How Robust is Comparative Advantage?

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The Issue

• How well does the concept of Comparative Advantage (CA) work beyond the simple 2×2 framework in which Ricardo explained it?
  – The answer depends, in part, on what you interpret CA to mean:
    • If it refers to the gains from trade, then it is very robust
    • If it is meant to predict trade in particular goods, then it generalizes poorly
    • But weak generalizations are possible and robust.
  – Overall, CA is a fundamental and valuable concept.
The Source


Which draws on:

CA in Ricardo

The Ricardian Model:

- 2 goods: 1, 2
- 2 countries: 1, 2
- 1 factor: \( L = \text{labor} \)
- Constant costs: \( a_g^c = \text{labor needed to produce one unit of good } g \text{ in country } c \)
- Perfect competition
CA in Ricardo

A country has comparative advantage in the good whose relative labor cost (compared to the other good) is lower than in the other country.

Country 1 has CA in good 1, relative to good 2, compared to country 2, if

$$\frac{a_1^1}{a_2^1} < \frac{a_1^2}{a_2^2} \quad (1)$$

Note, this is the same as

$$\frac{a_1^1}{a_2^2} < \frac{a_1^2}{a_2^1} \quad (1)$$
CA in Ricardo

Figure 1. The Ricardian Model: Production Possibilities and a Free-Trade Equilibrium
CA in Ricardo

• Implications
  – CA gives the opportunity for the world to increase output of everything by specializing
  – Thus CA implies Gains from Trade
  – These gains are obtained by each country…
    – …specializing in…
    – …and exporting…
  • …the good in which it has comparative advantage.
CA in Ricardo

• Thus CA is about two things:
  – The opportunity to Gain from Trade
  – Prediction of the Pattern of Trade
    (who exports what)

• As we’ll see
  – Gain from Trade is very robust
  – Pattern of Trade is much weaker
CA in Haberler (1930)

- The Ricardian Model assumed
  - only labor as a factor, and
  - constant unit labor requirements (the $a$’s).

- That is very restrictive, as more modern models drop both assumptions
  - The Heckscher-Ohlin Model
  - The Specific Factors Model

- These models are easily analyzed with a curved Production Possibility Frontier, together with Community Indifference Curves.
CA in Haberler (1930)

- CA is still easily defined in terms “opportunity cost,” which is measured by relative autarky prices, $\tilde{p}_g^c$:

A country has comparative advantage in the good whose autarky price, relative to the other good, is lower than in the other country.

Country 1 has CA in good 1, relative to good 2, compared to country 2,

if

$$\frac{\tilde{p}_1^1}{\tilde{p}_2^1} < \frac{\tilde{p}_1^2}{\tilde{p}_2^2}$$

(1')
CA in Haberler (1930)

- Autarky equilibrium:
CA in Haberler (1930)

Figure 2. Haberler Model: Production Possibilities and a Free-Trade Equilibrium
CA and Gains from Trade

• In Haberler’s model, it is again true that
  – If countries differ in relative autarky prices, there is both CA and Gain from Trade
  – In order to gain from trade, they must export the good in which they have CA

• Note that trading in accord with CA is necessary but not sufficient for gain from trade.
CA and Gains from Trade

- CA is necessary for Gain from Trade:

*Figure 3. Trade Contrary to Comparative Advantage Reduces Welfare*
CA and Gains from Trade

• It is **not** sufficient:

*Figure 4. Too Much Trade in Accord with Comparative Advantage Reduces Welfare*
Strong Generalizations of CA

• With many (C) countries and only 2 goods:
  – Rank the countries in order of \(
\frac{\tilde{p}_1^1}{\tilde{p}_2^1} < \frac{\tilde{p}_1^2}{\tilde{p}_2^2} < \cdots < \frac{\tilde{p}_1^C}{\tilde{p}_2^C}
\):

\[
\frac{\tilde{p}_1^1}{\tilde{p}_2^1} < \frac{\tilde{p}_1^2}{\tilde{p}_2^2} < \cdots < \frac{\tilde{p}_1^C}{\tilde{p}_2^C}
\]

• Then all countries that export good 1 will lie to the left of all that export good 2

\[
\frac{\tilde{p}_1^1}{\tilde{p}_2^1} < \cdots < \frac{\tilde{p}_1^{c_1}}{\tilde{p}_2^{c_1}} \leq \frac{\tilde{p}_1^{c_2}}{\tilde{p}_2^{c_2}} \cdots < \frac{\tilde{p}_1^C}{\tilde{p}_2^C}
\]

• Location of the line \((c_1, c_2)\) depends on country sizes.
Strong Generalizations of CA

• With many (G) goods and only 2 countries, a similar chain of comparative advantage works, but only in the Ricardian Model:
  
  – Rank the goods in order of relative labor requirements in the two countries:
  
  \[
  \frac{a_1^1}{a_1^2} < \frac{a_2^1}{a_2^2} < \ldots < \frac{a_G^1}{a_G^2}
  \]

• Then all goods that country 1 exports will lie to the left of all that it imports.

• This does not work with variable costs in Haberler’s model, since costs can be interdependent.
Strong Generalizations of CA

• Even these “chain propositions” fail, in both Ricardian and Haberler models, if there are both
  – Intermediate inputs
  – Barriers to trade

• This is shown in Deardorff (1979), in the context of the Heckscher-Ohlin trade model.

• It can be illustrated also in a Ricardian Model with intermediate inputs, as follows:
Impossibility of Strong CA

• Example: Assume...
  – 4 goods:
    Steel, input to Autos
    Wool, input to Cloth
    (1 unit → 1 unit, each)
  – 2 countries of equal size
  – Demands for autos and cloth: equal expenditure shares
<table>
<thead>
<tr>
<th>Direct unit labor requirements</th>
<th>Goods</th>
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<tbody>
<tr>
<td></td>
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</tr>
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<table>
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<th>Direct+Indirect unit labor requirements</th>
<th>Final Goods</th>
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<td></td>
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If all goods are traded without cost

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Results:
- Country 1 exports autos (and wool)
- Country 2 exports cloth (and steel)
If only final goods are traded

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Results:
- Country 1 exports cloth
- Country 2 exports autos
Impossibility of Strong CA

• Results of Example: Summary
  – If all goods are traded without cost
    • Country 1 exports autos
    • Country 2 exports cloth
  – If inputs, steel and wool, are not traded
    • Country 1 exports cloth
    • Country 2 exports autos
  – Thus, trade in autos and cloth reverse if steel and wool are not traded.
Imp possibility of Strong CA

- Implication: *Any* definition of CA that predicts trade correctly in one case will be wrong in the other.
  
  – (*Unless* the definition itself takes account of trade costs. That’s something I won’t address here, though I do in another place.)
Weak Generalizations of CA

• What does hold in general – with any numbers of goods and countries, as well as many other relaxed assumptions – is that CA predicts the Pattern of Trade On Average.

• Specifically, letting $T_c^g$ be net exports of good $g$ by country $c$ (so that $T_g^c < 0$ for an import), then

Theorem:

$$\tilde{p}^c T^c = \sum_g \tilde{p}_g^c T_g^c < 0$$  \hspace{1cm} (6)

• This says (since the vector $T^c$ has positive elements for exports and negative for imports) that autarky prices of exports are lower than of imports.
Weak Generalizations of CA

\[ \tilde{p}^c T^c = \sum_g \tilde{p}_g^c T_g^c < 0 \quad (6) \]

- More formally, letting \( X_g^c = \max \{ T_g^c, 0 \} \),
  \( M_g^c = \max \{ -T_g^c, 0 \} \), & \( \bar{X}^c = \bar{M}^c = \sum_g p_g^w X_g^c \)

\[ \sum_g \frac{\tilde{p}_g^c}{p_g^w} \frac{p_g^w X_g^c}{\bar{X}^c} < \sum_g \frac{\tilde{p}_g^c}{p_g^w} \frac{p_g^w M_g^c}{\bar{M}^c} \quad (7) \]

- That is, the country’s trade-weighted autarky prices relative to world prices, \( p^w \), are lower for its exports than for its imports.
Weak Generalizations of CA

\[ \tilde{p}_c^c T_c = \sum_g \tilde{p}_g^c T_g^c < 0 \quad (6) \]

- Other interpretations involve correlations, stated as Corollaries of (6) in Deardorff (1980).

**Corollary 1:**

- The simplest – and similar to (7) – is a negative correlation between a country’s autarky prices relative to the world and the value at world prices of its trade:

\[ \text{cor} \left( \frac{\tilde{p}_g^c}{p_g^w}, \frac{p_g^w T_g^c}{p_g^w} \right) < 0 \]
Weak Generalizations of CA

\[ \tilde{p}^c T^c = \sum_g \tilde{p}_g^c T_g^c < 0 \quad (6) \]

- Most broadly, autarky prices and trade are negatively correlated across all goods and countries:

**Corollary 4:**

- Let \( \tilde{P} \) be a \( CG \) length vector of all \( \tilde{p}_g^c, c = 1,\ldots,C; g = 1,\ldots,G \) and \( E \) be a vector of the same length of all \( T_g^c, c = 1,\ldots,C; g = 1,\ldots,G \), then

\[ \text{cor}\left(\tilde{P}, E\right) < 0 \]
Weak Generalizations of CA

\[ \tilde{p}^c T^c = \sum_g \tilde{p}_g^c T_g^c < 0 \quad (6) \]

- Proof of Theorem (omitting country superscript):
- Notation: \( T = Q - C \), where \( Q \) and \( C \) are vectors of output and consumption with trade, and \( \tilde{Q} = \tilde{C} \) are vectors of output and consumption in autarky.
- First the Gains from Trade:

\[ p^w T = p^w (Q - C) = 0 \quad \text{by balanced trade} \]
\[ p^w Q \geq p^w \tilde{Q} = p^w \tilde{C} \quad \text{by producer maximization} \]

\[ \therefore p^w C \geq p^w \tilde{C} \quad \text{so that} \quad C \text{ is revealed preferred to } \tilde{C} \]
Weak Generalizations of CA

• Proof (continued):
  \[ p^w C \geq p^w \tilde{C} \implies \tilde{p}C > \tilde{p}\tilde{C} \]
  
  by Weak Axiom of Revealed Preference (WARP)
  
  \[ \tilde{p}\tilde{Q} \geq \tilde{p}Q \]
  by producer maximization, again

  \[ \therefore \tilde{p}T = \tilde{p}(Q - C) < \tilde{p}(\tilde{Q} - \tilde{C}) = 0 \quad \text{Q.E.D.} \]
Weak Generalizations of CA

- **Result permits:** (I used more assumptions for the simple proof above, but the paper allows much greater generality.)
  - Multiple goods and countries (also, implicitly, multiple factors of production)
  - Tariffs and other artificial trade costs
  - Transport costs and other real trade costs
  - Intermediate inputs

- Note that these assumptions are enough to include the example earlier, where CA failed to predict trade of cars and cloth, with inputs of steel and wool
## Direct Unit Labor Requirements

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Assume wages = $1 in both

## Autarky Prices

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</table>
• Assume
  – Labor endowments = 120 in both
  – Consumers demand equal units of cloth and autos

• Without trade in inputs
  – Country 1
    • exports 15 cloth and
    • imports 15 cars
    \[ \tilde{p}^1 T^1 = 4(15) - 6(15) = -30 < 0 \]

• With trade in inputs
  – Country 1
    • exports 20 wool and 20 autos
    • Imports 20 steel and 20 cloth
    \[ \tilde{p}^1 T^1 = 1(20) + 6(20) - 4(20) - 4(20) = -20 < 0 \]
Weak Generalizations of CA

- Result also permits:
  - Arbitrary preferences of consumers
  - Services, traded or not
  - Dated goods
  - Differentiated goods
  - Unbalanced trade
  - Lumpy countries
Weak Generalizations of CA

- Result does not permit:
  - Domestic distortions
  - Increasing returns to scale

- Note though that while these can interfere with the result if they vary across sectors or countries so as to undermine CA, they could also do the opposite, enhancing CA.

- Thus their presence “suggests only that we are ignorant, not necessarily that we are wrong.”