Resource Overuse Hypothesis

The Theory
Resource Overuse Hypothesis

Model Assumptions:

- Small Open Economy
- Harvest good, H; All other goods, M
- No controls over resource use
- M is the numeraire, p is relative price of H
- Many identical agents, L.
- Two factors: labor and resource stock.
Tastes

\[ u = h^\beta m^{1-\beta} \]

- \( h \): per capita consumption of harvest good
- \( m \): per capita consumption of outside good
- No intertemporal optimization
- Tastes are homothetic
Technologies

- \( H^P = \alpha S L_H \)
- \( M^P = L_M \)

- \( S \): measure of resource stock
- \( L_H, L_M \): allocations of labour
- \( \alpha \): productivity parameter
Endowments

- \( L = N \)
- \( G(S) = rS(1 - S/K) \)
- \( dS/dt = G(S) - H \)

- *N number of agents, r intrinsic rate of growth; K carrying capacity; H aggregate harvest*
Autarky: Consumption Side

- Consumer’s budget constraint

\[ ph + m = I = w \]

- \( p \) : relative price of harvest good

- Aggregate demands are:

\[ H^C = \frac{\beta w L}{p} \quad M^C = (1 - \beta)wL \]
Autarky: Production Side

- \( p = w a_{LH} = \frac{w}{\alpha S} \)
- \( 1 = w a_{LM} = w \)

\[ L = L_H + L_M \]
Ricardian Temporary Equilibrium

Production + Consumption

\[ H = \alpha \beta LS \]
\[ M = [1 - \beta]L \]
Harvest

Manufactures

Tangency: 

\[-1/p = -\alpha S_0\]

\[H(S_0)\]

\[H = \alpha S_0 L - \alpha S_0 M\]
Resource Dynamics

\[ \frac{dS}{dt} = rS\left(1 - \frac{S}{K}\right) - \alpha \beta LS \]
Ricardian Temporary Equilibrium & Dynamics

\[ \frac{1}{p} = -\alpha S_0 \]

\[ H = \alpha S_0 L - \alpha S_0 M \]
Proposition 1.

(i) For all parameter values, a possible steady state exists at $S = H = 0$.

(ii) A steady-state solution with a positive stock exists if and only if

$$\frac{r}{L} > \alpha \beta$$  \hspace{1cm} (16)

(i) If a positive autarkic steady-state stock, $SA$, exists, then it is the unique positive solution, it is globally stable, and convergence to this steady state from any initial positive stock is monotonic (i.e., $dS/dt > 0$ for all positive stock levels less than $SA$ and $dS/dt < 0$ for all $S > SA$).

(ii) If (16) is not satisfied, the resource will be extinguished and the unique steady state is $S = H = 0$. 
Autarky Steady State

\[ S_A = K \left( 1 - \frac{\alpha \beta L}{r} \right) \]
\[ p_A = \frac{1}{\alpha S_A} \]
\[ H_A = \alpha \beta L S_A \]
\[ M_A = (1 - \beta)L \]
The Small Open Economy

- Does the Home country have a comparative advantage in Resource products?

- Can the economy specialize in the resource sector without extinguishing the resource stock?
Proposition 3. In the initial temporary equilibrium following the opening of trade, the small economy will

(i) specialize in and export the resource good if \( p^* > p_A \);

(ii) specialize in and export manufactures if \( p^* < p_A \); and

(iii) have an indeterminate pattern of trade and production if \( p^* = p_A \).
Comparative Advantage

- If home has a comparative advantage in the Harvest good, then:

\[ p > p_A = \frac{1}{\alpha S_A} \]

\[ p \alpha S_A > 1 \]

\[ L_H = L \]
Specialization or Diversification

\[ i_f, L > r / \alpha \]

\[ \text{then} \]

\[ \frac{dS}{dt} = G(S) - \alpha SL < 0 \]

\[ \text{for all } S \Rightarrow \text{economy must diversify} \]
Transition to a diversified-trading steady state: resource rich economy

Initial post-trade budget line (slope = \(-1/p^*\))

Trading st. PPF and budget line

Autarky PPF
Proposition 4. If $p^* > p_A$ and the trading steady state is diversified, then

(i) the small country exports the resource good and imports manufactures;

(ii) the small country’s steady-state utility is lower under free trade than in autarky; and

(iii) for sufficiently small but positive discount rates, the present discounted value of utility is reduced by trade.
**Proposition 5.** If $p^* > p_A$ and a specialized steady state arises, then

(i) the small country exports the resource good and imports manufactures;

(ii) if $p^* > p_r$, then both steady-state utility and the discounted value of utility are increased by trade;

(iii) if $p^* < p_r$, then steady-state utility is reduced by trade; the present discounted value of utility may be increased or reduced by trade, depending on the discount rate.
Summary

- Short run boom followed by bust. Productivity losses created by overuse of resources.

- Losses from trade in steady state, overall welfare effects negative if discount rate low.

- If Specialization is possible, then gains are also possible.
Transition to a diversified trading steady state: resource-poor economy

Autarky PPF

Trading budget line and PPF (slope $= -1/p^*$)
**Proposition 6.** If $p^* < pA$, then

(i) the small country exports manufactures and imports the resource good; and

(ii) steady state and present discounted utility are increased by trade.
Proposition 7.

(i) The small open economy will specialize in manufactures if (and only if)

\[ p^* \leq \frac{1}{(K\alpha)} \]

(ii) The small open economy will produce both goods if (and only if)

\[ p^* > \frac{1}{(K\alpha)} \text{ and } \frac{L}{r} > \frac{1}{\alpha}[1-1/(p^*K\alpha)]. \]

(iii) The small open economy will specialize in the resource good if (and only if)

\[ \frac{L}{r} \leq \frac{1}{\alpha}[1-1/(p^*K\alpha)]. \]
Steady-state utility and the terms of trade

$u^T$ if $r/L > \alpha$

$u^A$

$u^A$
**Corollary 7.1.** If $r/L > \alpha$, the steady-state pattern of production can be characterized as a function of the world price, $p^*$. 

\[
p^* \leq 1/(K\alpha) \quad \Rightarrow \text{specialization in manufactures}
\]

\[
1/(K\alpha) < p^* < 1/[(1- \alpha L/r)K\alpha] \quad \Rightarrow \text{diversified production}
\]

\[
p^* \geq 1/[(1- \alpha L/r)K\alpha] \quad \Rightarrow \text{specialization in the resource good.}
\]

If $r/L > \alpha$, then the country cannot specialize in the resource good, regardless of the world price.
What do we need in terms of Empirical Evidence?

- Exogenous trade liberalization
- Data on resource stock pre and post trade
- Trade data pre and post liberalization
- No confounding factors: no ongoing domestic changes; no simultaneous domestic policy reforms; no change in regulatory regime;
- Nice if small open economy