Inequality, Openness, and Growth through Creative Destruction

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- Inequality impacts growth through various channels
- The net effect remains unclear and empirical evidence is mixed
- We focus on one specific channel: The effect of inequality on the demand for high quality goods
- We show that in developing countries this channel may be reversed in an open when compared to a closed economy
 - Increasing the income of the rich is beneficial for growth in a closed economy because it increases their willingness-to-pay for innovated high-quality goods
 - In an open economy, an increase in the income of the rich intensifies competition from foreign high-quality providers
- Theoretical predictions in line with suggestive evidence from growth regressions using both aggregate data and industry-level data on export quality

Motivational Fact

Developing countries satisfy their demand for high quality goods via importing

- Effects of inequality on the demand for innovations and growth: Matsuyama (2002,2019), Foellmi and Zweimüller (2006), Foellmi et al. (2014), Latzer (2018)
- Growth effects of international trade: Grossman and Helpman (1991), Acemoglu (2003), Galor and Mountford (2008), Nunn and Trefler (2010), Acemoglu et al. (2015), Arkolakis et al. (2018), Gersbach et al. (2018), Eaton and Kortum (1999)
- Competition and growth: Nickell (1996), Blundell et al. (1999), Schmitz (2005), Aghion et al. (2005,2009), Hashmi (2013)
- Inequality and growth: Bénabou (1996), Easterly (2007), Ostry et al. (2014), Voitchovsky (2005), Halter et al. (2014), Barro (2000), Brueckner and Lederman (2018)
- Infant industry protection: Krugman (1987), Lucas (1988), Young (1991), Matsuyama (1992), Krugman and Elizondo (1996), Puga and Venables (1999), Hausmann and Rodrik (2003), Rodrik (2004), Melitz (2005), Greenwald and Stiglitz (2006)

Households

- Instantaneous utility is $u^h = \int_0^1 (q_i^h(t))^{1-\beta} di (z^h(t))^\beta$
- i is one consumption need, q_i a different quality of that good
- Two types of households that differ in their income I^H, I^L (endowments with effective labor)

Homogeneous good

- Sector is perfectly competitive and $z = a_z AL_z$

Differentiated good and innovation

- Linear production $q_i = a_q AL_i$
- Blueprints up to $\bar{q}_i(t-1)$ are publicly available $\rightarrow$ competitive fringe
- Convex cost of quality upgrading $h(\bar{q}_i(t)/\bar{q}_i(t-1))$
- One period patent for all qualities $q_i \in (\bar{q}_i(t-1), \bar{q}_i(t)]$
- After one period, varieties spill over to the aggregate economy, such that $A(t+1) = \frac{\bar{q}(t)}{\bar{q}(t-1)} A(t)$

Firms' problem

- Revelation principle: Problem of incumbent firm

$$\begin{aligned}
\max_{q_i^H, p_i^H, q_i^L, p_i^L, \bar{q}_i(t)} \quad & \lambda \left(p_i^H - \frac{1}{a_q A} q_i^H \right) + (1 - \lambda) \left(p_i^L - \frac{1}{a_q A} q_i^L \right) - h \left(\frac{\bar{q}_i(t)}{\bar{q}_i(t-1)} \right) \\
\text{s.t.} \quad & \theta^h v(q_i^h) - p_i^h \geq \operatorname{argmax}_{q \in [0, \bar{q}_i(t-1)]} \left\{ \theta^h v(q) - \frac{1}{a_q A} q \right\}, \quad h \in \{L, H\} \quad (\text{IR}) \\
& \theta^H v(q_i^H) - p_i^H \geq \theta^H v(q_i^L) - p_i^L \quad (\text{IC}^H) \\
& \theta^L v(q_i^L) - p_i^L \geq \theta^L v(q_i^H) - p_i^H \quad (\text{IC}^L) \\
& q_i^h \leq \bar{q}_i(t), \quad h \in \{L, H\}.
\end{aligned}$$

Optimal non-linear pricing with (1) endogenous upper bound on quality and (2) GE effects on firms' behaviour due to endogenous θ

Equilibrium

- All households with income $I^h \leq \hat{I} := 1/[a_q(1 - \beta)]$ will find it optimal to consume some quality $q \leq \bar{q}(t - 1)$ at marginal cost
- There is a unique equilibrium that is symmetric
 - $I^L \leq I^H \leq \hat{I}$: No growth equilibrium
 - $I^L \leq \hat{I} < I^H$: Separating equilibrium
 - $\hat{I} < I^L \leq I^H$: Pooling or separating equilibrium

Inequality and Growth: σ

- Growth determined by quality for highest type, H
- $\omega^H = 1 + \sigma\sqrt{\frac{1-\lambda}{\lambda}}$ and $\omega^L = 1 - \sigma\sqrt{\frac{\lambda}{1-\lambda}}$
- Consider redistribution from the poor to the rich: $\sigma \uparrow$
- For $\hat{I} \geq \bar{w}$: $\sigma \uparrow$ monotonously increases growth
- For $\hat{I} < \bar{w}$: $\sigma \uparrow$ U-shaped with lowest growth at change from pooling to separating equilibrium

Small Open Economy

- Consider Small Open Economy that is not at frontier and iceberg trade cost τ
- $A^{ROW} > A^{SOE}$ ($\bar{q}(t-1)^{ROW} > \bar{q}(t-1)^{SOE}$), otherwise perfectly symmetric
- Trade: SOE exports the homogeneous good z and imports high quality goods. Homogeneous good z must be priced competitively in the world market, i.e.

$$p_z^{ROW} = \tau \frac{w^{SOE}}{a_z A^{SOE}} = \frac{w^{ROW}}{a_z A^{ROW}}. \quad (1.1)$$

- It follows that quality q ($q < \bar{q}(t-1)^{ROW}$) can be imported at price

$$\tau \frac{w^{ROW}}{a_q A^{ROW}} q = \tau^2 \frac{1}{a_q A^{SOE}} q \quad (1.2)$$

- Introduces additional *IR* constraint into firm's optimization problem

Firms' Problem Small Open Economy

$$\begin{aligned} \max_{q_i^H, p_i^H, q_i^L, p_i^L, \bar{q}_i(t)} \quad & \lambda \left(p_i^H - \frac{1}{a_q A} q_i^H \right) + (1 - \lambda) \left(p_i^L - \frac{1}{a_q A} q_i^L \right) - h \left(\frac{\bar{q}_i(t)}{\bar{q}_i(t-1)} \right) \\ \text{s.t.} \quad & \theta^h v(q_i^h) - p_i^h \geq \operatorname{argmax}_{q \in [0, \bar{q}_i(t-1)]} \left\{ \theta^h v(q) - \frac{1}{a_q A} q \right\}, \quad h \in \{L, H\} \end{aligned} \quad (\text{IR})$$

$$\theta^h v(q_i^h) - p_i^h \geq \operatorname{argmax}_{q > \bar{q}_i(t-1)} \left\{ \theta^h v(q) - \tau^2 \frac{1}{a_q A} q \right\}, \quad h \in \{L, H\} \quad (\text{IRf})$$

$$\theta^H v(q_i^H) - p_i^H \geq \theta^H v(q_i^L) - p_i^L \quad (\text{IC}^H)$$

$$\theta^L v(q_i^L) - p_i^L \geq \theta^L v(q_i^H) - p_i^H \quad (\text{IC}^L)$$

$$q_i^h \leq \bar{q}_i(t), \quad h \in \{L, H\}.$$

Inequality and Growth SOE

- Rule out that low types find it attractive to import differentiated goods
- We consider the case with $\hat{I} < \bar{\omega}$ and increasing σ

- If σ increases further, (IRf) becomes binding
- Firm has to improve the value of the contract for the high types (reduce p^H) to keep serving the rich

Inequality and Growth SOE

- What are the effects of lowering p^H ?
 - Positive *demand effect*: lower p^H of all firms increases θ^H
 $\Rightarrow q^H$ higher
 - Negative *pro-competitive effect*: lower mark-ups decrease profits from innovation
 - Negative *business stealing effect*: as inequality increases further, domestic firms will not serve rich consumers any longer and high qualities are imported. The positive *price effect* from the closed economy is no longer present
- Therefore, compared to the closed economy, the effect of inequality on growth is typically smaller in the SOE and may even be negative

Consequences of inequality

- Developing countries with higher inequality have more high quality imports from the ROW, and hence less domestic innovation
- We test this prediction using data on sectoral import and export quality
- For a developing country, higher inequality should have a smaller effect on growth in an open than in a closed economy
- Hence, we estimate

$$\ln \left(\frac{q_{x,c,t}^s}{q_{x,c,t-j}^s} \right) = \beta_1 \ln(q_{x,c,t-j}^s) + \beta_2 Open_{c,t-j}^s + \beta_3 Ineq_{c,t-j} + \beta_4 Dist_c^s \\ + \beta_5 [Open_{c,t-j}^s \times Ineq_{c,t-j}] + \beta_6 [Open_{c,t-j}^s \times Dist_c^s] + \beta_7 [Ineq_{c,t-j} \times Dist_c^s] \\ + \beta_8 [Open_{c,t-j}^s \times Ineq_{c,t-j} \times Dist_c^s] + controls$$

- Our prime interest is in the sum of β_5 and β_8

Main results I

Dependent variable in t :	Growth t to $t + 1$ in export quality			
	(1)	(2)	(3)	(4)
Log export quality	-0.73***	-0.73***	-0.67***	-0.75***
Openness	0.00**	0.01	0.01***	-0.01
Gini	-0.27***	-0.48**	0.50***	1.06***
Distance	-0.35***	-0.30***		
Openness $\times$ Gini		-0.01		0.06***
Openness $\times$ Distance		0.02		0.04***
Gini $\times$ Distance		-0.15		-0.94***
Openness $\times$ Gini $\times$ Distance		-0.06*		-0.13***
Control variables	Yes	Yes	No	No
Industry $\times$ Year FE	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes
Key coefficient		-0.07		-0.07
Wald test		0.00		0.00
Observations	95211	95211	125287	121769

Main results II

Dependent variable in t :	Growth t to $t + 1$ in GDP per capita			
	(1)	(2)	(3)	(4)
Log GDP per capita	-0.09***	-0.09***	-0.48***	-0.51***
Openness	0.01	-0.11	0.04	-0.25
Gini	-0.13	0.53*	1.20**	0.46
Distance	0.05**	0.40***		
Openness $\times$ Gini		0.37		0.50
Openness $\times$ Distance		0.18		0.48*
Gini $\times$ Distance		-1.00**		-0.04
Openness $\times$ Gini $\times$ Distance		-0.50		-1.01
Control variables	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes
Key coefficient		-0.14		-0.50
Wald test		0.44		0.02
Observations	379	379	486	486

Appendix: Firms' Problem II

- All households with income $I^h \leq \hat{I} := 1/[a_q(1 - \beta)]$ will find it optimal to consume some quality $q \leq \bar{q}(t - 1)$ at marginal cost
- Suppose $\hat{I} < I^L \leq I^H$: First order conditions for profit maximization

$$\theta^L \left(v(q_i^L) - v(\bar{q}(t - 1)) \right) + \frac{1}{a_q} = p_i^L \quad (1.3)$$

$$\theta^H \left(v(q_i^H) - v(q_i^L) \right) + p_i^L = p_i^H \quad (1.4)$$

$$\theta^L v'(q_i^L) - \lambda \theta^H v'(q_i^L) - (1 - \lambda) \frac{1}{a_q A} \leq 0 \quad (1.5)$$

$$\lambda \theta^H v'(q_i^H) - \lambda \frac{1}{a_q A} - h' \left(\frac{q_i^H}{\bar{q}(t - 1)} \right) = 0, \quad (1.6)$$