Agricultural and Rural Finance Markets in Transition

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An Economic Evaluation of Forecasts of Relevance to Agribusinesses and Agricultural Lenders

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Importance of Forecast Evaluation

- Forecasts for future business conditions are important.
- Developing forecasting models requires resources.
- Public and commercial forecasts are available.
- It is necessary to evaluate competing forecasts for the same variable.
Slide 3

Forecast Series Evaluated

- Cattle on-feed report forecasts.
  - On-feed
  - Placements
  - Marketings
- Inflation forecasts.
  - Federal Reserve Green Book
  - Survey of Professional Forecasters

Slide 4

Testing Framework

- A random variable can be expressed as the sum of its expected mean plus a residual.
  \[ y_{t+1} = \mu_{t+1} + u_{t+1} \]
  \[ \mu_{t+1} = E(y_{t+1} | \Psi_t) \]
  \[ E(u_{t+1} | \Psi_t) = 0 \]

\( E(\cdot | \Psi_t) \) is “rational” expectation operator conditional on “public” information set \( \Psi_t \).
Testing Framework

- Information set available to analyst $a$ as of time $t$ is $\Psi_t^{a} \supseteq \Psi_t$

$$\mu^{t+1} = E(y_{t+1} | \Psi_t)$$

Let $x_{at}^{t+1}$ denote analyst $a$’s forecast of $y_{t+1}$ as of time $t$. If the forecast is rational, then

$$x_{at}^{t+1} = \mu_{at}^{t+1}$$

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Testing Framework

- If the forecast is rational, then $\theta = 0, \psi = 1, Var(c), = 0$ in the following regression

$$x_{at}^{t+1} = \theta + A\mu_{at}^{t+1} + e_t$$

The difficulty with the above regression is that we do not know $\mu_{at}^{t+1}$. 

Testing Framework

- Analyst’s private information could forecast part of the residual $u_{t+1}$.
  
  $u_t^* = E(u_{t+1} | \Psi_t)$

  $\mu_{t+1}^{t+1} = \mu_{t+1}^t + u_{t+1}^*$

  Substitute into last regression,

  $x_{at}^{t+1} = \theta + A(\mu_{t+1}^{t+1} + u_{t+1}^*) + e_t$

  $x_{at}^{t+1} = \theta + A\mu_{t+1}^{t+1} + Au_{t+1}^* + e_t$

The Predictive System

- It can be shown that $\text{Var}(e_t) = \text{Var}(\gamma_t) - A\text{cov}(u_{t+1}, \gamma_t)$

- A unit-free measure of the amount of private information:
  
  $R^2 = \frac{\text{Var}(u_t^*)}{\text{Var}(u_t^*) + \text{Var}(u_{t+1}^*)} = \frac{\text{cov}(u_{t+1}, \gamma_t)}{A\text{Var}(u_{t+1})}$
Previous Rationality Tests

- The Mincer-Zarnowitz regression

\[ y_{t+1} = a + bx_{t+1}^a + \epsilon_{t+1} \]

- In the current framework

\[ y_{t+1} = x_{t+1}^a - \frac{\theta - e_t^u}{A} + \frac{\theta}{A} x_{t+1}^a + \frac{(u_t^a - e^u_t)}{A} \]

If \( \text{var}(\epsilon_t) \neq 0 \), \( x_{t+1}^a \) is correlated with the regression error. OLS is not consistent.

COF Report

- OLS

<table>
<thead>
<tr>
<th></th>
<th>On-Feed</th>
<th>Placements</th>
<th>Marketings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.01 (0.02)</td>
<td>-0.04 (0.06)</td>
<td>0.08 (0.04)</td>
</tr>
<tr>
<td>Slope</td>
<td>1.01 (0.02)</td>
<td>1.14 (0.06)</td>
<td>0.92 (0.04)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.97</td>
<td>0.84</td>
<td>0.92</td>
</tr>
<tr>
<td>F</td>
<td>0.33</td>
<td>2.64</td>
<td>2.91</td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.72</td>
<td>0.08</td>
<td>0.06</td>
</tr>
<tr>
<td>N</td>
<td>63</td>
<td>63</td>
<td>63</td>
</tr>
</tbody>
</table>

- Predictive System

<table>
<thead>
<tr>
<th></th>
<th>On-Feed</th>
<th>Placements</th>
<th>Marketings</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\theta} )</td>
<td>0.06</td>
<td>0.22</td>
<td>-0.04</td>
</tr>
<tr>
<td>( \hat{\lambda} )</td>
<td>0.96</td>
<td>0.05</td>
<td>0.86</td>
</tr>
<tr>
<td>( \hat{R}^2 )</td>
<td>0.52</td>
<td>0.13</td>
<td>0.69</td>
</tr>
<tr>
<td>( \text{Var}(\epsilon_t) )</td>
<td>1.49</td>
<td>0.51</td>
<td>5.47</td>
</tr>
</tbody>
</table>
## Inflation Forecasts (Green Book)

**OLS**

<table>
<thead>
<tr>
<th></th>
<th>Current Quarter</th>
<th>1-Quarter-Ahead</th>
<th>2-Quarter-Ahead</th>
<th>3-Quarter-Ahead</th>
<th>4-Quarter-Ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.16 (0.34)</td>
<td>0.19 (0.48)</td>
<td>0.54 (0.66)</td>
<td>0.56 (0.66)</td>
<td>0.64 (0.86)</td>
</tr>
<tr>
<td>Slope</td>
<td>0.99 (0.08)</td>
<td>1.02 (0.08)</td>
<td>0.97 (0.11)</td>
<td>0.96 (0.12)</td>
<td>1.10 (0.32)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.7622</td>
<td>0.6139</td>
<td>0.4689</td>
<td>0.4218</td>
<td>0.5814</td>
</tr>
<tr>
<td>F</td>
<td>0.17</td>
<td>1.31</td>
<td>1.87</td>
<td>2.23</td>
<td>0.49</td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.8441</td>
<td>0.274</td>
<td>0.1605</td>
<td>0.114</td>
<td>0.6177</td>
</tr>
<tr>
<td>N</td>
<td>91</td>
<td>91</td>
<td>90</td>
<td>87</td>
<td>64</td>
</tr>
</tbody>
</table>

**Predictive System**

<table>
<thead>
<tr>
<th></th>
<th>Current Quarter</th>
<th>1-Quarter-Ahead</th>
<th>2-Quarter-Ahead</th>
<th>3-Quarter-Ahead</th>
<th>4-Quarter-Ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta )</td>
<td>0.24</td>
<td>0.32</td>
<td>0.44</td>
<td>0.52</td>
<td>0.47</td>
</tr>
<tr>
<td>( \gamma )</td>
<td>0.07</td>
<td>0.08</td>
<td>0.07</td>
<td>0.05</td>
<td>0.08</td>
</tr>
<tr>
<td>( \delta )</td>
<td>0.65</td>
<td>0.68</td>
<td>0.89</td>
<td>0.12</td>
<td>0.68</td>
</tr>
<tr>
<td>R²</td>
<td>0.29</td>
<td>0.30</td>
<td>0.12</td>
<td>0.09</td>
<td>0.27</td>
</tr>
<tr>
<td>Var(\epsilon)</td>
<td>0.50</td>
<td>0.26</td>
<td>0.56</td>
<td>0.24</td>
<td></td>
</tr>
</tbody>
</table>
Inflation Forecasts (SPF)

- **OLS**
  - Current Quarter, 1-Quarter-Ahead, 2-Quarter-Ahead, 3-Quarter-Ahead, 4-Quarter-Ahead
  - Constant: -0.03 (0.42), 0.52 (0.58), 1.05 (0.75), 1.68 (0.91), 0.51 (0.87)
  - Slope: 1.04 (0.107), 0.96 (0.14), 0.75 (0.17), 0.85 (0.15)
  - R-squared: 0.6949, 0.4852, 0.3015, 0.1777, 0.332
  - F: 0.8, 1.2, 1.67, 1.85, 1.39
  - Prob>F: 0.4521, 0.3049, 0.1946, 0.1639, 0.2576
  - N: 91, 91, 90, 87, 64

- **Predictive System**
  - Current Quarter, 1-Quarter-Ahead, 2-Quarter-Ahead, 3-Quarter-Ahead, 4-Quarter-Ahead
  - \( \hat{\gamma} \) range: 0.54 to 0.87, 0.75 to 0.98
  - \( \hat{A} \) range: 0.87 to 0.98, 0.77 to 0.87, 0.74 to 0.87, 0.71 to 0.87
  - \( \hat{\rho} \) range: 0.18 to 0.21, 0.08 to 0.09, 0.03 to 0.03, 0.02 to 0.01
  - \( \text{Var} \) range: 0.45 to 0.69, 0.20 to 0.20

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**Conclusion**

- **COF reports**
  - On-feed, placements, and marketings forecasts are unbiased. On-feed forecasts are not efficient. Other two are efficient.
  - Marketings forecasts contain the most amount of private information. OLS results indicate on-feed forecasts have the most information as shown by the R-squared value.
Inflation forecasts

- The current quarter GB inflation forecasts appear to be unbiased and efficient. Unbiasedness support for other horizons is weak. One quarter ahead forecasts are not efficient.
- SPF forecasts are biased and inefficient for all forecast horizons.
- OLS results show that for all forecast series, the joint null hypothesis that the intercept is zero and the slope is one can not be rejected at the 5% level.