

# Studying Social Inequality with Data Science

INFO 3370 / 5371  
Spring 2024

## **Opportunity**

operationalized by economic mobility  
and measured by predictability

# Learning goals for today

By the end of class, you will be able to

- ▶ reason about economic opportunity
- ▶ reason about equal opportunity
- ▶ connect these to a data science idea: prediction

What does economic opportunity mean to you?

## Economic opportunity: Two definitions

**absolute mobility**    out-earning your parents

**relative mobility**    out-ranking your parents

# Absolute upward mobility: Out-earning your parents

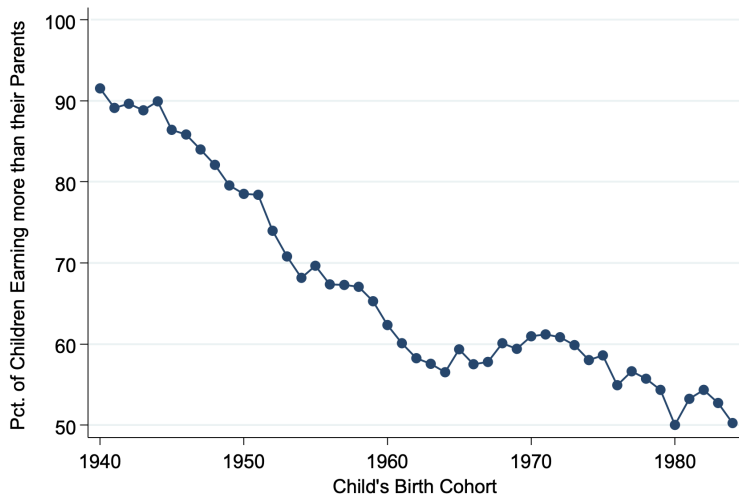
Chetty et al. 2017

What proportion earn more than their parents at age 30?

- ▶ among those born in 1940
- ▶ among those born in 1984

# Absolute upward mobility: Out-earning your parents

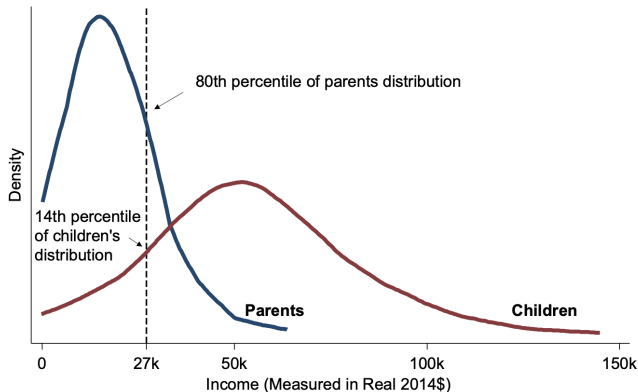
Chetty et al. 2017



# Absolute upward mobility: Out-earning your parents

Chetty et al. 2017

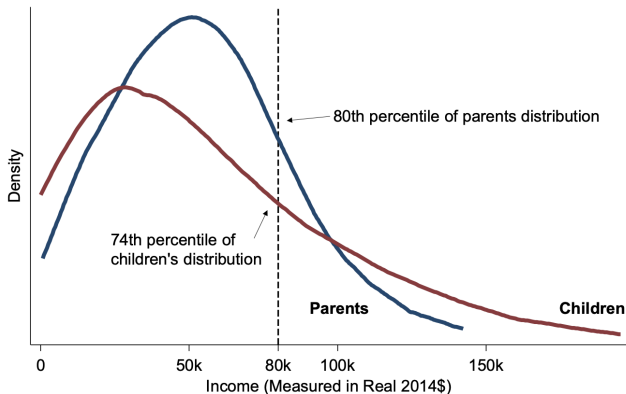
## B. Family Income Distributions: 1940 Birth Cohort



# Absolute upward mobility: Out-earning your parents

Chetty et al. 2017

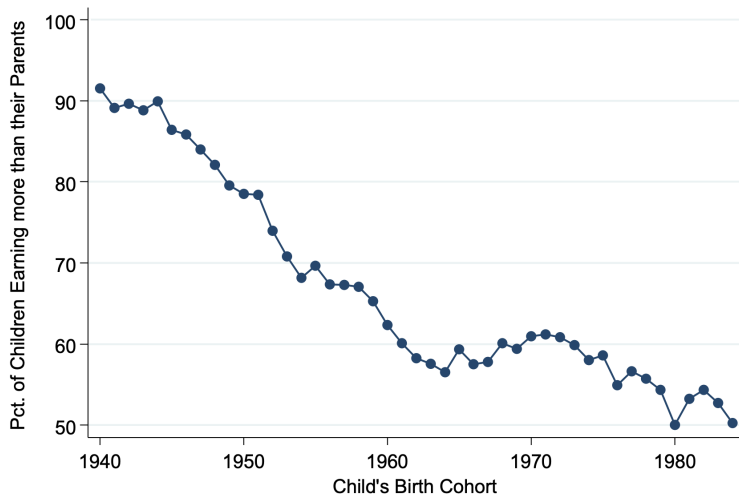
## C. Family Income Distributions: 1980 Birth Cohort





# Absolute upward mobility: Out-earning your parents

Chetty et al. 2017



## Economic opportunity: Two definitions

<b>absolute mobility</b>	out-earning your parents	has fallen
<b>relative mobility</b>	out-ranking your parents	

Parent  
Income  
(Inflation–  
Adjusted  
Dollars)

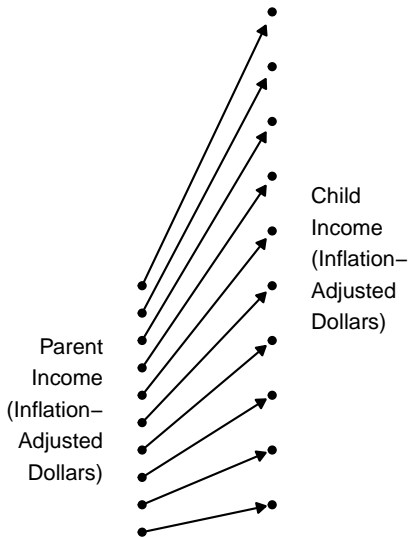
•  
•  
•  
•  
•  
•  
•  
•  
•

•  
•  
•  
•  
•  
•  
•  
•  
•

Child  
Income  
(Inflation–  
Adjusted  
Dollars)

**absolute upward  
mobility**

landing higher than  
your parents in  
dollars



**absolute upward  
mobility**

landing higher than  
your parents in  
dollars

Parent  
Income  
(Inflation–  
Adjusted  
Dollars)

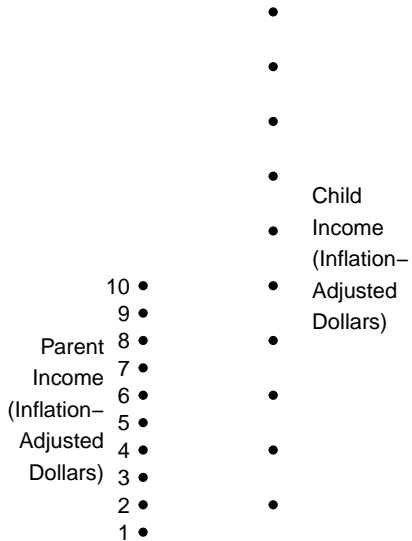
•  
•  
•  
•  
•  
•  
•  
•  
•

•  
•  
•  
•  
•  
•  
•  
•  
•

Child  
Income  
(Inflation–  
Adjusted  
Dollars)

**absolute upward  
mobility**

landing higher than  
your parents in  
dollars



		• 10
		• 9
		• 8
		• 7
	Child	• 6
	Income	(Inflation–
	Adjusted	• 5
	Dollars)	• 4
		• 3
		• 2
		• 1
10 •		
9 •		
8 •	Parent	
7 •	Income	
6 •	(Inflation–	
5 •	Adjusted	
4 •	Dollars)	
3 •		
2 •		
1 •		

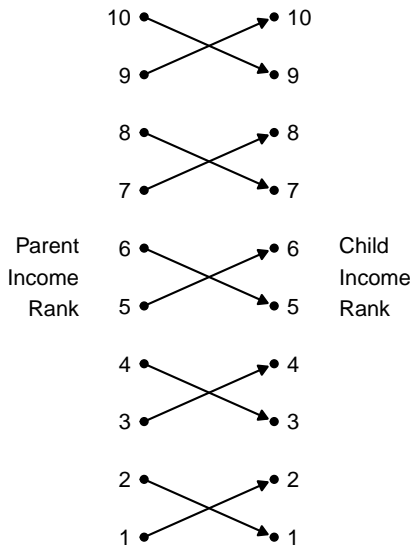
	10 •	• 10	
	9 •	• 9	
	8 •	• 8	
	7 •	• 7	
Parent	6 •	• 6	Child
Income			Income
Rank	5 •	• 5	Rank
	4 •	• 4	
	3 •	• 3	
	2 •	• 2	
	1 •	• 1	



	10 •	• 10	
	9 •	• 9	
	8 •	• 8	
	7 •	• 7	
Parent	6 •	• 6	Child
Income	5 •	• 5	Income
Rank	4 •	• 4	Rank
	3 •	• 3	
	2 •	• 2	
	1 •	• 1	

**relative upward  
mobility**

landing higher than  
your parents in  
ranks



## **relative upward mobility**

landing higher than  
your parents in  
ranks

## **example**

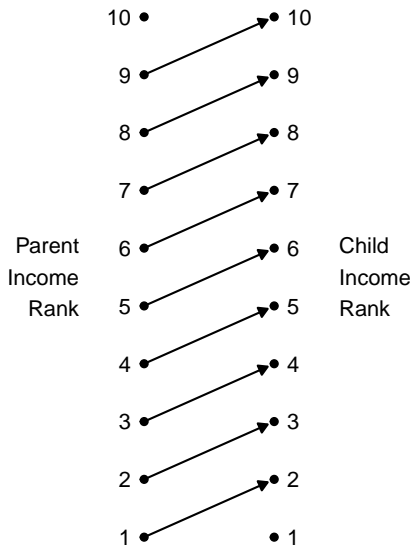
half move up  
half move down

	10 •	• 10	
	9 •	• 9	
	8 •	• 8	
	7 •	• 7	
Parent	6 •	• 6	Child
Income			Income
Rank	5 •	• 5	Rank
	4 •	• 4	
	3 •	• 3	
	2 •	• 2	
	1 •	• 1	

**relative upward  
mobility**

landing higher than  
your parents in  
ranks

**example**  
90% move up

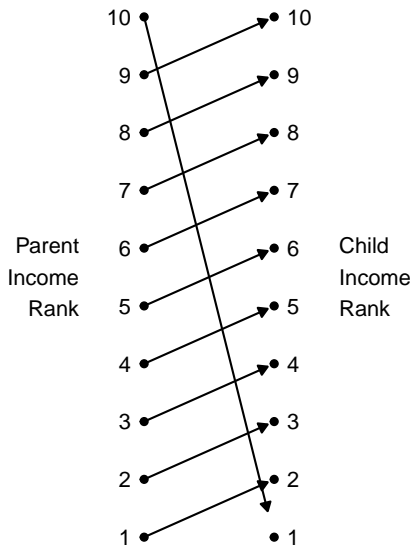


## **relative upward mobility**

landing higher than  
your parents in  
ranks

## **example**

90% move up



## **relative upward mobility**

landing higher than your parents in ranks

## **example**

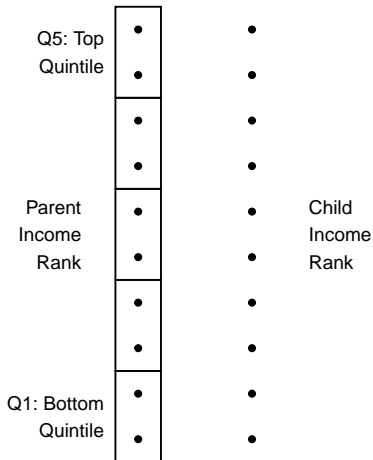
90% move up

# Relative upward mobility: Reaching the top

Chetty et al. 2014

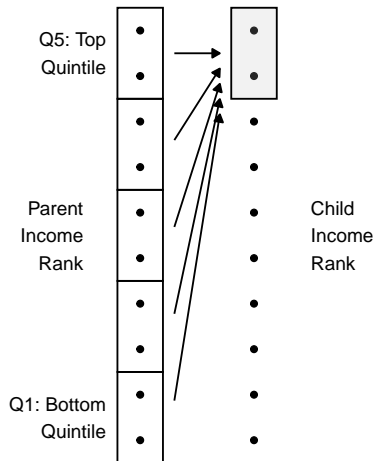
## Relative upward mobility: Reaching the top

Chetty et al. 2014



# Relative upward mobility: Reaching the top

Chetty et al. 2014





# Relative upward mobility: Reaching the top

Chetty et al. 2014

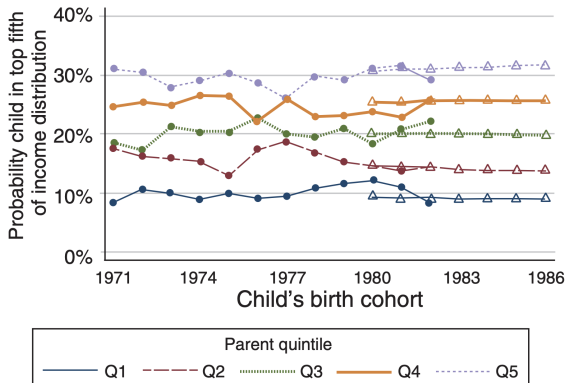


FIGURE 3. PROBABILITY OF REACHING TOP QUINTILE AT AGE 26 BY BIRTH COHORT

## Economic opportunity: Two definitions

<b>absolute mobility</b>	out-earning your parents	has fallen
<b>relative mobility</b>	out-ranking your parents	roughly constant

What does **equal** opportunity mean to you?

Now, the premise that we're all created equal is the opening line in the American story. And while we don't promise equal outcomes, we've strived to deliver equal opportunity – the idea that success doesn't depend on being born into wealth or privilege, it depends on effort and merit.

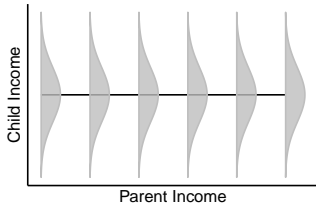
— Barack Obama, [Remarks on the Economy](#), Dec 2013. [\[Video\]](#)

Now, the premise that we're all created equal is the opening line in the American story. And while we don't promise equal outcomes, we've strived to deliver equal opportunity – the idea that success doesn't depend on being born into wealth or privilege, it depends on effort and merit.

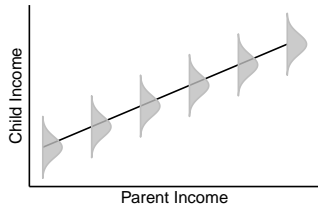
— Barack Obama, [Remarks on the Economy](#), Dec 2013. [\[Video\]](#)

How would you quantify opportunity using data science?

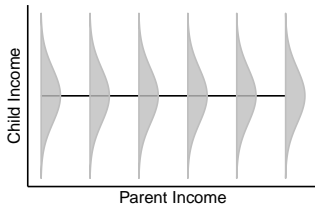
## Equal Opportunity



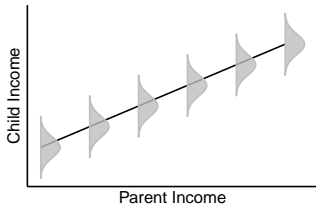
## Unequal Opportunity



## Equal Opportunity

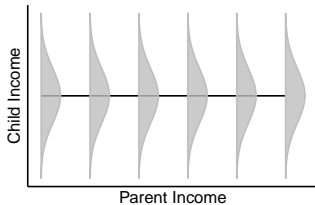


## Unequal Opportunity



Child outcomes are **predictable** given family background

## Equal Opportunity



Child outcomes are **unpredictable** given family background



Respondent Education	Parent Education	Grandparent Education	Sex	Race	Grandparent Income	Parent Income	
							Case 1
							Case 2
							Case 3
							Case 4
							Case 5

Respondent Income


Respondent Education

Parent Education

Grandparent Education

Sex

Race

Grandparent Income

Parent Income

Case 1

Case 2


Case 3

Case 4

Case 5


Respondent Income


Learn a  
prediction  
function



Respondent Education

Parent Education

Grandparent Education

Sex

Race

Grandparent Income

Parent Income

Case 1

Case 2

Case 3

Case 4

Case 5


Respondent Income


?

?

?

Learn a  
prediction  
function  
→

Respondent Education

Parent Education

Grandparent Education

Sex

Race

Grandparent Income

Parent Income

Case 1

Case 2

Case 3

Case 4

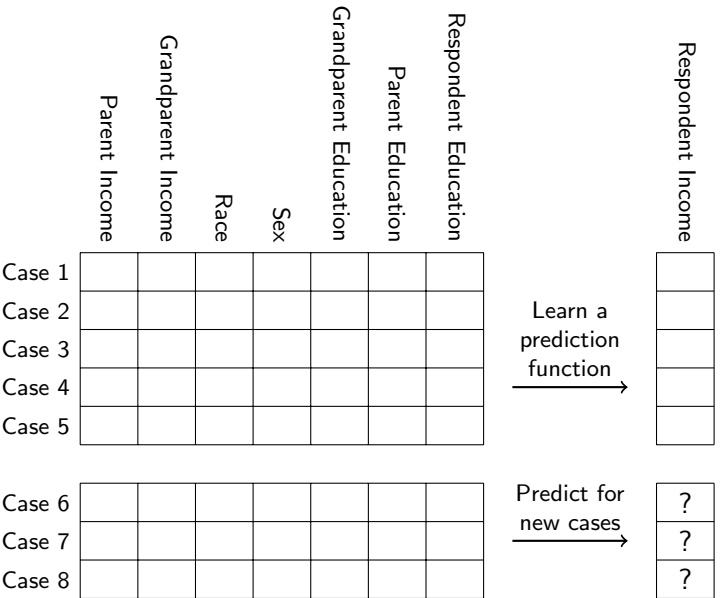
Case 5

Case 6

Case 7

Case 8





Respondent Income


Learn a  
prediction  
function



Predict for  
new cases



?

?

?

Respondent Education

Parent Education

Grandparent Education

Sex

Race

Grandparent Income

Parent Income

Case 1

Case 2

Case 3

Case 4

Case 5


Case 6

Case 7

Case 8


Learning Set

Holdout Set

# The challenge

How well can you predict respondent incomes?

Get started [here](#)

# Learning goals for today

By the end of class, you will be able to

- ▶ reason about economic opportunity
- ▶ reason about equal opportunity
- ▶ connect these to a data science idea: prediction