Inequality and the Process of Development

Ömer Özak

Department of Economics
Southern Methodist University

Economic Growth and Comparative Development

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
  - Income Distribution $\not\Rightarrow$ Growth Process

The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
  - Income Distribution $\not\Rightarrow$ Growth Process

The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
  - Income Distribution $\not\Rightarrow$ Growth Process

The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
  - Income Distribution $\not\Rightarrow$ Growth Process

The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
  - Income Distribution $\not\Rightarrow$ Growth Process

The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution $\Rightarrow$ the growth process

- Unlike the Classical Perspective

  Underlined the adverse effect of Inequality on the growth process

The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution $\Rightarrow$ the growth process

- Unlike the Classical Perspective

  Underlined the adverse effect of Inequality on the growth process

The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution ⇒ the growth process

- Unlike the Classical Perspective

  Underlined the adverse effect of Inequality on the growth process

The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution $\Rightarrow$ the growth process

- Unlike the Classical Perspective

  Underlined the adverse effect of Inequality on the growth process

The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution $\Rightarrow$ the growth process

- Unlike the Classical Perspective

  Underlined the adverse effect of Inequality on the growth process

The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution $\Rightarrow$ the growth process

- Unlike the Classical Perspective

  Underlined the adverse effect of Inequality on the growth process

The Credit Market Imperfections Approach: Assumptions

Main assumptions:

- Credit market imperfections
  - Differences in the interest rates for borrowers and lenders

and either

- Fixed investment cost in education or in other individual-specific projects

or

- Saving and bequest rates are increasing function of wealth (Moav, (2002) Galor and Moav (2004))

The Credit Market Imperfections Approach: Assumptions

Main assumptions:

- Credit market imperfections
  - Differences in the interest rates for borrowers and lenders

and either

- Fixed investment cost in education or in other individual-specific projects

or

- Saving and bequest rates are increasing function of wealth (Moav, (2002) Galor and Moav (2004))

The Credit Market Imperfections Approach: Assumptions

Main assumptions:

- Credit market imperfections
  - Differences in the interest rates for borrowers and lenders

and either

- Fixed investment cost in education or in other individual-specific projects

or

- Saving and bequest rates are increasing function of wealth (Moav, (2002) Galor and Moav (2004))

The Credit Market Imperfections Approach: Assumptions

Main assumptions:

- Credit market imperfections
  - Differences in the interest rates for borrowers and lenders

and either

- Fixed investment cost in education or in other individual-specific projects

or

- Saving and bequest rates are increasing function of wealth (Moav, (2002) Galor and Moav (2004))

The Credit Market Imperfections Approach: Assumptions

Main assumptions:

- Credit market imperfections
  - Differences in the interest rates for borrowers and lenders

and either

- Fixed investment cost in education or in other individual-specific projects

or

- Saving and bequest rates are increasing function of wealth (Moav, (2002) Galor and Moav (2004))

The Credit Market Imperfections Approach: Mechanism

- Inequality affects occupational choices: skilled vs. unskilled workers or entrepreneurs vs. workers
  - Non-poor economies:
    - Inequality $\Longrightarrow$ under-investment in human capital (inv't projects) that is transmitted across generations $\Longrightarrow$ lower output growth in the short-run and in the long-run
  - Poor economies:
    - Inequality permits some investment in HC (inv't projects) and may thus promote output growth
- The human capital channel is consistent with evidence (Perotti (1996))

The Credit Market Imperfections Approach: Mechanism

- Inequality affects occupational choices: skilled vs. unskilled workers or entrepreneurs vs. workers
  - Non-poor economies:
    - Inequality $\Longrightarrow$ under-investment in human capital (inv't projects) that is transmitted across generations $\Longrightarrow$ lower output growth in the short-run and in the long-run
  - Poor economies:
    - Inequality permits some investment in HC (inv't projects) and may thus promote output growth
- The human capital channel is consistent with evidence (Perotti (1996))

The Credit Market Imperfections Approach: Mechanism

- Inequality affects occupational choices: skilled vs. unskilled workers or entrepreneurs vs. workers
  - Non-poor economies:
    - Inequality $\Longrightarrow$ under-investment in human capital (inv't projects) that is transmitted across generations $\Longrightarrow$ lower output growth in the short-run and in the long-run
  - Poor economies:
    - Inequality permits some investment in HC (inv't projects) and may thus promote output growth
- The human capital channel is consistent with evidence (Perotti (1996))

The Credit Market Imperfections Approach: Mechanism

- Inequality affects occupational choices: skilled vs. unskilled workers or entrepreneurs vs. workers
  - Non-poor economies:
    - Inequality $\Longrightarrow$ under-investment in human capital (inv't projects) that is transmitted across generations $\Longrightarrow$ lower output growth in the short-run and in the long-run
  - Poor economies:
    - Inequality permits some investment in HC (inv't projects) and may thus promote output growth
- The human capital channel is consistent with evidence (Perotti (1996))

The Credit Market Imperfections Approach: Mechanism

- Inequality affects occupational choices: skilled vs. unskilled workers or entrepreneurs vs. workers
  - Non-poor economies:
    - Inequality $\Longrightarrow$ under-investment in human capital (inv't projects) that is transmitted across generations $\Longrightarrow$ lower output growth in the short-run and in the long-run
  - Poor economies:
    - Inequality permits some investment in HC (inv't projects) and may thus promote output growth
- The human capital channel is consistent with evidence (Perotti (1996))

The Political Economy Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ political pressure for redistribution
  - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (1994) Persson and Tebelini (1994)

- This channel is inconsistent with evidence (Perotti (1996))

The Political Economy Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
    - Inequality $\Longrightarrow$ political pressure for redistribution
    - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (1994) Persson and Tebelini (1994)

- This channel is inconsistent with evidence (Perotti (1996))

The Political Economy Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ political pressure for redistribution
  - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (1994) Persson and Tebelini (1994)

- This channel is inconsistent with evidence (Perotti (1996))

The Political Economy Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ political pressure for redistribution
  - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (1994) Persson and Tebelini (1994)

- This channel is inconsistent with evidence (Perotti (1996))

The Political Economy Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ political pressure for redistribution
  - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (1994) Persson and Tebelini (1994)

- This channel is inconsistent with evidence (Perotti (1996))

The Political Economy Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
    - Inequality $\Longrightarrow$ political pressure for redistribution
    - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (1994) Persson and Tebelini (1994)

- This channel is inconsistent with evidence (Perotti (1996))

The Political Economy Approach: An Alternative Channel

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ incentive for better endowed agents (landowners) to block redistribution
  - Efficient redistribution policies are not implemented

Benabou, (2000), Galor-Moav-Vollrath (2009)

The Political Economy Approach: An Alternative Channel

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ incentive for better endowed agents (landowners) to block redistribution
  - Efficient redistribution policies are not implemented

Benabou, (2000), Galor-Moav-Vollrath (2009)

The Political Economy Approach: An Alternative Channel

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ incentive for better endowed agents (landowners) to block redistribution
  - Efficient redistribution policies are not implemented

Benabou, (2000), Galor-Moav-Vollrath (2009)

The Political Economy Approach: An Alternative Channel

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ incentive for better endowed agents (landowners) to block redistribution
  - Efficient redistribution policies are not implemented

Benabou, (2000), Galor-Moav-Vollrath (2009)

The Socio-Political Instability Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Socio-Political instability
  - Socio-Political instability $\Longrightarrow$ reduces the security of property rights $\Longrightarrow$ lower investment and slower economic growth (Alesina and Perotti (1996))
- This channel is consistent with evidence (Perotti (1996))

The Socio-Political Instability Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Socio-Political instability
  - Socio-Political instability $\Longrightarrow$ reduces the security of property rights $\Longrightarrow$ lower investment and slower economic growth (Alesina and Perotti (1996))
- This channel is consistent with evidence (Perotti (1996))

The Socio-Political Instability Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Socio-Political instability
  - Socio-Political instability $\Longrightarrow$ reduces the security of property rights $\Longrightarrow$ lower investment and slower economic growth (Alesina and Perotti (1996))
- This channel is consistent with evidence (Perotti (1996))

The Socio-Political Instability Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Socio-Political instability
  - Socio-Political instability $\Longrightarrow$ reduces the security of property rights $\Longrightarrow$ lower investment and slower economic growth (Alesina and Perotti (1996))
- This channel is consistent with evidence (Perotti (1996))

The Socio-Political Instability Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Socio-Political instability
  - Socio-Political instability $\Longrightarrow$ reduces the security of property rights $\Longrightarrow$ lower investment and slower economic growth (Alesina and Perotti (1996))
- This channel is consistent with evidence (Perotti (1996))

The Socio-Political Instability Approach

Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Socio-Political instability
  - Socio-Political instability $\Longrightarrow$ reduces the security of property rights $\Longrightarrow$ lower investment and slower economic growth (Alesina and Perotti (1996))
- This channel is consistent with evidence (Perotti (1996))

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

$\Longrightarrow$ slows the growth process

A unified theory of inequality and economic development

Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

A unified theory of inequality and economic development

Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

A unified theory of inequality and economic development

Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

A unified theory of inequality and economic development

Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

A unified theory of inequality and economic development

Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition
  (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

A unified theory of inequality and economic development

Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition

  (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process
- Places the dominating modern theories within a broader unified structure
- Provides an intertemporal reconciliation between the Classical viewpoint and the Modern perspective

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process
- Places the dominating modern theories within a broader unified structure
- Provides an intertemporal reconciliation between the Classical viewpoint and the Modern perspective

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process
- Places the dominating modern theories within a broader unified structure
- Provides an intertemporal reconciliation between the Classical viewpoint and the Modern perspective

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process
- Places the dominating modern theories within a broader unified structure
- Provides an intertemporal reconciliation between the Classical viewpoint and the Modern perspective

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Central Argument

Fundamental asymmetry between:

- Human capital accumulation
- Physical capital accumulation

Central Argument

Fundamental asymmetry between:

- Human capital accumulation
- Physical capital accumulation

Central Argument

Fundamental asymmetry between:

- Human capital accumulation
- Physical capital accumulation

Central Argument

Fundamental asymmetry between:

- Human capital accumulation
- Physical capital accumulation

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Inequality and Physical and Human Capital Accumulation

- **Inequality** is conducive for **physical capital** accumulation, as long as the marginal propensity to save rises with income
- **Inequality** is harmful for **human capital** accumulation, as long as credit constraints are binding

Inequality and Physical and Human Capital Accumulation

- **Inequality** is conducive for **physical capital** accumulation, as long as the marginal propensity to save rises with income
- **Inequality** is harmful for **human capital** accumulation, as long as credit constraints are binding

Inequality and Physical and Human Capital Accumulation

- **Inequality** is conducive for **physical capital** accumulation, as long as the marginal propensity to save rises with income
- **Inequality** is harmful for **human capital** accumulation, as long as credit constraints are binding

Inequality and Growth in Different Stages of Development

- **Inequality** stimulates economic growth in stages of development in which **physical capital** accumulation is the prime engine of growth
- **Inequality** is harmful for economic growth in stages of development in which **human capital** accumulation is the prime engine of economic growth and credit constraints are still binding

Inequality and Growth in Different Stages of Development

- **Inequality** stimulates economic growth in stages of development in which **physical capital** accumulation is the prime engine of growth
- **Inequality** is harmful for economic growth in stages of development in which **human capital** accumulation is the prime engine of economic growth and credit constraints are still binding

Inequality and Growth in Different Stages of Development

- **Inequality** stimulates economic growth in stages of development in which **physical capital** accumulation is the prime engine of growth
- **Inequality** is harmful for economic growth in stages of development in which **human capital** accumulation is the prime engine of economic growth and credit constraints are still binding

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, \ldots$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, \ldots$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, \ldots$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

Production

Total output produced

$$Y_t = Y_t^s + Y_t^u$$

- Production in the skilled-intensive sector:

$$Y_t^s = F(K_t, L_t^s) \equiv L_t^s f(k_t); \qquad k_t \equiv K_t / L_t^s$$

- Production in the unskilled-intensive sector:

$$Y_t^u = aL_t^u$$

Production

Total output produced

$$Y_t = Y_t^s + Y_t^u$$

- Production in the skilled-intensive sector:

$$Y_t^s = F(K_t, L_t^s) \equiv L_t^s f(k_t); \qquad k_t \equiv K_t / L_t^s$$

- Production in the unskilled-intensive sector:

$$Y_t^u = aL_t^u$$

Production

Total output produced

$$Y_t = Y_t^s + Y_t^u$$

- Production in the skilled-intensive sector:

$$Y_t^s = F(K_t, L_t^s) \equiv L_t^s f(k_t); \qquad k_t \equiv K_t / L_t^s$$

- Production in the unskilled-intensive sector:

$$Y_t^u = aL_t^u$$

Production

Total output produced

$$Y_t = Y_t^s + Y_t^u$$

- Production in the skilled-intensive sector:

$$Y_t^s = F(K_t, L_t^s) \equiv L_t^s f(k_t); \qquad k_t \equiv K_t / L_t^s$$

- Production in the unskilled-intensive sector:

$$Y_t^u = aL_t^u$$

Inverse Demand for Factors

- Capital:

$$r_t = f'(k_t) \equiv r(k_t)$$

- Skilled labor:

$$w_t^s = f(k_t) - f'(k_t)k_t \equiv w^s(k_t)$$

- Unskilled labor:

$$w_t^u = a \equiv w^u$$

Inverse Demand for Factors

- Capital:

$$r_t = f'(k_t) \equiv r(k_t)$$

- Skilled labor:

$$w_t^s = f(k_t) - f'(k_t)k_t \equiv w^s(k_t)$$

- Unskilled labor:

$$w_t^u = a \equiv w^u$$

Inverse Demand for Factors

- Capital:

$$r_t = f'(k_t) \equiv r(k_t)$$

- Skilled labor:

$$w_t^s = f(k_t) - f'(k_t)k_t \equiv w^s(k_t)$$

- Unskilled labor:

$$w_t^u = a \equiv w^u$$

Factor Prices

- Small open economy
- World interest $= r$

$$\Longrightarrow$$

$$\begin{aligned} r_t &= r \\ k_t &= f'^{-1}(r) \equiv k \\ w_t^s &= w^s(k) \equiv w^s \end{aligned}$$

$$\Longrightarrow$$

$$(r_t, w_t^s, w_t^u) = (r, w^s, w^u) \qquad \forall t$$

Factor Prices

- Small open economy
- World interest $= r$

$$\Longrightarrow$$

$$\begin{aligned} r_t &= r \\ k_t &= f'^{-1}(r) \equiv k \\ w_t^s &= w^s(k) \equiv w^s \end{aligned}$$

$$\Longrightarrow$$

$$(r_t, w_t^s, w_t^u) = (r, w^s, w^u) \qquad \forall t$$

Factor Prices

- Small open economy
- World interest $= r$

$$\Longrightarrow$$

$$\begin{aligned} r_t &= r \\ k_t &= f'^{-1}(r) \equiv k \\ w_t^s &= w^s(k) \equiv w^s \end{aligned}$$

$$\Longrightarrow$$

$$(r_t, w_t^s, w_t^u) = (r, w^s, w^u) \qquad \forall t$$

Factor Prices

- Small open economy
- World interest $= r$

$$\Longrightarrow$$

$$\begin{aligned} r_t &= r \\ k_t &= f'^{-1}(r) \equiv k \\ w_t^s &= w^s(k) \equiv w^s \end{aligned}$$

$$\Longrightarrow$$

$$(r_t, w_t^s, w_t^u) = (r, w^s, w^u) \qquad \forall t$$

Individuals

- Continuum of measure 1
- Each Individual has 1 parent and 1 child
- Identical in:
    - Preferences
    - Innate abilities
- Differ in:
    - Parental income $\Rightarrow$ Inv't in HC

Individuals

- Continuum of measure 1
- Each Individual has 1 parent and 1 child
- Identical in:

    Preferences

    Innate abilities

- Differ in:

    Parental income $\Rightarrow$ Inv't in HC

Individuals

- Continuum of measure 1
- Each Individual has 1 parent and 1 child
- Identical in:
  - Preferences
  - Innate abilities
- Differ in:
  - Parental income $\Rightarrow$ Inv't in HC

Individuals

- Continuum of measure 1
- Each Individual has 1 parent and 1 child
- Identical in:

  Preferences

  Innate abilities

- Differ in:

  Parental income $\Rightarrow$ Inv't in HC

Individuals

- Continuum of measure 1
- Each Individual has 1 parent and 1 child
- Identical in:

  Preferences

  Innate abilities

- Differ in:

  Parental income $\Rightarrow$ Inv't in HC

Member of Generation t: Period of Life

- First period of life (Period t):
  - [invest in HC] or [work as unskilled]
- Second period of life (Period $t+1$):
  - [work as unskilled / no inv't in HC] or [work as skilled / inv't in HC in 1st period]

Member of Generation t: Period of Life

- First period of life (Period t):
  - [invest in HC] or [work as unskilled]
- Second period of life (Period $t+1$):
  - [work as unskilled / no inv't in HC] or [work as skilled / inv't in HC in 1st period]

Member of Generation t: Period of Life

- First period of life (Period t):
  - [invest in HC] or [work as unskilled]
- Second period of life (Period $t+1$):
  - [work as unskilled / no inv't in HC] or [work as skilled / inv't in HC in 1st period]

Member of Generation t: Endowment and Preferences

- Time endowment:
  - 1 units of time in each period
- Capital endowment:
  - $b_t \equiv$ capital inherited in 1^{st} period
- Preferences:

$$u^t = \alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1} \qquad \alpha \in (0,1)$$

Member of Generation t: Endowment and Preferences

- Time endowment:
  - 1 units of time in each period
- Capital endowment:
  - $b_t \equiv$ capital inherited in 1^{st} period
- Preferences:

$$u^t = \alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1} \qquad \alpha \in (0,1)$$

Member of Generation t: Endowment and Preferences

- Time endowment:
  - 1 units of time in each period
- Capital endowment:
  - $b_t \equiv$ capital inherited in 1^{st} period
- Preferences:

$$u^t = \alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1} \qquad \alpha \in (0,1)$$

Member of Generation t: Endowment and Preferences

- Time endowment:
  - 1 units of time in each period
- Capital endowment:
  - $b_t \equiv$ capital inherited in 1^{st} period
- Preferences:

$$u^t = \alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1} \qquad \alpha \in (0,1)$$

Member of Generation t: Budget Constraint

Second period budget constraint:

$$c_{t+1} + b_{t+1} \leq \omega_{t+1}$$

$c_{t+1} \equiv$ consumption

$b_{t+1} \equiv$ transfers to offspring

$\omega_{t+1} \equiv$ wealth in period $t+1$

Member of Generation t: Budget Constraint

Second period budget constraint:

$$c_{t+1} + b_{t+1} \leq \omega_{t+1}$$

$c_{t+1} \equiv$ consumption

$b_{t+1} \equiv$ transfers to offspring

$\omega_{t+1} \equiv$ wealth in period $t+1$

Member of Generation t: Budget Constraint

Second period budget constraint:

$$c_{t+1} + b_{t+1} \leq \omega_{t+1}$$

$c_{t+1} \equiv$ consumption

$b_{t+1} \equiv$ transfers to offspring

$\omega_{t+1} \equiv$ wealth in period $t+1$

Member of Generation t: Budget Constraint

Second period budget constraint:

$$c_{t+1} + b_{t+1} \leq \omega_{t+1}$$

$$\begin{aligned} c_{t+1} &\equiv \text{consumption} \\ b_{t+1} &\equiv \text{transfers to offspring} \\ \omega_{t+1} &\equiv \text{wealth in period } t+1 \end{aligned}$$

Member of Generation t: Optimization

$$\{c_{t+1}, b_{t+1}\} = \arg\max[\alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1}]$$

$$\text{s.t.} \quad c_{t+1} + b_{t+1} \leq \omega_{t+1}$$

Member of Generation t: Optimization

$$b_{t+1} = (1-\alpha)\omega_{t+1}$$

$$c_{t+1} = \alpha\omega_{t+1}$$

Indirect Utility: $\implies$

$$\begin{aligned} v^t &= \alpha \ln \alpha\omega_{t+1} + (1-\alpha)\ln \omega_{t+1} \\ &= [\alpha \ln \alpha + (1-\alpha)\ln(1-\alpha)] + \ln \omega_{t+1} \end{aligned}$$

$\implies$ v^t is monotonic increasing in 2nd period wealth, ω_{t+1}

$\implies$ maximization of ω_{t+1}, is the basis of occupational choices

Member of Generation t: Optimization

$$b_{t+1} = (1-\alpha)\omega_{t+1}$$

$$c_{t+1} = \alpha\omega_{t+1}$$

Indirect Utility: $\Longrightarrow$

$$v^t = \alpha \ln \alpha\omega_{t+1} + (1-\alpha)\ln \omega_{t+1}$$

$$= [\alpha \ln \alpha + (1-\alpha)\ln(1-\alpha)] + \ln \omega_{t+1}$$

$\Longrightarrow$ v^t is monotonic increasing in 2nd period wealth, ω_{t+1}

$\Longrightarrow$ maximization of ω_{t+1}, is the basis of occupational choices

Member of Generation t: Optimization

$$b_{t+1} = (1-\alpha)\omega_{t+1}$$

$$c_{t+1} = \alpha\omega_{t+1}$$

Indirect Utility: $\Longrightarrow$

$$v^t = \alpha \ln \alpha\omega_{t+1} + (1-\alpha)\ln \omega_{t+1}$$

$$= [\alpha \ln \alpha + (1-\alpha)\ln(1-\alpha)] + \ln \omega_{t+1}$$

$\Longrightarrow$ v^t is monotonic increasing in 2nd period wealth, ω_{t+1}

$\Longrightarrow$ maximization of ω_{t+1}, is the basis of occupational choices

Member of Generation t: Optimization

$$b_{t+1} = (1-\alpha)\omega_{t+1}$$

$$c_{t+1} = \alpha\omega_{t+1}$$

Indirect Utility: $\Longrightarrow$

$$\begin{aligned} v^t &= \alpha \ln \alpha\omega_{t+1} + (1-\alpha) \ln \omega_{t+1} \\ &= [\alpha \ln \alpha + (1-\alpha) \ln(1-\alpha)] + \ln \omega_{t+1} \end{aligned}$$

$\Longrightarrow$ v^t is monotonic increasing in 2nd period wealth, ω_{t+1}

$\Longrightarrow$ maximization of ω_{t+1}, is the basis of occupational choices

Member of Generation t: Optimization

$$b_{t+1} = (1-\alpha)\omega_{t+1}$$

$$c_{t+1} = \alpha\omega_{t+1}$$

Indirect Utility: $\Longrightarrow$

$$\begin{aligned} v^t &= \alpha \ln \alpha\omega_{t+1} + (1-\alpha) \ln \omega_{t+1} \\ &= [\alpha \ln \alpha + (1-\alpha) \ln(1-\alpha)] + \ln \omega_{t+1} \end{aligned}$$

$\Longrightarrow$ v^t is monotonic increasing in 2nd period wealth, ω_{t+1}

$\Longrightarrow$ maximization of ω_{t+1}, is the basis of occupational choices

Fundamental Assumptions

- Imperfect Capital Markets:

$$r < i \tag{A1}$$

$$r \equiv \text{interest rate for lender}$$
$$i \equiv \text{interest rate for borrowers (for inv't in HC)}$$

- Fixed cost of education (Indivisibility of inv't in HC) Weighted average of the payments to teachers, administrators, and maintenance workers in the school system (i.e., weighted average of the wages skilled and unskilled workers):

$$C^H = \theta w^s + (1-\theta) w^u \equiv h > 0 \qquad \theta \in [0,1] \tag{A2}$$

Fundamental Assumptions

- Imperfect Capital Markets:

$$r < i \tag{A1}$$

$$r \equiv \text{interest rate for lender}$$
$$i \equiv \text{interest rate for borrowers (for inv't in HC)}$$

- Fixed cost of education (Indivisibility of inv't in HC) Weighted average of the payments to teachers, administrators, and maintenance workers in the school system (i.e., weighted average of the wages skilled and unskilled workers):

$$C^H = \theta w^s + (1-\theta)w^u \equiv h > 0 \qquad \theta \in [0,1] \tag{A2}$$

Income: Unskilled Individuals

$$\omega_{t+1}^u = (w^u + b_t)(1+r) + w^u$$
$$= w^u(2+r) + (1+r)b_t$$

Income: Unskilled Individuals

$$\omega^u_{t+1} = (w^u + b_t)(1+r) + w^u$$

$$= w^u(2+r) + (1+r)b_t$$

Income: Unskilled Individuals

$$
\begin{aligned}
\omega_{t+1}^{u} &= (w^{u} + b_t)(1 + r) + w^{u} \\
&= w^{u}(2 + r) + (1 + r)b_t
\end{aligned}
$$

Income: Skilled Individuals

$$\omega^s_{t+1} = \begin{cases} w^s - (h - b_t)(1+i) & \text{if} \quad b_t \leq h \\ w^s + (b_t - h)(1+r) & \text{if} \quad b_t \geq h \end{cases}$$

$\Longrightarrow$

$$\omega^s_{t+1} = \begin{cases} w^s - (1+i)h + (1+i)b_t & \text{if} \quad b_t \leq h \\ w^s - (1+r)h + (1+r)b_t & \text{if} \quad b_t \geq h \end{cases}$$

Income: Skilled Individuals

$$\omega_{t+1}^{s} = \begin{cases} w^{s} - (h - b_t)(1+i) & \text{if} \quad b_t \leq h \\ w^{s} + (b_t - h)(1+r) & \text{if} \quad b_t \geq h \end{cases}$$

$\Longrightarrow$

$$\omega_{t+1}^{s} = \begin{cases} w^{s} - (1+i)h + (1+i)b_t & \text{if} \quad b_t \leq h \\ w^{s} - (1+r)h + (1+r)b_t & \text{if} \quad b_t \geq h \end{cases}$$

Assumptions

- Investment in human capital is *not* beneficial for individuals who must finance the entire cost of education via borrowing

$$w^s - (1+i)h < 0 \tag{A3}$$

- Investment in human capital is beneficial for individuals who can finance the entire cost of education *without* borrowing

$$w^s - (1+r)h > w^u(2+r) \tag{A4}$$

Assumptions

- Investment in human capital is *not* beneficial for individuals who must finance the entire cost of education via borrowing

$$w^s - (1+i)h < 0 \tag{A3}$$

- Investment in human capital is beneficial for individuals who can finance the entire cost of education *without* borrowing

$$w^s - (1+r)h > w^u(2+r) \tag{A4}$$

Income from Being Unskilled Worker

Income from Being Unskilled Worker

Income from Being Skilled Worker: Borrowers

Income from Being Skilled Worker: Borrowers

Income from Being Skilled Worker: Borrowers

Income from Being Skilled Worker: Borrowers

Income from Being Skilled Worker: Lenders

Bequest and Occupational Choice

Bequest and Occupational Choice

Bequest and Occupational Choice

$$b_t \quad \begin{cases} < f & \rightarrow x^u_{t+1} > x^s_{t+1} \text{ (individual } t \text{ becomes unskilled)} \\ > f & \rightarrow x^u_{t+1} < x^s_{t+1} \text{ (individual } t \text{ becomes skilled)} \end{cases}$$

where

$$f = \frac{w^u(2+r) - [w^s - (1+i)h]}{i-r} > 0$$

Bequest and Occupational Choice

$$b_t \quad \begin{cases} < f & \rightarrow x^u_{t+1} > x^s_{t+1} \text{ (individual } t \text{ becomes unskilled)} \\ > f & \rightarrow x^u_{t+1} < x^s_{t+1} \text{ (individual } t \text{ becomes skilled)} \end{cases}$$

where

$$f = \frac{w^u(2+r) - [w^s - (1+i)h]}{i-r} > 0$$

Bequest Dynamics

$$b_{t+1} = (1-\alpha)x_{t+1}$$

$$b_{t+1} = \begin{cases} (1-\alpha)[w^u(2+r) + (1+r)b_t] & b_t \in [0, f] \\ (1-\alpha)[w^s - (1+i)h + (1+i)b_t] & b_t \in [f, h] \\ (1-\alpha)[w^s - (1+r)h + (1+r)b_t] & b_t \in [h, \infty] \end{cases}$$

Bequest Dynamics

$$b_{t+1} = (1-\alpha)x_{t+1}$$

$$b_{t+1} = \begin{cases} (1-\alpha)[w^u(2+r) + (1+r)b_t] & b_t \in [0, f] \\ (1-\alpha)[w^s - (1+i)h + (1+i)b_t] & b_t \in [f, h] \\ (1-\alpha)[w^s - (1+r)h + (1+r)b_t] & b_t \in [h, \infty] \end{cases}$$

Bequest Dynamics: Sufficiet Conditions for Multiplicity of Steady-Sate

$$\begin{aligned}(1-\alpha)(1+r) &< 1 \\ (1-\alpha)(1+i) &> 1\end{aligned} \tag{A5}$$

$$(1-\alpha)w^s > h \tag{A6}$$

Bequest Dynamics

Bequest Dynamics: Multiple Steady-State Equilibrium

Bequest Dynamics: Stability of High Bequest Equilibrium

Bequest Dynamics: Stability of Steady- State Equilibria

The Distribution of the Inheritance in Period t

Income Distribution and the Long Run Decomposition of the Labor Force

$\xi_t(b_t) \equiv$ Distribution of inheritance at time t

$\Longrightarrow$

$$L_t = \int_0^\infty \xi(b_t) db_t \equiv 1$$

The Distribution of the Inheritance in Period t

Income Distribution of the Long Run Decomposition of the Labor Force

$$\lim_{t\to\infty} l_t^u = \int_0^g \xi_t(b_t)db_t \equiv \bar{l}^u$$

$$\lim_{t\to\infty} l_t^s = \int_g^\infty \xi_t(b_t)db_t \equiv \bar{l}^s$$

where

$$\partial \bar{l}^s / \partial g < 0$$

and

$$g = \frac{(1-\alpha)[(1+i)h - w^s]}{(1-\alpha)(1+i) - 1} > 0$$

Income Distribution of the Long Run Decomposition of the Labor Force

$$\lim_{t\to\infty} l_t^u = \int_0^g \xi_t(b_t)db_t \equiv \bar{l}^u$$

$$\lim_{t\to\infty} l_t^s = \int_g^\infty \xi_t(b_t)db_t \equiv \bar{l}^s$$

where

$$\partial\bar{l}^s/\partial g < 0$$

and

$$g = \frac{(1-\alpha)[(1+i)h - w^s]}{(1-\alpha)(1+i)-1} > 0$$

Income Distribution of the Long Run Decomposition of the Labor Force

$$\lim_{t\to\infty} l_t^u = \int_0^g \xi_t(b_t)db_t \equiv \bar{l}^u$$

$$\lim_{t\to\infty} l_t^s = \int_g^\infty \xi_t(b_t)db_t \equiv \bar{l}^s$$

where

$$\partial \bar{l}^s / \partial g < 0$$

and

$$g = \frac{(1-\alpha)[(1+i)h - w^s]}{(1-\alpha)(1+i) - 1} > 0$$

Income Distribution of Skill Composition

Income Distribution of Skill Composition

Income Per Capita in the Long Run

- Income of a skilled individual in the second period of life (wage and capital income)

$$I_2^s = w^s + (\bar{b}^s - h)r$$

- Income of an unskilled individual in the second period of life (wage and capital income)

$$I_2^u = w^u + (\bar{b}^u + w^u)r$$

- Income of an unskilled individual in the first period of life (only wage income)

$$I_1^u = w^u$$

Income Per Capita in the Long Run

- Income of a skilled individual in the second period of life (wage and capital income)

$$I_2^s = w^s + (\bar{b}^s - h)r$$

- Income of an unskilled individual in the second period of life (wage and capital income)

$$I_2^u = w^u + (\bar{b}^u + w^u)r$$

- Income of an unskilled individual in the first period of life (only wage income)

$$I_1^u = w^u$$

Income Per Capita in the Long Run

- Income of a skilled individual in the second period of life (wage and capital income)

$$I_2^s = w^s + (\bar{b}^s - h)r$$

- Income of an unskilled individual in the second period of life (wage and capital income)

$$I_2^u = w^u + (\bar{b}^u + w^u)r$$

- Income of an unskilled individual in the first period of life (only wage income)

$$I_1^u = w^u$$

Income Per Capita in the Long Run

- Aggregate income in the steady-state

$$\bar{Y} = I_2^s \bar{I}^s + I_2^u \bar{I}^u + I_1^u \bar{I}^u$$

- Aggregate income (note: $\bar{l}^s + \bar{l}^u = 1$)

$$\begin{aligned} Y &= [w^s - rh + r\bar{b}^s]\bar{l}^s + [w^u(2+r) + r\bar{b}^u](1 - \bar{l}^s) \\ &= w^u(2+r) + r\bar{b}^u + [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]\bar{l}^s \end{aligned}$$

- Income per capita

$$\bar{y} = \bar{Y}/2$$

Income Per Capita in the Long Run

- Aggregate income in the steady-state

$$\bar{Y} = l_2^s \bar{I}^s + l_2^u \bar{I}^u + l_1^u \bar{I}^u$$

- Aggregate income (note: $\bar{l}^s + \bar{l}^u = 1$)

$$\begin{aligned} Y &= [w^s - rh + r\bar{b}^s]\bar{l}^s + [w^u(2+r) + r\bar{b}^u](1-\bar{l}^s) \\ &= w^u(2+r) + r\bar{b}^u + [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]\bar{l}^s \end{aligned}$$

- Income per capita

$$\bar{y} = \bar{Y}/2$$

Income Per Capita in the Long Run

- Aggregate income in the steady-state

$$\bar{Y} = I_2^s \bar{l}^s + I_2^u \bar{l}^u + I_1^u \bar{l}^u$$

- Aggregate income (note: $\bar{l}^s + \bar{l}^u = 1$)

$$\begin{aligned} Y &= [w^s - rh + r\bar{b}^s]\bar{l}^s + [w^u(2+r) + r\bar{b}^u](1 - \bar{l}^s) \\ &= w^u(2+r) + r\bar{b}^u + [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]\bar{l}^s \end{aligned}$$

- Income per capita

$$\bar{y} = \bar{Y}/2$$

Skill Composition and Income Per Capita in the Long Run

- An increase in the fraction of skilled workers increases income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial \bar{l}^s} = [(w^s - rh) - w^u(2 + r) + (\bar{b}^s - \bar{b}^u)]/2 > 0$$

since

$$w^s - (1 + r)h > w^u(2 + r)$$

$$\bar{b}^s > \bar{b}^u$$

- An increase in g reduces income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial g} = \frac{\partial \bar{y}}{\partial \bar{l}^s} \frac{\partial \bar{l}^s}{\partial g} < 0$$

Skill Composition and Income Per Capita in the Long Run

- An increase in the fraction of skilled workers increases income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial \bar{l}^s} = [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]/2 > 0$$

since

$$w^s - (1+r)h > w^u(2+r)$$

$$\bar{b}^s > \bar{b}^u$$

- An increase in g reduces income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial g} = \frac{\partial \bar{y}}{\partial \bar{l}^s}\frac{\partial \bar{l}^s}{\partial g} < 0$$

Skill Composition and Income Per Capita in the Long Run

- An increase in the fraction of skilled workers increases income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial \bar{l}^s} = [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]/2 > 0$$

since

$$w^s - (1+r)h > w^u(2+r)$$

$$\bar{b}^s > \bar{b}^u$$

- An increase in g reduces income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial g} = \frac{\partial \bar{y}}{\partial \bar{l}^s}\frac{\partial \bar{l}^s}{\partial g} < 0$$

Inequality and Development: Rich Economies

Rich Economies: Inequality is Harmful for Development

Inequality reduces human capital formation

Rich Economies: Inequality is Harmful for Development

Rich Economies: Inequality is Harmful for Development

Inequality and Development: Poor Economies

Poor Economies: Inequality may Benefit Development

Inequality stimulates human capital formation

Poor Economies: Inequality may Benefit Development

Robustness

The qualitative results are robust to:

- Education cost that is indexed to wages
- Labor augmenting technical change
- Shocks the outcome of investment in human capital, as long as wages are endogenous
- Concave production function of human capital (Moav (EL, 2002), Galor-Moav (RES, 2004))

Robustness

The qualitative results are robust to:

- Education cost that is indexed to wages
- Labor augmenting technical change
- Shocks the outcome of investment in human capital, as long as wages are endogenous
- Concave production function of human capital (Moav (EL, 2002), Galor-Moav (RES, 2004))

Robustness

The qualitative results are robust to:

- Education cost that is indexed to wages
- Labor augmenting technical change
- Shocks the outcome of investment in human capital, as long as wages are endogenous
- Concave production function of human capital (Moav (EL, 2002), Galor-Moav (RES, 2004))

Robustness

The qualitative results are robust to:

- Education cost that is indexed to wages
- Labor augmenting technical change
- Shocks the outcome of investment in human capital, as long as wages are endogenous
- Concave production function of human capital (Moav (EL, 2002), Galor-Moav (RES, 2004))

Robustness: Technological Progress and Endogenous Education Cost

Labor Augmenting Technological Progress: increases the productivity of workers in both the skilled-intensive and the unskilled intensive sector.

- Production in the skilled-intensive sector

$$Y_t^s = F(K_t, A_t L_t^s) \equiv A_t L_t^s f(k_t); \qquad k_t \equiv K_t / A_t L_t^s$$

- Production in the unskilled-intensive sector

$$Y_t^u = A_t a L_t^u$$

- Technological progress

$$A_{t+1} = (1+\lambda)A_t \qquad \lambda > 0.$$

Robustness: Technological Progress and Endogenous Education Cost

Labor Augmenting Technological Progress: increases the productivity of workers in both the skilled-intensive and the unskilled intensive sector.

- Production in the skilled-intensive sector

$$Y_t^s = F(K_t, A_t L_t^s) \equiv A_t L_t^s f(k_t); \qquad k_t \equiv K_t / A_t L_t^s$$

- Production in the unskilled-intensive sector

$$Y_t^u = A_t a L_t^u$$

- Technological progress

$$A_{t+1} = (1+\lambda) A_t \qquad \lambda > 0.$$

Robustness: Technological Progress and Endogenous Education Cost

Labor Augmenting Technological Progress: increases the productivity of workers in both the skilled-intensive and the unskilled intensive sector.

- Production in the skilled-intensive sector

$$Y_t^s = F(K_t, A_t L_t^s) \equiv A_t L_t^s f(k_t); \qquad k_t \equiv K_t / A_t L_t^s$$

- Production in the unskilled-intensive sector

$$Y_t^u = A_t a L_t^u$$

- Technological progress

$$A_{t+1} = (1+\lambda)A_t \qquad \lambda > 0.$$

Robustness: Technological Progress and Endogenous Education Cost

Factor Prices

$$w_t^s = A_t[f(k) - f'(k)k] \equiv A_t w^s$$

$$w_t^u = A_t a \equiv A_t w^u$$

$$r_t = r$$

Cost of Education

- Weighted average of the payments to teachers, administrators, and maintenance workers in the school system
- $\Rightarrow$ Weighted average of the wages skilled and unskilled workers

$$C_t^H = \theta A_t w^s + (1-\theta) A_t w^u \equiv A_t h$$

Cost of Education

- Weighted average of the payments to teachers, administrators, and maintenance workers in the school system
- $\Rightarrow$ Weighted average of the wages skilled and unskilled workers

$$C_t^H = \theta A_t w^s + (1-\theta) A_t w^u \equiv A_t h$$

Cost of Education

- Weighted average of the payments to teachers, administrators, and maintenance workers in the school system
- $\Rightarrow$ Weighted average of the wages skilled and unskilled workers

$$C_t^H = \theta A_t w^s + (1-\theta) A_t w^u \equiv A_t h$$

Income: Unskilled Individuals

$$
\begin{aligned}
x^u_{t+1} &= (A_t w^u + b_t)(1+r) + A_{t+1} w^u \\
&= A_t w^u (2 + r + \lambda) + (1+r) b_t
\end{aligned}
$$

Income: Unskilled Individuals

$$
\begin{aligned}
x^u_{t+1} &= (A_t w^u + b_t)(1+r) + A_{t+1} w^u \\
&= A_t w^u (2 + r + \lambda) + (1+r) b_t
\end{aligned}
$$

Income: Skilled Individuals

$$x^s_{t+1} = \begin{cases} A_{t+1}w^s - (A_t h - b_t)(1+i) & \text{if} \quad b_t \leq A_t h \\ A_{t+1}w^s + (b_t - A_t h)(1+r) & \text{if} \quad b_t \geq A_t h \end{cases}$$

$\Longrightarrow$

$$x^s_{t+1} = \begin{cases} A_t[w^s(1+\lambda) - (1+i)h] + (1+i)b_t & \text{if} \quad b_t \leq A_t h \\ A_t[w^s(1+\lambda) - (1+r)h] + (1+r)b_t & \text{if} \quad b_t \geq A_t h \end{cases}$$

Income: Skilled Individuals

$$x_{t+1}^s = \begin{cases} A_{t+1}w^s - (A_t h - b_t)(1+i) & \text{if} \quad b_t \leq A_t h \\ A_{t+1}w^s + (b_t - A_t h)(1+r) & \text{if} \quad b_t \geq A_t h \end{cases}$$

$\Longrightarrow$

$$x_{t+1}^s = \begin{cases} A_t[w^s(1+\lambda) - (1+i)h] + (1+i)b_t & \text{if} \quad b_t \leq A_t h \\ A_t[w^s(1+\lambda) - (1+r)h] + (1+r)b_t & \text{if} \quad b_t \geq A_t h \end{cases}$$

Threshold level of Bequest for Becoming Skilled Worker in Period t

$$f = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)}$$

$$\frac{f_t}{A_t} = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)} \equiv \hat{f} > 0$$

for

$$w^u(2+r) > [w^s - (1+i)h] + \lambda(w^s - w^u)$$

Threshold level of Bequest for Becoming Skilled Worker in Period t

$$f = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)}$$

$$\frac{f_t}{A_t} = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)} \equiv \hat{f} > 0$$

for

$$w^u(2+r) > [w^s - (1+i)h] + \lambda(w^s - w^u)$$

Threshold level of Bequest for Becoming Skilled Worker in Period t

$$f = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)}$$

$$\frac{f_t}{A_t} = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)} \equiv \hat{f} > 0$$

for

$$w^u(2+r) > [w^s - (1+i)h] + \lambda(w^s - w^u)$$

Bequest Dynamics

$$b_{t+1} = \begin{cases} (1-\alpha)\{A_t w^u(2+r+\lambda)+(1+r)b_t\} & b_t \in [0,f] \\ (1-\alpha)\{A_t[w^s(1+\lambda)-(1+i)h]+(1+i)b_t\} & b_t \in [f, A_t h] \\ (1-\alpha)\{A_t[w^s(1+\lambda)-(1+r)h]+(1+r)b_t\} & b_t \in [A_t h, \infty] \end{cases}$$

Bequest Dynamics

Let $\hat{b}_{t+1} \equiv b_{t+1}A_{t+1}$

$$\hat{b}_{t+1} = \begin{cases} \left[\frac{1-\alpha}{1+\lambda}\right]\{w^u(2+r+\lambda)+(1+r)\hat{b}_t\} & \hat{b}_t \in [0,(\hat{f})] \\ \left[\frac{1-\alpha}{1+\lambda}\right]\{[w^s(1+\lambda)-(1+i)h]+(1+i)\hat{b}_t\} & \hat{b}_t \in [\hat{f},h] \\ \left[\frac{1-\alpha}{1+\lambda}\right]\{[w^s(1+\lambda)-(1+r)h]+(1+r)\hat{b}_t\} & \hat{b}_t \in [h,\infty] \end{cases}$$

$\Rightarrow$ The dynamical system is unaffected qualitatively by labor-augmenting technological progress

Bequest Dynamics

Let $\hat{b}_{t+1} \equiv b_{t+1}A_{t+1}$

$$\hat{b}_{t+1} = \begin{cases} \left[\frac{1-\alpha}{1+\lambda}\right]\{w^u(2+r+\lambda)+(1+r)\hat{b}_t\} & \hat{b}_t \in [0,(\hat{f})] \\ \left[\frac{1-\alpha}{1+\lambda}\right]\{[w^s(1+\lambda)-(1+i)h]+(1+i)\hat{b}_t\} & \hat{b}_t \in [\hat{f},h] \\ \left[\frac{1-\alpha}{1+\lambda}\right]\{[w^s(1+\lambda)-(1+r)h]+(1+r)\hat{b}_t\} & \hat{b}_t \in [h,\infty] \end{cases}$$

$\Rightarrow$ The dynamical system is unaffected qualitatively by labor-augmenting technological progress

Sufficient Conditions for Multiple Steady-States

$$(1-\alpha)(1+r) < (1+\lambda)$$

$$(1-\alpha)(1+i) > (1+\lambda)$$

$$w^s(1+\lambda) - (1+i)h < 0$$

$\Rightarrow$ The system is characterized by multiple steady-state, where the unstable equilibrium

$$\hat{g} = \frac{(1-\alpha)[(1+i)h - w^s(1+\lambda)]}{[(1-\alpha)(i+i) - (1+\lambda)]} > 0$$