



PURDUE AGRICULTURAL ECONOMICS REPORT

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FROM THE EDITORS:

Welcome to the new Purdue Agricultural Economics Report (PAER)! Since 1920, the Department of Agricultural Economics at Purdue University has been working to acquire and transmit new economic knowledge to the citizens of Indiana, the nation, and the world. PAER has long been an important component in our efforts to provide value information on today’s real world problems to our diverse stakeholders. The report series carries the legacy that began in [1929](#), when the department published its large-scale Farm Outlook report. In the more than 90 years that followed that landmark publication, economic challenges have come and gone (and in some cases have come back again). As a result, the information needs of those who turn to PAER for expert advice have also changed.

PAER’s new publication format was designed to reflect these changing needs. We still plan to provide regular updates on the topics that are important to stakeholders, but we hope our readers will benefit from many of the new features of PAER. In the new format, articles will be posted individually which will allow us to provide more timely information as it become available. Users will be able to browse articles by topic or keyword and easily share articles through social media. We have to admit that the new PAER website is still a bit of a “work in progress.” We’re currently in the process of converting previous issues to the new publication format, and we look forward to launching additional content in support of PAER articles, such as video presentations and podcast discussions.

Our first digital issue demonstrates the breadth and depth of expertise of the Department of Agricultural Economics.

Here's an overview of the articles available in the October 2020 issue of Purdue Agricultural Economics Report:

“Cash Flow Problems and Resource Intermingling: Do They Affect Small Business Recovery and Resilience in the Wake of a Natural Disaster?”

A research team led by Farm Management Specialist Renee Wiatt and Professor Maria Marshall discuss their recent findings on small business management following a natural disaster. They discuss the challenges of intermingling financial decisions between the household and family business.

“Farmland Assessments and Tax Bills in 2021 and Beyond”

Professor Larry DeBoer and Extension Educator Tamara Ogle outline upcoming farmland property tax declines across Indiana.

“Understanding the Downward Bias in USDA’s Farm Income Forecasts”

Professor Todd Kuethe summarizes his recent research on the downward bias in USDA’s aggregate farm income forecasts.

“Recent Hog and Pork Market Dynamics”

Professor Jayson Lusk explains the impact of COVID19 on hog and pork prices.

“Data Usage in the Agricultural Value Chain”

Professor Brady Brewer summarizes key findings of a survey on agribusiness’ use of data conducted by the Department’s Center for Food and Agricultural Business (CAB).

“Marketing Sustainable Beer”

Professors Carson Reeling, Nicole Olynk-Widmar, and Jason Lusk, along with former graduate student Aaron Staples, discuss their research in the market for beer produced using sustainable practices.

“Appreciating Chris Hurt’s Impact in Outlook and PAER”

The final article in this issue was written by Professor, and former Department Head, Ken Foster. Dr. Foster provides a tribute to recently retired Professor Chris Hurt who previously served as PAER Editor. Dr. Hurt was a strong advocate for and champion of PAER, and we join Dr. Foster in thanking him for his many years of leadership and service.

Before we go, we would be remiss to not also thank our web development team Sarah Zahn and Kami Goodwin for their outstanding work in developing the new PAER website. We also wish to thank Jayson Lusk, our department head, who served as the PAER editor for several recent issues and Linda Klotz who served as an administrative assistant and editor of the PAER alongside Chris Hurt.

PAER Editors

Brady Brewer, Assistant Professor

Roman Keeney, Associate Professor

Todd Kuethe, Associate Professor and Schrader Chair in Farmland Economics



Title: Cash Flow Problems and Resource Intermingling: Do They Affect Small Business Recovery and Resilience in the Wake of a Natural Disaster?

Author(s): Renee Wiatt, Yoon Lee, Maria Marshall, and Virginia S. Zuiker

Issue: *PAER-2020-11*

Date: October 2020

Summary: Small and family businesses will continually face disasters and disruptions such as the COVID-19 pandemic and hurricanes, hence disrupting the flow of resources between the family and the business. Therefore, it is important for these small and family businesses to understand how cash flow issues and financial intermingling can affect recovery, specifically long-term resilience.

Related Report: <https://doi.org/10.1007/s10834-020-09710-y>

In small and family businesses, the family system and the business system often overlap and share resources, such as time and money. When there is a business or family disruption, it would seem logical and obvious to look to the other system for resources, such as money. Financial intermingling can expose the family or the business to vulnerabilities. Disruptions such as a natural disaster or a recession would pose greater threats to businesses who were already experiencing cash flow problems. We examined cash flow problems and financial intermingling between family and business following a natural disaster. The goal of this study was to determine what effects, if any, cash flow problems and financial intermingling have on business recovery and resilience following a natural disaster.

We surveyed business owners who had an operational business in 2004 in the lower 10 counties of Mississippi to examine how resilience was influenced by a number of important variables including pre-Katrina cash flow, financial intermingling of family and business, among other business and owner characteristics. The businesses in this survey endured Hurricane Katrina and the effects of that disaster were measured. In order to measure recovery, operational status was observed for each business. For this study, businesses were classified as open if they were currently operating with the same owner or if the business reopened after Katrina, even though it was not currently operating. Businesses were classified as closed if the business was closed by Hurricane Katrina. Resilience was measured by comparing the business owner's perception of business' success before and after Hurricane Katrina. For open businesses, resilience is classified into three categories: survived (the business is less successful post-Katrina), recovered (the business has the same level of perceived success pre- and post-Katrina), or resilient (higher levels of success post-Katrina).

Our study found that recovery and resilience are affected in different ways by cash flow problems and financial intermingling of the business and the household. Cash flow problems and financial intermingling did not affect short-term business survival following Katrina. The largest factor that affected short-term recovery following Hurricane Katrina was the level of storm damage. Businesses with major damage were 10% less likely to continue operation following the hurricane. However, cash flow problems and financial intermingling had a large effect on long-term resilience.

Of those businesses that survived Katrina, only 16% had cash flow problems before the disaster. After Katrina, however, 82% of survived businesses, 57% of recovered businesses, and 68% of resilient businesses had cash flow problems. Businesses with cash flow problems following Hurricane Katrina were 6% more likely to have less success following Katrina, 3% less likely to have the same amount of success pre- and post-Katrina, and 2% less likely to be better off following the storm.

There was only a 1% difference between businesses that did and did not survive Katrina in terms of financial intermingling, with 88% of survived businesses participating and 89% of demised businesses participating. Businesses that intermingled household and business finances to fund the business were 11% more likely to have less success following Katrina, 7% less likely to have the same amount of success pre- and post-Katrina, and 4% less likely to be better off after the hurricane.

Disasters and disruptions will continue to occur and affect small and family businesses. The flow of resources from the family to the business and vice versa in such operations will undoubtedly continue. Even during the recent COVID-19 pandemic, most small and family businesses probably faced the dilemma of taking resources from the family to fund the business, or vice versa. However, our research showed that financial intermingling lessened the likelihood of long-term business resilience. It is important for these small and family businesses to understand how cash flow issues and financial intermingling can affect recovery, specifically long-term resilience.

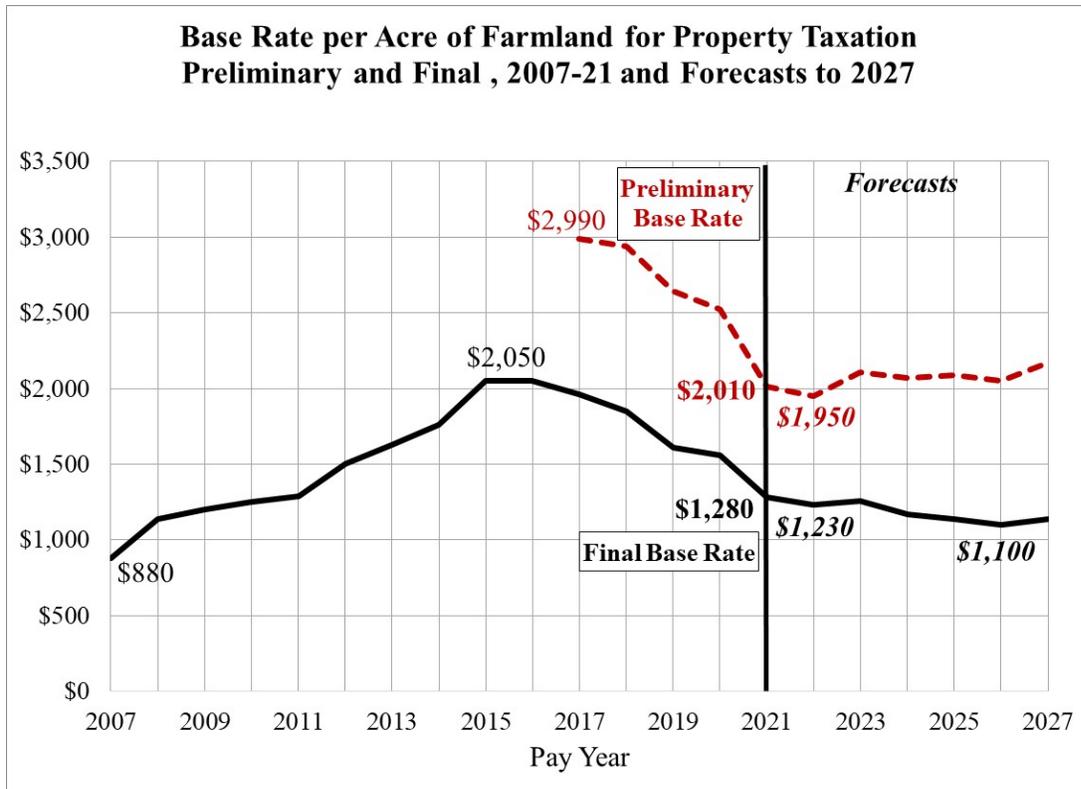


Title: Farmland Assessments and Tax Bills in 2021 and Beyond
Author(s): Larry DeBoer and Tamara Ogle
Issue: *PAER-2020-12*
Date: October 2020
Summary: The assessed value of farmland will decrease in 2021, and property tax bills for most farmland owners should fall too. We project farmland assessments to decline a little over the next few years, but tax bill changes depend on the effect of the recession on the values of residential, commercial and industrial property.

The assessed value of farmland will fall for property taxes in 2021, and almost certainly again in 2022. This will reduce tax bills for most farmland owners in 2021. Tax bills in 2022, though, depend on the course of the corona-recession.

The assessed value of farmland in Indiana peaked for taxes in 2015 and 2016, and has been falling in the years since. The reason is the fall of the base rate of farmland, which is the starting point for setting the assessed value of farmland for the property tax. The Indiana Department of Local Government Finance (DLGF) sets the base rate each year, at the beginning of January. Local assessors multiply this dollar figure by a soil productivity index for each acre, so that the assessed value is higher for more productive land, and lower for less productive land. An influence factor is applied to some acreage, to reduce assessments for factors such as frequent flooding or forest cover. The resulting assessed value is multiplied by the sum of the tax rates of the county, school district, and other units in which the acreage is located, to determine the tax bill.

Figure 1



The Base Rate for Taxes in 2021

In January, the DLGF announced the base rate for farmland for 2020, to be used for tax bills next year, 2021. It was \$1,280 per acre, down 17.9% from \$1,560 an acre for taxes this year. This continued five years of substantial drops in the base rate. It was \$2,050 in 2016, so it’s down 38% since then (Figure 1).

Table 1.

<u>Calculation of the Base Rate for an Acre of Farmland</u>						
Preliminary						
Assessment Year 2020; Tax Year 2021						
	<u>NET INCOMES</u>			<u>MARKET VALUE IN USE</u>		
Year	Cash Rent	Operating	Cap. Rate	Cash Rent	Operating	Average
2014	205	171	4.77%	4,298	3,585	3,941
2015	198	-39	4.74%	4,177	-823	1,677
2016	173	75	4.78%	3,619	1,569	2,594
2017	175	30	5.04%	3,472	595	2,034
2018	181	79	5.58%	3,244	1,416	2,330
2019	181	-25	5.57%	3,250	-449	1,400
Average Market Value in Use					\$2,010	
Existing Base Rate					\$1,560	
Percent Change from Current Rate					29%	

Calculation of the Base Rate for an Acre of Farmland						
Final						
Assessment Year 2020; Tax Year 2021						
	<u>NET INCOMES</u>			<u>MARKET VALUE IN USE</u>		
Year	Cash Rent	Operating	Cap. Rate	Cash Rent	Operating	Average
2014	205	171	8.00%	2,563	2,138	2,350
2015	198	-39	8.00%	2,475	-488	994
2016	173	75	8.00%	2,163	938	1,550
2017	175	30	8.00%	2,188	375	1,281
2018	181	79	8.00%	2,263	950	1,606
2019	181	-25	8.00%	2,263	-313	975
Average Market Value in Use						\$1,280
Previous Year						\$1,560
Percent Change						-17.9%

Table 1 shows how the DLGF calculated the base rate for 2020 pay-2021, that is, the base rate for 2020 to be used for tax bills in 2021. It’s a capitalization formula, which means a measure of income is divided by a rate of return, to estimate the maximum price an investor would pay for an asset such as an acre of farmland. The formula uses the most recent six years of data available. Since the calculation was done at the end of 2019, data for 2014 through 2019 were used. There’s always a two-year lag between the last year of data and the year the base rate is used to calculate taxes. The DLGF documents the data they use each year, on their website at www.in.gov/dlgf/7016.htm.

The formula has a preliminary and a final step. Both use two measures of income. Cash rent income is the average rent for an average acre, from the Purdue Department of Agricultural Economics’ annual Land Values and Cash Rents survey, which is published in the Purdue Agricultural Economics Report each summer. Average property tax payments are subtracted. Operating income is calculated as price times yield, plus government payments, less costs, averaged for corn and soybeans.

The average of the real estate and operating loan interest rates is used as the capitalization rate in the preliminary calculation. Cash rent and operating income are divided by this rate for each year, giving the “market value in use” for both. These two numbers are averaged for all six years. Then the highest figure is dropped and the remaining five are averaged to get the preliminary average market value in use, which is the base rate. For pay-2021 it was \$2,010, much higher than the final pay-2020 base rate of \$1,560. That’s where the final calculation comes in.

The preliminary base rate is compared to the existing base rate. If the preliminary rate is more than 10% above the existing rate, a capitalization rate of 8% is used in the final calculation, for all 6 years. If the preliminary rate is within 10% of the existing rate, the capitalization rate is 7%. If the preliminary rate is more than 10% below the existing rate, the capitalization rate is 6%. The pay-2021 preliminary base rate of \$2,010 was 29% higher than the \$1,560 existing pay-2020 rate, so the capitalization rate was set at 8% for the final step.

That 8% rate was much higher than the actual real estate and operating loan interest rates, so the calculations of all six years of market value in use were lower than in the preliminary calculation. The highest value was dropped—from 2014—and the remaining 5 averaged to \$1,280. This is the final base rate, for taxes in 2021.

The Future of the Base Rate

The base rate is a rolling average. At the end of December, the DLGF will calculate the base rate for 2021 pay-2022 by dropping the data for 2014, and adding the new data for 2020. Five of the six entries in that base rate average are already set (though there may be slight revisions in the 2019 data). To predict the base rate for pay-2022, we only need to estimate rents, prices, yields, fixed and variable costs, government payments and interest rates for this year, 2020. That's all!

We already know rent. The PAER for July 2020 published the results of the annual value and rents survey. The pay-2022 base rate estimate uses the June 2020 statewide cash rent for the average land class, which was \$217 per acre. An estimate of the statewide property tax per acre is subtracted for the calculation. We estimate property taxes per acre at \$27, so the after-tax rent is \$190.

Looking at the operating costs for 2020, we already know some of the numbers. The overhead and variable costs come from Purdue Crop Cost and Return guide published by the Center for Commercial Agriculture each spring. Corn and bean prices in the formula are an average of the calendar year average price, the previous marketing year average and the November price. We know prices for some of the months and used the Center for Commercial Agriculture's crop basis tool with futures prices to forecast the rest. Their price predictions for the 2020 formula are \$3.54 per bushel for corn and \$8.77 for soybeans. These prices are lower for soybeans than in 2015 through 2019 and in the lower end of the range for corn, the same years. We adjusted yield predictions from FAPRI, the Food and Agricultural Policy Research Institute at the University of Missouri, to Indiana's trend to predict corn yield at 180 bushels per acre and soybean yield at 55.

The capitalization rate will be 8% in the final calculation. We can count on the final capitalization rate remaining at 8% through the whole coming decade. This is mainly because actual interest rates are very likely to remain low. It is an oddity of the base rate formula that low actual interest rates cause the final cap rate to be as high as possible.

Interest rates are in the denominator of the capitalization formula. When actual interest rates are low, the preliminary base rate calculation is high. When it is more than 10% higher than the existing base rate, the cap rate is set at 8%.

Over the past 5 years, the preliminary base rate has averaged 45% above the existing base rate. Since actual interest rates were higher during those 5 years than they are projected to be in coming years, the preliminary base rate will be even higher relative to the existing base rate well into the 2020's. So the formula will continue to set the cap rate at 8%. This is fortunate from a forecasting point of view. Since actual interest rates don't enter the final calculation, there is one less data entry to predict, and therefore one less source of error.

Our forecast for the pay-2022 final calculation is in Table 2. The rolling average drops the 2014 value, but this also was the highest value for the previous year, which was excluded from the average. The new highest value is \$1,606 from 2018. Since the new 2020 value of \$1,344 is less than that, the base rate declines to \$1,230. That's 3.9% lower than the pay-2021 base rate. We extended our base rate per acre predictions through 2027 which means we need predicted market value in use data through 2025. For prices, yields, variable costs, and government payments beyond 2020 we use the FAPRI forecasts adjusted for Indiana. FAPRI published an update of their baseline forecast in June of 2020, available on their website at www.fapri.missouri.edu.

FAPRI predicts continued lower commodity prices through the 2020's. Yields continue on their long-term upward trend. Government payments are more challenging to forecast, but FAPRI predicts them to stay around \$20 per acre after 2020. Variable costs for both corn and soybeans decreased in 2020 and are estimated to dip again before steadily increasing in the long run. We expect overhead costs to increase steadily at 1.5% a year. We forecasted cash rents for 2021-2025 using a regression with lagged cash rent, November soybean price and soybean yield. The model shows cash rents dropping in 2021-2022 before stabilizing around \$190 per acre.

Table 2.

Calculation of the Base Rate for an Acre of Farmland						
Final						
Assessment Year 2021; Tax Year 2022						
	<u>NET INCOMES</u>			<u>MARKET VALUE IN USE</u>		
Year	Cash Rent	Operating	Cap. Rate	Cash Rent	Operating	Average
2015	198	-39	8.00%	2,475	-488	994
2016	173	75	8.00%	2,163	938	1,550
2017	175	30	8.00%	2,188	375	1,281
2018	181	79	8.00%	2,263	950	1,606
2019	181	-25	8.00%	2,263	-313	975
2020	190	25	8.00%	2,375	313	1,344
Average Market Value in Use						\$1,230
Previous Year						\$1,280
Percent Change						-3.9%

As we move forward, of course, known market value in use numbers drop from the average, to be replaced with predictions. The 2027 base rate will use data from the years 2020 through 2025—in other words, six predicted values. It’s probably best to stop there. Table 3 shows the base rate predictions through pay-2027. The final base rate remains under \$1,280 throughout.

Table 3.

	Preliminary	Final Base	% Change
	Base Rate	Rate	in Final
			Base Rate
2020	2,520	1,560	-3%
2021	2,010	1,280	-18%
2022	1,950	1,230	-4%
2023	2,110	1,260	2%
2024	2,070	1,170	-7%
2025	2,090	1,140	-3%
2026	2,050	1,100	-4%
2027	2,170	1,140	4%

Tax Bills and the Corona-Recession

The drop in the base rate for pay-2021, already set by the DLGF, will probably mean lower property tax bills for most farmland owners. We predict another drop in the base rate for pay-

2021, but tax bills that year depend on how the corona-recession affects residential, commercial, and industrial property values.

Assessed values in 2020 will be used to set tax bills in 2021. Those assessments are based on property values in 2019. Assessors used property selling prices and replacement costs from 2019 to set assessed values in 2020. Since those values were from the last year of the long economic expansion, most will be higher than they were in 2018. The assessed values of residential, commercial, and industrial property probably will rise for taxes in 2021, in most places.

The revenue collected from the property tax is called the tax levy. For each local government unit, the increase in this levy is limited by the state's maximum levy growth quotient (MLGQ). This rate is based on the six-year average of non-farm personal income growth. The six years used for the MLGQ for 2021 are 2014 through 2019—before the recession. The DLGF has already set the 2021 quotient at 4.2%.

Each local government unit recalculates tax rates each year, by dividing the budgeted levy by taxable assessed value. Total taxable assessed value growth averaged 2.5% per year in the second half of the 20-teens expansion. If that continued for another year, and levies rise with the MLGQ, 4.2%, average tax rates will rise by about 1.7%. Tax bills are the product of taxable assessed value and the property tax rate. The base rate of farmland will fall 17.9%, so a tax rate rise of 1.7% will leave little doubt that almost all farmland owners will see tax bill reductions in 2021.

Pay-2022 is a different story. That's the year that 2020 values will enter the base rate formula, and the taxable assessed value of property, and the MLGQ 6-year average income growth. We predict a 3.9% decline in the base rate. What might happen to the average property tax rate?

Assessed values are vulnerable to recession. In recessions, the values of homes, business buildings, and business equipment tend to fall, and new construction and purchases are reduced. If this happens in 2020, assessors will record the changes in 2021, and lower assessed values will be used for tax bills in 2022.

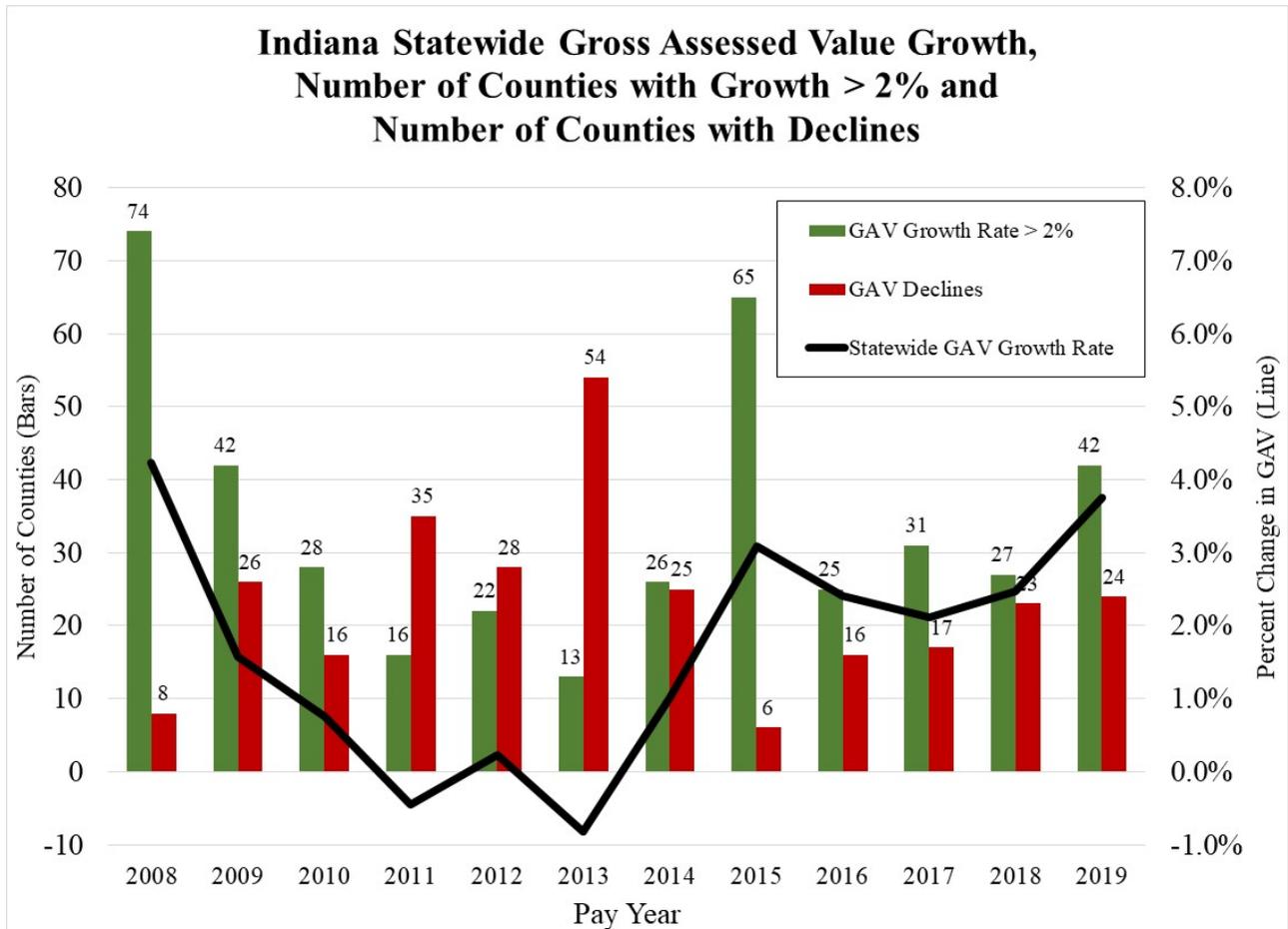
We have experience with only one recession since the current assessment procedures came into use. That was the Great Recession of 2007-2009. Figure 2 shows what happened to gross assessed values in pay-2010 through pay-2013. The later years account for the two year lag between economic events and tax bills. Gross assessed values are those determined by local assessors. Deductions are subtracted to get taxable (or net) assessed value. Deductions are affected by policy changes, so gross assessed value is the better measure of a recession's effect.

Statewide, gross assessed value fell in 2011 and 2013, and barely increased in 2012. More than two-thirds of Indiana counties experienced at least one year of assessed value decline, and in 2013 alone, 54 counties saw their assessed values drop.

Many of the counties that saw assessments rise were rural, where farmland is a large share of assessed value. The farmland base rate was rising rapidly during 2010-13 (Figure 1). We know that will not happen again. Rural county assessments will behave more like urban and suburban counties this time.

So assessed values *can* fall or grow slowly after recessions. *Will* they fall after the corona-recession? Perhaps not. The Great Recession began with a housing crisis. Home values fell, and home construction dropped even more. This does not appear to be happening in 2020. Instead, retail and commercial real estate may be affected. Sales at restaurants, clothing stores, electronics stores, and gas stations are down. Telecommuting may reduce the demand for office space. If these changes affect property values, construction and equipment purchases in 2020, assessments could fall in 2021, and tax bills would be affected in 2022.

Figure 2.



Incomes fall during recessions. The MLGQ fell after the Great Recession. It dropped below 3% from 2011 to 2016, then rebounded to near 4% in 2017. That's the year when the 2009 income decline finally left the formula. Unemployment is up and pay is down in 2020, which should

reduce income growth. However, the CARES act delivered more than \$2 trillion in additional unemployment benefits and direct aid to individuals. Total income has increased from 2019 as a result. It's possible that the MLGQ will not fall as much in 2022 as it did in 2011.

If taxable assessed values do not grow for pay-2022, while the MLGQ rises between 3% and 4%, tax rates will also increase 3% to 4%. We predict the pay-2022 base rate of farmland will fall by 3.9%. This drop could be offset by a rise in tax rates. Rate changes will vary with levy and assessed value changes in each county, school district and other local unit. In 2022, some farmland owners will see tax bill reductions, but others will see tax bills rise.



Title: Understanding the Downward Bias in USDA's Farm Income Forecasts
Author: Todd H. Kuethe
Issue: *PAER-2020-13*
Date: October 2020
Summary: USDA's farm income forecasts are downward bias due to high costs of over-prediction.

The United States Department of Agriculture's (USDA) farm income estimates are among the department's most cited statistics. Farm income is the Federal government's official measure of the farm sector's contribution to the national economy. Estimating sector-wide farm income is a significant undertaking, and as a result, official estimates of farm income are released with a significant time lag, in August following the reference year. For example, the USDA's Economic Research Service (ERS) released the official estimates of 2019 net cash income of [\\$110.3 billion](#) on September 2, 2020.

USDA's farm income measures are widely used by decision-makers across the agricultural sector and play an important role in the development of farm policy. In order to provide more timely information, USDA-ERS releases four periodic forecasts of farm income. USDA's initial farm income forecast is typically released in February to coincide with the USDA's Outlook Forum. The forecasts are revised in August, to reflect updated information on planting and crop progress, and in November, to reflect updated information on crop harvest. The forecasts are revised a third time the following February, when the initial forecast of the new year are released.

Figure 1 plots USDA's official estimate of net cash income, as well as the four forecasts in February, August, November, and February, between 1980 and 2020. On September 2, 2020, ERS forecast 2020 net cash income of \$115.2 billion. The forecast represents a 4.4% increase from the 2019 official estimate of \$110.3 billion. In addition, the September 2 forecast was 5.1% higher than the initial forecast released February 5, 2020. Figure 1 suggests that the improvement between the initial forecast and the first revision is not unique to 2020 as it is common in the forecast history.

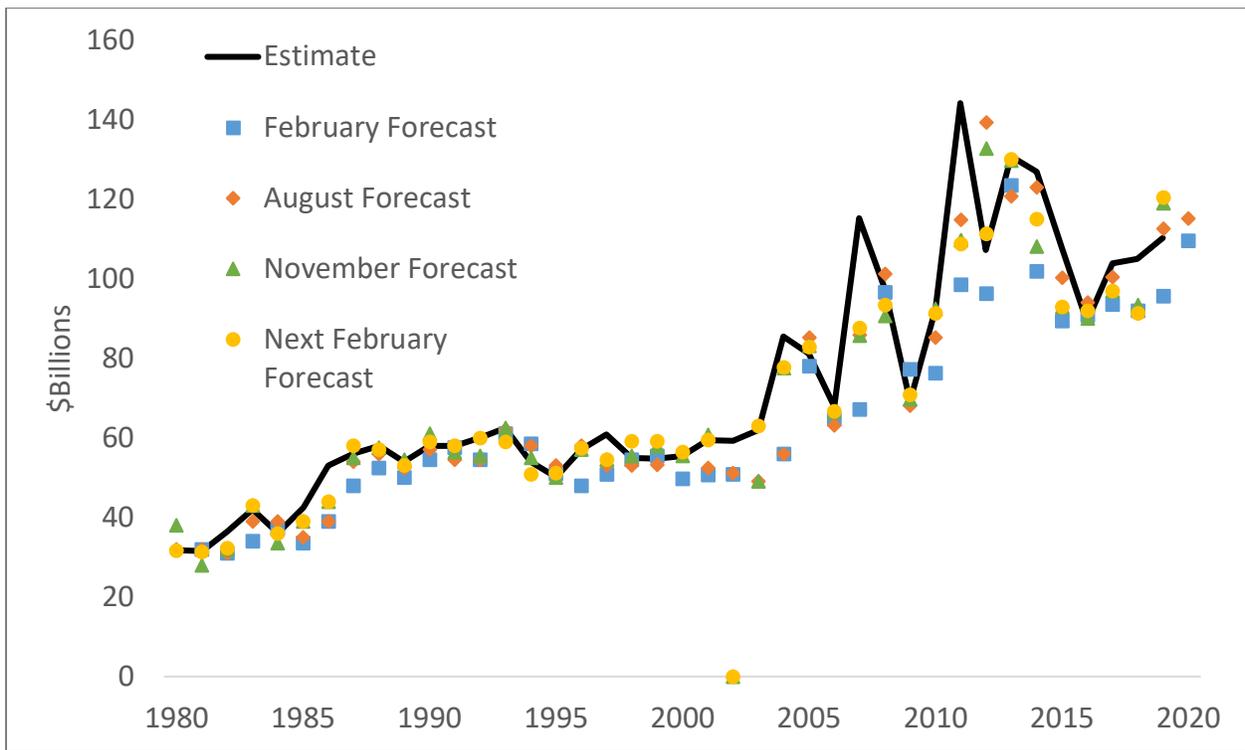


Figure 1: USDA Net Cash Income Forecast, 1980-2020

Figure 1 also shows that early forecast tend to under-predict realized net cash income. This pattern can be observed directly in Figure 2. The vertical gray bars represent the percentage difference between the initial net cash farm income forecast and the realized value. Negative values represent under-predictions. The dashed line represents the average forecast error between 1981 and 2019. Thus, on average, initial forecasts of net cash income are 10.4% below realized values. Between 1981 and 2019, ERS' initial net income forecast under-predicted realized values 79.5% of the time.

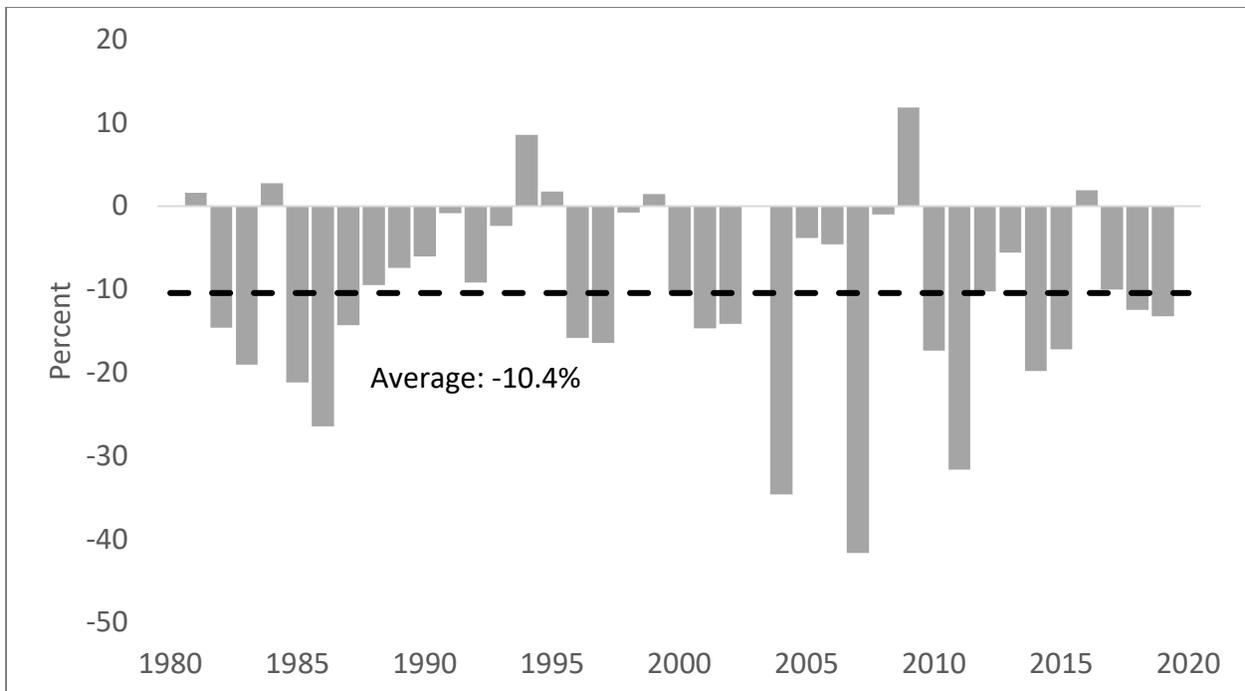


Figure 2: Initial Forecast Error, 1981-2019

Kuethe, Hubbs, and Sanders (2018) documented a similar pattern for ERS' net farm income forecast between 1975 and 2016. Net cash income, shown in Figures 1 and 2, is limited to cash related income and expenses and does not reflect changes in the value of noncash sources, such as the value of inventory adjustment. Formally, net cash income is defined:

$$\text{Net cash income} = (\text{Crop Receipts} + \text{Livestock receipts} + \text{Cash farm-related income} + \text{Total direct government payments}) - \text{Cash expenses} = \text{Gross cash income} - \text{Cash expenses}$$

ERS uses a bottom-up forecasting approach in which the elements of net cash income are forecast individually and combined into a forecast of the net cash income state according the accounting equation above. Isengildina-Massa, et al. (2020) examined the various components of net cash income between 1986 and 2017. The authors confirmed the previous findings of Kuethe, Hubbs, and Sanders (2018) and found that under-prediction in early net cash income forecasts stems from under-prediction of crop and livestock receipts and cash expenses.

All predictions of future economic conditions are subject to mistakes due to changes in the economy between the forecast release and the end of the period, problems with forecasters' information set, or deficiencies in the forecasters' skill set. Forecasters develop their best guess of future economic conditions in order to avoid the costs associated with forecast mistakes or forecast errors. Economists call this the forecaster's "loss function." And the forecaster is assumed to minimize a particular loss function. Recently, Bora, Katchova, and Kuethe (2020) estimated ERS' loss function for net cash income and its components. The study found that the under-prediction identified by Kuethe, Hubbs, and Sanders (2018) and Isengildina-Mass, et al. (2020) was attributable to the high cost of over-prediction relative to under-prediction. In other words, ERS prefers to "aim low" as predicting higher cash income than realized is costly to the USDA. Thus, while early ERS forecasts tend to under-predict net cash income, they are rational cost minimizers.

ERS is scheduled to revise their 2020 farm income forecasts again on December 2. The studies cited previously suggest that the December 2nd revision is an unbiased predictor of realized net cash income. It will be interesting to see if ERS' outlook for 2020 farm income continues to grow more optimistic.

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- Kuethe, Todd H., Todd Hubbs, and Dwight Sanders (2018) "Evaluating the USDA's Net Farm Income Forecast" *Journal of Agricultural and Resource Economics* 43: 457-468.

Title: Recent Hog and Pork Market Dynamics
Author: Jayson L. Lusk
Issue: PAER-2020-14
Date: October 2020
Summary: The pork industry experienced unprecedented disruptions, including the temporary closure of two major Indiana pork packing plants, during the outbreak of COVID19 that are still being felt into the fall of 2020. Farm-level hog prices have improved but the industry is still resolving the backlog of hogs on the farm.

The pork industry experienced unprecedented disruptions during the outbreak of COVID19 that are still being felt into the fall of 2020. Despite the shutdown of restaurants in mid-March, the run on grocery stores initially helped pull up wholesale pork and hog prices (see figure 1). Shortly thereafter, however, farm-level and wholesale-level prices fell as the loss of demand from food service establishments took its toll. Then in April and May, workers in pork packing plants began contracting COVID19, leading to plant slowdowns and shutdowns. The worse of it occurred in late April and early May when the number of daily hogs slaughtered was 40% below the prior year’s levels.

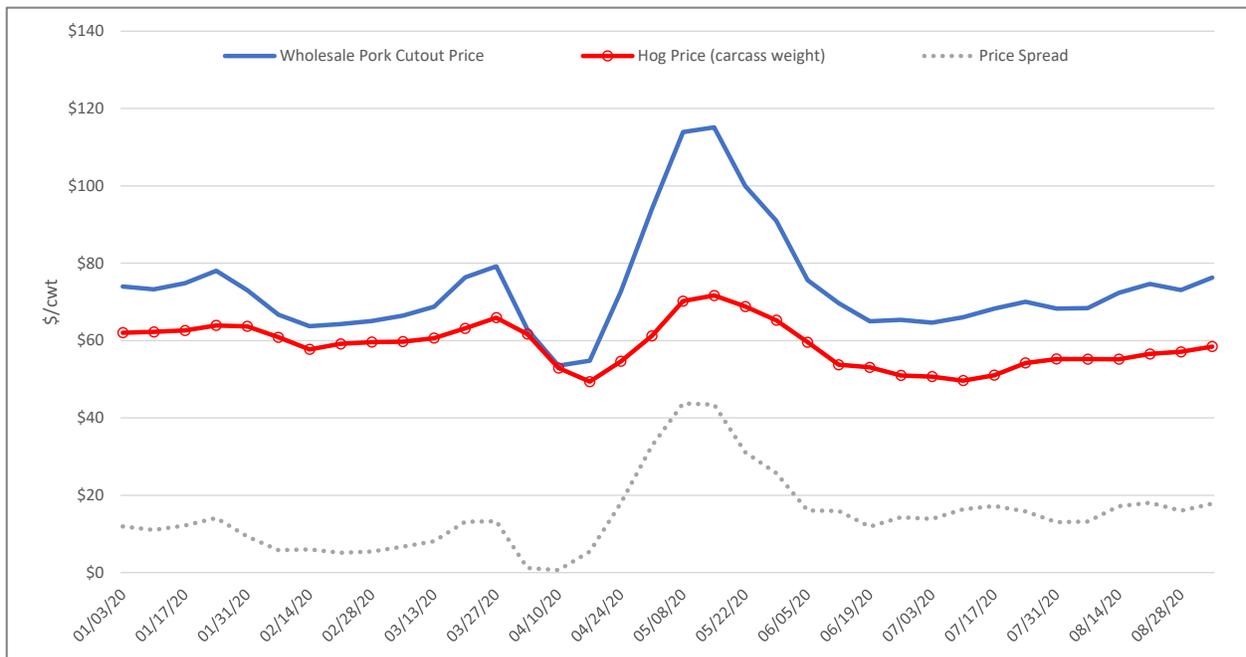


Figure 1. Weekly Wholesale Pork Cutout and Dressed Hog Prices

Such a massive disruption in the processing sector caused a significant widening between farm and wholesale prices, as shown in figure 1. Farm-level prices are measured on a carcass (or dressed) basis (the figure shows the national barrows and gilts weighted average base purchase price across all producer-sold hogs in the National Daily Direct Hog Prior Day Report–Slaughtered Swine (LM_HG201) report by the USDA-AMS and compiled by the Livestock Marketing Information Center). The significant increase in the price spread in May is explained more by the increase in wholesale pork prices than a change in hog prices. The farm-to-wholesale pork price spread averaged about \$9/cwt in January and February 2020, reaching a peak of almost \$44/cwt in early and mid-May, a 388% increase.

The increased price spread during late April and early May has created significant controversy, primarily in the beef sector, but in the pork industry as well. The fact that wholesale meat prices can increase at the same time livestock prices are falling can seem almost paradoxical, but these divergent price movements have a straightforward economic explanation. When packing plants ceases operations due to worker illnesses, packers can't take as many hogs. A plant closure results in an excess supply of hogs relative to the ability of packers to process them. Thus, plant closures cause a reduction in demand for hogs, and as a result, hog prices fall.

At the same time, a plant closure means fewer hogs being converted to ham and bacon. A plant closure results in less meat on the market. Grocers, restaurants, and exporters are left vying for a smaller amount of meat, which results in meat prices being bid up. That is, there is a reduction in meat supply. The combined effect of rising wholesale meat prices and falling livestock prices results in an increasing price spread.

Because the majority of hogs are not sold in negotiated markets, but rather are sold on contract, many hog producers are not directly affected by the adverse movements in hog prices witnesses during parts of this spring and summer. The main adverse impacts to many producers have resulted in the backlog of hogs on farms that occurred as a result of the slowdowns and shutdowns in packing plants, as producers had to euthanize animals, extend feeding periods, or delay the arrival of new feeders. Figure 2 shows the number of weekly hogs slaughter since the first of the year. The significant drop-off that occurred starting in early April is apparent. In addition, the figure shows an estimate of the backlog of market hogs on farms that occurred as a result of the plant shutdowns and slow-downs. The estimate assumes no hogs were euthanized and that processing would have occurred at the same levels of January and February 2020 (after adjusting for typical seasonal swings) had COVID19 not occurred. The estimated backlog peaked at about 3.5 million hogs at the end of May, equal about 1.3 weeks worth of normal processing capacity. Resumption of processing and extra Saturday operations enabled packers to reduce the estimated excess inventory to about 1.5 million hogs by the end of August. However, the excess hogs in that remain in the system are likely continuing to put downward pressure on hog prices.

The biological lags in hog production, which include a little over three months in gestation and roughly six months of feeding, mean it will take some time to work through the COVID19 disruptions. Decisions to delay breeding or liquidate sows during the worst of the COVID19 shutdowns will likely help further reduce the backlog in the months ahead. These same decisions will likely imply a smaller market hog supply, and thus possibly elevated hog prices, around the end of 2020.

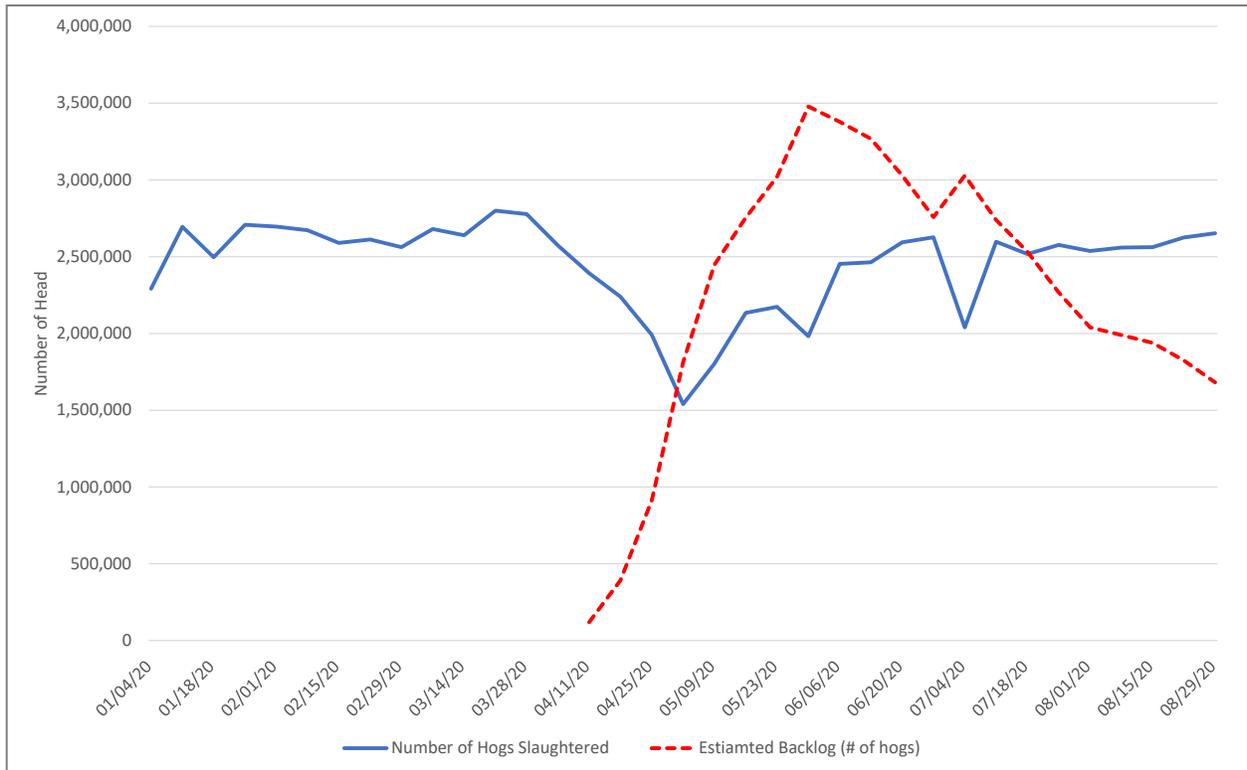


Figure 2. Number of Weekly Hogs Slaughtered Weekly and Estimated Backlog in Market Hogs



Title: Data Usage in the Agricultural Value Chain
Author: Brady Brewer
Article: PAER-2020-15
Issue: October 2020
Tags: Data, Analytics, Value Chain
Summary: *Summary of data usage and data analytics in the agricultural value chain.*

Firms at various levels of the agricultural value chain face a consistently high level of competition. At every level of the value chain, participants compete for strategic advantages that will lead to an increase in market share or lower costs. With advances in technology, customer segmentation practices, and a changing consumer base, it is not surprising that many firms are increasingly turning to data analytics to provide strategic advantage over their competitors. Data have the potential to provide insights into both demand and supply issues, helping companies better target new customers or cutting costs of production along the way. Data analytics, under all its various uses, is driven by the goal of improving a business' bottom line.

To this end, the Purdue University Center for Food and Agricultural Business (CAB) conducted a survey project on data usage and analytics along the food and agricultural value chain from the farmer to the food retailer. The purpose of this research was to examine the degree to which these businesses gathered, analyzed and shared data.

The survey was conducted during the summer of 2019 with 1,500 responses from all levels of the value chain, across a wide array of employees. The resulting survey is highly representative of the overall food sector. While other research has focused on one particular sector within the value chain, this research is the first comprehensive look at the entire data environment from farmer to consumer. The following were the levels of the value chain survey participants were classified as: 1) Farmer, 2) Agricultural Input Manufacturer, 3) Agricultural Retailer, 4) Processor/Trader/First Handler, 5) Food Manufacturer, and 6) Food Retailer. For this article, we exclude farmers and focus on the insights provided for the other segments of the value chain.

Figure 1 shows the results for overall data collection within the agricultural value chain. Ninety-two percent of the sample indicated that the agribusiness they work for collects data, with 43% indicating their firm collects an extensive amount of data and 49% indicating their firm collects some data. Figure 1 demonstrates the importance of data and data analytics across the value chain.

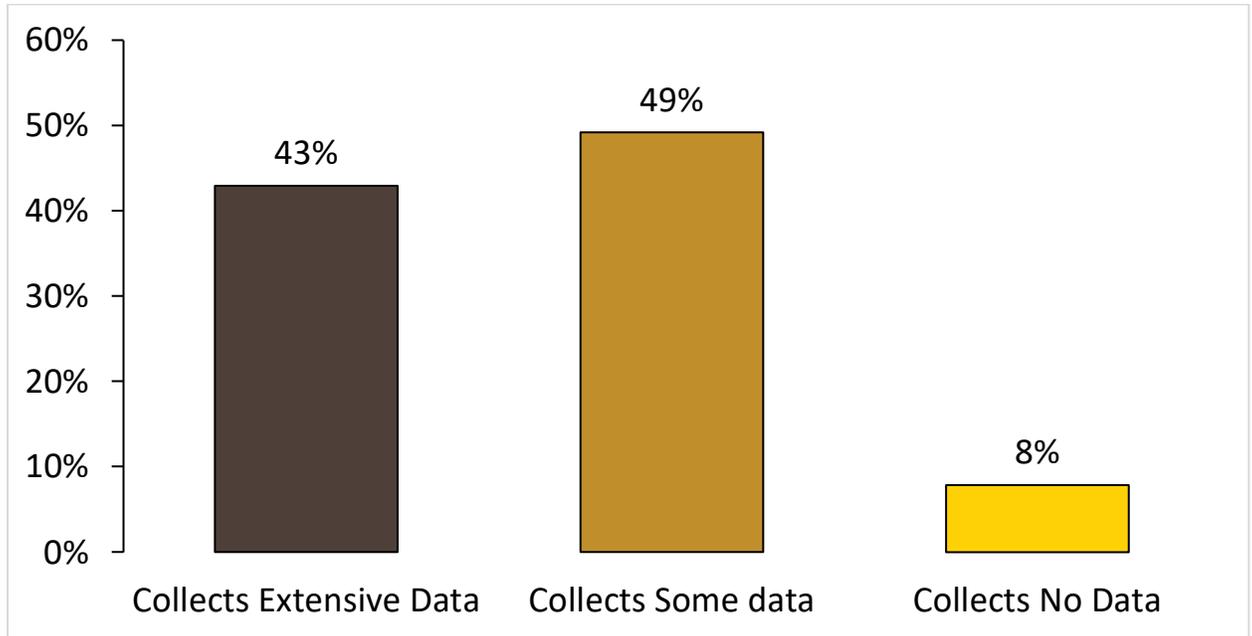


Figure 1. Data Collection Among the Agricultural Value Chain

Our study found that the amount of data collected by businesses varies across the value chain. Figure 2 provides a breakdown of the level of data collected by firms at various stages along the value chain. Agricultural input manufacturers (e.g., equipment manufacturers, chemical manufacturers, feed and nutrition manufacturers) collect the most data with only 3% of respondents indicating that their company does not collect data. Food retailers, on the other hand, were found to collect the least amount of data in the agricultural value chain.

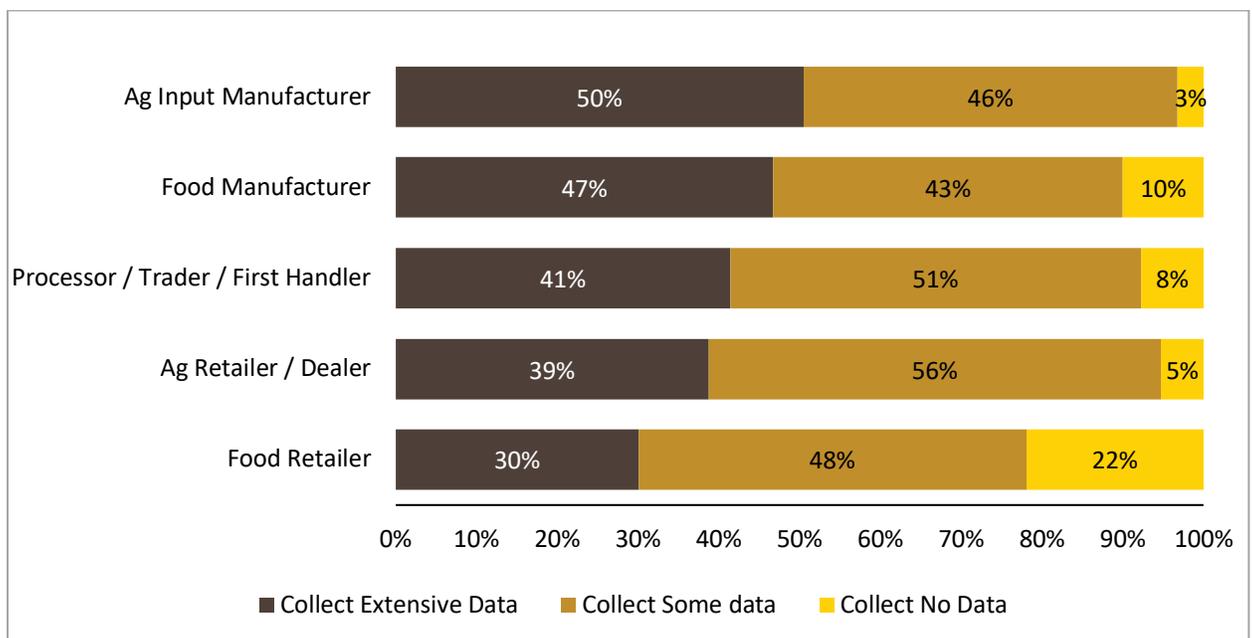


Figure 2. Data Collection by Level of the Value Chain

Collecting data, however, is only the first step. The goal for these companies is to turn this data into actionable insights. The survey next asked respondents the percent of all decisions made at their organization that were based on data analytics. The results to this question are shown in Figure 3. Results show that 15% of agribusiness use data analytics in over three-quarters of their decisions. Thirty-six percent of agribusinesses base half to three-quarters of their decisions on data analytics, and 33% of agribusinesses base one-quarter to half of their decisions on data analytics. This shows that a small number of firms use the data they collect on almost all decisions made, with most agribusinesses using the data to aid in making somewhere between 25% to 75% of their decisions.

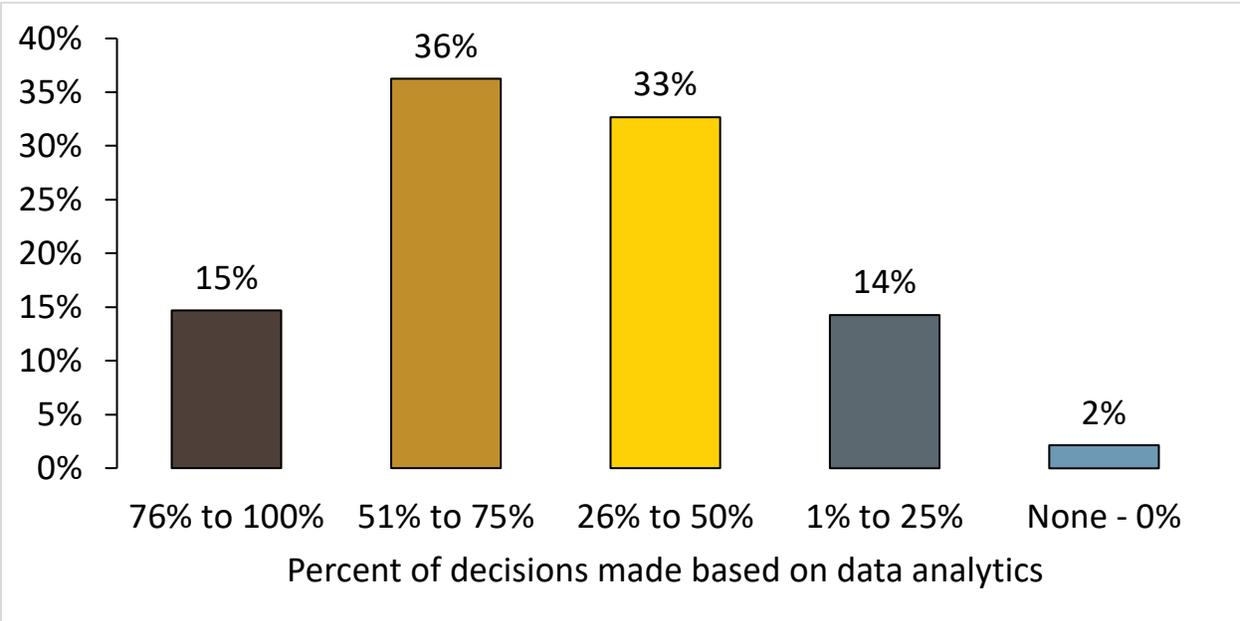


Figure 3. Overall Decisions Made based on Data Analytics

The value of collecting data is driven by data analytics, or business' ability to effectively study the data to aid in decision making. Figure 4 further examines the usage of data analytics by separating data analytics usage by how extensively agribusinesses collect data. What is revealed is that agribusinesses that more extensively collect data make more decisions by drawing on the insights provided through data analytics. Of the firms that indicated they base more than three-quarters of their decisions off of data analytics, 82% also indicated that they collect extensive data, yet only 18% indicated they collect some data. Firms that base fewer decisions off of data analytics tend to indicate they collect less data.

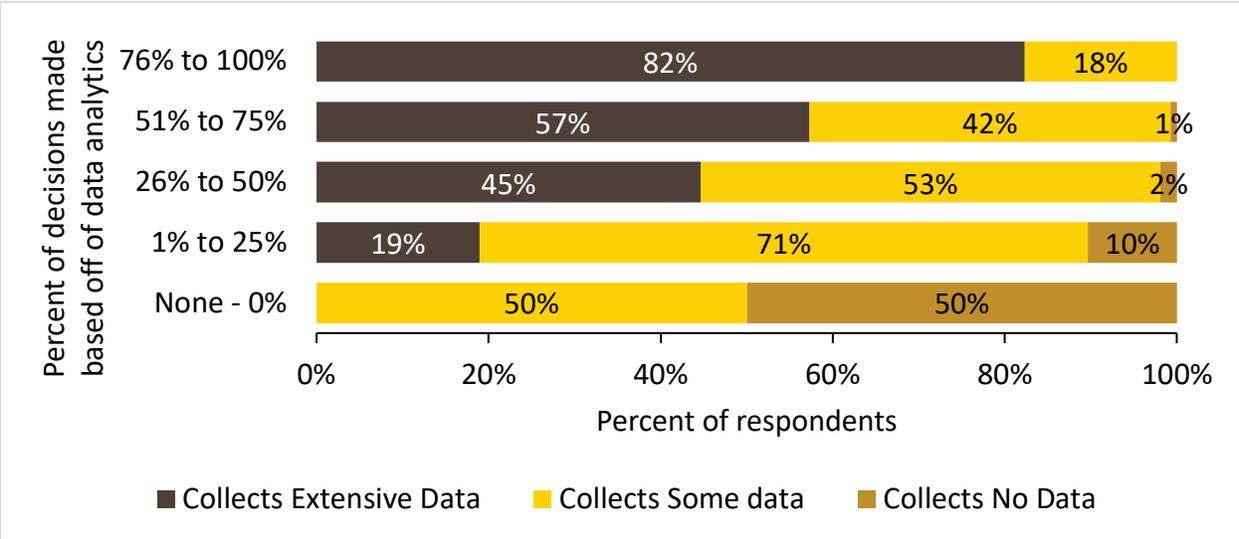


Figure 4. Percent of Decisions Made Using Data Analytics by the Extent Data is Collected

The survey also asked companies to grade themselves on the use of this data and data analytics. Only 30 percent said that their organization was using data and data analytics to their full advantage. About half of the respondents said their firm is at par or behind the competition. Respondents attribute this deficiency to challenges associated with collecting data in a usable form in a timely manner. Timely data collection and analysis is the biggest challenge to fully capitalize on the potential offered by data. In other words, decisions must be made faster than a company can collect and analyze data.

Many leaders across the food and agricultural value chain argue that how data is used and what insights it generates is going to be of vital understanding in the future. Through modern technology, huge swathes of data are being generated from everyone along the value chain, from farmers to consumers, and firms along the value chain attempt to collect and capture the potential value created by this large volume of data. This research shows that most agricultural business are collecting data in some form, but many feel they are not yet able to fully use data to provide actionable insights.



Title: Marketing Sustainable Beer
Author(s): Aaron J. Staples, Carson Reeling, Nicole Olynk-Widmar, and Jayson L. Lusk
Issue: *PAER-2020-16*
Date: October 2020
Summary: Brewing beer is an environmentally intensive process, and technology to reduce a brewer's footprint can be costly. However, we find 75% of beer drinkers are willing to pay a premium for sustainably brewed beer and incorporating eco-labels or environmental graphics onto beer labels could serve as a low-cost way for brewers to communicate a commitment to sustainability.
Related Report: Staples, A.J., Reeling, C.J., Widmar, N.J.O., Lusk, J.L. (2020). Consumer willingness to pay for sustainability attributes in beer: A choice experiment using eco-labels. *Agribusiness*, 1-22. DOI: <https://doi.org/10.1002/agr.21655>

Brewing beer is a water- and energy-intensive process that generates a tremendous amount of solid waste, both in the form of spent grain and recyclable material. Commercial and regional brewers are increasingly investing in environmental sustainability equipment that reduces input use, operating costs, and environmental impacts. These technologies incorporate different aspects of environmental sustainability, including water use and wastewater reduction, energy use reduction and decreased carbon emissions, and increased landfill diversion or solid waste reduction.

Sustainability investments often require high costs that can prohibit access among many smaller breweries, such as microbreweries and brewpubs. One potential solution is to market sustainability initiatives through labeling or social media campaigns to communicate a commitment to sustainability. If a small brewery could differentiate their product through environmentally friendly marketing, then they could potentially attract new consumers to their product—or charge a small premium for their product—making these investments less risky.

There is reason to believe beer buyers would be willing to pay a premium for sustainably produced beer, as demand for environmental sustainability attributes in food has increased in general. Our recent study determines which U.S. beer buyers value sustainability attributes in beer and places a dollar figure on their valuation.

We used a hypothetical experiment to estimate the value U.S. beer buyers have for sustainable beer. We presented a sample of beer buyers with pictures of multiple, hypothetical six-packs and

asked them to select the one they were most likely to buy (Figure 1). The six-packs varied in primary packaging (aluminum cans or glass bottles), price, whether the beer was “locally brewed” or not, and three sustainability attributes. The three sustainability attributes included water conservation practices, energy conservation practices, and landfill diversion practices. Incorporating multiple dimensions of environmental sustainability allowed us to determine which sustainability factors consumers value most. We created eco-labels to indicate the presence of each sustainability attribute on the six pack (Figure 2). We repeated the experiment over multiple rounds comparing different combinations of beer attributes. Doing so allowed us to observe the trade-offs buyers make between the different attributes. For example, are you willing to pay \$1.50 more for a locally brewed beer with water conservation practices? Or do you prefer the non-local beer in glass bottles at the lower price?

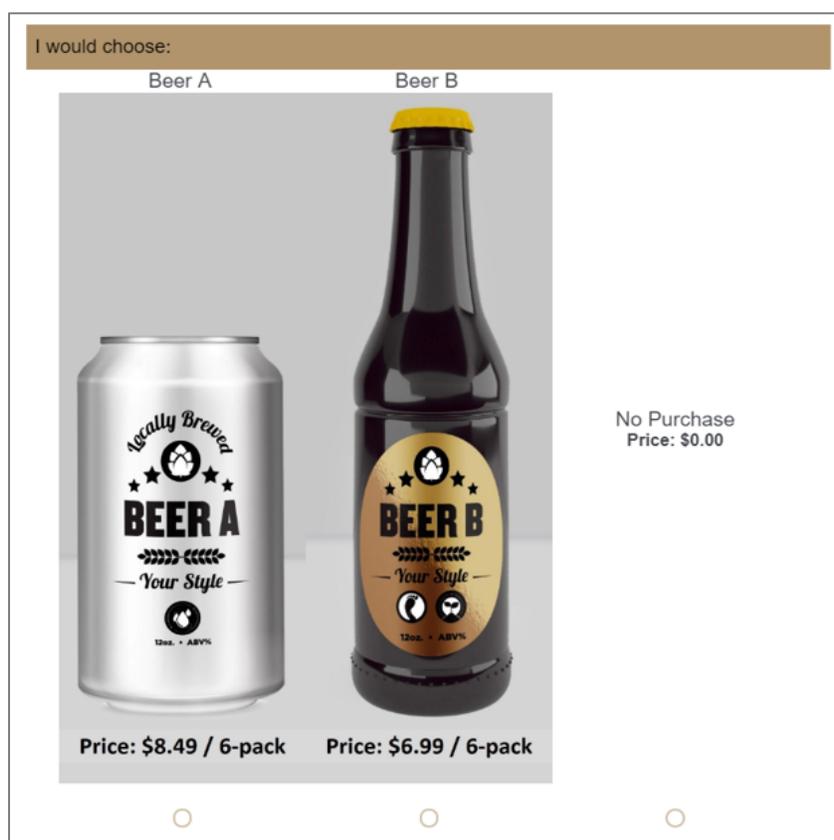


Figure 1. An example of a choice exercise from our experiment

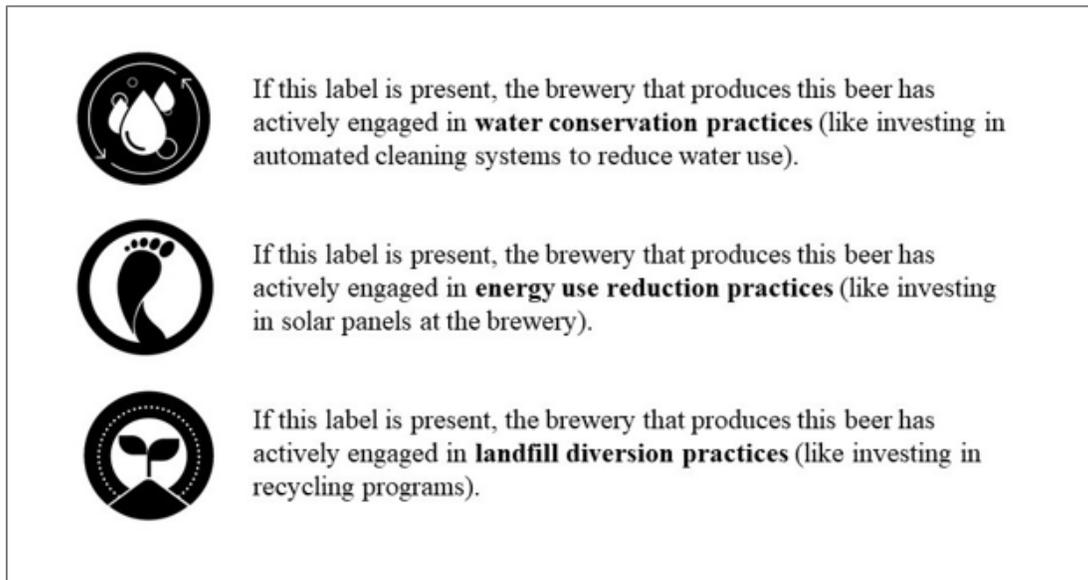


Figure 2. Ecolabels indicating the sustainability attributes present on a given hypothetical beer in our experiment

Who is willing to pay for sustainable beer?

We expected that not all beer buyers were willing to pay a premium for sustainable beer. We therefore asked respondents to describe themselves (their age, income, education levels, and so on), state their beer consumption habits, and offer their general attitudes towards sustainability. We were able to split beer buyers into three groups based on their personal characteristics and which six-packs they selected in the experiment.

Group 1 (36% of beer buyers) and Group 2 (39% of beer buyers) comprise higher-income, younger adults (\$100,000 +). Group 1 is the youngest age group, composed primarily of beer buyers aged 21–24. Group 2 buyers are predominantly aged 25–44. Buyers in Group 3 (25% of beer buyers) are the oldest.

Importantly, Group 1 and Group 2 also enjoy buying new beers and are more likely to recycle in their household. While variety-seeking is much more common amongst the craft beer community, where 80% of craft beer drinkers in our study stated they enjoy trying new beers as opposed to just 40% of commercial only buyers, craft and commercial drinkers were found throughout all three classes. Household recycling was also more common in Groups 1 and 2, potentially indicating that these beer drinkers hold higher sustainability preferences.

Our results suggest that Groups 1 and 2—younger, higher-income beer drinkers who enjoy trying new beers and recycle in their household—demand sustainable beer and are willing to pay a premium for these products.

What are consumers willing to pay for sustainable beer?

Figure 3 depicts price premium—or the dollar amount beer buyers are willing to pay—for different beer attributes for each group. The height of the bars indicates the average premium for each attribute. The error bars indicate 95% confidence interval. Note that if a confidence interval encompasses both positive and negative values—that is, the error bars cross over zero—we cannot say with confidence that the premium is different from zero.

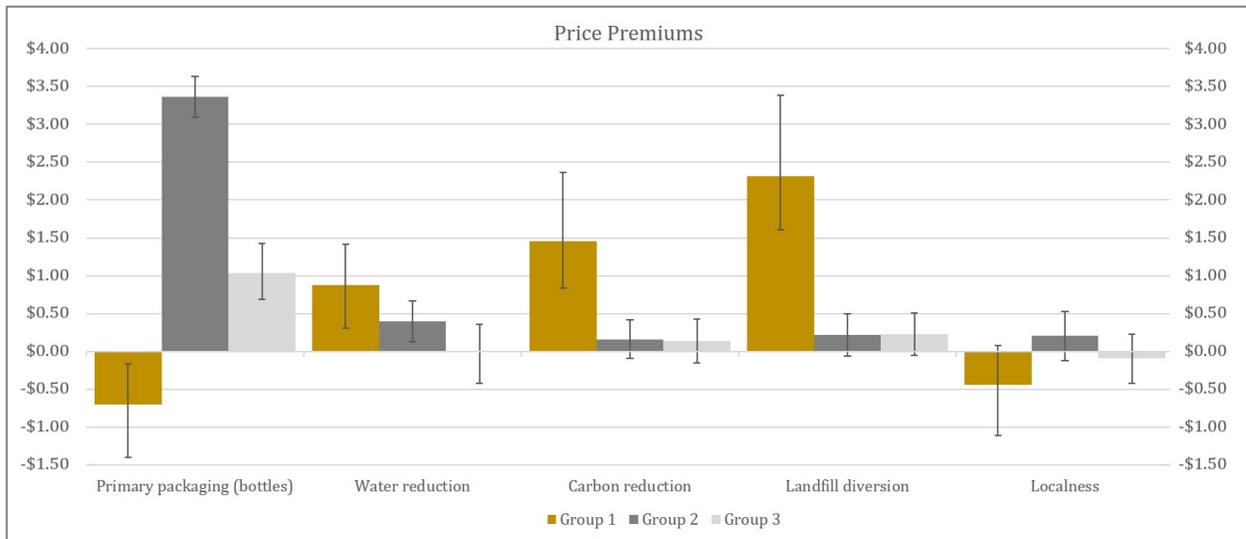


Figure 3. Estimated price premiums for beer attributes

Group 1 (36% of beer buyers) has the greatest preference for environmental sustainability in beer. Average premiums for water sustainability, energy sustainability, and landfill diversion practices are \$1.45, \$2.08, and \$2.31 per six-pack, respectively. This group also prefers aluminum cans, which are thought to be a more environmentally friendly form of packaging; the negative average premium on primary packaging in Figure 3 implies consumers are willing to pay \$0.70 less on beer packaged in glass bottles relative to cans. Localness, which we define here as the beer being “locally brewed,” is not significantly different from zero. (This is also the case for Groups 2 and 3. We discuss potential explanations for this later.)

Group 2 (39% of beer buyers) has weaker preferences for environmental sustainability in beer. These consumers are only willing to pay an average premium of \$0.40 per six-pack for water sustainability practices—much less than the \$1.45 premium estimated for Group 1. Group 2

prefers glass bottle packaging, placing a significant premium on glass bottles at \$3.36 per six-pack. Greater preference for glass bottles is consistent with weaker preferences for carbon and landfill diversion sustainability attributes, as glass bottles are heavier to transport and more difficult to recycle. Nonetheless, Group 2 is indeed willing to pay a small premium for beer brewed with water sustainability practices.

Finally, Group 3 (24.5% of beer buyers) is not willing to pay any premium for environmental sustainability attributes in beer. The only premium Group 3 is willing to pay is for glass bottle packaging, with an average premium of \$1.04 per six-pack.

Marketing Implications

Our results suggest that there is considerable consumer demand for sustainable beer, as approximately 75% of beer consumers are willing to pay premiums for beer brewed using environmentally sustainable practices. These consumers are, on average, younger, higher-income beer buyers who enjoy trying new beers and are more likely to recycle.

Our findings are important for brewers, and potentially other alcohol producers, seeking to differentiate their products in highly competitive industries. With over 8,000 craft breweries in the country, making your product stand out among the seemingly endless options has become increasingly difficult. Marketing sustainability efforts through eco-labels or environmental graphics could be a potential means of product differentiation and increased sales.

Although labels can inform consumers of sustainability habits directly at the point of sale, getting consumers to engage with labels can be a challenge. Fortunately, we find the beer buyers most likely to pay premiums for environmental sustainability attributes in beer are also the respondents who stated they enjoy purchasing new beers. In other words, these are variety-seeking beer buyers, a trait commonly seen amongst the craft beer community. Labels could serve as an effective marketing strategy for variety-seeking consumers as this group is already likely engaging with can or bottle design, beer style, alcohol content, bitterness, and other characteristics when making purchasing decisions. When a variety-seeking beer buyer enters a retail outlet in search of a new beer, they will consider an array of potential purchasing alternatives before making their choice. If they have never purchased a beer in consideration before, they are forced to rely on the information presented to them on the label, including the brand, the beer style, and so on. Incorporating sustainability into can or bottle label design would be a low-cost way for craft brewers to differentiate their product, provide valuable information at the point-of-sale, and appeal to variety-seeking, sustainability-minded beer buyers.

Limitations

We identify two limitations to this study. The first is that this study is purely hypothetical, and thus these results could serve as an upper limit on the price premium consumers are willing to pay for these attributes. Nonetheless, the positive price premiums discussed above are a preliminary indicator of consumer preference for sustainability attributes in beer.

The other limitation is regarding the insignificance of “Locally Brewed” beer. There are three potential explanations for this result:

1. We never explicitly defined localness in our experiment, which may have caused respondents to disregard this attribute and focus more on the relatively better-explained sustainability attributes.
2. We asked respondents to envision that each six-pack is their favorite style of beer. Instead of envisioning a style of beer (e.g., lager), a respondent may have envisioned a brand of beer that they know is not locally brewed (e.g., Bud Light) leading them to disregard the localness label.
3. A similar study, Hart (2018), argues that consumers are willing to pay a premium for local beer when the beer is not of their usual style, but the premium vanishes when the beer is of their preferred style. In other words, the style of the beer matters more than the localness attribute when the consumer is buying their favorite style, which was the exact design of our experiment. Thus, we are not ready to dismiss the idea that consumers do not value locally produced beer.

It is also important to remember that many smaller craft breweries already rely heavily on local consumption. Furthermore, our results suggest variety-seeking drinkers—a common trait amongst the craft community—are more likely to pay premiums for sustainably brewed beer. This could suggest that improved marketing of sustainability habits could complement the localness branding, leading to further product differentiation and attracting a wider consumer base.

In Summary

Sustainability investments in the beer industry are costly and can limit access among smaller breweries. However, marketing initiatives through eco-labeling could make the investment worthwhile. We find positive price premiums attached to sustainability attributes, showing that marketing sustainability efforts could be an effective way for breweries to attract new beer consumers, or to charge a premium for their product. Water sustainability practices generate the largest share of consumer interest at a modest premium, while a smaller portion of consumers are willing to pay larger premiums for landfill diversion and carbon reduction practices. Our hope is that with this knowledge, breweries will be better equipped to handle sustainability investment

decisions, continue to reduce their environmental footprint, and market their sustainability efforts to U.S. beer drinkers.

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Title: Appreciating Chris Hurt’s Impact in Outlook and *PAER*
Author: Ken Foster
Issue: *PAER-2020-17*
Date: October 2020
Summary: Dr. Ken Foster reflects on the career of Dr. Chris Hurt, retired professor of agricultural economics and former editor of the Purdue Agricultural Economics Report.

Over the past four decades, it would be virtually impossible to interact with the Purdue Department of Agricultural Economics without meeting Dr. Chris Hurt. For many years, Chris was among the most quoted experts in the Purdue community. That’s saying a lot when one considers who the competition was over the past four decades and it speaks volumes to Chris’ passion for education and willingness to share his knowledge freely to anyone with interest.

Many years ago, I was a new assistant professor with a livestock Extension appointment but without much experience beyond *4-H*. I felt like a ship destined to sink. Chris came to my office one day and said, “*Swine Day* is coming up soon, and we should write something for the annual publication.” Chris threw me a life preserver, and, like any lost and drowning soul, I clutched to it for all it was worth. Chris reeled in the line. Chris soon clued me in to similar opportunities with *Beef Day*, *Dairy Day*, and the annual state forage conference, each offering an opportunity to present to key livestock industry stakeholders and to write for a bulletin. Perhaps the most influential of these suggestions was when Chris introduced me to *Purdue Ag Econ Report*, suggesting that I should also be writing for our Ag Econ stakeholder audience.

In the mid-1990s, farmers across the state were dealing with changing marketing needs due to dramatic shifts in government programs and aggressive consolidation in the livestock industry. During this time, Chris found space in his busy schedule to take ownership of the fall issue of the *Purdue Ag Econ Report*. He marshaled colleagues, not just in Ag Econ but from across Purdue, to create a broad-based Agricultural Outlook program each year that blanketed the state through in-person presentations, webinars, and, of course, a popular issue of *PAER*. Chris’ enthusiasm for the Outlook issue of *PAER* was contagious and drove home the importance of engagement to many of us in the department and beyond.

Chris served on the editorial board of *PAER* for a number of years, watching the impact of the printed publication decline in an increasingly digital age. In 2014, Chris requested the job of

PAER editor while I was the Ag Econ department head. Chris had a strong desire to reinvigorate and modernize *PAER*. During the next six years, Chris led a format redesign that gave *PAER* a strong digital presence on the web with easy to navigate links, often with supporting video and audio content. Stakeholders' interest in the publication soared, as did faculty desire to provide content.

Chris has a keen understanding about the importance of audience. It's a combination of "you can't teach effectively if you don't know who you are teaching" and "the best people to teach are the ones who are open to being taught at the time." For economists, the latter usually means taking advantage of some sort of economic or financial stress or uncertainty. Under Chris' leadership the scope of *PAER* broadened beyond the traditional farm production and marketing fare (he would still tell you that is the core audience) to include applied research directed at other interests such as health economics, family business and estate planning, demographic and environmental concerns, and others. This effort expanded the readership to better meet the informational needs of the department's diverse stakeholders and to better reflect the impactful research across the department.

As many know, Chris retired last summer. We will miss having him around in the Krannert Building for many reasons – his economic insight, his wit, his wisdom, his support and encouragement of others. Chris' legacy of translating applied research into information of value to members of the community will continue under new editorship. Chris' leadership sets a high bar for the future of *PAER* and instills its importance in these new leaders. I expect that *PAER* will continue strong into the future. It's a tribute to Chris' innovation and impact on others that three of our productive, young professors have stepped forward to take leadership of *PAER* into the future. Thanks Chris! And happy retirement.