Monetary Policy, Regime Shifts, and Inflation Uncertainty in Peru (1949 – 2006)

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Central Reserve Bank of Peru
Motivation (1)

<table>
<thead>
<tr>
<th>Period</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951 - 1960</td>
<td>0.60</td>
<td>0.99</td>
</tr>
<tr>
<td>1961 - 1970</td>
<td>0.78</td>
<td>0.97</td>
</tr>
<tr>
<td>1971 - 1980</td>
<td>2.41</td>
<td>2.40</td>
</tr>
<tr>
<td>1981 - 1990</td>
<td>16.40</td>
<td>38.28</td>
</tr>
<tr>
<td>1991 - 2000</td>
<td>1.88</td>
<td>2.58</td>
</tr>
<tr>
<td>2001 - 2006</td>
<td>0.16</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Money Growth Rate

Inflation Rate

Blue: Money Growth Rate
Red: Inflation
Motivation (2)

• Empirical evidence of link among inflation and inflation uncertainty

• From a policy-oriented perspective, high inflation and high uncertainty are associated to higher stabilization costs
  – what about inflation persistence?

• This link might be subject to regime shifts in monetary policy
Objective

- Evaluate empirically the link between inflation and inflation uncertainty in a context of monetary policy regime shifts for the Peruvian economy

- As a by-product:
  - Assess inflation persistence
Related Literature

Univariate models

• Ball and Cecchetti (BPEA, 1990)
  • Unobserved components

• Kim and Nelson (MIT, 1999)
  • Unobserved components subject to regime switching

Learning models

• Marcet and Nicolini (RED, 2005)
  • Regime switching in money growth

• Sargent, Williams, and Zha (2006)
  • Regime switching in fiscal policy
Unobserved Components of Inflation

\[ \pi_t = \pi^T_t + \eta_t \]

Short-term uncertainty

\[ \pi^T_t = \pi^T_{t-1} + \epsilon_t \]

Long-term uncertainty

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Coefficient on Average Inflation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Shock ( \sigma^2_\epsilon )</td>
<td>0.173 ( (7.617) )</td>
<td>0.84</td>
</tr>
<tr>
<td>Transitory Shock ( \sigma^2_\eta )</td>
<td>0.163 ( (2.003) )</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Numbers in parenthesis are t-statistics. Information for 1985-1995 is excluded.
Regime Switching in Inflation Rate

\[ \pi_t = c(s_t) + \beta_1(s_t)\pi_{t-1} + \eta_t(s_t) \]
Markov Switching Heteroskedasticity

\[ \pi_t = \pi^T_t + \mu_2 S_{1,t} + \mu_3 S_{2,t} + \mu_4 S_{1,t} S_{2,t} + \left( h_0 + h_1 S_{2,t} \right) \eta_t \]

\[ \pi^T_t = \pi^T_{t-1} + \left( Q_0 + Q_1 S_{1,t} \right) \epsilon_t \]

Permanent shock \hspace{1cm} Transitory shock

\[ S_{1,t} \hspace{1cm} S_{2,t} \]

Discrete State Variables = 0 \hspace{1cm} Low variance

= 1 \hspace{1cm} High variance
Permanent Shocks

![Graph showing Permanent Inflation (%) and Probability High Variance State over time. The x-axis represents years from 1950 to 2000, and the y-axis represents inflation percentages ranging from -10% to 40% and probability ranging from 0.0 to 1.0.]
Transitory Shocks

Probability High Variance State

Transitory Inflation (%)
Hyperinflation: Permanent Shocks

Inflation (%) vs. Probability High Variance State
Regime Shifts in Monetary Policy

\[ m_t = c(s_t) + \beta_1(s_t) m_{t-1} + u_t(s_t) \]
What about inflation persistence?

• Short-run and long-run uncertainty has changed: inflation persistence varies across regimes

• Ratio between long-run vs. short-run uncertainty contains information on central bank credibility

\[
\frac{\sigma^2_{\varepsilon}}{\sigma^2_{\eta}} = S = \frac{-1}{\text{corr}(\Delta\pi_t, \Delta\pi_{t-1})} - 2
\]
What about inflation persistence?

• Agent has to forecast inflation based on the unobserved component model

\[
\hat{E}_t \pi_{t+1} = \hat{E}_{t-1} \pi_t + K \left( \pi_t - \hat{E}_{t-1} \pi_t \right), \quad 0 < K < 1
\]

\[
= K \left[ \pi_t + (1 - K) \pi_{t-1} + (1 - K)^2 \pi_{t-2} + \ldots \right]
\]

• Positive link between Signal to Noise Ratio (S) and Kalman Gain (K)

\[
K = \frac{-S + \sqrt{S^2 + 4S}}{2}
\]
What about inflation persistence?

- Larger S, larger K, more weight to recent inflation, hence, larger persistence

<table>
<thead>
<tr>
<th></th>
<th>Regime 1 (low-volatility)</th>
<th>Regime 2 (high-volatility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$</td>
<td>0.295</td>
<td>0.604</td>
</tr>
<tr>
<td>$S$</td>
<td>0.262</td>
<td>0.584</td>
</tr>
<tr>
<td>$K$</td>
<td>0.398</td>
<td>0.526</td>
</tr>
</tbody>
</table>
Conclusions (1)

• High inflation relates to high (short- and long-run) uncertainty

• Both permanent and transitory components of inflation have been subject to regime switching

• Regime switching in monetary policy has induced shifts in inflation dynamics
Conclusions (2)

- Inflation-intolerant policies reduce volatility of both permanent and transitory shocks

- Reduction in persistence (and in stabilization costs) might be due to fall in long-run/short-run uncertainty