“Tariff De-Escalation with Successive Oligopoly”*

Ian Sheldon

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* S. McCorriston and I. Sheldon, “Tariff De-Escalation with Successive Oligopoly”
Tariff Escalation


- Cadot *et al.* (2004) report nominal protection escalates with degree of processing in both industrial and agricultural goods

- Extent of tariff escalation highlighted as key issue affecting developing country exports (UNCTAD, 2002; World Bank, 2003)

- Provides rationale for *formula approaches* to reducing tariffs, i.e., percentage reduction in higher tariffs exceeds that for lower tariffs (Francois and Martin, 2003)
Basic Result

• In vertically-related market, simultaneous and equal reduction of upstream and downstream tariffs has *non-equivalent* effects on upstream and downstream firms’ profits

• Result due to *within* (horizontal) stage and *between* (vertical) stage impact of tariff cuts, where latter is made up of *pass-through* and *pass-back* effects

• To extent firms are concerned about relative profitability, outcome provides potential source of opposition to tariff reductions

• Generates strong argument for tariff *de-escalation*
Literature

- Relates to literature on *cascading contingent protection* where upstream tariffs have spillover effect, increasing chance of tariffs downstream (Hoekman and Leidy, 1992; Sleuwaegen *et al.*, 1998)

- Different, however, to literature on optimal tariffs in vertically-related markets (Spencer and Jones, 1991, 1992; Ishikawa and Spencer, 1999)

- Paper also abstracts from explicit political economy considerations in order to focus on *mechanisms* arising with simultaneous tariff reductions
Vertical Market Structure

Stage

Upstream:

Downstream:

Technology:

Final Demand

Domestic

Imports

Policy

$x_1^u$

$x_2^u$

$x_1^u$

$x_2^u$

Tariff - $t^u$

$x_1 = \phi x^u$

$x^u = x_1^u + x_2^u$

Tariff - $t^d$

$t^d > t^u$
Equilibrium

- Three-stage game:
  (1) Government commits to \( t^u \) and \( t^d \)
  (2)/(3) Nash equilibria upstream and downstream

- Downstream revenue functions:

\[
R_1(x_1, x_2) \quad (1)
\]
\[
R_2(x_1, x_2) \quad (2)
\]

- Downstream profit functions:

\[
\pi_1^d = R_1(x_1, x_2) - c_1 x_1 \quad (3)
\]
\[
\pi_2^d = R_2(x_1, x_2) - c_2 x_2 - t^d x_2 \quad (4)
\]
Equilibrium

● First-order conditions are:
\[ R_{1,1} = c_1 \]  \hspace{1cm} (5)
\[ R_{2,2} = c_2 + t^d \]  \hspace{1cm} (6)

● Nash equilibrium downstream:
\[
\begin{bmatrix}
R_{1,11} & R_{1,12} \\
R_{2,21} & R_{2,22}
\end{bmatrix}
\begin{bmatrix}
dx_1 \\
dx_2
\end{bmatrix}
=
\begin{bmatrix}
dp_1^u \\
dc_2 + dt^d
\end{bmatrix}
\]  \hspace{1cm} (7)

● Slopes of reaction functions:
\[
\frac{dx_1}{dx_2} = r_1 = - \frac{R_{1,12}}{R_{1,11}} \]  \hspace{1cm} (8)
\[
\frac{dx_2}{dx_1} = r_2 = - \frac{R_{2,21}}{R_{2,22}} \]  \hspace{1cm} (9)

Substitutes (complements), \( R_{i,ij} < 0(> 0) \), \( r_i < 0(> 0) \)
Equilibrium

- Solution found by re-arranging and inverting (7), and simplifying notation:

\[
\begin{bmatrix}
\frac{dx_1}{dx_2}
\end{bmatrix} = \Delta^{-1}
\begin{bmatrix}
a_2 & -b_1 \\
-b_2 & a_1
\end{bmatrix}
\begin{bmatrix}
dp_1^u \\
dc_2 + dt^d
\end{bmatrix}
\]

(10)

where: \( a_1 = R_{1,11} \) \( a_2 = R_{2,22} \)
\( b_1 = R_{1,12} \) \( b_2 = R_{2,21} \),

and for stability, \( a_i < 0 \), and \( \Delta^{-1} = a_1a_2(1-r_1r_2) > 0 \)

- From (8) and (9), substitute \( r_i = -(b_i)/a_i \) into (10):

\[
\begin{bmatrix}
\frac{dx_1}{dx_2}
\end{bmatrix} = \Delta^{-1}
\begin{bmatrix}
a_2 & a_1r_1 \\
a_2r_2 & a_1
\end{bmatrix}
\begin{bmatrix}
dp_1^u \\
dc_2 + dt^d
\end{bmatrix}
\]

(11)
**Equilibrium**

- Upstream firms’ profits are:

\[
\pi_1^u = R_1^u(x_1^u, x_2^u) - c_1^u x_1^u \tag{12}
\]

\[
\pi_2^u = R_2^u(x_1^u, x_2^u) - c_2^u x_2^u - t^u x_2^u \tag{13}
\]

- Given technology, upstream Nash equilibrium is:

\[
\begin{bmatrix}
    dx_{1}^u \\
    dx_{2}^u
\end{bmatrix} = (\Delta^u)^{-1}
\begin{bmatrix}
    a_2^u & a_1^u r_1^u \\
    a_2^u r_2^u & a_1^u
\end{bmatrix}
\begin{bmatrix}
    dc_1^u \\
    dc_2^u + dt^u
\end{bmatrix} \tag{14}
\]

where for stability \(a_i^u < 0\), \((\Delta^u)^{-1} > 0\), and also \(|a_i^u| > |a_i|\), i.e., perceived marginal revenue steeper upstream (see Lemma 1)
Incidence of Tariff Reductions

To identify market access effects, assume initially that:

(i) \( dt^u > 0, dt^d = 0 \), and then (ii) \( dt^u = 0, dt^d > 0 \):

**Pass-through of \( dt^u \):**

\[
\frac{dp^u_1}{dt^u} = p^u_{1,1}(dx^u_1 + dx^u_2) = p^u_{1,1}D
\]

where \( \frac{dp^u_1}{dx^u} = p^u_{1,1} < 0 \), and \( D = \{(\Delta^u)^{-1}[a^u_i(1 + r^u_i)]\} < 0 \)

Likely that \( p^u_{1,1}D < 1 \), i.e., under-shifting of reduction in upstream tariff (linear or weakly convex demand curve generates this result, Fullerton and Metcalf, 2002)
Incidence of Tariff Reductions

- **Pass-back of** $dt^d$:

\[
\frac{dp^u_1}{dt^d} = \frac{dp^u_1}{d(x^u_1 + x^u_2)} \frac{d(x^u_1 + x^u_2)}{dt^d} = \Delta^{-1} a_1 r_1 (1 + p^u_{1,1})
\]

(a) $\Delta^{-1} a_1 r_1 (1 + p^u_{1,1}) > 0$ if $r_i < 0$ - substitutes 

(b) $\Delta^{-1} a_1 r_1 (1 + p^u_{1,1}) < 0$ if $r_i > 0$ - complements

- **Pass-through and pass-back** effects not equivalent:

\[
p^u_{1,1}(\Delta^{-1})^u [a^u_1 (1 + r^u_i)] \neq \Delta^{-1} a_1 r_1 (1 + p^u_{1,1})
\]

(see Lemma 2)
Tariff Reductions and Market Access

- Effect of lowering \( t^u \) on market access:

\[
\frac{dx_2^u}{dt^u} = (\Delta^{-1})^u a_1^u < 0
\]  

\( (16) \)

- Imports of intermediate good increase

\[
\frac{dx_2}{dp_1^u} \frac{dx_2}{dp_1^u} = (\Delta^{-1}) a_2 r_2 p_{1,1}^u [(\Delta^{-1})^u (a_1^u (1+r_1^u))] 
\]  

\( (17) \)

\[
\frac{dx_2}{dt^u} > 0 \text{ if } r_2 < 0 \text{ or } \frac{dx_2}{dt^u} < 0 \text{ if } r_2 > 0
\]

- Imports of final good fall (increase) depending on whether final goods are substitutes (complements)
Tariff Reductions and Market Access

- **Effect of lowering $t^d$ on market access:**

  \[
  \frac{dx_2^u}{dt^d} = \Delta^{-1} a_1 [1 + a_2 r_1 r_2 \Delta^{-1} (1 + p_{1,1}^u)] < 0
  \]  
  \[18\]

  **Imports of final good increase**

  \[
  \frac{dx_2^u}{dt^d} = s(\Delta^{-1}) a_1 r_1 [1 + a_2 \Delta^{-1} (1 + p_{1,1}^u)]
  \]  
  \[19\]

  \[dx_1 = d(x_1^u + x_2^u), \text{ so } (dx_2^u / dx_1) = 1 - (dx_1^u / dx_1) = s\]

  \[
  \frac{dx_2^u}{dt^d} > 0 \text{ if } r_1 < 0 \text{ or } \frac{dx_2^u}{dt^d} < 0 \text{ if } r_1 > 0
  \]

  **Imports of intermediate good fall (increase) if final goods are substitutes (complements)**
Tariff Reductions and Market Access

- **Net effect on market access of lowering** $t^u$ and $t^d$:

\[
\frac{dx^u_2}{dt^u} + \frac{dx^u_2}{dt^d} = (\Delta^{-1})^u a^u_1 + s(\Delta^{-1}) a_1 r_1 [1 + a_2 \Delta^{-1} (1 + p^u_{1,1})] < 0 \quad (20)
\]

- Imports of *intermediate good* increase, partly offset by decline in derived demand downstream

\[
\frac{dx_2}{dt^u} + \frac{dx_2}{dt^d} = (\Delta^{-1}) a_2 r_2 p^u_{1,1} \{(\Delta^{-1})^u [a^u_1 (1 + r^u_1)]\} \\
+ \Delta^{-1} a_1 [1 + a_2 r_1 r_2 \Delta^{-1} (1 + p^u_{1,1})] < 0 \quad (21)
\]

- Imports of *final good* increase, as long as *vertical effect* of upstream tariff reduction is not too great...
Tariff Reductions and Market Access

● Which stage is most affected by change in access?

\[
\frac{dx_2}{dx^u_2}_{dt^u + dt^d} = \frac{\Delta^{-1} a_2 r_2 \left\{ p_{1,1}^u (\Delta^{-1})^u [a_1^u (1 + r_1^u)] + a_1 [1 + a_2 r_1 r_2 \Delta^{-1} (1 + p_{1,1}^u)] \right\}}{(\Delta^{-1})^u a_1^u + s \Delta^{-1} a_1 r_1 (1 + a_2 (1 + p_{1,1}^u) \Delta^{-1})} < 1
\]

(22)

■ Final good imports likely to increase by less than increase in imports of intermediate good (see Proposition 1)

● Result rationalizes why some firms may take a different stance on trade liberalization, reinforcing need for formula reductions in tariffs
Tariff Changes and Profits

- By how much would $t^d$ have to change, given unit reduction in $t^u$, in order to keep change in domestic firms’ profits equal between stages?

- Tariff rule is to find $dt^d$ such that:

$$dt^d = \left[ \left( \frac{d\pi_1^d}{dt^u} \right) + \left( \frac{d\pi_1^u}{dt^u} \right) \right] dt^u$$

$$\left( \frac{d\pi_1^d}{dt^d} + \frac{d\pi_1^u}{dt^d} \right)$$

$$\left( \frac{d\pi_1^d}{dt^d} > 0, \frac{d\pi_1^u}{dt^d} > 0, \frac{d\pi_1^d}{dt^u} < 0, \frac{d\pi_1^u}{dt^u} > 0 \right)$$
Tariff Changes and Profits

- (i) If $\frac{dt^d}{dt^u} > 1$, implies tariff de-escalation

(ii) If $0 < \frac{dt^d}{dt^u} < 1$, implies tariff escalation

Result (i) means percentage reduction in downstream tariff should exceed that for upstream tariff.

Result (ii) means percentage reduction in downstream tariff should be less than that for upstream tariff.

- When vertical effects coupled with horizontal effects, effects of simultaneous tariff reductions may not have an equal effect on profits of firms located at upstream and downstream stages.
Policy Implications

● Equal reduction in tariffs in vertically-related market may result in greater impact on upstream (downstream) firm(s) compared to downstream (upstream) firm(s)

● To extent vested interests oppose trade liberalization, lobbying likely to come from upstream (downstream) – not just because profits fall, but as profits fall by more than downstream (upstream)

● Important justification for formula approaches to tariff reduction – not just simpler negotiations, but also formal basis in mechanisms arising in vertically-related markets

● Potentially beneficial to developing country exporters