

Platforms, Tokens, and Interoperability

Markus K. Brunnermeier

Jonathan Payne

Princeton University

Virtual Seminar Series on CBDC

18. November 2021



Tech Trends

- Digital platforms
 - Digital tokens
 - CBDC
- Interaction
- matching technology
payment technology

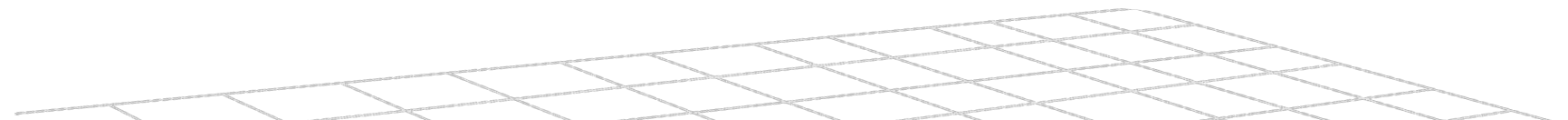
Policy Questions

- How to regulation **competition** between

- **Public Market** ↔ **Platform** (incumbent) ↔ **Platform** (entrant)
- \$ (CBDC) ↔ Private Token (stable coin) ₿ ↔ Private Token ₿'

- Should CBDC be legal tender?

- Key: **Interoperability**



Forms of Interoperability

1. Token **Exchangeability** (without fee)
 - Token platform cannot charge exchange (exit) fee
2. Token **Acceptability** (for contracting and payment)
 - All tokens are accepted on all platforms
 - CBDC as legal tender
3. Ledger **Portability**
 - Entrant platform can take over incumbent ledger



Forms of Interoperability

1. Token **Exchangeability** (without fee)
 - Token platform cannot charge exchange (exit) fee

➡ avoids lock-in effect
lower markup on retail platform
2. Token **Acceptability** (for contracting and payment)
 - All tokens are accepted on all platforms
 - CBDC as legal tender

➡ destroys commitment via smart contracts ➡ less credit
3. Ledger **Portability**
 - Entrant platform can take over incumbent ledger

➡ new platform can't credibly inflict defaults on old platform



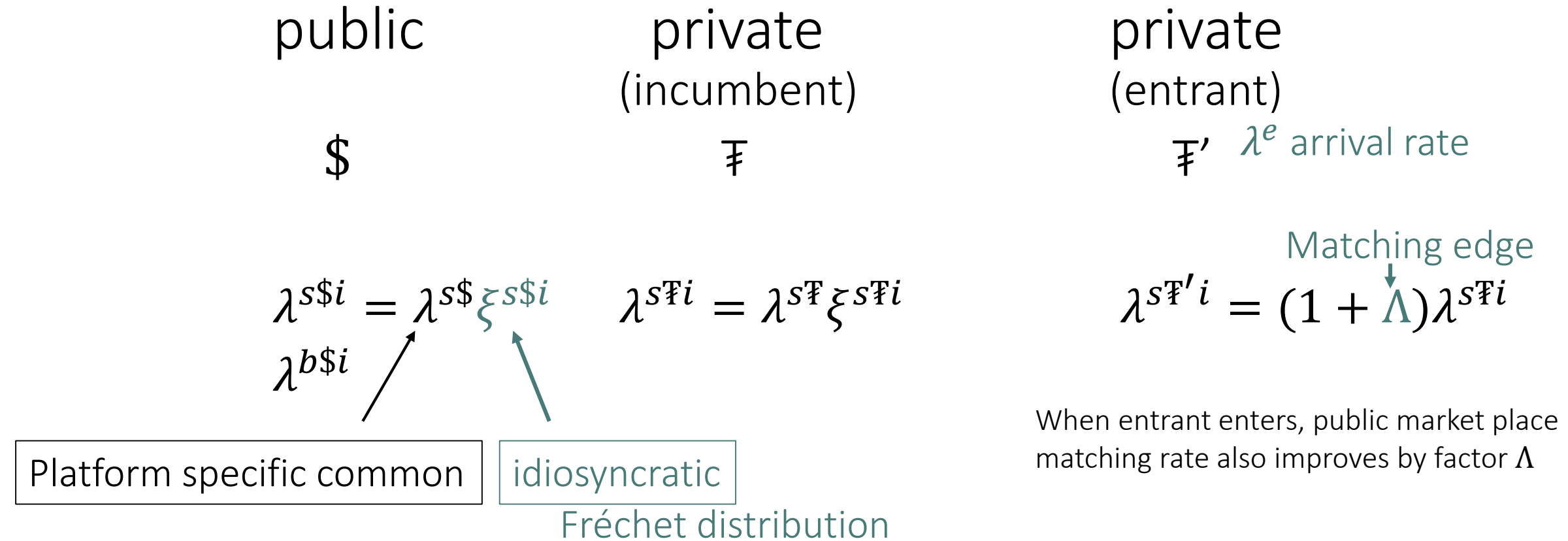
Model ingredients – big picture

- Usual: Matching model with matching intensity λ
No tokens
Agents have no platform choice
- Here: “Strategic platform” competes with public market + entrant platform
Platforms issue tokens
 - Choice:
 - On retail space: mark-up ψ
 - On payment space: interoperability of token, credit interest rate (κ)
- Agents (buyers/sellers) - risk-neutral with time preference rate ρ
 - Discrete Choice:
 - Which market/platforms



Model setup

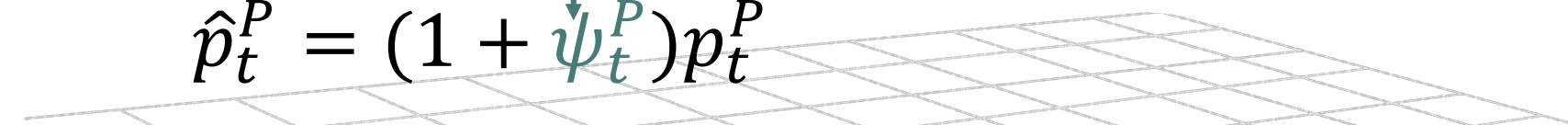
- Platforms
 - Payment technology
 - Matching technology
 - Selling arrival rate
 - Buying arrival rate



- Timing of agents (in cts. time)
 - Agent observes trading rates on platforms
 - Agents decides which platform to “search”
 - Trading opportunities arise
 - All “active agents trade competitively at platform specific price for seller for buyer

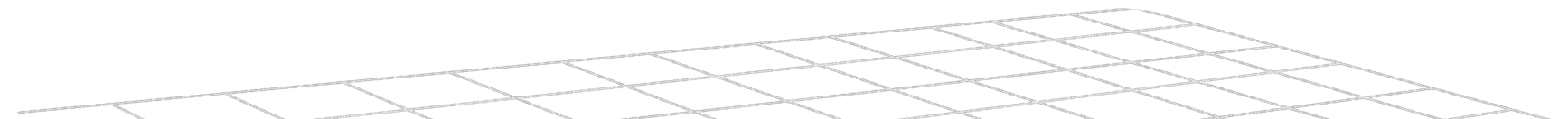
$$\hat{p}_t^P = (1 + \psi_t^P) p_t^P$$

Mark-up ψ_t^P



Roadmap

- Motivation and Preview
- **Model 1: without credit**
 - Sellers hold tokens until the opportunity to become buyer
- **Model 2: with credit** via smart contracts
 - Buyers borrow from platform until opportunity to become seller

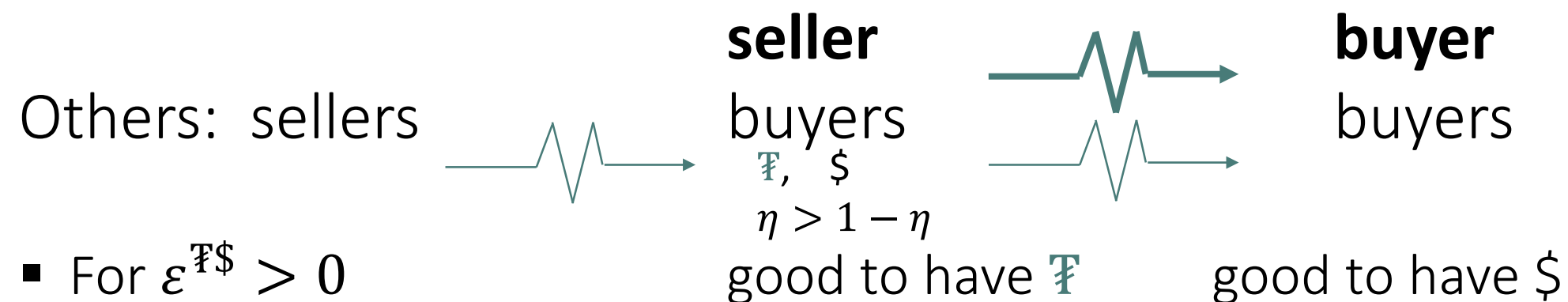


Model 1 (without Credit)

- **Platform** sets
 - mark-up ψ for goods price
 - exchange (exit) fee $\varepsilon^{\mathbb{T}\$}$, $\varepsilon^{\mathbb{T}\mathbb{T}'}$

- **Agents**

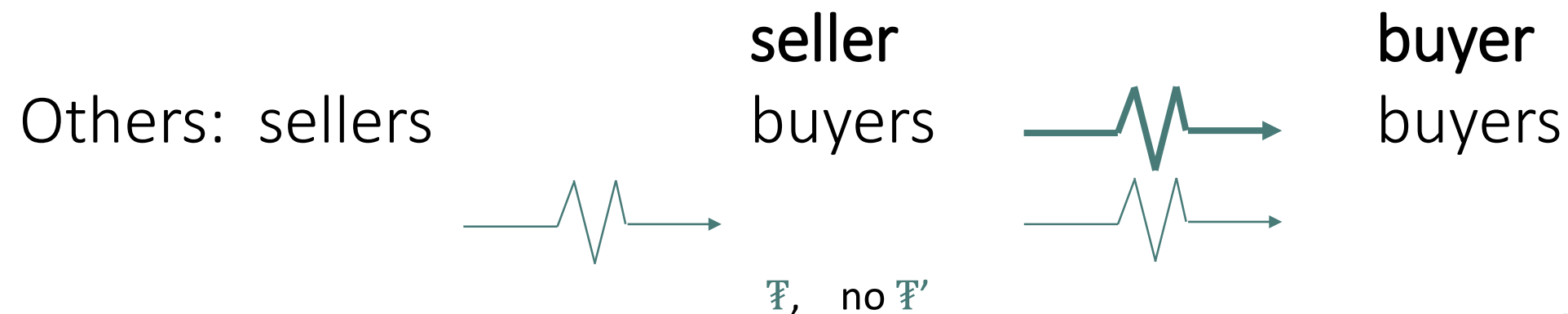
- *Decision between \mathbb{T} and $\$$*



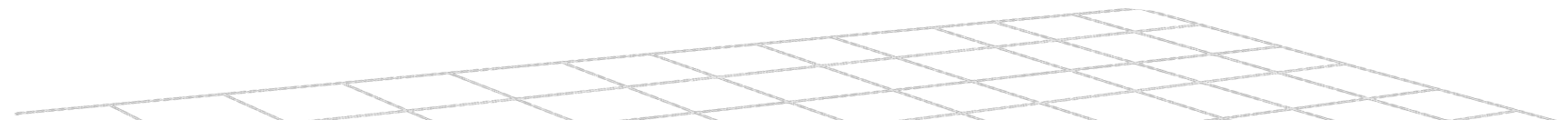
- For $\varepsilon^{\mathbb{T}\$} > 0$

➔ **Anticipated Lock-in Effect**
(agents stay away from lock-in)

- *Occasional decision between \mathbb{T} and \mathbb{T}'* (when λ^e)



➔ **Lock-in Effect**
Past sellers had no opportunity to hold \mathbb{T}'

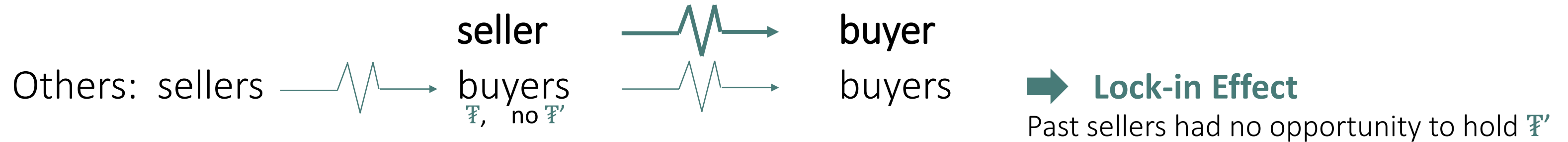


Model 1 (without Credit)

- **Platform** sets
 - mark-up ψ for goods price
 - exchange (exit) fee $\varepsilon^{\mathbb{T}\$}$, $\varepsilon^{\mathbb{T}\mathbb{T}'}$

- **Agents**

- *Occasional decision between \mathbb{T} and \mathbb{T}' (when λ^e)*



- **Token lock-in effect limits competition across (retail) platforms**

- For $\varepsilon^{\mathbb{T}\$} = 0$ and $\Lambda > 0$, platform sets

$\Rightarrow \varepsilon^{\mathbb{T}\mathbb{T}'} = 1$ maximum exchange rate fee

$\Rightarrow \psi^{\$} = \left(\frac{1}{1+\Lambda}\right)^{\frac{\xi^s + \xi^b}{1+\xi^b}} \left(\frac{1}{1-\eta}\right)^{\frac{1}{1+\xi^b}} - 1$ decreases in entrant's edge Λ

) **Interaction**
token & retail

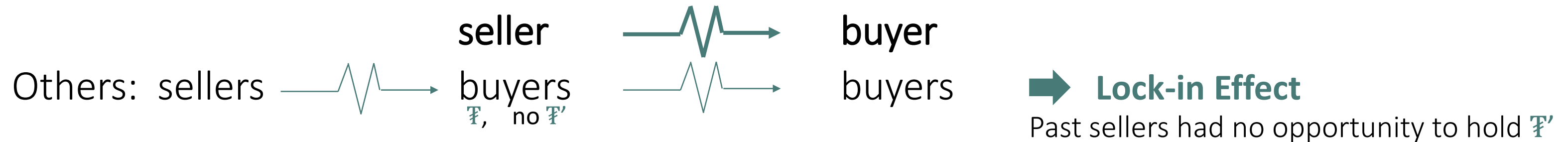


Model 1 (without Credit)

- **Platform** sets
 - mark-up ψ for goods price
 - exchange (exit) fee $\varepsilon^{\mathbb{F}\$}$, $\varepsilon^{\mathbb{F}\mathbb{F}'}$

- **Agents**

- *Occasional decision between \mathbb{F} and \mathbb{F}'* (when λ^e)



- **Token lock-in effect limits competition across (retail) platforms**

- For $\varepsilon^{\mathbb{F}\$} = 0$ and $\Lambda > 0$, platform sets

$\Rightarrow \varepsilon^{\mathbb{F}\mathbb{F}'} = 1$ maximum exchange rate fee

$\Rightarrow \psi^{\$} = \left(\frac{1}{1+\Lambda}\right)^{\frac{\xi^s + \xi^b}{1+\xi^b}} \left(\frac{1}{1-\eta}\right)^{\frac{1}{1+\xi^b}} - 1$ decreases in entrant's edge Λ

) **Interaction**
token & retail

- For $\Lambda = 0$ and $\varepsilon^{\mathbb{F}\mathbb{F}'} = 0$ (**exchange interoperability**)

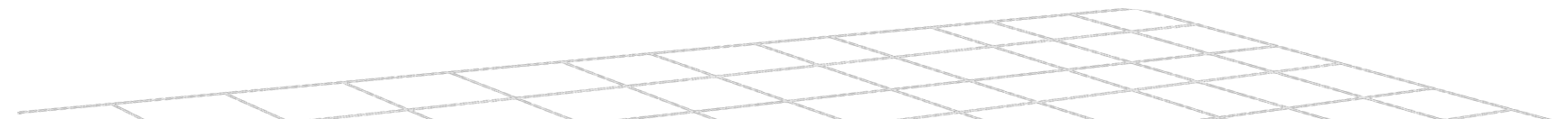
$\psi^{\$} = 0$

- Implementation of $\varepsilon^{\mathbb{F}\mathbb{F}'} = 0$ via “CBDC as digital ledger”



Roadmap

- Motivation and Preview
- **Model 1: without credit**
 - Sellers hold tokens until the opportunity to become buyer
- **Model 2: with credit** via smart contracts
 - Buyers borrow from platform until opportunity to become seller



Model 2 (with Credit and Production)

- Matching **platform** (not intermediary) (eBay, not Amazon)
 - $\psi = 0$ no mark-ups (by assumption)
 - κ amount of credit via smart contract
- **Agents** (with Production)

buyers

buyer

of 1 input good

seller

of $z > 1$ output goods

- \mathbb{F} vs. $\mathbb{\$}$

- Enforceability

Rate

agent's payoff

platform payoff

Default

- Output sold on \mathbb{F} platform

@ $\lambda^{\mathbb{F}i}$

$(1 - \kappa)zp^{\mathbb{F}}$

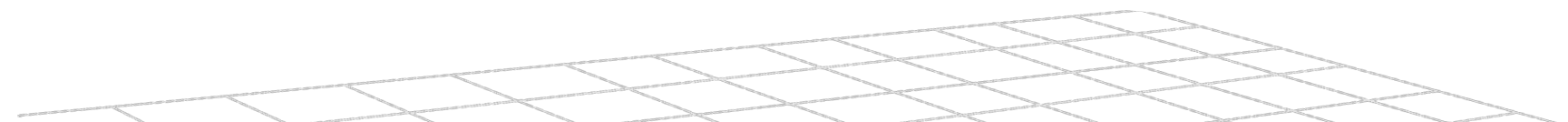
$\kappa p^{\mathbb{F}}$

- Output sold on $\mathbb{\$}$ platform

@ $\lambda^{\mathbb{\$}i}$

$\gamma_{(\kappa)}zp^{\mathbb{\$}}$ 0

if sold on $\mathbb{\$}$ platform



Model 2 (with Credit and Production)

- Matching **platform** (not intermediary) (eBay, not Amazon)

- $\psi = 0$ no mark-ups (by assumption)
 - κ amount of credit via smart contract

- Agents** (with Production)

buyers

buyer

of **1** input good

seller

of $z > 1$ output goods

- \mathbb{F} vs. $\$$

- Enforceability

Rate

agent's payoff

platform payoff

Default

- Output sold on \mathbb{F} platform

@ $\lambda^{\mathbb{F}i}$

$(1 - \kappa)zp^{\mathbb{F}}$

$\kappa p^{\mathbb{F}}$

- Output sold on $\$$ platform

@ $\lambda^{\$i}$

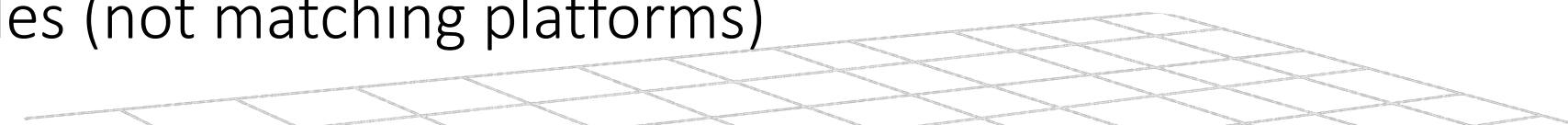
$\gamma_{(\kappa)}zp^{\$}$ 0

if sold on $\$$ platform

- Without acceptability: Default and sell for $\$$ if $\lambda^{\mathbb{F}i} - \lambda^{\$i}$ is small

- With acceptability** (e.g. via CBDC as legal tender) ➡ kills of commitment via smart contracts

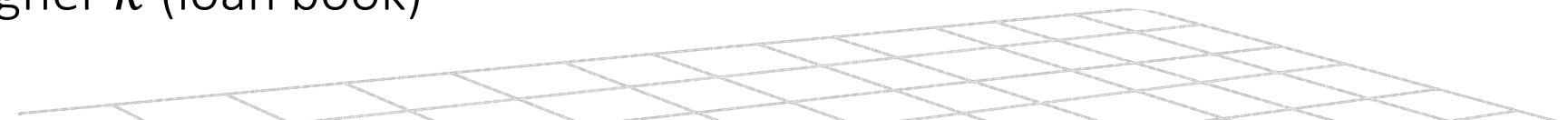
- ➡ Credit only from intermediated trades (not matching platforms)



Model 2 (with Credit and Production)

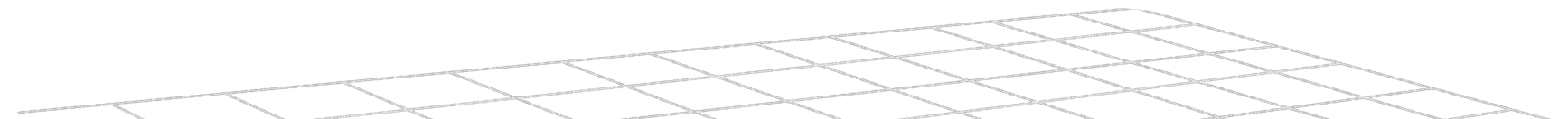
- Matching **platform** (not intermediary) (eBay not Amazon)
 - $\psi = 0$ no mark-ups (by assumption)
 - κ amount of credit via smart contract
- **Agents** (with Production)
 - \mathbb{T} vs. \mathbb{T}' entrant token platform (with arrival occurrence λ^e)
 - Entrant platform invites agents/creditors, who can default on incumbent platform
 - Incumbents platform's loss increases with size of its loan book
 - Lemma: For $\Lambda = 0$ (no competitive edge)
entrance = paying off entrant (via killer acquisition)
 - As if incumbent faces occasionally reoccurring killer acquisition costs
 - Higher λ^e \rightarrow lower κ (smaller loan book)
 - **Portability Interoperability**
 - Entrant can not credibly commit not to take over incumbent's loan book
 - Lower killer acquisition costs \rightarrow higher κ (loan book)

\rightarrow **Anti-Lock-in Effect**



Conclusion

- Platforms and token issuers - interaction
 - *Extra:* Should retail platforms and payment platforms be allowed to merge?
- How to regulate vs. compete with platforms with CBDC?
 - Interoperability implementation as CBDC
 - Exchange
 - Acceptability CBDC as legal tender
 - Portability (ledger)
- CBDC as legal tender
 - restores competition between private platforms (lower mark-ups)
 - hurts credit provision via smart contracts
- Portability of ledger
 - Reduces killer acquisitions and avoids excessive entry of platforms



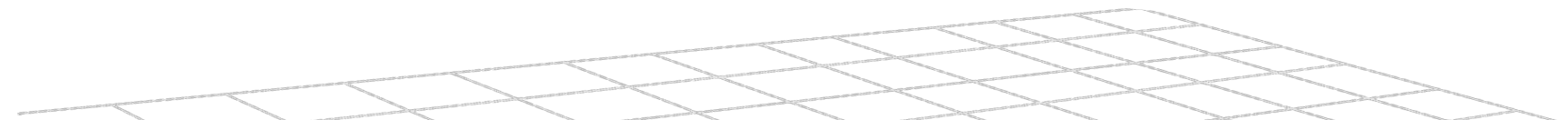
Extra Slides



1. Inversion of “Information Advantage”

- Information advantage for customer
 - Borrower
 - Insurance client, ...
- soon, for seller/platform
 - Lender (platform) “will know more about me than I know about myself”
 - Insurance company
 - Asset managers, ...
- Privacy regulation
- Customer has multiple attributes and knows most of them, but only platform can better connect/statistically infer them
 - STATISTICAL INFORMATION
 - Correlation between attributes
 - Traditional example:
 - I like a red car
 - Insurance companies knows (from big data) that drivers of red cars are more accident prone

Informed principal problem



1. From Adverse Selection to Inverse Selection

■ First generation

Rothschild Stiglitz

- Asymmetric information matters for markets
- Markets can unravel, so role for market design
- Coverage is increasing in riskiness (*Counterfactual!*)

■ Second generation – advantageous selection

Finkelstein, Einav, Fang

- Asymmetric information is multidimensional
- Low-risk types buy lots of insurance due to their high risk aversion
- Heterogeneity in risk aversion

■ Third generation (?)

- Big data changes the notion of asymmetric information
- “who knows what” needs to be updated
- Once insurer/platform knows some basic information about you, statistical inference allows it to know more about risks

