# Development Economics

Slides 15

Debraj Ray, NYU

# Inequality and Development: Evolving Together

- **Distribution of Endowments**

$\Rightarrow$ Supply and demand for goods

$\Rightarrow$ Equilibrium

$\Rightarrow$ Market prices, including wages, rents, profits

$\Rightarrow$ Human and physical capital accumulation

$\Rightarrow$ **New Distribution of Endowments**

# A Little Taxonomy For Sources of Inequality

1. **Savings**: How do savings rates change with income?

2. **Rates of Return**: Variations in the rate of return to capital across people and across wealth levels.

3. **Occupational Choice**: Can wealth affect selection into occupations?

---

[Not for course]

4. **Demand**: Income distribution affects composition of demand, and therefore individual incomes.

5. **Politics and Policies**: Income distributions will affect taxes on labor and capital income via political lobbies.

# Microeconomic Concepts

## Individual accumulation equations:

$$\underbrace{k_t}_{\text{Today's Investments}} = \underbrace{W_t}_{\text{Today's Wealth}} + \underbrace{y_t}_{\text{Fresh Income}} - \underbrace{c_t}_{\text{Consumption}}, \tag{1}$$

- where $k_t$ can be a financial or human capital investment.

# Microeconomic Concepts

## Individual accumulation equations:

$$\underbrace{k_t}_{\text{Today's Investments}} = \underbrace{W_t}_{\text{Today's Wealth}} + \underbrace{y_t}_{\text{Fresh Income}} - \underbrace{c_t}_{\text{Consumption}}, \tag{1}$$

- where $k_t$ can be a financial or human capital investment.
- Financial: $k_t \rightarrow W_{t+1}$ plus fresh capital income.
- Human: education costs or setup costs $\rightarrow$ fresh human income or profits.

# Microeconomic Concepts

## Individual accumulation equations:

$$\underbrace{k_t}_{\text{Today's Investments}} = \underbrace{W_t}_{\text{Today's Wealth}} + \underbrace{y_t}_{\text{Fresh Income}} - \underbrace{c_t}_{\text{Consumption}}, \tag{1}$$

- where $k_t$ can be a financial or human capital investment.
- Financial: $k_t \rightarrow W_{t+1}$ plus fresh capital income.
- Human: education costs or setup costs $\rightarrow$ fresh human income or profits.
- These are exogenous mappings for the individual but often endogenously determined within the economy.

# Microeconomic Concepts

## Examples:

# Microeconomic Concepts

## Examples:

- Financial: $k_t = W_{t+1}$ plus capital income $rk_t$ ($r =$ financial rate of return)

# Microeconomic Concepts

**Examples:**

- Financial: $k_t = W_{t+1}$ plus capital income $rk_t$ ($r =$ financial rate of return)
- Human or Entrepreneurial:

$$k_t \to w_u \text{ for } k < \bar{k}$$

$$\to w_s \text{ for } k > \bar{k}.$$

- where $\bar{k}$ is a training cost to become skilled.

# Microeconomic Concepts

**Examples:**

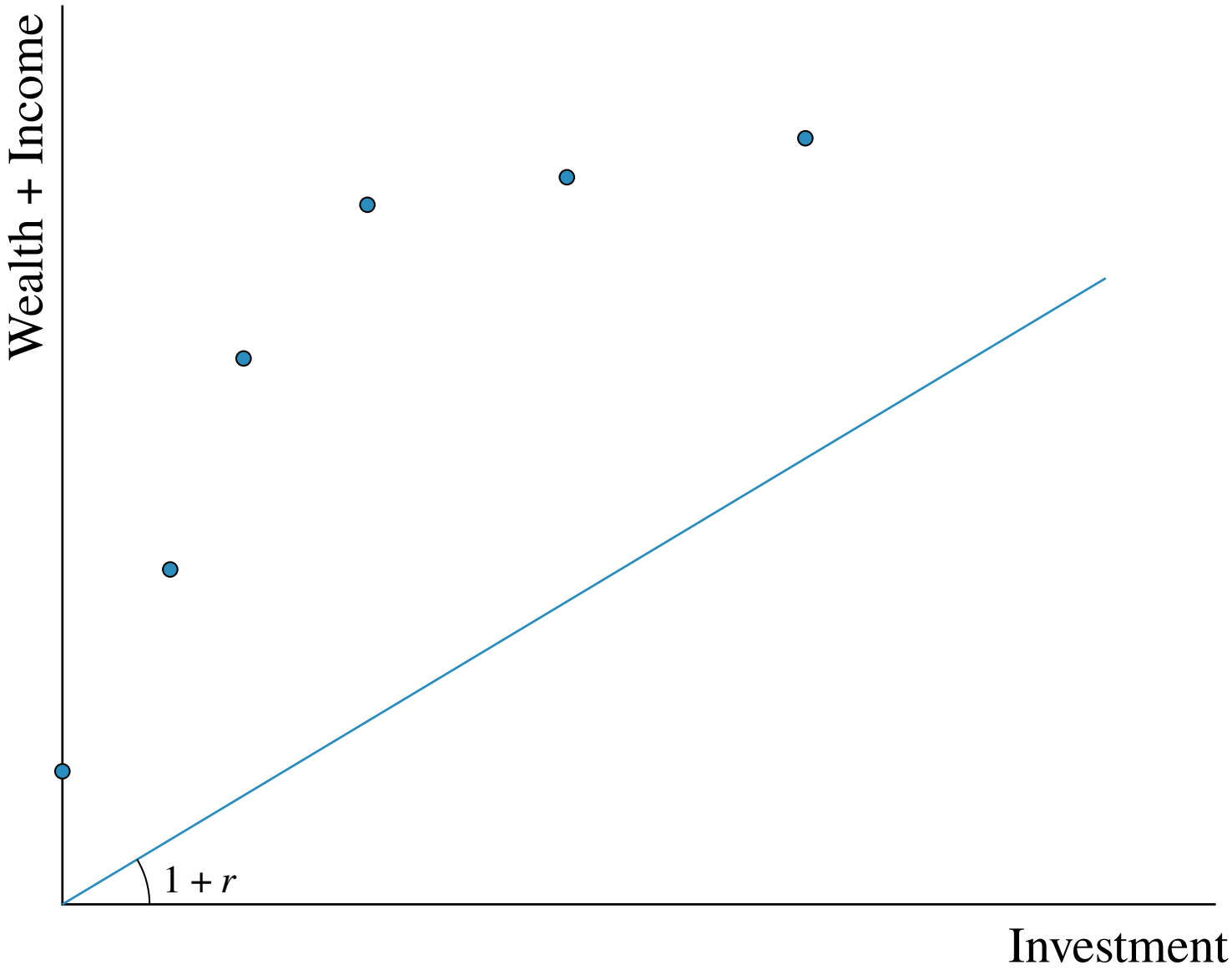
- Financial: $k_t = W_{t+1}$ plus capital income $rk_t$ ($r =$ financial rate of return)
- Human or Entrepreneurial:

$$k_t \to w_u \text{ for } k < \bar{k}$$

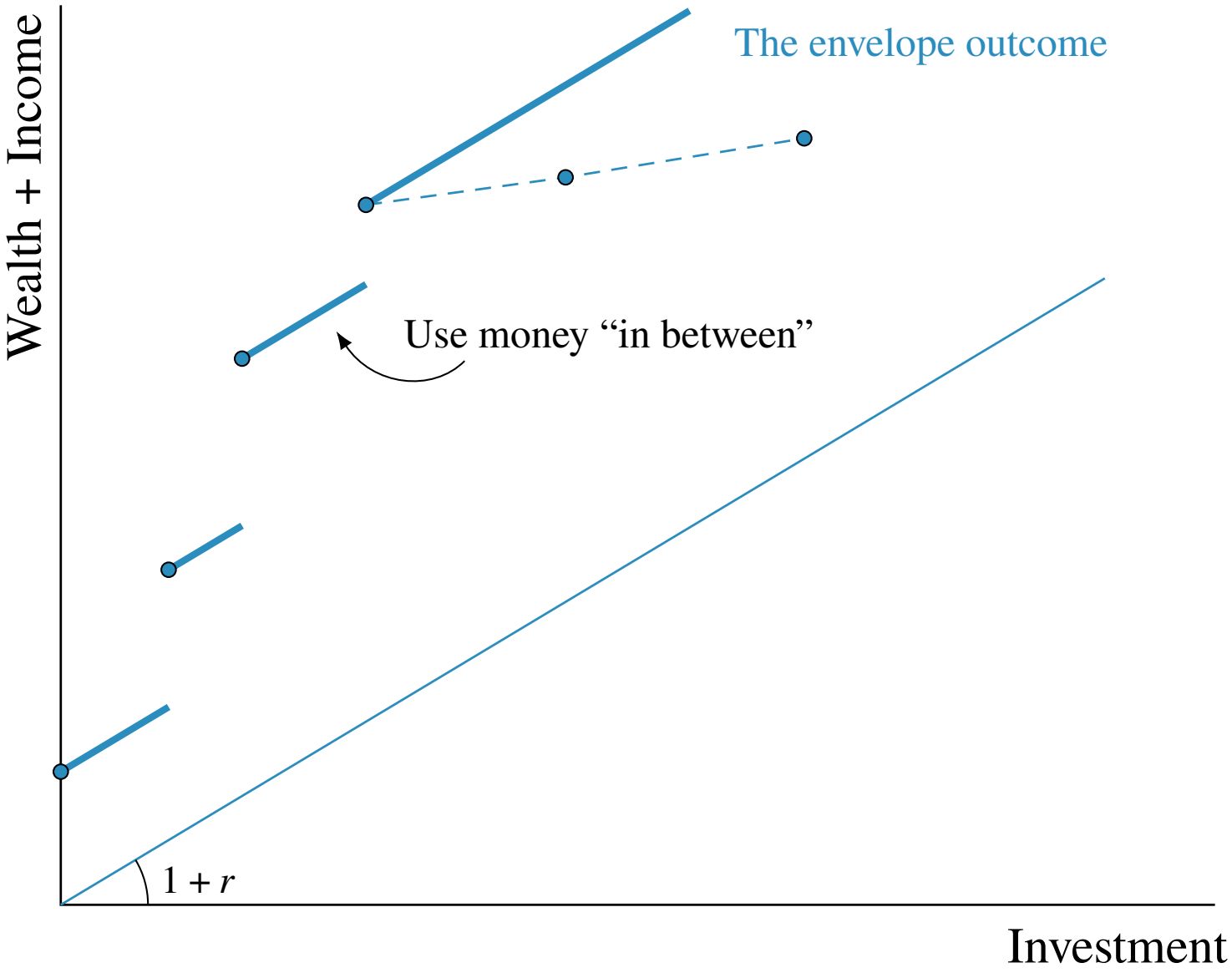
$$\to w_s \text{ for } k > \bar{k}.$$

- where $\bar{k}$ is a training cost to become skilled.
- Easily extended to setup costs, or multiple occupations.
- Also $k_t$ might be divided into both human and financial investments.

# The Household's "Production Function"



# The Household's "Production Function"



# Savings Rates and the Evolution of Wealth

- **Financial investment**: $k_t = W_{t+1}$, so equation (1) becomes

$$W_{t+1} = W_t + y_t - c_t.$$

# Savings Rates and the Evolution of Wealth

- **Financial investment**: $k_t = W_{t+1}$, so equation (1) becomes

$$W_{t+1} = W_t + y_t - c_t.$$

- Savings rate $s$ out of income: $c_t = (1 - s)y_t$. Eliminate $c_t$:

$$W_{t+1} = W_t + sy_t.$$

# Savings Rates and the Evolution of Wealth

- **Financial investment**: $k_t = W_{t+1}$, so equation (1) becomes

$$W_{t+1} = W_t + y_t - c_t.$$

- Savings rate $s$ out of income: $c_t = (1-s)y_t$. Eliminate $c_t$:

$$W_{t+1} = W_t + sy_t.$$

- Income $y_t = \underbrace{w_t}_{\text{labor income}} + \underbrace{rW_t}_{\text{capital income}} \equiv (\eta + r)W_t \equiv \rho W_t$, and therefore:

$$W_{t+1} = (1 + s\rho)W_t.$$

# Savings Rates and the Evolution of Wealth

- **Financial investment**: $k_t = W_{t+1}$, so equation (1) becomes

$$W_{t+1} = W_t + y_t - c_t.$$

- Savings rate $s$ out of income: $c_t = (1-s)y_t$. Eliminate $c_t$:

$$W_{t+1} = W_t + sy_t.$$

- Income $y_t = \underbrace{w_t}_{\text{labor income}} + \underbrace{rW_t}_{\text{capital income}} \equiv (\eta + r)W_t \equiv \rho W_t$, and therefore:

$$W_{t+1} = (1 + s\rho)W_t.$$

- **So** wealth grows at the rate $s\rho$: faster when $s$ is higher.
- If the rich have higher $s$ or $\rho$ (equal to $\eta + r$), they pull away.

# Differential Savings Rates

## Permanent versus temporary income

Friedman (1957), see discussion in Dynan-Skinner-Zeldes (2004)

- Estimates from Survey of Consumer Finances (SCF):

| | 6-Yr Income Average | Instrumented By Vehicle Consumption |
|---|---|---|
| Quintile 1 | 1.4 | 2.8 |
| Quintile 2 | 9.0 | 14.0 |
| Quintile 3 | 11.1 | 13.4 |
| Quintile 4 | 17.3 | 17.3 |
| Quintile 5 | 23.6 | 28.6 |
| Top 5% | 37.2 | 50.5 |
| Top 1% | 51.2 | 35.6 |

Source: Dynan-Skinner-Zeldes (2004), they provide other estimates

# How Much Do Differential Savings Rates Explain?

- Recall: $W_{t+1} = (1 + s\rho)W_t$.

# How Much Do Differential Savings Rates Explain?

- Recall: $W_{t+1} = (1 + s\rho)W_t$.
- For the rich (top 10%, or top 1%, or top 0.1%):
- Their income is a return on their **accumulated wealth** $\hat{W}_t$

  financial wealth, a business, land, education, ...
- Even likely that $\eta \approx 0$, so that $\rho = r$.

# How Much Do Differential Savings Rates Explain?

- Recall: $W_{t+1} = (1 + s\rho)W_t$.
- For the rich (top 10%, or top 1%, or top 0.1%):
- Their income is a return on their **accumulated wealth** $\hat{W}_t$

  financial wealth, a business, land, education, ...
- Even likely that $\eta \approx 0$, so that $\rho = r$.
- Both $\hat{y}$ and $\hat{W}$ grow together, so that $\hat{y}_t = \hat{y}_0[1 + \hat{s}\rho]^t$.

# How Much Do Differential Savings Rates Explain?

- Recall: $W_{t+1} = (1 + s\rho)W_t$.
- For the rich (top 10%, or top 1%, or top 0.1%):
- Their income is a return on their **accumulated wealth** $\hat{W}_t$

  financial wealth, a business, land, education, ...
- Even likely that $\eta \approx 0$, so that $\rho = r$.
- Both $\hat{y}$ and $\hat{W}$ grow together, so that $\hat{y}_t = \hat{y}_0[1 + \hat{s}\rho]^t$.
- Rich income share is $\text{Share}_t = n\hat{y}_t/y_t$, where $n$ is their share (10%, 1% etc.).
- **So:** $$\textbf{Share}_t = \textbf{Share}_0 \left(\frac{1 + \hat{s}\rho}{1 + g}\right)^t$$
- where $g$ is the overall growth rate of per-capita income.

# Backing Out Growth Rates From Shares

- From previous page:

$$\textbf{Share}_t = \textbf{Share}_0 \left( \frac{1 + \hat{s}\rho}{1 + g} \right)^t$$

- where $g$ is the overall growth rate of per-capita income.

# Backing Out Growth Rates From Shares

- From previous page:

$$\textbf{Share}_t = \textbf{Share}_0 \left( \frac{1 + \hat{s}\rho}{1 + g} \right)^t$$

- where $g$ is the overall growth rate of per-capita income.

- A constant share in national income for the rich requires $\hat{s}\rho = g$, i.e.

$$\rho = g/\hat{s}.$$

# Backing Out Growth Rates From Shares

- From previous page:

$$\textbf{Share}_t = \textbf{Share}_0 \left( \frac{1 + \hat{s}\rho}{1 + g} \right)^t$$

- where $g$ is the overall growth rate of per-capita income.
- A constant share in national income for the rich requires $\hat{s}\rho = g$, i.e.

$$\rho = g/\hat{s}.$$

- A rising share means $\hat{s}\rho > g$, and to be exact:

$$\hat{s}\rho = [\text{Share}_t/\text{Share}_0]^{1/t}(1 + g) - 1$$

# Backing Out Growth Rates From Shares

- From previous page:

$$\textbf{Share}_t = \textbf{Share}_0 \left( \frac{1 + \hat{s}\rho}{1 + g} \right)^t$$

- where $g$ is the overall growth rate of per-capita income.
- A constant share in national income for the rich requires $\hat{s}\rho = g$, i.e.

$$\rho = g/\hat{s}.$$

- A rising share means $\hat{s}\rho > g$, and to be exact:

$$\hat{s}\rho = [\text{Share}_t/\text{Share}_0]^{1/t}(1 + g) - 1$$

- This is the **required real growth rate** of top incomes:
- To match observed changes in shares.

# How Much Do Differential Savings Rates Explain?

## Top 1% income share, 1980–2022

Shares: WID pre-tax national income. $g$: WID real average national income per adult.

| | Top 1% share | | | Required $\rho$ at $\hat{s} =$ | | |
|---|---|---|---|---|---|---|
| | 1980 | 2022 | $g$ | 0.35 | 0.50 | 1.00 |
| India | 7.5 | 23.1 | 3.2% | **17.1%** | 12.0% | 6.0% |
| South Korea | 7.6 | 14.1 | 3.9% | **15.6%** | 10.9% | 5.5% |
| China* | 6.6 | 14.0 | 5.3% | **21.5%** | 15.1% | 7.5% |
| United States | 10.4 | 20.7 | 1.4% | 8.8% | 6.1% | 3.1% |

*China to 2015: WID's own data-quality flag falls sharply after that year.

- Benchmark: real return on world equities $\approx$ 5.2% (Dimson-Marsh-Staunton, 1900–2024); equities and housing $\approx$ 7% (Jordà et al. 2019, 1870–2015).

# A Minimum Floor on Rate of Return

- Set $\hat{s} = 1$: the rich consume nothing and reinvest every rupee.
- Even then, to match the income shares data:

  India's top 1% needs **6.0%** real, and the top 0.1% needs **7.3%**

  on everything they own, for forty years.
- Korea's top 0.1% needs **6.7%**. China's top 1% needs **7.5%**.

# A Minimum Floor on Rate of Return

- Set $\hat{s} = 1$: the rich consume nothing and reinvest every rupee.
- Even then, to match the income shares data:

  India's top 1% needs **6.0%** real, and the top 0.1% needs **7.3%**

  on everything they own, for forty years.
- Korea's top 0.1% needs **6.7%**. China's top 1% needs **7.5%**.
- That exceeds historical return on equities and housing in rich countries:
- and they obviously do consume.
- By contrast, the United States floor of 3.1% and France's 1.7% are easily met.

# Two Remarks

- **1. Churn at the top.** The top 1% in 2022 are not the same people as in 1980.
- But we never wanted to track people, just top percentiles.
- Good and bad years shuffle membership, but that doesn't matter in the net.

# Two Remarks

- **1. Churn at the top.** The top 1% in 2022 are not the same people as in 1980.
- But we never wanted to track people, just top percentiles.
- Good and bad years shuffle membership, but that doesn't matter in the net.
- **2. Labor income among top incomes?**
- Fine, if we read $W$ broadly:

  earnings $=$ return on accumulated human capital.

  $\rho = r + \eta$. Schooling your children is reinvestment.

# Where This Leaves Us: High Returns at the Top

- It isn't that these returns are impossible. Rather it says:
- Rich investments pay far more than the market return on financial wealth.
- The question isn't whether such returns exist
- But rather who can get them — and why.

# Where This Leaves Us: High Returns at the Top

- It isn't that these returns are impossible. Rather it says:
  - Rich investments pay far more than the market return on financial wealth.
  - The question isn't whether such returns exist
  - But rather who can get them — and why.
- **Two broad groups of answers**:
  - The rich have access to better information on rates of return
  - The rich have physical access to better rates of return.

# Information: Investing in Investment

**This section is omitted for the course.**

- **The greater is wealth, the more effort in finding good rates of return on it.**

- Simplest model:

$$\sum_{t=0}^{\infty} \delta^t c_t^{1-\sigma},$$

where $0 < \sigma < 1$, $0 < \delta < 1$, and

$$c_t = \underbrace{(1 + r_{t-1})F_{t-1}}_{\text{old wealth + return}} + \underbrace{w(1 - e_t)}_{\text{wages on } 1 - e \text{ time}} - \underbrace{F_t}_{\text{new wealth}},$$

and

$$r_t = \beta e_t$$

$F$: financial wealth, $w$: wage rate, and $e$: informational effort.

# Information: Investing in Investment

- Use $F_t$ to equate marginal benefits over time:

$$\left(\frac{c_{t+1}}{c_t}\right)^{\sigma} = \delta(1 + r_t)$$

- Use $e_t$ to equate marginal benefits over time:

$$\left(\frac{c_{t+1}}{c_t}\right)^{\sigma} = \delta\frac{F_t}{w}\beta.$$

- Proposition. Individuals with a higher ratio of $F$ to $w$ earn a higher rate of return, and grow faster.

- Proof. Combine the two equations above to see that for all $t$,

$$1 + r_t = \frac{F_t}{w}\beta.$$

- Or you can have your cake and eat it too. Consider

$$c_t = (1 + r_{t-1})F_{t-1} + w - z_t - F_t,$$

where $r_t = \gamma z_t$ (e.g., paying an expert to do your research).

- The $z$ that equates marginal benefits is given by

$$\left(\frac{c_{t+1}}{c_t}\right)^{\sigma} = \delta F_t \gamma.$$

- Proposition. Those with higher $F$ earn higher rates of return.

- PS: Contrast the two propositions.

# Access: Wealth and Rates of Return

**Back to course material**

**Why might wealth affect access to high rates of return?**

- Risk-taking
- Stock markets
- Politics (Sokoloff-Engerman on Latin America)
- Imperfect capital markets:

  Inability to seize opportunities with startup costs

  This last item will be our focus here.

# Entrepreneurs and Workers

- People indexed on $[0, 1]$: **all identical except for their initial wealth**.
- Choose to become workers or entrepreneurs.
- Startup cost $S$ for entrepreneurship.

# Entrepreneurs and Workers

- People indexed on $[0, 1]$: **all identical except for their initial wealth**.
- Choose to become workers or entrepreneurs.
- Startup cost $S$ for entrepreneurship.
- **Entrepreneurs have a production function** $f(\ell) = A\ell^{\alpha}$.
- They hire workers at wage $w$ to maximize profit:

$$A\ell^{\alpha} - w\ell$$

- $w$ adjusts to equate supply and demand.

# The Criterion for Social Efficiency

**Output net of setup costs**: Choose $n$ to maximize

$$\max_n nA\left(\frac{1-n}{n}\right)^{\alpha} - nS(1+r)$$

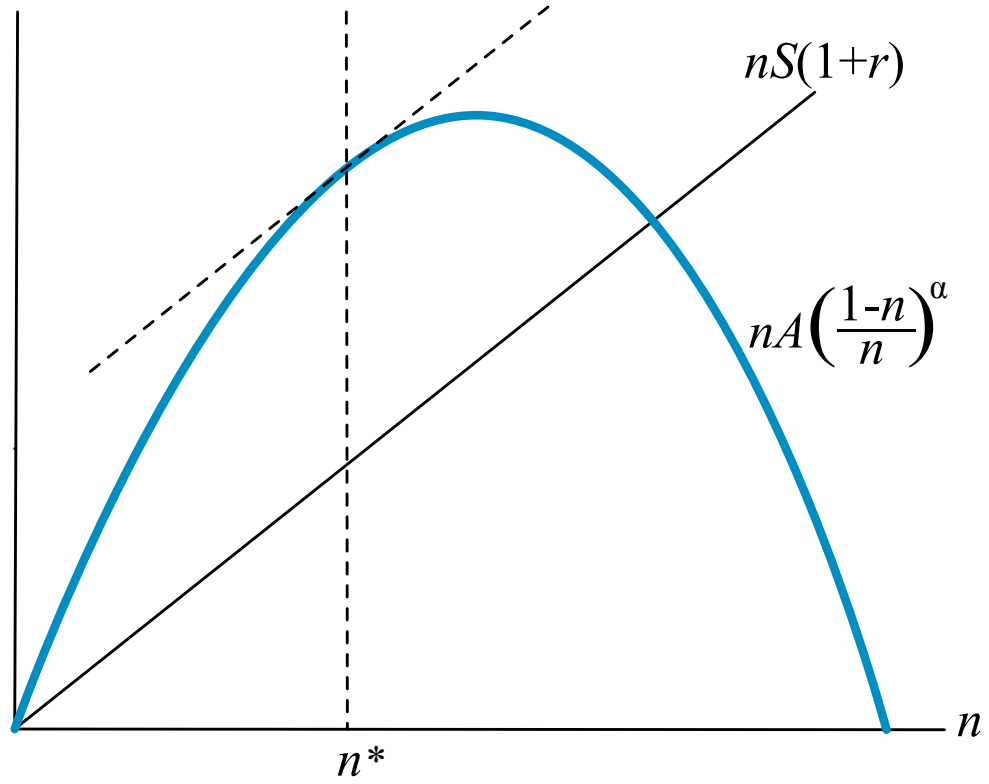
where $r$ is rate of return on alternative use of funds invested in startup.

# The Criterion for Social Efficiency

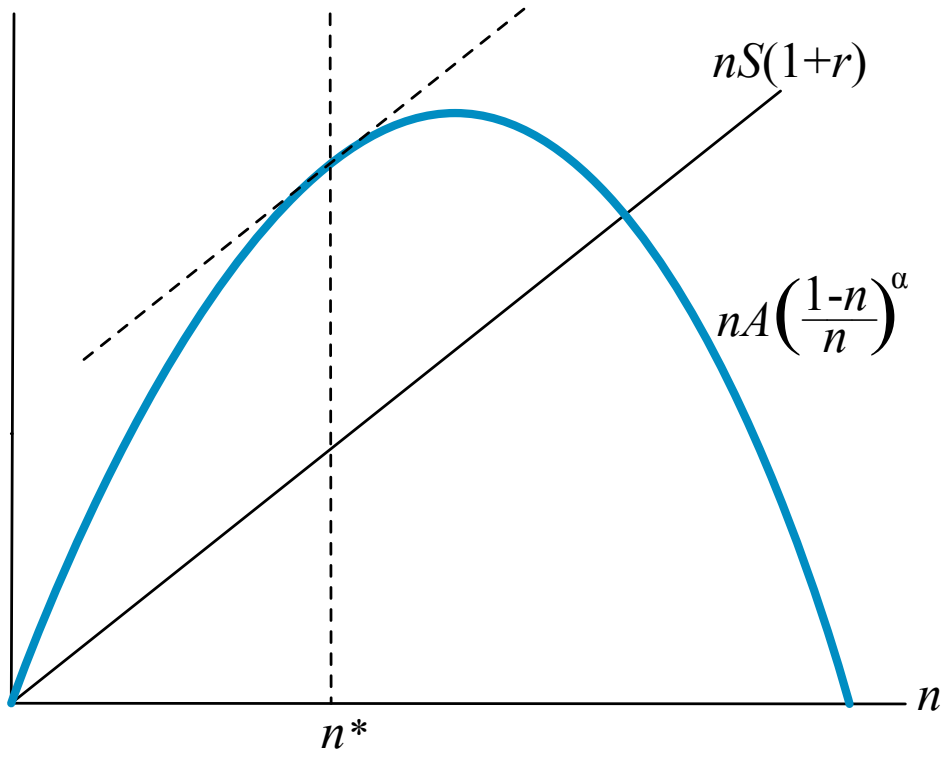
**Output net of setup costs**: Choose $n$ to maximize

$$\max_n nA\left(\frac{1-n}{n}\right)^{\alpha} - nS(1+r)$$

where $r$ is rate of return on alternative use of funds invested in startup.



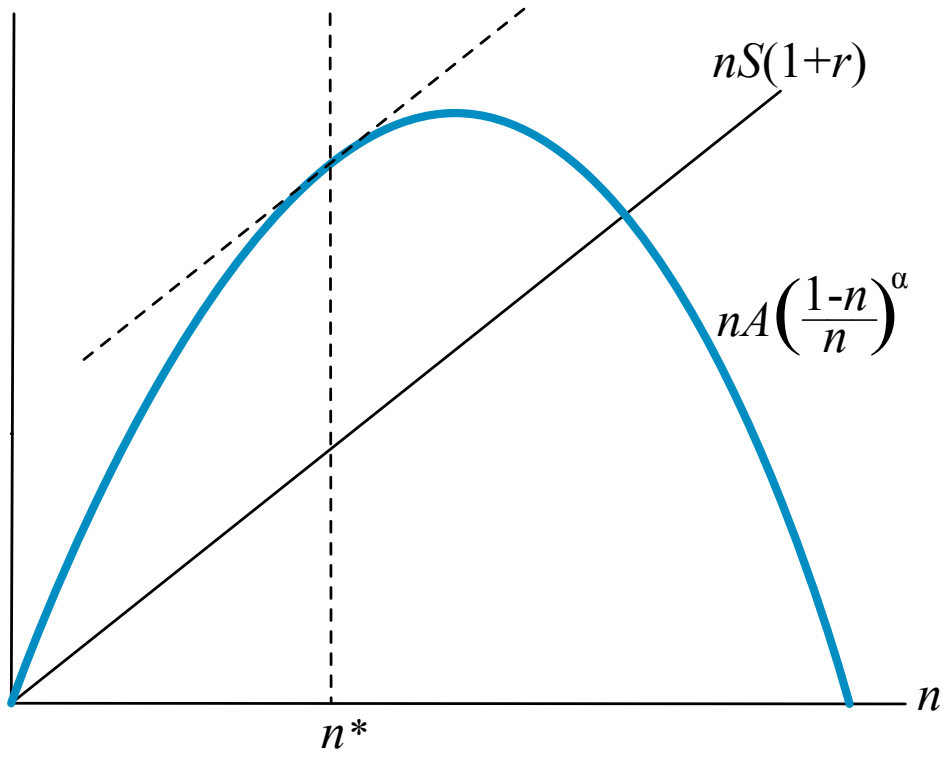
# The Criterion for Social Efficiency




- **First order condition for maximization of net output:**

$$A\left(\frac{1-n^*}{n^*}\right)^{\alpha} - \frac{\alpha}{n^*}A\left(\frac{1-n^*}{n^*}\right)^{\alpha-1} = S(1+r). \tag{2}$$

# The Criterion for Social Efficiency




- **First order condition for maximization of net output:**

$$A\left(\frac{1-n^*}{n^*}\right)^{\alpha} - \frac{\alpha}{n^*}A\left(\frac{1-n^*}{n^*}\right)^{\alpha-1} = S(1+r). \tag{2}$$

- Can this solution be **decentralized**? **Yes, if credit markets are perfect**.

# Decentralized First-Best Under Perfect Credit Markets

- **Market equilibrium** with $n$ entrepreneurs and wage $w$:
- Because credit markets are perfect, profits equal wages:

$$A\left(\frac{1-n}{n}\right)^{\alpha} - w\frac{1-n}{n} - S(1+r) = w, \tag{3}$$

- Wages equal marginal product:

$$w = \alpha A\left(\frac{1-n}{n}\right)^{\alpha-1} \tag{4}$$

# Decentralized First-Best Under Perfect Credit Markets

- **Market equilibrium** with $n$ entrepreneurs and wage $w$:
- Because credit markets are perfect, profits equal wages:

$$A\left(\frac{1-n}{n}\right)^{\alpha} - w\frac{1-n}{n} - S(1+r) = w, \tag{3}$$

- Wages equal marginal product:

$$w = \alpha A\left(\frac{1-n}{n}\right)^{\alpha-1} \tag{4}$$

- Substitute (4) into (3):

$$A\left(\frac{1-n}{n}\right)^{\alpha} - \frac{\alpha}{n}A\left(\frac{1-n}{n}\right)^{\alpha-1} = S(1+r). \tag{5}$$

- Compare (5) with (2) to **see that** $n$ **equals** $n^*$.

# Imperfect Capital Markets: An Introduction

- **The problem of collateral and repayment**:

# Imperfect Capital Markets: An Introduction

- **The problem of collateral and repayment**:
  - Example:
  - My assets = 100,000; startup costs = 200,000.
  - Business hires 50 workers, pays them 5,000 each
  - Revenue = 500,000.
  - After one period, repay. Interest rate = 10%.
- **If default**, then:
  - Half profits seized plus expected jailtime worth 60,000.

# Imperfect Capital Markets: An Introduction

- To pay or not to pay?

| Items | Repay | Default |
|---|---|---|
| Principal & Interest | 220,000 | 0 |
| Collateral Credit | -110,000 | 0 |
| Jail | 0 | 60,000 |
| Seizure of Profits | 0 | 125,000 |
| Total/Net | 110,000 | 185,000 |

- **Repay** if wealth/collateral is 100,000.

# Imperfect Capital Markets: An Introduction

- To pay or not to pay?

| Items | Repay | Default |
|---|---|---|
| Principal & Interest | 220,000 | 0 |
| Collateral Credit | -22,000 | 0 |
| Jail | 0 | 60,000 |
| Seizure of Profits | 0 | 125,000 |
| Total/Net | 198,000 | 185,000 |

- **Default** if wealth/collateral is 20,000.
- Note: It is the same person in both cases!

# Imperfect Capital Markets: An Introduction

- More generally, let:

- (i) $W =$ wealth (ii) $S =$ setup cost (iii) $F =$ jail/fines (iv) $w =$ wage
  (v) $\ell =$ labor (vi) $r =$ interest rate (vii) $f(\ell) =$ produced output.

# Imperfect Capital Markets: An Introduction

- More generally, let:

- (i) $W =$ wealth (ii) $S =$ setup cost (iii) $F =$ jail/fines (iv) $w =$ wage (v) $\ell =$ labor (vi) $r =$ interest rate (vii) $f(\ell) =$ produced output.

- Then repay if

$$S(1+r) - W(1+r) \leq F + \lambda \left[ f(\ell) - w\ell \right],$$

# Imperfect Capital Markets: An Introduction

- More generally, let:

- (i) $W =$ wealth (ii) $S =$ setup cost (iii) $F =$ jail/fines (iv) $w =$ wage (v) $\ell =$ labor (vi) $r =$ interest rate (vii) $f(\ell) =$ produced output.

- Then repay if

$$S(1+r) - W(1+r) \leq F + \lambda \left[ f(\ell) - w\ell \right],$$

- or rearranging, if

$$W \geq S - \frac{F + \lambda \left[ f(\ell) - w\ell \right]}{1+r}$$

# Entrepreneurship with Imperfect Capital Markets

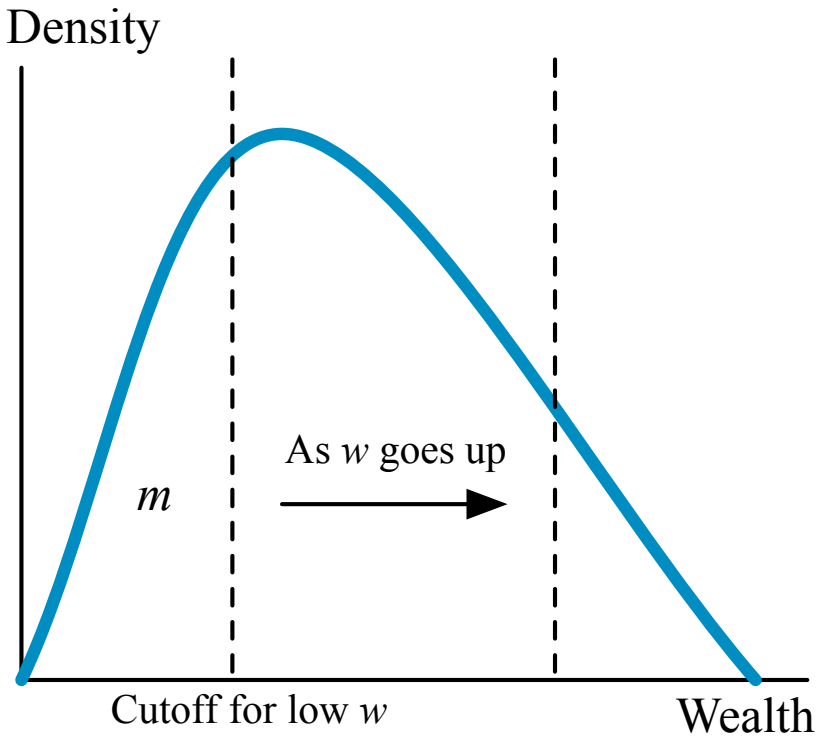
## Credit access determined by wage rate and wealth:

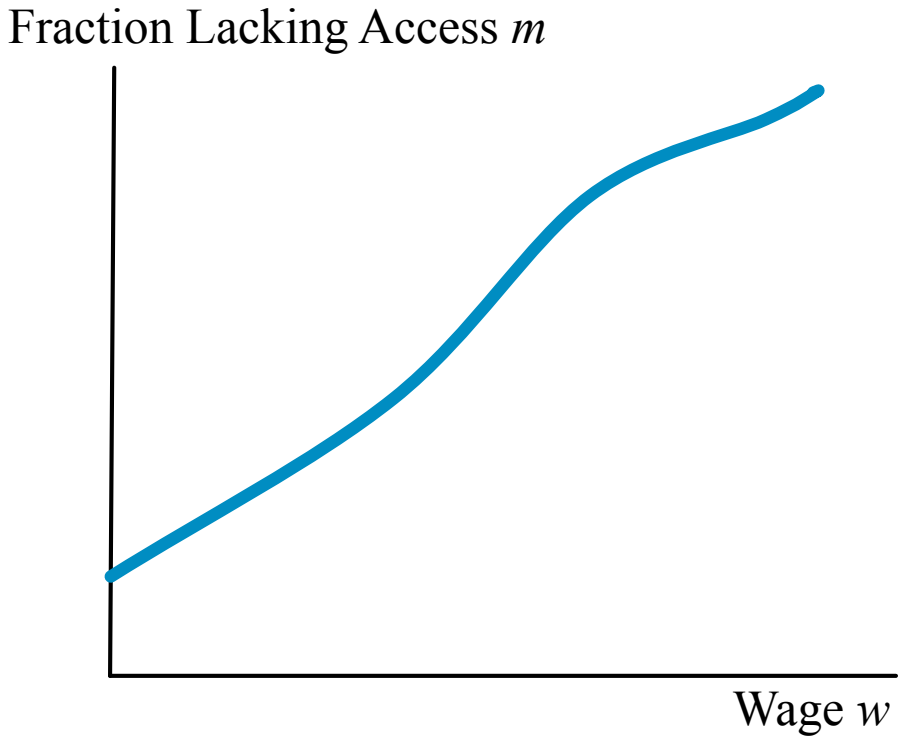
- Threshold defined by $W(w) = S - \dfrac{F + \lambda \{f(\ell) - w\ell\}}{1 + r}$.

# Entrepreneurship with Imperfect Capital Markets

## Credit access determined by wage rate and wealth:

- Threshold defined by $W(w) = S - \dfrac{F + \lambda\{f(\ell) - w\ell\}}{1 + r}$.



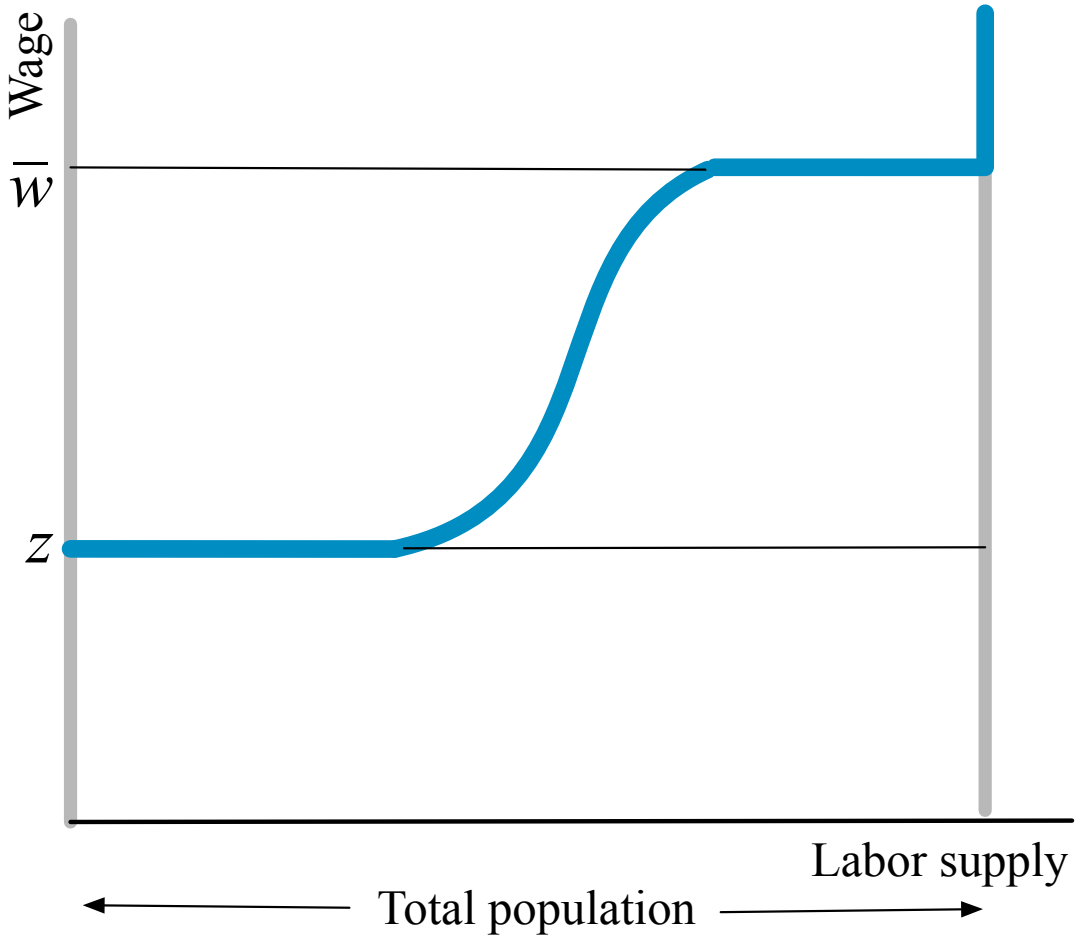



# Equilibrium Under Imperfect Credit Markets

- This generates supply and demand curves for labor:

# Equilibrium Under Imperfect Credit Markets

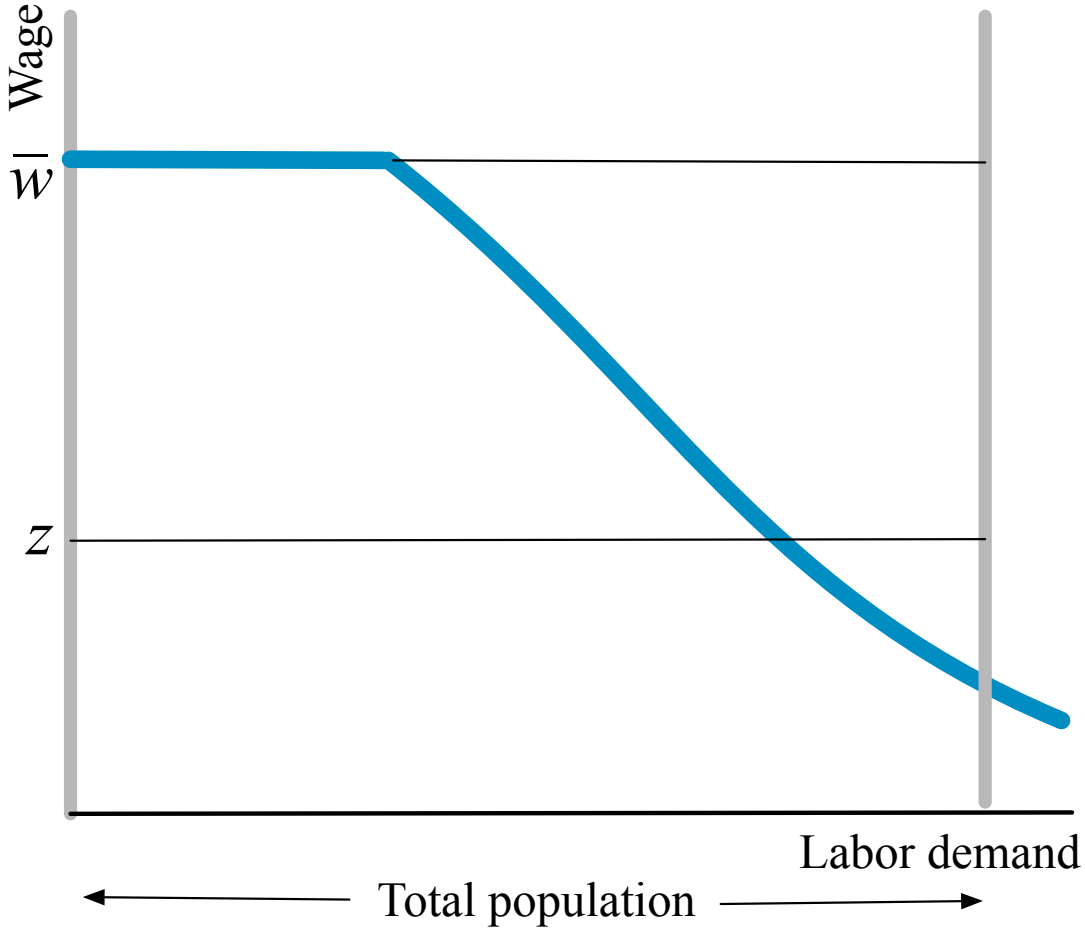
- **This generates supply and demand curves for labor:**




- $z =$ work subsistence; supply curve mirrors the “lack of access” diagram.

# Equilibrium Under Imperfect Credit Markets

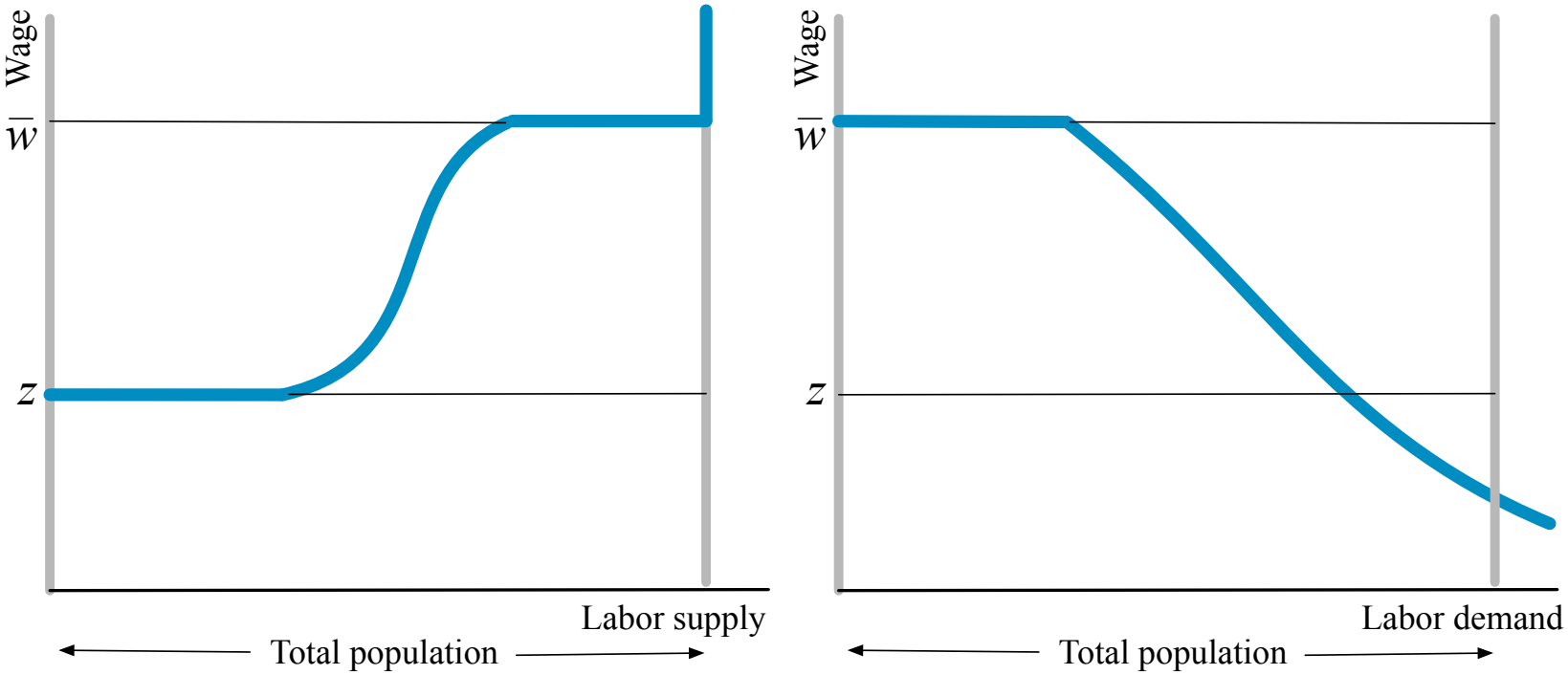
- **This generates supply and demand curves for labor:**




- Demand curve combines access and firm-level demand for labor.

# Equilibrium Under Imperfect Credit Markets

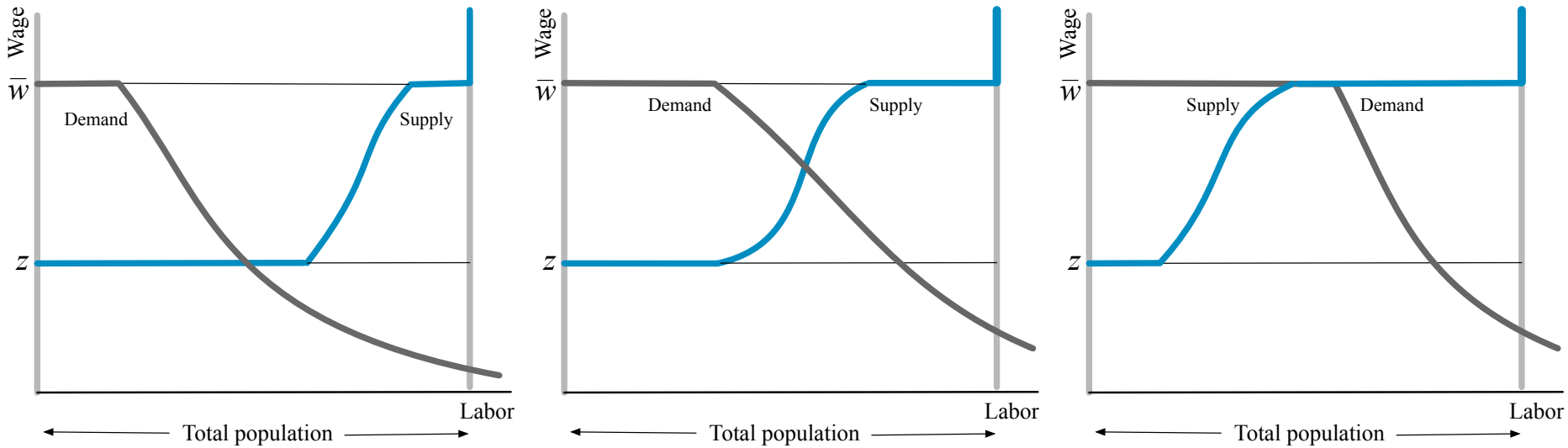
- **This generates supply and demand curves for labor:**




- Supply curve mirrors the “lack of access” diagram.
- Demand curve is “product” of access and firm demand for labor.

# Equilibrium Under Imperfect Credit Markets

- **Three regimes:**



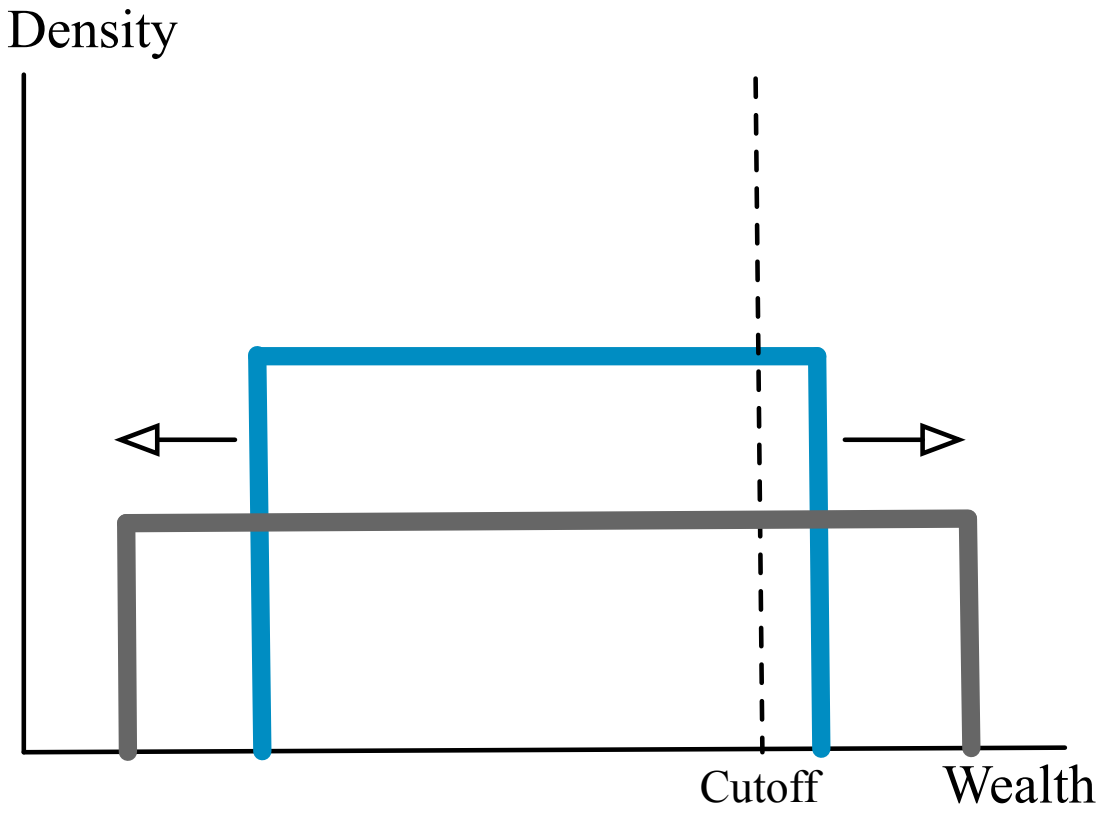

- **Inefficiency** in Panels A and B compared to the social planner's outcome.
- **Efficiency** in Panel C. (Always the solution with perfect capital markets.)

# Inequality and Inefficiency

- **Does inequality hinder efficiency or move the system towards it?**
  - It depends on how poor the economy is to begin with.

# Inequality and Inefficiency

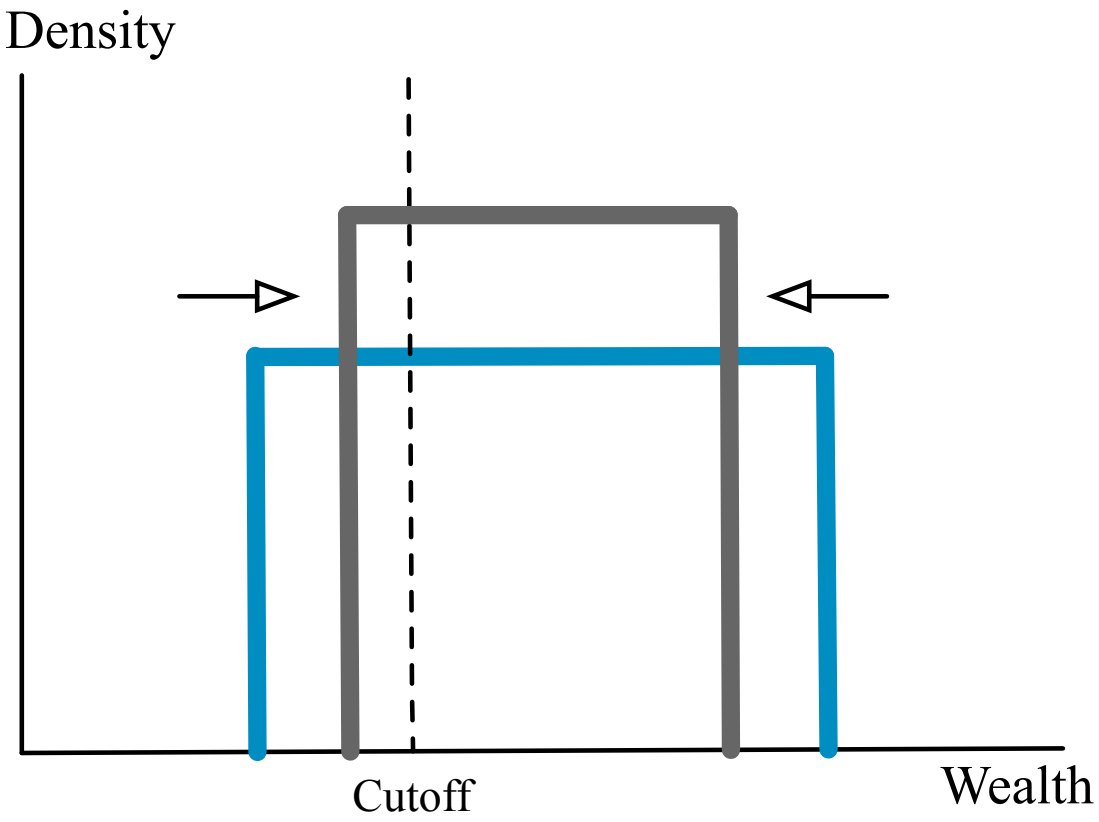
- **Does inequality hinder efficiency or move the system towards it?**
- It depends on how poor the economy is to begin with.




- Disequalization can help when average wealth levels are low relative to setup costs.

# Inequality and Inefficiency

- **Does inequality hinder efficiency or move the system towards it?**
- It depends on how poor the economy is to begin with.




- Equalization helps when average wealth levels are not so low relative to setup costs.

# Inequality and Development

- We studied a small set of topics on **inequality and development**
- Differential savings rates
- Differential access to occupations via imperfect capital markets

# Inequality and Development

- We studied a small set of topics on **inequality and development**
  - Differential savings rates
  - Differential access to occupations via imperfect capital markets
- **When markets are imperfect, inequality matters!**
  - In very poor societies, can create partial efficiency gains
  - In richer societies, causes efficiency losses
  - Traced to the imperfection of credit markets (our next topic).