TARIFFS AND TRADE WARS IN A RICARDIAN MODEL

Environment

2 countries/2 goods

\[ y_1^1 = \ell_1^1 \quad \quad y_1^2 = \ell_1^2 / 2 \]
\[ y_2^1 = \ell_2^1 / 2 \quad \quad y_2^2 = \ell_2^2 \]
\[ \bar{t}^1 = 12 \quad \quad \bar{t}^2 = 12 \]

Utility of the representative consumer/worker:

\[ u(c_1, c_2) = \log c_1 + \log c_2. \]

Autarky equilibrium

Country 1:

Normalize \( w^1 = 1 \). Profit maximization implies that \( p_1^1 = 1, \quad p_2^1 = 2 \).

Solve for consumer demands:

\[ c_1^1 = \frac{12w^1}{2p_1^1} = 6, \quad c_2^1 = \frac{12w^1}{2p_2^1} = 3 \]

Country 2:

Normalize \( w^2 = 1 \). Profit maximization implies that \( p_1^2 = 2, \quad p_2^2 = 1 \).

Solve for consumer demands:

\[ c_1^2 = \frac{12w^2}{2p_1^2} = 3, \quad c_2^2 = \frac{12w^2}{2p_2^2} = 6. \]

Autarky Equilibrium

<table>
<thead>
<tr>
<th></th>
<th>( \hat{p}_1^i )</th>
<th>( \hat{p}_2^i )</th>
<th>( \hat{w}^i )</th>
<th>( \hat{c}_1^i )</th>
<th>( \hat{c}_2^i )</th>
<th>( \hat{y}_1^i )</th>
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<tbody>
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<td>Country 1</td>
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<tr>
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<td>3</td>
<td>6</td>
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\[ \hat{u}^1 = \log 6 + \log 3 = \log 18, \quad \text{real income} = 6^{1/2} 3^{1/2} = 18^{1/2} = 4.2426 \]
\[ \hat{u}^2 = \log 3 + \log 6 = \log 18, \quad \text{real income} = 3^{1/2} 6^{1/2} = 18^{1/2} = 4.2426. \]
Trade Equilibrium

guess \quad y_1^1 = 12, \quad y_2^1 = 0, \quad y_1^2 = 0, \quad y_2^2 = 12

normalize \quad w^1 = 1 \Rightarrow p_1^1 = p_2^1 = p = 1

\[ p_2^1 = p_2^2 = p_2 w^2 \]

\[ x_1^1 = \frac{12w^1}{2p_1^1} = 6, \quad x_1^2 = \frac{12w^2}{2p_1^2} = 6w^2 \]

\[ x_1^1 + x_1^2 = y_1^1 = 12 \]

\[ 6 + 6w^2 = 12 \Rightarrow w^2 = 1 \quad \text{(not surprisingly!)} \]

\[ x_1^2 = \frac{12w^1}{2p_2^1} = 6, \quad x_2^2 = \frac{12w^2}{2p_2^2} = 6 \]

Trade Equilibrium

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<tr>
<th></th>
<th>( \hat{p}_1 )</th>
<th>( \hat{p}_2 )</th>
<th>( \hat{w} )</th>
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<th>( \hat{c}_2 )</th>
<th>( \hat{y}_1 )</th>
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<td>0</td>
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<tr>
<td>Country 2</td>
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<td>1</td>
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<td>6</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

\( \hat{u}^1 = \log 6 + \log 6 = \log 36 \), real income = \( 6^{1/2} 6^{1/2} = 36^{1/2} = 6 \)

\( \hat{u}^2 = \log 6 + \log 6 = \log 36 \), real income = \( 6^{1/2} 6^{1/2} = 36^{1/2} = 6 \).

Equilibrium with Tariffs

Let country 1 on imports of good 2 be \( \tau_2^1 \Rightarrow p_2^1 = (1 + \tau_2^1) p_2 \)

Tariff revenues are \( T^1 = (\tau_2^1 p_2) c_2^1 \)

Suppose tariff revenues are transferred back to consumers.

New consumers’ problem:

\[
\max \quad \log c_1^1 + \log c_2^1 \\
\text{s.t.} \quad \hat{p}_1 c_1^1 + \hat{p}_2 (1 + \tau_2^1) c_2^1 = \hat{w}^1 \hat{\ell}^1 + \hat{T}^1
\]
The solution is
\[
\hat{c}_1^i = \frac{\hat{w}^i \ell^i + \hat{T}^i}{2 \hat{p}_1}, \quad \hat{c}_2^i = \frac{\hat{w}^i \ell^i + \hat{T}^i}{2 \hat{p}_2 (1 + \tau_2^i)}
\]

new equilibrium condition: \( \hat{T}^i = \tau_2^i \hat{p}_2^i \hat{x}_2^i \) (government budget constraint)

Example: Suppose \( \tau_2^1 = 0.5 \) (50 percent tariff)

guess \( y_1^i = 12, \ y_2^1 = 0, \ y_1^2 = 0, \ y_2^2 = 12 \)

normalize \( w^1 = 1 \rightarrow p_1^i = p_2^i = 1 \)

\( p_2^2 = w^2, \quad p_2^1 = (1 + \tau_2^1) p_2^2 = 1.5 w^2 \)

\( T^1 = \tau_2^1 p_2^2 x_2^1 = 0.5 w^2 \frac{12 + T^1}{2(1.5 w^2)} \)

\( T^1 = \frac{12 + T^1}{6} \)

\( 6T^1 = 12 + T^1 \rightarrow T^1 = 2.4 \)

\( x_1^1 = \frac{12 w^1 + T^1}{2 \hat{p}_1^i} = \frac{14.4}{2} = 7.2 \)

\( x_1^2 = \frac{12 w^2}{2 \hat{p}_2^i} = 6w^2 \)

\( x_1^1 + x_1^2 = y_1^1 = 12 \)

\( 7.2 + 6w^2 = 12 \rightarrow w^2 = 0.8 \)

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<tr>
<th>( \hat{p}_1^i )</th>
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<th>( \hat{w}^i )</th>
<th>( \hat{T}^i )</th>
<th>( \hat{x}_1^i )</th>
<th>( \hat{x}_2^i )</th>
<th>( \hat{y}_1^i )</th>
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<td>0.8</td>
<td>0</td>
<td>4.8</td>
<td>6</td>
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\[ \hat{u}^1 = \log 7.2 + \log 6 = \log 43.2, \text{ real income } = 7.2^{1/2} 6^{1/2} = 43.2^{1/2} = 6.5727 \]

\[ \hat{u}^2 = \log 4.8 + \log 6 = \log 28.8, \text{ real income } = 4.8^{1/2} 6^{1/2} = 28.8^{1/2} = 5.3666 \]
Trade War

Suppose country 2 retaliates and puts 50 percent tariff on imports of good 1 from country 1 ($\tau_1^2 = 0.5$).

normalize $w^1 = 1 \rightarrow p^1_1 = 1, \quad p^2_1 = 1.5$

$p^2_2 = w^2, \quad p^1_2 = 1.5w^2$

$T^1 = 2.4$ as before.

Now $T^2 = \tau_2^2 p^1_1 x^2_i$

$T^2 = 0.5 \frac{12w^2 + T^2}{2(1.5)}$

$T^2 = \frac{12w^2 + T^2}{6}$

$6T^2 = 12w^2 + T^2 \rightarrow T^2 = 2.4w^2$

$x^1_1 = \frac{12w^1 + T^1}{2p^1_1} = \frac{14.4}{2} = 7.2$

$x^2_2 = \frac{12w^2 + T^2}{2p^2_1} = \frac{14.4w^2}{3} = 4.8w^2$

$x^1_1 + x^2_1 = y^1_i = 12$

$7.2 + 4.8w^2 = 12 \rightarrow w^2 = 1$ (not surprisingly!)

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$\hat{u}^1 = \log 7.2 + \log 4.8 = \log 34.6$, real income $= 7.2^{1/2}4.8^{1/2} = 34.56^{1/2} = 5.8788$

$\hat{u}^2 = \log 4.8 + \log 7.2 = \log 34.6$, real income $= 4.8^{1/2}7.2^{1/2} = 34.56^{1/2} = 5.8788$. 
Trade War - Prisoner’s Dilemma

| Country 1 | Country 2
|-----------|-----------|
| $\tau^1_2 = 0$ | $\tau^1_2 = 0.5$
| $(6.00, 6.00)$ | $(5.37, 6.57)$
| $(6.57, 5.37)$ | $(5.88, 5.88)$

A Ridiculously Costly Trade War

Suppose $\tau^1_2 = \tau^1_2 > 2$ (200 percent tariffs)

Guess that $y^1_1 = 12$, $y^1_2 = 0$, $y^2_1 = 0$, $y^2_2 = 12$ is wrong.

We revert to autarky!