Modeling Trade Tensions: Different Mechanisms in General Equilibrium

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IMF

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1The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management
Overview

- Motivation
- Two GE frameworks used for trade policy analysis
- Results in the two frameworks
- Main transmission channels
- Exercise: combine the two approaches
- Concluding remarks
Motivation

- Escalation of trade tensions has spurred analysis
- Analysis relied mainly on two different approaches
- Trade economists often rely on CGE models
- Others exploit DSGE frameworks
- What do these two frameworks measure when it comes to trade tariffs?
Previous studies

- Macro literature: Erceg, Prestipino, Raffo (2018); Erceg, Guerrieri, Gust (2006); Linde, Pescatori (2017)
- Trade literature: Caliendo, Feenstra, Romalis, Taylor (2017); Bekkers, Teh (2019)
- Macro literature focuses on dynamic models, limited sectoral details
- Trade literature has a multi-country approach, rich sectoral details, but no dynamics
- Our paper relates to both strands of literature
A DSGE model: GIMF

- IMF GIMF as lab to study DSGE frameworks

- It is a complex set of layers and decision rules
  
  1. Multi-country (USA, China, Asia, Euro, Japan, RoW)
  2. Non-Ricardian households
  3. Real and nominal rigidities
  4. Different currency pricing
  5. Dynamic consistency
A CGE model: GTAP

- Purdue GTAP as lab to study CGE frameworks
- It is a complex system of equations
  1. Multi-country (USA, China, Asia, Euro, Japan, RoW)
  2. Sectoral disaggregation (13 sectors)
  3. Input/output structure
  4. Comparative static analysis
  5. Fixed endowment of production factors
Stylized experiment

- Bilateral 10 ppt increase in US and China import tariffs
- Both models yield negative outcomes for the two countries
- Loss of exports, decline in GDP
- In GIMF, even with retaliation:
  1. Asymmetric trade volumes and responses
  2. Net appreciation of the ER for the US
  3. Depreciation for China
GIMF results: mechanisms

- In the LR, results driven mostly by distortion of investment
- In SR, results affected by movements in exports/ER
- Response in the SR depends on:
  1. Currency invoicing (rigidities in pricing: LCP vs PCP)
  2. (Deep and policy) parameters
  3. Nominal and real rigidities
  4. Elasticity of substitution
  5. How the revenue from tariffs is used
To simplify: three main equations

Relative demand for foreign varieties
\[
\frac{y_t^M}{y_t^H} = f \left( \tau_m, \epsilon_t, \frac{P^*_t}{P_t} \right)
\]

Balance of payments
\[
B_t^F = g \left( B_{t-1}^F, P_t^M, Y_t^M, P_t^X, Y_t^X, \tau_m, \tau^*_m, \epsilon_t \right)
\]

Intertemporal condition for foreign bond holdings
\[
1 = \beta E_t \left[ \Lambda_{t,t+1} \frac{P_t}{P_{t+1}} \frac{\epsilon_{t+1}}{\epsilon_t} R^*_t \right]
\]

Tariffs do not affect (directly) last equation: exchange rate (\(\epsilon\)) jumps to preserve dynamic consistency

Less simplified mechanism: UIP condition
GIMF: mechanisms of a tariff increase

**China**

- **REER**
- **Exports**

**USA**

- **REER**
- **Exports**

**Investment**

**GDP**

**Japan**

**RoW**

**GDP**
GIMF

Trade diversion

Export volumes

China

USA

Asia

Euro

Japan

RoW
Long run dynamics

- **China**: % Change in Invest, Exp, and GDP over the long run.
- **USA**: % Change in Invest, Exp, and GDP over the long run.
- **Asia**: % Change in Invest, Exp, and GDP over the long run.
- **Euro**: % Change in Invest, Exp, and GDP over the long run.
- **Japan**: % Change in Invest, Exp, and GDP over the long run.
- **RestWorld**: % Change in Invest, Exp, and GDP over the long run.

Legend:
- **year1**: Year 1 changes
- **long run**: Long run changes
GTAP results: mechanisms

- Tariffs introduce a wedge in relative prices
- Sectors more exposed to trade lose competitiveness
- This generates a contraction of production factor demand
- But total stock of production factors is fixed
- Prices fall to support full employment, given higher tariffs
- Demand for output of other sectors increases
- The input/output structure governs propagation
- Resources reallocate across sectors
- Δ(factor prices) measures the inefficiency of new allocations
Sectoral reallocation in the U.S. and China

Output by sector

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<tr>
<th>Sector</th>
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<th>China</th>
<th>USA</th>
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Sectoral reallocation in other countries

Output by sector

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% Change

RestWorld

Asia

Euro

Japan
Real returns on production factors

% Change

China

USA

Land

Labor

Capital
GTAP

GDP and exports

[Bar chart showing GDP and exports changes for different regions: China, USA, Asia, Euro, Japan, RestWorld. Bars are color-coded with blue for GDP and orange for Exports. Values range from -3% to 0% change.]
## Trade diversion GIMF-GTAP

### GIMF

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<tr>
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<th>Euro</th>
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### GTAP

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Positive exercise: combining the estimates

- Tariff effects in GTAP measure inefficiency of resource reallocation
- Absent multiple sectors in GIMF, how much could we miss?
- Interpret real GDP results in GTAP in terms of an aggregate production function
- Given the constraint on factors: changes in GDP as changes in productivity (residual)
- Impose a shock to aggregate productivity in GIMF, using GTAP estimates
- Main caveat: this could lead to overestimate of impact
- Measure how much *larger* the effects of a tariff could be
Combined shocks: adding TFP shock in GIMF

China

baseline

with TFP shock

USA

baseline

with TFP shock
Concluding remarks

- Two models ask complementary questions about tariff distortions
  - DSGE (GIMF): What is the impact on total resources?
  - CGE (GTAP): What is the impact if resources are fixed but need to be reallocated?
- Different channels imply different overall effects
- Absent multiple sectors in GIMF, how much could we miss?
- Exercise: combine estimates from the two models
- Impact of tariffs could be much larger
Back-up slides
Price and quantity rigidities

LCP (high pass-through) v. PCP

Import adjustment costs

USA

baseline  PCP  higher adjustment costs
GIMF

Trade diversion with different rigidities

LCP (high pass-through) v. PCP

Import adjustment costs

USA

China

RestWorld

Asia

Euro

Japan

USA

RestWorld

% Change

-20

-15

-10

-5

0

5

10

% Change

-20

-15

-10

-5

0

5

10

% Change

-20

-15

-10

-5

0

5

10
China exports to the U.S.

- Electronics
- Textiles
- Light manuf.
- Heavy manuf.
- Others

U.S. exports to China

- Crops and food
- Light manufact (incl. textiles)
- Heavy manufact. (incl. automobile)
- Services
- Others
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**Trade diversion SR v. LR**

*Larger trade diversion in the SR (year 1)*

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Sectoral exports

Exports by sector

% Change

USA
China

Exports by sector

% Change

Asia
Euro
Japan
RestWorld
Sensitivity to different elasticities
Combining shocks

**China**

Baseline

With labor prod. shock

**USA**

Baseline

With labor prod. shock