Preference Bias and Outsourcing to Market: A Steady-State Analysis

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**Observation: global rise in trade**

- Global rise in trade, \([\text{export+import}/2]/\text{GDP}\) (IFS data):

<table>
<thead>
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<tbody>
<tr>
<td>Germany</td>
<td>14.5</td>
<td>16.5</td>
<td>21.6</td>
<td>24.0</td>
<td>33.5</td>
</tr>
<tr>
<td>Japan</td>
<td>8.8</td>
<td>8.3</td>
<td>11.8</td>
<td>8.4</td>
<td>10.1</td>
</tr>
<tr>
<td>U.K.</td>
<td>15.3</td>
<td>16.5</td>
<td>20.3</td>
<td>20.6</td>
<td>29.0</td>
</tr>
<tr>
<td>U.S.</td>
<td>3.4</td>
<td>4.1</td>
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<td>8.0</td>
<td>13.1</td>
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Observation: diversified outsourcing

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- Tomiura (2005) computes the comparable figure for Japan in 1998 to be below 1%
- More global sourcing need not make U.S. firms more competitive over Japanese firms, particularly concerning automobile and electronics industries.
Product outsourcing:
Literature

Product outsourcing:

- Ethier (1986) shows that arm’s length contracting (such as outsourcing) emerges when information exchanges between the principal and the agent are simple.
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  - Jones (2000) emphasizes on comparative advantage
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- Ethier (1986) shows that arm’s length contracting (such as outsourcing) emerges when information exchanges between the principal and the agent are simple.
  - low search and communication costs and severe in-house shirking problems (Grossman and Helpman 2002, 2005; Grossman-Rossi-Hansberg 2008)
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  - higher outsourcers’ ability to monitor subcontractors’ shirking problem (Grossman and Helpman 2004)
  - low product-defect rate and high diversification cost (Lu–Peng-Wang 2009)
Purpose of this Paper

- Our paper develops a preference-based theory of outsourcing
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Our paper develops a **preference-based** theory of outsourcing

- outsourcing is beneficial because it mitigates the information problem with respect to the identification of local tastes for the manufactured good
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- Real world examples
  - Taiwan GI
  - Beijing Jeep
Main Issues

- What are the key factors inducing outsourcing in equilibrium?
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- How would preference biases interact with technological advantages in the dynamic process?
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- How would preference biases interact with technological advantages in the dynamic process?
- **Would outsourcing always emerge as an equilibrium outcome as the host country becomes more developed?**
Structure of the Model

- Two countries:
Structure of the Model

- **Two countries:**
  - a low-income developing local country (L)

Two countries:

- a low-income developing local country (L)

- a high-income developed source country (S)

Two types of goods:

- a homogeneous good (food, N) produced only in L
- a particular variety j of a manufactured good (laptop computer, Mj) that may be produced in L or in S (outsourcing to L)

R&D: only conducted in S, for improving the production technology of M

Only through outsourcing, the local economy’s ideal variety-specific preference (i) is identified

Specific factor:

- S uses general capital H (for both production and R&D)
- L uses physical capital K (for production only)
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Main Decisions

- Manufacturers in S maximize its value by choosing
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  - whether to accept the outsourcer’s contract (if offered)
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  - whether to accept the outsourcer’s contract (if offered)
  - how to allocate consumption and capital intertemporally
Main Decisions

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  - whether to outsource the production of their good
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- An integrated representative consumer-producer in L decides
  - whether to accept the outsourcer’s contract (if offered)
  - how to allocate consumption and capital intertemporally
  - how to allocate resources intersectorally if an outsourcing contract is offered and accepted
Source Country (S)

- General capital allocation and evolution:

\[ H_t = H_t^M + H_t^R \]

\[ H_t = H_0 = 1 \quad \forall t = 1, 2, \ldots \]
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Evolution of manufacturing technology:

\[ A_{t+1}^j = \psi \left( A_t^j \right)^\mu (s_t + z_t)^{1-\mu} \]

where \( \psi > 0 \) and \( \mu \in (0, 1) \).
Optimization when exporting (EX)

• Production of the exporting manufactured good $M^j_t$:

$$M^j_t = A^j_t \left( H^M_t \right)^\gamma = A^j_t (1 - s_t)^\gamma$$

where $\gamma \in (0, 1)$.
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  where $\gamma \in (0, 1)$.

- Optimization by the source firm:
  \[
  W^{EX}(A^j_t) = \max_{s_t, z_t} \left[ p^j_t A^j_t (1 - s_t)^\gamma - q_t z_t \right] + \frac{1}{1 + r} W^{EX}(A^j_{t+1}) \\
  \text{s.t. } A^j_{t+1} = \psi \left( A^j_t \right)^\mu (s_t + z_t)^{1-\mu} 
  \]
  where current profit = revenue from producing/exporting $M^j_t$ - R&D investment cost
Optimization when outsourcing (OS)

- Production of the manufactured good of the *ideal variety* $i$:

$$M_t^i = A_t^i \left( K_t^M \right)^\gamma$$
Optimization when outsourcing (OS)

- Production of the manufactured good of the ideal variety $i$:
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- Technology evolution under OS ($s_t = 1$):
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- Technology evolution under OS ($s_t = 1$): 
  \[ A^i_{t+1} = \psi \left( A^i_t \right)^\mu (1 + z_t)^{1-\mu} \]

- Outsourcing contract: *revenue-sharing* with a fraction $\phi$ of the value of the contracted good going to L
Optimization when outsourcing (OS)

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- Optimization by the source firm:

$$W^{OS}(A_t^i) = \max_{z_t} \left[ (1-\phi) p_t A_t^i \left( K_t^M \right)^\gamma - q_t z_t \right] + \frac{1}{1+r} W^{OS} \left( A_{t+1}^i \right)$$

s.t.  $$A_{t+1}^i = \psi \left( A_t^i \right)^\mu \left( 1 + z_t \right)^{1-\mu}$$
Local Country (L)

• Physical capital allocation and evolution:

\[ K_t = K_t^N + K_t^M, \quad K_{t+1} = (1 - \delta) K_t + \nu_t, \quad \delta \in (0, 1) \]
Local Country (L)

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- Production of and local demand for the necessity \( N_t \):
  \[ N_t = \left( K_t^N \right)^\beta, \quad N_t^d = \eta_t \left( K_t^N \right)^\beta \]
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- **Preference with discount rate** \( \rho > 0 \) and periodic utility:
  \[ U^i(N_t^d, M_t^i) = \ln(N_t^d) + \ln\left(\theta + \Gamma^j M_t^j\right) \]

where \( \theta > 0 \) (\( M_t^i \) not necessary) and \( \Gamma^j = 1 - \left(\frac{\Gamma_0}{J/2}\right)^{d^j} \leq 1 \) (variety discounting for \( j \neq i \))
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- Intertemporal budget constraint:
  \[ K_{t+1} - K_t = Y_t - \delta K_t - N_t^d - p_t^j M_t^j \]
In this case, $K_t^N = K_t$, $K_t^M = 0$, and $Y_t = (K_t)^\beta$
Optimization when importing

- In this case, $K_t^N = K_t$, $K_t^M = 0$, and $Y_t = (K_t)^\beta$

- Optimization by the local integrated consumer-producer:

\[
V^{EX}(K_t) = \max_{N_t^d, M_t^j} \left\{ \ln(N_t^d) + \ln(\theta + \Gamma^j M_t^j) \right\} + \frac{1}{1 + \rho} V^{EX}(K_{t+1}) \\
\text{s.t. } K_{t+1} = (K_t)^\beta + (1 - \delta) K_t - N_t^d - p_t^j M_t^j
\]
Optimization when outsourced

In this case, $K_t^M = K_t - K_t^N$, $N_t = (K_t^N)^\beta$,

$M_t^i = A_t^i (K_t - K_t^N)^\gamma$, and $Y_t = (K_t^N)^\beta + \phi p_t^i A_t^i (K_t - K_t^N)^\gamma$
Optimization when outsourced

- In this case, $K^M_t = K_t - K^N_t$, $N_t = (K^N_t)^eta$,
  $M^i_t = A^i_t (K_t - K^N_t)\gamma$, and $Y_t = (K^N_t)\beta + \phi p^i_t A^i_t (K_t - K^N_t)\gamma$
- Optimization by the local integrated consumer-producer:

  
  $V^{OS}(K_t) = \max_{N^d_t, M^i_t, v_t} \left\{ \ln(N^d_t) + \ln(\theta + M^i_t) \right\} + \frac{1}{1 + \rho} V^{OS}(K_{t+1})$

  s.t. $K_{t+1} = (K^N_t)\beta + \phi p^i_t A^i_t (K_t - K^N_t)\gamma$

  $+ (1 - \delta) K_t - N^d_t - p^i_t M^i_t$
Timing of Event

1. S determines whether to outsource production of $M$ to $L$ with a revenue-sharing contract.
2. The local country decides whether to accept this outsourcing contract, if offered.
3. Under each regime, optimal allocations and equilibrium relative price of $M$ are determined.

$$p^j_t = \frac{(K^j_t)^\beta \eta_t}{\theta / \Gamma^j + A^j_t (1-s^j_t)}; \quad p^i_t = \frac{(K^N_t)^\beta \eta_t}{\theta + A^i_t (K^j_t - K^N_t)}$$

<table>
<thead>
<tr>
<th>Comparison</th>
<th>$p^j$ vs. $p^i$</th>
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<tr>
<td>(1) $\Gamma^j &lt; 1$</td>
<td>$&lt;$</td>
</tr>
<tr>
<td>(2) $K^N &lt; K$</td>
<td>$&gt;$</td>
</tr>
<tr>
<td>(3) $A^j &lt; A^i$</td>
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<tr>
<td>(4) $H^M$ vs. $K^M$</td>
<td>?</td>
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Stage 3-EX regime: tradeoff relationships

- Optimal investment: \( \gamma p_t^j A_t^j (1 - s_t)^{\gamma^{-1}} = q_t \)
Stage 3-EX regime: tradeoff relationships

- Optimal investment: \( \gamma p_t^j A_t^j (1 - s_t)^{\gamma - 1} = q_t \)
- Intertemporal production:

\[
\frac{p_t^j}{p_{t-1}^j} = \frac{(1 + r) \gamma (A_{t-1}^j)^{1-\mu} (s_t + z_t)^\mu}{(1 - \mu) \psi (1 - s_{t-1})^{1-\gamma} (1 - s_t)^\gamma \left(1 + \frac{\mu}{1-\mu} \frac{s_t + z_t}{1-s_t}\right)}
\]
Stage 3-EX regime: tradeoff relationships

- **Optimal investment:**\[ \gamma p^j_t A^j_t (1 - s_t)^{\gamma - 1} = q_t \]

- **Intertemporal production:**\[
\frac{p^j_t}{p^j_{t-1}} = \frac{(1 + r) \gamma (A^j_{t-1})^{1-\mu} (s_t + z_t)^{\mu}}{(1 - \mu) \psi (1 - s_{t-1})^{1-\gamma} (1 - s_t)^{\gamma} \left(1 + \gamma \frac{\mu}{1-\mu} \frac{s_t + z_t}{1-s_t}\right)}
\]

- **Intratemporal and intertemporal optimization:**

\[
MRS = \frac{MU_M}{MU_N} = \frac{\Gamma^j \eta^j N^t}{\theta + \Gamma^j M^j} = p^j_t
\]
\[
MRIS = \frac{MU_{N,t-1}}{\frac{1}{1+\rho} MU_{N,t}} = \frac{(1+\rho) \eta^j N^t}{\eta^j_{t-1} N^t_{t-1}} = \beta (K_t)^{\beta - 1} + (1-\delta)
\]
Stage 3-EX regime: tradeoff relationships

- Optimal investment: $\gamma p_t^j A_t^j (1 - s_t)^{\gamma - 1} = q_t$
- Intertemporal production:
  \[
  \frac{p_t^j}{p_{t-1}^j} = \frac{(1 + r) \gamma (A_{t-1}^j)^{1-\mu} (s_t + z_t)^\mu}{(1 - \mu) \psi (1 - s_{t-1})^{1-\gamma} (1 - s_t)^\gamma \left(1 + \gamma \frac{\mu}{1-\mu} \frac{s_t + z_t}{1-s_t}\right)}
  \]
- Intratemporal and intertemporal optimization:
  \[
  \begin{align*}
  MRS & = \frac{MU_M}{MU_N} = \frac{\Gamma^j \eta_t N_t}{\theta + \Gamma^j M_t^j} = p_t^j \\
  MRIS & = \frac{MU_{N,t-1}}{1+\rho MU_{N,t}} = \frac{(1+\rho) \eta_t N_t}{\eta_{t-1} N_{t-1}} = \beta (K_t)^{\beta - 1} + (1-\delta)
  \end{align*}
  \]
- Modified golden rule: $\beta (K_t)^{\beta - 1} = \rho + \delta$
Human Capital Accumulation

- S-S: $\bar{K} = \left(\frac{\beta}{\delta + \rho}\right)^{\frac{1}{1-\beta}}$, $\nu = \delta \bar{K}$, $p^j M^j + \delta \bar{K} = (1-\eta)Y$

- Share of general capital in production:
  
  $$1 - s = \frac{\gamma}{q} \left[ \frac{\delta + \rho}{\beta} (1 - \eta) - \delta \right] \bar{K}$$

  Higher export share of $N$ in $L$ $(1 - \eta \uparrow)$

  $\implies$ more affordable to demand for more $M$

  $\implies$ encourage $S$ to allocate more $H$ to production $(1 - s \uparrow)$

  $\implies$ upward-sloping exportable production ($XP$) locus

- S-S R&D investment:
  
  $$z = \frac{(1-\mu) - [(1-\mu) + \gamma (1-\mu+r)]}{\gamma(1-\mu+r)} s$$

  where $dz/ds < -1$

- S-S technology:
  
  $$A^j = \frac{\psi (1-\mu)(1-\mu)}{\gamma(1-\mu+r)} (1 - s)$$

  $s \uparrow \implies z \downarrow$ more than proportionately $\implies A \downarrow$
Stage 3-EX regime: fundamental relationships

- The intertemporal trade locus (IT):

\[
\frac{1}{p^j} = B_0 (\bar{K})^\gamma \left[ \frac{\delta + \rho}{\beta} (1 - \eta) - \delta \right]^\gamma
\]

where \( B_0 = \frac{1 - \mu}{1 - \mu + r} \frac{\gamma \psi^{1-\mu}}{q^{1+\gamma}} > 0 \) and the locas is increasing & concave in \((1 - \eta, 1/p^j)\), with horizontal intercept \( \frac{\delta \beta}{\rho + \delta} \)
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- The balance of payments locus (BP):

\[
\frac{1}{p^j} = \frac{\theta}{\Gamma j \bar{K} \left[ \delta + \frac{\delta + \rho}{\beta} - 2 \frac{\delta + \rho}{\beta} (1 - \eta) \right]}
\]

which is strictly increasing & convex in \((1 - \eta, 1/p^j)\), with asymptote \(1 - \eta = (\delta + \frac{\delta + \rho}{\beta})/(2 \frac{\delta + \rho}{\beta}) > \delta \beta / (\rho + \delta)\)
Stage 3-EX regime: fundamental relationships

- The *intertemporal trade* locus (IT):

\[
\frac{1}{p^j} = B_0 (\bar{K})^\gamma \left[ \frac{\delta + \rho}{\beta} (1 - \eta) - \delta \right]^\gamma
\]

where \( B_0 = \frac{1 - \mu}{1 - \mu + r} \frac{\gamma \psi \frac{1}{q^{1 + \gamma}}}{1 - \mu} > 0 \) and the locas is increasing & concave in \((1 - \eta, 1/p^j)\), with horizontal intercept \( \frac{\delta \beta}{\rho + \delta} \)

- The *balance of payments* locus (BP):

\[
\frac{1}{p^j} = \frac{\theta}{\Gamma j \bar{K} \left[ \delta + \frac{\delta + \rho}{\beta} - 2 \frac{\delta + \rho}{\beta} (1 - \eta) \right]}
\]

which is strictly increasing & convex in \((1 - \eta, 1/p^j)\), with asymptote \(1 - \eta = (\delta + \frac{\delta + \rho}{\beta}) / (2 \frac{\delta + \rho}{\beta}) > \delta \beta / (\rho + \delta)\)

- Two fixpoints: the low stationary point violates the non-negativity constraint of \(1 - s\)
Stage 3-EX regime: fundamental relationships
Stage 3-EX regime: comparative statics

- $\Gamma_j \downarrow$ (greater variety-specific preference bias)

$\implies BP \uparrow$ (higher price of $N$ given $1 - \eta$), $IT$ unchanged
$\implies$ export share of $N \uparrow$, $VMPH \downarrow$
$\implies 1 - s \downarrow, z \downarrow$ more than proportionately
$\implies A \downarrow$, supply of $M \downarrow$
$\implies p \uparrow$

- $\psi \uparrow$ (more productive R&D),

$\implies IT \uparrow$ (lower price of $M$ given $1 - \eta$), $BP$ unchanged
$\implies A \uparrow, z \uparrow$
$\implies s \downarrow$ less than proportionately, supply of $M \uparrow$
$\implies p \downarrow$
Stage 3-OS regime: tradeoff relationships

- Optimal allocation of capital: $\beta \left( K_t^N \right)^{\beta-1} = \gamma \phi p_t A_t^i \left( K_t - K_t^N \right)^{\gamma^{-1}}$
Stage 3-OS regime: tradeoff relationships

- **Optimal allocation of capital:** \( \beta (K_t^N)^{\beta-1} = \gamma \phi p_t^i A_t^i (K_t-K_t^N)^{\gamma-1} \)

- **Intertemporal production:**

\[
p_t^i = \frac{\mu}{1-\mu} \left[ \frac{1+r}{\mu \psi} \left( \frac{1+z_{t-1}}{A_{t-1}^i} \right)^\mu q_{t-1} - \frac{1+z_t}{A_t^i} q_t \right] \frac{(K_t-K_t^N)^\gamma}{1-\phi}
\]
Stage 3-OS regime: tradeoff relationships

- Optimal allocation of capital: \( \beta (K_t^N)^{\beta-1} = \gamma \phi p_t A_t (K_t^N)^{-1} \)
- Intertemporal production:

\[
p_t^i = \frac{\mu}{1-\mu} \left[ \frac{1+r}{\mu \psi} \left( \frac{1+z_{t-1}}{A_{t-1}^i} \right)^\mu q_{t-1} - \frac{1+z_t}{A_t^i} q_t \right] \frac{(K_t^N)^\gamma}{1 - \phi}
\]

- Intratemporal and intertemporal optimization:

\[
MRS = \frac{\eta_t N_t}{\theta + \bar{M}_t} p_t^i
\]

\[
MRIS = \frac{(1 + \rho) \eta_t N_t}{\eta_{t-1} N_{t-1}} = \beta \left( K_t^N \right)^{\beta-1} + (1 - \delta)
\]
Stage 3-OS regime: tradeoff relationships

- Optimal allocation of capital: \( \beta (K_t^N)^{\beta-1} = \gamma \phi p_t^i A^i_t (K_t - K^N_t) \gamma^{-1} \)
- Intertemporal production:
  \[
p^i_t = \frac{\mu}{1-\mu} \left[ \frac{1+r}{\mu \psi} \left( \frac{1+z_{t-1}}{A^i_{t-1}} \right)^{\mu} q_{t-1} - \frac{1+z_t}{A^i_t} q_t \right] \frac{(K_t - K^N_t)^\gamma}{1 - \phi}
  \]
- Intratemporal and intertemporal optimization:
  \[
  MRS = \frac{\eta_t N_t}{\theta + M^i_t} p^i_t
  \]
  \[
  MRIS = \frac{(1 + \rho) \eta_t N_t}{\eta_{t-1} N_{t-1}} = \beta \left( K^N_t \right)^{\beta-1} + (1 - \delta)
  \]
- Modified golden rule: \( \beta (K_t^N)^{\beta-1} = \rho + \delta \)
Stage 3-OS regime: S-S relationships

- S-S: $\overline{K}^N = \left( \frac{\beta}{\delta + \rho} \right)^{1-\beta}$, $v = \delta K$, $(1-\phi) p^i M^i + \delta K = (1-\eta) N$
Stage 3-OS regime: S-S relationships

- S-S: $\bar{K}^N = \left( \frac{\beta}{\delta + \rho} \right)^{1-\beta}, \upsilon = \delta K, (1-\phi) p^i M^i + \delta K = (1-\eta) N$
- S-S resource allocation: $p^i \theta + \frac{\rho + \delta}{\gamma \phi} (K - \bar{K}^N) = \frac{\rho + \delta}{\beta} \bar{K}^N \eta$
Stage 3-OS regime: S-S relationships

- S-S: $K^N = \left(\frac{\beta}{\delta+\rho}\right)^{\frac{1}{1-\beta}}, \nu=\delta K, (1-\phi) p^i M^i + \delta K = (1-\eta) N$

- S-S resource allocation: $p^i \theta + \frac{\rho+\delta}{\gamma \phi} (K - K^N) = \frac{\rho+\delta}{\beta} K^N \eta$

- S-S capital allocation: $\frac{K-K^N}{K^N} = \frac{\rho+\delta}{\beta} \frac{(1-\eta)-\delta}{\frac{1-\phi}{\phi} \frac{\rho+\delta}{\gamma} + \delta}$
Stage 3-OS regime: S-S relationships

- **S-S**: $\overline{K}^N = \left( \frac{\beta}{\delta + \rho} \right)^{\frac{1}{1-\beta}}$, $\nu = \delta K$, $(1-\phi) p^i M^i + \delta K = (1-\eta)N$

- **S-S resource allocation**: $p^i \theta + \frac{\rho + \delta}{\gamma \phi} (K - \overline{K}^N) = \frac{\rho + \delta}{\beta} \overline{K}^N \eta$

- **S-S capital allocation**: $\frac{K - \overline{K}^N}{\overline{K}^N} = \frac{\rho + \delta}{\beta} (1-\eta) - \delta$

- **S-S R&D investment**: $1 + z = \frac{\rho + \delta}{\gamma \phi \psi^{1-\mu} p^i} \left[ \frac{\rho + \delta}{\beta} (1-\eta) - \delta \overline{K}^N \right]^{1-\gamma}$
Stage 3-OS regime: S-S relationships

- S-S: \( \bar{K}^N = \left( \frac{\beta}{\delta + \rho} \right)^{\frac{1}{1-\beta}} \), \( \nu = \delta K, (1-\phi) p^i M^i + \delta K = (1-\eta) N \)

- S-S resource allocation: \( p^i \theta + \frac{\rho + \delta}{\gamma \phi} (K - \bar{K}^N) = \frac{\rho + \delta}{\beta} \bar{K}^N \eta \)

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- S-S R&D investment: \( 1 + z = \frac{\rho + \delta}{\gamma \phi \psi^{1-\mu}} p^i \left[ \frac{\rho + \delta}{\beta} (1-\eta) - \delta \frac{1-\phi}{\phi} \frac{\rho + \delta}{\gamma} + \delta \right]^{1-\gamma} \)

- S-S technology: \( A^i = \psi^{\frac{1}{1-\mu}} (1 + z) \)
Stage 3-OS regime: fundamental relationships

- The *intertemporal trade* locus (IT):

\[
\frac{1}{p^i} = \frac{(1 - \mu) (1 - \phi) \psi^{\frac{1}{1-\mu}}}{(1 - \mu + r) q \left( \frac{K^N}{\phi} \right)^{\gamma}} \left[ \frac{\frac{\rho+\delta}{\beta} (1 - \eta) - \delta}{\frac{1-\phi \rho+\delta}{\phi \gamma} + \delta} \right]^{-\gamma}
\]

which is *downward-sloping* and convex in \((1 - \eta, 1/p^j)\), with asymptote \(1 - \eta = \frac{\delta \beta}{\rho + \delta}\)
Stage 3-OS regime: fundamental relationships

- The intertemporal trade locus (IT):

\[
\frac{1}{p^i} = \frac{(1 - \mu)(1 - \phi)}{(1 - \mu + r)q}\psi^{1-\mu} \left[ \frac{\phi+\delta}{\beta} (1 - \eta) - \delta \right]^{-\gamma} \left[ \frac{1-\phi\rho+\delta}{\frac{1-\phi}{\phi} \frac{\rho+\delta}{\gamma} + \delta} \right]
\]

which is downward-sloping and convex in \((1 - \eta, 1/p^j)\), with asymptote \(1 - \eta = \frac{\delta \beta}{\rho + \delta}\).

- The balance of payments locus (BP):

\[
\frac{1}{p^i} = \frac{\beta \theta}{(\rho + \delta) K^N} \left[ B_1 - B_2 (1 - \eta) \right]^{-1}
\]

where \(B_1 = 1 + \frac{\beta}{\gamma \phi} \frac{\delta}{\frac{1-\phi}{\phi} \frac{\rho+\delta}{\gamma} + \delta} > 1\), \(B_2 = 1 + \frac{\frac{\rho+\delta}{\gamma \phi}}{\frac{1-\phi}{\phi} \frac{\rho+\delta}{\gamma} + \delta} > 1\), and the locus is strictly increasing and convex in \((1 - \eta, 1/p^j)\), with asymptote \(1 - \eta = \frac{B_1}{B_2} > \frac{\delta \beta}{\rho + \delta}\).
Stage 3-OS regime: fundamental relationships

- Relative price of the necessity ($1/p^1$)
- Export share of the necessity ($1-\eta$)
Stage 3-OS regime: comparative statics

- $\theta \uparrow$ (preference shift away from $M$)
  
  $\implies BP \uparrow$ (lower price of $M$ given $1 - \eta$), $IT$ unchanged
  $\implies$ export share of $N \uparrow$, $p \downarrow$, demand for $M \downarrow$
  $\implies K^M \downarrow$, $\bar{K}^N$ unchanged, $K \downarrow$
  $\implies z$ may $\uparrow$ (more exporting income $\implies$ lower pref. bias)
  or $\downarrow$ ($K^M$ complement to $A$ under OS)
  $\implies A$ ?

- $\psi \uparrow$ (more productive R&D),
  
  $\implies IT \uparrow$ (lower price of $M$ given $1 - \eta$), $BP$ unchanged
  $\implies K^M \uparrow$, $\bar{K}^N$ unchanged, $K \uparrow$
  $\implies p \downarrow$, demand for $M \uparrow$, $N^d \uparrow$, export share of $N \uparrow$
  $\implies A \uparrow$ (no sectoral allocation via $z$)
  $\implies z$ may $\uparrow$ (higher VMPA) or $\downarrow$ (factor saving)
Stage 2: acceptability of OS contract by L if offered

- L’s value under each regime (aside from a constant):

\[ W^{EX} = (1 + \rho) \left[ \ln \eta^{EX} + \ln \left\{ \theta + \Gamma j \frac{K^N \left[ \frac{\delta + \rho}{\bar{\beta}} (1 - \eta^{EX}) - \delta \right]}{(p^i)^{EX}} \right\} \right] \]

\[ W^{OS} = (1 + \rho) \left[ \ln \eta^{OS} + \ln \left\{ \theta + \frac{\rho + \delta}{(\rho + \delta) - \phi (\rho + (1 - \gamma) \delta)} \frac{\bar{K}^N \left[ \frac{\rho + \delta}{\bar{\beta}} (1 - \eta^{OS}) - \delta \right]}{(p^i)^{OS}} \right\} \right] \]
Stage 2: acceptability of OS contract by L if offered

- L’s value under each regime (aside from a constant):

  \[ W^{EX} = \frac{(1+\rho) \left[ \ln \eta^{EX} + \ln \left\{ \theta + \Gamma j \frac{\bar{K}^{\left[ \frac{\delta+\rho}{\beta} \left(1-\eta^{EX}\right) - \delta \right]}{\left(p^j\right)^{EX}} \right\} \right]}{\rho} \]

  \[ W^{OS} = \frac{(1+\rho) \left[ \ln \eta^{OS} + \ln \left\{ \theta + \frac{\rho+\delta}{(\rho+\delta) - \phi} \frac{\bar{K}^{N} \left[ \frac{\rho+\delta}{\beta} \left(1-\eta^{OS}\right) - \delta \right]}{\left(p^i\right)^{OS}} \right\} \right]}{\rho} \]

- The less desirable the manufactured good is (in the case when L is poor), the smaller the gap between the willingness to pay for an ideal variety and the reference variety \( j \) and hence the lower \( (p^i)^{OS} - (p^j)^{EX} \) is
Stage 1: desirability to OS by S

- S’s value under each regime:

\[ V^{EX} = \frac{(1+r) \left\{ q + \left[ \frac{r-\gamma(1-\mu+r)}{1-\mu+r} \right] R^{EX} (1-\eta) \right\} }{r} \]

\[ V^{OS} = \frac{(1+r) \left\{ q + (1-\phi) R^{OS} (1-\eta) - \frac{q \left( \frac{\rho+\delta}{\gamma \phi} \right)^{\gamma}}{\psi^{1-\mu} p^i} \left[ R^{OS} (1-\eta) \right]^{1-\gamma} \right\} }{r} \]

where \( R^{EX} = \frac{\delta + \rho}{\beta} (1-\eta) - \delta \), \( R^{OS} = \frac{\rho+\delta}{\gamma \phi} \)

- When L is poor, \((p^i)^{OS} - (p^j)^{EX}\) is low, so outsourcing is less desirable

<table>
<thead>
<tr>
<th>Equilibrium outcome</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exporting (EX)</td>
<td>( W^{EX} - W^{OS} &gt; 0 ) and ( V^{EX} - V^{OS} &gt; 0 )</td>
</tr>
<tr>
<td>Outsourcing (OS)</td>
<td>( W^{EX} - W^{OS} &lt; 0 ) and ( V^{EX} - V^{OS} &lt; 0 )</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>((W^{EX} - W^{OS}) (V^{EX} - V^{OS}) &lt; 0)</td>
</tr>
</tbody>
</table>
Numerical Analysis

- Benchmark parametrization:
  - $\Gamma^i = 0.8, \, q = 0.3, \, \theta = 0.07$
  - $\beta = 0.3, \, \gamma = 0.35$ (production of $M$ is more capital intensive than $N$)
  - $\psi = 0.85, \, \mu = 0.9, \, r = 10\%$
  - Solution of prices: $p^j = 3.63$ and $p^i = 3.30$ (under $\phi = 0.25$), so supply effects dominate

<table>
<thead>
<tr>
<th></th>
<th>1-\eta</th>
<th>s</th>
<th>z</th>
<th>A</th>
<th>$\frac{K^M}{K}$</th>
<th>$N^d$</th>
<th>M</th>
<th>$\frac{N^d}{Y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX</td>
<td>.48</td>
<td>.4</td>
<td>.5</td>
<td>.17</td>
<td>0</td>
<td>.84</td>
<td>.14</td>
<td>.52</td>
</tr>
<tr>
<td>OS</td>
<td>.46</td>
<td>1</td>
<td>.2</td>
<td>.24</td>
<td>.1</td>
<td>.86</td>
<td>.20</td>
<td>.48</td>
</tr>
</tbody>
</table>

Under OS, technology is far better
  \[\rightarrow\] generate a “trickle-down” effect via revenue-sharing
  \[\rightarrow\] enable $L$ to consume more and to export more $N$
Numerical Results

- Equilibrium regime:
Numerical Results

- **Equilibrium regime:**
  - \( \phi \in \Phi \equiv (0.21143, 0.33179) \implies \text{OS} \)
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- Equilibrium regime:
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  - $\phi$ too low $\implies$ L desires to import $M$ but S to outsource
Numerical Results

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- OS is more likely when L has a relatively high initial capital stock (crucial for \( \Phi \neq \emptyset \))
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- OS never arises if
  - L’s capital is scarce (sufficiently low initial capital stock or sufficiently higher discount rate),
  - L’s income is low (sufficiently low capital return associated with low $\beta$),
  - L’s consumers spend a major portion of their income on the necessity (sufficiently high value of $\theta$)
Main Findings

- For the source country,
Main Findings

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  - the advantage of outsourcing is for better information about local preferences
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- For the host country,
  - they accept the outsourcing contract if the higher price they pay for the outsourced good is worth the benefit of consuming a manufactured good closer to their ideal variety.
  - preference based outsourcing is more likely to occur with higher income host countries.
Consider the dynamic transition form no to more global outsourcing

Extensions

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  - Capital accumulation with a scale barrier
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  - subcontractor spin-off at the later stage