Preferential Trade Agreements and Global Sourcing

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The world

- Expansion of global sourcing
- Proliferation of PTAs

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- Proliferation of PTAs

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

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
- Relationship-specific investments
- Costly search and matching
- Trade of 'generic' and of 'customized' inputs

- Exogenous formation of PTAs

- Partial equilibrium
    - Focus on input trade: structure is s.t. production of final good is fixed
    - 'Outside sector' pins down wages
    - TR rebated back to consumers

Literature

- GVCs and PTAs (Baldwin, 2011; WTO, 2011; Johnson & Noguera, 2016)

- Welfare impacts of PTAs (Freund & Ornelas, 2010; Maggi, 2014; Limao 2016; Ornelas, 2005)

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

- Most closely related to literature on trade of intermediates in the context of incomplete contracts (Antràs & Helpman, 2004; Grossman & Helpman, 2005; Ornelas & Turner, 2012; Antràs & Staiger, 2012; Antràs, 2016)

  - Here: emphasis on how PTA affects *dynamic* inefficiencies

    - Too low ex-ante cost-reducing investment
    - Too little search for high-productivity partners

Benchmark 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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- 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 in this industry
  - Customized inputs, q, from a specialized supplier S, located in either *Foreign* or *ROW*, at a negotiated price in addition to the unit tariff
  - $Q = q + g$

- Each specialized supplier S is identified by parameter ω:

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

  - MC increases with q: $C_q = \omega - bi + cq$
  - ω shifts MC *up*: lower ω, higher productivity; $\omega \in [0, \bar{\omega}]$, $\omega \sim G(\omega)$

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- Investment:
  - Shifts MC down
  - Costs

$$I(i) = i^2$$

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

Timing

- Each B searches for 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

Dual sourcing
Benchmark model

- Focus on case where B produces final good using both g and q

  - Assume $V'(0) > p_w + t$
    - ▶ $Q^* >> 0$ (B always produces some final good)
  - Assume $C_q(0, 0, \bar{\omega}) < p_w \Leftrightarrow \bar{\omega} < p_w$
    - ▶ $q^* >> 0$ (B always purchases some specialized inputs)
  - Assume $C_q(Q^*, i^{max}, 0) > p_w + t$
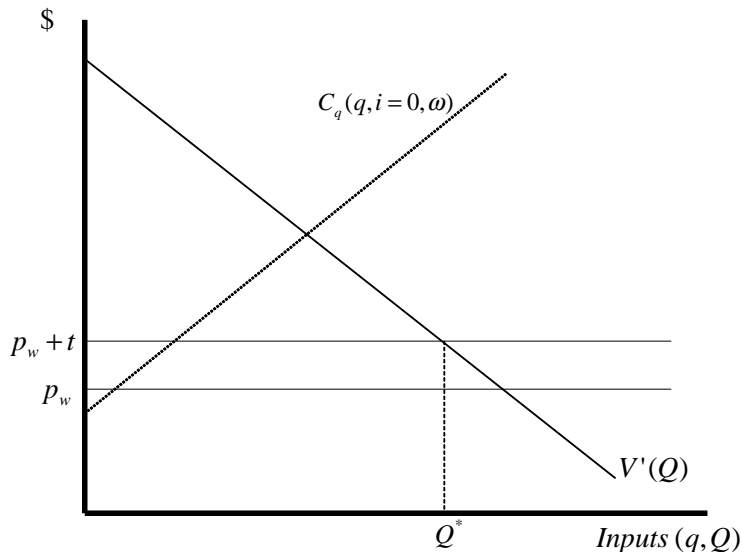   - ▶ $g^* >> 0$ (B always purchases some generics)

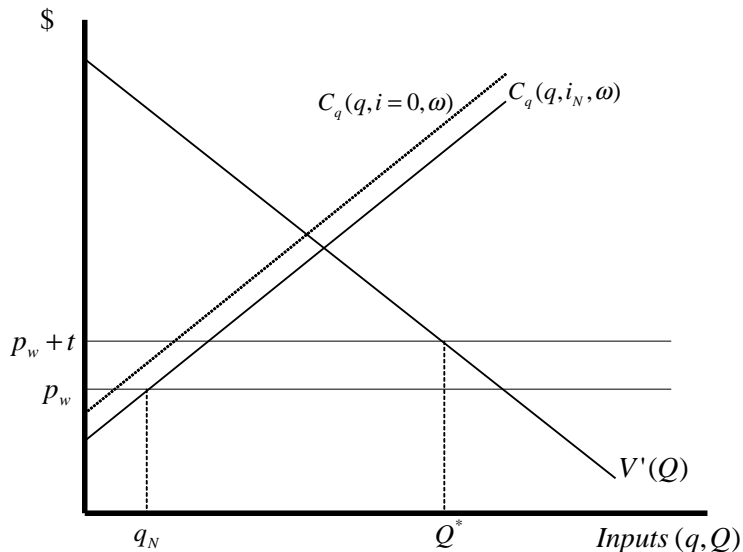# Privately optimal sourcing
No trade agreement

- In the spirit of the property-rights literature (e.g. Grossman & Hart, 1986), conditional on i, B-S trade is privately optimal

- Conditional on i, privately optimal sourcing requires:

$$\begin{cases} V'(Q^*) = p_w + t \\ C_q(q_N^*, i, \omega) + t = p_w + t \\ Q^* = q_N^* + g_N^* \end{cases}$$
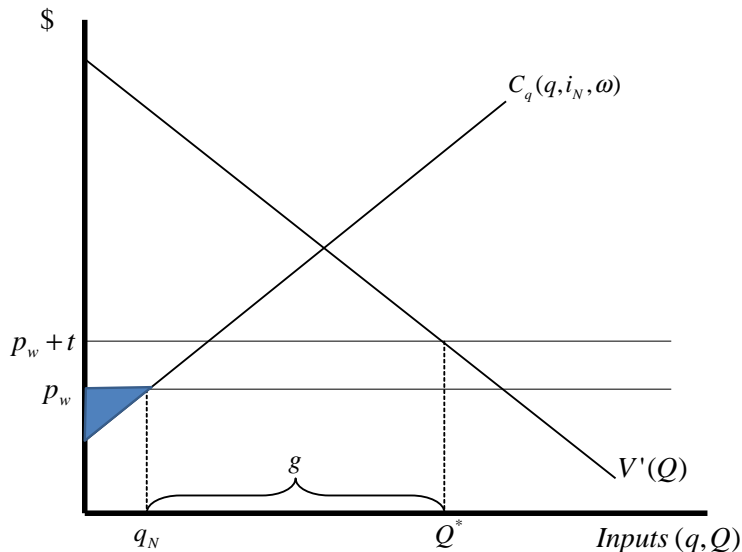
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Privately optimal sourcing

- 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

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

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

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

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- Using condition for privately optimal sourcing:

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

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

▶ t affects Q^* but has no effect on q_N^* or i_N^*

Efficient investment
No trade agreement

- Social welfare:

$$\begin{aligned} \Psi &= [V(Q^*) - p_w Q^*] + \Omega_N(i) - I(i) \\ &= V(Q^*) - p_w(Q^* - q_N) - C(q_N, i, \omega) - I(i) \end{aligned}$$

- Efficient investment maximizes Ψ:

$$I'(i^e) = -C_i(\cdot)$$

$$\Leftrightarrow i^e = \left(\frac{b}{2c - b^2}\right)(p_w - \omega)$$

- Since $\alpha < 1$, $i^e > i_N^*$
  - $(i^e - i_N^*) \nearrow$ as $\omega \downarrow$: contract incompleteness more consequential for relationships that involve more productive suppliers
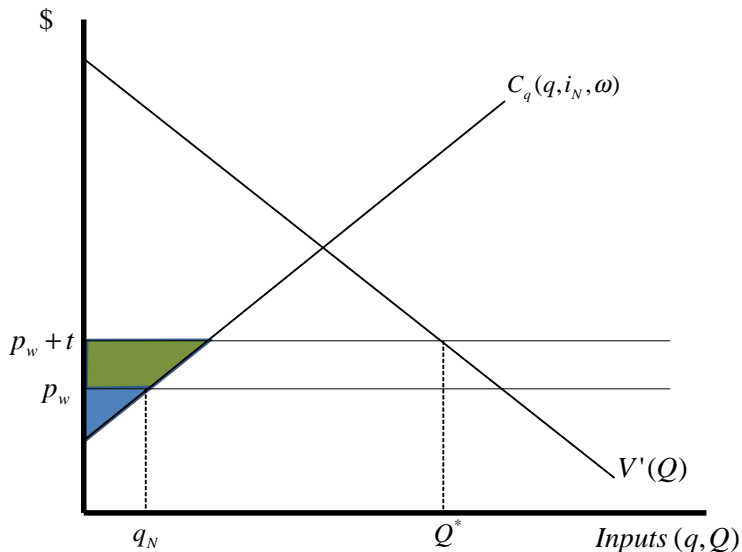
PTA

- 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

Privately optimal sourcing
PTA

- Conditional on i, privately optimal sourcing now requires:

$$\begin{cases} V'(Q^*) = p_w + t \\ C_q(q_P^*, i, \omega) = p_w + t \\ Q^* = q_P^* + g_P^* \end{cases}$$

$$\Omega_P = (p_w + t)q_P - C(q_P, i_P, \omega)$$

- S chooses i_P to maximize

$$\max_i \alpha\Omega_P - I(i_P)$$

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

- As before,

$$q_P^* = \left(\frac{2}{\alpha b}\right) i_P^*$$

Effects of the PTA

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

$$
\begin{aligned}
\Delta i &\equiv i_P^* - i_N^* = \left(\frac{\alpha b}{2c - \alpha b^2} \right) t \\
\Delta q &\equiv q_P^* - q_N^* = \left(\frac{2}{2c - \alpha b^2} \right) t
\end{aligned}
$$

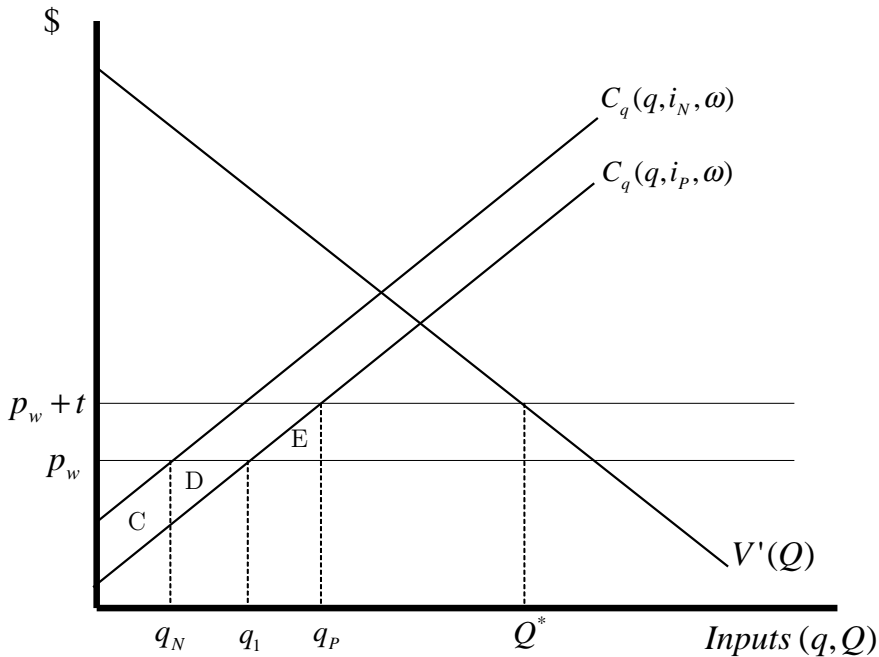- Changes in i and in q are proportional to the tariff preference:

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- Part of Δq is trade ('sourcing') diversion:

$$
\Delta q(i \; constant) = \Delta q(\alpha = 0) = \frac{t}{c}
$$

- Under the PTA, i has a bigger impact on Ω 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: $C_q(q_1, i_P, \omega) = p_w$
  ▶ $q_P^* = q_1 + \frac{t}{c}$

- Recall: by construction, no Vinerian trade creation
  - Consumer's welfare from consumption of the final good unchanged

The welfare effects of the PTA

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  - Consumer's welfare from consumption of the final good unchanged

- 2 effects ($\Delta\Psi = \Delta\Psi_R + \Delta\Psi_S$):

1. A relationship-strengthening effect ($\Delta\Psi_R$)
2. A sourcing-diversion effect ($\Delta\Psi_S$)

Relationship-strengthening effect

Welfare consequences of PTA due to Δi, inclusive of the extra investment cost, given ex-post efficient production of q:

$$
\begin{aligned}
\Delta\Psi_R &= p_w(q_1^* - q_N^*) - [C(q_1^*, i_P^*) - C(q_N^*, i_N^*)] - [I(i_P^*) - I(i_N^*)] \\
&= \Delta i \left[\underbrace{(1-\alpha)bq_N^*}_{>0} + \underbrace{\left(\frac{b^2}{2c} - 1\right)\Delta i}_{<0} \right]
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$$

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

Sourcing-diversion effect

Welfare consequences of PTA due to changes in the outsourcing decisions, given i_P^*:

$$\begin{aligned} \Delta\Psi_S &= p_w(q_P^* - q_1^*) - [C(q_P^*, i_P^*) - C(q_1^*, i_P^*)] \\ &= -\frac{t^2}{2c} \end{aligned}$$

- $\Delta\Psi_S$ is unaffected by i or ω

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 bilateral relationship:)

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

Proposition The PTA boosts the firms' joint payoff by more, the higher is S's productivity.

- 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, $\nearrow$ initially with t but eventually $\searrow$ 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'.

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

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

- Before investment, bargaining and production takes place within relationships, Bs and Ss need to match:

Search and matching

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- 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): $K > 0$

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- Payoff of B that finds S with productivity ω':

$$V_B^N(\omega') = \max \left\{ U_B^N(\omega'), \int_0^{\bar{\omega}} V_B^N(\omega) dG(\omega) - K \right\}$$

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

$$U_B^N(\tilde{\omega}_N) = -K + \int\limits_0^{\bar{\omega}} V_B^N(\omega)dG(\omega) \qquad (1)$$

- If $\omega > \tilde{\omega}_N$, new search: $V_B^N(\omega) = -K + \int\limits_0^{\bar{\omega}} V_B^N(\omega)dG(\omega) = U_B^N(\tilde{\omega}_N)$
- If $\omega \leq \tilde{\omega}_N$, stop searching: $V_B^N(\omega) = U_B^N(\omega)$
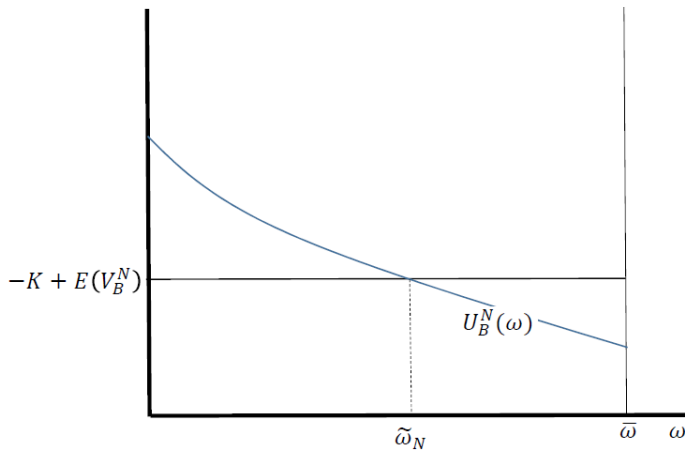
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- If $\omega \leq \tilde{\omega}_N$, stop searching: $V_B^N(\omega) = U_B^N(\omega)$
- Substituting back into (1):

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

$$\Leftrightarrow U_B^N(\tilde{\omega}_N) = E\left[U_B^N(\omega; \omega \leq \tilde{\omega}_N)\right] - \frac{K}{G(\tilde{\omega}_N)}$$

Proposition In the absence of a PTA, there is *too little search*.

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- *However*,

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

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

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

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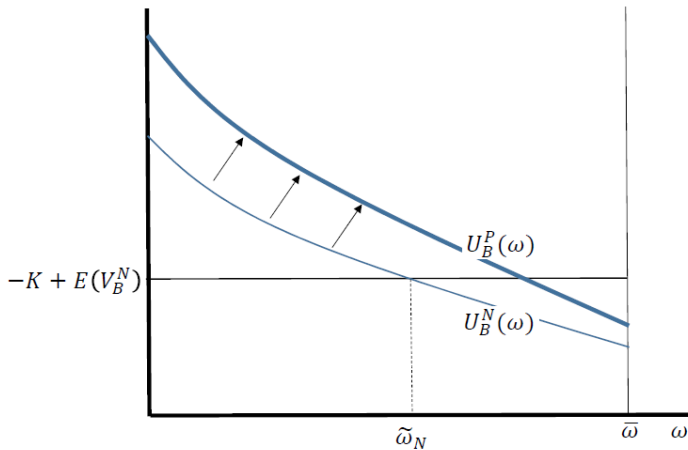$$\tilde{\omega}_P < \tilde{\omega}_N$$

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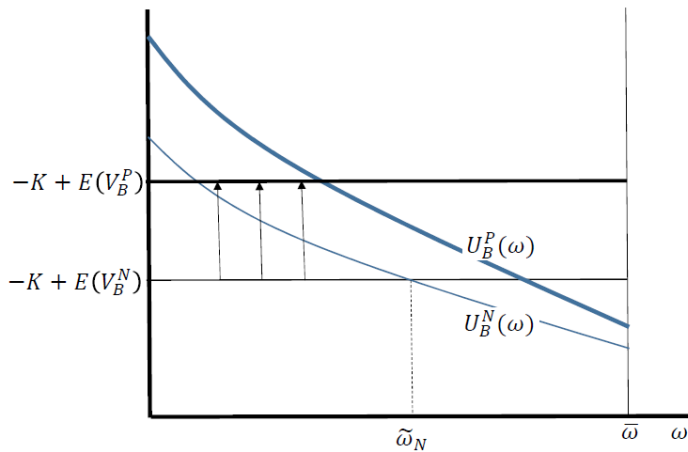
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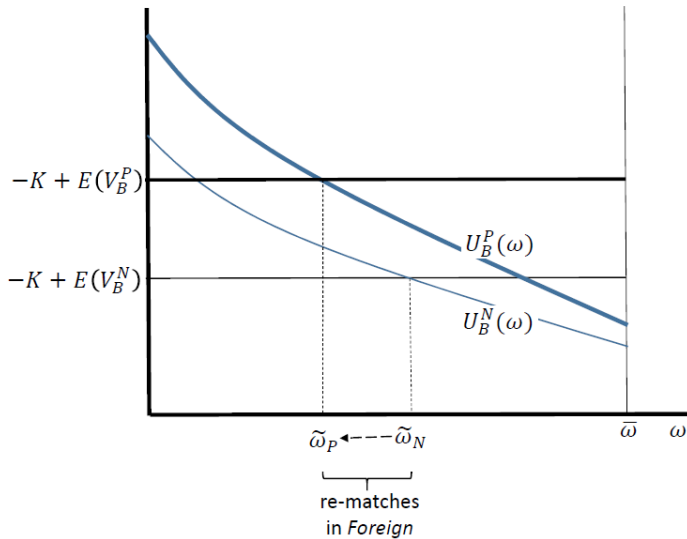
$$\frac{d\tilde{\omega}_P}{dt} < 0$$

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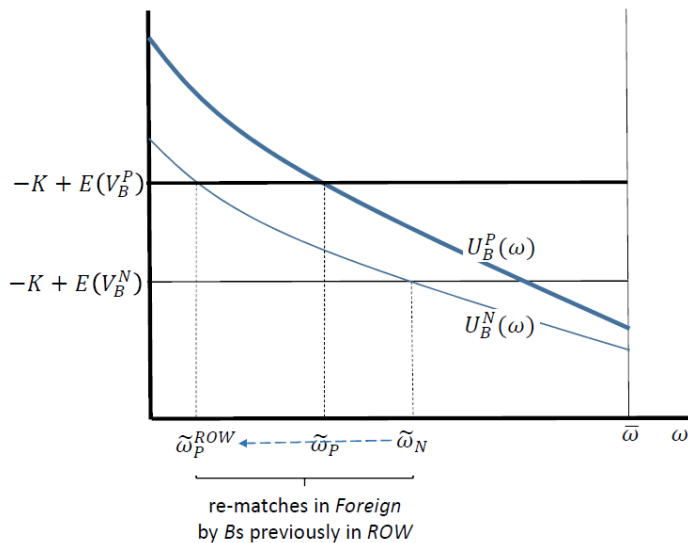   - If $\omega \in (\tilde{\omega}_P, \tilde{\omega}_N]$: re-match

- Bs with initial matches in *ROW*:
  - Comparison is now between keeping match in *ROW vs.* re-matching in *Foreign*
  - If $\omega \leq \tilde{\omega}_P^{ROW}$ $(< \tilde{\omega}_P)$: keep match
  - If $\omega \in (\tilde{\omega}_P^{ROW}, \tilde{\omega}_N)$: re-match in *Foreign*

re-matches in *Foreign*
by *B*s previously in *ROW*

- PTA $\Rightarrow$ better average matches for Bs in *Foreign*
- PTA $\Rightarrow$ better *Foreign* average matches for some Bs initially in *ROW*

Consequences of the PTA
Search and matching

- PTA $\Rightarrow$ better average matches for Bs in *Foreign*
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- Better matches $\Rightarrow$ better welfare consequences of PTA
  - Stronger relationship-strengthening effect

Consequences of the PTA
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- PTA $\Rightarrow$ better *Foreign* average matches for some Bs initially in *ROW*
- Better matches $\Rightarrow$ better welfare consequences of PTA
  - Stronger relationship-strengthening effect
- More search $\Rightarrow$ mitigates inefficient low search efforts
  - But if t is too high, the PTA can induce excessive search
    [NEEDS FURTHER SCRUTINY]

Take away

- The consequences of PTAs under global sourcing and incomplete contracts can be quite different from the usual type

1. A PTA can be welfare-enhancing even if trade creation $\equiv 0$
   - If suppliers are high-productivity, because then the beneficial relationship-strengthening effect is more valuable

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2. Endogenous choice of partner and location through search & matching reinforces those effects
   - PTA induces buyers with not-so-good relationships within the bloc to seek higher-productivity suppliers there
   - PTA induces buyers with not-great relationships elsewhere to seek higher-productivity suppliers within the bloc

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3. Results help to justify view that PTAs $\Rightarrow$ intensification of GVCs
   - "more depth": more investment and production in existing relationships
   - "more width": formation of new (stronger) relationships

Take away

- Baldwin (2011), WTO (2011): 'new regionalism' in world of international fragmentation needs new thinking

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

Comparison to Antràs & Staiger (2012)

- AS study optimal trade policy when intermediate inputs are subject to hold-up problems and prices are determined via bargaining
- In contrast to AS, we look at the welfare impact of PTAs
- Most importantly, our model addresses an almost entirely complementary set of issues that might confront policy makers
  - In AS, bilateral bargaining leads to *allocative* inefficiency: too few inputs are produced; bargaining surpluses are independent of production technology
  - Here, provision of inputs is (privately) optimal for given technology, but hold-up problems lead to *dynamic* inefficiency: suppliers do not make optimal technology investments, and buyers are not sufficiently patient in searching for high-productivity suppliers
- Because tariffs affect investment and search decisions, which interact with firm productivity, our framework allows us to highlight how the welfare consequences of preferential access depend upon supplier productivity