Optimal Trade Policy with Trade Imbalances

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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?
  - Restricting imports when there is a trade deficit?
  - Restricting exports when there is trade surplus?
- Interdependence of capital control and trade policy.
  - To what extent can capital control substitute for trade policy? (Staiger and Sykes 2010)

Why Analyzing Optimal Trade Policy?

- Globally efficient trade policy is free trade (in our framework).
  - Then, what's the benefit of studying unilateral trade policy?
- Benefits:
  - To understand the *purpose* of trade agreements, we need to understand the reason that unilateral policies are inefficient.
  - To understand the consequences of *incomplete* trade agreements
    - Due to policy interdependencies, governments may undermine the intent of the agreement by manipulating their unrestricted policies. (Horn, Maggi, and Staiger 2010, Beshkar and Lashkaripour 2019)
    - Optimal sequencing of trade liberalization. (Beshkar and Lashkaripour 2019)

A Dynamic Terms of Trade Framework

- A dynamic model of international trade
  - Ricardian technologies: fixed unit-labor requirement.
  - Productivity shocks in each period.
- Consumption smoothing motives: Home and Foreign Households engage in inter-temporal trade to smooth their consumption over time.
- Government's motivation: manipulating static and dynamic terms of trade to maximize Home welfare.
  - Government acting as Monopoly/Monopsonist: Extracting maximum rent from trading partners.
- Instruments of policy: Trade taxes/subsidies and capital control.

What Difference Do Trade Imbalances Make?

Trade policy analysis under static vs. Dynamic Trade Models

- In comparison to static trade policy analyses, the problem of optimal policy under a dynamic setting has at least two novel features.

1. Household savings may be manipulated by a time-varying trade policy.
   - For instance, if governments announce a commitment to gradually reduce import tariffs over time, households are induced to decrease their current consumption in order to save for consumption at more favorable prices in the future.
2. Emergence of an additional tax instrument, namely, the capital control tax, which may complement or substitute trade policy.

Literature

- Costinot, Lorenzoni, and Werning (2014): Optimal Capital Control under *free trade*.
  - Key insight: Under optimal capital control, consumption is *pro-cyclical*.
    - Under Laissez-Faire, households *smooth* their consumption over time.
  - Dynamic terms-of-trade manipulation
- Beshkar and Lashkaripour (2019): Optimal trade taxes, assuming *balanced trade*.
  - Key insight: Policy interdependence and the structure of optimal policy in a static general equilibrium model.
- Bagwell and Staiger (1990, 2003): Optimal tariffs and optimal agreement in a multi-period model with *per-period balanced trade*

Results: Determinants of Optimal Trade Policy

- Optimal import and export taxes in a given period are determined by the productivity of the country relative to the rest of the world.
- Lower relative productivity $\rightarrow$ Higher protection for industries (higher import tariffs and export subsidies)
- Intuition: Dynamic Terms of Trade Manipulation
  - Households save in booms to consume more in recessions.
  - More demand for saving decreases the interest rates, which benefits foreign lenders.
  - The government is interested in reducing the *national saving rate* in booms to achieve a better *inter-temporal* term-of-trade.
  - This may be achieved by choosing more protection in recessions than in booms, which encourages a pro-cyclical consumption.

Results: Optimal Policy for the US 1995-2016

Outline

Basics of the Model

- Two countries $i, j \in \{h, f\}$
- Infinitely many periods t
- Multiple products $k \in \{1, ..., K\}$, with country-specific varieties.
- Notations
  - $x^j_{t,i,k}$: Trade flows
  - $p^j_{t,i,k}$: Consumer price
  - Bold variables: vectors (e.g, $\boldsymbol{x}^j_{t,i}$), Capitalized variables: aggregate values (e.g., $X^j_{t,i}$).
- Technology: CRS with labor as the only factor of production.
  - $a_{t,i,k}$: Labor productivity:

Preferences

- Inter-temporal preferences in country j

$$\sum_t \beta^t u\left(g\left(\boldsymbol{x}_t^j\right)\right)$$

  - u is increasing and concave
  - Aggregate consumption in period t (nested CES):

$$g\left(\boldsymbol{x}_t^j\right) \equiv \left[\sum_k \left(\left[\left(x_{t,h,k}^j\right)^{\frac{\sigma_k-1}{\sigma_k}} + \left(x_{t,f,k}^j\right)^{\frac{\sigma_k-1}{\sigma_k}}\right]^{\frac{\sigma_k}{\sigma_k-1}}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

Government's Policy Problem

- Instruments of policy at Home: tax/subsidy on trade and capital flows
  - No domestic instrument.
  - Foreign government is passive/Laissez-Faire.
- Primal approach:
  - Planner directly chooses allocations (as opposed to policies) to maximize home welfare
  - subject to implementability constraints imposed by the competitive equilibrium.
- We then find trade/capital control taxes that implements the planner's desired allocation under a competitive market.

Planner's Problem

- $\max_{\left\{\boldsymbol{x}_t^h\right\}} \sum_{t=0}^{\infty} \beta^t u\left(g\left(\boldsymbol{x}_t^h\right)\right)$ subject to
- Per-period labor-market clearing conditions:

$$\left(\boldsymbol{x}_{t,h}^h + \boldsymbol{x}_{t,h}^f\right) \cdot \frac{1}{\boldsymbol{a}_{t,h}} = 1, \quad \left(\boldsymbol{x}_{t,f}^h + \boldsymbol{x}_{t,f}^f\right) \cdot \frac{1}{\boldsymbol{a}_{t,f}} = 1,$$

- Implementability Condition (Budget constraint of foreign country's consumer):

$$\sum_{t=0}^{\infty} \beta^t \nabla u\left(g\left(\boldsymbol{x}_t^f\right)\right) \cdot \boldsymbol{x}_t^f = \sum_{t=0}^{\infty} \beta^t \left[\nabla u\left(g\left(\boldsymbol{x}_t^f\right)\right)\right]_{\boldsymbol{x}_{t,f}^f} . \mathbf{y}_t^f .$$

- No domestic distortion in either country:

$$\frac{\partial g\left(\boldsymbol{x}_t^f\right)}{\partial x_{t,f,k}^f} = \frac{\lambda_t^f}{a_{t,f,k}},$$
$$\frac{\partial g\left(\boldsymbol{x}_t^h\right)}{\partial x_{t,h,k}^h} = \frac{\lambda_t^h}{a_{t,h,k}}.$$

Intra-Temporal Structure of Optimal Policy

- Optimal import tariffs are uniform in a static Ricardian model (Opp 2010, Costinot, Donaldson, Vogel, and Werning 2015, and Beshkar and Lashkaripour 2019)
- We show that this result may be extended to a dynamic setting:

Theorem 1

Under a dynamic Ricardian model, the optimal import tariffs (export taxes) across products are uniform (differential).

Lemma 2

Under within-period CES preferences, both optimal import and export taxes are uniform within each period.

Problem under the CES Preferences

- With CES preferences, the Planner's problem can be written using aggregate values (capitalized letters):

$$\max_{\left\{X^h_{t,h}, X^h_{t,f}\right\}_{t=1,\ldots,\infty}} \sum_{t=1}^{\infty} \beta^t \left(X^h_t\right)^{\frac{\eta-1}{\eta}} \text{ subject to constraints.}$$

where $X^h_{t,h} = \left[\left(X^f_{t,h}\right)^{1-\frac{1}{\sigma}} + \left(X^f_{t,f}\right)^{1-\frac{1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$.

Optimal MU Wedges

- The FOC w.r.t the allocation of the Home's aggregate good:

$$\frac{1}{\mu}\underbrace{\frac{du\left(X_t^h\right)/dX_{t,h}^h}{du\left(X_t^f\right)/dX_{t,h}^f}}_{\frac{1}{\theta_{t,h}}} = 1 - \frac{1}{\eta} + \left(\frac{1}{\eta} - \frac{1}{\sigma}\right)\frac{\lambda_{t,f}^f}{\pi_t^f}.$$

  - $\theta_{t,h}$: The **"wedge"** between Home and Foreign consumer's MU from the **Home good**.

- The FOC w.r.t the allocation of the Foreign's aggregate good:

$$\frac{1}{\mu}\underbrace{\frac{du\left(X_t^h\right)/dX_{t,f}^h}{du\left(X_t^f\right)/dX_{t,f}^f}}_{\theta_{t,f}} = 1 - \frac{1}{\eta} + \left(\frac{1}{\eta} - \frac{1}{\sigma}\right)\frac{\lambda_{t,f}^f}{\pi_t^f} + \frac{1}{\sigma}\frac{1}{\pi_t^f}.$$

  - $\theta_{t,f}$: The **"wedge"** between Home and Foreign consumer's MU from the **Foreign good**.

- *Intertemporal wedge*, may be defined as

Optimal Intertemporal MU Wedge

- *Intertemporal wedge*, may be defined as

$$\phi_t = \frac{1 + \theta_{t,h}/\theta_{t-1,h}}{1 + \theta_{t,f}/\theta_{t-1,f}} - 1.$$

Relating Taxes and Prices to Allocations

Consumer Prices

- Find the corresponding tax rates that would recreate the planner's optimal allocation in a competitive market.
- Consumers' Lagrangian in country j:

$$\sum_t \beta^t u(X_t^j) + \lambda^j \sum_t \left[P_{t,h}^j X_{t,h}^j + P_{t,f}^j X_{t,f}^j - I_t^j \right].$$

  - Country j consumer's FOCs:

$$P_{t,h}^j = -\frac{\beta^t}{\lambda^j} \frac{du(X_t^j)}{dX_{t,h}^j},$$

$$P_{t,f}^j = -\frac{\beta^t}{\lambda^j} \frac{du(X_t^j)}{dX_{t,f}^j}.$$

Relating Taxes and Prices to Allocations

Trade Taxes

- Definition of export tax:

$$1+\tau_{t,h} \equiv \frac{P^f_{t,h}}{P^h_{t,h}} = \frac{\lambda^h}{\lambda^f} \underbrace{\frac{\frac{du(X^f_t)}{dX^f_{t,h}}}{\frac{du(X^h_t)}{dX^h_{t,h}}}}_{\text{Wedge for H good.}} .$$

- Definition of import tax:

$$1+\tau_{t,f} \equiv \frac{P^h_{t,f}}{P^f_{t,f}} = \frac{\lambda^h}{\lambda^f} \underbrace{\frac{\frac{du(X^f_t)}{dX^h_{t,f}}}{\frac{du(X^h_t)}{dX^f_{t,f}}}}_{\text{Wedge for F good.}} .$$

Optimal Import and Export Taxes

- Optimal import tax:

$$\frac{1+\tau_{t,h}}{1+\tau_{t-1,h}} = \frac{\theta_{t,h}}{\theta_{t-1,h}}.$$

- Optimal export tax in period t relative to the optimal export tax in period $t-1$:

$$\frac{1+\tau_{t,f}}{1+\tau_{t-1,f}} = \frac{\theta_{t,f}}{\theta_{t-1,f}}.$$

- *Both import and export taxes are necessary for the implementation of the optimal policy*
- Total protection in period t :

$$(1+\tau_{t,f})(1+\tau_{t,h}) = \frac{\theta_{t,f}}{\theta_{t,h}}.$$

The Effect (or Lack Thereof) of Trade Imbalances

Theorem 3

The optimal import and export taxes/subsidies in period t, relative to export tax in period 0, is uniquely determined by the relative productivities in period t.

- *Therefore, the size and direction of current trade balance has no bearing on the current optimal trade policy!*
- *Across periods with equal relative productivities, the optimal trade policy is identical but trade imbalances could be widely different.*
- *In general, there is no relationship between optimal trade policy and trade balance in a given period.*
  - *We will come back to this!*

Cyclicality of Optimal Trade Policy

Theorem 4

Optimal export tax (import tariff) is increasing in the relative productivity of the home country, z_t. Moreover, the optimal intra-temporal wedge between the home and foreign relative price of the foreign good, $(1+\tau_{t,f})(1+\tau_{t,h})-1$, is always positive and increasing in z_t.

- *Therefore, import taxes are counter-cyclical and export taxes are pro-cyclical.*
- *Intuition:*
  - *The government is interested in reducing the national saving rate in booms, in order to reduce the country's demand for imports during recessions, thereby achieving a better inter-temporal term-of-trade.*
  - *This goal may be achieved by a higher import tariff during recessions or a higher export tax in booms.*

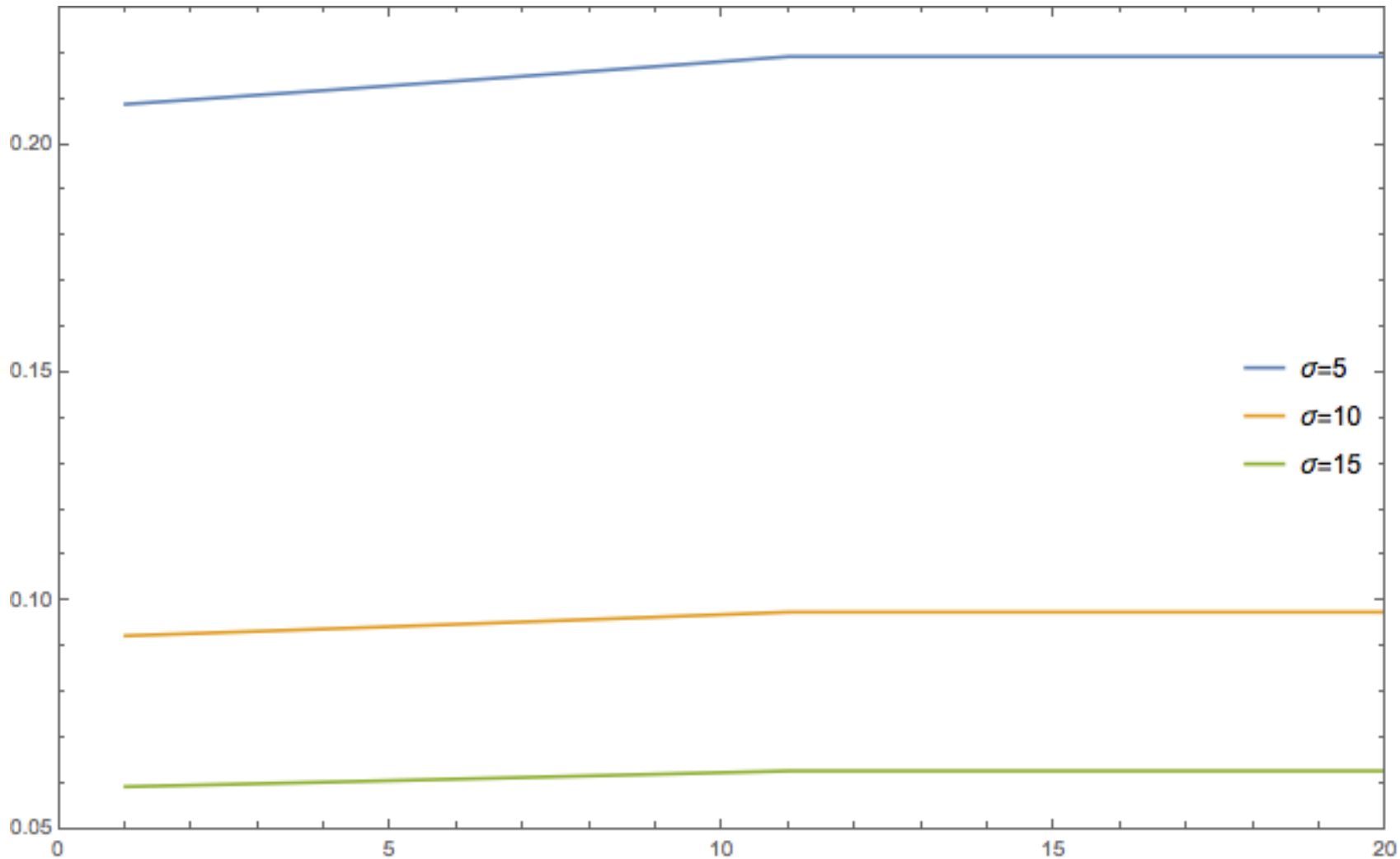
Exogenous Growth

- We showed that the level of trade deficit has no bearing on the optimal policy.
- Can trade deficit and the level of protection be *correlated* under reasonable growth scenarios?
  - That would create the impression that governments respond to trade deficits with higher protection.
- Example: $\eta = 1.1$, Home's growth rate=4%, Foreign growth rate=2%. Period-0 export tax normalized to zero.

Protection During the Period of Fast Growth

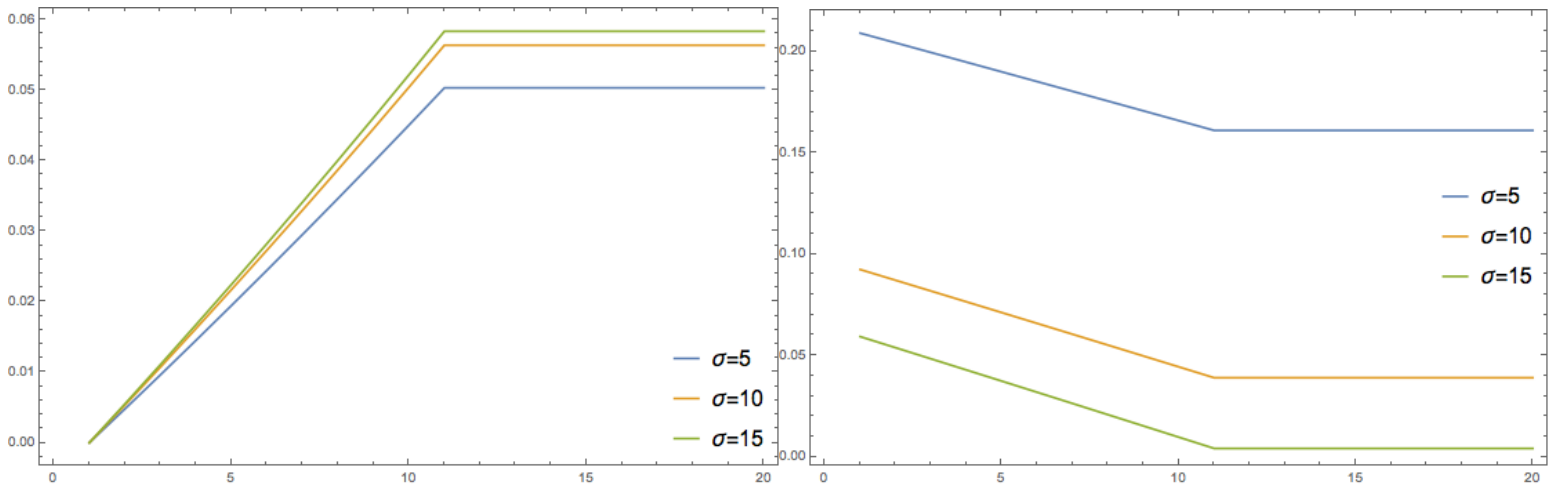
Overall Protection $(1+\tau_{t,f})(1+\tau_{t,h})$

- Increasing in relative size and decreasing in elasticity of sub.



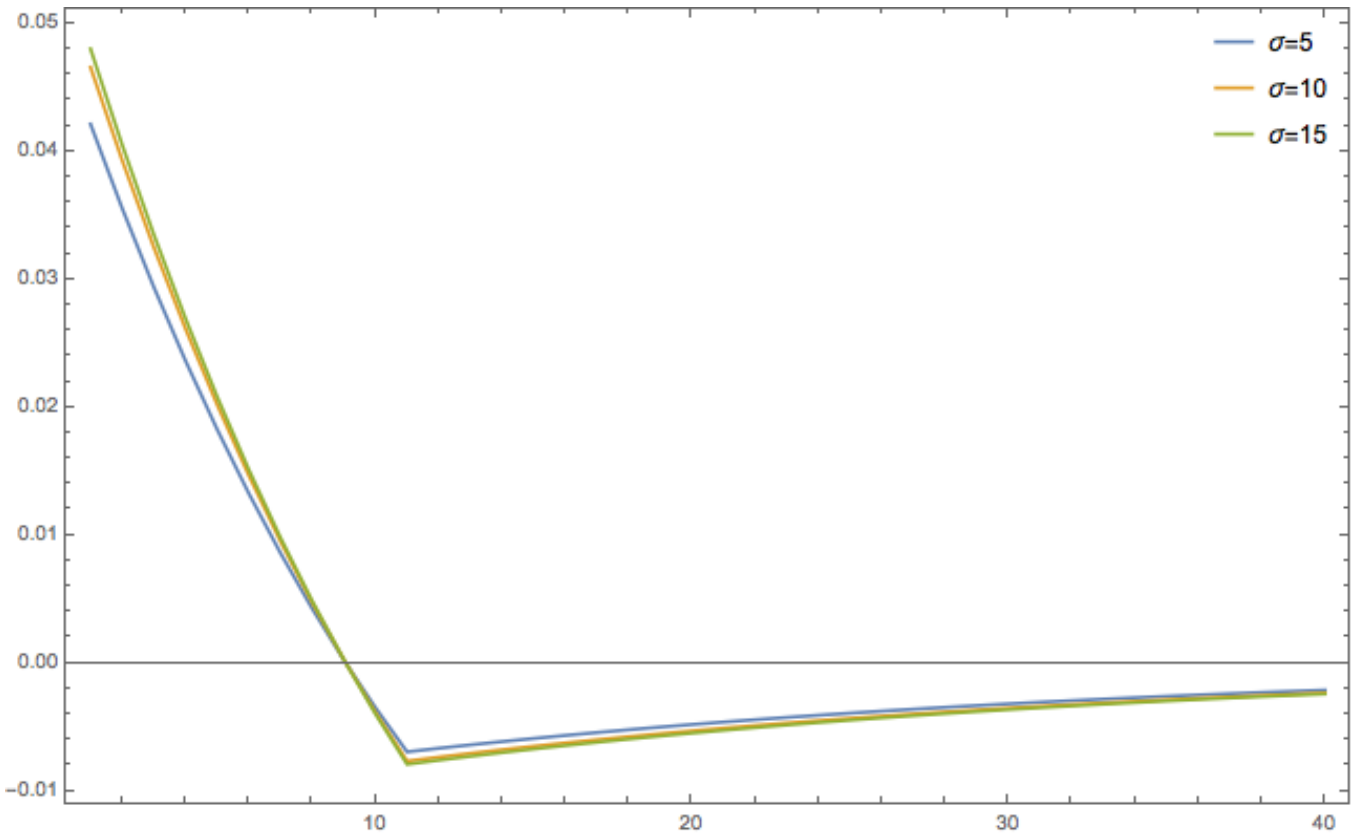
Protection During the Period of Fast Growth

Import Tariffs vs. Export Tax



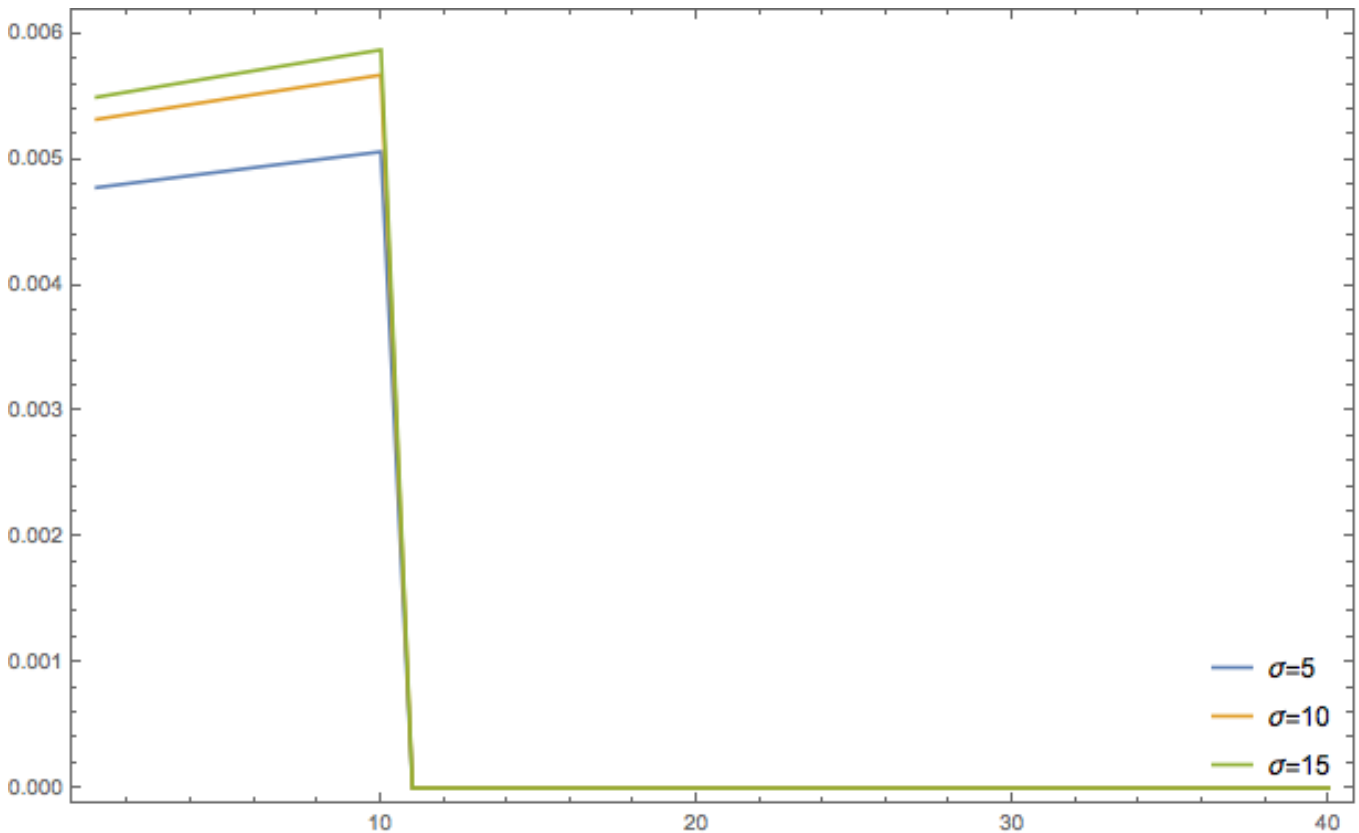
- Export (import) tax is increasing (decreasing) in relative productivity.
- Higher elasticity of substitution, σ, implies higher export tax and lower import tax.

Deficit During the Period of Fast Growth



Capital Control During the Period of Fast Growth

- Tax on the sale of home assets.



Optimal Unrestricted Taxes

- Therefore, when the economy is growing (shrinking), the optimal capital control policy is to subsidize (tax) net foreign asset positions. In other words,
- These results are also valid under free trade.

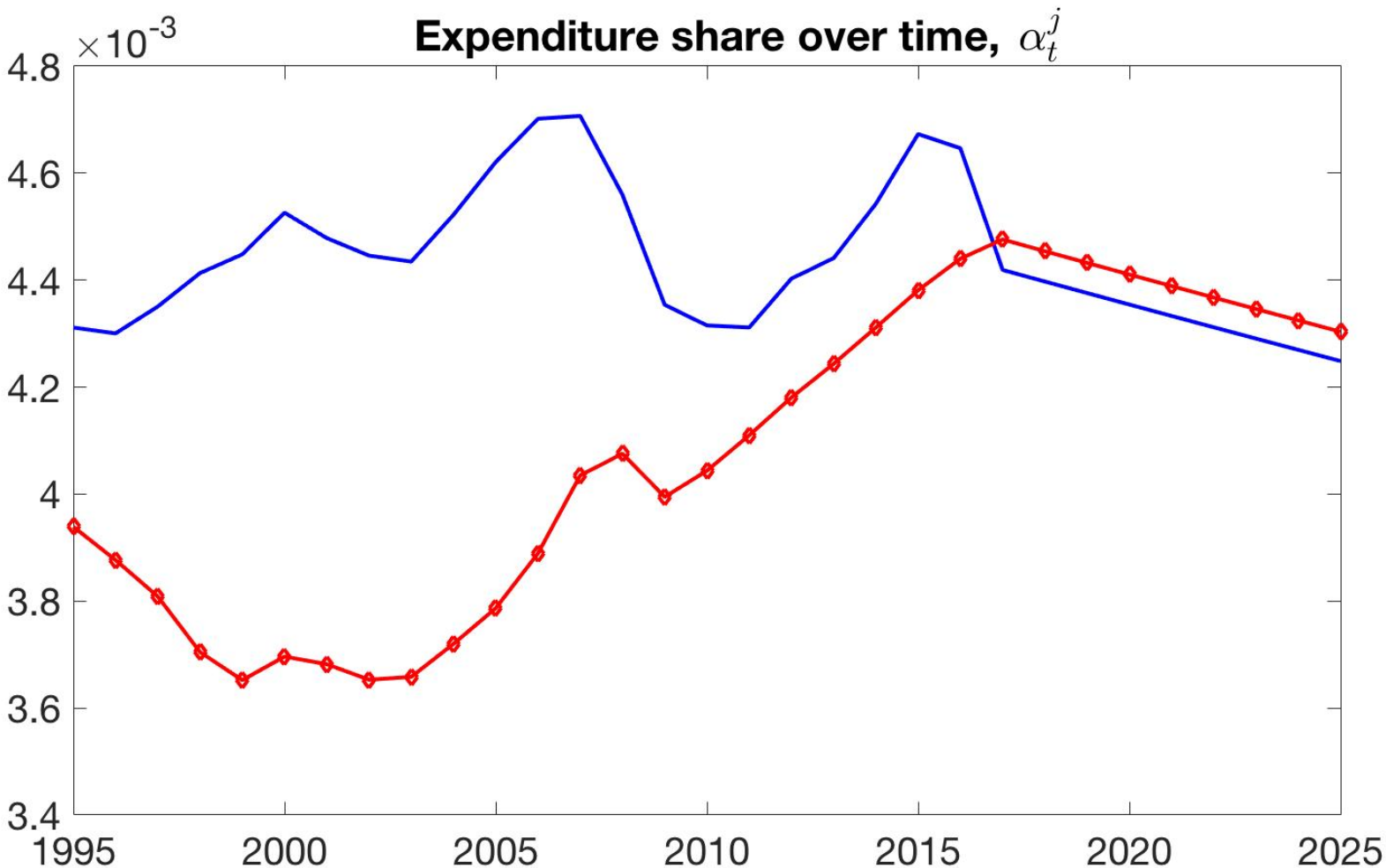
Hat Algebra Methodology for the Primal Approach

- $\max_{\left\{\hat{X}^i_{t,j}\right\}_{i,j},\hat{X}^f_t} \sum_{t=0}^{\infty} \alpha^h_t \left(\left[\sum_j \lambda^h_{t,j} \left(\hat{X}^h_{t,j} \right)^{1-\frac{1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \right)^{1-\frac{1}{\eta}}$
  - Implementability:
    $\sum_{t=0}^{\infty} \alpha^f_t \left(\hat{X}^f_t \right)^{1-\frac{1}{\eta}} = \sum_{t=0}^{\infty} \frac{\alpha^f_t \lambda^f_{t,f}}{\pi^f_t} \left(\hat{X}^f_t \right)^{\frac{1}{\sigma}-\frac{1}{\eta}} \left(\hat{X}^f_{t,f} \right)^{-\frac{1}{\sigma}}.$
  - Resource constraints
    $\pi^h_t \hat{X}^h_{t,h} + \left(1-\pi^h_t\right) \hat{X}^f_{t,h} = 1,$ and $\pi^f_t \hat{X}^f_{t,f} + \left(1-\pi^f_t\right) \hat{X}^h_{t,f}.$
- Required data:
  - α^j_t : Fraction of income spent in period t,
  - π^j_t : Fraction of domestic output consumed domestically
  - $\lambda^f_{t,f}$: Fraction of income spent on domestic output.
- Required parameter estimates: σ and η.

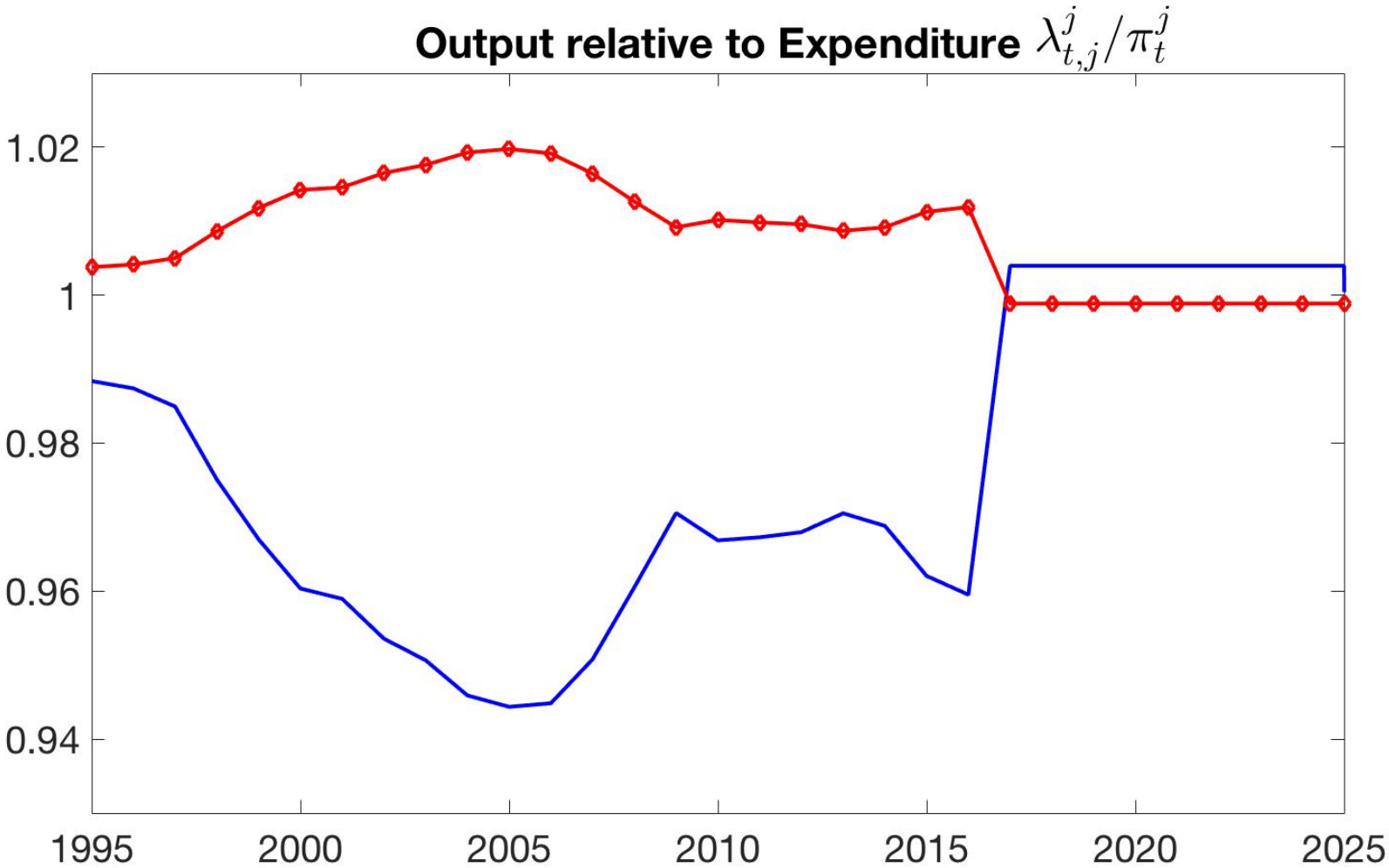
Data and Parameter Estimates

- 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).

Calculated Statistics

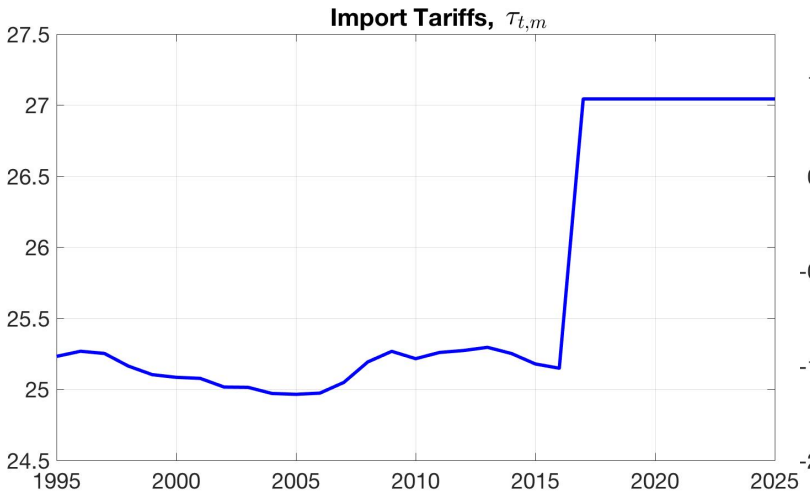


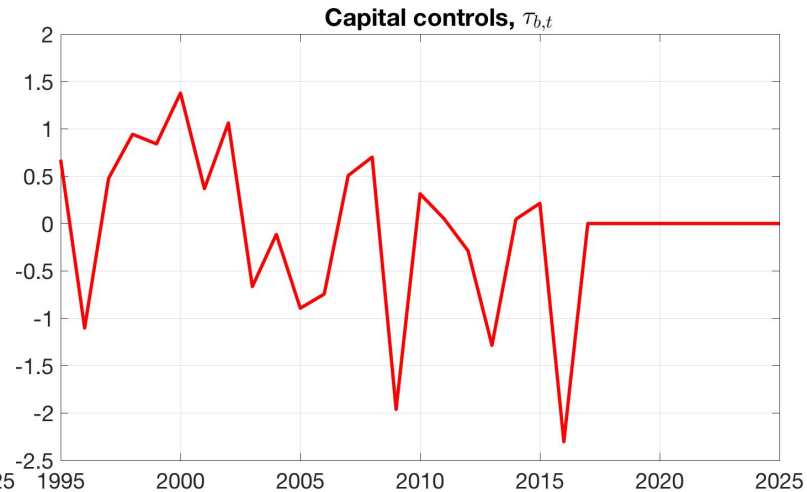
Calculated Statistics



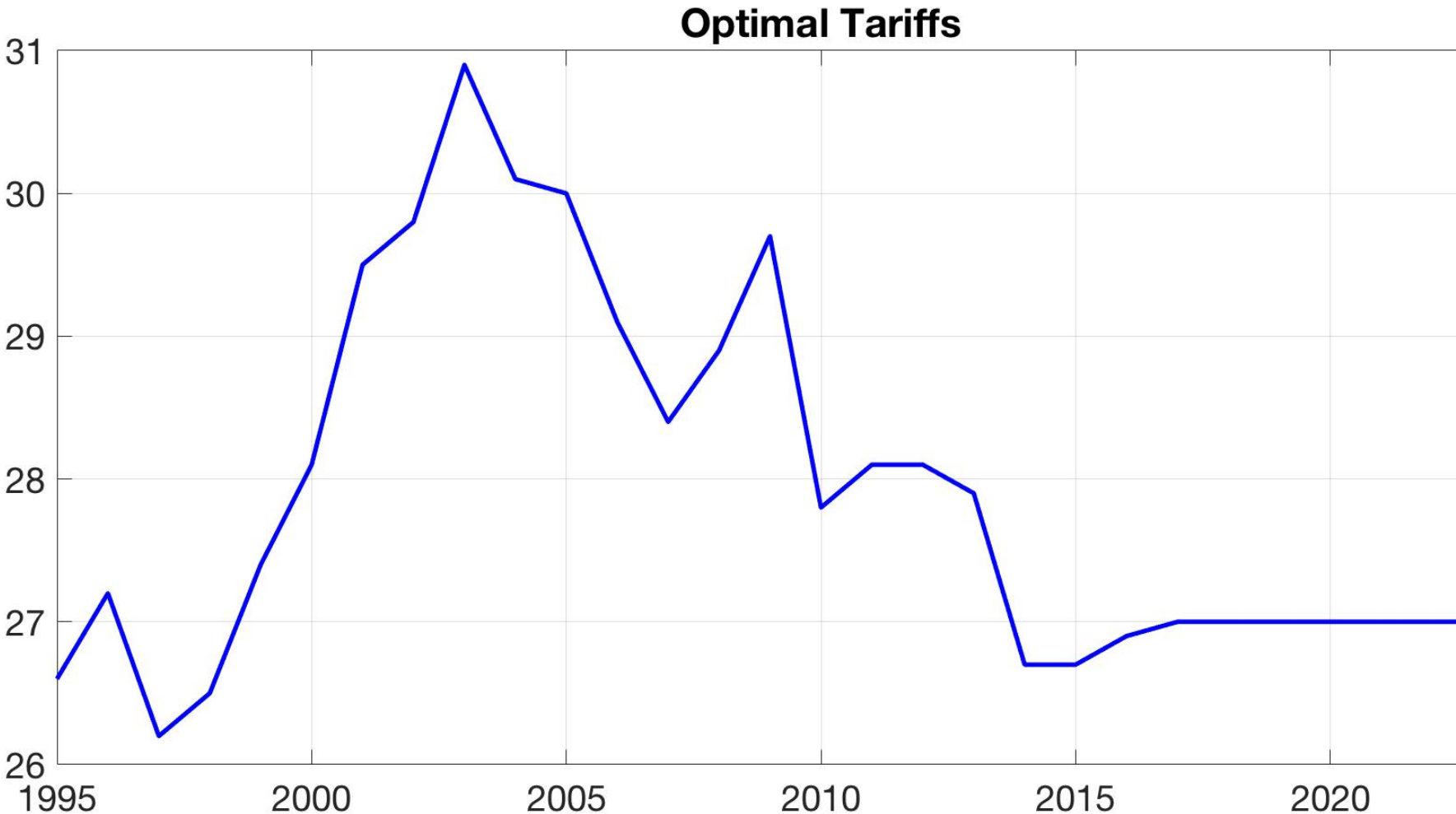
Optimal Unrestricted Policy (US 1995-2016)

Optimal Tariffs and Capital Control Taxes





Optimal Tariffs in absence of other policies



Welfare Effects: Static vs Dynamic ToT Effects

△Welfare	Cap Cont.	Const. Tariff	Tariff Only	Unrestricted
$\sigma = 5, \eta = 0.5$	0.001%	1.771%	1.772%	1.773%
$\sigma = 5, \eta = 0.33$	0.002%	1.772%	1.773%	1.775%
$\sigma = 10, \eta = 0.5$	0.001%	0.807%	0.808%	0.809%
$\sigma = 10, \eta = 0.33$	0.002%	0.808%	0.809%	0.811%

- Our model implies very small *dynamic ToT effects* compared to static ToT effects for the US.
  - Gains from changing tariffs over time or using capital controls are very small.

Concluding Remarks

- What we did:
  - Analyzed unilaterally-optimal trade policy under a dynamic model with one factor of production.
    - Key time-varying parameter is relative productivity.
  - Characterized the interdependence of capital control and trade policy for a simple two-good model
- Potential applications for the study of trade agreements:
  - Revisiting the notion of Reciprocity and the ***balance of concessions***
    - Countries differ in their ability to use capital control to restore their lost policy space due to trade agreements.
    - Institutional differences
    - Differences in the size of imbalances.
  - Can capital control play a useful role as a ***flexibility mechanism*** to improve self-enforceability of trade agreements? (As in Bagwell and Staiger 1990)