

A Model of Intermediation, Money, Interest, and Prices

Monetary Policy and Heterogeneity Conference

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Introduction

> Background

Standard Monetary Approaches

- ★ articulate: interest-rate | inflation tax channels

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- ★ implementation | many short rates
- ★ Bianchi-Biggio (2020a)
 - ★ intermediation | settlement frictions
 - ★ implementation by easing frictions

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> Paper

Two instruments → two targets:

$$\{level, spread\} = \begin{cases} \text{loan rate} & = IOR + LiqPrem^L \left(\underbrace{M}_{\text{reserves}}, \underbrace{D}_{\text{savings}} \right) \\ \text{deposit rate} & = IOR + LiqPrem^D \left(\underbrace{M}_{\text{reserves}}, \underbrace{D}_{\text{savings}} \right) \end{cases}$$

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Integrates: implementation|intermediation|spread

- ★ incomplete-market monetary economy
- ★ w/ wage rigidity
- ★ effects of instruments
 - ★ two Instruments → two channels
 - ★ rate channel | credit channel

> Three Regimes I

Corridor System | Lean Balance Sheet:

- ★ Both Instruments Work

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Floor System | Fat Balance Sheet:

- ★ OMO No Longer Work

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Floor System | Fat Balance Sheet:

- ★ OMO No Longer Work

“Deposit ZLB”:

- ★ Negative IOR
- ★ OMO → transformed to currency → liquidity trap
- ★ Policy Rate → Reverse Credit Channel!

> Normative Message

Why Positive Spread? Why Heterogeneity? Why ZLB? Why shocks?

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Boom → **Lean Balance Sheet:**

- ★ open spread → contract credit

Crisis → **Stabilize AD:**

- ★ fat balance sheet → close spread
- ★ drop IOR below ZERO but stop at DZLB

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Stabilization w/ Heterogeneity

- ★ more powerful if you start from higher spread
- ★ sacrifice a bit of micro-insurance for macro insurance

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Trade-off micro insurance for macro insurance:

- ★ **Message:** Don't give up instrument!
- ★ **Important:** heterogeneity+DZLB+shocks+Spreads!

Two Blocks

- * Underlying Environment

Two Blocks

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> Environment

- * Banking Block
- * Incomplete-Market Block

Bank Block

> Banks

- * Static
- * Intermediary
 - ★ lends to borrowers
 - ★ fund from lenders
 - ★ hold reserves
- * Competitive, free entry, no equity
- * Simple Budget
- * Aggregates: capital letter

$$m + l = a$$

> Bank Problem

- * Profits per interval Δ

$$\Pi = \max_{\{m,a\}} \underbrace{i^m m + i^l l - i^a a}_{\text{Portfolio}} + \underbrace{\mathbb{E}[\chi(b|\theta)]}_{\text{Settlement}}$$

- * Reserve balances at CB:

$$b = \begin{cases} m \text{ pr. } 1/2 \\ m - \delta a \text{ pr. } 1/2 \end{cases}$$

> Microfoundation - Intermediation Cost

- * Dynamic OTC: Bianchi and Bigio (2020b)
 - * Alfonso and Lagos (2014) + Atkeson et al. (2015)
 - * Search Market for Reserves (match and bargain)

$$\theta \equiv - \frac{\overbrace{M - \delta A}^{\text{deficit}}}{\underbrace{M}_{\text{surplus}}}$$

- * Outside Options
 - * interest on reserves i^m
 - * discount window: $i^m + \text{penalty } \iota$

- * Average Rates

$$\chi(b|\theta) \equiv \begin{cases} \chi^+ \cdot b & \text{for } b > 0 \\ \chi^- \cdot b & \text{for } b < 0 \end{cases}$$

> Back in bank Problem

* Instantaneous profits:

$$\Pi = \max_{\{m,a\}} \underbrace{i^m m + i^l l - i^a a}_{\text{Portfolio}} + \underbrace{\mathbb{E}[\chi(b|\theta)]}_{\text{Settlement}}$$

> Role of Liquidity Ratio

Proposition 1 (Nominal rates)

Equilibrium

$$i^l = i^m + \underbrace{\frac{1}{2} [\chi^+ + \chi^-]}_{\text{shadow val of m}}$$

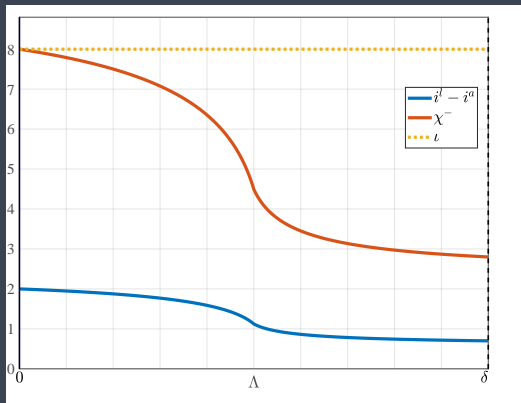
$$i^a = i^m + \underbrace{\frac{1}{2} [\chi^+ + \chi^-]}_{\text{shadow val of m}} - \underbrace{\frac{\delta}{2} \chi^-}_{\text{of d}}$$

Spread:

$$\Delta r \equiv \frac{\delta}{2} \chi^-$$

Takeaway #1: CB influences spread via OMO

> Control over rates



Spreads and Δ

Non-Financial Block

- * Central Bank and Government Block

> Households

- * Continuum
- * CRRA expected utility
- * State
 - * Real wealth
 - * employment status: $z \in \{e, u\}$

> Employment Dynamics

- * Transition probabilities

$$\Gamma_t^{eu} = \nu^{eu} + \phi_t^+ \text{ and } \Gamma_t^{ue} = \nu^{ue} - \phi_t^-$$

- * Natural Flows $\{\nu^{ue}, \nu^{eu}\}$ | Endogenous Flows: ϕ_t

- * Real income :

$$dw = y(z) dt + T dt.$$

> Wealth Law of Motion

* Wealth:

$$ds = \left((i^a - \pi) \cdot \frac{a}{P} - \pi \cdot \frac{m}{P} - \left(i^l - \pi \right) \cdot \frac{l_t}{P_t} - c \right) dt + dw$$

* Portfolio

$$a + m = P \cdot s + l$$

Optimality

* Never borrow and lend

* i^a for savers

* i^l for borrowers

* currency only if $i^a \leq 0$.

* ZLB on deposits DZLB

> Aggregate Demand Block

- * NK Phillips Curve:

$$\dot{\pi}_t = \rho (\pi_t - \pi_{ss}) - \kappa (U_{ss} - U_t),$$

- * Unemployment:

$$\dot{U}_t = [\nu^{eu} + \phi_t^+] (1 - U_t) - [\nu^{ue} - \phi_t^-] U_t.$$

- * ϕ_t adjusts:

Good Demand = Good Output

- * Taylor rule

$$i_t^m = i_{ss}^m + \eta \cdot (\pi_t - \pi_{ss})$$

Non-Financial Block

- * Central Bank and Government Block

> Central Bank

CB operations:

$$dM_t = dL_t^{CB}$$

Reserve Market: i_t^m Profits

- * portfolio | discount window
- * distributes transfers

> Markets

I. Goods market

II. Deposits market

III. Loan market

IV. Money Market

Analysis

- * 4 Results on Implementation
- * Positive Analysis
- * Normative Analysis
- * Conclusions

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> Summary Conditions - Steady State

Proposition 2 (Steady State)

* Given Δr_{SS} , then r_{SS}^a clears:

$$\int_{\bar{s}}^{\infty} s f_{SS}(s) ds = 0$$

and policy rate determines inflation

$$\pi_{SS} = \bar{i}_{SS}^m - r_{SS}^s$$

Takeaway #2: \bar{i}_{SS}^m controls inflation target, OMO influence real long-run rate!

> Summary Conditions - Transitions

Proposition 3 (Real-Wealth Clearing)

- * Given Δr_t , then ϕ_t clears

$$\int_{\bar{s}}^{\infty} s f_t(s) ds = 0$$

and ϕ_t determines inflation pressure

- * $\Delta r_t \in [0, \iota]$ implemented with L_t^{CB}
- * i^m floor on nominal rates

Takeaway #3: i_t^m controls r_t^a (and AD) and Δr redistribution

> Implementation

Proposition 4 (Regimes)

Corridor system | Lean Balance Sheet

- ★ **Open Market Ops** → ease spreads → insurance + AD
- ★ **Policy Rate Drops** → interest rate channel → AD

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Floor System | Fat Balance Sheet

- ★ **Open Market Ops** → Wallace irrelevance
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“Deposit ZLB”

- ★ **Negative IOR**
- ★ **OMO** → irrelevance (currency)
- ★ **Policy Rate** → **Reverse Credit Channel**

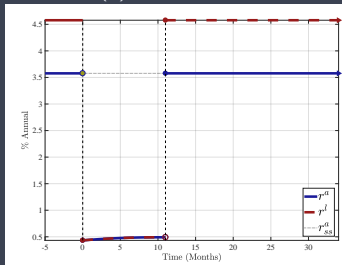
Takeaway #4: positive i^m satiation limit, negative i^m DZLB and reversal

Analysis

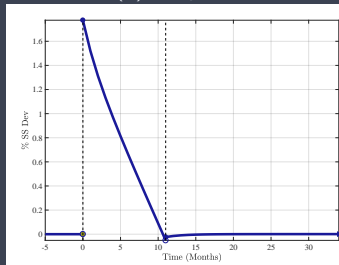
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> Dynamic Effects of an OMO

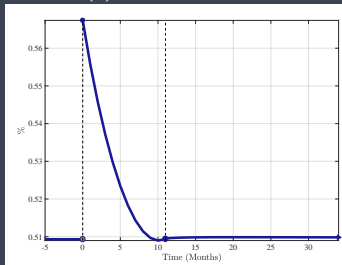
(a) Real Rates



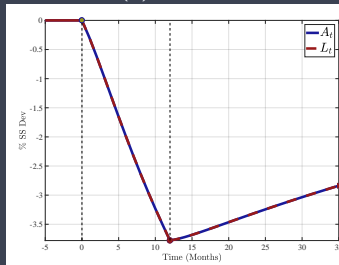
(b) Output



(c) Inflation Rate

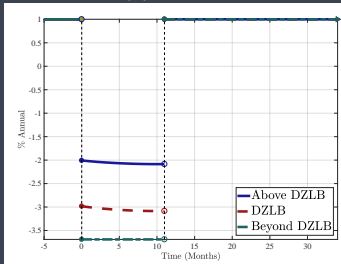


(d) Credit

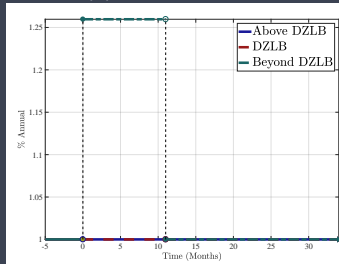


> Negative IOR and the DZLB

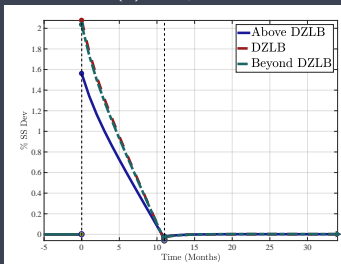
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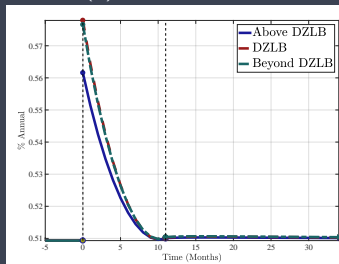
(b) Credit Spread



(c) Output



(d) Inflation Rate



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Aggregate Credit Shock

- ★ borrowers → yes roll-over debt | no borrow more
- ★ poor unemployed → contract consumption → AD channel
- ★ one time shock

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Policy Response

- ★ after shock → eliminate spread forever
- ★ deviate from the Taylor rule → make shocks comparable:

$$i_t^m = \bar{i}_t^m + \eta_t \cdot (\pi_t - \pi_{ss})$$

- ★ Compare:
 - * initial spread Δr_{ss}
 - * response on impact \bar{i}_0^m

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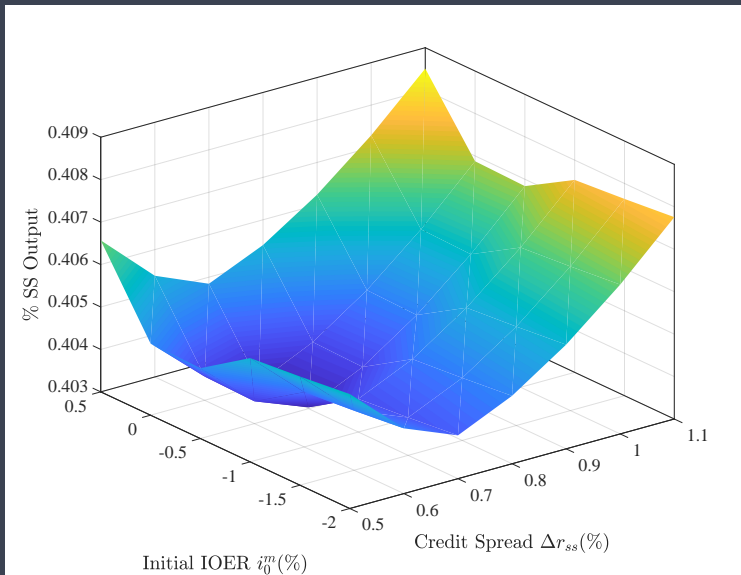
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Welfare

- ★ In draft risky steady-state
- ★ Today:
 - * weight on steady-state (ex-ante insurance)
 - * weight on transition (ex-post aggregate demand stability)

> Welfare Loss Comparison - Certainty Equivalent



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> Conclusion

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Principles

- ★ MP toolkit rich enough: control credit spreads
- ★ Policy rates: **nominal control** independent of spread

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Paper

- ★ Desirable to open spreads prior to aggregate shock
- ★ CBs: do not give up on an important tool!