Financial Markets, Imbalances, and the Elusive Gains from Nationally-Oriented Monetary Policy[1]

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[1]The views expressed in this paper/presentation are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or any other person associated with the Federal Reserve System.

Keep your house in order

- The consensus in recent literature: Gains from international monetary cooperation are negligible, and so are the costs of a breakdown in cooperation.
- Maxim of "Keep your house in order"
  - Taylor (2013) in relation to the Great Moderation period, "[...] policies were executed under a basic understanding that the outcome would be nearly as good as if countries coordinated their policy choices in a cooperative fashion."
- Literature supporting consensus suggests virtually no welfare cost in switching from cooperation to non-cooperation.
  - Even under forceful pursuit of national objectives.
  - Even under aggressive retaliation.

Our questions

Can this theory be trusted to provide reliable guidance for policy decisions?

- What are the costs of nationally-oriented policies?
- Under which economic conditions are there greater incentives to pursue national policies aggressively?

This paper

We use workhorse open economy framework that has provided the analytical backbone, but follow a less restrictive approach.

- We assess how the gains from cooperation depend on and evolve dynamically with prevailing economic conditions.
  - Accumulation of foreign debt/asset positions.
  - Multiple distortions due to, e.g., wage and price rigidities, or sectoral (traded and non-traded goods) inflation of history-dependent magnitude, that exacerbate policy trade-offs.

- Distance between cooperative (or under regimes of implicit cooperation such as IT) and non-cooperative policies widens with large imbalances. basic mechanism

- Cost of pursuing purely domestic objectives can rise to multiple times the cost of business cycles.

Baseline Model

International New Keynesian model (Corsetti et al. (2010)):

- two countries, model structure is symmetric,
- each country produces a specialized good,
- prices and wages are sticky,
- goods are imperfect substitutes and trade internationally,
- export prices set in currency of origin country,
- cross-border trade in short-term debt,
- shocks to technology.

Households

Preferences:

$$\mathcal{U}_1 = E_t \sum_{h=0}^{T} \beta^h \left\{ ln\left(C_{1,t+h} - \kappa C_{1,t+h-1}\right) - \frac{\chi_0}{1+\chi} L_{1,t+h}^{1+\chi} \right\}$$

χ is the Inverse of the Frisch labor supply elasticity, χ, set to 2.84 (Chetty et al. (2011)).

Budget constraint:

$$\begin{aligned} & P_{1,t}^c C_{1,t} + \frac{1}{\phi_{1,t}^b} \left\{ P_{1,t}^b B_{11,t} + e_{1,t} P_{2,t}^b B_{12,t} \right\} \\ & = W_{1,t} L_{1,t} + B_{11,t-1} + e_{1,t} B_{12,t-1} + T_{1,t}. \end{aligned}$$

Households

We only track net foreign asset (NFA) positions; impose condition

$$\eta B_{11,t} = (1-\eta) e_{1,t} B_{12,t}.$$

If $\eta = 0.5$:

- households hold equal amounts of the home and foreign bond,
- setup can be fully symmetric and exclude valuation effects.

Consumption Basket

Households buy domestically produced and imported foreign goods:

$$C_{j,t} = \left(\left(\omega^d\right)^{\frac{\rho^c}{1+\rho^c}} \left(C^d_{j,t}\right)^{\frac{1}{1+\rho^c}} + \left(1-\omega^d\right)^{\frac{\rho^c}{1+\rho^c}} \left(M_{j,t}\right)^{\frac{1}{1+\rho^c}} \right)^{1+\rho^c}$$

- share of domestic goods $\omega^d = 0.88$
- elasticity of substitution between domestic and foreign goods $\varepsilon_T = \frac{1+\rho^c}{\rho^c} \in [0.65; 4]$

Wage and Price Phillips Curve/ Market Clearing

We follow the New Keynesian literature and introduce nominal rigidities in prices and wages using Calvo contracts.

Wage Phillips Curve

Price Phillips Curve

Goods and financial markets have to clear in equilibrium.

Market Clearing Conditions

Parameterization

Monetary Policy

Monetary policymakers in each country set the path of policy to optimize their assigned objective function subject to the optimality and market clearing conditions.

Distinguish three settings:

1. cooperative policies
2. non-cooperative/ nationally-oriented policies
3. keep-your-house-in-order policies (flexible IT).

Cooperative Policies

Policymakers maximize global welfare:

$$\max_{\{\tilde{x}_t, i_{1,t}, i_{2,t}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t \left[\omega U_1(\tilde{x}_{t-1}, \tilde{x}_t, \zeta_t) + (1-\omega) U_2(\tilde{x}_{t-1}, \tilde{x}_t, \zeta_t)\right],$$

$$s.t.$$

$$E_t g(\tilde{x}_{t-1}, \tilde{x}_t, \tilde{x}_{t+1}, i_{1,t}, i_{2,t}, \zeta_t) = 0.$$

Non-Cooperative/ Nationally-Oriented Policies

Open-loop Nash game, each policymaker maximizes national welfare given the policy choices of the other country:

$$\max_{\{\tilde{x}_t, i_{j,t}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t U_j(\tilde{x}_{t-1}, \tilde{x}_t, \zeta_t),$$

$$s.t.$$

$$E_t g(\tilde{x}_{t-1}, \tilde{x}_t, \tilde{x}_{t+1}, i_{1,t}, i_{2,t}, \zeta_t) = 0$$

for given $\{i_{-j,t}\}_{t=0}^{\infty}$.

Keep-Your-House-In-Order Policies

In practice, central banks

- have assigned mandates and are not "maximizing the utility of the representative household,"
- the mandates are national and do not explicitly incorporate the well-being of other countries.

Keep-Your-House-In-Order Policies

Open-loop Nash game, each policymaker maximizes *assigned* objective given the policy choices of the other country:

$$\max_{\{\tilde{x}_t, i_{j,t}\}_{t=0}^{\infty}} -E_0 \sum_{t=0}^{\infty} \beta^t L_j(\tilde{x}_{t-1}, \tilde{x}_t, \zeta_t),$$

$$s.t.$$

$$E_t g(\tilde{x}_{t-1}, \tilde{x}_t, \tilde{x}_{t+1}, i_{1,t}, i_{2,t}, \zeta_t) = 0$$

for given $\{i_{-j,t}\}_{t=0}^{\infty}$.

Model flexible inflation targeting with the simple loss function

$$L_j = w_\pi(\pi_{j,ct}^4 - \bar{\pi}^4)^2 + w_y(y_{j,t}^{gap})^2.$$

Roadmap

1. Example of the transition between cooperative and non-cooperative policies and analytical framework
2. Fragility of cooperation with large imbalances
   - NFA positions and gains from cooperation
   - incentives to deviate from cooperation (two-stage game)
   - Pareto frontier and efficiency gains
   - keep-your-house-in-order policies
3. Generality of results
   - asymmetric asset portfolios and valuation effects
   - exchange rate passthrough
   - non-technology shock sources
   - alternative financial market arrangements
4. Conclusions

From Cooperative Policies to Currency Wars

Consider arbitrary initial conditions (from ergodic distribution) with home country being a creditor in an otherwise symmetric setup.

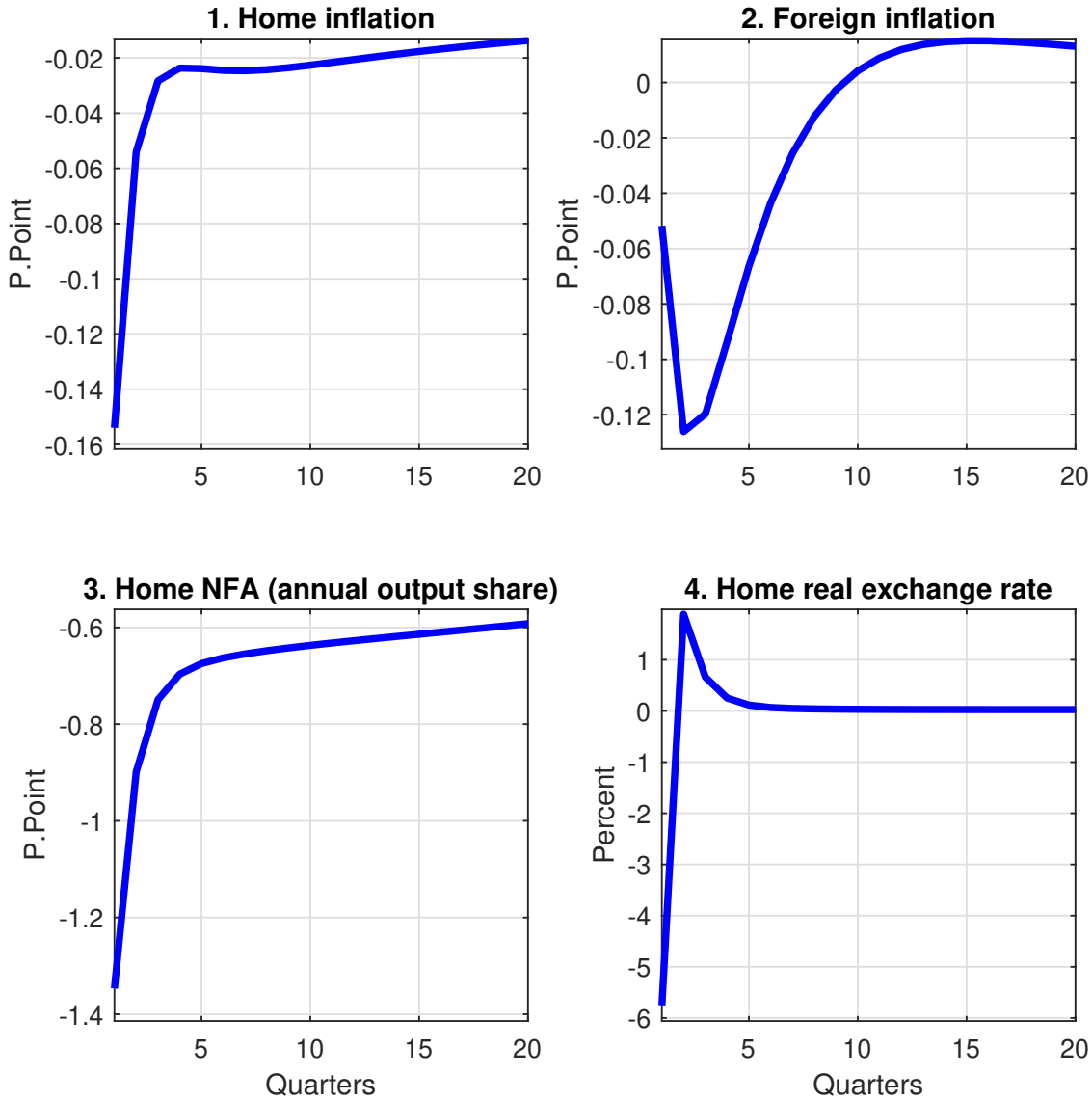
Under **cooperation**, policymaker enhances global welfare by compressing the creditor's consumption per unit of labor effort and by expanding the debtor's.

From Cooperative Policies to Currency Wars

Under **nationally-oriented** policymaking, the policymaker in the creditor country wants to reverse the cooperative redistribution.

- Creditor chooses monetary contraction to appreciate currency.
- This action reduces the labor effort relative to the consumption level, net exports and NFAs fall.
- Debtor leans against home appreciation.
- Overly tight monetary policy in both countries.
- Exchange rate war leads to distortions from deflation and real wage misalignment.
- Distortions offset the sought-after gains from improving consumption-labor-ratio.
- Both countries experience welfare loss relative to cooperation.

From Cooperative Policies to Currency Wars



Exploring the Gains from Cooperation

The Literature typically starts the analysis from zero initial NFA position.

We show that the gains from cooperation depend importantly on the initial conditions. To explore the gains systematically, we

- approximate the ergodic distribution of endogenous variables under cooperation,
- draw initial conditions from this ergodic distribution to compute welfare loss of switching from cooperation to nationally-oriented policies details,
- translate welfare losses into consumption equivalent details,
- compare these losses to the cost of business cycles.

We start with a symmetric setup **without valuation effects** ($\eta = 0.5$, $\omega = 0.5$).

Net Foreign Assets and the Gains from Cooperation

Technology shocks only, symmetric bond portfolio

The gains from cooperation are increasing in the (absolute value of the) NFA position.

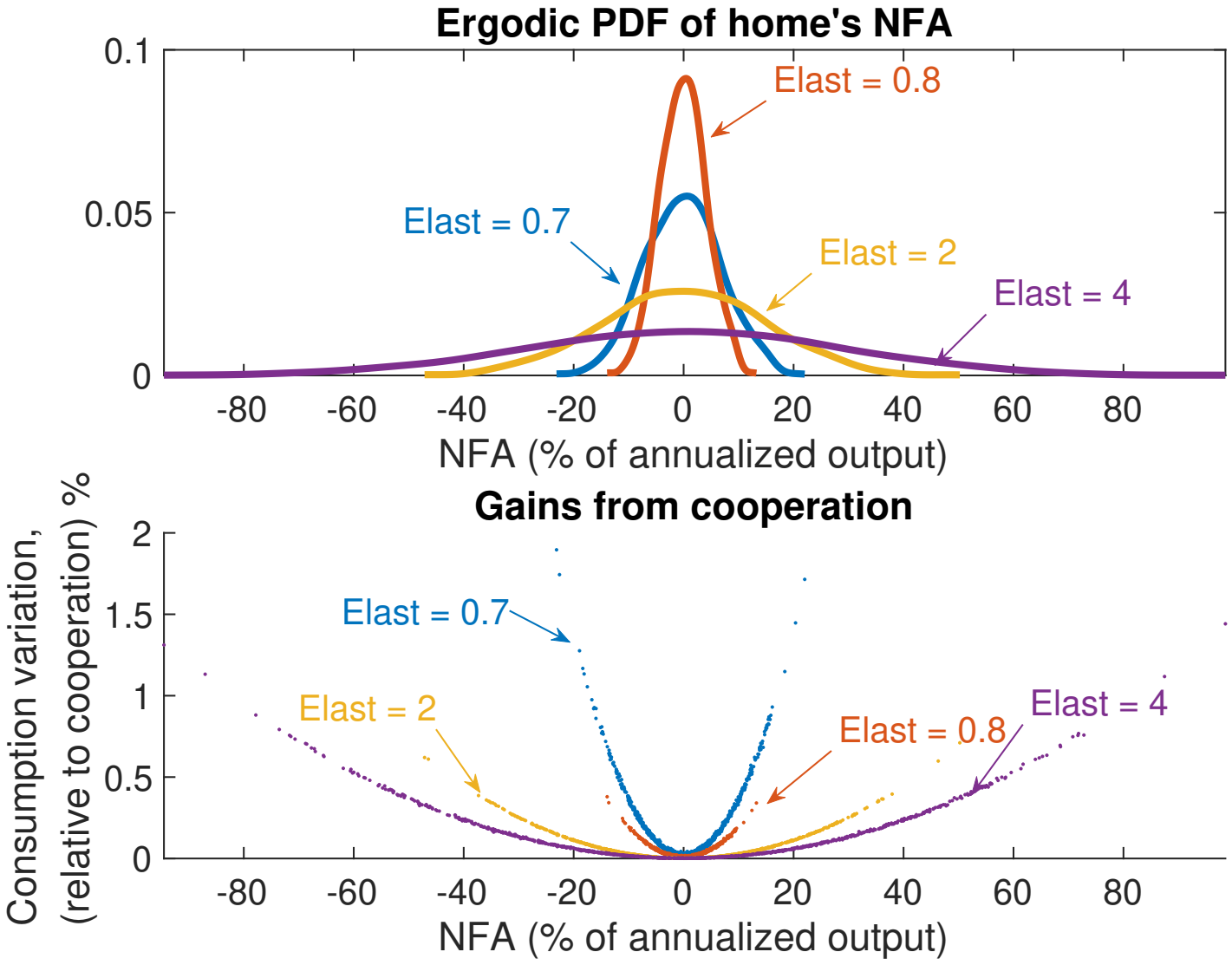
For a given NFA position, the gains vary with the value of the trade elasticity, ε_T.

The trade elasticiy also influences the distribution of the NFA position — more on this point below.

If terms of trade movements provide effective insurance against technology shock, NFA distribution is concentrated around zero (Cole and Obstfeld, 1991) $\rightarrow$ minimal gains from cooperation.

NFA, Trade elasticity, and Gains from Cooperation

Technology shocks only, symmetric bond portfolio

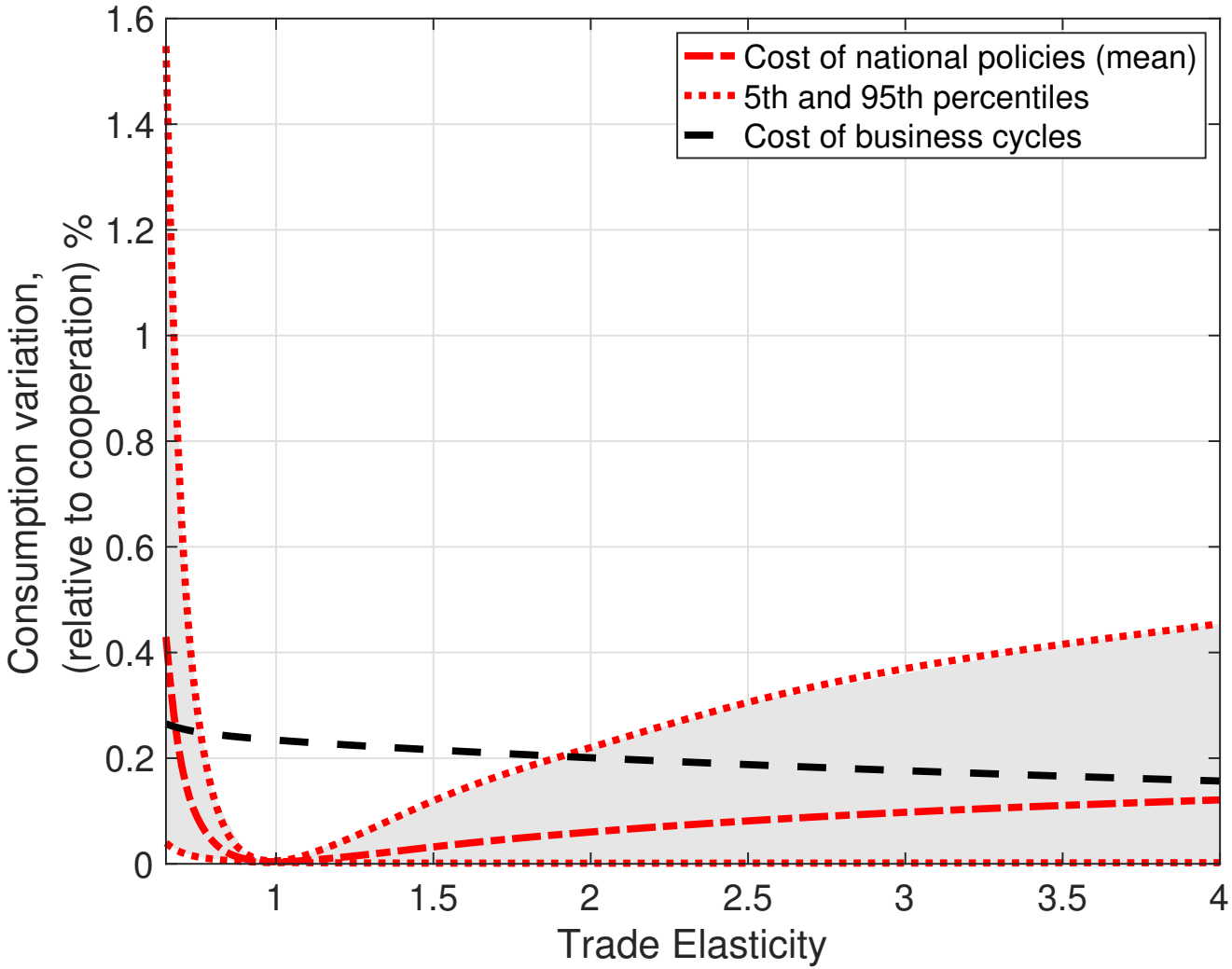


Gains from Cooperation and The trade Elasticity

- As established by the previous slide, the distribution of the gains from cooperation depends on the distribution of the net-foreign-asset position.
- A regression of the gains from cooperation on the net foreign asset position (and its square) yields and R^2 statistic of 0.99, confirming the importance of the net foreign asset position in driving the gains from cooperation.
- The preceding analysis also served as a reminder of the importance of the trade elasticity in shaping distribution of the net-foreign-asset position.
- The next slide links more explicitly the trade elasticity to the distribution of the gains from cooperation.

Gains from Cooperation and Trade Elasticity

Technology shocks only, symmetric bond portfolio



Gains from Cooperation and Trade Elasticity: Cheatsheet

Gains from cooperation can be much higher than the cost of business cycle.

- $\varepsilon_T > 1$: higher likelihood of large NFA positions
- $\varepsilon_T < 1$: pronounced terms of trade response to monetary policy
- $\varepsilon_T = 1$: NFA position concentrated at zero

Incentives to Deviate and Distribution of Gains and Losses

Comparison of cooperative and non-cooperative equilibria:

- measures possible gains from cooperation,
- ignores distribution of gains and losses of cooperation,
- abstracts from incentives to deviate from cooperation.

Consider two-stage game!

Two-stage Game

The size of the gains from cooperation depends on the initial conditions, in particular on the net-foreign-asset position.

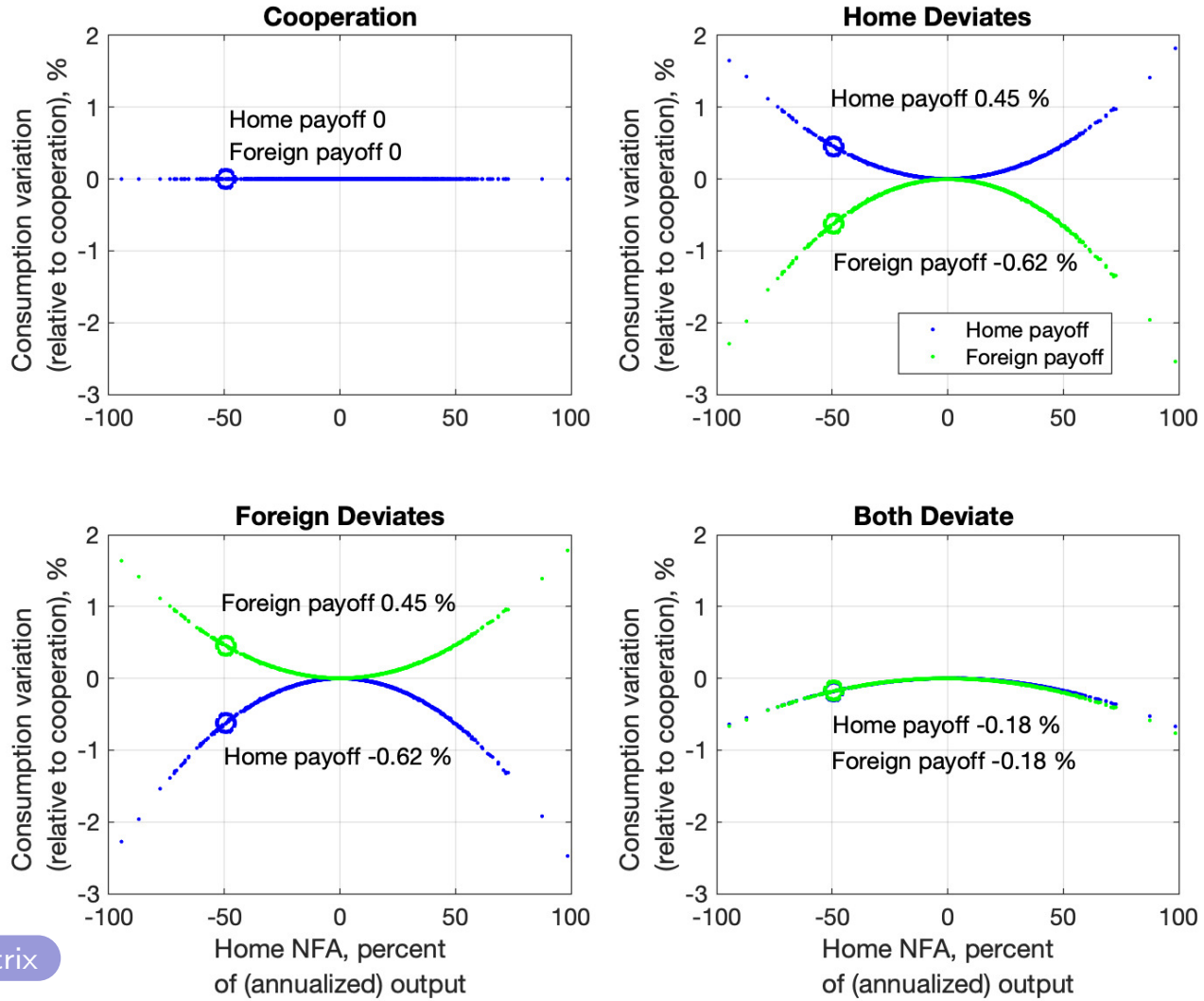
Two-stage game to explore incentives to deviate from cooperation given initial conditions:

1. Stage 1: each country chooses between {cooperate, deviate}
   - if player j chooses "cooperate," the policy objective of country j is the joint welfare function
   - if player j chooses "deviate," the policy objective of country j is the national welfare function
2. Stage 2: the countries engage in an open-loop Nash game where each country pursues the objective function chosen in the first stage.

If both countries "cooperate," this meta game reproduces the outcomes under cooperation.

Distribution of Gains and Losses in Two-Stage Game

Technology shocks only, symmetric bond portfolio, $\varepsilon_T = 4$



Payoff matrix

Takeaway from the Two-Stage Game

- The same economic conditions that magnify the gains from cooperation—large external imbalances—also magnify the incentives to deviate from cooperation unilaterally
- Cooperation is more fragile exactly when it is more beneficial.
- {deviate, deviate} is the unique first-stage Nash equilibrium of the two-stage game.

Gains from Cooperation: Efficiency vs. Redistribution

We do not impose $\omega = 0.5$ to compute cooperative allocations to reflect that NFA may not be zero under initial conditions.

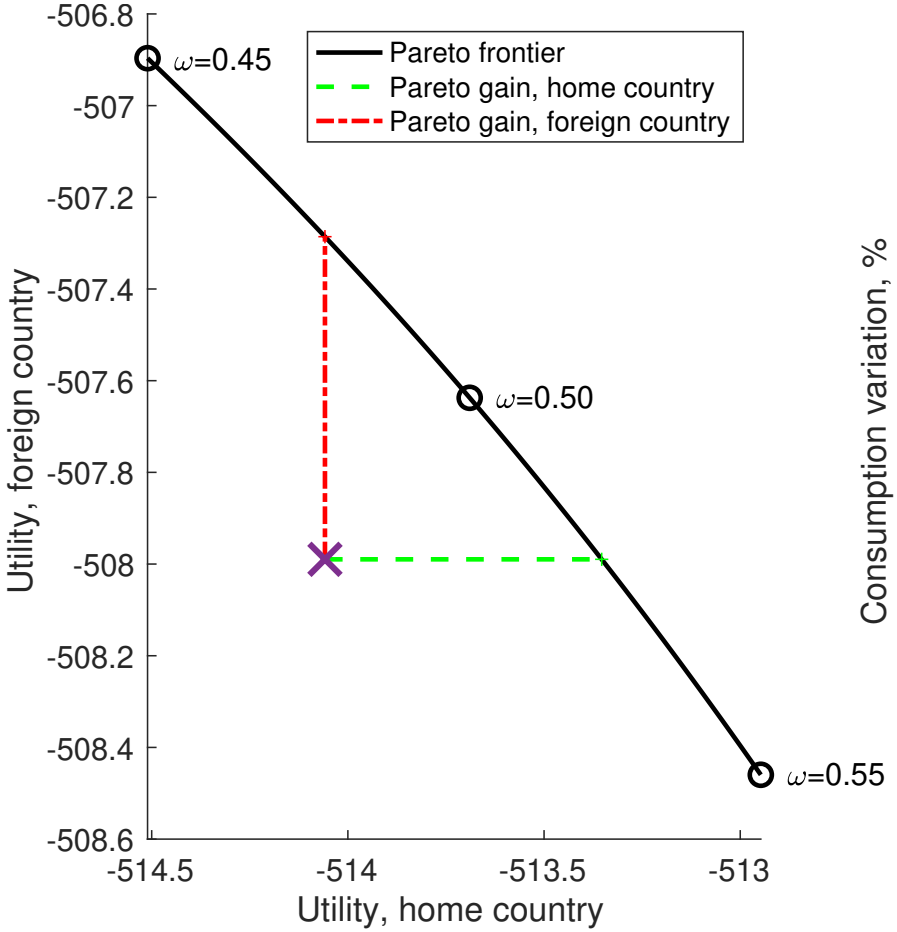
Given the initial conditions, construct the Pareto frontier by varying ω.

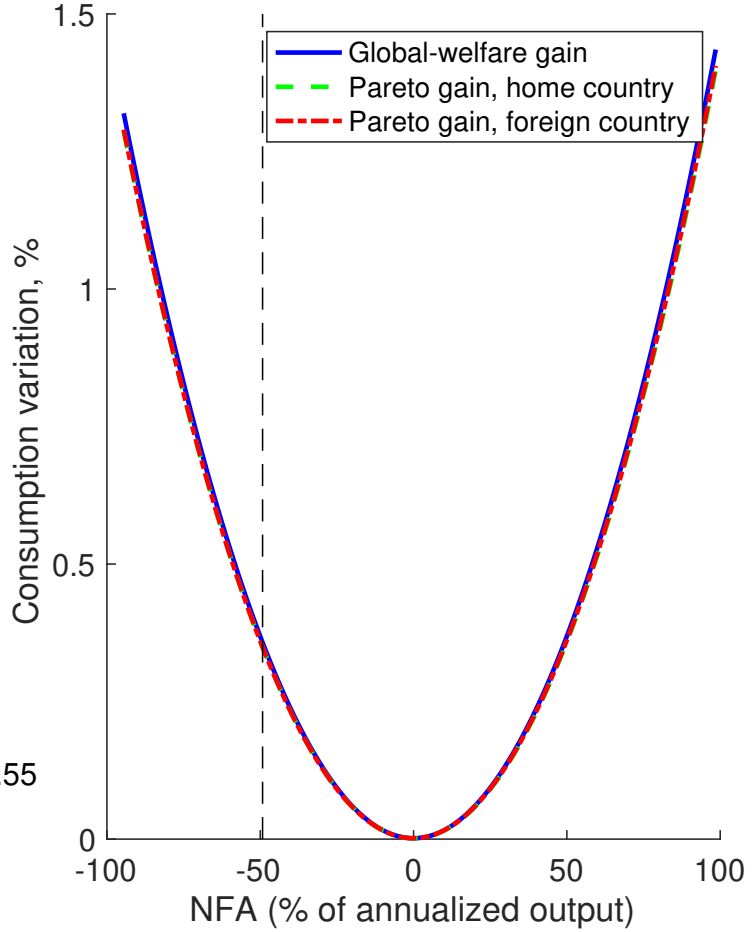
We compare the non-cooperative and cooperative allocations that make no country worse off but make one better off.

In the symmetric setup, the (global) gains from cooperation are primarily efficiency gains.

Pareto Frontier and Efficiency Gains from Cooperation

Technology shocks only, symmetric bond portfolio, $\varepsilon_T = 4$





Keep Your House in Order

National Inflation Targeting as Proxy for Global Cooperation

Just theory? In practice, central banks

- have assigned mandates and are not "maximizing the utility of the representative household,"
- the mandates are national and do not explicitly incorporate the well-being of other countries.

If countries pursue

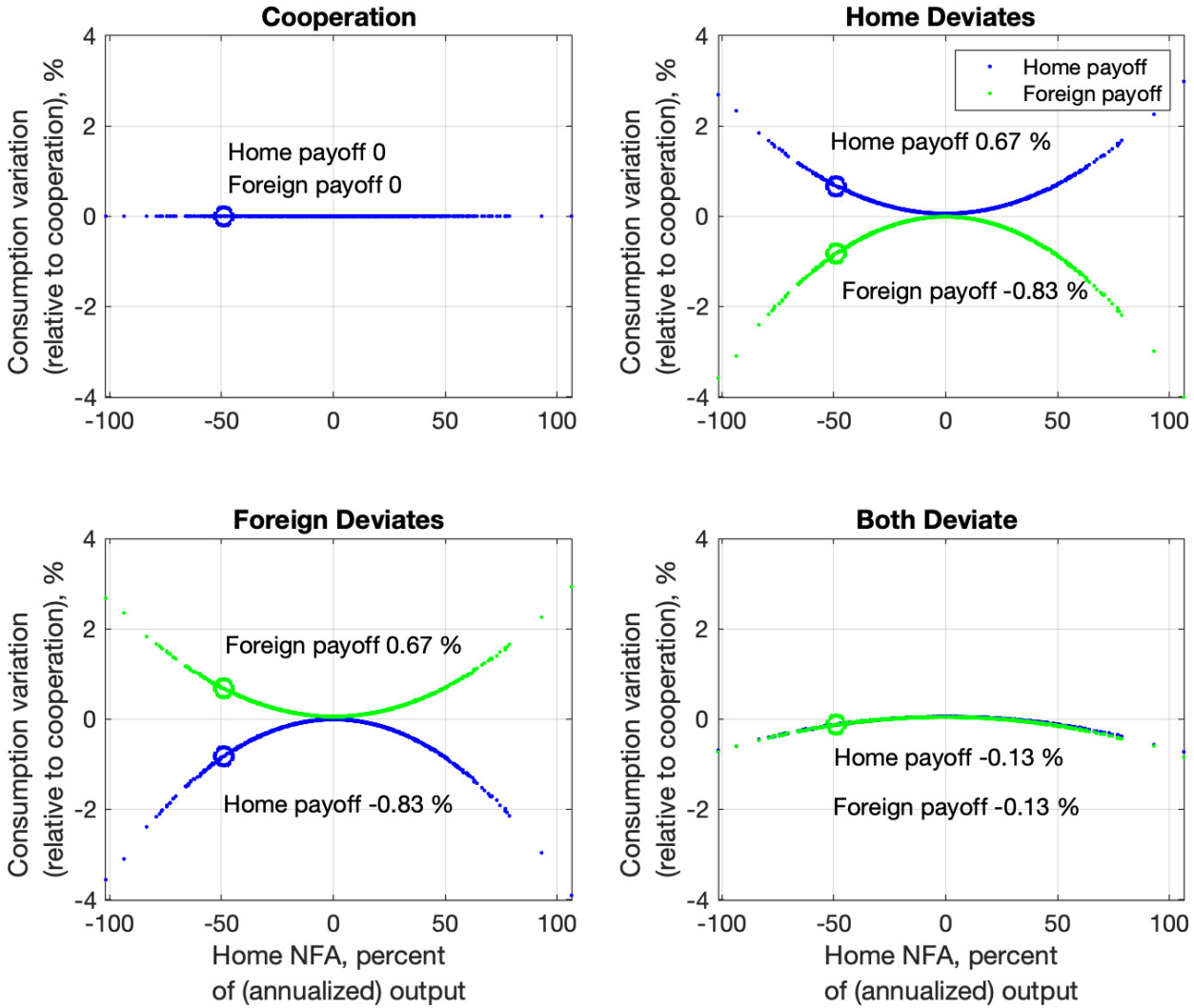
- **flexible inflation targeting** (price stability and full resource utilization)
- without global cooperation

allocations **close to cooperation** under global welfare function.

details IT

Incentives to deviate from Flexible Inflation Targeting

Technology shocks only, symmetric bond portfolio, $\varepsilon_T = 4$



Fragility of Flexible Inflation Targeting

Under inflation targeting, the incentives to deviate to nationally-oriented policies:

- are qualitatively similar to the incentives to deviate from cooperation,
- are stronger as inflation targeting may not be optimal; each country has added motive to focus on its own utility.

Asymmetric International Asset Portfolio

A different type of currency war—valuation effects

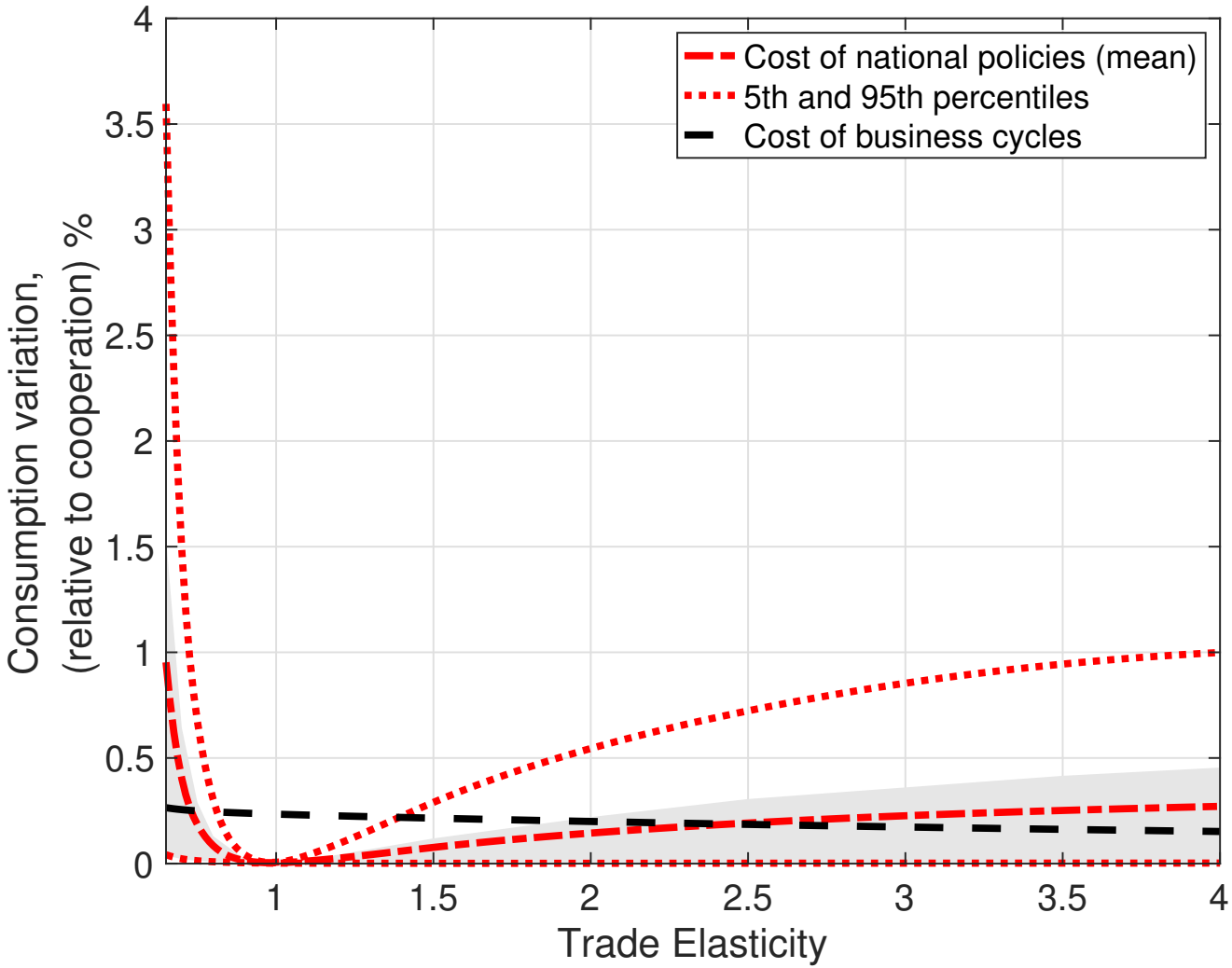
Home country transact exclusively in its own currency ($\eta = 0$):

- There is still a global loss in efficiency when switching to nationally-oriented policies,...
- ... but the game is redistributive.
- Losses in foreign country exceed gains in home country.
- This result is driven by valuation effects that are absent from the symmetric portfolio ($\eta = 0.5$).

Home country gains from deviating even if the foreign country retaliates.

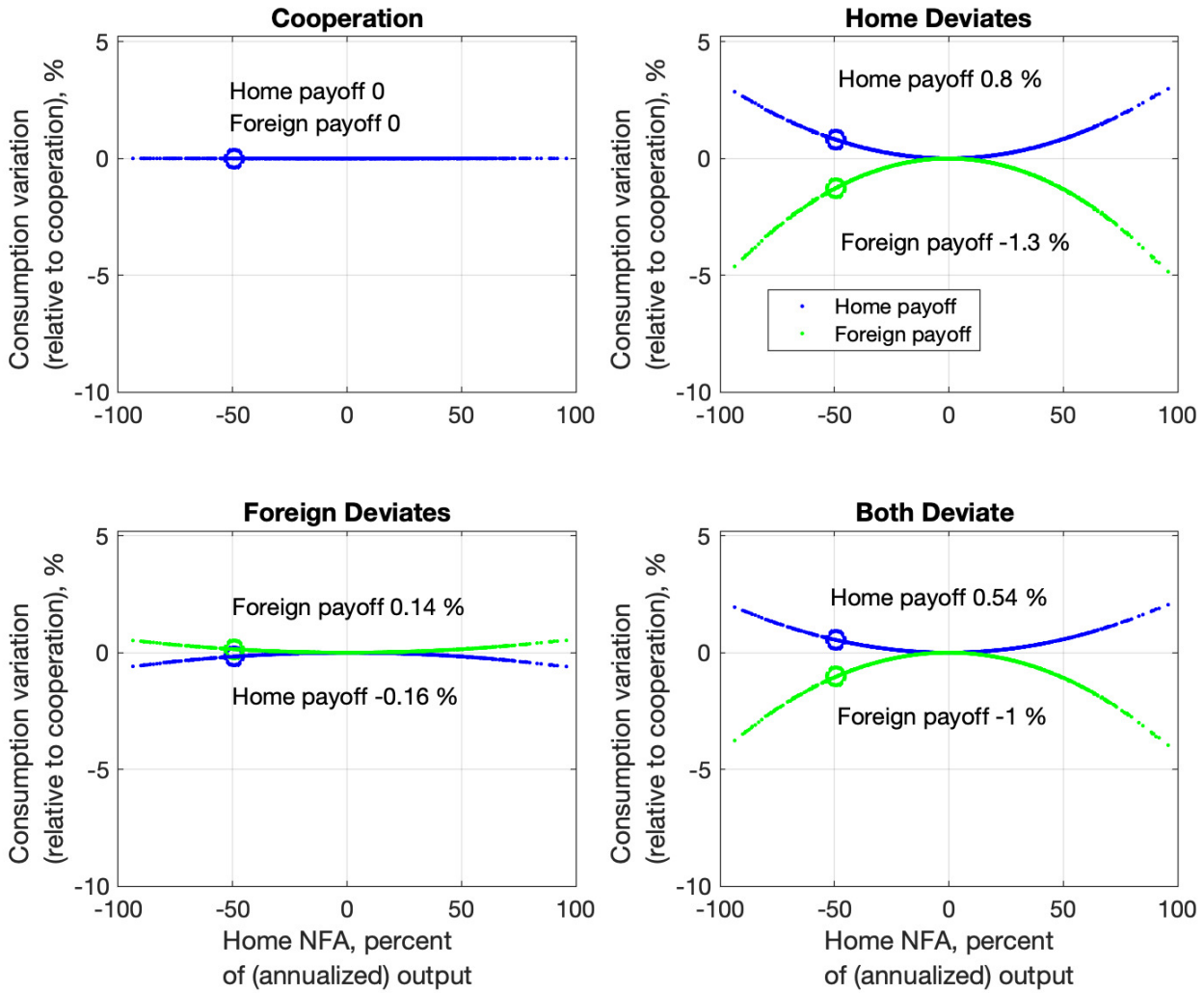
Valuation Effects Magnify the Gains from Cooperation

Asymmetric bond portfolio

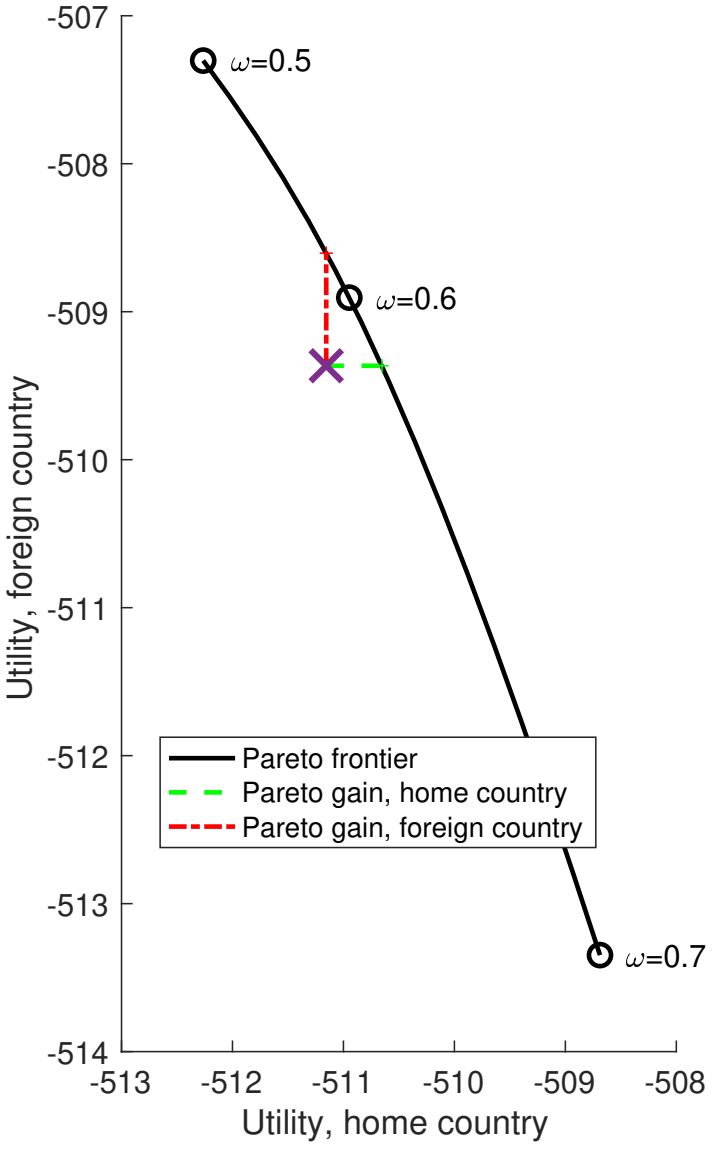


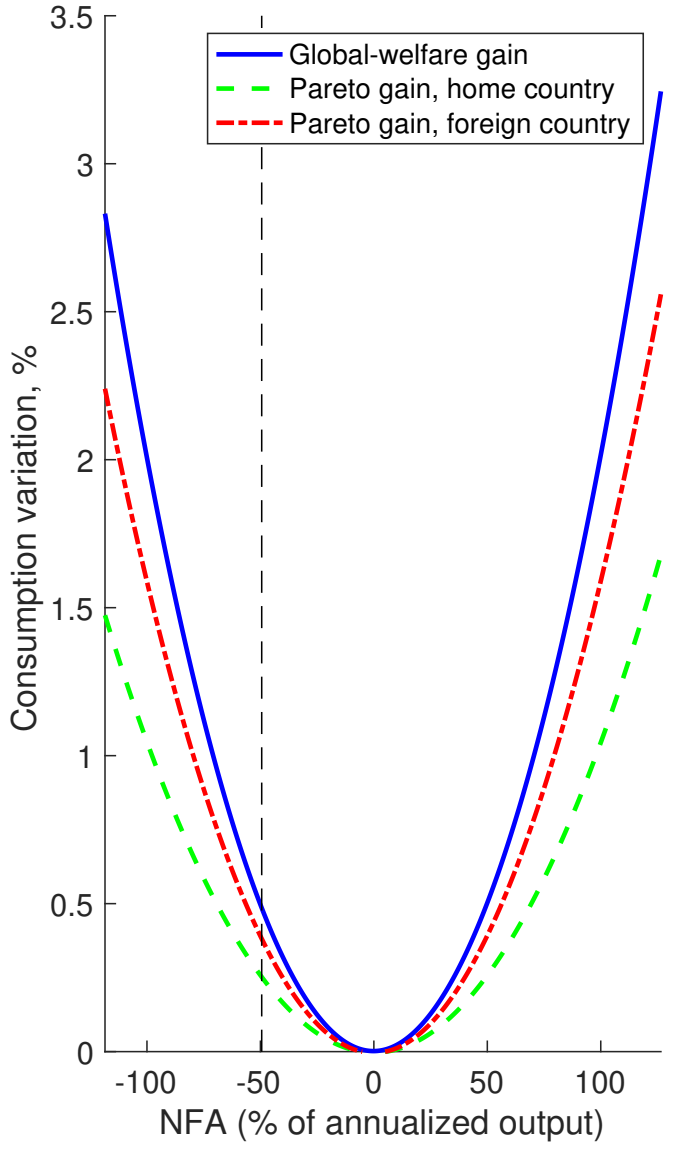
Gains from Deviation Positive even with Retaliation

Asymmetric bond portfolio, $\varepsilon_T = 4$



Pareto Frontier, Asymmetric Bond Portfolio



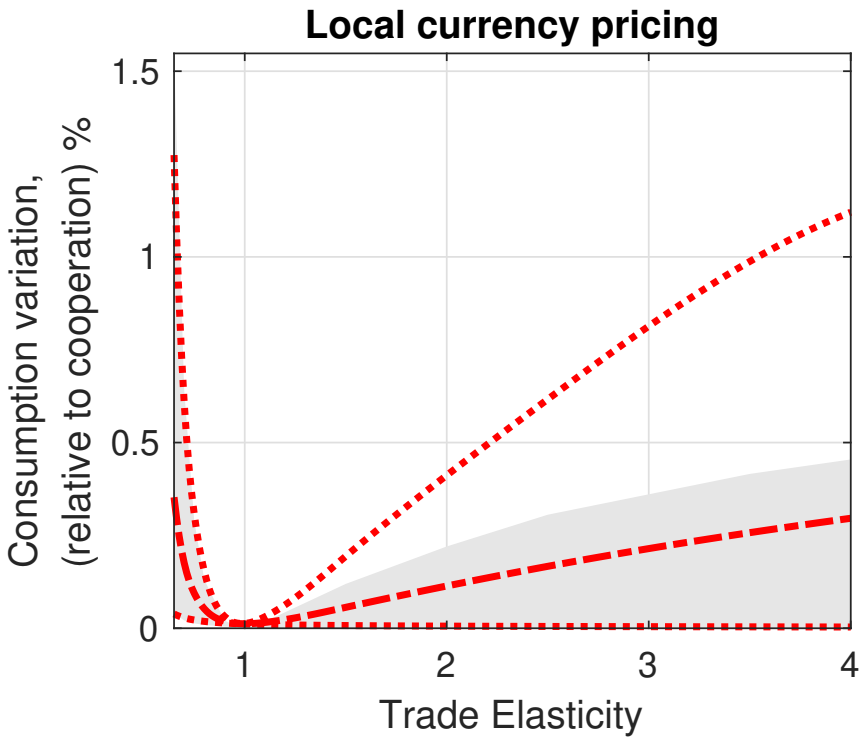


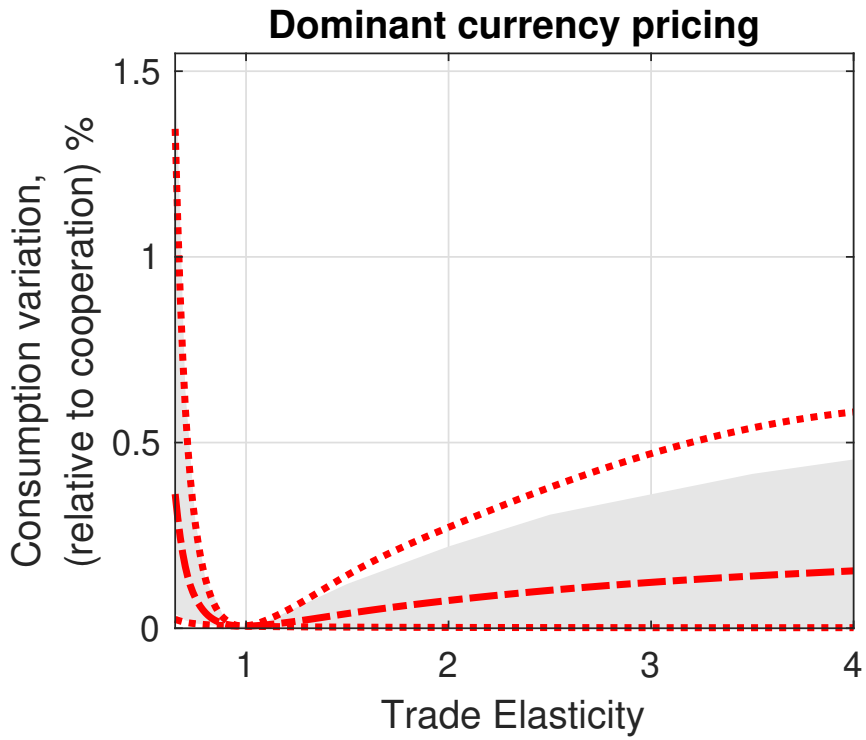
Efficiency and Redistribution with Portfolio Asymmetry

- Redistribution is more important in this case, but efficiency gains continue to be sizable.
- Nationally-oriented policy moves the allocation both well inside the Pareto frontier and away from the equal-weight point.
- Redistribution is in favor of the home country, which has a more powerful monetary policy instrument when all bonds are denominated in its currency.
- Pareto gains for the home country are lower than for the foreign country, as the redistribution lowers its marginal utility of consumption relative to the foreign country.

Low Exchange Rate Passthrough

...exacerbates the incentives to pursue inward looking policies

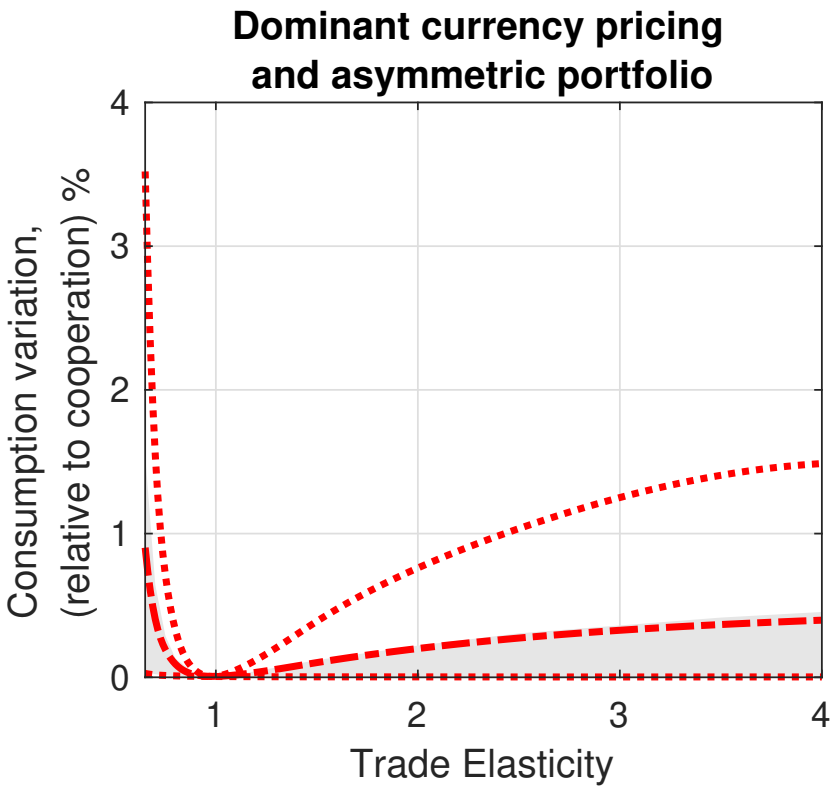


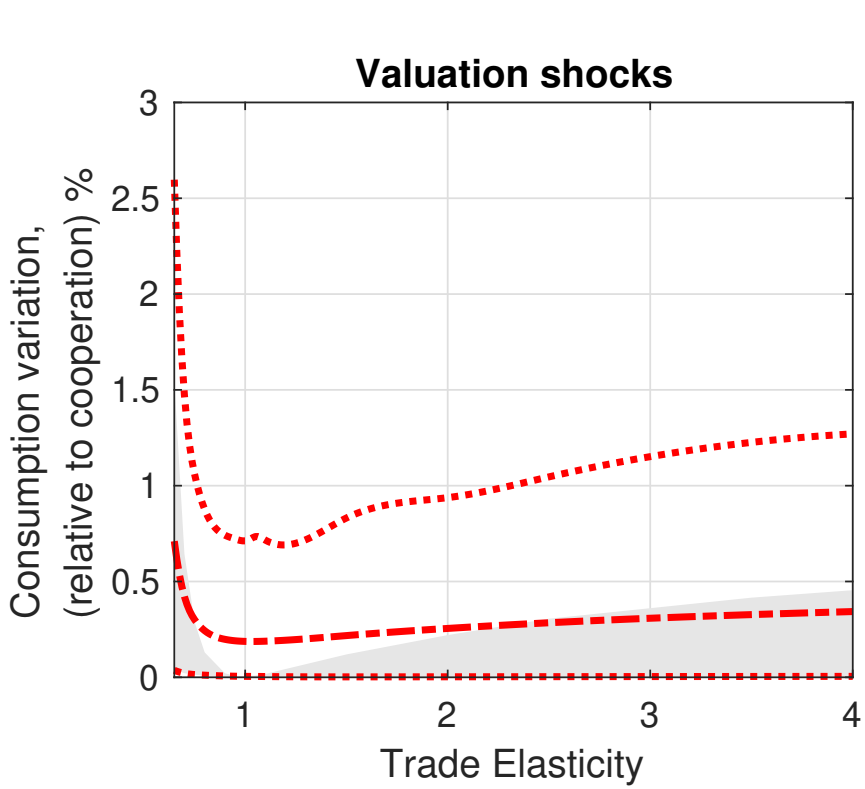


Valuation/Saving Shocks

- So far, we have worked with a model specification as close as possible to the one predicting that, unconditionally, the welfare costs of nationally-oriented policies are identically equal to zero.
- Losses from nationally-oriented policies can be much larger allowing for, e.g., saving shocks (patience, anticipated future taxes and capital controls, tastes). Terms of trade do not provide insurance.
- These shocks generate large NFA positions regardless of the value of the elasticity.

Valuation/Saving Shocks Multiply Gains from Cooperation



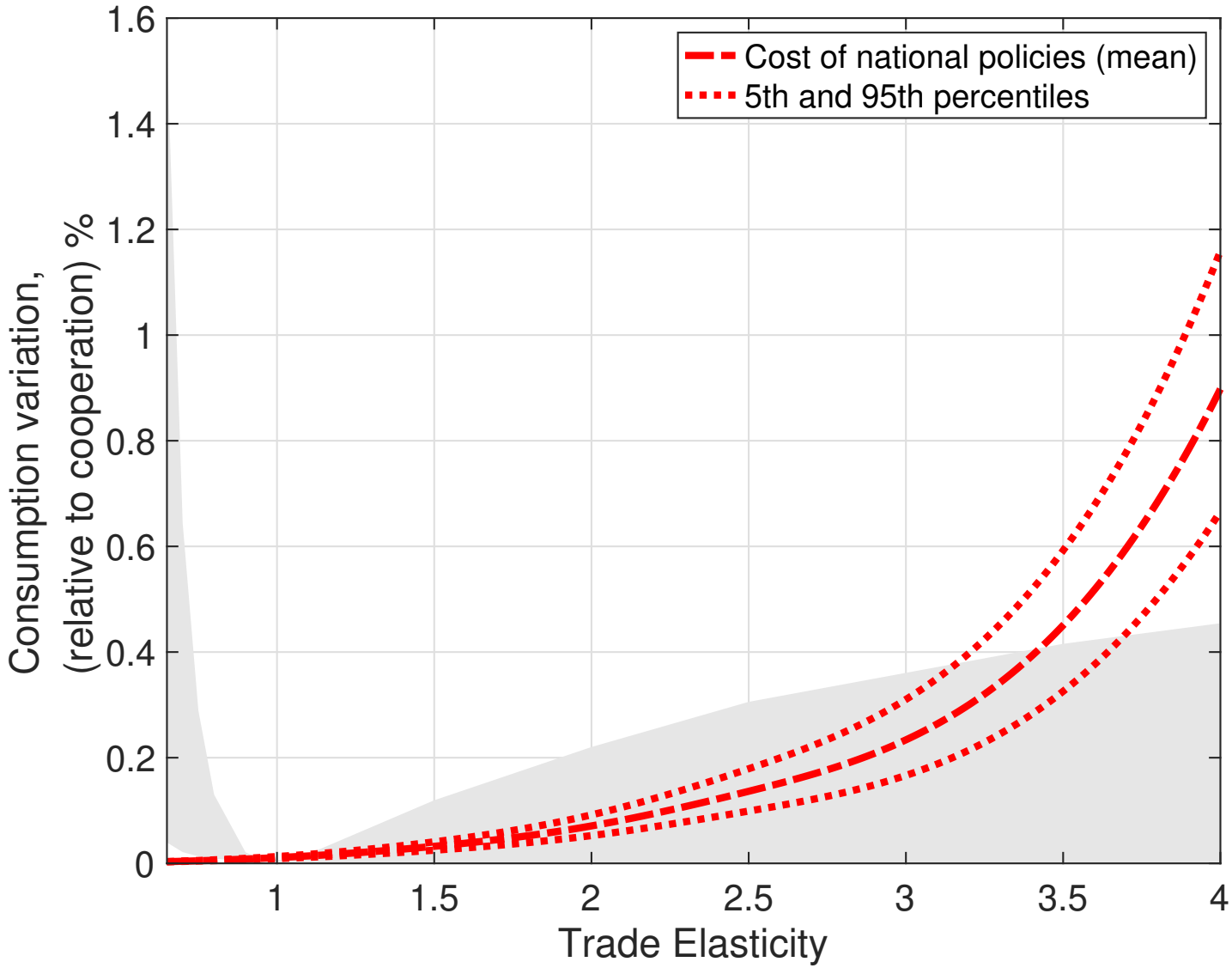


Revisiting Gains under Complete Markets

Trade-offs among domestic objectives

- Under complete markets, agents have access to a full set of state-contingent claims.
  - Monetary policy loses the ability to influence asset positions through inflation.
- But monetary policy can still influence real allocations, and the real wage, in particular.
- If national policymakers judge internal tradeoffs differently than under cooperation, non-internalized spillover effects of their actions on foreign welfare can be large.

Gains from Cooperation Persist with Complete Markets



The Real Wage Tracks the Gains from Cooperation

- Gains from cooperation depend on the characteristics of the transition point between cooperation and non-cooperation.
  - Under complete markets it is the domestic and foreign real wage. Not the NFA.
  - Regressing gains from cooperation on domestic and foreign real wages (and their squares) yields an R^2 of 0.99.
- The real wages maintain an imprint of how the cooperative policies have allocated consumption and hours worked in each country.
  - Similar to the role of the NFA position under incomplete markets.
- Countries with higher real wages (possibly because of positive technology shocks) would like to pursue nominal and real exchange rate appreciation to benefit from higher leisure.

autarchy

Summary

Our contributions to the literature can be summarized in six points:

1. Using the same kind of workhorse model of Obstfeld and Rogoff (2002), we find the gains from cooperation to be several times larger than the cost of economic fluctuations.
2. Importance of assessing welfare gains from cooperation conditional on economic conditions—the steady state, used by the rest of the literature, is special.
3. Welfare gains from cooperation are largely driven by Pareto efficiency gains—the efficiency cost of non-cooperative policies can be large.

Summary

4. The same economic conditions that magnify the gains from cooperation also magnify the incentives to deviate from cooperation unilaterally, thus making cooperation more fragile exactly when it is more beneficial.
5. Monetary policy regimes that deliver de facto cooperation, such as flexible inflation targeting, are subject to the same incentives to reoptimize towards fully national objectives as formal cooperative arrangements.
6. The economic conditions that magnify the gains from cooperation arise under both incomplete and complete financial markets arrangements.

Conclusion

With persistent external and internal imbalances, domestic policymakers may become less tolerant of the requirements of good behavior from a global perspective.

The risk is that strong policy actions may end up magnifying external spillovers, especially if they trigger a spiral of retaliatory actions.

Basic Mechanism Under Incomplete Markets

Under **cooperation**, policymaker enhances global welfare by compressing the creditor's consumption per unit of labor effort and expand the debtor's.

Under **nationally-oriented** policymaking, policymaker in creditor country wants to reverse the cooperative redistribution.

- Creditor chooses monetary contraction to appreciate currency.
- Debtor leans against home appreciation.
- Overly tight monetary policy in both countries.
- Size of contraction increasing in global imbalances.

return

Wage Phillips Curve

Differentiated labor services aggregate into $L^d_{1,t}$

$$L^d_{1,t} = \left[\int_0^1 L_{1,t}(h)^{\frac{1}{1+\theta^w}} dh\right]^{1+\theta^w}.$$

Under Calvo wage contracts labor unions solve

$$\max_{W_{1,t}(h)} E_t \sum_{j=0}^{\infty} (\xi^w)^j \Lambda_{1,t+j} \left[(1+\tau^w)\bar{\Pi}^j W_{1,t}(h) - \tilde{W}_{1,t+j}\right] L_{1,t+j}(h)$$

$$s.t.$$

$$L_{1,t}(h) = \left[\frac{W_{1,t}(h)}{W_{1,t}}\right]^{-\frac{1+\theta^w}{\theta^w}} L^d_{1,t}.$$

return

Price Phillips Curve

Production of differentiated goods

$$Y_{1,t}(i) = \exp\left(z_{1,t}\right) L^d_{1,t}(i).$$

Differentiated goods aggregate into $Y^d_{1,t}$

$$Y^d_{1,t} = \left[\int_0^1 Y_{1,t}\left(i\right)^{\frac{1}{1+\theta^p}} di\right]^{1+\theta^p}.$$

Price Phillips Curve

Under Calvo price contracts monopolistically competitive firms solve

$$\max_{P_{1,t}} E_t \sum_{j=0}^{\infty} (\xi^p)^j \Lambda_{1,t+j} \left((1+\tau^p) \bar{\Pi}^j P_{1,t}(i) - \frac{W_{1,t+j}}{\exp\left(z_{1,t+j}\right)} \right) Y_{1,t+j}(i)$$

$$s.t.$$

$$Y_{1,t+j}(i) = \left[\frac{P_{1,t+j}(i)}{P^d_{1,t+j}} \right]^{-\frac{1+\theta^p}{\theta^p}} Y^d_{1,t+j}.$$

return

Market Clearing Conditions

Goods markets

$$Y_{1,t}^d = C_{1,t}^d + M_{2,t}$$
$$Y_{2,t}^d = C_{2,t}^d + M_{1,t}$$

Bond markets

$$B_{11,t} + B_{21,t} = 0,$$
$$B_{12,t} + B_{22,t} = 0.$$

return

Parameterization

Key model parameters: labor supply elasticity, trade elasticity (varied from 0.65 to 4)

Parameter	Used to Determine	Parameter	Used to Determine
$\beta = 0.995$	discount factor	$\kappa = 0.5$	consumption habits
$\chi = 1/2.84$	labor supply elasticity $= \frac{1}{\chi}$	$\bar{L} = 1/3$	steady-state labor supply to fix χ_0
$\xi^p = 0.75$	price stickiness	$\xi^w = 0.75$	wage stickiness
$\theta_p = 0.1$	price markup (before subsidy)	$\theta_w = 0.1$	wage markup (before subsidy)
$\tau_p = 0.1$	subsidy to producers	$\tau_w = 0.1$	subsidy to unions
$\omega^c = 0.88$	home bias in consumption	$\omega = 0.5$	weight of home country in global welfare
$\phi^b = 10^{-4}$	governs bond intermediation cost	$\eta = 0.5$	share of bonds in home country currency
$\rho^z = 0.95$	persistence of tech. shock	$\sigma^z = 0.015$	std. of tech. shock

return

Ergodic Distribution and Gains from Cooperation

- We simulate a given economy under cooperation many times (1000) for a large number of periods (250).
- We draw from this ergodic distribution to generate the distribution of gains from cooperation (or from inflation targeting) over non-cooperation.
  - We compute the equilibrium (from period 251), and record $Welfare_{251}^{coop}$ and $Welfare_{251}^{non-coop}$;
  - We compute the distribution of gains from cooperation based on the 1000 (simulated) points (expressed in CEV).
- Welfare is conditional on the endogenous states.

return

Global Welfare Function with Constant Weights

Global welfare (here under cooperation) is computed as

$$Welf_t^{coop} = \omega \mathcal{U}_{1,t}^{coop} + (1-\omega)\mathcal{U}_{2,t}^{coop} \tag{1}$$

regardless of initial conditions with fixed weights ω and $1-\omega$.

We use the same approach to obtain global welfare under nationally-oriented policies.

Express welfare gains from cooperation as a consumption subsidy:

$$\tau = \exp\left(\frac{1-\beta}{\omega}\left(Welf_t^{coop} - Welf_t^{nat}\right)\right) - 1.$$

return

Extra Slide: Payoff Matrix in the Two-Stage Game

		home: cooperate	home: deviate
foreign	cooperate	$(0, 0)$	$(0.45\%, -0.62\%)$
foreign	deviate	$(-0.62\%, 0.45\%)$	$(-0.18\%, -0.18\%)$

- Payoff matrix shows each country's gains/losses in the second stage of the game given the choices in the first stage.
- Home country has a debt position of 50 percent of (annualized) output.
- {deviate, deviate} is the unique first-stage Nash equilibrium.

return

Extra Slide: Inflation Targeting

Open-loop Nash game, each policymaker maximizes *assigned* objective given the policy choices of the other country:

$$\max_{\{\tilde{x}_t, i_{j,t}\}_{t=0}^{\infty}} -E_0 \sum_{t=0}^{\infty} \beta^t L_j(\tilde{x}_{t-1}, \tilde{x}_t, \zeta_t),$$

$$s.t.$$

$$E_t g(\tilde{x}_{t-1}, \tilde{x}_t, \tilde{x}_{t+1}, i_{1,t}, i_{2,t}, \zeta_t) = 0$$

for given $\{i_{-j,t}\}_{t=0}^{\infty}$.

Model flexible inflation targeting with the simple loss function

$$L_j = w_\pi(\pi_{j,ct}^4 - \bar{\pi}^4)^2 + w_y(y_{j,t}^{gap})^2.$$

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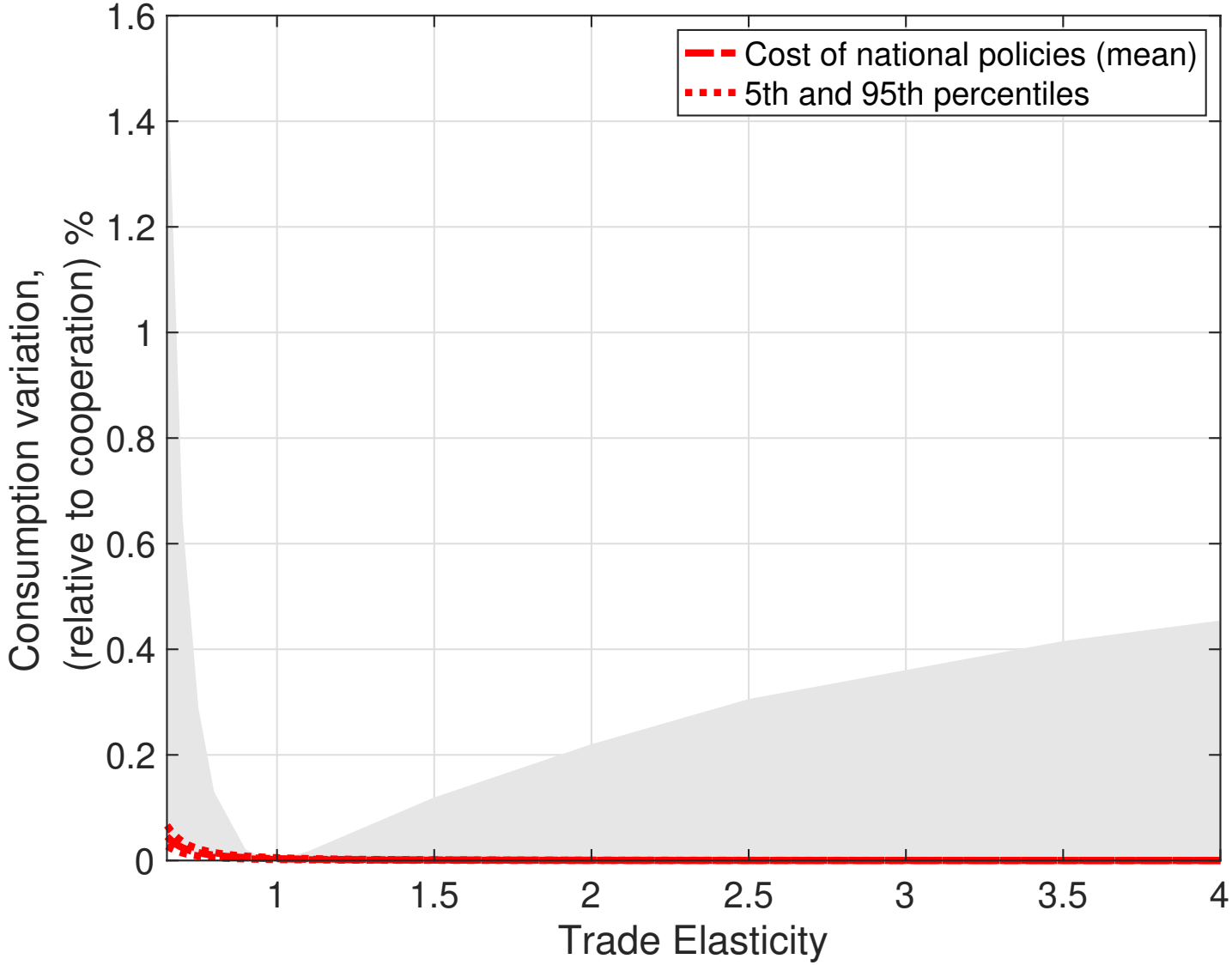
The Gains from Cooperation with Financial Autarky



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Financial autarky

- The incentives faced by policymakers are very similar to those under complete markets: A regression of the gains from cooperation associated with different transition points on the real wage at home and abroad (and their squares) at each transition point has, again, an R^2 statistic of 0.99 (irrespective of the trade elasticity chosen).
- The gains from cooperation however are much diminished, though not necessarily negligible for a low elasticity of substitution (0.7 or lower).
- Consumption is no longer insured by financial markets. For high elasticities, the gains from manipulating the terms of trade are small relative to the costs of nationally-oriented policy actions in terms of consumption-leisure distortions and price dispersion.

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