The Feed

Farmer Mac's Quarterly Perspective on Agriculture

Winter 2017/18



Table of Contents

A Message from Curt Covington2
Special Report: Farm Labor3
Severe Weather5
USDA Forecast Accuracy7
Weather9
Happy Holidays10
Corn and Soybeans11
Livestock and Dairy13
Analyst Corner15
Resources17
About the Authors 18

ABOUT THE FEED

The Feed is a quarterly economic outlook for current events and market conditions within agriculture. The report is broad-based, covers multiple regions and commodities and incorporates data and analysis from numerous sources to present a mosaic of the leading industry information, with a focus on the latest information from the United States Department of Agriculture and their Economic Research Service. There are several regularly included sections like weather and major industry segments, but the authors rotate through other industries and topics as they become relevant in the seasonal agricultural cycle. Where the report adds value to readers is through its unique synthesis of these multiple sources into a single succinct report. Please enjoy.

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A MESSAGE FROM CURT COVINGTON

My daughter moved from California to Staten Island, New York in September 2012. About a month later, Hurricane Sandy hit the east coast and wreaked havoc on her bottom-floor apartment. Since she had lived most of her life to that point in California, I asked her which was worse: an east coast hurricane, or a west coast earthquake. She replied: "I don't like either very much, but I knew the hurricane was coming, so I had time to get out of town."

With the 2017 harvest "in the books," growers across this great country are looking to recover from hurricanes, flooding, droughts, and wildfires. And while you, like my daughter, might be able to get out of town, you can't take the crop with you. Such is the nature of farming. It takes a very special breed to be a farmer or an agricultural lender: both share the same passion and commitment to feeding a hungry world and both are calculated risk takers. There are some things you just can't plan for, and some of these things can and will sink a farm business.

2017 will likely go down as the year of the unbelievably unexpected in agriculture. Let me explain: I visited Corpus Christi, Texas in late June and toured thousands of acres of cotton that were expected to produce record yields. When Hurricane Harvey hit, most producers had harvested the crop; but almost everything that was stored in the field waiting to be ginned was either blown away or severely rain damaged. In late September, I visited central Florida shortly after Hurricane Irma swept through central Florida. Hurricane Irma's path could not have been more lethal to an already beleaguered citrus industry. I toured several citrus groves where the entire crop was on the ground, and the trees were shredded or uprooted by the storm. And perhaps the most unexpected was the devastating wildfires in the Northwest and in northern California (some that might be the deadliest and most destructive in California history). An estimated 75 percent or more of the wine grape crop had been picked before the firestorm hit. But, the fires reportedly killed 43 persons, destroyed an estimated 5,700 structures, and burned almost a quarter of a million acres. Conversely, it has also been reported that less than a dozen of the more than a thousand wineries in the region were destroyed.

So, while it was an unbelievably unexpected year, the expected result from all of this will emerge as it always has - rural America and its farmers will find a way to recover, and their lenders will be there ready to provide the financial support they and their community deserve.

Happy holidays and many thanks to all,





The Feed - Winter 2017/18 2

SPECIAL REPORT: DRIVERS OF FARMWORKER SHORTAGES AND INCREASING LABOR COSTS (resource 1, 2, 3, 4, 5, 6, 7, 8)

By Jennifer Ifft and Travis Grout (Cornell University)

Key Highlights

Immigration restrictions have received attention, but other factors have also contributed to rising farmworker shortages and increasing labor costs.

A strong domestic economy, rising minimum wages, and differences in nonwage labor costs all contribute.

Farmers are likely to respond by moving toward business strategies designed to help them succeed in a higher labor cost environment.

Difficulties hiring and retaining farmworkers are certainly not new, but several concurrent trends influencing access to farm labor will drastically alter the structure of U.S. agriculture over the next decade. While effective immigration reform would provide some much-needed relief for farms desperate for a stable labor supply, even comprehensive reform would not stanch rising wages. U.S. and foreign labor market characteristics, as well as state-level labor regulations, are putting additional upward pressure on farm labor costs. This pressure will only intensify in coming years, likely causing farms relying on hired labor to undergo substantial transformations.

Despite decades of technological improvement, mechanization, and farm consolidation, many farming tasks remain highly labor intensive. Examples include: hand-harvesting fresh market fruits and vegetables, managing grazing livestock, and packing meat for retail sale. Many of these physically intense jobs require lowerskill workers. However, fewer American workers are familiar with or interested in manual farm work. Further, the general economy is producing enough jobs to drive the national unemployment rate below 4.5%, a level many consider to be at or near "full employment." U.S. immigration policy has long recognized the unique nature of the agricultural labor market. From the Bracero program in the 1940s to the current H-2A program, immigration policy reflects that the U.S. does not have a sufficient pool of domestic farmworkers. However, even without taking the current domestic political environment into account, expansion of job opportunities and a declining birthrate in Mexico suggest that this source of labor is not limitless.

While labor markets are generally tight across the U.S., there is substantial regional variation in labor costs, regulations, and living costs, which help shape a state's labor market competitiveness. Currently, nearly two-thirds of fruits and vegetables are produced in states including California, New York, and Washington that have or are scheduled to have substantial increases in minimum wage levels, often to levels above current average farmworker wages. Other fruit and vegetable producing states like Florida and Texas are not expected to see the minimum wage rise as quickly. However, differences in labor market competitiveness also extend beyond wages. As illustrated by California in Figure 1, many of the states with increasing minimum wages also have relatively high living costs. In contrast, states like Florida with a relatively low minimum wage may not necessarily realize a cost advantage for farm labor (Figure 1). If farm wages are low relative to living costs, those areas may be less competitive in attracting and retaining farmworkers.

Non-wage costs also vary substantially by state. Across the U.S., the cost of workers' compensation per \$100 of payroll varies from \$1 to \$11 for crop workers and between \$4 and \$22 for animal workers (see Figure 2). As labor costs increase, this state-level variation may become more important, altering the current regional patterns of comparative advantage for certain types of crop and livestock production. For example, California's weather and water advantages for fruit and vegetable production





(2) Projected RLW is based on linear extrapolation from 2014-2016 trend.

(3) California minimum wage increases scheduled through 2022. Thereafter, the minimum wage will rise with cost of living



Figure 2: Workers' Compensation Rates Vary Substantially by Region



may be affected by its move towards a \$15/hour minimum wage, as well as high non-wage costs.

As labor costs increase, those farms relying on hired labor are likely to be reshaped by a need to remain costcompetitive, while retaining a sufficient workforce. Accordingly, labor-enhancing or -saving equipment will continue to become more attractive. New York state, for example, is approaching wage levels that make an investment in milking robots cost-effective. Rising wages are also likely to make investments in other labor-saving technology more attractive. A cost-benefit analysis we conducted for investment in apple harvest platforms-a classic example of a labor-enhancing technologysuggested positive returns across the industry only after increasing wages were considered. Advanced technologies-robots to pick fresh fruit, milking robots, self-driving tractors—can already be found on some farms and point towards a future of "remote farming," where farm operators or farm workers don't need to be physically present where production takes place. While many of these technologies may not be profitable investments at present, tight labor markets, in addition to aging farm owners, move us closer to this future.

Upward pressure on farm labor costs will likely also accelerate the trend of increasing farm size. The days of easy recruitment and management of farm labor, if such days even ever existed, are over. Managing a modernday farm labor force is time intensive and requires increasingly specialized knowledge, such as managing paperwork for guestworkers, maintaining compliance with labor regulations, and developing creative recruitment strategies. On top of this, investment in "soft skills" related to human resources management is essential – developing a mission statement, leading team meetings, providing regular feedback to workers, and, more generally, ensuring a rewarding and safe work environment sufficient to retain a dependable labor force. As with many aspects of farm management, there are economies of scale associated with these activities, whether a farm has a full-time human resources manager or contracts out activities such as guestworker recruitment.

LOOKING FORWARD. Two things are certain when we look towards the future. First, more than ever, farms using hired labor will need to pay competitive wages and invest in human resource management. Second, accelerating wage growth will drive innovation in a variety of forms,

just as U.S. agriculture has historically innovated and adapted when faced with such challenges. Some farms will develop business models that support higher wages. Local foods, organic, and other premium markets may become more attractive for some farms. Some farms will develop creative labor recruitment strategies, such as working with refugee communities. Others will switch to less labor-intensive crops, for example from fresh blueberries to processing blueberries. Others may bet on early advances in robotics. Another path forward may be through taking advantage of growing consumer interest in farmworker welfare. This pressure may lead some companies to provide incentives for farmers to provide more attractive working conditions (one such program was recently announced by Ben and Jerry's). Certainly, in some cases, farm operators will decide to exit early or to not enter into full-time farming. There is no silver bullet to navigating and surviving this transition. Tight labor markets and growing wages will persist even with regulatory relief or improved access to migrant labor. Anticipating and actively managing these changes will be key for farms to survive and thrive through challenging labor markets.

SEVERE WEATHER AND AGRICULTURE

Key Highlights

(resource 9, 10, 11

The cost of damage from severe weather is likely to set a record in 2017.

High-cost weather events are increasing in frequency, an effect of higher revenues generated by increasingly efficient agricultural production.

Crop insurance indemnities and government ad-hoc disaster payments partially offset losses from severe weather and help smooth farm incomes across the country.

Severe weather risk is nothing new to farmers and ranchers. Most Midwestern producers vividly remember the 2012 drought that set corn yields back by 20 years. Dakotan ranchers can undoubtedly recall when an early winter storm killed tens of thousands of cattle in 2013. And Florida citrus producers are not too far removed from the disastrous hurricane season in 2004, which brought three major storms in August and September that caused massive flooding and tremendous agricultural loss. But 2017 may prove to be one of the worst years for high-cost weather events. In this article, we examine the frequency, types, and locations of significant weather events and their impacts on agricultural production.

The National Oceanic and Atmospheric Association (NOAA) provides a helpful dataset on high-cost weather events. Since 1980, NOAA has estimated the CPIadjusted economic cost of seven major types of episodic weather events in the United States, and has recorded the location, timing, cost, and number of deaths related to each event. These data series account for events that cost more than \$1 billion (adjusted for inflation). Figure



3 shows the frequency of each type of episodic weather event by type and decade. While tropical cyclones (i.e., hurricanes and tropical storms) may be the most costly, severe storms that generate damaging tornados and hail are far more frequent. Since 1980, there have been 38 tropical cyclones that have each caused more than \$1 billion in economic damages, but there have been more than double that number of severe storms. Sixty-four of the 90 highcost severe storms since 1980 have occurred since 2005. Grouped by decade, the severe storm category is the only type showing an upward trend in frequency (Figure 3).

The geographic dispersion of high-cost episodic weather events follows a logical pattern (see Figure 4). States located along the Gulf of Mexico and the Atlantic seaboard see most of the weather-related damage due to hurricanes and tropical depressions. Hurricanes Katrina (2005), Sandy (2012), and Andrew (1992) are the top three inflationadjusted episodic weather disasters, although the trio of storms in 2017 (Harvey, Irma, and Maria) may displace one or more of those once the damage is finally tallied. When high-cost weather disasters hit the Midwest, they tend to be droughts, floods, or severe storms. Western and northern states tend to see more wildfires, freezes, and droughts, although they are significantly rarer in the western U.S. than other parts of the country. For example, in Washington state, there was a \$1 billion weather event in 19 out of the 38 years analyzed; that compares to 25 years with events in both Iowa and Florida. Texas has the highest rate of high-cost weather events (33 years or 87 percent of years analyzed), and Utah has the lowest rate (11 years or 29 percent of years analyzed).

These damage costs estimated by NOAA are structured to reflect total costs of the events. Analysts include insured and uninsured losses, and that covers structural damages as well as single-year crop losses experienced by agricultural producers. Tropical cyclones tend to cause high rates of loss because they hit more populated areas where structural damages can be substantial. Droughts, floods, and severe storms tend to cause more agricultural damage given the colocation of these events with areas engaged in higher levels of farm production. The rising count of billion-dollar disasters in the Midwest is largely related to

5



Figure 4: Location and Estimated Damage Caused by Billion-Dollar Weather Disasters since 1980

the increasing value of agricultural production in the 2000s. For example, in 2004, to generate a \$1 billion loss, a storm would have to damage over two million acres of production at average yields and market prices. By the end of 2005, that number fell to 1.5 million acres, and by 2012 dropped below a million acres. Similarly, cattle prices increased more than 30 percent in the early 2000s, and cattle weights continue to improve as better genetics and feeding techniques increase meat production efficiency. Higher per-acre and per-animal revenues increase the efficiency of agricultural production, but they also increase the value at risk for weather disasters.

While these weather events do impede farm revenue, market losses are often largely offset by crop insurance indemnities and government emergency payments. Looking at state-level USDA income data, there is a correlation between income levels and natural weather disasters, but the relationship is weakened by the influence of offsetting payments from government disaster payments and crop insurance indemnity payouts. For example, after a deadly series of hurricanes in 2004 and 2005, Florida agricultural net cash income increased in both years, and the increase was in part from government ad-hoc emergency payments and crop insurance payments. Similarly, net cash farm income in Iowa fell by more than 20 percent in 2013 following the extreme drought of 2012, but crop insurance payments and government program payments helped offset more than \$5 billion in lost income between 2012 and 2013. So, while these high-cost episodic weather events can be devastating, farmers and ranchers have valuable risk mitigation tools to lessen the financial burden of such events.

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The Feed - Winter 2017/18 6

ANALYZING USDA'S FARM INCOME FORECAST ACCURACY (resource 11, 12)

Key Highlights

In addition to their widely cited aggregate net income forecasts, the USDA also publishes projections of the subcomponents underlying net farm income and net cash income.

The USDA's cash receipt and cash expense forecasts have proven relatively accurate.

Although they are a relatively small portion of sector revenues and expenses, cash farm-related income and noncash revenues/expenses show the most extensive variations over reporting periods.

In the Spring 2017 issue of The Feed, the authors began a multi-article dive into the accuracy of the United States Department of Agriculture's (USDA) farm income forecasts. Because USDA's net income numbers are widely reported, the Spring 2017 analysis focused on net cash income (NCI) and net farm income (NFI), finding that the initial projections released each February tend to be conservative. Last quarter, we expanded our analysis to examine how the forecasts change over time, and we noted NCI and NFI forecasts improve over the USDA's forecasting cycle, with NCI forecasts improving more quickly. This quarter we dive into the differences between NCI and NFI and analyze how the forecast accuracy of each series' components affects the overall deviation in the USDA's NCI and NFI projections.

Although NFI is widely cited, NCI excludes noncash items and is, therefore, a better measure of the annual cash the







agricultural sector has available to cover living expenses and pay bills. At a high level, NCI is the difference between gross cash revenues and cash expenses. Rather than forecasting the total cash revenues and expenses directly, the USDA forecasts multiple subcomponents of gross revenues and expenses and aggregates those forecasts. Using compiled historical USDA forecasts, we break out the four main components of the sector's gross cash revenue and total cash expenses. Figure 5 expands on our prior analysis of the improvement in the USDA's net income forecasts over time by showing how each component's median absolute percentage error (APE) changes over the course of the USDA's farm income forecast cycle.

As shown in Figure 5, the USDA's initial projections for cash farm-related income and government payments are less accurate compared to the other major subcomponents of NCI. Given a median APE near 12 percent for NCI initially, each of these series is also less accurate than the aggregated NCI projection. On the other hand, the initial predictions for crop receipts, livestock receipts, and cash expenses are all more accurate than the aggregate NCI forecast, with a median APE less than 6 percent for each series. Although the subcomponent series have varying levels of initial accuracy, they each improve over the USDA's forecasting cycle; the median APE is lower in the following year February forecasts in each case.

Both commodity revenue projections are initially relatively accurate and improve over time. The accuracy of the livestock series improves particularly fast, potentially due to more frequently updated information on the livestock complex's production and pricing throughout the year. The ability to incorporate updated commodity data throughout the year is also likely an important factor in the



substantial improvement seen in the government payments forecasts each data release. Initial government payment forecasts compound production and price uncertainty with further uncertainty on the timing of payouts across calendar years and with less information on potential policy changes. However, given a prescribed set of government programs, additional information on production and pricing should improve payment predictions substantially. Unlike the other series, official farm sector expense and cash farm-related income estimates are based on annual survey data, typically updated each August. The timing of this information gain helps explain the large improvement in forecast accuracy in the August reports.

Because NFI is a complete measure of profitability, it also accounts for noncash revenues and expenses. When calculating NFI, cash revenues are adjusted for noncash items like changes in inventory levels and other noncash income, while cash costs are adjusted for economic depreciation and other nonmoney expenses. Figure 6 illustrates that the USDA's noncash revenue and expense adjustments have been less accurate than their cash counterparts, particularly for noncash revenue adjustments. The noncash revenue forecasts also do not improve greatly over time. This is likely the primary driver of slower accuracy improvement in the USDA's NFI forecasts compared to their NCI forecasts, which was illustrated in the last issue of The Feed.

Although some components of the USDA's forecasts are less accurate than others, the less precise series tend to represent a smaller portion of the sector's gross revenues and expenses. Figure 7 illustrates crop and livestock cash receipts constitute the bulk of the sector's cash revenue stream on average over the past five years. Likewise, noncash expenses are small compared to their cash counterparts, accounting for an average of 12 percent of total sector expenses over the same period. Accordingly, equal sized percentage

Figure 6: Cash and Noncash Component Forecast Accuracy (Median Absolute Percentage Error)

Series	Revenue		Expenses	
	Cash	Noncash	Cash	Noncash
February (current year)	4.2	39.4	3.8	6.0
August	2.0	34.5	2.0	3.1
November	1.6	32.2	2.4	3.0
February (following year)	1.0	35.0	1.3	2.8

forecasting deviations for sector cash receipts and cash expenses will necessarily have a larger effect on gross revenue, expense, and net income projections. Evidence from the last 25 years of farm income forecasts suggests that the USDA's projections perform well in each of these areas. Given the USDA's ability to accurately project cash receipts and cash expenses, research into methods to better predict cash farm-related income, noncash revenues, and noncash expenses, is a potential avenue for reducing variation in the USDA's overall NCI and NFI projections, despite each of these series being a small portion of total sector revenues and expenses.

Figure 7: Farm Sector Revenue Stream Sources and Relative Sizes



(resource 13, 14)

Key Highlights

Weak La Niña conditions have developed over the equatorial region of the Pacific Ocean.

The La Niña may strengthen somewhat as we head into the fall and winter, influencing weather conditions throughout the country.

Over the summer and early fall, weak El Niño-like sea temperatures gradually transitioned to weak La Niña sea temperatures. This trend is likely to continue through the fall and into the early winter, and it may become the dominant influence on weather conditions throughout the country over the winter. La Niña-influenced weather patterns are notoriously fickle, but several broad patterns emerge. First, because the La Niña conditions tend to suppress the energy of the subtropical jet stream, drier and milder than normal conditions are likely from central and southern California through Texas and the Gulf Coast. Second, the northern branch of the jet stream can become more influential. This often results in enhanced precipitation along the northern tier of states from the Pacific Northwest through the Great Lakes. The active northern branch of the jet stream can also usher in periodic bouts of abnormally cold weather across the region as well. The region between the previously highlighted areas (the southern Plains through the Tennessee Valley to the Mid-Atlantic) will see highly variable weather, particularly with regard to temperature, as the northern and southern influences ebb and flow as they battle each other.





HAPPY HOLIDAYS FROM THE AUTHORS

Last year the U.S. produced over 800 million gallons of wine, enough to fill 1,200 Olympic swimming pools – cheers to grape growers!

Pumpkin pie – patching relationships since the second Thanksgiving

Here's a statistic to butter you up – 30% of all US spuds originate in Idaho

Pecan – America's 3rd favorite pie. Isn't that nuts? 46 million turkeys are gobbled up every Thanksgiving A mind-boggling 63% of all U.S. Cranberry production happens in Wisconsin

CORN AND SOYBEANS

(resource 15, 16, 17)

Key Highlights

U.S. corn production is expected to fall 6 percent on lower acres planted to corn and lower expected yields.

Soybean production is expected to set a record this season as a large uptick in acres planted more than offsets slightly lower expected average yields.

Despite higher supplies, U.S. ending stocks for both corn and soybeans are likely to remain below historical averages at the end of the 2018 marketing year.

Analysts expect the U.S. corn and soybean supply functions to be mixed in 2017. Corn growers pared back acres planted, rotating a higher percentage into soybeans in the spring. Growing conditions varied regionally throughout the summer months, but they were generally worse than in 2016 when the national average corn yield set a record at 174.6 bushels per acre. Due to poorlytimed heat and dryness, the USDA World Agricultural Outlook Board (WAOB) expects corn yields for the 2017 crop to be 171.8 bushels per acre. That would be a decrease from the prior year; however, if realized, it would still represent the second highest national average corn yield in history. A 6 percent decline in corn production is expected for this harvest, due to that lower acreage and lower yield.

Meanwhile, soybean growers planted the largest crop in U.S. history, with an estimated 90.2 million acres planted this past spring. This large planting is only partially

2017/18 Marketing Year	U.S. Only		World Total	
Rank (Last 50 Years)	Corn	Soybeans	Corn	Soybeans
Production	2	1	2	2
Total Supply	2	1	2	1
Exports	25	1	2	1
Domestic Consumption	1	1	1	1
Ending Stocks	6	5	5	1

offset by lower expected yields from average growing conditions. The WAOB October release forecasted national average soybean yields of 49.5 bushels per acre, a 5 percent decline from 2016. If realized, that yield would equate to the second highest on record, and the total production would set a record for U.S. soybean production. These supplies are coming onto the market at a time when world stocks for both corn and soybeans are at or near historical highs. This market year is expected to set records for world soybean supplies and ending stocks, and rank in the top five for years in world corn production and ending stocks (see Figure 10).

Fortunately, the record supply of grains is still supported by a very robust demand function. The number of animals on feed is rising, pushing up the usage of corn for feed throughout 2017. Corn demand also continues to be supported by ethanol production, and the USDA estimates that roughly 33 percent of the 2017/18 corn supply will be brewed into ethanol. Exports are the weak link for corn producers, as analysts expect an 8 percent decline in corn exports during the 2017/18 marketing year due to more competition from large crops in Brazil and Argentina. For soybeans, export demand continues to be the growth driver; the WAOB projects a 3.5 percent increase in bulk soybean exports in the coming year, and predicts that nearly half of the total crop will be exported. Domestic demand for oil and meal is also expected to increase on higher biodiesel and feed demand, but exports are still the primary use of U.S. soybean production. China remains the world's largest soybean destination, and U.S. soybean growers continue to see stiff competition from Brazilian producers for the Chinese market.

The forces of supply and demand look to equalize at or near current price levels. Despite record crops and ending stocks, prices have stabilized around \$3.25 per bushel for corn and around \$9.25 per bushel for soybeans. Each time the price drops below these levels, the demand function picks up, and cash prices tend to move upward with it. The WAOB projects a season-average corn price around \$3.20 per bushel and soybean price near \$9.20 per bushel. These levels are not dramatically different than the cash prices farmers experienced throughout much of 2017.

Figure 10: Marketing Year Supply/Demand Ranks



Figure 11: Ending Stocks of U.S. Corn & Soybeans Converted to Months of Use

*Marketing years for U.S. corn and soybeans run from Sep. 1 to Aug. 31

One explanation for this tight equilibrium in corn and soybeans is the relative levels of ending stocks to demand. As the law of supply lays out, the larger the stockpile of something, in general, the less that something is worth. We certainly have a growing stockpile of both corn and soybeans both at home and abroad. However, the law of demand states that the more consumers demand of something, the higher the price. Therefore, if rising supplies are met with increasing demand, the market price could remain unchanged. Figure 11 lays out the level of corn and soybean stocks relative to demand, by showing the number of months of use still in storage at the end of each market year. For example, U.S. corn is projected to end the next marketing year at 2 months of use in storage; this means that if absolutely no corn was imported or grown in 2018, U.S. corn consumers would run out of stocks by November of 2018. As the chart indicates, months of use for both corn and soybeans are expected to remain below their long-run average in 2018. The chart also highlights just how extraordinary conditions were from 2012 to 2014 when ending stocks of both corn and soybeans were below one month worth of usage. Figure 11 also provides historical context by allowing readers to compare today's conditions to those experienced in the 1980s - there could not be a starker contrast between then and now.

The Feed - Winter 2017/18 12

LIVESTOCK AND DAIRY (resource 18, 19, 20, 21, 22)

Key Highlights

Cattle, hog, and dairy production is forecast to continue expanding into 2018.

Exports have been an important source of demand, helping to maintain higher prices.

Global socioeconomic trends bode well for foreign demand growth, but probably not the levels we saw earlier in the 2000s.

As we move into the final quarter of the year, the USDA's outlook for U.S. cattle, hog, and dairy markets remains largely consistent with last quarter. Each industry is in expansion mode which is predicted through at least 2018. Despite higher supplies, prices have been resilient and in the case of cattle and hogs, higher-than-expected coming into the year. One of the primary drivers has been a rebound in foreign demand. Year-to-date exports are up by at least 10 percent for each of these protein segments (Figure 12).

Looking specifically at the cattle market, the U.S. herd is expanding as the industry continues to rebound from historically low levels. Although cattle weights were a bit lower earlier this year, signs point to heavier cattle moving forward, which should also act to lift beef production into 2018. Pork producers have also been expanding hog inventories. Higher-than-anticipated pricing earlier this year gave producers a signal to continue expanding their hog inventories. The USDA's September hog and pig inventory figures show the highest levels for the month since the survey began back in 1988. With new processing plants coming online this fall and next year, producers should continue to see growing hog marketing opportunities.

U.S. dairy production has also moved higher in 2017, and is

Figure 12: January-August Protein Export Levels



projected to do so again next year. Domestic stocks of butter, cheese, and nonfat dry milk products have risen with U.S. production and remain elevated. However, individual dairy segments have responded differently in response to the additional supply. U.S. cheese demand has been running higher than expected, creating extra demand for milk fat products. World demand for milk fat has also remained high, particularly for butter. The result has been rising world butter prices, particularly in western Europe, where export prices were at all-time highs in September. By comparison, U.S. butter prices have been relatively low, and the pricing competitiveness has allowed year-to-date U.S. butter exports to double relative to last year. The side effect of strong milk fat demand has been an additional supply of nonfat dry milk and other skim solids, which has helped depress prices in these markets. Lower global prices have helped stimulate some additional demand, and U.S. nonfat dry milk prices remain competitive with other major producing regions,

allowing year-to-date exports to remain up 20 percent. However, remaining stockpiles in Europe and the U.S., as well as additional powder supply from Canada, are likely to keep pressure on overall nonfat dry milk price levels.

Looking ahead to 2018 and beyond, export expansion remains a key driver for higher beef, pork, and dairy product prices, as well as each industry's overall health. The United Nations currently predicts the population in less-developed regions will grow by 38 percent in 2050 relative to 2015 (Figure 13). Not only will there be a larger population to feed in developing areas, but the International Monetary Fund's real GDP growth forecasts continue to predict that emerging markets and developing countries will drive world economic growth. Further supporting foreign demand prospects, lower and middleincome countries tend to have higher income elasticities for agricultural products than their counterparts in highincome countries. This means consumers in lower income



countries tend to spend a higher percentage of each additional dollar of income on food compared to those in developed countries. Higher incomes in developing regions also tend to afford consumers in these countries the opportunity to purchase protein in their diets from additional sources, providing further long-term support for the dairy and livestock sectors.

Although long-run socioeconomic trends bode well for the U.S. protein complex, it is important to keep in mind that the confluence of factors that led to the rapid expansion of exports earlier in the 2000s is unlikely to repeat. According to the Organization of Economic Cooperation and Development (OECD), agricultural commodity demand for most major protein commodities is expected to rise more slowly over the next decade as compared to the last. One exception is the market for fresh dairy products; however, the difficulty and cost of storing and transporting fresh dairy products over long distances likely limits the overall upside in that market for U.S. producers. Given growing, but slower world demand for livestock and dairy products, ensuring that U.S. products have equal market access will be key. Like all segments of agriculture, livestock and dairy producers will be watching the ongoing NAFTA talks with great interest, while hoping the U.S. opens new market access with other key trading partners.

ANALYST CORNER: UNDERSTANDING THE VALUE OF THE OPEN PREPAYMENT OPTION

Key Highlights

The option to prepay or refinance a mortgage is an important financial decision and should be analyzed accordingly.

The benefits of refinancing should be weighed against alternative investment options.

Higher transactions fees reduce the return to refinancing, while greater interest rates savings have a positive effect.

Financing decisions are central to the purchasing process for farmland, housing, and many other large expenditures. While some buyers can finance large purchases with cash, most rely on secured financing, such as a mortgage. Taking out a mortgage is an important decision to many people, and much attention is paid to interest rates, payment frequencies, and loan maturities. An oftenunderappreciated mortgage feature, however, is the prepayment option.

The idea behind prepayment is simple: if you, a borrower, have extra cash, you can increase a mortgage payment to reduce the outstanding balance and future interest charges. Furthermore, the prepayment option can allow you to refinance an existing loan into a new one at better terms. This optionality can only benefit you. Quantifying this value is complex, but one can understand it better by thinking of prepayment and refinancing as investment opportunities, just like stocks, bonds, and land.





While it might not feel like it as a borrower, all mortgages are assets to someone, often a lender. Like all financial assets, a mortgage has a value that fluctuates as expected future cash flows and interest rates change. An open prepayment is a call option on the mortgage, letting you buy it at a certain price if its value rises without requiring you to do so if it falls. To understand a mortgage's value, think about what someone might pay your bank to purchase it. When interest rates are low, the value of a mortgage that pays a high rate of interest will increase, the same relationship found in standard bond pricing models. Prepayments are investments in that mortgage that earn a risk-free return equal to the interest rate on the loan. Prepaying principal and saving future interest expense is equivalent to buying an asset that earns the same yield and using the proceeds to pay the interest instead.

From this perspective, we can draw an important conclusion: deciding whether to prepay mortgage principal depends on the opportunity cost of money. What are the risks and returns of other investment opportunities? Say you have a mortgage with a 5 percent interest rate and the stock market is expected to return 10 percent per year. You might earn more money by making your minimum mortgage payment and investing extra funds in equities rather than prepayments.

However, with all investments, risk is also important. Most investments are risky, while prepayments are not.

A comparable investment might be a U.S. Treasury bond, where yields will likely be lower than the interest rate on a retail mortgage, and the return on prepayments might look attractive in that light. Your mortgage is just as important as the rest of your investment portfolio, and viewing prepayment as an investment opportunity can help optimize your overall performance.

Another essential component of prepayment analysis is refinancing. Refinancing occurs when you borrow money to completely pay your current mortgage, replacing it with one or more favorable terms. There are often administrative fees, appraisal fees, and discount points associated with refinancing, and they can be significant. The profitability of a refinancing decision hinges on the degree to which the benefit of favorable loan terms exceeds the cost of executing the transaction.

This is an opportunity to introduce a quantitative perspective. You can consider upfront refinancing fees as an investment, and changes in future cash flows as the return on that investment. By subtracting the cash flows of the new mortgage from the existing one on the same timeline, we find the size and timing of the incremental cash flows. Combining these with up-front fees, we can analyze a refinancing transaction like other standard investments. For example, consider a \$1 million, 6 percent semi-annual fixed rate mortgage with a 15-year maturity. After five years of minimum payments, the remaining balance is \$759,038. When considering refinancing options, we can use traditional investment analysis tools like the net present value (NPV) profile and internal rate of return (IRR).

Assume a lender offers up the chance to refinance into a 5.5 percent semi-annual pay mortgage with a 10year maturity. This will cost \$15,181, or 2 percent of the refinanced balance. After mapping out fees and incremental cash flows, Figure 14 shows the NPV profile for the proposed transaction.

Looking at the Y-intercept, this deal will save approximately \$8,250 over the next 10 years, while the





X-intercept shows expected IRR of around 9.5 percent per year on our investment in refinancing fees. Comparing this against alternative financial products provides valuable information when deciding between refinancing and other investments. It is also important to consider the IRR sensitivity to any assumed terms of the deal.

Because fees are the price of our investment, it follows that the IRR is incredibly sensitive to what we pay up-front (Figure 15). Here, the proposed 0.5 percent interest rate reduction is unprofitable if total fees exceed 3 percent of the loan balance. Conversely, lowering the interest rate on the mortgage dramatically increases the IRR of a refinancing. Obviously, interest rates will impact profitability, but the sensitivity may be surprising. Figure 15 shows that IRR rises rapidly with interest rate savings. Even small reductions in an interest rate can be tremendously profitable.

While this article has focused on one example, the specific numbers are not what is important. Rather, what matters most is the process of identifying changes to economic cash flows, understanding what determines them, and comparing them to other investments to make the best decision. The example is intended to illustrate the sensitivity of a refinancing transaction's profitability to its inputs, and each decision should be analyzed thoroughly. By understanding the option value and cash flow implications of prepayment and refinancing, we can look at these types of transactions objectively and make the best financial decision for our current position.

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