FORECASTING NON-PERFORMING LOAN RATIO IN TURKEY USING BOX-JENKINS APPROACH

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Agenda

• Motivation
• Objective
• Data Description
• Statistical Background
• Summary of Results
• Conclusion
Why NPL Ratio is Important?

- Increased in non-performing loans (NPLs) ratio reflects the bank failure.
- High NPL ratio negatively affects the country’s financial situation.
- Evident forecast and observes the effect of financial crisis.
Purpose

• The primary purpose of this research is to forecast the future trends of non-performing loan ratio by using Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) in Turkey.
Monthly NPL Ratio, Jan 2006-Apr 2012
ARIMA Models

ARIMA models consist of three components:

1. Lagged values of the variable (the autoregressive component, AR),

2. Lagged values of the error term (the moving average component, MA)

3. The degree of integration (the number of differences required to make a series stationary)

ARIMA model can be written:

\[ y_t = \mu + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \cdots + \phi_p y_{t-p} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_q \varepsilon_{t-q} + \varepsilon_t \]
Box-Jenkins Procedure

Step 1: Model Identification
- Plot Series
- Is It Stationary?
  - Yes
    - Identify Possible Model
  - No
    - Difference “Integrate” Series

Step 2: Parameter Estimation
- Identify Possible Model
- Estimate Parameter Value
- Model Diagnostics Ok?
  - Yes
    - Use Model to Forecast
  - No

Step 3: Diagnostic Checking
Actual and Estimated NPL Ratio

ARIMA(6,2,6): \( \hat{Y}_t = 2Y_{t-1} - Y_{t-2} + 0.928Y_{t-6} - 1.8543Y_{t-7} + 0.928Y_{t-8} - 0.927\varepsilon_{t-6} \)
# The Test of Estimations

<table>
<thead>
<tr>
<th>Date</th>
<th>Actual NPL Ratio</th>
<th>Forecasted NPL Ratio</th>
<th>Forecast Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>May.12</td>
<td>2.57%</td>
<td>2.50%</td>
<td>0.07%</td>
</tr>
<tr>
<td>Jun-12</td>
<td>2.52%</td>
<td>2.57%</td>
<td>-0.05%</td>
</tr>
<tr>
<td>Jul-12</td>
<td>2.57%</td>
<td>2.53%</td>
<td>0.04%</td>
</tr>
<tr>
<td>Aug-12</td>
<td>2.66%</td>
<td>2.62%</td>
<td>0.04%</td>
</tr>
<tr>
<td>Sep-12</td>
<td>2.79%</td>
<td>2.71%</td>
<td>0.08%</td>
</tr>
<tr>
<td>Oct-12</td>
<td>2.81%</td>
<td>2.97%</td>
<td>-0.16%</td>
</tr>
</tbody>
</table>
# The Result of Forecast

<table>
<thead>
<tr>
<th>Date</th>
<th>Forecasted NPL Ratio</th>
<th>Monthly % Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-13</td>
<td>2.50%</td>
<td>-0.44%</td>
</tr>
<tr>
<td>Jun-13</td>
<td>2.57%</td>
<td>-0.17%</td>
</tr>
<tr>
<td>Jul-13</td>
<td>2.53%</td>
<td>2.88%</td>
</tr>
<tr>
<td>Aug-13</td>
<td>2.62%</td>
<td>2.19%</td>
</tr>
<tr>
<td>Sep-13</td>
<td>2.71%</td>
<td>1.59%</td>
</tr>
<tr>
<td>Oct-13</td>
<td>2.97%</td>
<td>2.94%</td>
</tr>
</tbody>
</table>

![Line chart showing actual and fitted NPL trends from March 07 to July 13](chart).
Questions and Comments
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