ME7* p. 158-160, modified slightly MCM
[200] https://en.wikipedia.org/wiki/Phillips_curve#/media/File:U.S._Phillips_Curve_2000_to_2013.png

The IS-LM-PC model, presented in *ME7* chapter 9, unites the good markets, financial market, and labor market. The upper left diagram shows the IS-LM model curves pertaining to the goods and financial markets and real policy interest rate r. Higher investment leads to higher demand and increased output. Lower policy rate r also increases output equilibrium level.

The IS-LM-PC model is useful for analyzing the dynamic impacts and effects of:
(1) **financial shocks or policy changes (such as fiscal consolidation)**;
(2) the **zero lower bound** (on nominal interest) and the **deflationary spiral**; and
(3) an **oil price increase**, etc.

The lower left diagram connects the aggregate output/demand axis of the IS-LM curve with the output Y axis of the revised and recast Phillips curve (i.e., recast in terms of output Y rather than unemployment u, and with changes in inflation rate). Positive changes in inflation rate increase output.[201]

Chapter 8 derives equation 8.10 : $\Delta\pi = \pi_t - \pi_{t-1} = \alpha(u_t - u_n)$ which relates inflation rate (price level changes) to unemployment.

A needed relation is $Y - Y_n = -L \bullet (u - u_n)$

where Y = current output (dropping t index)
Y_n -= **natural level of output** at the natural rate of unemployment u_n (aka **potential output**)
L = labor force
u = current unemployment rate (dropping t index)
u_n = natural rate of unemployment

The revised and recast Phillips curve plotting inflation change against output is given by equation 9.4 (*ME7* p. 179):

$\pi - \pi(-1) = (\alpha/L)\,(Y - Y_n)$ (Eqn. 9.4)

where $\pi(-1) = \pi_{(t-1)}$, the inflation rate for previous period relative to current rate $\pi = \pi_t$
and we assume[202] that $\pi_t^e = \pi_{t-1}$
i.e., that future expected inflation is equal to inflation in the past period

This is the equation that defines the way the Phillips curve as plotted in this section.

The IS-LM-PC model tells us that a low real interest policy rate leads to higher output and this leads to a larger positive change in inflation.

This model also tells us that **when output is above potential** (i.e., the **output gap** $Y - Y_n > 0$-, as shown in the lower right diagram above), the real interest rate r rises and the change in inflation rate decreases toward zero (from that at A to that at A′). **When output is below potential** (the **output gap** $Y - Y_n < 0$), the change in inflation rate increases toward zero. The Phillips curve thus increases with increasing output, and crosses the horizontal axis where $Y = Y_n$, the value of output which stabilizes inflation (change in inflation rate becomes zero). Rephrased, **in the medium run, output is equal to potential output**.

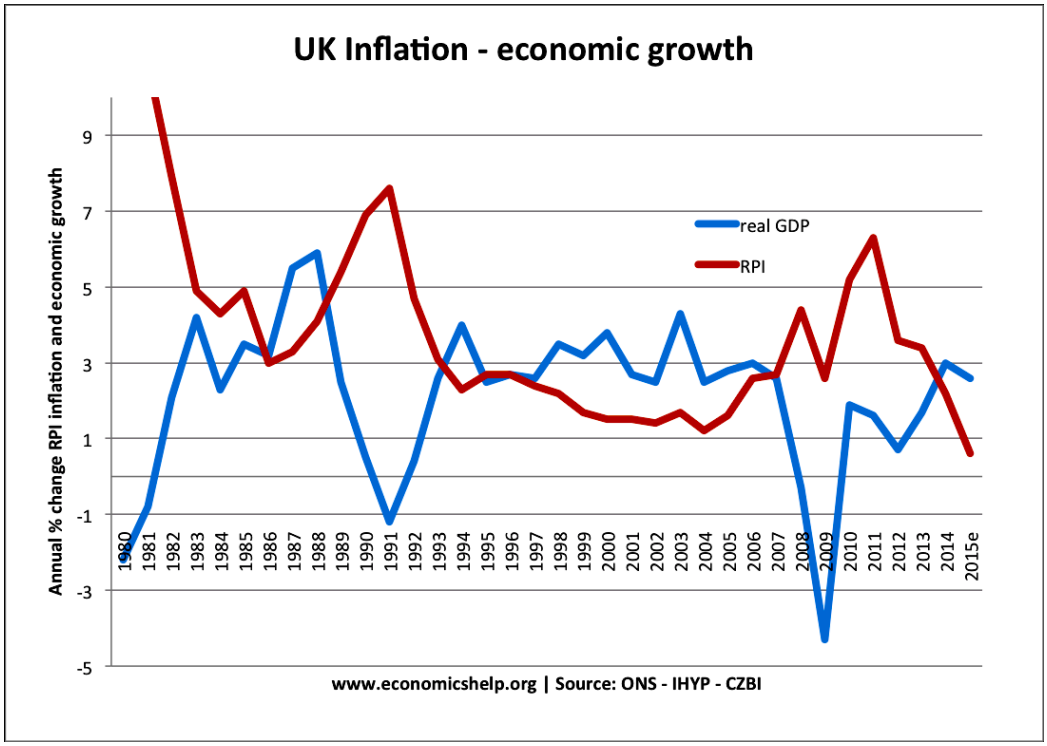
In the left diagrams in equilibrium at point A, $Y > Y_n$, output is above potential, and inflation is increasing. This is a short-run equilibrium. If r does not change over time, inflation continues to increase.

Eventually, perhaps in the **medium run**, real policy interest r will be raised in response to inflation and "overheating" of the economy. In the right diagrams, the new medium run equilibrium is shown at A′, at which $r' = r_n$, where $\mathbf{r_n}$ = the **natural rate of interest** or **neutral rate of interest** or **Wicksellian rate of interest** [after Knut Wicksell 1851 - 1926]. This adjustment is difficult to make precisely by the central bank, because potential output Y_n is not well known, the signal is noisy, and there is a lag in economic response, consumer response, demand response, etc. Thus to attain a stable inflation over the medium run, the initial boom (overheating economy with inflation) may in the short run be followed by an overcorrection and a recession. (*ME7* p. 181-3).

[201] adapted from Lecture 09.pdf
[202] Lecture Ch. 09.pdf and *ME7* p. 179

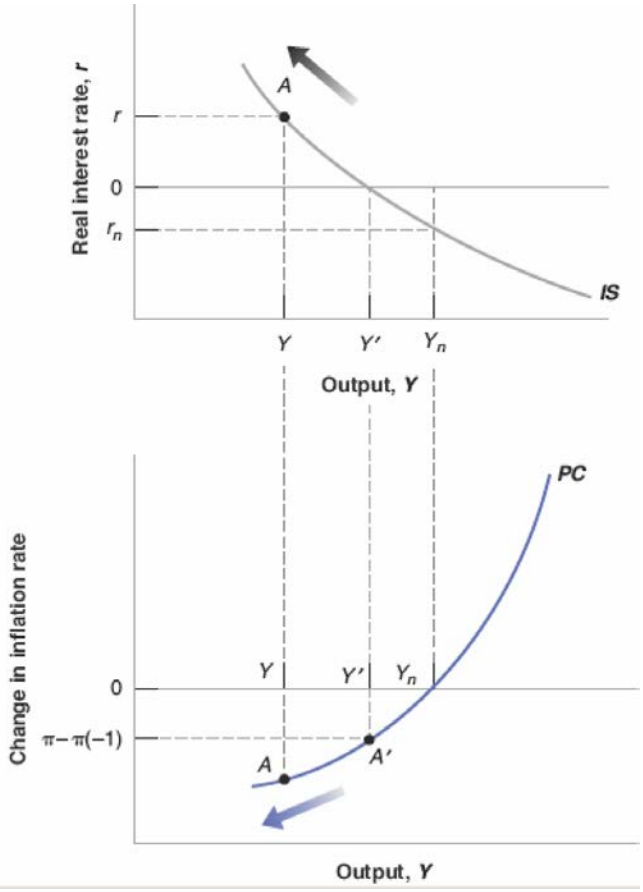
If we assume that inflation will be constant = ($\overline{\pi}$), termed a so-called **anchored inflation expectation**,[203] the central bank may elect to not increase r beyond r_n. [204]

An example of how changes in inflation rate actually varied with changes in real GDP output (economic growth) is given with the following graph from the UK.[205] The ordinate is annual % change in Retail Price Index (RPI, red curve) and real GDP output (thus economic growth, blue curve). RPI is a now deprecated measure of nominal inflation in the price of retail goods and services published monthly by the Office for National Statistics, now effectively superseded by the CPI. There is much noise, but it appears to me by inspection that real GDP growth tends to vary inversely with some of the larger excursions of % inflation change.



[203] **Anchored inflation expectations**, 2 discussions:
(1) "… If inflation over the past year is 1 percentage point higher than expected, the least-squares regression results show that people tend to raise their long-run expectations by some number γ [gamma] of percentage points—for 1983–2011, γ is 0.11… This means that, on average over the period 1983 to 2011, a 1 percentage point surprise in the inflation rate raised long-term inflation expectations by 0.11 percentage points. **The smaller the value of γ, the more anchored are long-run inflation expectations**—if γ is not significantly different from zero, then long-run expectations are perfectly anchored."
http://www.dallasfed.org/research/eclett/2012/el1213.cfm
(2) Fed chairman Ben Bernanke in 2007 said: "Long-run inflation expectations do vary over time. That is, they are not perfectly **anchored** in real economies; moreover, the extent to which they are anchored can change, depending on economic developments and (most important) the current and past conduct of monetary policy. In this context, I use the term '**anchored**' to mean **relatively insensitive to incoming data**. So, for example, if the public experiences a spell of inflation higher than their long-run expectation, but their long-run expectation of inflation changes little as a result, then inflation expectations are well anchored. If, on the other hand, the public reacts to a short period of higher-than-expected inflation by marking up their long-run expectation considerably, then expectations are poorly anchored."
https://www.federalreserve.gov/newsevents/speech/bernanke20070710a.htm
[204] *ME7* p. 183, Instructor_Pearson_File_7e_PPT_09.pptx
[205] http://www.economicshelp.org/blog/3511/economics/is-inflation-caused-by-economic-growth/

Deflationary Spiral: Even if output is too low and the economy is in recession (diagram to right),[206] the Fed (CB) cannot lower nominal interest below zero. (In this diagram, the broad arrows indicate the more adverse direction, not what is actually happening.) This **zero lower bound constraint** can make it impossible to achieve a negative real policy rate r. This constraint could kick in if initial inflation π = 0 and r = 0: the CB can only decrease r to 0 at Y′, but at Y′ output is still below potential Y_n and inflation continues to decrease (the change in inflation becomes negative). This can start a **deflation spiral** or **deflation trap**. If the nominal rate i_t remains 0, the real policy rate r_t increases because ($r_t \cong i_t - \pi^e_{t+1}$) and expected inflation is negative. As r_t rises, demand and output continues to fall. This is a self-reinforcing trend, and the economy steadily worsens. The CB tries to maintain positive inflation to avoid the deflation trap. Japan has experienced a deflation spiral since the early 1990s, after a prolonged price bubble in real estate and stocks in the 1980s.[207]



Great Depression: A Deflation Trap probably happened in the **Great Depression** (**GD**), 1929 to c. 1933, following a **boom** in asset prices which preceded the GD in the 1920s. "Between 1929 and 1932, worldwide GDP fell by an estimated 15%. By comparison, worldwide GDP fell by less than 1% from 2008 to 2009 during the Great Recession."[208]

The **collapse of the US stock market** on October 29, 1929 was accompanied by a shock propagating throughout the banking system, leading to a severe worldwide depression.

Regarding the Great Depression, "The consensus among demand-driven theories is that a large-scale loss of confidence led to a sudden reduction in consumption and investment spending. Once panic and deflation set in, many people believed they could avoid further losses by keeping clear of the markets. Holding money became profitable as prices dropped lower and a given amount of money bought ever more goods, exacerbating the drop in demand. Monetarists believe that the Great Depression started as an ordinary recession, but the **shrinking of the money supply** greatly exacerbated the economic situation, causing a recession to descend into the Great Depression… Economists and economic historians are almost evenly split as to whether the traditional monetary explanation that monetary forces were the primary cause of the Great Depression is right, or the traditional Keynesian explanation that a **fall in autonomous spending, particularly investment**, is the primary explanation for the onset of the Great Depression. Today the controversy is of lesser importance since there is mainstream support for the debt deflation theory and the expectations hypothesis that building on the monetary explanation of Milton Friedman and Anna Schwartz **add non-monetary explanations**… There is consensus that **the Federal Reserve System should have cut short the process of monetary deflation and banking collapse**. If the Fed had done that the economic downturn would have been far less severe and much shorter."[209]

The table below[210] shows for the Great Depression era: the Year; Unemployment u (which markedly increased); real GNP per capita and GNP Growth Rate (both of which substantially decreased, reflecting very low investment demand and consumption); GNP Deflator including Price Levels (which

---

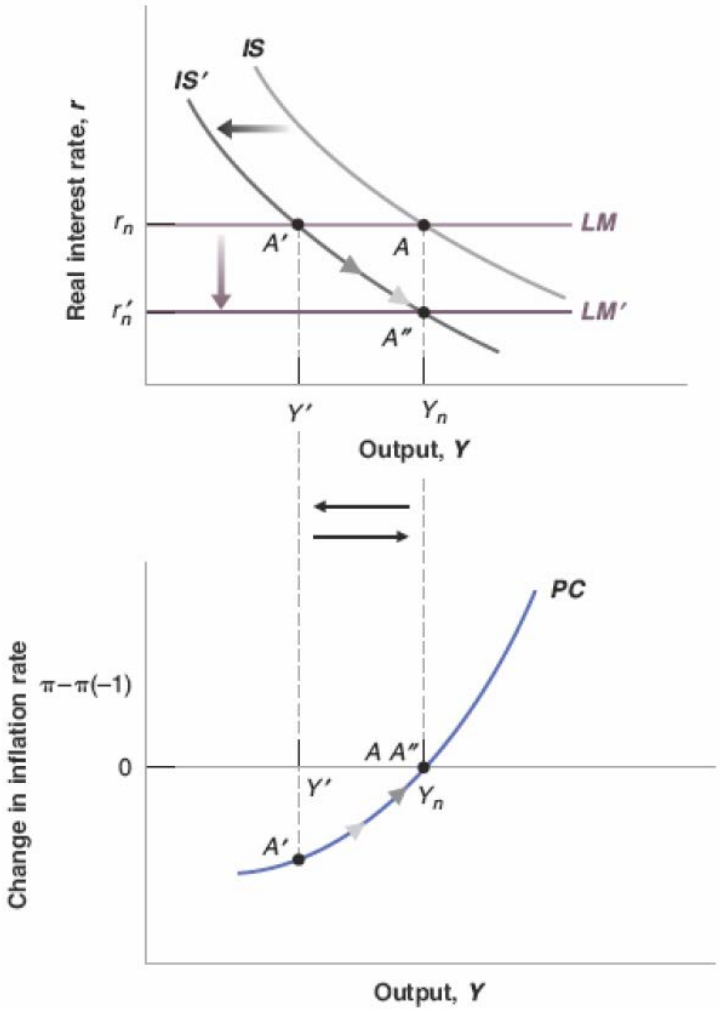
[206] diagram from Lecture Ch. 09.pdf; comments per ME7 p. 181-185, and https://www.stlouisfed.org/~/media/Files/PDFs/Great-Depression/the-great-depression-wheelock-overview.pdf etc.
[207] https://en.wikipedia.org/wiki/Deflation
[208] https://en.wikipedia.org/wiki/Great_Depression
[209] ibid.
[210] https://www.reed.edu/economics/parker/f10/201/cases/depression.html, adapted by MCM with addition of Real interest data from *ME7* p. 185.

decreased) and Inflation Rate (which decreased markedly to negative values); and nominal Interest Rates (which decreased only modestly, mostly in shorter term instruments). I have added Real one-year interest rates on the right, which depict the high cost of borrowing faced by struggling persons and firms. By 1933, the economy appeared to be in a deflation trap. By 1934, deflation gave way to inflation and a decrease in real interest rate r, and the economy began to recover. What allowed the deflation to end is debated and politically controversial, though an increase in money supply, a temporary **bank holiday**, **FDIC insurance**, a **minimum wage**, and **other New Deal policies** surely helped, along with the onset of **WWII**.

Year	Unemployment Rate (%)	Per-capita real GNP (1958 prices)		GNP deflator (1958 = 100)		Interest rates (% per year)			r = % Real One-Year Interest
		Level	Growth Rate	Price level	Inflation rate	Prime 4-6 month commercial paper	3-month Treasury bills	30-year corporate bonds	
1925	3.2	1,549	6.83%	51.9	1.37%	4.02%	NA	4.50%	
1926	1.8	1,619	4.52%	51.1	-1.54%	4.34%	NA	4.40%	
1927	3.3	1,594	-1.54%	50.0	-2.15%	4.11%	NA	4.30%	
1928	4.2	1,584	-0.63%	50.8	1.60%	4.85%	NA	4.05%	
1929	3.2	1,671	5.49%	50.6	-0.39%	5.85%	NA	4.42%	5.3 %
1930	8.7	1,490	-10.83%	49.3	-2.57%	3.59%	NA	4.40%	6.9 %
1931	15.9	1,364	-8.46%	44.8	-9.13%	2.64%	1.40%	4.10%	12.3 %
1932	23.9	1,154	-15.40%	40.2	-10.27%	2.73%	0.88%	4.70%	14.8 %
1933	24.9	1,126	-2.43%	39.3	-2.24%	1.73%	0.52%	4.15%	7.8 %
1934	21.7	1,220	8.35%	42.2	7.38%	1.02%	0.26%	3.99%	
1935	20.1	1,331	9.10%	42.6	0.95%	0.75%	0.14%	3.50%	
1936	16.9	1,506	13.15%	42.7	0.23%	0.75%	0.14%	3.20%	
1937	14.3	1,576	4.65%	44.5	4.22%	0.94%	0.45%	3.08%	
1938	19.0	1,484	-5.84%	43.9	-1.35%	0.81%	0.05%	3.00%	
1939	17.2	1,598	7.68%	43.2	-1.59%	0.59%	0.02%	2.75%	
1940	14.6	1,720	7.63%	43.9	1.62%	0.56%	0.01%	2.70%	
1941	9.9	1,977	14.94%	47.2	7.52%	0.53%	0.13%	2.65%	

Source: *Historical Statistics of the United States, Colonial Times to 1970* (Washington, DC: United States Bureau of the Census, 1975).

- has been previously evaluated in the short term (see *Demand for Money, LM Curve, and IS-LM Model*).
- The IS-LM-PC model allows extension to the medium run. See diagram[211] to right, for which the economy starts with output at the natural rate.
- When **fiscal consolidation** is adopted (reduction of (G – T) perhaps by raising T and thus **reducing the budget deficit**), the short term response as previously mentioned is a shift of the IS curve to the left causing a **reduction of output** to Y′ without a change in interest rates (LM curve), causing a recession with **decreased demand** and consumption and decreased investment. Inflation decreases to 0 at Y′.
- But in the medium run, the **CB will lower r_n to r_n'**, the economy moves down the IS curve to a new equilibrium at A″ which takes us back to the original Y_n output in this idealized diagram. Inflation rises back per the Phillips Curve, and becomes stable. At this point, a lower policy rate r_n' is needed. The decrease in consumption is offset by an increase in Investment, so demand is unchanged. Unlike the short term prospects, **fiscal consolidation is attractive in the medium run**.



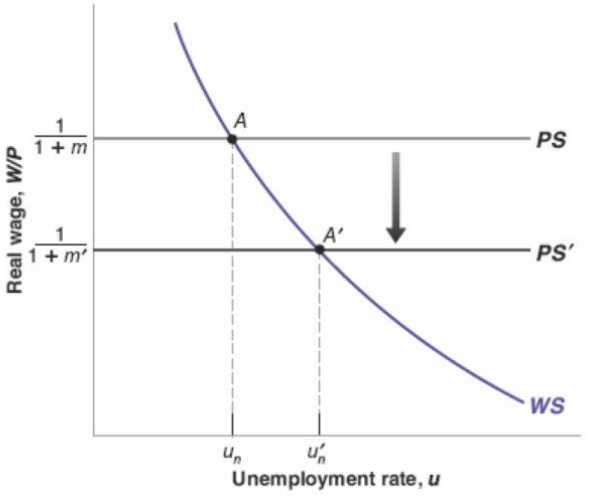
- "The proper combination of fiscal and monetary policy can achieve the [desired] medium-run equilibrium outcome [even] in the short run." (*ME7* p. 187) This may not be possible if the zero lower bound problem is encountered.

[211] from Chapter 09.pdf

Oil Price Shock

Shocks to the economy can take different forms and the **propagation mechanisms** can differ.

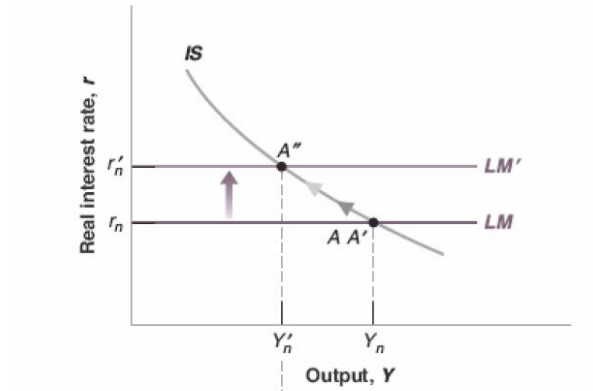
A shock to the economy that reduces supply, demand and output can include an Oil Price Shock. (See diagrams to right)[212] Oil is a major input in production, and increased price reduces demand and potential output. The shocks were caused: by OPEC in the 1970s, and by increased Chinese demand in the 2000s. The shock causes not just a marked increase in the nominal oil price $Oil but also the real oil price index $Oil/P where P = CPI.



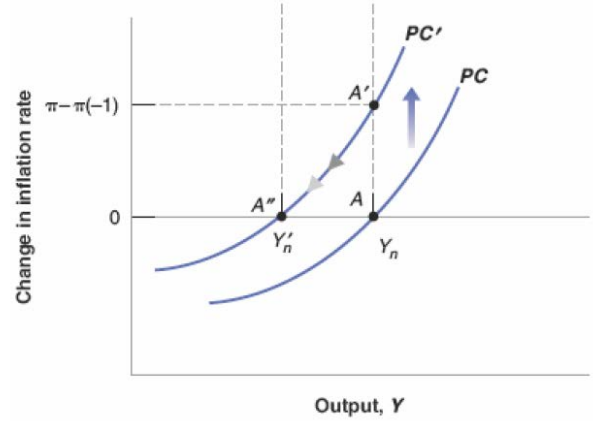
The impact of an oil shock can be modelled, in the existing framework presented for the short run in the textbook, as an **increase in the markup m** in the price over the nominal wage. The rationale is that given fixed wages, an increase in $Oil increases the cost of production, forcing firms to increase prices to maintain the same profit rate. (See price-setting relation depicted in *Wage Determination and Natural Rate of Unemployment*.) When ↑m, a new equilibrium value at A′ occurs as the price-setting line PS shifts downward to PS′ (top diagram to right). This leads to ↑**natural rate of unemployment** to $\mathbf{u_n'}$. **Real wages W/P** decrease because the Price Setting line PS moves to PS′ where

$$W/P = 1/(1+m').$$

The higher m goes up, the further real wage W/P decreases. **Unemployment** increases to $\mathbf{u_n'}$. Correspondingly, natural employment decreases, causing a **decrease in potential output** $\mathbf{Y_n'}$.



In the IS-LM-PC model and diagram (middle and bottom diagrams to right), output Y_n decreases to Y_n'. In the short run, the PC curve shifts up, increasing inflation, and firms increase their prices, but output does not change. But in the medium run, the CB will increase r to stabilize inflation. Output decreases to Y_n' at the medium run equilibrium. Because potential output Y_n' is lower, the price or oil $Oil is increased and there is a permanent lower level of output. Lower output combined with increased inflation and often higher unemployment is termed **stagflation**.[213] The IS curve may also shift to the left (not shown in the diagrams), also contributing to decrease in output (*ME7* p. 190).



Because output is reduced, inflation continues to increase, and output would need to be reduced below potential Y_n by the CB to reduce inflation. "The economy may go through a large recession, with only a partial recovery." (*ME7* p. 192). Inflation expectations also play a role.

Inflation expectations can play an important role in the dynamic effect of shocks. If inflation is initially assumed to remain constant (there are more anchored inflation expectations), as output declines, inflation declines. When point A″ is reached, inflation is back to its original level, and no CB intervention is needed. Along with a possible effect of **decreased bargaining power of workers**, inflation that was **more anchored by monetary policy** may have contributed to the more benign effects of the oil shock of the 2000s compared to that of the 1970s. (*ME7* p. 191-2)

---

[212] Lecture Ch. 09.pdf, all 3 diagrams

[213] http://www.investopedia.com/terms/s/stagflation.asp and *ME7* p. 190

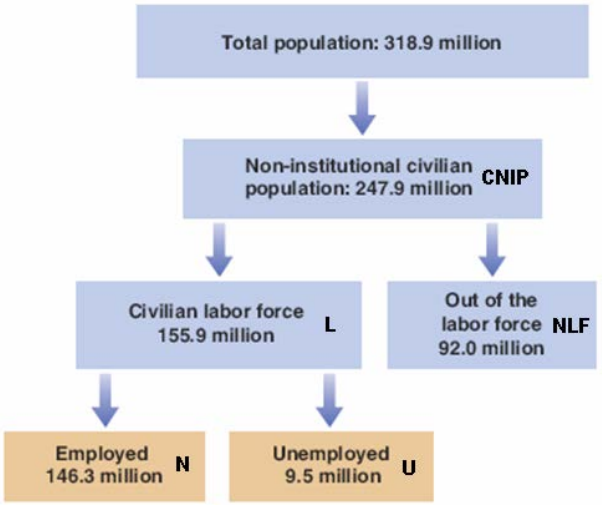
Economists when considering **different time spans** (see *Time spans (Output Horizons) in Macroeconomics*) can understandably differ regarding conclusions drawn. A focus on medium or long run can for example justify fiscal consolidation. If it seems the return of output to potential will be slow and take too long, one may wish to emphasize the short run. If it seems the return of output to potential will occur quickly, one may wish to emphasize the medium run effects of policy.

L

Labor Force, Employment, and Unemployment in the Labor Market

The US population may be divided into generations, see *Population of the US: By Generations and Age Brackets*.

The following definitions apply per the BLS for the US population, and all quotations are derived from their page on **Labor force characteristics**[214] except as otherwise noted, with symbols taken from *ME7*. I have added some acronyms for clarity, and have inserted these into quotations. A breakdown of the categories of the labor force is shown in diagram to the right,[215] with the same acronyms that I have added.



The **Total Population** of the US (all humans resident in the country) was estimated at 325,085,852 in November 26, 2016, or 318.9 m in 2014. This includes persons too young to work, prison inmates, and active duty military personnel.

According to the BLS table that follows below, the **[Civilian] Labor Force L** [L = N + U] added to the "**Not in labor force NLF**" add up to the **Civilian Non-institutional Population CNIP** (estimated at 247.9m in 2014). Specifically included in CNIP "are persons 16 years of age and older residing in the 50 states and the District of Columbia who do not live in institutions (for example, correctional facilities, long-term care hospitals, and nursing homes) and who are not on active duty in the Armed Forces."[216] Thus, to summarize,

Tot. Pop = CNIP + Exclusions_for_TooYoung_Imprisoned_ActiveMilitary (not shown in diagram)

CNIP = L + NLF
= N + U + NLF

The **Labor Force L** (aka the **Civilian Labor Force L**): "The labor force is the sum of employed and unemployed persons [est. in US 155.9m in 2014]. The **Labor force participation rate** is the [civilian] labor force L as a percent of the **civilian non-institutional population CNIP**." The **Civilian Labor Force L** is more specifically, "the subset of Americans who have jobs or are seeking a job, are at least 16 years old, are not serving in the military, and are not institutionalized [e.g., in prison]. In other words, all Americans who are eligible to work [and capable of working] in the everyday U.S. economy."[217] Note that "... students, retirees, the disabled, homemakers, and the voluntarily idle are not counted in the labor force L"[218], nor are the discouraged workers (see below).

Employed persons N: are persons who did any work for pay or profit during the survey reference week; persons who did at least 15 hours of unpaid work in a family-operated enterprise; and persons who were temporarily absent from their regular jobs because of illness, vacation, bad weather, industrial dispute, or various personal reasons. The **employment-population ratio** represents the proportion of

---

[214] http://www.bls.gov/cps/lfcharacteristics.htm#unemp
[215] Lecture Ch. 07.pdf, image annotated by MCM
[216] http://www.bls.gov/bls/glossary.htm
[217] http://www.investopedia.com/terms/c/civilian-labor-force.asp
[218] http://www.econport.org/content/handbook/Unemployment/Define.html

the civilian non-institutional population that is employed (N/CNIP)—this is not identical to the **Labor force participation rate**, which is defined as (N+U)/CNIP and thus includes unemployed persons.[219]

Unemployment or Unemployed persons U: "Persons are classified as unemployed if they do not have a job, have actively looked for work in the prior 4 weeks, and are currently available for work. Persons who were not working and were waiting to be recalled to a job from which they had been temporarily laid off are also included as unemployed. Receiving benefits from the Unemployment Insurance (UI) program has no bearing on whether a person is classified as unemployed."

Those US citizens classified as '**Not in the Labor Force NLF**' (est. 92m in 2014) are neither employed nor unemployed. This category includes "retired persons, students, those taking care of children or other family members, and others who are neither working nor seeking work." It also includes **persons marginally attached to the labor force**. These include discouraged workers: "**Discouraged workers** are a subset of persons marginally attached to the labor force. The marginally attached are those persons not in the labor force [neither N nor U] who want and are available for work, and who have looked for a job sometime in the prior 12 months, but were not counted as unemployed because they had not searched for work in the 4 weeks preceding the survey. Among the marginally attached, discouraged workers were not currently looking for work specifically because they believed no jobs were available for them or there were none for which they would qualify."

The **unemployment rate** u = U/L, expressed as a percent. (*ME7* p. 27). Unemployment is an important index because it is associated with financial and psychological suffering. (*ME7* p. 29) Unemployment was 4.6% in Nov. 2016, compared to 6.8% in Nov. 2008, 9.9% in Nov. 2009, 9.8% in Nov. 2010, 8.6% in Nov. 2011, etc.[220] See more at *Unemployment and Employment Rate*.

The **Employment Rate** = ratio of employment N to population available to work CNIP.

Full time [work] is 35 hours or more worked per week; **part time** is 1 to 34 hours per week.

Unemployment and other statuses above are assessed by the monthly *Current Population Survey CPS* of US households by the Census Bureau of the BLS.[221] This is based on 60,000 households that are interviewed every month in a rotating schedule.

The following is a sample BLS chart of civilian non-institutional population 16 years and over (for males only, due to space limitations). This breaks down annual average employment status by population categories above, from 1975 to 2015. The table headers help to clarify the divisions of the population:[222]

[219] https://www.bls.gov/cps/lfcharacteristics.htm#nlf
[220] http://data.bls.gov/timeseries/LNS14000000
[221] http://www.bls.gov/cps/
[222] http://www.bls.gov/cps/cpsaat02.htm Chart modified MCM to combine separate screens

HOUSEHOLD DATA
ANNUAL AVERAGES
2. Employment status of the civilian noninstitutional population 16 years and over by sex, 1975 to date
[Numbers in thousands]

Sex and year	Civilian noninsti-tutional population	Civilian labor force								Not in labor force
				Employed				Unemployed		
		Total	Percent of population	Total	Percent of population	Agri-culture	Nonagri-cultural industries	Number	Percent of labor force	
Men										
1975	72,291	56,299	77.9	51,857	71.7	2,824	49,032	4,442	7.9	15,993
1976	73,759	57,174	77.5	53,138	72.0	2,744	50,394	4,036	7.1	16,585
1977	75,193	58,396	77.7	54,728	72.8	2,671	52,057	3,667	6.3	16,797
1978	76,576	59,620	77.9	56,479	73.8	2,718	53,761	3,142	5.3	16,956
1979	78,020	60,726	77.8	57,607	73.8	2,686	54,921	3,120	5.1	17,293
1980	79,398	61,453	77.4	57,186	72.0	2,709	54,477	4,267	6.9	17,945
1981	80,511	61,974	77.0	57,397	71.3	2,700	54,697	4,577	7.4	18,537
1982	81,523	62,450	76.6	56,271	69.0	2,736	53,534	6,179	9.9	19,073
1983	82,531	63,047	76.4	56,787	68.8	2,704	54,083	6,260	9.9	19,484
1984	83,605	63,835	76.4	59,091	70.7	2,668	56,423	4,744	7.4	19,771
1985	84,469	64,411	76.3	59,891	70.9	2,535	57,356	4,521	7.0	20,058
1986	85,798	65,422	76.3	60,892	71.0	2,511	58,381	4,530	6.9	20,376
1987	86,899	66,207	76.2	62,107	71.5	2,543	59,564	4,101	6.2	20,692
1988	87,857	66,927	76.2	63,273	72.0	2,493	60,780	3,655	5.5	20,930
1989	88,762	67,840	76.4	64,315	72.5	2,513	61,802	3,525	5.2	20,923
1990	90,377	69,011	76.4	65,104	72.0	2,546	62,559	3,906	5.7	21,367
1991	91,278	69,168	75.8	64,223	70.4	2,589	61,634	4,946	7.2	22,110
1992	92,270	69,964	75.8	64,440	69.8	2,575	61,866	5,523	7.9	22,306
1993	93,332	70,404	75.4	65,349	70.0	2,478	62,871	5,055	7.2	22,927
1994	94,355	70,817	75.1	66,450	70.4	2,554	63,896	4,367	6.2	23,538
1995	95,178	71,360	75.0	67,377	70.8	2,559	64,818	3,983	5.6	23,818
1996	96,206	72,087	74.9	68,207	70.9	2,573	65,634	3,880	5.4	24,119
1997	97,715	73,261	75.0	69,685	71.3	2,552	67,133	3,577	4.9	24,454
1998	98,758	73,959	74.9	70,693	71.6	2,553	68,140	3,266	4.4	24,799
1999	99,722	74,512	74.7	71,446	71.6	2,432	69,014	3,066	4.1	25,210
2000	101,964	76,280	74.8	73,305	71.9	1,861	71,444	2,975	3.9	25,684
2001	103,282	76,886	74.4	73,196	70.9	1,708	71,488	3,690	4.8	26,396
2002	104,585	77,500	74.1	72,903	69.7	1,724	71,179	4,597	5.9	27,085
2003	106,435	78,238	73.5	73,332	68.9	1,695	71,636	4,906	6.3	28,197
2004	107,710	78,980	73.3	74,524	69.2	1,687	72,838	4,456	5.6	28,730
2005	109,151	80,033	73.3	75,973	69.6	1,654	74,319	4,059	5.1	29,119
2006	110,605	81,255	73.5	77,502	70.1	1,663	75,838	3,753	4.6	29,350
2007	112,173	82,136	73.2	78,254	69.8	1,604	76,650	3,882	4.7	30,036
2008	113,113	82,520	73.0	77,486	68.5	1,650	75,836	5,033	6.1	30,593
2009	114,136	82,123	72.0	73,670	64.5	1,607	72,062	8,453	10.3	32,013
2010	115,174	81,985	71.2	73,359	63.7	1,665	71,694	8,626	10.5	33,189
2011	116,317	81,975	70.5	74,290	63.9	1,698	72,592	7,684	9.4	34,343
2012	117,343	82,327	70.2	75,555	64.4	1,626	73,930	6,771	8.2	35,017
2013	118,555	82,667	69.7	76,353	64.4	1,611	74,742	6,314	7.6	35,889
2014	119,748	82,882	69.2	77,692	64.9	1,685	76,007	5,190	6.3	36,865
2015	121,101	83,620	69.1	79,131	65.3	1,826	77,305	4,490	5.4	37,481

The subdivisions of persons who are **Not in the labor force** (NLF, defined above) are given in the following chart through 2015, arranged by desire and availability for work, age, and sex (including some footnotes, with numbers in parentheses referring to the footnotes). The footnotes clarify the definition of persons **Marginally attached** (**to the labor force**, wanting and available to work now**)** and workers **Discouraged over job prospects**:[223]

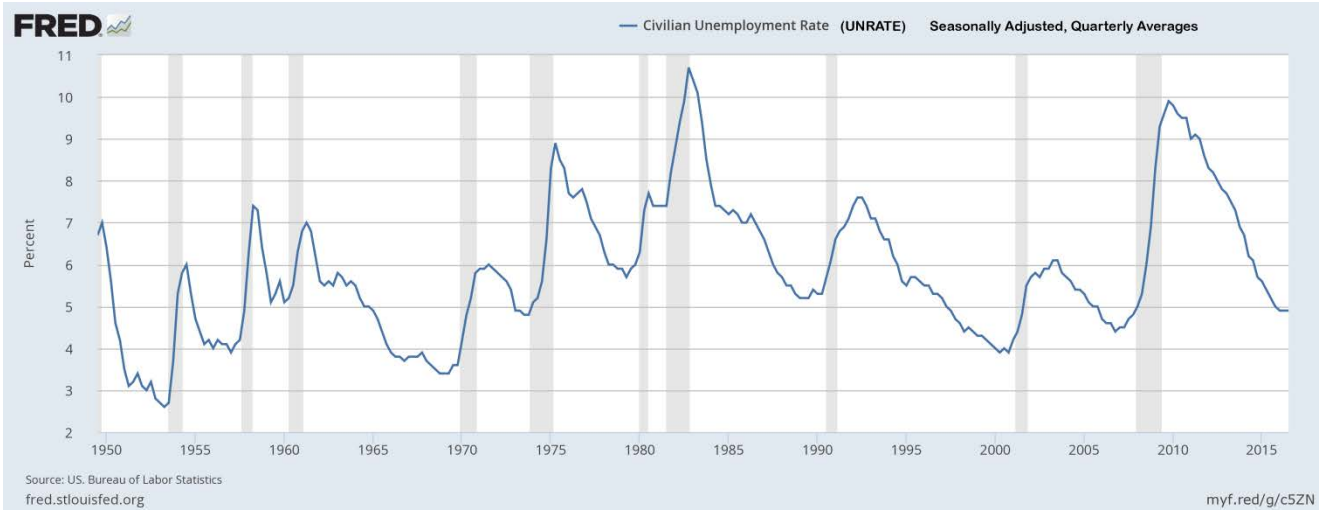
[223] http://www.bls.gov/cps/cpsaat35.htm

HOUSEHOLD DATA
ANNUAL AVERAGES
35. Persons not in the labor force by desire and availability for work, age, and sex
[In thousands]

Category	Total		Age						Sex			
			16 to 24 years		25 to 54 years		55 years and over		Men		Women	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Total not in the labor force	92,025	93,671	17,418	17,367	23,744	23,957	50,863	52,347	36,865	37,481	55,159	56,190
Do not want a job now(1)	85,702	87,589	15,377	15,525	21,075	21,344	49,250	50,719	33,932	34,681	51,770	52,907
Want a job(1)	6,323	6,082	2,041	1,842	2,669	2,612	1,614	1,628	2,934	2,799	3,389	3,283
Did not search for work in previous year	3,448	3,454	1,072	1,030	1,337	1,357	1,039	1,067	1,524	1,507	1,924	1,947
Searched for work in previous year, but not in past 4 weeks(2)	2,875	2,628	969	812	1,332	1,256	574	561	1,409	1,292	1,465	1,336
Not available to work now	667	673	303	287	284	307	81	79	270	277	397	395
Marginally attached (available to work now)(3)	2,207	1,956	666	525	1,048	949	493	482	1,139	1,015	1,068	941
Discouraged over job prospects(4)	739	664	184	159	350	316	205	189	443	404	296	261
Reasons other than discouragement	1,468	1,291	482	366	697	632	289	293	696	611	772	680
Family responsibilities	239	216	34	23	160	138	45	55	65	64	174	153
In school or training	267	212	208	154	54	51	4	7	149	106	118	107
Ill health or disability	161	168	16	16	84	77	61	75	82	84	80	84
Other(5)	801	695	224	174	398	366	179	155	400	358	401	337

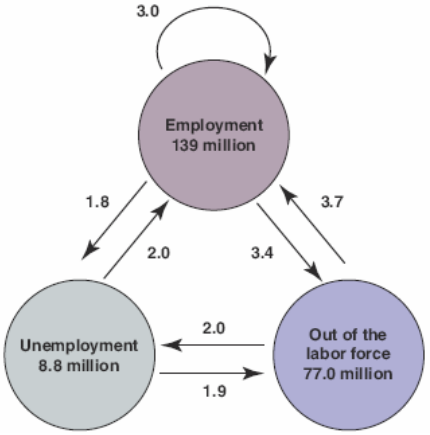
Footnotes
(1) Includes some persons who are not asked if they want a job.
(2) Persons who had a job in the prior 12 months must have searched since the end of that job.
(3) Persons "marginally attached to the labor force" are those who want a job, have searched for work during the prior 12 months, and were available to take a job during the reference week, but had not looked for work in the past 4 weeks.
(4) Discouraged workers are persons marginally attached to the labor force who did not actively look for work in the prior 4 weeks for reasons such as thinks no work available, could not find work, lacks schooling or training, employer thinks too young or old, and other types of discrimination.
(5) Includes those who did not actively look for work in the prior 4 weeks for such reasons as child-care and transportation problems, as well as a small number for which reason for nonparticipation was not ascertained.

The following graph depicts the US civilian unemployment rate 1949 to 2016 3Q as seasonally adjusted quarterly averages.[224] The impact of the Great Recession is obvious, peaking in 2009 Q4 at 9.9%, and only recently has employment substantially recovered to 4.9% for 2016 3Q under the Obama administration:



[224] https://fred.stlouisfed.org/series/UNRATE#0 LNS14000000

There are substantial flows of persons among the various categories, N, U, and NLF.[225] In the diagram to the right, we see a chart of flows apparently summing the years 1996 - 2014 for the US. Of the 139m employed, 3.0m change jobs but remain employed, 1.8m become unemployed, 3.4m changed to NLF status, for a total of 8.2m who changed jobs or lost work. Total flows in and out of the labor force L, including new workers (0.45m) and retirements (0.35m), are 11.2m. Because some of the NLF wish to work, the **Employment Rate** (ratio of employment N to population available to work CNIP) is considered a more useful index than the unemployment rate. (*ME7* p. 140)



See below about *Wage Determination and Natural Rate of Unemployment*.

Leverage and Lending

Leverage Definition 1: Banks must keep some of their financial assets in the form of **reserves**, which consist of currency held as **vault cash** or **reserve deposits kept at the central bank** (in the **US**, the **Federal Reserve**). The demand for central bank money consists of demand for currency and demand for reserves by banks. In the US, banks must hold at least 10% of the value of checkable deposits as **required reserves** that are not lent out. Amounts in excess of the required amount are **excess reserves**.[226]

More precisely, "A depository institution's reserve requirements vary by the dollar amount of NTAs [Net Transaction Accounts] held by customers of that institution. Effective November 17, 2015, institutions with net transactions accounts:

Of less than $15.2 million have no minimum reserve requirement;
Between $15.2 million and $110.2 million must have a liquidity ratio of 3% of NTAs;
Exceeding $110.2 million must have a liquidity ratio of 10% of NTAs."[227]

A bank balance sheet consists of Assets and Liabilities.[228]

Assets include Securities in bank credit, Loans, Fed funds, cash assets, trading assets, and other assets.

Liabilities include Deposits, Borrowings, Trading liabilities, Net due to related foreign offices, other liabilities

Total assets = Total Liabilities + Capital (see table)

[225] *ME7* p., 139 and Lecture Ch. 07; see also https://www.stlouisfed.org/annual-report/2010/essay-4

[226] http://www.investopedia.com/terms/b/bank-reserve.asp?ad=dirN&qo=investopediaSiteSearch&qsrc=0&o=40186&lgl=no-infinite and ME7 p. 77

[227] https://en.wikipedia.org/wiki/Reserve_requirement#United_States

[228] Example: https://www.boundless.com/users/233416/textbooks/money-banking-and-international-finance/the-banking-business-10/the-banking-business-31/a-bank-s-balance-sheet-99-15197/ Table from that article

Table 1. Commercial Banks Assets and Liabilities on December 2013

Assets in billions of dollars		Liabilities in billions of dollars	
Securities in bank credit	2,515.0	Deposits	
Loans			
Commercial and industrial loans	1,334.2	Large time deposits	702.8
Real estate loans	3,498.2	Other deposits	8,114.2
Consumer loans	1,155.8	Borrowings	
All other loans and leases	756.5	Borrowings from U.S. banks	97.1
Allowance for loan and lease losses	*(123.3)*	Borrowings from others	840.3
Fed funds	81.8	Trading liabilities	116.7
Loans to commercial banks	8.9	Net due to related foreign offices	40.5
Cash assets	1,379.1	Other liabilities	360.1
Trading assets	119.9		
Other assets	1,060.0	Capital	1,514.6
Total assets	11,786.2	Total Liabilities plus capital	11,786.3

Source: Board of Governors of the Federal Reserve System. February 7, 2014. Assets and Liabilities of Commercial Banks in the United States (Weekly) - H.8. Available at http://www.federalreserve.gov/releases/h8/current/default.htm (access date: 02/12/14).

The **capital ratio** of a bank is the ratio of its capital to its assets. In the table shown, this would be 12.9%. The **leverage ratio** is the ratio of assets to capital (thus the inverse of capital ratio). In the table shown, this would be 7.8. A higher leverage ratio may lead to **higher expected profits**, but at **greater risk of insolvency and bankruptcy**. Insolvency is "the state of being unable to pay the money owed, by a person or company, on time; those in a state of insolvency are said to be **insolvent**. There are two forms: **cash-flow insolvency** and **balance-sheet insolvency**." "**Bankruptcy** is a legal status of a person or other entity that cannot repay the debts it owes to creditors. In most jurisdictions, bankruptcy is imposed by a court order, often initiated by the debtor… Bankruptcy is not the only legal status that an insolvent person or other entity may have, and the term bankruptcy is therefore not a synonym for insolvency… In the United States, bankruptcy is applied more broadly to formal insolvency proceedings."[229]

Banks may encounter liquidity problems, especially if the demand deposits are requested in short notice, often in a **bank run**, which central banks attempt to limit. (*ME7* p. 120)

Leverage Definition 2: The term **leverage** is also applied to investors. "Leverage is an investment strategy of using borrowed money to generate outsized investment returns… If the cost of a vehicle is $20,000 and a buyer hands over $2,000 in cash and $18,000 in borrowed money in exchange for the vehicle, the buyer's cash outlay was only 10% of the vehicle's purchase price… From an investment perspective, this buyer was **levered** [or **leveraged**] 10 to one (10:1). That is to say, the ratio of personal cash to borrowed cash is $1 in personal cash for every $10 spent…

The use of leverage can be applied to real estate, stocks, bonds, commodities, currencies and other investments. Consider a real estate investor who has $50,000 in cash. That investor could use that money to buy one home valued at $50,000. If that home could be quickly sold for $55,000, the investor would have gained $5,000. If that same investor used the original $50,000 in cash to put a $5,000 down payment on 10 different homes valued at $50,000 each, financed the rest of the money, and then sold all 10 homes for $55,000 each, the investor's profit would have been $50,000—an astounding 100% return on investment…

… Margin loans, futures contracts and options are a few of the more common methods investors use to add leverage to their portfolios. Just as in the real estate example, a limited amount of money can be employed to control a larger amount of stock than would be possible through a direct purchase made with available cash… Bond-market investors can also use leverage. Consider a scenario in which the interest rate on a one-year loan is 1% while the interest rate on a 10-year loan is 5%. By borrowing money at the short-term rate and investing it at the long-term rate, an investor can profit from the difference in rates…

… When it comes to leverage, unless you are a professional trader and your losses will be

[229] https://en.wikipedia.org/wiki/Insolvency and https://en.wikipedia.org/wiki/Bankruptcy

covered by your employer, leveraged investing should probably not be your primary investment strategy…"[230]

M

Markets in Economics

There are many ways to categorize markets, but this entry will emphasize the categories of items exchanged. Economic markets include those for **products** (**final goods** and **services**), **factors of production** (such as **capital, capital goods, labor, raw materials**, and **land**), and many other subdivisions. "In mainstream economics, the concept of a market is any structure that allows buyers and sellers to exchange any type of goods, services and information. The exchange of goods or services, with or without money, is a **transaction**. Market participants consist of all the buyers and sellers of a good who influence its price, which is a major topic of study of economics and has given rise to several theories and models concerning the basic market forces of supply and demand. A major topic of debate is how much a given market can be considered to be a 'free market', that is free from government intervention… Markets include: **Physical consumer markets**, **Physical business markets**, **Non-physical markets** (**media, internet, artificial** such as derivatives), **Financial markets** (**stock, bond, currency, money market, futures, prediction markets**), and **Illegal** or **Unauthorized markets**.[231]

"Capital markets are markets for buying and selling equity and debt instruments. Capital markets channel savings and investment between suppliers of capital such as retail investors and institutional investors, and users of capital like businesses, government and individuals. Capital markets are vital to the functioning of an economy, since **capital is a critical component for generating economic output**. Capital markets include **primary markets**, where new stock and bond issues are sold to investors, and **secondary markets**, which trade existing securities."[232]

Mathematics and Modelling in Macroeconomics

Like most disciplines attempting to define itself in a quasi-scientific manner, the validity of economic relationships and mathematical formulations are subject to empirical verification. Macroeconomics looks at large complex systems that are hard or impossible to precisely quantitate—populations, markets, flows of money and capital, etc. As in astronomy, it is also nearly impossible to conduct properly controlled macroeconomics experiments that unequivocally establish and quantitate cause and effect. Correlation is, of course, not causation.

The use of equal signs can be confusing. In some instances, an equation with = represents a **definition** or **identity**, expressing exact equivalence. It is best to substitute the symbol ≡ for these, though neither Blanchard nor I have not been consistent in this.

Equations in the text can also represent what Blanchard terms **behavioral equations**,[233] such as the consumption function $C = c_0 + c_1 Y_D$. These represent empirical or postulated behavior of one set of variables as a function of other variables.

A third type of similar equation is the **equilibrium relationship** or **equilibrium condition**, such as Y = Z.

The latter two types are typically based on hypotheses of postulated behavior and on modelling, and they depend on specified conditions that may or may not be realistic. Such equations often derive from models based on numerous simplifying assumptions, models which are therefore possibly greatly oversimplified, and depart from known complex reality. Ultimately, such equations must, to the greatest extent possible, stand the tests of time and empirical verification, the relationship may need to be expressed in less precise statistical terms that include correlation coefficients and confidence

---

[230] http://www.investopedia.com/articles/investing/073113/leverage-what-it-and-how-it-works.asp
[231] https://en.wikipedia.org/wiki/Market_(economics) edited and paraphrased
[232] http://www.investopedia.com/terms/c/capitalmarkets.asp
[233] *ME7* p. 53

limits etc., and they should be revised to reflect contradictory findings that arise with the accumulation of greater data and experience (such as occurred with the Phillips Curve).

The textbook can be confusing and frustrating in its sloppy use of mathematics. For instance, Blanchard uses the expression $c_1(Y-T)$ as a standard math expression—c_1 times the difference of Y and T—whereas he uses C(Y-T) to indicate that C is a function of the quantity (Y-T).

Medium Run

See under *Wage Determination and Natural Rate of Unemployment* and other topics.

Money and Wealth

Money is a financial asset which, as Blanchard defines it, is what can be used to pay for transactions. It is highly liquid, pays no interest [or minimal interest], and in the real world is found either as **currency** (coins and bills) or **checkable deposits** (e.g., checking accounts that can be drawn on with checks or debit cards). (*ME7* p. 68,69) Money is a stock, not a flow.

In contrast, **Bonds** are a stock which pay interest but cannot be used directly for transactions, are more illiquid, and carry some risk (if not issued by the US government).

Money market mutual funds are "an open-ended mutual fund that invests in short-term debt securities such as US Treasury bills and commercial paper. Money market funds are widely (though not necessarily accurately) regarded as being as safe as bank deposits yet providing a higher yield."[234] These can be used for indirectly investing in very short term bonds.

Income is what you earn from working plus interest and dividends, etc.—it is also a flow.

Per FRED, the US **M1 Money Stock** "... includes funds that are readily accessible for spending. M1 consists of:
(1) currency outside the U.S. Treasury, Federal Reserve Banks, and the vaults of depository institutions;
(2) traveler's checks of nonbank issuers;
(3) demand deposits; and
(4) other checkable deposits (OCDs), which consist primarily of negotiable order of withdrawal (NOW) accounts at depository institutions and credit union share draft accounts.

Seasonally adjusted M1 is calculated by summing currency, traveler's checks, demand deposits, and OCDs, each seasonally adjusted separately."

Annual changes in US M1 (in billions of seasonally adjusted current dollars) are shown as follows:[235]

Wealth is a stock of financial and other assets, accumulated over time. "Wealth measures the value of all the assets of worth owned by a person, community, company or country. Wealth is determined by taking the total market value of all physical and intangible assets owned, then subtracting all debts. Essentially, wealth is the accumulation of resources. Specific people, organizations and nations are said to be wealthy when they are able to accumulate many valuable resources or goods...

Perceptions of what constitutes wealth changes over time among societies. The ancient Egyptians once had a monetary system based on wheat. Some cultures have used commodities such

[234] https://en.wikipedia.org/wiki/Money_market_fund
[235] https://fred.stlouisfed.org/series/M1 including quote and diagram

as rice and salt in place of money at times. Inuit and Eskimo societies traded in seal oil and blubber, which they could eat as food, or burn as fuel to provide light and heat. African and Native American tribes once traded with wampum and shells, and used those as the basis of their monetary systems. Heads of cattle [thus, ***capital stock*** from ***caput*=head**] and livestock are still used as mediums of exchange in some cultures.

Gold and silver are precious metals and valuable commodities that have formed the basis of the monetary systems in many countries. However, the prices of gold and silver were subject to fluctuating price valuations and rarely remained stable for long periods. During World War II, the government outlawed the private ownership of gold. Economists have argued for decades about tying the value of a government's currency to its gold and silver reserves. The United States abandoned the gold standard during the 1970s. The money is instead backed by the "**full faith and credit" of the U.S. government**."[236]

Monetary Policy

"**Monetary policy** is the process by which the monetary authority of a country controls the **supply of money**, often targeting an inflation rate or **interest rate** to ensure price stability and general trust in the currency."[237]

Expansionary Monetary Policy: The Fed enacts an expansionary open market monetary policy when the FOMC [**Federal Open Market Committee**, a committee of the **Federal Reserve Board**] aims to **decrease the federal funds rate** [aka **policy rate**] and increase economic growth and output. The **Fed purchases government securities** through private bond dealers and deposits payment into the bank accounts of the individuals or organizations that sold the bonds. The deposits become part of the cash that commercial banks hold at the Fed [as **reserves**, *ME7* p. 77), and therefore increase the amount of money that commercial banks have available to lend. Commercial banks actively want to loan cash reserves and try to attract borrowers by **lowering their interest rates**, which includes the federal funds rate.

Contractionary Monetary Policy: The Fed enacts a contractionary open market monetary policy when the FOMC looks to increase the federal funds rate, thereby slowing economic growth and output. The **Fed sells government securities** to individuals and institutions, which decreases the amount of money left for commercial banks to lend (as **reserves** at the CB). This increases the cost of borrowing and **increases interest rates**, including the federal funds rate.[238]

The **money supply** of a country is expressed using the metric **M1**. (See also *Money and Wealth*.) This includes "physical money — both paper and coin — as well as checking accounts, demand deposits and negotiable order of withdrawal (NOW) accounts. The most liquid portions of the money supply are measured by M1 because it contains currency and assets that can be converted to cash quickly. "Near money" and "near, near money," which fall under **M2** and **M3**, cannot be converted to currency as quickly..."[239]

N

National Bureau of Economic Research NBER

"Founded in 1920, the NBER is a private, non-profit, non-partisan organization dedicated to conducting economic research and to disseminating research findings among academics, public policy makers, and business professionals... NBER-affiliated researchers study a wide range of topics and they employ many different methods in their work. Key focus areas include developing new statistical measurements, estimating quantitative models of economic behavior, and analyzing the effects of public policies...

Over the years the NBER's research agenda has encompassed a wide variety of issues

---

[236] http://www.investopedia.com/terms/w/wealth.asp?lgl=no-infinite
[237] https://en.wikipedia.org/wiki/Monetary_policy
[238] http://www.investopedia.com/terms/o/openmarketoperations.asp
[239] http://www.investopedia.com/terms/m/m1.asp

that confront our society. Early research focused on the aggregate economy, examining in detail the business cycle and long-term economic growth. Simon Kuznets' pioneering work on national income accounting, Wesley Mitchell's influential study of the business cycle, and Milton Friedman's research on the demand for money and the determinants of consumer spending were among the early studies done at the NBER...

The NBER is the nation's leading nonprofit economic research organization. Twenty-six Nobel Prize winners in Economics and thirteen past chairs of the President's Council of Economic Advisers have held NBER affiliations. The more than 1,400 professors of economics and business now teaching at colleges and universities in North America who are NBER researchers are the leading scholars in their fields... The NBER is supported by research grants from government agencies and private foundations, by investment income, and by contributions from individuals and corporations..."[240]

National Debt and National Budget Deficit of the US

All information to follow is quoted or paraphrased from this Treasury Dept. webpage[241] except as noted.

Information is maintained by the **Bureau of the Fiscal Service** of the **Treasury Department**.

As of Dec. 31, 2016:

Debt Held by the Public (Marketable and Nonmarketable):	14,434,842 million
Intragovernmental Holdings (Marketable and Nonmarketable):	5,541,985 million
Total Public Debt Outstanding:	19,976,827 million

"The **Debt Held by the Public** is all federal debt held by individuals, corporations, state or local governments, Federal Reserve Banks, foreign governments, and other entities outside the United States Government less Federal Financing Bank securities. Types of securities held by the public include, but are not limited to, Treasury Bills, Notes, Bonds, TIPS, United States Savings Bonds, and State and Local Government Series securities." Nonmarketable line items include Domestic Series, Foreign Series, State and Local Govt. Series, US Savings Securities, Govt. Acct. Series, and Other.

"**Intragovernmental Holdings** are Government Account Series securities held by Government trust funds, revolving funds, and special funds; and Federal Financing Bank securities. A small amount of marketable securities are held by government accounts."

"The Public Debt Outstanding decreases when there are more redemptions of Treasury securities than there are issues..."

"The **Federal Financing Bank (FFB)** is a government corporation, created by Congress in 1973 under the general supervision of the Secretary of the Treasury. The FFB was established to centralize and reduce the cost of federal borrowing as well as federally-assisted borrowing from the public. Obligations are issued to the public by the Federal Financing Bank (FFB) to finance its operations. Obligations are limited to $15 billion unless otherwise authorized by the Appropriations Acts."

"**What's the difference between the Public Debt Outstanding and the Public Debt Subject to Limit?**: The Public Debt Outstanding represents the face amount or principal amount of marketable and non-marketable securities currently outstanding. The Public Debt Subject to Limit is the maximum amount of money the Government is allowed to borrow without receiving additional authority from Congress. Furthermore, the Public Debt Subject to Limit is the Public Debt Outstanding adjusted for Unamortized Discount on Treasury Bills and Zero Coupon Treasury Bonds, Miscellaneous debt (very old debt), Debt held by the Federal Financing Bank and Guaranteed Debt."

Contributions: You can make a contribution to reduce the debt, see the website.

[240] http://www.nber.org/info.html

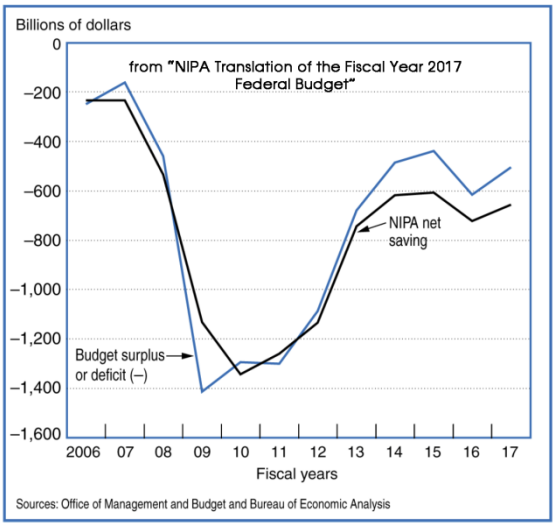
[241] https://www.treasurydirect.gov/govt/resources/faq/faq_publicdebt.htm#DebtOwner including text quoted; also *Monthly Statement of the Public Debt* [Mspd] o*f the United States*, December 31, 2016

"**What is the difference between the debt and the deficit?**
The deficit is the fiscal year difference between what the United States Government (Government) takes in from taxes and other revenues, called **receipts**, and the amount of money the Government spends, called **outlays**. The items included in the deficit are considered either **on-budget** or **off-budget**.

You can think of the total debt as accumulated deficits plus accumulated off-budget surpluses [sic]. The on-budget deficits require the U.S. Treasury to borrow money to raise cash needed to keep the Government operating. We borrow the money by selling securities like Treasury bills, notes, bonds and savings bonds to the public.

The Treasury securities issued to the public and to the Government Trust Funds (Intragovernmental Holdings) then become part of the total debt…"

Chart 1. Federal Fiscal Position, Budget Surplus or Deficit (–) and NIPA Net Saving



"Net federal government saving versus Budget Deficit: "For both 2016 and 2017, NIPA estimates of federal government current receipts are greater than budget estimates of receipts, and NIPA estimates of federal government current expenditures are greater than budget estimates of outlays. **Net federal government saving** [black graph], defined as the difference between NIPA estimates of current receipts and current expenditures, is –$655.4 billion for 2017, up $67.2 billion [thus improved] from –$722.6 billion for 2016. The budget deficit [blue graph] is –$503.5 billion for 2017, down $112.3 billion [thus improved] from –$615.8 billion for 2016 (chart 1, table 1)."[242] Note that the term **Net federal government [NIPA] saving**, which closely resembles the budget deficit in value, might cause confusion, in that it has for years been a negative amount, so it could hardly be considered to be a "saving", though it might be called a **saving deficit**.

National Income and Product Accounts NIPA

In the US, this body of economic data is produced by the **Bureau of Economic Analysis BEA**[243] (in the Dept. of Commerce). These accounts were initiated during the early 1930s. The NIPAs feature several widely followed measures of aggregate U.S. economic activity, including gross domestic product (GDP), gross domestic income (GDI), personal income, and personal saving among others. The NIPA accounting is quite complex and I don't pretend to have it mastered.

The Seven Summary National Accounts [NIPA] of the BEA

This subsection and tables partly derives from the 2016 Annual Revision of the National Income and Product Accounts [NIPA], August 2016, BEA[244] and the BEA's *A Guide to the National Income and Product Accounts* [NIPA] *of the United States*.[245]

Each of the seven NIPA summary accounts have double entry accounting as follows:

For definitions of the line items in the various accounts, see this Dec. 2015 appendix.[246] Note that "Line 1–10: Current surplus of government enterprises (4–28)" means that for "Account 1", line 10 on the **left** of two columns (thus a **debit entry**) is "Current surplus of government enterprises (4-28)". This debit entry (at Line 1–10) is matched (in this case) by an identical single entry in the **right** of 2 columns (thus a **credit entry**), namely: Account 4 Line 28 "Current surplus of government enterprises (1–10)". Line 4-28 therefore refers back to the matching debit entry at Line 1-10.

---

[242] https://www.bea.gov/scb/pdf/2016/04%20April/0416_nipa_translation_of_the_2017_federal_budget.pdf, including image
[243] http://www.bea.gov/index.htm
See also *A Guide to the National Income and Product Accounts of the United States*, the source of most of the quotes, at https://www.bea.gov/national/pdf/nipaguid.pdf
[244] http://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf
[245] https://www.bea.gov/national/pdf/nipaguid.pdf
[246] https://www.bea.gov/national/pdf/appendix%20summary%20nipas.pdf

The duplicated occurrences of line items arises as follows: "The seven summary accounts constitute a **double-entry accounting system**[247] in which each of the entries in a summary account **appears again** in that account or in one of the other summary accounts. The numbers in parentheses indicate these "**counterentries**." In some cases, an entry **may be equal to another entry** in the summary accounts. For example, supplements to wages and salaries appears in account 1, line 5, and in account 3, line 14. In other cases, an entry **may be equal to a combination of other entries** (or of parts of other entries). For example, for private enterprise interest payments (account 2, line 2), the counterentry includes parts of private enterprise interest receipts (account 2, line 21), of personal interest income (account 3, line 20), of government interest receipts (account 4, line 22), and of interest payments to the rest of the world (account 5, line 17)."[248] See *Double-Entry Accounting System* for more about this type of accounting.

Account 1. **Domestic Income and Product Account**: This consists of **GROSS DOMESTIC PRODUCT GDP** and **Gross domestic income**. These should match, aside from any "Statistical discrepancy". "The first account … shows the consolidated—that is, unduplicated—production of all sectors of the economy as the sum of **[final] goods and services** sold to **final users** on the right side and the income generated by that production on the left side… [in footnote:] The estimate of GDP avoids double counting (of, for example, the semiconductors that go into computers or the flour that goes into bread) because the purchase by one business of materials and services on current account (intermediate purchases) from another business is canceled by the corresponding sale by another business in the consolidation."[249]

Annual NIPA Update August 2016

Table A. Summary National Income and Product Accounts, 2015
[Billions of dollars]

Account 1. Domestic Income and Product Account

Line			Line		
1	Compensation of employees, paid	9,704.1	15	Personal consumption expenditures (3–3)	12,283.7
2	Wages and salaries	7,865.8	16	Goods	4,012.1
3	Domestic (3–12)	7,847.8	17	Durable goods	1,355.2
4	Rest of the world (5–15)	18.1	18	Nondurable goods	2,656.9
5	Supplements to wages and salaries (3–14)	1,838.2	19	Services	8,271.6
6	Taxes on production and imports (4–15)	1,237.6	20	Gross private domestic investment	3,056.6
7	*Less:* Subsidies (4–8)	56.6	21	Fixed investment (6–2)	2,963.2
8	Net operating surplus	4,574.5	22	Nonresidential	2,311.3
9	Private enterprises (2–19)	4,593.3	23	Structures	507.3
10	Current surplus of government enterprises (4–28)	–18.8	24	Equipment	1,086.1
11	Consumption of fixed capital (6–14)	2,830.8	25	Intellectual property products	717.9
			26	Residential	651.9
12	**Gross domestic income**	**18,290.3**	27	Change in private inventories (6–4)	93.4
			28	Net exports of goods and services	–522.0
13	Statistical discrepancy (6–20)	–253.7	29	Exports (5–1)	2,264.3
			30	Imports (5–13)	2,786.3
			31	Government consumption expenditures and gross investment (4–1 plus 6–3)	3,218.3
			32	Federal	1,225.0
			33	National defense	732.0
			34	Nondefense	493.0
			35	State and local	1,993.3
14	**Gross domestic product**	**18,036.6**	36	**Gross domestic product**	**18,036.6**

NIPA Account 1 Domestic Income and Product Account for 2015[250]

[247] http://www.accountingcoach.com/accounting-basics/explanation/5
[248] https://www.bea.gov/national/pdf/appendix%20summary%20nipas.pdf
[249] https://www.bea.gov/national/pdf/nipaguid.pdf
[250] http://www.bea.gov/scb/pdf/2015/08%20August/0815_2015_annual_nipa_revision.pdf

Account 2. **Private Enterprise Income Account**: Consist of **Uses of Private Enterprise Income** and **Sources of Private Enterprise Income.** [This account] "provides additional information on the sources and uses of income by private enterprises, which give rise to the bulk of the output in the U.S. economy."[251]

Account 3. **Personal Income and Outlay Account.** Consist of **Personal Taxes, Outlays, and Saving** and **Personal Income.** "Accounts 3–5 show the receipts and expenditures of the other major sectors of the U.S. economy: The personal sector, which is made up of households and nonprofit institutions serving households; the government sector; and the foreign sector."[252]

Account 4. **Government receipts and expenditures account** (see Account 3)

Account 5. **Foreign transactions current account** (see Account 3)

Account 6. **Domestic capital account**: This account "provides information on the saving and investment of the domestic sectors of the economy".

Account 7. **Foreign transactions capital account.** This account "provides information on capital transactions with the rest of the world".

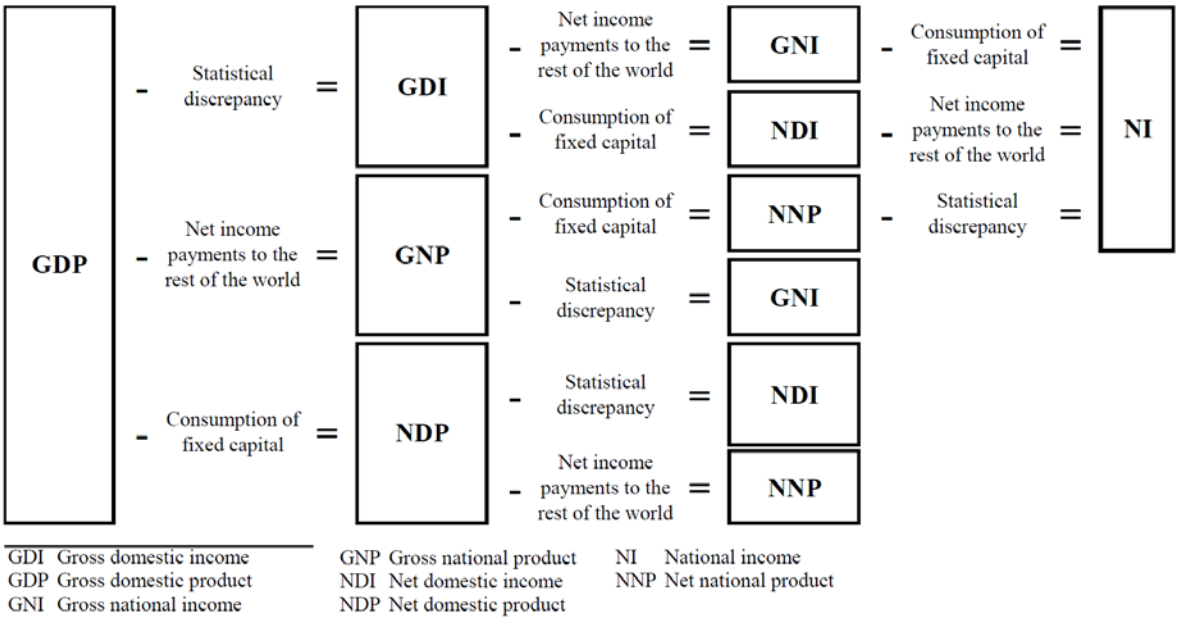
"National accounts or **national account systems (NAS)** are the implementation of complete and consistent accounting techniques for measuring the economic activity of a nation. These include detailed underlying measures that rely on **double-entry accounting**. By design, such accounting **makes the totals on both sides of an account equal even** though they each measure different characteristics, for example production and the income from it."[253]

The Major Aggregates

These are defined by the BEA/NIPA. Items not appearing in the Seven Summary NIPA Accounts may be found in the Appendix sections of the various NIPA updates:[254]

The following helpful chart shows some of the relationships among the major aggregates: One goes
- "from a 'product' measure to an 'income' measure by subtracting the statistical discrepancy,
- from a 'gross' measure to a 'net' measure by subtracting consumption of fixed capital (CFC), and
- from a 'domestic' measure to a 'national' measure by subtracting net income payments to the rest of the world (or equivalently, by adding net income receipts from the rest of the world)" [255]

Chart 2.2—Relationships Between Major NIPA Measures of Income and Product



[251] https://www.bea.gov/national/pdf/nipaguid.pdf
[252] https://www.bea.gov/national/pdf/nipaguid.pdf also descriptions of Accounts 6 and 7
[253] https://en.wikipedia.org/wiki/National_accounts
[254] For example, https://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf
[255] http://www.bea.gov/national/pdf/allchapters.pdf Chart 2.2 and quotes

Gross domestic product (GDP):

GDP is the main measure of U.S. aggregate output, and "is the market value of the **goods and services produced by labor and property located in the United States**. Because the labor and property are located in the United States, **the suppliers**— that is, **the workers** and, for property, **the owners—may be either U.S. residents or residents of the rest of the world**."[256] Components for 2015 GDP (1-36) are shown above.

Formula for GDP (from **product side**, *ME7* Appendix 1 A-4, etc.):

GDP = Y_t = C + I + G + (EX – IM) + InvInv

where **Y_t** = **Gross Domestic Output/Product**
(which should be nearly equal to Gross Domestic Income, see table above; subscript t indicates here that GDP is a flow determination over a specified time period)

C = Personal consumption expenditures
(a flow, durable and nondurable goods plus services)

I = Gross private [non-governmental] fixed Investment (a flow), includes
residential (new homes and apartments built)
non-residential: Structures, equipment, and software, etc.

G = Government purchases (a flow)
Federal (National Defense and Nondefense)
State and local governments

X = **NX** = Net Exports (a flow); consists of
(**EX Exports**, a flow) minus (**IM Imports**, a flow)

InvInv = Inventory Investment (a flow)
(change in business inventories, goods produced less goods sold;)

GDP appears in Account 1.

Gross domestic income (GDI):

Appears in Account1, "measures output as the costs incurred and the incomes earned in the production of GDP. In theory, **GDP should equal GDI**, but in practice, they differ because their components are estimated using largely independent and use less than perfect source data. This difference is termed the '**statistical discrepancy'**..." GDI appears in Account 1.

Gross national product (GNP):

is the market value of the goods and services produced by **labor and property supplied by U.S. residents**. Because the labor and property are supplied by U.S. residents, they may be **located either in the United States or abroad**. The difference between GDP and GNP [GNP minus GDP] is **net receipts of income from the rest of the world**. These net receipts represent income from the goods and services produced abroad using labor and property supplied by U.S. residents less payments to the rest of the world for the goods and services produced in the United States using labor and property supplied by foreign residents. The income receipts and payments are measured as compensation of employees, corporate profits (earnings of both incorporated and unincorporated affiliates), and interest.

GNP may substantially exceed GDP, for example when high Kuwait oil revenues up to 1989 (prior to the war 1990-1991) had been invested abroad, giving a steady accumulation of foreign assets and a large current account surplus. GNP appears in Table 13 of the updates, etc. [257]

Net domestic product (NDP) is the net market value of the goods and services attributable to labor and property located in the United States and is equal to **GDP less consumption of fixed capital (CFC)**.[258]

---

[256] https://www.bea.gov/national/pdf/nipaguid.pdf p. 5, also applies to the other major aggregates herein

[257] *ME7* p. 362; appears in https://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf

[258] NDP appears in Appendix A Table B. CFC resembles depreciation and is "The charge for the using up of private and government fixed capital located in the United States. It is the decline in the value of the stock of fixed assets due to wear and tear, obsolescence, accidental damage, and aging. For general government and for nonprofit institutions that primarily serve individuals, CFC serves as a measure of the value of the current services of the fixed assets owned and used by these entities." https://bea.gov/glossary/glossary_c.htm

NDP may be viewed as an estimate of **sustainable product**, which is a rough measure of the level of consumption that can be maintained while leaving capital assets intact. NDP appears in Appendix A Table B [259]

Net national product (NNP) is the net market value of goods and services attributable to the labor and property supplied by U.S. residents and is equal to **GNP less CFC**. The measure of CFC used for both NDP and NNP relates only to fixed capital located in the United States. The investment in capital is measured by private fixed investment and government gross investment. NNP appears in Appendix A Table B of the updates.

National income (NI) includes all net incomes (net of CFC) earned in production. National income is the sum of compensation of employees, proprietors' income with inventory valuation adjustment (IVA)[260] and capital consumption adjustment (CCAdj), [261] rental income of persons with CCAdj, corporate profits with IVA and CCAdj, net interest and miscellaneous payments, taxes on production and imports, business current transfer payments, and the current surplus of government enterprises, less subsidies.

Blanchard (*ME7* p. 361) states that
NI = GNP - GDP where NI is "the net payments from the rest of the world"
(this is apparently not the same as NIPA's National Income NI)
Investopedia[262] says
Net Foreign Factor Income (NFFI) = GNP - GDP
One may infer from Blanchard (*ME7* p. A-1 Table A1-1) that National Income NI is given by
National Income NI = GDP
plus {receipts of factor income from the rest of the world
minus payments of factor income to the rest of the world}
(where quantity in { } is NFFI)
minus CFC and minus statistical discrepancy.
Thus there seems to be potential confusion in terminology for NIPA vs. BOP accounting.
NI appears in Table 10, 11, and others of the Annual NIPA Update.

Gross national income (GNI) is equal to national income plus CFC. (GNI and GNP also differ by the statistical discrepancy.) GNI appears in Table 11, 13, etc. of the NIPA Updates.

Personal income is the income received by persons from all sources—that is, from participation in production and from current transfer receipts from both government and business. "Persons" consists of individuals, nonprofit institutions that primarily serve households, private noninsured welfare funds, and private trust funds. Personal income is calculated as compensation of employees, received; proprietors' income with IVA and CCAdj; rental income of persons with CCAdj; personal income

---

[259] NDP Appears in Appendix A Table B of
https://www.bea.gov/scb/pdf/2016/08%20August/0816_2016_annual_nipa_update.pdf

[260] **Inventory valuation adjustment (IVA)** "is the difference between the cost of inventory withdrawals valued at acquisition cost and the cost of inventory withdrawals valued at replacement cost. The IVA is needed because inventories as reported by business are often charged to cost of sales (that is, withdrawn) at their acquisition (historical) cost rather than at their replacement cost (the concept underlying the NIPAs). As prices change, businesses that value inventory withdrawals at acquisition cost may realize profits or losses. Inventory profits, a capital-gains-like element in business income (corporate profits and nonfarm proprietors' income), result from an increase in inventory prices, and inventory losses, a capital-loss-like element, result from a decrease in inventory prices. In the NIPAs, inventory profits or losses are shown as adjustments to business income; that is, they are shown as the IVA with the sign reversed. No adjustment is needed to farm proprietors' income because farm inventories are measured on a current-market cost basis."

[261] **The private capital consumption adjustment (CCAdj)** is "The difference between private capital consumption allowances (CCA) and private consumption of fixed capital (CFC)."
https://bea.gov/glossary/glossary_c.htm

[262] http://www.investopedia.com/terms/n/net-foreign-factor-income-nffi.asp

receipts on assets; and personal current transfer receipts; less contributions for government social insurance. Personal Income appears in Account 3.

Disposable personal income (DPI) is personal income less personal current taxes. It is the income available to persons for spending or saving. DPI appears in Table 12 of the updates.

O

Okun's Law (Okun Law)

See *Unemployment and Employment Rate*

Open vs. Closed Economy

This topic is *not* about closed versus open societies or closed versus open governments (which are distinguished by the relative levels of tolerance, political transparency and flexibility, access to and freedom of information, etc. By one definition, "Open government is the governing doctrine which holds that citizens have the right to access the documents and proceedings of the government to allow for effective public oversight. In its broadest construction it opposes reason of state [*national interest* or *raison d'État*] and other considerations, which have tended to legitimize extensive state secrecy."[263]

Virtually all current national economies are **Open** at least to some extent, in that there are economic activities between the domestic community and other countries. (Even North Korea trades with China, etc.) Thus, to varying degrees:

- People and businesses can trade in goods and services with other people and businesses in the international community in the goods markets. Trade can take the form of managerial exchange, technology transfers, and all kinds of goods and services. Open goods markets provide ↑access to more diverse goods, and ↑price competition benefits consumers by lowering prices.
- Funds can flow for and as investments across the border in the financial markets.[264] This provides better risk sharing, spreading risk across a broader group of people. People can buy different assets, domestic and foreign, providing better portfolio allocation and diversification. But increased financial openness can lead to greater probability that a financial crisis can propagate widely, including from foreign to the domestic economy.[265]

Closed economies do not permit outside interactions, so that international trade and finance cannot take place. Although these are uncommon, it can be convenient to consider an open economy as closed in order to simplify analysis for didactic purposes.

The term **autarky** is defined by Merriam-Webster[266] as "self-sufficiency, independence; specifically: national economic self-sufficiency and independence". This term might thus be used to characterize a closed economy.

In open economies, the individual is free to choose between buying domestic or foreign goods.

Openness in Goods Markets and Financial Markets (Intro)

This discussion is an introductory or limited summary of the subject matter of *ME7* chapter 17 and a little of 18—these chapters deal primarily with the Short and Medium Run. Openness here refers not to governments but to markets. More details may be found in *Open Economy: Impacts on Good Market*.

Economies of many developed countries tend to be linked or interconnected, so that a crisis in the US such as the **Great Recession** is to a substantial extent mirrored in other advanced countries, but also in emerging and developing economies, and in the world as a whole. This interconnection is seen in the following graph of real GDP for 12 countries including the US, following the 2007-2008 US

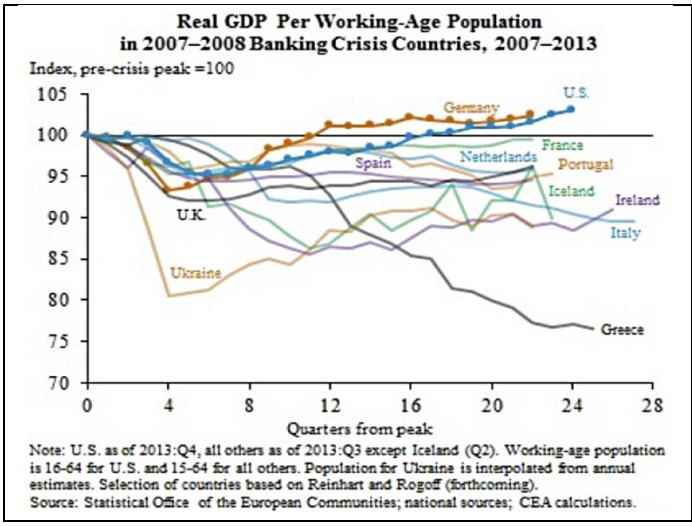
---

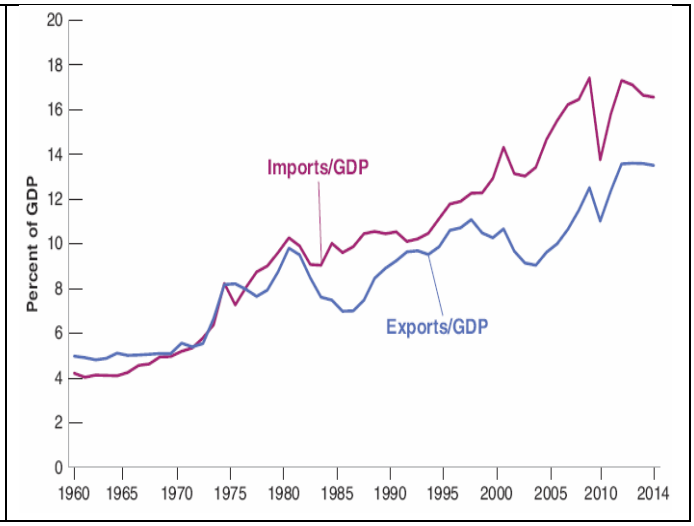
[263] https://en.wikipedia.org/wiki/Open_government and https://en.wikipedia.org/wiki/National_interest
[264] quoted and paraphrased partly from https://en.wikipedia.org/wiki/Open_economy
[265] Lecture Ch. 17.pdf
[266] https://www.merriam-webster.com/dictionary/autarky

banking crisis (left diagram below). The US fared the best, along with Germany, in real GDP recovery.[267]

Comparing 1960 to 2014, US exports and imports have more than tripled in relation to GDP. The United States has become a much more open economy by this measure. US Exports were 13.5% of GDP in 2014 and US Imports were 16.5% of GDP. Since the late 1970s, imports have consistently exceeded exports, leading to a persistent growing **trade deficit**. See graph below right. Other countries have much higher exports in relation to their GDP: China 22.1%, UK 28.3%, Germany 45.7%, Switzerland 64.1%, and Netherlands 82.9%. In 2014, the ratio of exports to GDP in Singapore was 188%, because some of their exports are intermediate goods (which are not counted in GDP).[268]

In assessing the degree of openness, one should consider only potentially **tradable goods** (books, cars, TVs, computers, etc.), and not non-tradable items (such as housing, most medical services, personal care, etc.) Tradable goods comprise about 60% of aggregate goods output in the US. (*ME7* p. 351)





Openness in the Financial Markets allows investors to hold foreign as well as domestic assets, and to speculate on movements in interest rates, etc. (though there may be limitations on the quantities one may possess or trade). These processes resulting from financial openness is called **Foreign Exchange**. In 2013, there was $5.5 trillion in *daily* world foreign exchange transactions, with 87% involving USD on one side. In comparison, **foreign trade of goods** for the US in 2013 was $4 trillion for the whole year… Most US foreign transactions therefore are associated with purchases and sales of **financial assets** ($4.8 trillion daily) rather than of trade in goods ($11 billion, only ~0.3% of the former). (*ME7* p. 358-9) Countries can run a trade deficit by borrowing from other countries (by selling Treasuries, etc.)

Regarding openness in markets:

(1) Openness in goods markets is the ability of consumers and firms to choose between domestic and equivalent foreign goods, based primarily on the real exchange rate. Even countries most committed to free trade may have **tariffs** (taxes on certain imported goods, which are on the decline) and/or may have **quotas** (restrictions on the quantity of certain imported goods).[269]

(2) Openness in financial markets is the ability of financial investors (individuals and firms) to choose between domestic assets and foreign assets. Until recently, even some rich countries had **capital controls**, which are restrictions on the foreign assets their domestic residents could hold and the domestic assets that foreigners could hold. The choice made depends primarily on the relative rates of return and on the expected rate of appreciation of the domestic currency (as well as relative risks).

(3) Openness in factor markets is the ability of firms to choose where to locate production, and of workers to choose where to work. For instance, the **North American Free Trade Agreement (NAFTA)**

---

[267] http://www.huffingtonpost.com/2014/03/10/us-economic-recovery_n_4935182.html image sl. modified MCM

[268] ME7 p. 350-2 and Instructor_Pearson_File_7e_PPT_17.v2.pptx and (for percent exports) http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS

[269] after *ME7* p. 349, 365 and Instructor_Pearson_File_7e_PPT_17.v2.pptx; also for the following 2 paragraphs

signed in 1993 by the U.S., Canada, and Mexico centered on how it would affect the relocation of U.S. firms to Mexico. Openness in factor markets plays much less of a role in the short and medium run than do (1) and (2).

Open Economy: Impacts on Goods Market

This section derives mostly from *ME7* Chapter 18. I have introduced clarifying abbreviations DeDoG, DoDeG, and DoDeDoG.

The **Demand for Domestic Goods Z** (**DeDoG**) in an open economy becomes

Z = [C + I + G] - IM/ε + X

where ε = real exchange rate for goods, and

[C + I + G] = the **Domestic Demand for Goods** (**DoDeG**) or **DD** (domestic or imported),

The concepts and terminology get a bit confusing to me.

To adjust Y **[C + I + G]** for NX, we first subtract imports because they are not domestic goods and factor in the real exchange rate **ε**, the price of domestic good in terms of foreign goods. By dividing by ε, **IM/ε** becomes **the value of imports in terms of domestic goods**. Thus we obtain

Domestic Demand for Domestic Goods DoDeDoG = [C + I + G] - IM/ε

To get the overall **Demand for Domestic Goods** DeDoG (as above), we also add in exports X, because exports are domestic goods that are demanded abroad. (*ME7* p. 370)

Thus **Demand for Domestic Goods DeDoG Z = [C + I + G] - IM/ε + X**

These relations are tentatively depicted in the diagram that follows:[270]

As in earlier chapters, $\text{Domestic Demand} = C(Y - T) + I(Y, r + x) + G$, where Blanchard subsequently in this chapter omits risk premium x and role of expectations such as expected inflation rate π^e. (*ME7* p. 370)

Imports are regarded as an undefined function of income and exchange rate:

IM = IM(Y, ε)

This implies an increase in domestic income (or production) Y causes an increase in IM, and an increase in real exchange rate ε (appreciation of US goods) also causes an increase in IM.

Exports depend on foreign income Y* and the real exchange rate, as shown in the following undefined function:

X = X(Y*, ε)

This implies an increase in foreign income (or production) Y* causes an increase in X, and an increase in the real exchange rate ε (appreciation of US goods in terms of foreign goods) leads to a decrease in exports. (*ME7* p. 371)

[270] MCM original diagram,

The interrelationships of demand, output, imports, exports and trade surplus/deficit are shown in the diagrams to follow:[271]

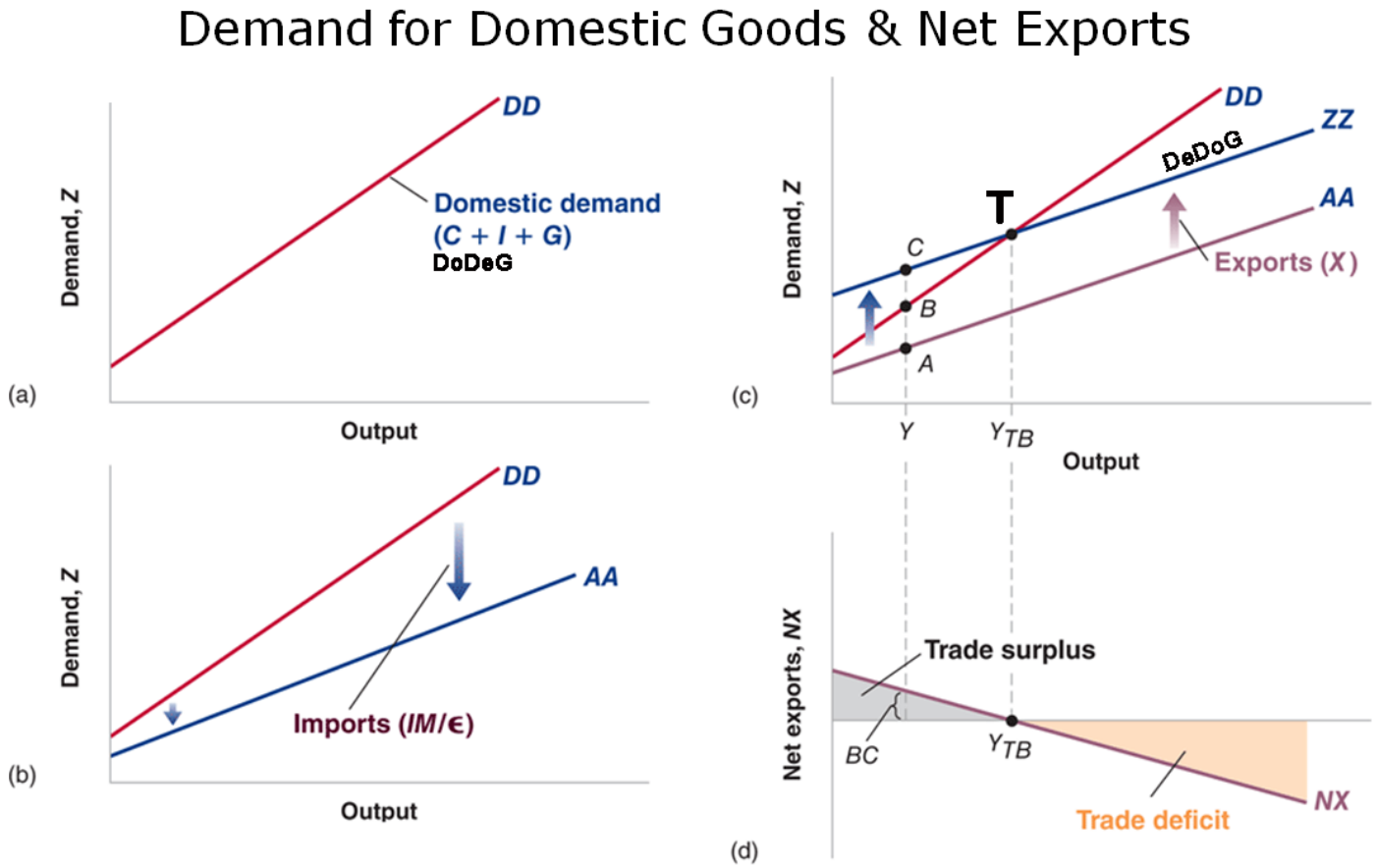
Domestic Demand for Goods DoDeG = [C + I + G] is shown in figure (a) labelled **DD**, with slope MPC and for which NX = 0. This, like other curves in the figures, is shown as a straight line, though it may actually be a curve. It has positive slope (less than the 45° Z=Y line, not shown), so that ↑domestic income/output Y → ↑ demand Z.

The **Demand for Domestic Goods DeDoG** line/curve labelled **ZZ** is created in figure (c), adding in trade flow terms as follows:

1. Subtract imports IM/ε from DD, creating line/curve AA in figure (b), which has positive but smaller slope than that of DD (i.e., slope of AA < MPC). The smaller positive slope arises from the fact that ↑Y → ↑demand for goods, but this is only partially satisfied with ↑domestic goods, with the balance being provided by ↑imported goods. Line/curve AA represents the **domestic demand for domestic goods (DoDeDoG)**.
2. Add Exports X to line/curve AA to create ZZ in figure (c), the **Demand for Domestic Goods DeDoG** labelled **ZZ**, which is parallel to AA (has the same slope that is < MPC) because exports are determined only by foreign demand and are assumed to be constant with respect to Y. ZZ also has lower slope than DD but still positive, so ↑Y → ↑DeDoG.

The bottom right figure (d) shows that **Net Exports NX = (X - IM/ ε)** are in **trade balance (TB)**, namely when Y = Y_{TB} and NX = 0.

This value Y_{TB} corresponds to the point T where curves ZZ and DD intersect, because at that point **DoDeG = DeDoG** and NX = 0. At output Y on figure (d), demand interval AB represents imports **IM/ ε**, and demand interval AC represents exports X, so that net exports NX = demand interval BC. At the point **T** where DD intersects ZZ, X = IM/ε (and BC = 0), representing **trade balance** at which NX = 0.
If output Y < Y_{TB}, NX > 0 and there is a **trade surplus**;
If output Y > Y_{TB}, NX < 0 and there is a **trade deficit**.



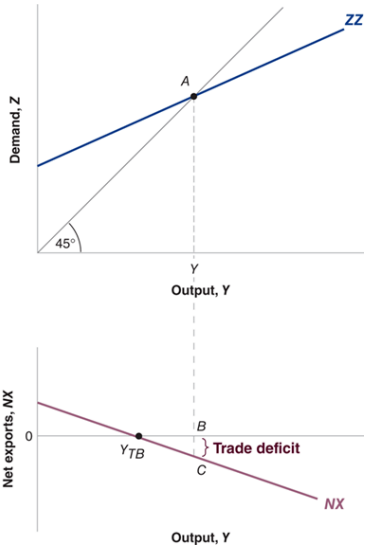
[271] MCM modified from Instructor_Pearson_File_7e_PPT_18.pptx; see also *ME7* p. 371-3

The **goods market is in equilibrium** when domestic output/income equals demand (foreign and domestic) for goods, Y = Z, as before. The goods market equilibrium relation becomes:[272]

$$Y = C(Y - T) + I(Y, r) + G - IM(Y, \varepsilon)/\varepsilon + X(Y*, \varepsilon)$$

The output Y_A at which there is goods equilibrium occurs where ZZ intersects the 45° line for which Y = Z. This level of output Y_A is not expected to coincide with the output Y_{TB} at which a trade balance exists.

The diagrams to right[273] demonstrate this non-equality $Y_{TB} \neq Y_A$, namely that at goods equilibrium (point A, for which $Z = Y_A$), there happens in this example to be a trade deficit (gap BC), but there could just as easily have been a trade surplus. Note that Y_{TB} is not at point B where output $Y = Y_A$.

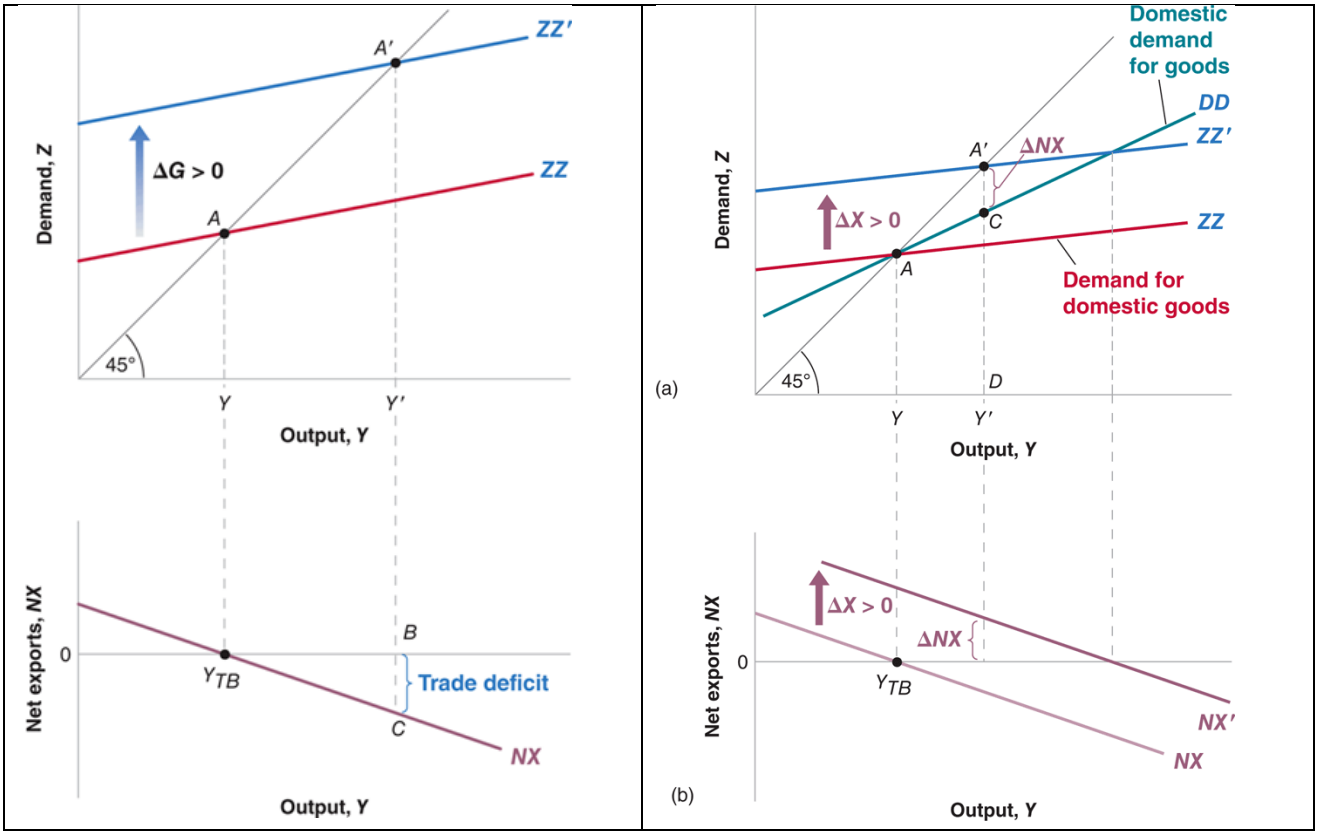


Blanchard provides several examples of how changes in exports in imports impact output and other important measures, as follows:

Example 1. ↑G (↑Government Domestic Demand): If the government chooses to increase government spending G by a fixed increment ΔG>0, the effect is shown in the left diagrams below.[274] The initial condition is arbitrarily set for simplicity at the unlikely coincidence of goods market equilibrium output Y_A (at A) = Y_{TB}, thus also at trade balance so that NX = 0. The demand curve ZZ is shifted upward by ΔG to a parallel line ZZ′ by ΔG. A new goods market equilibrium at A′ arises, corresponding with a higher level of output Y′, for which ΔY is proportionately greater than ΔG, due to a multiplier effect. (This effect is similar to the effect of introducing an increase in autonomous spending c_0 when NX =0, see *Demand for Goods, Equilibrium Goods Output, and I-S Curve*.) However, the effect on output is lower for an open economy than it would be in a closed economy for which NX=0 (multiplier is less effective), because consumers will buy more foreign goods. At the same time, what had been a trade balance becomes a trade deficit.

To summarize, an ↑G or other fixed ↑domestic demand, causes:
(1) ↑domestic output Y (with a smaller multiplier than in a closed economy, because some ↑demand is now met with ↑imports while exports X remain constant); but also
(2) ↓NX leading to a deterioration in trade balance (↓trade surplus or ↑trade deficit).

[272] *ME7* p. 373, including four undefined functions of C, I, IM, and X
[273] Instructor_Pearson_File_7e_PPT_18.pptx and *ME7* p. 374
[274] Instructor_Pearson_File_7e_PPT_18.pptx and *ME7* p. 374-5



Example 2. ↑Foreign Demand ↑Y* → ↑X: If a foreign trading partner country has increased output Y* and this increases its own domestic demand Z*, and it chooses to deal with this in part by having the US increase exports to it by an increment ΔX>0, the effect is shown in right diagrams above.[275] Again for simplicity, assume we are starting at the unlikely coincidence of market equilibrium $Z = Y_A = Y_{TB}$ (trade starts in balance so that NX=0). Recall that DD (DoDeG) has slope steeper than that of ZZ (DeDoG, demand for domestic goods, which includes demand by foreign countries).

When exports increase by ΔX from foreign demand, line ZZ (DeDoG) shifts up by ΔX to ZZ′; a new goods market equilibrium level is established with DeDoG = DA′ at A′ with higher output Y′ at D; and DoDeG = DC. (diagram upper right). NX are now CA′ > 0. Imports also increase (due to ↑Y, but not as much as exports). Note that ↑Y* does not shift line DD nor does it change C, I, or G.

At the same time, line NX (diagram lower right) shifts up by ΔX to line NX′. The demand interval AC (upper right) represents ΔNX—this increment is also shown in the lower right diagram. Moreover, formerly the NX = 0 and ΔNX=0, now NX′ > 0 and ΔNX>0. Thus the starting trade balance has improved to a trade surplus.

To summarize: an ↑foreign demand for exports, causes
(1) ↑domestic output Y; and also
(2) ↑NX leading to an improvement in trade balance (↑trade surplus or ↓trade deficit).

Financial shocks in a major country may affect many or all other countries through not just their financial links but also through their trade, and ↑interconnectedness → ↑economic impact.. The effects of the recent US-initiated crisis in 2008 were strongest between the US and other countries that were most closely interconnected financially and through trade (e.g., the G20 countries)—the latter manifested especially by decreased exports to the US. The G20 members engaged in a coordinated 2009 stimulus using increased private or public (governmental) spending that increased public debt in many countries. (*ME7* p. 377-9) Such **Macroeconomic Policy coordination** is helpful (for example, in preventing or reducing worsening of trade imbalance and worsening of national debt) if all countries participate on an equitable basis and do not seek to gain a competitive advantage. But policy

[275] Instructor_Pearson_File_7e_PPT_18.pptx and *ME7* p. 376-7

coordination between countries is not easy, such efforts are prone to cheating and false or broken promises, and they "often fizzle". (*ME7* p. 379)

For a country such as the US, depreciation of our country's currency is a reduction in nominal exchange rate ↓E, which in turn is also reflected in ↓ε (real exchange rate). When our currency is depreciated, our goods become cheaper to our trading partners, and we might expect US exports to rise ↑X and imports to fall ↓(IM/ ε). The effect on net exports NX is however less clear, and whether or not NX rises (improves) when a currency depreciates is evaluated with the **Marshall-Lerner Condition (MLC)**.[276] The expression for net exports is:

$NX = X - IM/\varepsilon$, or

$NX = X(Y^*, \varepsilon) - IM(Y, \varepsilon)/\varepsilon$

where the 2nd version includes the undefined functions X and IM.

The real exchange rate ε appears in 3 places in the second equation (so -called 3 "**channels**" per Blanchard's terminology, an unusual usage). The Marshall-Lerner Condition MLC may best be deduced through calculus using partial derivatives. When the initial state is assumed for simplicity to be trade balance (NX = 0), the MLC may be stated in non-calculus terms and for ε = real exchange rate as the inequality, Blanchard states:

$(\Delta NX)/X = (\Delta\varepsilon)/\varepsilon + (\Delta X)/X - \Delta IM/IM > 0$

where a reduction of IM (i.e., $\Delta IM < 0$) means that the term $(-\Delta IM/IM)$ is > 0 and by definition for depreciation, $(\Delta\varepsilon)/\varepsilon < 0$.

In words, the fractional change of the real exchange rate plus the fractional change of exports minus the fractional change of the imports must be > 0 for trade balance to improve with depreciation of the currency. Blanchard states that the MLC is satisfied in reality, at least after a time delay that arises from initially inelastic demand for imports and exports in the short run—this delay is depicted in the "**J- curve**".

After a real depreciation, there is typically an initial worsening of trade balance (↓NX and ↑trade deficit during the descent phase of the "J-curve") while X and IM remain relatively unchanged. Gradually, however, quantities of goods traded adjust and NX rises with time improving trade balance (↑NX and ↓trade deficit during the ascent phase of the "J-curve"). Thus, trade elasticities may differ substantially in the short versus the long run.[277]

For example, after the currency depreciation ↓ε that occurred in the US during the latter half of the 1980s, a **lag** of up to 2 years was seen before the trade deficit (expressed as a % of GDP) shrunk. In other words, ↓trade deficit and ↑NX occurred in delayed synchrony with respect to the ↓ε.[278]

The MLC may also be expressed (in terms of nominal exchange rate E) by:[279]

$PED_X + PED_{IM} > 1$

where PED_X = price **elasticity** of demand for exports = $(dX/dE) \bullet E/X$
PED_{IM} = price elasticity of demand for imports = $(dIM/dE) \bullet E/IM$

Mishita Mehra derived the MLC by differentiating NX by (1/ ε) and assuming initial trade balance (so that initially X = IM/ε), concluding that

$dNX / d(1/\varepsilon) > 0$

and trade balance will improve with currency depreciation in ε when

$\boldsymbol{\varepsilon_X + \varepsilon_{IM} > 1}$

where Elasticity $\varepsilon_X \equiv$ real exchange rate elasticity of demand for exports
$= (dX/X) / [\, (d(1/\varepsilon)] / (1/\varepsilon) \,]$
Elasticity $\varepsilon_{IM} \equiv$ real exchange rate elasticity of demand for imports
$= (dIM/IM) / [\, (d(1/\varepsilon)] / (1/\varepsilon) \,]$

---

[276] The ML Condition MLC is also known as **Marshall-Lerner-Robinson Condition MLRC**, named after Alfred Marshall 1842 - 1924, Abba P. Lerner 1903 - 82, and Joan Robinson 1903 - 83.

[277] after Lecture Ch. 18.pdf

[278] *ME7* p. 380, 385, 390, figures 18-6 and 18-7

[279] Adapted from https://warwickeconomics.wordpress.com/2015/03/26/mathematical-proof-of-the-marshall-lerner-condition/ and http://welkerswikinomics.com/blog/2008/12/12/the-marshall-lerner-condition-the-j-curve-and-the-us-trade-deficit/

She concludes that, given a depreciation,

"If price changes lead to sufficiently large changes in quantity (elastic), then the trade balance will improve! If they do not (inelastic), then the trade balance will not improve."[280]

Admittedly, I have *not* mastered the confusing intricacies and profusion of proofs of the MLC/MLRC.[281]

Combining Exchange Rate policy with Fiscal policy (Domestic Policy Mixing)

The following diagram (on the left)[282] illustrates how exchange rate and fiscal policies can be combined by a government to effect a **depreciation** of currency that improves a trade deficit while **fiscal consolidation** is used to keep output stable rather than overheating.

The example assumes an initial goods market equilibrium at A (upper left diagram), for which output Y is at the natural level (usually shown as Y_n, corresponding to the natural level of unemployment u_n), and at which there is a trade deficit (shown as BC in the lower left diagram).

The trade deficit is reduced to 0 by a real exchange rate depreciation, causing the shift of the ZZ curve to ZZ′ by $\Delta NX > 0$ so that NX becomes 0 (trade balance).

However, this would increase output to Y′, which would no longer be at the natural rate. The government therefore elects also to reduce government spending G, so that $\Delta G < 0$. This shifts ZZ′ back to ZZ and restores output Y to the original natural level, while not further affecting the trade balance that has been achieved. Both policies were needed to achieve the desired result.

In general, the following combinations may be considered:

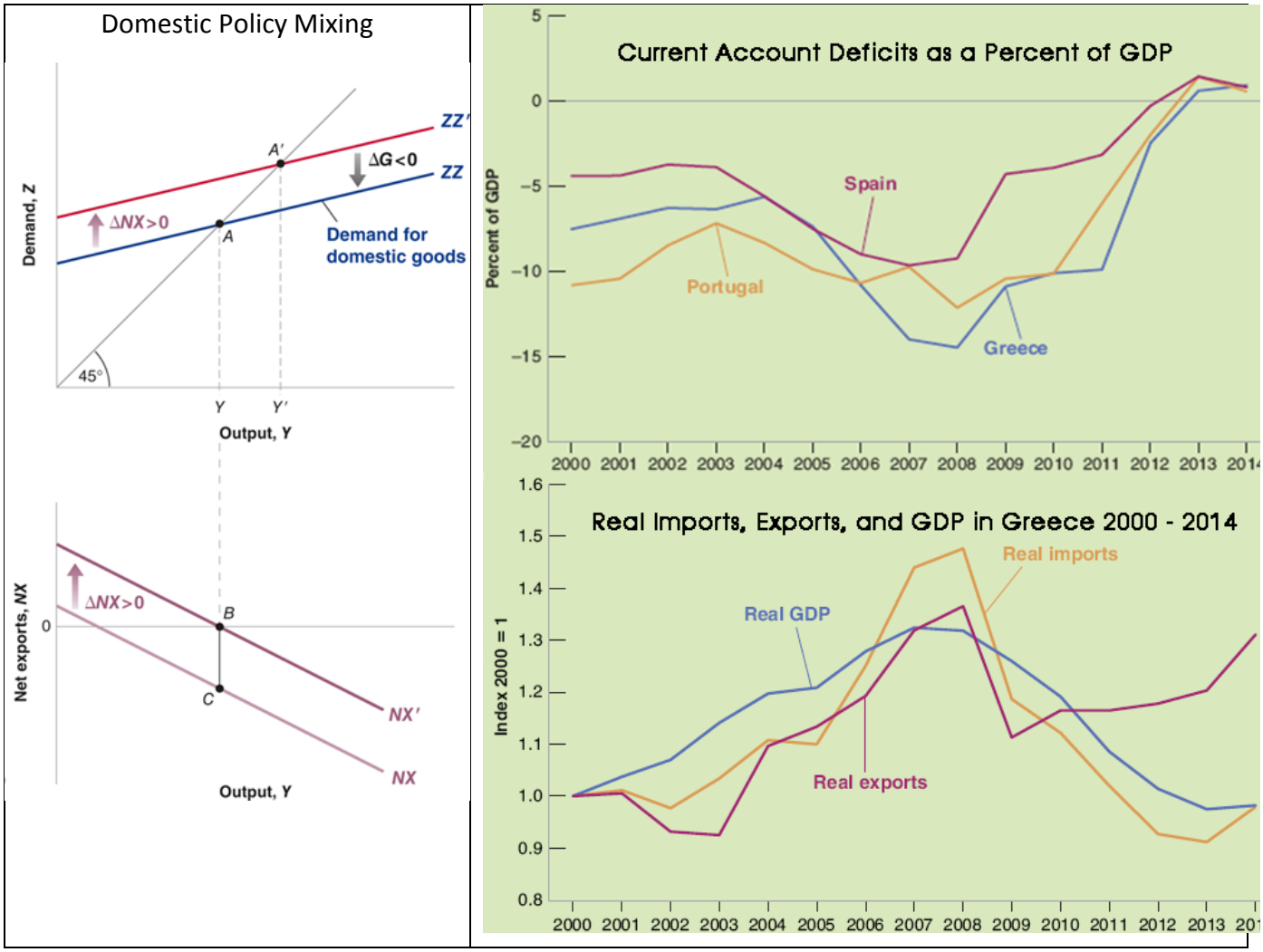
If Output is low, and there is a Trade Surplus	consider	?ε & ↑G
If Output is high, and there is a Trade Surplus	consider	↑ε & ?G
If Output is low, and there is a Trade Deficit	consider	↓ε & ?G
If Output is high, and there is a Trade Deficit	consider	?ε & ↓G

where the ? question marks indicate that ↑ or ↓ may be indicated, and more analysis is needed.

[280] Lecture Ch. 18.pdf

[281] See paper on trade elasticities and MLC complexity: https://www.aeaweb.org/conference/2011/retrieve.php?pdfid=84 (you may need to insert this URL in your browser directly)

[282] *ME7* p.381-2 and Instructor_Pearson_File_7e_PPT_18.pptx



Blanchard gives examples for 3 euro area countries—Portugal, Spain, and Greece—in which efforts during the 2000's to reduce their high current account deficits led to decreased borrowing from other countries. This improved their current account deficits to modest surpluses by 2013 (diagrams on right above).[283] Although the latter can be due to improved competitiveness, in the case of Portugal, Spain, and Greece, the belt-tightening actions imposed on them eventually led to marked reduction in their real output (real GDP) and real imports (termed an **import compression**), neither of which had recovered by 2014. Exports also dropped in the late 2000's but have partially recovered by 2014. These countries, being on the common Euro area currency, could not change their exchange rate, so they could only reduce wages and prices to improve the current account.

Saving, Investment, and the Current Account Balance (CA)

When NX is non-zero, it is no longer valid to conclude that

Investment I = Total Saving = S by consumers + (T – G) , as in *Demand for Goods, Equilibrium Goods Output, and I-S Curve*.

When exports and imports are included, the goods market equilibrium condition is

$Z = Y = C + I + G - IM/\varepsilon + X$

Subtracting C and T from both, and adding NI and NT to both, and setting $X - IM/\varepsilon = NX$, we get

[283] *ME7* p. 382-3 and Instructor_Pearson_File_7e_PPT_18.pptx

(Y + NI + NT – T) – C = I +(G – T) + (NX + NI + NT)
| Disp. Income | | Current Account Balance CA|
| Personal Saving S | so
S = I + (G –T) + CA or
I = S + (T – G) – CA so
CA = S + (T – G) – I thus

CA = private saving plus public (govt.) saving minus investment (*ME7* p. 386)

Note: Blanchard uses "CA" to represent the Current Account Balance.

For clarity, let us call private saving plus public (govt.) saving = $\mathbf{S_{tot}}$. Then

A **CA surplus** (CA > 0) means that

S_{tot} > Investment, so the country saves total more than it invests, & invests less than it saves
Such a country is a **net lender** to the rest of the world.

A **CA deficit** (CA < 0)means that

S_{tot} < Investment, so the country saves total less than it invests, & invests more than it saves.
Such a country is a **net borrower** from the rest of the world.

It also follows that

- ↑I → ↑S or ↑(T–G) or ↓CA
  (↓CA is a CA deterioration moving toward ↑CA deficit)
- ↓(govt. budget balance T – G) → ↑S or ↓I or ↓CA
  (↓CA is a CA deterioration moving toward ↑CA deficit)
- High S_{tot} → high I or high CA surplus (CA ≫ 0)

But

(1) NOT THE FOLLOWING: (T – G) < 0 → CA < 0,
(2) NOT THE FOLLOWING: (T – G) < 0 → ↓I or ↑S

In these two NOT THE FOLLOWING cases, more analysis of output and its components would be needed to predict effects.

Note also that a depreciation ↓ε improves NX (↑NX) and, in the absence of change in NI or NT, would → ↑CA (improvement in CA toward surplus). But ↓ε actually → ↑Y → ↑S_{tot} > ↑I and so ↓CA (if T – G is constant).

Organization for Economic Co-operation and Development OECD

Alternative spellings include *Organisation for Economic Cooperation and Development.*

Current membership consists of 35 countries and produce 70% of world output.[284]

Australia	Austria	Belgium	Canada	Chile	
Czech Republic	Denmark	Estonia	Finland	France	
Germany	Greece	Hungary	Iceland	Ireland	Israel
Italy	Japan	Korea	Latvia	Luxembourg	Mexico
Netherlands	New Zealand	Norway	Poland	Portugal	
Slovak Republic	Slovenia	Spain	Sweden	Switzerland	
Turkey		United Kingdom		United States	

"The mission of the Organisation for Economic Co-operation and Development (OECD) is to promote policies that will improve the economic and social well-being of people around the world… The OECD provides a forum in which governments can work together to share experiences and seek solutions to common problems. We work with governments to understand what drives economic, social and environmental change. We measure productivity and global flows of trade and investment. We analyse and compare data to predict future trends. We set international standards on a wide range of things, from agriculture and tax to the safety of chemicals… We also look at issues that directly affect everyone's daily life, like how much people pay in taxes and social security, and how much leisure time they can take. We compare how different countries' school systems are readying their young people for modern life, and how different countries' pension systems will look after their citizens in old age…"[285]

[284] http://www.oecd.org/about/membersandpartners/
[285] http://www.oecd.org/about/

P

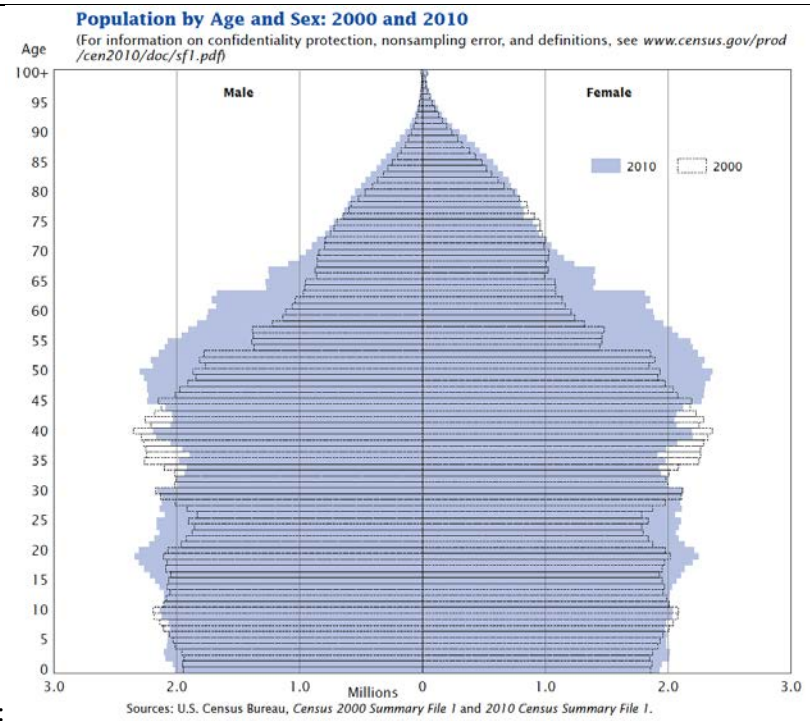
Phillips Curve PC

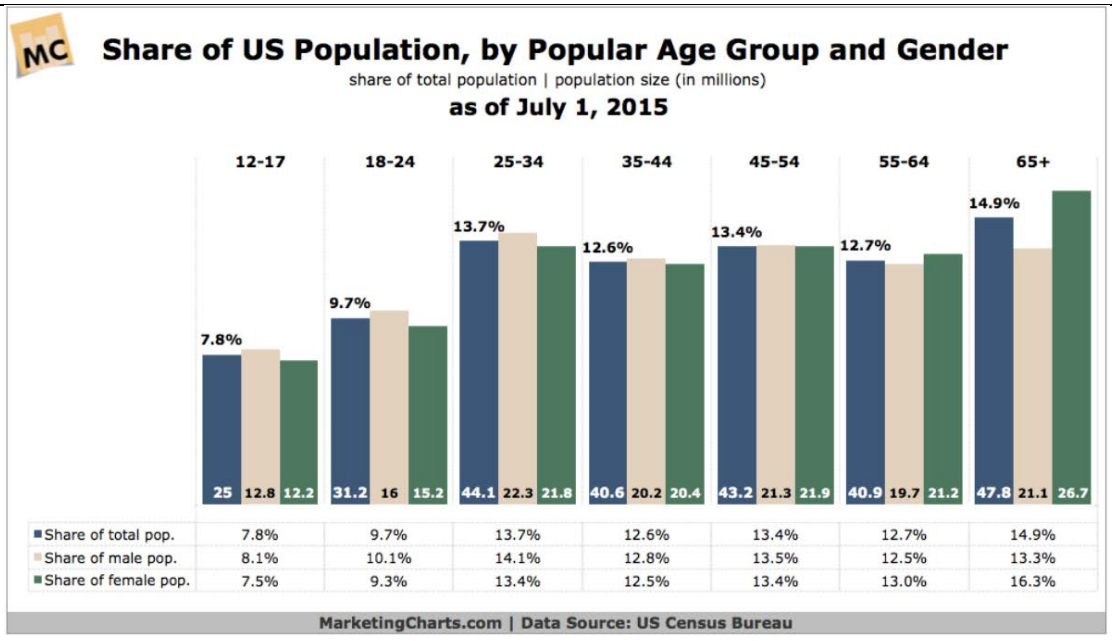
See *Unemployment and Employment Rate* and also *IS-LM-PC Model*

Population of the US By Sex, Age Brackets, and Generations

The following is the 2010 Census Bureau breakdown by age and sex, [286] and a 2015 estimate[287]

2015:





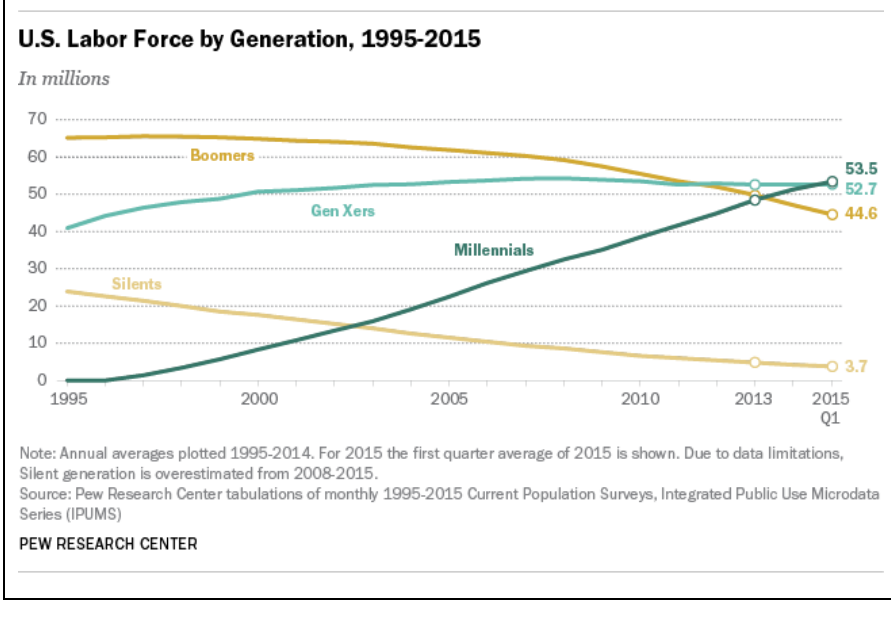
[286] http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf

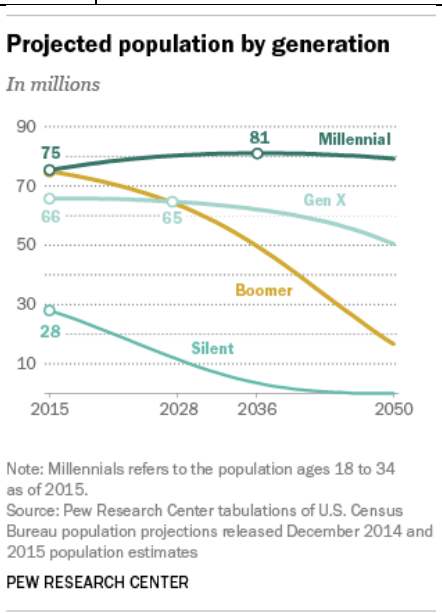
[287] http://www.marketingcharts.com/traditional/so-how-many-millennials-are-there-in-the-us-anyway-30401/attachment/censusbureau-share-of-pop-by-age-group-gender-apr2016/

There seems to be no agreement on what to call our US generations. The following are approximate start and ending birth years from various sources (some are broadened to Western generations rather than US only).

Generation	Wikipedia[288]	Pew Research[289]	Center for Gen. Kinetics CGK[290] Michael T. Robinson MTR[291]
Lost Generation	1883 – 1900		MTR: 1890 – 1915
Greatest Generation; **G.I. Generation**	1901 – 1924	< 1928	MTR: Interbellum: 1901–1913 MTR: Greatest Gen: 1910–1924
Silent Generation	1925 – 1945	1928 – 1945	CGK: b. ≤ 1945 MTR: 1925 – 1945
Baby Boomers	1946 – 1964	1946 – 1964	CGK: 1946 to 1964 MTR: 1946 – 1964
Generation X (Gen X); **Baby Bust)**	start: c. 1965 end: late 1970s to early 1980s	1965 – 1980	CGK: 1965 to 1976 MTR: 1965 – 1979
Millennial Generation; **Millennials;** **Gen Y;** **Gen Next**	start: late 1970s to early 1980s end: mid-1990s to early 2000s	1981 – 1997	CGK: 1977 – 1995 MTR: 1980 – 1995
Generation Z (Gen Z); **Post-Millennials;** **Centennials;** **iGen**	start: mid-1990s to early 2000s ending: ?		CGK: ≥ 1996 MTR: Gen Z: 1996 – 2010 MTR: Gen Alpha: 2011 – 2025

This row's graphs from Pew Research[292]





[288] https://en.wikipedia.org/wiki/Generation
[289] http://www.pewresearch.org/fact-tank/2016/04/25/millennials-overtake-baby-boomers/ etc.
[290] http://genhq.com/faq-info-about-generations/
[291] https://www.careerplanner.com/Career-Articles/Generations.cfm
[292] http://www.pewresearch.org/fact-tank/2016/04/25/millennials-overtake-baby-boomers/ and http://www.pewresearch.org/fact-tank/2015/05/11/millennials-surpass-gen-xers-as-the-largest-generation-in-u-s-labor-force/

Production

The processes and methods used to transform tangible inputs (raw materials, semi-finished goods, subassemblies) and intangible inputs (ideas, information, knowledge) into goods or services. Resources are used in this process to create an output that is suitable for use or has exchange value.[293]

QR

Real vs. Nominal

Nominal quantities are expressed in current dollars and shown as $P, $Y, etc. Real inflation-adjusted quantities are expressed without the $ sign and are shown (somewhat ambiguously) as P, Y, etc.

Recession

"In general usage, the word **recession** connotes a marked slippage in economic activity. While gross domestic product (GDP) is the broadest measure of economic activity, the often-cited identification of a recession with two consecutive quarters of negative GDP growth is not an official designation. The designation of a recession is the province of a committee of experts at the **National Bureau of Economic Research (NBER)**, a private non-profit research organization that focuses on understanding the U.S. economy. The **NBER recession** is a monthly concept that takes account of a number of monthly indicators—such as employment, personal income, and industrial production—as well as quarterly GDP growth. Therefore, while negative GDP growth and recessions closely track each other, the consideration by the NBER of the monthly indicators, especially employment, means that the identification of a recession with two consecutive quarters of negative GDP growth does not always hold. For information on recession, or business-cycle, dating, see [The NBER's Recession Dating Procedure]."[294]

S

Saving vs. Savings

Saving is an economic flow over a period of time.

Private saving is shown as S, where $S \equiv Y_D - C \equiv Y - T - C$. It is the after-tax (discretionary) income that you do not spend (consume).

Public saving is governmental saving, thus (T – G), where T is taxes received minus transfers paid out, and G is governmental spending (which does not include transfers). This quantity may be negative.

Savings is an ambiguous term shunned by Blanchard. Savings is/are a stock taken generally to be the liquid financial assets owned by a person, domestic unit, etc. at a particular point in time. It is "The money one has saved, especially through a bank or official scheme."[295] Opinions vary on whether longer-term less liquid and riskier financial investments, such as securities, are included in savings.

Other Definitions:
(1) Savings: "The portion of disposable income not spent on consumption of consumer goods but accumulated or invested directly in capital equipment or in paying off a home mortgage, or indirectly

---

[293] http://www.businessdictionary.com/definition/production.html
[294] http://www.bea.gov/faq/index.cfm?faq_id=485 Recession: How is that defined
[295] https://en.oxforddictionaries.com/definition/saving

through purchase of securities."[296]
(2) Saving: "the excess of income over consumption expenditures —often used in plural"[297]
(3) Saving: "is income not spent, or deferred consumption. Methods of saving include putting money aside in, for example, a deposit account, a pension account, an investment fund, or as cash. Saving also involves reducing expenditures, such as recurring costs. In terms of personal finance, saving generally specifies low-risk preservation of money, as in a deposit account, versus investment, wherein risk is higher; in economics more broadly, it refers to any income not used for immediate consumption."[298]

Standard of Living and Purchasing Power Parity PPP

A standard of living is "the level of wealth, comfort, material goods and necessities available to a certain socioeconomic class or a certain geographic area. The standard of living includes factors such as income, gross domestic product, national economic growth, economic and political stability, political and religious freedom, environmental quality, climate, and safety. The standard of living is closely related to **quality of life..**.

One measure of standard of living is the United Nations's **Human Development Index (HDI)**, which scores 188 different countries based on factors including life expectancy at birth, education and income per capita. As of December 2015, the countries with the five highest HDI scores are Norway (0.944), Australia (0.935), Switzerland (0.930), Denmark (0.923) and the Netherlands (0.922). Conversely, the countries with the five lowest 2015 HDI scores are Niger (0.348), Central African Republic (0.350), Eritrea (0.391), Chad (0.392) and Burundi (0.400), although Syria and Libya experienced the most dramatic decreases in living standard.

To exemplify the difference between the standard of living scores of 0.944 and 0.348, Norway has a life expectancy at birth of 81.6 years, 17.5 expected years of schooling (per citizen), Gross National Income (GNI) per capita of $64,922.30 (**PPP-adjusted currency units** [see below]), a homicide rate (per 100,000 people) of 2.2, a mobile phone subscription rate (per 100 people) of 116.5 and an internet usage rate of 96.3% of its population. Niger, meanwhile, has a life expectancy at birth of 61.4 years, 5.4 expected years of schooling, a GNI per capita of $908.30, a homicide rate of 4.7, a mobile phone subscription rate of 44.4 and an internet usage rate of 2%...

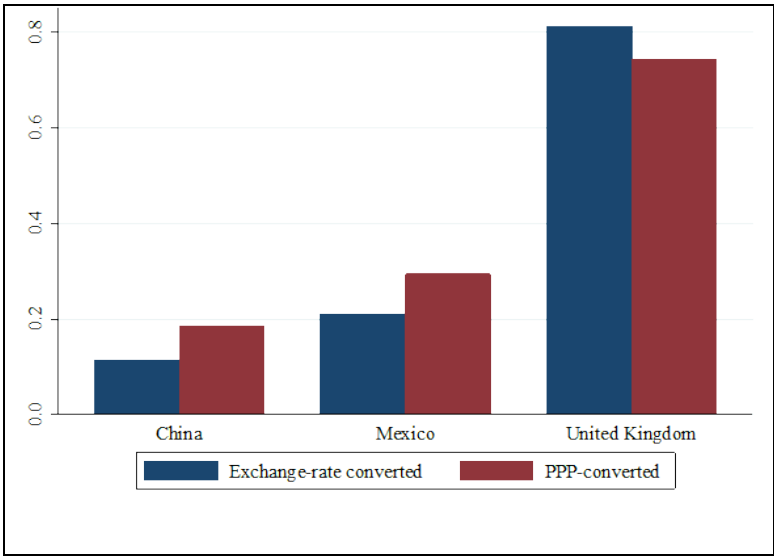
The **U.S. scored eighth on the list** with a combined standard of living score [HDI] of 0.915, a life expectancy at birth of 79.1 years, 16.5 expected years of schooling and GNI PPP per capita of $52,946.50."[299] The US in 2014 had 23% of world output. The US had higher GDP than Germany

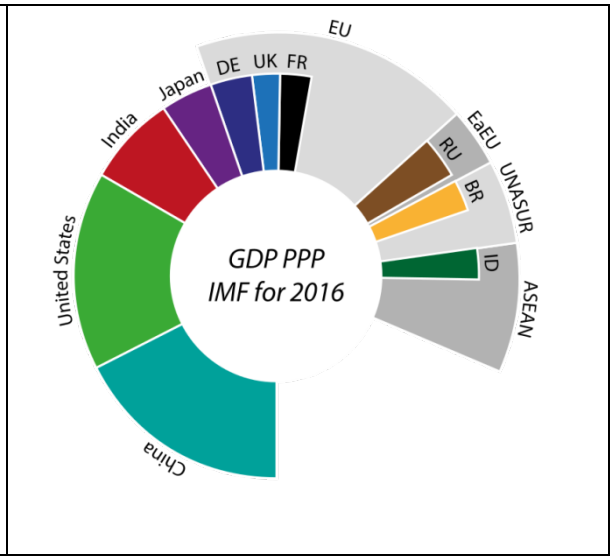
The standard of living is closely related to **output per person** or **expenditures/consumption per person**, adjusted for exchange rates, but more importantly for the price levels for basic goods and services (which may be much lower in countries with low output per person). For instance, comparing GDP in India to the US, the ratio is 1/31.3, whereas for PPP, the ratio is 1:11 (*ME7* p. 200ff) In comparing the GDP of countries, it is not sufficient to simply use **exchange rates**. The best metric for optimal comparison of adjusted real GDP among different countries is the **purchasing power parity PPP**. PPP-related numbers were initially presented in the *Penn World Tables*, a project initiated by Irving B. Kravis [1916 - 1992], Alan W. Heston [b. 1934], and Robert Summers [1922 - 2012]. The hosts of this project are now UC Davis and U. Groningen, and the data is currently downloadable (in version 9.0 in Excel format as of Dec. 2016).[300] Data for the US and other developed countries is currently presented from 1950 to 2014, data for other countries often go back fewer years. A wide range of variables is presented. One of the key variables is "**rgdpe**", the "Expenditure-side real GDP at chained PPPs (in millions of 2011 US$)", which is "well-suited for comparisons across countries and over time".[301] However, I have not mastered this ambitious and well-regarded but difficult data presentation.

---

[296] http://www.businessdictionary.com/definition/savings.html
[297] https://www.merriam-webster.com/dictionary/saving
[298] https://en.wikipedia.org/wiki/Saving
[299] http://www.investopedia.com/terms/s/standard-of-living.asp?lgl=no-infinite
[300] Center For International Data - UC Davis: http://cid.econ.ucdavis.edu/pwt.html
Current Penn World Table website: http://www.rug.nl/ggdc/productivity/pwt/
Excel table: http://www.rug.nl/ggdc/docs/pwt90.xlsx
[301] Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer. 2015. "The Next Generation of the Penn World Table." *American Economic Review*, 105(10): 3150-82. DOI: 10.1257/aer.20130954

The **calculation of PPPs** is mathematically complex. For instance, see here[302] how **Eurostat** (a key to European statistics) and the **OECD** jointly calculate PPPs for EU member states and OECD member countries.





The diagram to left above illustrates **GDP per capita** in 2011 for 3 countries, with US = 1 (but not shown). The blue bars are adjusted only for exchange rate, whereas the red bars are PPP-converted comparisons, and the latter show smaller differences among the three countries.[303]

A list of countries ranked by **real PPP GDP per capita** is given here: in the 3 tables from various organizations, the US ranks 11th, 9th, and 13th, respectively.[304] In these tables, the common measure of PPP currency utilized is the hypothetical **Geary–Khamis**[305] **International dollars** (**Intl.$** or **Int'l.$** or **Int$**; probably for base year 2000 though not stated).

I assume that **per capita** in economic usage means per person found in the total population of the country at the time of the census or extrapolated from the census, whether resident or not. This is not always the definition of **total population** used: "The total of all usual **residents** [in a country] is generally referred to as the **de jure population**, and the total of all **persons present** as the **de facto population**."[306]

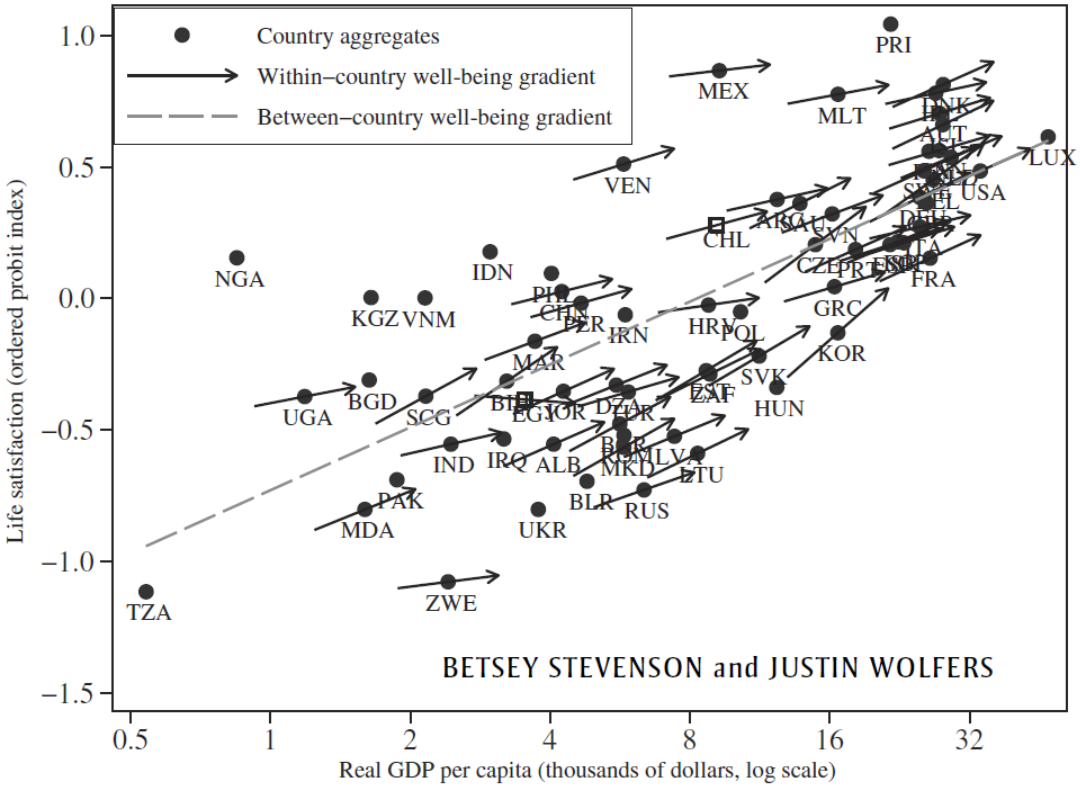
The diagram above to right shows the relative sizes of total GDP PPP for 2016 in INT$ for the top 10 countries. The US has now become second after China (and is lower than the EU as a whole).[307] Grouping of countries and organizations mentioned include

Union of South American Nations = **Unión de Naciones Suramericanas**: **UNASUR**.
Eurasian Economic Union: **EAEU** or **EaEU**.
Association of Southeast Asian Nations: **ASEAN.**

[302] http://www.oecd.org/std/prices-ppp/eurostat-oecdmethodologicalmanualonpurchasingpowerparitiesppps.htm
[303] http://voxeu.org/article/recasting-international-income-differences-next-generation-penn-world-table
[304] https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita . Data fetched Dec. 2016
[305] Roy C. Geary [1896-1983] initiated, subsequent work by Salem Hanna Khamis [1919 - 2005
[306] https://stats.oecd.org/glossary/detail.asp?ID=2090
[307] https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)

The ultimate test of standard of living might be **Life Satisfaction**. A study from 2008 set out to revisit the **Easterlin paradox**,[308] which had suggested that there is no link between a society's economic development and its average level of happiness. The new study's diagram below[309] (similar to *ME7* p. 204) compares satisfaction among 69 developed and developing countries. The overall regression (dashed line) suggests that increasing Real GDP per capita brings greater life satisfaction. Within countries, arrows that have higher slope values (i.e., are less horizontal) have greater satisfaction in higher income people than in lower income people, whereas arrows that have slope values (i.e., are more horizontal) indicate that higher income people and lower income people are more similar in life satisfaction. (These dollars are PPP-adjusted 2000 Intl.$ dollars.) In conclusion, money can buy happiness but only to a certain extent.

Within-Country and Between-Country Estimates of the Life Satisfaction–Income Gradient: 1999–2004 World Values Survey[a]



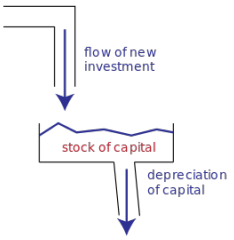
Source: World Values Survey, 1999-2004 wave; authors' regressions. Sources for GDP per capita are described in the text.

a. Each solid circle plots life satisfaction against GDP per capita for one of sixty-nine developed and developing countries; hollow squares denote samples that are not nationally representative. The slope of the arrow represents the satisfaction-income gradient estimated for that country from a country-specific ordered probit regression of satisfaction on the log of household income, controlling for gender, a quartic in age, and their interaction, as well as indicator variables for missing age or gender. Usable household income data were unavailable for eighteen countries. The dashed line represents the between-country satisfaction-income gradient estimated from an OLS regression of the satisfaction index on the logarithm of real GDP per capita. GDP per capita is at purchasing power parity in constant 2000 international dollars.

[308] Richard Easterlin, 1973, "Does Economic Growth Improve the Human Lot? Some Empirical Evidence." http://graphics8.nytimes.com/images/2008/04/16/business/Easterlin1974.pdf

[309] Betsey Stevenson and Justin Wolfers "Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox": Brookings Papers on Economic Activity, 2008, No. 1. https://users.nber.org/~jwolfers/papers/EasterlinParadox.pdf Graphic slightly modified by MCM.

Stock versus Flow Variables



Economics, business, accounting, and related fields often distinguish between quantities that are stocks and those that are flows. These differ in their units and manner of measurement.

A **stock variable** is measured at one specific time [e.g., Y_t], and represents a quantity existing at that point in time (say, December 31, 2004), though the stock may have accumulated over a period of time.

A **flow variable** is measured over an interval of time. Therefore a flow would be measured per unit of time (e.g., a year). Flow is roughly analogous to **rate** or speed in this sense… For example, **U.S. nominal gross domestic product $Y** refers to a total number of dollars spent over a time period, typically a quarter or year. Therefore it is a flow variable, and has units of dollars/year, etc.

In contrast, the **U.S. nominal capital stock** is the total value, in dollars, of equipment, buildings, inventories, and other real assets in the U.S. economy, and has units of dollars. The diagram provides an intuitive illustration of how the stock of capital currently available is increased by influx of **new investment** and depleted by **depreciation**.[310]

T

Technological Progress and Its Impact

I refer throughout this document to the vital role of **Technological Progress (TP)** in improving output and standard of living (for many if not for all).

TP can lead to better products, new products, and a greater and thus a more satisfying variety of products.

The production function Y = F(K,N) may be modified to accommodate the role of ↑Tech (or TP).

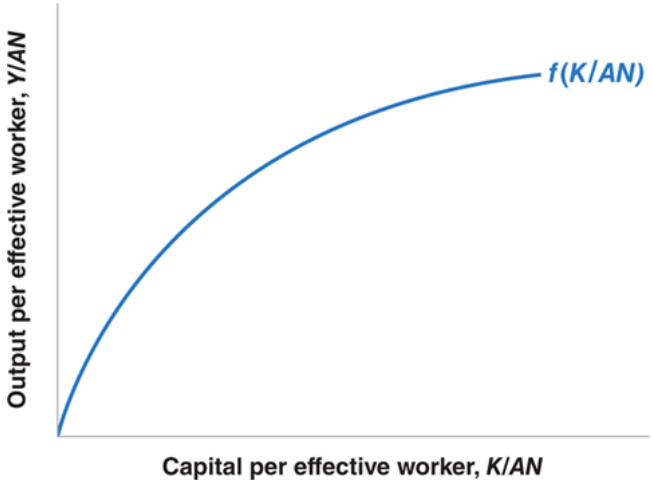
Y = F(K, A, N) or F(K, AN)

where AN becomes effective labor, and ↑A , ↑AN, or ↑K will → ↑F.

Effective labor A expresses a multiplier that **increases the productivity of a worker** by his/her technological skills and capabilities. The revised production function is again assumed to have constant returns to scale, so xY = F(xK, xAN), and as before we can derive for x=1/AN:

Y/AN = f(K/AN)

so that output per effective becomes a function only of capital per effective worker K/AN. (*ME7* p. 243).



Blanchard posits (graph to right) that the revised f will exhibit **decreasing returns to output per effective worker Y/AN** for ↑**K/AN** [311] (the latter may be caused by ↑**K** or ↓**AN**).

As before, we assume I = S = sY under assumptions of Ch. 11, so that I = S, (T – G = 0), and s is constant. Then

I/AN = s(Y/AN) = sf(K/AN).

Define **δ** = depreciation rate
$\mathbf{g_A}$ = growth rate of technological progress > 0
$\mathbf{g_N}$ = growth rate of population

[310] https://en.wikipedia.org/wiki/Stock_and_flow
[311] Instructor_Pearson_File_7e_PPT_12.pptx

The growth rate of effective labor is $\mathbf{g_{AN} \approx g_A + g_N}$.[312]

We may depict the effect of TP (upper graph on the left), similar to simpler graphs without technological growth.)[313] As before, the blue upper curve represents output per effective worker Y/AN = f(K/AN) as a function of capital per effective worker K/AN. The green lower curve represents investment per effective worker sf(K/AN) as a function of capital per effective worker K/AN.

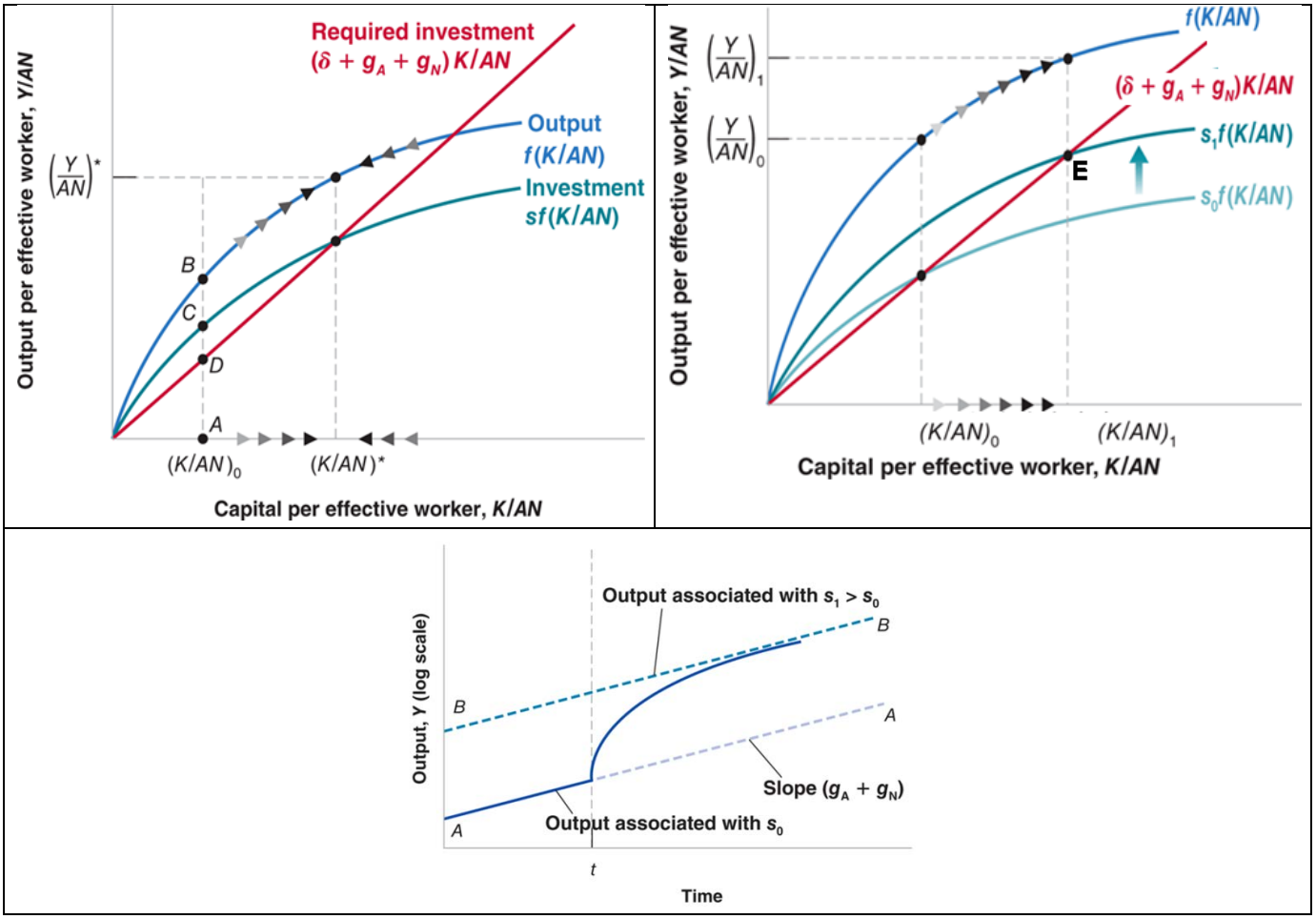
To maintain a given (constant) level of capital per effective worker K/AN, we consider that A, N, and AN all may be increasing over time. The goal then is to increase capital stock K in proportion to the increase in effective workers AN. We assume that the ratio of employment of the population is constant. Then the level of investment needed to maintain a given level of capital per effective worker is:

$$I = \delta K + (g_A + g_N)K = (\delta + g_A + g_N)K \quad \text{or}$$

$$\frac{I}{AN} = (\delta + gA + gN)\frac{K}{AN}$$

The required investment needed to keep K/AN constant is depicted along the straight red line with slope = $(\delta + g_A + g_N)$. This line allows for capital depreciation, growth of technological capability, and population growth (thus, growth of effective labor). But at point C (left diagram for $(K/AN)_0$), Investment ($sf((K/AN)_0$) exceeds the equilibrium value. So the economy will gradually move to increase K/AN until a new equilibrium approximately constant value for capital per effective worker **(K/AN)*** is attained. At the new unnamed equilibrium point (where red and green curves intersect),

Required Investment/AN = Equilibrium Investment/AN = sf((K/AN)*)
Output / AN = Equilibrium output/AN = Y(K/AN)* = f((K/AN)*)



[312] *ME7* .p. 245 and appendix A-2. Note that if $z = xy$ and $z + \Delta z = (x + \Delta x)(y + \Delta y)$, then $(1 + g_z) = (1 + g_x)(1 + g_y) \approx \mathbf{g_x + g_y}$ where g are growth rates $\Delta x/\Delta t$ etc.

[313] Instructor_Pearson_File_7e_PPT_12.pptx

At this new equilibrium steady state for the economy, a state which is termed **balanced growth**,[314] the following apply:

• Capital per effective worker (K/AN)* and Output per effective worker (Y/AN)* are constant (growth of both = 0).

• Capital per worker (K/N) and Output per worker (Y/N) are both growing at the rate of technological progress g_A.

• Labor N is growing at g_N (as defined).

• Capital and Output are both growing at the rate of ($g_A + g_N$).

When the **saving rate s is increased**, as in the upper right diagram above, a higher equilibrium value of $\left(\frac{K}{AN}\right)^*_1$ will eventually be established.[315] The saving rate increasing from s_0 to s_1 shifts the curve for Investment up, so that a new equilibrium point E at $s_1 f\left[\left(\frac{K}{AN}\right)^*_1\right]$ now applies. At this new equilibrium steady state for the economy, again at **balanced growth**,[316] the following apply:

• Capital per effective worker (K/AN) and Output per effective worker (Y/AN) gradually and asymptotically increase to new constant values, respectively $\left(\frac{K}{AN}\right)^*_1$ and $f\left[\left(\frac{K}{AN}\right)^*_1\right]$; growth of both returns gradually to 0).

• Capital per worker (K/N) and Output per worker (Y/N) are again both growing at the rate of technological progress g_A.

• Capital and Output are both again growing at a rate of ($g_A + g_N$) so that their curves have slope = ($g_A + g_N$). The new saving rate does not change these steady state growth rates.

• The economy is growing at the same rate as before, but on a higher growth path (bottom diagram above),[317] so that for any given time after the increase in s, the new output Y is higher than the old.

Technological progress TP arises from many pursuits, and I can only name some of these that I have come across: major **discoveries** and **innovations;** more mundane **research & development R&D** leading to useful results and **ideas**; better **management** techniques and improvements in **efficiency;** new & **better machines, processes, and techniques**; etc. The usefulness of results and ideas arising from R&D is said to indicate the **fertility of research**. Ideas and techniques that are readily disseminated, whether intentionally or unintentionally, are said to have high **appropriability**, which may be good or bad for the firm (depending on **patentability**, **protection of property rights**, **trade secrets**), etc. Other factors affecting the level and success of TP include **level of protection against corruption, theft**, **anti-trust laws** and **fairness of competition**, **risk of expropriation**; **vigor and efficiency of societal institutions**; **cultural traits, legal and judicial systems**, **financial systems**, **barriers to entry**, **favorable geography**, **degree of democratization** (compare **North vs. South Korea** since 1970); **living standards, health**, **urbanization**, and **populace satisfaction**; investment in **education and skills**; etc. Some firms are better at **copying** technologies than innovating them. Some are better at **applied research**, others better at **theoretical research** (with longer times until it pays off). A culture of **entrepreneurship** can promote TP. New discoveries can take many years to **diffuse** through an industry or to other countries, especially if there various are barriers and impaired communication. Persistent weakness in **technological absorptive capacity** may increasingly constrain developing-country technological progress.[318]

The following graph from 2004 depicts a correlation between risk of expropriation and GDP per capita in 1995 PPP:[319] The US is at the top in highest level of protection, Haiti is near the bottom.

---

[314] *ME7* p. 247 and table in Instructor_Pearson_File_7e_PPT_12.pptx

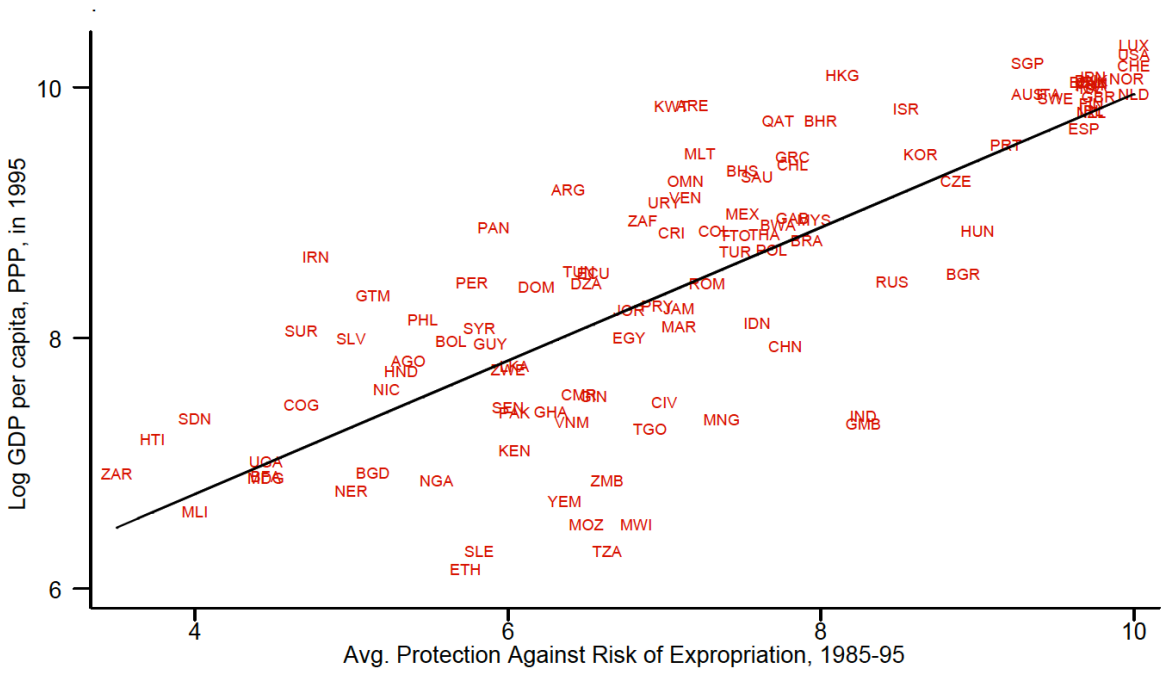
[315] graph from Instructor_Pearson_File_7e_PPT_12.pptx, modified MCM for scale

[316] *ME7* p. 247 and table in Instructor_Pearson_File_7e_PPT_12.pptx

[317] Instructor_Pearson_File_7e_PPT_12.pptx

[318] https://www.oecd.org/innovation/41708397.pdf

[319] Daron Acemoglu, "Understanding Institutions", Lionel Robbins Lectures, London School Economics, Feb.23-25, 2004. http://economics.mit.edu/files/1353.pdf



The contribution of technological progress TP to GDP growth can be estimated by the **Solow Residual**.[320] This takes inputs:

growth rate of output g_Y
growth rate of labor g_N
growth rate of capital g_K
the shares of labor $\alpha = (WN/PY)$ where W/P are real wages and $0 \le \alpha \le 1$
the share of capital = $(1 - \alpha)$

The share of labor in output is the total wage bill WN in nominal dollars divided by the value of output in nominal dollars.

Now $gY = \alpha g_N$

The growth in output attributable to growth in both labor and capital = $(\alpha g_N + (1 - \alpha) g_K)$

Then the excess of actual growth over growth in output attributable to growth in both labor and capital is the Solow Residual:

residual = $gY - (\alpha g_N + (1 - \alpha) g_K)$, usually expressed as a percent.

The residual is also called the **rate of growth of total factor productivity**, or **rate of TFP growth** or just TFP.[321]

Then residual = αg_A or

growth rate attributable to TP = TFP = g_A = residual / α

[320] Robert M. Solow, "Technical Change and the Aggregate Production Function", *The Review of Economics and Statistics*, Vol. 39, No. 3 (Aug., 1957), pp. 312-320.
[321] https://en.wikipedia.org/wiki/Solow_residual and *ME7* p. 261.

"Robert Solow won the Nobel prize in economics for his work. His declaration—that only about 'one-eighth of productive increase is due to capital' while 'the **remaining seven-eighths is technical change**'—was very influential in creating public emphasis on the role of technology in the economy."[322]

Chapter 13 of *ME7* (which we omitted), takes up the question of adverse effects of technological progress TP on **unemployment** and on **income inequality**. (Unfortunately, in this summary I have not been able to give adequate attention to unemployment, and to job and wage inequality, which are of great social importance, but see later in this topic.)

In the **short run SR**, TP may decrease or increase employment. A major new invention may, especially in the SR, greatly increase demand, output, investment, and local employment. But greater efficiencies and productivity may increase or decrease demand for goods, can cause downsizing, and may lead to ↑job insecurity, resulting in ↓demand for goods and ↓consumption. The latter trends are accompanied by a shift of the familiar IS curve (real interest r vs. output Y) to the left. The effect on employment of these changes over time interval Δt can be expressed by

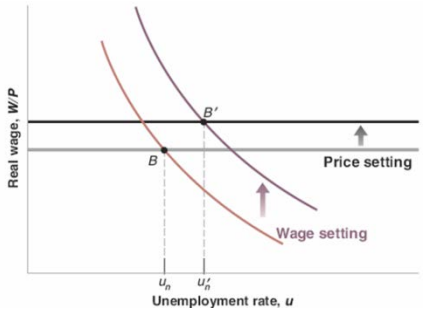
$$\Delta\text{employment}/\Delta t = (\Delta\text{output} - \Delta\text{productivity})/\Delta t \ ,$$

or equivalently

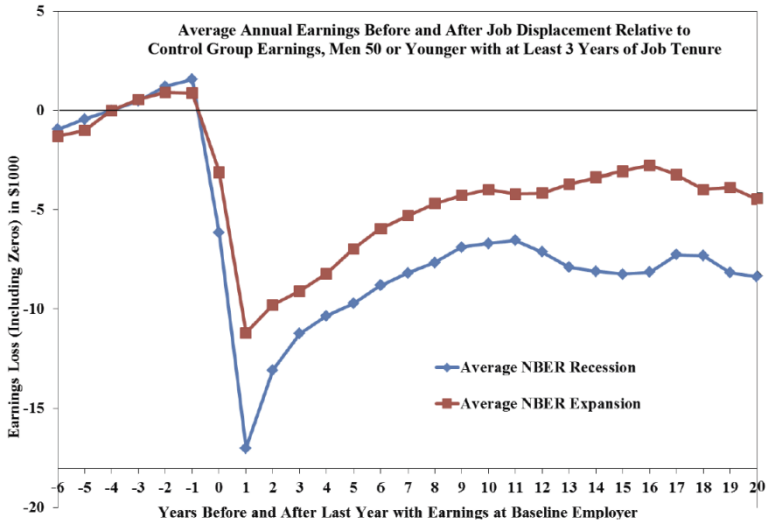
$$g_N = g_Y - g_A$$

where the RHS can obviously be either positive or negative. (*ME7* p. 265) Blanchard states that "There is a strong positive relation between output growth and productivity growth. [see graph *ME7* p. 266] But the causality runs from output growth to productivity, not the other way around."[323]

In the **medium run**, the economy tends to return to the natural rate of unemployment u_n. Increases in **productivity growth** may cause a shift upward of the price setting and wage setting curves and may have no effect on u_n. (graph *ME7* p. 269). Increases in productivity growth has minimal correlation with u but there appears to be at least a tendency toward *lower* actual unemployment. (graph *ME7* p. 270, details omitted) However, in the special case where "if it takes time for workers to adjust their expectations of productivity growth [and they continue to ask for higher wages than can be justified], a slowdown in productivity growth will lead to an increase in the natural rate [of unemployment u_n] for some time."(graph to right)[324]



But in the **long run**, TP can adversely affect those who lose their jobs, including those with outmoded job skills. Although they receive the benefits that all consumers receive from technological advances, they may experience prolonged unemployment or find themselves settling for lower wages, resulting in increasing income inequality. (*ME7* p. 263) "Fears of **technological unemployment** probably come from **structural change**—the change in the structure of the economy induced by technological progress."[325] These changes can include "**creative destruction**—new goods make old ones obsolete" and "**churning**: New techniques of production require new skills, making some old skills less useful."[326] The diagram to right demonstrates the long term impact of job loss on average

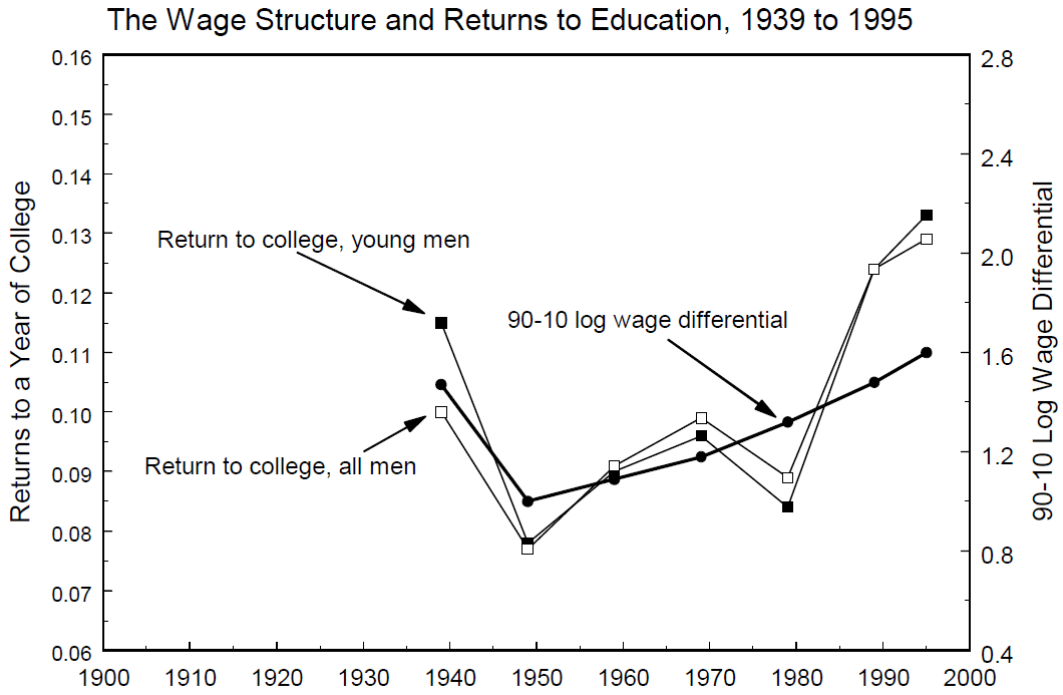


[322] http://www.investopedia.com/ask/answers/062315/according-neoclassical-growth-theory-what-factors-influence-growth-economy.asp?, quoting Solow's 1957 article "Technical Change and the Aggregate Production Function", op cit.
[323] Instructor_Pearson_File_7e_PPT_13.pptx
[324] ibid
[325] ibid
[326] ibid; see also Joseph A. Schumpeter, "The Churn: The Paradox of Progress", 1992, https://www.dallasfed.org/assets/documents/fed/annual/1999/ar92.pdf

annual earnings relative to control group earnings—for Men ≤50 with at least 3 years of job tenure, based on Social Security records for U.S. workers from 1974 to 2008. Clearly, the effects are of long duration, worse during recessionary times.[327] "The workers who experience mass layoffs are the clear losers." (*ME7* p. 273)

Factors contributing to **wage inequality** include the following:

- Wages decline for workers in **sectors of declining importance and demand** or in firms requiring relatively **low skill workers** (who are competed against by foreign workers)
- **Educational level** (e.g., low level of education such as having had only some high school vs. advanced degree. The benefit ("returns") per year of college taken is especially apparent after 1980, *ME7* p. 275 and diagram to follow[328])
- **Low vs. High skill level** attained (especially in technological sectors with advanced equipment). This occurs even in those sectors not exposed to foreign competition.
- **Innovation**: The rising number of patents in the US paralleling income rise reflects in a general way the value of innovation in boosting income. (*ME7* p. 278)



Relative returns per incremental year of college, compared over period 1939 to 1995.
The wage differential compares earnings at the 10th vs. 90th percentiles in wages for workers in 9 to 12 industries, specifically for full time, full year, non-agricultural male wage and salary workers.
The scale of 90-10 log wage differential is a log scale, so that 1.6 in 1995 represents a factor of $10^{1.6}$ = 40×.

The following table from the BLS[329] (below, to left) depicts the striking differences in average wages and unemployment found at various educational levels (the highest level of education attained). "[The data] do not take into account completion of training programs in the form of apprenticeships and other on-the-job training, which may also influence earnings and unemployment rate… Data are for persons age 25 and over. Earnings are for full-time wage and salary workers." See also graph below to right, showing time trends.[330]

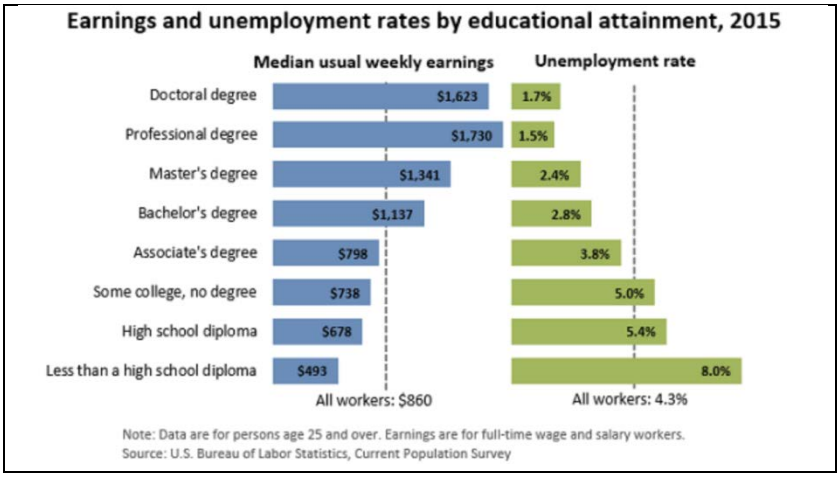
---

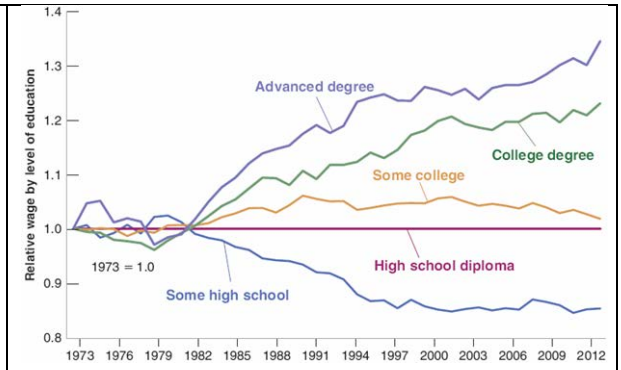
[327] Steven J. Davis, Till M. von Wachter "Recessions and the Cost of Job Loss", *NBER Working Paper No. 17638*, December 2011. http://www.nber.org/papers/w17638.pdf . This article does not appear to address TP per se.

[328] Claudia Goldin, Lawrence F. Katz , "Decreasing (and then Increasing) Inequality in America: A Tale of Two Half-Centuries", 1999 http://scholar.harvard.edu/goldin/files/decreasing_and_then_increasing.pdf

[329] https://www.bls.gov/emp/ep_chart_001.htm

[330] *ME7* p. 274 and Instructor_Pearson_File_7e_PPT_13.pptx





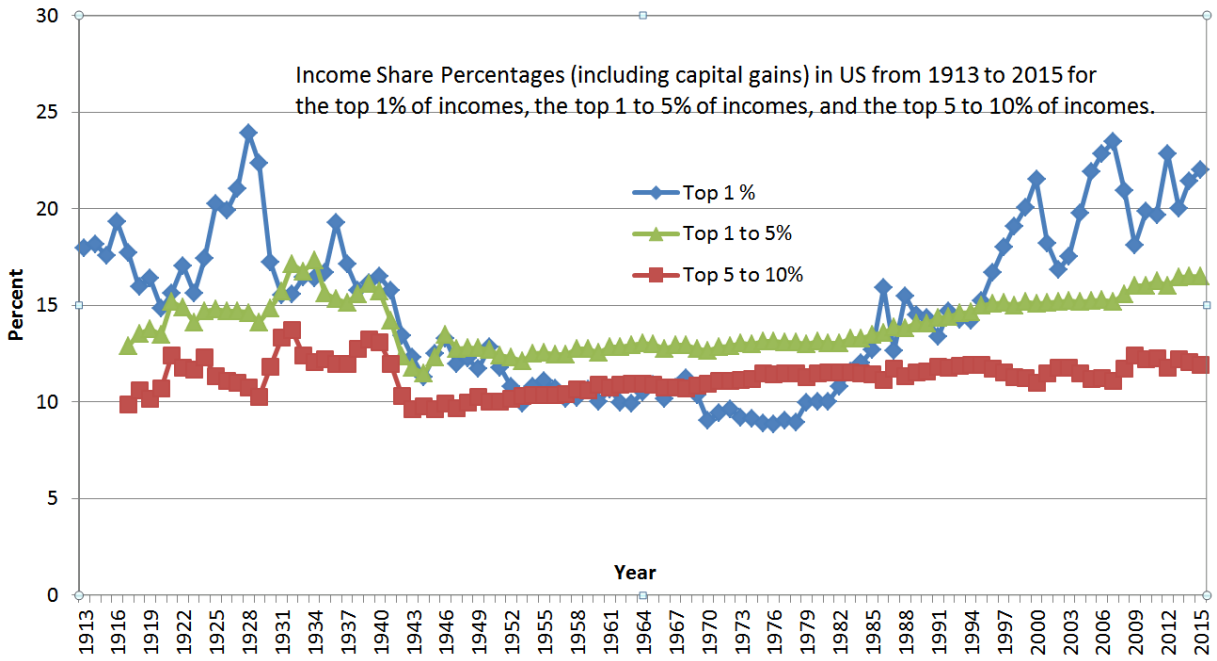
The general conclusion is that "Wage inequality is largely caused by a steady increase in the demand for high-skilled workers relative to the demand for low-skill workers because:
(1) ...U.S. firms that employ higher proportions of low-skill workers are increasingly driven out of markets by imports from similar firms in low-wage countries; and
(2) New machines and new methods of production [from TP] require more and more high skill workers [who earn more]."[331]

Income inequality in the US has become steadily worse since the 1970s. The following graph's data is taken from the **World Wealth and Income Database**.[332] The income data is for the US, including capital gains, from 1913 to 2015, for

the top 1% of incomes	(99% of incomes fall below this group),
the top 1% to 5%	(95% fall below this plus the first group), and
the top 5% to 10%	(90% fall below the three groups shown).

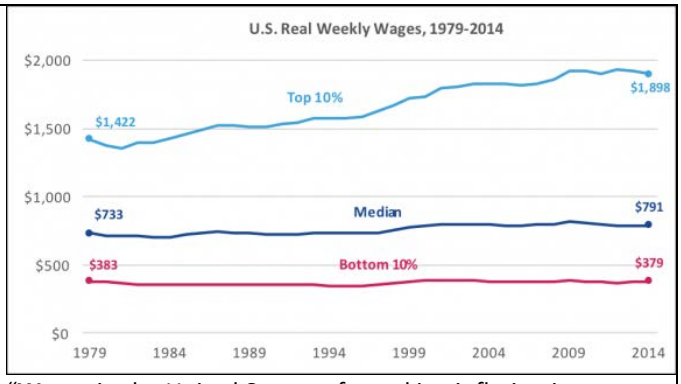
It is apparent that income share percentages held fairly steady in recent decades for the 5% to 10% group, but have risen significantly in recent decades for the top 1% to 5% group, and have risen even more dramatically for the highest group, the top 1%. This makes clear the rising income inequality in the US, especially at the very top. (a similar graph is at *ME7* p. 277) The disparity becomes even more apparent for the top 0.1% (which had 10.9% of US income including capital gains in 2015) or the top 0.01% (which had 5.1% of US income including capital gains in 2015).

[331] Instructor_Pearson_File_7e_PPT_13.pptx
[332] Data downloaded 17 Dec 2016 from http://www.wid.world/#Database: and graphed in Excel by MCM. Facundo Alvaredo, Anthony B. Atkinson, Thomas Piketty, Emmanuel Saez, and Gabriel Zucman, *The World Wealth and Income Database.*
See also the noted recent book by Thomas Piketty: *Capital in the Twenty-First Century*, Belknap Press, 2013.



Other measures of the rising gross inequality in US incomes include: (1) the obscene disparity between CEO pay and average Worker Pay (left graph below) and (2) comparisons of US real weekly wages for the top 10% vs. the median and bottom 10% (right graph below):[333]

"In the United States today, unions have a much smaller economic presence than they did decades ago. With unions playing a smaller economic role, the gap between worker and CEO **pay** was eight times larger in 2015 than in 1980 [i.e., 335:1 versus 42:1]."

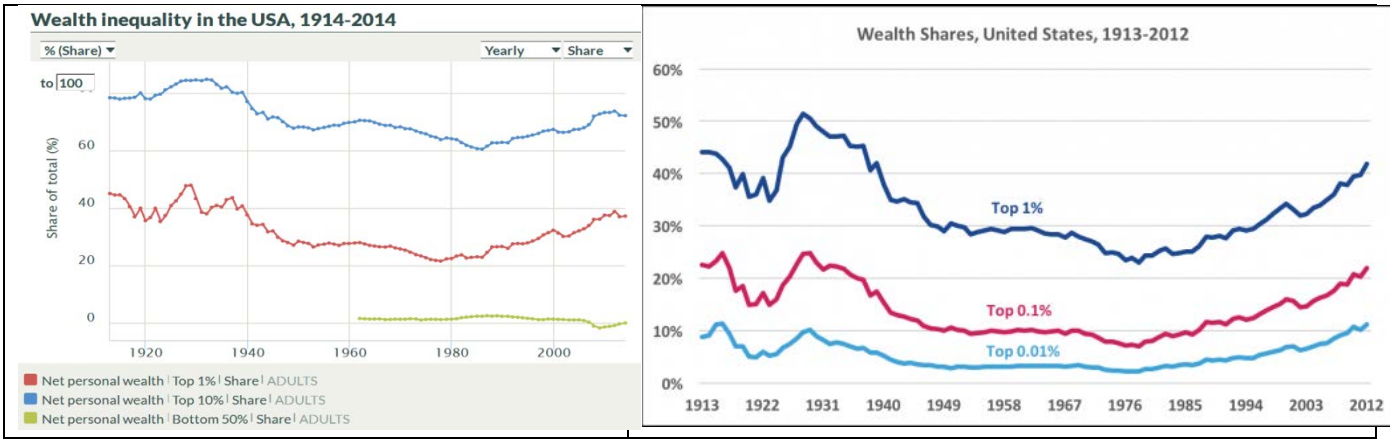


"**Wages** in the United States, after taking inflation into account, have been stagnating for more than three decades. Typical American workers and the nation's lowest-wage workers have seen little or no growth in their real weekly wages."

Finally, the distribution of **wealth** in the US has become increasingly inequitable in recent decades, as shown in the following graphs below. On the left is shown the relative % share of US wealth during 1914 to 2014 for the top 1% (red), the top 10% (blue, including the top 1%), and the bottom 50% (green). These depict the steady rise since c. 1980 of wealth in the top 1% and top 10% compared to the bottom 50%, which shows no rise at all.[334]

On the right is a similar graph for 1913 to 2012,[335] showing the % share of US wealth held by the top 1% (dark blue), the top 0.1% (red), and the top 0.01% (light blue). All of these high wealth categories have been rising since 1980, but the disproportionate wealth of the wealthiest categories is striking.

[333] http://inequality.org/income-inequality/
[334] http://wid.world/country/usa/ graph customized and adapted by MCM
[335] http://inequality.org/wealth-inequality/



Time spans (Output Horizons) in Macroeconomics

These time spans are convenient handles—though inexact in terms of actual time duration, they are defined by what conditions dominate the economy's output.

Short Run SR: The short run spans roughly 6 months to a year or a few years at most. Year to year movements (fluctuations) in the SR in **aggregate output** are driven primarily by **Demand**. Many factors affect demand in the SR, such as consumer confidence, the state or health of the financial system, fiscal policy, and monetary policy, etc.. There are few supply constraints, and inflation and the labor market are ignored, as are exports and imports. Short run modelling is exemplified in *Demand for Money, LM Curve, and IS-LM Model*.

Medium Run MR: The medium run spans perhaps a decade. Aggregate output in the economy tends to return to the level of output determined by the **natural rate of unemployment**. (*ME7* p. 152) It is also influenced by **Supply** factors, such as the **capital stock**, the **prevailing level of technology**, and the **size and skill of the labor force L**, along with ongoing **demand constraints**. Medium run modelling is exemplified in *IS-LM-PC Model*.

Long Run: The long run spans roughly a few decades or more. Output **growth** (rather than fluctuations) dominates and is determined by the evolution of longer range factors: the **educational system** and **sophisticated institutions**, the **technological skills of workers and development**, the **saving rate** (**capital accumulation**), and the role of **government**.[336] Incidentally, John Maynard Keynes is quoted as saying, "But this long run is a misleading guide to current affairs. In the long run we are all dead."[337]

U

[336] *ME7* p. 36, 45, 135, 197 etc. and lecture1.pptx)

[337] https://en.wikiquote.org/wiki/John_Maynard_Keynes, citing *A Tract on Monetary Reform* (1923), Ch. 3, p. 80.

Unemployment and Employment Rate

L = N + U, or U = L - N, where

L = Labor Force (sum of U and N)

U = Unemployment (number of persons in labor force L who do not have a job)

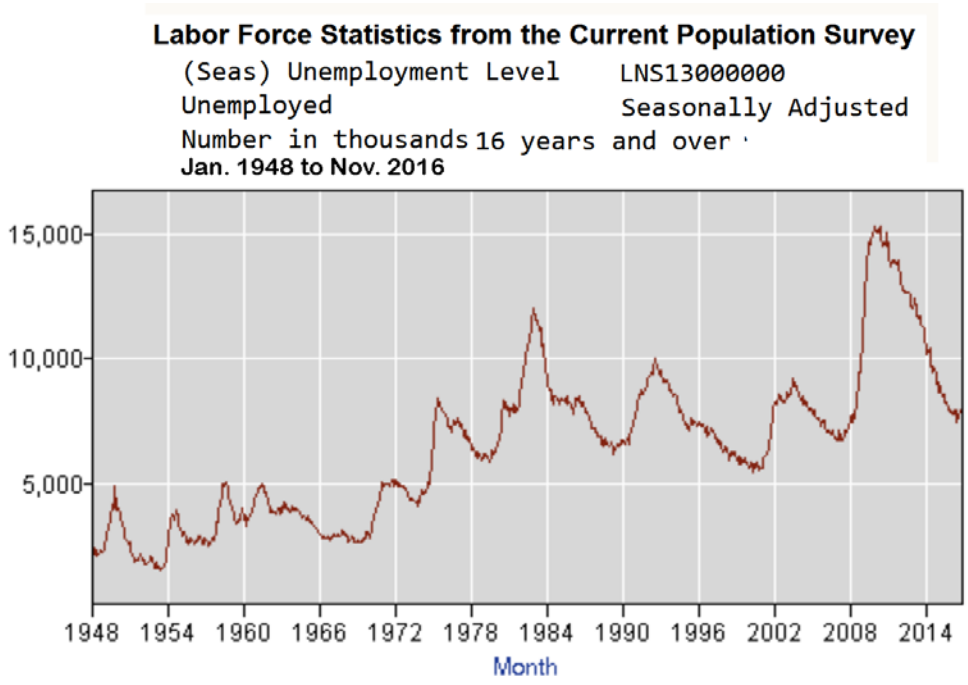
N = Employment (number of persons in labor force L who have a job)

Unemployment Rate u = U/L, usually expressed as a percent.

Employment Rate = ratio of employment N to population available to work CNIP, defined above and including discouraged workers, usually expressed as a %.

The following data may be found in the **Current Population Survey.**[338] The graph from FRED shows monthly average seasonally adjusted rates of unemployment u from 1948 to 2016 (in percent).[339] The graph shows the close relationship between US recessions (gray vertical bands) and rising US unemployment rates (the rise typically begins close to the start of a recession).

The next graph from the BLS[340] shows a similar distribution, here expressed as thousands of unemployed persons ≥ 16 y/o, 1948 to 2016:



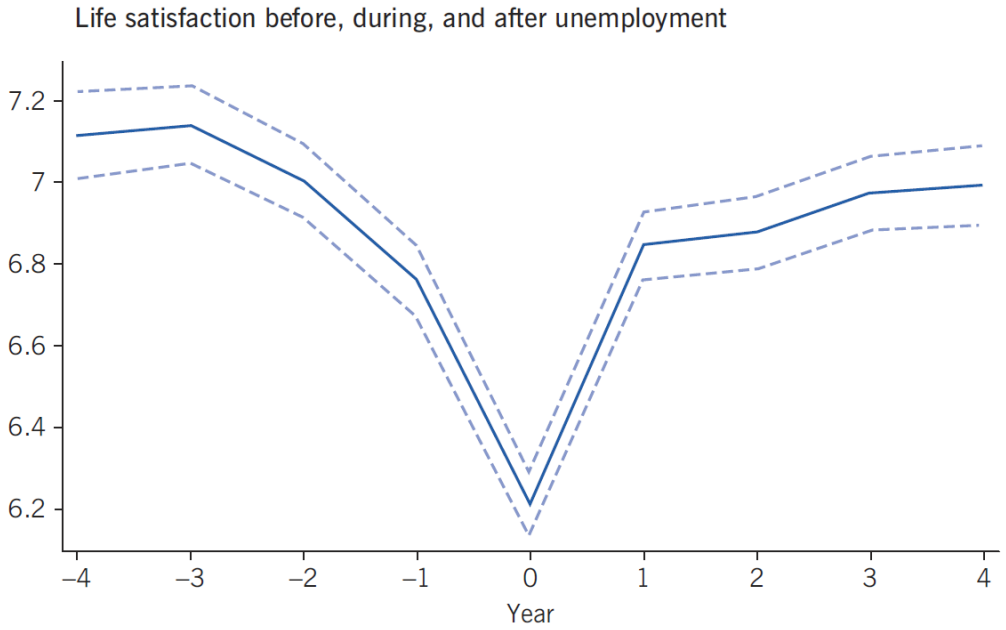
[338] http://www.census.gov/programs-surveys/cps.html See also *Current Population Survey CPS*

[339] https://fred.stlouisfed.org/series/UNRATE

[340] http://data.bls.gov/timeseries/LNS13000000

Unemployment is associated with financial and psychological suffering and unhappiness. It is also an indicator that the economy is probably not using some of its resources efficiently. (*ME7* p. 29) The percent of unemployed workers finding a job each month closely inversely tracks with the unemployment rate. (*ME7* p. 142). Similarly, the rate of worker separation (losing their job) tracks closely with the unemployment rate. (*ME7* p. 143)

According to a study from Germany by Rainer Winkelmann, the start of a major decrease in **unhappiness typically precedes the onset of unemployment** by one or more years and often lasts for years past the onset (graph to follow).[341]

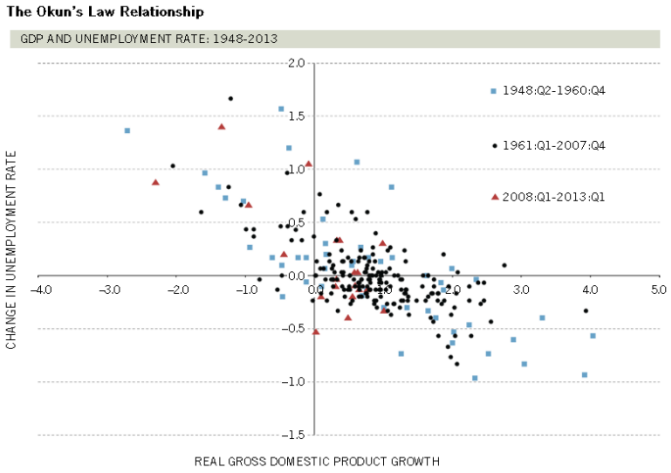


Source: Author's calculations based on data from the German Socio-Economic Panel (GSOEP). Online at: http://www.diw.de/en/soep

Note: The dashed lines indicate 95% confidence bands.

Okun's Law (Okun Law)

This "law" [first described in its original form by Arthur M. Okun, 1928 – 1980] describes a relationship between changes in unemployment rate [g] and the level of real GDP growth. Blanchard (*ME7* p. 34) states that an increase of growth rate of 1% decreases unemployment rate u by roughly -0.4%. The correlation exists but is rather loose—see graph to follow, which depicts US data points from 1948 to 2013.[342]



[341] http://wol.iza.org/articles/unemployment-and-happiness.pdf

[342] https://www.stlouisfed.org/~/media/Publications/Regional%20Economist/Image%20Issues/October-2013/okun_fig1B.png see also *ME7* p. 180

Blanchard cites US data from 1960 to 2014, and derives the following empirical relation (*ME7* p. 180):

$u - u(-1) = -0.4(g_Y - 3\%)$

where $u - u(-1)$ = change in unemployment rate between times t and t–1

g_Y = growth rate of output.

This suggests (method omitted) that to maintain a constant unemployment rate, employment must grow at the same rate as the labor force (some of the new workers derived from those who were out of or not in the labor force). The 3% has evolved in the past 10 years to 2%. Firms tend to prefer to keep current workers and not lay them off when output is lower than normal, and also ask them to work overtime rather than hire new employees when output is higher than normal. This phenomenon is called **labor hoarding**. (*ME7* p. 180-1)

Edward S. Knotek, II concludes, "As a relationship between changes in the unemployment rate and economic growth, Okun's law predicts that growth slowdowns typically coincide with rising unemployment. The recent experience of 2006 shows, however, that this is not always the case. This article has documented several reasons for this… First among these is that Okun's law is not a tight relationship. There have been many exceptions to Okun's law, or instances where growth slowdowns have not coincided with rising unemployment. This is true when looking over both long and short time periods. This is a reminder that Okun's law—contrary to connotations of the word 'law'—is only a rule of thumb, not a structural feature of the economy. This article has also documented that Okun's law has not been a stable relationship over time. Part of this variation is related to the state of the business cycle: The relationship between output and unemployment is different in recessions and expansions, and recent expansions have been longer than average. Additionally, the data suggest that a weakening of the contemporaneous relationship between output and unemployment has coincided with a stronger relationship between past output growth and current unemployment. This finding favors versions of Okun's law that are less restrictive in the timing of this dynamic relationship. These findings have practical applications. For instance, forecasting the unemployment rate via Okun's law is much improved by taking into account its changing nature. These forecasts can be improved even more by allowing for a dynamic relationship between unemployment and output growth."[343]

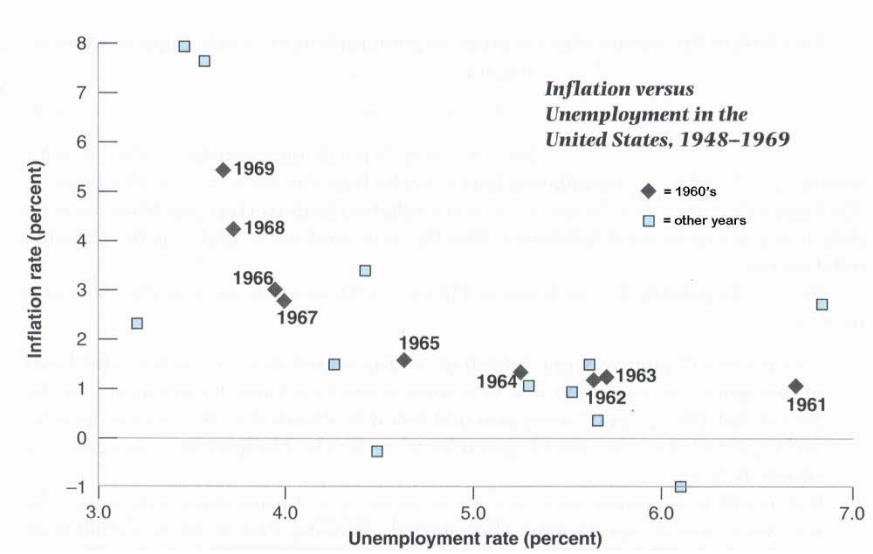
[343] https://www.kansascityfed.org/publicat/econrev/pdf/4q07knotek.pdf

Phillips Curve PC

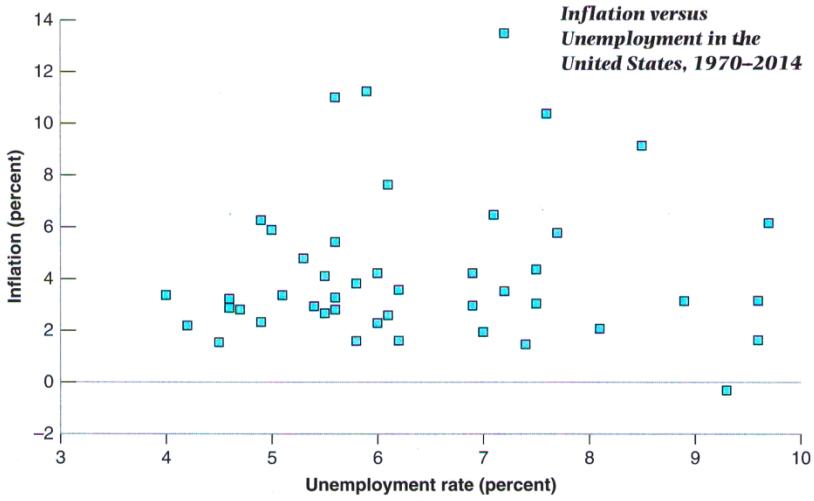
This topic is a bit turbid and confusing, and I have omitted most of the mathematical modelling, which is outlined in *ME7* in chapters 8 and 9.

The "**original Phillips Curve**" [developed in 1958 for the UK by A. W. H. Phillips, 1914 –1975] found a negative correlation of **rate of inflation** with **rate of unemployment**. The general relation was affirmed for the US by Paul Samuelson (1915 – 2009) and Robert Solow (b. 1924) in c. 1960, again comparing the inflation rate with the unemployment rate. When there is low unemployment and the economy begins to overheat, inflation increases. As unemployment rate u increases, the inflation rate declines in the short-run.

The original Phillips curve plotting Inflation rate % against Unemployment rate % for the US from 1948 to 1969 showed good correlation (diamonds are values from the 1960's, squares are for other years):[344]



However, the original Phillips curve for the US broke down in the 1970 – 2014 period and showed no correlation between inflation % and u %:[345]



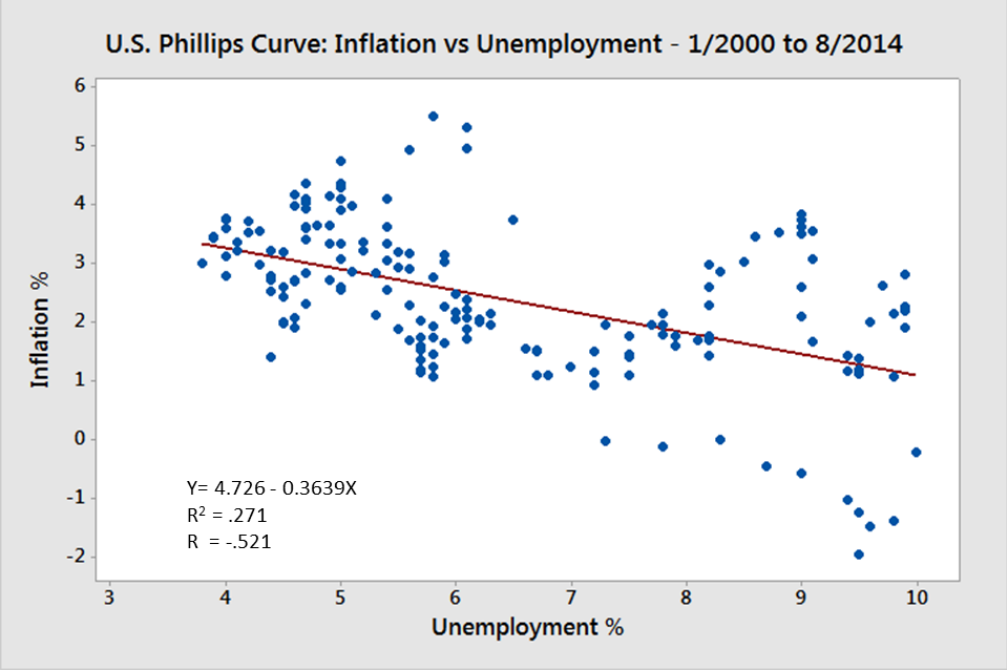
More recent data 2000 - 2014 for Inflation rate versus employment rate is shown from FRED. Again, the data is scattered and correlation is rather modest, especially for higher values of u %. The coefficient of determination R^2 is 0.271, meaning that only 27% of the variation in inflation values is attributable to variation in u: [346]

---

[344] Adapted from *ME7* p. 161

[345] ibid.

[346] https://en.wikipedia.org/wiki/Phillips_curve#/media/File:U.S._Phillips_Curve_2000_to_2013.png

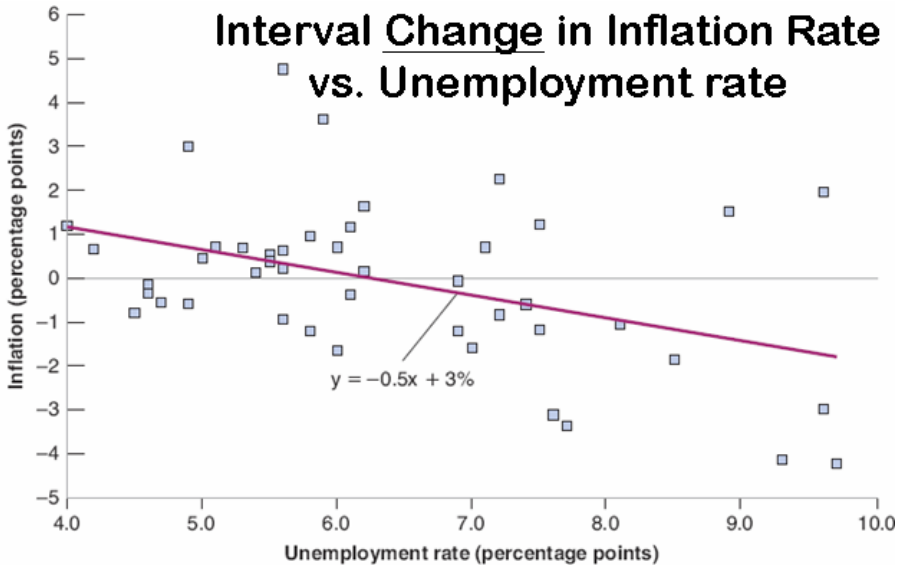


Source Data: FRED Database
Inflation: CPI for All Urban Consumers

More generally useful was a new version of the Phillips Curve: the so-called "**modified Phillips curve**" or "**expectations-augmented Phillips curve**" that plots the change in inflation rate (i.e., **acceleration of the price level**, analogous to a second derivative value) against Unemployment rate u % points. For low unemployment, the inflation rate increases, so that acceleration in price level is positive.

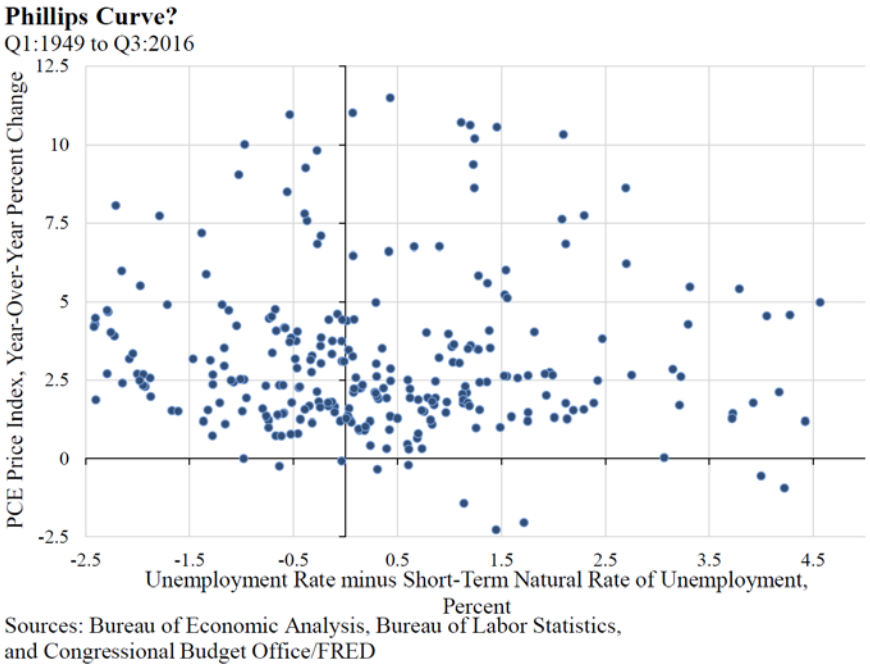
The textbook depicts a scatter plot for 1970 to 2014. I have added an annotation to make it clear that unlike the original Phillips curves (above), this new PC diagram shows **Interval Change in Inflation Rate** as the Y axis value, plotted as before against unemployment rate u. A linear regression line has been drawn, but the textbook does not specify the important statistical measure of degree of correlation, R^2.[347] The best fit regression line is:

$$\Delta\pi = \pi_t - \pi_{t-1} = 3.0\% - 0.5u_t.$$



[347] *ME7* p. 163 & Instructor_Pearson_File_7e_PPT_08.pptx (the latter says the earliest year of data is 1974, not 1970).

An alternate way of depicting longer-term price versus unemployment data follows below, using quarterly values from 1949 to 2016.[348] Here, the **PCE Price** is the **personal consumption expenditures (PCE)** that appear in Account 1 of the NIPA tables, rather than the Inflation rate. The ordinate of this graph is the year over year % change in this chain-type Price Index PCE price [shown as **PCEPI** per FRED[349]], thus depicting a rate of a subset of US inflation. The x-axis is unemployment rate minus natural rate of unemployment ($u - u_n$). The correlation appears unimpressive to my inexperienced eyes (other than a few more negative PCEPI values when ($u - u_n > 0$).



The economists Milton Friedman (1912 - 2006) and Edmund Phelps (b. 1933) argued against the concepts behind the Phillips curve, holding that [in the medium or long run] the unemployment rate could not be sustained below the natural rate of unemployment. They suggested that when the actual unemployment rate is higher than the natural rate of unemployment ($u - u_n > 0$), the inflation rate will decrease, and when the actual unemployment rate is lower than the natural rate of unemployment ($u - u_n < 0$), the inflation rate will increase. Thus the natural rate of unemployment u_n becomes the rate of unemployment required to keep the inflation rate constant, and might be called the "**non-accelerating inflation rate of unemployment (NAIRU)**", and which since 1970 has been about 6%. (*ME7* p. 165)

Blanchard derives (*ME7* p. 160-2),

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t \ ,$$

which leads to ...

$$\pi_t - \pi_{t-1} = (m + z) - \alpha u_t$$ (expectations-augmented Phillips curve. Eqn. 8.6, if $\pi^e \approx \pi_{t-1}$)

He states (*ME7* p. 165), "the relation between unemployment and inflation in the United States today is well captured by the relation between the **change in the inflation rate** and **the deviation of the unemployment rate from the natural rate of unemployment** [i.e., by the equation that follows after the assumption that expected inflation rate $\pi^e \approx \pi_{t-1}$]...":

$$\Delta\pi = \pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$ equation 8.10

where π_t = inflation rate at time t
π_{t-1} = inflation rate at previous time t-1
u_t = unemployment rate at time t
u_n = natural unemployment rate (presumably at time t)
z increases when unemployment benefits are better
α "captures the strength of the effect of unemployment on the wage, as introduced in $F(u, z) = 1 - \alpha u + z$, where $W = P^e F(u, z)$ (*ME7* p. 159)

[348] Stephen Williamson, "Low Inflation, Phillips Curves, and Neo-Fisherism", https://research.stlouisfed.org/conferences/professors-conference-2016/docs/professors_conference_slides_2_Williamson.pdf
[349] https://fred.stlouisfed.org/series/PCEPI

Note that $u_t < u_n \rightarrow \pi > \pi_{t-1}$, and
$u_t > u_n \rightarrow \pi < \pi_{t-1}$
where π is inflation rate at an unspecified future time (*ME7* p. 166)

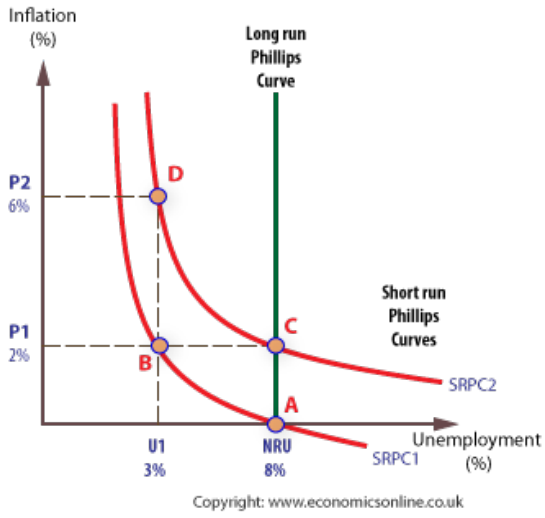
He cautions, "This relation has held well since 1970. But evidence from its early history, as well as the evidence from other countries, points to the need for a number of warnings … The unemployment rate in the euro area [has] averaged close to 9% since 1990… A high average unemployment rate for 25 years, together with no sustained decrease in inflation, surely reflects a high natural rate. This tells us where we should look for explanations, namely in the factors determining the wage-setting and the price-setting relations." He suggests this high unemployment may be due to generous unemployment insurance and employment protection, high national minimum wages, extension agreements in labor contracts, but also other factors (*ME7* p. 166-9)

In the US, the natural rate of unemployment **u_n has declined from 7-8% in the 1980s to close to 5% today**. This may be due to many factors: ↑globalization & stronger foreign competition (reducing markups); ↑firm mobility & weaker unions → ↓bargaining power, ↑temp jobs & ↑networking for matching available positions with unemployed workers, ↓young workers, ↑incarceration rate, and ↑workers on disability. (*ME7* p. 169)

Wage indexation to match inflation has become more prevalent, and it increases the effect of unemployment on inflation. If it becomes widespread, small changes in unemployment can lead to large changes in inflation. (*ME7* p. 170)

With **deflation** (negative inflation), as in the **Great Depression** of the 1930s, unemployment was high but in addition, the inflation rate was surprisingly high for this degree of unemployment, so that deflation was limited, and actually turned positive in 1934 to 1937 despite high unemployment. This might be explained by a large adverse shift of demand, but also possibly by a weakening or breakdown of the Phillips curve relation… Similarly, in the recent financial crisis beginning c. 2008, unemployment increased dramatically in many countries, yet inflation tended to remain higher than expected. Workers suffering the "**money illusion**" also may be reluctant to accept decreases in nominal wages, though willing to accept cuts in real wages. (*ME7* p. 170-2, referring to Figure 8.1)

Another summary: "But still today, modified forms of the Phillips Curve that take inflationary expectations into account remain influential. The theory goes under several names, with some variation in its details, but all modern versions distinguish between **short-run** and **long-run** effects on unemployment. Modern Phillips curve models include both a short-run Phillips Curve and a long-run Phillips Curve. This is because in the short run, there is generally an inverse relationship between inflation and the unemployment rate; as illustrated in the downward sloping short-run Phillips curve. In the long run, that relationship breaks down and the economy eventually returns to the natural rate of unemployment [NRU = u_n] regardless of the inflation rate."[350]



In the diagram[351] to the right, the curve SRPC1 = short-run Phillips Curve #1 and the curve SRPC2 = short-run Phillips Curve #2 define different levels of inflation for the same u, whereas the vertical green line is the Long run Phillips Curve positioned at the u=NRU=u_n… " This same article states the Keynesian interpretation of the breakdown of the simple Phillips curve in terms of the Non-Accelerating Inflation Rate of Unemployment (NAIRU): "NAIRU, which exists at the Long Run Phillips Curve, is the rate of unemployment at which inflation will stabilise—in other words, at this rate of unemployment, prices will rise at the same rate each year."

[350] https://en.wikipedia.org/wiki/Phillips_curve
[351] http://www.economicsonline.co.uk/Global_economics/Phillips_curve.html

Wage Determination and Natural Rate of Unemployment

In the **Medium Run**, prices and wages are allowed to adjust over time (so that **actual price P = expected price P^e**), and that output returns to its natural level (see below). We also introduce supply constraints (via the labor market)[352]:

↑Output → ↑labor usage;
↑factor input demand → ↑labor demand;
↑input factor prices → ↑wages;
↑Production cost → ↑marginal cost; and
Output changes → price changes.
Ultimately, at medium run equilibrium, output tends to return to its natural level Y_n, as determined by the natural rate of unemployment (see below).

Worker wages are determined by a variety of factors. Some are set by **collective bargaining** between firms and unions (only about 10% of US workers (*ME7* p. 143). Individual bargaining is more successful for workers with high skills. The **reservation wage** is the wage that would make the worker indifferent between working and being unemployed, thus, the lowest wage rate at which a worker might be willing to accept a particular type of job. The term *reservation* is akin to the term used in auctions: "Auctions may set a **reservation price** which is the least/maximum acceptable price for which a good may be sold/bought."[353] Firms often pay more than the reservation wage in order to make workers more productive, reduce turnover, improve worker morale, retain highly skilled and trained workers—all presumably contributing to greater productivity. Such higher wages are termed **efficiency wages**. (*ME7* p. 144) Efficiency wage theories pertain to these issues. The status of the labor market also affects wages: higher unemployment leads to lower wages, low unemployment leads to higher wages.

Aggregate nominal wages are estimated by the (nominal) **wage setting relation WS** (*ME7* p. 146, 158):

$W = P^e F(u , z)$
where P^e = expected price level (of goods and services)
u = unemployment rate (increases have a negative effect on wages)
z = "other factors" (with sign chosen so increases have a positive effect on wages)

The **real wage setting relation W/P** is therefore

$W/P^e = F(u , z)$
where ↑u →↓F → ↓W/P^e
↑z →↑F → ↑W/P^e

Blanchard states, "It will be convenient to assume a specific form for the function F:[354]
$F(u , z) = 1 - \alpha u + z$

(See also *Unemployment and Employment Rate*.)

Wages are set in nominal dollars for a designated contract interval (often one year), but both workers and firms really care more about the **real purchasing power of wages (W/P)**, thus adjusted for inflation. Therefore, **P^e** is included to estimate future price levels during the contract period. A critical medium run assumption[355] is that $P = P^e$.

The other factors represented by z include **unemployment insurance** and **unemployment benefits**, both of which may make a worker more inclined to become unemployed. Also, **employment protections** (policies making it hard and more expensive to fire workers) raise wages.

---

[352] Lecture Ch. 07.pdf
[353] https://en.wikipedia.org/wiki/Auction
[354] *ME7* p. 159
[355] Lecture Ch. 7

A firm's output (production) may be expressed as

$Y = A \bullet N$

where Y = output
A = Labor productivity, which is set arbitrarily to 1 unit so that one worker produces one unit of output
N = employment (# of employees)

and thus **Y = N** . The total units of output Y = Number of employees N × 1 unit/employee. The cost of producing one more unit of output (**the marginal cost of production**) is the cost paid for each unit of labor, **W**.

A firm's **price setting relation PS** for its product is

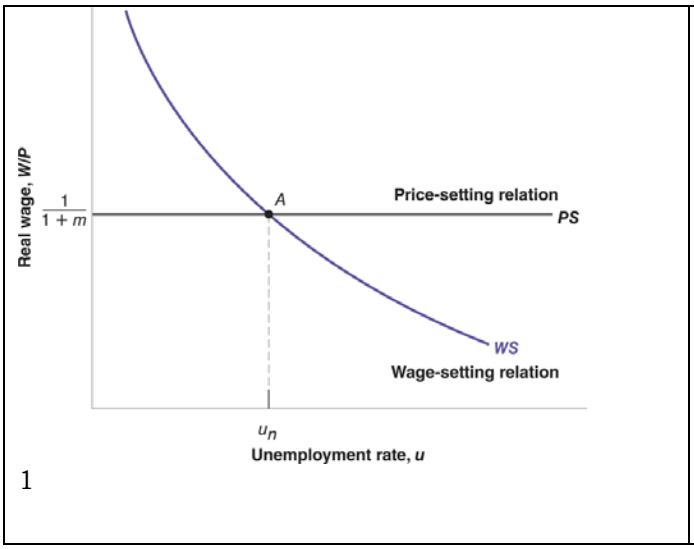
$P = (1 + m) W$

where P = price for a good
m = markup by firms that enjoy market power (0 if all firms are perfectly competitive)
m captures the degree of market power that firms have
W = Wage

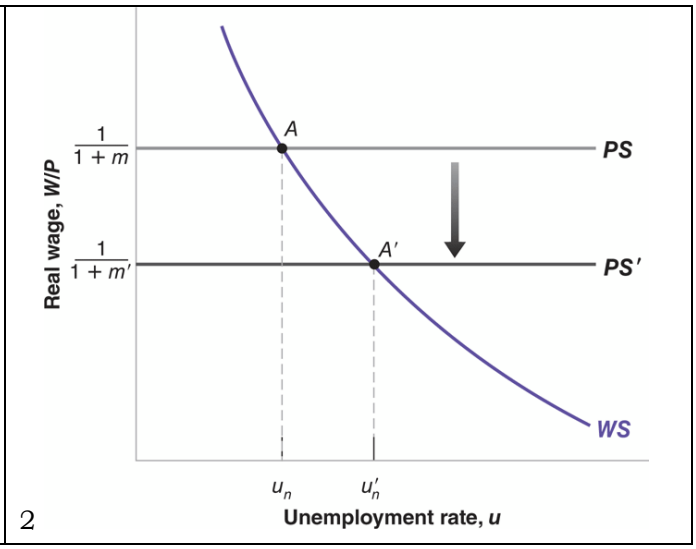
or $W/P = 1/(1 + m)$ at equilibrium when $P = P^e$ (this assumption is relaxed in Chapter 8).

Plotting the two equations for real wages W/P, we find that the Price setting curve PS (a horizontal line) intersects the Wage setting WS curve (which varies with u).[356] The unemployment level at this point of intersection, when the labor market is in equilibrium, is termed the **natural rate of unemployment u_n** (also called the **non-accelerating inflation rate of unemployment** (**NAIRU**). As there is nothing "natural" about this rate, Blanchard suggests a better term might by the **structural rate of unemployment**. (*ME7* p. 151; diagram below from Lecture Ch. 7, other authors differ on definitions[357])

When **prices go up by increases in the markup m** (such as from increase in non-labor costs for firms, or an increase in market power allowing firms to charge prices higher above costs), this will shift the price-setting relation PS downwards, and **real wages go down** on the WS curve at every unemployment level (W/P moves lower). Correspondingly, **the natural rate of unemployment increases** to u_n' (i.e., employees will accept the lower real wage only if unemployment is higher and they have less bargaining power). These effects are illustrated in the following diagrams.[358]



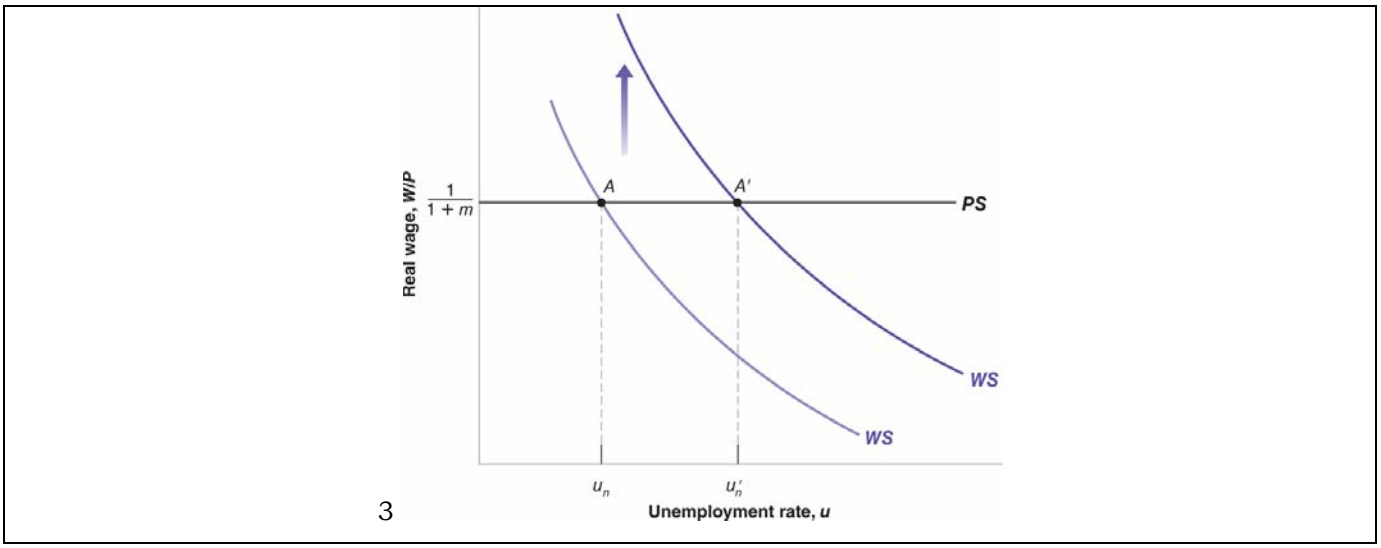
1



2

[356] https://mnmeconomics.wordpress.com/2011/06/25/what-determines-the-natural-rate-of-unemployment/
[357] https://en.wikipedia.org/wiki/Natural_rate_of_unemployment
[358] all 3 diagrams and text adapted from Lecture Ch. 7

If **unemployment benefits rise** (**z increases**), such as from an increase in trade union power or other increase in benefits, it is less painful to be unemployed. Markup m remains unchanged, but ↑z will shift the WS curve up and to the right, point A moves to the right to A′, so the WS′ curve will intersect the price-setting curve PS at a **higher natural rate of unemployment u_n′**, even though W/P appears to be unchanged (diagram below, same source).



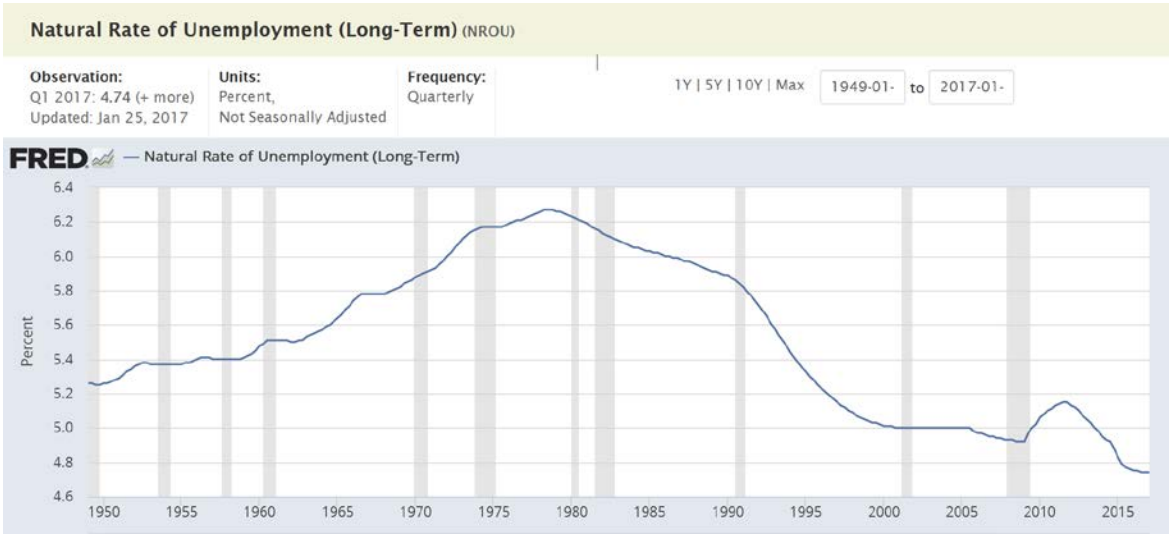
3

At an equilibrium in the labor market for a given labor force, the **natural rate of unemployment u_n** also defines a level of employment. This level of unemployment in the medium run determines a corresponding **natural level of output** Y_n via Y=N. Thus, unlike in the short run, in the medium run, output tends to return to its natural level:

$$Y_n = N_n = L \bullet (1-u_n) \quad \text{where L = Labor force, N = Employed persons}$$

One may alternatively plot Real wage W/P against the level of **Employment N**, again using the intersection of the Price Setting Curve W/P = 1/(1 + m) with the Wage Setting curve as defining a **Natural Level of Employment N_n**, for which $N_n < L$, where U (unemployment) + N = L (labor force)

The history of the varying natural rate of unemployment is shown as follows, with the most recent 2016 Q4 value being 4.7%.[359]



[359] https://fred.stlouisfed.org/series/NROU