Optimal Trade Policy with Trade Imbalances

Published in the Journal of Monetary Economics (2020)

Mostafa Beshkar\textsuperscript{1}    Ali Shourideh\textsuperscript{2}

\textsuperscript{1}Indiana University

\textsuperscript{2}Carnegie-Mellon University

December 2, 2019
Motivation

• Trade policy analysis is usually conducted under the assumption of balanced trade.

• Nevertheless, trade imbalances are a salient feature of international trade.

• Do trade imbalances affect the government’s incentive to restrict international trade?
What Difference Do Trade Imbalances Make?

Trade policy analysis under static vs. Dynamic Trade Models

- Household savings may be manipulated by a time-varying trade policy.
  - Example: gradual tariff cuts

- Emergence of an additional policy instrument: the capital control tax
  - Do capital controls complement or substitute trade policy?
Literature

- Optimal Capital Control under free trade:
  - Dynamic terms-of-trade manipulation

- Optimal trade taxes in general equilibrium, assuming balanced trade:
  - Beshkar and Lashkaripour 2019, and Costinot et al. 2015, Ossa 2014.

- Capital controls for non-ToT purposes (large literature):
  - Davis and Presno 2017 (monetary policy), Brunnermeier and Sannikov 2015 (financial stability).
Preview of Results

- Optimal trade protection (import tariffs and export subsidies) is counter-cyclical.

- Optimal trade policy is independent of (endogenous) trade imbalances.

- Capital controls mitigate the need to change trade policy over time.
Outline

Model

Primal Approach

Optimal Policy

Quantitative Analysis

Conclusion
Basics of the Model

- Two countries $i, j \in \{h, f\}$

- Infinitely many periods $t$

- Two goods: home and foreign varieties.
  - see the paper for a multiple-product version.

- Ricardian technologies: CRS with labor as the only factor of production.
Preferences

• Lifetime utility in country $j$:

$$\sum_{t=1}^{\infty} \beta^t u \left( X_t^j \right)$$

• $X_t^j$ is the aggregate consumption in period $t$:

$$X_t^j = \left[ \left( X_{t,h}^j \right)^{\frac{\sigma-1}{\sigma}} + \left( X_{t,f}^j \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

$\sigma$: Armington elasticity.

• $u$ represents intertemporal preferences. We assume CES:

$$u \left( X_t^j \right) \equiv \left( X_t^j \right)^{\frac{\eta-1}{\eta}}$$

$\eta$: Intertemporal elasticity of substitution.
Intertemporal Budget Constraint

- One-period international bonds are available.
- Budget constraint in period $t$ for country $j$ consumers:

$$P_{t,h}^j \cdot X_{t,h}^j + P_{t,f}^j \cdot X_{t,f}^j + q_t^j b_{t+1}^j = w_{t,j} + b_t^j - T_t^j.$$  

- $b_{t+1}^j$: Quantity of financial claim on the numeraire good in period $t + 1$.
- $q_t^j$: Price of a unit of bond in period $t$ with maturity date of $t + 1$.
- $T_t^j$: lump-sum tax/subsidy.
Government’s Policy Problem

- Home government’s objective: maximizing national welfare.

- Policy instruments include taxes/subsidies on
  - import
  - export
  - capital flow (international bonds).

- No domestic policy instruments.

- Foreign government is passive/laissez-faire.

- Government commits to its announced policy.
The Primal Approach

- First solve the **planner’s problem**:
  - Choose allocations (as opposed to policies) to maximize home welfare,
  - subject to implementability constraints imposed by the competitive equilibrium.

- Then find trade/capital control taxes that **implements** the planner’s desired allocation under a competitive market.
Home Planner’s Problem

Primal Approach

- The planner chooses an allocation \( \{ X_{t,h}^h, X_{t,f}^h \} \) to maximize lifetime utility, \( \sum_{t=1}^{\infty} \beta^t u(X_t^h) \), subject to:
  
  - Resource constraints:
    
    \[
    X_{t,h}^h + X_{t,h}^f = A_{t,h}, \\
    X_{t,f}^h + X_{t,f}^f = A_{t,f}.
    \]

  - Implementability constraint:

    \[
    \sum_{t=0}^{T} \beta^t \left( \frac{d u(X_t^f)}{d X_t^f} X_t^f + \frac{d u(X_{t,h}^h)}{d X_{t,h}^h} X_{t,h}^h \right) \geq \sum_{t=0}^{T} \beta^t \frac{d u(X_t^f)}{d X_t^f} A_{t,f}. 
    \]

Foreign expenditure

Foreign income
Optimal MU Wedges

- **Notations:**
  - $\lambda_{t,f}^f$: Expenditure share in $f$
  - $\pi_t^f \equiv \frac{X_{t,f}^f}{X_t^f}$: Local consumption share in $f$
    - If trade is balanced in period $t$, then $\lambda_{t,f}^f = \pi_t^f$.
  - $\theta_{t,j} \equiv \frac{\frac{1}{d}X_{t,j}^h}{\frac{1}{d}X_{t,j}^f}$: MU wedge for country $j$’s good

- **Optimal wedge for the home good:**
  \[
  \theta_{t,h}^* = \mu \left[ \frac{1}{\eta} \left( \frac{\lambda_{t,f}^f}{\pi_t^f} - 1 \right) + 1 - \frac{1}{\sigma} \frac{\lambda_{t,f}^f}{\pi_t^f} \right].
  \]

- **Optimal wedge for the foreign good:**
  \[
  \theta_{t,f}^* = \mu \left[ \frac{1}{\eta} \left( \frac{\lambda_{t,f}^f}{\pi_t^f} - 1 \right) + 1 + \frac{1}{\sigma} \frac{\lambda_{t,f}^h}{\pi_t^f} \right].
  \]
Relating Taxes and Prices to Allocations

- Optimal consumer choice implies:

\[
\beta_t \frac{d\mu(X^j_t)}{dX^j_{t,i}} = \chi^j_t P^j_{t,i},
\]

where, \(\chi^j_t\) is the Lagrange multiplier on country \(j\) consumers’ budget constraint in period \(t\).

- Definition of export tax:

\[
1 + \tau_{t,h} \equiv \frac{P^f_{t,h}}{P^h_{t,h}} = \frac{\chi^h_t du(X^f_t)/dX^f_{t,h}}{\chi^f_t du(X^h_t)/dX^h_{t,h}} = \frac{\chi^h_t}{\chi^f_t} \frac{1}{\theta_{t,h}}.
\]

- Definition of import tax:

\[
1 + \tau_{t,f} \equiv \frac{P^h_{t,f}}{P^f_{t,f}} = \frac{\chi^h_t du(X^f_t)/dX^f_{t,f}}{\chi^f_t du(X^h_t)/dX^h_{t,f}} = \frac{\chi^h_t}{\chi^f_t} \theta_{t,f}.
\]
The Effect (or Lack Thereof) of Trade Imbalances

- Define: \( z_t \equiv \frac{A_{t,h}}{A_{t,f}} \) as the ratio of home to foreign country productivity

- **Proposition:** Up to a normalization, the optimal import and export taxes/subsidies in period \( t \) are uniquely determined by the relative productivities in period \( t \), i.e., \( z_t \).

- Across periods with equal relative productivities, the optimal trade policy is identical but trade imbalances could be widely different.

- *Thus, in general, there is no relationship between optimal trade policy and trade balance in a given period.*

  - Optimal policy and trade balance may be correlated under certain growth paths.
Cyclicality of Optimal Trade Policy

• **Proposition:** Under optimal trade policy, the share of foreign production that is consumed abroad, $\pi_t^f$, is decreasing in $z_t$.

• Under optimal policy, consumption is pro-cyclical!
  • Therefore, import taxes and export subsidies are counter-cyclical.

• Intuition: The government is interested in reducing the *national saving rate* in booms to increase world interest rate
  • This goal may be achieved by a higher import tariffs and export subsidies during recessions (or the opposite in booms.)
Co-movement of trade policy and deficits

- Optimal tariffs show a comovement with deficits under constant growth rates.
- Numerical example: Home and Foreign grow at 4% and 2%, respectively, for 10 years.
Quantification

• We fit our model the the US as home, and the rest of the world as the foreign country.
• To fit the data we allow for $\beta$ to vary over time.
• Preferences:

$$\sum_{t=0}^{\infty} \prod_{s=0}^{t} \beta_s^j \left( \left[ \sum_{k=h,f} \left( X_{t,k}^j \right)^{1-\frac{1}{\sigma}} \right]^{\frac{1}{1-\frac{1}{\sigma}}} \right)^{1-\frac{1}{\eta}} \frac{1}{1 - 1/\eta}. $$
Hat-Algebra

Objective Function

- The hat-algebra technique that obviates the need to have information about productivity and taste parameters.
- Notation: $\hat{z} \equiv \frac{z'}{z}$, where $z$: observed variables, $z'$: counterfactual variables.
- CES structure allows us to write down utility under the counterfactual outcome as follows:

$$
\sum_{t=0}^{\infty} \frac{\alpha_t^h \left( \left[ \sum_j \lambda_{t,j}^h \left( \hat{X}_{t,j}^h \right)^{1-\frac{1}{\sigma}} \right]^\frac{\sigma}{\sigma-1} \right)^{1-\frac{1}{\eta}}}{1 - \frac{1}{\eta}},
$$

where, $\alpha_t^h \equiv \left( \frac{X_t^h}{\hat{X}^h} \right)^{\frac{1}{\eta}-1}$ and $\lambda_{t,j}^h \equiv \left( \frac{X_{t,j}^h}{\hat{X}_t^h} \right)^{\frac{1}{\sigma}-1}$.

- The optimization problem is to choose $\hat{X}_{t,j}^h$ that maximizes the above subject to the constraints.
Hat-Algebra

Constraints

- The constraints under the counterfactual may also be written in terms of \textit{factual} variables and the changes:

- Implementability condition:

\[
\sum_{t=0}^{\infty} \alpha_t^f (\hat{X}_t^f)^{1-\frac{1}{\eta}} = \sum_{t=0}^{\infty} \frac{\alpha_t^f \lambda_t^f}{\pi_t^f} (\hat{X}_t^f)^{\frac{1}{\sigma}-\frac{1}{\eta}} (\hat{X}_t,\pi^f)^{-\frac{1}{\sigma}}.
\]

- Resource constraints:

\[
\pi_t^h \hat{X}_{t,h}^h + (1 - \pi_t^h) \hat{X}_{t,h}^f = 1, \\
\pi_t^f \hat{X}_{t,f}^f + (1 - \pi_t^f) \hat{X}_{t,f}^h = 1,
\]
Data and Parameters

- Required observations:
  - Local consumption share:
    \[ \pi_t^j = \frac{GDP_t^j - EX_t^j}{GDP_t^j}. \]
  - Expenditure shares:
    \[ \chi_{t,j}^j = \frac{GDP_t^j - EX_t^j}{GDP_t^j - EX_t^j + IM_t^j}. \]
  - Fraction of income spent in period \( t \):
    \[ \alpha_t^j = \frac{GDP_t^j - EX_t^j + IM_t^j}{I_t^j} \frac{1}{(1 + r_1^j) \cdots (1 + r_t^j)}. \]

- Required parameter estimates: \( \sigma \), \( \eta \), and the real interest rates, \( r_t^j \).
Data and Parameters

- Trade flow and GDP data for the United States from 1995 to 2016.
  - For post 2016, we assume a growth rate of 1.5% both in the US and the rest of the world.
- Real interest rate:
  - For the US, calculated as interest rate on 10-year US treasury notes minus inflation.
  - For the rest of the world: Jordà et al. (2019)
  - For post 2016 we assume a 2% real interest rate.
- $\sigma = 5$ and $\eta = 0.5$ (for the baseline).
Optimal Unrestricted Policy (US 1995-2016)
Optimal Tariffs and Capital Control Taxes

Import Tariffs, $\tau_{t,m}$

Capital controls, $\tau_{b,t}$

Graphs showing the trend of import tariffs and capital controls over the years.
Optimal Tariffs in absence of other policies
Welfare Effects: Static vs Dynamic ToT Effects

<table>
<thead>
<tr>
<th>( \triangle \text{Welfare} )</th>
<th>Cap Cont.</th>
<th>Const. Tariff</th>
<th>Tariff Only</th>
<th>Unrestricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma = 5, \eta = 0.5 )</td>
<td>0.001%</td>
<td>1.771%</td>
<td>1.772%</td>
<td>1.773%</td>
</tr>
<tr>
<td>( \sigma = 5, \eta = 0.33 )</td>
<td>0.002%</td>
<td>1.772%</td>
<td>1.773%</td>
<td>1.775%</td>
</tr>
<tr>
<td>( \sigma = 10, \eta = 0.5 )</td>
<td>0.001%</td>
<td>0.807%</td>
<td>0.808%</td>
<td>0.809%</td>
</tr>
<tr>
<td>( \sigma = 10, \eta = 0.33 )</td>
<td>0.002%</td>
<td>0.808%</td>
<td>0.809%</td>
<td>0.811%</td>
</tr>
</tbody>
</table>

- Relatively small *dynamic ToT effects*:
  - Gains from changing tariffs over time or using capital controls are very small.
Concluding Remarks

Findings

- Analyzed unilaterally-optimal trade policy under a dynamic model with one factor of production.

- Main findings:
  - Optimal import tariffs and export subsidies are counter-cyclical

  - Capital controls mitigate the need to change trade policy over time.
Concluding Remarks

Potential extensions

• Investment and FDI: Does investment magnify the effect of capital control?

• Use of Capital control as a flexibility mechanism in trade agreements.
  • Can capital control play a useful role as a flexibility mechanism to improve self-enforceability of trade agreements? (As in Bagwell and Staiger 1990)
References


