14.581: International Trade
— Lecture 22 —
Trade Policy (Empirics I)

Plan for today's lecture on empirics of trade policy

Political economy of trade policy:

- Emphasis here is on non-utilitarian governments (i.e. political economy of trade policy)
- "First Generation": Baldwin (1985) and Trefler (1993)
- "Second Generation": Goldberg and Maggi (1999)

Explaining Trade Policy

- Gawande and Krishna (Handbook chapter, 2003) have a nice survey of this literature.
- "If, by an overwhelming consensus among economists, trade should be free, then why is it that nearly everywhere we look, and however far back, trade is in chains?" Broad answers:
  - Terms of trade manipulation: even in a neoclassical economy, protection might be optimal for a non-SOE. (Broda, Limao and Weinstein (2008) have recently improved support for this claim, as we will discuss shortly).
  - Second-best arguments: we live in an imperfectly competitive world where it is *possible* that even a SOE would want import tariffs/export subsidies. (Helpman and Krugman, 1987 book).
  - Political economy (lobbying/redistribution) motives: governments don't maximize utilitarian social welfare.

Gawande and Krishna (2003) Survey

- Divide empirical work on 'explaining trade policy' into two epochs:
  1. "First generation": pre-Grossman and Helpman (1994)
  2. "Second generation": post-GH (1994).

- Nice example of the influence of theory on empirical work.

"First Generation" Empirical work I

- This body of work was impressive and large, but it always suffered from a lack of strong theoretical input that would suggest:
  - What regression to run.
  - What the coefficients in a regression would be telling us.
  - What endogeneity problems seem particularly worth worrying about.

"First Generation" Empirical work II

- Still, theoretical ideas (not formal theory) provided some input, such as:
  - "Pressure Group model": Olson (1965) on collective action problems within lobby groups. Suggests concentration as empirical proxy.
  - "Adding machine model": Caves (1976) has workers voting for their industries. Suggests labor force as proxy.
  - "Social change model": governments aim to reduce income inequality. Suggests wage rate as proxy.
  - "Comparative cost model": lobbies have finite resources and decide what to lobby for (between protection and other policies). Suggests that the import penetration ratio should matter.
  - "Foreign policy model": governments have less international bargaining power if, eg, lots of its firms are investing abroad. Suggests FDI rate should matter.

GK (2003): Survey of First Generation work

Results summarize Baldwin (1985 book)

Variables	Tariffs		Tariff Cuts	
	Baldwin (85) (1)	Baldwin (85) (2)	Baldwin (85) (3)	Baldwin (85) (4)
CONCENTRATION				
Seller Concentration	0.0002		−0.65(−3)	
Seller Number of Firms	−.46(−5)**	−.32(−5)**		−.14(−4)
Scale (Output/firm)				
Buyer Concentration				
Buyer Number of Firms				
Geog. Concentration				
TRADE				
Import Penetration Ratio		−0.02		
Change in Import Penetration Ratio			0.26	0.03**
ln (Import Penetration Ratio)			0.54(−2)	−0.03**
Exports/ Value Added				
exports/ shipments	0.34(−1)			
CAPITAL				
Capital Stock			.62(−5)	
LABOR				
Wage	−0.16(−1)**			−0.13***
Unskilled Payroll/ Total Payroll		.14*	.97***	
Prodn.Workers/ Value Added		.03**		
Unionization				
Employment	.94(−4)*			0.51(−3)***
Tenure				
%change in employment	0.84(−2)			−0.11*
% Eng. And Scientists				
%White Collar				
% Skilled				
%Semi skilled				
% Unskilled				
%Unemployed				
Labor Intensity	0.19(−1)			
OTHER VARIABLES				
Industry Growth				
Foreign Tax Credit/Assets		1.1	9.90**	
Change in [(VA-Wages)/ K-Stock]			−0.02	
VA/Shipments		0.05		−0.14
Tariff level			−0.13	
NTB indicator	0.46(−2)**	.61(−2)*	.03*	
Constant	0.26	0.15(−1)	−0.81	−0.11
Adjusted R2	0.39	0.51	0.1	0.18
N	292	292	292	292

Trefler (JPE 1993)

- Trefler (1993) conducts a similar empirical exercise to Baldwin (1985), but for:
  - Focus on 'NTB coverage ratios' (the proportion of imports in an industry that are subject to any sort of NTB) rather than tariffs. This is attractive since US tariffs are so low in this period that there isn't much variation. Also true that tariffs (being under the remit of GATT/WTO) are constrained by international agreements in a way that NTBs are not.
  - Attention to endogeneity issues and specification issues:
    - Simultaneity: Protection depends on import penetration ratio (IPR) but IPR depends on protection.
    - Truncation: IPR can't go negative. NTB coverage ratio can't go negative.

Trefler (1993)

- Trefler (1993) estimates the following system by FIML:

$$N = \begin{cases} M\boldsymbol{\gamma}_M + \mathbf{X}_N\boldsymbol{\beta}_N + \boldsymbol{\varepsilon}_N & M^* > 0, N^* > 0 \\ 0 & M^* > 0, N^* \leq 0 \\ 0 & M^* \leq 0, \end{cases}$$

$$M = \begin{cases} N\boldsymbol{\gamma}_N + \mathbf{X}_M\boldsymbol{\beta}_M + \boldsymbol{\varepsilon}_M & M^* > 0, N^* > 0 \\ \mathbf{X}_M\boldsymbol{\beta}_M + \boldsymbol{\varepsilon}_M & M^* > 0, N^* \leq 0 \\ 0 & M^* \leq 0, \end{cases}$$

- Where $N^* = M\gamma_M + X_N\beta_N + \varepsilon_N$, $M^* = N\gamma_N + X_M\beta_M + \varepsilon_M$, N is the NTB coverage ratio and M is the import penetration ratio.
- X_N is Baldwin (1985) style variables explaining protection.
- X_M is H-O style variable explaining trade flows.
- Exclusion restrictions in X_N and X_M vectors necessary for identification of γ's.

Trefler (1993): Results

The equation for $N^* = M\gamma_M + X_N\beta_N + \varepsilon_N$

TABLE 2

NTB EQUATION

Dependent Variable: NTBs	Estimated Coefficient (1)	*t*-Statistic (2)	Beta Coefficient (3)	Sensitivity Analysis (4)
Comparative Advantage:				
Import penetration	.17	.46	.11	† ‡
Δ(import penetration)	3.31	2.58*	**1.74**	
Exports	−1.82	−5.26*	**−.94**	
Business:				
Seller concentration	.53	2.43*	**.42**	†
Seller number of firms	−.22	−1.86	**−.33**	
Buyer concentration	−1.13	−2.08*	**−.33**	
Buyer number of firms	−.06	−2.16*	**−.32**	
Scale	−1.83	−2.04*	**−.46**	
Capital stock	−.27	−2.02*	−.24	
Labor:				
Union	.10	.42	.05	† ‡
Employment size	.08	.31	.03	
Tenure	−.01	−.33	−.04	† ‡
Geographic concentration§	.11	.71	.07	‡
Broad-based:				
Occupation:				
Engineers, scientists	1.63	1.70	**.58**	
White-collar	.40	.67	**.34**	†
Skilled	−.31	−.61	−.21	†
Semiskilled	.15	.61	.16	†
Unskilled	.90	1.57	**.53**	†
Unemployment	1.22	1.96*	**.30**	
Industry growth	.03	.26	.03	† ‡

NOTE.—There are 322 observations, of which 144 have both positive NTBs and import penetration, 144 have zero NTBs and positive import penetration, and 34 have both zero NTBs and import penetration. Large beta coefficients (greater than .30) are set in boldface.

* Significant at the 5 percent level.

† The sign of the coefficient is sensitive to the choice of included regressors (see table 3 below and Sec. IIIA).

‡ The sign of the coefficient is sensitive to the omission of two-digit SIC observations (see Sec. IIIC).

§ Geographic concentration is relevant to all three interests.

Trefler (1993): Results

The equation for $M^* = N\gamma_N + X_M\beta_M + \varepsilon_M$

TABLE 4

THE IMPORT EQUATION

DEPENDENT VARIABLE: IMPORT PENETRATION	ESTIMATED COEFFICIENT (1)	t-STATISTIC (2)	BETA COEFFICIENT (3)	SENSITIVITY ANALYSIS (4)	SENSITIVITY ANALYSIS γ_N[a] (5)
NTBs (γ_N)	−.51	−11.56*	**−.80**		
Capital:					
Physical capital	−2.01	−4.44*	**−.44**		−.52
Inventories	1.71	1.69	.17		−.46
Labor:					
Engineers, scientists	.54	.98	.07	†	−.55
White-collar	−1.70	−4.90*	**−.45**		−.50
Skilled	−1.27	−3.44*	**−.34**		−.55
Semiskilled	−.59	−2.01*	−.15		−.52
Unskilled	.40	1.98*	.20		−.54
Land:					
Cropland	.26	.61	.11	‡	−.53
Pasture	.85	1.77	.15		−.53
Forest	1.19	.15	.01	† ‡	−.53
Subsoil:					
Coal	1.62	.39	.02		−.51
Petroleum	−.16	−.78	−.05	†	−.61
Minerals	1.29	.39	.02		−.50
Constant	.81	15.89*	.00		

NOTE.—There are 322 observations, of which 144 have both positive NTBs and import penetration, 144 have zero NTBs and positive import penetration, and 34 have both zero NTBs and import penetration. Large beta coefficients (greater than .30) are set in boldface.

* Significant at the 5 percent level.

† The sign of the coefficient is sensitive to the choice of regressors in the NTB equation (see table 3 and Sec. III*A*).

‡ The sign of the coefficient is sensitive to the omission of two-digit SIC observations (see Sec. III*C*).

[a] Alternative estimates of the coefficient on NTBs. Each row represents a different specification in which the regressor listed in the row is endogenized by estimating a separate equation for it. If the estimate of γ_N differs significantly from −.51 then there is evidence of regressor endogeneity. In every case the Hausman test rejects endogeneity (see Sec. III*B*).

Trefler (1993): Results

Does simultaneity of N and M matter?

TABLE 5

EVIDENCE OF SIMULTANEITY BIAS

DESCRIPTION OF THE MODEL	IMPORT EQUATION* γ_N (1)	t-Statistic (2)	R^2 (3)	TRADE LIBERALIZATION (4)†	(5)‡
Simultaneous equations	−.511	−11.56	.80	1.65%	$49.5
Single equation, Tobit	−.044	−2.01	.58	.19%	$5.5
Single equation, OLS§	−.081	−2.71	.49	. . .	. . .

* γ_N is the coefficient on NTBs in the import equation. The R^2 is the usual one based on positive-NTB observations and with $E[M_i|M_i^* > 0]$. The expectation is not conditional on NTBs, so the R^2 also reflects errors in predicting NTBs.

† The average percentage point change in import penetration as a result of eliminating all U.S. NTBs in manufacturing. It is calculated as $\Sigma\Delta M_i/144$, where ΔM_i is defined in the text and the summation is taken over the 144 industries with positive NTBs.

‡ The increase in imports (billions of 1983 dollars) as a result of eliminating all U.S. NTBs in manufacturing.

§ Ordinary least squares is estimated using observations with nonzero import penetration. It is presented as a simple data summary.

"Second Generation" Empirical Work

- Grossman and Helpman ("Protection for Sale", AER 1994) provided a clean theoretical 'GE' (the economy is not really GE, but the lobbying of one industry does affect the lobbying of another) model that delivered an equation for industry-level equilibrium protection as a function of industry-level observables (as you saw with Arnaud):

$$\frac{t_i}{1+t_i} = -\frac{\alpha_L}{a+\alpha_L}\left(\frac{z_i}{e_i}\right) + \frac{1}{a+\alpha_L}\left(I_i \times \frac{z_i}{e_i}\right). \tag{1}$$

- Where:
  - t_i is the *ad valorem* tariff rate in industry i.
  - I_i is a dummy for whether industry i is organized or not.
  - $0 \leq \alpha_L \leq 1$ is the share of the population that is organized into lobbies.
  - $a > 0$ is the weight that the government puts on social welfare relative to aggregate political contributions (whose weight is normalized to 1).
  - z_i is the inverse import penetration ratio.
  - e_i is the elasticity of import demand.

Testing 'Protection for Sale'

- Two papers took this equation to the data:
  1. Goldberg and Maggi (AER, 1999)
  2. Gawande and Bandyopadhyay (ReStat, 2000)

- There are a lot of similarities but we will focus on GM (1999).

Goldberg and Maggi (1999)

- There a host of challenges in taking the GH (1994) equation to the data:
  - How to measure t_i? Ideally want NTBs (not set cooperatively under GATT/WTO) measured in tariff equivalents. Absent this, GM (1999) use coverage ratios, as in Trefler (1993). They experiment with different proportionality constants ($1/\mu$) between coverage ratios and t and also correct for censoring of coverage ratios.
  - Data on e_i is obviously hard to get. GM (1999) use existing estimates but also consider them as measured with error, so GM (1999) take e_i over to the left-hand side of the estimation equation.

Goldberg and Maggi (1999)

- More challenges:
  - How to measure I_i? Can get data on *total* political contributions in the US by industry (by law these are supposed to be reported), but all 'industries' have at least some contributions, so all seem 'organized'. GM (1999) experiment with different cutoffs in this variable. This isn't innocuous since contributions are endogenous in the GH (1994) model. GM (1999) use as instruments for I_i a set of typical Baldwin (1985)-style regressors, ie Trefler's N equation.
  - z_i is endogenous (as Trefler (1993) highlighted). GM (1999) use Trefler-style instruments for z_i (Trefler's M equation).

Goldberg and Maggi (1999)

- This amounts to estimating the following system (via MLE—that is, with added assumptions about distribution of error terms):

$$(4) \quad y_i^* = \frac{t_i^* e_i}{1 + t_i^*} = \gamma \frac{X_i}{M_i} + \delta I_i \frac{X_i}{M_i} + \epsilon_i$$

$$(5) \quad t_i = \begin{cases} \frac{1}{\mu} t_i^* & \text{if } 0 < t_i^* < \mu \\ 0 & \text{if } t_i^* \leq 0 \\ 1 & \text{if } t_i^* \geq \mu \end{cases}$$

$$(6) \quad \frac{X_i}{M_i} = \zeta_1' \mathbf{Z}_{1i} + u_{1i}$$

$$(7) \quad I_i^* = \zeta_2' \mathbf{Z}_{2i} + u_{2i}$$

$$(8) \quad I_i = \begin{cases} 1 & \text{if } I_i^* > 0 \\ 0 & \text{if } I_i^* \leq 0 \end{cases}.$$

Goldberg and Maggi (1999)

- Where:
  - $z_i \equiv \frac{X_i}{M_i}$ (the inverse IPR).
  - $\gamma \equiv -\frac{\alpha_L}{a+\alpha_L}$ and $\delta \equiv \frac{1}{a+\alpha_L}$.
  - Z_1 is vector of instruments from Trefler's M equation.
  - Z_2 is vector of instruments from Trefler's N equation.
  - t_i is the measured NTB coverage ratio (with $0 \leq t_i \leq 1$), t_i^* is the true measure of protection, and μ is the unknown extent to which these variables are related.

GM (1999): Results

MLE estimates. NB: $\beta \equiv \frac{a}{1+a}$, so β is the true weight (where 'true weights' sum to one) that government puts on consumer welfare instead of lobbying contributions.

TABLE 1—RESULTS FROM THE BASIC SPECIFICATION (G-H MODEL)

Variable	$\mu = 1$	$\mu = 2$	$\mu = 3$
X_i/M_i	−0.0093	−0.0133	−0.0155
	(0.0040)	(0.0059)	(0.0070)
$(X_i/M_i) * I_i$	0.0106	0.0155	0.0186
	(0.0053)	(0.0077)	(0.0093)
Implied β	0.986	0.984	0.981
	(0.005)	(0.007)	(0.009)
Implied α_L	0.883	0.858	0.840
	(0.223)	(0.217)	(0.214)

GM (1999): Results

MLE results when including variables that should *not* matter

TABLE 2—ALTERNATIVE SPECIFICATIONS ($\mu = 1$)

Variable	Specification 1 Log-likelihood: −134.9	Specification 2 Log-likelihood: −132.06	Specification 3 Log-likelihood: −132.04	Specification 4 Log-likelihood: −130.61
X_i/M_i	—	−0.0093	−0.0096	−0.0109
		(0.0040)	(0.0043)	(0.0045)
$(X_i/M_i) * I_i$	—	0.0106	0.0105	0.0123
		(0.0053)	(0.0053)	(0.0055)
Constant	−0.0640	—	−0.0287	−0.2619
	(0.1104)		(0.1375)	(0.2559)
Unemployment	—	—	—	1.5722
				(1.5884)
Employment size	—	—	—	1.1836
				(0.8235)

Note: Dependent variable: $(t_i^* e_i/1 + t_i^*)$.

Subsequent Work

- A number of papers have extended this work in a number of directions:
  - Other countries: Mitra, Thomakos and Ulubasoglu (ReStat 2002) on Turkey and McCalman (RIE 2002) on Australia. Turkey paper has 'democracy vs dictatorship' element to it.
  - Mobarak and Purbasari (2006): firm-level import licenses and connections to Suharto in Indonesia.
  - Heterogeneous firms and how organized an industry's lobbying is: Bombardini (JIE 2008)
  - "What do governments maximize?" (ie estimates of a around the world): Gawande, Krishna and Olarreaga (2009).
  - Nunn and Trefler (2009): rich/growing countries appear to put tariffs relatively more on skill-intensive goods. Perhaps this is because countries with good institutions have low a, and they recognize that skill-intensive sectors (might) have more positive externalities (eg knowledge spillovers) to them.
  - Freund and Ozden (AER, 2008): GH (1994) with loss aversion and application to US steel price pass-through.