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PURDUE AGRICULTURAL ECONOMICS REPORT

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CONSUMER PERCEPTIONS OF ANIMAL AGRICULTURE: FARMERS, FOOD SAFETY, AND MEAT PRODUCTS

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Consumers' perceptions of animal agriculture are increasingly impacting food production systems in the United States. Consumers have been joined by large food retailers and some restaurant chains who have increased their demands about the way animal products are produced. These demands include the space given to each animal, the animals' freedom of movement, the use of antibiotics, the way animals are handled, and environmental and social impacts of various production systems, as well as others. To align our animal industries with consumer desires, it is critical to better understand their perceptions. To help do this, an online survey of 825 U.S. consumers was conducted in late 2014 to gain insight into their views and perceptions of food safety, farmers, and the animal products they buy.

What We Asked Them

A total of 825 U.S. residents were surveyed online using the Qualtrics survey platform. Global Market Insite (GMI), provided a panel of respondents from their large opt-in panel that were targeted to be representative of the 18 year old and above U.S. population in terms of gender, age, household income, education level, and region of residence. In addition to demographics, respondents were also asked their feelings about food safety, participation in producing their own food, and opinions about the safety of the meat supply.

Who was in the Sample?

Table 1 shows respondent demographics. The average age was 47 years with a household income of $50,169, slightly lower than the median U.S.

household income of $53,046 (U.S. Census Bureau, 2014). Respondents spent $220 per week on food with 76%, allocated to food consumed at home (versus away from home).

Respondents are slightly more educated than the national average with 97% graduating from high school and 33% earning at least a bachelor's degree. Nationwide, 85.7% of Americans over 25 years of age have graduated high school, and 28.5% have a four year degree (US Census Bureau, 2014). The mean household size for this sample is 2.64 persons and is comparable to the US average of 2.61 persons per household (U.S. Census Bureau, 2014).

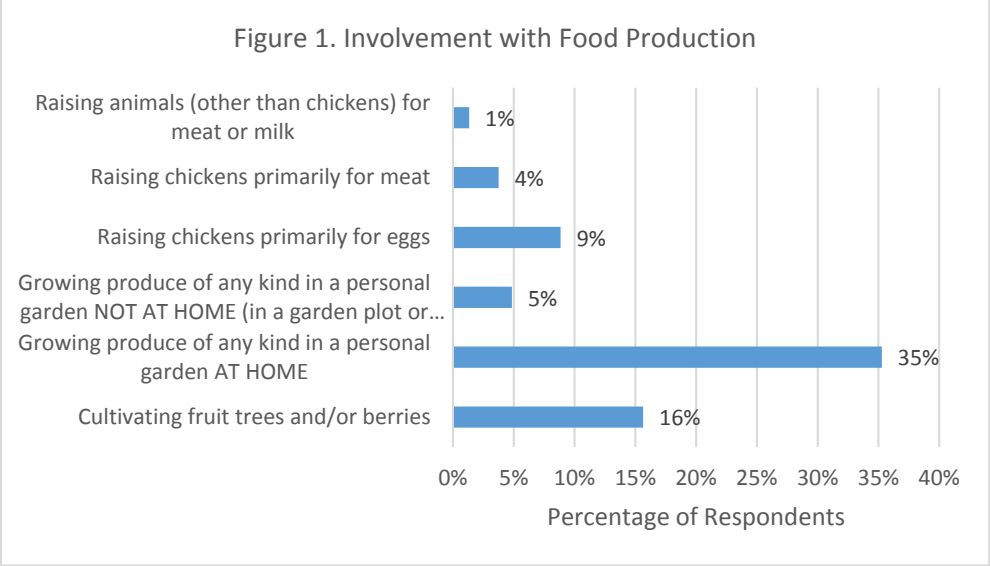


Table 1: Respondent Demographics (n=825)

Demographic Variable	Value
Mean Age of Respondents	47
Male	49%
Education	
• High School Graduate	97%
• Attained at least a bachelor's degree	33%
Annual Household Pretax Income	
• Less than $20,000	19%
• $20,000 - $39,999	29%
• $40,000 - $59,999	24%
• $60,000-$79,999	12%
• $80,000-$99,999	7%
• $100,000-$119,999	3%
• $120,000 or more	6%

Because meat consumption and feelings about meat safety were of particular interest in this study, respondents were asked if they or a member of their household was vegetarian or vegan. Choosing to not consume meat may be related to opinions on food safety, among other factors. Six percent reported that they were vegetarian and 4% reported being vegan. Five percent of respondents reported a member of their household was vegetarian and 4% of respondents reported a vegan member of the household.

Respondents were asked if they were members of a number of organizations. Seven percent of respondents reported being members of the National Rifle Association (NRA). In terms of animal welfare related organizations, 6% reported being members of the Humane Society of the United States (HSUS) and 2% reported being members of People for the Ethical Treatment of Animals (PETA). Three percent were reportedly members of the American Farm Bureau.

Because participation in activities such as hunting and fishing could be related to feelings about food safety, respondents were also asked about their participation. Twenty-four percent of respondents reported regularly fishing and 10% of respondents reported regularly hunting. Of those who hunted, 68% reported that they themselves, or a member of their household, consumed the meat obtained from hunting. Fifty-one percent of respondents did not consume wild game and 17% did not consume fish.

Respondents' knowledge and experience regarding food production may be related to their feelings about food safety in general. Thus, respondents were asked if they had been actively involved in producing food for their own family in the past three years (Figure 1). Not surprisingly, growing produce, fruit trees, and/or berries was more

Figure 2. Opinions on the Safety and Quality of U.S. Meat

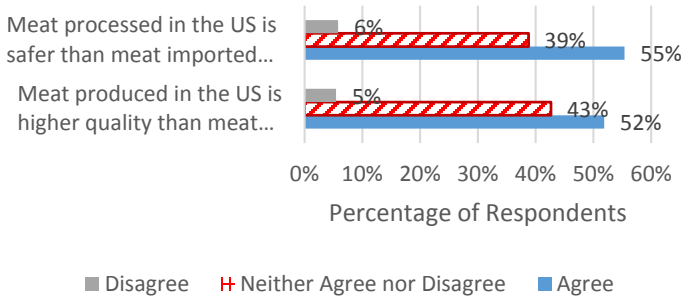
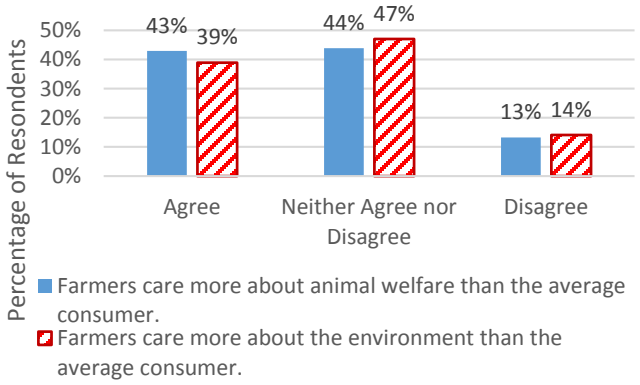


Figure 3. Perceptions of Farmers



prevalent than the raising of animals for meat or eggs. Cultivating a garden and/or having fruit trees or berries is understandably more accessible to much of the population, who may live in residences in which caring for animals may be difficult or impossible (but growing produce is more easily accomplished). Thirty-five percent had been involved in growing produce at home while 5% reported growing produce in a community plot or garden (away from home). A total of 16% of respondents reported growing fruit trees or berries. On the other hand, 9% reported raising chickens for eggs and 4% raised chickens for meat. Only 1% of respondents reported raising animals for meat or milk.

Public Perceptions of Farmers and the U.S. Meat Supply

Respondents were asked their opinions of the safety and quality of meat processed and/or produced in the U.S. relative to meat imported from other countries (Figure 2). Fifty-five percent agreed that meat processed in the U.S. was safer than imported meat. Thirty-nine percent neither agreed nor disagreed with this statement and 6% disagreed with this statement. Fifty-two percent of respondents agreed that meat produced in the U.S. was higher quality than imported meat while 43% neither agreed nor disagreed. Five percent disagreed that meat produced in the U.S. is higher quality than that imported from other countries.

Respondents were also asked about their perceptions of farmers with regards to the environment and animal welfare (Figure 3). Forty-three percent agreed that farmers care more about animal welfare than the average consumer; 44% neither agreed nor disagreed; 13% disagreed that farmers care more about animal welfare than the average consumer. Thirty-nine percent agreed that farmers care more about the environment than the average consumer; 47% neither agreed nor disagreed; 14% disagreed that farmers care more about the environment than the average consumer.

They were also asked if they agreed, disagreed, or neither agreed nor disagreed with the statement "Meat processed in a state or federally inspected facility is safer than self or home processing." Seventeen percent disagreed with this statement; 36% neither agreed nor disagreed; and 47% agreed that meat processed in a state or federally inspected facility is safer than home processing.

Changes in Consumption due to Food Safety and Animal Welfare Concerns

Respondents were also asked if they had altered their meat consumption due to food safety and animal welfare concerns. Over 75% said they had not made any changes in meat consumption. Sixteen percent had reduced total meat consumption due to animal welfare concerns; 19% had reduced meat consumption due to food safety concerns. (Figure 4, page 4)

Proper Cooking?

Proper cooking is an important food safety procedure for meat products. Thus, consumers'

perceptions of whether they can properly cook meat products can affect demand for those products. The meaning of "properly cook" was intentionally left open to the respondent's interpretation. Proper cooking could include knowing how to safely cook or how to cook meat so that it tastes good or is appealing. Sixty-eight percent said they know how to properly cook a steak; 34% said they know how to properly cook lamb; 61% said they know how to properly cook a whole turkey. Thus, there are a significant portion of consumers who believe they can properly cook some meat products, but not others. This inconsistency across meat products may be of concern for some livestock species as consumers are less confident in their ability to prepare certain products.

Summary and Implications

Increased interest in animal production practices by various consumer groups have prompted many food retailers, processors, and producers to implement changes in production systems to fulfill new consumer demands. Understanding of consumers' perceptions about meat, including the safety of products and welfare of the animals

Figure 4. Changes in Meat Consumption due to Animal Welfare and Food Safety Concerns

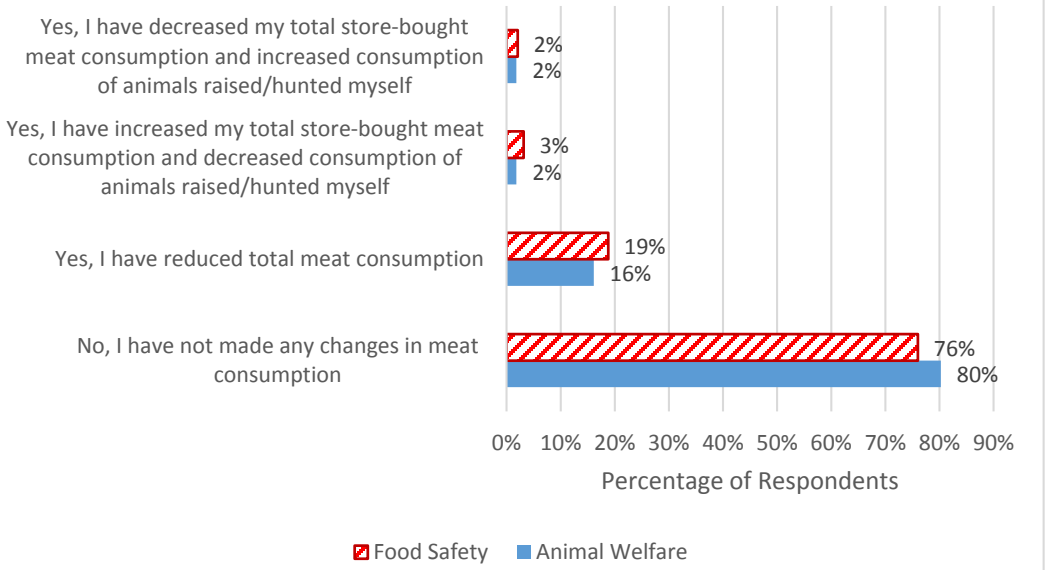
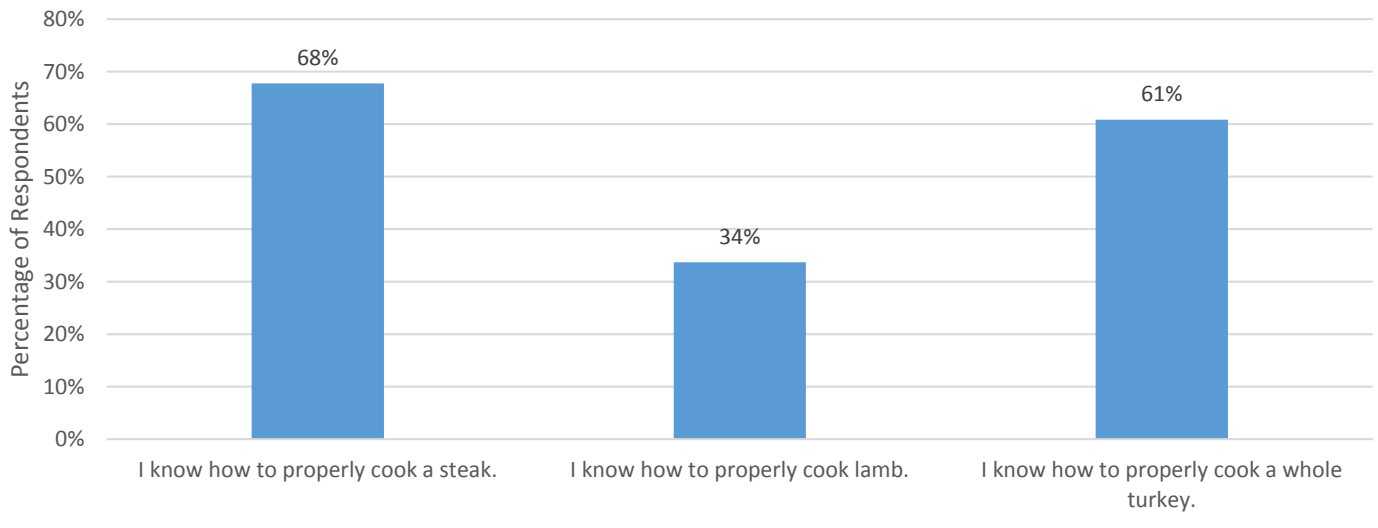


Figure 6. Percent of Respondents who feel they can properly cook Meat Products



employed in production can inform decision making by supply chain players.

A majority of respondents in this national survey of 825 consumers felt the U.S. meat supply was safer than imported meat (55%) and was higher quality than imported (52%). Only 43% felt that farmers cared more about animal welfare than the average consumer and just 39% said farmers cared more about the environment than the average consumer. A number said they had reduced their meat consumption due to a food safety issue (19%), or due to an animal welfare issue (16%).

These results suggest that a meaningful number of consumers' meat consumption has been reduced by food safety and animal welfare concerns. In addition, consumers said they are not very highly convinced that farmers always conduct practices in the best interest of their animals' welfare nor are farmers as concerned about the environment as the general population. This may suggest that there remains a gap between farmers and consumers and thus supports calls for farm groups to continue efforts to raise standards among producers.

The data analyzed here on perceptions of food safety and animal welfare, and perceptions of respondents of farmers' level of care/concern presents a small portion of the ongoing analyses on these topics in the Department of Agricultural Economics. You can view more of that work at the following sites:

http://www.vet.purdue.edu/CAWS/files/documents/051815-PerceptionofIndianaStateResidents.pdf

http://agribusiness.purdue.edu/resources/consumer-perceptions-of-livestock-products-and-animal-welfare

http://www.vet.purdue.edu/CAWS/files/documents/outdoor-enthusiasts-perception-of-hunting-and-animal-welfare.pdf

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Is Your Farm Labor Efficient?

Michael Langemeier, Professor Center for Commercial Agriculture

It takes a lot of family and hired labor to run modern farms. People-power is an important and costly input and farm managers need to ask if they are getting the efficiency and productivity needed from that labor to be competitive. One way to evaluate this question is to use benchmarks compared to other farms. Labor benchmarks should include family labor as well as all hired labor. This article discusses labor efficiency (a costs measure) and labor productivity (an output measure) and illustrates benchmark computations and comparisons.

Key Labor Benchmarks

1. Labor Efficiency measures labor costs as a percent of the $ output of the farm. It is computed by dividing total labor cost (family and operator labor plus hired labor) by the value of farm production. Hired labor cost and value of farm production can be found on a farm's income statement. Family and operator labor can be represented by family withdrawals, which can be found on a farm's sources and uses of funds statement. Family living expenses from farm management associations can provide guidance when examining family and operator labor cost. Average annual family living expenses for the Illinois and Kansas farm management association farms from 2009 to 2013 were $80,089 and $62,947, respectively.

2. Labor Productivity is an output per unit of labor measure. It is computed by dividing the value of farm production by the number of workers. If all of the employees, including the operator or operators, are fully employed, it is relatively easy to compute the number of workers. It is more difficult to compute this figure when employing part-time or seasonal workers. If some of the hired labor is seasonal or part-time, the total months worked by all hired and seasonal employees should be summed and then divided by 12 to arrive at the number of "full time" workers.

If labor efficiency is relatively high and labor productivity is relatively low, it is important to evaluate whether the farm has excess labor. Timeliness of operations should be incorporated into the evaluation of whether a farm has excess labor. Conversely, if labor efficiency is relatively low and labor productivity is relatively high, it is important to check the efficiency of machinery use. A farm that is efficient and productive with respect to labor would have a relatively low labor efficiency measure, a relatively high labor productivity measure, and relatively low machinery investment and cost measures. More information pertaining to machinery investment and cost benchmarks can be found in an article in the June 2014 issue of *Purdue Agricultural Economics Report* at https://ag.purdue.edu/agecon/Documents/PAER_June%202014.pdf

Farm Management Association Benchmarks

Labor benchmarks were computed using 2009 to 2013 data from the Kansas Farm Management Association for grain farms. Average labor efficiency was 0.1298 or 12.98% over the five-year period. This means that labor costs were about 13% of the total value of the farm's output. Labor efficiency varied substantially among farms. Farms in the top one-third in terms of labor efficiency had an average measure of 7.48%. All farms in the top one-third had labor efficiency measures that were below 11.3%, which is substantially below the average measure.

Average labor productivity was $420,083. This means that each farm worker was generating $420,000 of output on average. Farms in the top one-third in terms of labor productivity had measures greater than $485,500. Labor productivity measures for this group averaged $708,216. On average, 4.4% of the farms had a labor productivity measure above $1,000,000; so it is certainly possible to achieve a labor productivity level that is more than double the average measure.

Benchmarks for a Case Farm

To further illustrate how these labor benchmarks are computed an example farm is presented in Table 1. This case farm is located in west central Indiana, and has 1500 acres of corn and 1500 acres of soybeans. The number of workers include the operator, one full-time hired employee, and several part-time employees. Information pertaining to hired labor, family and operator labor, and value of farm production is needed to computer labor efficiency. For the case farm, labor efficiency is 6.35%. This means labor cost are 6.35% of the total value of farm production.

Labor productivity is $983,856 per worker for this example. This is calculated by dividing the value of farm production by the number of workers (hired employees, family employees, and operators). Information from farm management associations suggest that labor efficiency should be below 11% and labor productivity should be above $500,000 per worker. The benchmark values for this case farm easily achieved these values. Though not illustrated in this article, this case farm also has solid machinery use benchmarks. Thus, the case farm seems to be doing a good job of controlling both labor and machinery costs.

Conclusions

This article defined, described, and illustrated labor efficiency and productivity benchmarks. Using farm

management association data, labor efficiency measures for farms in the top one-third in terms of labor efficiency averaged 7.48%. Farms in the top one-third had labor efficiency measures less than 11.3%. Labor productivity measures for farm management association farms in the top one-third in terms of labor productivity averaged $708,216. Farms in the top one-third had labor productivity measures above $485,500. Using these results, farms that are effectivity utilizing their labor should target a labor efficiency measure (total labor cost divided by value of farm production) below 11% and labor productivity measure (value of farm production per worker) above $500,000. It is important to note that these benchmarks were developed using 2009 to 2013 data. The recent decline in value of farm production resulting from lower crop prices will make it more difficult to achieve these benchmark targets.

Table 1: Labor Efficiency and Productivity for a Case Farm, 2014

Plot Area ficiency	
Hired Labor	$41,201
Family & Operator Labor	$89,130
Total Labor Cost (TLC)	$130,331
Value of Farm Production (VFP)	$2,052,324
Labor Efficiency (TLC/VFP)	6.35%
Labor Productivity	
Value of Farm Production (VFP)	$2,052,324
Number of Workers	2.086
Labor Productivity (VFP/#Workers)	$983,856

Farmland Property Tax Assessments: Indiana General Assembly Slows the Explosive Growth Rate, For Now

Larry DeBoer, Professor and Tamara Ogle, Purdue Extension-Community Development Regional Specialist

Senate Enrolled Act 436 passed the General Assembly on the last day of the session, April 29, 2015. The vote was unanimous in both houses. The bill was signed by the Governor as Public Law 249 on May 6. The bill made many changes to property tax procedures. For agriculture, the most important change was the method used to calculate the base rate of farmland for property tax assessment.

Surging Farmland Taxes with the Old Formula

The base rate is the dollar figure per acre set by the Indiana Department of Local Government Finance (DLGF) each year. It's the starting point for the assessment of farm acreage for property taxes. The base rate has increased from $880 per acre in 2008 to $2,050 per acre for taxes this year, and was projected to rise above $3,000 per acre for taxes in 2018. These assessment increases caused a 47% increase in total agricultural property taxes during this period, at a time when total property taxes were falling by 6%.

The base rate has been calculated using a capitalization formula, which divides the net income from an average acre by a rate of return. The big base rate increase was due to rising corn and soybean prices and rising rents, which increased net income in the numerator of the formula, and due to falling interest rates which reduced the rate of return in the denominator. The data entered the formula with a four-year lag—meaning data from 2006 through 2011 were used to calculate the base rate for taxes in 2015. *Purdue Agricultural Economics Report* articles from April 2015 and August 2014 explain the workings of the capitalization formula in detail. See, https://ag.purdue.edu/agecon/Documents/PAER.April.2015.pdf

https://ag.purdue.edu/agecon/Documents/PAER_August%202014.pdf

Slower Increases with the New Formula

The General Assembly addressed the farmland assessment problem in SEA 436. Here's the text:

SECTION 7. IC 6-1.1-4-13.2 is added to the Indiana code as a new section to read as follows:

Notwithstanding the provisions of this chapter and any real property assessment guidelines of the department of local government finance, for the property tax assessment of agricultural land for the *2015 assessment date*, the statewide agricultural land base rate value per acre used to determine the value of agricultural land is *two thousand fifty dollars ($2,050)*. For the *2016 assessment date and each assessment date thereafter*, the statewide agricultural land base rate value per acre is equal to:

(1) the base rate value for the immediately preceding assessment date; multiplied by

(2) the *assessed value growth quotient* determined under IC 6-1.1-18.5-2 in the year including the assessment date.

This amount shall be substituted for any agricultural land base rate value included in the Real Property Assessment Guidelines or any other guidelines of the department of local government finance that apply for those assessment dates. (Italics added.)

When the legislature starts a bill with "notwithstanding," it means that the new law replaces any previous laws or regulations. In this case, the act says (twice) that this new rule replaces the existing guidelines of the DLGF. The base rate capitalization formula will be replaced.

The act mentions the 2015 assessment date. That's the base rate for taxes to be paid in 2016. Likewise, the 2016 assessment date is for taxes paid in 2017. We often use the phrase 2015-pay-2016 to keep this straight. The changes in this act take effect for taxes paid in 2016.

The base rate will be $2,050 for taxes in 2016. That's the same base rate being used for taxes this year, 2015. The base rate will be frozen for one year.

A new formula will be used for taxes in 2017 and for every year after that. The act as passed and signed makes a *permanent* change in the base rate formula.

The percentage increases in the base rate for taxes in 2017 and after will be based on the assessed value growth quotient (AVGQ). This is the six-year average of Indiana non-farm personal income, with a two-year lag. The AVGQ determines the annual increase in the maximum property tax levy for most local government funds.

The calculation excludes farm income in order to lessen big swings in maximum levy percentage changes. Farm income is more variable than other income. Using the AVGQ means that farmland assessments will be based on non-farm income. Of course, sometimes the farm and non-farm economies perform very differently.

For 2016 the AVGQ is expected to be 2.5%. After that the negative income growth rate from the recession year 2009 will drop out of the formula, and the AVGQ will be closer to 4% per year.

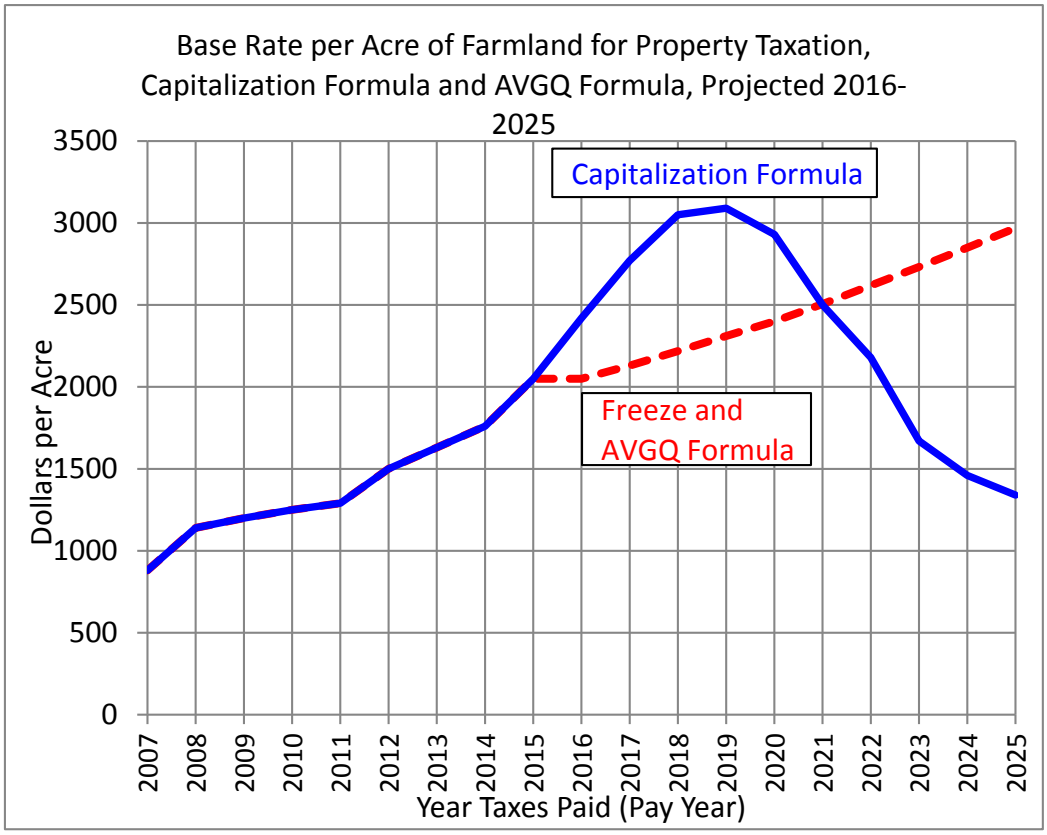
So, the base rate will be unchanged for taxes in 2016, and will increase by about 4% per year for taxes in 2017 and after.

Comparing Old and New Formulas

The figure (page 9) shows projections of the results of the two base rate formulas for 2015 to 2025. Later we explain the methods and sources for these projections. Of course, no one knows what will happen to prices, rents, interest rates or incomes over the next ten years, but these projections are based on the best estimates currently available. The results offer some idea of how the two formulas differ.

Under our estimates, the base rate per acre from the old capitalization formula continues to rise until 2019 when it is projected to peak at $3,090. After that, the lower prices starting in 2013 and the

estimated lower rents and higher interest rates starting in 2015 begin to enter the formula. The base rate begins to fall in 2020. By 2025 it's projected to be back near its value in 2011, at $1,340.



The new AVGQ formula increase is estimated to be between 3.9% and 4.5% per year from 2017 to 2025. Note that these are long-term projections of average income growth. No one tries to predict recessions so far in advance. In 2018 the AVGQ base rate is projected to be $2,219, 27% less than the capitalization projection of $3,050. However, the AVGQ base rate keeps increasing—the AVGQ has always been a positive number. In 2021 the two formula estimates meet at $2,500. After that, the AVGQ base rate is projected to be higher than the capitalization base rate. It is important to note that the act does not say "choose the lower base rate from the two formulas." Rather the AVGQ "replaces" the capitalization formula. Thus, sometime in the early 2020's, the AVGQ is anticipated to move base rates higher than if the capitalization formula had stayed in place.

Impact on Farmland Property Taxes

The Indiana Legislative Services Agency estimated in its fiscal note for SEA 436 that the switch to the AVGQ base rate formula will reduce farmland property taxes compared to what they would have been by $52.4 million in 2016, $86.5 million in 2017 and $111.1 million in 2018—a three year total of $250 million. So, farmland taxes will be lower compared to what would have happened under the capitalization formula for the next three years! However, it is important to note that the act does not reduce current farmland tax bills. It does mean that under the new formula, farmland property taxes will not rise rapidly, as they have in recent years, but farmland property taxes will not fall.

Under the AVGQ formula for the next several years, assessed values will be lower than they would have been. This means tax rates will be higher than they would have been. And, that means that the tax bills of other taxpayers will be higher. The LSA estimates that homeowners will pay $92 million more than they would have over the years 2016 to 2018. Tax rates will rise more where farmland is a larger share of the tax base, so the tax shifts will be greater in rural areas. In addition, higher tax rates mean that more taxpayers will be eligible for credits under the tax caps. Tax cap credits are lost revenue for local governments. LSA estimates the total revenue losses for 2016-18 at $67 million.

Real people won't be comparing their tax bills to what would have happened under an alternate formula. That's for policy analysts. Real people look at their tax bills year to year. For taxpayers under the AVGQ base rate, instead of big increases in

farmland taxes and smaller increases (or decreases) in homeowner taxes, there will be similar increases in the taxes on all kinds of property.

In 1999 the Indiana Supreme Court issued a decision that defined the Constitutional assessment standard as "objective measures of property wealth." Capitalization is a recognized method of measuring the value of assets. The AVGQ formula is not. We won't know whether the AVGQ formula is Constitutional in Indiana until there is a court case that ask the courts to make that evaluation.

The act makes the change to the AVGQ formula permanent, but at least some members of the Indiana General Assembly must think this is not the final word. Section 35 of SEA 436 reads

The legislative council is urged to request the appropriate study committee to study during the 2015 legislative interim the issue of alternative means of agricultural land assessment.

The topic has been assigned to an interim study committee. There likely will be hearings about farmland assessment in the State House during the summer and fall of 2015.

How We Estimated Farmland Base Rate Estimates to 2025?

For the projection of the farmland base rate using the capitalization formula we used long-term forecasts from the University of Missouri's Food and Agricultural Policy Research Institute (FAPRI) publication, *U.S. Baseline Briefing Book: Projections for Agricultural and Biofuel Markets.* The publication includes forecasts for price, yield and variable costs by crop from crop year 2014/2015 to crop year 2024/2025. These figures for corn and soybeans are included directly into the capitalization formula.

Estimates for Government Payments

In recent years, price or revenue safety net government programs in most cases have not been triggered for corn and soybeans. Only direct payments have entered the capitalization formula. However this changed with the 2014 Farm Bill. Direct payments are no longer used and in their place are basically two alternatives for farmers: Average Revenue Coverage and Price Loss Coverage. FAPRI has estimated the adoption rate for the two different programs both in corn and soybeans as well as the payments under each program over the next ten years. A weighted average based on the forecasted adoption rate of the two different programs was calculated for both corn and soybeans each year to estimate the government payments received for the capitalization formula. The corn and soybean average payments were then averaged to come up with an average total government payment for the given year.

Overhead Costs

Aside from a few outlier years, overhead costs have risen on average by 3% per year. This growth rate was used to forecast the overhead costs through 2025.

Cash Rent

The cash rent number used in the capitalization formula is the average cash rent for the state as reported by the Purdue Land Value and Cash Rent Survey less DLGF's estimate of the average property taxes per acre. To come up with this value we projected rent and average property tax separately.

For cash rent, we used Purdue's Michael Langemeier's projections for a west central Indiana farm taking the projected change in the west central Indiana cash rent and applying it to the state average.

For property taxes per acre, we ran a simple regression of the base rate on the property taxes per acre as estimated by DLGF. This equation was then used to estimate the property taxes per acre through 2025. The forecasted cash rent less this property tax estimation was used in the capitalization formula.

Capitalization Rate

The average farm real estate and farm operating interest rates are closely correlated with the ten-year Treasury bond rates. In January 2015 the Congressional Budget Office projected the ten-year Treasury rate will reach its long-term level of 5.0% in 2019. On average during 1993-2014, the farm rate exceeds the ten-year Treasury rate by 2.8 percentage points. We assume that the long-term farm rate will be 7.8%, that this rate will be reached in 2019, and that it will rise by annual six-tenth increments from 2014 to 2019.

Indiana Non-Farm Personal Income

The assessed value growth quotient (AVGQ) is based on the 6-year average of annual Indiana non-farm personal income growth. Non-farm income forecasts for Indiana were not available, so total income forecasts were used. Real Indiana income growth for 2015-17 was taken from the Indiana State Budget Agency's April 2015 Indiana budget forecast. Long run real income growth for Indiana was estimated at 2.15% per year by the State Utility Forecast Group in 2013. Nominal personal income growth is the sum of real growth and inflation. Inflation rates were taken from the Congressional Budget Office's ten-year economic projections from January 2015.

International Benchmarks for Corn Production

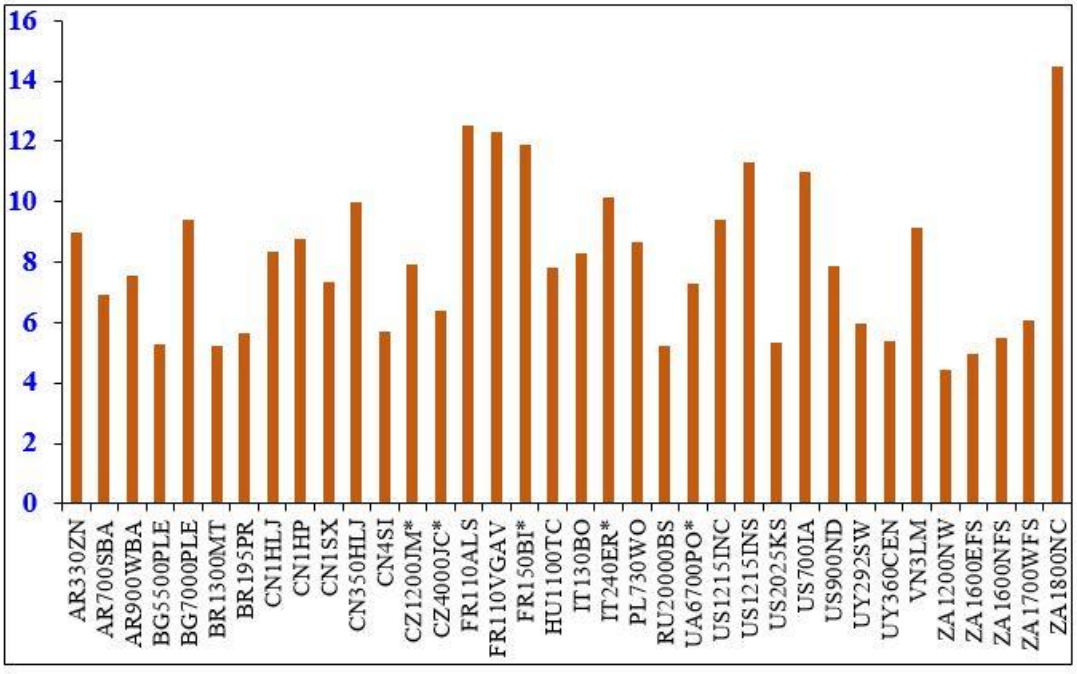
Elizabeth Lunik, Graduate Assistant, and Michael Langemeier, Center for Commercial Agriculture

Examining the competitiveness of corn production in different regions of the world is often difficult due to lack of comparable data and agreement regarding what needs to be measured. To be useful, international data needs to be expressed in common production units and converted to a common currency. Also, production and cost measures need to be consistently defined across production regions or farms.

This paper examines the competitiveness of corn production for important international corn regions using 2008 to 2013 data from the Agribenchmark network. Agribenchmark is a global network led by the Johann Heinrich von Thunen Institute of Farm Economics (vTI) in Braunschweig, Germany. They collect data on beef, cash crops, dairy, pigs and poultry, horticulture, and organic products for 32 countries. The Agribenchmark concept of typical farms was developed to understand and compare current farm production systems around the world. Participant countries follow a standard procedure to create typical farms that are representative of national farm output shares, and categorized by production systems or combinations of enterprises and structural features. Purdue contributes data for Indiana farms.

The sample of farms used in this paper came from 35 corn farms representing 16 countries (Argentina, Brazil, Bulgaria, Canada, China, Czech Republic, France, Hungary, Italy, Poland, Russia, South Africa, Ukraine, United States, Uruguay, and Vietnam) with data from 2008 to 2013. The country and farm abbreviations used in this paper are listed in Table 1.

Figure 1: Average Corn Yields (tons per hectare)



While the farms produce a variety of crops, this paper only considers corn production. Typical farms used in the Agribenchmark network are defined

Table 1. Abbreviations of Countries.

Country	Abbreviation
Argentina	AR
Brazil	BR
Bulgaria	BG
Canada	CA
China	CN
Czech Republic	CZ
France	FR
Hungary	HU
Italy	IT
Poland	PL
Russia	RU
South Africa	ZA
Ukraine	UA
United States	US
Uruguay	UY
Vietnam	VN

using country initials, hectares (1 hectare = 2.47 acres) on the farm, and location in the country. For example, the US1215INC farm is a U.S. farm with 1215 hectares (3000 acres) located in central Indiana. The other U.S. farms are defined as follows: US1215INS is a farm with 1215 hectares (3000 acres) located in southern Indiana, US2025KS is a farm with 2025 hectares (5004 acres) in northwestern Kansas, US700IA is a farm with 700 hectares (1730 acres) located in Iowa, and US900ND is a farm with 900 hectares (2224 acres) located in eastern North Dakota.

Corn Yields

Although yield is only a partial gauge of whole-farm performance, it reflects the available production technology across farms. Average corn yield for the farms in 2013 was 7.98 tons per hectare (127 bushels per acre). Figure 1 illustrates the average corn yield per hectare for each farm for the years data were available (between 1 to 6 years). Corn yields ranged from approximately 5 to 15 tons per hectare (80 to 239 bushels per acre). Farms with the highest yields were located in France, United States, or South Africa. The average land used for corn varied significantly across the farms, from 0.16 hectares to 1,870 hectares (0.4 to 4,621 acres).

Input Cost Shares

The mix of input use across the farms varies substantially. This is due to differences in technology adoption, input prices, fertility levels, efficiency of the farm operators, trade policy restrictions, exchange rate effects, and labor and capital market constraints, Figure 2 presents the average input cost shares for each farm. Cost shares were broken down into seven categories: seed, fertilizers, crop protection, labor, land, fixed capital, and other direct services. Fixed capital included the ownership costs associated with machinery and buildings, custom charges, depreciation, repairs and maintenance, energy costs other than drying, irrigation costs, crop insurance, and financing costs on direct inputs such as seed, fertilizers, and crop protection.

The average input cost shares for corn, beginning with the largest shares are as follows: fixed capital (27.8%), fertilizers (19.9%), land (18.3%), seed (11.9%), labor (11.2%), crop protection (5.6%), and other direct services (5.3%).

There is a lot of variation in costs across these world farms. Labor wage rates averaged $18 per hour, but ranged from $0.64 per hour to $140 per hour. Land rental rates averaged $285 per hectare ($115 per acre), but ranged from $13.81 per hectare ($5.59 per acre) to $1,161 per hectare ($470 per acre). Long-term interest rates averaged 7.3%, and ranged from 3% to 21%. Such large differences across the world mean that much different production systems are used in various areas.

Efficiency Measures

Technical and cost efficiency are commonly used benchmark measures. This paper focuses on cost efficiency which measures whether individual farms are producing on the production frontier (producing as much output as possible given its technology and input usage) and using the optimal mix of

inputs. A cost efficient firm is producing at the lowest cost for a specific level of output. An index of 1 indicates that a farm is cost efficient. Farms with indices less than 1 could improve cost efficiency by adjusting their production system and/or using a different input mix.

Table 2 presents cost efficiency indices for 13 world farms that had continuous corn data from 2008 to 2013. Cost efficiency indices ranged from 0.456 for one Brazilian farm to 1.000 for two farms from Argentina, a farm from Italy, a farm from the Ukraine, and one U.S. farm (Iowa farm). The farm from North Dakota (US900ND) had a cost efficiency index of 0.773. This farm has the potential to reduce cost by 22.7% (1.000 – 0.773) and still achieve the same level of output.

Conclusions

Purdue has been participating in a project to compare farms across the globe. This is not an easy task because of so many differences across borders and currencies and requires standardized procedures. Over time, we will be able to make more comparisons that can be beneficial to understanding how U.S. farms compare against competitors.

This paper examined the competitiveness of 35 corn farms in 16 countries using data from the Agribenchmark network. Corn yields and input cost shares varied substantially among the farms. If all of the farms were adopting the best available technology in their region and using the appropriate mix of inputs given local input prices, the cost efficiency index would be 1 for each farm. This, however, was not the case.

Cost efficiency averaged 0.84. This means that on average, farms could potentially lower costs by 16% and still achieve the same level of output.

Table 2: Summary of Cost Efficiency Indices for Corn Farms, 2008-2013.

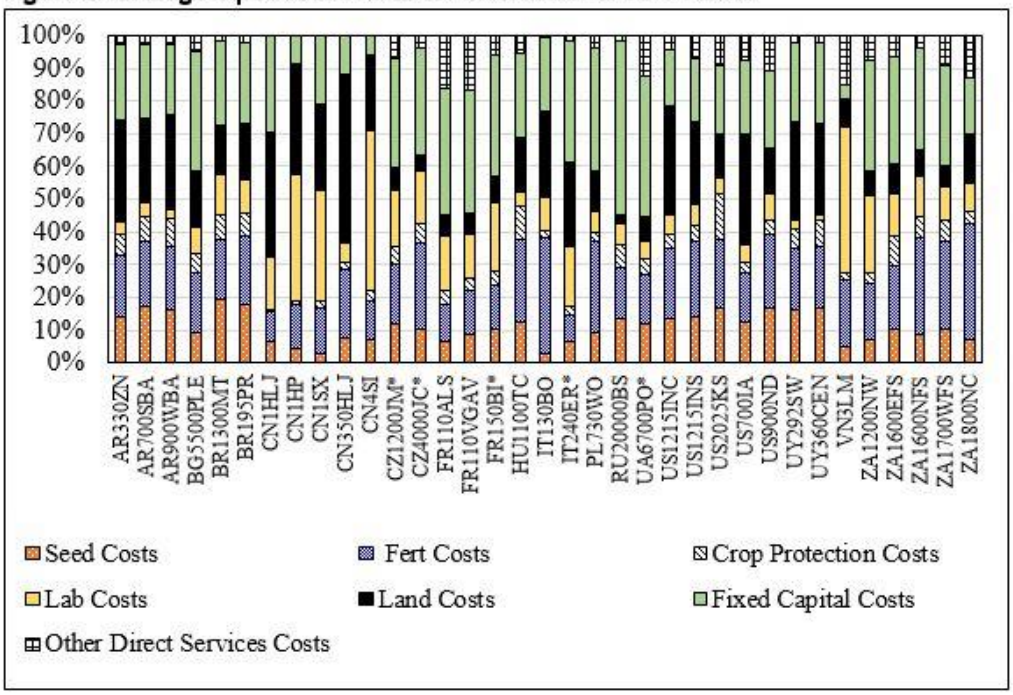
Farm	Index
AR330ZN	**1.000**
AR700SBA	0.861
AR900WBA	**1.000**
BR1300MT	0.812
BR195PR	0.456
CZ1200JM*	0.887
CZ4000JC*	0.715
HU1100TC	0.649
IT240ER*	**1.000**
UA6700PO*	**1.000**
US700IA	**1.000**
US900ND	0.773
ZA1700WFS	0.771

Note: Farms in bold are cost efficient.

This could be done with a better set of technology or a more optimum mix of inputs. Several farms had a cost efficiency index of 1 which means they were achieving their output at the lowest costs possible. These farms were from Argentina, Italy, Ukraine, and the United States.

In the future we hope to gain more insight into how Indiana farms can be among the most competitive in the world.

Figure 2: Average Input Cost Shares for International Corn Farms



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