Forward-looking vs. backward-looking behavior in inflation dynamics: a new test

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Motivation

- The New Keynesian Phillips Curve (NKPC) predicts that inflation is determined exclusively by forward looking behavior of firms.

- However, there is evidence of backward-looking behavior. No agreement about its quantitative importance.

- Debate on backward vs. forward looking behavior: crucial to understand inflation persistence, the costs of disinflation process and optimal monetary policy.
How to incorporate Backward-looking behavior


- Partial indexation to past inflation when not re-optimizing: Smets and Wouters (2003) and Christiano et al. (2005)
Contribution

- Novel methodology to test the importance of backward-looking behavior.

- Three key advantages over Galí and Gertler (1999) proposal:
  1. It does not include measures of real marginal costs or output gap.
  2. It does not require assumptions about how expectations are formed.
  3. It directly identifies the structural parameters that describe the nature of the price setting.
Plan of Talk

1. Galí and Gertler´s Model

2. Standard identification of backward-looking behavior

3. My methodology

4. Estimation Results

5. The Case with Positive Inflation in SS

6. Conclusions
1. Galí and Gertler’s Hybrid Model

- **Households:**
  - Consume basket of differentiated goods and supply labor.
  - Elasticity of Substitution among goods: $\epsilon$

- **Firms:**
  - Each one produces a differentiated good for which it sets the price.
  - $Y_t(i) = A_t N_t(i)^{1-\alpha}$
  - Change prices with probability $1 - \theta$. 
- From those firms resetting prices, only a fraction \((1 - \omega)\) resets price optimally, as in Calvo (1983).

- The remaining fraction \(\omega\) chooses \(p^b_t = p^*_{t-1} + \pi_{t-1}\)

- \(p^*_t = \omega p^b_t + (1 - \omega)p^f_t\)

- \(p_t = \theta p_{t-1} + (1 - \theta)p^*_t\)

- A firm reoptimizing chooses a price that maximizes the current market value of the profits generated while that price remains effective.

- Market clearing.
2. Identification of Backward-looking behavior

- Galí and Gertler’s (1999) hybrid NKPC:

\[ \pi_t = \lambda_n \lambda_r \overline{mc}_t + \gamma_b \pi_{t-1} + \gamma_f E_t \{ \pi_{t+1} \} + \varepsilon_t \]

with

\[ \lambda_n = \frac{(1 - \omega)(1 - \theta)^2}{\theta + \omega}, \quad \lambda_r = \frac{1 - \alpha}{1 + \alpha(\varepsilon - 1)}, \quad \gamma_b = \frac{\omega}{\theta + \omega}, \quad \gamma_f = \frac{\theta}{\theta + \omega} \]

- They estimate \( \theta \) and \( \omega \) by fitting the following orthogonality condition:

\[ E_t \left\{ \left[ \pi_t - \lambda_n \lambda_r \overline{mc}_t - \gamma_b \pi_{t-1} - \gamma_f \pi_{t+1} \right] z_t \right\} = 0 \]
3. Novel Methodology

By using Galí and Gertler’s (1999) hybrid model, I derive the following structural relationship:

\[ \text{Var}_i \{ \pi_t(i) \} = \theta \text{Var}_i \{ \pi_{t-1}(i) \} + f(\pi_t, \pi_{t-1}) + (1 - 2\theta)f(\pi_{t-1}, \pi_{t-2}) \]

where \( f(\pi_t, \pi_{t-1}) \) is given by:

\[ f(\pi_t, \pi_{t-1}) = \frac{\theta}{1 - \theta} \pi_t^2 + \frac{\omega}{(1 - \theta)(1 - \omega)} (\pi_t - \pi_{t-1})^2 \]

How do I get it?

1. \( \text{Var}_i \{ p_t(i) \} = \theta \text{Var}_i \{ p_{t-1}(i) \} + f(\pi_t, \pi_{t-1}) \)

2. Price setting assumptions combined with price level identity.
4. Estimation Results: Austria

Estimates of the Structural Parameters

<table>
<thead>
<tr>
<th></th>
<th>$\theta$</th>
<th>$\omega$</th>
<th>$D$</th>
<th>$\gamma_b$</th>
<th>$\gamma_f$</th>
<th>$J$ test</th>
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<tbody>
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</tr>
</tbody>
</table>

Note: Standard errors shown in brackets.
4. Estimation Results: Spain

Estimates of the Structural Parameters

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<tbody>
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Note: Standard errors shown in brackets.
5. The Case with Positive Inflation in SS

Considering \( \pi > 0 \) leads to the following relationship:

\[
\text{Var}_i \{ \pi_t(i) \} = \theta \text{Var}_i \{ \pi_{t-1}(i) \} + f(\pi_t, \pi_{t-1}) + (1 - 2\theta)f(\pi_{t-1}, \pi_{t-2})
\]

where \( f(\pi_t, \pi_{t-1}) \) is given by:

\[
f = -\pi_t^2 + \frac{(1 - \theta)\omega}{1 - \omega} \left\{ \frac{\pi_t - \pi_{t-1}}{1 - \theta(1 + \pi)^{\xi - 1}} \right\}^2 + (1 - \theta) \left\{ \frac{\pi_t - \bar{\pi}}{1 - \theta(1 + \pi)^{\xi - 1}} + k \right\}^2
\]

and

\[
k = \bar{\pi} + \frac{1}{\xi - 1} \log \left[ \frac{1 - \theta}{1 - \theta(1 + \bar{\pi})^{\xi - 1}} \right]
\]
5. Estimation Results: Austria

Estimates of the Structural Parameters when $\pi > 0$

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5. Estimation Results: Spain

Estimates of the Structural Parameters when $\pi > 0$

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<td>(1.833)</td>
<td>(0.040)</td>
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6. Conclusion

1.- I have presented a new dynamic structural relationship between the cross-sectional variance of individual price changes and aggregate inflation.

2.- This relation has important advantages to identify rule of thumb behavior.

3.- Backward looking behavior is almost as important as the forward looking one in describing Austrian and Spanish inflation.

4.- Estimated price stickiness is consistent with average price duration in the disaggregated data.

5.- Results are robust to considering positive inflation in steady state.