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Measuring the Benefits of Global Liberalization with a Consistent Tariff Aggregator

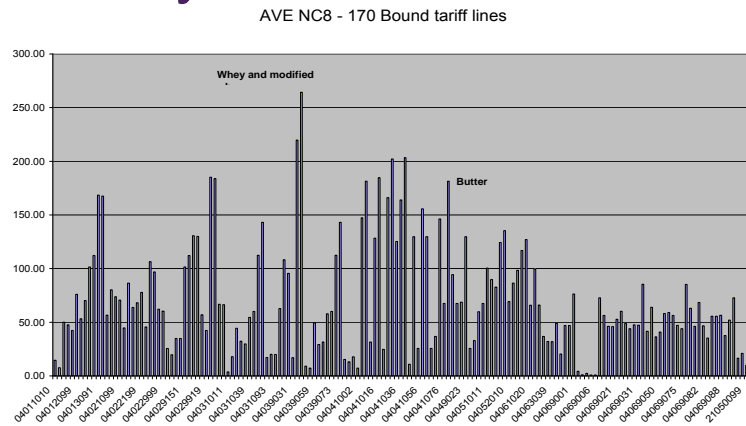
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Overview

- Why we need to aggregate and why it's a problem
- Theory
- Implementation
- Results

The reality

- Tariffs (and tariff equivalents) are highly diverse
 - Illustration the EU dairy sector



- Trade negotiations aimed to reduce tariff dispersion
 - Harmonizing formulas

The constraint

- Typically aggregate from 10,000 tariff lines to 20-25
 - Even largest databases, will have fewer than 40 traded sectors
 - Enormous waste of information
- Can we do better?
 - Yes we can
 - Yes we must
 - Have *the theory* and the data to do better
 - The data: MAcMapHS6 database (<http://www.ifpri.org/book-5078/ourwork/program/macmap-hs6>) , the TASTE software (<http://www.ifpri.org/book-5080/ourwork/program/taste-tariff-analytical-and-simulation-tool-economists>) .

Caveats

- Tariff revenue?
 - Theoretical tariff revenue
 - Tariffs x Trade
 - Collected custom duties (but not customs revenue!)
- Discrepancies:
 - Difference in trade... even in the sectoral value is right
 - Official tariff suspension/waivers
 - Unofficial tariff exemption (= corruption)
- What to do:
 - Focus on official tariffs (including preferences): it matters for trade negotiations
 - Discrepancies can be handle in the model but requires different modeling assumptions (marginal vs average collect efficiency)

How to aggregate

- Appropriate aggregator depends on the objective of aggregation
 - Weighted average tariff is *ad hoc*
- What possible objective function?
 - Expenditure
 - Tariff revenue
 - Mercantilist aggregator
 - Value of exports at world prices

National model

- Can characterize an economy using a *Balance of Trade* function
- $B = e(p,u) - r(p,v) - z_p(p-p^w)$
 - $e(p,u)$ = Expenditure need to achieve utility u
 - $r(p,v)$ = Max revenue at price p , with resources v
 - $z_p(p,u,v) = (e_p - r_p)(p - p^w) =$ Tariff revenues

Potential aggregators

- Expenditure aggregators
- Revenue (production) aggregators
- Tariff revenue aggregators

Expenditure (& qty) aggregators

- Assume imperfect substitution between different goods at tariff line or HS 6 category
 - For 2-stage budgeting, utility functions must be weakly separable & the sub-utility functions homothetic
 - But we assume this every time we use an aggregate
 - Then can write the expenditure function in terms of aggregated prices and quantities
- Within the group, expenditure increases with the tariff, but at a decreasing rate
 - Slope = e_p

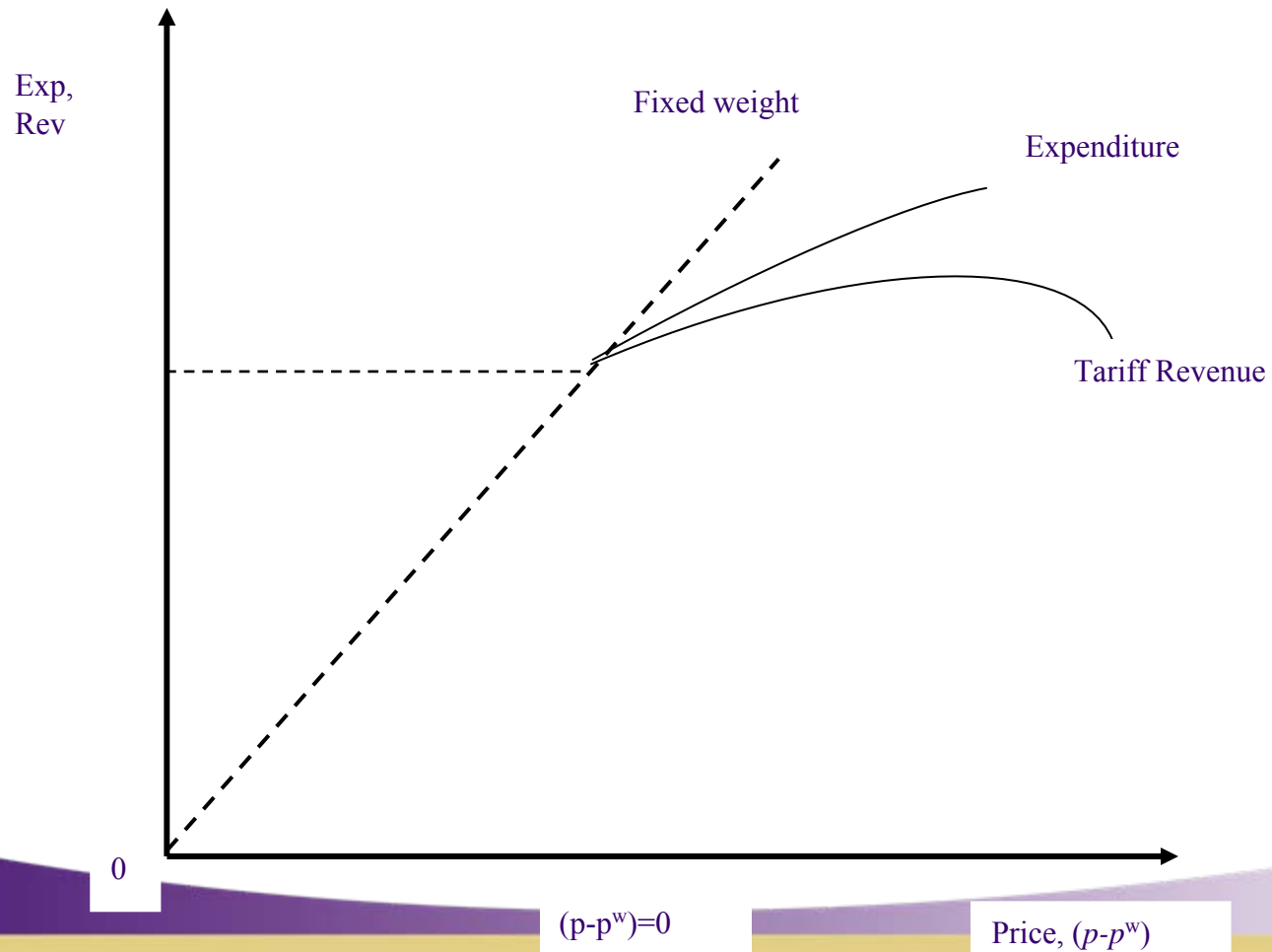
Revenue aggregator

- Assume linear production possibility frontiers between varieties
 - No need to track production & trade of varieties
- In reality, conversion of apples into oranges on the supply side is not costless
 - May use a lower elasticity of substitution on the demand side to allow for this
- Or explicit modeling at a detailed level:
 - See Laborde and Gohin (2006) or Grant, Hertel and Rutherford (2008)

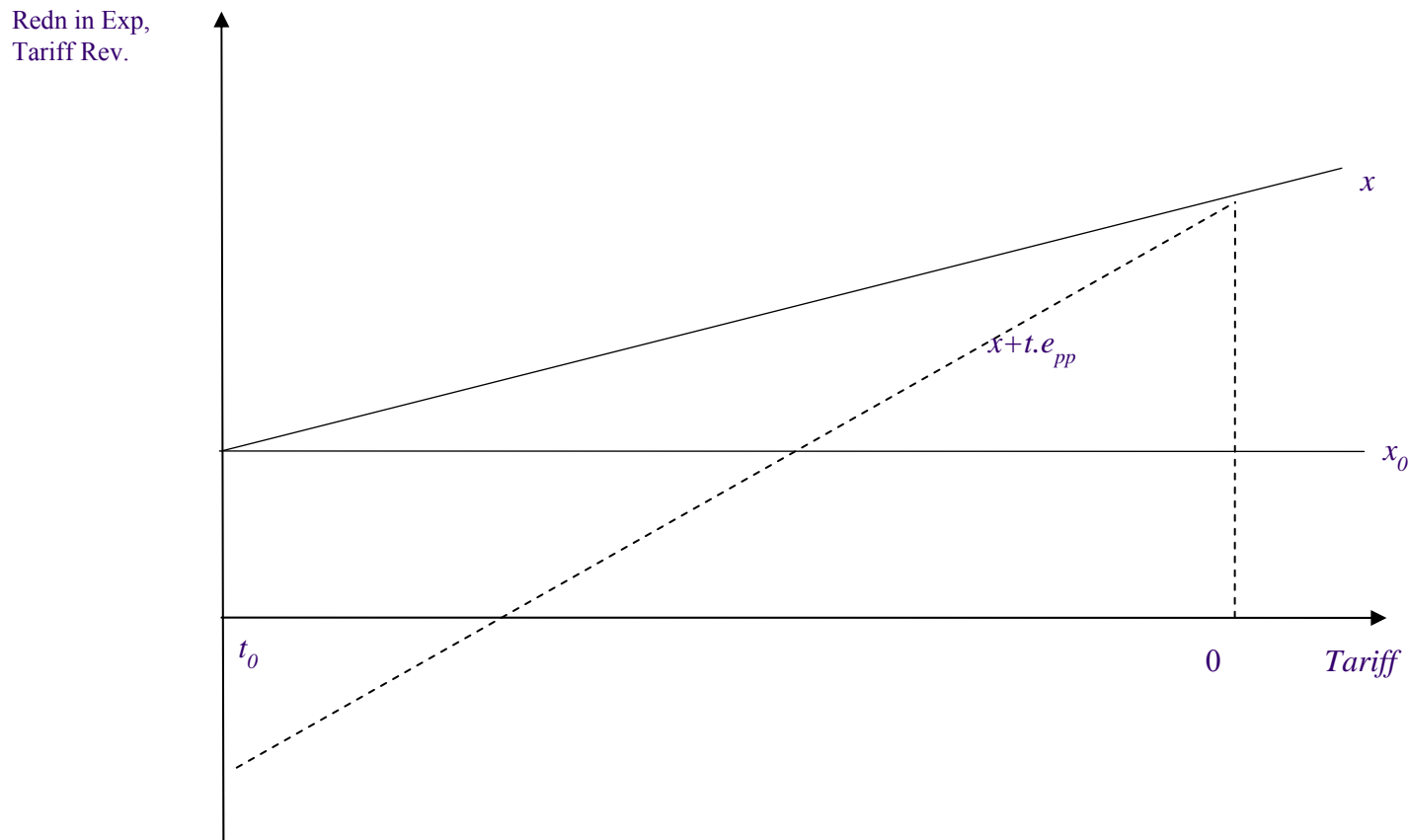
Tariff revenue aggregator

- Want a measure that takes account of the fact that increases in high tariffs reduce revenues by more than the quantity loss
- Slope of the tariff revenue function
 - $e_p + (p-p^w) \cdot e_{pp}$
 - Becomes negative for large enough tariff
 - The “Laffer curve”

Diagrammatically



Marginal impacts of a tariff reduction on expenditure and tariff revenue



Why aggregation matters: libn

- Within the group, a tariff cut reduces expenditure (good)
 - at the slope of the expenditure function, e_p
 - which determine quantities demanded, & terms-of-trade effects in a global model
- Tariff decline reduces revenue (bad)
 - at a rate given by the slope of the revenue function:
 - $e_p + (p - p^w)e_{pp}$
- Miss these within-group gains if we use the same aggregator for expenditure & revenue

Insights

- We need to capture changes in the price dispersion
 - True price index
- We need to capture the right “average” tariff
 - “trade” Weights are endogenous
- We aggregate over several dimensions:
 - Products
 - Exporters
 - Importers

To solve a global model

- Walras' law a problem at the global level
 - Couldn't solve as income didn't equal expenditure
- Jim Anderson distinguishes quantities at domestic (u_i) & world prices (x_i^*)
- $u_i = x_i^* (1 + \tau_i^R) / (1 + \tau_i^e)$
- Which allows global adding up
 - $u_i (1 + \tau_i^e) p^w = x_i^* (1 + \tau_i^R) p^w$

Computing aggregates

- Compute the expenditure tariff aggregator y using a domestic price index

- $P = PCIF * \left(\sum_i \alpha_i (1 + t_i)^{1-\sigma} \right)^{1/(1-\sigma)}$

- So $\tau^e = P/PCIF - 1$

Tariff revenue aggregator

- Initial tariff

$$\tau_0^R = \frac{\sum v_i^0 \times t_i^0}{\sum v_i^0}$$

- Where v_i is the value of imports of i

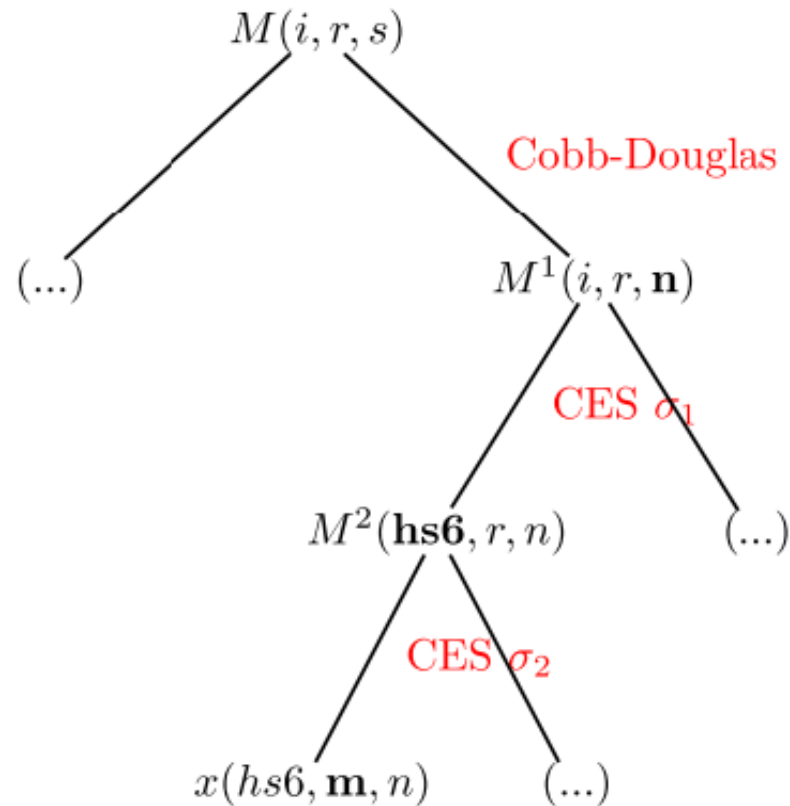
- Final tariff

$$\tau_1^R = \frac{\sum v_i^0 \left\{ \frac{1+t_i^0}{1+t_i^1} \right\}^\sigma \times t_i^1}{\sum v_i^0 \left\{ \frac{1+t_i^0}{1+t_i^1} \right\}^\sigma}$$

Implementation

- Modify model to distinguish quantities at domestic and at world prices
- Calculate the expenditure and tariff revenue aggregators
- Simulate impacts of changes

Nesting structure



Parameter estimates needed

- Great uncertainty about the elasticity of substitution at the six-digit level.
- Averages:
 - Kee, Nicita & Olarreaga $\eta = 3.12$
 - Hummels & Klenow $\sigma_2 = 7.5$
 - Broda and Weinstein $\sigma_2 = 13$
- Consider $\sigma_1 = 2$ or 5 in this initial study
- We ignore effects of new varieties

Results: Global Libn, \$bn ($\sigma=2$)

	Standard	Aggregators
Chile	2.2	2.1
Brazil	21.7	30.8
China	-21.4	-8.6
India	18.9	24.3
High inc ctries	384	484
Developing ctries	111	241
LAC	41	62
Sub Saharan Africa	13	30
EU 27	135	180
United States	48	54
Japan	52	65
World total	496	725

Sensitivity to elasticity: DDA

	TW0	Sig=2	Sig=5
Chile	0.2	0.2	0.2
Brazil	4.2	4.7	6.0
China	5.7	8.9	13.9
India	2.5	2.4	2.4
High inc ctries	71.3	90.7	117.6
Developing ctries	22.2	30.7	43.7
LAC	10.4	12.1	14.8
Sub Saharan Africa	0.1	0.6	1.5
EU 27	30	39	53
United States	19	22	26
Japan	6	10	14
World total	94	121	161

Conclusions

- Feasible to solve global models with efficient aggregators
 - Eliminates the need to throw away information
- Depending upon the elasticities, the impacts can be very substantial
 - 50% increase in global welfare gains with $\sigma=2$
- Serious need for estimates of this key elasticity
- This problem goes beyond tariffs