Tariff De-Escalation with Successive Oligopoly

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Tariff Escalation

- ***Tariff escalation*** **long-recognized issue in trade policy literature, (Corden, 1966; Ethier, 1977; Anderson, 1998)**
- **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)

		EU	Japan	US
Cocoa	Primary	0	0	0
	Processed	17	43.0	13
Coffee	Primary	4	0	0
	Processed	8	12	2
Sugar	Primary	406	397	90
	Processed	36	80	55
Fruits	Primary	8	9	5
	Processed	19	19	11
Oilseeds	Primary	0	60	18
	Processed	29	6	5
Grains	Primary	30	67	1
	Processed	34	153	3
Rice	Primary	40	702	2
	Processed	60	847	5

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**

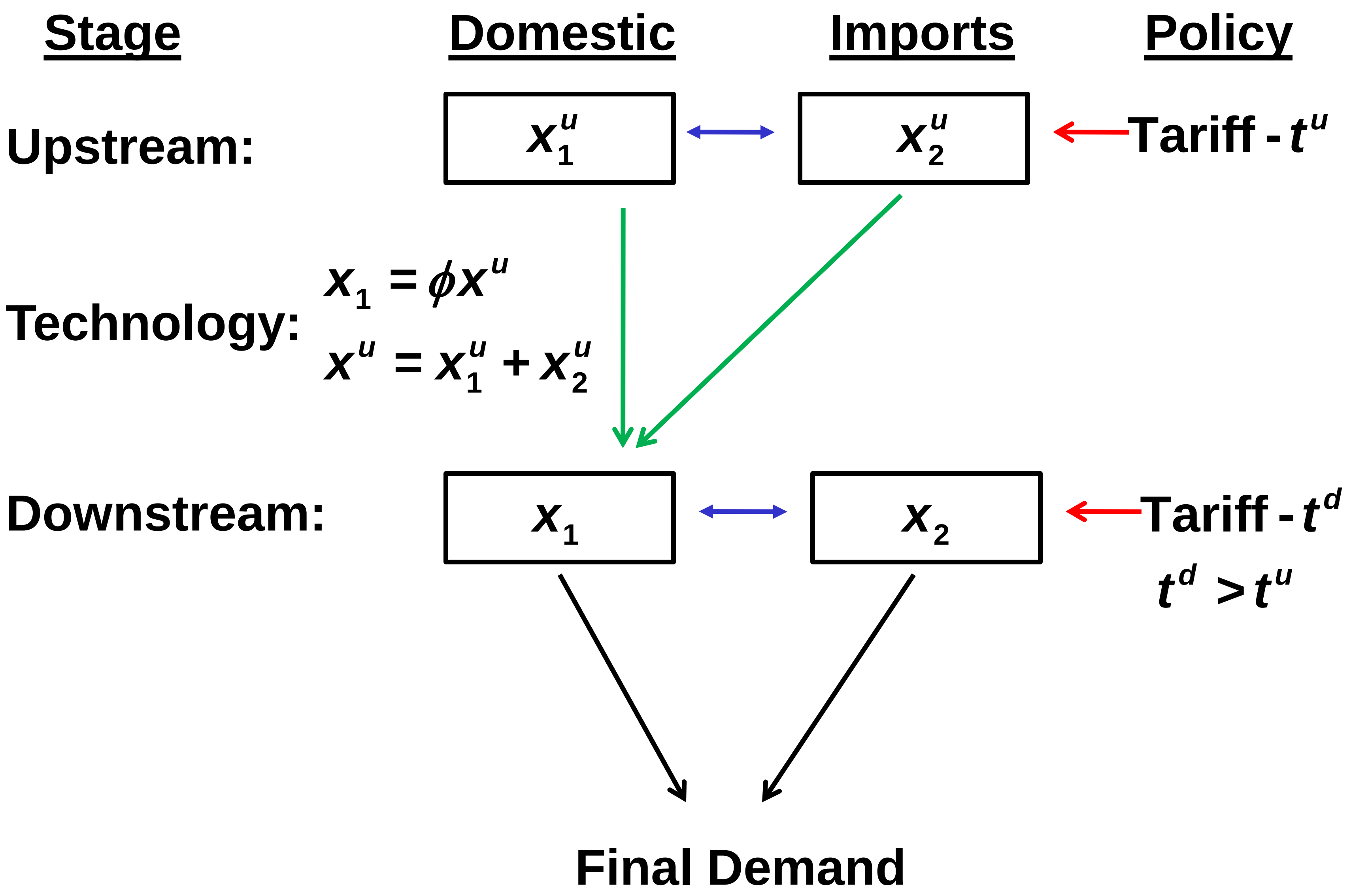
- **To extent firms are concerned about relative profitability, outcome provides potential source of opposition to tariff reductions**

- **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



Equilibrium

- **Three-stage game:**

  (1) Government commits to t^u and t^d

  (2)/(3) Nash equilibria upstream and downstream,

- **Downstream revenue functions:**

$$R_1(x_1, x_2) \qquad (1)$$

$$R_2(x_1, x_2) \qquad (2)$$

- **Downstream profit functions:**

$$\pi_1^d = R_1(x_1, x_2) - c_1 x_1 \qquad (3)$$

$$\pi_2^d = R_2(x_1, x_2) - c_2 x_2 - t^d x_2 \qquad (4)$$

Equilibrium

- **First-order conditions are:**

$$R_{1,1} = c_1 \quad (5)$$

$$R_{2,2} = c_2 + t^d \quad (6)$$

- **Nash equilibrium downstream:**

$$\begin{bmatrix} R_{1,11} & R_{1,12} \\ R_{2,21} & R_{2,22} \end{bmatrix} \begin{bmatrix} dx_1 \\ dx_2 \end{bmatrix} = \begin{bmatrix} dp_1^u \\ dc_2 + dt^d \end{bmatrix} \quad (7)$$

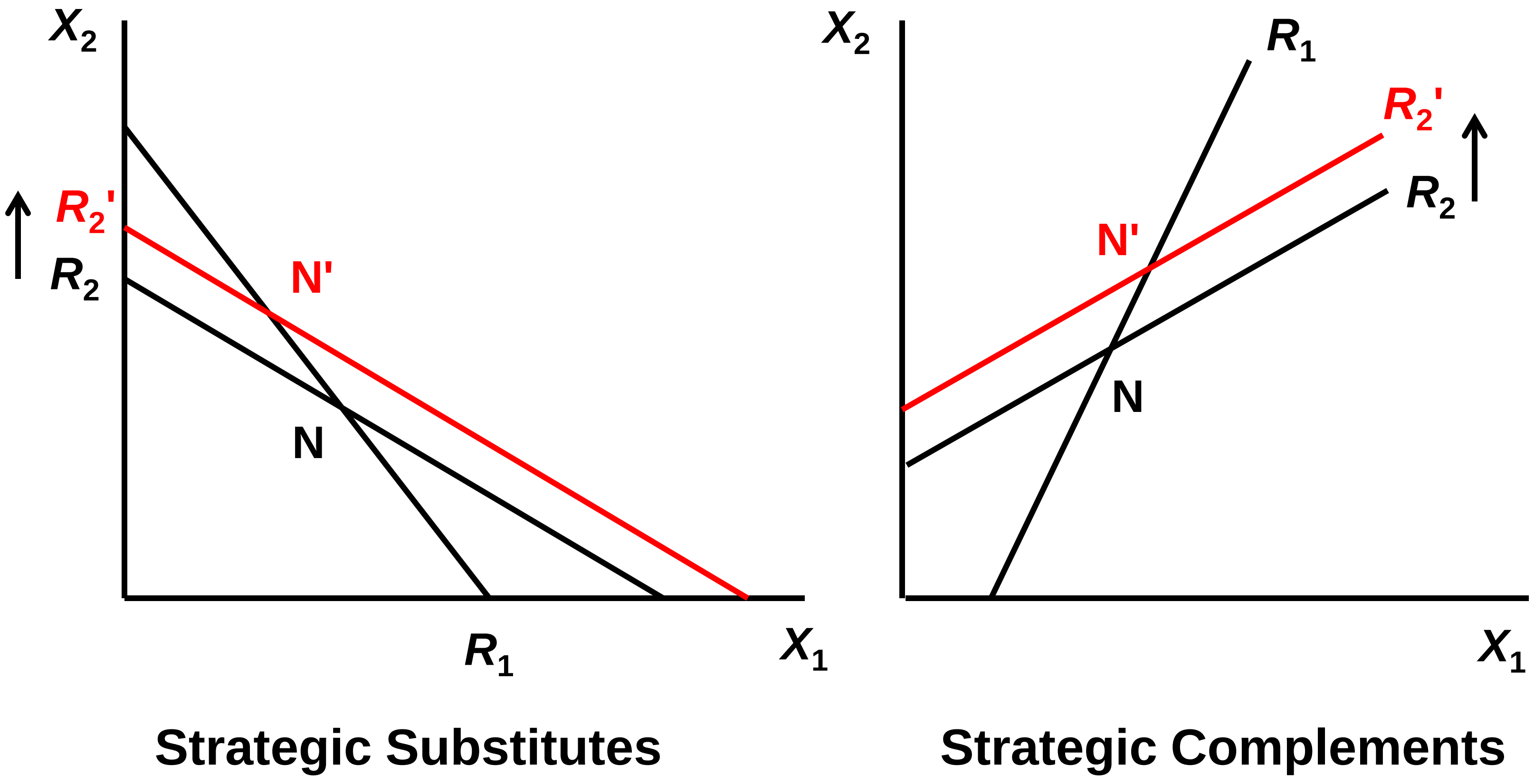
- **Slopes of reaction functions:**

$$\frac{dx_1}{dx_2} = r_1 = -\frac{R_{1,12}}{R_{1,11}} \quad (8)$$

$$\frac{dx_2}{dx_1} = r_2 = -\frac{R_{2,21}}{R_{2,22}} \quad (9)$$

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:**

$$\begin{bmatrix} dx_1 \\ dx_2 \end{bmatrix} = \Delta^{-1} \begin{bmatrix} a_2 & -b_1 \\ -b_2 & a_1 \end{bmatrix} \begin{bmatrix} dp_1^u \\ dc_2 + dt^d \end{bmatrix} \qquad (10)$$

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):**

$$\begin{bmatrix} dx_1 \\ dx_2 \end{bmatrix} = \Delta^{-1} \begin{bmatrix} a_2 & a_1 r_1 \\ a_2 r_2 & a_1 \end{bmatrix} \begin{bmatrix} dp_1^u \\ dc_2 + dt^d \end{bmatrix} \qquad (11)$$

Equilibrium

- Upstream firms' profits are:

$$\pi_1^u = R_1^u(x_1^u, x_2^u) - c_1^u x_1^u \qquad (12)$$

$$\pi_2^u = R_2^u(x_1^u, x_2^u) - c_2^u x_2^u - t^u x_2^u \qquad (13)$$

- Given technology, upstream Nash equilibrium is:

$$\begin{bmatrix} dx_1^U \\ dx_2^U \end{bmatrix} = (\Delta^U)^{-1} \begin{bmatrix} a_2^U & a_1^U r_1^U \\ a_2^U r_2^U & a_1^U \end{bmatrix} \begin{bmatrix} dc_1^u \\ dc_2^U + dt^u \end{bmatrix} \qquad (14)$$

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) $dt^u = 0, dt^d > 0$:**

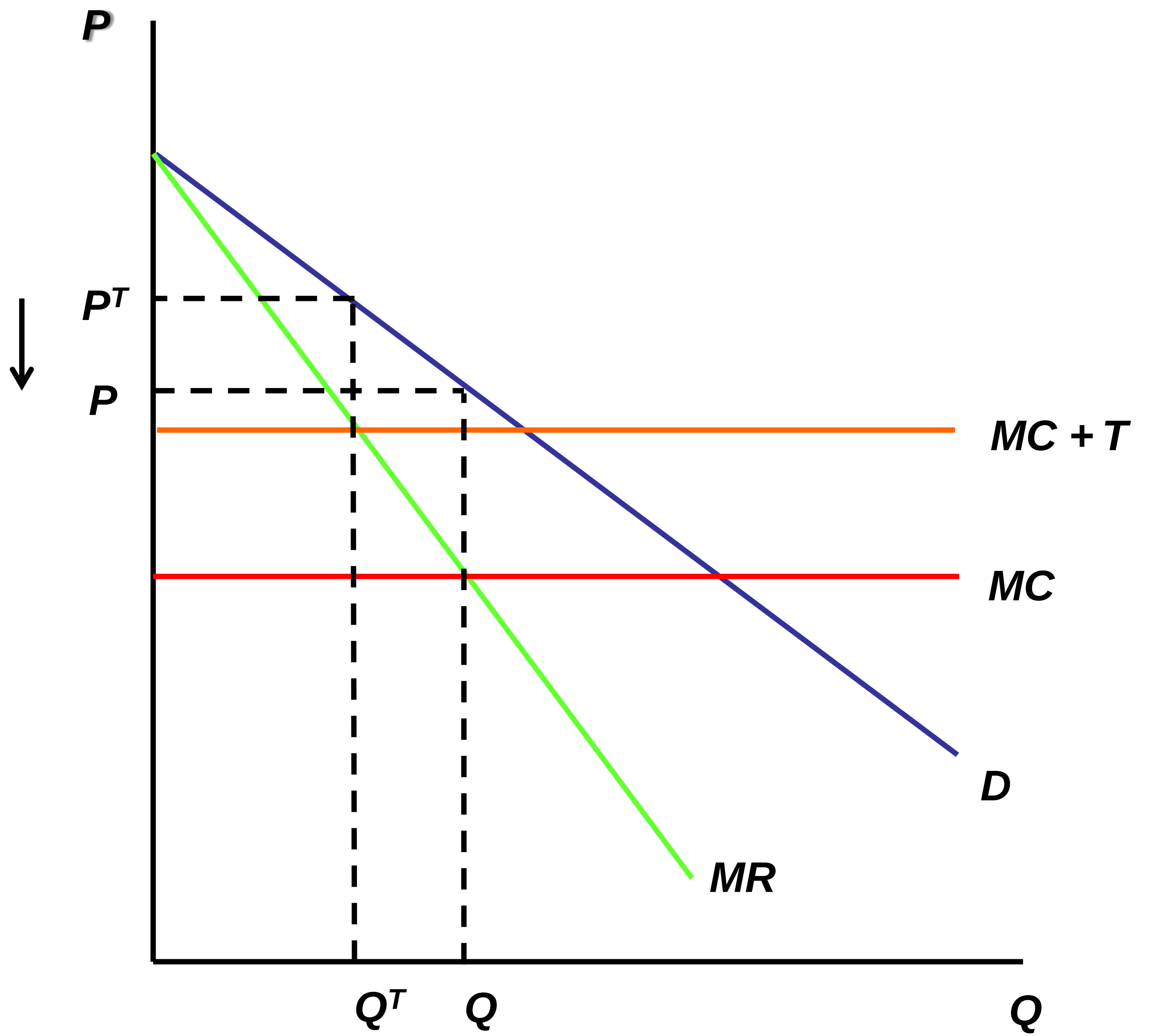
- ***Pass-through* of dt^u:**

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

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*:

$$\frac{dx_2^u}{dt^u} = (\Delta^{-1})^u a_1^u < 0 \qquad (16)$$

- Imports of *intermediate good* increase

$$\frac{dx_2}{dt^u} = \frac{dx_2}{dp_1^u}\frac{dp_1^u}{dt^u} = (\Delta^{-1}) a_2 r_2 p_{1,1}^u [(\Delta^{-1})^u (a_1^u (1 + r_1^u))] \qquad (17)$$

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

- 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*:

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

- Imports of *final good* increase

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

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

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

- 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 **:**

$$\frac{dx_2^u}{dt^u}+\frac{dx_2^u}{dt^d}=(\Delta^{-1})^u a_1^u+s(\Delta^{-1})a_1r_1[1+a_2\Delta^{-1}(1+p_{1,1}^u)]<0 \qquad (20)$$

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

$$\frac{dx_2}{dt^u}+\frac{dx_2}{dt^d}=(\Delta^{-1})a_2r_2p_{1,1}^u\left\{(\Delta^{-1})^u[a_1^u(1+r_1^u)]\right\}+\Delta^{-1}a_1[1+a_2r_1r_2\Delta^{-1}(1+p_{1,1}^u)]<0 \qquad (21)$$

- **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?**

$$\left.\frac{dx_2}{dx_2^u}\right|_{dt^u+dt^d} = \frac{\Delta^{-1}a_2r_2\left\{p_{1,1}^u(\Delta^{-1})^u[a_1^u(1+r_1^u)]+a_1[1+a_2r_1r_2\Delta^{-1}(1+p_{1,1}^u)]\right\}}{(\Delta^{-1})^u a_1^u + s\Delta^{-1}a_1r_1(1+a_2(1+p_{1,1}^u)\Delta^{-1})} < 1 \qquad (22)$$

- ***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 $d\hat{t}^d$ such that:

$$d\hat{t}^d = \frac{\left[\left(\frac{d\pi_1^d}{dt^u}\right) + \left(\frac{d\pi_1^u}{dt^u}\right)\right] dt^u}{\left(\frac{d\pi_1^d}{dt^d} + \frac{d\pi_1^u}{dt^d}\right)} \qquad (23)$$

$$\frac{d\pi_1^d}{dt^d} > 0, \frac{d\pi_1^u}{dt^d} > 0, \frac{d\pi_1^d}{dt^u} < 0, \frac{d\pi_1^u}{dt^u} > 0$$

Tariff Changes and Profits

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

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