Lecture 1 - Introduction to Macroeconomics

UCLA - Econ 102 - Fall 2018

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Contents


```
rm(list = ls())
devtools::install_github("dbnomics/rdbnomics")
pklist <- c("tidyverse", "lubridate", "rdbnomics")
source("https://fgeerolf.github.io/datasets/load-packages.R")
options(tibble.print_max = 100)
```

Syllabus

General

Lectures: Mondays and Wednesdays, 3:30-4:45pm, Dodd Hall, Room 147.

Office hours: Tuesdays, 4-6pm. (Bunche 8389)

Recommended textbook (not mandatory): Olivier Blanchard's Macroeconomics, 7th Edition.

Prerequisites: a strict prerequisite for the class is that you have taken Econ 101. If you do not meet this prerequisite, you are advised to take this course during another term. You should also be familiar with some elementary mathematics. For example, you need to know what a logarithm is, and how to calculate a geometric sum:

$$1 + c_1 + c_1^2 + ... = \frac{1}{1 - c_1} \quad \text{if} \quad 0 < c_1 < 1,$$

because that is really useful to understand how a Keynesian multiplier works, for example.

Questions: If you have any question about the material covered during the course, you should consider the following options in order:

1. First, you should never refrain from asking questions during class.

2. Second, you may ask questions during recitation sections. The smaller group should allow you to ask questions more freely. Our teaching assistants are all passionate graduate students, writing a phD thesis on macroeconomics or other related subjects, so they will be very happy to help you.
3. Third, TAs will hold their office hours. The times for their office hours is here:

- Sections 1E-1I. Paula Beltran. OH: F 11-12; 2-3. pabeltran90@gmail.com
- Sections 1H-1M. Alvaro Boitier. OH: M 2:30-3:30; T 2-3. alvaro.boitier@gmail.com
- Sections 1N-1K. Conor Foley. OH: T 2-4. conor.teaches.econ@gmail.com
- Sections 1D-1J. Kun Hu. OH: R; 9-11. rickhukun@ucla.edu
- Sections 1G-1O. Ivan Lavrov. OH: W 1-3. ilavrov113@gmail.com
- Sections 1B-1C. Anthony Papac. OH: M 10-11; R 12:30-1:30. anthonypapac@g.ucla.edu
- Sections 1A-1F. Mengbo Zhang. OH: W 10-12. zmbruc@gmail.com

4. Fourth, you should feel free to ask questions on the discussion board (not by email). We will never respond to questions about contents by email (in particular those starting with "is X, Y, Z, test material"), because doing so would be unfair to the rest of the class. In contrast, we commit to respond to all questions on the Moodle Website within 24 hours (either me or the TAs will). Beware ! You should start studying for the midterm exam earlier than April 29, 2018 − we will stop answering questions at 6pm the day before each exam (either the midterm on April 30, or the final on June 14).
5. Finally, I will hold regular office hours on Tuesdays, 4-6pm, in my office 8389. Please send me an email prior if you plan to come after 5pm.

Exams: Everything that I say during the class, that is covered during recitation sections, is potentially examinable. Therefore, it is absolutely necessary that you attend all lectures! I encourage you to take notes during the class. Class notes will be posted *after* each class, so as to encourage you to take notes. Again, notes might not always be comprehensive, and everything I will say during class is potentially examinable. Thus, to do well it's best if you attend all lectures.

(Would be) Data scientists: A lot of what we do in the class involves a fair amount of data. I use **R statistical software** in order to prepare my lecture notes and input the data from official sources. I will always provide the required code to replicate all the analysis available in my lecture notes. For example, this document has a counterpart with the R code available here. I hope that proiding you will this will encourage you to explore the data more. However, understanding code is not required at all to succeed in that class, so you are welcome to skip this if you are not interested.

Exam Dates

Your final grade has two components: one midterm exam, and a comprehensive final exam. Your final grade will be given by whichever of these two options gives you the best grade: (**Midterm (40%)** + **Final Exam (60%)**) or (**Final Exam (100%)**) at the following dates:

1. November 5, 2018, 3:30pm to 4:45pm: Midterm Exam.
2. December 14, 2018, 10:30am to 1:30pm: Final Exam.

In any case, there will be no makeup exams. If a midterm exam is missed due to a documented serious illness or emergency, the final exam will be worth 100 % of your grade. Note that attending the midterm is like an "option value": you are necessarily better off attending the midterm, no matter what your grade is. Please make sure right away that you can be there on November 5, 2018 !

Topics (tentative)

Below you will find the tentative list of topics that we will cover, as well as the corresponding readings in Olivier Blanchard's textbook. Again, readings are not compulsory and do not always cover all the material in my lectures. I only give them for your reference.

Neoclassical macroeconomics. (5 lectures)

1. National accounting, Cobb-Douglas. (Appendix 1)
2. Solow Growth Model. (Chapter 11)
3. Consumption: Intertemporal optimization. (Chapter 15)
4. Technological Growth. (Chapters 10, 12)
5. Inflation and Unemployment. (Chapters 7, 8)

Keynesian macroeconomics; empirics. (7 lectures)

6. Consumption function, multiplier. (Chapter 3)
7. Paradox of thrift. (Chapter 3)
8. Public debt, Say's law. (Chapter 16)
9. Redistributive Policies. (Chapter 3)
10. Empirics of Fiscal Policy. (Chapter 22)
11. Monetary Policy. (Chapters 4, 5, 6)
12. Empirics of Monetary Policy. (Chapter 23)

Open-Economy macroeconomics. (5 lectures)

13. Keynesian Cross and the Open Economy. (Chapters 17, 18)
14. Twin Deficits. (Chapters 17, 18)
15. The Phillips Curve. (Chapter 8)
16. Mundell-Fleming, Depreciations. (Chapter 19, 20)
17. Currency Wars, Manufacturing Decline. (Chapter 19, 20)

There is no class on Memorial Day. There will be a review session on the last day of class. There is a midterm exam on November 5, 2018.

Disclaimer: Teaching Philosophy

To the extent possible, I will strive to emphasize **facts** over **theories**. This is a major difference with the way that I taught this class in the past. Many of the issues that we will look at are politically charged, and theories have been developed to back out either views. For example:

- Is public debt an issue?
- Should Keynesian stimulus be used to fight recessions?
- What is the cause of unemployment? (how much is voluntary or involuntary?)
- etc.

Therefore, we will try to "let the data speak", and put the different theories that we will study to the test. I will try to be as objective as possible, and try to avoid any conservative or liberal bias. According to this article (link), the latter is more of a risk than the former. I will always try to give you both sides of the debate, and arguments supporting each side. You are welcomed (and even encouraged !) to disagree with what I say during class !

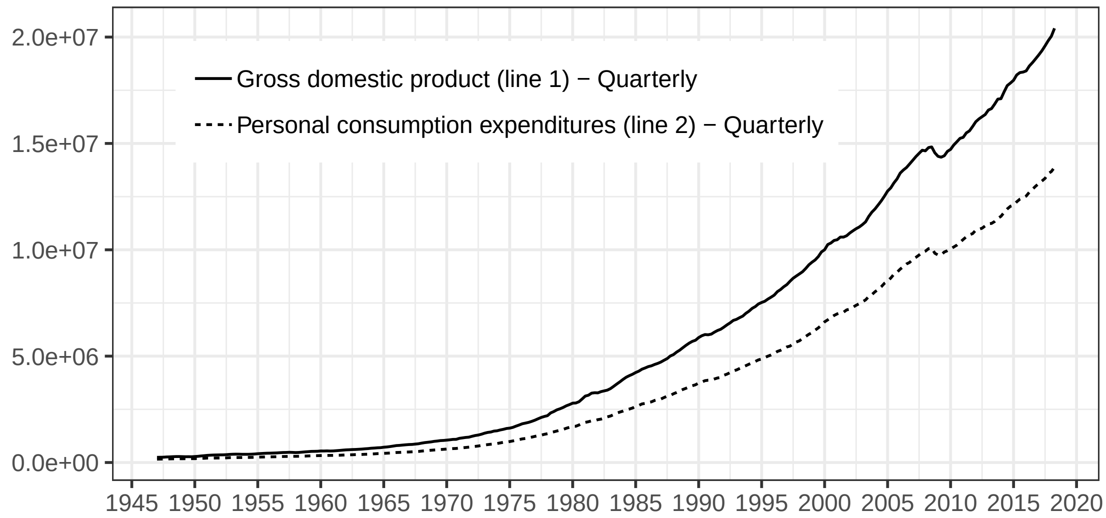

Figure 1: US GDP from NIPA (BEA)

GDP: The Product Side

Let us start with what is perhaps the most important accounting identity in macro:

$$Y = C + I + G + X - M.$$

Note that very often we denote net exports NX as $NX = X - M$ so that GDP is simply:

$$Y = C + I + G + NX.$$

Thus, GDP is the sum of: - Consumption (C)
- Investment (I)
- Government Purchases (G)
- Exports (X)
- Imports (M)

Personal Consumption Expenditures - Consumption (C)

Figure 1 plots GDP from the BEA, as well as PCE, in millions of dollars. US GDP being in the vicinity of USD 20 trillion dollars (or USD 20,000 billions, or USD 20,000,000 millions), this looks about right. On this figure, data for GDP is taken from the Bureau of Economic Analysis's National Income and Product Accounts (NIPA) here and data for Personal Consumption Expenditures is taken from there.

```
rdb(ids = c('BEA/NIPA-T10105/A191RC-Q', "BEA/NIPA-T10105/DPCERC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         yearmonth = year + (month - 1)/12) %>%
  select(yearmonth, value, series_name) %>%
  ggplot(aes(x = yearmonth, y = value, linetype = series_name)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) + xlab("") + ylab("")
```

To get a better of sense of how big consumption is as a fraction to GDP (although you may eyeball it on this picture), we might plot consumption as a function of GDP, which is what I do below. You can see that

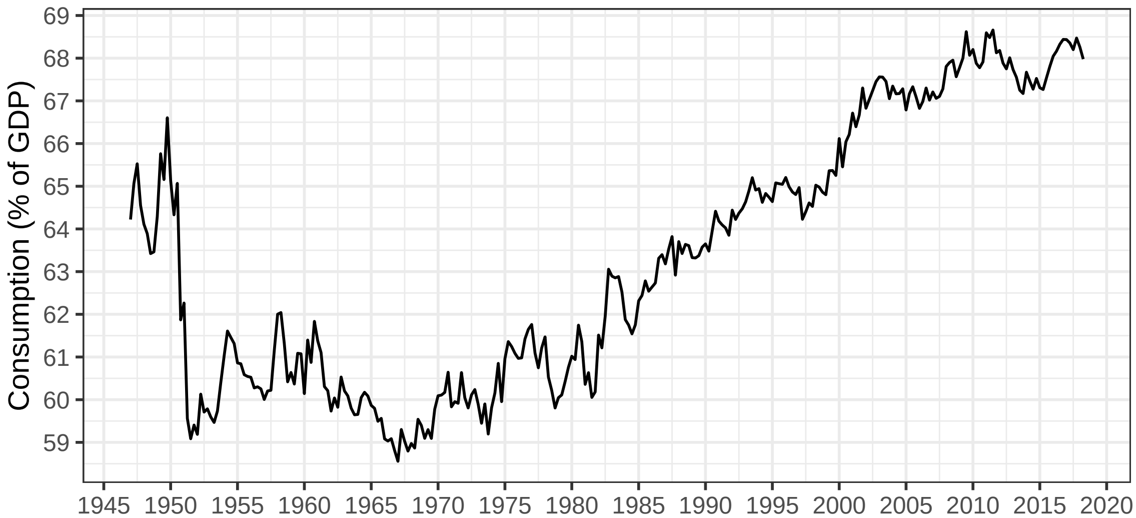

Figure 2: Consumption as a share of GDP from NIPA (BEA)

Personal Consumption Expenditures are approximately **60 to 70 % of GDP**. You can also see that it's been rising since the end of the sixties. We will discuss that.

```
rdb(ids = c('BEA/NIPA-T10105/A191RC-Q', "BEA/NIPA-T10105/DPCERC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         date = year + (month - 1)/12) %>%
  select(series_name, date, value) %>%
  arrange(date, series_name) %>%
  group_by(date) %>%
  mutate(cons_gdp = 100*value[2]/value[1]) %>%
  select(series_name, date, cons_gdp) %>%
  ggplot(aes(x = date, y = cons_gdp)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) +
  scale_y_continuous(breaks = seq(58, 69, 1)) +
  xlab("") + ylab("Consumption (% of GDP)")
```

Personal Consumption Expenditures are divided up into:
- Durable Goods (more than 3 years of durability): e.g. cars.
- Non-durable Goods (less than 3 years of durability).
- Services.

Services have become more important than Goods in total consumption since the 1970s.

```
rdb(ids = c('BEA/NIPA-T10105/A191RC-Q', "BEA/NIPA-T10105/DGDSRC-Q", "BEA/NIPA-T10105/DSERRC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         date = year + (month - 1)/12) %>%
  select(series_name, date, value) %>%
  arrange(date, series_name) %>%
  group_by(date) %>%
  mutate(Goods = 100*value[1]/value[2],
         Services = 100*value[3]/value[2]) %>%
  select(date, Goods, Services) %>%
```

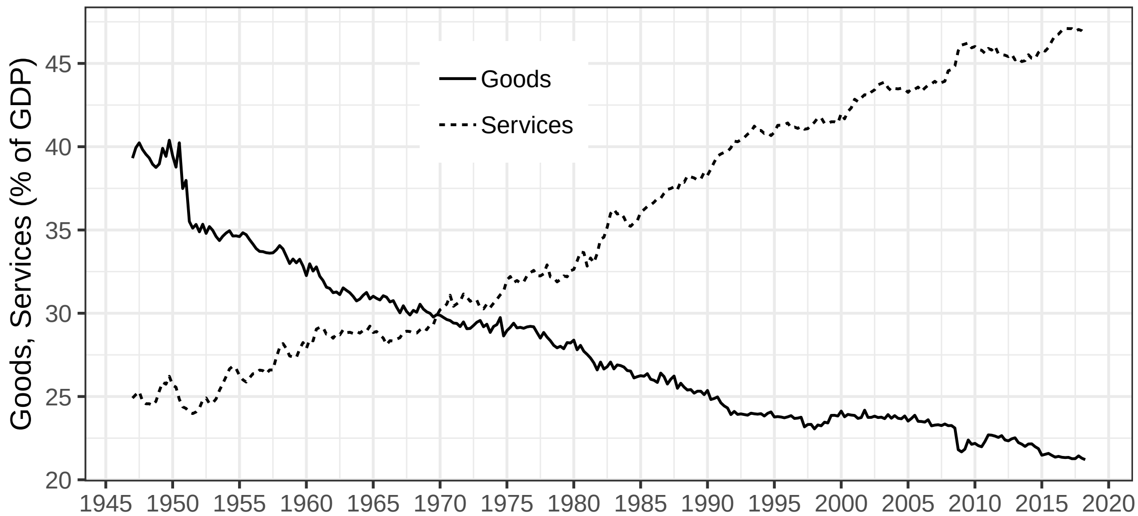

Figure 3: Goods and Services Consumption as a share of GDP from NIPA (BEA)

```
  gather(variable, value, -date) %>%
  ggplot(aes(x = date, y = value, linetype = variable)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) +
  scale_y_continuous(breaks = seq(20, 50, 5)) +
  xlab("") + ylab("Goods, Services (% of GDP)")
```

Gross private domestic investment - Investment (I)

Investment has two components: - non residential investment is the purchase of new capital goods by firms: structures, new plants.
- residential investment is the purchase of new houses.

Gross private domestic investment is approximately **15 to 20 % of GDP**, as you can see on Figure 4. It is also very volatile over the cycle.

```
rdb(ids = c('BEA/NIPA-T10105/A191RC-Q', "BEA/NIPA-T10105/A006RC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         date = year + (month - 1)/12) %>%
  select(series_name, date, value) %>%
  arrange(series_name, date) %>%
  group_by(date) %>%
  mutate(cons_gdp = 100*value[2]/value[1]) %>%
  select(series_name, date, cons_gdp) %>%
  ggplot(aes(x = date, y = cons_gdp)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) +
  scale_y_continuous(breaks = seq(12, 25, 1)) +
  xlab("") + ylab("Investment (% of GDP)")
```

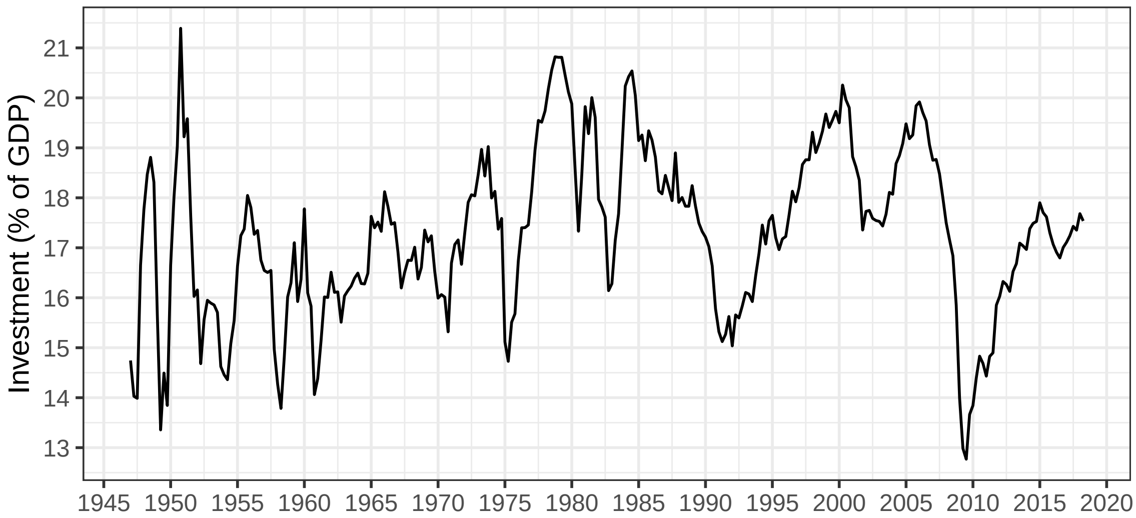

Figure 4: Investment as a share of GDP from NIPA (BEA)

Government Purchases (G)

Government purchases are composed of purchases of goods by the government plus the compensation of government employees. Overall, they comprise about approximately 20% of GDP, as can be seen on Figure 5. Note however that they do not include transfers from the government of interest payments on government debt.

```
rdb(ids = c('BEA/NIPA-T10105/A191RC-Q', "BEA/NIPA-T10105/A822RC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         date = year + (month - 1)/12) %>%
  select(series_name, date, value) %>%
  arrange(series_name, date) %>%
  group_by(date) %>%
  mutate(cons_gdp = 100*value[1]/value[2]) %>%
  select(series_name, date, cons_gdp) %>%
  ggplot(aes(x = date, y = cons_gdp)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) + xlab("") +
  ylab("Government Purchases (% of GDP)") +
  scale_y_continuous(breaks = seq(15, 25, 1))
```

Net Exports (NX)

Net exports of goods and services are approximately **-2 to -6 % of GDP**, at least in the modern period (and in the United States), as you can see on Figure 6.

```
rdb(ids = c('BEA/NIPA-T10105/A191RC-Q', "BEA/NIPA-T10105/A019RC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         date = year + (month - 1)/12) %>%
  select(series_name, date, value) %>%
  arrange(series_name, date) %>%
```

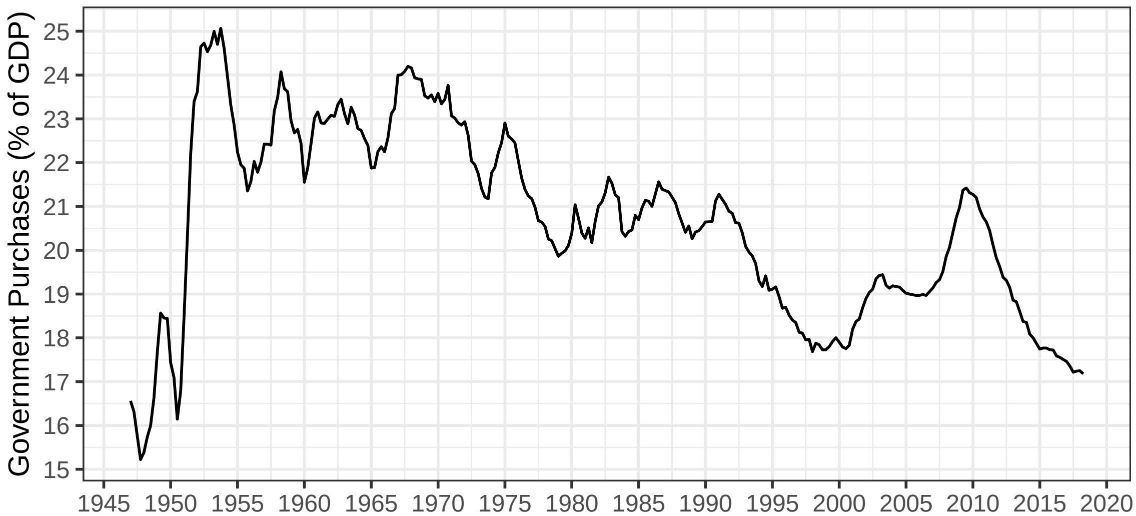

Figure 5: Government Purchases as a share of GDP from NIPA (BEA)

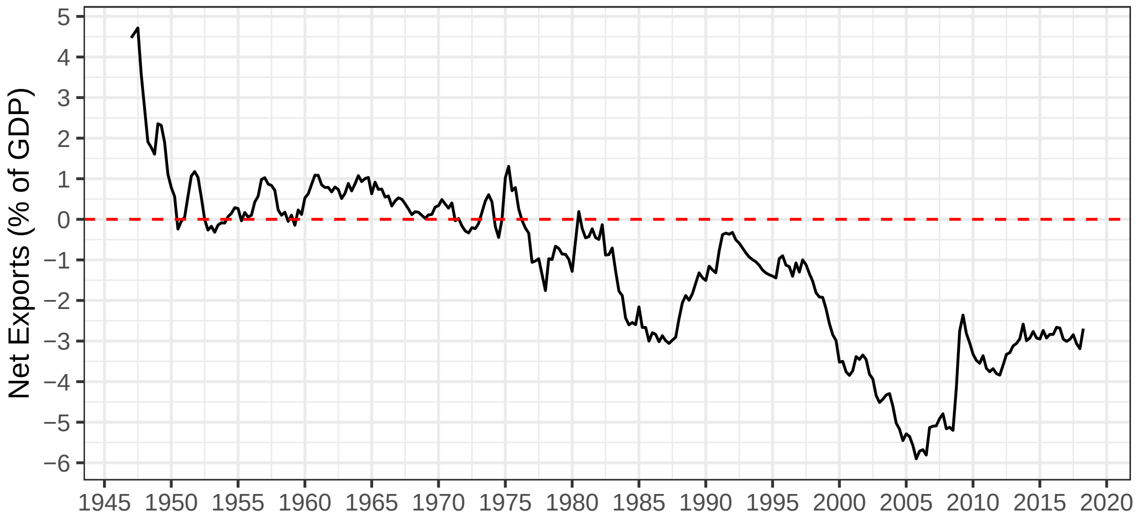

Figure 6: Net Exports as a share of GDP from NIPA (BEA)

```
  group_by(date) %>%
  mutate(cons_gdp = 100*value[2]/value[1]) %>%
  select(series_name, date, cons_gdp) %>%
  ggplot(aes(x = date, y = cons_gdp)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) + xlab("") +
  ylab("Net Exports (% of GDP)") +
  scale_y_continuous(breaks = seq(-6, 5, 1)) +
  geom_hline(yintercept = 0, linetype = "dashed",  color = "red")
```

GDP: The Income Side

Cobb Douglas Production function.

In order to organize our thinking, let's write out a Cobb-Douglas production function, defined as:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha},$$

where α is a number between 0 and 1. Let us think of a firm who chooses the amount of labor it uses L_t as well as the amount of capital it uses K_t in order to maximize its profits:

$$\max_{K_t, L_t} \quad A_t K_t^\alpha L_t^{1-\alpha} - rK_t - wL_t.$$

From Econ 101, it should be clear that a way to solve this problem is simply to set the derivatives of the profit function equal to 0 with respect to K_t and L_t which gives:

$$\alpha A_t K_t^{\alpha-1} L_t^{1-\alpha} - r = 0$$

when differentiating with respect to K_t and

$$(1-\alpha) A_t K_t^\alpha L_t^{-\alpha} - w = 0$$

when differentiating with respect to L_t.

The total wage bill wL_t is then given by:

$$wL_t = (1-\alpha) A_t K_t^\alpha L_t^{-\alpha} * L_t = (1-\alpha) Y_t.$$

The total income going to capital rK_t is given by:

$$rK_t = \alpha A_t K_t^{\alpha-1} L_t^{1-\alpha} * K_t = \alpha Y_t.$$

Thus, the share of capital in value added is:

$$\boxed{\frac{rK_t}{Y_t} = \alpha},$$

while the share of labor in value added is

$$\frac{wL_t}{Y_t} = 1 - \alpha.$$

The Income Side in the Data

So in practice, how much goes to the compensation of employees, and how much goes to the returns to capital? The answer is that it goes approximately for 1/3 to capital and for 2/3 to labor. The calculations for these are less straightforward than for computing the share of consumption, investment, as we did above. The reason is that in practice, the division between labor and capital is not as clear cut in the national accounts as one might hope: for example, someone who owns her/his own business reports most of her/his income in the form of capital income, even when a large part of it is actually labor income, so that compensation of employees is (vastly) understated. Figure 7 shows which results are obtained using this understated measure. It needs to be adjusted upwards by about 10% of GDP, for the reasons mentioned above.

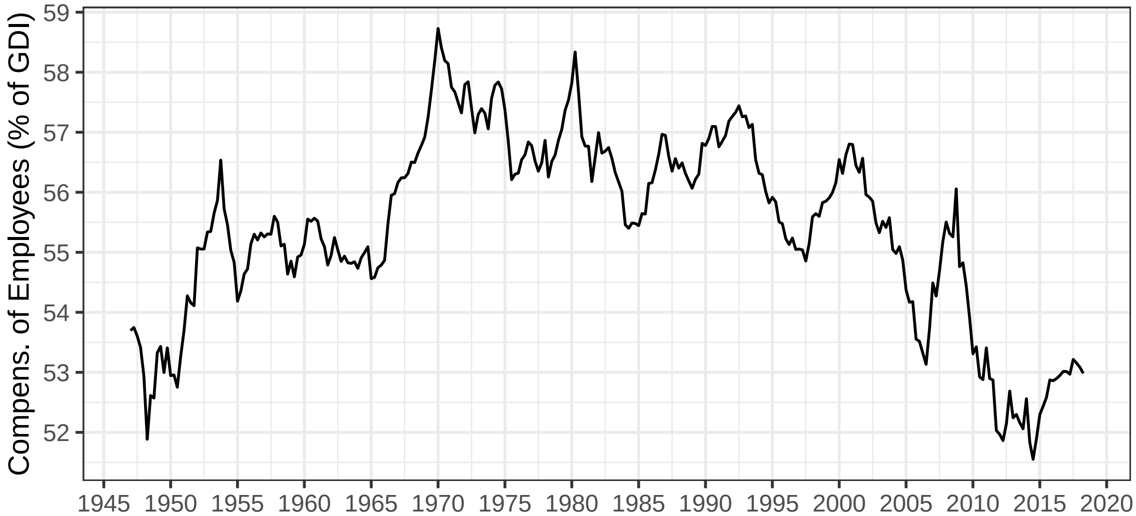

Figure 7: Compensation of Employees as a share of GDP from NIPA (BEA)

```
rdb(ids = c("BEA/NIPA-T11000/A4002C-Q", "BEA/NIPA-T11000/A261RC-Q")) %>%
  mutate(year = year(period),
         month = month(period),
         date = year + (month - 1)/12) %>%
  select(series_name, date, value) %>%
  arrange(series_name, date) %>%
  group_by(date) %>%
  mutate(comp_gdp = 100*value[1]/value[2]) %>%
  select(series_name, date, comp_gdp) %>%
  ggplot(aes(x = date, y = comp_gdp)) + geom_line() + theme_bw() +
  theme(legend.title = element_blank(),
        legend.position = c(0.4, 0.8)) +
  scale_x_continuous(breaks = seq(1920, 2025, 5)) +
  scale_y_continuous(breaks = seq(50, 60, 1)) +
  xlab("") + ylab("Compens. of Employees (% of GDI)")
```

For our purposes, we only need to remember that the share of compensation of employees is approximately 2/3 of value added. Therefore, we will very often work with a Cobb-Douglas production function such that:

$$Y_t = A_t K_t^{1/3} L_t^{2/3}.$$

Lecture 2 will walk you through the Solow growth model, where we shall make heavy use of that Cobb-Douglas production function.