

*Osher Lifelong Learning Institute, Spring 2019*  
**What Economists Know About Important  
Policy Issues**

**Lecture 5: Climate Change  
& Inequality**

April 23, 2019

**Jon Haveman, Ph.D.**  
National Economic Education Delegation

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## National Economic Education Delegation

- **Vision**

- One day, the public discussion of policy issues will be grounded in an accurate perception of the underlying economic principles and data.

- **Mission**

- NEED unites the skills and knowledge of a vast network of professional economists to promote understanding of the economics of policy issues in the United States.

- **NEED Presentations**

- Are **nonpartisan** and intended to reflect the consensus of the economics profession.



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- **This slide deck was authored by:**

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## Outline

- Climate change science
- Impacts of climate change
- Economics of responding to climate change
- **Addressing the sources of our emissions**
- Climate change policy
- Policy in action



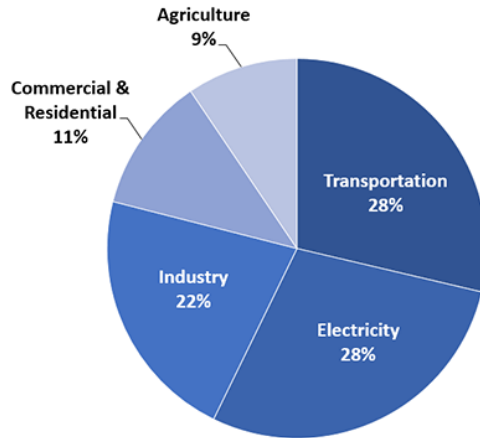
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## Addressing the Sources of Our Emissions



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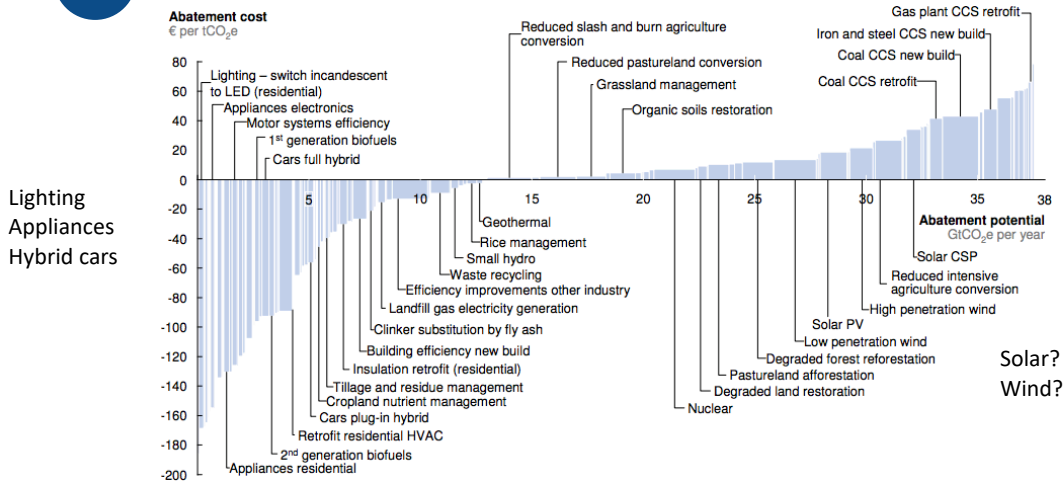
# Total U.S. Greenhouse Gas Emissions by Economic Sector in 2016



U.S. Environmental Protection Agency (2018). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016



# Global GHG Abatement Cost Curve



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO<sub>2</sub>e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.  
Source: Global GHG Abatement Cost Curve v2.1



## Challenges with Renewable Energy

- **It's intermittent - only produced if there is sun or wind.**
- **Energy is needed all day and night, with peak times.**
- **Limited w/o storage.**
  - Creative storage options are under development



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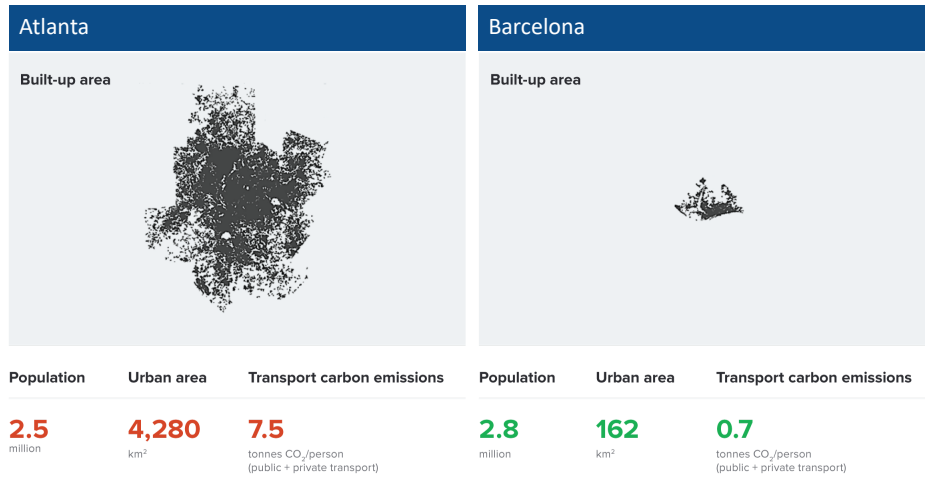
## Infrastructure and Climate Change

- **\$90 trillion in investment will be needed for U.S. infrastructure, 2015-2030.**
- **Add \$4 trillion (< 5%) to make it low-carbon infrastructure.**
  - This would also reduce climate damage to infrastructure.
  - Railway, urban transport, renewables.
- **The electrical grid is particularly troublesome.**
  - It is outdated and not suited for renewable energy storage.
  - Those with solar panels use the grid but contribute little to its upkeep.



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## Atlanta and Barcelona Have Similar Populations but Very Different Carbon Productivity



Source: New Climate Economy Report, 2014

## Land Use: Restoration Is Possible



South Korea restored its forest cover from 35% to 64% of the country's total area



# Climate Change Policy

## Policies That Reduce Emissions: Directly

- **Regulation**

- Emissions standards or limits

- **Market oriented policies**

- Putting a price on emissions
  - Subsidizing green energy (*e.g.*, feed-in tariffs)
  - Tax or cap & trade

## How Does Cap and Trade Work?

- **Activities to be covered are determined.**
- **Acceptable emissions levels are indicated.**
- **“Permits” that allow acceptable emissions levels are issued.**
  - How?
    - According to historical emissions?
    - Evenly across emitters?
    - Sold at some price?
- **A “market” is developed.**
- **Those desiring to emit will have to buy sufficient permits to accommodate their emissions.**
- **Those wishing to abate will offer their permits on the “market”.**
  - The price of a permit indicates:
    - The cost of eliminating further emissions.
    - The cost of emitting.
- **Gov’t agency determines equality of permits in possession and emissions.**



## How Does a Carbon Tax Work?

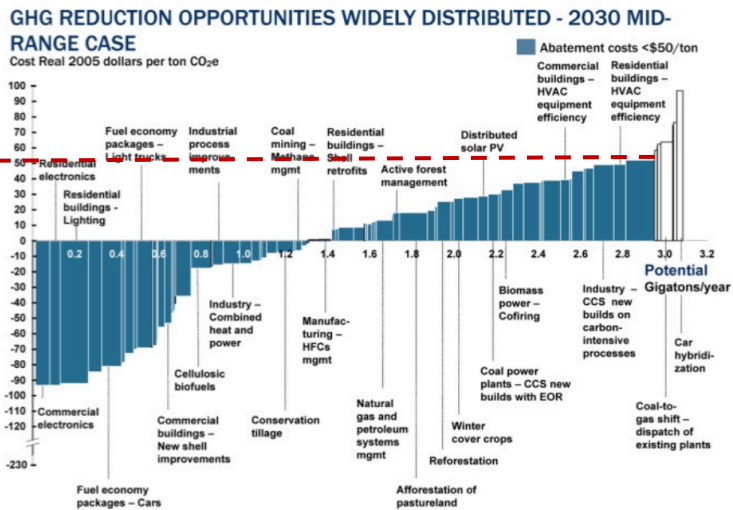
- **Activities to be covered are determined.**
- **The price of emissions is determined.**
  - Presumably some relation to the social cost of polluting.
- **Emissions are measured.**
- **Taxes are determined.**
- **Q: What to do with the tax revenue?**





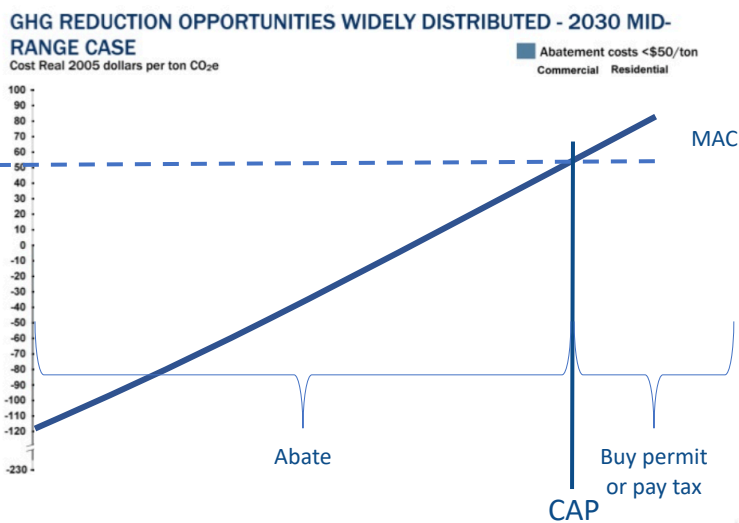
# Putting a Price on Carbon

Suppose a Social Cost Of Carbon of \$50



# Putting a Price on Carbon

TAX  
= Permit Price  
= Carbon Price



## Carbon Prices: the Good and Bad

- **Good:**
  - Provide price signal to lower emissions.
  - They yield low-cost reductions in emissions.
- **Bad:**
  - Regressive
    - Costs weigh more heavily on low-income people.
  - Firms might leave to flee regulation.
  - It is necessary to monitor emissions.



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## Carbon Tax and Cap & Trade: the Differences

	Carbon Tax	Cap & Trade



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## Carbon Tax and Cap & Trade: the Differences

	Carbon Tax	Cap & Trade
Carbon Price	Certain	Uncertain
Emissions	Uncertain	Certain
Ease of Implementation	May be easier to implement	
Additional concerns	Always generates revenue May require legislation to change	May be more susceptible to lobbying Only generates revenue if government sells permits Cap can be changed by regulator



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## Policies That Reduce Emissions: INDIRECTLY

- Subsidizing R&D
- Grid / infrastructure
- Land use policies
- Energy efficiency mandates and subsidies
- Mandating renewable energy (*e.g.*, renewable portfolio standards)



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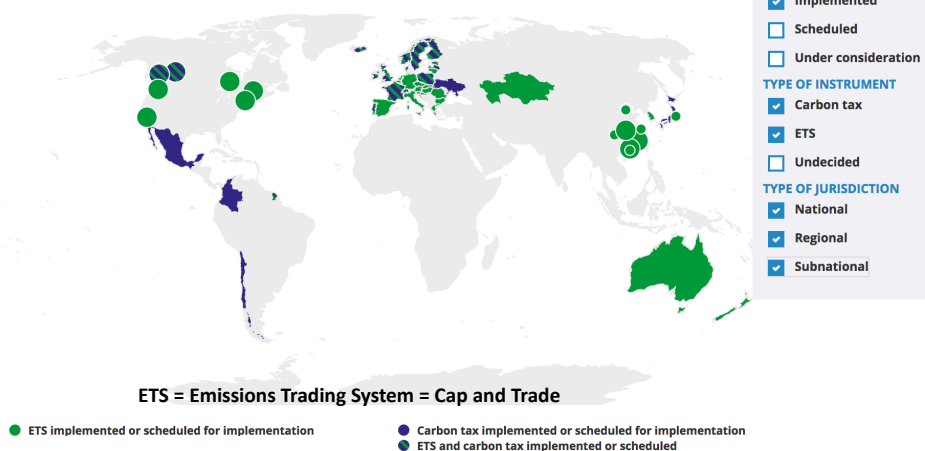
# Climate Change Policy in Action



## Carbon Policies Across the World

Data last updated December, 01 2017

Summary map of regional, national and subnational carbon pricing initiatives



Source: World Bank Carbon - Pricing Dashboard

# Cap and Trade

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# Cap and Trade Policies Around the World

Summary map of regional, national and subnational carbon pricing initiatives

STATUS	
<input type="checkbox"/>	Implemented
<input type="checkbox"/>	Scheduled
<input type="checkbox"/>	Under consideration

TYPE OF INSTRUMENT	
<input type="checkbox"/>	Carbon tax
<input checked="" type="checkbox"/>	ETS
<input type="checkbox"/>	Undecided

TYPE OF JURISDICTION	
<input type="checkbox"/>	National
<input type="checkbox"/>	Regional
<input type="checkbox"/>	Subnational


ETS implemented or scheduled for implementation  
 ETS or carbon tax under consideration

**ETS = Emissions Trading System = Cap and Trade**

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Source: World Bank - Carbon Pricing Dashboard

# European Union's Emissions Trading Scheme

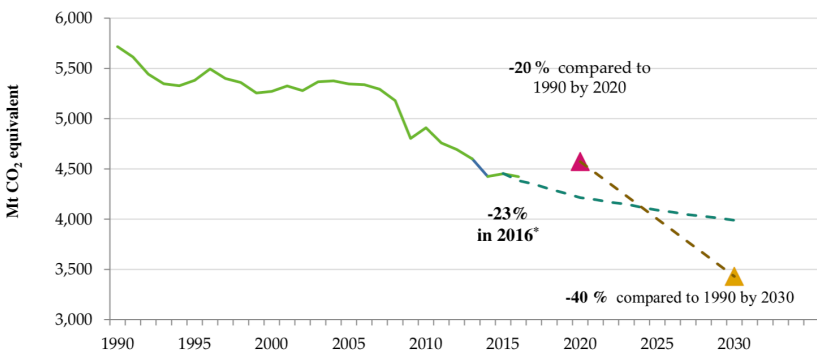


## 4%

of global  
greenhouse gas  
emissions  
Circa 2005

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# Progress Towards Meeting Europe 2020 And 2030 Targets (EU Total GHG Emissions)



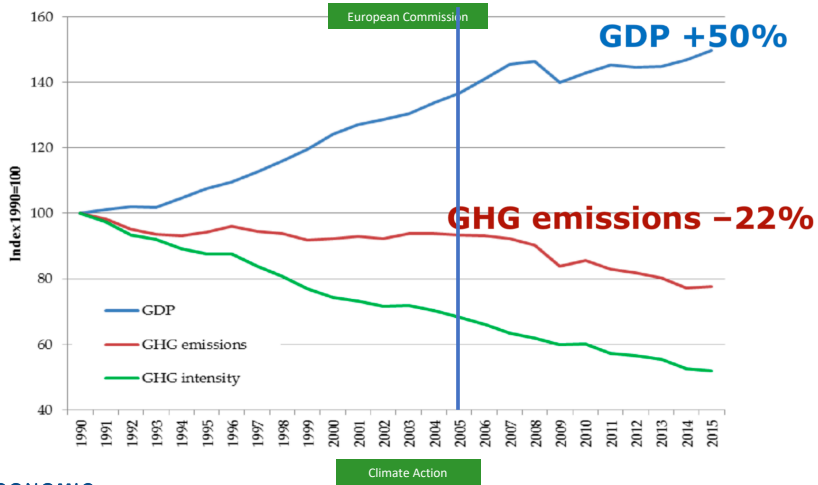
**Legend:**

- Historic emissions
- - - Projections with existing measures -WEM- (based on MS submissions)
- - - Proposed greenhouse gas emissions trajectory

\*proxy 2016

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## EU Has Decoupled Economic Growth from Greenhouse Gas Emissions



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## California's Cap and Trade System: 2012+



0.7%  
of global  
greenhouse gas  
emissions

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## California's System Is Flexible



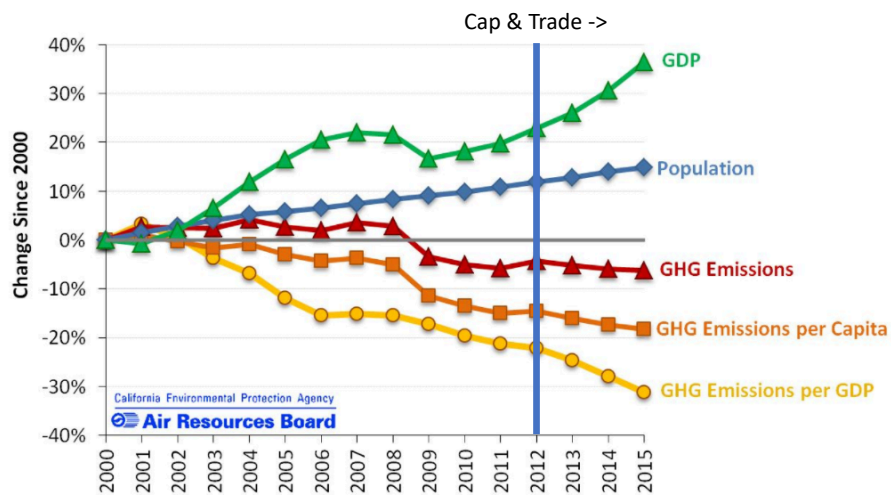
### California's goals:

- Reduce emissions to 1990 levels by 2020
- An 80% reduction in emissions from 1990 levels by 2030

### California's Tools:

- Cap and Trade
- Renewable Portfolio Standard
- Clean Cars Program
- Low Carbon Fuel Standard

## Change in California GDP, Population, and GHG Emissions since 2000





## RGGI: the Regional Greenhouse Gas Initiative

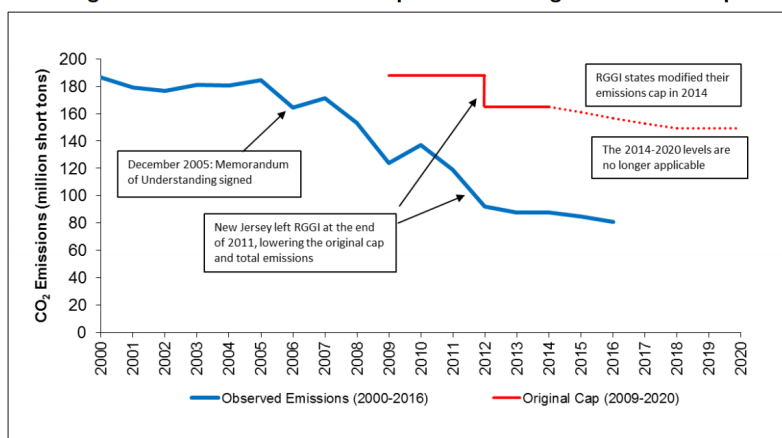
- **Participants: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont**
  - 7% of US emissions
- **Covers power plants**
- **First implemented in 2009**
- **Caused emissions reduction of 24% below what they would have been**



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## RGGI's Effect on Emissions

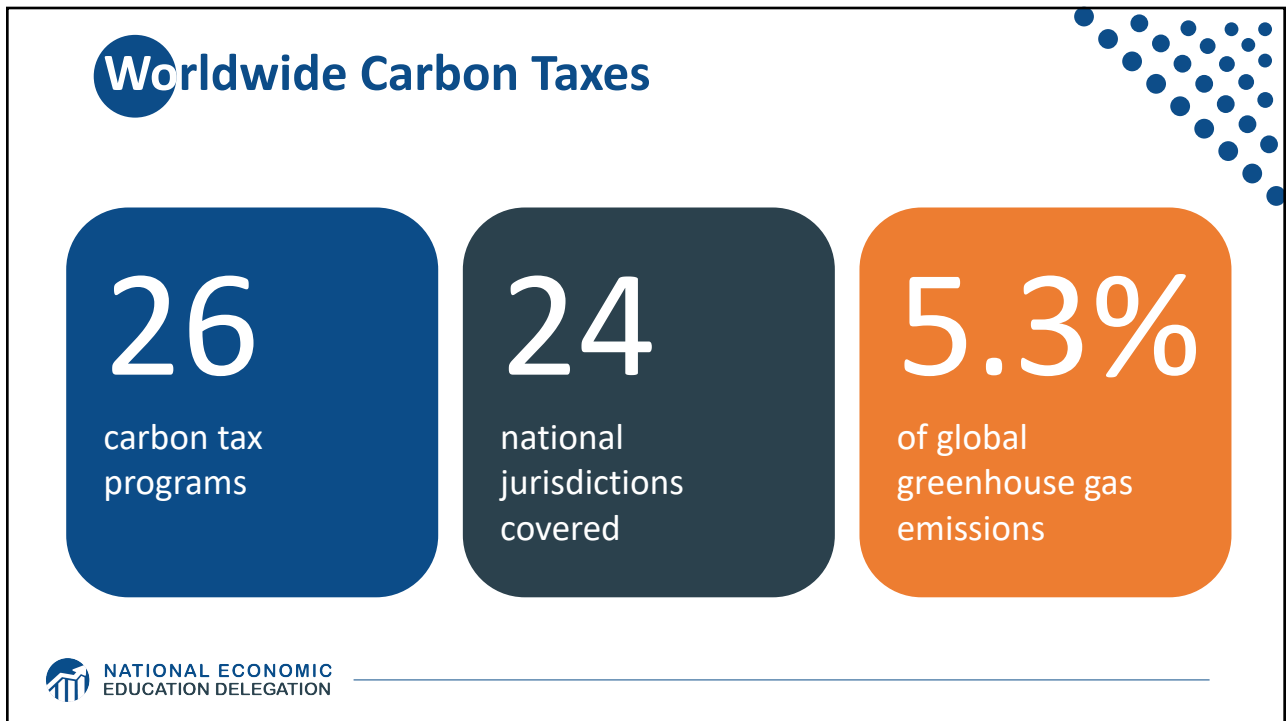
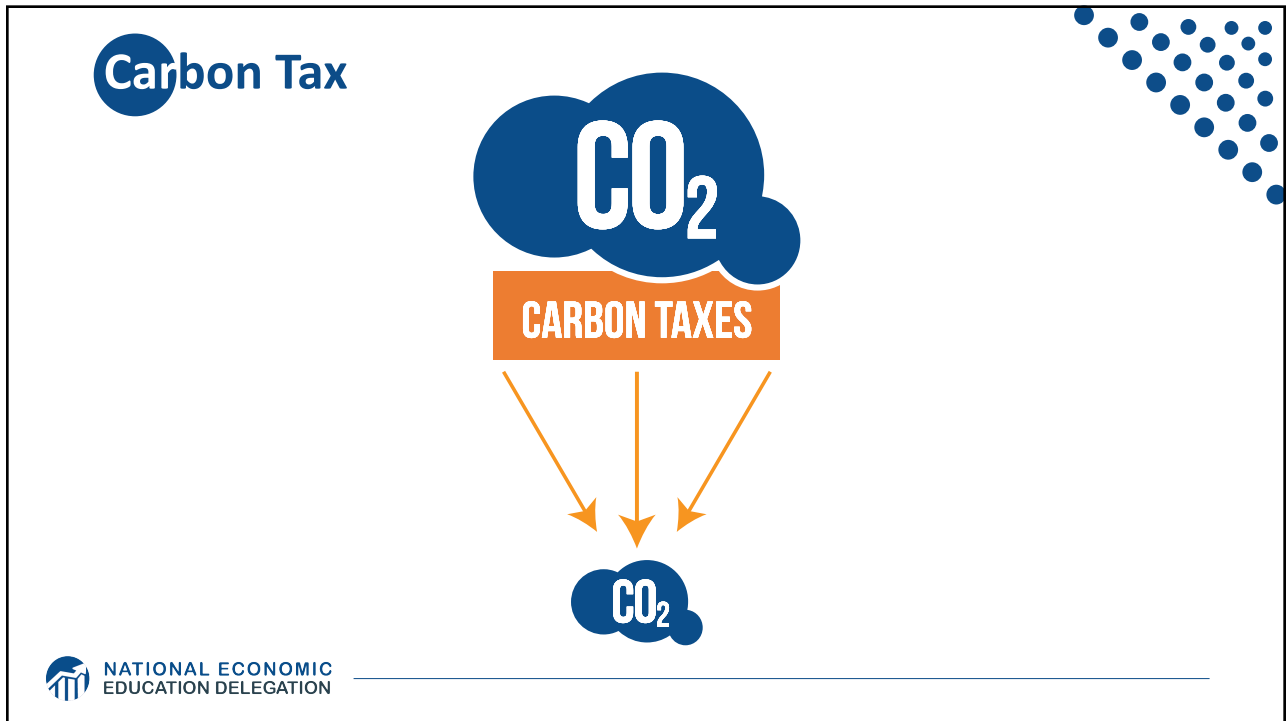
Figure I. Observed Emissions Compared to the Original Emissions Cap



Source: Prepared by CRS; observed state emission data (2000-2016) provided by RGGI at <http://www.rggi.org>.



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## British Columbia's Carbon Tax Policy



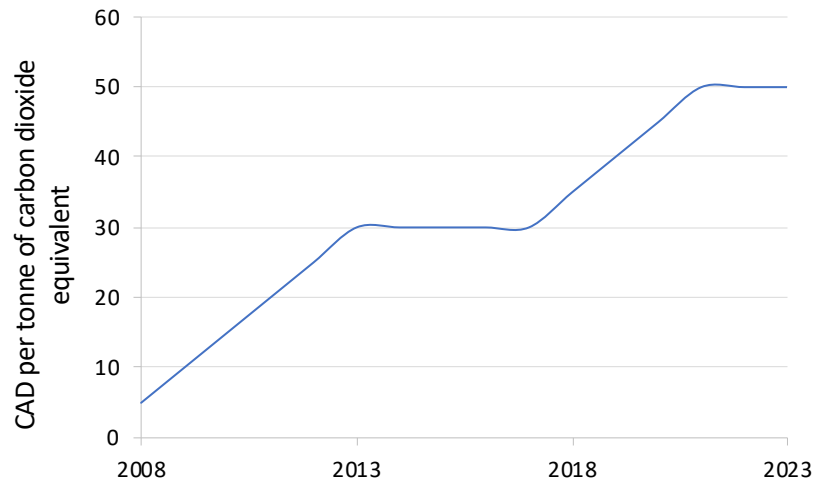
0.1%

of global  
greenhouse gas  
emissions

**“ Tax the pollution we do not want, and return the money for what we do want — money in people’s pockets, jobs and investment. ”**

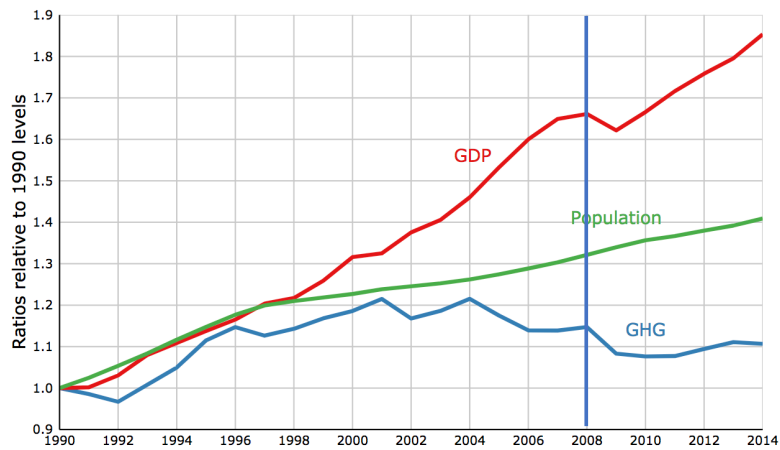
- B.C. Government - Carbon Tax Brochure

## British Columbia's Tax on Carbon



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## Relative Greenhouse Gas Emissions, GDP & Population Size: British Columbia



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**Sweden's Carbon Tax Policy**




**Oldest  
Carbon  
Tax**




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**Sweden's Carbon Tax Policy**

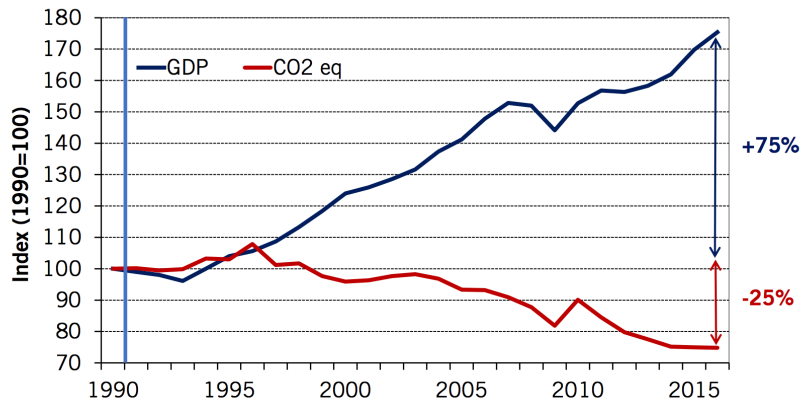


**Started  
in 1991**  
Currently at \$140/ton



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## Real GDP and Domestic CO<sub>2</sub>eq Emissions<sup>1</sup> In Sweden, 1990-2016



<sup>1</sup> In accordance with Sweden's National Inventory Report, submitted under the UNFCCC and the Kyoto Protocol. CO<sub>2</sub> = approx. 80 % of total CO<sub>2</sub>eq emissions. Preliminary data for 2016.

**Sources:** Swedish Environmental Protection Agency, Statistics Sweden



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## U.S. Carbon Tax Plans

- Climate Leadership Council
- Citizens Climate Lobby
- States and municipalities:  
Washington state, Oregon,  
Washington, DC



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**“ Economic policies will be central to accomplishing the goals we choose.”**

- Harris and Roach (2007)

## Summary

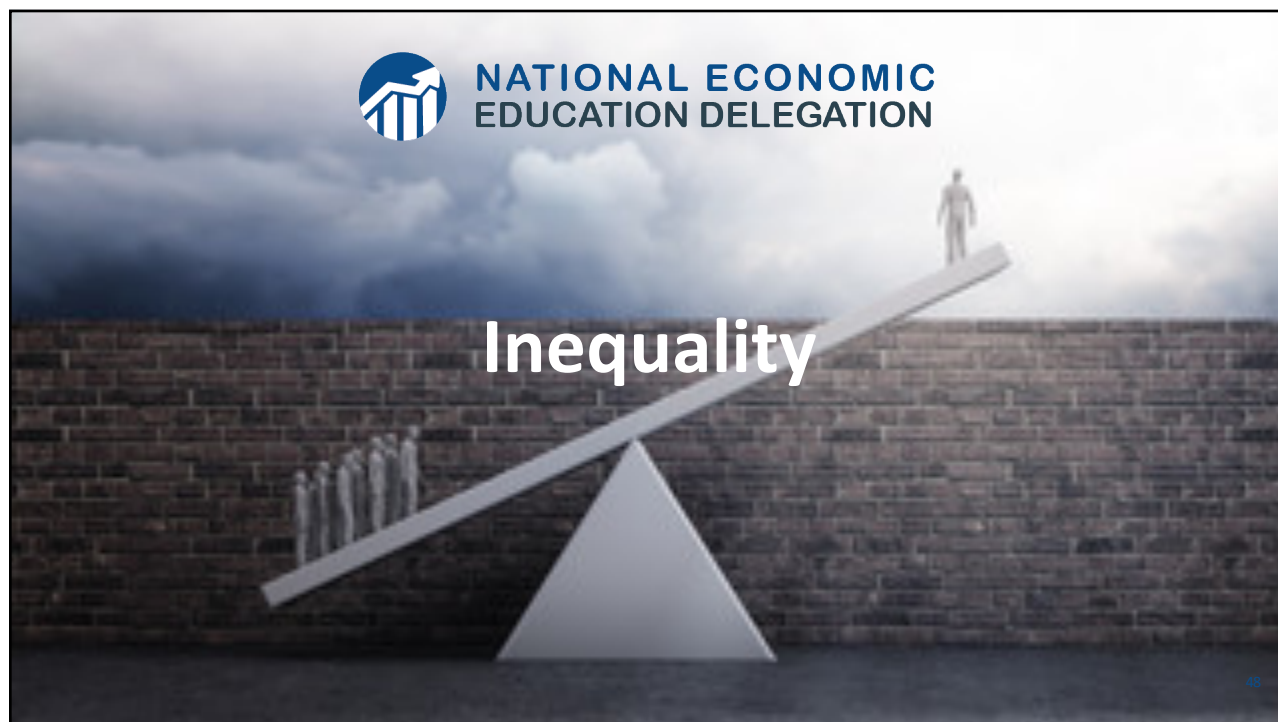
- **Climate change is real, is caused by human actions, and has impacts we're already feeling.**
- **We need to reduce emissions to balance the costs of action against the costs of inaction.**
- **Scientists and the IPCC recommend that we work to keep warming below 2 degrees celsius.**

- *Economists believe that this goal is well worth the costs!*



## Summary – *continued*

- There are many ways to reduce emissions.
- Economics-inspired policies can help us do this at the lowest cost.
- Taxes and cap and trade are proven effective tools to fight climate change!
- Other tools may also be necessary.





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- **This slide deck was reviewed by:**
  - Timothy Smeeding, University of Wisconsin
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## Outline

- **Definition**
- **Measurement**
- **How does it happen?**
- **Does it matter?**
- **Is it a problem?**
- **What to do about it**



## Economic Inequality: Income

- **Definition:**

- The extent to which the distribution of income deviates from complete equality
- The dispersion of income throughout the economy

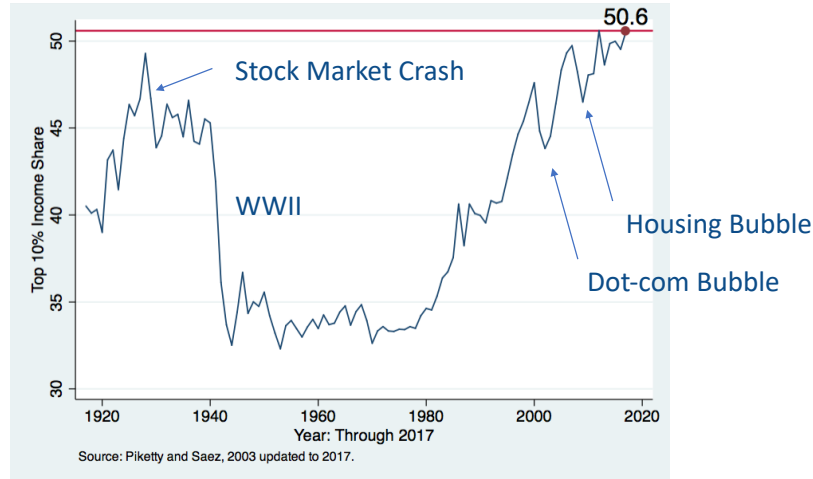


## Different Ways of Thinking About Inequality

- **Income Inequality**
  - Before taxes and transfers
  - After taxes and transfers
- **Wealth Inequality**
- **Consumption Inequality**



## National Income Inequality: Share of Top 10%



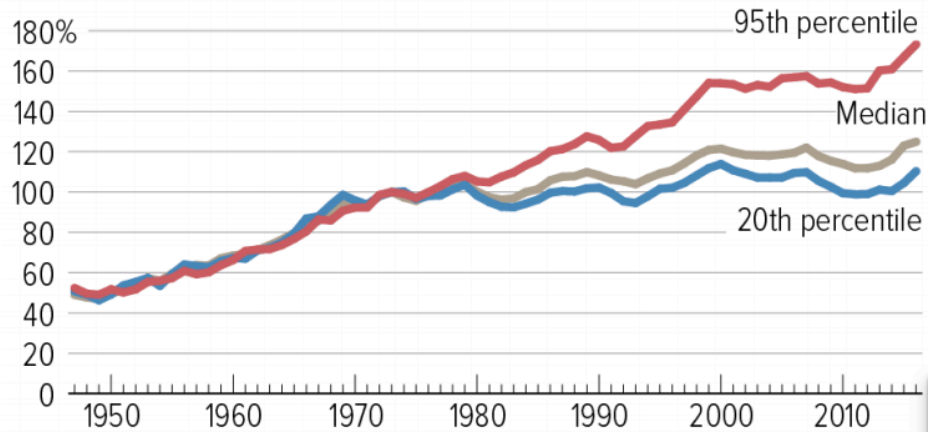
## Recent Facts on Income Inequality

- **Beginning in the 1970s, the income gap widened.**
  - Income in the middle and lower parts of the distribution slowed
  - Incomes at the top continued to grow strongly
  - Income shares at the very top of the distribution rose to levels last seen more than 80 years ago



## The Abrupt Increase in Inequality

Real family income between 1947 and 2016, as a percentage of 1973 level

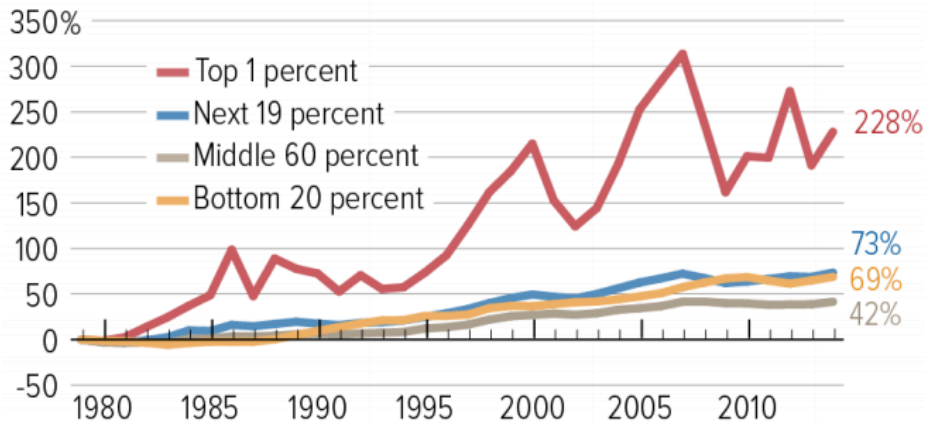


Source: Chad Stone, Danilo Trisi, Arloc Sherman, and Roderick Taylor, "A Guide to Statistics on Historical Trends in Income Inequality," Center on Budget and Policy Priorities, Policy Futures, May 15, 2018, page 10.

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## Most of the Action Is at the Very Top

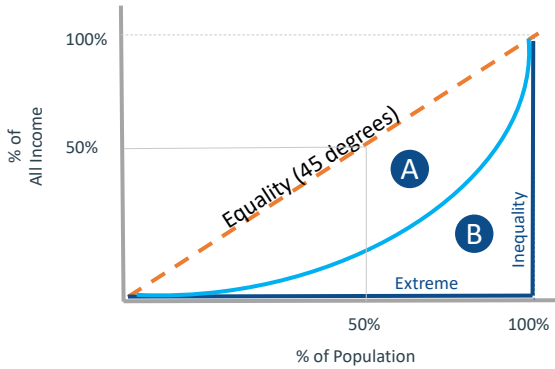
Percent change in income after transfers and taxes since 1979



Source: Chad Stone, Danilo Trisi, Arloc Sherman, and Roderick Taylor, "A Guide to Statistics on Historical Trends in Income Inequality," Center on Budget and Policy Priorities, Policy Futures, May 15, 2018, page 11.

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# The Gini Coefficient

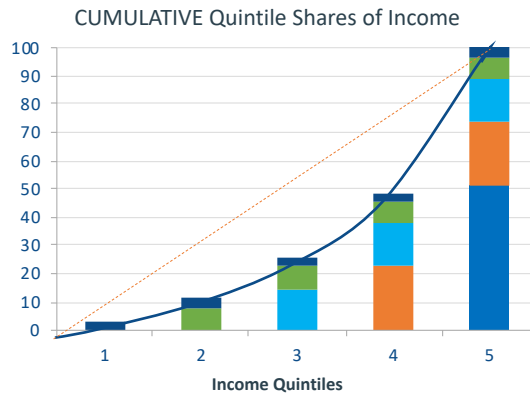
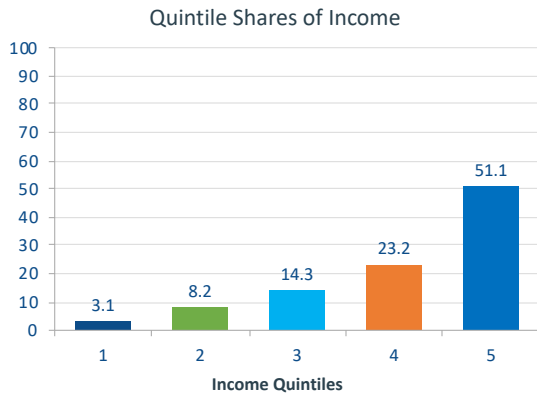


$$\text{Gini} = \frac{A}{A + B} \times 100$$

Bigger A: More inequality  
Smaller A: Less inequality

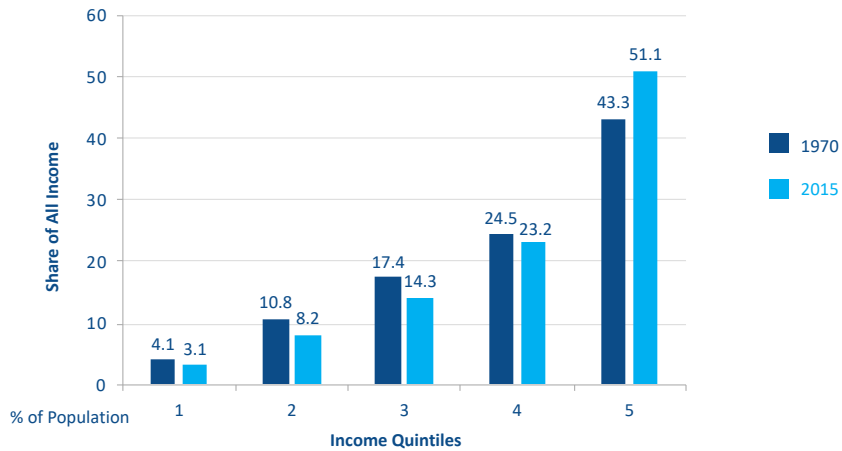


# Forming the GINI Coefficient: 2015



Source: 2015 1-year American Community Survey, based on pre-tax household income.

## Income Share Changes Between 1970 and 2015



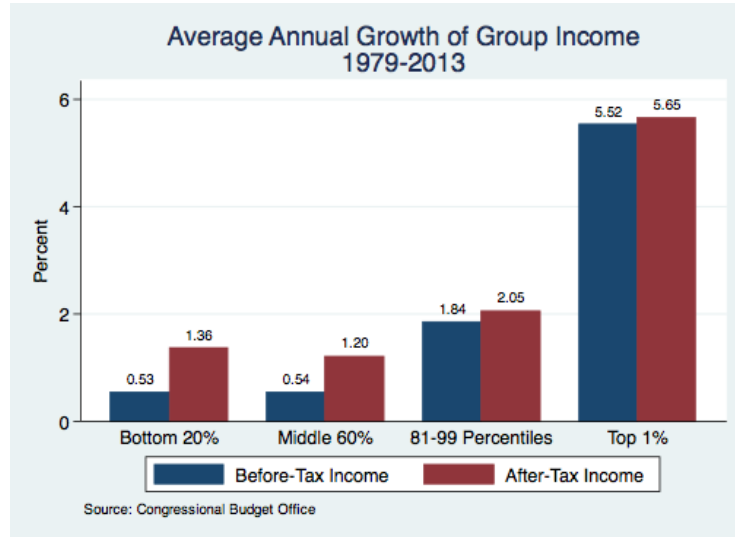
## Income Changes from Growing Inequality

Bottom 90% of Households

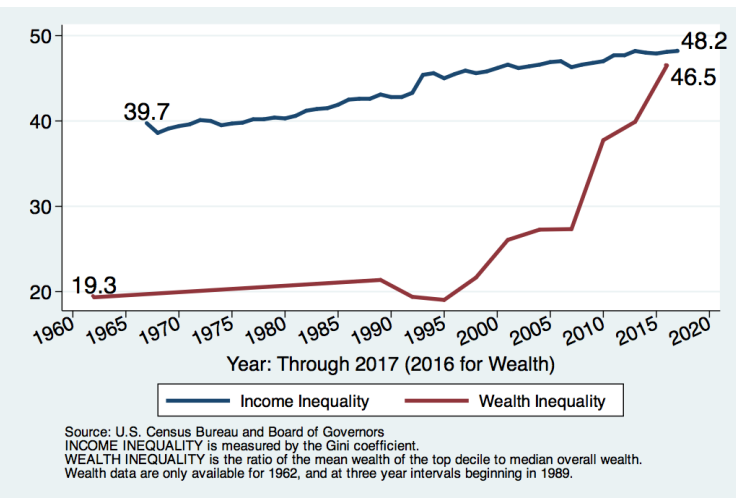
INCOME GROUP	TOTAL LOSS/GAIN IN ANNUAL INCOME*	AVERAGE LOSS/GAIN PER HOUSEHOLD PER YEAR*
<b>TOP 1%</b>	\$673 billion more	\$597,241 more
<b>96-99</b>	\$140 billion more	\$29,895 more
<b>91-95</b>	\$29 billion more	\$4,912 more
<b>81-90</b>	\$43 billion less	\$3,733 less
<b>61-80</b>	\$194 billion less	\$8,598 less
<b>41-60</b>	\$224 billion less	\$10,100 less
<b>21-40</b>	\$189 billion less	\$8,582 less
<b>BOTTOM 20%</b>	\$136 billion less	\$5,623 less

\* Compared to what incomes would have been had all income groups seen the same growth rate in 1979-2005 as they did during previous decades.  
Source: Jacob Hacker, Yale University; Paul Pierson, UC-Berkeley

## Growth Has Been Primarily at the Very Top



## Income and Wealth Inequality

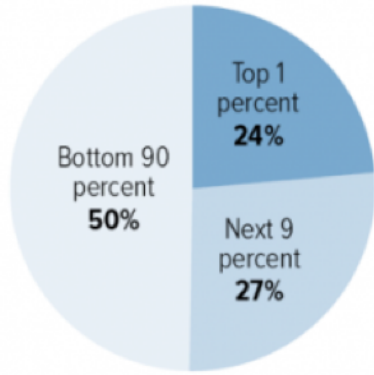


### Income Inequality (Gini)

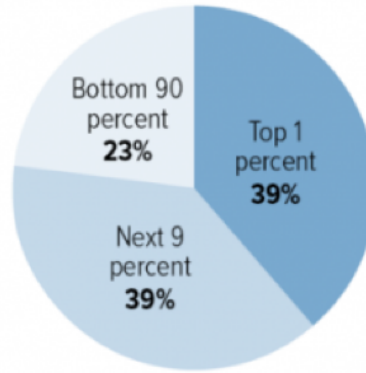
- US: 48.2%
- CA: 48.7%
- Marin: 51.5%

# Wealth Inequality Exceeds Income Inequality

Distribution of before-tax income, 2016



Distribution of wealth, 2016

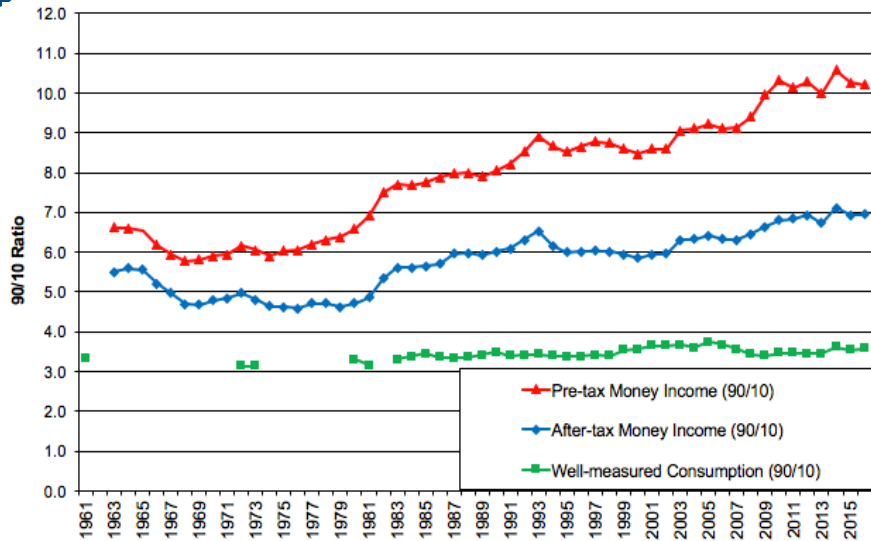


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Source: Chad Stone, Danilo Trisi, Arloc Sherman, and Roderick Taylor, "A Guide to Statistics on Historical Trends in Income Inequality," Center on Budget and Policy Priorities, Policy Futures, May 15, 2018, page 15, Figure 4.

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# A Third Measure of Inequality: Consumption



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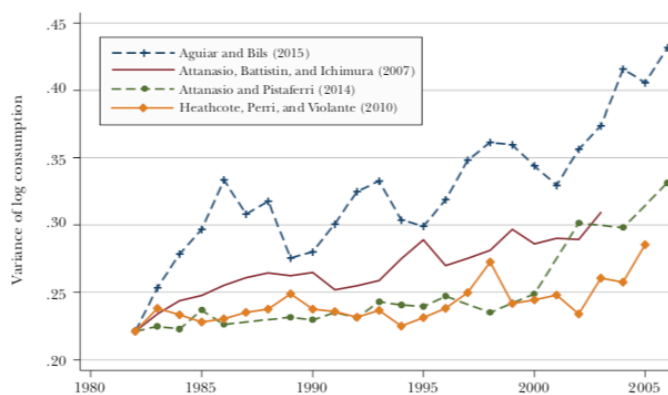
## Consumption Inequality

- Consumption is another important metric for judging inequality
- Arguably a better indicator of “well-being”
- Extremely difficult to measure
- Growing evidence that consumption inequality has also increased



## Growing Evidence: Consumption Inequality

The Evolution of Consumption Inequality over Time as Measured by Different Papers



## Case Study: Economic Research

- **Early, controversial result is published**
- **Flurry of effort to understand the result**
- **Growing body of evidence**
- **Consensus reached**
  - Not always
  - Sometimes data continue to conflict
  - Often merely a preponderance of evidence drives understanding
- **Why has this happened with consumption inequality?**
  - Inadequacy of data and methods



## Summary: Consumption Inequality

- **Early research indicated that although income inequality may be increasing, consumption inequality may not be.**
  - How is this possible? Borrowing, or otherwise smoothing consumption.
- **Mounting evidence that it is increasing along with income and wealth inequality.**
- **Consensus reached? No.**



## Where Does Inequality Come From?

- **Labor Characteristics**

- Demographics
  - o Age distribution
- Personal Choices
  - o Educational attainment
  - o Effort
  - o Priorities
  - o Household composition
- Immigration

- **Market Forces**

- Technology
- Changing demand patterns
- Competition for labor

- **Government Policy**

- Market influence
- Redistribution



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## Government Policy and Inequality

- **Market Influence: PRE-distribution**

- Characteristics of labor
  - o Access to education
- Effects on labor demand
  - o Market regulation
    - Competition policy
  - o Labor regulations
    - Minimum wage, overtime, health insurance, etc.

- **RE-distribution**

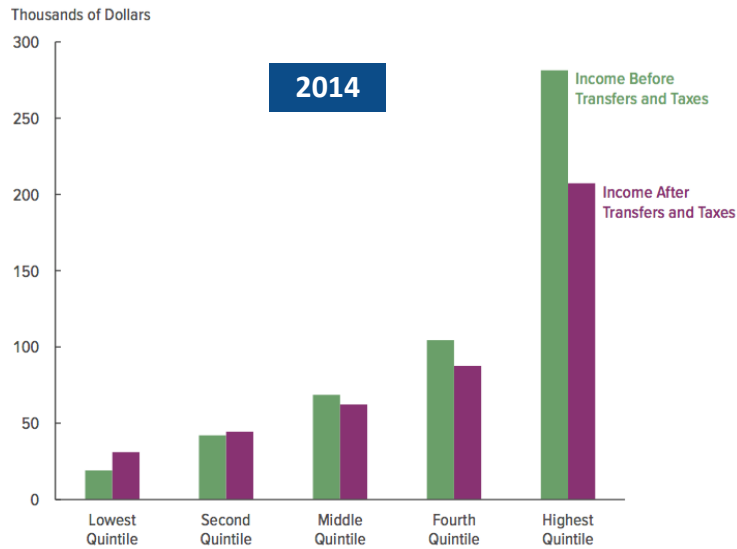
- Tax Rates
- Income support
  - o Direct aid
  - o Food stamps



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## Tax and Transfer Programs and Inequality



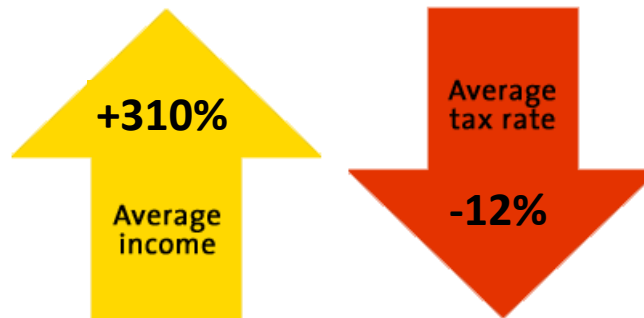
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Source: U.S. Congressional Budget Office, "The Distribution of Household Income, 2014", Average Income Before and After Means-Tested Transfers and Federal Taxes, by Income Group, 2014.

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## What About Tax Rates?

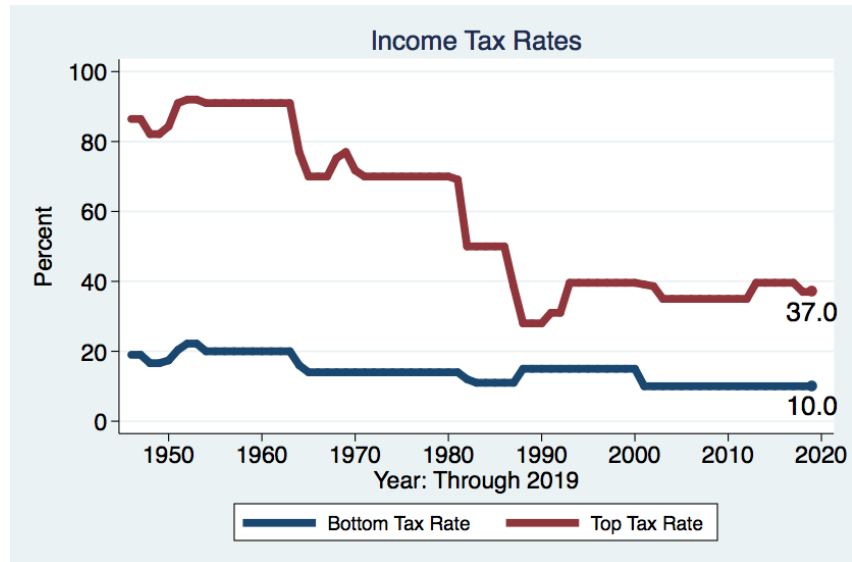
**400 TAXPAYERS WITH HIGHEST INCOMES**  
1992-2014



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Source: IRS, Statistics of Income Division, December 2016.

## Tax Rates Over Time



## Market Forces and Inequality

- **Changing demand patterns**

- Technology
- Globalization
- Industry composition
  - PCs instead of typewriters
  - Services instead of goods
  - Professional services instead of personal services

- **Competition in labor markets**

- Unionization
- Market concentration

## Where Does Inequality Come From? Summary

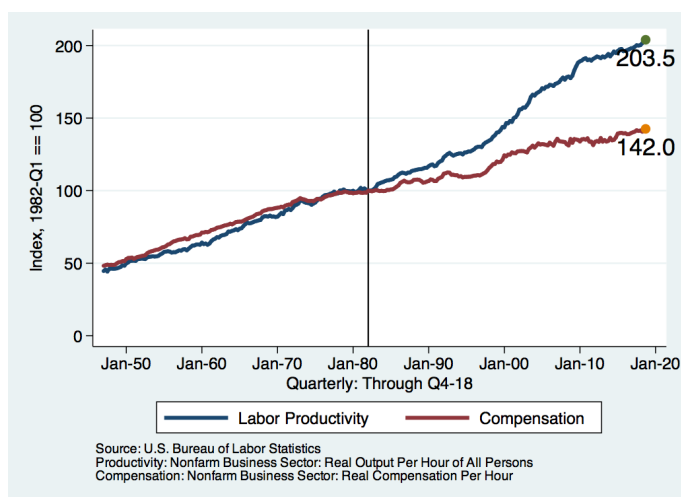
- **Labor characteristics**
  - What do workers bring to the market?
- **Market forces**
  - How does the market value the labor characteristics?
- **Government policies**
  - PRE-distribution – affecting markets
  - Redistribution – affecting incomes



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## Labor Income is Unhinged from Productivity



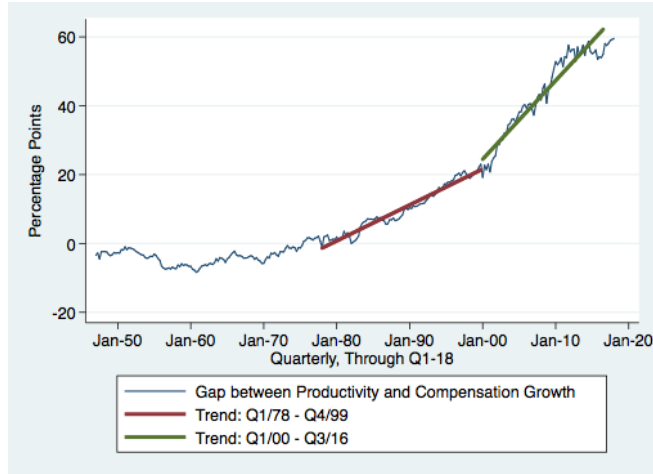
### Why?

- Declining unionization
- Globalization
- Immigration
- Competition policy
- Cheap technology

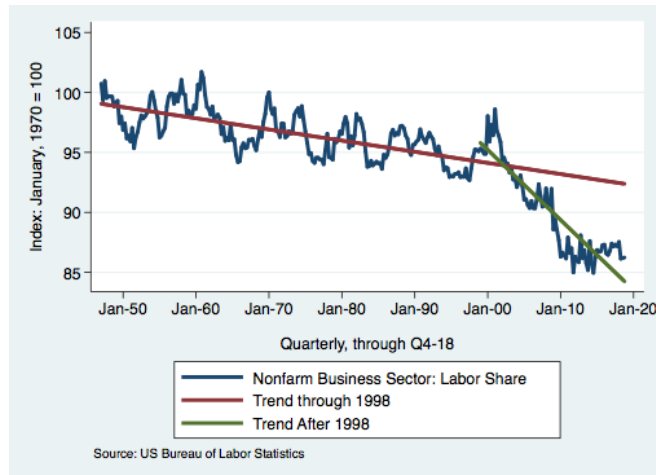


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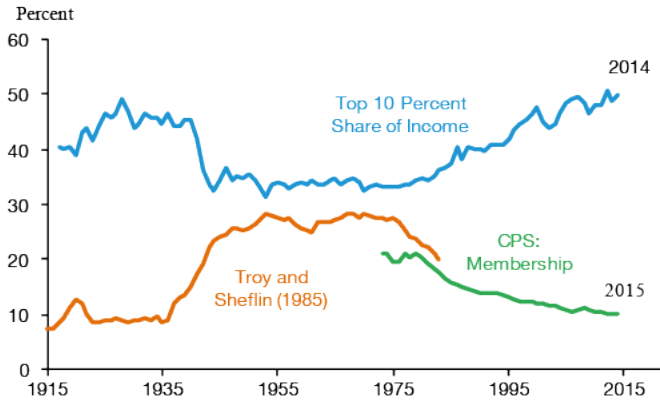
# Labor Share Gap Acceleration



# Effects of the Unhinging?



## Declining Unionization



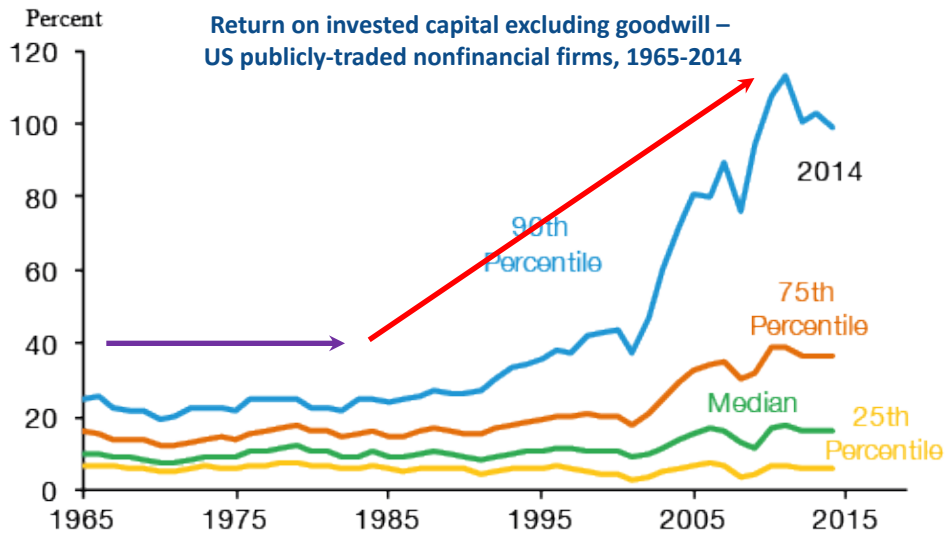
### Unionization Rates

- **1983:** 20.1%
- **2018:** 10.5%

### Unionization Rates

- **Public:** 33.9%
- **Private:** 6.4%

## Competition in the Economy





## Growing Revenue Concentration

Industry	Percentage Point Change in Revenue Share Earned by 50 Largest Firms, 1997-2007
Transportation and Warehousing	12.0
Retail Trade	7.6
Finance and Insurance	7.4
Real Estate Rental and Leasing	6.6
Utilities	5.6
Wholesale Trade	4.6
Educational Services	2.7
Accommodation and Food Services	2.6
Professional, Scientific and Technical Services	2.1
Administrative/Support	0.9
Other Services, Non-Public Admin	-1.5
Arts, Entertainment and Recreation	-2.3
Health Care and Social Assistance	-3.7

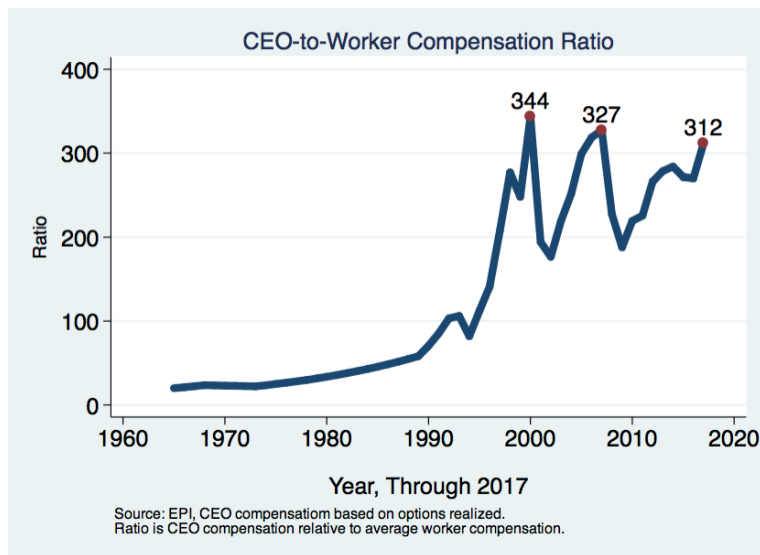


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Source: Furman and Orszag, "A Firm-Level Perspective on the Role of Rents in the Rise in Inequality", 2015.

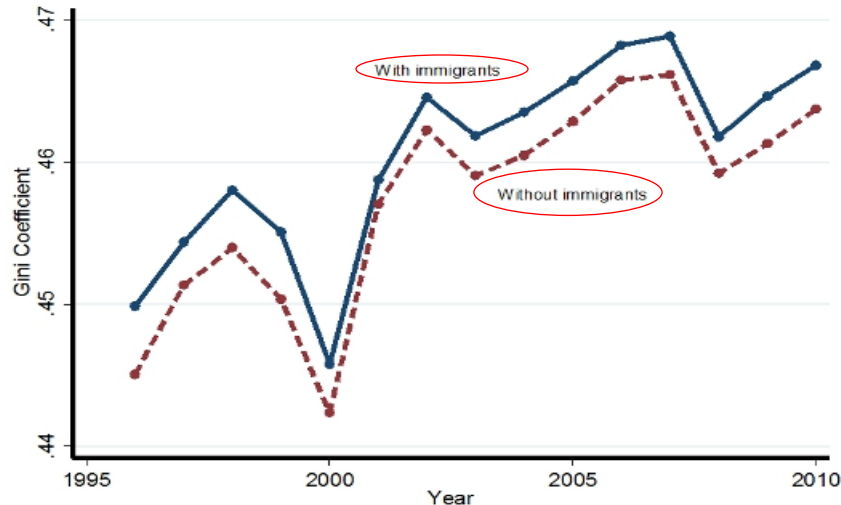
## CEO Pay Has Been Growing Rapidly



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## Immigration and Inequality



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Source: Ping Xu, James C. Garand, and Ling Zhu, "How immigration makes income inequality worse in the U.S.", October, 2015, Figure 1.

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## Immigration and Inequality- Summary

- **Beginning in about 1970, the immigrant share of the U.S. Population increased dramatically.**
  - 5% in 1970 and 14% in 2016
- **Immigration tends to happen most often among:**
  - Low-skilled low-wage workers
  - High-skilled high-wage workers
- **Immigration has likely increased income inequality.**
- **Its effect has likely been small.**
  - ~5% between 1980 and 2000
  - No reason to think it has been bigger since



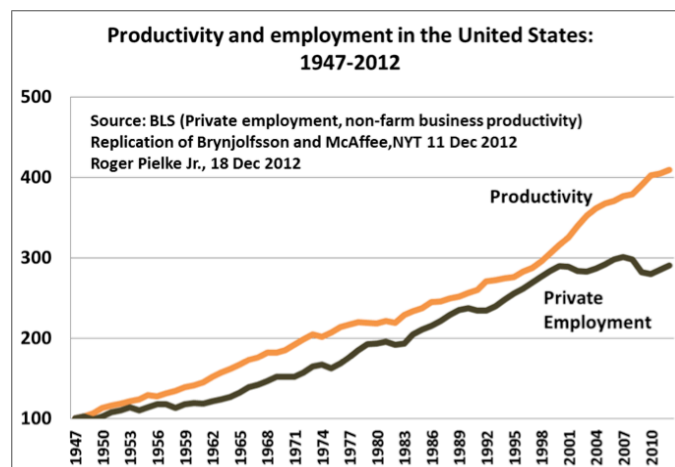
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## Technological Change and Inequality

- **Much of the technology adopted in the last 30 years has eliminated low-skill or low-wage jobs.**
  - Computers, advanced manufacturing equipment, steel mini-mills, automation
- **There is a “winner take all” aspect of the technology-driven economy.**
  - This likely favors a small group of individuals.
- **Both aspects increase inequality by increasing the rewards to:**
  - Those with significant labor market skills.
  - Owners over workers

## Technology Benefits Ownership over Labor



## Technology can Hurt Low Income Workers



Early on, technology was good to low income workers



Until it was bad for them....



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## A Modern Example: Uber & Lyft

- **Technology:**

- Facilitates market power for owners.
- Reduces bargaining power for labor.
- Shifts costs of doing business onto labor.

- **Modern day Robber Barons?**

- Ruthlessly absorbing as much income as they can.
- Lack of regard for labor.



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## Globalization

- **What is globalization?**
  - Flow of goods, services, capital, and labor across international borders
- **How does it affect inequality?**
  - Through a differential impact on low-skilled workers and hence their wages
  - For the United States, globalization is thought to lower the wages of low skilled and hence low-wage workers relative to those of high-skilled workers



## Mechanisms for the Effects of Globalization

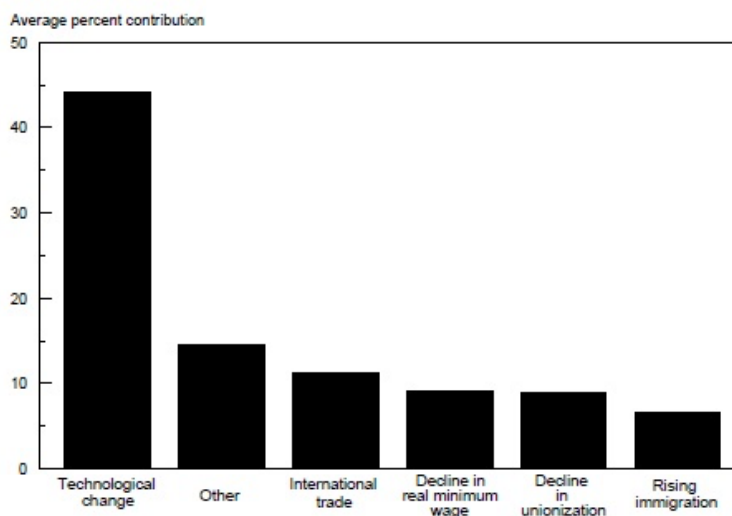
- **Merchandise trade**
  - Importing goods that are made with low-skilled workers and exporting goods that are made with high-skilled workers
    - Lowers the wages of unskilled relative to skilled
      - making the distribution of income **less equal**
- **Outsourcing**
  - Similar channel as with merchandise trade
- **Trade in services**
  - US imports of middle-skill services: business and some professional services
- **Intuitively: The same as if we were to move the actual workers.**



## What is driving increasing inequality?

- **Primary drivers:**
  - Technology
  - Globalization
  - Institutions
- **These drivers can also influence personal choices in ways that affect measured income inequality.**
  - For example, educational choices or labor force participation

## Sources of Inequality Through Late 1990s



Source: Federal Reserve Bank of New York.

# Why Does Inequality Matter?

- **Too little inequality can:**

- Reduce individual motivation
- Slow economic growth

- **Too much inequality can:**

- Reduce individual motivation
- Slow economic growth

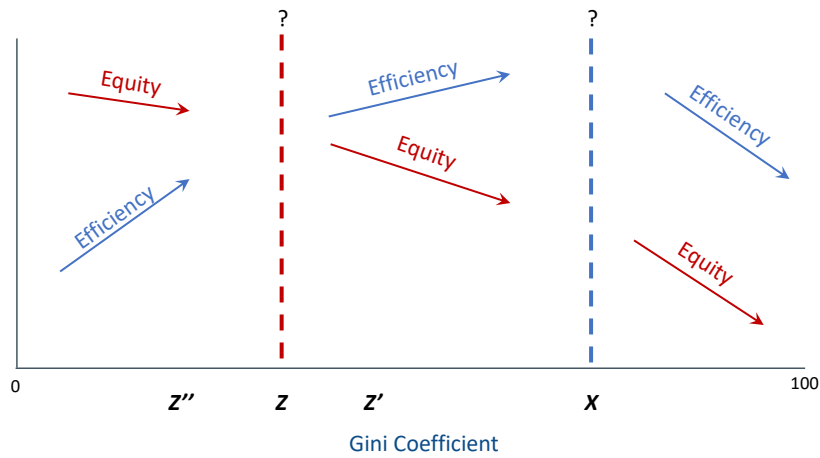
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- **Too much inequality may also:**

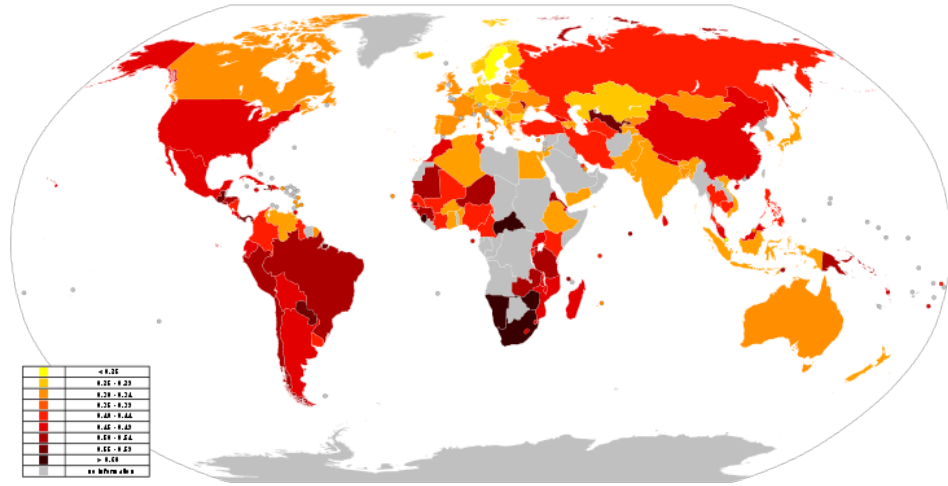
- Divide society
- Distort political environment
- Reduce political participation
- Reduce investments in public goods
  - o Education
  - o Environmental protections



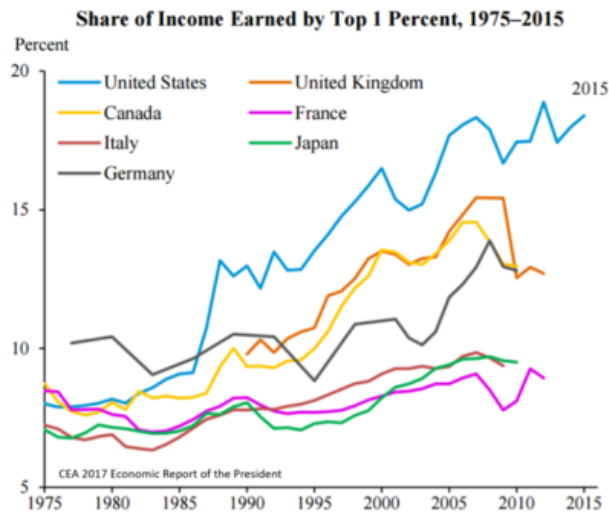
# How Much Inequality Is too Much?



## An International Perspective



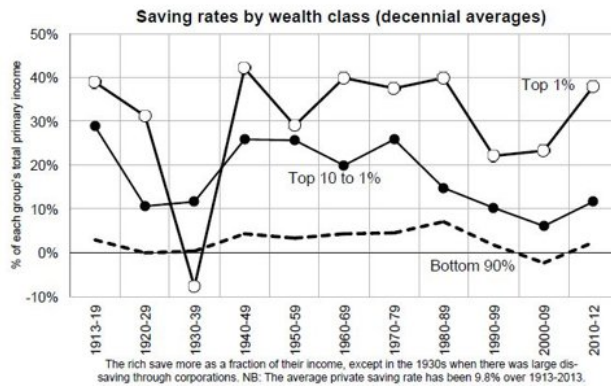
## An International Perspective: Comparables



Source: World Wealth and Income Database.



## But the High-Income Households Save More



Source: Emmanuel Saez and Gabriel Zucman, *The Distribution of U.S. Wealth, Capital*

- Facilitates the Consumption of: **Wealth**
- Which facilitates the consumption of: **Leisure**



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## Addressing Inequality: Is It A Problem?

### • Why it might be a problem.

- Economic issues (*Efficiency*)
  - There is evidence that at some level, increased inequality slows economic growth.
  - Or, inequality concentrates resources among investors.
- Noneconomic issues (*Equity*)
  - Values, ethics and morals will drive individual evaluations of the level of inequality.
    - E.g., inequality is primarily a function of market outcomes, so should be left alone.
    - Or, a solid middle class is important for maintaining a civil society, which runs contrary to a high degree of inequality.

### • Suppose you think it's a problem. How might it be addressed?



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## Addressing Inequality: Long Term

- **It's all about access to resources:**

- Education, in particular
  - Improve public education
  - Reduce disparities in quality of public education
  - Improve counseling in low-income schools
    - With respect to college – paths to success and funding
- Investments are needed in early education, not later
  - Universal pre-K
  - Upgrade quality of elementary schools in low-income areas



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## What to do About Inequality?

- **Nothing?**
- **Redistribution?**
- **PRE-distribution?**
- **Access to resources?**



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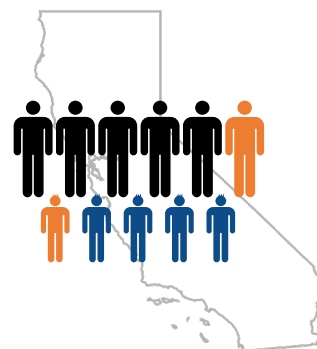
## Tension in Policy Solutions

- **Is it possible to increase growth at the same time that you reduce income inequality?**
  - Common refrain among some that government intervention in the economy is always and everywhere bad for growth.
- **Possibly: expanding equality of access promotes the full utilization of resources.**
  - Expanding equality of access requires resources likely from the well-to-do.



## Summary

- **Income inequality is clearly increasing.**
  - The economy is clearly favoring owners of productive resources over labor.
- **The causes appear to be largely driven by:**
  - The market – technology, competition, and trade
  - Changing institutions.
- **Open questions are:**
  - To act or not to act?
  - If so, how?



**Thank you!**

## Any Questions?

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