

P. Kehoe's Discussion of
He and Xiong's
Dynamic Debt Runs

Idea: Static vs. Dynamic Coordination Problems _____

- Diamond Dybvig: Static coordination problem
 - If lots of others run *today*, I want to run *today*
- He-Xiong: Intertemporal coordination problem
 - If other lenders won't lend in *future*, I want to run *today*
- Point: Aggregate shocks + upper and lower dominance region
 - Get unique equilibrium w/global game (GG) logic
 - Key idea: Aggregate shocks play same role as noisy signal in GG
 - Closely related to Frankel-Pauzner

Outline

- Lay out Frankel-Pauzner
- Lay out Cole-Kehoe (actually more related?)
- Comments on this paper
 - Compare/contrast with Cole-Kehoe
 - Do assumptions that generate upper and lower dominance regions make sense?
 - What is main economic point of paper?

Resolving Indeterminacy in Dynamic Settings: The Role of Shocks (QJE)

Frankel and Pauzner

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Point: Adding aggregate shocks eliminates multiple equilibria

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Point: Adding aggregate shocks eliminates multiple equilibria

Idea: Shocks make optimal so global game logic gives result

- Shade action down when upper dominant edge
- Shade action up when at lower dominant edge
- Iterative deletion of dominated strategies gives uniqueness

Simplified Matsuyama Poverty Trap Model ---

- Small open economy with **A**griculture and **M**anufacturing
 - A: Constant returns
 - M: External increasing returns
- Exogenous stochastic opportunity to switch sectors

Simplified Matsuyama Poverty Trap Model

- Small open economy with **A**griculture and **M**anufacturing

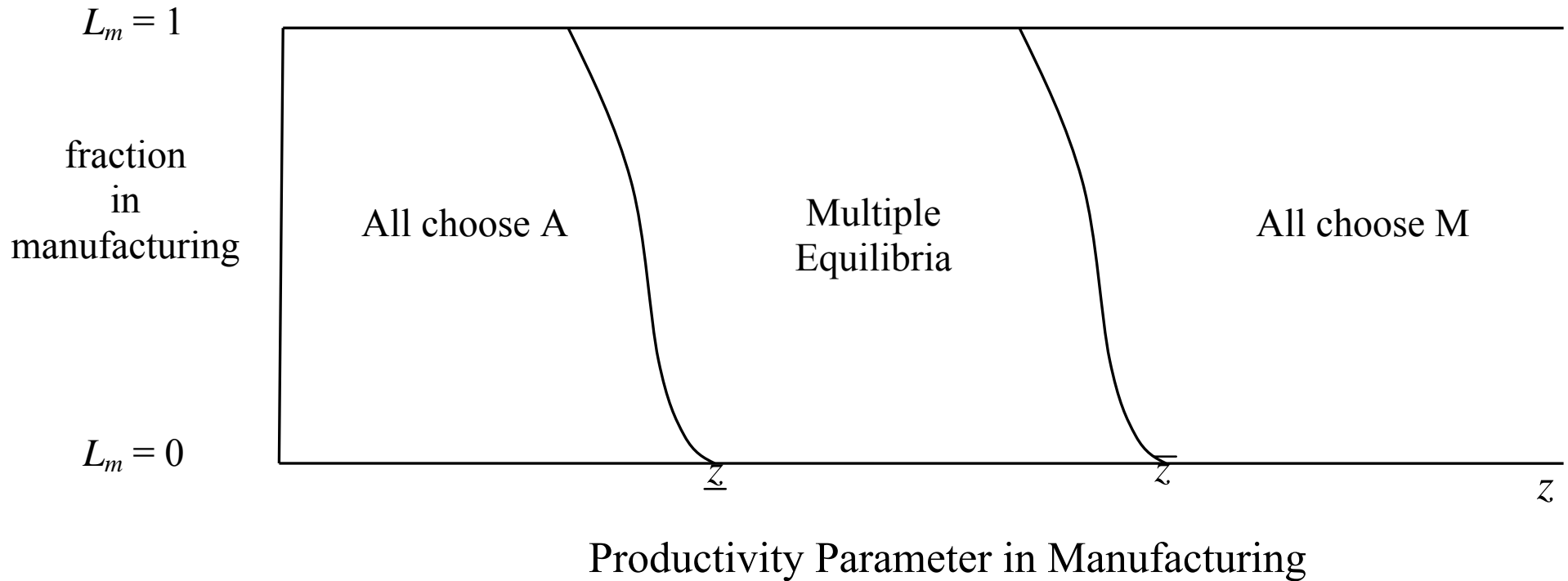
- A: Constant returns (produce 1 each)
- M: External increasing returns (produce $\pi(L_m, z)$)

where L_m = fraction of agents in manufacturing

z = shift parameter, eventually make stochastic

- Exogenous stochastic opportunity to switch sectors

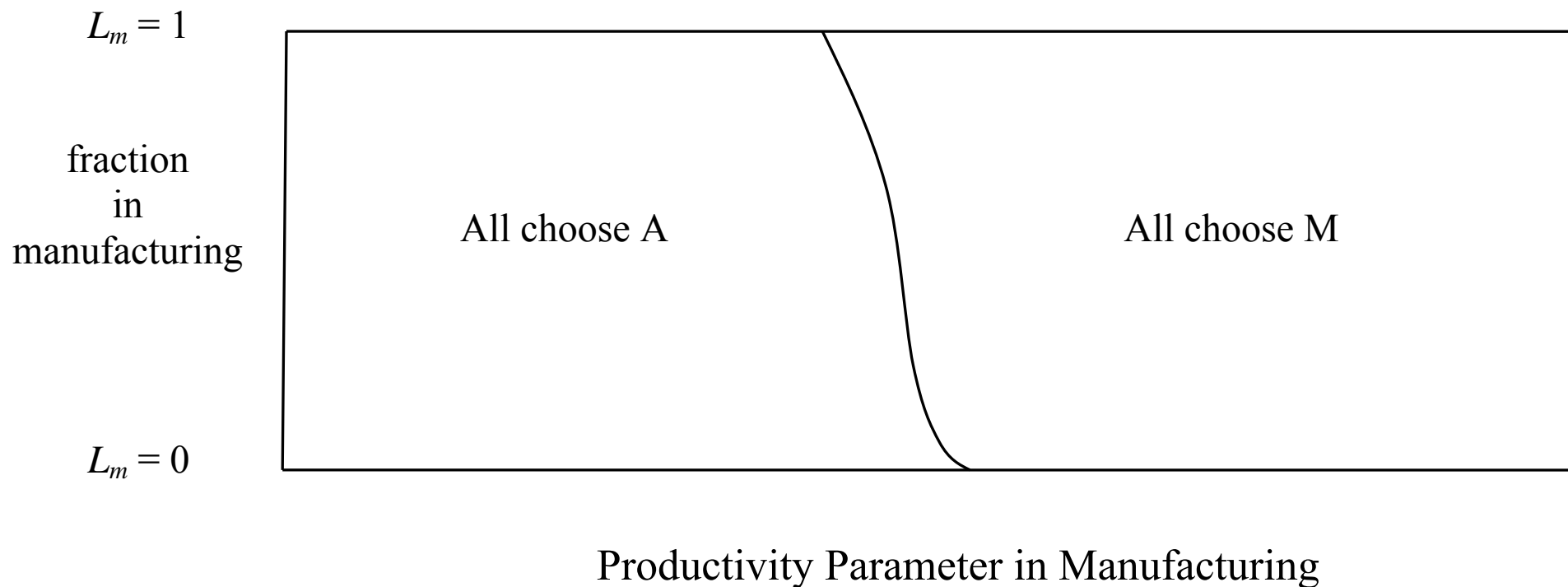
Fixed Productivity z



Assume there exist lower and upper dominance regions

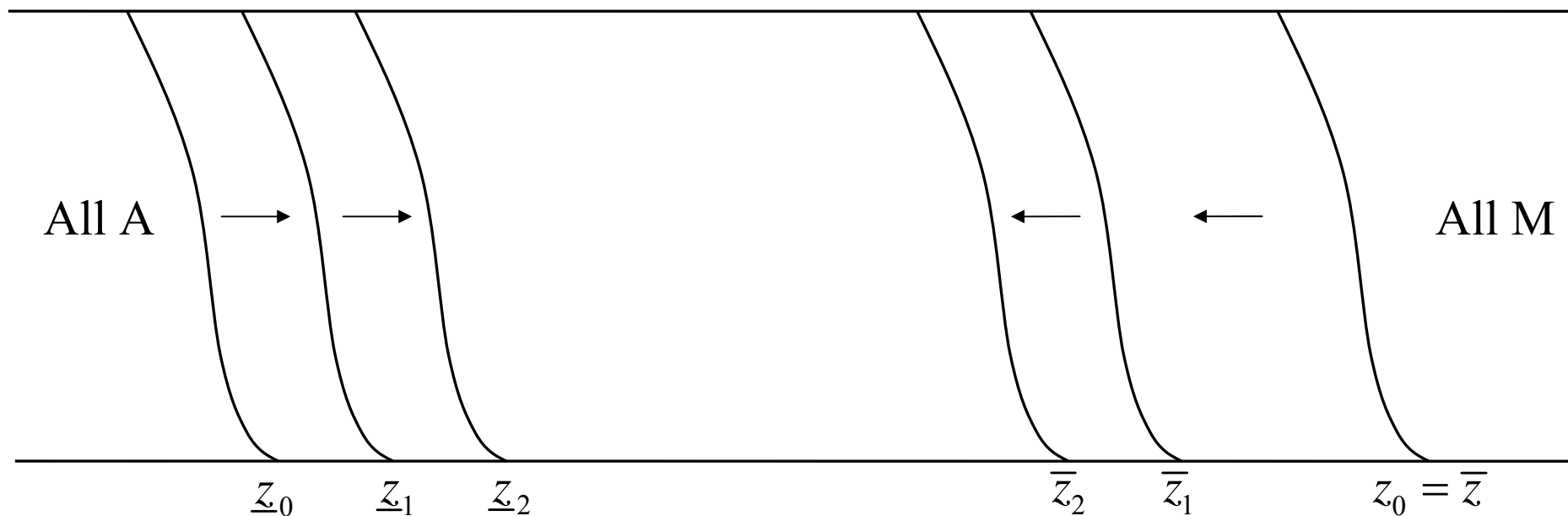
- $z < \underline{z}$: all movers pick A
- $z > \bar{z}$: all movers pick M

Stochastic Productivity z (Brownian Motion)



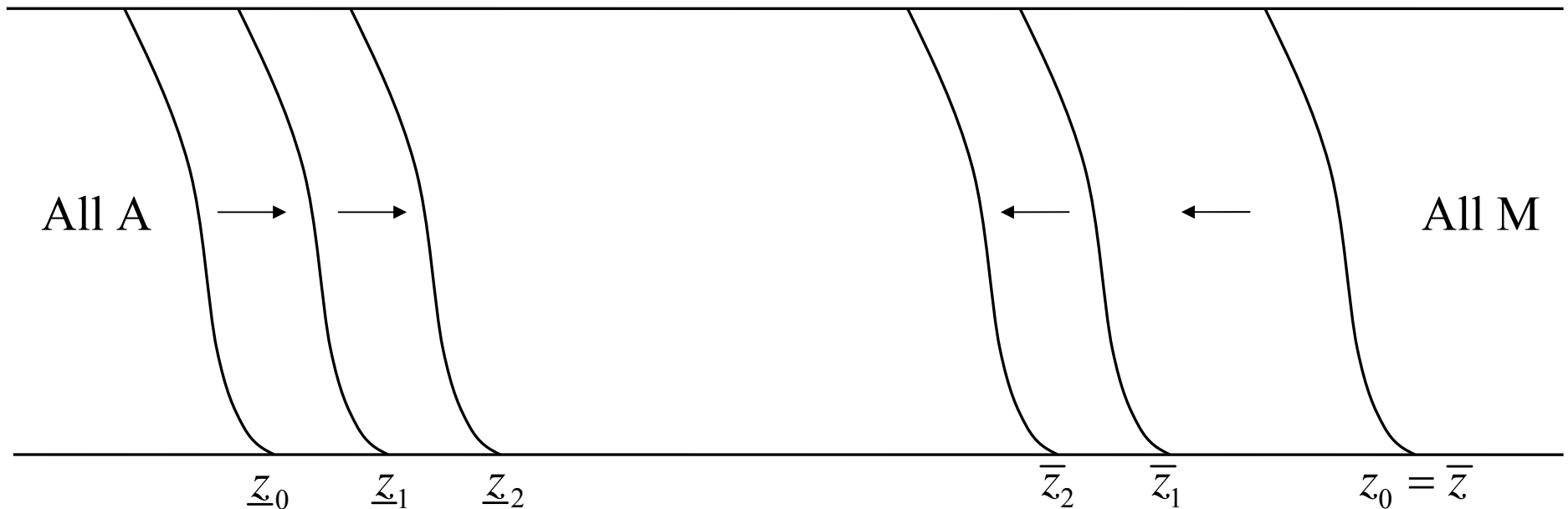
- Existence of dominance regions starts iterative contagion effect that spreads through parameter space

Stochastic Productivity z (Brownian Motion)



- \underline{z}_0 = if all others choose M **forever**, indifferent to choosing A or M
- \bar{z}_0 = if all others choose A **forever**, indifferent to choosing A or M

Stochastic Productivity z (Brownian Motion)



- \underline{z}_0 = if all others choose M **forever**, indifferent to choosing A or M
- \bar{z}_0 = if all others choose A **forever**, indifferent to choosing A or M
- But shocks imply some descendants at \underline{z}_0 will choose M
- But shocks imply some descendants at \bar{z}_0 will choose A

Punchline

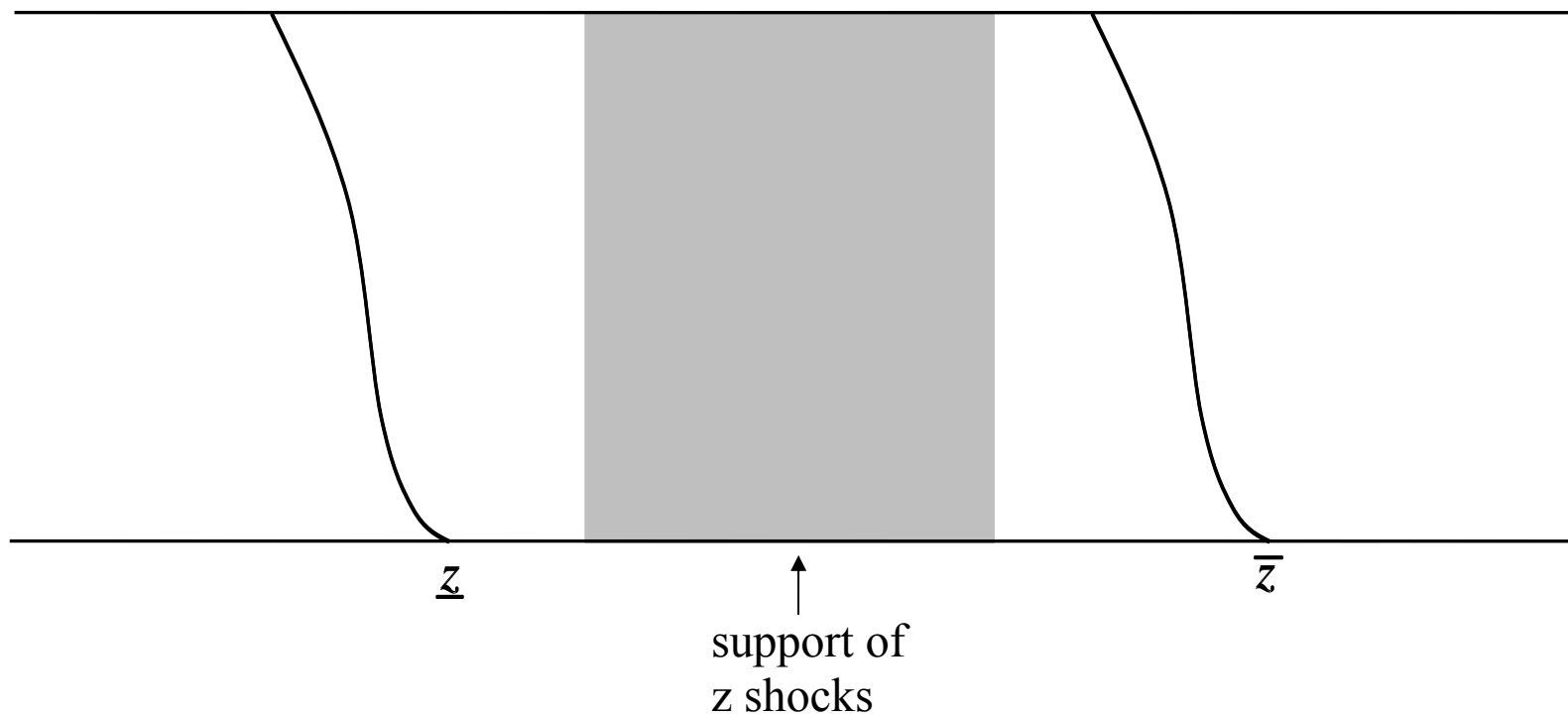
- Technical idea
 - Aggregate shocks in public info dynamic coordination games
 - Can play same role as
 - Noisy signals in heterogenous info static coordination games
- Why
 - Both make agents shade in from U and L dominance boundaries
 - Iterative deletion of dominated strategies then gives result

Interpretation Question

- The He Xiong paper says it builds on Frankel Pauzner who show
“In dynamic coordination games, fundamental shocks act as a coordination device for agents who choose actions at different times.”
- I don't understand this interpretation
- What is standard coordination device?: Sunspots
- Sunspot: Publicly observable random variable that does not enter technology or preferences that lets agents coordinate.
- But with sunspots and no fundamental shocks get uniqueness

Technical Question

- If shocks have bounded support, can multiplicity reappear?



- If so then seems not helpful to say shocks can be arbitrarily small.

Self-Fulfilling Debt Crises

Hal Cole and Tim Kehoe

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“Because of the government’s need to roll over its debt, a liquidity crunch induced by the inability to sell new debt can lead to a self-fulfilling debt default”

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Paper about rollover risk resulting from dynamic coordination problem

Model

- Government is only interesting strategic agent

- New borrowing B_{t+1} , default decision on old debt ϕ_t , spending g_t

$$g_t + \phi_t B_t \leq a_t \tau f(k_t) + q_t B_{t+1}$$

- τ is constant tax on income
 - a_t drops from 1 to $\alpha < 1$ forever if default
 - Lowering spending g_t to pay off debt is costly in utility
- Key timing assumption
 - Government can use new debt to pay off old debt

Bankers

- Measure 1 or risk neutral bankers, endowment \bar{x}

$$E \sum_{t=0}^{\infty} \beta^t x_t$$

$$q_t b_{t+1} \leq \bar{x} \quad (\text{when lending } b_{t+1} \text{ at b.o.p.})$$

$$x_t \leq \bar{x} + \phi_t b_t - q_t b_{t+1} \quad (\text{when consume } x_t \text{ at e.o.p.})$$

Consumers and Sunspot Variable ---

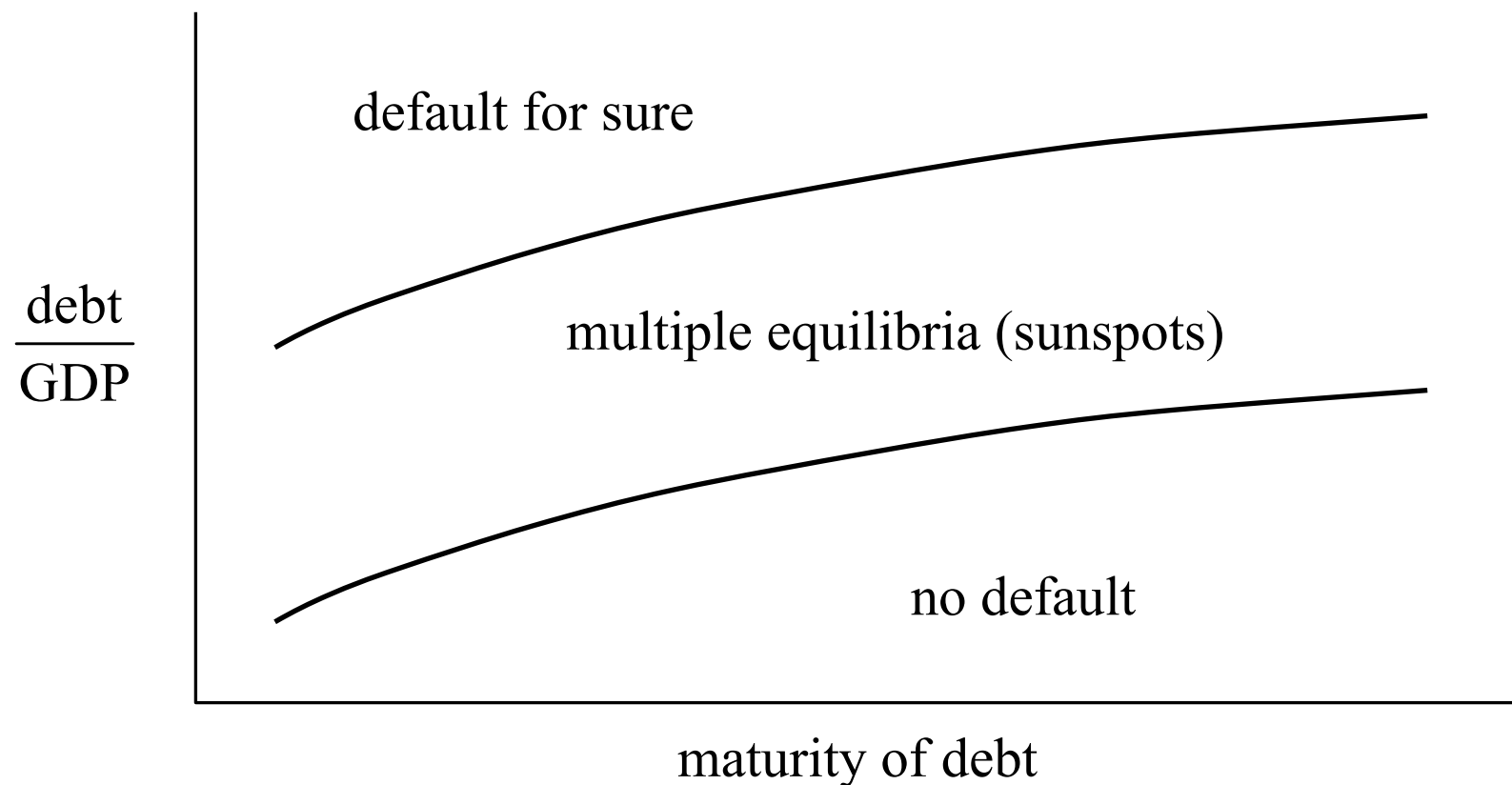
- Measure 1 of consumers

$$E_0 \sum_{t=0}^{\infty} \beta^t (c_t + v(g_t))$$

$$c_t + k_{t+1} \leq (1 - \tau) a_t f(k_t)$$

- Exogenous sunspot variable z_t at b.o.p.

Equilibria: 3 Zones

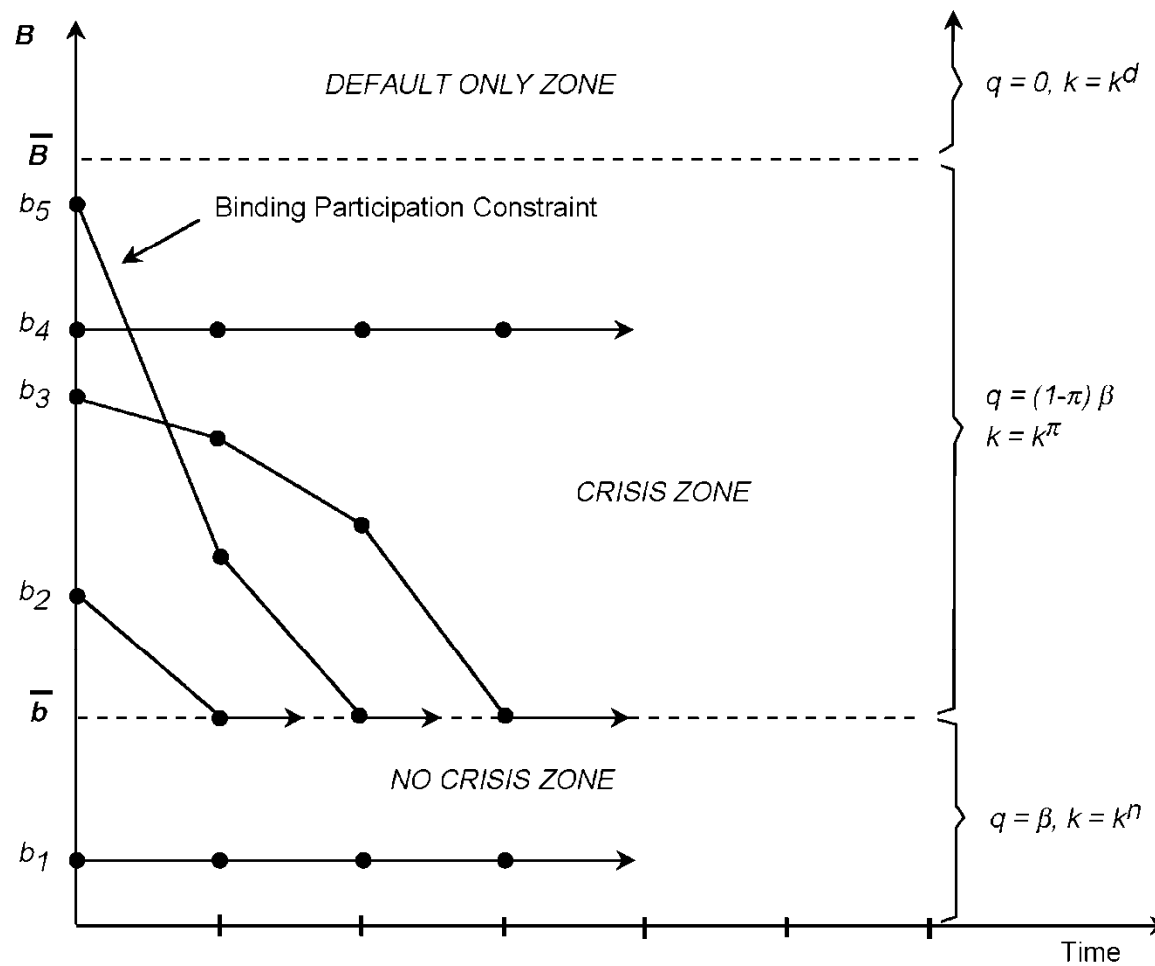


- Why: If period $t + 1$ lenders won't roll over the debt, then period t lenders predict default on anything they lend at t so don't lend.

Government Optimality

- Flee multiple equilibrium zone

Figure 2. DEBT TRAJECTORIES IF A CRISIS IS AVOIDED



Logic

- Default for sure zone:
 - Debt at t is so high that even if lenders at $t + 1$ lend, the government will default
- No default zone
 - Debt at t is so low that even if no lender at t lends, the government will not default
- Multiple equilibria zone
 - Debt at t is s.t.
 - If lenders at $t + 1$ lend then won't default
 - If lenders at $t + 1$ won't lend then default

He and Xiong

Dynamic Debt Runs

Logic in Introduction

- Introduces rollover risk in contrast to static coordination risk
- “Time-varying fundamental shocks allows creditors to coordinate their asynchronous actions”
- Paper says it builds on Frankel Pauzner who show
“In dynamic coordination games, fundamental shocks act as a coordination device for agents who choose actions at different times.”

Model: Firm

- Borrows 1 at $t = 0$, generates constant cash flow r per unit time
- Poisson arrival ϕ of times τ_ϕ , at which asset matures and gives final payoff y_t
- Final payoff y_t follows

$$\frac{dy_t}{y_t} = \mu dt + \sigma dz_t$$

- Value of asset: add cash flows and final payoff

$$\begin{aligned} F(y_t) &= E_t \left[\int_t^{\tau_\phi} e^{-\rho(s-t)} r ds + e^{-\rho(\tau_\phi-t)} y_{\tau_\phi} \right] \\ &= \frac{r}{\rho + \phi} + \frac{\theta}{\rho + \phi - \mu} y_t \end{aligned}$$

Debt Contracts

- Exogenously imposed restrictions
 - Debt spread uniformly among measure 1 of small creditors
 - Lenders get constant r until either asset matures or forced liquidation occurs
- Contracts die with probability δ
- Lenders then decide to roll over or run

Credit Lines

- If creditors run, firm draws on “credit lines”
 - Prob $\theta\delta$ credit line fails and have forced liquidation
 - Prob $1 - \theta\delta$ can pay running creditors
 - Not explicitly modeled
- Costly liquidation:
 - Get $aF(y_t)$ with $a < 1$ vs. $F(y_t)$ if matures

Staggered Debt and Continuous Time

- Fraction of maturing creditors over small interval is small
- Individual creditor's decision not affected by concurrent decisions of other creditors
- No Diamond-Dybvig static coordination, only coordination problem b/w lenders at different points in time

Key: Existence of Upper and Lower Dominance Regions _____

- Upper Region: exists \bar{y} s.t. $y_t > \bar{y}$, dominant to rollover
- Lower Region: exists \underline{y} s.t. $y_t < \underline{y}$, dominant to run

Key: Existence of Upper and Lower Dominance Regions _____

- Upper Region: exists \bar{y} s.t. $y_t > \bar{y}$, dominant to rollover
 - Even if all other creditors choose to run in future firms liquidation value sufficient to pay off debt in forced liquidation
- Lower Region: exists \underline{y} s.t. $y_t < \underline{y}$, dominant to run
 - Even if all creditors roll over always, expected payoff at maturity plus interest before maturity lower than 1\$ now

Compare He-Xiong with Cole-Kehoe ---

- Same
 - Both focus on rollover risk
 - Emphasize role of maturity structure
 - Dynamic coordination game
- Different
 - CK general equilibrium, HX not
 - CK optimizing government, HK mechanical firm
- CK multiple equilibria, HX unique (within class)
 - HX have upper and lower dominance region
 - CK do not

Two Questions

Do upper and lower dominance regions
make (quantitative) sense?

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What is main economic point of paper?

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Suggestion: propose alternative to Merton model of Credit Risk

Rethink Credit Risk

- Standard credit model (Merton)
 - Insolvency risk \equiv risk asset value falls below liabilities
 - Credit risk \equiv risk firm defaults on its debt
 - Assumes insolvency risk is only source of credit risk
- He and Xiong: add rollover risk
 - Fear of future rollover risk can cause creditors to run
 - So rollover risk important source of credit risk

Rethink Credit Risk

- Implication of He-Xiong: corporate bond spread depends
 - not only on fundamental risk and leverage
 - but also on asset illiquidity
 - and debt maturity structure

Conclusion

- Interesting paper
- Need to relate to work by Cole and Kehoe (rollover risk)
- Need to focus more sharply on 1 point
- Emphasize application more