# Why Has Inequality Been Rising? (based on work with M. Kremer) 

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I.S.E.O. Summer School

June 2017

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- Increases are theoretically puzzling

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- Why not?
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- leads to greater relative segregation of skill within firms
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- segregation prediction borne out by evidence for U.S., U.K., and France


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- globalization (increase in trade) aggravated inequality


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- after trade opened, factor prices should equalize
- high-skill wages in Mexico should fall
- low-skill wages in Mexico rise
- trade should decrease inequality in Mexico
- Will argue that same matching model explains Mexico’s higher inequality
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- But first return to inequality in U.S. (also U.K. and France)
- 1-good economy
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- $p(q)=$ proportion of workers having skill $q$


## All firms have same production process

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(ii) different tasks within firm complementary

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(iii) different tasks differentially sensitive to skill


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- so inequality between $q$-worker and $\frac{q}{2}$-worker can't increase


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\text { implies } q_{m}>q_{s}
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& q\left(q^{\prime}\right)^{2}-w^{*}(q)-w^{*}\left(q^{\prime}\right) \leq 0 \\
& -\quad \text { equality if } \pi^{*}\left(q, q^{\prime}\right)>0 \quad \text { (no profit in equilibrium) }
\end{aligned}
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(1) $2 L M^{2}>L^{3}+M^{3}$
- if $\pi^{*}(L, L)>0$ ( $L$-workers "self-matched") then
$\pi^{*}(M, M)=0 \quad$ from (1)
- similarly, $\pi^{*}(H, H)=0 \quad$ because $2 L H^{2}>L^{3}+H^{3}$
- similarly, $\pi^{*}(H, H)=0$ because $2 L H^{2}>L^{3}+H^{3}$
- hence, $\pi^{*}(M, H)>0$
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- but $L M^{2}+L H^{2}>L^{3}+M H^{2}$, contradiction
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\end{aligned}
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- Notice $\frac{\partial w^{*}(L)}{\partial M}>0 \quad \frac{\partial w^{*}(H)}{\partial M}<0$
- $w^{*}(L)=\frac{L M^{2}+L H^{2}-M H^{2}}{2}$

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- Notice

$$
\frac{\partial w^{*}(L)}{\partial M}>0 \quad \frac{\partial w^{*}(H)}{\partial M}<0
$$

Proposition 1: Starting from low skill dispersion, $H<\sqrt{2} L$, increase in median skill reduces inequality in wages (and raises mean and median wage)

But opposite occurs if skill distribution dispersed

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- claim: this what happened in U.S., U.K., and France

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Proposition 2: Starting from sufficiently dispersed skill distribution $\left(M>\frac{4}{3} L\right.$ and $\left.H>\sqrt{\frac{3}{2}} M\right)$, increase in median $M$ magnifies inequality:

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\frac{\partial w^{*}(L)}{\partial M} \leq 0 \quad \text { and } \quad \frac{\partial w^{*}(H)}{\partial M} \geq 0
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and if either $L$-workers or $M$-workers not selfmatched, at least one equality strict

Proof: Suppose $p(L)=p(H)=\frac{1}{5} \quad p(M)=\frac{3}{5}$

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(2)
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- $w^{*}(L)=L M^{2}-\frac{M^{3}}{2}, w^{*}(H)=M H^{2}-\frac{M^{3}}{2}$

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- $\frac{\partial w^{*}(H)}{\partial M}=H^{2}-\frac{3 M^{2}}{2}>0$, since $H>\sqrt{\frac{3}{2}} M$

Segregation

Segregation
Index of relative segregation

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$$
\rho=\frac{B}{B+W},
$$

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Index of relative segregation

$$
\begin{gathered}
\rho=\frac{B}{B+W} \\
B=\text { skill variation between firms }
\end{gathered}
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H>\left(\frac{1+\sqrt{5}}{2}\right) L
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then mean-preserving spread in distribution increases segregation index $\rho$

Proof: Suppose $L=2, M=3, H=4 \quad p(L)=p(H)=\frac{1}{3}+\varepsilon$ and $p(M)=\frac{1}{3}-2 \varepsilon$

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$\pi^{*}(H, H)=3 \varepsilon$
- $B=\left(\frac{L+L}{2}-M\right)^{2}\left(\frac{1}{6}+\frac{1}{2} \varepsilon\right)+\left(\frac{M+H}{2}-M\right)^{2}\left(\frac{1}{3}-2 \varepsilon\right)+\left(\frac{H+H}{2}-M\right)^{2}(3 \varepsilon)$

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- $W=\left(\frac{L+L}{2}-L\right)^{2}\left(\frac{1}{6}+\frac{1}{2} \varepsilon\right)+\frac{1}{2}\left(\frac{M+H}{2}-M\right)^{2}\left(\frac{1}{3}-2 \varepsilon\right)+\frac{1}{2}\left(\frac{M+H}{2}-H\right)^{2}\left(\frac{1}{3}-2 \varepsilon\right)+\left(\frac{H+H}{2}-H\right)^{2}$

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- B increasing in $\varepsilon$
- $W$ decreasing in $\varepsilon$
- So $\frac{B}{B+W}$ increasing in $\varepsilon$
- intuitively, $B$ rises as weight in tails increases

Return to globalization and Mexico

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Puzzles:

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- Mexico has comparative advantage in low-skill labor

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- hence, U.S. and Malawi should trade more than U.S. and Mexico (Malawi more different than Mexico from U.S.)

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- Mexico has comparative advantage in low-skill labor but
trade increased gap between high- and low-skill workers
- contradicts Heckscher-Ohlin theory
- H-O implies that
as 2 countries become more different (in factor endowments), should trade more
- hence, U.S. and Malawi should trade more than U.S. and Mexico (Malawi more different than Mexico from U.S.)
- but Mexico trades much more than Malawi with U.S.


## Resolution:

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- think of globalization as increase in international production


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- Delhi call centers (outsourcing)


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- Delhi call centers (outsourcing)
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designed in U.S.


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- think of globalization as increase in international production
- Delhi call centers (outsourcing)
- computers
designed in U.S.
programmed in Europe


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- think of globalization as increase in international production
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## Resolution:

- think of globalization as increase in international production
- Delhi call centers (outsourcing)
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- due to lower communication/transport costs
- 2 countries - one rich, one poor
- 2 countries - one rich, one poor
- rich country
- 2 countries - one rich, one poor
- rich country
- workers of skill levels $A$ and $B$
- 2 countries - one rich, one poor
- rich country
- workers of skill levels $A$ and $B$
- poor country
- 2 countries - one rich, one poor
- rich country
- workers of skill levels $A$ and $B$
- poor country
- workers of skill levels $C$ and $D$
- 2 countries - one rich, one poor
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$$
A>B>C>D
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(conclusions still hold if $C>B$ )

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- production output $=q_{s} q_{m}^{2}$
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- rich country
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$$
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- production output $=q_{s} q_{m}^{2}$
- before globalization (i.e., in autarky), workers can match only domestically
- 2 countries - one rich, one poor
- rich country
- workers of skill levels $A$ and $B$
- poor country
- workers of skill levels $C$ and $D$

$$
A>B>C>D
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(conclusions still hold if $C>B$ )

- production output $=q_{s} q_{m}^{2}$
- before globalization (i.e., in autarky), workers can match only domestically
- after globalization, international matching possible


## $\underbrace{A>B}_{\begin{array}{c}\text { rich } \\ \text { country }\end{array}}>\underbrace{C>D}_{\begin{array}{c}\text { poor } \\ \text { country }\end{array}}$

## $\underbrace{A>B}_{\begin{array}{c}\text { rich } \\ \text { country }\end{array}}>\underbrace{C>D}_{\begin{array}{c}\text { poor } \\ \text { country }\end{array}}$

Proposition 3: If $D$-workers have sufficiently low skill, i.e.,

## $\underbrace{A>B}_{\begin{array}{c}\text { rich } \\ \text { country }\end{array}}>\underbrace{C>D}_{\begin{array}{c}\text { poor } \\ \text { country }\end{array}}$

Proposition 3: If $D$-workers have sufficiently low skill, i.e.,
(*) $B>\left(\frac{1+\sqrt{5}}{2}\right) D$,

## $\underbrace{A>B}_{\substack{\text { cichny } \\ \text { county }}}>\underbrace{C>D}_{\substack{\text { poonr } \\ \text { county }}}$

Proposition 3: If $D$-workers have sufficiently low skill, i.e.,
(*) $B>\left(\frac{1+\sqrt{5}}{2}\right) D$,
then globalization increases inequality in poor country

$$
\underbrace{A>B}_{\begin{array}{c}
\text { rich } \\
\text { country }
\end{array}}>\underbrace{C>D}_{\begin{array}{c}
\text { por } \\
\text { country }
\end{array}} \quad\left({ }^{*}\right) B>\left(\frac{1+\sqrt{5}}{2}\right) D
$$

Proof: 2 cases

$$
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\text { rich } \\
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Proof: 2 cases
Case I $p(D)>p(C)$

$$
\underbrace{A>B}_{\begin{array}{c}
\text { rich } \\
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## Proof: 2 cases

Case $I \quad p(D)>p(C)$

- $\pi_{a}^{*}(D, D)>0$,

$$
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## Proof: 2 cases

Case $I \quad p(D)>p(C)$

- $\pi_{a}^{*}(D, D)>0$,
- $\pi_{g}^{*}(D, D)>0$ (because, from (*), $D$-worker can't match with $A$ - or $B$-worker)

$$
w_{a}^{*}(D)=w_{g}^{*}(D)=\frac{D^{3}}{2}
$$

$a=$ autarky $\quad g=$ post-globalization

$$
\underbrace{A>B}_{\begin{array}{c}
\text { rich } \\
\text { country }
\end{array}}>\underbrace{C>D}_{\begin{array}{c}
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\end{array}} \quad(*) B>\left(\frac{1+\sqrt{5}}{2}\right) D
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w_{a}^{*}(D)=w_{g}^{*}(D)=\frac{D^{3}}{2}
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$$
a=\text { autarky } \quad g=\text { post-globalization }
$$

- $w_{g}^{*}(C) \geq w_{a}^{*}(C)$ because of possible matching with $B$ or $A$

$$
\underbrace{A>B}_{\begin{array}{c}
\text { rich } \\
\text { country }
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a=\text { autarky } \quad g=\text { post-globalization }
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- $w_{g}^{*}(C) \geq w_{a}^{*}(C)$ because of possible matching with $B$ or $A$
- Hence, $w_{g}^{*}(C)-w_{g}^{*}(D) \geq w_{a}^{*}(C)-w_{a}^{*}(D)$ - - globalization causes rise in inequality


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- Hence, again $w^{*}(C)-w^{*}(D)$ rises with globalization


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- workers in Malawi have very low skills $\Rightarrow$ no international matching opportunities

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- not worker
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- role for investment by third parties
domestic government
international agencies, NGOs
foreign aid
private foundations

