

# Investment

Intermediate Macroeconomics - UCLA - Econ 102

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October 12, 2020

# Section 1

## Introduction

## Question

- What are the sources of GDP growth, and of GDP differences across countries?
- Supply-side approach to GDP presented in lecture 1, with GDP given as  $Y_t = A_t K_t^\alpha L_t^{1-\alpha}$ , implies that growth in GDP may arise from technology, capital, or population.
- Population is not that interesting from an economist's point of view, since the object of interest for an economist usually is **GDP per capita**. However, population is very important for discussions of relative economic or military power, which ultimately also impact the economy.
- In this lecture, we study the Solow (1956) / Swan model of economic growth, which deals with the problem of capital accumulation.

## Solow (1956)

- Solow (1956) emphasized the importance of capital accumulation.
- He built what is now referred to as the neoclassical growth model.
- Production requires that some people forgo consumption for later, which allows to build machines, and railroads, and increases the capital stock.
- One long-standing question in the economics literature however is whether there can be too much savings. (that is, is any amount of savings going to be demanded by the private sector?)

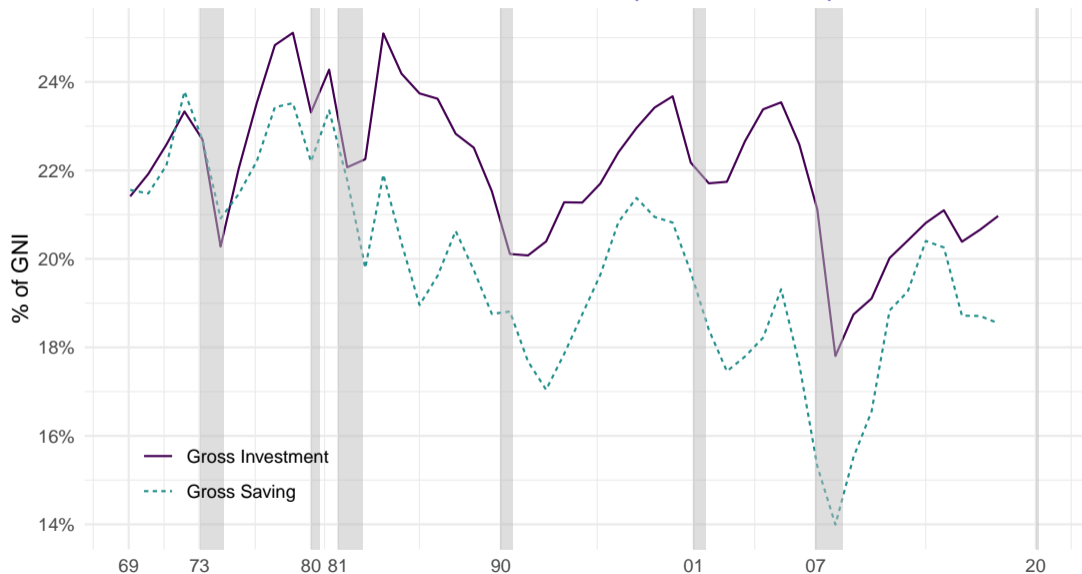
## Crucial question

- After the war, important discussions were held around the substitutability between capital and labor:
  - ▶ According to Keynesian economists, the growth process was basically unstable, because there wasn't much substitutability between capital and labor. As a consequence, capital would quickly fall into diminishing returns, and “too much saving” would result in stagnant growth.
  - ▶ According to neoclassical economists (including Solow), the growth process was stable, as there would always be enough demand for capital to absorb excess savings.
- While we look at the data on the capital stock, and investment, keep thinking about whether you can increase production by just adding capital; and keep thinking about the substitutability between capital and labor.

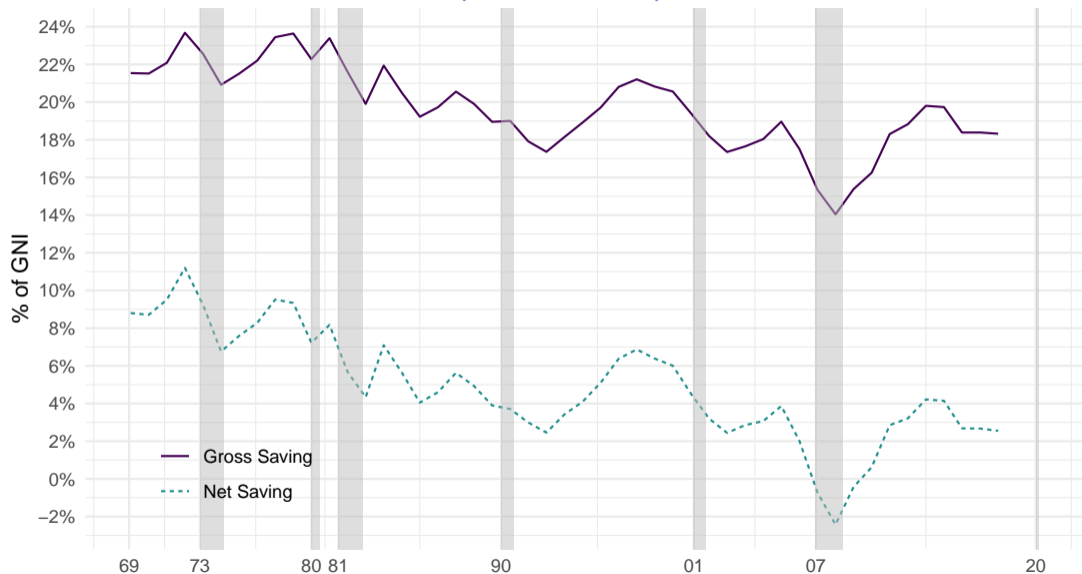
## Section 2

# U.S. Saving and Investment

# Gross Savings and Investment in the U.S. (World Bank)

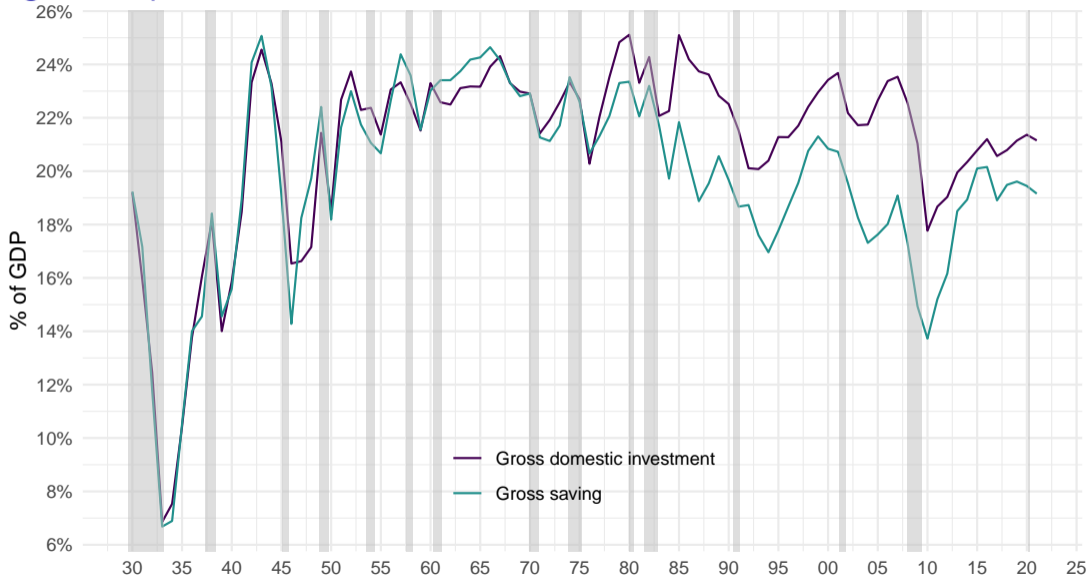


# Net Savings and Gross savings (World Bank)





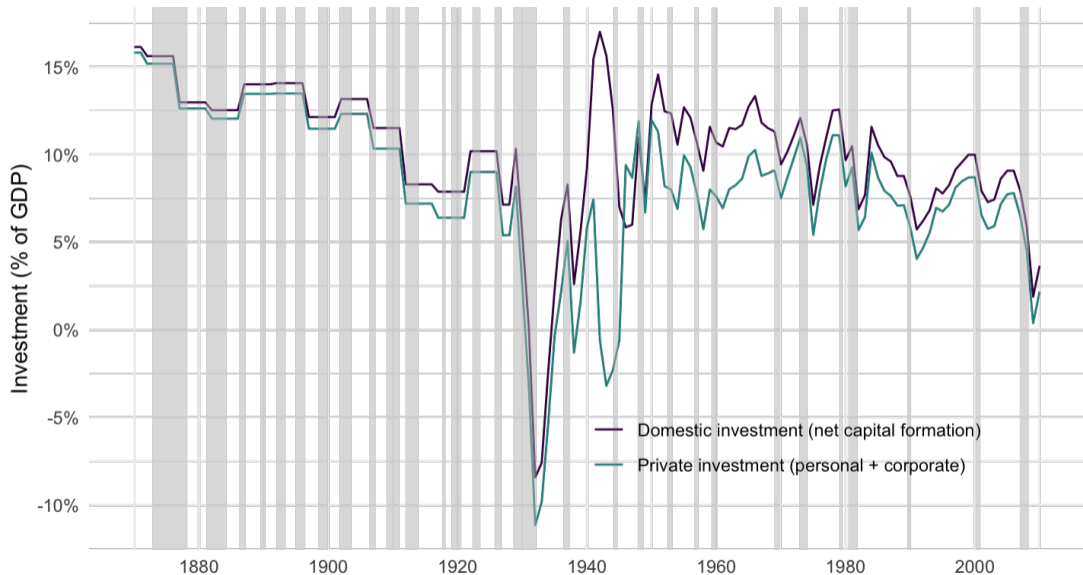
# Longer Perspective: NIPA



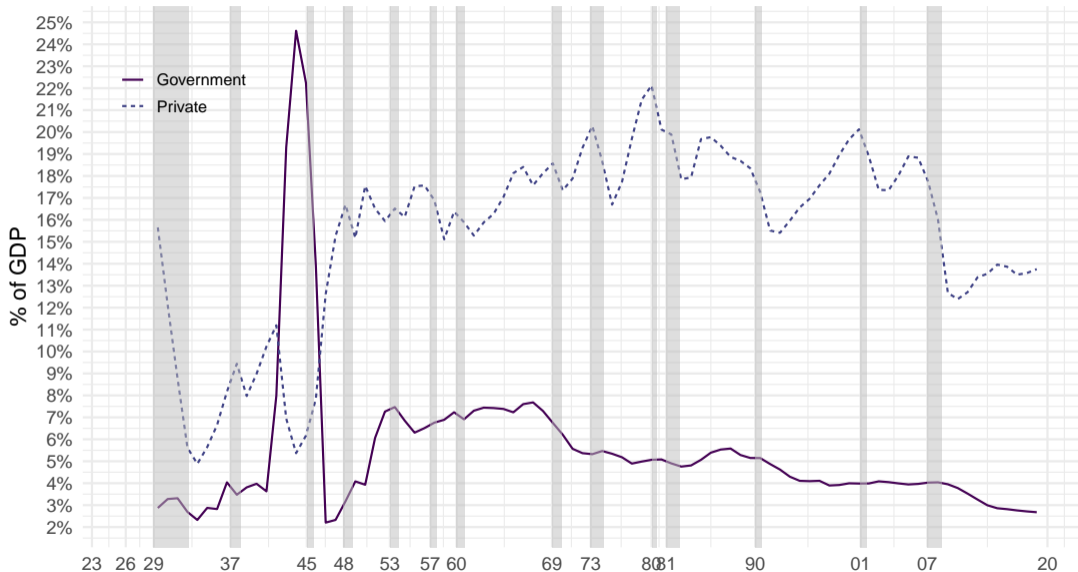
# Saving and Investment (NIPA)

Table 5.1. Saving and Investment by Sector	Line	1938	1958	1978	1998	2008	2018
Gross saving	1	14.6 %	21.6 %	23.3 %	21.3 %	15.2 %	18.4 %
Net saving	2	3.1 %	8.6 %	9.4 %	6.9 %	-0.8 %	2.4 %
Consumption of fixed capital	13	11.5 %	13 %	13.9 %	14.5 %	16 %	16 %
Gross domestic investment	21	14 %	21.5 %	24.8 %	23 %	21.1 %	21 %
Capital account transactions (net)	28			0 %	0 %	0 %	0 %
Net lending or net borrowing (-), NIPAs	35	1.3 %	0.2 %	-0.5 %	-2.3 %	-4.6 %	-2.5 %
Statistical discrepancy	42	0.8 %	0.1 %	1 %	-0.6 %	1.2 %	0.1 %

# U.S. Private and Total Net Investment



# U.S. Investment, Government VS Private



## Section 3

# World Saving and Investment





# OECD Data, 2018

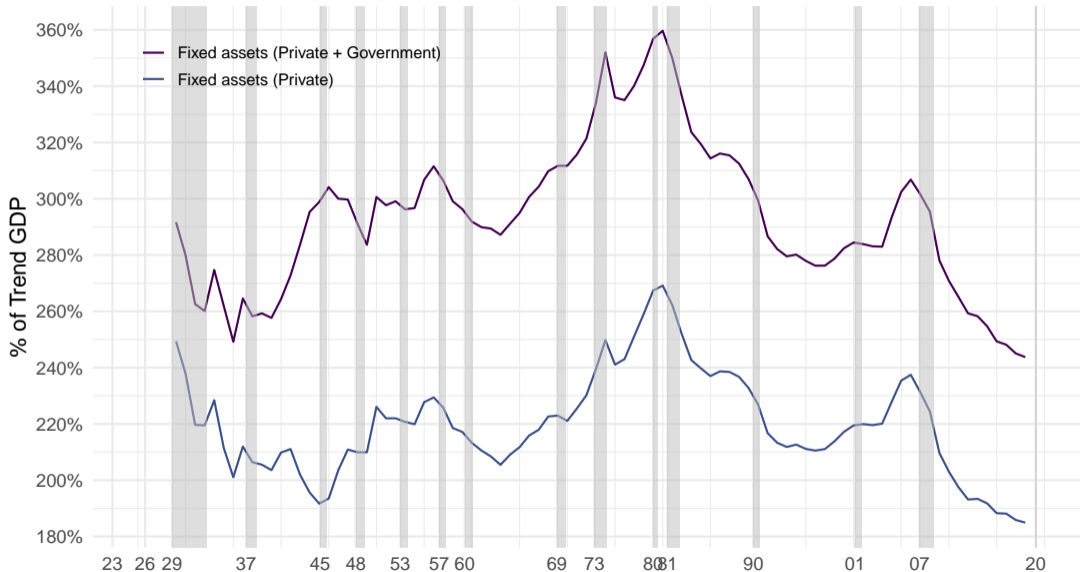
TRANSACT	Transact	DEU	FRA	GBR	USA
B1_GE	Gross domestic product (expenditure approach)	100 %	100 %	100 %	100 %
B1_GS1	Gross domestic product	100 %	100 %	99.8 %	100 %
B5_GS1	Gross national income at market prices	102.8 %	102.3 %	98.5 %	101.2 %
B5_NS1	Net national income at market prices	84.6 %	84 %	83.8 %	85.3 %
B6GS1	Gross national disposable income	101.5 %	100.2 %	97.3 %	100.6 %
B6NS1	Net national disposable income	83.3 %	82 %	82.6 %	84.6 %
B8NS1	Saving, net	11.2 %	4.6 %	-1.2 %	2.4 %
B9S1	Net lending/net borrowing	7.5 %	-0.5 %	-4.5 %	-2.5 %
D1_D4FRS2	Primary incomes receivable from the rest of the world	6.5 %	7.3 %	10 %	5.4 %
D1_D4NFRS2	Net primary incomes from the rest of the world	2.8 %	2.3 %	-1.3 %	1.3 %
D1_D4TOS2	Primary incomes payable to the rest of the world	3.7 %	5.1 %	11.3 %	4.1 %
D5_D7FRS2	Current transfers receivable from the rest of the world	2.1 %	1 %	0.9 %	0.8 %
D5_D7NFRS2	Net current transfers from the rest of the world	-1.3 %	-2.1 %	-1.2 %	-0.7 %
D5_D7TOS2	Current transfers payable to the rest of the world	3.4 %	3.1 %	2.1 %	1.4 %
D8S1	Adjustment for the change in net equity of households in pension funds	0 %	0 %	0 %	0 %
D9FRS2	Capital transfers receivable from the rest of the world	0.1 %	0.1 %	0.1 %	0 %
D9NFRS2	Net capital transfers from the rest of the world	-0.3 %	0.1 %	-0.1 %	0 %
D9TOS2	Capital transfers payable to the rest of the world	0.4 %	0 %	0.2 %	0 %
GDIS1	Gross domestic income	100 %	100 %	99.8 %	NA %
K1MS1	Consumption of fixed capital	18.2 %	18.2 %	14.6 %	16 %
K1S1	Consumption of fixed capital, capital account	18.2 %	18.2 %	14.6 %	16 %
K2S1	Acquisitions less disposals of non-financial non-produced assets	-0.2 %	0 %	0 %	0 %
P3S1	Final consumption expenditures	72 %	77.3 %	83.9 %	82.1 %
P5S1	Gross capital formation	21.8 %	23.5 %	17.7 %	21 %



## Section 4

### Data on the capital stock

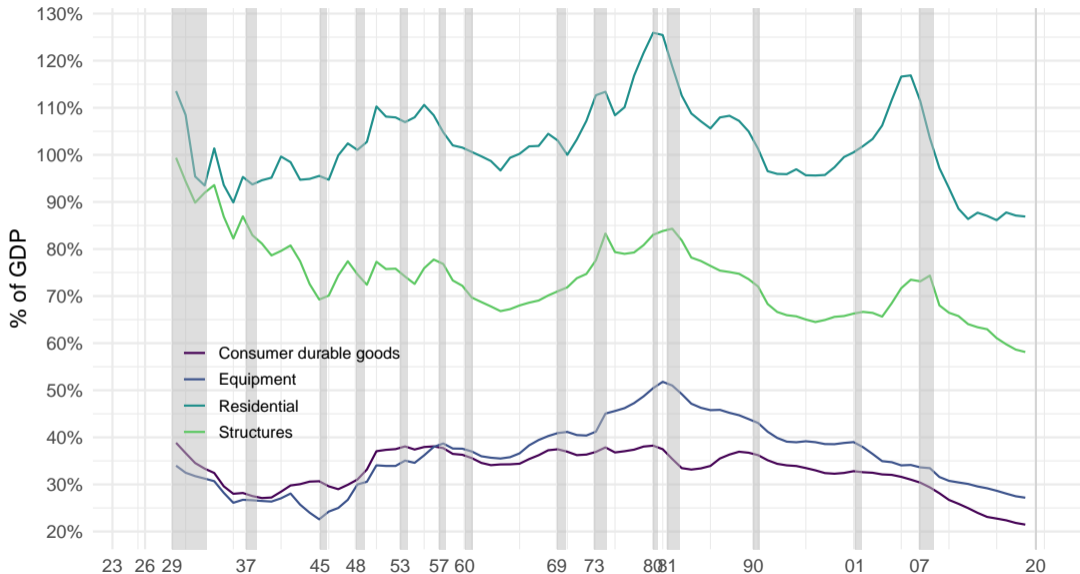
# Private and Government Fixed Assets (Book)



## Types of Capital (Broad Categories)

Description	2017
Fixed assets and consumer durable goods	267%
Fixed assets	245.2%
Private	186.3%
Nonresidential	99.3%
Equipment	27.5%
Structures	58.5%
IPP	13.2%
Residential	87.1%
Government	58.9%
Nonresidential	57.1%
Equipment	4.2%
Structures	48.1%
IPP	4.8%
Residential	1.8%
Consumer durable goods	21.8%

# U.S. Main Fixed Asset Components



# U.S. Main Fixed Asset Components

Table 1.1. Current-Cost Net Stock of Fixed Assets and Consumer Durable Goods	1938	1958	1978	1998	2018
Fixed assets and consumer durable goods	370.1 %	329.9 %	342.6 %	301.9 %	333.7 %
Fixed assets	335.1 %	294.1 %	308.8 %	270.6 %	306.8 %
Private	265.6 %	214.9 %	230.2 %	207.8 %	233.3 %
Nonresidential	143.3 %	114.6 %	122.1 %	113.4 %	124.3 %
Equipment	34.2 %	37 %	43.3 %	37.3 %	34.2 %
Structures	104.9 %	72.1 %	71.8 %	63.5 %	73.3 %
Intellectual property products	4.2 %	5.5 %	6.9 %	12.5 %	16.8 %
Residential	122.3 %	100.3 %	108.1 %	94.3 %	109.1 %
Government	69.5 %	79.2 %	78.6 %	62.9 %	73.4 %
Nonresidential	69.1 %	77.2 %	76.2 %	60.6 %	71.3 %
Equipment	3.5 %	15.8 %	9.5 %	7.1 %	5.2 %
Structures	64.9 %	56.7 %	58.6 %	46.8 %	60.2 %
Intellectual property products	0.7 %	4.6 %	8.1 %	6.8 %	5.9 %
Residential	0.3 %	2 %	2.4 %	2.3 %	2.2 %
Consumer durable goods	35 %	35.9 %	33.8 %	31.3 %	26.9 %
Private and government fixed assets	335.1 %	294.1 %	308.8 %	270.6 %	306.8 %
Nonresidential	212.5 %	191.7 %	198.2 %	174 %	195.5 %
Equipment	37.8 %	52.8 %	52.8 %	44.4 %	39.4 %
Structures	169.8 %	128.8 %	130.5 %	110.3 %	133.5 %
Intellectual property products	4.9 %	10.1 %	15 %	19.3 %	22.7 %
Residential	122.6 %	102.3 %	110.5 %	96.6 %	111.2 %
Government fixed assets	69.5 %	79.2 %	78.6 %	62.9 %	73.4 %

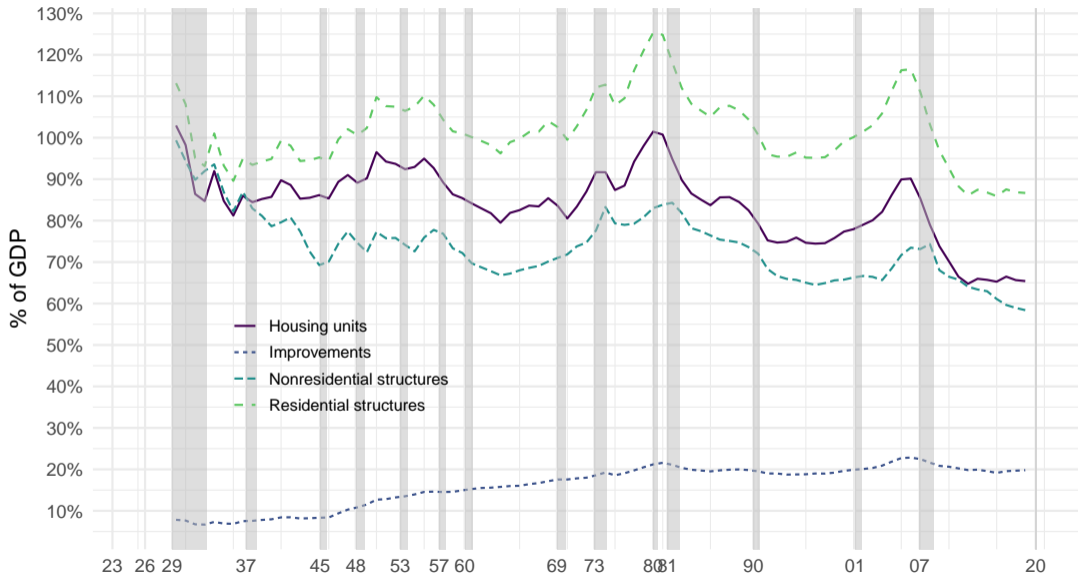
## Capital: mostly railroads in XIXth century



# Structures (% of GDP)

Description	2017	Manufacturing	6.7%	Residential structures	86.9%
Private fixed assets	187%	Power & communication	11.3%	Housing units	65.7%
Structures	145.8%	Power	8.7%	Permanent site	64.6%
Nonresidential structures	58.9%	Electric	6.3%	1 to 4 unit	55.4%
Commercial & health care	21.3%	Other power	2.4%	5-or more-unit	9.3%
Office	8%	Communication	2.7%	Manufactured homes	1%
Health care	4.5%	Mining exploration, shafts, & wells	7.3%	Brokers' commissions	1.2%
Hospitals & special care	3.5%	Petroleum & natural gas	6.7%	Improvements	19.7%
Hospitals	2.9%	Mining	0.6%	Other residential	0.4%
Special care	0.6%	Other structures	12.3%		
Medical buildings	0.9%	Religious	1.4%		
Multimerchandise shopping	3.1%	Educational & vocational	2.3%		
Food & beverage establishments	1.4%	Lodging	2.7%		
Warehouses	2%	Amusement & recreation	1.6%		
Other commercial	2.3%	Transportation	2%		
		Air	0.2%		
		Land	1.8%		
		Farm	1.6%		
		Other	0.7%		

# Decomposition of Structures

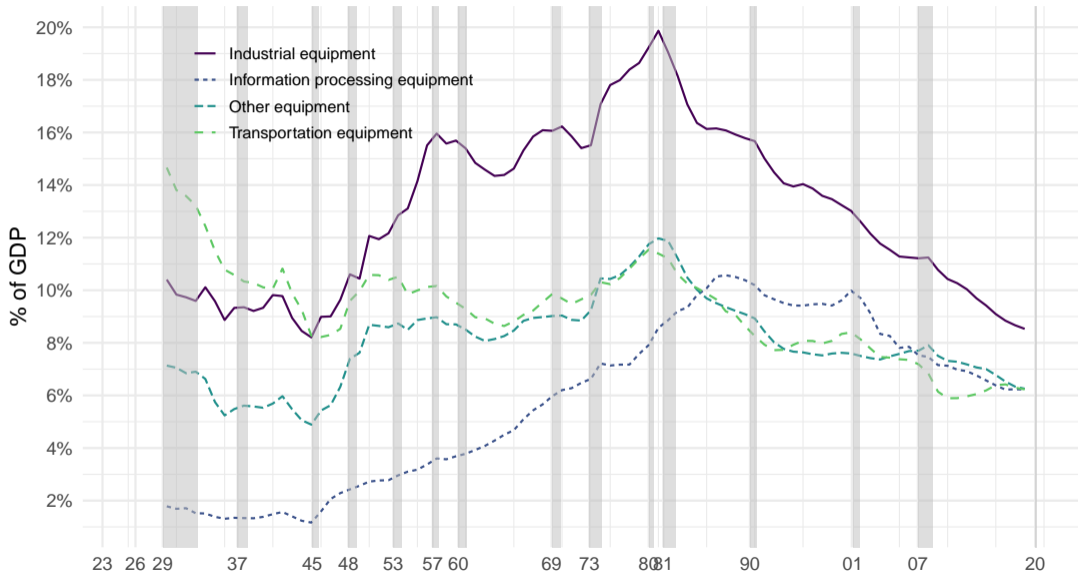




# Equipment Capital (% of GDP)

Description	2017		
Private fixed assets	186.3%	Transportation equipment	6.3%
Equipment	27.7%	Trucks, buses, & truck trailers	2.6%
Nonresidential equipment	27.5%	Light trucks (including utility vehicles)	1.7%
Information processing equipment	6.3%	Other trucks, buses, & truck trailers	0.9%
Computers & peripheral equipment	1%	Autos	0.8%
Communication equipment	2.3%	Aircraft	1.8%
Medical equipment & instruments	1.8%	Ships & boats	0.4%
Nonmedical instruments	0.9%	Railroad equipment	0.7%
Photocopy & related equipment	0.2%	Other equipment	6.3%
Office & accounting equipment	0%	Furniture & fixtures	1.4%
Industrial equipment	8.6%	Agricultural machinery	0.9%
Fabricated metal products	0.7%	Construction machinery	1%
Engines & turbines	0.6%	Mining & oilfield machinery	0.6%
Metalworking machinery	1.2%	Service industry machinery	0.8%
Special industry machinery, n.e.c.	1.4%	Electrical equipment, n.e.c.	0.1%
Gen. industrial, incl. materials handling, equip.	2.7%	Other nonresidential equipment	1.5%
Electrical transmission, distrib., & ind. apparatus	2.1%	Residential equipment	0.2%

# Decomposition of Equipment Capital



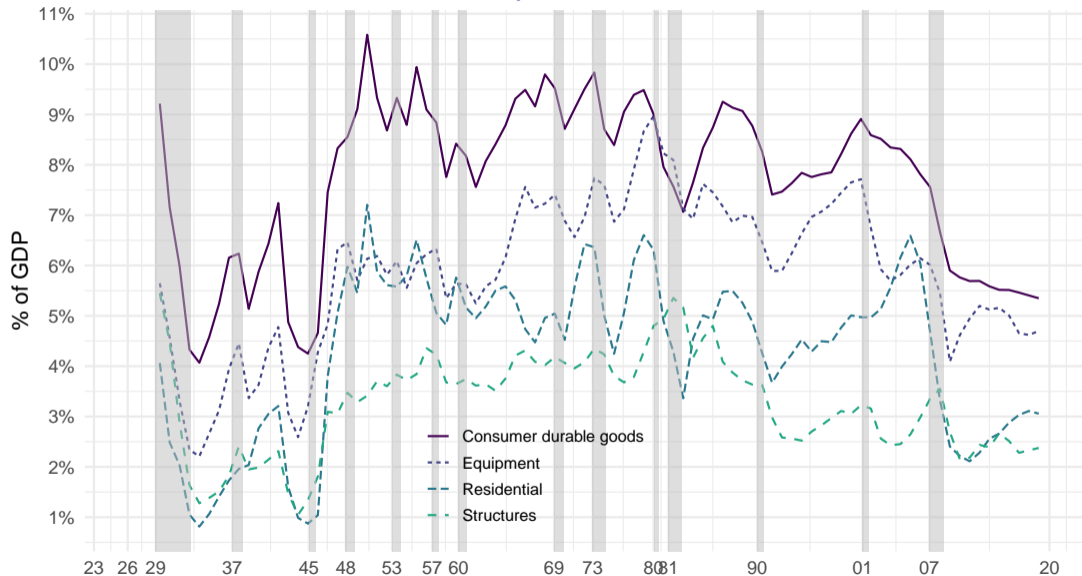
## Section 5

### Data on investment

## Investment (Broad Categories)

Description	2017
Fixed assets and consumer durable goods	21.6%
Fixed assets	16.2%
Private	13.6%
Nonresidential	10.4%
Equipment	4.6%
Structures	2.3%
IPP	3.5%
Residential	3.1%
Government	2.7%
Nonresidential	2.6%
Equipment	0.6%
Structures	1.2%
IPP	0.8%
Residential	0%
Consumer durable goods	5.4%

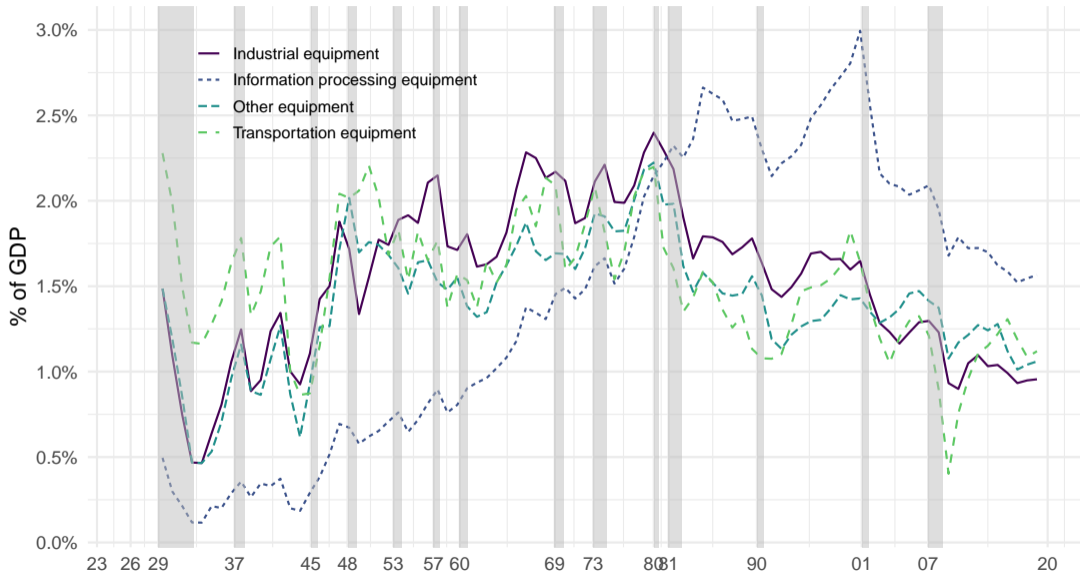
# U.S. Main Private Investment Components



## Equipment Investment (Detailed Categories)

Description	2017		
Private fixed assets	13.6%	Transportation equipment	1.1%
Equipment	4.7%	Trucks, buses, & truck trailers	0.7%
Nonresidential equipment	4.6%	Light trucks (including utility vehicles)	0.5%
Information processing equipment	1.6%	Other trucks, buses, & truck trailers	0.2%
Computers & peripheral equipment	0.4%	Autos	0.1%
Communication equipment	0.5%	Aircraft	0.2%
Medical equipment & instruments	0.4%	Ships & boats	0%
Nonmedical instruments	0.2%	Railroad equipment	0%
Photocopy & related equipment	0%	Other equipment	1%
Office & accounting equipment	0%	Furniture & fixtures	0.2%
Industrial equipment	0.9%	Agricultural machinery	0.1%
Fabricated metal products	0.1%	Construction machinery	0.2%
Engines & turbines	0.1%	Mining & oilfield machinery	0.1%
Metalworking machinery	0.1%	Service industry machinery	0.2%
Special industry machinery, n.e.c.	0.2%	Electrical equipment, n.e.c.	0%
Gen. industrial, incl. materials handling, equip.	0.3%	Other nonresidential equipment	0.3%
Electrical transmission, distrib., & ind. apparatus	0.2%	Residential equipment	0.1%

# Equipment Investment



## Section 6

### Data on depreciation



## How much is depreciation?

- The Solow (1956) growth model is very stylized (some would say, too stylized): it only has one type of capital.
- In practice, depreciation is very different for different types of capital. Some examples:
  - ▶ Office and accounting equipment, after 1978: **31.2%**.
  - ▶ Office buildings: **2.5%**.
- Here you can find 6 pages of BEA's depreciation estimates for different types of capital. (needless to say, this is not exam material...)

# Equipment

Type of Asset	Rate of depreciation	Service life
<b>Private nonresidential equipment</b>		
Computers and peripheral equipment /2/	.....	.....
Communications equipment:		
Rental and leasing and computer systems design and related services /3/	0.1500	11
Other industries /3/	0.1100	15
Nonmedical instruments/4/	0.1350	12
Medical equipment and instruments:		
Medical instruments /4/	0.1350	12
Electromedical equipment /5/	0.1834	9
Photocopy and related equipment /6/	0.1800	9
Office and accounting equipment:		
<i>Years before 1978</i>	0.2729	8
<i>1978 and later years</i>	0.3119	7
Nuclear fuel /7/	.....	4
Other fabricated metal products /8/	0.0917	18
Steam engines and turbines /9/	0.0516	32
Internal combustion engines /9/	0.2063	8

# Structures

## Private nonresidential structures

Office buildings /17/	0.0247	36
Medical buildings /17/	0.0247	36
Commercial warehouses /17/	0.0222	40
Other commercial buildings /17/	0.0262	34
Multimurchase shopping /17/	0.0262	34
Food and beverage establishments /17/	0.0262	34
Mobile offices /17/	0.0556	16
Hospitals	0.0188	48
Special care	0.0188	48
Manufacturing	0.0314	31
Electric light and power /18/:		
<i>Years before 1946</i>	0.0237	40
<i>1946 and later years</i>	0.0211	45
Gas /18/	0.0237	40
Petroleum pipelines /18/	0.0237	40

# Intellectual Property Products

Type of Asset	Rate of depreciation	Service life
<b>Private intellectual property products</b>		
Software /23/		
Prepackaged	0.5500	3
Custom	0.3300	5
Own-account	0.3300	5
Research and development /24/		
Pharmaceutical and medicine manufacturing	0.1000	.....
Chemical manufacturing, excluding pharmaceutical and medicine	0.1600	.....
Semiconductor and other electronic component manufacturing	0.2500	.....
Other computer and electronic product manufacturing		
Other computer and electronic product manufacturing, nec	0.4000	.....
Computers and peripheral equipment manufacturing	0.4000	.....
Communications equipment manufacturing	0.2700	.....
Navigational, measuring,electromedical, and control instrument manufacturing	0.2900	.....
Motor vehicles, bodies and trailers, and parts manufacturing	0.3100	.....

# Residential

## Residential capital (private and government)

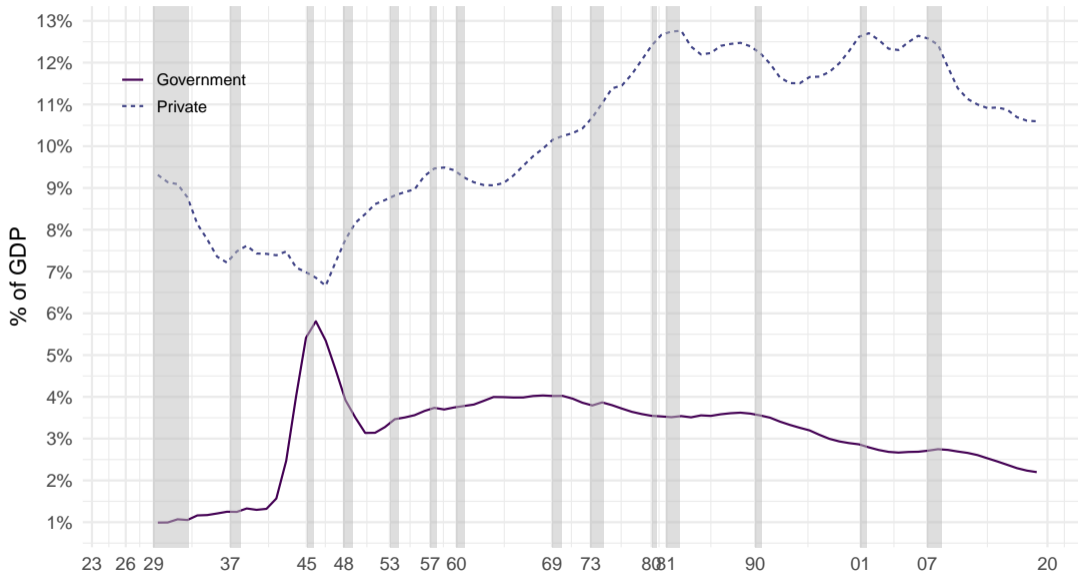
1-to-4-unit structures-new /21/	0.0114	80
1-to-4-unit structures-additions and alterations /21/	0.0227	40
1-to-4-unit structures-major replacements /21/	0.0364	25
5-or-more-unit structures-new /21/	0.0140	65
5-or-more-unit structures-additions and alterations /21/	0.0284	32
5-or-more-unit structures-major replacements /21/	0.0455	20
Brokers' commissions and other ownership transfer costs /26/	0.1375	12
Manufactured homes /21/	0.0455	20
Other structures /21/	0.0227	40
Equipment /16/	0.1500	11

# Durables

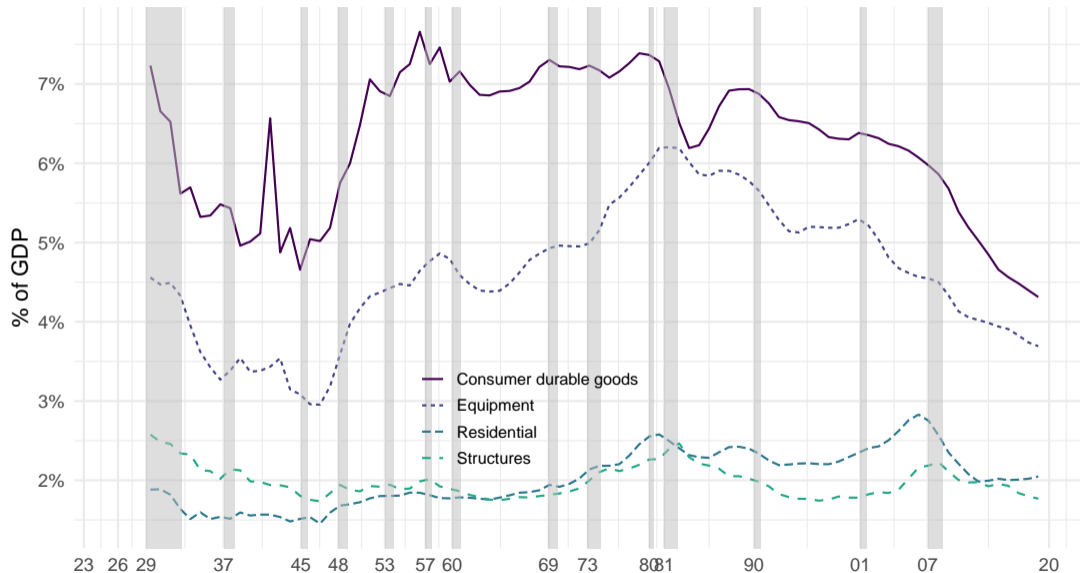
## Durable goods owned by consumers /27/

Motor vehicles and parts		
Autos /12/	.....	.....
Trucks		
<i>Years before 1992 /28/</i>	0.2316	8
<i>1992 and later years /11/</i>	0.1925	17
Recreational vehicles /28/	0.2316	8
Tires, tubes, accessories, and other parts /28/	0.6177	3
Furniture, including mattresses and bedsprings	0.1179	14
Household appliances	0.1500	11
Glassware, tableware, and household utensils /29/	0.1650	10
Other durable household equipment /29/	0.1650	10
Video and audio products, including musical instruments /30/	0.1833	9
Personal computers and peripheral equipment /2/	.....	.....
Computer software and accessories	0.5500	3
Jewelry and watches /29/	0.1500	11
Therapeutic appliances and equipment /29/	0.2750	6
Books and maps /29/	0.1650	10
Sports equipment and vehicles and photographic equipment /31/	0.1650	10
Luggage	0.1179	14

# U.S. Depreciation, Gvt VS Private (% of GDP)



# U.S. Private Depreciation

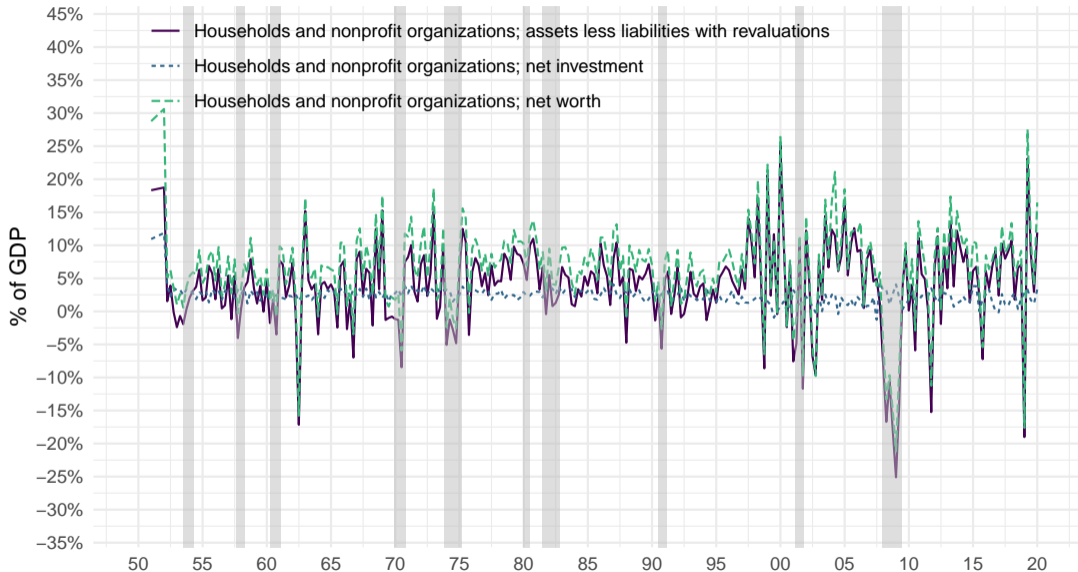




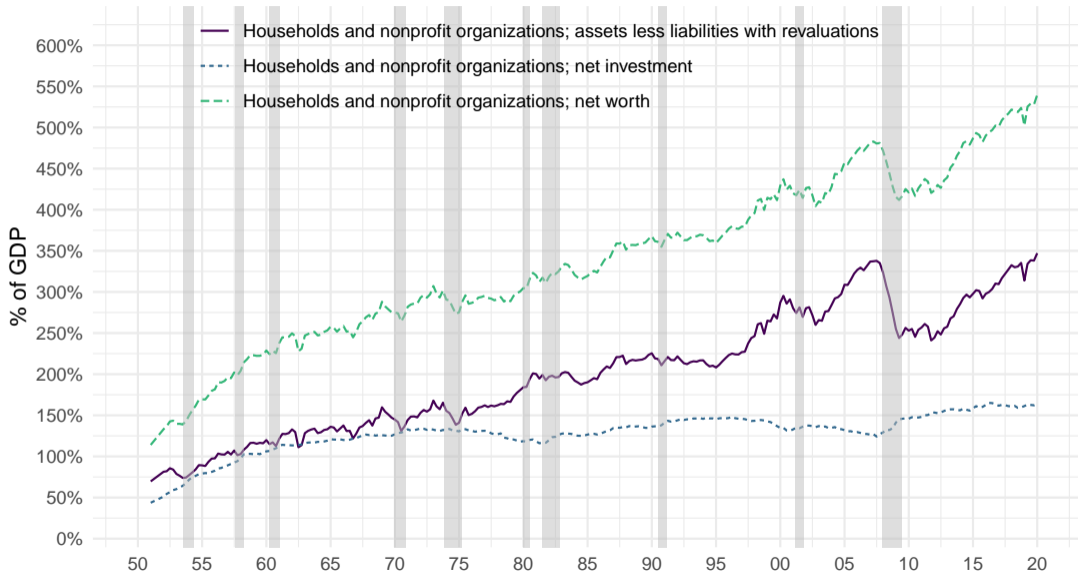
## Section 7

### Value VS Quantity of Capital

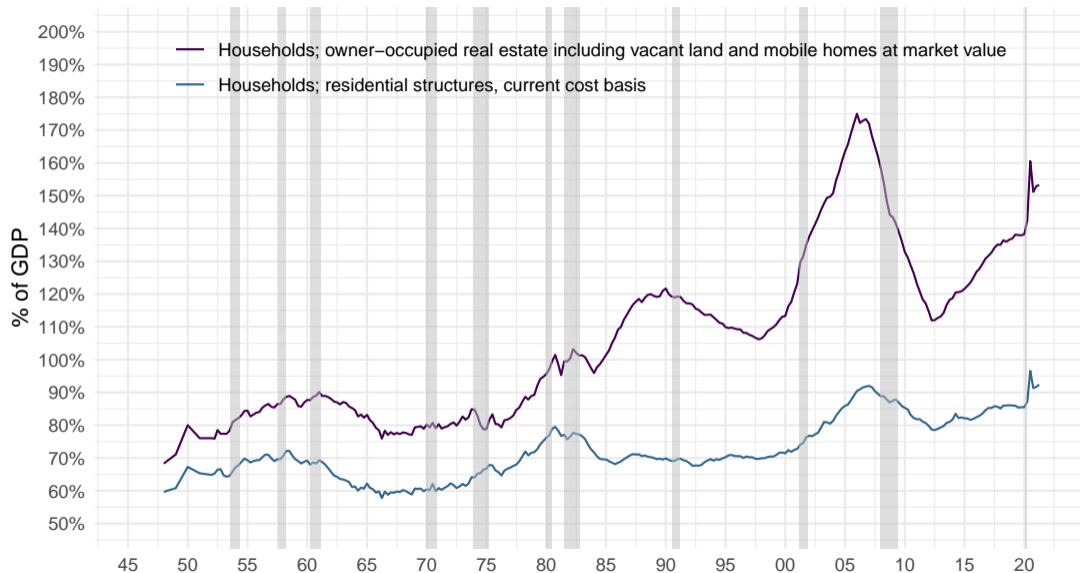
# Change in Net Worth of Households - R101



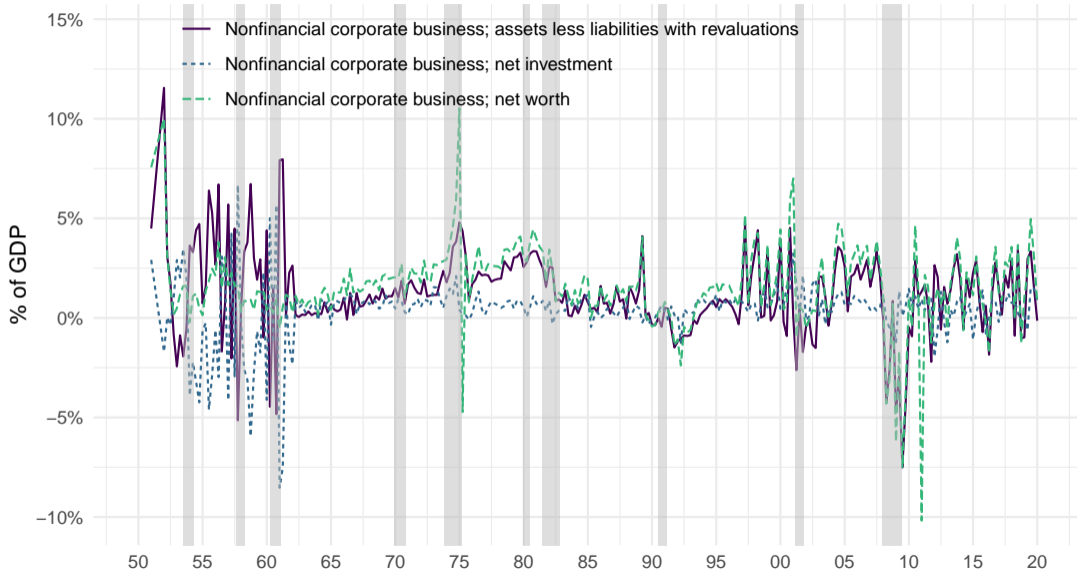
# Value VS Quantity - Households - R101



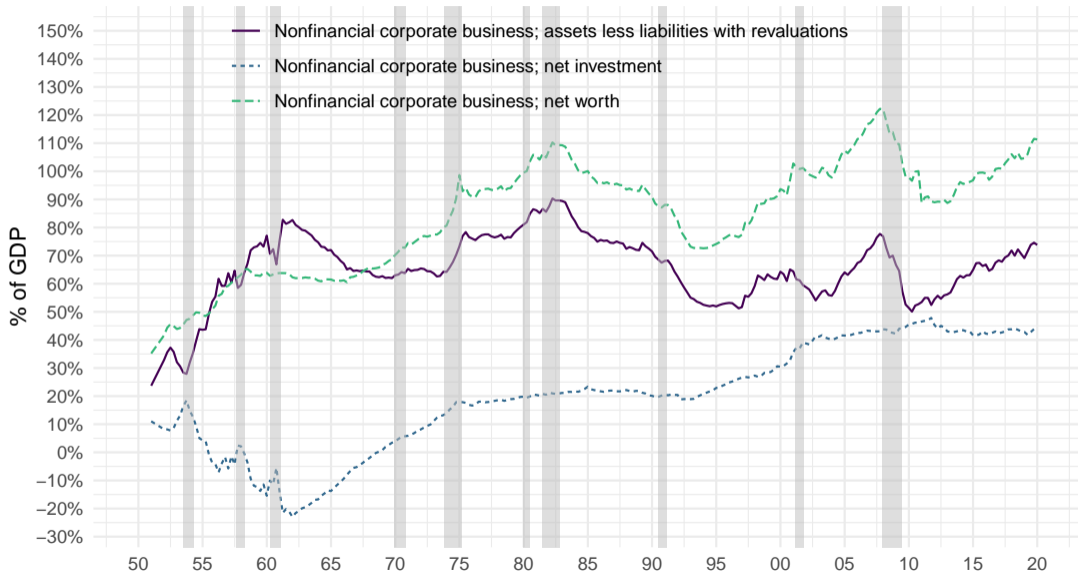
# Balance Sheets - Households - B101



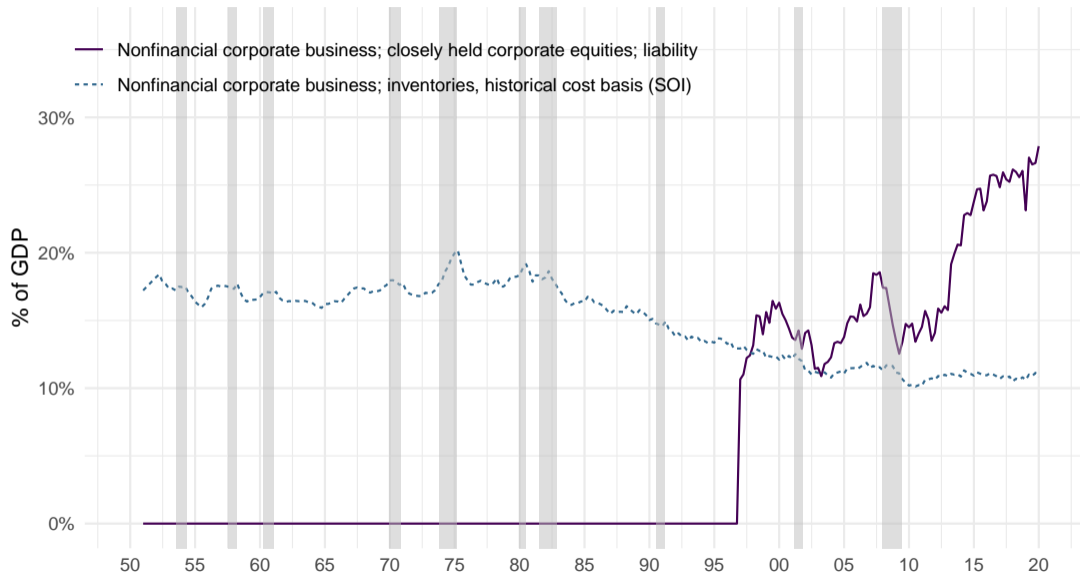
# Change in Net Worth - Corporates - R103



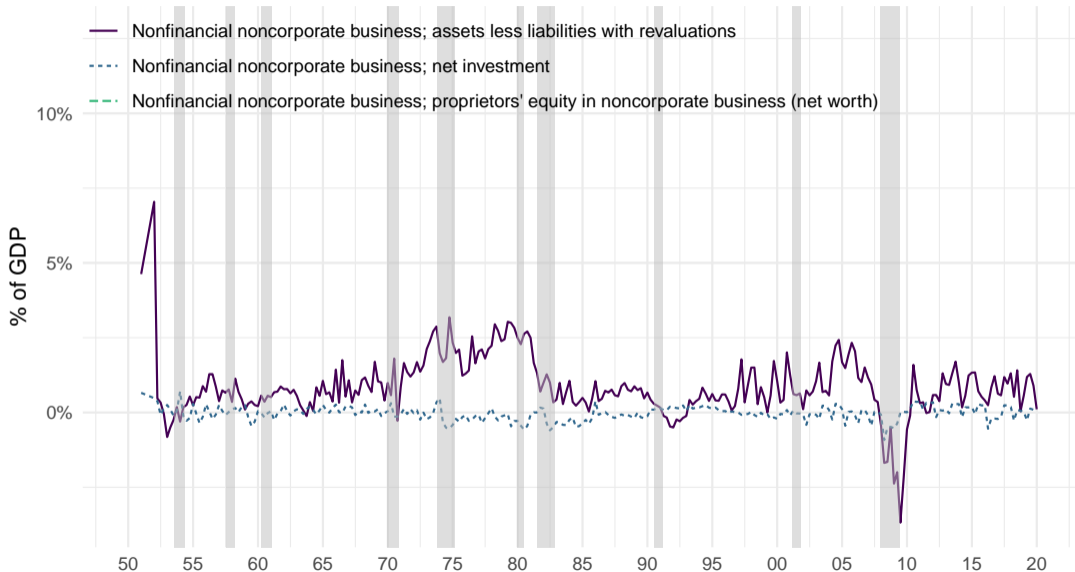
# Value VS Quantity - Corporates - R103



# Balance Sheets - Corporates - B103

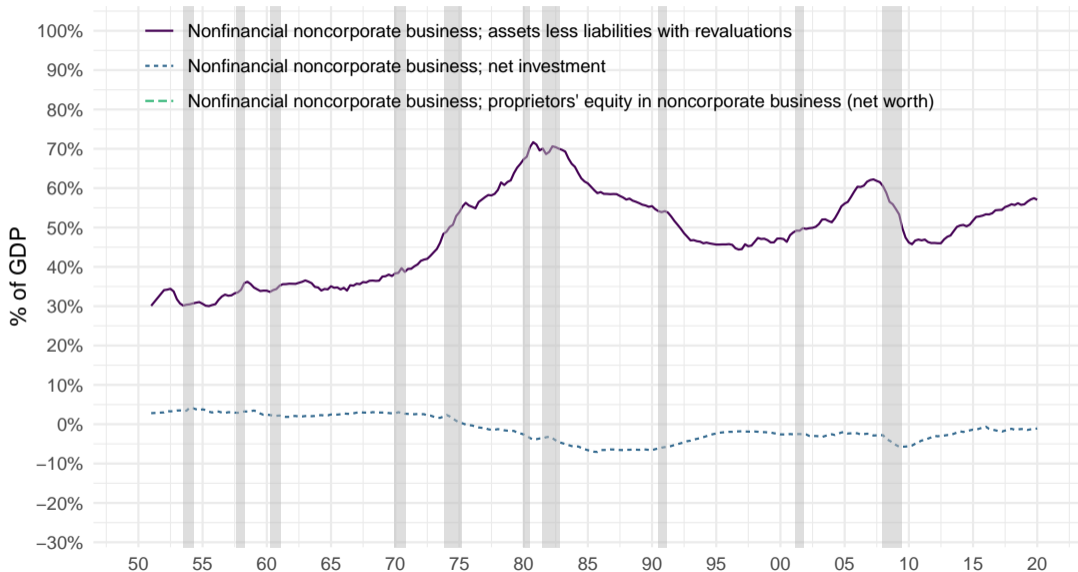


# Change in Net Worth - Noncorporates - R104

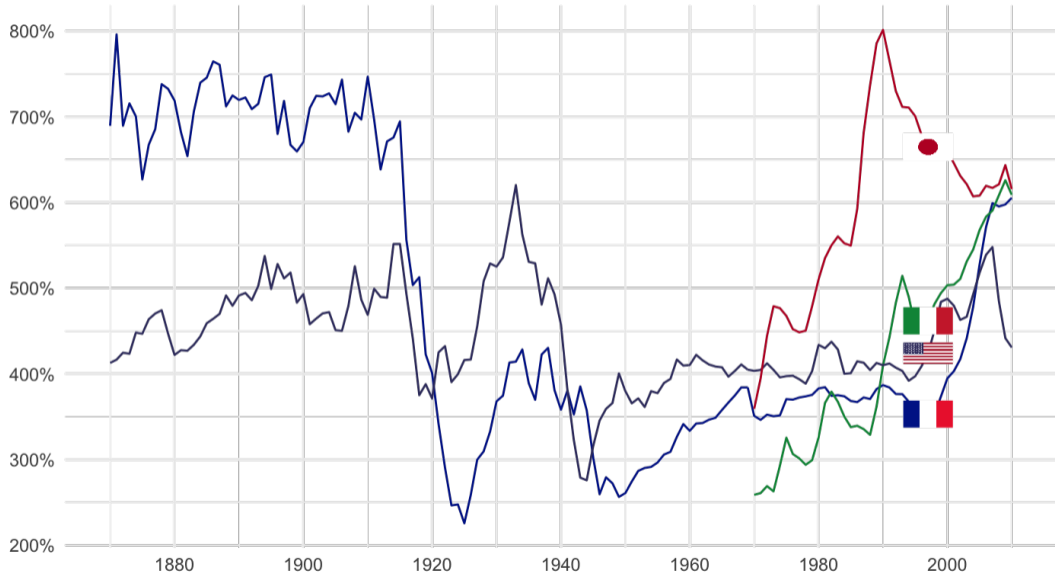




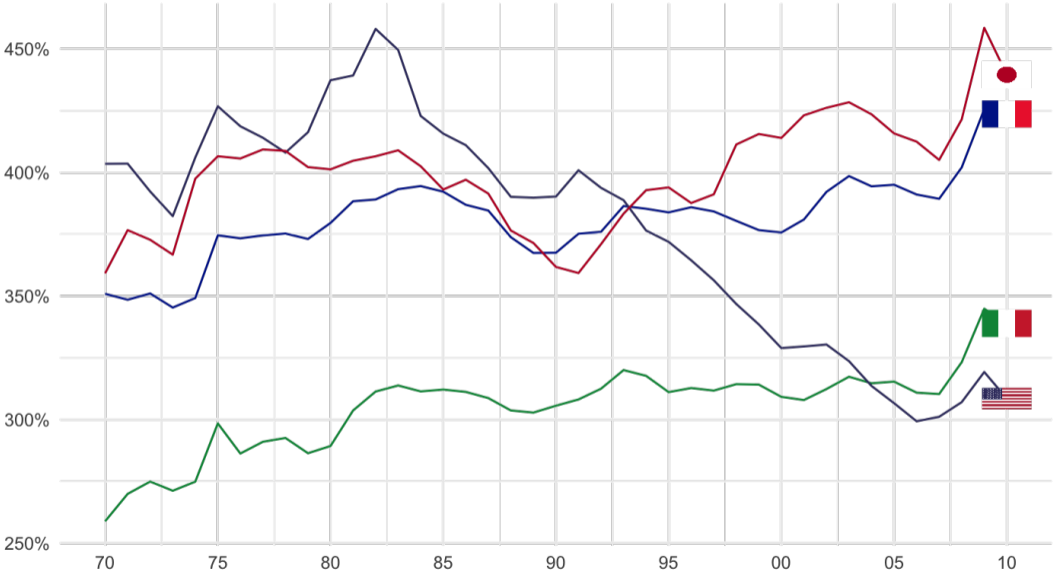
# Value VS Quantity - Noncorporates - R104



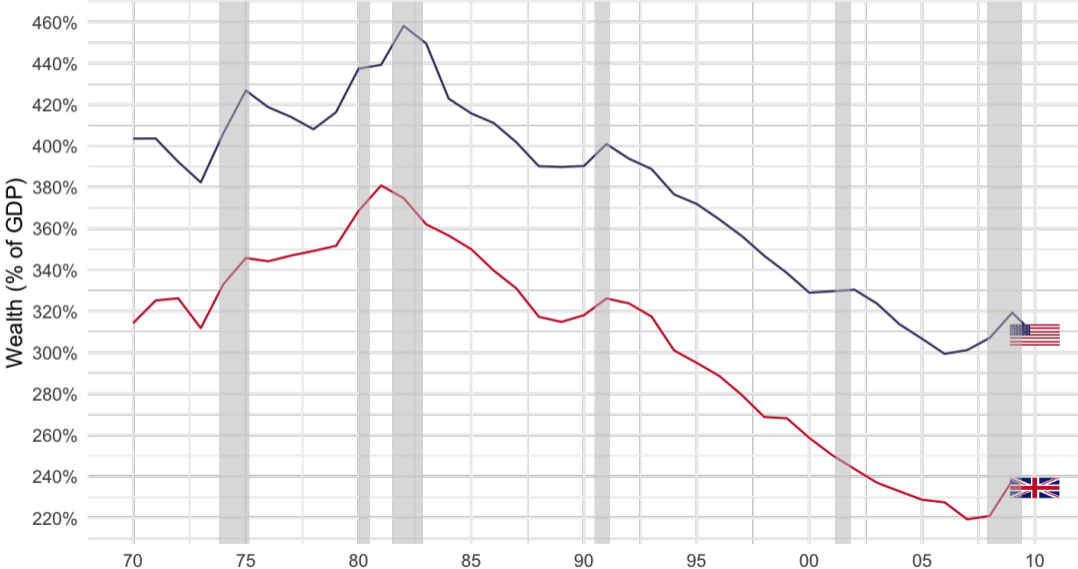
# Market Value of Capital (% of GDP)



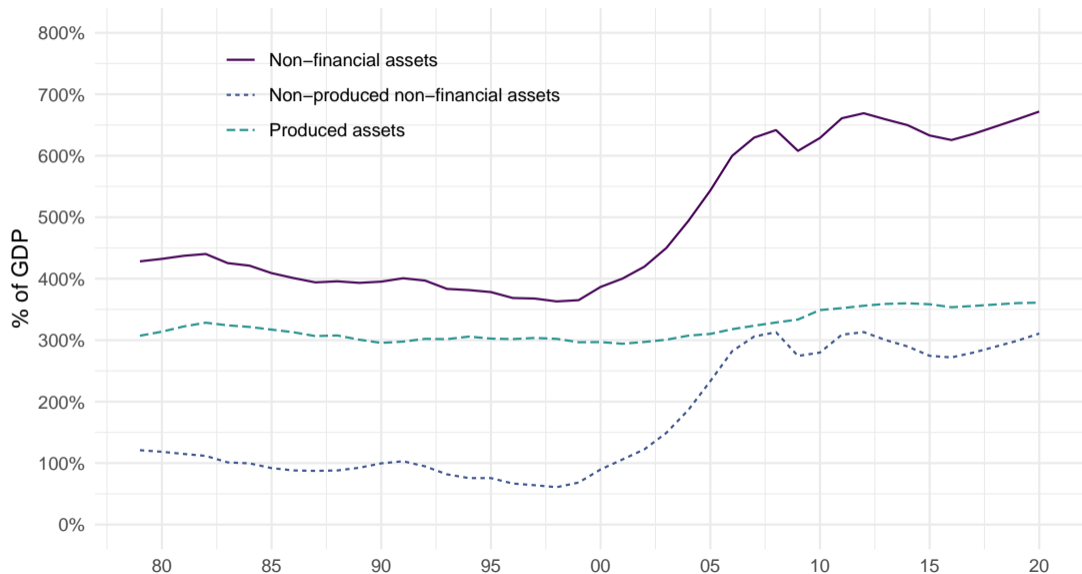
# Simulated 1970-2010 based on saving flows 1/2



# Simulated 1970-2010 based on saving flows 2/2



# France - Value of Assets



# Japan - Value of Assets

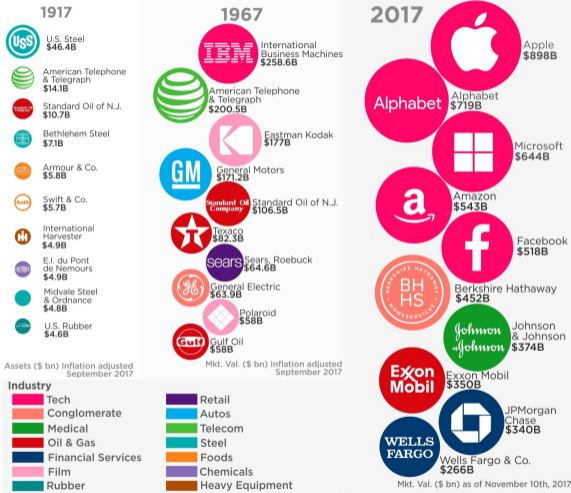


## Section 8

### “Intangible capital”

# The nature of “capital” has changed

## 100 Years of America's Top 10 Companies



Source and Article:  
<https://howmuch.net/articles/100-years-of-americas-top-10-companies>  
<https://forbes.com>

howmuch.net



# Tech companies

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Tech company valuations:

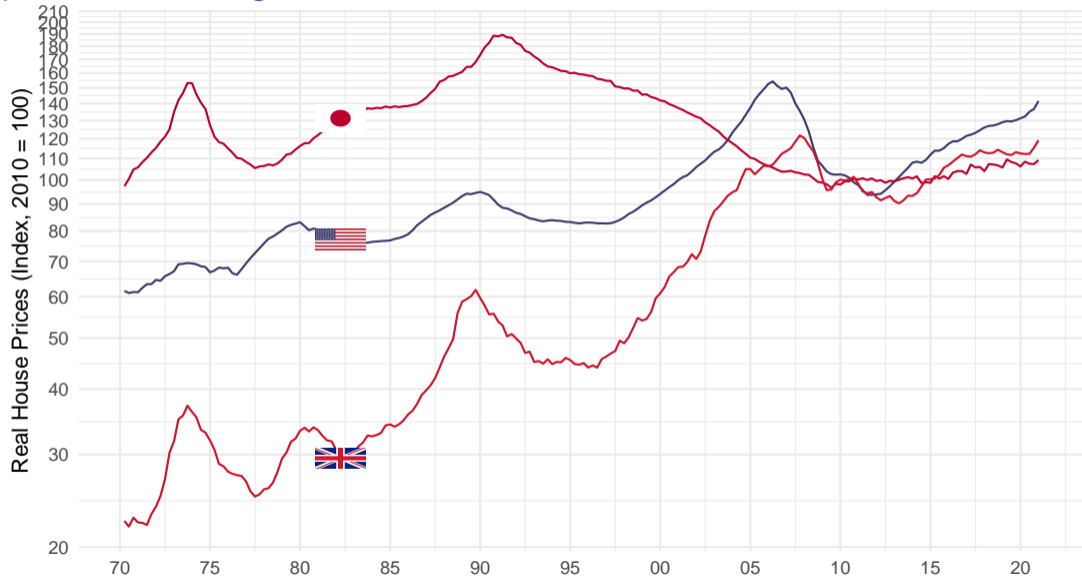
Apple:	\$1.42 trillion
Microsoft:	\$1.41 trillion
Amazon:	\$1.23 trillion
Google:	\$975 billion
Facebook:	\$655 billion
Netflix:	\$182 billion
Tesla:	\$162 billion
<b>Total:</b>	<b>\$6 trillion</b>

 12  154  578 

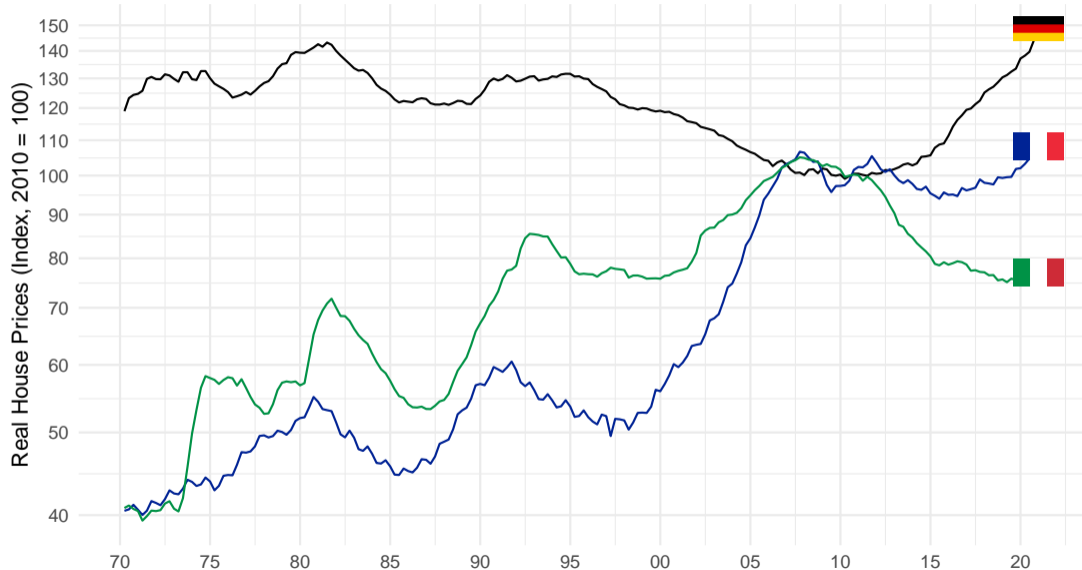
## Section 9

### Real House Prices

# Japan, United Kingdom, United States



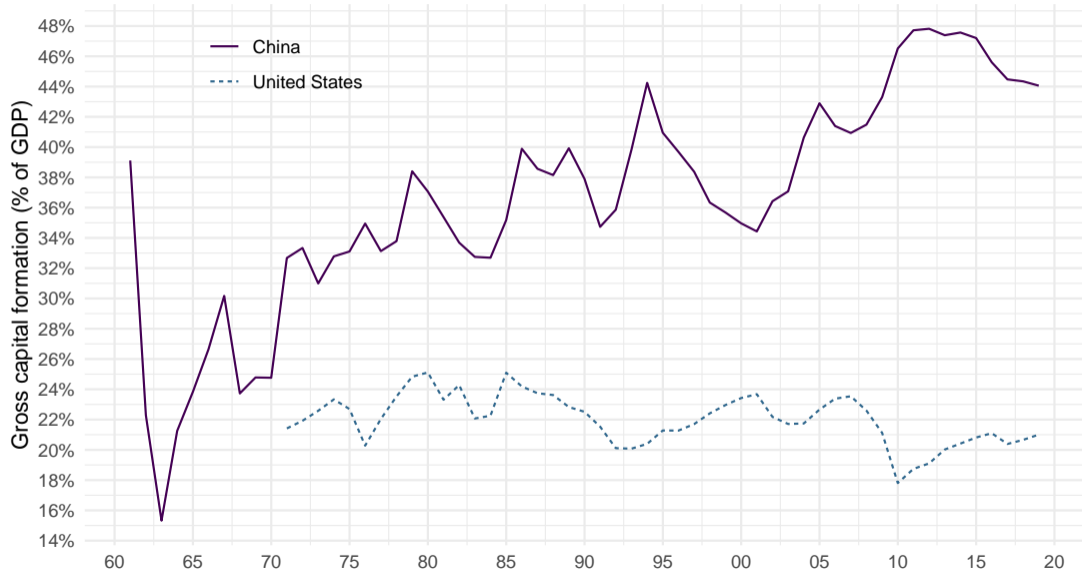
# Germany, France, Italy



## Section 10

### Over-accumulation of capital?

# Chinese investment



## Low returns to K: Chinese ghost cities

```
# [1] "Link to the video:"  
# [1] "https://fgeerolf.com/econ102/investment.html"
```

## Decreasing Returns to capital

```
# [1] "Link to the video:"  
# [1] "https://fgeerolf.com/econ102/investment.html"
```



# Section 11

## Bibliography

Solow, Robert M. 1956. "A Contribution to the Theory of Economic Growth." *The Quarterly Journal of Economics* 70 (1): 65–94. <https://doi.org/10.2307/1884513>.