

Econ 110A: Lecture 2

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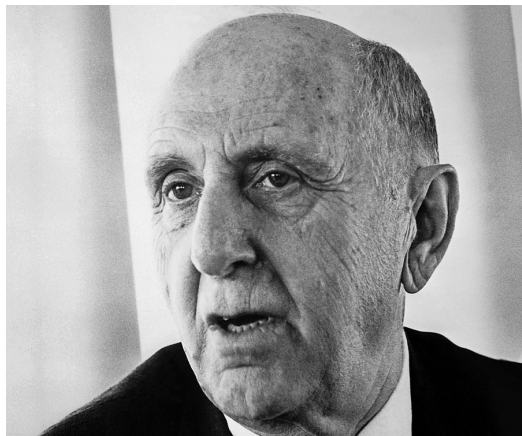
UCSD, Summer Session II

Gross Domestic Product: market value of the final goods and services produced in an economy over a certain period of time.

An introduction to GDP

Simon Kuznets

1901-1985



Nobel Prize in Economics, 1971

An introduction to GDP

How can we measure GDP?

Production = Income = Expenditure

- **Production**: value added produced
- **Income**: remuneration to factors of production
- **Expenditure**: end-use of value added produced

Example: the economy of Truckopia

In Truckopia there are only two companies: SteelCo and TruckCo. SteelCo: extracts ore, turns it into steel. TruckCo buys steel from SteelCo, turns it into trucks, sells trucks.

Eco. Acc. SteelCo		Eco. Acc. TruckCo	
Wages	70	Wages	250
Cost of Inputs	0	Cost of Inputs	100
Profits	30	Profits	150
Sales	100	Sales	500

- GDP by Value Added (= Sales - Cost of Inputs):

- GDP by Income (= Wages + Profits):

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$$(\$100 - \$0) + (\$500 - \$100) = \$500$$

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- GDP by Income (= Wages + Profits):

$$(\$70 + \$30) + (\$250 + \$150) = \$500$$

Example: the economy of Truckopia

Expenditure	
Consumers	280
Government	150
Investment	100
Exports	50
Imports	80

The Expenditure Approach:

$$\begin{aligned} \text{Expenditure} &= \underbrace{C}_{\text{private consumption}} + \underbrace{G}_{\text{gov. consumption}} + \underbrace{I}_{\text{investment}} + \underbrace{X}_{\text{exports}} - \underbrace{M}_{\text{imports}} \\ 500 &= 280 + 150 + 100 + 50 - 80 \quad \checkmark \end{aligned}$$

Example: the economy of Truckopia

But, be careful.... does imports reduce GDP? Remember...

$$\text{Production} = \text{Income} = \text{Expenditure}$$

This is just saying:

$$\underbrace{Y + M}_{\substack{\text{output + imports} \\ \text{"stuff available in the country"}}} = \underbrace{C + G + I + X}_{\substack{\text{domestic absorption + exports} \\ \text{"stuff consumed in the country or shipped abroad"}}}$$

Beware of causal inference from accounting identities!

Ok, how does the U.S. Economy look like?

U.S GDP: Value Added, Income, Expenditure
NIPA tables:

<https://apps.bea.gov/national/pdf/SNTables.pdf>

Example: U.S. economy from an income perspective

$$\begin{aligned}\text{Income} &= \text{Wages and Benefits to Employees} \\ &+ \text{Taxes (less subsidies) on Businesses} \\ &+ \text{Profits} \\ &+ \text{Depreciation of Fixed Capital}\end{aligned}$$

- Wages: remuneration to labor as factor of production
- Taxes: remuneration to government as factor of production
- Profits: remuneration to owners/managers as factor of production
- Depreciation of Fixed Capital: remuneration to capital as factor of production

Example: U.S. economy from an income perspective

Question 2 (5 pts)

The economic accounts of United Airlines, a U.S. airline company, shows that in 2019 the company paid \$5,000,000 in wages and benefits to employees, made \$1,000,000 in profits (net operating surplus), and paid \$200,000 in taxes (net of subsidies) to the Government. Is this enough information to compute United's contribution to the U.S. GDP for 2019? If so, what is such contribution? If not enough information, what is missing? Please explain.



Example: U.S. economy from an income perspective

Bureau of Economic Analysis

Table 1.10. Gross Domestic Income by Type of Income

[Billions of dollars] Seasonally adjusted at annual rates

Last Revised On: Jun 29 2023 8:30AM - Next Release Date: Jul 27 2023 8:

Line		2021	2022
1	Gross domestic income	23,444.0	25,625.4
2	Compensation of employees, paid	12,549.1	13,578.3
3	Wages and salaries	10,300.8	11,203.4
4	To persons	10,283.2	11,182.5
5	To the rest of the world	17.6	20.9
6	Supplements to wages and salaries	2,248.4	2,374.9
7	Taxes on production and imports	1,663.4	1,772.4
8	Less: Subsidies¹	481.9	123.7
9	Net operating surplus	5,881.8	6,113.6
10	Private enterprises	5,879.8	6,117.0
11	Net interest and miscellaneous payments, domestic industries	872.7	804.5
12	Business current transfer payments (net)	171.0	183.3
13	Proprietors' income with inventory valuation and capital consumption adjustments	1,753.6	1,848.3
14	Rental income of persons with capital consumption adjustment	723.8	781.9
15	Corporate profits with inventory valuation and capital consumption adjustments, domestic industries	2,358.7	2,499.1
16	Taxes on corporate income	388.2	473.8
17	Profits after tax with inventory valuation and capital consumption adjustments	1,970.5	2,025.3
18	Net dividends	1,401.6	1,312.6
19	Undistributed corporate profits with inventory valuation and capital consumption adjustments	568.9	712.7
20	Current surplus of government enterprises ¹	2.1	-3.4
21	Consumption of fixed capital	3,831.6	4,284.7
22	Private	3,184.5	3,568.3
23	Government	647.1	716.5
	Addendum:		
24	Statistical discrepancy	-128.9	-162.6

What is the difference between Nominal and Real GDP?

Nominal GDP: measures dollars at given period

Real GDP: measures quantities of products



The Role of Prices: Comparing GDP Across Time

- Nominal GDP:

$$GDP_t = \sum_i P_{i,t} \times Q_{i,t}$$

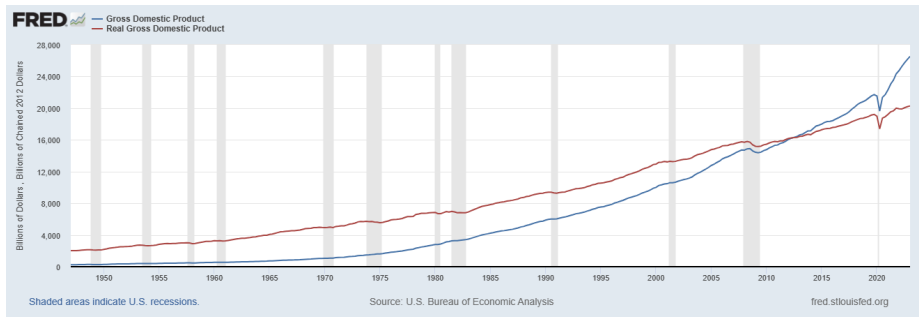
for $i \in \{\text{food, rent, cars, haircuts, clothes, } \dots \}$
for $t \in \{1951, 1952, \dots, 2021, 2022, 2023\}$

- Real GDP:

$$RGDP_t = \sum_i P_{i,X} \times Q_{i,t}$$

- Initial Price method (Laspeyres): $P_{i,X}$ are earliest date prices
- Final Price method (Paasche): $P_{i,X}$ are latest date prices
- Chained-Weighted method: $P_{i,X}$ are “weighted” averages across dates

Nominal and Real GDP



- $GDP_{1998} = \sum_i P_{i,1998} \times Q_{i,1998} = \$9,325B$
- $GDP_{2019} = \sum_i P_{i,2019} \times Q_{i,2019} = \$21,729B$
- $RGDP_{1998} = \sum_i P_{i,2012} \times Q_{i,1998} = \$11,832B$
- $RGDP_{2019} = \sum_i P_{i,2012} \times Q_{i,2019} = \$19,221B$

The Role of Prices: Comparing GDP Across Countries

$$\begin{aligned} \$GDP_t^{US} &= \sum_i \$P_{i,t}^{US} \times Q_{i,t}^{US} \\ ¥GDP_t^{CH} &= \sum_i ¥P_{i,t}^{CH} \times Q_{i,t}^{CH} \end{aligned}$$

- Nominal GDP in the U.S. in 2017 = 19,754 Billion **Dollars**
- Nominal GDP in China in 2017 = 82,712 Billion **Yuan**
- Which of the two economies had a larger Real GDP in 2017?
- How can we compare economies measured in different currencies?
- Remember, the objective is to compare **quantities of products**

The Role of Prices: Comparing GDP Across Countries

- Step 1: express everything in the same currency:

$$\text{Exchange Rate :} \quad \$1 = ¥6.7 \iff ¥1 = \frac{1}{6.7} \$$$

$$\implies \$GDP_{2017}^{CH} = ¥82,712B \times \frac{1}{6.7} = \$12,365B$$

The Role of Prices: Comparing GDP Across Countries

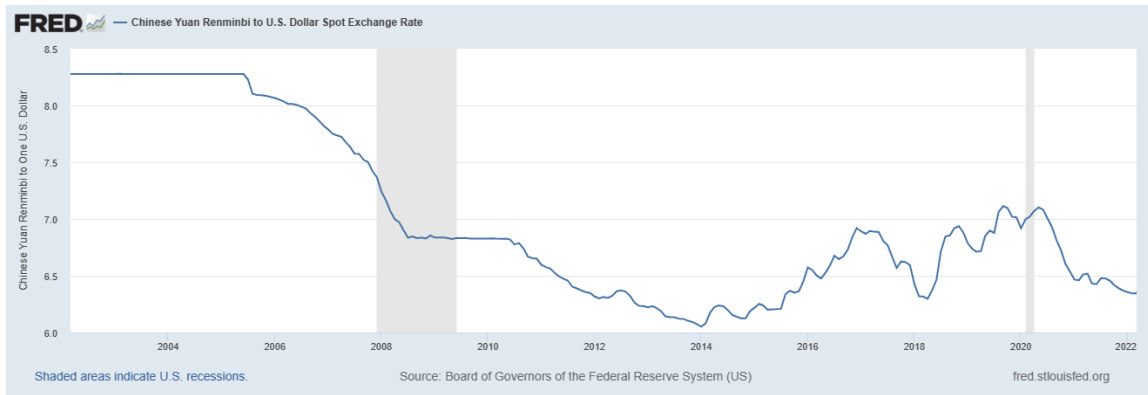
- Step 1: express everything in the same currency:

$$\begin{aligned}\text{Exchange Rate :} \quad & \$1 = ¥6.7 \iff ¥1 = \frac{1}{6.7} \$ \\ \implies & \$GDP_{2017}^{CH} = ¥82,712B \times \frac{1}{6.7} = \$12,365B\end{aligned}$$

- Step 2: express everything in the same price level:

$$\begin{aligned}\text{Price Ratio Across Countries :} \quad & \frac{P_{2017}^{US}}{P_{2017}^{CH}} = \frac{1}{0.6} \\ \implies & \$GDP_{2017}^{CH} \times \frac{P_{2017}^{US}}{P_{2017}^{CH}} = \$12,365B \times \frac{1}{0.6} = \$20,575B\end{aligned}$$

USD-CNY Exchange Rate



<https://fred.stlouisfed.org/series/DEXCHUS#>

US-CH Price Conversion Factors

Price level ratio of PPP conversion factor (GDP) to market exchange rate - China, United States

International Comparison Program, World Bank | World Development Indicators database, World Bank | Eurostat-OECD PPP Programme.

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<https://data.worldbank.org/indicator/PA.NUS.PPPC.RF?locations=CN-US>

The Role of Prices: Comparing GDP Across Countries

Now, dropping the \$ and ¥ to accommodate any potential currency in the world:

$$GDP_{t,PUS}^{FC} = GDP_t^{FC} \times E_t \times \frac{P_t^{US}}{P_t^{CH}}$$

where

- $GDP_{t,PUS}^{FC}$: foreign GDP in U.S. dollars and in U.S. prices
- E_t : exchange rate (U.S. dollar per foreign currency)
- $\frac{P_t^{US}}{P_t^{FC}}$: Price Level Ratio GDP Conversion Factor (prices in the U.S. relative to prices in foreign country)

What are the limits to GDP?

- Inequality?
- Environment?
- Home production?
- Health?
- Education?
- Capital stocks?
- Does it still say a lot about all of the about all of the above?

Stock Market and GDP

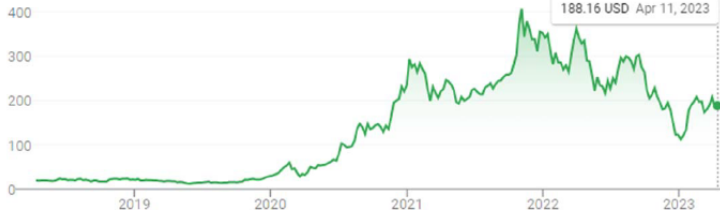
Suppose you purchased 100 Tesla stocks on Jan 1 2021 at \$600 per share for a total of \$60,000, and you sold the same 100 Tesla stocks on Dec 31 2021 at \$1200 per share, for a total of \$120,000. What is your capital gain, and should it be included in the 2021 GDP?

188.14 USD

+168.12 (839.76%) ↑ past 5 years

Apr 11, 2:49 PM EDT • Disclaimer

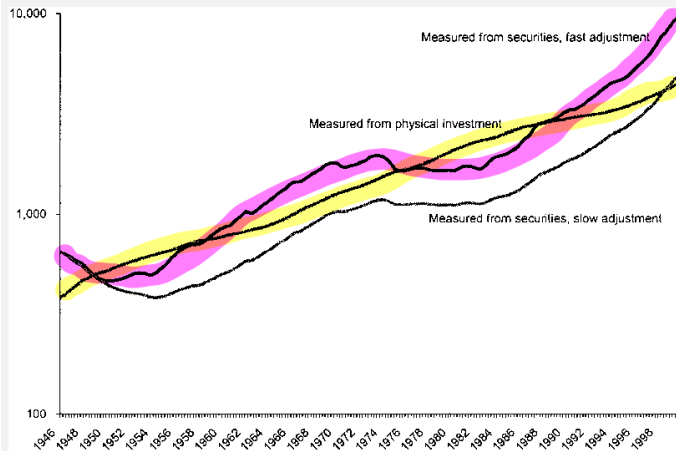
1D | 5D | 1M | 6M | YTD | 1Y | 5Y | Max



Stock Market and GDP

- Should Capital Gains be accounted for in GDP?
- **Standard view:** stock price reflects expected future profits, so capital gains are changes in expected future profits; future profits are part of **future GDP**, so capital gains should **not** count for **current GDP**
- **Alternative view:** capital gains may reflect the production of intangible capital (business organization, customers loyalty/brand) inside a firm; in that case they should be included in current GDP

Stock Market and GDP



Estimates of U.S. Capital Stock

The Stock Market and Capital Accumulation

By ROBERT E. HALL*

American Economic Review, 2001

Our deduction is that the main portion of the computer-related intangible assets comes from the new business processes, new organizational structure, and new market strategies, which each complement the computer technology ... [C]omputer use is complementary to new workplace organizations which include more decentralized decision making, more self-managing teams, and broader job responsibilities for line workers.

Should we care about GDP?

Our Gross National Product, now, is over \$800 billion dollars a year, but that Gross National Product - if we judge the United States of America by that - that Gross National Product counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage.

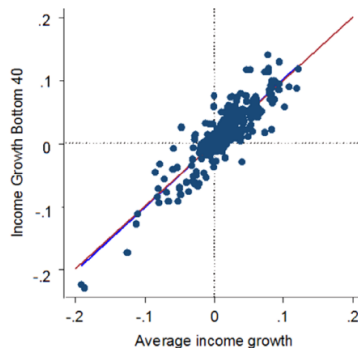
It counts special locks for our doors and the jails for the people who break them. It counts the destruction of the redwood and the loss of our natural wonder in chaotic sprawl.

Yet the gross national product does not allow for the health of our children, the quality of their education or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials.

Bob Kennedy, 1968

Turns out that we do...

Sample of Minimum Five Year Spells



Dollar, David, Tatjana Kleineberg, and Aart Kraay. "Growth still is good for the poor." European Economic Review 81 (2016): 68-85.

But we can go Beyond GDP...

- Recall that the ultimate objective in economics is welfare, e.g.:

$$\max_{\{C_1, C_2\}} U(C_1) + \beta U(C_2)$$

- Inappropriate use of GDP to approximate Welfare is the issue. What happens if we go beyond GDP?

Beyond GDP? Welfare across Countries and Time[†]

By CHARLES I. JONES AND PETER J. KLENOW*

We propose a summary statistic for the economic well-being of people in a country. Our measure incorporates consumption, leisure, mortality, and inequality, first for a narrow set of countries using detailed micro data, and then more broadly using multi-country datasets. While welfare is highly correlated with GDP per capita, deviations are often large. Western Europe looks considerably closer to the United States, emerging Asia has not caught up as much, and many developing countries are further behind. Each component we introduce plays a significant role in accounting for these differences, with mortality being most important. (JEL D63, E21, E23, E24, I12, O57)

Beyond GDP...?

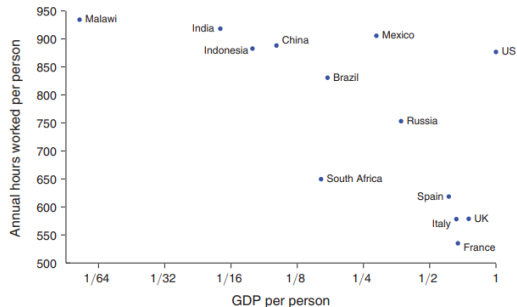


FIGURE 2. ANNUAL HOURS WORKED ACROSS COUNTRIES

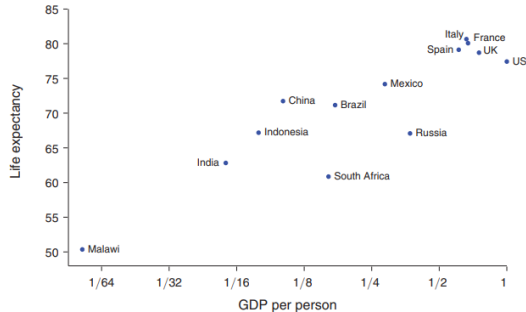


FIGURE 4. LIFE EXPECTANCY

Jones, Charles I., and Peter J. Klenow. "Beyond GDP? Welfare across countries and time." *American Economic Review* 106.9 (2016): 2426-2457.

Beyond GDP...?

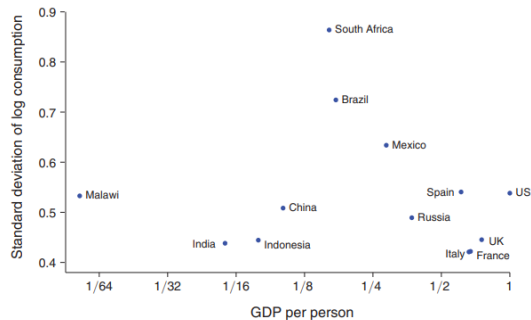
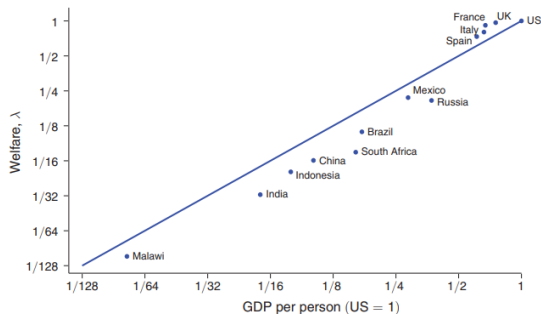


FIGURE 1. WITHIN-COUNTRY INEQUALITY

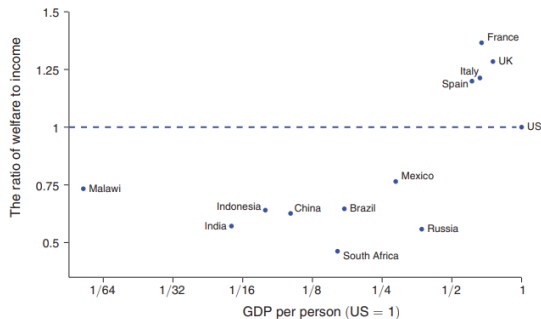
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Beyond GDP...? GDP does a good job, but masks some limits

Panel A. Welfare and income are highly correlated at 0.98



Panel B. But this masks substantial variation in the ratio of λ to GDP per capita



Jones, Charles I., and Peter J. Klenow. "Beyond GDP? Welfare across countries and time." *American Economic Review* 106.9 (2016): 2426-2457.

Accounting for Natural Capital Depreciation

- **Idea:** depreciation of natural resources to produce value in the economy should be accounted as the use of natural capital

$$\begin{aligned} \text{"Green" Net Domestic Product} &= \\ &\quad \text{Net Domestic Product} \\ &\quad - \text{Depreciation of Natural Capital} \end{aligned}$$

- **Major Problem:** market prices of natural capital usually do not exist, or, if they do, they usually do not reflect externalities of use of natural capital (see Geoffrey Heal, "Endangered Economies," 2017)

Gross vs. Net Domestic Product

Bureau of Economic Analysis

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- The focus is usually on “Gross” Domestic Product because, in practice, it is difficult to measure loss of value of existing capital!
- Remember: we can still arrive at the value of GDP through the Expenditure or Income approach!
- Current preferred method is based on amortization for taxation purposes, which has little to do with economic value.

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Sales	100	Sales	500

- SteelCo: extracts ore, turns it into steel.
- Reduction in total stock of ore in the ground is depreciation of natural capital!
- “Green” Net Domestic Product = ?

Final point: life beyond the market



- GDP only accounts for the price of goods and services **exchanged at the market!**
- When Gordon Ramsay cooks a Beef Wellington...
 - ...and serves it to a client for a price in his restaurant, it **adds to GDP** at the point of service.
 - ...and serves it to friends and family at home, it **does not to GDP** at the point of service.
- As more activities are added to the market, more things mechanically count toward GDP (think laundry, seamstress, daycare, etc...).

Summing up on GDP

- GDP sophisticated accounting measure of value created by the economy
- National Accounts offer rich perspective on economy (value added, income, expenditure)
- GDP has limits, use of GDP as measure of welfare is inappropriate

Summing up on GDP

“The valuable capacity of the human mind to simplify a complex situation in a compact characterization becomes dangerous when not controlled in terms of definitely stated criteria.

With quantitative measurements especially, the definiteness of the results suggests, often misleadingly, a precision and simplicity in the outlines of the object measured.

Measurements of national income are subject to this type of illusion and resulting abuse, especially since they deal with matters that are the center of conflict of opposing social groups where the effectiveness of an argument is often contingent upon oversimplification.

Simon Kuznets, 1934.