

# MACROECONOMIC IMPLICATIONS OF COVID-19: CAN NEGATIVE SUPPLY SHOCKS CAUSE DEMAND SHORTAGES?

GUERRIERI + LORENZONI + STRAUB + WERNING

(BOOTH)

(NWU)

(HARVARD)

(MIT)

# OUR QUESTION...

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- ▶ **Say's Law (misquoted!)**

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**Goal: simple theory for insights**

**+**

**policy implications**

# RESULTS: EXCESS DEMAND FROM SUPPLY SHOCK?

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	Complete Markets	Incomplete Markets
Single Sector	<b>NO (Standard)</b>	
Multiple Sectors		

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# INTUITIONS

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- ▶ **Single Sector (Representative Agent)**

  - Negative supply shock = Positive news (relative to today!)

- ▶ **Single sector + Incomplete Markets**

  - ▶ Incomplete markets helps...

  - ▶ ... but in extreme case, workers that lose income stop consuming...

  - ▶ ...workers in unaffected sector consume same as before at same interest rate

# INTUITIONS

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- ▶ **Multisector...**

- ▶ 50% drop for everyone  $\neq$  100% for half sectors (Nick Rowe)

- ▶ poor substitution across sectors (e.g. food at home and durables or entertainment)

- ▶ **Multisector + Incomplete Markets**

- ▶ Incomplete markets further helps case



# OTHER RESULTS...

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## ▶ **Fiscal Policy**

- ▶ may be less effective per dollar spent
- ▶ but may still be optimal!

## ▶ **Going Deeper...**

- ▶ mobility + supply chains
- ▶ business exit (restaurants → clothing stores)
- ▶ labor hoarding vs. job-match destruction  
perfect insurance

# DEMAND VS SUPPLY

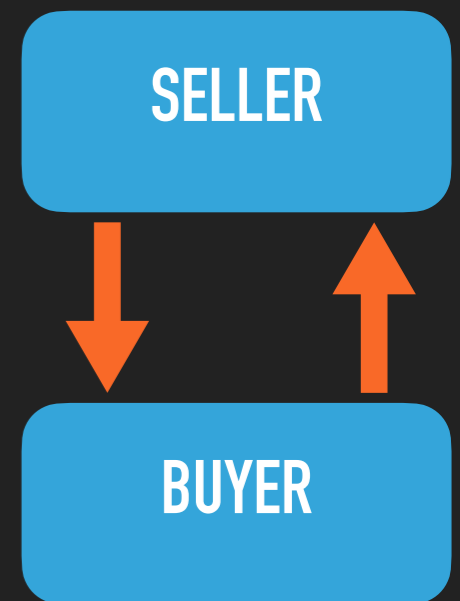
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- ▶ **Demand vs. Supply** terminology...
  - ▶ not always clear, meanings differ...
  - ▶ ...supply shock lowers demand, but...  
...more than supply? excess demand?
- ▶ Taste shock = Supply shock  
both give drop buyer/seller gains from trade...

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both give drop buyer/seller gains from trade...
- ▶ **Today:** Demand deficiency...
  - ▶ natural (flex price) interest rate (full employment) falls
  - ▶ holding fixed interest rate: recession





**SINGLE SECTOR**

**TAKE #1**

**COMPLETE MARKETS**



# SINGLE SECTOR

## TAKE #1

# COMPLETE MARKETS

	Complete Markets	Incomplete Markets
Single Sector	?	
Multiple Sectors		

# PREFERENCES AND TECHNOLOGY

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- ▶ Preferences

$$\sum_{t=0}^{\infty} \beta^t U(c_t)$$

- ▶ Fixed endowment of labor (supplied inelastically)  $\bar{n}$

- ▶ Technology

$$Y_t = N_t$$

# SUPPLY SHOCK

---

- ▶ MIT shock...

- ▶  $t=0$  temporary reduction labor supply (e.g. shutdown)

$$\bar{n} \longrightarrow (1 - \phi)\bar{n}$$

- ▶  $t=1,2,3..$  back to normal, flexible price allocation

- ▶ Flexible price equilibrium (natural) interest rate...

$$1 + r_0 = \frac{1}{\beta} \frac{U'((1 - \phi)\bar{n})}{U'(\bar{n})} > \frac{1}{\beta}$$

- ▶ ... equilibrium with fixed interest rate (e.g. ZLB)

$$U'(c_0) = \beta \frac{1}{\beta} U'(\bar{n})$$



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# SUPPLY SHOCK

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**Proposition.** Single-sector + Complete Markets

Negative  
Supply Shock



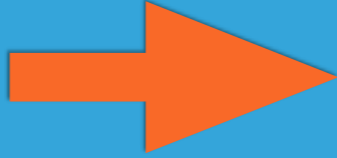
Rise natural rate  
+  
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**Up Next: Can Incomplete Markets Save Us?**



**SINGLE SECTOR**

**TAKE #2**

**INCOMPLETE MARKETS**



# SINGLE SECTOR

## TAKE #2

# INCOMPLETE MARKETS

	Complete Markets	Incomplete Markets
Single Sector	NO	?
Multiple Sectors		

# INCOMPLETE MARKETS

---

- ▶ Budget constraints

$$c_{it} + a_{it} \leq w_t n_{it} + (1 + r_{t-1}) a_{it-1}$$

- ▶ Fraction  $\mu$  face borrowing constraint (results generalize)

$$a_{it} \geq 0$$

- ▶ Euler for unaffected + unconstrained

$$U'(c_{i0}) = \beta (1 + r_0) U'(c_{i1})$$

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$$\mathbf{c}_1 + \mu \phi \bar{n} = \bar{n}$$

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$$\mathbf{c}_1 + \mu\phi\bar{n} = \bar{n}$$

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$$1 + r_0^* = \frac{1}{\beta} \frac{U'((1 - \phi)\bar{n})}{U'((1 - \mu\phi)\bar{n})} \geq \frac{1}{\beta}$$

**Natural rate rises!**

# INCOMPLETE MARKETS

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**Proposition.** Single-sector + Incomplete Markets

Negative  
Supply Shock



Rise natural rate  
+  
Increase excess demand

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- ▶ same as dropping out which is neutral

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**Lose a producer, lose a consumer... it's a wash!**

~\_(ツ)\_/



**MULTIPLE SECTORS**

**TAKE #1**

**COMPLETE MARKETS**



# MULTIPLE SECTORS

TAKE #1

COMPLETE MARKETS

	Complete Markets	Incomplete Markets
Single Sector	NO	NO
Multiple Sectors	?	

# MULTIPLE SECTORS

---

$$\sum_{t=0}^{\infty} \beta^t U(c_{1t}, c_{2t})$$

$$U(c_{1t}, c_{2t}) = \frac{1}{1-\sigma} \left( \phi^\rho c_{1t}^{1-\rho} + (1-\phi)^\rho c_{2t}^{1-\rho} \right)^{\frac{1-\sigma}{1-\rho}}$$

$$Y_{jt} = N_{jt}$$



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$$Y_{jt} = N_{jt}$$

$$c_1^* = Y_1^* = \phi \bar{n}$$

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$$p^* = 1$$

Steady State

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Steady State

$$c_{10} = Y_{10} = n_{10} = 0$$

Asymmetric MIT shock

# MULTIPLE SECTORS

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$$1 + r_t \equiv (1 + i_t) \frac{P_{2t}}{P_{2t+1}}$$

Real Interest Rate (for good 2)

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$$(1 - \phi)^{\frac{\rho - \sigma}{1 - \rho}} < 1$$

Interest Rate Falls

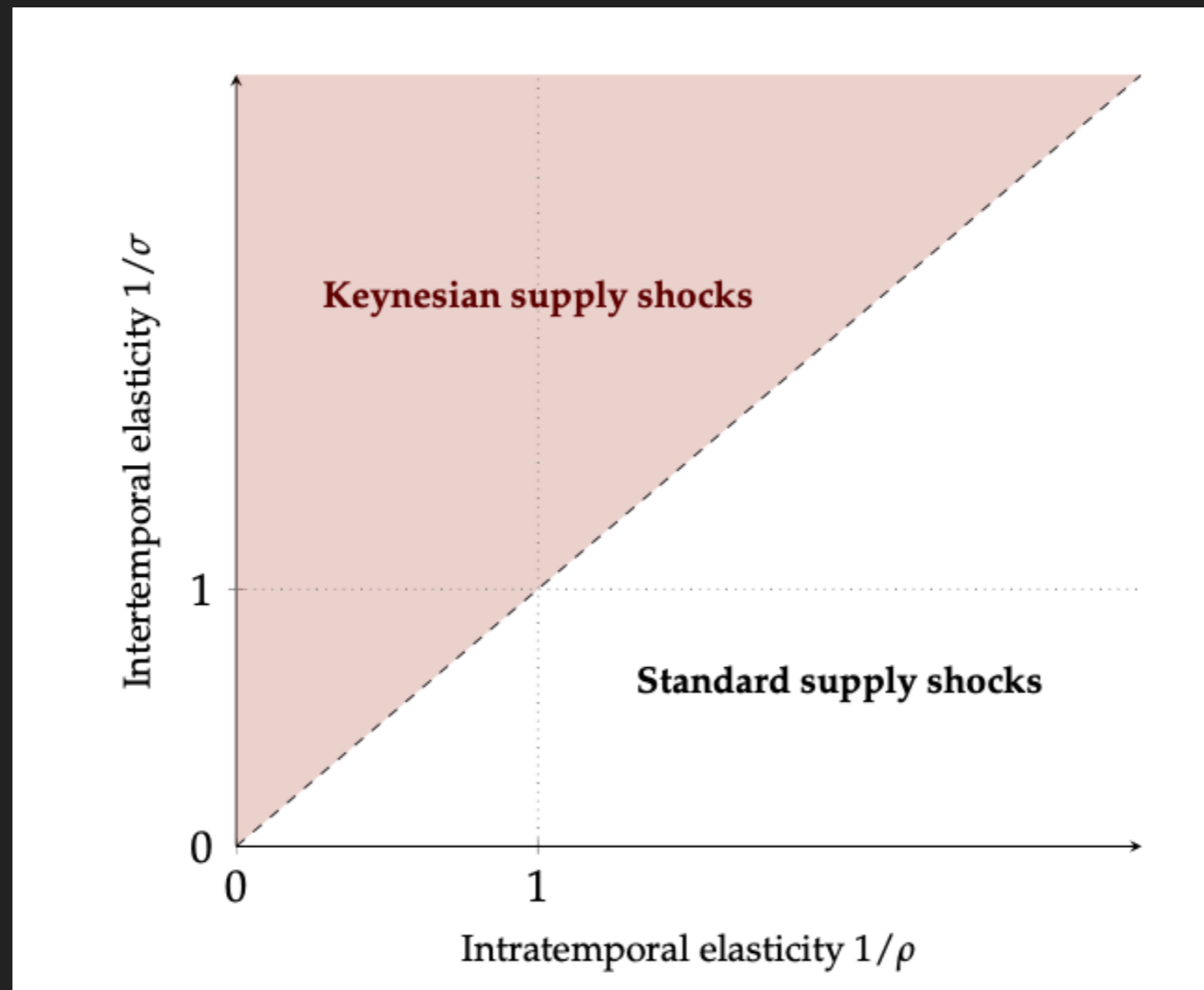
# Proposition. Multiple Sectors + Complete Markets

Negative  
Supply Shock



Lower natural rate  
+  
deficient excess demand

$$\frac{1}{\sigma} > \frac{1}{\rho}$$



**MULTIPLE SECTORS**

**TAKE #2**

**INCOMPLETE MARKETS**



# MULTIPLE SECTORS

TAKE #2

# INCOMPLETE MARKETS

	Complete Markets	Incomplete Markets
Single Sector	NO	NO
Multiple Sectors	POSSIBLE	?

# MULTIPLE SECTORS + INCOMPLETE MARKETS

---

$$1 + r_0 = \frac{1}{\beta} \frac{U_{c_2}(0, \mathbf{c}_{20})}{U_{c_2}(\mathbf{c}_{11}, \mathbf{c}_{21})}$$

Unconstrained agents

$$\mathbf{c}_{20} = (1 - \phi)\bar{n}$$

$$\mathbf{c}_{11} = \phi(1 - \phi\mu)\bar{n}, \quad \mathbf{c}_{21} = (1 - \phi)(1 - \phi\mu)\bar{n}.$$

$$\longrightarrow 1 + r_0 = \frac{1}{\beta} (1 - \phi)^{\frac{\rho - \sigma}{1 - \rho}} (1 - \phi\mu)^\sigma$$

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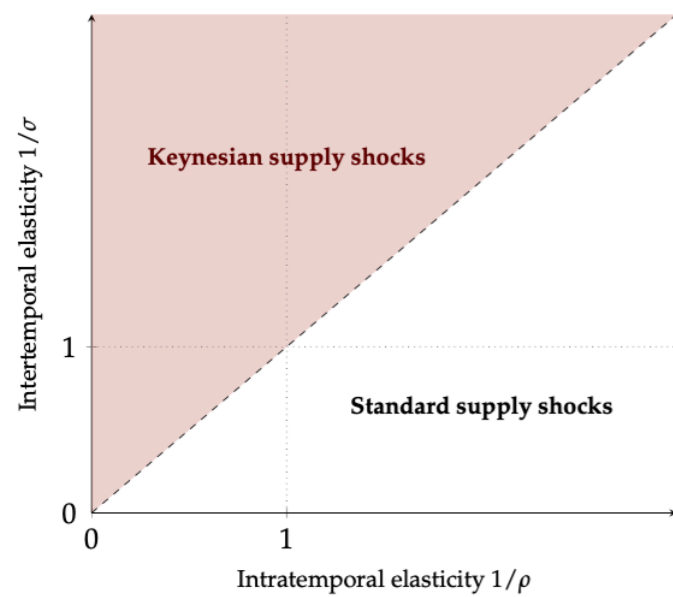
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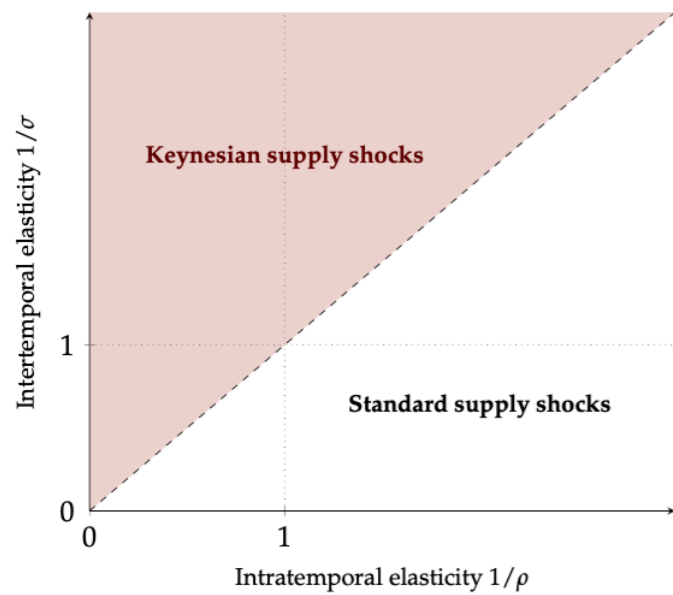
$$\sigma^{-1} > \frac{1 - \mu}{1 - \phi\mu} \cdot \rho^{-1} + \frac{\mu(1 - \phi)}{1 - \phi\mu}$$

# MULTIPLE SECTORS + INCOMPLETE MARKETS

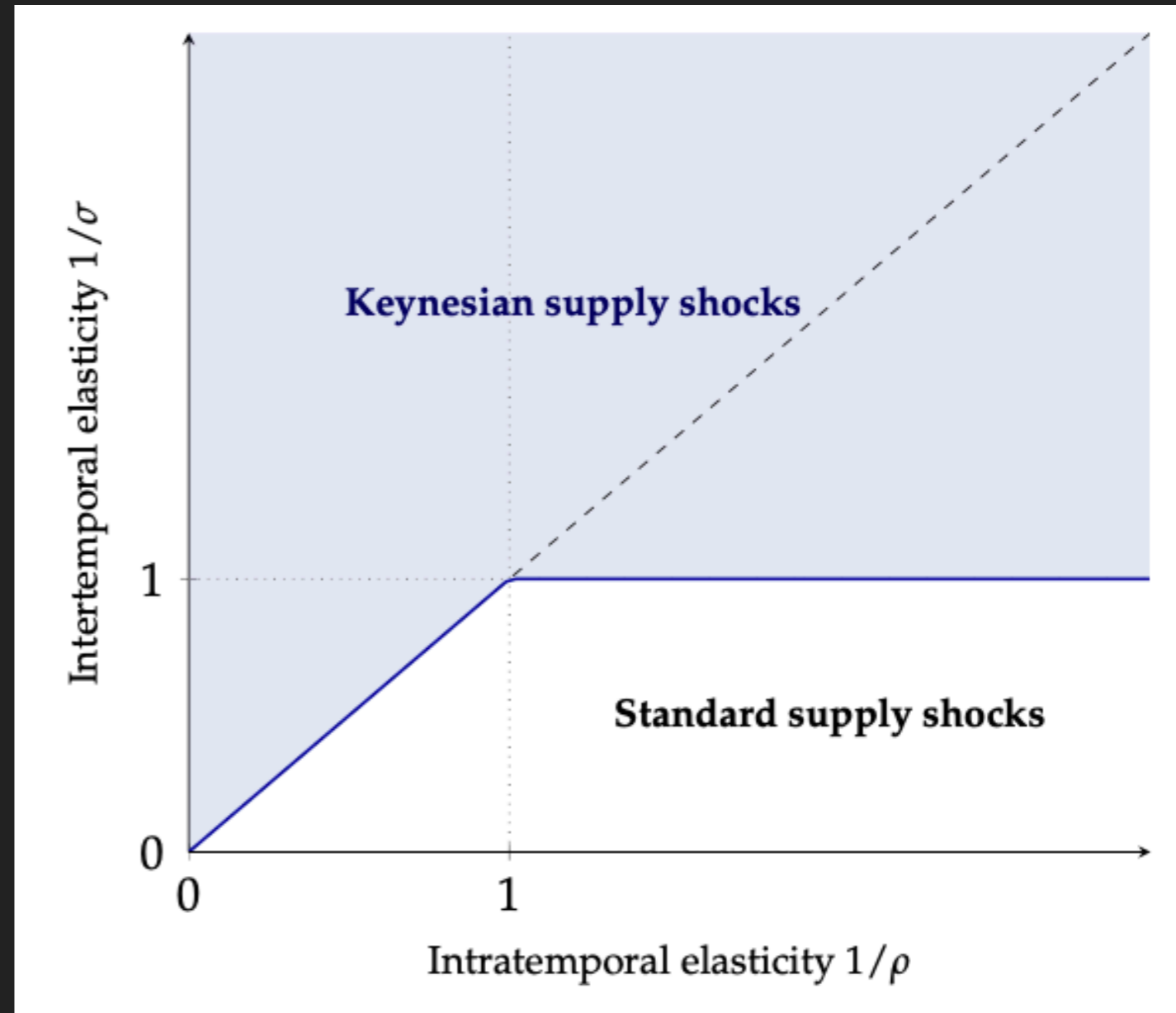


complete markets

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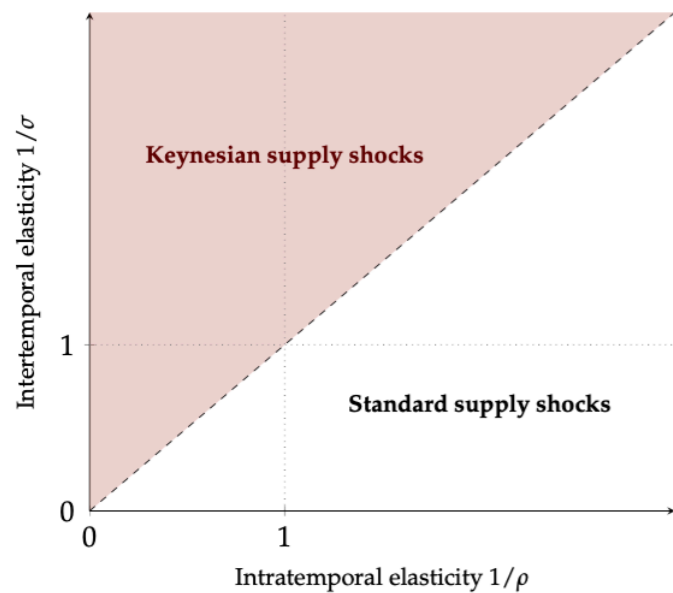


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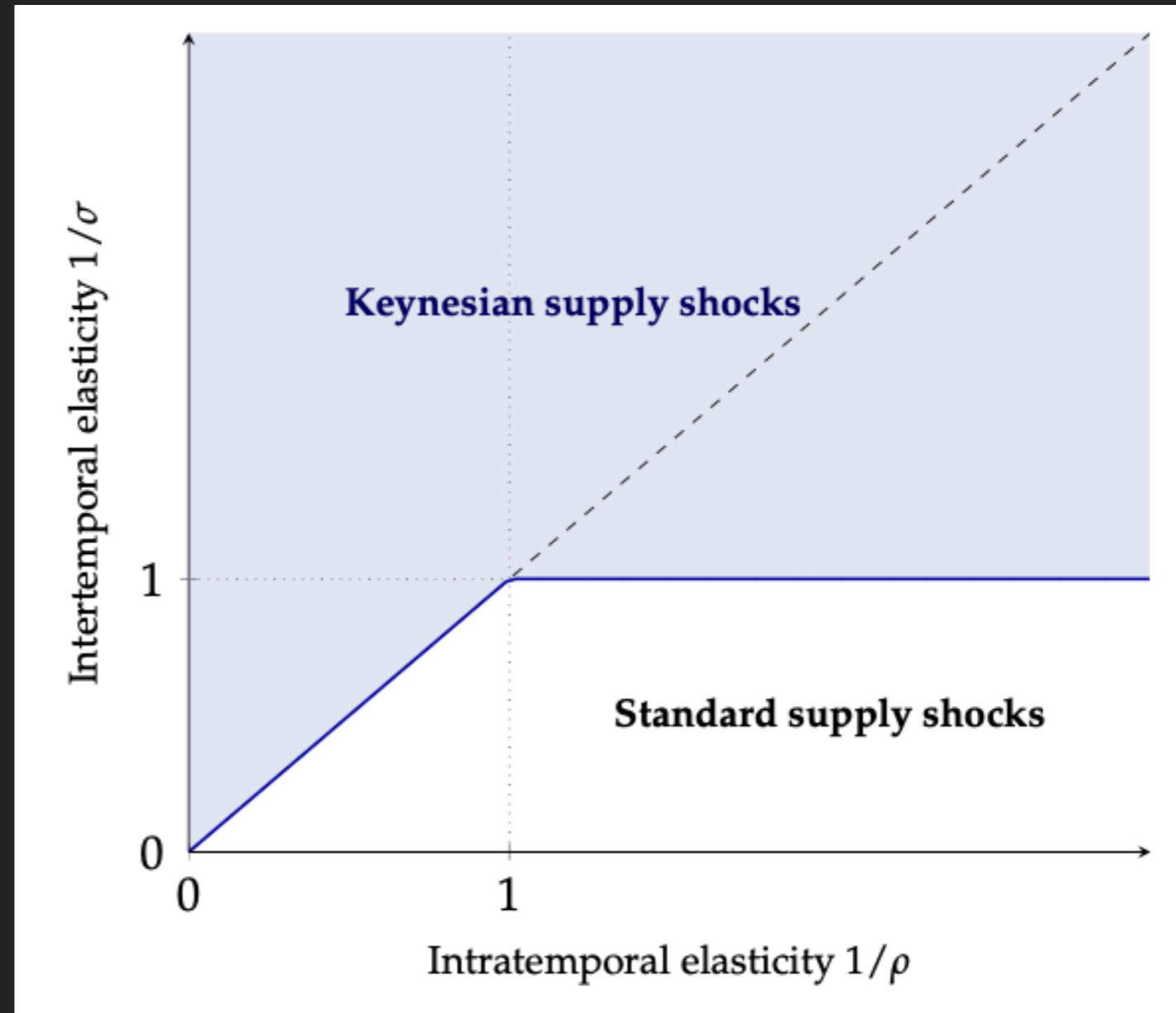


Incomplete Markets

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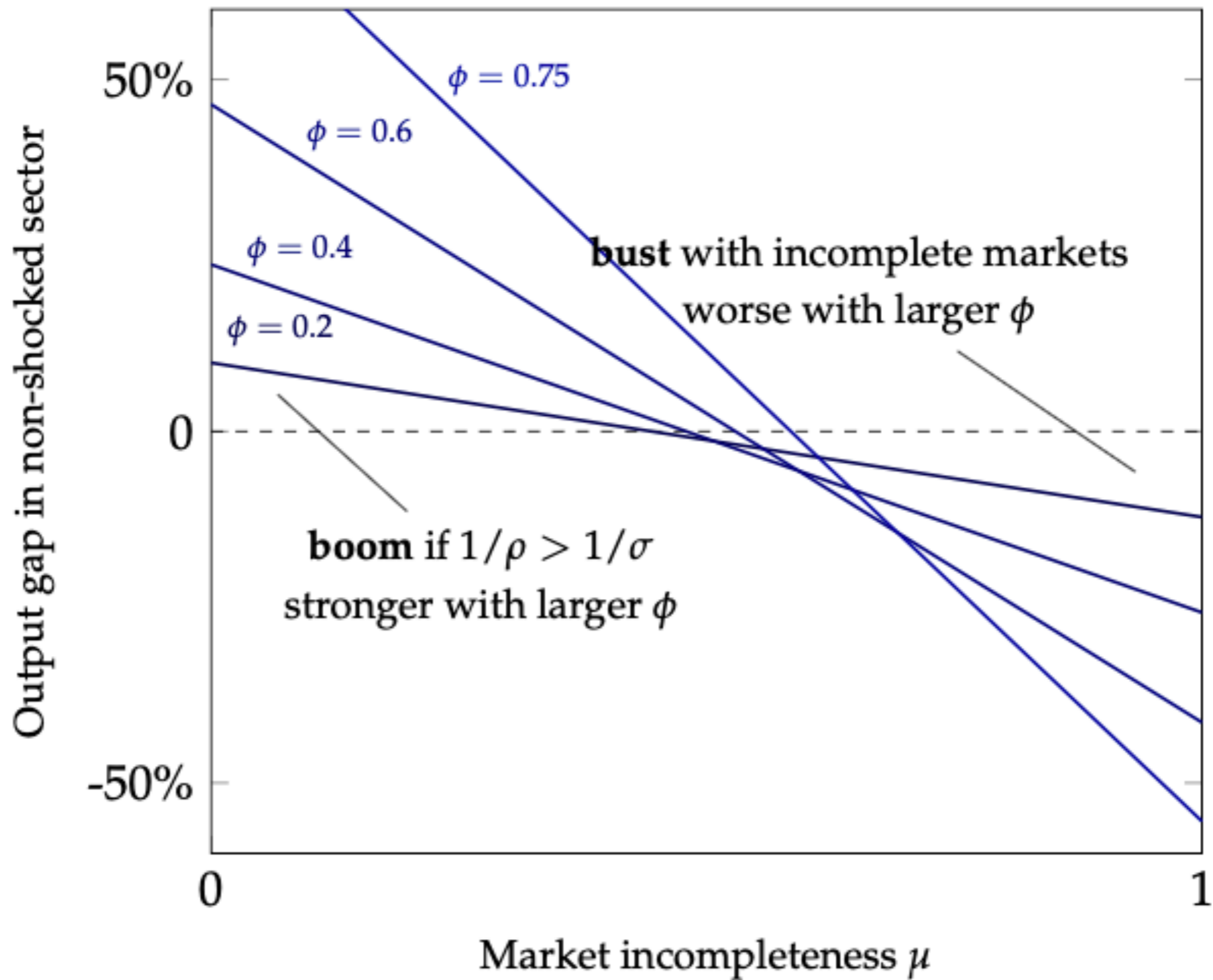


complete markets



Incomplete Markets

**NOTE: No "Paradox of Toil"**



# BINGO!

---

	Complete Markets	Incomplete Markets
Single Sector	<b>NO (Standard)</b>	<b>NO! (New)</b>
Multiple Sectors	<b>POSSIBLE</b>	<b>EVEN MORE POSSIBLE</b>



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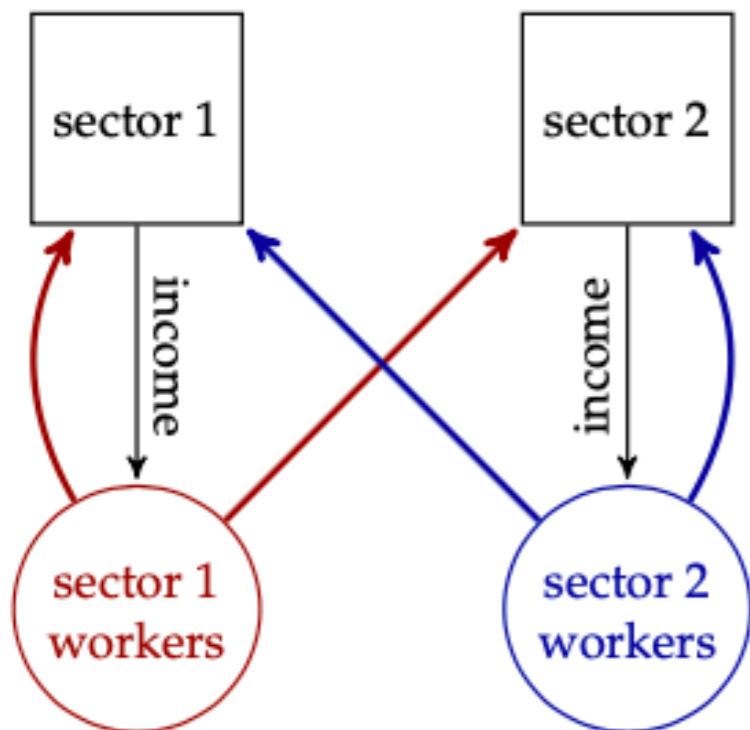
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- ▶  $G$  multiplier = 1
- ▶  $T$  multiplier = Avg MPC
- ▶ No 2nd round Keynesian Cross operating!

# FISCAL POLICY

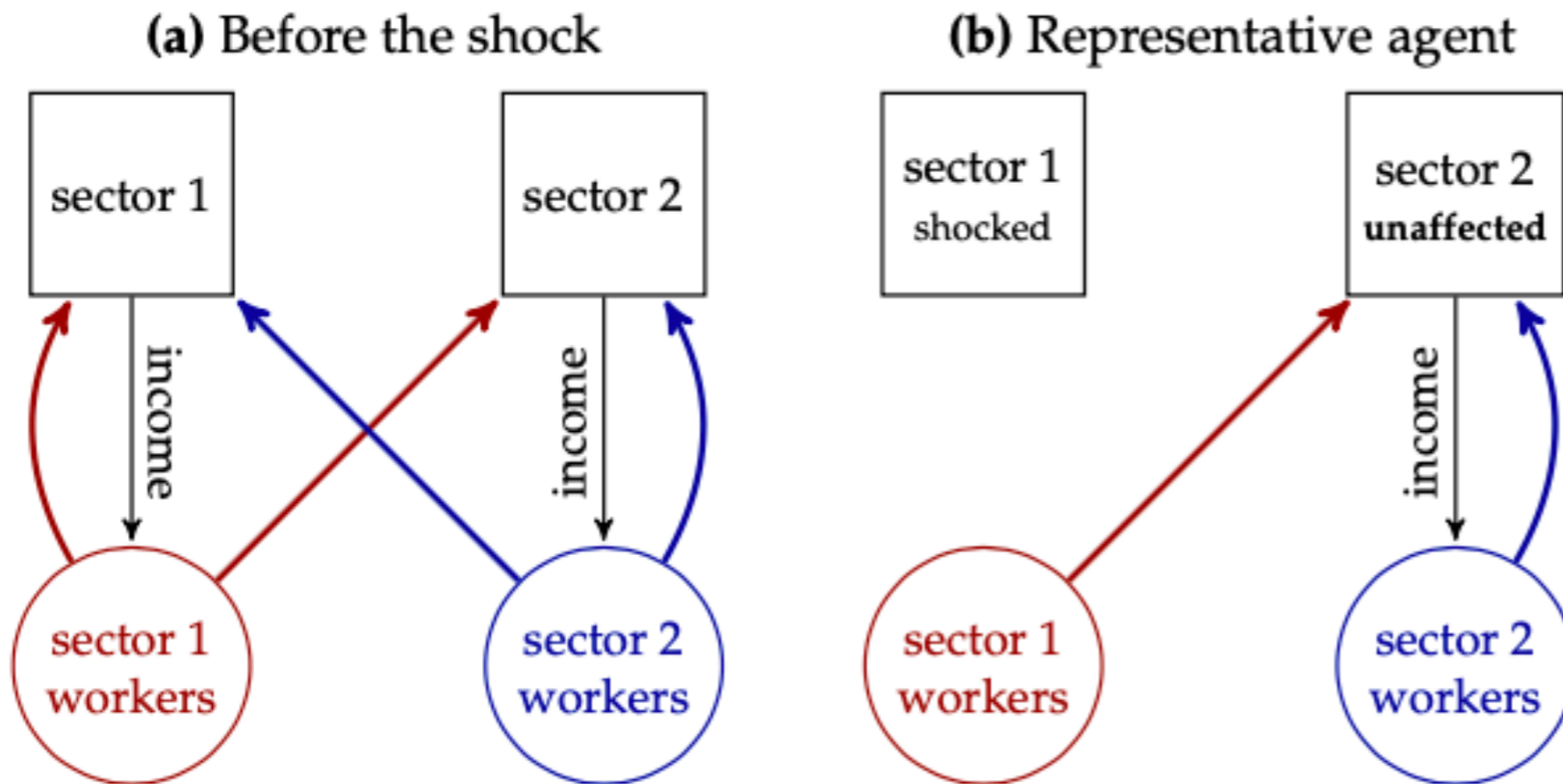
**Figure 1:** How negative supply shocks can lead to demand shortages  
— Case with equal inter- and intra-temporal elasticities —

(a) Before the shock



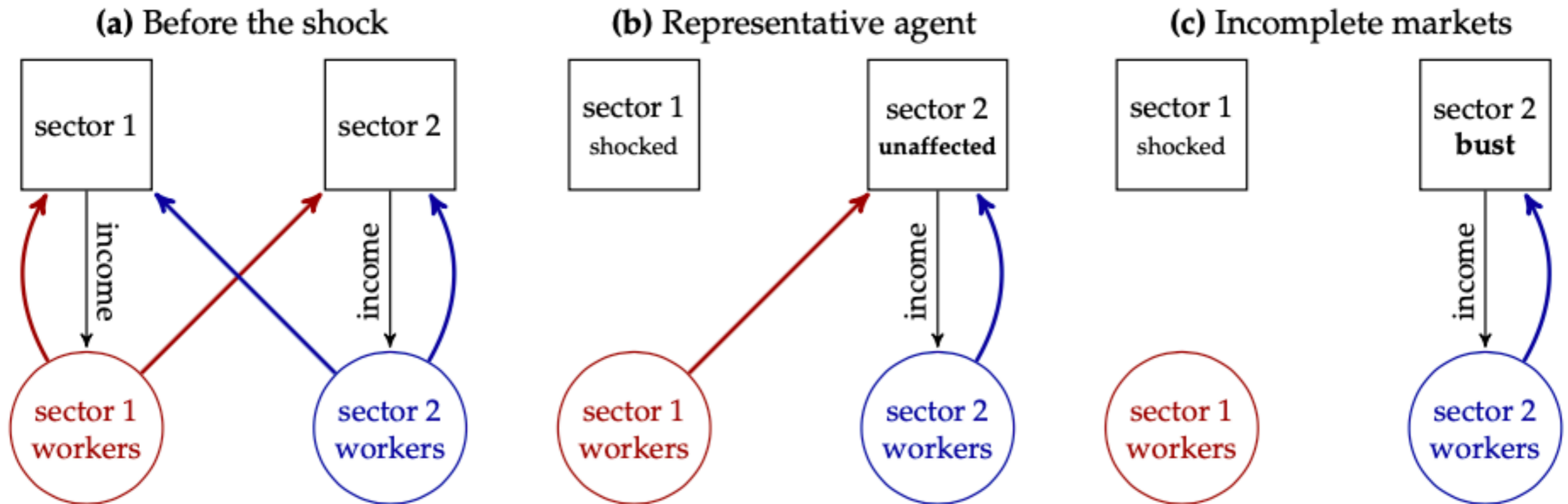
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**MOBILITY**

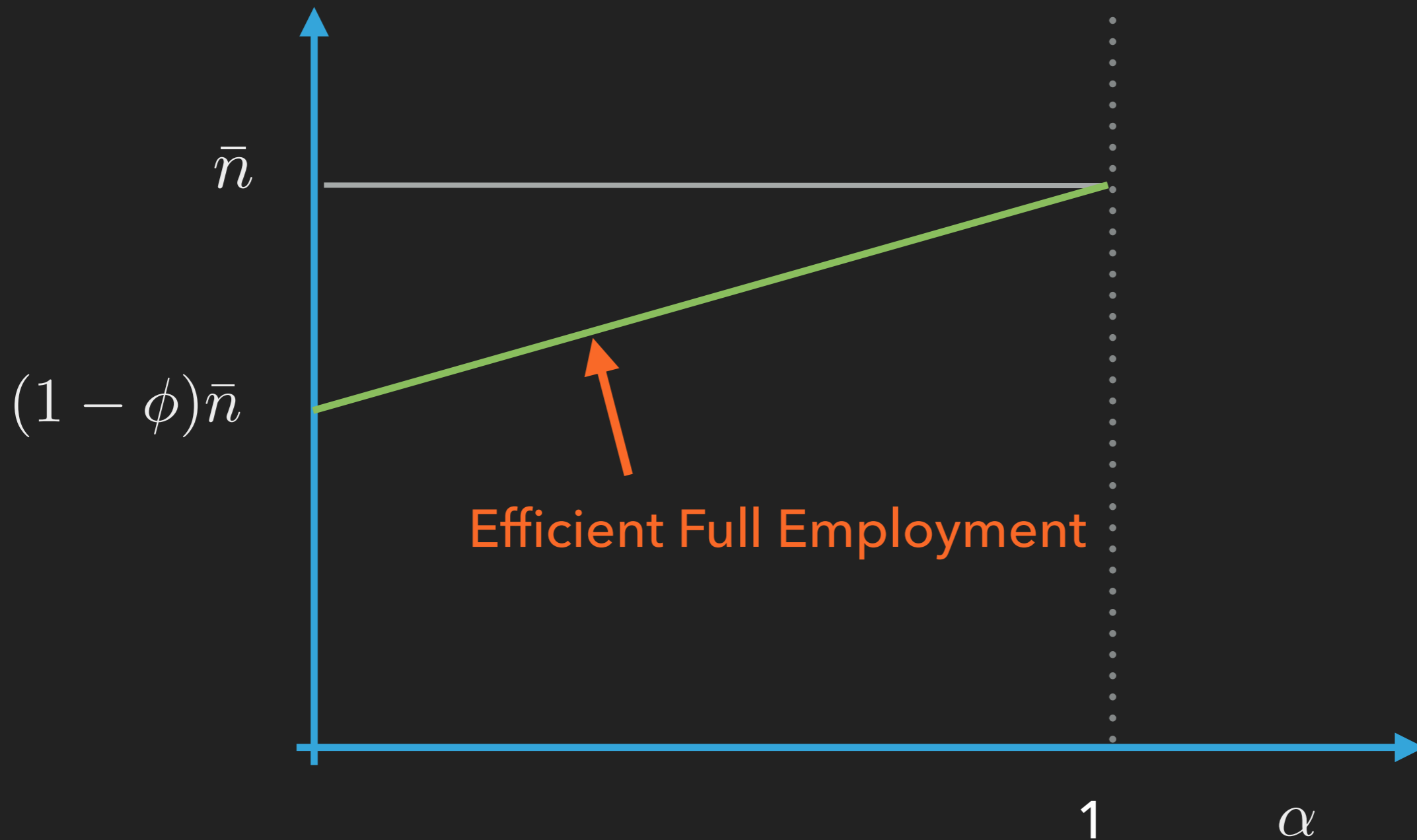
**+**

**DEMAND CHAINS**



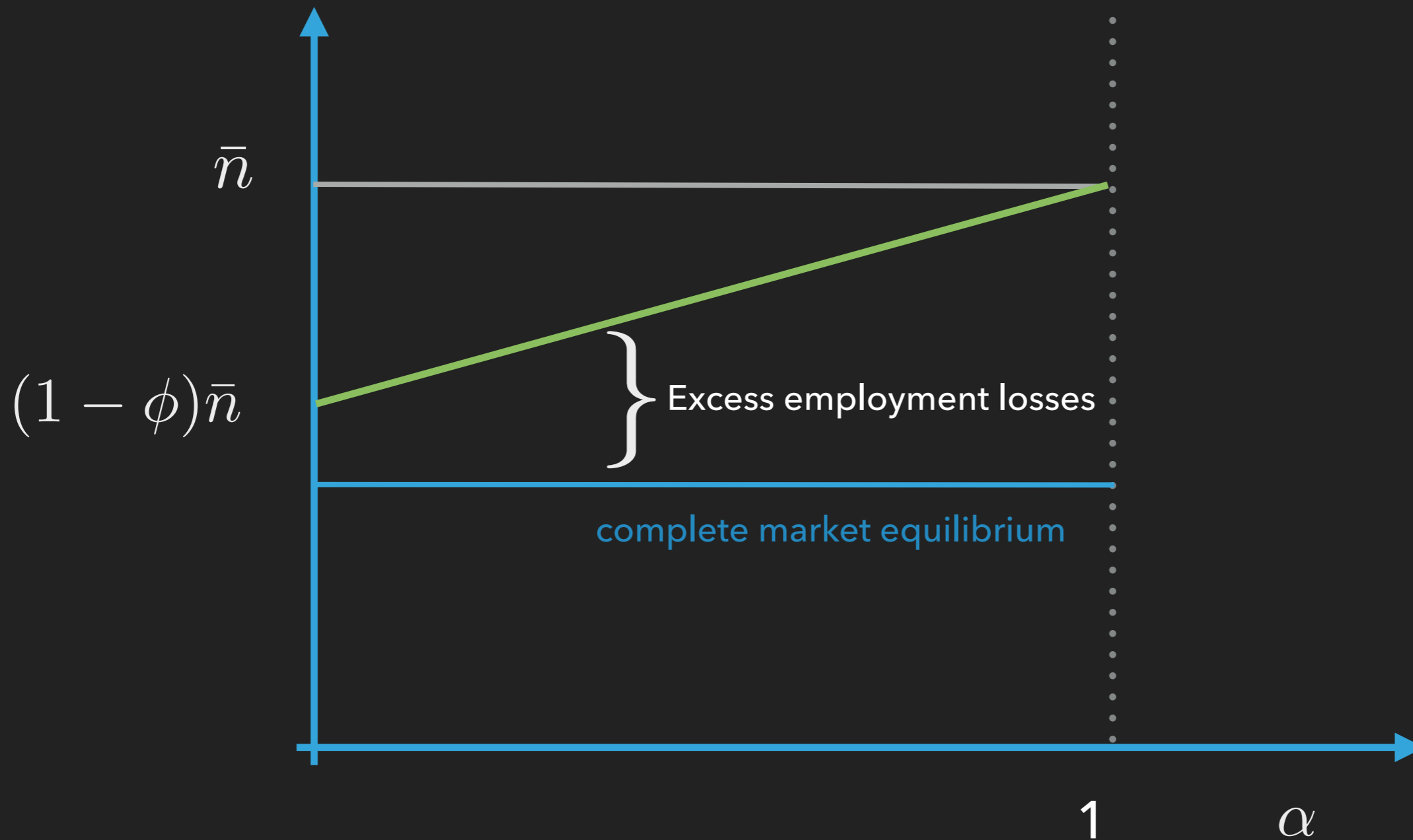
# LABOR MOBILITY

- ▶ Suppose a fraction  $\alpha$  of workers can move sectors

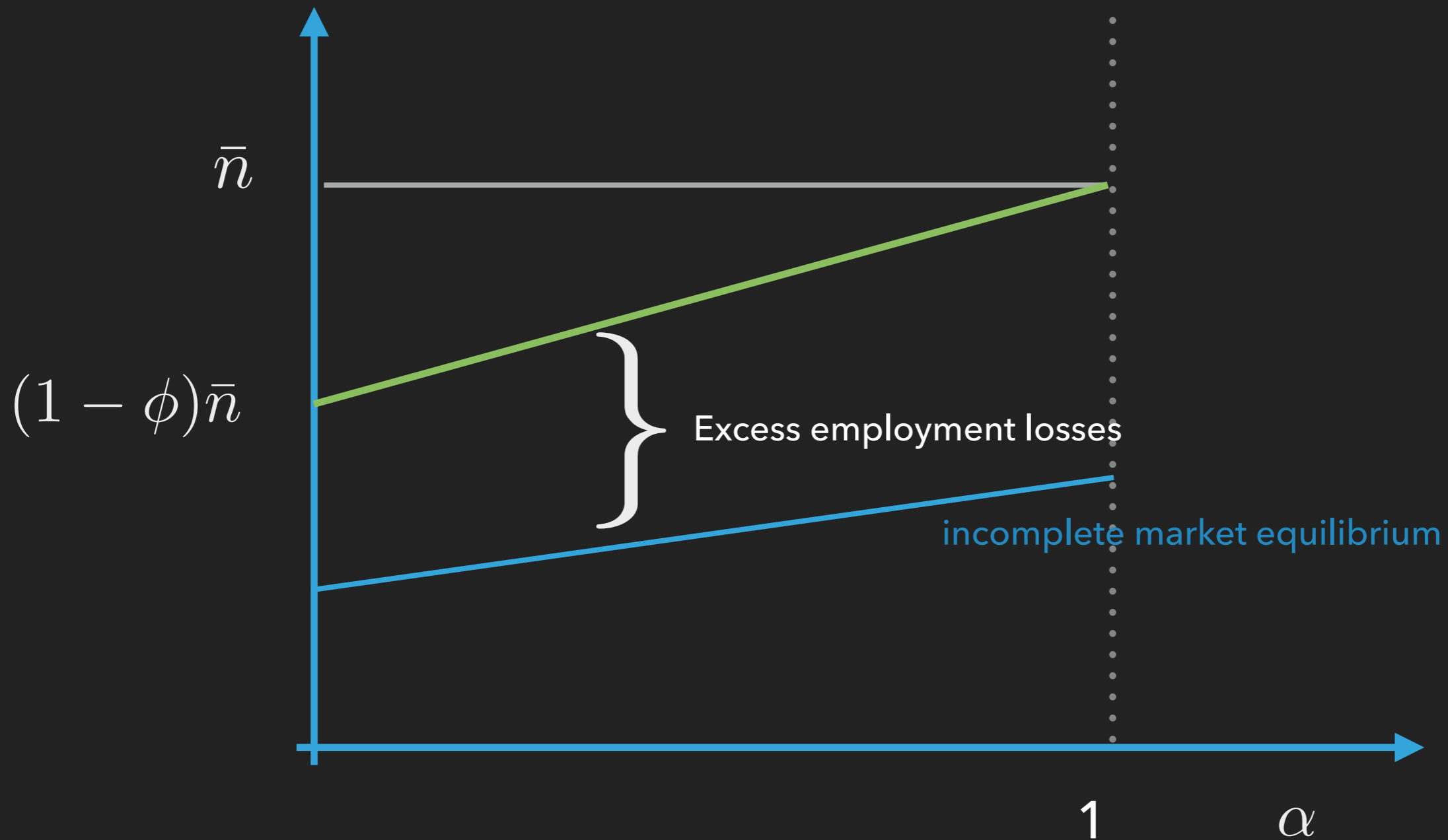


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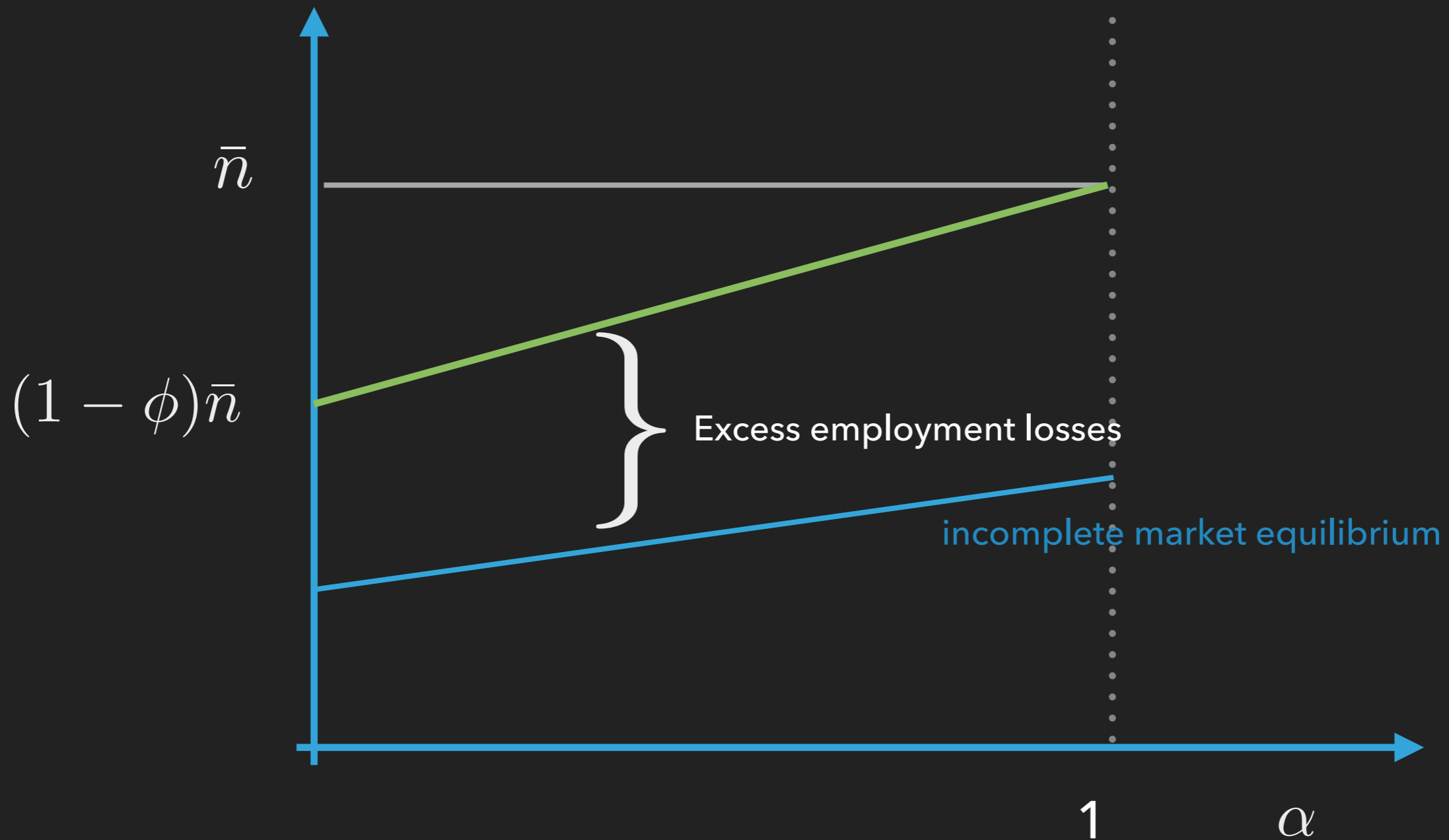
## ▶ Complete markets



# LABOR MOBILITY + INCOMPLETE MARKETS



# LABOR MOBILITY + INCOMPLETE MARKETS



Rises or Falls with  $\alpha$ ?

**BUSINESS EXIT  
CASCADES**

# ENDOGENOUS BUSINESS ACTIVITY

---

- ▶ From 2 sectors to continuum of varieties

$$C_t = \left( \int c_{jt}^{1-\rho} dj \right)^{1/(1-\rho)}$$

- ▶ Monopolistic competition generates profits

$$\Pi_{jt} = \rho N_{jt}$$

- ▶ Each variety produced by separate representative worker who also own that variety

- ▶ **Key: businesses only active when**

$$\Pi_{jt} > v_{jt} \quad \sim \Upsilon(v)$$

Random fixed cost

Chosen so that all firms are active in steady state

# DEMAND AND BUSINESS EXIT

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- ▶ Shock as before: Shut down mass  $\phi$  of businesses
- ▶ Mass  $\hat{\phi}_0$  of inactive businesses = endogenous
- ▶ Two equilibrium conditions

- ▶ Demand for labor in active sectors

$$\frac{N_0}{\bar{n}} = (1 - \hat{\phi}_0)^{\frac{\rho}{\sigma} \frac{1-\sigma}{1-\rho}}$$

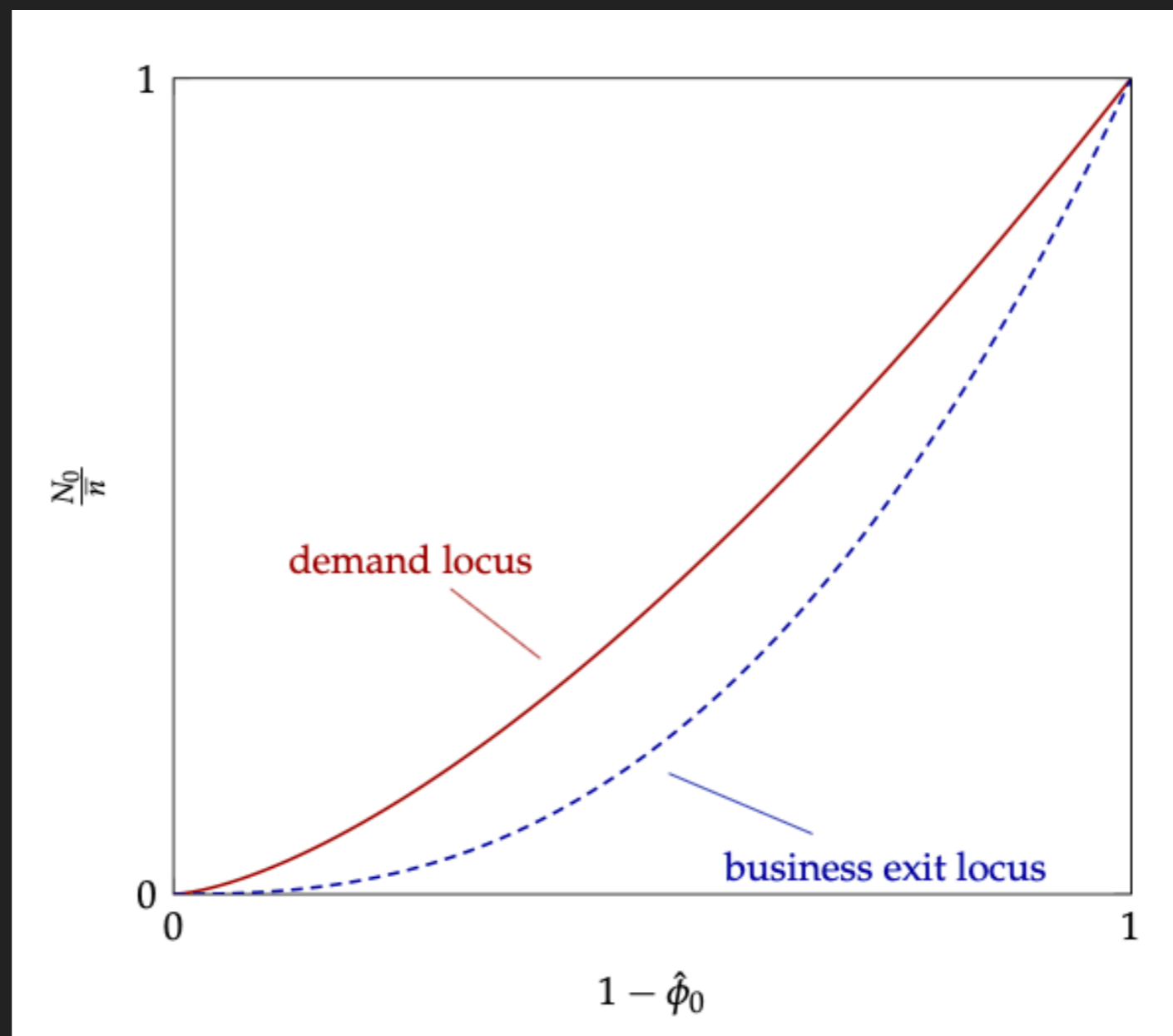
Assume incomplete markets

Keynesian supply shock regime

- ▶ Supply of active sectors

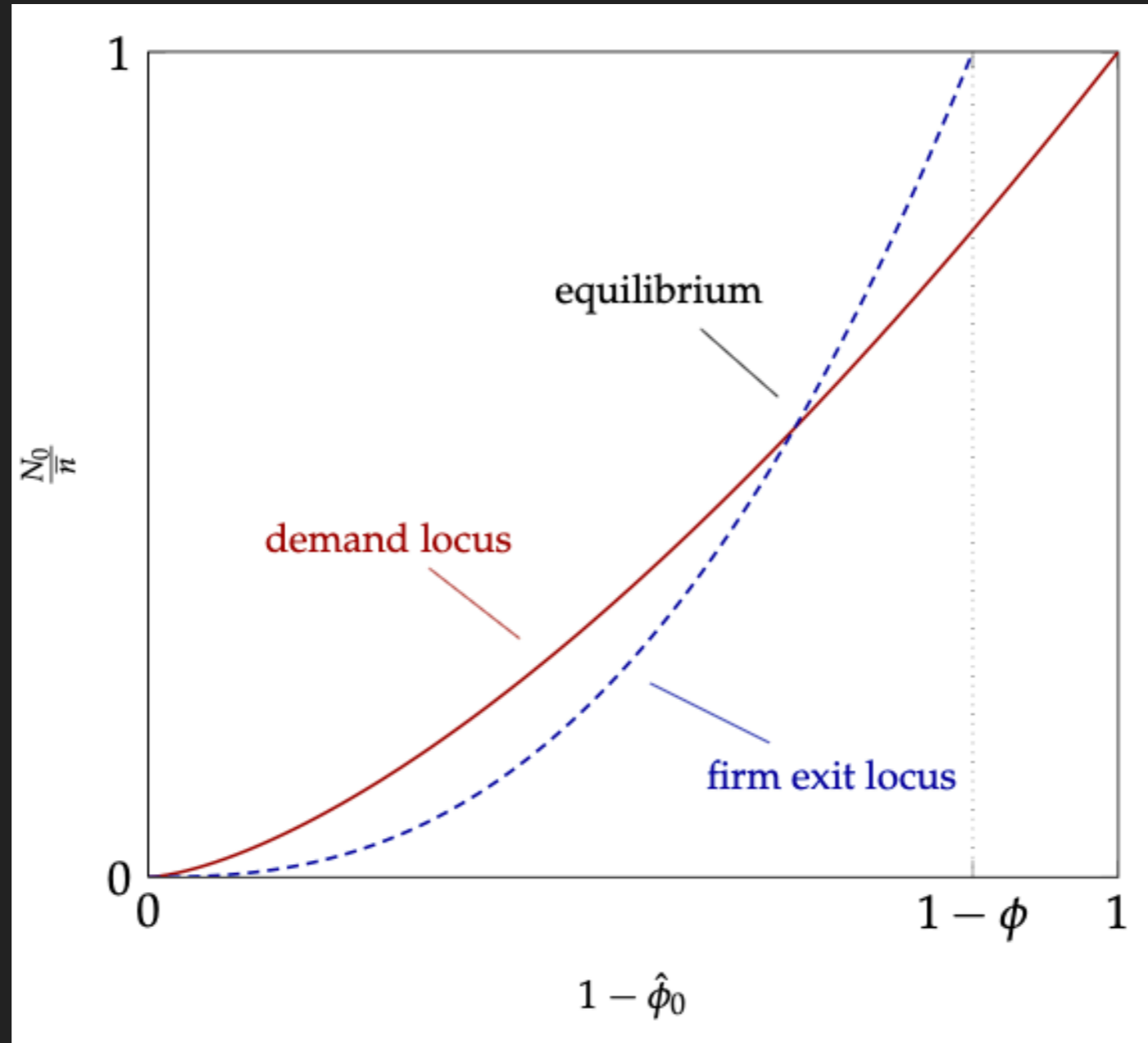
$$1 - \hat{\phi}_0 = (1 - \phi) \Upsilon(\rho N_0)$$

# DEMAND AND BUSINESS EXIT CASCADES





# DEMAND AND BUSINESS EXIT CASCADES



# BUSINESS EXIT MULTIPLIER

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- ▶ Simple functional form

$$\Upsilon(v) = \left( \frac{v}{\rho \bar{n}} \right)^\eta$$

- ▶  $\eta$  = elasticity of business exit to demand

$$\log \frac{N_0}{\bar{n}} = \underbrace{\frac{1}{1 - \eta \frac{\sigma^{-1} - 1}{\rho^{-1} - 1}}}_{\text{firm exit multiplier}} \frac{\sigma^{-1} - 1}{\rho^{-1} - 1} \log(1 - \phi)$$

# POLICY IMPLICATION: SUBSIDIZING LABOR

- ▶ Imagine we subsidize wage bill with some  $\tau > 0$ 
  - ▶ e.g. employer-side payroll tax cut
- ▶ Result:

$$\log \frac{N_0}{\bar{n}} = \frac{1}{1 - \eta \frac{\sigma^{-1} - 1}{\rho^{-1} - 1}} \frac{\sigma^{-1} - 1}{\rho^{-1} - 1} (\log(1 - \phi) + \eta \log(1 + \tau))$$

Amplified effect due to business exit multiplier

Helps businesses stay afloat!

- ▶ Can get similar result for monetary policy:
  - ▶ lower rates keep businesses in business
  - ▶ “business exit channel”

**LABOR HOARDING**

**VS**

**JOB WORKER**

**MATCH DESTRUCTION**

# LABOR HOARDING TO PRESERVE JOB MATCHES

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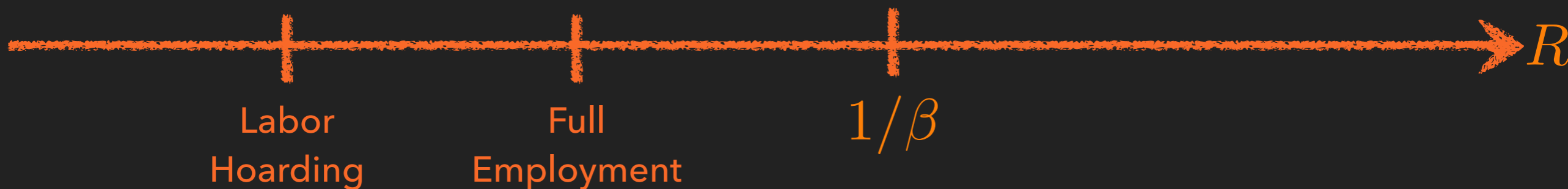
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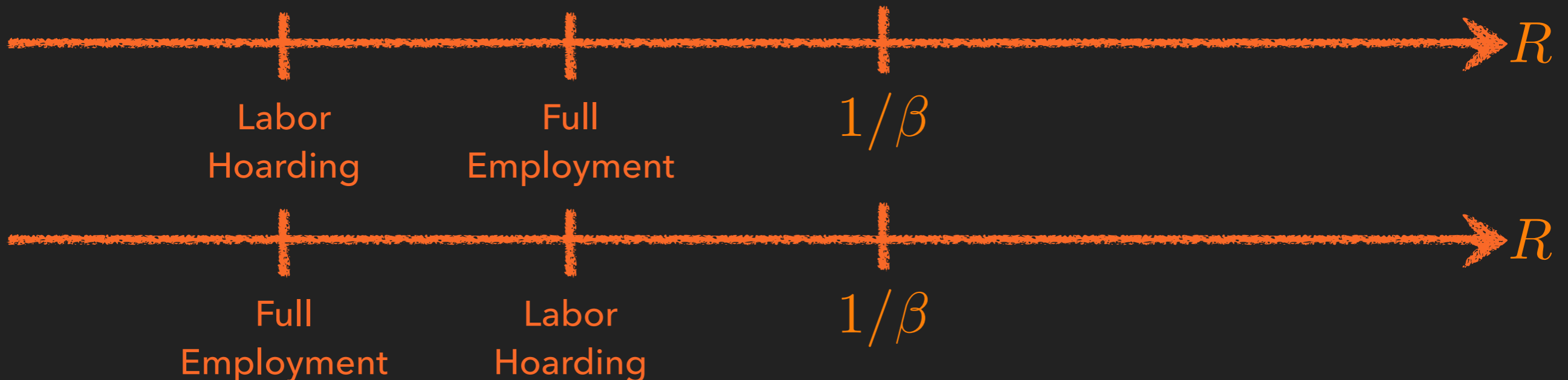


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**OPTIMAL POLICY**

**HEALTH + MACRO**

# OPTIMAL POLICY

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- ▶ Add public health dimension

$$\sum_{t=0}^{\infty} \beta^t (U(c_{1t}, c_{2t}) + h_t)$$

- ▶ Health depends on private behavior and on aggregates (externality)

$$h_t = H(c_{1t}, n_{1t}, Y_{1t}, \xi_t)$$

- ▶ Three sources of inefficiency...
  - ▶ health externality (as in Eichenbaum-Rebelo-Trabandt)
  - ▶ lack of insurance
  - ▶ involuntary unemployment

# PUBLIC HEALTH AND MACRO POLICIES

---

- ▶ Start with no public health policy...
  - ▶ Private decisions to limit consumption in sector 1
  - ▶ consumption dominates labor: involuntary unemployment!
- ▶ **Remark 1:** Unemployment may not be socially inefficient! (reduce labor further)
- ▶ Keynesian Wedge vs. Pigouvian Externality  $H_{Y_1}$
- ▶ **Remark 2 (complementarity):** Shutdown of sector 1 optimal, but can cause KSS, so we need to lower  $r_0$
- ▶ **Remark 3 (optimal policy):** With incomplete markets targeted transfers hit three birds with one stone
  - ▶ Provides insurance
  - ▶ Raises natural rate (important if at ZLB): may not need to raise  $r_0$
  - ▶ Makes public health policy more desirable

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**THREE WAY COMPLEMENTARITY!**

# CONCLUSIONS

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	Complete Markets	Incomplete Markets
Single Sector	<b>NO (Standard)</b>	<b>NO! (New)</b>
Multiple Sectors	<b>POSSIBLE</b>	<b>EVEN MORE POSSIBLE</b>

**Thank You!**

**EXTRA SLIDES**

# ABSTRACT FROM UNCERTAINTY...

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- ▶ Uncertainty: well understood, clear mechanism, potential relevant and complement to what we do...
- ▶ But, pandemic + lockdown...
  - ▶ relatively front-loaded shock
  - ▶ uncertainty endogenous?
  - ▶ uncertainty on duration: not deliver recessionary effects
  - ▶ some uncertainty increases demand: toilet paper
- ▶ If story is uncertainty or future dip, then after we bottom out: recovery should be swift

# DEMAND VS SUPPLY

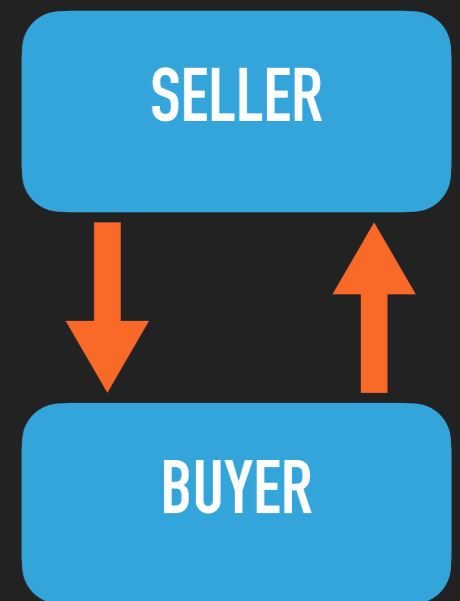
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  - ▶ not always clear, meanings differ...
  - ▶ ...supply shock lowers demand, but...  
...more than supply? excess demand?
- ▶ Taste shock = Supply shock  $\neq$  Demand shock  
both give drop buyer/seller gains from trade...
- ▶ **Today:** Demand deficiency...
  - ▶ natural (flex price) interest rate (full employment) falls
  - ▶ holding fixed interest rate: recession

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