

International trade and labor market discrimination:
aggregate productivity, firm composition and income distribution

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1 Overview

setup:

- directed search model of labor market
- labor market discrimination
- endogenous co-existence of discriminatory and non-discriminatory firms

purpose:

discrimination \times international trade \rightarrow aggregate productivity and income distribution

results:

- labor market discrimination \rightarrow aggregate productivity \downarrow , # of active firms \downarrow
- trade liberalization:
 - aggregate productivity: increase smaller due to discrimination
 - relative # of non-discriminatory firms \uparrow
 - wage gap \uparrow

1 Overview

Why **trade** liberalization?

Why not **economic growth**?

Economic growth: all firms benefit **proportionately**

Trade: **different** firms **benefit differently** if trade is **costly**

2 Motivation – labor market discrimination prevalent

OECD Employment Outlook (2010):

"...women earn...on average, 17% less than men per hour worked"

Williams and Ceci (2015) *PNAS*:

US: tenure track positions in academia: **male** name → lower prob. of job interview

Bertrand and Mullainathan (2004) *AER*:

US: black name → lower prob. of job interview

extensive literature on nepotism:

Bloom and van Reenen (2007) *QJE*, Jaskiewicz et al. (2013) *FBR*, Leone et al. (2016) *WP*,...

2 Motivation – labor market discrimination → firm and country performance

Becker (1957):

- taste based discrimination **costly**
- aggregate **productivity** ↓
- competition ↑: taste based discrimination ↓

extensive literature on labor market discrimination (wage gap), economic growth or international trade:

Black and Brainerd (2004), Cavalcanti and Tavares (2011), Hsieh et al. (2016),...

2 Motivation – our paper

labor market discrimination

→ aggregate productivity and income distribution?

trade liberalization

→ aggregate productivity, firm composition and income distribution

2 Motivation – our paper

our paper relative to existing literature:

- existing literature either **purely empirical** or **partial equilibrium**
- **no co–existence** of **discriminatory** and **non–discriminatory** firms

our paper:

the only **general equilibrium** setting with **labor market discrimination**

→ impact of discrimination on **aggregate productivity**

→ impact of **trade on wage–gap**

→ impact of **trade on firm composition**

2 Motivation – our paper

this paper relative to Chisik and Emami Namini (2016), *WP*:

- Chisik and Emami Namini (2016):
 - **inter**-industry trade
 - discrimination → **trade pattern**
 - short–run: **exogenous** firm composition
- **this paper**:
 - **intra**-industry trade
 - long–run: **endogenous** firm composition
 - endogenous firm composition: **firm heterogeneity** in TFP
 - discrimination → **aggregate productivity**

2 Motivation – our paper

starting point:

Lang, Manove, Dickens (2005) for interaction between job seekers and wage posting firms

→ extension to general equilibrium

→ extension to international trade setting

→ extension to endogenous co-existence of discriminatory and non-discriminatory firms

→ extension to firm heterogeneity in TFP

3 The model

3.1 Consumers

CES utility function: $U = \left(\int q(\phi)^{\frac{\sigma-1}{\sigma}} d\phi \right)^{\frac{\sigma}{\sigma-1}}, \sigma > 1$

3.2 Countries

- 2 countries, home and foreign (“*”)
- 1 sector: manufacturing
- labor endowments: $L = L^*, S = S^*$

3 The model

3.3 Production and firms

- single **manufacturing** firm ϕ :

$$l = \frac{q}{\phi}$$

← unskilled labor ← productivity parameter

if **matched** with a **skilled worker** (works as **manager**);

no production if **no match** (search frictions);

3 The model

3.4 Workers

- A s and B s, objectively identical
- A s and B s: identical share of **skilled workers**
- each **skilled worker**: unique productivity ϕ , unknown until **match** with **managerial** position
- **free mobility** of skilled workers between **jobs**
- # of applicants at single firm: Poisson distributed **random variable**
- **unskilled & unmatched** skilled workers: manufacturing **production workers**

3 The model

3.6 Timing

skilled workers: apply for managerial job?

firms: post bonus b for manager (identical for A and B)

skilled workers: observe $b = \{b\}$; where to apply?

firms with ≥ 1 applicant: draw ϕ from density $g(\phi)$ & production

firms with 0 applicant: no production

unmatched skilled workers: work as unskilled

4 Autarkic equilibrium – without discrimination, no index $k (= A, B)$ for worker label

4.1 Characterization of *SPMCE* (subgame perfect monopolistically competitive equilibrium)

1. each bonus offer \hat{b} best response to $\hat{\mathbf{b}}$
2. each skilled worker's application strategy best response to $\hat{\mathbf{b}}$ and strategies of other workers
3. each matched firm chooses profit maximizing $p(\tilde{\phi})$
4. free entry of firms
5. free mobility of skilled workers between jobs (managerial vs. production)
6. consumers: maximize utility, s.t. budget constraint & P_M
7. demand = supply

4 Autarkic equilibrium – without discrimination, no index $k (= A, B)$ for worker label

4.1 Characterization of SPMCE

assumption: unskilled labor is numeraire

$$b = \pi(\tilde{\phi}) \frac{\lambda}{e^{\lambda} - 1}$$

$$\pi(\phi^*) - b = 0$$

$$E(\pi^{net}) = f_e \rightarrow (1 - e^{-\lambda}) [1 - G(\phi^*)] [\pi(\tilde{\phi}) - b] = f_e$$

$$b \geq 1$$

$$\frac{I}{P_M} = L + S - M$$

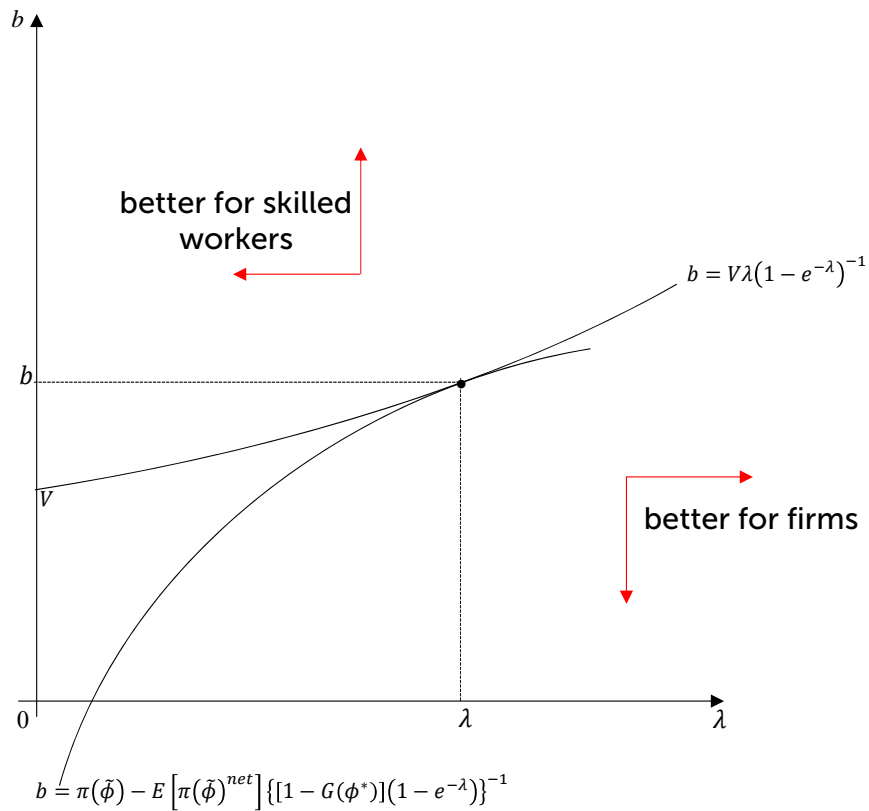
$$\lambda = \frac{S}{N}$$

$$\pi(\tilde{\phi}) = \frac{(1+f)k}{k-\sigma+1} - f$$

$$\frac{\lambda}{e^{\lambda} - 1} = \frac{k - \sigma + 1}{k + f(\sigma - 1)}$$

$$1 - G(\phi^*) = \frac{f_e}{(f+1)(1-e^{-\lambda})} \frac{k - \sigma + 1}{\sigma - 1}$$

4 Autarkic equilibrium – without discrimination, no index $k (= A, B)$ for worker label



5 Autarkic equilibrium – with only discriminatory firms

- labels A and B for skilled workers matter
- all firms: disutility δ when employing B -label skilled workers; however: $\delta \rightarrow 0$
- thus, lexicographic firm preferences:

first: prefer a match

second: given a match, prefer A -labels

5 Autarkic equilibrium – **with only** discriminatory firms

adjustments for derivation of *SPMCE*?

- **no adjustment** for application strategy of *As*: **ignore *Bs***
- **adjustment** for application strategy of *Bs*:
 - **hired only** if **no** *A* applies
 - **do not** apply at firm offering “too high” bonus: **too many *As***
 - **do not** apply at firm offering “too low” bonus

Proposition 4:

*In any SPMCE firms **separate**:*

*some firms choose b so that only **A**–labels apply, other firms choose b so that only **B**–labels apply.*

5 Autarkic equilibrium – with only discriminatory firms

$$b_A = \pi(\tilde{\phi}_A) \frac{\lambda_A}{e^{\lambda_A} - 1}$$

$$b_B = V_A = b_A \frac{1 - e^{-\lambda_A}}{\lambda_A}$$

$$(1 - e^{-\lambda_A})[1 - G(\phi_A^*)][\pi(\tilde{\phi}_A) - b_A] = f_e$$

$$(1 - e^{-\lambda_B})[1 - G(\phi_B^*)][\pi(\tilde{\phi}_B) - b_B] = f_e$$

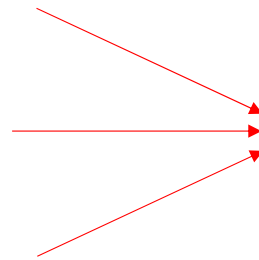
$$\pi(\phi_A^*) - b_A = 0$$

$$\pi(\phi_B^*) - b_B = 0$$

$$b_A \geq 1$$

$$b_B \geq 1$$

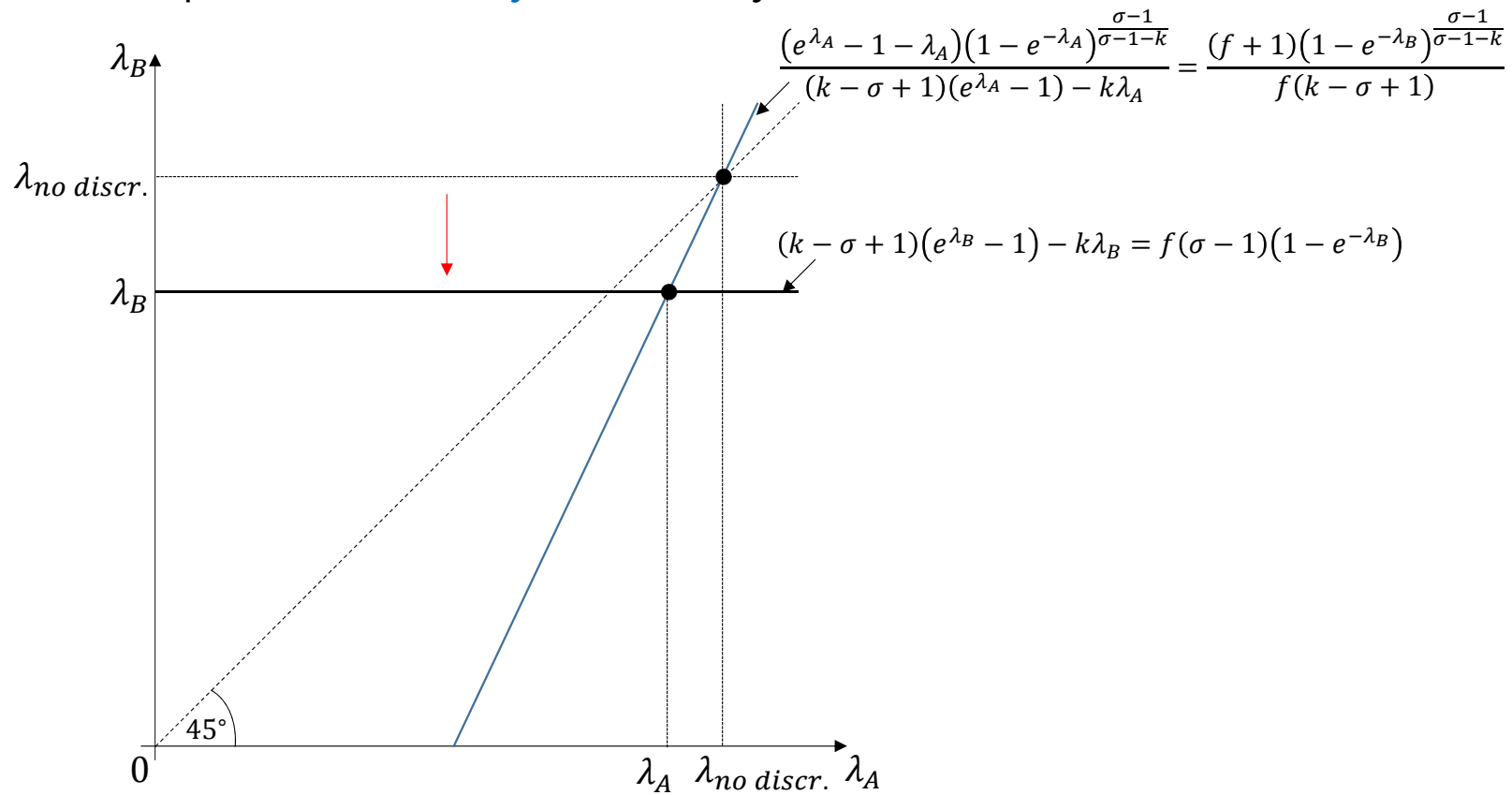
$$\frac{\pi(\tilde{\phi}_A) + f}{\pi(\tilde{\phi}_B) + f} = \left(\frac{\tilde{\phi}_A}{\tilde{\phi}_B}\right)^{\sigma-1}$$



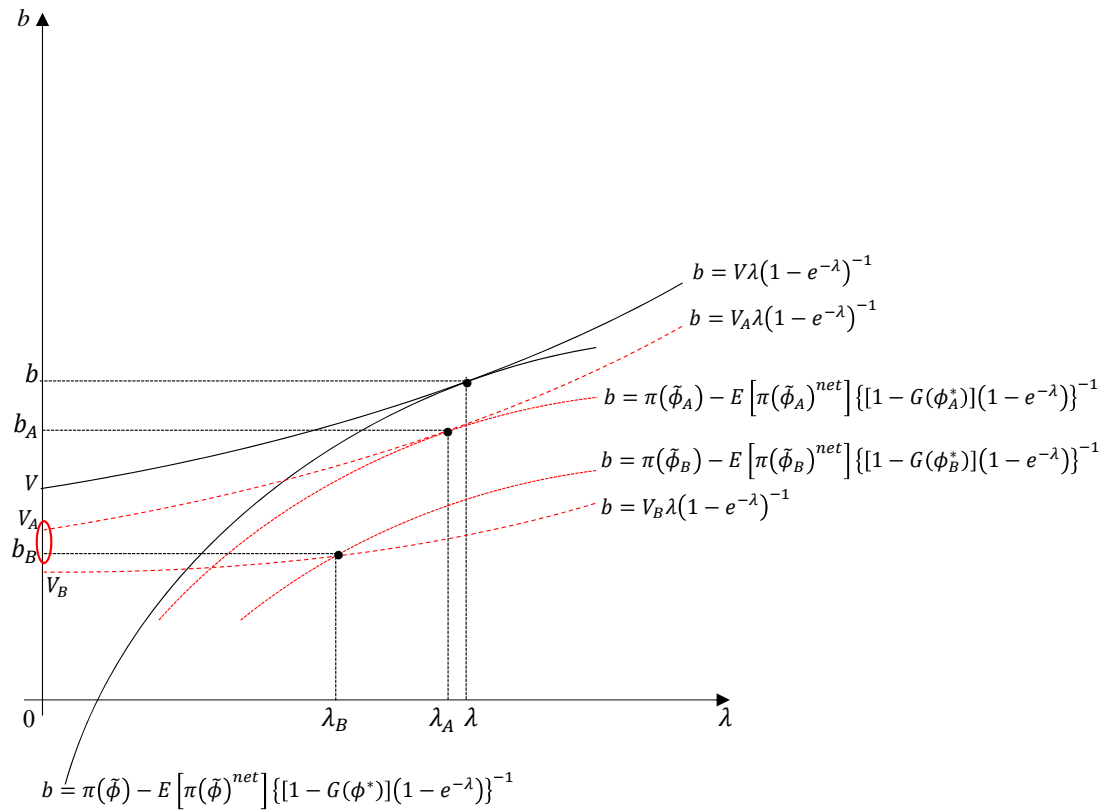
$$(k - \sigma + 1)(e^{\lambda_B} - 1) - k\lambda_B = f(\sigma - 1)(1 - e^{-\lambda_B})$$

$$\frac{(e^{\lambda_A} - 1 - \lambda_A)(1 - e^{-\lambda_A})^{\frac{\sigma-1}{\sigma-1-k}}}{(k - \sigma + 1)(e^{\lambda_A} - 1) - k\lambda_A} = \frac{(f + 1)(1 - e^{-\lambda_B})^{\frac{\sigma-1}{\sigma-1-k}}}{f(k - \sigma + 1)}$$

5 Autarkic equilibrium – with only discriminatory firms



5 Autarkic equilibrium – with only discriminatory firms



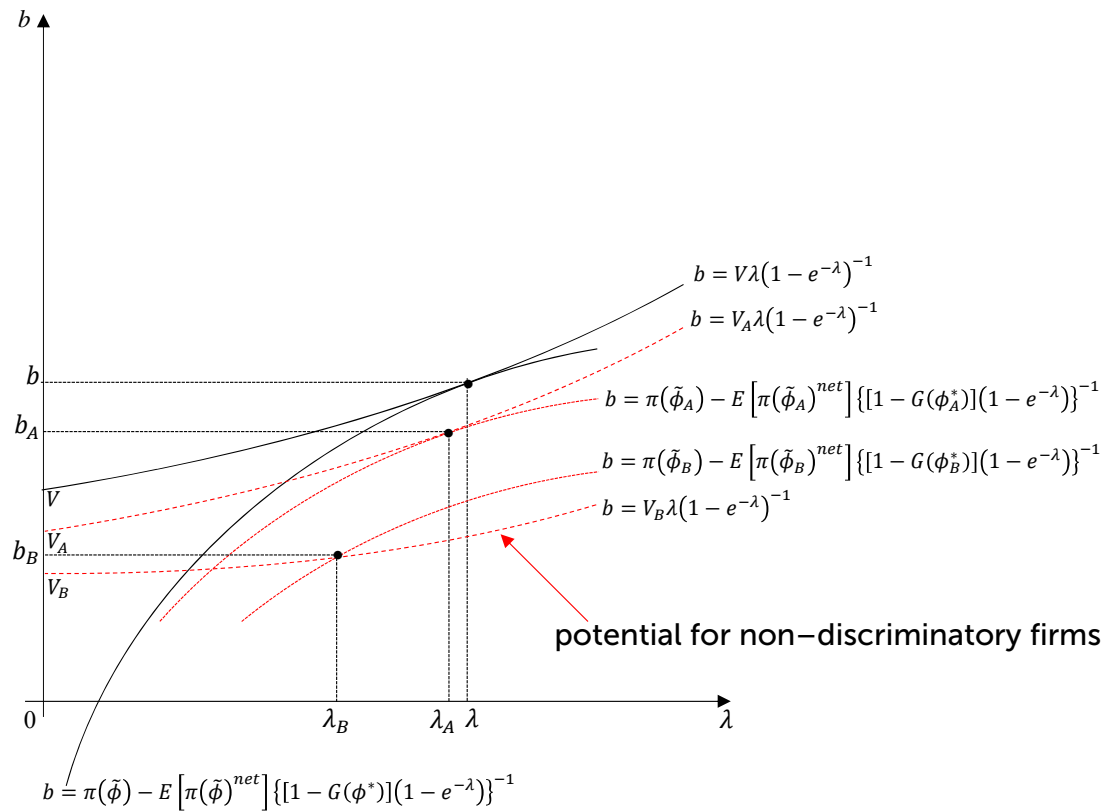
5 Autarkic equilibrium – **with only** discriminatory firms

comparison:

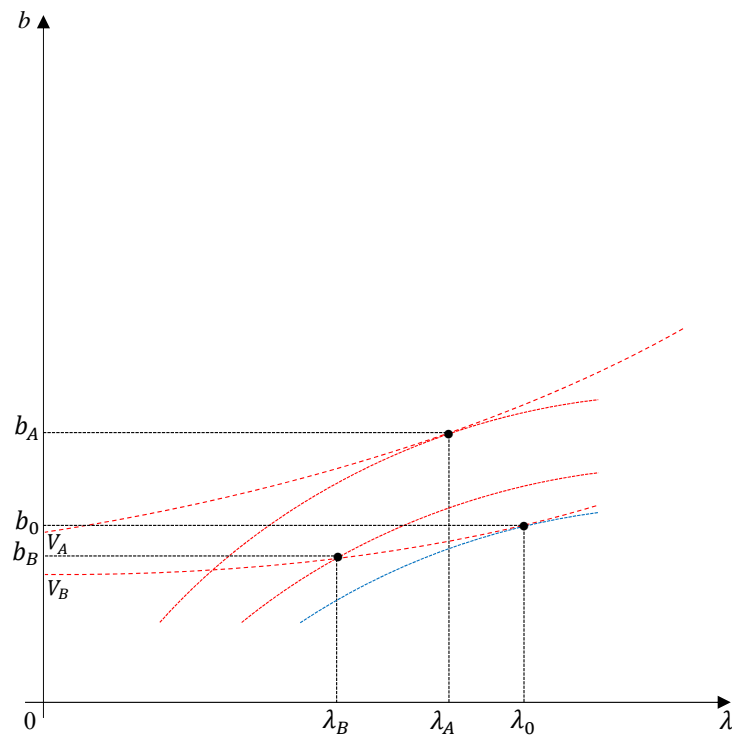
without discrimination **vs. with only** discriminatory firms:

- vacancy rate **higher** (i.e. **less matches**) with **discrimination**: $\lambda > \lambda_A > \lambda_B$
- firm profits \uparrow
- productivity thresholds: $\phi^* > \phi_A^* > \phi_B^*$
- bonuses: $b > b_A > b_B$

6 Co-existence of discriminatory and non-discriminatory firms



6 Co-existence of discriminatory and non-discriminatory firms



discriminatory vs. non-discriminatory firms:

- some B-labels apply at non-discriminatory firms;
- $\lambda_0 > \lambda_A > \lambda_B$: # of total matches increases
- productivity thresholds: $\phi_A^* > \phi_0^* > \phi_B^*$
- bonuses: $b_A > b_0 > b_B$

7 Trade liberalization & co-existence of **discriminatory** and **non-discriminatory** firms

- 2 **symmetric** countries
- fixed **export costs** $f_X > f + 1$

→ only **part** of active firms exports

7 Trade liberalization & co-existence of discriminatory and non-discriminatory firms

$$b_A = [\pi(\tilde{\phi}_A) + s_{AX}\pi(\tilde{\phi}_{AX})] \frac{\lambda_A}{e^{\lambda_A} - 1}$$

...

$$(1 - e^{-\lambda_A})[1 - G(\phi_A^*)][\pi(\tilde{\phi}_A) + s_{AX}\pi(\tilde{\phi}_{AX}) - b_A] = f_e$$

...

$$\pi(\phi_A^*) - b_A = 0$$

$$\pi(\phi_{AX}^*) = 0$$

$$\pi(\phi_B^*) - b_B = 0$$

$$\pi(\phi_{BX}^*) = 0$$

$$\pi(\phi_0^*) - b_0 = 0$$

$$\pi(\phi_{0X}^*) = 0$$

...

7 Trade liberalization & co-existence of discriminatory and non-discriminatory firms

share of exporters?

$$\pi(\phi_A^*) - b_A = 0$$

$$\pi(\phi_{AX}^*) = 0$$

$$\pi(\phi_B^*) - b_B = 0$$

$$\pi(\phi_{BX}^*) = 0$$

$$\pi(\phi_0^*) - b_0 = 0$$

$$\pi(\phi_{0X}^*) = 0$$

$$\frac{r(\phi_A^*)}{\sigma} - f - b_A = 0$$

$$\frac{r(\phi_{AX}^*)}{\sigma} - f_X = 0$$

$$\frac{r(\phi_B^*)}{\sigma} - f - b_A = 0$$

$$\frac{r(\phi_{BX}^*)}{\sigma} - f_X = 0$$

$$\frac{r(\phi_0^*)}{\sigma} - f - b_A = 0$$

$$\frac{r(\phi_{0X}^*)}{\sigma} - f_X = 0$$

$$\frac{r(\phi_{AX}^*)}{r(\phi_A^*)} = \frac{f_X}{f + b_A}$$

$$\frac{r(\phi_{BX}^*)}{r(\phi_B^*)} = \frac{f_X}{f + 1}$$

$$\frac{r(\phi_{0X}^*)}{r(\phi_0^*)} = \frac{f_X}{f + b_0}$$

7 Trade liberalization & co-existence of **discriminatory** and **non-discriminatory** firms

share of exporters?

$$\frac{r(\phi_{AX}^*)}{r(\phi_A^*)} = \frac{f_X}{f + b_A}$$

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$$\frac{r(\phi_{0X}^*)}{r(\phi_0^*)} = \frac{f_X}{f + b_0}$$

$$\frac{r(\phi_{BX}^*)}{r(\phi_B^*)} > \frac{r(\phi_{0X}^*)}{r(\phi_0^*)} > \frac{r(\phi_{AX}^*)}{r(\phi_A^*)} \longrightarrow S_{AX} > S_{0X} > S_{BX}$$

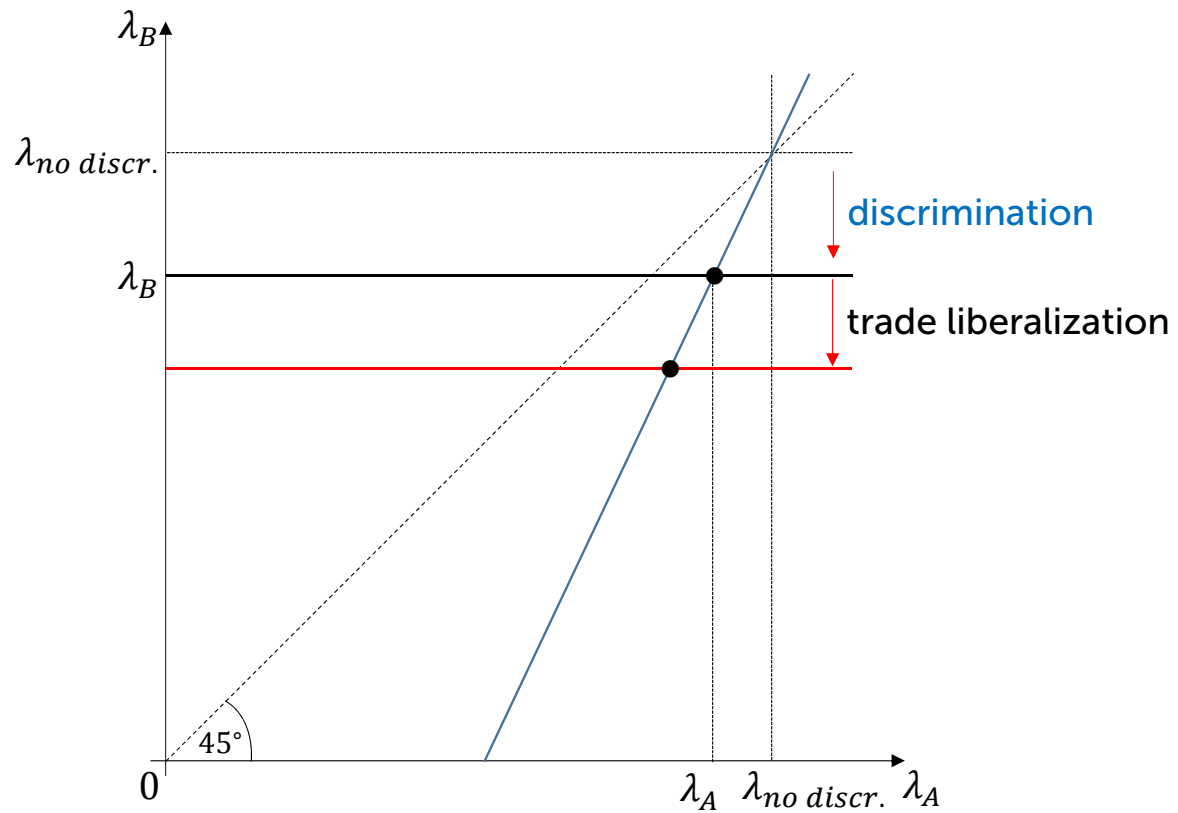
B-label attracting **discriminatory** firms

benefit least from trade liberalization

A-label attracting **discriminatory** firms

benefit most from trade liberalization

7 Trade liberalization & co-existence of discriminatory and non-discriminatory firms



7 Trade liberalization & co-existence of **discriminatory** and **non-discriminatory** firms impact of trade liberalization?

- income distribution and firm composition:
 - **low-wage B**-label attracting **discriminatory** firms: ↓
 - **high-wage A**-label attracting **discriminatory** firms: ↑
 - **non-discriminatory** firms: ↑
 - wage gap $b_A - b_B$: ↑
- aggregate **productivity**: ↑
- **vacancy rate** ↑:

aggravation of distortion: discrimination and trade increase firm profits → excessive firm entry

8 Numerical exercise?

- f & f_x :

all variables depend on λ_A , λ_B and λ_0

→ determine unsuccessful matches (related to search unemployment?)

and λ_A , λ_B and λ_0 depend on f & f_x

- real income loss due to discrimination?
- aggravation of discrimination induced distortion due to trade liberalization?

9 Conclusions

setup:

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purpose:

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results:

- labor market discrimination \rightarrow aggregate productivity \downarrow , # of active firms \downarrow
- trade liberalization:
 - aggregate productivity: increase smaller due to discrimination
 - relative # of non-discriminatory firms \uparrow
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