Income, inflation tax and money demand

Estimate a money demand function to measure how responsive is money demand to income:

\[ m = f(p, y) \]

\( p = \) inflation
\( y = \) income

Estimation strategy

- Two alternatives: General-to-Particular, Engle-Granger approach

- General-to-particular: estimate a short-run model (ADL-error correction model) \( \rightarrow \) infer a long run relationship. Problem: not enough data (loss of precision, multicollinearity, asymptotic methods are not reliable)

- Engle-Granger: start from a long-run relationship (cointegration) and then estimate a short run model (error correction). Uses less degrees of freedom
Engle-Granger approach:

- Long run: Cointegration:
  1) All series must be I(1) (unit root in every series)
  2) Estimate a long-run relationship
  3) Test for stationary residuals (cointegration)

- Short run: error-correction model

Long run model

\[ m_t = \alpha_0 + \alpha_1 p_t + \alpha_2 y_t + \eta_t \quad (1) \]

Short run

\[ \Delta m_t = \beta_1 \Delta p_t + \beta_2 \Delta y_t + \beta_3 z_{t-1} + \delta W_t + u_t, \]

With \( Z_{t-1} \) = residuals from (1) (“errors”) \( \Rightarrow \beta_3 Z_{t-1} \) (error correction term)

\[ \alpha_2 = \text{long run income elasticity.} \]
\[ \beta_2 = \text{short run income elasticity.} \]
Results

![Graphs showing time series data for M1, P, and Y from 1980 to 1989.]
Long-run relationship

a) Test for unit-roots in every series

<table>
<thead>
<tr>
<th></th>
<th>DF Statistic</th>
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<tbody>
<tr>
<td>M1</td>
<td>-2.577362</td>
</tr>
<tr>
<td>Inflation</td>
<td>-2.395383</td>
</tr>
<tr>
<td>GDP</td>
<td>-3.053772</td>
</tr>
</tbody>
</table>

Critical value (5%): -3.5426

• We do not reject the null in all cases (all series seem to be I(1))

b) Estimation of the long-run relationship

\[ m(t) = 1.8404 - 2.0883 \, p(t) + 0.7068 \, y(t) \]

\[ R^2 = 0.54; \text{ std error: 0.51; sample: 1980.1-1988.4} \]

Observations: 36
Short-run relationship (error-correction)

\[ \Delta m(t) = -0.0138 - 1.2719 \Delta p(t) + 0.2275 \Delta y(t) \\
-0.2296 \text{ERRC}(t-1) + \delta W(t) \]

\[ R^2 = 0.51; \text{ std error: 0.084; sample:1980.2-1989.1} \]
\[ \text{observations:36} \]

The short run income elasticity is 0.2275
The long run income elasticity is 0.7068