Protection for Sale without Aggregation Bias

Jean-Marc Solleder[1] Fulvio Silvy[1] Marcelo Olarreaga[1,2]

[1]University of Geneva

[2]CEPR

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Motivation

- PFS workhorse of political economy of trade policy
- Trade protection result of a lobbying game
- Explains well variation in protection across sectors
- Key structural parameter has the right sign
- But not the right magnitude...

Weight on welfare

- Key parameter in PFS: β
  - Relative weight of welfare to lobbies contributions in government's objective function
- First estimates for the US:
  - Goldberg & Maggi 1999: $\beta = 0.98$
  - Gawande & Bandyopadhyay 2000: $\beta \approx 1$
- Back of the envelope calculation in Gawande & Bandyopadhyay 2000:
  - $\beta = 0.0018$ looking at lobbying for 1983 Sugar quota
  - $\beta = 0.0026$ for the dairy subsidy of 1984

Extensions

- Political competition (intermediates): Gawande, Krishna & Olarreaga 2012: $\beta = 0.95$
- Unemployment and labor unions - Matschke & Sherlund 2006: $\beta \approx 1$
- Rent leaking and NTM - Facchini et al. 2006: $\beta = 0.98$
- Tariff revenue - Gawande, Krishna & Olarreaga 2015: $\beta = 0.94$
- Firm heterogeneity - Bombardini 2008: $\beta \approx 1$
- Free riding - Gawande & Maggi 2013: $\beta = 0.97$

Aggregation bias

- Empirical studies: 30 to 250 industries.
- There are thousands of tariff lines and important variance
- HS 64 (footwear) average tariff of 13%, varies from 0% in footwear with wood platform (HS 640330) to 38% in waterproof footwear (HS 640110)

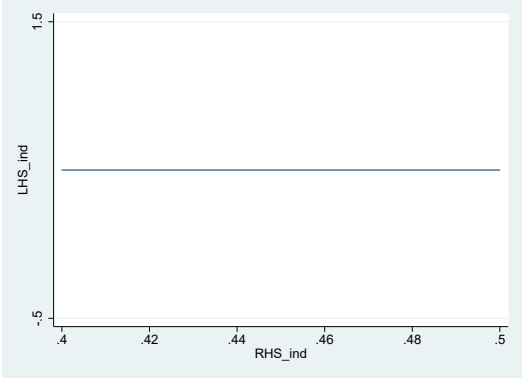
→ Can aggregation bias explain this difference?

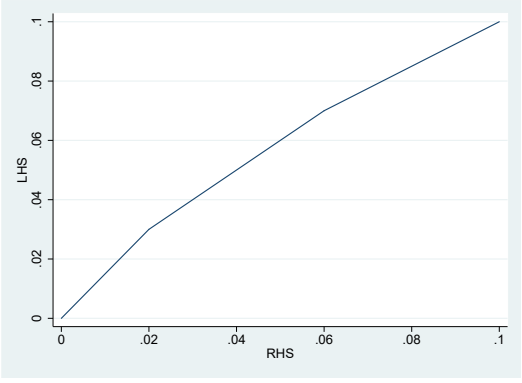
A simple example

$$\frac{t_i}{1+t_i} = \frac{1-\beta}{\beta}\frac{z_i}{e_i}$$

	Industry 1		Industry 2	
	$t_i/(1+t_i)$	z_i/e_i	$t_i/(1+t_i)$	z_i/e_i
Tariff line 1	0	0	0.03	0.03
Tariff line 2	0.10	0.10	0.07	0.05
Industry average	0.05	0.05	0.05	0.04

Visualizing aggregation bias





- At industry level $\widehat{\beta} = 1$
- At tariff line level $\widehat{\beta} \approx 0.5$

Estimation at the tariff line level

$$\frac{t_i}{1+t_i} = \underbrace{\frac{1-\beta}{\beta}}_{\delta} l_i \frac{z_i}{e_i}$$

$$\frac{t_i}{1+t_i}\frac{e_i}{z_i} = \delta l_i + \mu_i$$

And

$$\widehat{\beta} = \frac{1}{1+\widehat{\delta}}$$

Problems to solve for estimation at the (HS6) tariff line level

- MFN tariffs from WTO's IDB: t_i
- Import demand elasticities from Nicita et al. (2018): e_i
- Import data from UN's COMTRADE: $z_i = y_i / m_i$
- **Unobserved organized lobby** l_i
- **Unobserved output:** $z_i = y_i / m_i$

Estimating output at the tariff line level

- **Prodcom** dataset by Eurostat
  - Covers manufactured goods, mining, and quarrying
  - 34 countries: EEA + Turkey from 1995-2020
  - Production is reported at the 8-digit level (CN8)
  - 79% of the lines from Prodcom can be converted to HS6
  - The 2376 usable converted lines correspond to 61% of world trade » concordance
- Agriculture, livestock, fishing, and forestry production data from FAO
- Use a Lasso estimator to predict production at HS6 level
  - Using WDI, net exports from ComTrade, and Barro & Lee (2013) data
  - Panel of 26 years across countries at HS6 level

Least Absolute Shrinkage and Selection Operator

- Penalized regression : constraint added to a linear model

$$\widehat{\beta}_i = argmin \sum_{i}^{N} (y_i - \beta_0 - \sum_j \beta_j x_{ij})^2 s.t. \sum_j |\beta_j| \leq \lambda$$

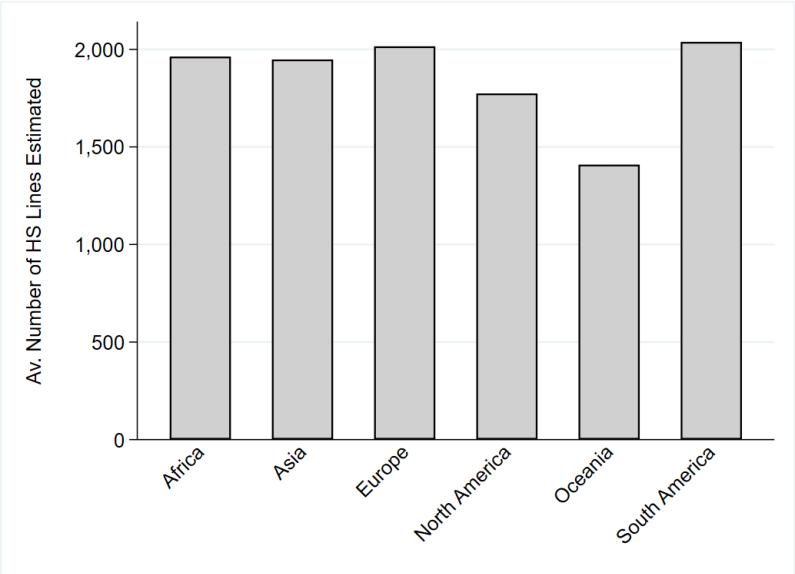
- where $\sum_j |\beta_j|$ is the L1-norm (sum of absolute values) of β_js
- λ is the key hyper parameter
  - the value of λ controls the shrinkage (number of β_j set to 0)
  - λ too low : model fails to capture important components
  - λ too high : the model loses generality (overfitting)
- Estimate λ using cross-validation

Estimating λ

- We use cross-validation (CV) to identify the "best" value of λ
  - The sample is divided in n folds
  - For each value of λ the model is estimated on $n-1$ folds and validated on the n^{th}
  - This is repeated until all folds have been left-out once
  - The prediction error on all left-out folds is averaged
  - The λ selected is the one minimizing the averaged prediction error

Output Results

- We estimate 2'157 HS lines for 266 countries and 26 years with some variation



Internal test

	(1) Prodcom
Predicted val.	0.996***
	(0.0135)
β=1 (p-value)	0.771
Correlation	0.726
N	1'014'186

Robust standard errors in parentheses

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

External tests: comparing with UNIDO data

	(1) IndStat (€ conv.)	(2) IndStat (€ conv.)
Prodcom data (€)	0.818***	
	(0.150)	
Predicted val. (€)		0.417***
		(0.0532)
Correlation	0.663	0.467
N	22319	91422

Robust standard errors in parentheses

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

External tests: Ukrainian data

	(1) Log Ukrainian data (UAH)	(2) Log Ukrainian data (UAH)
Log Predicted val. (€)	0.561***	0.631***
	(0.0339)	(0.0557)
Correlation	0.439	0.509
FE	Year	-
N	1371	477

2nd column: 2013 only

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Unobserved I_i

- Assumption that all 6-digit sectors are organized is problematic
- Thresholds on PAC contributions also problematic: trade or other reasons?
- Belloc (2007), McCalman (2004) use industry meetings with trade authorities: impossible at HS 6-digit and for all countries.
- Data driven approach as in Cadot et al. (2013)
  - Combining model prediction and grid-search
  - Model suggests organized sectors have higher protection
  - Use this to predict I_i for conditional high tariff sectors
  - Grid search determines how high tariffs need to be for sectors to be organized

⏩ estimation

Aggregation bias in the PFS

- Values of β:

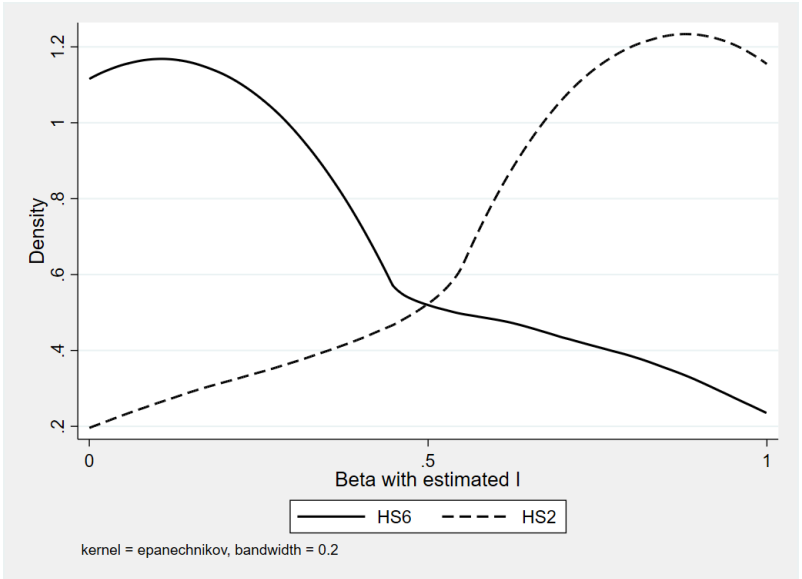
	HS 2	HS 4	HS 6
Mean	0.7619	0.3663	0.2490
Std. dev	0.2928	0.3513	0.3073
Median	0.9043	0.2460	0.0897
Nbr obs.	563	563	563

Aggregation bias in the PFS

- Values of β, all sectors organized :

	HS 2	HS 4	HS 6
Mean	0.9357	0.7322	0.5208
Std. dev	0.1666	0.3186	0.3938
Median	0.9890	0.8898	0.6021
Nbr obs.	563	563	563

With estimated I_i: HS6 vs HS2



β with I_i using Prodcom (HS) and US data (NAICS)

	2 digits HS	4 digits HS	6 digits HS
Prodcom EU data	0.68	0.037	0.00073
Estimated EU data	0.71	0.032	0.00016

	2 digits NAICS	3 digits NAICS	4 digits NAICS	6 digits NAICS
NAICS US data	0.95	0.42	0.22	0.14

Conclusion

- Show how aggregation bias can influence estimates in a PFS model
- Estimate a panel of manufacturing production at the HS 6 level for 200+ countries and 26 years
- Find significantly lower estimates for the share of welfare relative to lobbying in the government's objective function at the HS 6 compared to HS 2 level

Estimation at the tariff line level

back

$$\frac{t_i}{1+t_i} = \frac{l_i - \alpha}{\frac{\beta}{1-\beta}+\alpha}\frac{z_i}{e_i} = \underbrace{-\frac{\alpha}{\frac{\beta}{1-\beta}+\alpha}}_{\gamma}\frac{z_i}{e_i} + \underbrace{\frac{1}{\frac{\beta}{1-\beta}+\alpha}}_{\delta} l_i \frac{z_i}{e_i}$$

$$\frac{t_i}{1+t_i}\frac{e_i}{z_i} = \gamma + \delta l_i + \mu_i$$

And

$$\widehat{\beta} = \frac{1-\widehat{\gamma}}{1+\widehat{\delta}-\widehat{\gamma}}$$

$$\widehat{\alpha} = \frac{\widehat{\gamma}}{\widehat{\delta}}$$

Concordance

- The CN8 production data needs to be brought into HS6
  - CN8 broadly corresponds to HS6 with a further breakdown at the eight-digit level
  - Most CN8 lines can be converted 1-to-1 according to Eurostat's RAMON correspondence index
  - The remaining CN8 lines are assessed manually to see if a correspondence to HS6 is possible
  - All lines are converted to the 1992 HS version, H0
- 79% of the lines from Prodcom can be converted to HS6
- 2963 lines out of 3762 on average - only 2376 with data due to data for lines with few participating firms being confidential
- The 2376 usable converted lines correspond to 61% of world trade

back

4 steps

1. Estimate PFS assuming none of the sectors are organized
2. Determine I_i as:

$$I_i = \begin{cases} 1 & \text{if } \mu_i > \rho\sigma_\mu \\ 0 & \text{otherwise} \end{cases}$$

   where μ_i is the error term from step 1, σ_μ is st. dev of μ_i, and $-10 < \rho < 10$ is a hyper parameter to be estimated through grid-search.
3. For each value of ρ construct I_i and estimate PFS
4. Select the ρ that minimizes the MSE

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