NEW KEYNESIAN PHILLIPS CURVE

Problems with NKPC

Taylor $\pi_t = \frac{1}{2}\left({}_t\pi^e_{t+1} + {}_{t-1}\pi^e_t\right) + \phi(y_t \text{ etc.})$

Rotemberg $\pi_t = {}_t\pi^e_{t+1} + \phi y_t$

Calvo without discount factor, as in Roberts:

$\pi_t = {}_t\pi^e_{t+1} + \phi y_t$ (same as Rotemberg)

Calvo with discount factor (we'll derive it later):

$\pi_t = \beta\, {}_t\pi^e_{t+1} + \phi y_t$

Most common in models: Calvo with discount factor.

Problems in matching data:

1) Calvo with discount factor requires long-run trend π to be zero. Obviously untrue in many historical eras.

2) All + rational expectations imply that y (output gap) should be negatively correlated with <u>change</u> in inflation.
"Disinflation" (decreases in π) correlated with booms $(y > 0)$. Not true.

3) All + rational expectations imply that current inflation should be + correlated with near-future y. Not true.

NKPC

Problems

Calvo with discount factor requires trend π = 0

$$\pi_t = \beta_t \pi^e_{t+1} + \phi y_t$$

In LRSS,

$$\bar{\pi} = \beta \bar{\pi} + \phi y \nwarrow \text{zero}$$

LRSS inflation

Can only work if $\bar{\pi} = 0$.

We *assumed* that in deriving $p_t = \sum_{t=0}^{\infty} \tilde{\omega} E[p_t^*]$

("inflation is low" so that $E[p_{\text{future}}] = \text{constant}$)

but not plausible for, e.g., US 1970s.

If you derive Calvo with $\bar{\pi} > 0$, so that you don't assume "inflation is low," Phillips curve doesn't look like above.

NKPC

Problems

NKPC + rational expectations problem

Rationality means any error in your forecast could not be forecast (predicted) at time you made your forecast.

You can turn out to be wrong, but you're not <u>predictably</u> wrong - if you were, you'd adjust your forecast.

$$X_t = E_{t-j} X_t + \varepsilon \leftarrow$$

error, must be uncorrelated with variables observable at time t-j. Otherwise you could forecast ε with regression

For NKPC,

$$\pi_{t+1} = + \pi^e_{t+1} + \varepsilon \leftarrow$$

must be uncorrelated with any variables observable at time t, including y_t

Combination of this and

$$\pi_t = {}_t\pi^e_{t+1} + \phi y_t \text{ or } \pi_t = \beta_t \pi^e_{t+1} + \phi y_t$$

<u>not</u> consistent with data.

Two ways to see this:

1) Regression of $\Delta\pi$ on y
2) Regression of future y on π

NKPC

Is it true?

Two ways...

1) $\Delta\pi$ & y

$$\pi_t = {}_t\pi^e_{t+1} + \gamma y_t \quad \text{plus} \quad \pi_{t+1} = {}_t\pi^e_{t+1} + \varepsilon_{t+1}$$

$$\boxed{\Rightarrow \pi_{t+1} - \varepsilon_{t+1} = \pi^e}$$

$$\Rightarrow \pi_t = \pi_{t+1} - \varepsilon_{t+1} + \gamma y_t$$

$$\Rightarrow \underbrace{\pi_{t+1} - \pi_t}_{\Delta\pi} = -\gamma y_t + \varepsilon_{t+1} \leftarrow \left(\begin{array}{l} \text{under RE, uncorrelated} \\ \text{with } y_t \end{array} \right.$$

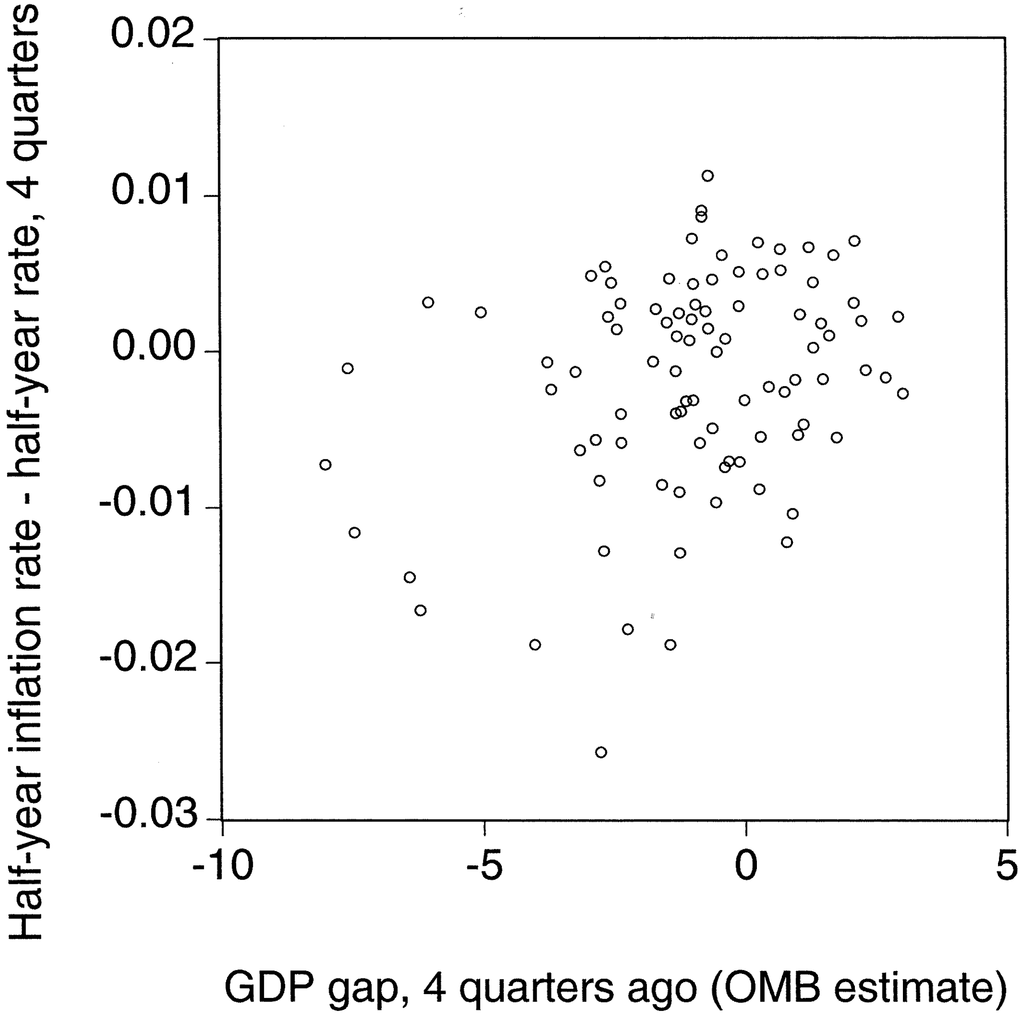
So coefficient on y_t should be negative.

"high levels of output are associated with falls in inflation"

"GMM estimation of" $\pi_t = \pi^e_{t+1} + \gamma y_t$

imposing that $(\pi_{t+1} - \pi^e_{t+1})$ uncorrelated with y_t, etc.

But not true!



Change in inflation and lagged GDP gap
1980:4 2003:4

③

NKPC

IS IT TRUE?

Two ways...

2) Future y & π

Assume in LRSS

— $y = 0$ $(Y = \bar{Y})$

— $\pi = 0$ recall we assumed this to derive "General result for time-dependent pricing"

$$\Rightarrow \pi_t = \gamma \sum_{k=0}^{\infty} \beta^k \, {}_t y^e_{t+k}$$ (Rudd & Whelan, eqn. 5)

How? Work back from LRSS at $t+\infty$

$$y_{t+\infty} = 0 \qquad \pi_{t+\infty} = 0$$

$$\pi_{t+\infty-1} = 0 + \gamma y_{t+\infty-1}$$

$$\pi_{t+\infty-2} = \beta \, {}_{t+\infty-2}\pi^e_{t+\infty-1} + \gamma y_{t+\infty-2}$$

$$= 0 + \beta \gamma \, {}_{t+\infty-2} y^e_{t+\infty-1} + \gamma y_{t+\infty-2}$$

$$\pi_{t+\infty-3} = 0 + \beta \gamma \, {}_{t+\infty-3} y^e_{t+\infty-1} + \beta^2 \gamma \, {}_{t+\infty-3} y^e_{t+\infty-2} + \gamma y_{t+\infty-3}$$

& so on back to present.

See: on average, high π_t should be associated with high future y. Not true!

NKPC

Is it TRUE?

How does π really behave? "Inertia"

π is more "persistent" than predicted by NKPC.

NKPC says π can jump (note this is not P jumping) whenever expected future output gaps change, & RE of Σy_t jumps sometimes,

But π seems to change more gradually, tied to past π, like:

$$\pi_t = \alpha\left({}_t\pi^e_{t+1}\right) + (1-\alpha)\pi_{t-1} + \tilde{\gamma} y_t$$

or

$$\pi_t = \alpha\gamma\sum_{k=0}^{\infty} {}_t y^e_{t+k} + (1-\alpha)\pi_{t-1}$$

How should we explain this?

What's better model than NKPC + Rat. Exp.?

NKPC

Is it true?

Better models?

NKPC predictions for π came from:

1) Assumed constraint on price adjustment (Taylor, Calvo, Rotemberg...) which creates relnship between p_{it}^* & p_t

2) $p_{it}^* = p_t + \phi y_t$ from $p_{it}^* = \mu + mc_t$

3) Rational expectations

so try:

1) Different constraints on price adjustment

2) A different implication of $p_{it}^* = \mu + mc$

3) Not-rational expectations

(recall Roberts uses surveys. Survey π^e not rational)

NKPC

Is it true?

Better models?

1) Different constraints on price adjustment

Example: Christiano, Eichenbaum & Evans (2005).
Like Calvo, but a firm that can't adjust p_i this period needn't hold it's price Fixed; rather "index" to past inflation

$$p_{it} = p_{it-1} + (\bar{p}_{t-1} - \bar{p}_{t-2})$$

We'll return to this later.

2) Different implication of $p_{it}^* = \mu + mc_i$

"labor's share" Gali & Gertler (1999), Sbordone 2002

Recall Calvo $x_t = \alpha E_t \sum_{j=0}^{\infty} (1-\pi)^j p_{t+j}^*$

reset price

prob. I can adjust in a period

By assuming $p_{it}^* - p_t = \phi y_t \rightarrow \pi_t = \pi^e + \frac{\alpha^2}{1-\alpha}\phi y_t$

Instead say, more generally, $p_{it}^* - p_t = \mu + mc_t - p_t$

$$\rightarrow \pi_t = \pi^e + \frac{\alpha^2}{1-\alpha}(mc - p)_t$$

"Real marginal cost"

NK PC

Is it true?

2) (Cont'd, [illegible])

How can we measure real mc?

Sbordone (2002)

Use data on "unit labor costs": wages minus labor productivity

Concludes that Calvo model using mc works OK!

Gali & Gertler (1999)

Uses labor's share of income as proxy for real mc, concludes Calvo works OK.

Why is labor's share a proxy?

Cobb-Douglas $Y = AK^{\alpha}L^{1-\alpha}$, $MPL = (1-\alpha)A(K/L)^{\alpha}$

$$MC = w \cdot \frac{\partial L}{\partial Y} = \frac{1}{MPL} = w(1-\alpha)^{-1}A^{-1}K^{-\alpha}L^{\alpha}$$

Multiply by $L/L \Rightarrow$

$$MC = wL(1-\alpha)^{-1}A^{-1}K^{-\alpha}L^{\alpha-1} = \frac{wL}{(1-\alpha)\underbrace{AK^{\alpha}L^{1-\alpha}}_{Y}} = \frac{wL}{(1-\alpha)Y}$$

Divide by $P \Rightarrow$

$$\frac{MC}{P} = \frac{(W/P)L}{Y}(1-\alpha)^{-1}$$

labor's share of output

in logs

$$mc - p = -\ln(1-\alpha) + \ln(\text{labor's share})$$

Conclusion:

Price stickiness model is OK! Fits data!

[illegible]

NKPC

Is it true?

2) (cont.)

Problem with this:

it works because, in data, "labor's share"

is countercyclical (rises in recessions).

Do we believe "real mc" is countercyclical?

No.

Rudd & Whelan say:

labor's share in data is average,

what should matter is marginal.

It's possible for average to be countercyc.

while marginal is procyc.