Comments for Deardorff 2016

RIETI Workshop on Trade Costs 2016

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"Rue the ROOs: Rules of Origin and the Gains (or Losses) from Trade Agreement"

- ROO = Rules of Origin
- FTA = Free Trade Agreements
- Fragmentation => 2 stage production process (First, use a_{Xin} unit of labor to produce input for X, then use a_{Xout} unit of labor and intermediate input (for X) to produce output X.)

This paper

- Uses stylized theoretical G.E. examples.
- Compares welfare among
  1. Autarky
  2. Final goods free trade
  3. Fragmentation (both final and intermediate goods free trade)
  4. (All pairwise) FTA with ROO
  5. No FTA with positive tariffs

This paper

- Compares welfare among
  1. Autarky
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  5. No FTA with positive tariffs
- $1 < 2 < 3$ is obvious.

Model 1

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5
Y	2	3	5	1	2	3	3	1	4
Z	3	1	4	2	3	5	1	2	3

- 3 Industries (X,Y,Z) each: input + output
- Ricardian (only labor used)
- Numbers are labor requirement coefficients
- Leontief utility: $c_X = c_Y = c_Z$, $u = \min(c_X, c_Y, c_Z)$

Model: Autarky

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5
Y	2	3	5	1	2	3	3	1	4
Z	3	1	4	2	3	5	1	2	3

- If labor endowment is L = 252 for A, B, C, then
- In autarky, each country needs 12 labor unit to produce (X,Y,Z) = (1,1,1) tuple.
- From $u = \min(c_X, c_Y, c_Z)$, welfare is 21 = 252/12

Model: Free Trade (final goods)

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5
Y	2	3	5	1	2	3	3	1	4
Z	3	1	4	2	3	5	1	2	3

- Final goods comparative advantage
- In 2.Final Goods Free Trade, each country needs 9 labor unit to consume (X,Y,Z) = (1,1,1).
- From u = min (c_X,c_Y,c_Z) , welfare is 28 = 252/9

Model: Fragmentation

	Country A			Country B			Country C		
Industry	Input	output		Input	output		Input	output	
X	1	2		3	1		2	3	
Y	2	3		1	2		3	1	
Z	3	1		2	3		1	2	

- All goods (inputs and outputs) comparative advantage
- In 3.Fragmentation (both input and output free trade), each country needs 6 labor unit to consume (X,Y,Z) = (1,1,1) tuple.
- From u = min (c_X,c_Y,c_Z) , welfare is 42 = 252/6

This paper

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  1. Autarky u = 21
  2. Final goods free trade u = 28
  3. Fragmentation (both final and intermediate goods free trade) u = 42
  4. (All pairwise) FTA with ROO
  5. No FTA with positive tariffs
- 1 < 2 < 3 is obvious.
- 4 and 5 is not easy to see.

Model

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5
Y	2	3	5	1	2	3	3	1	4
Z	3	1	4	2	3	5	1	2	3

- Because all 3 countries and industries are symmetric, we can analyze about X and extend the results without loss of generality.

Model

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5

- (All pairwise) FTA with ROO
  - A and B
  - B and C
  - C and A
- No FTA with positive tariffs
  - Ad valorem tariff t > 0 for all inputs and outputs
  - P(1+t) …. Not P+t (specific tariff)

All pairwise FTA with ROO

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5

- In fragmentation, A produce input and B produce output and export to A and C.
- But FTA w ROO, B cannot ship to C.
- In A and B, they can consume X made with 1+1 =2 unit of labor. In C, it can do best by use input from C and output B so consume X made with 2+1 = 3 units of labor.

All pairwise FTA with ROO

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5

- In A and B, they can consume X made with 2 unit of labor. In C, it can consume X made with 3 units of labor.
- In A, to consume (X,Y,Z) = (1,1,1) tuple, total usage of labor is 7.
- From u = min (c_X,c_Y,c_Z) , welfare is 36 = 252/7

This paper

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  4. (All pairwise) FTA with ROO u = 36
  5. No FTA with positive tariffs
- 1 < 2 < 3 is obvious.
- 4 and 5 is not easy to see.

No FTA with positive tariffs

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5

- All transactions with positive tariffs
  - Ad valorem tariff t > 0 for all inputs and outputs
- In A, either consume domestic production (3) or export input 1*(1+t) to B and assemble in B (1+t) +1 = (2+t) and ship back to A: (2+t)*(1+t)

No FTA with positive tariffs

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5

- In B, either consume domestic production (input, output)=(B,B): cost is 4, or import input (1+t) from A and assemble in B: (A,B) cost (2+t).
  - Domestic production (B,B): Export to A and C at 4(1+t) or
  - A-input B-output case (A,B): Ship back to A or ship to C at (2+t)*(1+t)

No FTA with positive tariffs

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	1	2	3	3	1	4	2	3	5

- In C, production patterns are (input, output) = (C,C), (A,A),(A,B),(A,C),(B,B)
  - Domestic production (C,C): Export to A and B at 5(1+t), this won't happen (because dominated by (A,A))
  - Import final goods from A, (A,A): 3(1+t)
  - A-input B-output case(A,B): Ship to A and C at (2+t)*(1+t)
  - Import only input from A, (A,C): 4+t
  - Import final goods from B, (B,B): 4(1+t) dominated by (A,A)

consume	A	A	A	B	B	B	C	C	C	C
input	A	A	B	B	A	A	C	A	A	A
output	A	B	B	B	B	A	C	A	B	C
t	3	(2+t)(1+t)	4(1+t)	4	2+t	3(1+t)	5	3(1+t)	(2+t)(1+t)	4+t
2.1	**3**	12.71	12.4	**4**	4.1	9.3	**5**	9.3	12.71	6.1
2	**3**	12	12	4	4	9	**5**	9	12	6
1.9	**3**	11.31	11.6	4	**3.9**	8.7	**5**	8.7	11.31	5.9
1.5	**3**	8.75	10	4	**3.5**	7.5	**5**	7.5	8.75	5.5
1.2	**3**	7.04	8.8	4	**3.2**	6.6	**5**	6.6	7.04	5.2
1	**3**	6	8	4	**3**	6	5	6	6	5
0.9	**3**	5.51	7.6	4	**2.9**	5.7	5	5.7	5.51	**4.9**
0.8	**3**	5.04	7.2	4	**2.8**	5.4	5	5.4	5.04	**4.8**
$\sqrt{3}-1$	**3**	4.732	6.93	4	**2.73**	5.2	5	5.2	4.732	4.732
0.7	**3**	4.59	6.8	4	**2.7**	5.1	5	5.1	**4.59**	4.7
0.6	**3**	4.16	6.4	4	**2.6**	4.8	5	4.8	**4.16**	4.6
1/2 = 0.5	**3**	3.75	6	4	**2.5**	4.5	5	4.5	**3.75**	4.5
0.4	**3**	3.36	5.6	4	**2.4**	4.2	5	4.2	**3.36**	4.4
$(\sqrt{13}-3)/2$	3	3	5.211	4	**2.303**	3.908	5	3.908	**3**	4.303
0.3	3	**2.99**	5.2	4	**2.3**	3.9	5	3.9	**2.99**	4.3
0.2	3	**2.64**	4.8	4	**2.2**	3.6	5	3.6	**2.64**	4.2
0.1	3	**2.31**	4.4	4	**2.1**	3.3	5	3.3	**2.31**	4.1

According to my calculation

consuming (input, output)

Tariff \ Country	A	B	C
$2 < t$	(A,A)	(B,B)	(C,C)
$1 < t < 2$	(A,A)	(A,B)	(C,C)
$\sqrt{3} - 1 < t < 1$	(A,A)	(A,B)	(A,C)
$\frac{1}{2} < t < \sqrt{3} - 1$	(A,A)	(A,B)	(A,B)
$\frac{\sqrt{13} - 3}{2} < t < \frac{1}{2}$	(A,A)	(A,B)	(A,B)
$0 < t < \frac{\sqrt{13} - 3}{2}$	(A,B)	(A,B)	(A,B)

In page 16, it reads

- A can produce domestically at 3.
- A's export price is at 3(1+t).
- B can import input from A at (1+t) and do so if $t < 2$ because B's domestic input cost is 3.
- B's cost {1+min[(1+t), 3]} is always ≤ 4.
- B can export at the price (1+t){1+min[(1+t), 3]}.
- C will import A's input if $t < 1$. C's cost {3+min[(1+t), 2]} is always ≥ 4. C won't export.

In page 16,

- If t is not too large, then B will import the input from A and export the output to ***both*** countries.
- This "If t is not too large," actually means that "If $t < {\sqrt{13}-3}/{2} := 0.3028$,"
- If $t > {\sqrt{13}-3}/{2} := 0.3028$, B imports input from A, but export only to C. A will produce domestically.

Page 16 looks to say,

Country / Tariff	A	B	C
$2 < t$	(A,A)	(B,B)	(C,C)
$1 < t < 2$	(A,A)	(A,B)	(C,C)
$\sqrt{3} - 1 < t < 1$	(A,A)	(A,B)	(A, ?)
$\frac{1}{2} < t < \sqrt{3} - 1$	(A,A)	(A,B)	(A, ?)
$\frac{\sqrt{13} - 3}{2} < t < \frac{1}{2}$	(A,A)	(A,B)	(A, ?)
$0 < t < \frac{\sqrt{13} - 3}{2}$	(A,B)	(A,B)	(A,B)

According to my calculation

Tariff \ Country	A	B	C
$2 < t$	(A,A)	(B,B)	(C,C)
$1 < t < 2$	(A,A)	(A,B)	(C,C)
$\sqrt{3} - 1 < t < 1$	(A,A)	(A,B)	(A,C)
$\frac{1}{2} < t < \sqrt{3} - 1$	(A,A)	(A,B)	(A,B)
$\frac{\sqrt{13} - 3}{2} < t < \frac{1}{2}$	(A,A)	(A,B)	(A,B)
$0 < t < \frac{\sqrt{13} - 3}{2}$	(A,B)	(A,B)	(A,B)

If t < 30%,

- The production pattern is the same as fragmentation (free trade for both inputs and outputs).
- So welfare is the same as fragmentation.
- This is an artifact of the assumption about Leontief utility. (No consumption distortion)

This paper

- Compares welfare among
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  5. No FTA with positive tariffs u = 42
- 1 < 2 < 4 < 3 = 5

P17 says

- “Depending on how high tariff is, Country B may also use the X-input from itself, and Country C may produce the X output for itself.”
- The above statement can be written more precise as follows: When tariff rate is above 200% for B and above 100% for C, the domestic procurement prevails for both countries.

Non prohibitive tariffs

- If t > 50%, then B chooses (C,B) to export to C.
- If t < 30%, then no FTA achieves the same welfare as Fragmentation (free trade).
- In model 1, there is no tariff levels that overlaps (no FTA = Fragmentation) and (B procures from inefficient source C) regions.
- So Deardorff comes up with Model 2.

Model 2

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	10	30	40	20	10	30	15	40	55
Y	15	40	55	10	30	40	20	10	30
Z	20	10	30	15	40	55	10	30	40

- L = 780, Autarky = 780/125 = 6.24
- Free trade = 780/90 = 8.666…
- Fragmentation = 780/60 = 13
- FTA with ROOs = 780/(20+20+25) = 12

According to my calculation

Tariff \ Country	A	B	C
$1 < t$	(A,A)	(B,B)	(C,C)
$0.8979 := \frac{\sqrt{23}-3}{2} < t < 1$	(A,A)	(A,B)	(C,C)
$\frac{\sqrt{17}-3}{2} < t < \frac{\sqrt{23}-3}{2}$	(A,A)	(A,B)	(A,B)
$0 < t < \frac{\sqrt{17}-3}{2} := 0.5615$	(A,B)	(A,B)	(A,B)

- Are there any tariff levels within this where FTA with ROO forces inefficient outcome?

Model 2

	Country A			Country B			Country C		
Industry	Input	output	total	Input	output	total	Input	output	total
X	10	30	40	20	10	30	15	40	55
Y	15	40	55	10	30	40	20	10	30
Z	20	10	30	15	40	55	10	30	40

- FTA with ROOs
- Focus on consumption in C
  - (A,B) case: (10+10)*(1+t)
  - (C,B) case: (15+10)
  - When t > 25%, choose (C,B)!

Cost of FTA w ROO

- May increase if
  - There are more production stages
  - There are more countries and industries

Comments

- Very interesting and relevant paper!
- Extremely well-thought out examples!
- How can I add values?