Globalization, Inequality and Welfare

Pol Antràs
Harvard University

Alonso de Gortari
Harvard University

Oleg Itskhoki
Princeton University

Harvard - September 7, 2016

Introduction

- Trade integration raises real income but often increases inequality

Introduction

- Trade integration raises real income but often increases inequality
- Standard approach to demonstrating and quantifying the gains from trade largely ignores trade-induced inequality
  - Kaldor-Hicks compensation principle

Introduction

- Trade integration raises real income but often increases inequality
- Standard approach to demonstrating and quantifying the gains from trade largely ignores trade-induced inequality
  - Kaldor-Hicks compensation principle
- Two basic shortcomings with this approach:
  - How much compensation/redistribution **actually** takes place?
  - Is this redistribution **costless**, as the Kaldor-Hicks approach assumes?

Introduction

- Trade integration raises real income but often increases inequality
- Standard approach to demonstrating and quantifying the gains from trade largely ignores trade-induced inequality
  - Kaldor-Hicks compensation principle
- Two basic shortcomings with this approach:
  - How much compensation/redistribution **actually** takes place?
  - Is this redistribution **costless**, as the Kaldor-Hicks approach assumes?
- These issues are relevant not just for trade, but also for any policy with redistributive effects

This Paper

- We study welfare implications of trade liberalization in a model in which trade affects income distribution...
- ... and in which redistribution policies are constrained by information frictions (Mirrlees, 1971)

This Paper

- We study welfare implications of trade liberalization in a model in which trade affects income distribution...
- ... and in which redistribution policies are constrained by information frictions (Mirrlees, 1971)
- We propose two types of adjustments to standard welfare measures:
  1. A **welfarist** correction reflecting the preferences of an inequality-averse social planner (c.f., Atkinson, 1970)

This Paper

- We study welfare implications of trade liberalization in a model in which trade affects income distribution...
- ... and in which redistribution policies are constrained by information frictions (Mirrlees, 1971)
- We propose two types of adjustments to standard welfare measures:
  1. A **welfarist** correction reflecting the preferences of an inequality-averse social planner (c.f., Atkinson, 1970)
  2. A **costly-redistribution** correction capturing behavioral responses to *trade-induced* shifts across marginal tax rates

Building Blocks

- Skeleton of Trade Model: Itskhoki (2008)
  - Melitz (2003) with heterogeneous worker/entrepeneurs and a labor supply decision

Building Blocks

- Skeleton of Trade Model: Itskhoki (2008)
  - Melitz (2003) with heterogeneous worker/entrepeneurs and a labor supply decision
- Welfarist correction: constant degree of inequality- (or risk-) aversion
  - widely used in Public Finance and Macro (veil of ignorance rationale)

Building Blocks

- Skeleton of Trade Model: Itskhoki (2008)
  - Melitz (2003) with heterogeneous worker/entrepeneurs and a labor supply decision
- Welfarist correction: constant degree of inequality- (or risk-) aversion
  - widely used in Public Finance and Macro (veil of ignorance rationale)
- Costly Redistribution: nonlinear progressive income tax system
  - After-tax income is log-linear function of pre-tax income (Heathcoate et al., 2014)

Building Blocks

- Skeleton of Trade Model: Itskhoki (2008)
  - Melitz (2003) with heterogeneous worker/entrepeneurs and a labor supply decision
- Welfarist correction: constant degree of inequality- (or risk-) aversion
  - widely used in Public Finance and Macro (veil of ignorance rationale)
- Costly Redistribution: nonlinear progressive income tax system
  - After-tax income is log-linear function of pre-tax income (Heathcoate et al., 2014)
- Model calibrated to fit 2007 U.S. data: Trends
  - distribution of skills calibrated to match U.S. distribution of (adjusted gross) income from IRS public records
  - trade cost parameters calibrated to match key U.S. trade moments

Related Literature

- Trade models with heterogeneous workers: Itskhoki (2008) but also
  - matching/sorting models (see Grossman, 2013, and Costinot and Vogel, 2015, for recent surveys)
  - models with imperfect labor markets (Helpman, Itskhoki, Redding..., and earlier Davidson and Matusz)
- Gains from trade and costly redistribution: Dixit and Norman (1986), Rodrik (1992), Spector (2001), Naito (2006)
- Old literature on Kaldor-Hicks: Kaldor (1939), Hicks (1939), Scitovszky (1941)
- Welfarist approach: Bergson (1938), Samuelson (1947), Diamond & Mirlees (1971), Atkinson (1970), Saez more recently
- Costly-redistribution: Kaplow (2008), Hendren (2014), Heathcoate et al. (2014)

Road Map

1. A Motivating Example
2. Economic Model
3. Calibration
4. Counterfactuals: Inequality and the Gains from Trade

MOTIVATING EXAMPLE

A Motivating Example

- Consider a society composed of a measure one of individuals indexed by an ability φ and associated (real) earnings r_{φ}

A Motivating Example

- Consider a society composed of a measure one of individuals indexed by an ability φ and associated (real) earnings r_φ
- Agents' preferences u defined over consumption c_φ, which equals real disposable income

$$r_\varphi^d = \left[1 - \tau(r_\varphi)\right] r_\varphi + T_\varphi,$$

where $\tau\left(r_\varphi\right)$ is a nonlinear income tax and T_φ a lump-sum transfer

A Motivating Example

- Consider a society composed of a measure one of individuals indexed by an ability φ and associated (real) earnings r_φ
- Agents' preferences u defined over consumption c_φ, which equals real disposable income

$$r_\varphi^d = \left[1 - \tau(r_\varphi)\right] r_\varphi + T_\varphi,$$

  where $\tau\left(r_\varphi\right)$ is a nonlinear income tax and T_φ a lump-sum transfer
- The cumulative distribution of φ in the population is H_φ, while the associated income distribution for real earnings is $F\left(r\right)$

A Motivating Example

- Consider a society composed of a measure one of individuals indexed by an ability φ and associated (real) earnings r_φ
- Agents' preferences u defined over consumption c_φ, which equals real disposable income

$$r_\varphi^d = \left[1 - \tau(r_\varphi)\right] r_\varphi + T_\varphi,$$

  where $\tau\left(r_\varphi\right)$ is a nonlinear income tax and T_φ a lump-sum transfer
- The cumulative distribution of φ in the population is H_φ, while the associated income distribution for real earnings is $F\left(r\right)$
- Society is evaluating the consequences of a trade liberalization that would shift $F\left(r\right)$ from some initial F_r to F_r'.
- What are the welfare consequences of the move from F_r to F_r'?

The Kaldor-Hicks Principle: An Illustration

- Suppose only lump-sum transfers are used and government budget is balanced so $\int T_\varphi dH_\varphi = 0$ and $\int r_\varphi^d dH_\varphi = \int r dF(r)$
- Compensating variation v_φ for individual of type φ:

$$u\left(r_\varphi^{d\prime} + v_\varphi\right) = u\left(r_\varphi^d\right).$$

The Kaldor-Hicks Principle: An Illustration

- Suppose only lump-sum transfers are used and government budget is balanced so $\int T_\varphi dH_\varphi = 0$ and $\int r_\varphi^d dH_\varphi = \int rdF(r)$
- Compensating variation v_φ for individual of type φ:

$$u\left(r_\varphi^{d\prime} + v_\varphi\right) = u\left(r_\varphi^d\right).$$

- After compensating losers, society has a surplus of:

$$-\int v_\varphi dH_\varphi = \int r_\varphi^{d\prime} dH_\varphi - \int r_\varphi^d dH_\varphi = R' - R$$

The Kaldor-Hicks Principle: An Illustration

- Suppose only lump-sum transfers are used and government budget is balanced so $\int T_\varphi dH_\varphi = 0$ and $\int r_\varphi^d dH_\varphi = \int rdF(r)$
- Compensating variation v_φ for individual of type φ:

$$u\left(r_\varphi^{d\prime} + v_\varphi\right) = u\left(r_\varphi^d\right).$$

- After compensating losers, society has a surplus of:

$$-\int v_\varphi dH_\varphi = \int r_\varphi^{d\prime} dH_\varphi - \int r_\varphi^d dH_\varphi = R' - R$$

- Gains from trade = Aggregate Real Income Growth

$$\left.\frac{W'}{W}\right|_{\text{Kaldor-Hicks}} = 1 + \mu \equiv \frac{R'}{R}$$

Pros and Cons of the Kaldor-Hicks Principle

- Principle does not rely on interpersonal comparisons of utility
  - u can be heterogeneous across agents
  - relies on ordinal rather than cardinal preferences

Pros and Cons of the Kaldor-Hicks Principle

- Principle does not rely on interpersonal comparisons of utility
  - u can be heterogeneous across agents
  - relies on ordinal rather than cardinal preferences
- What if redistribution is not large enough to compensate the losers?
  - agents might see a probability distribution over potential outcomes
  - risk aversion $\approx$ inequality aversion (Vickery, 1945, Harsanyi, 1953)

Pros and Cons of the Kaldor-Hicks Principle

- Principle does not rely on interpersonal comparisons of utility
  - u can be heterogeneous across agents
  - relies on ordinal rather than cardinal preferences
- What if redistribution is not large enough to compensate the losers?
  - agents might see a probability distribution over potential outcomes
  - risk aversion $\approx$ inequality aversion (Vickery, 1945, Harsanyi, 1953)
- Even if some redistribution takes place, whenever it is costly, shouldn't W'/W reflect those costs?
  - Example: Dixit and Norman (1986)

A Welfarist Correction

- Welfarist approach posits the existence of a social welfare function:

$$V = \int u\left(r_{\varphi}^{d}\right) dH_{\varphi},$$

where $u(\cdot)$ is concave reflecting risk or inequality aversion

A Welfarist Correction

- Welfarist approach posits the existence of a social welfare function:

$$V = \int u\left(r_{\varphi}^{d}\right) dH_{\varphi},$$

where $u(\cdot)$ is concave reflecting risk or inequality aversion

- Assume preferences feature constant inequality/risk aversion

$$u\left(r^{d}\right) = \frac{\left(r^{d}\right)^{1-\rho} - 1}{1-\rho} \text{ for } \rho \geq 0$$

A Welfarist Correction

- Welfarist approach posits the existence of a social welfare function:

$$V = \int u\left(r_{\varphi}^{d}\right) dH_{\varphi},$$

where $u(\cdot)$ is concave reflecting risk or inequality aversion

- Assume preferences feature constant inequality/risk aversion

$$u\left(r^{d}\right) = \frac{\left(r^{d}\right)^{1-\rho} - 1}{1-\rho} \text{ for } \rho \geq 0$$

- With simple transformation, we have (c.f., Atkinson, 1970)

$$W = \frac{\left[\mathbb{E}\left(\left(r^{d}\right)^{1-\rho}\right)\right]^{1/(1-\rho)}}{\mathbb{E}\left(r^{d}\right)} \times \mathbb{E}\left(r^{d}\right) = \Delta \times R$$

where $\Delta \leq 1$ by Jensen's inequality

Welfarist Correction: Two Special Cases

- Suppose H_φ is such that the distribution of **disposable** income is

$$\text{Pareto:} \quad \Delta = \left(\frac{1+G}{1-G(1-2\rho)}\right)^{1/(1-\rho)} \frac{1-G}{1+G}$$

$$\text{Lognormal:} \quad \Delta = \exp\left\{-\rho\left[\Phi^{-1}\left(\frac{1+G}{2}\right)\right]^2\right\}$$

where G is the Gini coefficient of the distribution of r^d

- W increases in mean income R but decreases in inequality G

Welfarist Correction: Two Special Cases

- Suppose H_φ is such that the distribution of **disposable** income is

$$\text{Pareto:} \quad \Delta = \left(\frac{1+G}{1-G(1-2\rho)}\right)^{1/(1-\rho)} \frac{1-G}{1+G}$$

$$\text{Lognormal:} \quad \Delta = \exp\left\{-\rho\left[\Phi^{-1}\left(\frac{1+G}{2}\right)\right]^2\right\}$$

where G is the Gini coefficient of the distribution of r^d

- W increases in mean income R but decreases in inequality G
- In both cases:

$$\left.\frac{W'}{W}\right|_{\text{Welfarist}} = \frac{\Delta\left(G';\rho\right)}{\Delta\left(G;\rho\right)} \times (1+\mu),$$

- This corresponds to **consumption equivalent** welfare changes

A Costly Redistribution Correction

- Assume now that lump-sum transfers are not feasible and redistribution relies on an income tax-transfer system

A Costly Redistribution Correction

- Assume now that lump-sum transfers are not feasible and redistribution relies on an income tax-transfer system
- Focus on the particular case (as in Heathcoate et al., 2014) in which

$$1 - \tau(r) = k(r)^{-\phi}, \tag{1}$$

  for some constant k that ensures balanced budget
- Average net-of-tax rates decrease in reported income at a constant rate ϕ, which captures the degree of progressivity of the tax system

A Costly Redistribution Correction

- Assume now that lump-sum transfers are not feasible and redistribution relies on an income tax-transfer system
- Focus on the particular case (as in Heathcoate et al., 2014) in which

$$1 - \tau(r) = k(r)^{-\phi}, \tag{1}$$

  for some constant k that ensures balanced budget
- Average net-of-tax rates decrease in reported income at a constant rate ϕ, which captures the degree of progressivity of the tax system
- Behavioral response to taxation: positive, constant elasticity of reported income to the net-of-marginal-tax rate:

$$\varepsilon \equiv \frac{\partial r}{\partial(1 - \tau_m(r))} \frac{1 - \tau_m(r)}{r} > 0$$

A Costly Redistribution Correction

- Aggregate income can now be written as

$$R = (1-\phi)^{\varepsilon} \frac{(\mathbb{E}r)^{1+\varepsilon}}{(\mathbb{E}r^{1-\phi})^{\varepsilon} \cdot \mathbb{E}\left(r^{1+\varepsilon\phi}\right)} \times \mathbb{E}\left(\tilde{r}\right) = \Theta \times \tilde{R}$$

A Costly Redistribution Correction

- Aggregate income can now be written as

$$R = (1-\phi)^{\varepsilon} \frac{(\mathbb{E}r)^{1+\varepsilon}}{\left(\mathbb{E}r^{1-\phi}\right)^{\varepsilon} \cdot \mathbb{E}\left(r^{1+\varepsilon\phi}\right)} \times \mathbb{E}(\tilde{r}) = \Theta \times \tilde{R}$$

- By Hölder's inequality, $\Theta \leq 1$; Θ is reduced by mean preserving multiplicative spreads of the income distribution; Θ decreasing in ϕ

A Costly Redistribution Correction

- Aggregate income can now be written as

$$R = (1-\phi)^{\varepsilon} \frac{(\mathbb{E}r)^{1+\varepsilon}}{\left(\mathbb{E}r^{1-\phi}\right)^{\varepsilon} \cdot \mathbb{E}\left(r^{1+\varepsilon\phi}\right)} \times \mathbb{E}\left(\tilde{r}\right) = \Theta \times \tilde{R}$$

- By Hölder's inequality, $\Theta \leq 1$; Θ is reduced by mean preserving multiplicative spreads of the income distribution; Θ decreasing in ϕ
- Two parametric examples

$$\text{Pareto:} \quad \Theta = (1-\phi)^{\varepsilon} \frac{(1-\phi)(1+G)-(1+\varepsilon\phi)2G}{(1-\phi)(1+G)-2G} \left(\frac{(1-\phi)(1-G)}{(1-\phi)(1+G)-2G}\right)^{\varepsilon}$$

$$\text{Lognormal:} \quad \Theta = (1-\phi)^{\varepsilon} \exp\left\{-\frac{\phi^2\varepsilon(\varepsilon+1)}{(1-\phi)^2}\left[\Phi^{-1}\left(\frac{1+G}{2}\right)\right]^2\right\}$$

A Costly Redistribution Correction

- Aggregate income can now be written as

$$R = (1-\phi)^{\varepsilon} \frac{(\mathbb{E}r)^{1+\varepsilon}}{\left(\mathbb{E}r^{1-\phi}\right)^{\varepsilon} \cdot \mathbb{E}\left(r^{1+\varepsilon\phi}\right)} \times \mathbb{E}\left(\tilde{r}\right) = \Theta \times \tilde{R}$$

- By Hölder's inequality, $\Theta \leq 1$; Θ is reduced by mean preserving multiplicative spreads of the income distribution; Θ decreasing in ϕ
- Two parametric examples

$$\text{Pareto:} \quad \Theta = (1-\phi)^{\varepsilon} \frac{(1-\phi)(1+G)-(1+\varepsilon\phi)2G}{(1-\phi)(1+G)-2G} \left(\frac{(1-\phi)(1-G)}{(1-\phi)(1+G)-2G}\right)^{\varepsilon}$$

$$\text{Lognormal:} \quad \Theta = (1-\phi)^{\varepsilon} \exp\left\{-\frac{\phi^2\varepsilon(\varepsilon+1)}{(1-\phi)^2}\left[\Phi^{-1}\left(\frac{1+G}{2}\right)\right]^2\right\}$$

- More generally,

$$\frac{R'}{R} = \frac{\Theta'}{\Theta} \times (1+\tilde{\mu}^R)$$

CONSTANT-ELASTICITY MODEL

A Constant-Elasticity Model

- Unit measure of heterogeneous workers with ability $\varphi \sim H_\varphi$
- Each worker provides its own differentiated good or task (CES)
- Linear production technology $y_\varphi = \varphi \ell_\varphi$

A Constant-Elasticity Model

- Unit measure of heterogeneous workers with ability $\varphi \sim H_\varphi$
- Each worker provides its own differentiated good or task (CES)
- Linear production technology $y_\varphi = \varphi \ell_\varphi$
- Real market revenue of worker φ is

$$r_\varphi = Q^{1-\beta} y_\varphi^{\boldsymbol{\beta}},$$

where Q is the quantity of final output in the economy

A Constant-Elasticity Model

- Unit measure of heterogeneous workers with ability $\varphi \sim H_\varphi$
- Each worker provides its own differentiated good or task (CES)
- Linear production technology $y_\varphi = \varphi \ell_\varphi$
- Real market revenue of worker φ is

$$r_\varphi = Q^{1-\beta} y_\varphi^{\beta},$$

where Q is the quantity of final output in the economy

- Workers have utility over consumption and labor:

$$u_\varphi = c_\varphi - \frac{1}{\gamma} \ell_\varphi^{\gamma}, \qquad \gamma > 1$$

A Constant-Elasticity Model

- Unit measure of heterogeneous workers with ability $\varphi \sim H_\varphi$
- Each worker provides its own differentiated good or task (CES)
- Linear production technology $y_\varphi = \varphi \ell_\varphi$
- Real market revenue of worker φ is

$$r_\varphi = Q^{1-\beta} y_\varphi^{\boldsymbol{\beta}},$$

where Q is the quantity of final output in the economy

- Workers have utility over consumption and labor:

$$u_\varphi = c_\varphi - \frac{1}{\gamma} \ell_\varphi^{\boldsymbol{\gamma}}, \qquad \gamma > 1$$

- Consumption equals after-tax income:

$$r_\varphi - T(r_\varphi) = k r_\varphi^{1-\boldsymbol{\phi}},$$

and government runs balanced budget

Equilibrium

- Distribution of disposable income (and utility) is shaped by underlying distribution of ability and by parameters β, γ and ϕ:

$$c_\varphi \propto \varphi^{\frac{\beta(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}}$$

where

$$\varepsilon \equiv \frac{\beta}{\gamma - \beta}$$

governs the elasticity of market income to marginal tax rates

Equilibrium

- Distribution of disposable income (and utility) is shaped by underlying distribution of ability and by parameters β, γ and ϕ:

$$c_\varphi \propto \varphi^{\frac{\beta(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}}$$

where

$$\varepsilon \equiv \frac{\beta}{\gamma - \beta}$$

governs the elasticity of market income to marginal tax rates

- Higher after-tax income inequality when
  - labor supply is more elastic (lower $\gamma \implies$ higher ε)
  - taxes are less progressive (lower ϕ)
  - tasks are more substitutable (higher β)

Social Welfare

- With a constant degree of inequality aversion $\boldsymbol{\rho}$, we can write

$$W = \Delta \times \hat{\Theta} \times \tilde{W}$$

where

$$\Delta = \frac{\left[\mathbb{E}\left(\left(r^d\right)^{1-\rho}\right)\right]^{1/(1-\rho)}}{\mathbb{E}\left(r^d\right)}$$

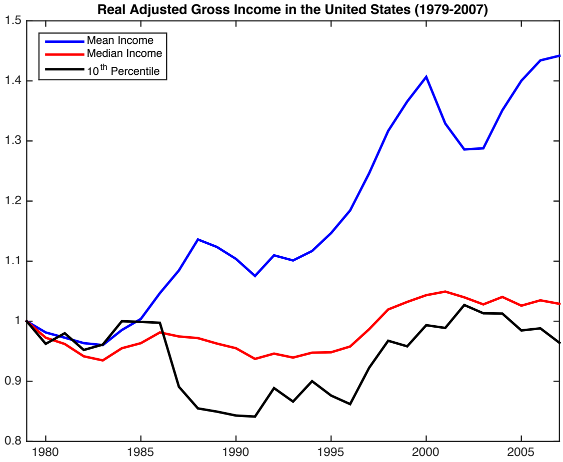
$$\hat{\Theta} = \boldsymbol{(1+\varepsilon\phi)}\,(1-\phi)^{\varepsilon\boldsymbol{\kappa}}\left[\frac{\left(\mathbb{E}r\right)^{1+\varepsilon}}{\left(\mathbb{E}r^{1-\phi}\right)^{\varepsilon}\cdot\mathbb{E}\left(r^{1+\varepsilon\phi}\right)}\right]^{\boldsymbol{\kappa}}$$

and $\kappa = 1/\left(1-(1-\beta)(1+\varepsilon)\right) > 1$.

- Δ is the same welfarist correction as in our example
- $\hat{\Theta}$ is a slightly modified costly-redistribution correction
- $\tilde{W}$ is welfare in a **hypothetical ‘Kaldor-Hicks’ economy**

A First Look at the Data

- Let us first use our closed-economy model to interpret these trends



Calibration: U.S. Income Growth (1979-2007)

- Use U.S. Individual Income Tax Public Use Sample to calibrate distribution of market income
  - approximately 150,000 anonymized tax returns per year
  - use NBER weights to ensure this is a representative sample
  - we map market income to adjusted gross income (AGI) in line 37 of IRS Form 1040

Calibration: U.S. Income Growth (1979-2007)

- Use U.S. Individual Income Tax Public Use Sample to calibrate distribution of market income
  - approximately 150,000 anonymized tax returns per year
  - use NBER weights to ensure this is a representative sample
  - we map market income to adjusted gross income (AGI) in line 37 of IRS Form 1040
- Use CBO data on before-tax and after-tax/transfer income to calibrate the degree of tax progressivity ϕ

Calibration: U.S. Income Growth (1979-2007)

- Use U.S. Individual Income Tax Public Use Sample to calibrate distribution of market income
  - approximately 150,000 anonymized tax returns per year
  - use NBER weights to ensure this is a representative sample
  - we map market income to adjusted gross income (AGI) in line 37 of IRS Form 1040
- Use CBO data on before-tax and after-tax/transfer income to calibrate the degree of tax progressivity ϕ
- Elasticity of taxable income is $\varepsilon = 0.5$ (Chetty, 2012)

Calibration: U.S. Income Growth (1979-2007)

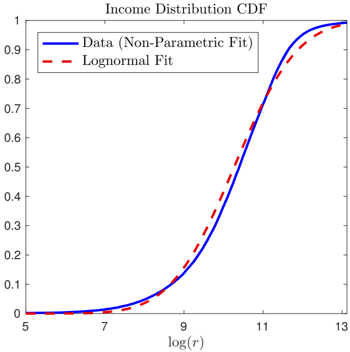
- Use U.S. Individual Income Tax Public Use Sample to calibrate distribution of market income
  - approximately 150,000 anonymized tax returns per year
  - use NBER weights to ensure this is a representative sample
  - we map market income to adjusted gross income (AGI) in line 37 of IRS Form 1040
- Use CBO data on before-tax and after-tax/transfer income to calibrate the degree of tax progressivity ϕ
- Elasticity of taxable income is $\varepsilon = 0.5$ (Chetty, 2012)
- Elasticity of substitution $= 5$ ($\beta = 4/5$)
  - slightly higher than in BEJK (2003) and Broda and Weinstein (2006)

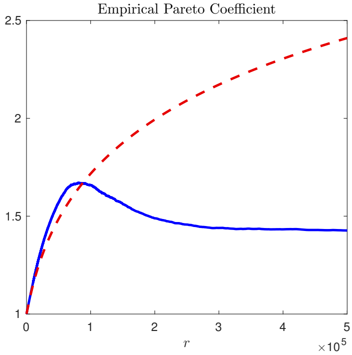
Calibration: U.S. Income Growth (1979-2007)

- Use U.S. Individual Income Tax Public Use Sample to calibrate distribution of market income
  - approximately 150,000 anonymized tax returns per year
  - use NBER weights to ensure this is a representative sample
  - we map market income to adjusted gross income (AGI) in line 37 of IRS Form 1040
- Use CBO data on before-tax and after-tax/transfer income to calibrate the degree of tax progressivity ϕ
- Elasticity of taxable income is $\varepsilon = 0.5$ (Chetty, 2012)
- Elasticity of substitution $= 5$ ($\beta = 4/5$)
  - slightly higher than in BEJK (2003) and Broda and Weinstein (2006)
- Experiment with various values of ρ (benchmark $\rho = 1$)

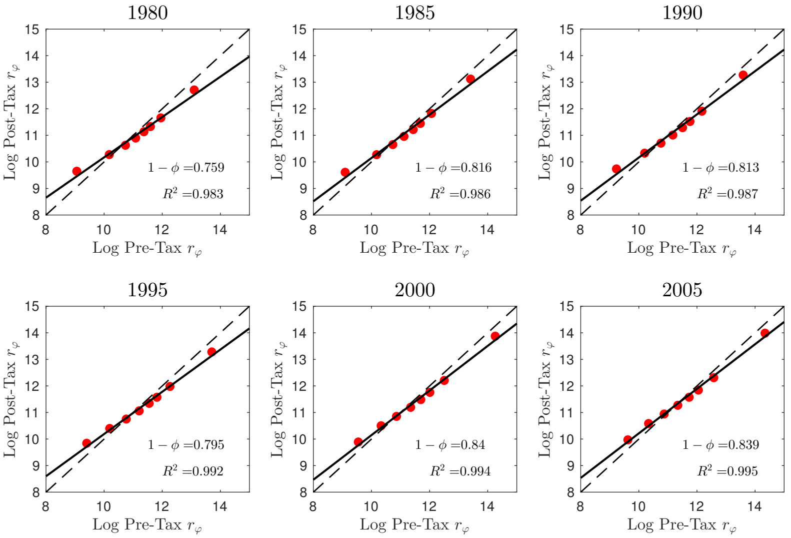
Calibrating the Income Distribution

- Lognormal provides a reasonably good approximation, but it does a poor fit for the right-tail of the distribution, which looks Pareto

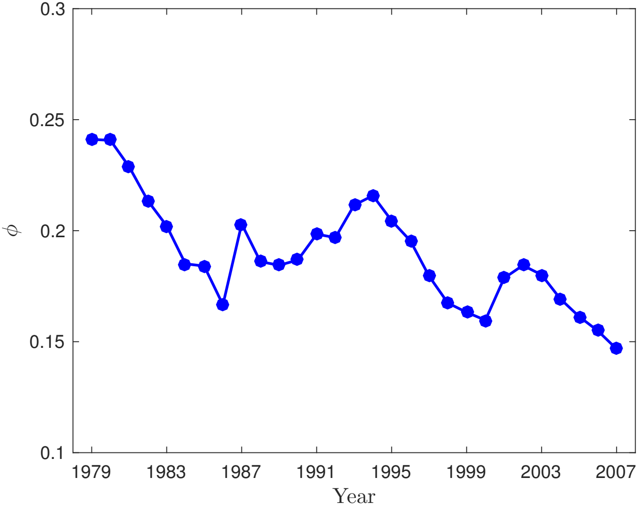




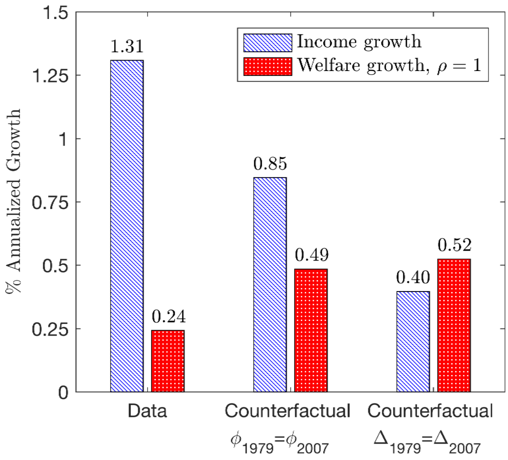
Calibrating Tax Progressivity



U.S. Progressivity Over Time

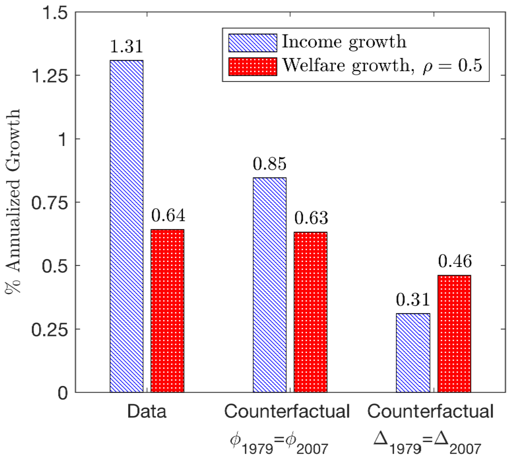


Social Welfare and Counterfactuals



Path of Corrections

Social Welfare and Counterfactuals



Path of Corrections

OPEN ECONOMY MODEL

Open Economy: Environment

- Consider a world economy with $N + 1$ symmetric countries
- Agents can market their output locally or in any other of N countries

Open Economy: Environment

- Consider a world economy with $N + 1$ symmetric countries
- Agents can market their output locally or in any other of N countries
- Trade/Offshoring involves two types of additional costs

1. Symmetric iceberg cost τ (reduces revenue per unit shipped)

Open Economy: Environment

- Consider a world economy with $N+1$ symmetric countries
- Agents can market their output locally or in any other of N countries
- Trade/Offshoring involves two types of additional costs

1. Symmetric iceberg cost $\boldsymbol{\tau}$ (reduces revenue per unit shipped)
2. Fixed cost $f(n)$ of exporting to n-th foreign market: $f(n) = \boldsymbol{f_x} n^{\boldsymbol{\alpha}}$
    - $\alpha \neq 0$ helps smooth effect of trade integration on income distribution

Open Economy: Environment

- Consider a world economy with $N+1$ symmetric countries
- Agents can market their output locally or in any other of N countries
- Trade/Offshoring involves two types of additional costs

1. Symmetric iceberg cost $\boldsymbol{\tau}$ (reduces revenue per unit shipped)
2. Fixed cost $f(n)$ of exporting to n-th foreign market: $f(n) = \boldsymbol{f_x} n^{\boldsymbol{\alpha}}$
   - $\alpha \neq 0$ helps smooth effect of trade integration on income distribution

- Sale revenue is now

$$r_\varphi = \Upsilon_{n_\varphi}^{1-\beta} Q^{1-\beta} y_\varphi^\beta, \tag{2}$$

where

$$\Upsilon_{n_\varphi} = 1 + n_\varphi \tau^{-\frac{\beta}{1-\beta}}$$

and $y_\varphi = \varphi \ell_\varphi$ is total output

Open Economy: Taxation

- Government only observes market revenue of individuals and taxes according to the same tax schedule $T(r)$ in (1)
  - exporting costs $f(n_\varphi)$ are not deductible from taxes

Open Economy: Taxation

- Government only observes market revenue of individuals and taxes according to the same tax schedule $T(r)$ in (1)
  - exporting costs $f(n_\varphi)$ are not deductible from taxes

- Disposable income and consumption are thus

$$c_\varphi = k r_\varphi^{1-\phi} - f_x \sum_{n=1}^{n_\varphi} n^\alpha, \tag{3}$$

Open Economy: Taxation

- Government only observes market revenue of individuals and taxes according to the same tax schedule $T(r)$ in (1)
  - exporting costs $f(n_\varphi)$ are not deductible from taxes

- Disposable income and consumption are thus

$$c_\varphi = k r_\varphi^{1-\phi} - f_x \sum_{n=1}^{n_\varphi} n^\alpha, \qquad (3)$$

- Agents choose labor input ℓ_φ and market access investment n_φ to maximize utility given the revenue function (2) and budget constraint (14)

- Given symmetry, goods market clearing imposes

$$Q = \left(\int_0^1 \Upsilon_{n_\varphi}^{1-\beta} y_\varphi^\beta dH_\varphi \right)^{1/\beta}$$

Trade and Inequality

- Result: Relative to autarky, trade increases inequality of revenues and utilities

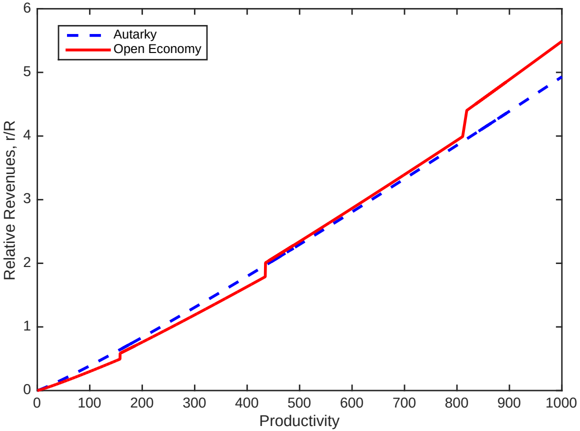
$$\frac{r_\varphi}{Q} \propto \begin{cases} \varphi^{\frac{\beta(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}}, & \varphi < \varphi_{x_1}, \\ \Upsilon_1^{\frac{(1-\beta)(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}} \varphi^{\frac{\beta(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}}, & \varphi < \varphi_{x2}, \\ \vdots & \vdots \\ \Upsilon_N^{\frac{(1-\beta)(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}} \varphi^{\frac{\beta(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}} & \varphi \geq \varphi_{xN} \end{cases} \qquad \Upsilon_n = 1 + n\tau^{-\frac{\beta}{1-\beta}}$$

- Two limiting cases:
  - no agent exports ($\varphi_{x1} \to \infty$)
  - all agents export ($\varphi_{xN} \to \varphi_{\min}$)

$$\frac{r_\varphi}{Q} = \frac{r_{\varphi,aut}}{Q_{aut}} \propto \varphi^{\frac{\beta(1+\varepsilon)(1-\phi)}{1+\varepsilon\phi}}$$

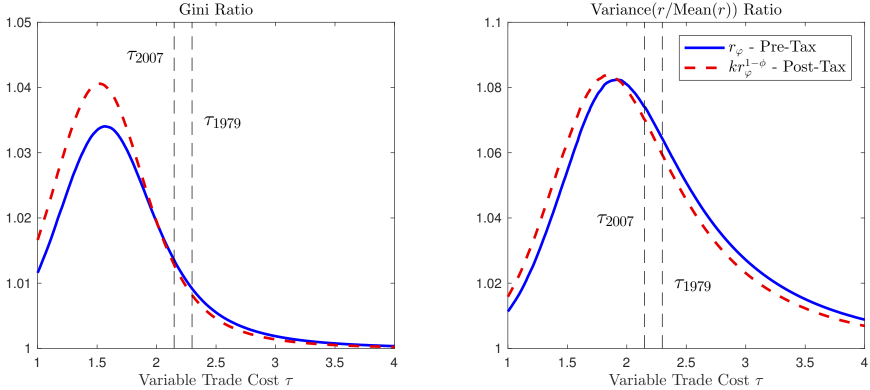
Trade and Inequality (cont.)

- Relative to autarky, trade increases relative sale revenue of high-ability workers but reduces that of low-ability workers



Trade and Inequality (cont.)

- Although inequality could eventually decline with trade, we are far from that region



Calibration and Counterfactuals: Road Map

- We first calibrate the model to 2007 U.S. data
  - as in the closed economy but with additional trade moments
- We then explore the implication of a move to autarky on
  1. Aggregate Income
  2. Income Inequality

Calibration and Counterfactuals: Road Map

- We first calibrate the model to 2007 U.S. data
  - as in the closed economy but with additional trade moments
- We then explore the implication of a move to autarky on
  1. Aggregate Income
  2. Income Inequality
- We use the model to gauge the quantitative importance of the two corrections developed above

$$W = \frac{\left[\mathbb{E}\left(u_\varphi\right)^{1-\rho}\right]^{\frac{1}{1-\rho}}}{\mathbb{E}u_\varphi} \times \frac{\mathbb{E}u_\varphi}{\tilde{W}} \times \tilde{W} = \Delta_T \times \Theta_T \times \tilde{W}_T.$$

Calibration and Counterfactuals: Road Map

- We first calibrate the model to 2007 U.S. data
  - as in the closed economy but with additional trade moments
- We then explore the implication of a move to autarky on
  1. Aggregate Income
  2. Income Inequality
- We use the model to gauge the quantitative importance of the two corrections developed above

$$W = \frac{\left[\mathbb{E}\left(u_\varphi\right)^{1-\rho}\right]^{\frac{1}{1-\rho}}}{\mathbb{E}u_\varphi} \times \frac{\mathbb{E}u_\varphi}{\tilde{W}} \times \tilde{W} = \Delta_T \times \Theta_T \times \tilde{W}_T.$$

1. How large is W'/W for different degrees of inequality aversion?

Calibration and Counterfactuals: Road Map

- We first calibrate the model to 2007 U.S. data
  - as in the closed economy but with additional trade moments
- We then explore the implication of a move to autarky on
  1. Aggregate Income
  2. Income Inequality
- We use the model to gauge the quantitative importance of the two corrections developed above

$$W = \frac{\left[\mathbb{E}\left(u_\varphi\right)^{1-\rho}\right]^{\frac{1}{1-\rho}}}{\mathbb{E}u_\varphi} \times \frac{\mathbb{E}u_\varphi}{\tilde{W}} \times \tilde{W} = \Delta_T \times \Theta_T \times \tilde{W}_T.$$

1. How large is W'/W for different degrees of inequality aversion?
2. How large would W'/W be in the absence of costly redistribution?

Calibration

- For our benchmark results, hold the following primitives constant
  1. As in closed economy, set $\beta = 4/5$ and $\gamma = 2.4$, so that $\varepsilon = 0.5$
  2. Number of countries $N = 5$ (i.e. U.S. is 18.3% of world GDP)

Calibration

- For our benchmark results, hold the following primitives constant
  1. As in closed economy, set $\beta = 4/5$ and $\gamma = 2.4$, so that $\varepsilon = 0.5$
  2. Number of countries $N = 5$ (i.e. U.S. is 18.3% of world GDP)

- Jointly calibrate trade parameters (τ, f_x, α) and the ability distribution H_φ to match:

1. 2007 trade share of 7.7% from NIPA $\Longrightarrow \tau = 2.15$
2. Share of exporter sales in total sales = 61.8% $\Longrightarrow f_x =$ \$675
3. Skewness of exporting firms' sales so that firms that export to $n > 1$ destinations account for 88.9% of total exporters' sales $\Longrightarrow \alpha = 0.55$
4. The 2007 distribution of market income from the IRS data ▸ Implied H_φ

Calibration

- For our benchmark results, hold the following primitives constant
  1. As in closed economy, set $\beta = 4/5$ and $\gamma = 2.4$, so that $\varepsilon = 0.5$
  2. Number of countries $N = 5$ (i.e. U.S. is 18.3% of world GDP)

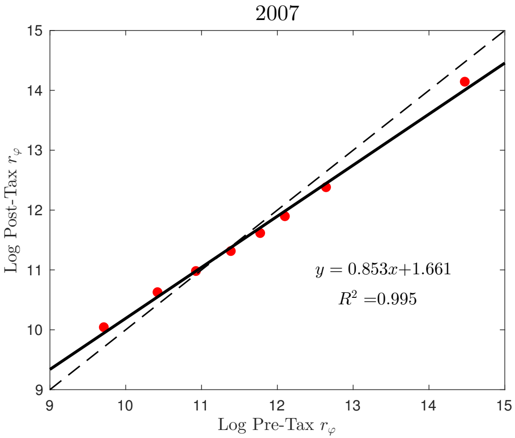
- Jointly calibrate trade parameters (τ, f_x, α) and the ability distribution H_φ to match:

1. 2007 trade share of 7.7% from NIPA $\Longrightarrow \tau = 2.15$
2. Share of exporter sales in total sales $= 61.8\% \Longrightarrow f_x =$\$675
3. Skewness of exporting firms' sales so that firms that export to $n > 1$ destinations account for 88.9% of total exporters' sales $\Longrightarrow \alpha = 0.55$
4. The 2007 distribution of market income from the IRS data Implied H_φ

- In the counterfactuals, we then set $\tau_{1979} = 2.30$ to match 1979 trade share of 4.9% (holding all else equal); also $\tau_{autarky} = +\infty$

Calibration: Progressivity

- Note from (1) that $\ln r^d = \ln k + (1-\phi)\ln r(\varphi) \implies \phi = 0.147$



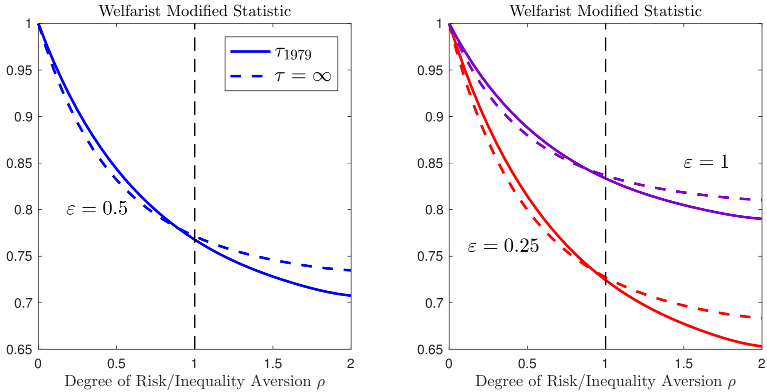
Calibrated Welfare Gains from Trade and Inequality

- Calibrated welfare gains from trade are higher, the higher is the labor supply elasticity ε (Arkolakis and Esposito, 2014)
- But relative to autarky trade induces more inequality when ε is high

	% Consumption Gains		% Welfare Gains ($\rho = 0$)		% Increase in Gini	
	τ_{1979}	$\tau = \infty$	τ_{1979}	$\tau = \infty$	τ_{1979}	$\tau = \infty$
$\varepsilon = 0.25$	0.8	2.4	0.8	2.3	0.4	1.1
$\varepsilon = 0.5$	1.2	3.4	1.1	3.2	0.5	1.3
$\varepsilon = 1$	2.0	6.0	1.9	5.6	0.6	1.6

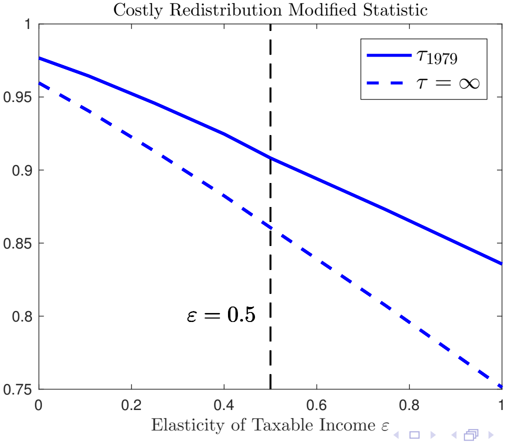
Welfarist Correction

- Welfarist correction is higher, the higher is ρ and the lower is ε
- With log utility ($\rho = 1$) and a labor supply elasticity of $\varepsilon = 0.5$, welfare gains are 23% lower

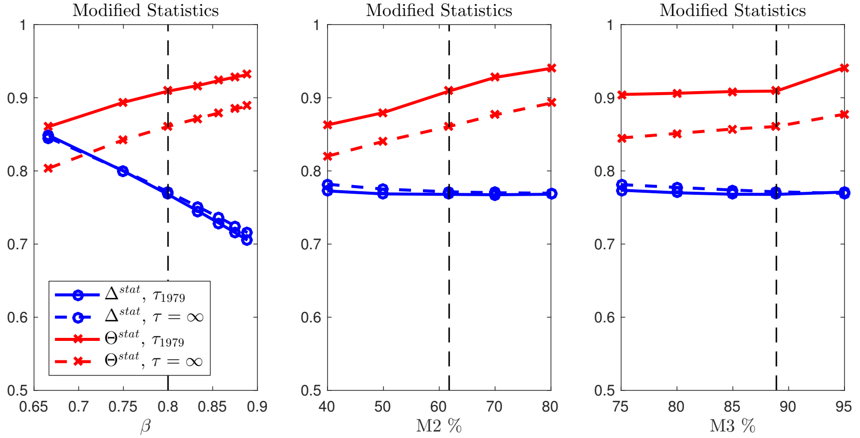


Costly Redistribution Correction

- Costly redistribution correction is higher, the higher is ε
- When $\varepsilon = 0.5$, welfare gains would be 10% higher (for τ_{1979}) and 16% highe (for $\tau_{autarky}$) with costless redistribution



Robustness and Additional Exercises



More Robustness

Conclusions

- Trade-induced inequality is partly mitigated via a progressive income tax system

Conclusions

- Trade-induced inequality is partly mitigated via a progressive income tax system
- Still, compensation is not full so trade induces an increase in the distribution of disposable income
  - Is the Kaldor-Hicks principle really free of value judgements?

Conclusions

- Trade-induced inequality is partly mitigated via a progressive income tax system
- Still, compensation is not full so trade induces an increase in the distribution of disposable income
  - Is the Kaldor-Hicks principle really free of value judgements?
- Income taxation induces behavioral responses that affect the aggregate income response to trade integration
  - Shouldn't the Kaldor-Hicks principle adjust for these inefficiencies?

Conclusions

- Trade-induced inequality is partly mitigated via a progressive income tax system
- Still, compensation is not full so trade induces an increase in the distribution of disposable income
  - Is the Kaldor-Hicks principle really free of value judgements?
- Income taxation induces behavioral responses that affect the aggregate income response to trade integration
  - Shouldn't the Kaldor-Hicks principle adjust for these inefficiencies?
- In this paper, we have developed welfarist and costly redistribution corrections to standard measures of the gains from trade integration

Conclusions

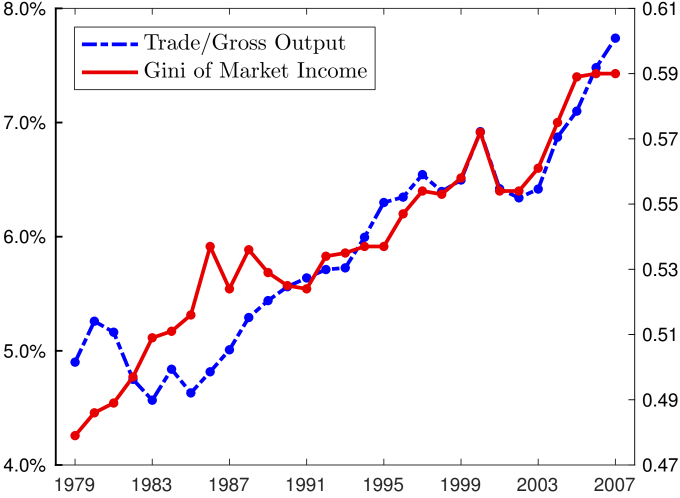
- Trade-induced inequality is partly mitigated via a progressive income tax system
- Still, compensation is not full so trade induces an increase in the distribution of disposable income
  - Is the Kaldor-Hicks principle really free of value judgements?
- Income taxation induces behavioral responses that affect the aggregate income response to trade integration
  - Shouldn't the Kaldor-Hicks principle adjust for these inefficiencies?
- In this paper, we have developed welfarist and costly redistribution corrections to standard measures of the gains from trade integration
- Under plausible parameter values, these corrections are nonneglible

Conclusions

"If, as will often happen, the best methods of compensation feasible involve some loss in productive efficiency, this loss will have to be taken into account."

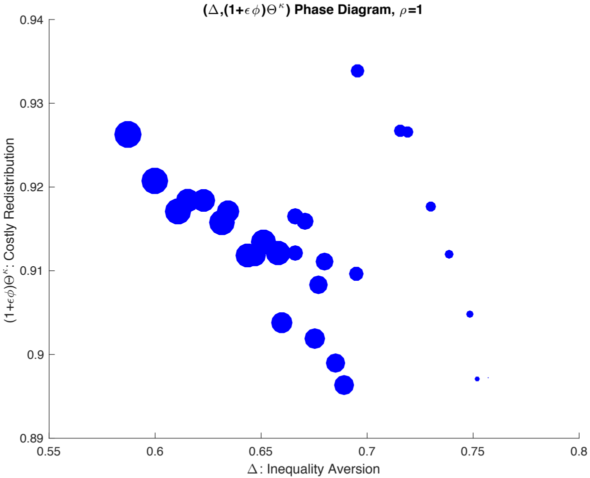
Hicks (1939, p. 712)

Trade Integration and Income Inequality in the U.S.



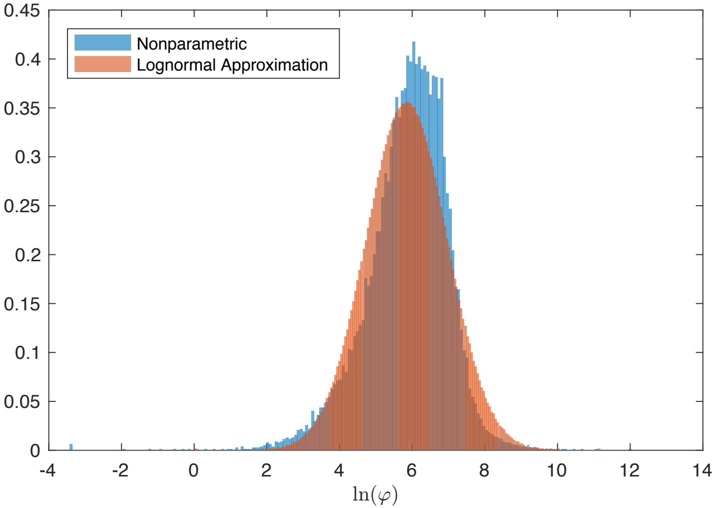
BACK

Evolution of Δ and $\hat{\Theta}$ Over Time



BACK

Implied 2007 Ability Distribution H_φ



BACK

Robustness and Additional Exercises

		Benchmark (a)	Avg. ϕ (b)	Endog. ϕ (c)	$N=3$ (d)	$N=7$ (e)	Manuf. (f)	LN φ (g)
Δ^{Stat}	1979	0.77	0.81	0.44	0.77	0.77	0.77	0.76
	Autarky	0.77	0.82	0.71	0.77	0.78	0.77	0.78
Θ^{Stat}	1979	0.91	0.88	1.81	0.93	0.90	0.99	0.93
	Autarky	0.86	0.81	1.04	0.88	0.85	0.94	0.83

BACK