Platforms and Tokens

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Introduction

- How to regulate private "digital currencies"
  - Regulation of fees for exchanging tokens with dollars? ("interoperability" with dollars)
  - Regulation of fees for exchanging tokens between platforms? ("interoperability" b/n platforms)

- We build a model to:
  - Understand how platforms design/manage private digital currencies ("IO approach")
  - Focus on interaction between **market design** and **currency design**
  - Study the impact of monetary policy and interoperability regulation on the design problem

- Policy implications:
  1. $\uparrow$ CB money growth rate $\Rightarrow \downarrow$ private platform markups
  2. Introducing perfect "digital interoperability" between currencies (e.g. CBDC) implies:
     - Private platform create "stable tokens" (i.e. tokens with a fixed exchange rate to money)
     - Private platform moves from "low markups & high volume" $\rightarrow$ "high markups & low volume"

Literature Review

- ⋆ Digital Currencies
  Gans & Halaburda (2013), Fernadez-Villaverde (2018), Cong, Li & Wang (2019); Rogoff & You (2019); Chiu et al. (2019); Benigno et al. (2019); Brunnermeier et al. (2020), Piazzesi et al. (2019); Keister & Sanches (2020); Uhlig (2019)
  - ⋆ This talk: focuses on private centralised digital currencies

- ⋆ Currency Competition
  Hayek (1976); Kareken & Wallace (1981); Brunnermeier & Sannikov (2018)
  - ⋆ This talk: focuses on currency competition across platforms (solving an IO problem)

- ⋆ Platform & Intermediaries
  Rubinstein & Wolinsky (1987), Rochet & Tirole (2002, 2003, 2006), Spulber (1999, 2018)
  - ⋆ This talk: focuses on integrating market and currency design

Model Setup

- ⋆ Continuous time, infinite horizon
- ⋆ One "input" good; one final consumption good (numeraire)
- ⋆ Continuum of buyers endowed with wealth a and of sellers endowed with "input" good:
- ⋆ Two Platforms $\mathcal{P}$ with platform-specific currencies $\mathcal{C}$:

Platform $\mathcal{P}$		Currency $\mathcal{C}$	
0		0	
1		1	

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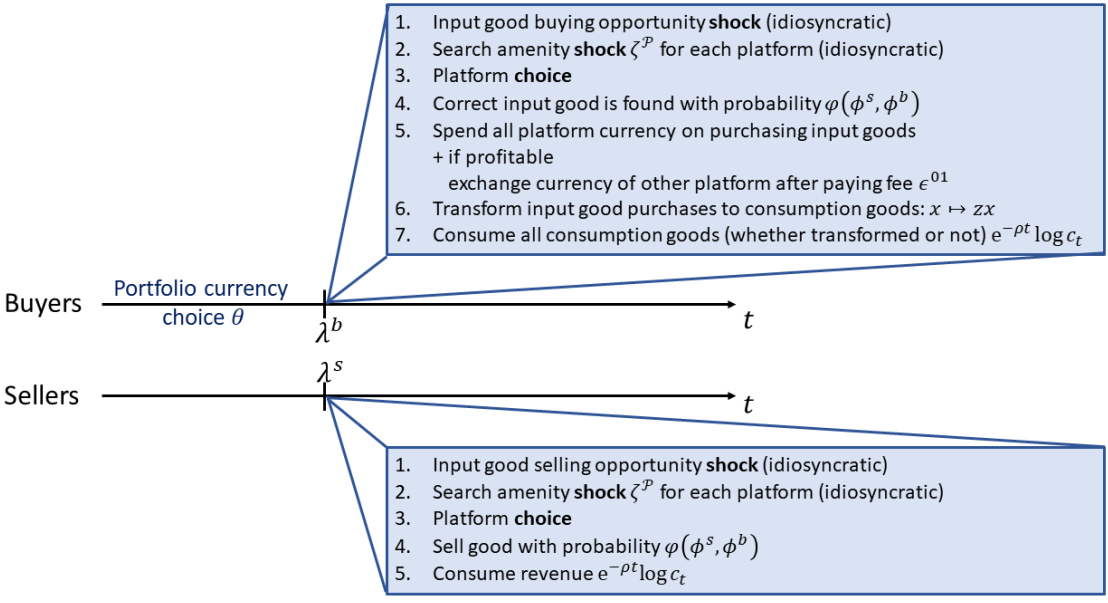
Platform $\mathcal{P}$		Currency $\mathcal{C}$	
0	p^0	ϵ^{10} 0 exchange	μ^{M0}
1	$p^1(1+\psi^1)$ mark-up	ϵ^{01} fee 1	μ^{M1} token growth


1. Input good buying opportunity **shock** (idiosyncratic)
2. Search amenity **shock** $\zeta^{\mathcal{P}}$ for each platform (idiosyncratic)
3. Platform **choice**
4. Correct input good is found with probability $\varphi(\phi^s, \phi^b)$
5. Spend all platform currency on purchasing input goods
+ if profitable
exchange currency of other platform after paying fee ϵ^{01}
6. Transform input good purchases to consumption goods: $x \mapsto zx$
7. Consume all consumption goods (whether transformed or not) $e^{-\rho t} \log c_t$
Buyers
Portfolio currency choice θ
λ^b
t
λ^s
Sellers
t
1. Input good selling opportunity **shock** (idiosyncratic)
2. Search amenity **shock** $\zeta^{\mathcal{P}}$ for each platform (idiosyncratic)
3. Platform **choice**
4. Sell good with probability $\varphi(\phi^s, \phi^b)$
5. Consume revenue $e^{-\rho t} \log c_t$

Buyer Problem: FOCs

- ⋆ bang-bang: spend all of (i) token (ii) money on "input" good or consume endowment
- ⋆ The buyer's choice of $\theta := \theta^1$ satisfies:

$$\underbrace{\mu^{q1} - \mu^{q0}}_{\substack{\text{Excess return} \\ \text{on currency 1}}} = - \underbrace{(\rho + \lambda)\xi \partial_\theta E\left[\text{Benefit}(\theta)\right]}_{\substack{\text{Marginal benefit of having more} \\ \text{currency 1 when buying goods}}}$$

where $E\left[\text{Benefit}(\theta)\right]$ is the expected profit (per unit a) from goods purchases across platforms (expectation with respect to platform ammenity $\zeta^{\mathcal{P}i} \sim \text{Gu}(\gamma + 1, -(\gamma + 1)\mathcal{E})$):

Precautionary Motive For Holding Tokens

- Buyers choose their portfolio to minimize expected exchange rate costs
- We also have that:
  - $\uparrow \psi^1$ (markup on platform 1) $\Rightarrow \downarrow \theta$ (less precautionary motive because platform is less attractive)
  - $\uparrow \epsilon^{01}$ (into token fee) $\Rightarrow \uparrow \theta$ (more precautionary motive because entry costs are higher)

Platform Problem

⋆ The platform (with full commitment) chooses $(\psi^1, \mu^{M1}, \epsilon^{01}, \epsilon^{10})$ to select the market equilibrium that maximizes profit each period (since the equilibrium is stationary):

$$\max_{\psi^1, \mu^{M1}, \epsilon^{01}, \epsilon^{10}} \left\{ \underbrace{\sum_{\mathcal{C}} \left(\frac{1+\psi^1}{1-\epsilon^{1\mathcal{C}}} \right) p^1 X^{b1\mathcal{C}} - p^1 X^{s1}}_{\text{Markup \& Into-Token Fee Rev.}} + \underbrace{\left(\frac{1}{1-\epsilon^{01}} - 1 \right) p^0 X^{b01}}_{\text{Out-of-Token Fee Rev.}} + \underbrace{\mu^{M1}\theta}_{\text{Seigiorage Rev.}} \right\}$$

subject to:

. . . goods market
. . . currency market
. . . portfolio choice
. . . purchase decision
. . . belief consistency

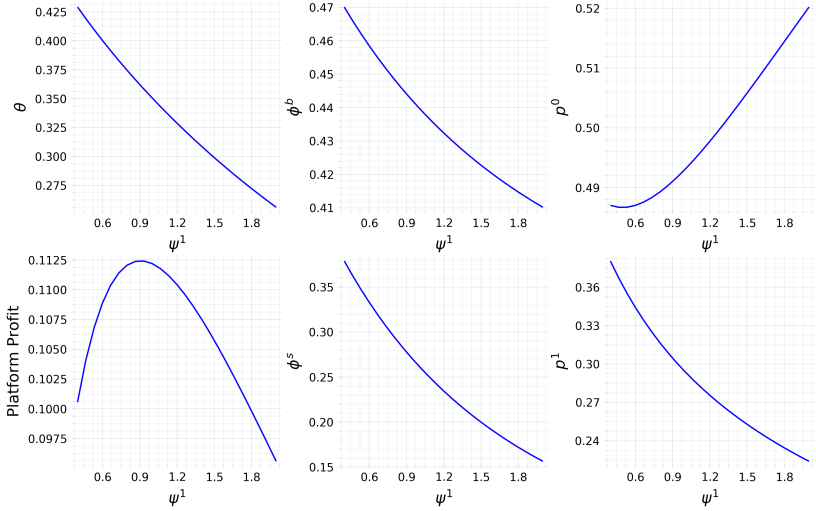
Platform Trade-offs

- Platform profit (substituting in the currency market):

$$\underbrace{\sum_{\mathcal{C}} \left(\frac{1+\psi^1}{1-\epsilon^{1\mathcal{C}}} \right) p^1 X^{b1\mathcal{C}} - p^1 X^{s1}}_{\text{Markup \& Into-Token Fee Rev.}} + \underbrace{\left(\frac{1}{1-\epsilon^{01}} - 1 \right) p^0 X^{b01}}_{\text{Out-of-Token Fee Rev.}} + \underbrace{\mu^{M1}\theta}_{\text{Seigiorage Rev.}}$$

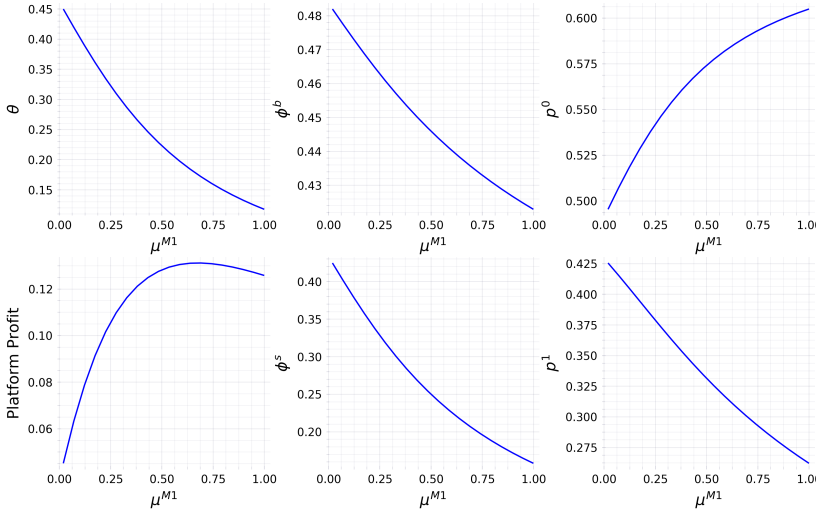
- $\uparrow \psi^1$ (platform markup) $\Rightarrow \downarrow X^{b1\mathcal{C}} \Rightarrow \downarrow \theta \Rightarrow \downarrow$ seigniorage revenue
- $\uparrow \mu^{M1}$ (token growth) $\Rightarrow$ token "inflation" $\Rightarrow \downarrow \theta \Rightarrow \downarrow X^{b1\mathcal{C}} \Rightarrow \downarrow$ markup revenue
- $\uparrow \epsilon^{01}/\epsilon^{10} \Rightarrow \uparrow \theta$ and $\downarrow \chi^{\mathcal{PC}} \Rightarrow$ ambiguous impact on $X^{b1\mathcal{C}}$

Increasing ψ^1 Decreases Trade Volume



Parameters: $\rho = 0.05$, $\lambda = 1.0$, $\gamma = 1$, $z = 2$, $\epsilon^{01} = \epsilon^{10} = 1$, $\mu^1 = \mu^0 = 0.05$, $\varphi = 1.0$

Increasing μ^{M1} Makes Currency Less Attractive



Parameters: $\rho = 0.05$, $\lambda = 1.0$, $\gamma = 1$, $z = 2$, $\epsilon^{01} = \epsilon^{10} = 1$, $\mu^0 = 0.05$, $\psi^1 = 0.05$, $\varphi = 1.0$

Two Policy Experiments

1. Increasing the growth rate of central bank money
2. Imposing perfect interoperability (or "CBDC legal tender")

1. Increasing The Growth Rate of CB Money

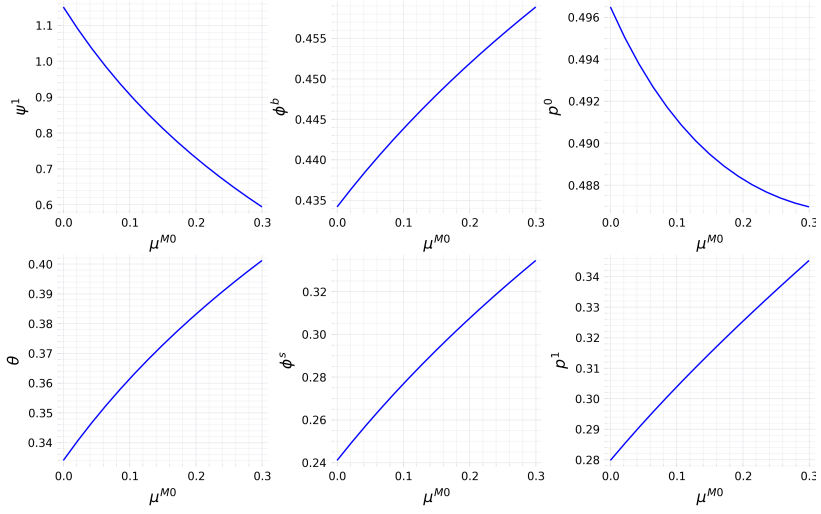
- Focus on special case (for simplicity)
  - no currency exchange at platforms ("no interoperability"): $\epsilon^{01} = \epsilon^{10} = 1$
  - "stable coins" $(q^1 = q^0) \Longrightarrow \mu^{M1} = \mu^{M0}$

- Platform chooses ψ^1 to balance markup and seignorage revenue

$$\max_{\psi^1} \left\{ \psi^1 p^1 \phi^{s\mathcal{P}}(p^0, p^1) + \mu^{M0}\theta \right\} \quad s.t. \quad \text{goods market clearing}$$

- $\uparrow \mu^{M0} \Rightarrow \uparrow$ marginal benefit of increasing θ
  - Platform $\downarrow \psi^1$ to make the platform more attractive and $\uparrow \theta$
    (i.e. the platform reoptimizes from markup revenue to seigiorage revenue)
  - End result is that platform profit increases (outside currency option is worse)

1. CB Money Growth Lowers Markups

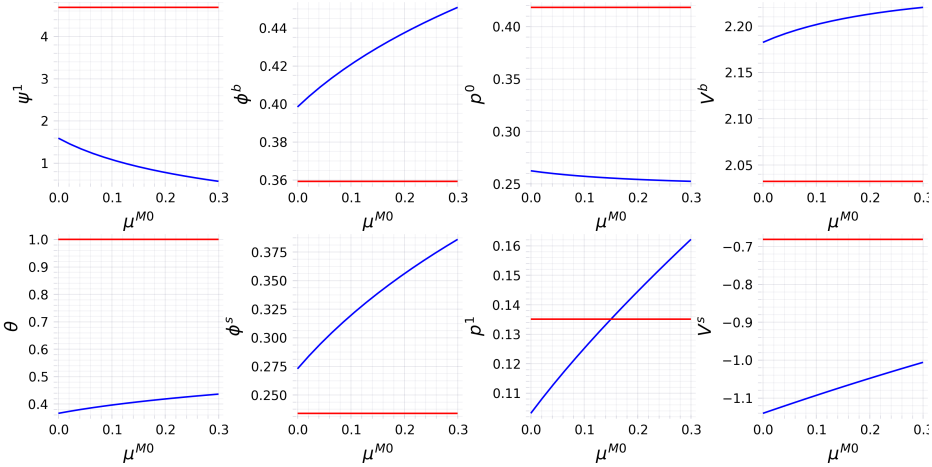


Parameters: $\rho = 0.05$, $\lambda = 1.0$, $\gamma = 0.5$, $z = 2$, $\epsilon^{01} = \epsilon^{10} = 1$, $\varphi = 1.0$

2. Interoperability: Platform Problem

- Interoperability: $\epsilon^{01} = \epsilon^{10} = 0$
  - $\epsilon^{01} = 0$: there is a central bank digital currency (CBDC) that is legal tender on all platforms
  - $\epsilon^{10} = 0$: regulate against private currency "exit fees"
- Platform chooses $q^1 = q^0$ ("stable coins") which requires $\mu^{M1} = \mu^{M0}$
  - Buyers are indifferent about which currency to pay with and so hold currency with higher return
  - In equilibrium platform chooses $\mu^{M1} = \mu^{M0}$ ("stable coins") and buyers choose $\theta = 1$

2. Interoperability: Higher Markups and Lower Volume



Red line depicts Interoperability ($\epsilon^{01} = \epsilon^{10} = 0$); Blue line depicts No-Interoperability ($\epsilon^{01} = \epsilon^{10} = 1$);
Parameters: $\rho = 0.05$, $\lambda = 1.0$, $\gamma = 0.5$, $z = 2$, $\epsilon^{01} = \epsilon^{10} = 1$, $\varphi = 1.0$

Conclusion

- Constructed new model of market and currency design by platforms
- Platform faces trade-off between:
  - Extracting seigniorage revenue (e.g. high token growth or relatively high "into-token" fees)
  - Extracting markup revenue (e.g. high markups or relatively low "into-token" fees)
- Increasing the central bank money growth rate leads to lower markups
- Introducing perfect "digital interoperability" between currencies (e.g. CBDC) implies:
  - Private platform create "stable coins"
  - Private platform moves from "low markups & high volume" $\rightarrow$ "high markups & low volume"

Next Steps

- ⋆ Long term contracting between platforms and sellers
- ⋆ Competition between private platforms

Thank you