Growth, Trade, and Inequality

Gene Grossman Elhanan Helpman

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Introduction

- Theoretical exploration of link between growth process and income distribution in the closed and open economies
- Focus on one mechanism:
  - Sorting of heterogeneous workers into idea-generating and manufacturing activities
  - Matching of workers in manufacturing with heterogeneous firms/technologies
- Many other mechanisms are absent; e.g.,
  - Differences in savings propensity between rich and poor (Kaldor)
  - Poor households face credit constraints (Galor and Zeira)
  - Greater inequality generates more redistribution via political process (Alesina and Rodrik; Persson and Tabellini)

Demand and Supply of Consumption Goods

- Mass N of heterogeneous individuals, indexed by a
- Cumulative distribution $H(a)$, with $H'(a) > 0$ on $[a_{\min}, a_{\max}]$
- Logarithmic intertemporal utility
- Consumption good assembled from CES differentiated intermediate inputs; consumption good priced competitively

Production of Intermediates

- Production of intermediates

$$x_\omega = \int_{a \in L_\omega} \psi\left(\varphi_\omega, a\right) \ell_\omega\left(a\right) da$$

- Assume $\psi\left(\varphi, a\right)$ is twice differentiable and strictly log supermodular
  - For arbitrary wage schedule, firm hires optimal labor type $m\left(\varphi\right)$
  - PAM: $m'\left(\varphi\right) > 0$
- Monopolistic competition yields mark-up pricing of intermediates

Inventing New Varieties

- Invention of new varieties à la Romer
  - Stock of knowledge: $\theta_K M$
  - Worker of type a has productivity $T(a)$ in research sector
  - $\ell_R(a)$ workers of type a invent $dM = \theta_K M T(a) \ell_R(a)$ new varieties per time dt (strong scale effects)
- Each invention generates a "Melitz draw" of φ from $G(\varphi)$
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- Comparative advantage in ideas: Assume $T(a)/\psi(\varphi, a)$ is increasing in a for all (φ, a)
- $\Rightarrow$ Sorting: $\exists\ a_R$ ("cutoff") such that $a < a_R \Rightarrow a \in L_M$ and $a > a_R \Rightarrow a \in L_R$ (like "occupational choice" in Lucas 78)

Labor-Market Equilibrium

- Labor market clearing: Supply of workers of type $m(\varphi)$ equals demand for workers by firms of type φ
- Differentiate this condition

$$\frac{m''(\varphi)}{m'(\varphi)} = (\sigma - 1)\frac{\psi_\varphi[\varphi, m(\varphi)]}{\psi[\varphi, m(\varphi)]} - \frac{\psi_a[\varphi, m(\varphi)]\, m'(\varphi)}{\psi[\varphi, m(\varphi)]} + \frac{G''(\varphi)}{G'(\varphi)} - \frac{H''[m(\varphi)]\, m'(\varphi)}{H'[m(\varphi)]}$$

- Boundary conditions

$$m(\varphi_{\min}) = a_{\min}, \qquad m(\varphi_{\max}) = a_R$$

Equilibrium Matching Function

- Differential equation has unique solution for given a_R
- If boundary points change and none of terms in diff eq change, new and old matching functions can intersect at most once

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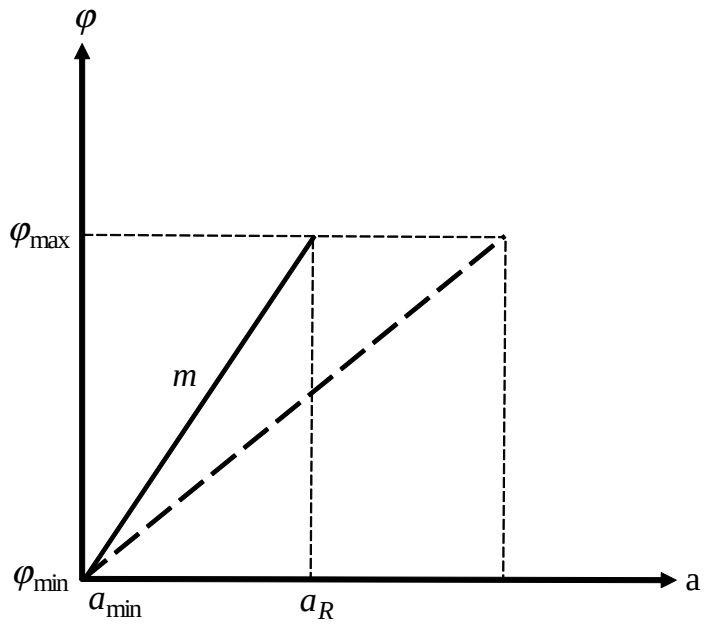


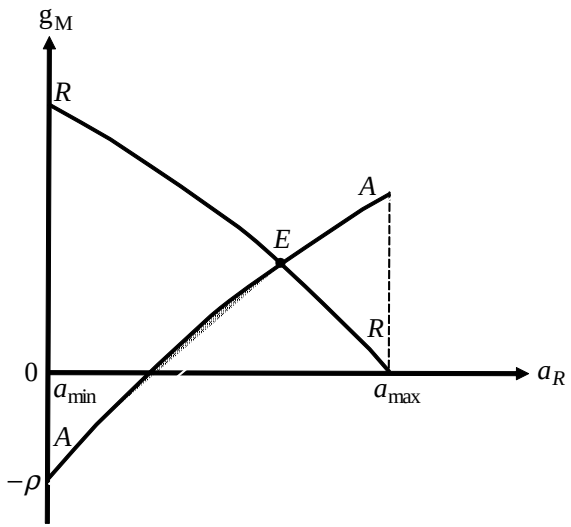
- So, $a_R \uparrow \Rightarrow$ (inverse)-matching function shifts down
  - every worker matches with lower productivity firm
  - due to log supermodularity of $\psi(\cdot)$, log wage profile on $[a_{\min}, a_R]$ must flatten (steepen) when a_R increases (decreases)

Balanced-Growth Path

$$g_M = \theta_K N \int_{a_R}^{a_{\max}} T(a)\, dH(a) \qquad \text{(RR)}$$

Combining labor-market clearing and free-entry condition:

$$\rho + g_M = \theta_K N \Lambda(a_R) \qquad \text{(AA)}$$



Analysis of Balanced Growth Paths

- Two Types of Results
  - Autarky
    - How do cross-country differences generate differences in autarky (steady-state) growth rates and wage inequality?
  - Integration
    - How does trade integration affect countries' growth rates and inequality?
    - How do growth and inequality compare across countries in a trade equilibrium?

Cross-country Comparisons in Autarky

Capacity to Innovate

- Capacity to innovate described by three parameters
  - Size of labor force: N_c
  - Efficiency of knowledge accumulation: θ_{Kc}
  - Productivity of inventors: θ_{Tc}
- In RR and AA curve, these parameters enter as product: $N_c\theta_{Kc}\theta_{Tc}$
- If $N_i\theta_{Ki}\theta_{Ti} > N_j\theta_{Kj}\theta_{Tj} \Rightarrow a_{Ri} < a_{Rj}$ and $g_{Mi} > g_{Mj}$
- Income inequality:
  - More unequal wages in manufacturing in i than in j due to better technology matches
  - Larger size of research sector, which pays higher reward to ability
  - $\Rightarrow$ more inequality!

International Integration: Trade and Knowledge Spillovers

- C countries
- Costly trade in intermediate goods due to tariffs and/or shipping. Delivered price in j is τ_{jc} times as great as source price in c.
- Final goods nontradable
- R&D subsidies at rate s_c
- Asymmetries: $\theta_{\psi c}, \theta_{Tc}, N_c$
- Partial (or complete) knowledge spillovers:

$$K_c = \sum_{j=1}^{C} \theta_{Kjc} M_j;\ \theta_{Kjc} > 0 \text{ for all } j \text{ and } c$$

Effects of Trade on Growth and Inequality

- Convergence in long-run growth rates.
- Opening of trade: analagous to increase in θ_K in closed economy.
  - More labor allocated to R&D in every country.
  - Growth rate faster in every country.
  - Greater income inequality in every country.

International Asymmetries

- Differences in Manufacturing Productivity and Trade Barriers
  - Convergence in growth rates and wage inequality
  - Change in τ_{jc} or $\theta_{\psi c}$ have no effect on long-run growth or inequality
- Differences in Innovation Capacity or in Ability to Create and Absorb Knowledge Spillovers
  - Convergence in growth rates and wage inequality
- Differences in R&D Subsidies
  - If $s_i > s_j$ and international knowledge spillovers are complete, then $a_{Ri} < a_{Rj}$ and more wage inequality in i than in j
- Differences in Technology Sets
  - If $\bar{\varphi}_i > \bar{\varphi}_j$ and international knowledge spillovers are complete, then $a_{Ri} > a_{Rj}$
  - Greater inequality in i than in j at bottom of distribution, but at least as great inequality in j at top.

Conclusions

- International integration affords researcher access to larger knowledge stock $\Rightarrow$ accelerates innovation and growth
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- Technological conditions and government policies typically have spillover effects abroad

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- Have abstracted from
  - Diversity in manufacturing industries (factor intensities, etc.)
  - Team production activities that involve multiple individuals
  - Capital inputs that may be complementary to certain types of worker or inventors
  - Market frictions in labor market and in financing new ideas
  - Superstar potential for those at top end, especially in open economy