The International Medium of Exchange

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Motivation

- USD assets play a special role in international financial system
  - serve as the main *international medium of exchange*
  - USD invoices 5 times US world trade share (Gopinath, 2015)
  - 60% of international debt securities issued in USD (BIS)

- US has a unique external position ("exorbitant privilege")
  - world's largest net debtor, but *positive* net investment income
  - excess return on foreign assets: $r^A_{US} - r^L_{US} \in [0.5\%, 3\%]$
  - could fund sizeable trade deficit
    $\hookrightarrow$ current positions/returns imply benefit up to 3% of GDP

- This paper: a framework where both arise endogenously
  - ex-ante identical countries and assets
  - persistent coordination and currency regimes

A Theory of Currency Dominance and EP

- Key friction: limited contract enforceability across borders
  - international transactions require collateral (on both sides)
  - borrowed in local search and matching credit markets
- Feedback between H.H. asset positions and trading sector

$$\text{wide availability of asset} \iff \text{use as medium of exchange}$$

- Key insight: asset availability matters for medium of exchange
- Embed in dynamic model
  - multiple steady-states, correspond to currency regimes
  - unique equilibrium paths – asset availability serves as coord. device

Implications

1. Empirically appealing model of the international monetary system
   - Persistent currency regimes, typically a single dominant currency
   - Prolonged, but unstable "mixed" regime periods
2. Dollar dominant steady state matches many features of the data
   - negative NFA, excess returns, trade deficit, portfolio home bias
3. Most welfare benefits accrue during transition
   - steady state welfare differs by only 10bp, but overall by 60bp
4. Trade wars worst for central country
   - wants to foster free trade among third parties
5. Importance of financial openness
   - Eichengreen and Flandreau (2010) evidence on 1920s
   - Euro area vs Chinese Road and Belt Initiative

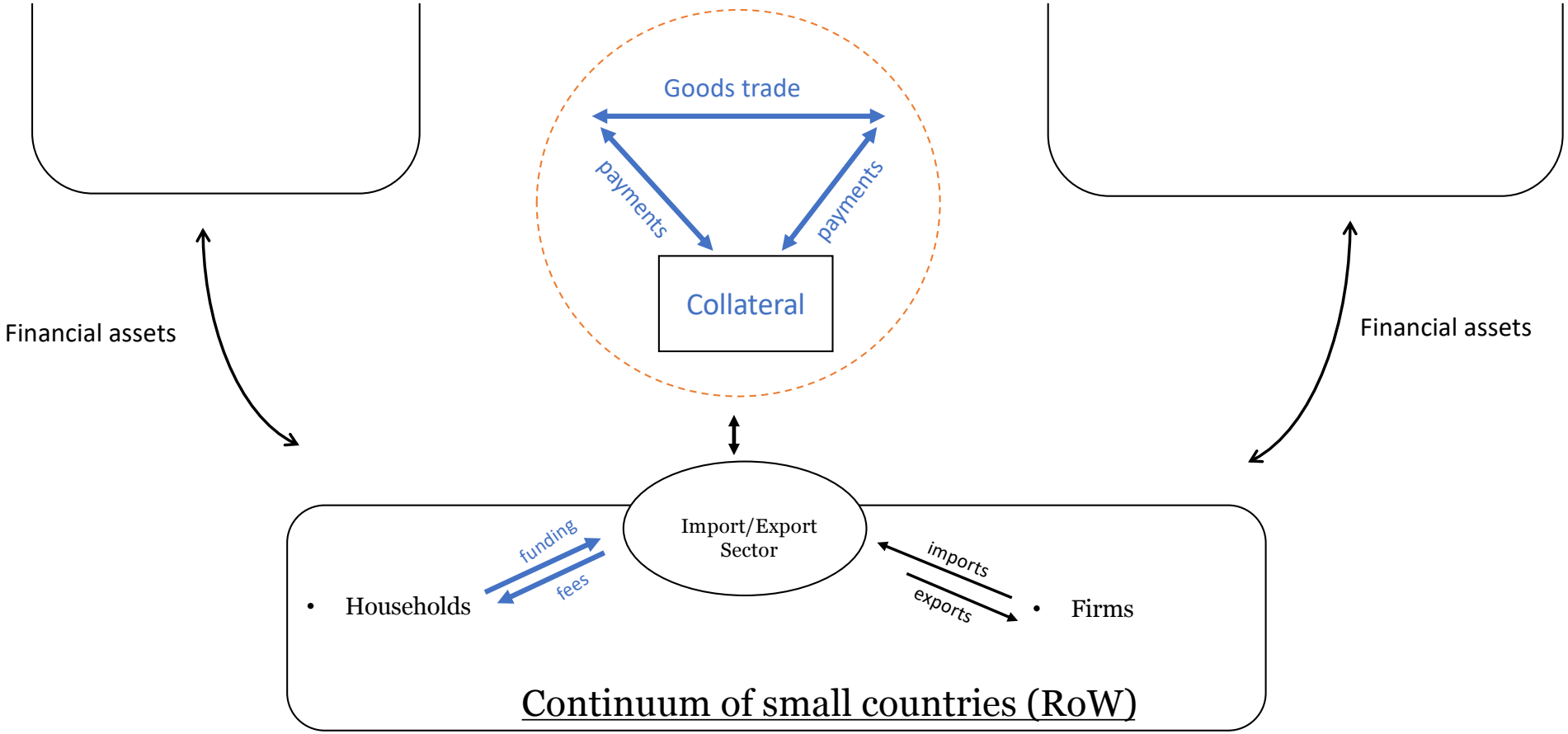
Literature

- **Exorbitant privilege in the data:** Gourinchas and Rey (2007), Gourinchas, Rey and Govillot (2010), Hassan (2013), Du, Im and Schreger (2018)
- **Dollar dominance in the data:** Portes and Rey (1998), Goldberg (2011), Gopinath (2016)
- **Models of exorbitant privilege:**
  - **Store of Value:** Caballero, Farhi, and Gourinchas (2008), Gourinchas, Rey and Govillot (2010), Hassan (2013), Farhi and Maggiori (2016), He and Krishnamurthy (2016), Maggiori (2017)
  - **Unit of Account:** Gopinath and Stein (2018)
  - **Medium of Exchange:** this paper
- **Models of trade invoicing/currency dominance:** Engel (2006), Gopinath, Itskhoki, and Rigobon (2010), Goldberg and Tille (2013), Doepke and Schneider (2015)
- **Money Theory:** Kiyotaki and Wright(1989), Lagos and Wright (2005), Matsuyama et al. (1993), Wright and Trejos(2001), Rey(2001), Ravkumar and Wallace (2002), Devereux and Shi (2013)

Outline

1. Toy Model
   - Steady-state analytical solutions
2. Full Model and Quantitative Results
   - Steady-state
   - Dynamics
3. Welfare
4. Counterfactuals

Simple Model Overview



Toy Model Overview

Two types of agents:

1. International trade firms
   - Engage in international transaction (within RW) with surplus 2π
   - To carry out international transactions need safe asset as collateral
   - Borrow assets from household in search and matching markets
     - ⋆ e.g. letter of credit
2. Households
   - Trade assets (in fixed supply $\bar{B}$) in international financial markets
   - Lend safe assets to local firms from their portfolios, earn fee $r > 0$

Case 0: Classic Coordination Game

- Firms choose whether to search for USD or EUR letter of credit
- Expected profit of choosing dollars relative to euros for firm i:

$$V_j^{\$} = \underbrace{p_j^{\$}}_{=\text{prob. obtaining \$}} \left[\pi - r - \kappa(1-\bar{X})\right] - \underbrace{p_j^{€}}_{=\text{ prob. obtaining €}} \left[\pi - r - \kappa\bar{X}\right]$$

where

  - $\pi - r$ – profit from trading net of financing costs
  - $\bar{X} \equiv \frac{1}{\mu_{rw}} \int_0^{\mu_{rw}} X_j dj$ – average dollar use among international trade firms
  - κ – currency mismatch cost (e.g. liquidity mgmt/transaction cost)

- Suppose $p_j^{\$} = p^{\$}$ and $p_j^{€} = p^{€}$ for all j and exogenous

Proposition 1

The economy has multiple equilibria (dollar, euro, mixed) if and only if

$$\kappa \geq \kappa_{sunspot} \equiv (1 - \min(\frac{p^{€}}{p^{\$}}, \frac{p^{\$}}{p^{€}}))\pi$$

Case 1: Endogenous $p_j^{\$}$ and $p_j^{€}$

- Search and matching funding markets: households match with firms
- Probability of obtaining each type of funding (for a firm):

$$p_j^{\$} = \frac{B_j^{\$}}{B_j^{\$} + X_j} \text{ and } p_j^{€} = \frac{B_j^{€}}{B_j^{€} + 1 - X_j}$$

- Funding choice strategic substitute *within* countries
- Assuming $B_j^{\$} = B^{\$}$ and $B_j^{€} = B^{€}$ for all j

Proposition 2

Multiple (sunspot) equilibria if and only if

$$\kappa \geq \frac{1}{\min\{B^{\$}, B^{€}\} + 1}\pi$$

- Sunspot equilibria existence depends on bond holdings
  1. Lower availability of liquid assets $\Rightarrow$ harder to sustain sunspot equilibria

Case 2: Endogenous Asset Holdings

- Household Problem:

$$\max_{C_{jt}, B^{\$}_{jt}, B^{€}_{jt}} E_0 \sum_{t=0}^{\infty} \beta^t \frac{C_{jt}^{1-\sigma}}{1-\sigma}$$

s.t.

$$C_{jt} + (Q^{\$}_t - \Delta^{\$}_{jt}) B^{\$}_{jt} + (Q^{€}_t - \Delta^{€}_{jt}) B^{€}_{jt} = B^{\$}_{jt-1} + B^{€}_{jt-1} + Y_{jt} + \Pi_{jt}$$

- Safe assets pay one unit of the final good
- Earn liquidity premia due to borrowing fees paid by trading firms

$$\Delta^{\$}_{jt} = \text{Prob(Lending \$ bond)} r = \frac{X_{jt}}{B^{\$}_{jt} + X_{jt}} r = \Delta^{\$}_t$$

$$\Delta^{€}_{jt} = \text{Prob(Lending € bond)} r = \frac{1 - X_{jt}}{B^{€}_{jt} + X_{jt}} r = \Delta^{€}_t$$

Case 2: Steady State

- Steady state Euler equations imply

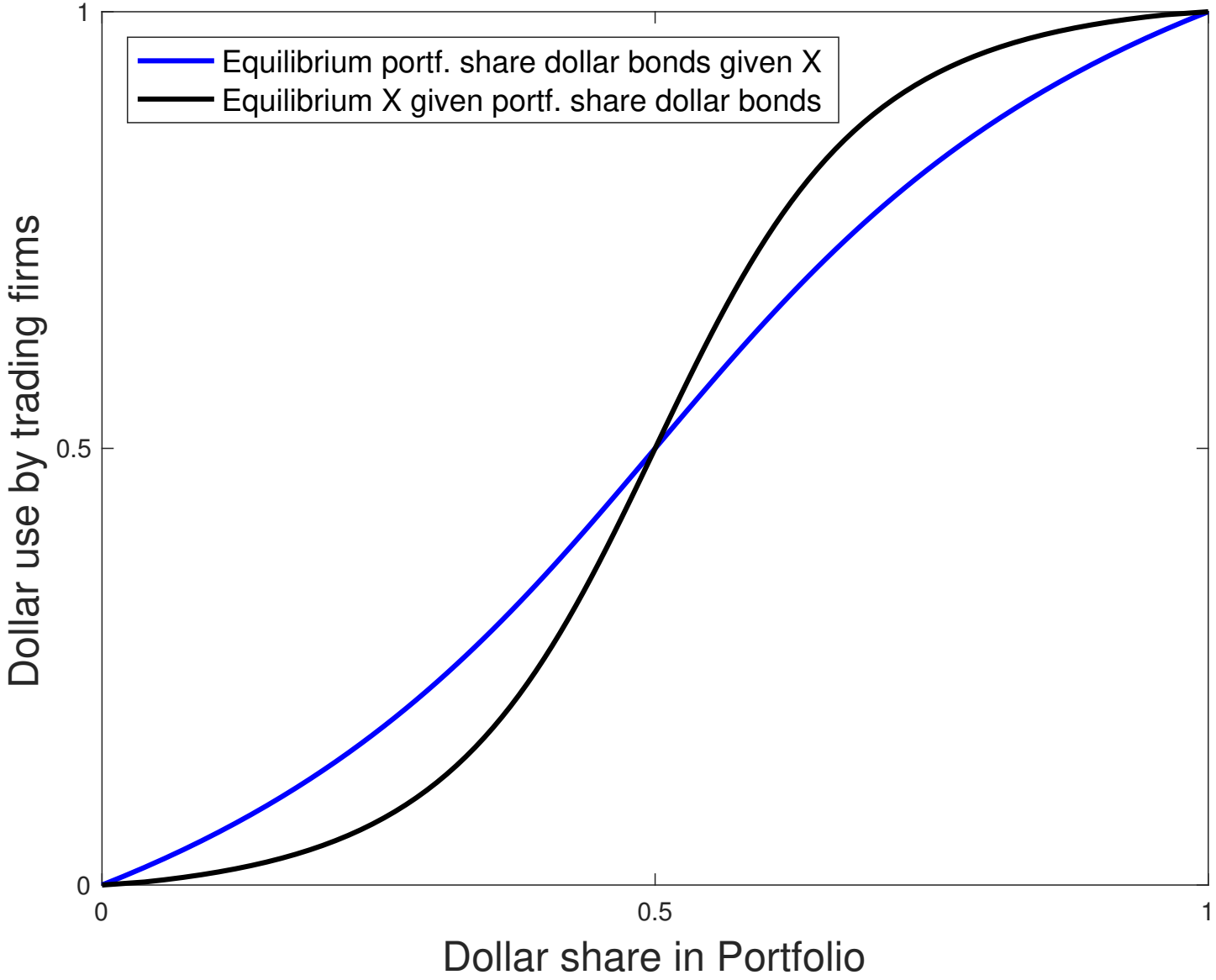
$$\frac{1}{Q^{\$} - \Delta^{\$}} = \frac{1}{Q^{€} - \Delta^{€}}$$

- Imposing market clearing in bond markets

$$\boxed{\frac{B_j^{\$}}{B_j^{€}} \propto \frac{X_j}{1 - X_j}}$$

- Summarizes feedback between HH holdings and firm currency choices
- Note: endogenous liquidity premia solve bond indeterminacy issue

Case 2: Steady-State Multiplicity



Case 2: Key Insights

$$\text{Bond holdings} \Rightarrow X_j \Rightarrow \text{Bond holdings}$$

Coordinated steady-state characteristics:

1. Higher liquidity premium on coordinated asset

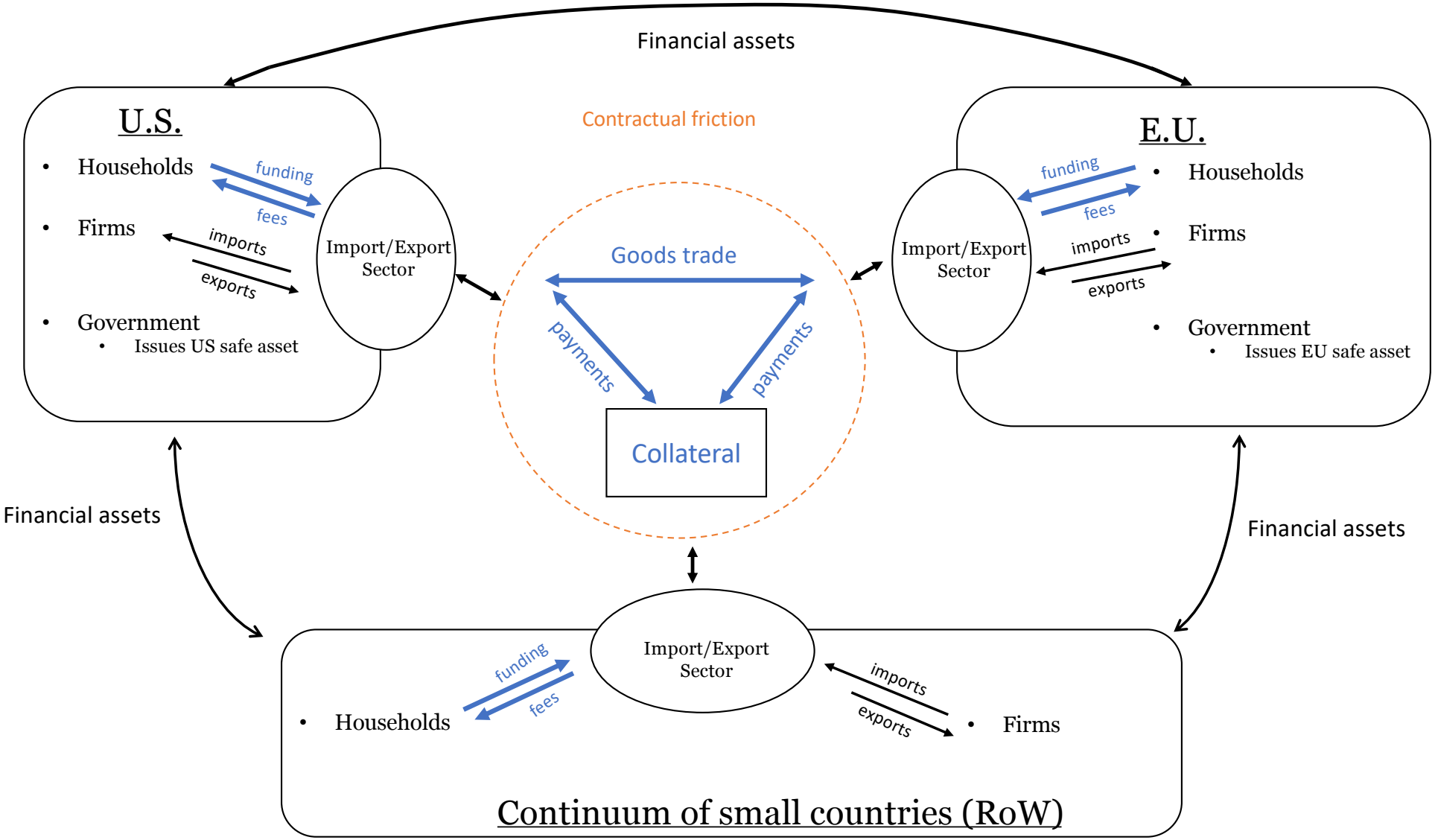
$$\Delta^{\$} = \frac{\mu_{\$}}{\bar{B} + \mu_{\$}} r > \frac{\mu_{€}}{\bar{B} + \mu_{€}} r = \Delta^{€}$$

2. Excess returns (UIP violation)
3. Could support indefinite trade deficit

$$TB_{us} = \underbrace{(\mu_{eu} B^{\$}_{eu} + \mu_{rw} B^{\$}_{j} - \mu_{us} B^{€}_{us})}_{-NFA} r^{€} - \underbrace{(\mu_{eu} B^{\$}_{eu} + \mu_{rw} B^{\$}_{j})(r^{€} - r^{\$})}_{\text{exorbitant privilege}}$$

4. Coordinated steady state stable iff $\kappa > \bar{\kappa}$
   - $\bar{\kappa} < \kappa^{sunspot} \Rightarrow$ mechanism can support multiplicity without sunspots

Full Model Overview



Full Model

- Calibration
  - Most parameters fixed to standard, *symmetric* values
    - ★ mismatch cost $\kappa = 0.01$, small, outside sunspot region
  - Calibrate $\bar{B}$, r, ϕ, a_h, σ_ϵ^2, ε_F targeting:
    - ★ Debt/GDP, US ex. privilege, import markups, RW trade share, funding prob., USD usage in RW.

Calibration Targets

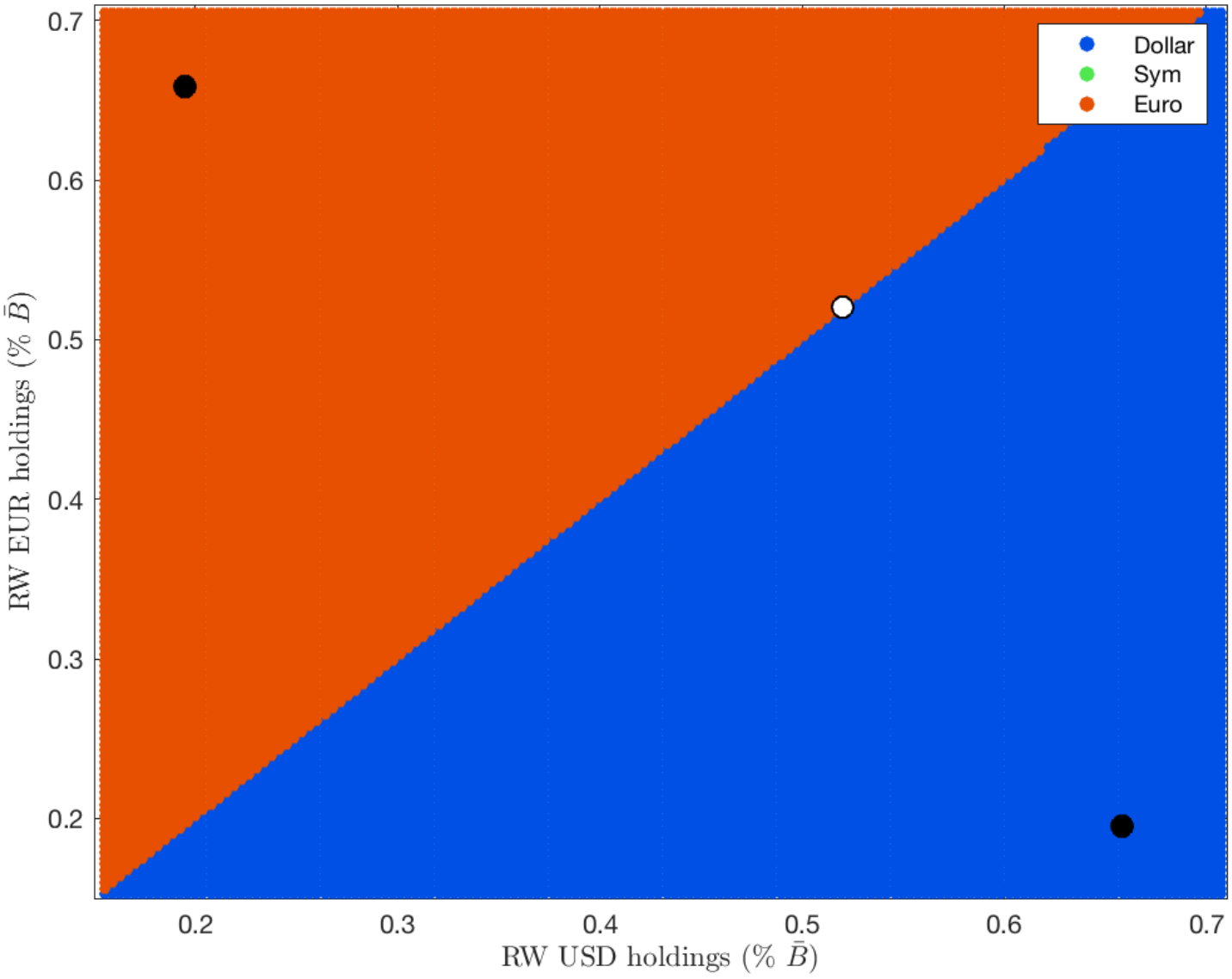
Concept	Value
ROW USD invoice share	89%
Exorbitant privilege ($i^e - i^\$$)	1.50% annually
Gross debt	60% of GDP
ROW trade share	55% of GDP
Funding prob	99%
Import Markup	25% over production cost

Steady-State Moments

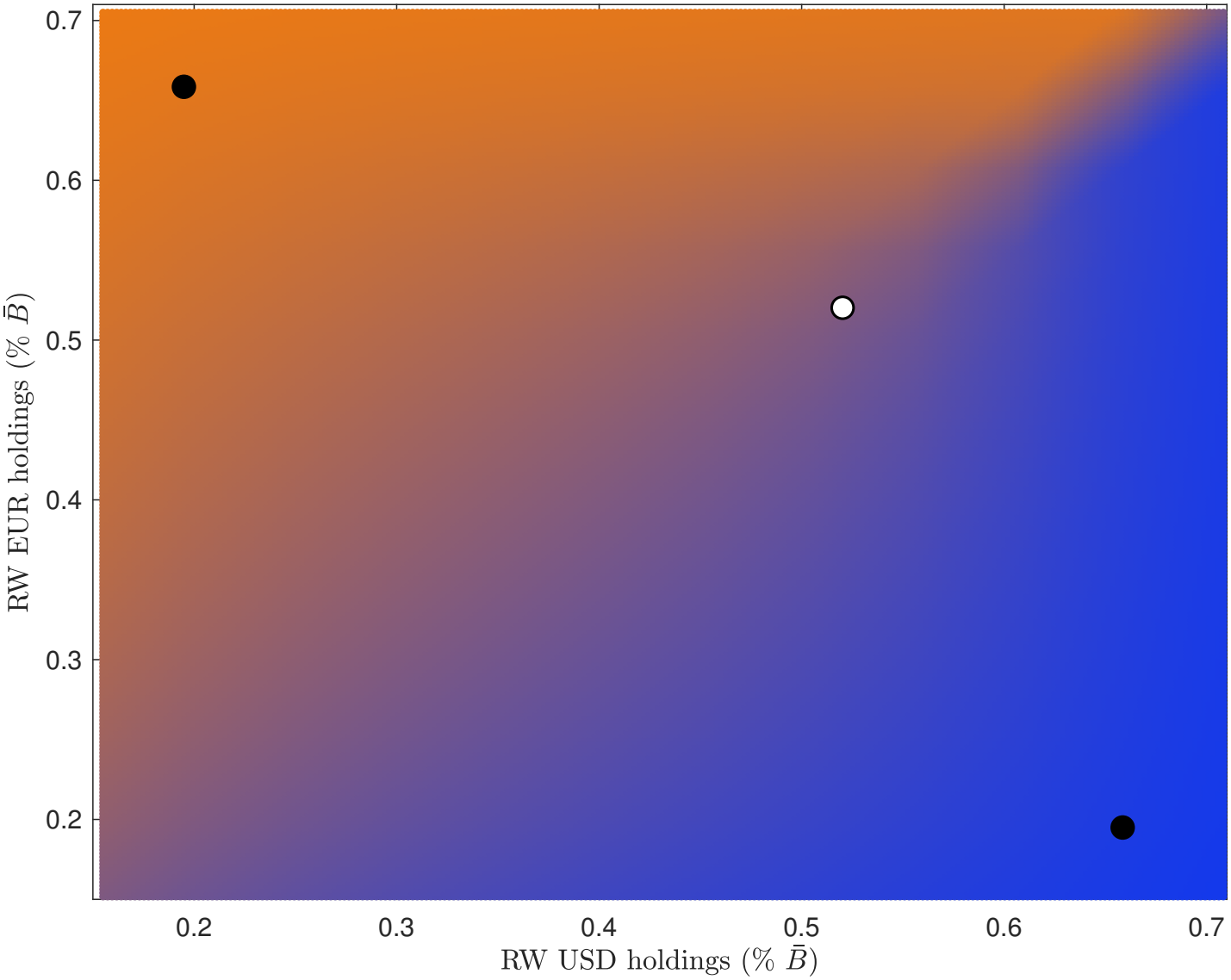
- 3 steady states (Dollar-centric, Euro-centric, multi-polar)
- showing USD and symmetric, EUR is mirror image of USD

	USD Coord.			Symmetric		
Moments	US	EU	RW	US	EU	RW
Dollar Share (X_j)	0.90	0.10	0.89	0.90	0.10	0.50
annualized ($r^{€} - r^{\$}$)	1.50	1.50	1.50	0.00	0.00	0.00
Implied revenue/GDP %	1.01	0.13	-	0.57	0.57	-
NFA/GDP	-0.37	-0.15	0.27	-0.31	-0.31	0.33
Portfolio Home Bias	0.58	0.91	0.00	0.80	0.80	0.00
Trade balance/GDP %	0.32	0.40	-0.38	0.56	0.56	-0.59
Consumption	0.962	0.961	0.896	0.959	0.959	0.898

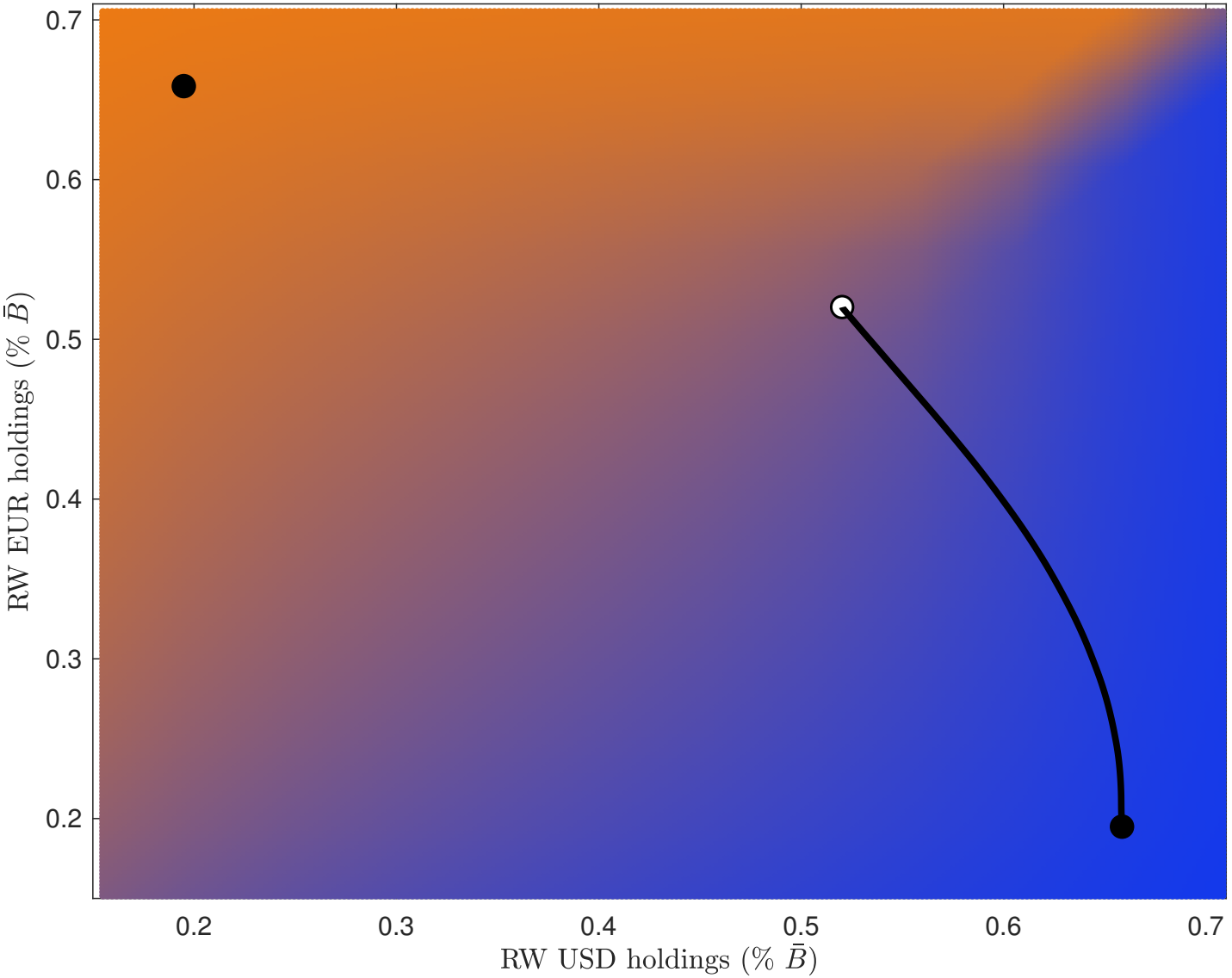
Dynamic Stability and Regions of Attraction



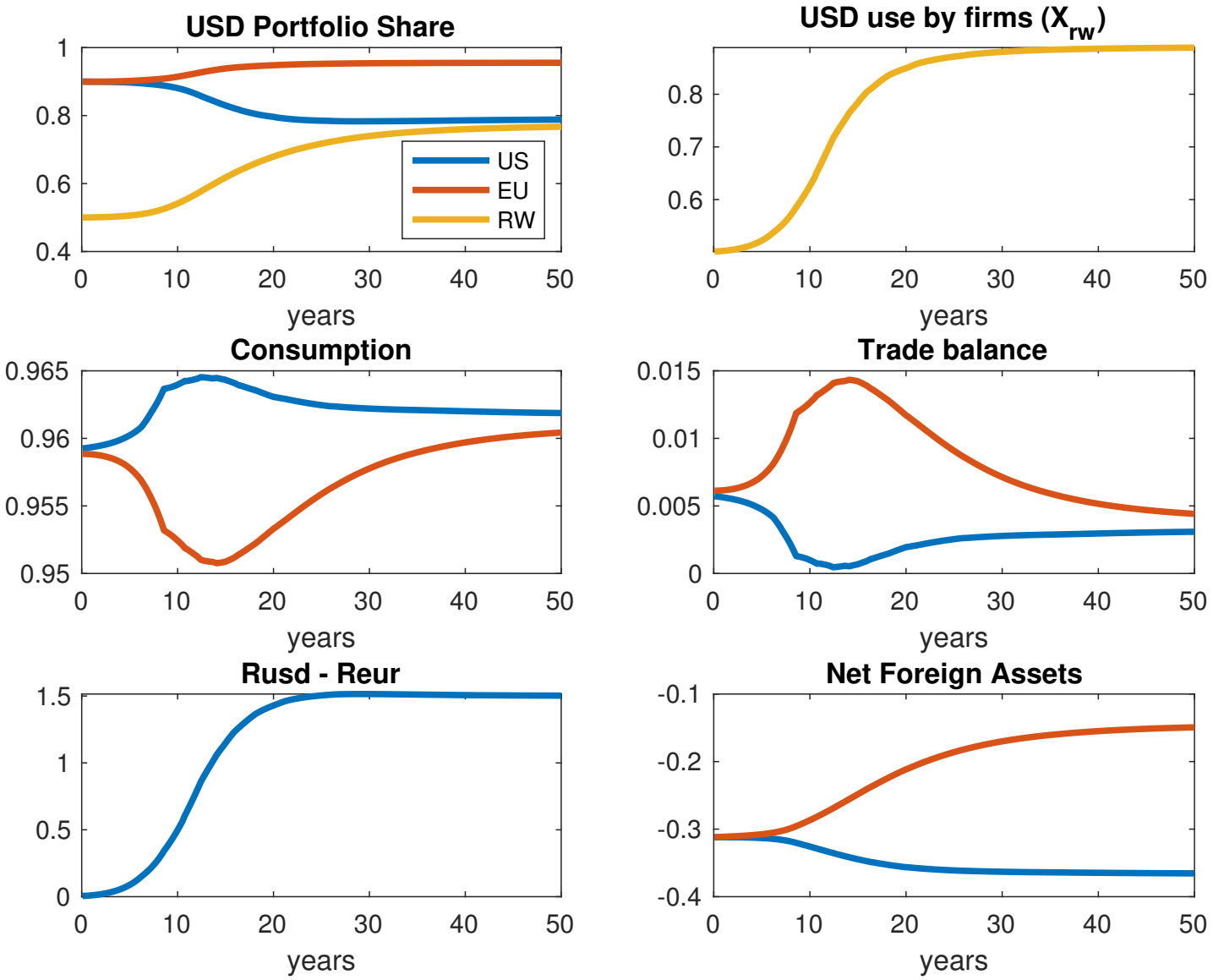
Degree of Dollarization



Degree of Dollarization



Transitions



Welfare Implications

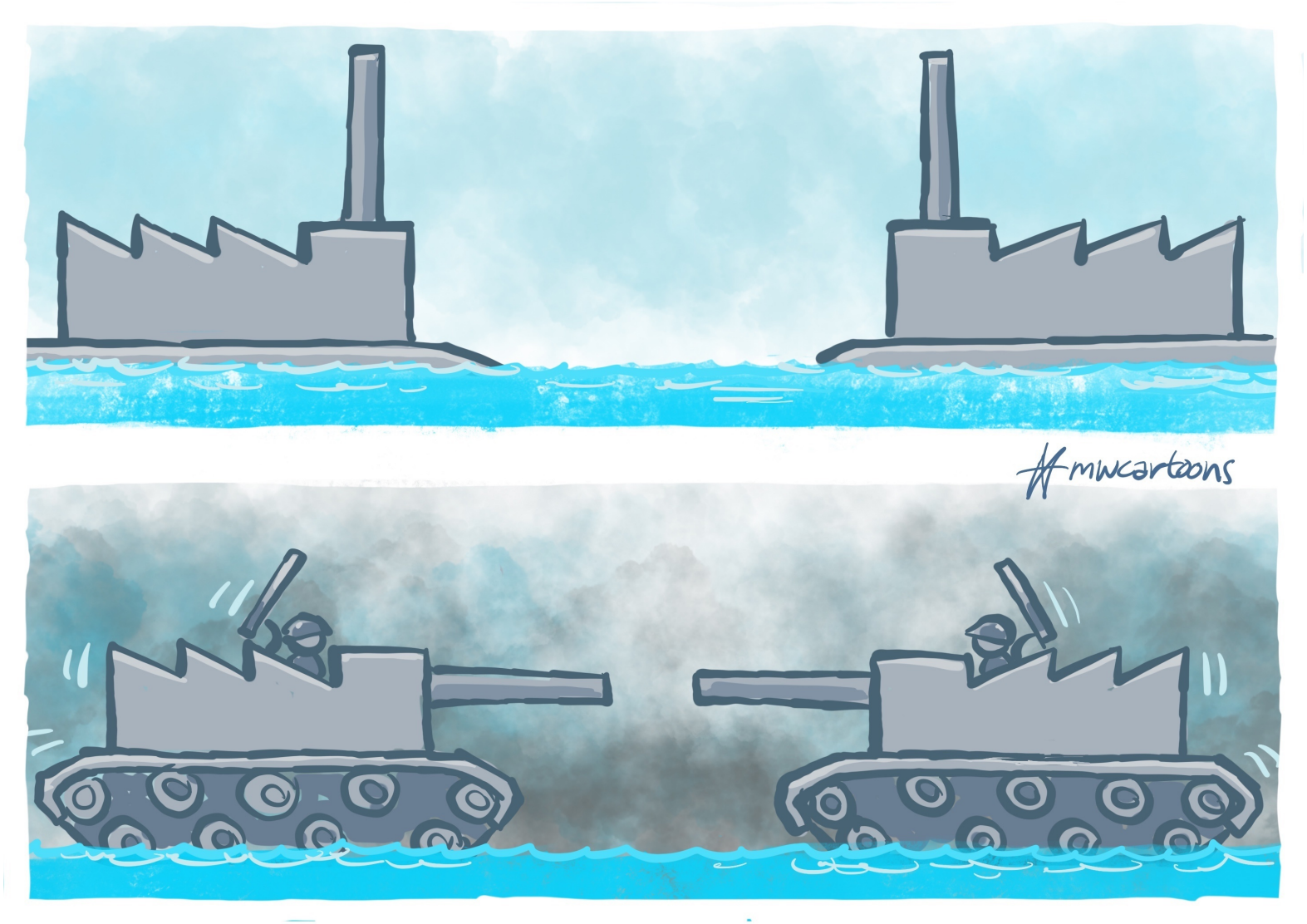
Consumption Equivalent gain relative to symmetric SS

	US	EU	RW
Coordinated Steady State	0.31%	0.21%	-0.22%
Including Transition	0.34%	-0.24%	-0.03%

- Net gains of $\approx$ 0.6% of consumption relative to non-dominant country.
  - $\approx$ 1% of consumption relative to a model with no contracting friction
- Rest of the world loses out in coordinated steady state
- Deadweight losses associated with coordinated equilibrium!
  $\hookrightarrow$ crowding in on a single funding/liquidity source wasteful.

Trade War Scenario

- Introduce 20% tariffs in all countries on all imports



Trade War Scenario

New Steady-State Moments

	USD Coord.			Symmetric		
Moments	US	EU	RW	US	EU	RW
Dollar Share	0.90	0.10	0.98	0.90	0.10	0.50
annualized $(r^{€} - r^{\$})$	1.26	-	-	0.00	0.00	0.00
Implied revenue/GDP %	0.76	0.01	-	0.38	0.38	
Trade balance/GDP %	0.60	0.21	-0.43	0.77	0.77	-0.80
NFA/GDP	-0.38	-0.06	0.23	-0.32	-0.32	0.33
Home Bias	0.49	0.93	0.00	0.80	0.80	0.00
Consumption	0.942	0.946	0.878	0.940	0.940	0.882
(Im. + Ex)/GDP	0.287	0.285	0.371	0.287	0.287	0.368

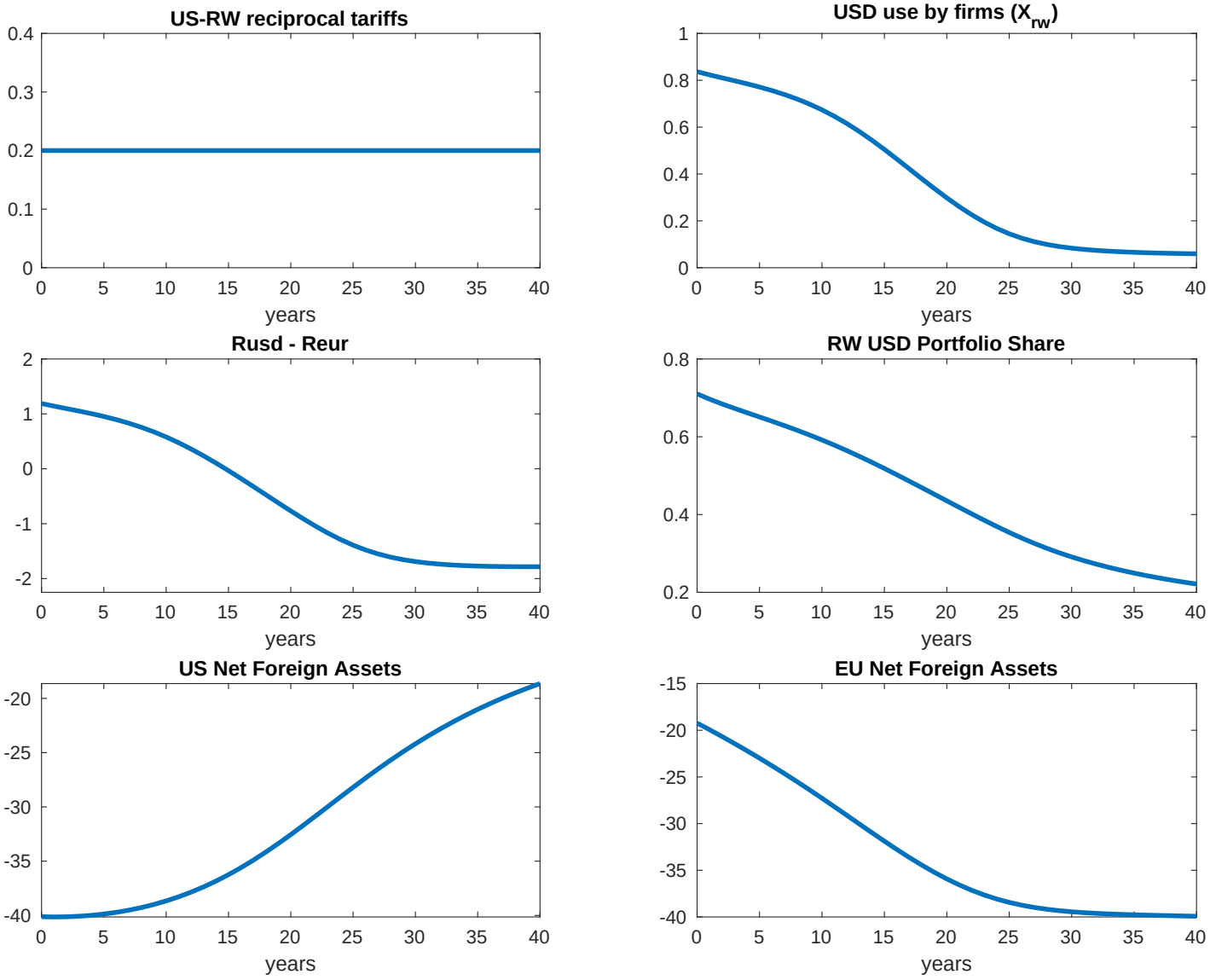
Welfare Implications

Consumption Equivalent loss

	US	EU	RW
New vs old steady state	-2.08%	-1.56%	-2.01%
Including Transition	-2.09%	-1.87%	-1.71%

- The dominant country loses the most out of a trade war
  - Especially relative to the other major country
- We can also use the model to quantify the additional deadweight loss of trade frictions due to lost exorbitant privilege revenue
  - $\approx 0.5\%$ of SS consumption
  - could also be much higher: $> 4\%$ if tariffs are asymmetric

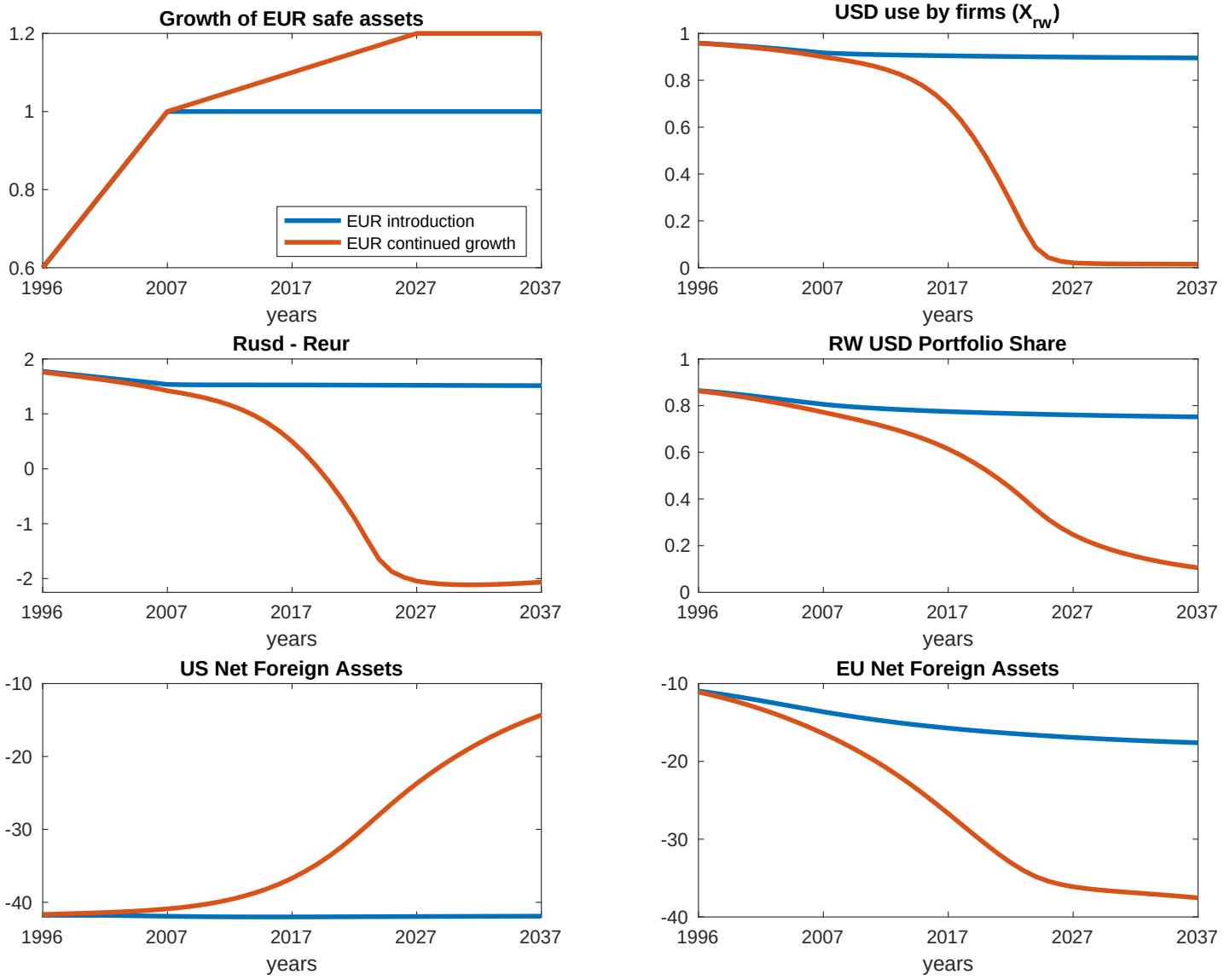
US-RW trade war



Inertia: Emergence of the Euro

- A switch in currency dominance pre-supposes the existence of a viable alternative
- In 1999, many viewed the Euro as the first legitimate challenger of the USD in terms of economic size
- Still, it was puzzling that the formation of the Euro did not seem to do much to erode the USD's position
  - Similarly US economy overtook UK back in late 1800s, USD did not gain dominance until after WWII
- Key: steady state multiplicity leads to inertia and path dependence
  - Existence of two large currencies does not necessarily lead to multi-polar world
    - ★ Symmetric steady state is not stable, emergency of alternative currency only allows for the possibility of a switch in who is dominant
  - For Euro to take over, it needs to grow significantly bigger than the US

Inertia: Emergence of the Euro



Conclusion

- Model with endogenous international medium of exchange and EP
  - complementarity between portfolio holdings and firms' currency choice
  - endogenous states $\Rightarrow$ serve as coordination device
  - model captures several long-run features of int. financial markets
- Model highlights importance of asset availability/financial openness
  - contrasts with trade openness and country size channels
- Welfare gains of dominance *at steady state* are modest, because endogenously dominance leads to large negative NFA
  - Significantly larger welfare gains once you take transition into account
  - Similarly, large losses of *losing* dominance
- While currency regimes are persistent, they are not permanent
  - Policy changes or availability of alternative currency can lead to change