MENU COST APPROACH

What the literature tries to show

Setup

— Single period (no future, no dynamics)

— $p_i^* = \phi m + (1-\phi) p$

Optimal (profit-maximizing) price for individual pricesetter depends on \$AD and prices charged by others

— Pre-existing prices, optimal for $m = \bar{m}$

$$\bar{p} = \bar{p}_i = \phi \bar{m} + (1-\phi)\bar{p}$$

— But realized $\hat{m} < \bar{m}$

— Menu cost: pricesetter must pay Z to change p_i from $\bar{p}_i$

Fixed-price equilibrium

It's best for individual to leave price at $\bar{p}_i$ if everyone else does

real profit

$$\underbrace{\pi_i(p_i^*, \hat{m}, \bar{p})}_{\pi_{ADJ}} - \underbrace{\pi_i(\bar{p}_i, \hat{m}, \bar{p})}_{\pi_{FIXED}} < Z$$

$$\pi_{ADJ} - \pi_{FIXED} < Z$$

so $y = m - \bar{p} < \underbrace{\bar{m} - \bar{p}}_{\text{Natural rate of output}} = \hat{m} - \hat{p}$

price level if everyone adjusted

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What the models are meant to show

? Can you get a fixed price equilibrium from a menu cost that is small relative to:

— A firm's revenue or profit

— Loss in utility or output resulting from low realization: $\hat{m}$ & $p = \bar{p}$ (a recession)

so that

total menu costs of adjusting prices to level that would give natural rate output, given realized m,

would be less than resulting increase in total utility or output,

yet economy remains stuck at $\bar{p}$!

("externality of price adjustment":
we'd all be better ~~off~~ if everyone adjusted p_i,
even accounting for menu costs,
but given that $p = \bar{p}$ no individual pricesetter has incentive to adjust p_i, given menu cost.)

$$\underbrace{U_{\hat{m}-\hat{p}}}_{\substack{\text{natural}\\ \text{rate of}\\ \text{output}}} - \underbrace{U_{\hat{m}-\bar{p}}}_{\text{recession}} > T Z$$

T ← number of pricesetters (firms)

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Perfectly competitive labor market

If labor market is competitive, answer is no:

as $y\downarrow$, $\frac{W}{P}\downarrow$ a lot; hence $W\downarrow$ a lot holding $P=\bar{P}$;

hence mc falls a lot & individual firm has big incentive to cut price. "Fixed-price equilibrium" can't hold.

Example: our model of imperfect competition in product markets

Recall: $L_i^* = \left(\frac{W}{P}\right)^{\frac{1}{\gamma-1}}$ $\}\leftarrow$ Elasticity of labor supply Labor supply. Rewrite as $L_i^* = \left(\frac{W}{P}\right)^{\nu}$

$$Y_i = L_i \qquad \text{Production function}$$

$\boxed{\text{Note: marginal product of labor is not diminishing!}}$

$$Y_i^D = \left(\frac{P_i}{P}\right)^{-\eta} \underbrace{YT}_{\text{total real income, redefine it to "}Y\text{"}}$$

η: elasticity of product demand

$$Y = \frac{M}{P}$$

hence

$$\pi_i(p_i, P, m, w) = \underbrace{\left(\frac{P_i}{P}\right)^{-\eta}\overbrace{\left(\frac{M}{P}\right)}^{Y}}_{Y_i}\overbrace{\left(\frac{P_i - W}{P}\right)}^{\text{profit on each unit sold}}$$

Labor supply function gives $W = PL^{\frac{1}{\nu}} = PY^{\frac{1}{\nu}} = P\left(\frac{M}{P}\right)^{\frac{1}{\nu}}$

$$\pi_i = \frac{M}{P}\left(\frac{P_i}{P}\right)^{1-\eta} - \left(\frac{M}{P}\right)^{(1+\nu)/\nu}\left(\frac{P_i}{P}\right)^{-\eta} \qquad (6.64)$$

$$P_i^* = \underbrace{\frac{\eta}{\eta-1}}_{\text{markup}} W = \frac{\eta}{\eta-1}P\left(\frac{M}{P}\right)^{\frac{1}{\nu}} \text{ or } \frac{P_i^*}{P} = \frac{\eta}{\eta-1}\left(\frac{M}{P}\right)^{\frac{1}{\nu}}$$

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$$\pi_{FIX} = \pi_i(\bar{p}_i, \hat{m}, \bar{p}) = \frac{\hat{M}}{\bar{P}} - \left(\frac{\hat{M}}{\bar{P}}\right)^{\frac{1+\nu}{\nu}} \qquad (6.65)$$

$$\pi_{ADJ} = \pi_i(p_i^*, \hat{m}, \bar{p}) = \frac{1}{\eta-1}\left(\frac{\eta}{\eta-1}\right)^{-\eta}\left(\frac{\hat{M}}{\bar{P}}\right)^{\frac{1+\nu-\eta}{\nu}} \qquad (6.66)$$

recall $\bar{P} = \dfrac{\bar{M}}{\left(\frac{\eta-1}{\eta}\right)^{\nu}}$ so $\dfrac{\hat{M}}{\bar{P}} = \dfrac{\hat{M}}{\bar{M}}\left(\dfrac{\eta-1}{\eta}\right)^{\nu}$

recall $\bar{Y} = \dfrac{\bar{M}}{\bar{P}} = \left(\dfrac{\eta-1}{\eta}\right)^{\nu}$

So is fixed-price equilibrium possible?

Can $\pi_{ADJ} - \pi_{FIX} < Z$ if Z is "small"?

Need to "calibrate" $\nu, \eta, \dfrac{\hat{M}}{\bar{M}}$

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Calibration

Put numbers into it

$\nu = 0.1$ Labor supply is inelastic (to get 1% ↑ in L, need 10% ↑ in $\frac{W}{P}$)

$\eta = 5$, means $p_i = \frac{5}{5-1} \cdot mc = 1.25 \cdot mc$

markup is 25%

$\frac{\hat{M}}{\bar{M}} = 0.97$ (3% "fall" in \$AD)

then $\frac{\bar{M}}{\bar{P}} = \frac{\hat{M}}{\hat{P}}$ = natural rate output or revenue per firm ≈ 0.978

$\pi_{ADJ} - \pi_{FIX} \approx 0.253$

As a share of revenue,

$$\frac{\pi_{ADJ} - \pi_{FIX}}{\text{revenue}} \approx \frac{0.253}{0.978} \approx \frac{1}{4}$$

For fixed-price equilibrium to hold,

$\pi_{ADJ} - \pi_{FIX} < z$

$$\frac{\pi_{ADJ} - \pi_{FIX}}{\text{revenue}} < \frac{z}{\text{revenue}}$$

Menu cost must be at least 25% of revenue!

Implausibly big!

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Mankiw (1985)

"Partial Equilibrium"

Assumptions

N \$AD variable (like our M)

Total Cost $= kqN \Rightarrow MC = kN$ (like our $MC = W$)

constant output

flat MC curve, constant marginal product

$P_i = f(q)N$ Inverse demand function

What's our inverse demand function?

Recall $Y_i^D = \left(\frac{P_i}{P}\right)^{-\eta} Y$

$$\Rightarrow P_i = Y_i^{-\frac{1}{\eta}} Y^{\frac{1}{\eta}} P = Y_i^{-\frac{1}{\eta}} M^{\frac{1}{\eta}} P^{(1-\frac{1}{\eta})}$$

$\left(\frac{M}{P}\right)$

Assuming constant elasticity of demand, his model means:

$$P_i = q_i^{-\frac{1}{\eta}} N \Rightarrow q_i = \left(\frac{P_i}{N}\right)^{-\eta}$$

recall (this) must be greater than 1

in logs $\ln(q_i) = -\eta p_i + \eta \ln(N)$

$$\partial \ln(q_i)/\partial \ln(N) = \eta > 1$$

in our model, $y_i^D = -\eta p_i + \eta p + (m-p)$

$$\partial y_i^D/\partial m = 1$$

Profit-maximizing price = Markup · MC

$$\Rightarrow P^* = \frac{\eta}{\eta-1} kM \quad \text{In logs } \partial \ln(P^*)/\partial \ln N = 1$$

in our model,

log $\rightarrow p_i^* = \ln\left(\frac{\eta}{\eta-1}\right) - (2-\gamma)p + (\gamma-1)m$

$\partial p_i^*/\partial m = (\gamma - 1)$ depends on labor supply

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Mankiw (1985) (cont.)

Mankiw says that in "general equilibrium" version of his model,

small menu cost prevents adjustment of prices in response to $N^e/N \neq 1$ (use $\bar{M}/\hat{M}$)

expected N

We said that must depend on labor market/wages.

What does Mankiw assume about wages,

how does it compare with our assumption?

To simplify comparison, replace

his	with our
N	M
q	Y_i

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Mankiw (1985)

Compare with Romer

Mankiw

$$p_i^* = \frac{\eta}{\eta - 1} kM \quad \longleftrightarrow$$

For any P

In logs,

$$\frac{\partial p_i^*}{\partial m} = 1$$

Romer

$$p_i^* = \frac{\eta}{\eta - 1} W$$

Recall $W = P\left(\frac{M}{P}\right)^{\frac{1}{\nu}} = P^{1-\frac{1}{\nu}} M^{\frac{1}{\nu}}$

where ν = elasticity of labor supply $= \frac{1}{\gamma - 1}$

$$p_i^* = \frac{\eta}{\eta - 1} P^{1-\frac{1}{\nu}} M^{1/\nu}$$

In logs,

$$\frac{\partial p_i^*}{\partial m} = \frac{1}{\nu}$$

If $\nu < 1$, $\partial p_i^* / \partial m > 1$!

In Mankiw, p_i^* falls with \$AD one-to-one (proportionally)

In Romer, p_i^* falls with \$AD more than one-to-one, because W falls.

? How does Mankiw justify his assumption?

Mankiw's "General Equilibrium" model

Mankiw assumes $q_i = L_i$ (production function)

translating to our notation

$$Y_i = L_i \quad \text{Same as Romer!}$$

So it's not technology.

What about preferences?

Menu Cost Approach
Mankiw (1985)
General Equilibrium

Mankiw

$$U_i = C + \theta \ln\left(\frac{M}{P}\right) - L$$

Constant marginal disutility of labor

First order condition:

$$\underbrace{-\frac{\partial U}{\partial L}}_{\text{Marginal disutility of labor}} = \underbrace{\frac{\partial U}{\partial\left(\frac{M}{P}\right)}}_{\text{MU of real balance}} \cdot \underbrace{\frac{\partial\left(\frac{M}{P}\right)}{\partial L}}_{\text{Increment to real balance if you work more}}$$

$$1 = \frac{1}{\frac{M}{P}}\theta \cdot \frac{W}{P}$$

hence

$$\frac{W}{P} = \frac{M}{P}\frac{1}{\theta}$$

$$\underbrace{W = \frac{1}{\theta}M}$$

condition that makes folks willing to hold supply of real balances.

hence

$$\frac{\partial \ln W}{\partial \ln M} = 1$$

Romer

$$U_i = C^{\gamma}\left(\frac{M}{P}\right)^{1-\gamma} - \frac{1}{\gamma}L^{\gamma}$$

Increasing marginal disutility of labor

$$-\frac{\partial U}{\partial L} = \underbrace{\underbrace{\frac{\partial U}{\partial\left(C^{\gamma}\left(\frac{M}{P}\right)^{1-\gamma}\right)}}_{\text{MU of real income}} \cdot \underbrace{\frac{\partial\left(C^{\gamma}\left(\frac{M}{P}\right)^{1-\gamma}\right)}{\partial L}}_{\text{Increment to real income if....}}}$$

$$L^{\gamma-1} = 1 \cdot \frac{W}{P}$$

hence

$$L_i^* = \left(\frac{W}{P}\right)^{\frac{1}{\gamma-1}} = \left(\frac{W}{P}\right)^{\nu}$$

$$W = PY^{\frac{1}{\nu}} = P\left(\frac{M}{P}\right)^{\frac{1}{\nu}} = P^{1-\frac{1}{\nu}}M^{\frac{1}{\nu}}$$

Romer says reasonable value for ν is 0.1, so

$$W = P^{1-\frac{1}{\nu}}M^{10}$$

Holding P Fixed,

$$\frac{\partial \ln W}{\partial \ln M} = 10$$

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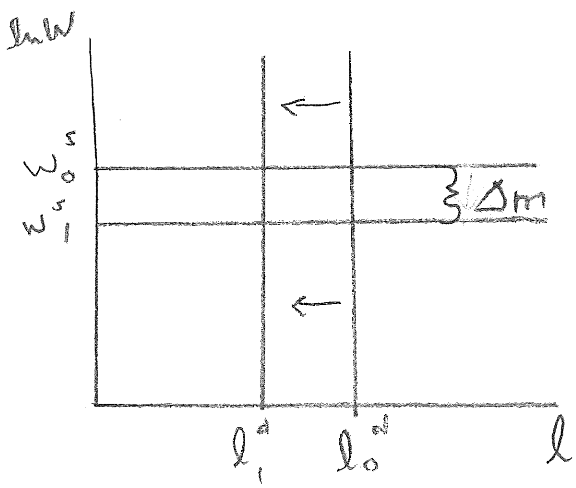
Mankiw (1985)

General equilibrium (cont'd)

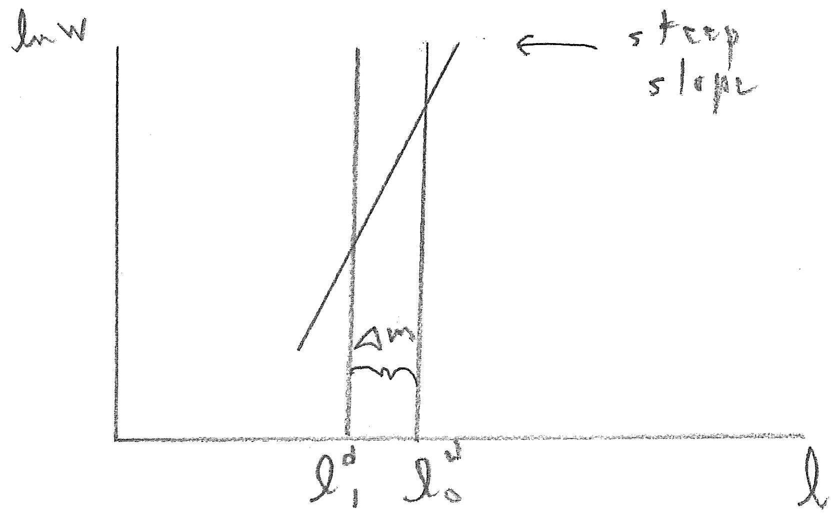
Graph: why does W fall less in Mankiw model?

Mankiw



$\ln w = -\theta + m$

Romer



From $L^{\gamma-1} = \frac{W}{P_j}$

$\ln w^s = p + (\gamma - 1) l$

and $\gamma - 1 = \frac{1}{\nu}$ ← labor supply elasticity

and

$\Delta l = \Delta y = \Delta m$ (holding p fixed)