Tariff De-Escalation with Successive Oligopoly

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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; FAO, 2007)

- Provides rationale for *formula approaches* to reducing tariffs, i.e., percentage reduction in higher tariffs exceeds that for lower tariffs (Francois and Martin, 2003) – essentially in draft WTO modalities (WTO, 2009)
End-Uruguay Round Bound Tariffs (FAO, 2007)

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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)

○ Feinberg and Kaplan (1997) in analyzing US anti-dumping cases found levels of protection upstream have an impact on protection downstream

○ 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:

*Domestic*

\[ x_1^u \]

*Imports*

\[ x_2^u \]

*Policy*

\[ \text{Tariff} - t^u \]

Technology:

\[ x_1 = \phi x^u \]

\[ x^u = x_1^u + x_2^u \]

Downstream:

\[ x_1 \]

\[ x_2 \]

\[ \text{Tariff} - t^d \]

\[ t^d > t^u \]

Final Demand
Equilibrium

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

- Downstream revenue functions:
  \[ R_1(x_1, x_2) \]  
  \[ R_2(x_1, x_2) \]

- Downstream profit functions:
  \[ \pi_1^d = R_1(x_1, x_2) - c_1 x_1 \]  
  \[ \pi_2^d = R_2(x_1, x_2) - c_2 x_2 - t^d x_2 \]
Equilibrium

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

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

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

Substitutes (complements), \( R_{i,ij} < 0(> 0) \), \( r_i < 0(> 0) \)
Figure 2: Strategic Substitutes vs. Strategic Complements*

* Bulow, Geanakoplos, and Klemperer (1985)
Equilibrium

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

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

(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 \(\Delta^{-1} = (a_1 a_2 - b_1 b_2) > 0\)

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

\[
\begin{bmatrix}
dx_1 \\
dx_2
\end{bmatrix} = \Delta^{-1} \begin{bmatrix}
a_2 & a_1 r_1 \\
a_2 r_2 & a_1
\end{bmatrix} \begin{bmatrix}
\rho^u \\
dc_2 + dt^d
\end{bmatrix}
\]

(11)
Equilibrium

- Upstream firms’ profits are:

\[ \pi_1^u = R_1^u(x_1^u, x_2^u) - c_1^u x_1^u \]  \hspace{1cm} (12)

\[ \pi_2^u = R_2^u(x_1^u, x_2^u) - c_2^u x_2^u - t^u x_2^u \]  \hspace{1cm} (13)

- Given technology, upstream Nash equilibrium is:

\[
\begin{bmatrix}
\frac{dx_1^u}{dx_2^u}
\end{bmatrix} = (\Delta^u)^{-1} \begin{bmatrix}
a_2^u & a_1^u r_1^u \\
a_2^u r_2^u & a_1^u
\end{bmatrix} \begin{bmatrix}
dc_1^u \\
dc_2^u + dt^u
\end{bmatrix} \hspace{1cm} (14)
\]

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 $dt^u$**:

  $$
  dp_1^u / dt^u = p_{1,1}^u (dx_1^u + dx_2^u) = p_{1,1}^u D
  $$

  where $dp_1^u / dx^u = p_{1,1}^u < 0$, and $D = \{(\Delta^u)\,^{-1}[a_1^u (1 + r_1^u)]\} < 0$

  Likely that $p_{1,1}^u D < 1$, i.e., *under-shifting* of reduction in upstream tariff (linear or weakly convex demand curve generates this result, Fullerton and Metcalf, 2002)
Figure 2: Pass-Through of Tariff Reduction
Incidence of Tariff Reductions

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

$$\frac{dp_1^u}{dt^d} = \frac{dp_1^u}{d(x_1^u + x_2^u)} \frac{d(x_1^u + x_2^u)}{dt^d} = \Delta^{-1} a_1 r_1 (1 + p_{1,1}^u)$$

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

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

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

$$p_{1,1}^u (\Delta^{-1})^u [a_1^u (1 + r_1^u)] \neq \Delta^{-1} a_1 r_1 (1 + p_{1,1}^u)$$

(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

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

(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:**

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

- **Imports of final good increase**

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

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

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

- **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

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

- 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?

\[
\frac{dx_2}{dx^u_2|_{dt^u+dt^d}} = \frac{\Delta^{-1}a_1r_2\left\{p^u_{1,1}(\Delta^{-1})^u[a^u_1(1+r^u_1)] + a^u_1[1+a^u_2r^u_1r^u_2\Delta^{-1}(1+p^u_{1,1})]\right\}}{(\Delta^{-1})^u a^u_1 + s\Delta^{-1}a^u_1r^u_1(1+a^u_2(1+p^u_{1,1})\Delta^{-1})} < 1
\]

(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
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:

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

(23)

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

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

- (ii) If $0 < \frac{d\hat{t}^d}{dt^u} < 1$, 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