Quantifying Disruptive Trade Policies

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Overview

1. Background
2. Trade theories
3. General Equilibrium Simulation Model
4. Results: Structural sensitivity
5. Conclusion

Policy analysis backdrop

- Disruptive trade policies: Brexit, Trump 1.0, Trump 2.0,..
- Economists generally agree that tariffs are inefficient at:
  - achieving domestic policy goals,
  - raising revenue,
  - affecting deficits,
  - etc.
- Cooperative trade (WTO) and the prisoner's dilemma.
- Do we have reasonable **quantitative** models that support our condemnation of disruptive trade policies?

- US optimal tariffs? 27%, 11%, or 6%
- US Welfare Trump 2.0? -$96B, -$370B, or -$874B

Balistreri, Ali, and McDaniel (2025) "Tariff: the most beautiful word in the dictionary?"

Overview: modeling framework

- **Method:** Theory with numbers (high-resolution general-equilibrium simulation).
  - First-order data: social accounts
  - Second-order data: elasticities
- **Features (not bugs):**
  - **Comparative-static** not a forecast and not calibrated to a forecast.
  - Labor and Capital Markets: **Macroeconomic stability**
- **Structural sensitivity:**
  - **ARM** Armington based multi-good trade
  - **KRU** Monopolistic competition country level entry
  - **BRF** Monopolistic competition bilateral entry

Three (+ one) trade theories for CGE applications

1. Armington (1969) Perfect Competition
2. Krugman (1980) Monopolistic Competition (symmetric firms)
3. Melitz (2003) Heterogeneous-firms MonopComp

+1 Why not a bilateral Krugman model where bilateral entry replaces the selection margin in Melitz? (convexity?) .

- Bilateral Entry (selection=entry)
- Bilateral Specific Factors (convexity)
- Computational Tractability

The local supply elasticity replaces the shape parameter, and Ricardian rents replace sunk-cost payments

Krugman full structure

- Price index:

$$P_{ir} = \left(\sum_s N_{is} p_{isr}^{1-\sigma} \right)^{1/(1-\sigma)}$$

- Compensated demand for an individual variety:

$$q_{isr} = Q_{ir} \left(\frac{P_{ir}(\vec{\boldsymbol{p}})}{p_{isr}} \right)^{\sigma}$$

- Optimal markup ($MR = MC$) for the individual monopolistic competitor:

$$p_{isr} = (1 + t_{isr}) \frac{\tau_{isr} c_{is}}{1 - 1/\sigma}$$

- Free entry ($\pi^* = pq/\sigma$):

$$c_{is} f_i = \sum_r \frac{p_{isr}}{(1 + t_{isr})} \frac{q_{isr}}{\sigma}$$

- Market clearance for **the** input (price c_{is}) across all firms:

$$x_{is} = N_{is} \left(f_i + \sum_r \tau_{irs} q_{irs} \right)$$

Bilateral Representative Firms (BRF) full structure

- Price index:

$$P_{ir} = \left(\sum_s N_{isr} p_{isr}^{1-\sigma} \right)^{1/(1-\sigma)}$$

- Compensated demand for an individual variety:

$$q_{isr} = Q_{ir} \left(\frac{P_{ir}(\vec{\boldsymbol{p}})}{p_{isr}} \right)^{\sigma}$$

- Optimal markup $(MR = MC)$ for the individual monopolistic competitor:

$$p_{isr} = (1 + t_{isr}) \frac{\tau_{isr} c_{isr}}{1 - 1/\sigma}$$

- Free entry $(\pi^* = pq/\sigma)$:

$$c_{isr} f_i = \frac{p_{isr}}{(1 + t_{isr})} \frac{q_{isr}}{\sigma}$$

- Market clearance for **the bilateral** input (price c_{isr}) across all firms:

$$x_{isr} = N_{isr} \left(f_i + \tau_{irs} q_{irs} \right)$$

Applied Comparable Armington:

$$A_{ir}, P_{ir}^{\text{ARM}}, x_{isr}^{\text{ARM}}, c_{isr}$$

1. Supply of the Armington composite equals Absorption of good i:

$$A_{ir} = D_{ir}(\cdot)$$

2. Price index:

$$P_{ir}^{\text{ARM}} = \left(\sum_s \lambda_{isr} \left[(1 + t_{isr}) c_{isr} \right]^{1-\sigma_i} \right)^{1/(1-\sigma_i)}$$

3. Bilateral export supply equals import demand:

$$x_{isr}^{\text{ARM}} = A_{ir} \lambda_{isr} \left(\frac{P_{ir}^{\text{ARM}}}{(1 + t_{isr}) c_{isr}} \right)^{\sigma_i}$$

4. Bilateral input price (zero unit profits on x_{isr}^{ARM}):

$$c_{isr} = \left[\alpha_{isr} (w_{is}(\cdot) + \gamma_{isr} \tau(\cdot))^{1-\eta_{isr}} + \beta_{isr} z_{isr}(\cdot)^{1-\eta_{isr}} \right]^{1/(1-\eta_{isr})}$$

Applied Comparable Krugman (regional-firm output is constant):

$$A_{ir}, P_{ir}^{\text{KRU}}, x_{isr}^{\text{KRU}}, c_{isr}$$

- Supply of the Dixit-Stiglitz composite equals Absorption of good i:

$$A_{ir} = D_{ir}(\cdot)$$

- Price index (NB: $\hat{y}_{is}(\cdot)$ is an index on output of good i in region s):

$$P_{ir}^{\text{KRU}} = \left(\sum_s \lambda_{isr} \hat{y}_{is}(\cdot) \left[(1 + t_{isr}) c_{isr} \right]^{1-\sigma_i} \right)^{1/(1-\sigma_i)}$$

- Bilateral export supply equals import demand:

$$x_{isr}^{\text{KRU}} = A_{ir} \lambda_{isr} \hat{y}_{is}(\cdot) \left(\frac{P_{ir}^{\text{KRU}}}{(1 + t_{isr}) c_{isr}} \right)^{\sigma_i}$$

- Bilateral input price (zero unit profits on x_{isr}^{KRU}):

$$c_{isr} = \left[\alpha_{isr} (w_{is}(\cdot) + \gamma_{isr} \tau(\cdot))^{1-\eta_{isr}} + \beta_{isr} z_{isr}(\cdot)^{1-\eta_{isr}} \right]^{1/(1-\eta_{isr})}$$

Applied BRF (bilateral-firm output is constant)

$$A_{ir}, P_{ir}^{\mathsf{BRF}}, x_{isr}^{\mathsf{BRF}}, c_{isr}$$

- Supply of the Dixit-Stiglitz composite equals Absorption of good i:

$$A_{ir} = D_{ir}(\cdot)$$

- Price index (NB: $\tilde{x}_{isr}$ is an index on bilateral export supply of good i from s to r):

$$P_{ir}^{\mathsf{BRF}} = \left(\sum_s \lambda_{isr} \tilde{x}_{isr}(\cdot) \left[(1 + t_{isr}) c_{isr} \right]^{1-\sigma_i} \right)^{1/(1-\sigma_i)}$$

- Bilateral export supply equals import demand:

$$x_{isr}^{\mathsf{BRF}} = A_{ir} \lambda_{isr} \tilde{x}_{isr} \left(\frac{P_{ir}^{\mathsf{BRF}}}{(1 + t_{isr}) c_{isr}} \right)^{\sigma_i}$$

- Bilateral input price (zero unit profits on x_{isr}^{BRF}):

$$c_{isr} = \left[\alpha_{isr} (w_{is}(\cdot) + \gamma_{isr} \tau(\cdot))^{1-\eta_{isr}} + \beta_{isr} z_{isr}(\cdot)^{1-\eta_{isr}} \right]^{1/(1-\eta_{isr})}$$

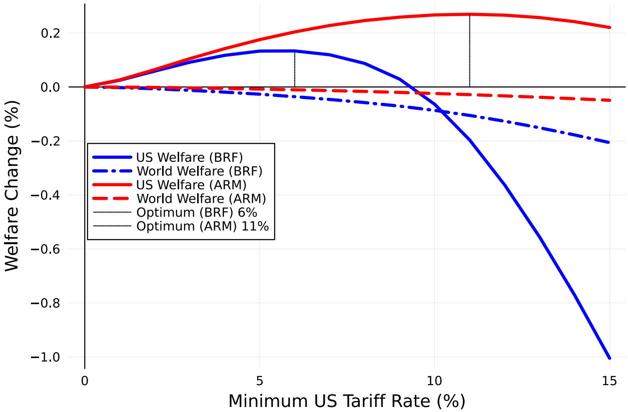
$$\tilde{x}_{isr} = 0.9 \hat{x}_{isr} + 0.1$$

High-resolution models (**ARM**, **KRU**, and **BRF**)

- **Theory:** extended GTAPinGAMS model (Lanz and Rutherford, 2016)
- **Numbers:** GTAP 11 (first and second-order data*) 2017 base year
- 57 commodities/production sectors (GTAP 10 sectors)
- 9 regions (USA,EUR,CHN,CAN,MEX,MRC,KOR,OEC,ROW)
- 8 primary factors (LAB,TEC,CLK,MGR,SRV,CAP,LND,RES)
- Alternative trade structures for **28** manufacturing and business services sectors (* $\sigma = 3.8$, BEJK, 2003)
- CAP payments are disaggregated to includes mobile capital and the bilateral specific factors (necessary for BRF).
- Non-linear system $\sim 14,000$ variables depending on the structural assumptions (PATH: robust MCP solver).

Optimal US tariff analysis **ARM** and **BRF** structures

Optimal **minimum** uniform tariff:
benchmark equilibrium includes 2017 commodity-specific tariffs



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Scenarios and welfare **ARM** perfect-competition model

Tariff Scenario:			(1)	(2)	(3)	(4)	(5)	(6)
2018 trade war (not in AVW model)*			yes	yes	yes	yes	yes	yes
USA 60% on CHN				yes	yes	yes	yes	yes
CHN 60% on USA					yes		yes	yes
USA 10% on Others						yes	yes	yes
Others 10% on USA								yes
	Benchmark							
ARM model:	GDP	Cons.			**Equivalent Variation ($B)**			
USA US	19,480	13,314	-20.7	-263.6	-317.1	-143.5	-201.3	-370.1
EUR EU-27 plus	18,708	10,582	8.5	80.4	98.2	47.5	67.6	106.3
ROW Rest of World	15,989	9,648	4.0	56.8	61.7	23.1	32.5	49.3
CHN China	12,652	5,071	-16.9	-27.0	-62.0	-35.6	-73.2	-44.4
OEC Rest of OECD	7,324	4,085	3.9	30.4	38.5	22.7	31.8	44.0
MRC Mercosur	2,810	1,832	2.4	8.6	11.6	4.4	7.6	11.7
CAN Canada	1,649	967	0.7	2.0	6.6	-15.3	-9.7	3.6
KOR S. Korea	1,624	751	2.2	12.6	18.7	6.9	13.0	22.7
MEX Mexico	1,159	754	0.6	3.5	5.6	-8.8	-6.1	8.2
Total	81,395	47,003	-15.3	-96.3	-138.1	-98.6	-137.7	-168.6

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Scenarios and welfare **BRF** monopolistic-competition model

Tariff Scenario:			(1)	(2)	(3)	(4)	(5)	(6)
2018 trade war (not in AVW model)*			yes	yes	yes	yes	yes	yes
USA 60% on CHN				yes	yes	yes	yes	yes
CHN 60% on USA					yes		yes	yes
USA 10% on Others						yes	yes	yes
Others 10% on USA								yes
	Benchmark							
BRF model:	GDP	Cons.	**Equivalent Variation ($B)**					
USA US	19,480	13,314	-81.9	-543.7	-643.5	-496.2	-582.8	**-874.3**
EUR EU-27 plus	18,708	10,582	40.6	173.0	187.8	138.5	157.7	227.5
ROW Rest of World	15,989	9,648	23.5	113.5	119.7	71.8	84.4	109.2
CHN China	12,652	5,071	-62.5	-58.9	-34.0	-12.2	-8.4	**54.6**
OEC Rest of OECD	7,324	4,085	16.5	65.3	73.9	63.6	72.8	91.9
MRC Mercosur	2,810	1,832	5.8	18.4	21.5	14.9	18.5	26.0
CAN Canada	1,649	967	1.8	8.2	11.8	-12.7	-8.9	-8.6
KOR S. Korea	1,624	751	9.0	26.5	31.3	24.3	28.9	39.8
MEX Mexico	1,159	754	2.8	9.7	11.2	-5.1	-3.4	8.1
Total	81,395	47,003	-44.3	-188.0	-220.4	-213.0	-241.3	-325.9

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Concluding remarks

- Standard perfect-competition models with production, intermediate inputs, benchmark distortions... etc. indicate high tariff costs, but do not feature bilateral-selection.
- Bilateral selection can be an important contributor to trade diversion on the supply side (independent of demand elasticities). Fighting a trade war alone is costly.
- Bilateral selection can indicate important variety losses from tariffs.
- There are some arguably reasonable structures that indicate **very** high costs of tariff wars: ($6,700 per annum per US household—based on Trump's campaign rhetoric scenario with retaliation.)
- US import-competing industries and domestic-only specific factors benefit.
- China gains from a broadening of the US trade conflict.
- Canada and Mexico are in a bad spot.

Thank You!

Backup slide: Trump 1.0 welfare by region

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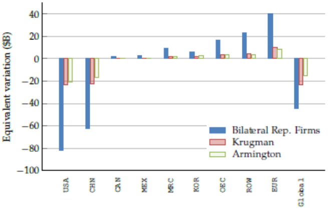

Figure 3. Welfare impacts

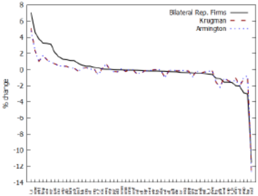

Figure 4. US sectoral impacts across models

Backup slide: Trump 1.0 Variety Impacts

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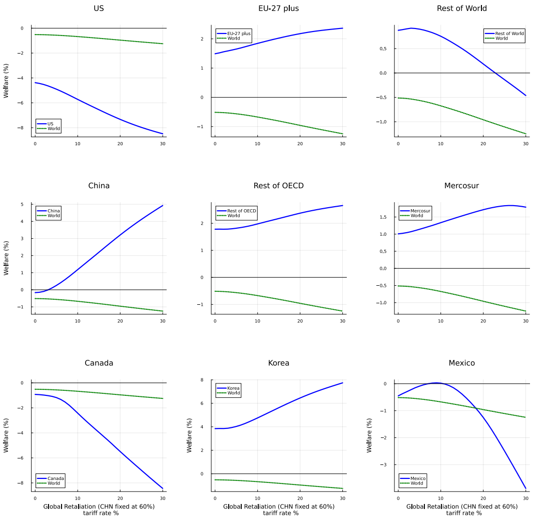
Table 5. Variety impacts across model structures

	Weighted average % change in Feenstra ratio	
	Bilat. Rep. Firm	Krugman
USA U.S.A	-0.078	-0.015
EUR EU-27 plus	0.019	0.002
ROW Rest of World	0.020	0.001
CHN China	-0.047	-0.020
OEC Rest of OECD	0.018	-0.002
MRC Mercosur	0.025	-0.021
CAN Canada	-0.015	-0.053
KOR S. Korea	0.027	-0.004
MEX Mexico	0.063	-0.016

Backup slide: Coordinated retaliation

Start with scenario 5 and add non-Chinese retaliation: (**BRF**)



Backup slide: Mathiesen-Rutherford General Equilibrium Formulation

Three types of complementary-slack equilibrium conditions that characterize an Arrow-Debreu GE:

- Zero profits on all CRTS transformation activities (X_i):

$$c_i(\boldsymbol{p}) - r_i(\boldsymbol{p}) \geq 0 \quad \perp \quad X_i \geq 0$$

- Market clearance for all commodities (P_j):

$$\sum_h [\bar{e}_{hj} - d_{hj}(\boldsymbol{p}, w_h)] + \sum_i X_i \left[\frac{\partial r_i(\boldsymbol{p})}{\partial P_j} - \frac{\partial c_i(\boldsymbol{p})}{\partial P_j} \right] \geq 0 \quad \perp \quad P_j \geq 0$$

- Income balance for all agents (nominal income $= w_h$):

$$w_h = \sum_j P_j \bar{e}_{hj} + (\text{net tax rev. and transfers})$$