14.581 International Trade

Class notes on 5/15/2013[1]

1 Trade Agreements

- Given the strong and robust predictions made by theories of trade agreements (the GATT/WTO in particular) it is surprising how little empirical work there is on testing these theories.

- Recall that the key claim in a series of Bagwell and Staiger papers is that the key international externality that trade policies impose is the terms-of-trade externality, and further that the key principles of the GATT/WTO seem well designed to force member countries to internalize these externalities.

- 2 recent papers take nice steps towards filling this gap:

  1. Broda, Limao and Weinstein (AER, 2008)
  2. Bagwell and Staiger (AER, 2010)

1.1 Broda, Limao and Weinstein (2008)

- With quasi-linear preferences across goods g, social welfare is given by (where π is producer surplus, ψ is consumer surplus and r is tariff revenue):

$$W = 1 + \sum_g [\pi_g(p_g) + r_g(p_g) + \psi_g(p_g)] \tag{1}$$

- Then (as in Johnson, 1954) the optimal tariff is given by the inverse (of the rest of the world's) export supply elasticity:

$$\tau_g^{opt} = \omega_g \equiv \frac{dp_g^* m_g^*}{dm_g^* p_g^*} \tag{2}$$

- In Grossman and Helpman (JPE 1995)—basically GH (1994) extended to a 2-country, strategically interacting, non-SOE world—the prediction is (where z is the inverse import penetration ratio and σ is the elasticity of import demand):

$$\tau_g^{GH} = \omega_g + \frac{I_g - \alpha}{a + \alpha} \frac{z_g}{\sigma_g} \tag{3}$$

[1] The notes are based on lecture slides with inclusion of important insights emphasized during the class.

- To test this, need estimates of ω_g. Postulate the following system of constant elasticity import demand and export supply (of variety v in good g into country i in year t) where s is a share (and $\Delta^{k_{ig}}$ differences across both time and an ig pair):

$$\Delta^{k_{ig}} \ln s_{igvt} = -(\sigma_{ig} - 1)\Delta^{k_{ig}} \ln p_{ivgt} + \varepsilon_{ivgt}^{k_{ig}} \tag{4}$$

$$\Delta^{k_{ig}} \ln p_{igvt} = \frac{\omega_{ig}}{1 + \omega_{ig}} \Delta^{k_{ig}} \ln s_{ivgt} + \delta_{ivgt}^{k_{ig}} \tag{5}$$

- BLW estimate this system through the same 'identification through heteroskedasticity' idea as Feenstra (AER, 1994) or Broda and Weinstein (QJE, 2006). Basic idea is that if $E[\varepsilon_{ivgt}^{k_{ig}} \delta_{ivgt}^{k_{ig}}] = 0$ and there is heteroskedasticity and there are more than 3 exporting countries, then can identify ω_{ig} and σ_{ig}.

- BLW then, having estimated ω_{ig}, estimate the relationship between tariffs and ω_{ig}.

- But for which countries? They do this on countries that (in certain time periods) were not part of the GATT/WTO and hence were presumably free to charge their unilaterally optimal tariff.

TABLE 1—DATA SOURCES AND YEARS

	GATT/WTO	Production data		Tariff data[a]	Trade data[b]
	Accession date	Source	Years		
Algeria				93	93–03
Belarus				97	98–03
Bolivia[c]	8-Sep-1990	UNIDO	93	93	93–03
China	11-Dec-2001	UNIDO	93	93	93–03
Czech[d]	15-Apr-1993			92	93–03
Ecuador	21-Jan-1996	UNIDO	93	93	94–03
Latvia	10-Feb-1999	UNIDO	96	97	94–03
Lebanon				00	97–02
Lithuania	31-May-2001	UNIDO	97	97	94–03
Oman	9-Nov-2000			92	94–03
Paraguay	6-Jan-1994			91	94–03
Russia				94	96–03
Saudi Arabia	11-Dec-2005			91	93–03
Taiwan	1-Jan-2002	UNIDO	96	96	92–96
Ukraine		UNIDO	97	97	96–02

[a] All tariff data are from TRAINS. Countries are included if we have tariff data for at least one year before accession (GATT/WTO).

[b] Except for Taiwan, all trade data are from COMTRADE. For Taiwan, data are from TRAINS.

[c] The date of the tariffs for Bolivia is post-GATT accession but those tariffs were set before GATT accession and unchanged between 1990–1993.

[d] The Czech Republic entered the GATT as a sovereign country in 1993. Its tariffs in 1992 were common to Slovakia with which it had a federation, which was a GATT member. So it is possible that the tariffs for this country do not reflect a terms-of-trade motive. Our results by country in Table 9 support this. Moreover, as we note in Section IVC, the pooled tariff results are robust to dropping the Czech Republic.

TABLE 3A—INVERSE EXPORT SUPPLY ELASTICITY STATISTICS

Statistic	Observations[a]	Median[b]			Mean		Standard deviation	
Sample	All	Low	Medium	High	All	W/out top decile	All	W/out top decile
Algeria	739	0.4	2.8	91	118	23	333	47
Belarus	703	0.3	1.5	61	85	15	257	36
Bolivia	647	0.3	2.0	91	102	23	283	49
China	1,125	0.4	2.1	80	92	17	267	35
Czech Republic	1,075	0.3	1.4	26	63	7	233	18
Ecuador	753	0.3	1.5	56	76	13	243	30
Latvia	872	0.2	1.1	9	52	3	239	8
Lebanon	782	0.1	0.9	31	56	7	215	18
Lithuania	811	0.3	1.2	24	65	6	235	16
Oman	629	0.3	1.2	25	209	7	3,536	21
Paraguay	511	0.4	3.0	153	132	67	315	169
Russia	1,029	0.5	1.8	33	48	8	198	18
Saudi Arabia	1,036	0.4	1.7	50	71	11	232	25
Taiwan	891	0.1	1.4	131	90	20	241	43
Ukraine	730	0.4	2.1	78	86	16	254	34
Median	782	0.3	1.6	54	85	13	243	30

[a] Number of observations for which elasticities and tariffs are available. The tariff availability did not bind except for Ukraine, where it was not available for about 130 HS4 goods for which elasticities were computed.

[b] The median over the "low" sample corresponds to the median over the bottom tercile of inverse elasticities. Medium and high correspond to the second and third terciles.

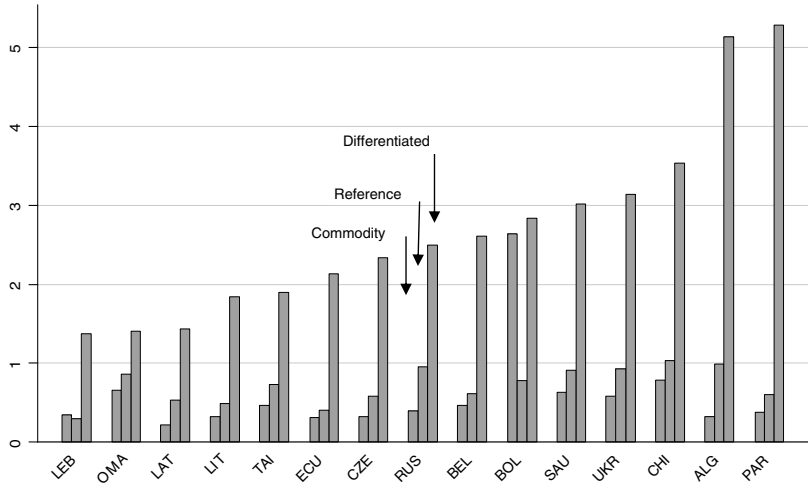

FIGURE 2. MEDIAN INVERSE ELASTICITIES BY PRODUCT TYPE
(*Goods classified by Rauch into commodities, reference priced products, and differentiated products*)

TABLE 4—CORRELATION OF INVERSE EXPORT SUPPLY ELASTICITIES ACROSS COUNTRIES

	Log inverse export supply			
Dependent variable: Statistic	Beta	Standard error	R^2	Number of observations
Algeria	0.80	(0.07)	0.13	739
Belarus	0.80	(0.07)	0.14	703
Bolivia	0.82	(0.09)	0.13	647
China	0.54	(0.06)	0.11	1,125
Czech Republic	0.61	(0.05)	0.12	1,075
Ecuador	0.73	(0.08)	0.12	753
Latvia	0.57	(0.07)	0.09	872
Lebanon	0.71	(0.08)	0.11	782
Lithuania	0.70	(0.07)	0.13	811
Oman	0.39	(0.08)	0.04	629
Paraguay	0.94	(0.11)	0.14	511
Russia	0.53	(0.05)	0.11	1,029
Saudi Arabia	0.48	(0.06)	0.08	1,036
Taiwan	0.31	(0.08)	0.02	891
Ukraine	0.83	(0.07)	0.17	730
Median	0.70	(0.07)	0.12	782

Note: Univariate regression of log inverse export supply elasticities in each country on the average of the log inverse elasticities in that good for the remaining 14 countries.

TABLE 6—INVERSE EXPORT SUPPLY ELASTICITIES, GDP, REMOTENESS, AND IMPORT SHARES

Dependent variable	Log inverse export supply		
Log GDP	0.17	0.18	
	(0.04)	(0.03)	
Log remoteness		0.40	
		(0.15)	
Share of world HS4 imports			7.19
			(1.48)
Observations	12,343	12,343	12,343
R^2	0.26	0.26	0.25
R^2 within	0.01	0.02	0.00

Notes: All regressions include four-digit HS fixed effects (1,201 categories). Robust standard errors in parentheses. In the log GDP regressions, standard errors are clustered by country. GDP is for 1996. Remoteness for country i is defined as $1/(\sum_j \text{GDP}_j/\text{distance}_{ij})$. The share of world imports is calculated in 2000.

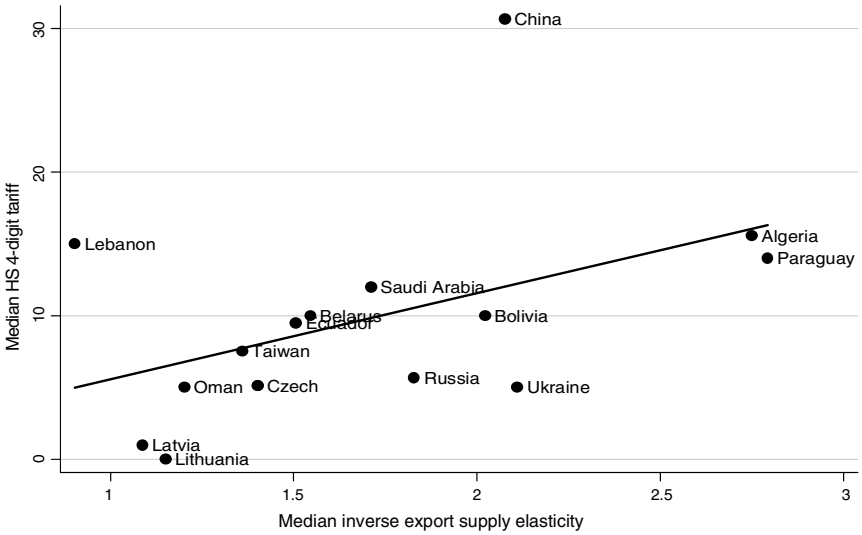

FIGURE 3. MEDIAN TARIFFS AND MARKET POWER ACROSS COUNTRIES

TABLE 7— TARIFFS AND MARKET POWER ACROSS GOODS (WITHIN COUNTRIES): OLS AND TOBIT ESTIMATES

Dependent variable	Average tariff at four-digit HS (%)								
Fixed effects	Country			Country and industry					
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS	Tobit	OLS[a]	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Inverse exp. elast.	0.0003			0.0004					
	(0.0001)			(0.0004)					
Mid and high inv exp elast		1.24			1.46			1.86	
		(0.25)			(0.24)			(0.31)	
Log(1/export elasticity)			0.12			0.17	0.17		
			(0.04)			(0.04)	(0.05)		
(Inv. exp. elast) × (1 − med hi)								1.45	
								(0.31)	
(Inv. exp. elast) × med hi								0.0003	
								(0.0001)	
Mid inv. exp. elast.									1.56
									(0.28)
High inv. exp. elast.									1.37
									(0.28)
Algeria	23.8	23.0	23.6	24.6	23.6	24.3	24.3	23.1	23.6
	(0.64)	(0.65)	(0.64)	(0.95)	(0.96)	(0.95)	(0.93)	(0.97)	(0.96)
Belarus	12.3	11.5	12.2	12.6	11.6	12.5	12.4	11.3	11.7
	(0.29)	(0.33)	(0.29)	(0.76)	(0.78)	(0.76)	(0.94)	(0.79)	(0.78)
Bolivia	9.8	9.0	9.7	10.1	9.2	10.0	10.0	8.8	9.2
	(0.03)	(0.17)	(0.06)	(0.73)	(0.75)	(0.73)	(0.95)	(0.77)	(0.75)
China	37.8	37.0	37.7	38.2	37.2	38.0	37.9	36.6	37.2
	(0.77)	(0.79)	(0.77)	(0.98)	(1.01)	(0.99)	(0.89)	(1.03)	(1.01)
Czech Republic	9.5	8.7	9.4	9.7	8.7	9.6	8.8	8.3	8.7
	(0.53)	(0.53)	(0.53)	(0.85)	(0.86)	(0.85)	(0.89)	(0.87)	(0.86)
Ecuador	9.8	9.0	9.7	10.3	9.4	10.2	10.1	9.0	9.4
	(0.19)	(0.26)	(0.20)	(0.73)	(0.74)	(0.73)	(0.93)	(0.76)	(0.74)
Latvia	7.3	6.4	7.2	7.3	6.3	7.2	6.9	6.0	6.3
	(0.35)	(0.40)	(0.35)	(0.76)	(0.78)	(0.76)	(0.91)	(0.79)	(0.78)
Lebanon	17.1	16.2	17.0	17.1	16.1	17.0	17.0	15.9	16.1
	(0.53)	(0.56)	(0.53)	(0.84)	(0.86)	(0.84)	(0.92)	(0.86)	(0.86)
Lithuania	3.6	2.8	3.6	3.6	2.6	3.5	−6.0	2.3	2.6
	(0.26)	(0.31)	(0.26)	(0.74)	(0.76)	(0.74)	(0.98)	(0.77)	(0.76)
Oman	5.6	4.9	5.6	5.7	4.8	5.6	4.9	4.4	4.8
	(0.34)	(0.37)	(0.34)	(0.77)	(0.79)	(0.77)	(0.94)	(0.79)	(0.79)
Paraguay	16.0	15.3	15.9	16.3	15.4	16.1	15.9	14.9	15.4
	(0.49)	(0.52)	(0.50)	(0.84)	(0.85)	(0.84)	(0.99)	(0.86)	(0.85)
Russia	10.6	9.8	10.5	10.8	9.9	10.7	10.0	9.4	9.9
	(0.34)	(0.38)	(0.34)	(0.77)	(0.79)	(0.77)	(0.89)	(0.82)	(0.79)
Saudi Arabia	12.1	11.3	12.0	12.4	11.4	12.2	12.1	10.9	11.4
	(0.08)	(0.18)	(0.09)	(0.71)	(0.74)	(0.72)	(0.89)	(0.76)	(0.74)
Taiwan	9.7	8.9	9.6	10.3	9.3	10.1	9.7	9.0	9.3
	(0.28)	(0.33)	(0.28)	(0.74)	(0.76)	(0.75)	(0.91)	(0.77)	(0.76)
Ukraine	7.4	6.6	7.2	8.1	7.1	7.9	6.8	6.6	7.1
	(0.28)	(0.33)	(0.29)	(0.74)	(0.76)	(0.74)	(0.93)	(0.78)	(0.76)
Observations	12,333	12,333	12,333	12,333	12,333	12,333	12,333	12,333	12,333
Number of parameters	16	16	16	36	35	36	35	38	36
Adj. R^2	0.61	0.61	0.61	0.66	0.66	0.66			0.66

Notes: Standard errors in parentheses (all heteroskedasticity robust except Tobit). Industry dummies defined by section according to Harmonized Standard tariff schedule.

[a] Optimal threshold regression based on minimum RSS found using a grid search over 50 points of the distribution of inverse exp. elast. (from first to ninety-ninth percentile in intervals of two). Optimal threshold is fifty-third percentile. Accordingly, med hi equals one above the fifty-third percentile and zero otherwise. Bruce E. Hansen (2000) shows that the dependence of the parameters on the threshold estimate is not of "first-order" asymptotic importance, so inference on them can be done as if the threshold estimate were the true value.

TABLE 8—TARIFFS AND MARKET POWER ACROSS GOODS (WITHIN COUNTRIES): IV ESTIMATES

Dependent variable	Average tariff at four-digit HS (%)								
Fixed effects	Country			Country and industry			Industry by country		
Estimation method	IV GMM (1)	IV GMM (2)	IV GMM (3)	IV GMM (4)	IV GMM (5)	IV GMM (6)	IV GMM (7)	IV GMM (8)	IV GMM (9)
Inverse exp. elast.	0.040			0.089			0.075		
	(0.027)			(0.055)			(0.028)		
Mid and high inv. exp. elast.		3.96			8.88			9.07	
		(0.76)			(1.18)			(1.08)	
Log(1/export elasticity)			0.75			1.71			1.73
			(0.15)			(0.23)			(0.21)
Observations	12,258	12,258	12,258	12,258	12,258	12,258	12,258	12,258	12,258
No. of parameters	16	16	16	35	35	35	284	282	283
1st stage *F*	5	1649	1335	2	653	517	3	691	544

Notes: Standard errors in parentheses (heteroskedasticity robust). Industry dummies defined by section according to the Harmonized Standard tariff schedule.

TABLE 10— MARKET POWER VERSUS TARIFF REVENUE OR LOBBYING AS A SOURCE OF PROTECTION

Dependent variable	Average tariff at four-digit HS (%)					
Fixed effects	Industry by country					
Estimation method	IV GMM					
Sample	Pooled (all)		Pooled (all)		Pooled (7)	
Theory	Market power		Market power and tariff revenue		Market power and lobbying	
Mid and high inv. exp. elast.	9.07		9.04		10.20	
	(1.08)		(1.24)		(1.79)	
Mid and high inv. imp. elast.			−0.20			
			(2.08)			
Mid and hi inv. imp. pen/imp. elast.					6.28	
					(1.97)	
Log(1/export elasticity)		1.73		1.81		1.94
		(0.21)		(0.23)		(0.38)
Log(1/import elasticity)				−0.90		
				(0.81)		
Log(inv. imp. pen/imp. elas.)						1.59
						(0.55)
Observations	12,258	12,258	12,258	12,258	5,178	5,178
No. of parameters	282	283	283	284	132	133
First stage *F* (market power)	691	544	370	312	171	129
First stage *F* (other)	na	na	102	144	131	188

Notes: Standard errors in parentheses (heteroskedasticity robust). Industry dummies defined by section according to the Harmonized Standard tariff schedule. The countries with available data for the lobbying specifications are Bolivia, China, Ecuador, Latvia, Lithuania, Taiwan, and Ukraine. These data are not available for mining and agricultural products.

TABLE 13— MARKET POWER AND LOBBYING AS A SOURCE OF PROTECTION IN THE US

Panel A: Nontariff barriers

Theory	*Market power*				*Market power and lobbying*			
Fixed effects	Industry				Industry			
Estimation method	IV Tobit				IV Tobit[b]			
Dependent variable	Coverage ratio (HS4)[a]		Advalorem equiv. (HS4, %)		Coverage ratio (HS4)		Advalorem equiv. (HS4, %)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mid and high inv. exp. elast.	0.90		38.8		4.93		70.8	
	(0.31)		(15.73)		(1.52)		(21.99)	
Mid and hi inv. imp. pen./imp. elast					−0.08		3.99	
					(0.86)		(13.14)	
Log(1/export elasticity)		0.22		9.71		1.16		16.0
		(0.08)		(4.00)		(0.39)		(5.47)
Log(inv. imp. pen./imp. elas.)						0.19		4.74
						(0.34)		(4.94)
Observations[c]	804	804	804	804	708	708	708	708
Number of parameters	17	17	17	17	17	17	17	17
First stage *z*-stat (market power)	7.1	6.6	7.1	6.6	6.2	5.3	6.2	5.3
First stage *z*-stat (other)	na	na	na	na	10.1	11.4	10.1	11.4

Panel B: Tariff barriers

Theory	*Market power*				*Market power and lobbying*			
Fixed effects	Industry				Industry			
Estimation method	IV Tobit				IV Tobit[b]			
Dependent variable	Non-WTO (HS4, %)		WTO (HS4, %)		Non-WTO (HS4, %)		WTO (HS4, %)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mid and high inv. exp. elast.	21.2		1.52		26.9		1.89	
	(5.53)		(1.18)		(8.05)		(1.58)	
Mid and hi inv. imp. pen./imp. elast					10.8		−0.63	
					(4.91)		(0.96)	
Log(1/export elasticity)		5.07		0.36		5.58		0.45
		(1.36)		(0.28)		(1.86)		(0.38)
Log(inv. imp. pen./imp. elas.)						4.76		−0.18
						(1.69)		(0.34)
Observations[c]	870	870	869	869	775	775	774	774
Number of parameters	20	20	20	20	21	21	21	21
First stage *z*-stat (market power)	7.3	7.1	7.3	7.1	6.0	5.3	6.0	5.3
First stage *z*-stat (other)	na	na	na	na	10.0	11.6	10.0	11.6
Mean	30.6	30.6	3.4	3.4	33.0	33.0	3.7	3.7
Mid-hi inv. exp. elast. /mean (%)	69		45		81		51	
Elasticity (at mean)		0.17		0.11		0.17		0.12

1.2 Bagwell and Staiger (AER, 2011)

- BS (2011) look at countries who joined the WTO/GATT, and examine how their tariffs *changed* in the process.
- Using similar logic to that seen above, they show that if governments are benevolent then (where 'BR' stands for 'best response'):

$$\tau^{BR} - \tau^{WTO} = \omega^{*BR} \tag{6}$$

- And if governments have political economy motives this generalizes to

$$\tau^{BR} - \tau^{WTO} = \eta^{BR} \equiv \sigma^{BR}\omega^{*BR}m^{BR} \tag{7}$$

- This can be extended to allow for the possibility that WTO negotiations do not preserve perfect reciprocity (i.e. that $p^{w,BR} \neq p^{w,WTO}$). Letting $r \equiv p^{w,WTO}/p^{w,BR}$ we have (where $\phi_1 = 0$ if $r = 1$):

$$\tau^{WTO} = \phi_0 + \phi_1 \tau^{BR} + \phi_2 \eta^{BR} \tag{8}$$

- This forms their estimating equation (with $\phi_1 > 0$ and $\phi_2 < 0$ expected). But for many countries they don't observe η so instead appeal to linear demand/supply case where η is proportional to m.

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Spring 2013