Heterogonous Expectations of Agricultural Bankers

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Land Value and Credit Conditions Survey
Land Value and Credit Conditions Survey

What trend in farmland values do you expect in your area in the next three months?
Possible answers: Up, Down, or Stable

• Good predictor of District farm real estate values (Covey, 1999; Zakrzewicz, et al., 2013 (KC Fed survey))
• Report diffusion index (balance statistic) quarterly
  • (Up – Down) + 100
Diffusion Index of Expected Changes
Land Value and Credit Conditions Survey

What trend in farmland values do you expect in your area in the next three months? Answers: Up, Down, or Stable

Very common elicitation method in business surveys:
• Respondents reluctant to report quantitative assessment
• Avoids “spurious precision”
• Less respondent burden

Yet...
• Can be difficult to interpret: *What do bankers actually mean by “up”?*
• Assumes symmetry of “up” and “down”
Qualitative surveys can be “quantified”

Assume:

• Respondents have some unobservable continuous distribution of expectations (latent expectations)

• The (ordinal) discrete responses are based on unobserved threshold values
Bankers’ (Latent) Expectations

\[ y_{it} = \downarrow \]

\[ y_{it} = \approx \]

\[ y_{it} = \uparrow \]

\[ y_{it}^* = f(\cdot) \]

\[ y_{it}^* \leq \mu_1 \]

\[ \mu_1 < y_{it}^* \leq \mu_2 \]

\[ \mu_2 < y_{it}^* \]
Bankers’ (Latent) Expectations

We do not observe \( y_{it}^* \)

We observe \( y_{it} \) such that:

\[
y_{it} = \begin{cases} 
  \uparrow & \text{if } y_{it}^* > \mu_2 \\
  \approx & \text{if } \mu_1 < y_{it}^* \leq \mu_2 \\
  \downarrow & \text{if } y_{it}^* \leq \mu_1 
\end{cases}
\]

\[ y_{it} = f(\cdot) \]
Bankers’ (Latent) Expectations

The region $\mu_1 < y_{it}^* \leq \mu_2$ is known as the “indifference interval” within which bankers report expected change of zero ($y_{i,t} = \approx$)
Bankers’ (Latent) Expectations

• A number of empirical methods have been proposed to estimate quantitative “mean” expectations ($\bar{y}_{it}^*$) and indifference interval ($\mu_1, \mu_2$) from aggregate survey responses
  • Probability method of Carlson and Parkin (1975)
  • Regression method of Pesaran (1984)

• Methods have a number of recognized limitations (Nardo, 2003)
  • Restrictive assumptions of indifference interval
  • Respondent heterogeneity
  • Assumed distribution of $y_{it}^*$

• More recent studies exploit respondent-level data (Lahiri and Zhao, 2015)
Empirical Model

• Estimate the distribution of bankers’ (latent) expectations ($y^*_{it}$) through ordered choice regression

$$
y_{it} = \begin{cases} 
\uparrow & \text{if } y^*_{it} = \sum_t \alpha_t D_{it} + \varepsilon_{it} > \mu_2 \\
\approx & \text{if } \mu_1 < y^*_{it} = \sum_t \alpha_t D_{it} + \varepsilon_{it} \leq \mu_2 \\
\downarrow & \text{if } y^*_{it} = \sum_t \alpha_t D_{it} + \varepsilon_{it} \leq \mu_1 
\end{cases}
$$

where $D_{it}$ is a dummy variable $= 1$ if bank $i$ responded in quarter $t$
Ordered Choice Regression

• Bankers’ expectations are a function quarter and i.i.d. error

• We must make an assumption on the distribution of the error (link function): $F(\cdot)$

• The model estimates the probabilities:

$$P[y_i = \uparrow] = 1 - F\left(\frac{\mu_2 - \alpha_t D_{it}}{\sigma}\right)$$

$$P[y_i = \approx] = F\left(\frac{\mu_2 - \alpha_t D_{it}}{\sigma}\right) - F\left(\frac{\mu_1 - \alpha_t D_{it}}{\sigma}\right)$$

$$P[y_i = \downarrow] = F\left(\frac{\mu_1 - \alpha_t D_{it}}{\sigma}\right)$$
Empirical Model

• Ordered probit model (standard normal link function)
• 787 banks
• 1992Q4 – 2016Q4 (97 quarters)
• 21,121 observations
• Mean of 36.6 responses per bank
• Control variables (observed heterogeneity)
  • Average farmland value
  • State-level fixed effects
Responses per Quarter

- Responses
- Ag Banks
Responses per Bank

![Bar chart showing the number of responses per bank. The x-axis represents the number of responses, ranging from 1 to 91. The y-axis represents the number of banks, ranging from 0 to 35. The chart displays a distribution of responses per bank, with peaks at various response counts.]
### Preliminary Results

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_1$</td>
<td>$-1.375$</td>
<td>$0.060$</td>
<td>***</td>
</tr>
<tr>
<td>$\mu_2$</td>
<td>$0.973$</td>
<td>$0.060$</td>
<td>***</td>
</tr>
</tbody>
</table>

• Lenders have asymmetric indifference interval

• In order to report “down,” bankers believe that farm real estate values will fall by more than 1.37%

• In order to report “up,” bankers believe that farm real estate values will rise by more than 0.97%

$*** \alpha \leq 0.01$
Observed Heterogeneity (marginal effects)

<table>
<thead>
<tr>
<th></th>
<th>Down</th>
<th>Stable</th>
<th>Up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal</td>
<td>Std. Error</td>
<td>Marginal</td>
</tr>
<tr>
<td>Farmland Price (level, in $10K)</td>
<td>–0.026</td>
<td>0.009**</td>
<td>–0.031</td>
</tr>
<tr>
<td>Illinois</td>
<td>–0.002</td>
<td>0.002</td>
<td>–0.002</td>
</tr>
<tr>
<td>Indiana</td>
<td>–0.022</td>
<td>0.002***</td>
<td>–0.034</td>
</tr>
<tr>
<td>Michigan</td>
<td>–0.009</td>
<td>0.004**</td>
<td>–0.013</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>–0.031</td>
<td>0.002***</td>
<td>–0.053</td>
</tr>
</tbody>
</table>

***α ≤ 0.01, **α ≤ 0.05, *α ≤ 0.10
Preliminary Results
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Temporal fixed effects follow the same general pattern as the diffusion index, but the values are directly interpretable.
Example – 1988 quarter 3:
• Respondents expected land values to fall by 1.28%, in quarter 4
• Diffusion index value of 58
Preliminary Results

Observed Changes

1993Q1  1996Q1  1999Q1  2002Q1  2005Q1  2008Q1  2011Q1  2014Q1

Axis Title
Preliminary Results

Temporal fixed effects can be compared directly to reported percentage change.
Example – 1988 quarter 3:
• Respondents expected land values to fall by 1.28%, in quarter 4
• Actual price change, in quarter 4, 0%
Thank you