Preferential Trade Agreements and Global Sourcing

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March 2016
Expansion of global sourcing
Proliferation of PTAs
The world

- Expansion of global sourcing
- Proliferation of PTAs

General sense that the 2 trends are linked (e.g. Baldwin, 2011, 2016; Johnson & Noguera, 2014; WTO, 2011)
The questions

1. How do PTAs affect the efficiency of global sourcing?

2. How does global sourcing affect the welfare consequences of PTAs?
Our approach

- Incomplete contracts
- Trade of customized inputs
- Relationship-specific investments
- Partial equilibrium
GVCs and PTAs (Baldwin, 2011; Johnson & Noguera, 2014)

Welfare impacts of PTAs (Freund & Ornelas, 2010; Maggi, 2014)

Trade of intermediates in the context of incomplete contracts (Antras & Helpman, 2004; Ornelas & Turner, 2012; Antras & Staiger, 2012; Antras, 2016)

The investment/innovation consequences of trade liberalization (Lileeva & Trefler, 2010; Bustos, 2011)
Basic model

- 3 countries
  - *Home* has a mass of producers, or *buyers* \((B)\), which assemble final goods from outsourced inputs.
  - Inputs are available from suppliers located in either *Foreign* or *ROW*; the mass of suppliers in either location is large relative to the mass of \(B\) in *Home*.
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- A buyer *B* obtains revenue \( V(Q) \) from purchasing and processing \( Q \) units of intermediate inputs; \( V'(Q) > 0 \), \( V''(Q) < 0 \)
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- A buyer B obtains revenue \( V(Q) \) from purchasing and processing \( Q \) units of intermediate inputs; \( V'(Q) > 0, V''(Q) < 0 \)

- When sourcing, B can purchase:
  - Standardized inputs, \( g \), from ROW at unit cost (adjusted for quality and compatibility) \( p_w + t \)
    - \( g \) is produced by a competitive fringe; \( t \) is the per-unit MFN tariff on intermediate goods
  - Customized inputs, \( q \), from a specialized supplier S, located in either Foreign or ROW, at a negotiated price in addition to the unit tariff
Each supplier $S$ is identified by parameter $\omega$ :

$$C(q, i, \omega) = (A + \omega - bi)q + \frac{c}{2}q^2$$

- $MC$ increases with $q$: $C_q = A + \omega - bi + cq$
- $\omega$ shifts $MC$ up: higher $\omega$, lower productivity; $\omega \in [0, \bar{\omega}]$, $\omega \sim G(\omega)$
- $b$ denotes the effectiveness of investment in reducing production costs (and $MC$)
Supply

Basic model

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Investment:

- Costs

\[ I(i) = i^2 \]

- Observed by both $B$ and $S$, but not verifiable in a court of law

Assume that $2c > b^2$
Dual sourcing

Basic model

- Focus on case where $B$ uses both $g$ and $q$

- Assume $C_q(0, 0, \omega) < p_w$ for all $\omega$
  - $q^* \gg 0$

- Assume $V'(0) > p_w + t$
  - Level of total inputs sourced, $Q^*$, pinned down: $V'(Q^*) = p_w + t$

- Assume $C_q(Q^*, i^{max}, 0) > p_w + t$
  - $g^* \gg 0$
Timing

- Each $B$ searches and matches with a supplier in either Foreign or ROW; once $B$ decides to form a match, the two parties adapt their technologies towards each other

- $S$ makes relationship-specific investment
- $B$ and $S$ bargain over price and quantity of $q$
- If bargaining is successful, trade of $q$ takes place and payments are made
- $B$ purchases $g$
- Final production occurs and final goods are sold
Conditional on $i$, privately optimal sourcing requires:

\[
\begin{align*}
V'(Q^*) &= p_w + t \\
Q^* &= q_N^* + g_N^* \\
C_q(q_N^*, i, \omega) &= p_w
\end{align*}
\]
After $S$ chooses $i$, $B$ and $S$ determine terms of trade through Generalized Nash Bargaining

- $S$ has bargaining power $\alpha \in (0, 1)$

**Bargaining surplus:**

$$\Omega \equiv (U_b^T - U_b^0) + (U_s^T - U_s^0)$$

**No TA:**

$$\Omega_N = p_w q_N - C(q_N, i_N, \omega)$$

**Bargaining outcome:** in addition to their reservation payoffs, $S$ receives $\alpha \Omega_N$ and $B$ receives $(1 - \alpha)\Omega_N$
$S$ chooses $i_N$ to

\[
\max_{i_N} \alpha \Omega_N - I(i_N)
\]

\[
\Rightarrow I'(i_N^*) = -\alpha C_i(\cdot)
\]

\[
\Leftrightarrow i_N^* = \left( \frac{\alpha b}{2c - \alpha b^2} \right) (p_w - A - \omega)
\]
S chooses $i_N$ to

$$\max_{i_N} \alpha \Omega_N - I(i_N)$$

$$\Rightarrow I'(i_N^*) = -\alpha C_i(\cdot)$$

$$\iff i_N^* = \left( \frac{\alpha b}{2c - \alpha b^2} \right) (p_w - A - \omega)$$

Using condition for optimal sourcing:

$$q_N^* = \left( \frac{2}{\alpha b} \right) i_N^*$$
Investment

No trade agreement

- $S$ chooses $i_N$ to

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- Using condition for optimal sourcing:

$$q_N^* = \left( \frac{2}{\alpha b} \right) i_N^*$$

- $t$ affects $Q^*$ but has no effect on $q_N^*$ or $i_N^*$
Efficient investment

No trade agreement

Social welfare:

\[ \Psi = V(Q^*) - p_w Q^* + p_w q_N - C(q_N, i, \omega) - I(i) \]

Efficient investment maximizes \( \Psi \):

\[ I'(i^e) = -\alpha C_i(\cdot) \]

\[ i^e = \left( \frac{b}{2c - b^2} \right) (p_w - A - \omega) \]

Since \( \alpha < 1 \), \( i^e < i^*_N \)

\( i^e - i^*_N \) as \( \omega \downarrow \): contract incompleteness more consequential for relationships that involve more productive suppliers
PTA: no tariffs between *Home* and *Foreign*; sourcing from *Foreign* now tariff-free

- *g* still purchased from *ROW*
  - Level of $Q^*$ unchanged, but its composition changes

>>> No trade creation
Conditional on $i$, privately optimal sourcing now requires:

\[
\begin{aligned}
V'(Q^*) &= p_w + t \\
Q^* &= q_P^* + g_P^* \\
C_q(q_P^*, i_P, \omega) &= p_w + t
\end{aligned}
\]
\( \Omega_P = (p_w + t)q_P - C(q_P, i_P, \omega) \)

- \( S \) chooses \( i_P \) to maximize

\[
\max_i \alpha \Omega_P - I(i_P)
\]

\[
\Rightarrow i_P^* = \left( \frac{\alpha b}{2c - \alpha b^2} \right) (p_w + t - A - \omega)
\]

- As before,

\[
q_P^* = \left( \frac{2}{\alpha b} \right) i_P^*
\]
Changes in $i$ and in $q$ are proportional to the tariff preference:

\[
\Delta i \equiv i_P^* - i_N^* = \left( \frac{\alpha b}{2c - \alpha b^2} \right) t
\]

\[
\Delta q \equiv q_P^* - q_N^* = \left( \frac{2}{2c - \alpha b^2} \right) t
\]
Effects of the PTA

- Changes in $i$ and in $q$ are proportional to the tariff preference:

\[ \Delta i \equiv i_P^* - i_N^* = \left( \frac{ab}{2c - \alpha b^2} \right) t \]

\[ \Delta q \equiv q_P^* - q_N^* = \left( \frac{2}{2c - \alpha b^2} \right) t \]

- Part of $\Delta q$ is standard trade (‘sourcing’) diversion:

\[ \Delta q(\alpha = 0) = \frac{t}{c} \]

- Under the PTA $i$ has a bigger impact on $\Omega$, because $q_P(i) > q_N(i)$; $S$ anticipates that and invests more, lowering its $MC$ curve

  - With the PTA, more units of $q$ should be traded: $C_q(q_1, i_P, \omega) = p_w$
  - $q_P^* = q_1 + \frac{t}{c}$
The welfare effects of the PTA

- A “within relationship” tradeoff between classic Vinerian trade diversion and a novel “investment enhancing” effect
  - Recall: by construction, no Vinerian trade creation
  - Consumer’s welfare from consumption of the final good unchanged
The welfare effects of the PTA

- A “within relationship” tradeoff between classic Vinerian trade diversion and a novel “investment enhancing” effect
  - Recall: by construction, no Vinerian trade creation
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- 2 effects ($\Delta \Psi = \Delta \Psi_R + \Delta \Psi_S$): a relationship-strengthening effect and a sourcing-diversion effect
The relationship-strengthening effect

The welfare effects of the PTA

Relationship-strengthening effect

Difference in surplus created by $\Delta i$, inclusive of the extra investment cost:

$$
\Delta \Psi_R = p_w(q_1^* - q_N^*) + [C(q_N^*, i_N^*) - C(q_1^*, i_P^*)] - [I(i_P^*) - I(i_N^*)]
$$

$$
= \Delta i \left[ (1 - \alpha) b q_N^* + \left( \frac{b^2}{2c} - 1 \right) \Delta i \right]
$$

The relationship-strengthening effect of the PTA is more important for more productive firms. Low-$\omega$ suppliers produce more at any given trade regime: when cost-reducing $i$ rises due to the PTA, the cost savings apply to more units for low-$\omega$ suppliers.
The relationship-strengthening effect

The welfare effects of the PTA

Relationship-strengthening effect

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$$

$$
= \Delta i \begin{cases} 
(1 - \alpha) b q_N^* + \left(\frac{b^2}{2c} - 1 \right) \Delta i & > 0 \\
& < 0 
\end{cases}
$$

$\frac{\partial \Delta \Psi_R}{\partial \omega} = (1 - \alpha) b \Delta i \frac{\partial \Delta q_N^*}{\partial \omega} < 0$: the relationship-strengthening effect of the PTA is more important for more productive firms

- Low-$\omega$ suppliers produce more at any given trade regime: when cost-reducing $i$ rises due to the PTA, the cost savings apply to more units for low-$\omega$ suppliers
Sourcing-diversion effect

Deadweight loss from using too expensive customized inputs:

\[
\Delta \Psi_S = C(q_1, i_P) - C(q_P, i_P) + p_w(q_P - q_1) = -\frac{t^2}{2c}
\]

- \(\Delta \Psi_S\) is unaffected by \(i\) or \(\omega\)
Lemma As $S$’s productivity rises, the cost savings from the PTA increase, but its sourcing diversion remains unchanged.

- Define $\hat{\omega}$ implicitly as $\Delta \Psi_R(\hat{\omega}) + \Delta \Psi_S = 0$
The effect of supplier productivity
The welfare effects of the PTA

Lemma  As $S$’s productivity rises, the cost savings from the PTA increase, but its sourcing diversion remains unchanged.

- Define $\hat{\omega}$ implicitly as $\Delta \Psi_R (\hat{\omega}) + \Delta \Psi_S = 0$

(Considering a single relationship:)

Proposition  The PTA enhances welfare only if $S$ is sufficiently productive: $\omega < \hat{\omega}$.

Proposition  $\frac{\partial \hat{\omega}}{\partial t} < 0$: more discriminatory PTA $\Rightarrow$ stricter requirement on supplier productivity to make $\Delta \Psi > 0$. 
The effect of the tariff preference

The welfare effects of the PTA

- The tariff preference $t$ affects the welfare impact of the PTA through the 2 channels:

1. $\partial \Delta \Psi_S / \partial t < 0$
2. $\Delta \Psi_R > 0$ for low $t$, initially with $t$ but eventually $\downarrow$ with $t$

**Proposition** $\Delta \Psi$ has a $\cap$-shape w.r.t. $t$; $\Delta \Psi > 0$ for ‘low $t$’ but $\Delta \Psi < 0$ for ‘high $t$’.
The effect of HUP intensity

The welfare effects of the PTA

**Proposition** The PTA can enhance welfare only when the *HUP* is ‘moderate’.

- If $\alpha \to 0$, the *HUP* is too severe and the PTA is a poor substitute for incomplete contracts: PTA merely distorts sourcing decisions
- If $\alpha \to 1$, there is little contractual inefficiency to substitute for: PTA distorts sourcing decisions *and* yields excessive investment
Search and matching

- Each $B$ searches as many times as he wants, with no recall, in either *ROW* or *Foreign*
- Cost of single search (which yields one match): $K > 0$
Search and matching

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Payoff of $B$ that finds $S$ with productivity $\omega'$:

$$V^N_B(\omega') = \max \left\{ U^N_B(\omega'), \int_0^{\bar{\omega}} V^N_B(\omega) dG(\omega) - K \right\}$$
Equilibrium
Search and matching

- Equilibrium characterized by cutoff rule that makes $B$ indifferent between stopping and searching:

$$U_B^N(\tilde{\omega}_N) = -K + \int_{0}^{\tilde{\omega}} V_B^N(\omega) dG(\omega)$$  \hspace{1cm} (1)

- If $\omega > \tilde{\omega}_N$, new search: $V_B^N(\omega) = -K + \int_{0}^{\tilde{\omega}} V_B^N(\omega) dG(\omega) = U_B^N(\tilde{\omega}_N)$

- If $\omega \leq \tilde{\omega}_N$, stop searching: $V_B^N(\omega) = U_B^N(\omega)$
Equilibrium
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- If $\omega \leq \tilde{\omega}_N$, stop searching: $V_B^N(\omega) = U_B^N(\omega)$
- Substituting back into (1):

$$U_B^N(\tilde{\omega}_N) = -K + \int_0^{\tilde{\omega}_N} U_B^N(\omega) dG(\omega) + [1 - G(\tilde{\omega}_N)] U_B^N(\tilde{\omega}_N)$$

$$\Leftrightarrow U_B^N(\tilde{\omega}_N) = E \left[ U_B^N(\omega; \omega \leq \tilde{\omega}_N) \right] - \frac{K}{G(\tilde{\omega}_N)}$$
Analogous expressions for cutoff $\omega$ under PTA: $\tilde{\omega}_P$

However,

$$\tilde{\omega}_P < \tilde{\omega}_N$$

- At $\tilde{\omega}_N$, $U_B$ \uparrow with PTA
- At $\tilde{\omega}_N$, $V_B$ \uparrow even more with PTA

Key: gain with PTA rises with productivity of supplier (as $\omega$ \downarrow), so benefit from searching for a great supplier increases with PTA
Adjustments with PTA

Search and matching

- $Bs$ with initial matches in $Foreign$:
  - If $\omega \leq \tilde{\omega}_P$: keep match
  - If $\omega \in (\tilde{\omega}_P, \tilde{\omega}_N]$: re-match
Adjustments with PTA

Search and matching

- Bs with initial matches in *Foreign*:
  - If $\omega \leq \tilde{\omega}_P$: keep match
  - If $\omega \in (\tilde{\omega}_P, \tilde{\omega}_N]$: re-match

- Bs with initial matches in *ROW*:
  - Comparison is now between keeping match in *ROW* vs. re-matching in *Foreign*
  - If $\omega \leq \tilde{\omega}^{ROW}_P (< \tilde{\omega}_P)$: keep match
  - If $\omega \in (\tilde{\omega}^{ROW}_P, \tilde{\omega}_N)$: re-match in *Foreign*
Because $B$ does not consider $U_S$ and $TR$, initially there is too little search.

With PTA, more search and better average matches for $B$s in Foreign.

Furthermore, $B$s without great matches in ROW move to inside PTA.
Because $B$ does not consider $U_S$ and $TR$, initially there is too little search.

With PTA, more search and better average matches for $Bs$ in Foreign.

Furthermore, $Bs$ without great matches in ROW move to inside PTA.

More search $\Rightarrow$ welfare $\nearrow$ because of too little search without the PTA.

Better matches $\Rightarrow$ welfare impact of PTA greater exactly in that case.

Could the PTA induce too much search?
The consequences of PTAs under global sourcing and incomplete contracts can be quite different from the usual type

- A PTA can be welfare-enhancing even if trade creation $= 0$
- The beneficial investment effect is especially valuable for high-productivity suppliers
- Search & matching reinforce those effects and justify view that PTAs and GVCs ‘go together’
  - For ‘true’ GVCs, where specialized inputs cross many national borders and incur many tariffs along the way, the effects we highlight tend to be magnified
The consequences of PTAs under global sourcing and incomplete contracts can be quite different from the usual type:

- A PTA can be welfare-enhancing even if trade creation \( \equiv 0 \).
- The beneficial investment effect is especially valuable for high-productivity suppliers.
- Search & matching reinforce those effects and justify view that PTAs and GVCs ‘go together’.
  - For ‘true’ GVCs, where specialized inputs cross many national borders and incur many tariffs along the way, the effects we highlight tend to be magnified.


- Here: a step toward a framework that incorporates the Vinerian view to the world of international fragmentation.