What do Long Data Tell Us About the Inflation Hike Post COVID-19 Pandemic?

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December 31, 2023
CPI Inflation, United States, 1900–2022
The Empirical Model*

\( \pi_t \) = inflation rate
\( i_t \) = nominal interest rate
\( y_t \) = log of real output per capita

\( X^m_t \) = permanent monetary shock
\( X^r_t \) = permanent natural rate shock
\( X_t \) = permanent productivity shock

Cyclical components of \( \pi_t, i_t, \) and \( y_t \)

\[ \hat{\pi}_t \equiv \pi_t - X^m_t \]
\[ \hat{i}_t \equiv i_t - X^m_t - X^r_t \]
\[ \hat{y}_t \equiv y_t - X_t - \delta X^r_t \]

The focus of the present paper is the behavior of the \textbf{latent variable} \( X^m_t \) representing the permanent component of inflation.

*The model is that of Schmitt-Grohé and Uribe (2022, ‘The Macroeconomic Consequences of Natural Rate Shocks: An Empirical Investivation’), which in turn builds on Uribe (2022).
• The law of motion of the stationary endogenous variables

\[
\begin{bmatrix}
\hat{y}_t \\
\hat{\pi}_t \\
\hat{i}_t
\end{bmatrix}
= B \begin{bmatrix}
\hat{y}_{t-1} \\
\hat{\pi}_{t-1} \\
\hat{i}_{t-1}
\end{bmatrix} + C \begin{bmatrix}
\Delta X^m_t \\
z^m_t \\
\Delta X^r_t
\end{bmatrix},
\]

where \(z^m_t\) = a stationary monetary shock and \(z_t\) = a stationary real shock

• The exogenous shocks follow univariate AR(1) processes,

\[
\begin{bmatrix}
\Delta X^m_{t+1} \\
z^m_{t+1} \\
\Delta X^r_{t+1}
\end{bmatrix}
= \rho \begin{bmatrix}
\Delta X^m_t \\
z^m_t \\
\Delta X^r_t
\end{bmatrix} + \Psi \begin{bmatrix}
e^X_{t+1} \\
e^z^m_{t+1} \\
e^z_{t+1} \\
e^X_{t+1} \\
e^z^m_{t+1} \\
e^z_{t+1}
\end{bmatrix},
\]

with \(\rho\) and \(\Psi\) diagonal and \(e^s_t\), for \(s = X^m, z^m, X, z, X^r\), i.i.d. \(N(0, 1)\).
Observation equations

Observables:
\( \Delta y_t = \text{output growth} \)
\( \Delta \pi_t = \text{change in consumer price inflation} \)
\( \Delta i_t = \text{change in the short-term nominal interest rate} \)

\[
\Delta y_t = \hat{y}_t - \hat{y}_{t-1} + \Delta X_t + \delta \Delta X^r_t + \mu^y_t,
\]
\[
\Delta \pi_t = \hat{\pi}_t - \hat{\pi}_{t-1} + \Delta X^m_t + \mu^\pi_t,
\]
\[
\Delta i_t = \hat{i}_t - \hat{i}_{t-1} + \Delta X^m_t + \Delta X^r_t + \mu^i_t,
\]

where \( \mu^s_t, \) for \( s = y, \pi, i, \) are normally distributed mean-zero i.i.d. measurement errors.
Inflation and Its Permanent Component: 1900 to 2022 Sample

Notes. $X_t^m$ is computed by two-sided smoothing using the Kalman filter at the posterior mean of the vector of estimated parameters and is normalized by adding a constant to match the sample mean of inflation.

$\pi_{2022} - \pi_{2019} = 6.0\%$; $X_{2022}^m - X_{2019}^m = 1.3\%$
Inflation and Its Permanent Component: 1900–2022 vs 1955–2022

Sample: 1900 to 2022

\[
X^m_{2022} - X^m_{2019} = 1.3\%
\]

Sample: 1955 to 2022

\[
X^m_{2022} - X^m_{2019} = 5.0\%
\]

- Between 2019 and 2022 the permanent component of inflation experienced an increase of \textbf{1.3\%} when model is estimated on 1900-2022 data but of \textbf{5.0\%} when model is estimated on 1955-2022 data.
Impulse Response to Monetary Shocks: 1900 to 2022 Sample

Permanent Monetary Shock, $X_t^m$
Response of the Interest Rate and Inflation

Temporary Monetary Shock, $z_t^m$
Response of the Interest Rate and Inflation

Permanent Monetary Shock, $X_t^m$
Response of Output

Temporary Monetary Shock, $z_t^m$
Response of Output

Notes. Posterior mean of impulse responses with 95-percent asymmetric Sims-Zha error bands.
**Impulse Response to Monetary Shocks**

Sample: 1900 to 2022

Sample: 1955 to 2022

- Impulse responses to monetary shocks (transitory or permanent) are little affected by sample.
Conclusion

• Seen from the perspective of a model estimated on postwar data the post-COVID-19 inflation spur is interpreted to be associated with a large increase in the permanent component of inflation.

• For the sample that includes the sudden, large, and short-lived swings in inflation observed in the first half of the 20th century, the same model attributes only a minor fraction of the post-COVID-19 inflation to an increase in its permanent component.

• The monetary transmission mechanism is estimated to be stable across the two sample periods.