Do Revisions Improve Agricultural Baselines?

Kexin Ding, The Ohio State University, ding.908@osu.edu
Ani L. Katchova, The Ohio State University, katchova.1@osu.edu

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THE OHIO STATE UNIVERSITY
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Introduction

- The long-term agricultural baseline projections, which are fixed-horizon (10 years) path projections providing dynamic information along the path, are of vital importance for farmers, market participants, and especially policymakers.
- Compared with the fixed-event agricultural forecasts, agricultural baselines focus more on capturing major factors influencing future trends of agricultural production, markets, and farm income rather than transient shocks, which become the data basis for many agricultural and financial long-term policies.

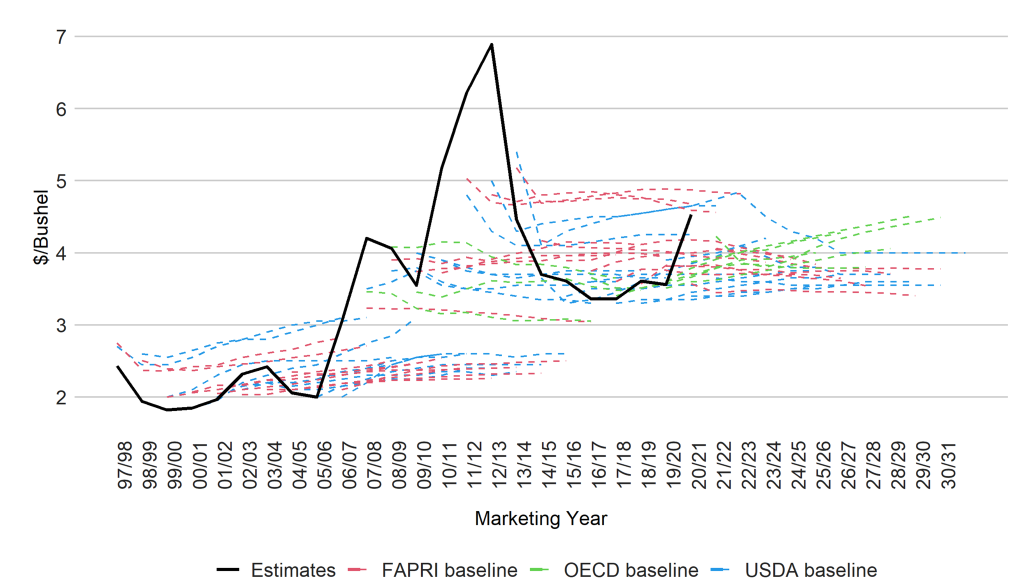

Fig. 1: Corn Price Realized Values and Baseline Projections, 1997-2021

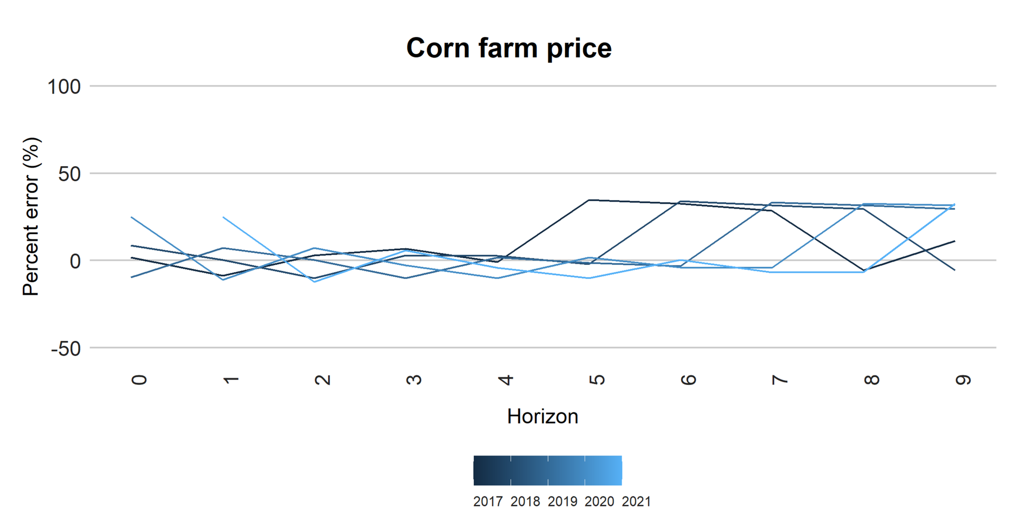

Fig. 2: USDA Corn Price Baseline Projections Revisions, 2017-2020

Objectives

- This study evaluates the agricultural baselines focusing on analyzing the characteristics of path forecasts by assessing usefulness of revisions and testing information rigidity.

Data

- For each commodity (harvested acres, farm price, and yield for corn, soybeans, and wheat) and farm income (net cash income and its components) projection, we define the realized value of year $t = \{1997, ..., 2020\}$ as Y_t, and the projections made for year t at horizon $h = \{0, ..., H\}$ by agency $i = \{USDA, FAPRI\}$ as $\hat{Y}^i_{h|t}$. Following Nordhaus (1987), the revision is then defined as $R^i_{h|t} = \hat{Y}^i_{h|t} - \hat{Y}^i_{h+1|t}, h = \{0, ..., H-1\}$.
- Within the study period from 1997 to 2020: there have been 171 revisions for the commodity projections and 170 revisions for the farm income projections produced by USDA and FAPRI.
- The mean projection (use log transformation to eliminate changing forecast level effects), $\hat{y}_{h|t}$, is definded as $\frac{1}{2}(\ln \hat{Y}^{USDA}_{h|t} + \ln \hat{Y}^{FAPRI}_{h|t})$. Accordingly, $y_{h|t} = \ln Y_{h|t}$, $r_{h|t} = \hat{y}_{h|t} - \hat{y}_{h+1|t}$.

Methods

- Tests for Usefulness of Revisions
  - Theil's U coefficients
  - Average difference in absolute forecast errors
  - Frequency of reductions in absolute forecast error
- Information Rigidity Assessment
  Projection errors will be predictable if forecasters act strategically to minimize revisions. We first test the predictability of average projection revisions $r_{h|t}$ as:

$$r_{h|t} = \theta_0 + \theta_1 r_{h+1|t} + error_t, \quad (1)$$

A statistically significant $\hat{\theta}_1$ only implies predictability of mean projection revisions. Whether this predictability is due to information rigidity or strategic smoothing is still questionable. Following Coibion and Gorodnichenko (2015), we test information rigidity using:

$$y_t - \hat{y}_{h|t} = \alpha_0 + \alpha_1 r_{h|t} + error_t. \quad (2)$$

In the context of a sticky-information model, we define λ as the probability of acquiring no new information which can be interpreted as the degree of information rigidity, which is defined as $\hat{\lambda} = \hat{\alpha}_1/(1+\hat{\alpha}_1)$. In the context of a noisy-information model, we define the relative weight placed on new information relative to previous projections as G which can be estimated as $\hat{G} = 1/(1+\hat{\alpha}_1)$.

Results

- Theils U coefficients are calculated to compare the accuracy of the initial and revised projections. For both USDA and FAPRI, the initial baseline projections performed better than the revised projections.
- The statistical significance of the reduction in absolute projection error is tested as shown in Fig 3 and 4. For harvested acres, the reductions made by 1-step revisions for all crops for both USDA and FAPRI are insignificant. For farm price, the reduction from small step revisions is insignificant. However, for yield, no significant reduction is revealed by revisions.

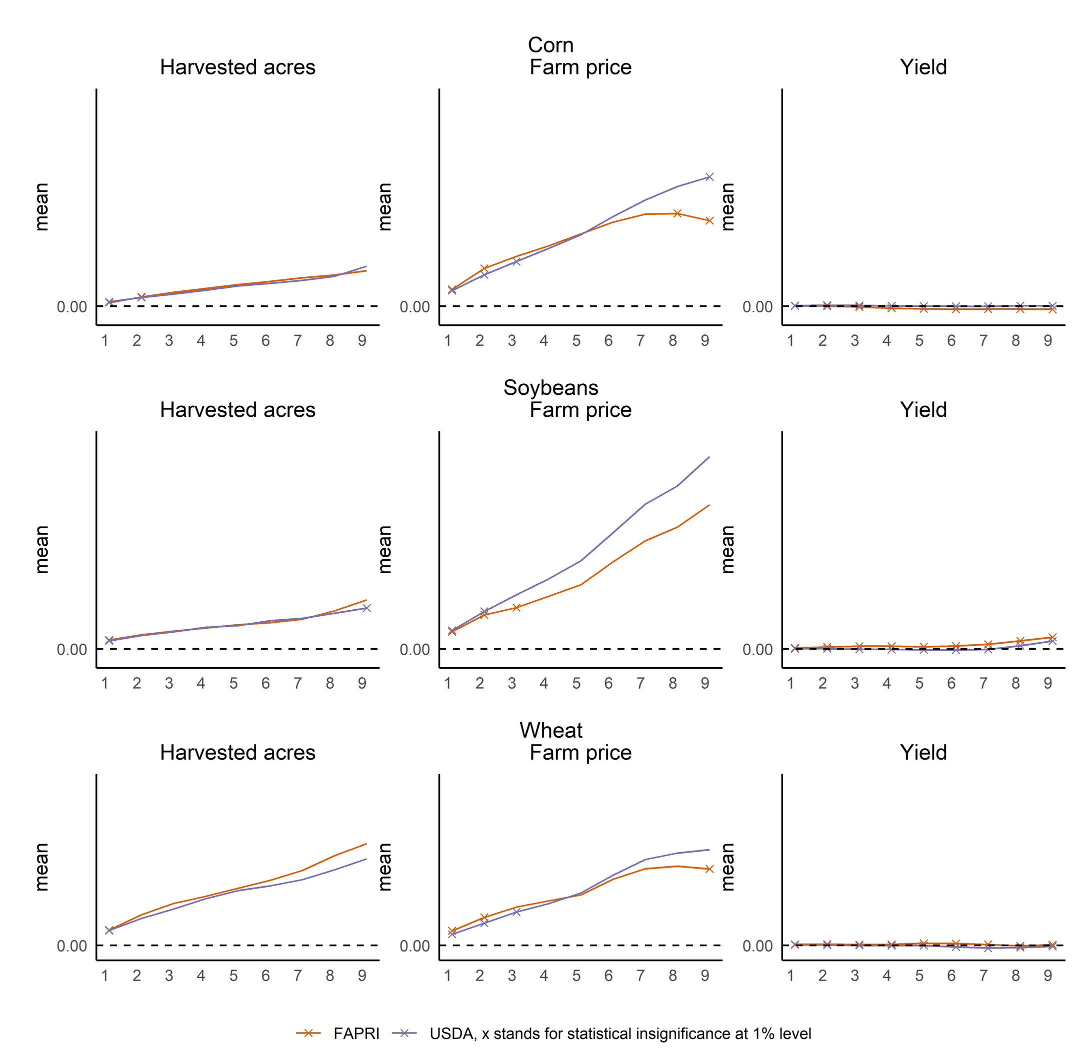

Fig. 3: Differences in Absolute Errors of Revised Baseline Projections of corn, soybeans and wheat by revision step s, 1997–2020

- For the farm income projections, FAPRI has less significant reduction in projection errors.

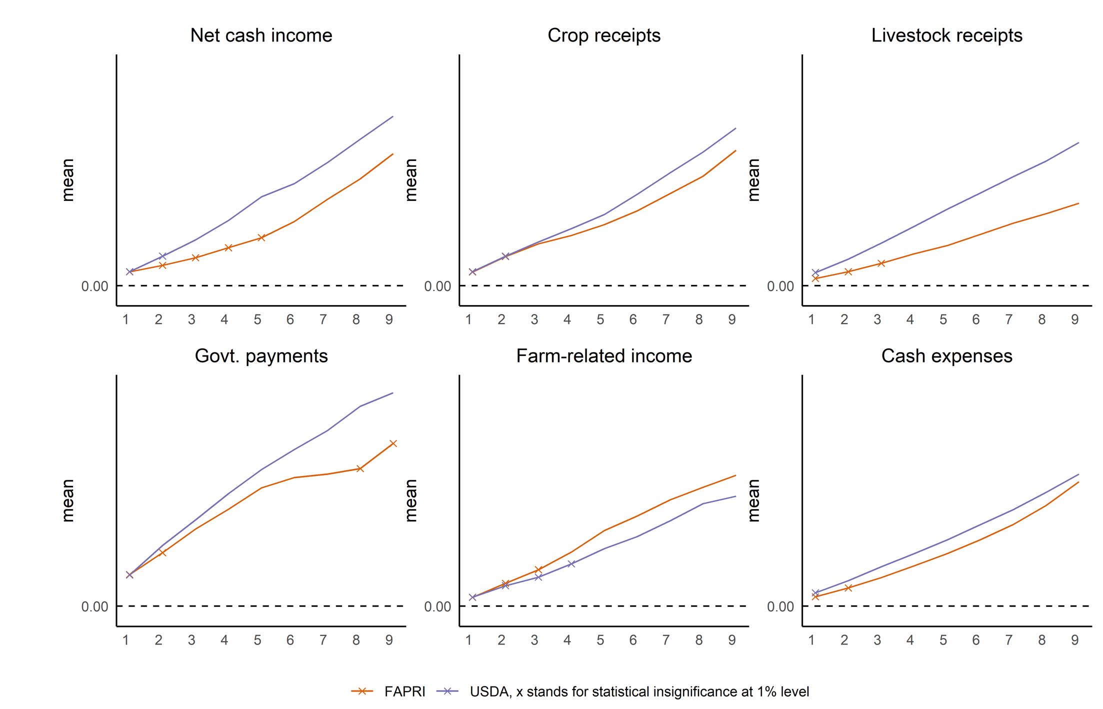

Fig. 4: Differences in Absolute Errors of Revised Baseline Projections of net cash income and its components by revision step s, 1997–2020

- The following table presents the results of frequency of reductions in absolute projection error by 1-step revisions. The number of times error reduced as a percentage of number of revisions is approximately 50-60%, yet the binomial probability (the probability of observing that number of reduction or more if the likelihood of a revision reducing the projection error were 50%) shows insignificance for many FAPRI baseline projections, and USDA wheat farm price and farm income baseline projections.

Table 3: Frequency of Reductions in Baseline Projections due to Revision, 1997–2020

	Percent		Binomial probability		Reduced/ revised up		Reduced/ revised down	
	USDA	FAPRI	USDA	FAPRI	USDA	FAPRI	USDA	FAPRI
Corn								
Harvested acres	0.585	0.585	0.016**	0.016**	0.630	0.538	0.532	0.637
Farm price	0.579	0.544	0.023**	0.142	0.584	0.562	0.573	0.531
Yield	0.579	0.491	0.023**	0.620	0.619	0.589	0.527	0.383
Soybeans								
Harvested acres	0.620	0.591	0.001***	0.011**	0.821	0.833	0.237	0.280
Farm price	0.591	0.515	0.011**	0.380	0.774	0.671	0.414	0.398
Yield	0.637	0.503	0.000***	0.500	0.671	0.630	0.609	0.354
Wheat								
Harvested acres	0.661	0.719	0.000***	0.000***	0.182	0.255	0.888	0.917
Farm price	0.509	0.585	0.439	0.016**	0.676	0.678	0.390	0.488
Yield	0.573	0.544	0.033*	0.142	0.657	0.691	0.458	0.351
Farm income								
Net cash income	0.494	0.614	0.591	0.002***	0.975	0.890	0.056	0.225
Crop receipts	0.553	0.544	0.096	0.142	0.785	0.648	0.273	0.425
Livestock receipts	0.582	0.678	0.019**	0.000***	0.759	0.825	0.241	0.333
Govt. payments	0.659	0.614	0.000***	0.002***	0.837	0.696	0.417	0.543
Farm-related income	0.524	0.550	0.296	0.111	0.787	0.692	0.197	0.328
Cash expenses	0.612	0.690	0.002***	0.000***	1.000	1.000	0.000	0.000

Notes: ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

- The predictability of mean projection revisions is only found in corn farm price, farm-related income, and cash expenses. Also, no wide range information rigidity exists.

Conclusions

- The general effectiveness of revisions in improving baseline projection accuracy is not signficant for both USDA and FAPRI. Also, there is no evidence that revisions reduce the projection errors significantly for yield. Further, the improvements for almost half of the FAPRI baseline projections are not signficantly different from the expected random revision of which likelihood of improving the projections is 50%.
- Suprisingly, information rigidity is not the main reason causing the ineffectiveness of revisions.