

**P. Benigno, L. Schilling, H. Uhlig**  
**“Cryptocurrencies, Currency Competition, and  
the Impossible Trinity”**

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# Caught In a Web of Euler Equations

A nice paper worth reading—plain economic theory

My five points

- Complete markets assumption can be relaxed
- Interpretation
- Implicit assumptions matter
- Liquidity assumption is key
- Other webs to watch out for

# Complete Markets Assumption Can Be Relaxed

Authors assume

- Identical nominal sdfs,  $\mathcal{M}_{t+1} = \mathcal{M}_{t+1}^* S_t / S_{t+1}$
- Law of one price for gc,  $Q_t = S_t Q_t^*$   
 $\Rightarrow \mathcal{M}_{t+1} \frac{Q_{t+1}}{Q_t} = \mathcal{M}_{t+1}^* \frac{Q_{t+1}^*}{Q_t^*}$  in all states

Less is needed

- Both countries hold asset with return characteristics of gc

$$(A1) \quad \mathbb{E}_t \left[ \mathcal{M}_{t+1} \frac{Q_{t+1}}{Q_t} \right] = \mathbb{E}_t \left[ \mathcal{M}_{t+1}^* \frac{Q_{t+1}^*}{Q_t^*} \right]$$

## Basic argument

1. Home and foreign hold gc

$$1 = \mathbb{E}_t \left[ \mathcal{M}_{t+1} \frac{Q_{t+1}}{Q_t} \right] + L_t \quad \text{and} \quad 1 = \mathbb{E}_t \left[ \mathcal{M}_{t+1}^* \frac{Q_{t+1}^*}{Q_t^*} \right] + L_t^*$$

2. Home and foreign hold domestic monies

$$1 = \mathbb{E}_t [\mathcal{M}_{t+1}] + L_t \quad \text{and} \quad 1 = \mathbb{E}_t [\mathcal{M}_{t+1}^*] + L_t^*$$

3. Home and foreign hold domestic bonds

$$1 = \mathbb{E}_t [\mathcal{M}_{t+1}] I_{t+1} \quad \text{and} \quad 1 = \mathbb{E}_t [\mathcal{M}_{t+1}^*] I_{t+1}^*$$

# Interpretation

What does the result say?

- If (A1) & both countries hold gc & domestic monies circulate & domestic bonds are held ...
- ... then also  $I_{t+1} = I_{t+1}^*$

Is monetary policy constrained? No and yes

- Policy rates equal zero by assumption  
They “constrain” bond rates,  $I_{t+1} = I_{t+1}^*$
- But  $I_{t+1} \neq I_{t+1}^*$  affects money demand

# Implicit Assumptions Matter

Conclusions change if

- Domestic monies pay interest. Then (steps 2. & 3.)

$$1 = \mathbb{E}_t [\mathcal{M}_{t+1}] I_{t+1}^{\$} + L_t \quad \text{and} \quad 1 = \mathbb{E}_t [\mathcal{M}_{t+1}^*] I_{t+1}^{\$*} + L_t^*$$

$$1 = \mathbb{E}_t [\mathcal{M}_{t+1}] I_{t+1}^{\$} I_{t+1} / I_{t+1}^{\$} \quad \text{and} \quad 1 = \mathbb{E}_t [\mathcal{M}_{t+1}^*] I_{t+1}^{\$*} I_{t+1}^* / I_{t+1}^{\$*}$$

*Opportunity costs* of holding money are equal

- Returns are differentially taxed. Ditto
- Interest rates are stochastic (e.g., long-term debt). Then

$$1 = \mathbb{E}_t [\mathcal{M}_{t+1} I_{t+1}] \quad \text{and} \quad 1 = \mathbb{E}_t [\mathcal{M}_{t+1}^* I_{t+1}^*]$$

*Opportunity costs* of holding money are *linked*

# Liquidity Assumption Is Key

Recall basic argument (steps 1. & 2.)

- Home and foreign hold gc and domestic monies

$$1 = \mathbb{E}_t \left[ \mathcal{M}_{t+1} \frac{Q_{t+1}}{Q_t} \right] + L_t \quad \text{and} \quad 1 = \mathbb{E}_t \left[ \mathcal{M}_{t+1}^* \frac{Q_{t+1}^*}{Q_t^*} \right] + L_t^*$$

$$1 = \mathbb{E}_t [\mathcal{M}_{t+1}] + L_t \quad \text{and} \quad 1 = \mathbb{E}_t [\mathcal{M}_{t+1}^*] + L_t^*$$

But “ $L_t \neq L_t^*$ ” and “ $L_t^* \neq L_t^*$ ” when liquidity services are less than perfect substitutes globally

- Portfolio balance effect, interior equilibrium and  $I_{t+1} \neq I_{t+1}^*$
- See Irizawa (2020)? Online appendix

# Other Webs To Watch Out For

With linearity, over determinacy is rampant. Examples

- Two households hold money and bonds

Their income tax rates differ

Problem?

- Banks are long/short in reserves, cash, deposits

Households hold deposits, cash

Households globally indifferent between reserves and cash?

(If so, don't worry about CBDC)



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