Dynamic Oligopoly and Price Stickiness

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Imperfect Competition

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- Monopolistic competition: continuum of firms (Dixit-Stiglitz)
  - simple and tractable
  - reigns supreme: trade, macro, growth, …

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  - simple and tractable
  - reigns supreme: trade, macro, growth, …
- Oligopoly: finite number of firms
  - more realistic and complicated
  - extensive IO literature
  - "rise in market power": markups, concentration, superstar firms, …
- **Q:** Oligopoly important for macro ?

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  - representative agent, infinite horizon
  - consumption, labor and money
  - nominal rigidities a la Calvo

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- Here:
  - oligopoly with any n firms
  - general demand structure (e.g. Kimball, not just CES)
- Results
  1. Sufficient statistics for M shocks
  2. Calibration and counterfactuals
  3. Inspecting the mechanism
  4. Phillips Curve

Literature

- Mongey (2016)
- Rotemberg-Saloner (1986), Rotemberg-Woodford (1992)
- IO Literature (dynamic): Ericson-Pakes (1995), Bajari-Benkard-Levin (2007), …
- Passthrough Literature (static): Goldberg (1985), Atkeson-Burstein (2008), Gopinath-Itskhoki (2010), Arkolakis-Costinot-Donaldson-Rodríguez Clare (2015), Amiti-Itskhoki-Konings (2019)

Setup

- Households: consumption, labor, money
- Firms: continuum of sectors s…
    - n_s firms within sector s
    - Calvo price rigidity: constant probability of price change λ_s

- Equilibrium concepts for oligopoly game…
    - Markov: dominant equilibrium concept in IO

$$\int_0^\infty e^{-\rho t} U\left(C(t), L(t), \frac{M(t)}{P(t}\right) dt$$

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(Golosov-Lucas)

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Poisson arrival
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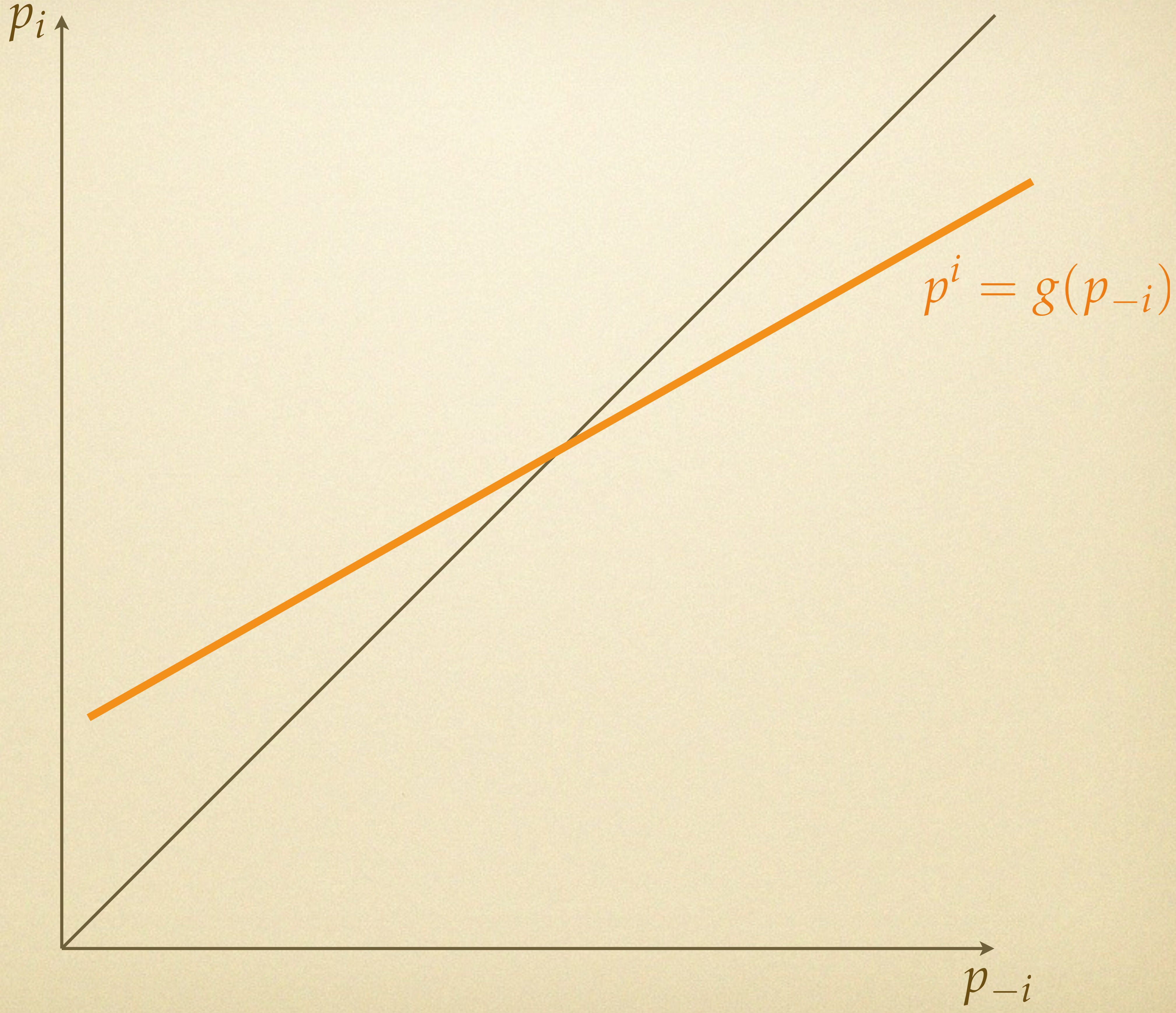
  - steady state price vector $P = g(P, P, \ldots, P)$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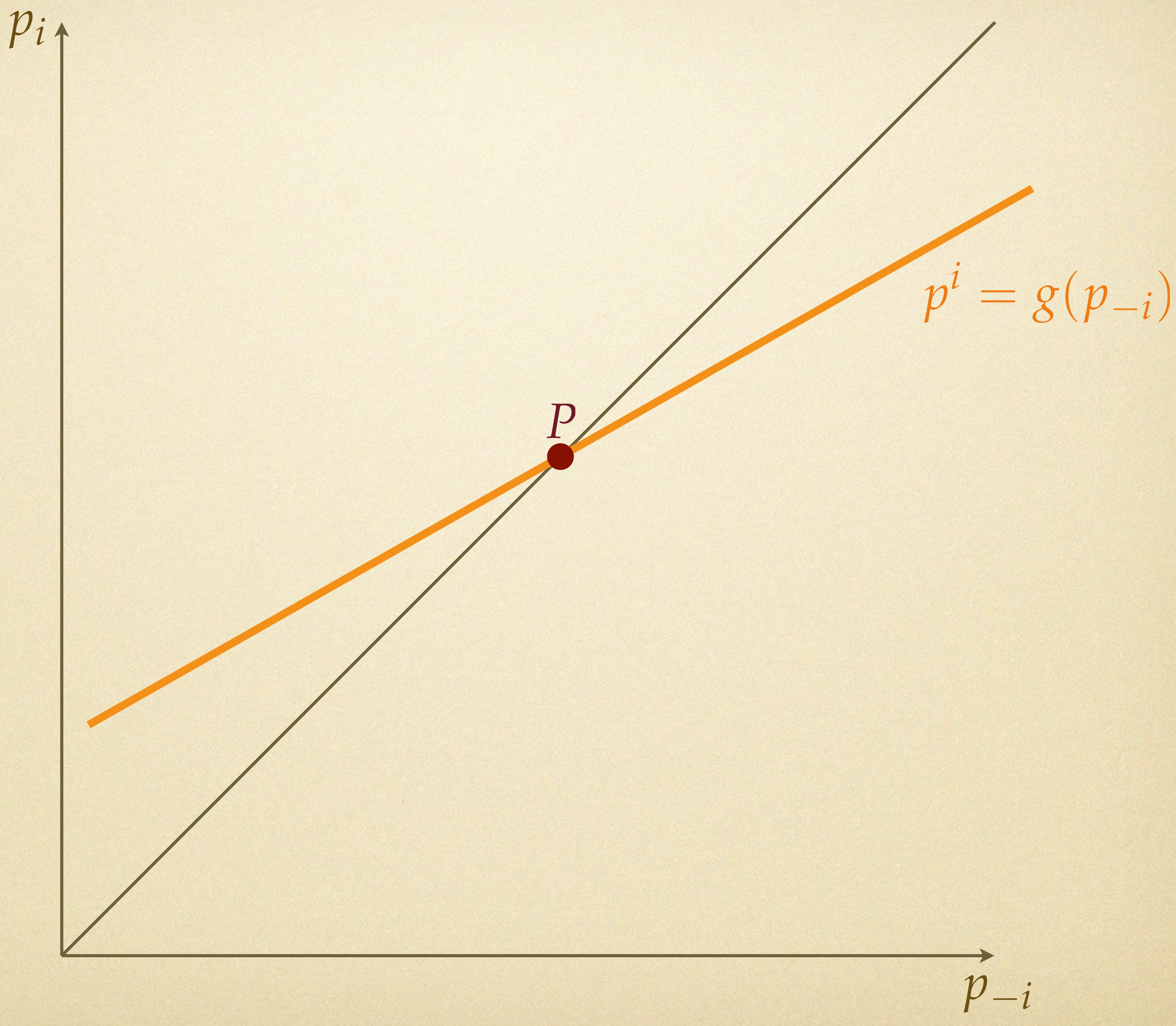
p_{-i}



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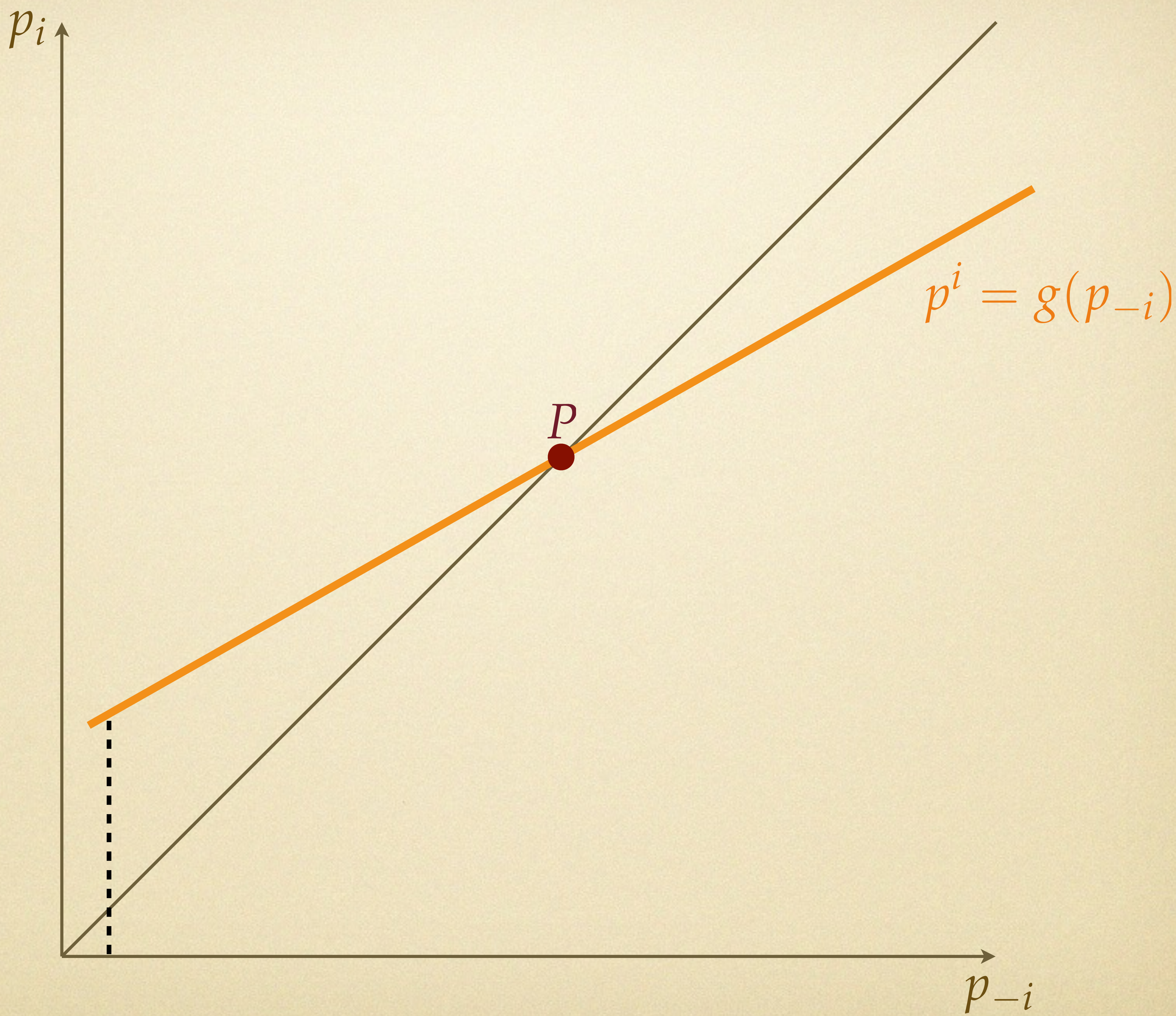
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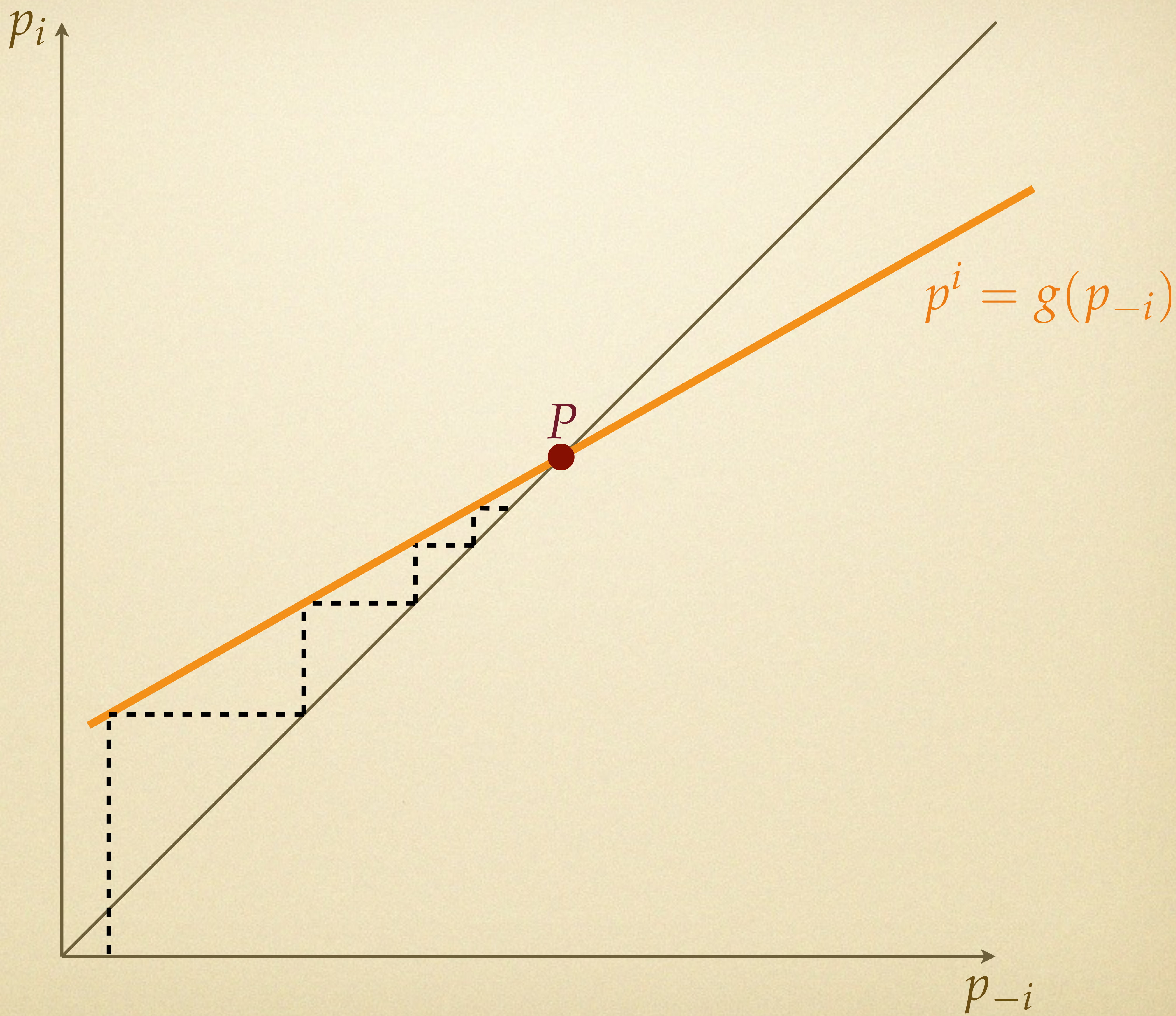

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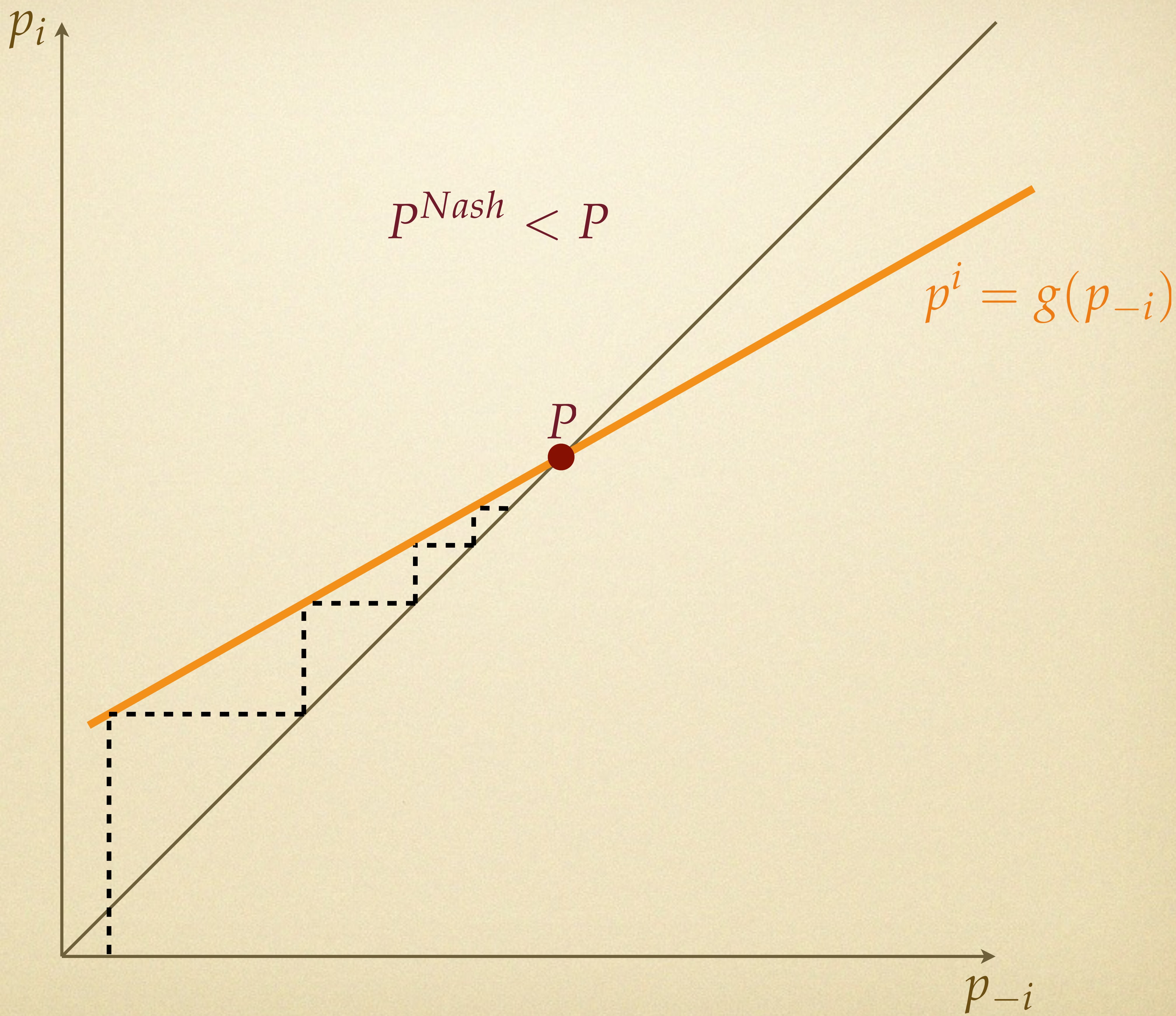

p_i
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1. Sufficient Statistics

Money Shock

- Starting at steady state…

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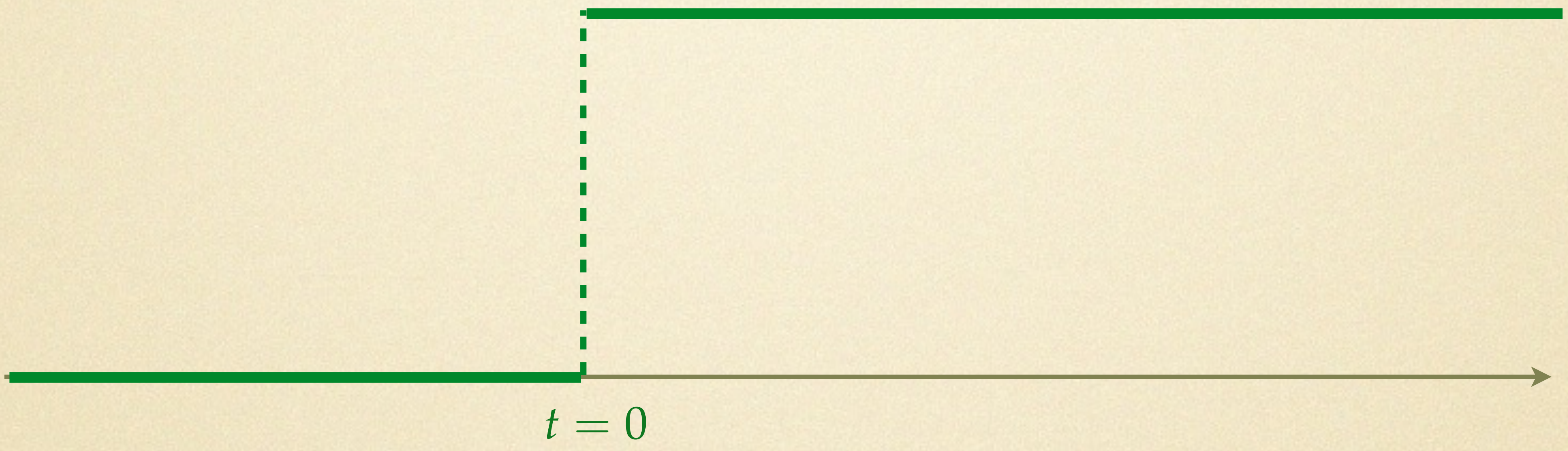

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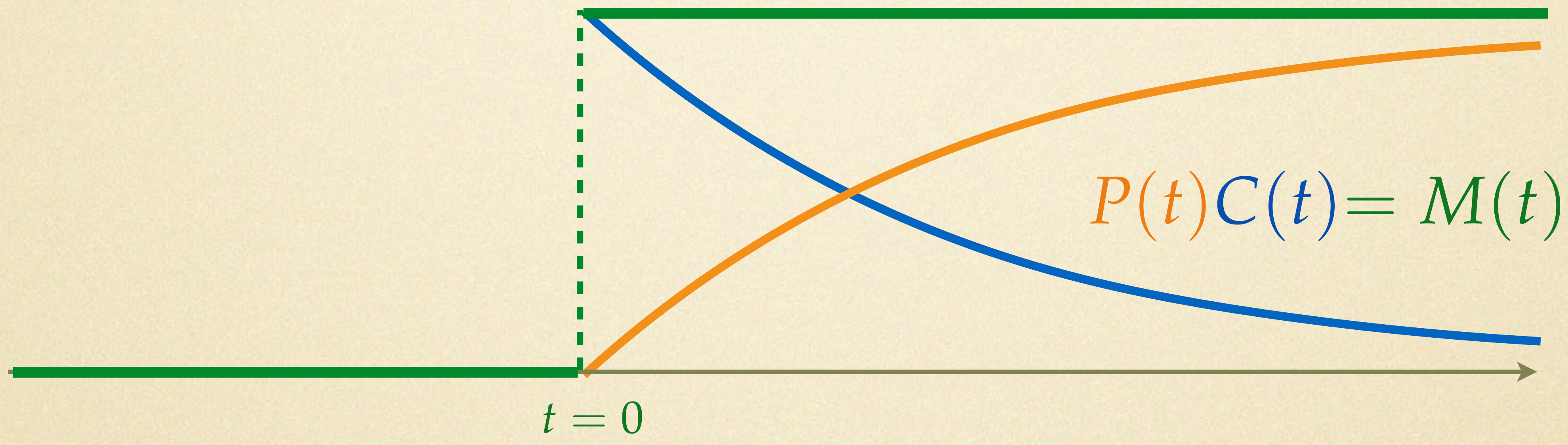

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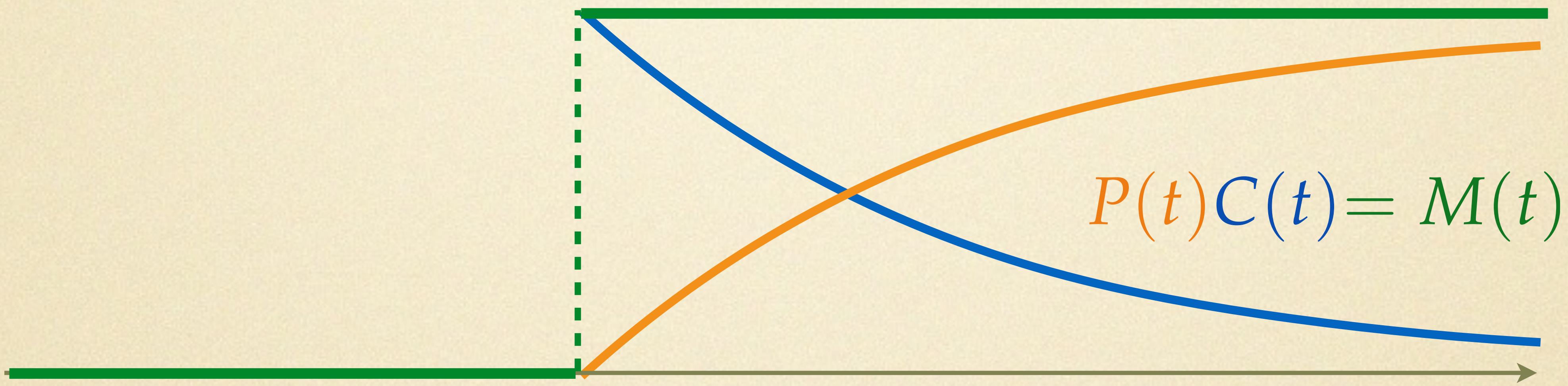

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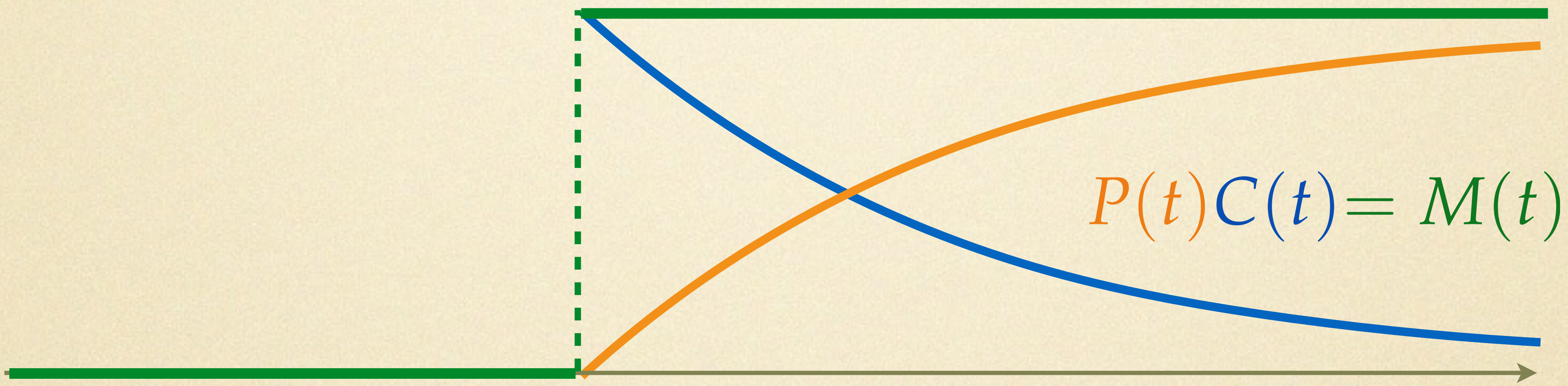

Proposition. (Aggregation)

$$\log \frac{P(t)}{P^*} \approx \log \frac{P(0)}{P^*} e^{-\lambda(1-\sum_n (n-1)\beta_n \omega_n)t}$$

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extensions: heterogeneous λ, productivity, costs

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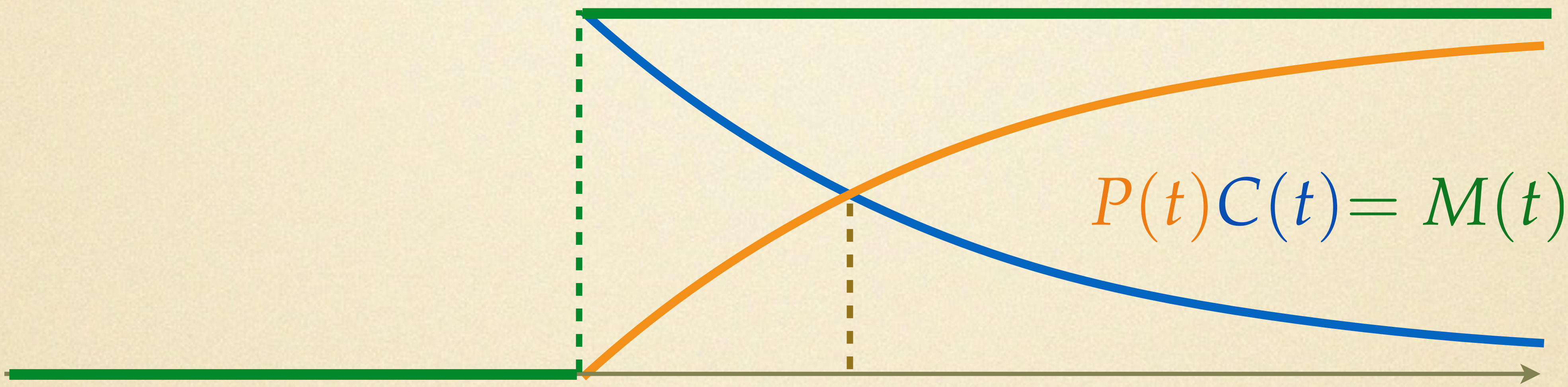

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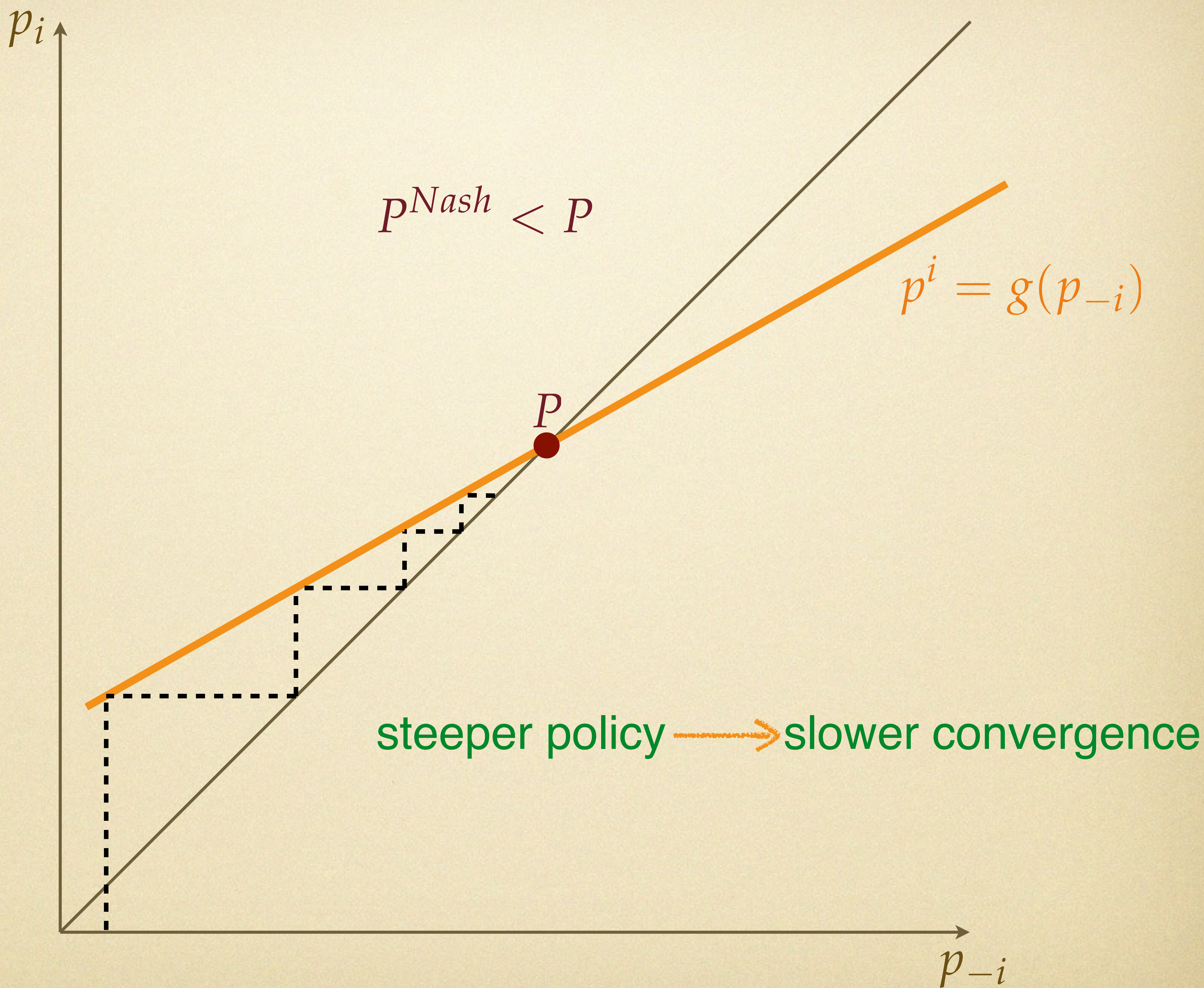
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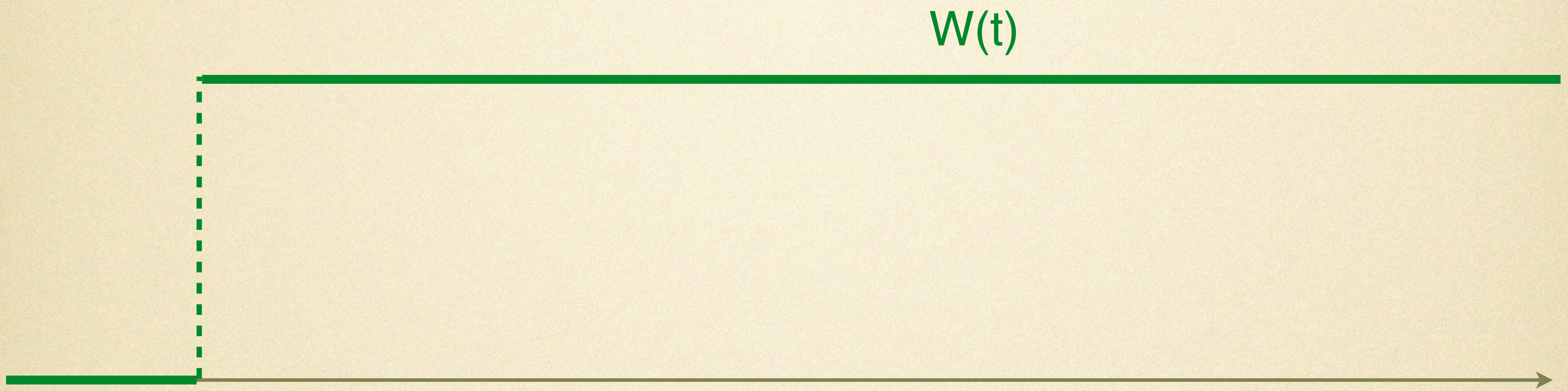
P
steeper policy ⟶ slower convergence
p_{-i}

Monopolistic vs Duopoly with CES



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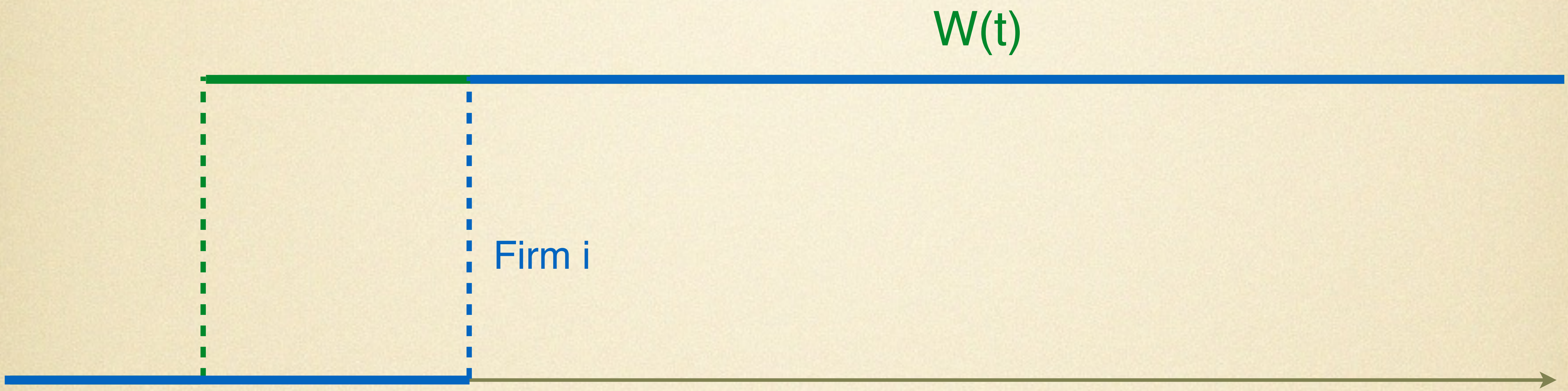

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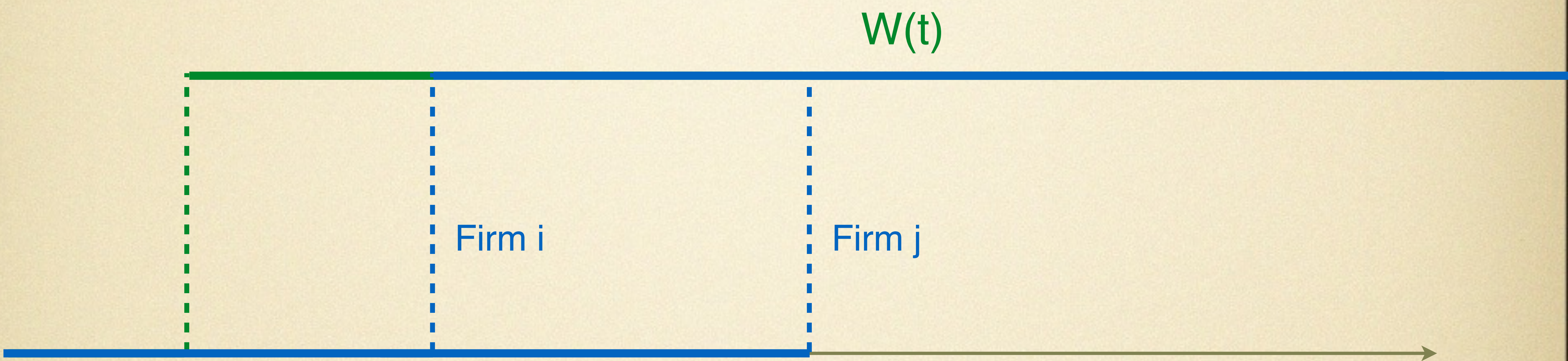

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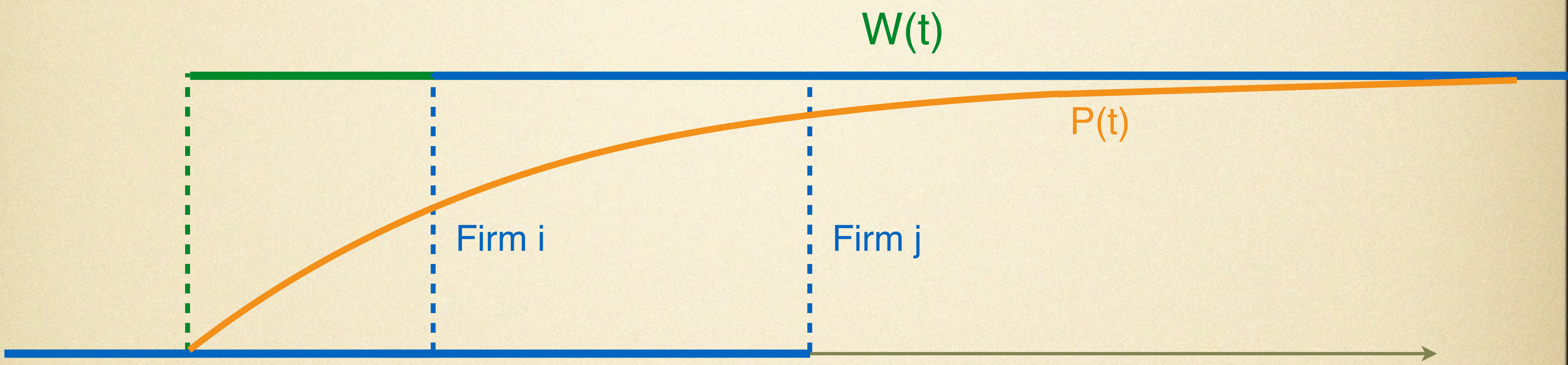

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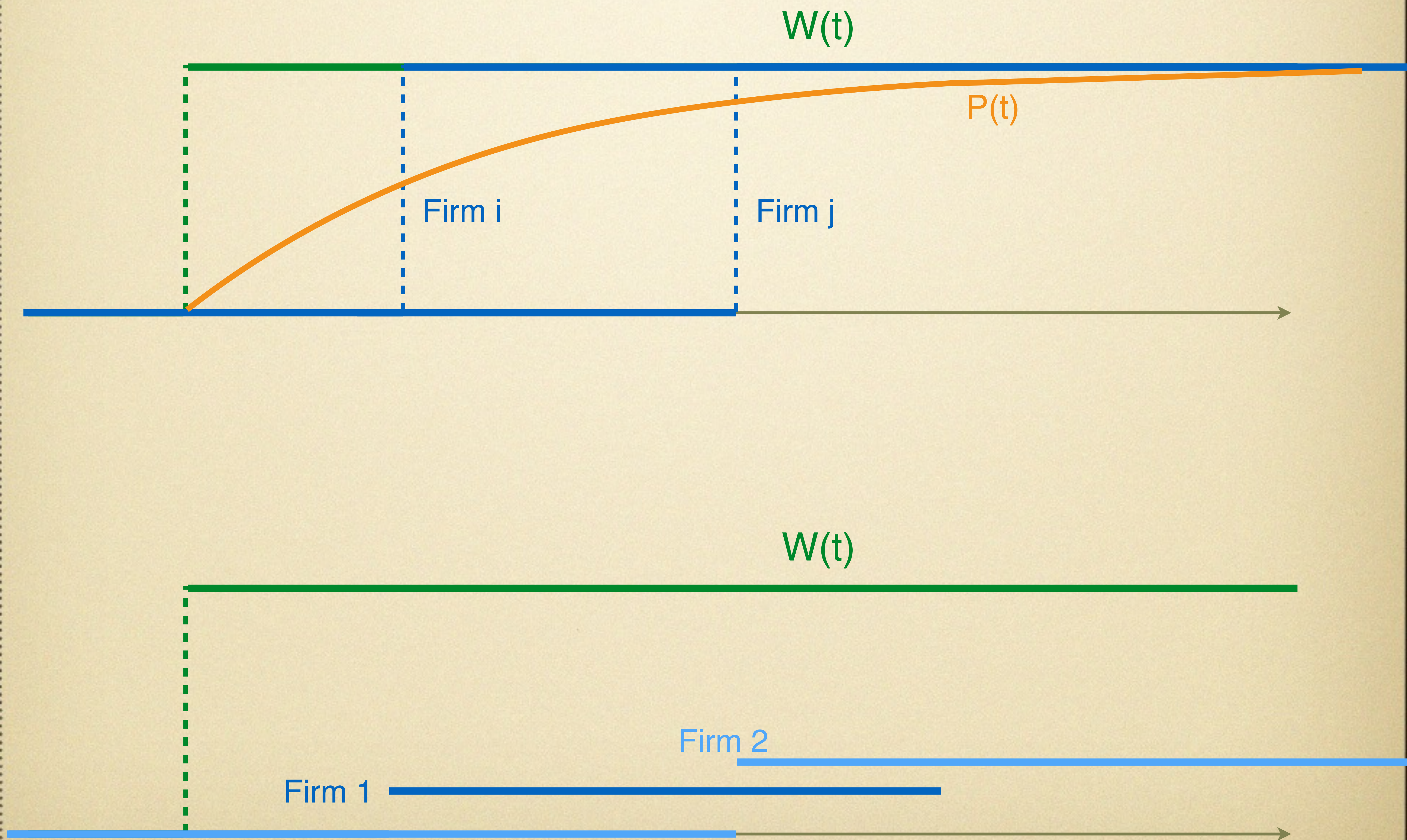

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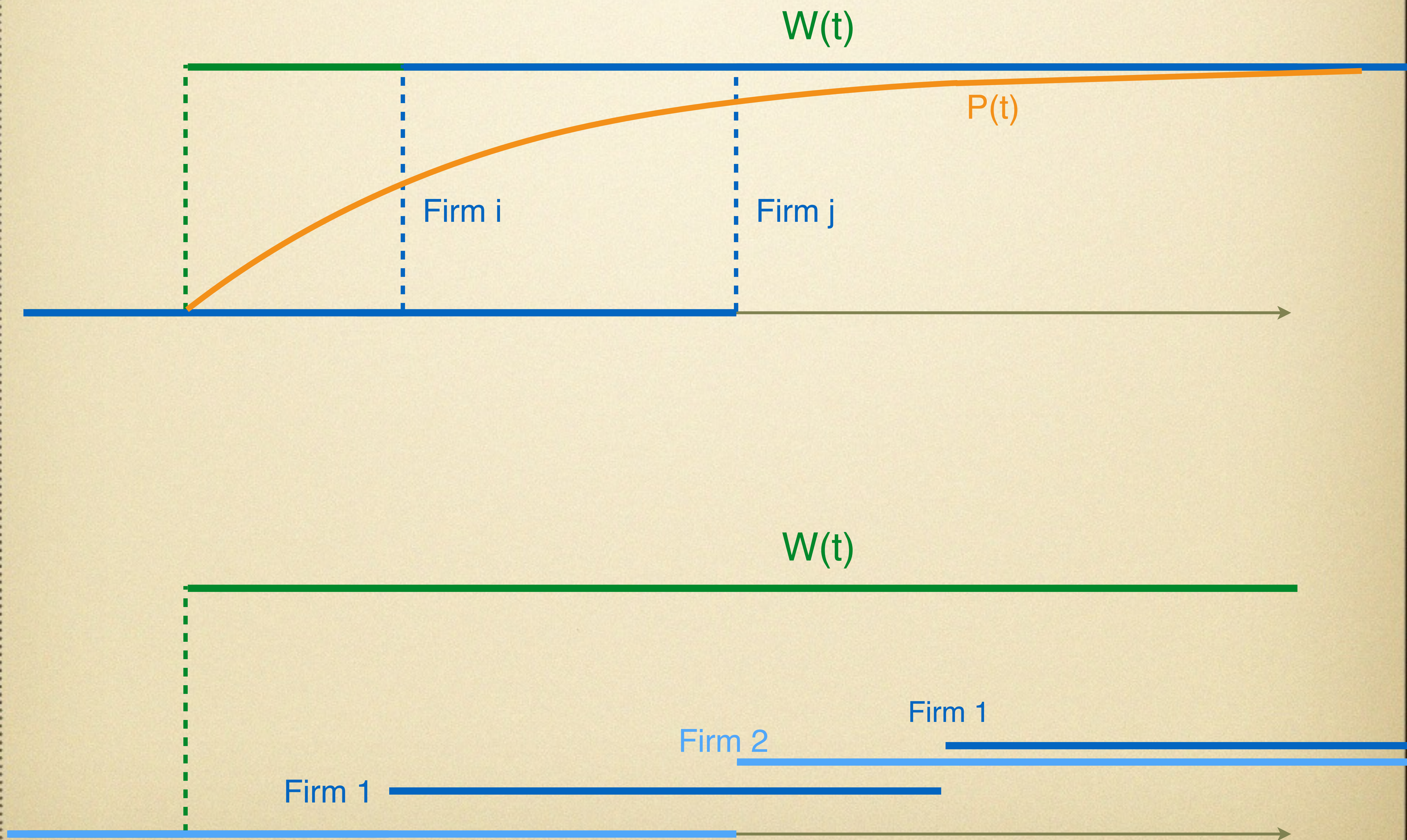

Monopolistic vs Duopoly with CES

Sufficient Statistic

Proposition.

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  - Nash markup $\Longleftrightarrow$ $\beta = 0$
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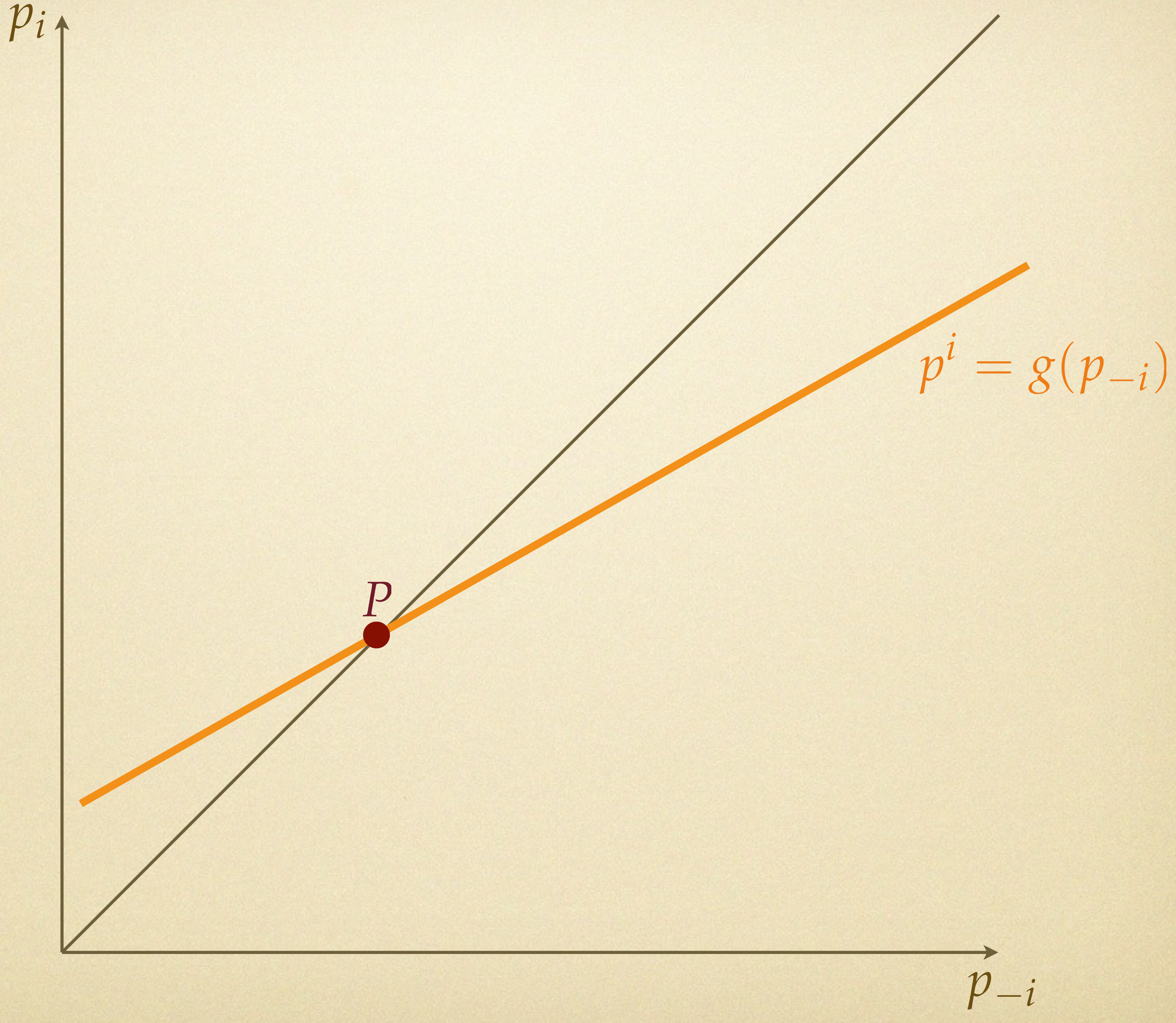
- Very few statistics needed!
  - markup observable? maybe
  - elasticity observable? maybe



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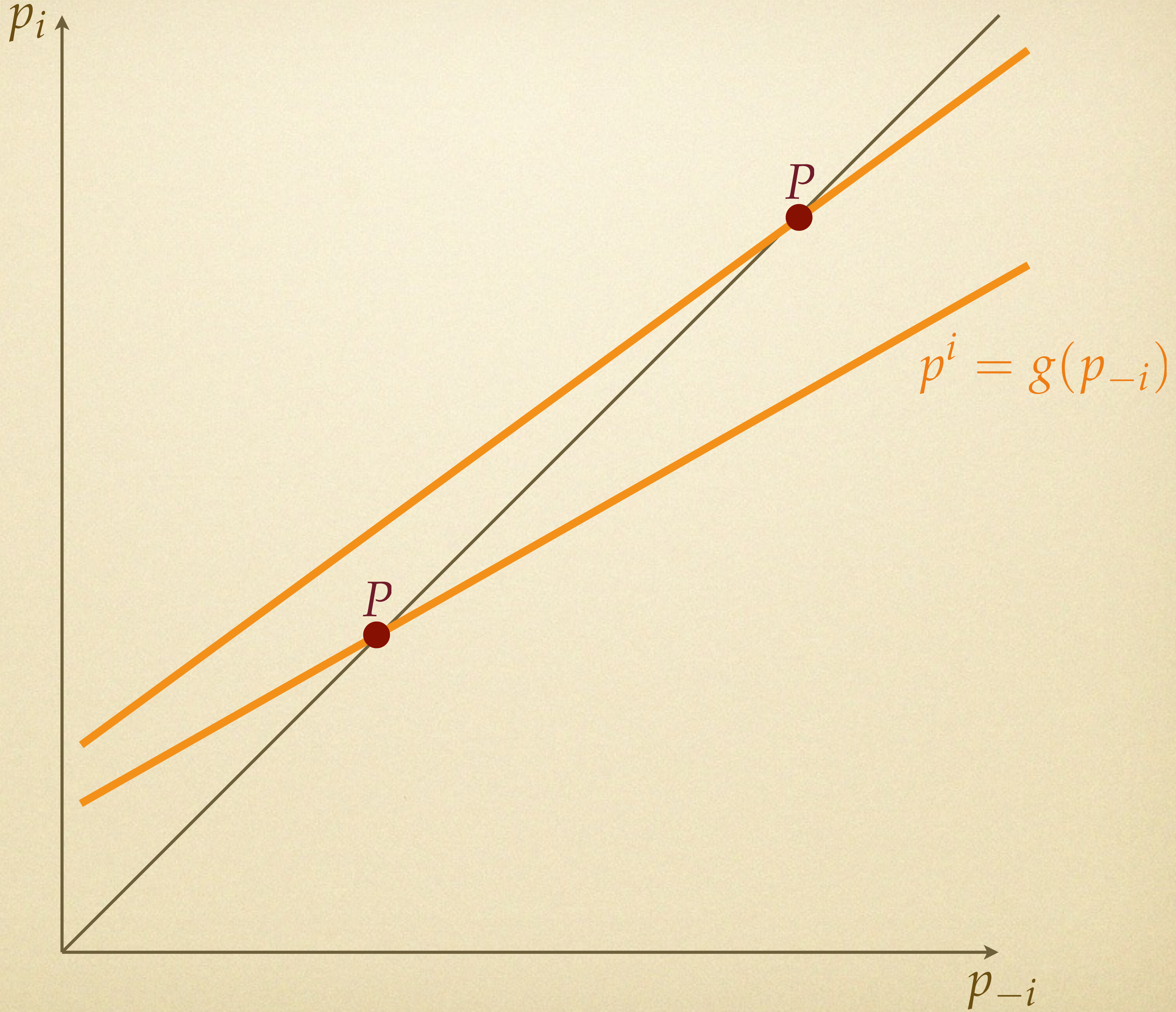

p_i
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2. Counterfactuals

Kimball Demand

$$\frac{1}{n}\sum \Psi\left(\frac{c_i}{C}\right) = 1$$

$$\Psi'(x) = \frac{\eta - 1}{\eta} \exp\left(\frac{1 - x^{\theta/\eta}}{\theta}\right)$$ (Klenow-Willis)

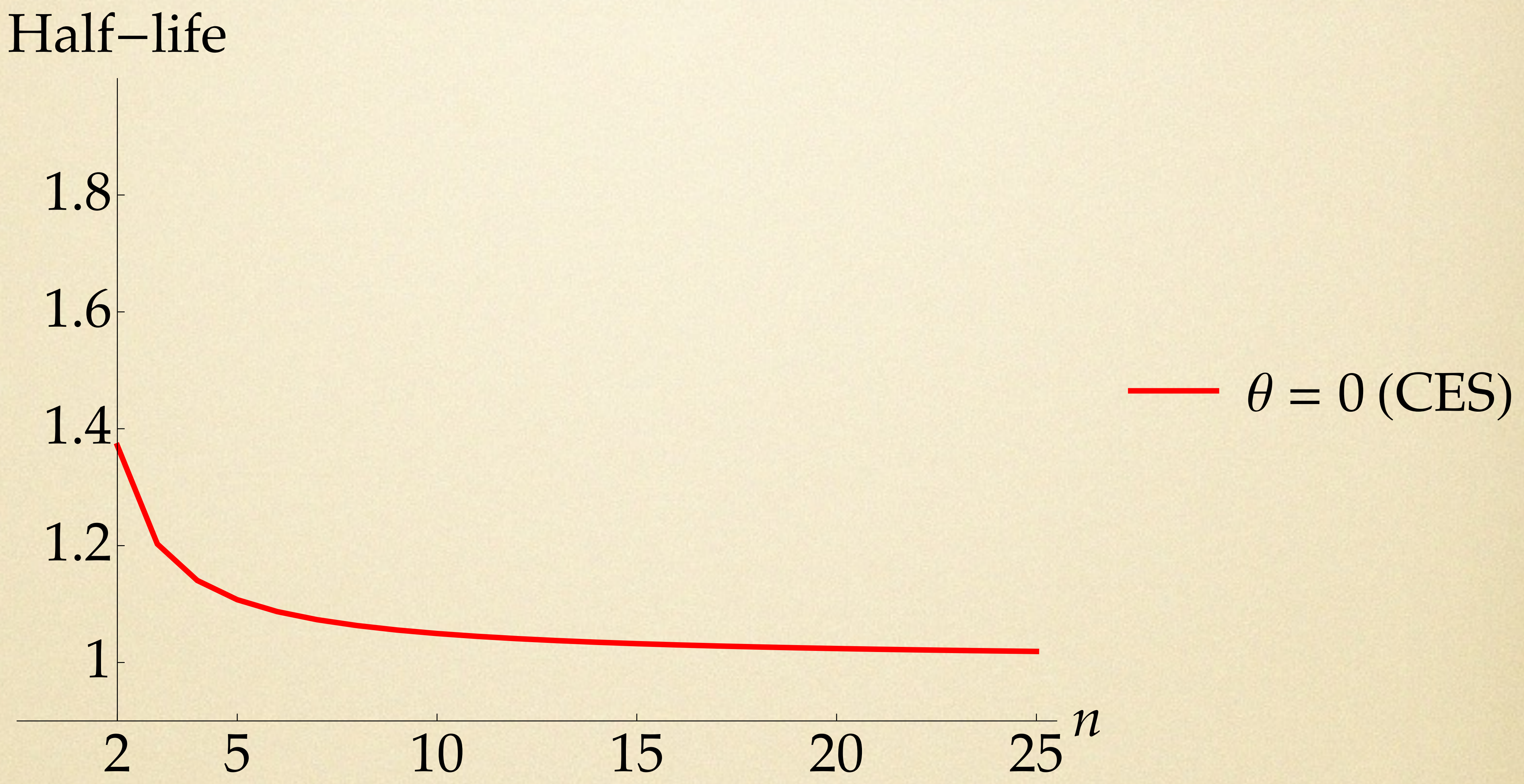
- Under monopolistic competition

  ⟶ elasticity η

  ⟶ superelasticity θ

- Oligopoly: elasticities also depend on n

Kimball Demand



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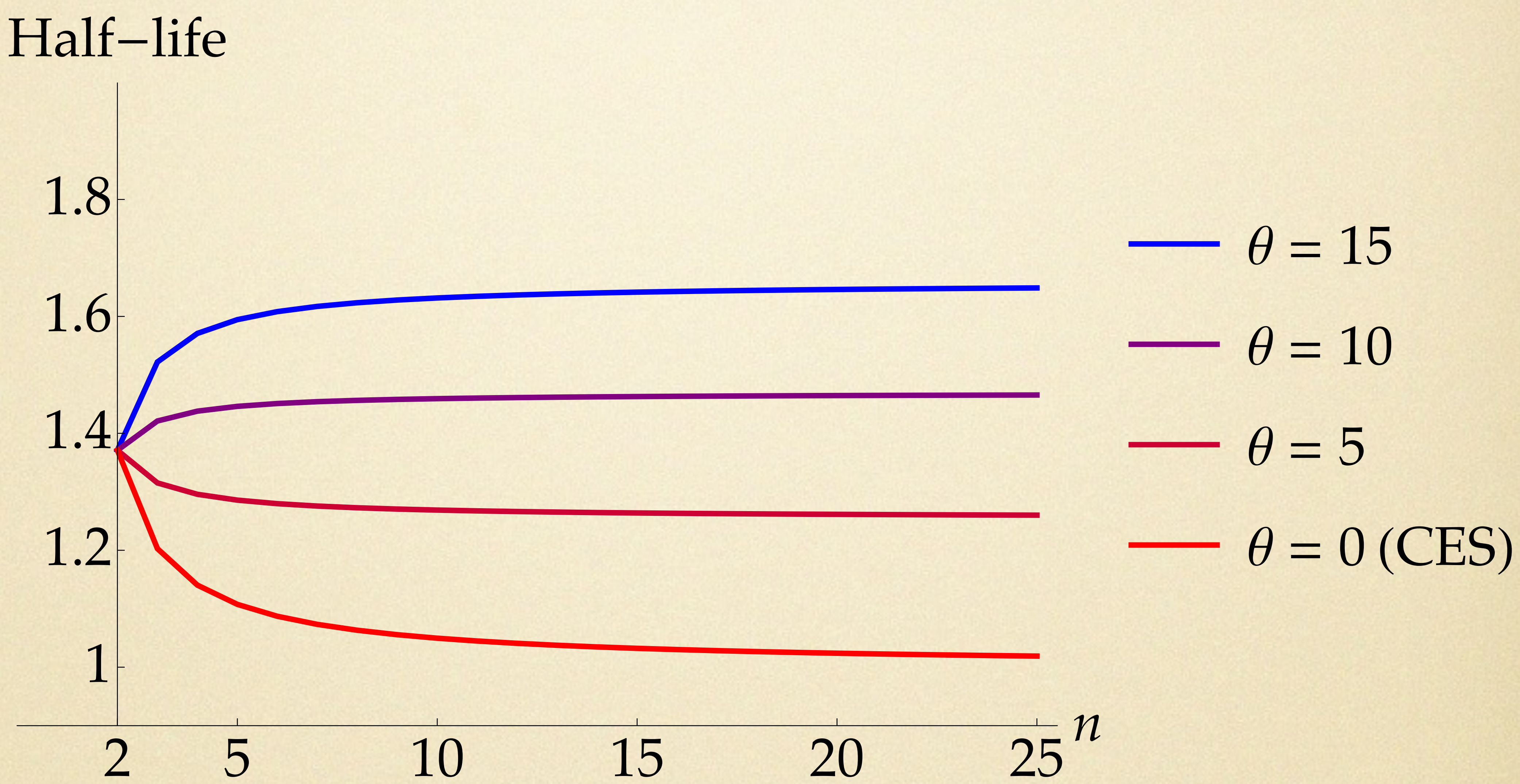

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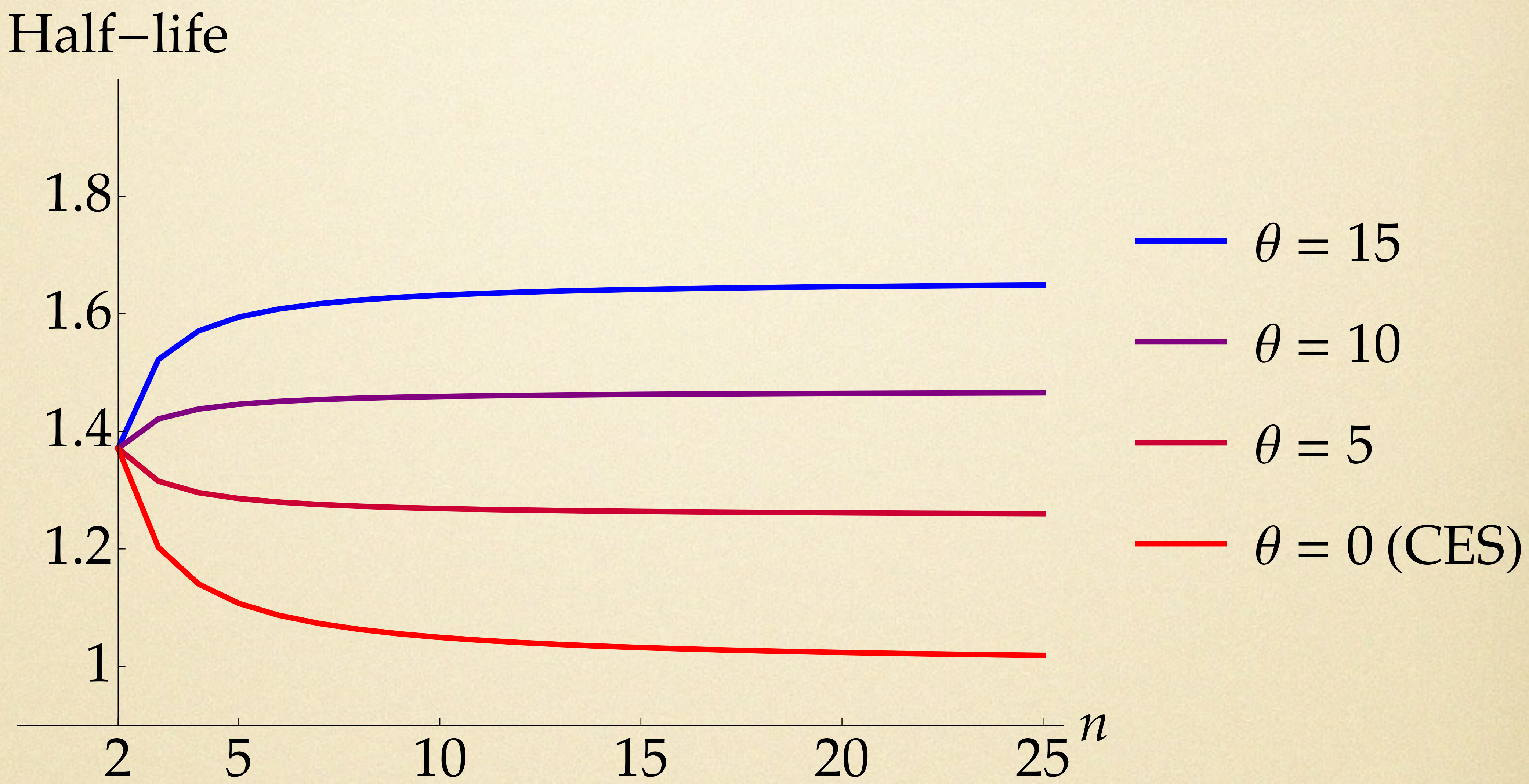


- Low θ similar to CES: slowest convergence at $n=2$
- But with high enough θ, fastest convergence at $n=2$!
- Duopoly is knife-edge: half-life stuck at CES level… … in contrast: $n \geq 3$ arbitrarily large as θ increases

Pass-Through

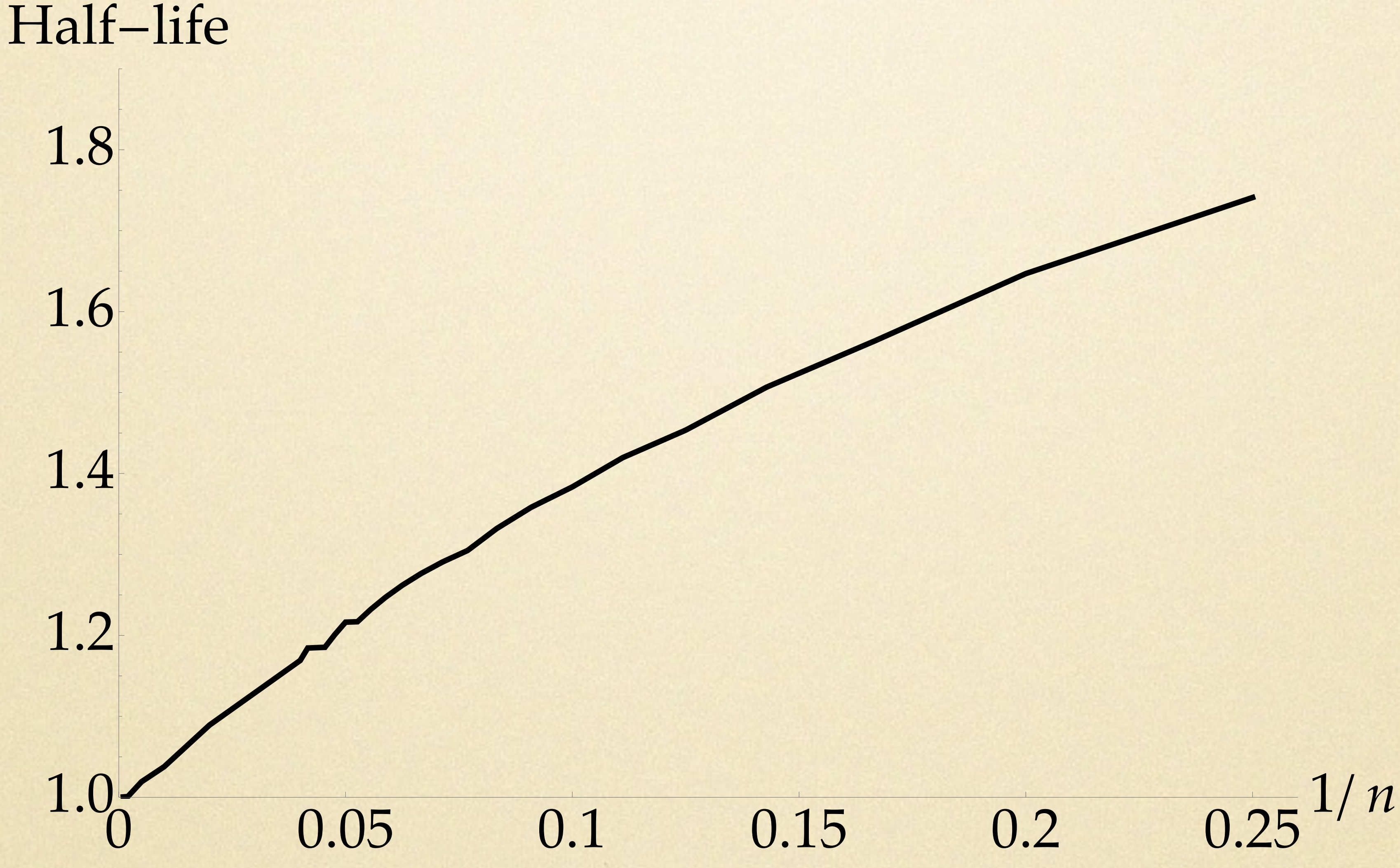
- Amiti-Itskhoki-Konings 19: own cost pass-through
  - high for small firms
  - low for large firms
  - consistent with CES Cournot but not Bertrand

- Depart from CES to match

pass-through = f(market share)

in dynamic (Bertrand) model

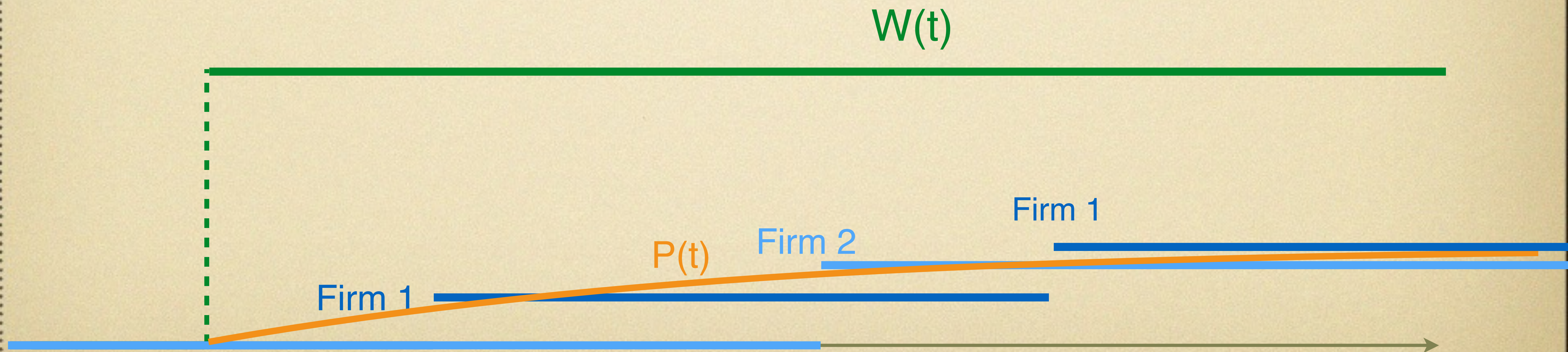
HHI and Half-life



- National HHI 0.05 to 0.1 (e.g., Gutierrez-Philippon): MP 15% stronger
- Local HHI 0.15 to 0.05 (Rossi-Hansberg, Sarte, Trachter): MP 25% weaker

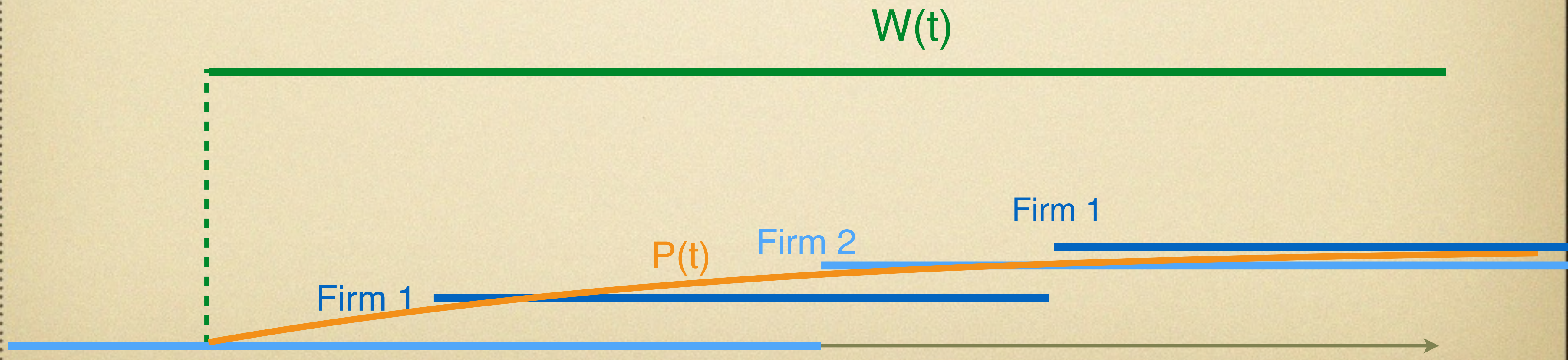
3. Inspecting the mechanism

Inspecting Mechanism



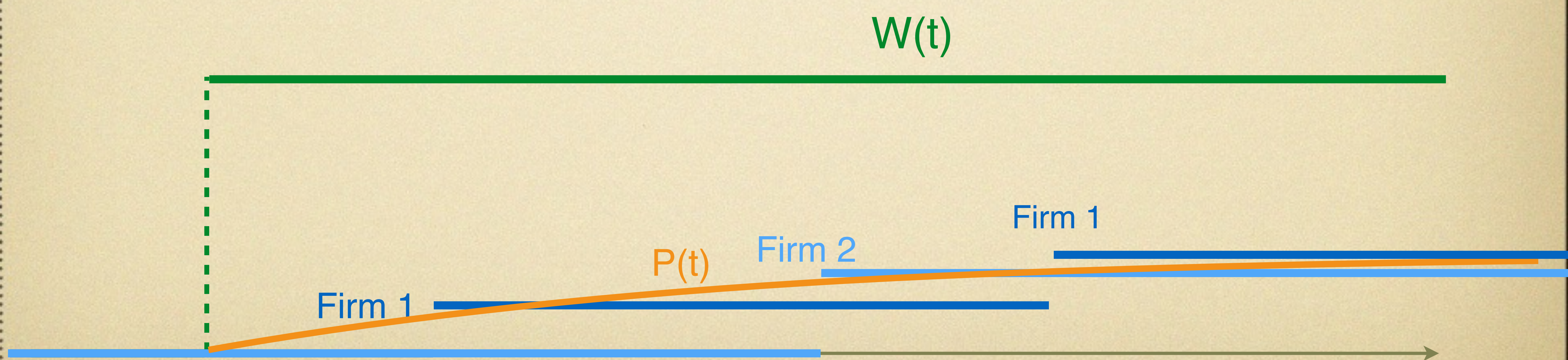
Inspecting Mechanism

- Two effects with finite *n*…
  - feedback: firm i cares about others' prices
  - strategic: firm i can affect others' prices



Inspecting Mechanism

- Two effects with finite n...
  - feedback: firm i cares about others' prices
  - strategic: firm i can affect others' prices
- Feedback effect with $n = \infty$
  - inputs from other firms
  - Kimball (1995) demand



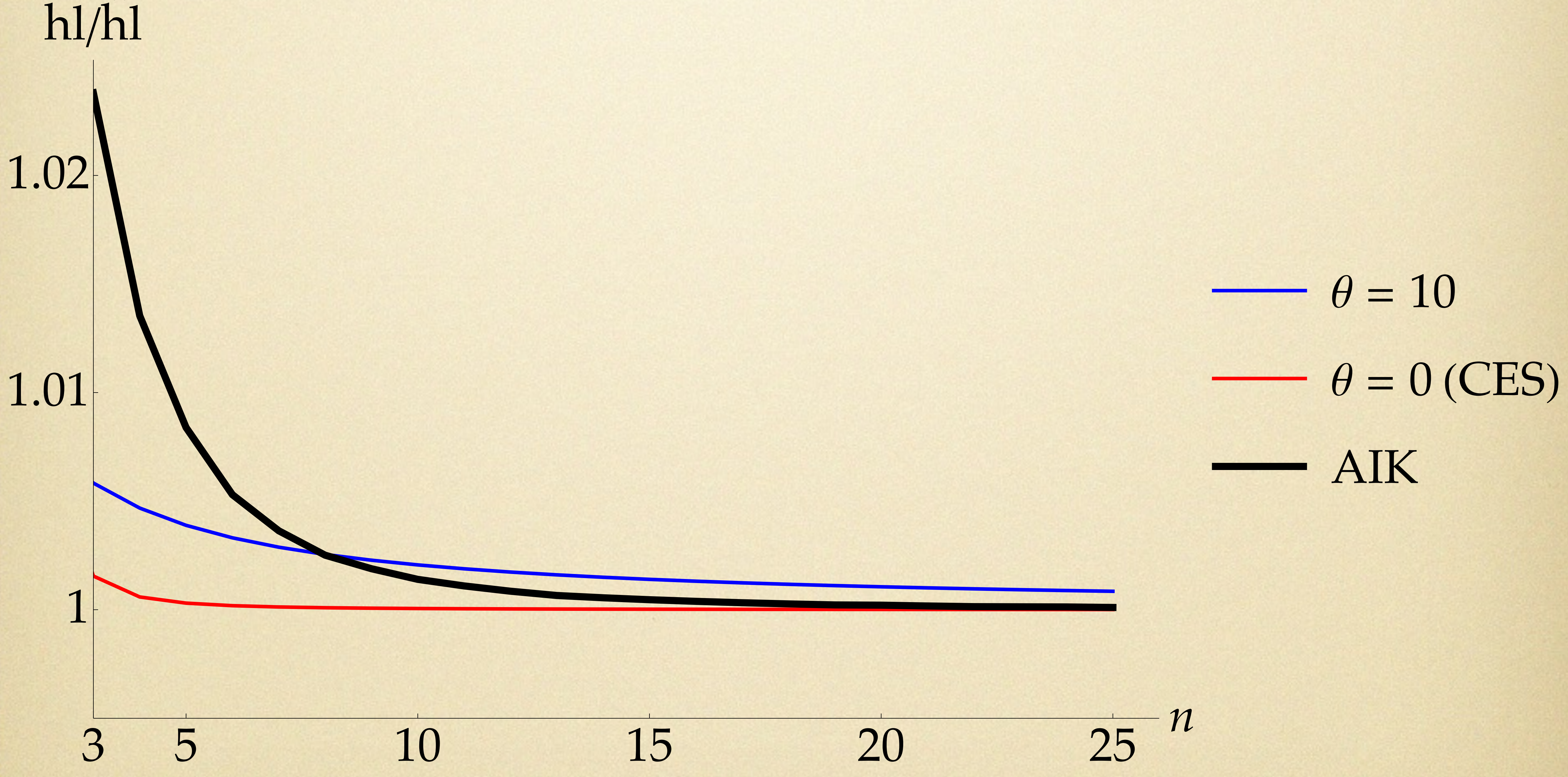
Inspecting Mechanism

- Compare MPE with n firms to

  as if monopolistic market

  - $n = \infty$ and modified Kimball preferences to match elasticities
  - $\Leftrightarrow$ equilibrium if n firms ignore how they affect rivals' pricing → "non-strategic" model

Small strategic effects



4. Phillips Curve

Phillips Curve

- Generalize preferences and allow arbitrary paths of
  - Interest rate shocks
  - Real shocks

- Monopolistic NKPC
  - First order ODE
  - Inflation only depends on future MC
  - Kimball $\Leftrightarrow$ less frequent adjustment (lower λ)

- Oligopolistic NKPC
  - Higher order ODE: inflation persistence
  - Not just MC: demand, interest rates
  - Not equivalent to lower λ

Phillips Curve

- Standard NKPC

$$\dot{\pi} = 0.05\pi - 1.05mc$$

- Oligopoly: Example with $n = 3$
  - MPE

$$\dot{\pi} = 0.07\pi - 0.28mc$$

$$+1.31\ddot{\pi} + 0.45\dot{mc} + 0.03(r - \rho)$$

  - Non-strategic (= monopolistic Kimball)

$$\dot{\pi} = 0.05\pi - 0.27mc$$

3-Eq Oligopoly NK

- Combine with Euler equation

$$\dot{c} = \sigma^{-1}\left(r - \pi - \rho - \epsilon^r\right)$$

- Taylor rule

$$r = \rho + \phi\pi + \epsilon^m$$

- AR(1) ϵ^r, ϵ^m shocks

n	Model	$\sigma(\pi)$		$\sigma(c)$	
		ϵ^r	ϵ^m	ϵ^r	ϵ^m
∞	$\theta = 0$ (CES)	2.2%	2.7%	0.8%	1.0%
∞	$\theta = 10$	2.0%	2.4%	1.0%	1.3%
10	MPE	2.3%	2.8%	1.1%	1.4%
	Non-strategic	2.7%	3.3%	1.4%	1.7%

Conclusions

- Monopolistic competition used pervasively
- Our paper: oligopoly…

1. sufficient statistics for micro to macro
2. calibration: concentration amplifies non-neutrality
3. for simple shocks: mostly driven by implied demand shape, rather than strategic interactions
4. more differences with Phillips curve and general shocks