TARIFFS AND TRADE WARS IN A RICARDIAN MODEL

Environment

2 countries/2 goods

$$y_1^1 = \ell_1^1 \qquad y_1^2 = \ell_1^2 / 2$$
$$y_2^1 = \ell_2^1 / 2 \qquad y_2^2 = \ell_2^2$$
$$\bar{\ell}^1 = 12 \qquad \bar{\ell}^2 = 12$$

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 $p_1^1 = 1$, $p_2^1 = 2$.

Solve for consumer demands:

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

Country 2:

Normalize $w^2 = 1$. Profit maximization implies that $p_1^2 = 2$, $p_2^2 = 1$.

Solve for consumer demands:

$$c_1^2 = \frac{12w^2}{2p_1^2} = 3 \qquad c_2^2 = \frac{12w^2}{2p_2^2} = 6 .$$

Autarky Equilibrium

	$\hat{p}_1^i$	$\hat{p}_2^i$	$\hat{w}^i$	$\hat{c}_1^i$	$\hat{c}_2^i$	$\hat{y}_1^i$	$\hat{y}_2^i$	$\hat{\ell}_1^i$	$\hat{\ell}_2^i$
Country 1	1	2	1	6	3	6	3	6	6
Country 2	2	1	1	3	6	3	6	6	6

$\hat{u}^1 = \log 6 + \log 3 = \log 18$, real income $= 6^{1/2}3^{1/2} = 18^{1/2} = 4.2426$

$\hat{u}^2 = \log 3 + \log 6 = \log 18$, real income $= 3^{1/2}6^{1/2} = 18^{1/2} = 4.2426$.

Trade Equilibrium

guess $y_1^1 = 12$, $y_2^1 = 0$, $y_1^2 = 0$, $y_2^2 = 12$

normalize $w^1 = 1 \Rightarrow p_1^1 = p_1^2 = p_1 = 1$

$p_2^1 = p_2^2 = p_2 w^2$

$x_1^1 = \dfrac{12w^1}{2p_1^1} = 6,$ $x_1^2 = \dfrac{12w^2}{2p_1^2} = 6w^2$

$x_1^1 + x_1^2 = y_1^1 = 12$

$6 + 6w^2 = 12 \Rightarrow w^2 = 1$ (not surprisingly!)

$x_1^2 = \dfrac{12w^1}{2p_2^1} = 6,$ $x_2^2 = \dfrac{12w^2}{2p_2^1} = 6$

Trade Equilibrium

	$\hat{p}_1^i$	$\hat{p}_2^i$	$\hat{w}^i$	$\hat{c}_1^i$	$\hat{c}_2^i$	$\hat{y}_1^i$	$\hat{y}_2^i$	$\hat{\ell}_1^i$	$\hat{\ell}_2^i$
Country 1	1	1	1	6	6	12	0	12	0
Country 2	1	1	1	6	6	0	12	0	12

$\hat{u}^1 = \log 6 + \log 6 = \log 36$, 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 $\tau_2^1 \Rightarrow p_2^1 = \left(1+\tau_2^1\right) p_2$

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

Suppose tariff revenues are transferred back to consumers.

New consumers' problem:

$$\max \ \log c_1^1 + \log c_2^1$$
$$\text{s.t.} \quad \hat{p}_1 c_1^1 + \hat{p}_2 (1+\tau_2^1) c_2^1 = \hat{w}^1 \hat{\ell}^1 + \hat{T}^1$$

The solution is

$$\hat{c}_1^1 = \frac{\hat{w}^1\overline{\ell}^1 + \hat{T}^1}{2\,\hat{p}_1}, \quad \hat{c}_2^1 = \frac{\hat{w}^1\overline{\ell}^1 + \hat{T}^1}{2\,\hat{p}_2(1+\tau_2^1)}$$

new equilibrium condition: $\hat{T}^1 = \tau_2^1 \hat{p}_2^2 \hat{x}_2^1$ (government budget constraint)

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

guess $y_1^1 = 12$, $y_2^1 = 0$, $y_1^2 = 0$, $y_2^2 = 12$

normalize $w^1 = 1 \rightarrow p_1^1 = p_1^2 = 1$

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

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

$$T^1 = \frac{12+T^1}{6}$$

$6T^1 = 12 + T^1 \rightarrow T^1 = 2.4$

$$x_1^1 = \frac{12w^1 + T^1}{2\,\hat{p}_1^1} = \frac{14.4}{2} = 7.2 \qquad x_1^2 = \frac{12w^2}{2\,\hat{p}_1^2} = 6w^2$$

$x_1^1 + x_1^2 = y_1^1 = 12$

$7.2 + 6w^2 = 12 \rightarrow w^2 = 0.8$

	$\hat{p}_1^i$	$\hat{p}_2^i$	$\hat{w}^i$	$\hat{T}^i$	$\hat{x}_1^i$	$\hat{x}_2^i$	$\hat{y}_1^i$	$\hat{y}_2^i$	$\hat{\ell}_1^i$	$\hat{\ell}_2^i$
Country 1	1	1.2	1	2.4	7.2	6	12	0	12	0
Country 2	1	0.8	0.8	0	4.8	6	0	12	0	12

$\hat{u}^1 = \log 7.2 + \log 6 = \log 43.2$, real income = $7.2^{1/2}6^{1/2} = 43.2^{1/2} = 6.5727$
$\hat{u}^2 = \log 4.8 + \log 6 = \log 28.8$, 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 $\left(\tau_1^2 = 0.5\right)$.

normalize $\quad w^1 = 1 \rightarrow p_1^1 = 1, \quad p_1^2 = 1.5$

$p_2^2 = w^2, \quad p_2^1 = 1.5w^2$

$T^1 = 2.4$ as before.

Now $T^2 = \tau_1^2 p_1^1 x_1^2$

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

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

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

$$x_1^1 = \frac{12w^1 + T^1}{2p_1^1} = \frac{14.4}{2} = 7.2 \qquad x_1^2 = \frac{12w^2 + T^2}{2p_1^2} = \frac{14.4w^2}{3} = 4.8w^2$$

$$x_1^1 + x_1^2 = y_1^1 = 12$$

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

	$\hat{p}_1^i$	$\hat{p}_2^i$	$\hat{w}^i$	$\hat{T}^i$	$\hat{x}_1^i$	$\hat{x}_2^i$	$\hat{y}_1^i$	$\hat{y}_2^i$	$\hat{\ell}_1^i$	$\hat{\ell}_2^i$
Country 1	1	1.5	1	2.4	7.2	4.8	12	0	12	0
Country 2	1.5	1	1	2.4	4.8	7.2	0	12	0	12

$\hat{u}^1 = \log 7.2 + \log 4.8 = \log 34.6$, 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: $\tau_2^1 = 0$	$\tau_2^1 = 0.5$
$\tau_2^1 = 0$	(6.00, 6.00)	(5.37, 6.57)
$\tau_2^1 = 0.5$	(6.57, 5.37)	(5.88, 5.88)

A Ridiculously Costly Trade War

Suppose $\tau_2^1 = \tau_2^1 > 2$ (200 percent tariffs)

Guess that $y_1^1 = 12$, $y_2^1 = 0$, $y_1^2 = 0$, $y_2^2 = 12$ is wrong.

We revert to autarky!