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Past and Future of Farm Bill Payments

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IN THE summer of 2015, producers were allowed to elect their farms into one of the two new commodity programs introduced by the 2014 Farm Bill: Price Loss Coverage (PLC) or Agricultural Risk Coverage (ARC). The coverage of the latter program is offered at the county level (ARC-CO), and at the individual farm level (ARC-IC). Less than one percent of all US base acres are enrolled in ARC-IC. Each spring, farmers who want to participate in the elected commodity programs must enroll their farms, but cannot modify the program election decisions made in 2015. So far, farmers were able to enroll twice in ARC/PLC programs: in 2015 for the 2014/15 and the 2015/16 marketing years, and in 2016 for the 2016/17 marketing year.

Farm Bill payments corresponding to the marketing year 2015/16 were issued in October 2016. Total ARC-CO and PLC payments amounted to $7.7 billion and surpassed the 2014/15 payments by $2.4 billion.

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Lower commodity prices were the main drivers of the increase. Corn and soybean base acres account for 62 percent of total base acres in the United States, and 71 percent of the cumulative payments in 2015 and 2016 (Table 1).

The average marketing year corn price declined by 2 percent from $3.70 in 2014/15 to $3.61 in 2015/16, increasing the gap between annual prices and the Olympic average price used in the calculation of the ARC-CO revenue guarantee ($5.29 for both years), and triggering the first PLC payments for corn base acres (the reference price is $3.70).

The average marketing year soybean price declined by 11 percent from $10.10 in 2014/15 to $8.95 in 2015/16, increasing the gap with the Olympic average price in ARC-CO calculations ($12.27 for both years). However, PLC payments were not triggered for soybean base acres since the annual price was higher than the reference price: $8.40.

Payments by states

The states that received the largest cumulative Farm Bill payments are Iowa, Nebraska, Illinois, Minnesota, and Indiana. Corn and soybean base acres account for at least three-quarters of total base acres in each of those states. Those five states jointly account for 45 percent of the cumulative ARC-CO and PLC payments in the nation, and 99 percent of the payments were made through the ARC-CO program.

Since ARC-CO targets revenue risks at the county level, the distribution of payments across states changes not only due to national prices and the proportion of base acres in each covered

commodity, but also due to the evolution of county yields with respect to their historical averages. Average corn yields in Illinois and Indiana were lower in 2015 than in 2014, compounding the effect of lower corn prices and resulting in higher ARC-CO payments (Table 2). Indiana also experienced lower soybean yields in 2015. Iowa and Minnesota had higher corn and soybean yields in 2015, which resulted in lower payments. Nebraska, where wheat base acres account for 12 percent of all base acres, experienced a large fall in wheat yields that compounded the effect of much lower wheat prices and offset the effect of small increases in corn and soybean yields.

The number of farms receiving ARC-CO payments in any particular state varies from year to year. At the national level, 923,924 farms received ARC-CO payments across all covered commodities in 2015, and the number of farms increased to 1,208,392 in 2016. Iowa, Nebraska, Indiana, and Illinois had more farms that received ARC-CO payments in 2016 than in 2015. The average payment per farm increased in Illinois and Indiana, and declined in Iowa, Minnesota, and Nebraska (last column in Table 2).

Payments by county in Iowa

In Iowa, 22,528,220 base acres of covered commodities were elected into the Farm Bill programs, the equivalent of 9.3 percent of the national total (excluding generic acres). Corn and soybean base acres account, respectively, for 69 percent and 30 percent of all base acres. ARC-CO is the preferred program, with 97 percent of all base acres.

Since detailed information on the number of base acres per covered commodity, county, and program is not publicly available, the best possible approximation to county payments that can be calculated using official data

Table 1. Total U.S. ARC-CO/PLC Payments in 2014 and 2015, by Covered Commodity

	Base acres elected into ARC-CO/PLC		2014/15 ARC-CO/PLC payments		2015/16 ARC-CO/PLC payments		2015/16 vs. 2014/15
Covered Commodity	Number of Acres	% of Total	Dollars	% of Total	Dollars	% of Total	% Change
Corn	96,768,447	40%	$3,748,793,917	71%	$4,072,355,927	53%	9%
Soybeans	54,514,972	22%	$324,623,758	6%	$1,082,636,570	14%	234%
Other*	91,071,787	38%	$1,186,226,030	23%	$2,504,695,627	33%	111%
U.S. total	242,355,206	100%	$5,259,643,705	100%	$7,659,688,124	100%	46%

*Other covered commodities include barley, canola, chickpeas, crambe, flaxseed, lentils, mustard, oats, peas, rapeseed, safflower, sesame, sorghum, and sunflower.

Table 2. ARC-CO Payments in Selected States, Total and Average per Farm Paid

	Total Payment			Average payment per farm paid*		
State	2014/15	2015/16	Change	2014/15	2015/16	Change
Illinois	$234,772,932	$904,199,880	$669,426,948	$3,900	$6,197	$2,297
Indiana	$153,514,276	$529,577,483	$376,063,207	$2,509	$5,746	$3,237
Iowa	$907,407,794	$656,361,515	-$251,046,279	$7,576	$4,868	-$2,708
Minnesota	$678,862,759	$390,439,265	-$288,423,494	$7,748	$5,395	-$2,353
Nebraska	$620,801,639	$634,924,778	$14,123,139	$8,674	$8,436	-$238
Other States	$1,890,515,567	$2,704,721,647	$814,206,080	$3,611	$3,932	$321
US Total	$4,485,874,967	$5,820,224,568	$1,334,349,601	$4,855	$4,817	-$39

*Total ARC-CO payment / number of ARC-CO farms paid

Table 3. Average Farm Bill Payments per Base Acre in Iowa, by Crop Reporting Districts

Covered Commodity and District	ARC-CO				PLC		
	2014/15	2015/16e	2016/17f A	2016/17f B	2014/15	2015/16e	2016/17f
Corn							
CRD1	$74.53	$38.24	$0.80	$15.72	$0.00	$11.65	$38.84
CRD2	$72.00	$38.69	$5.17	$25.20	$0.00	$11.02	$36.73
CRD3	$71.97	$49.82	$16.34	$39.81	$0.00	$10.93	$36.45
CRD4	$60.62	$40.23	$8.78	$29.39	$0.00	$11.16	$37.19
CRD5	$47.97	$36.07	$6.05	$29.45	$0.00	$11.00	$36.66
CRD6	$58.76	$58.18	$30.61	$53.44	$0.00	$10.89	$36.31
CRD7	$38.21	$27.61	$11.53	$14.76	$0.00	$9.76	$32.54
CRD8	$0.57	$1.35	$3.75	$9.47	$0.00	$7.72	$25.73
CRD9	$1.19	$11.87	$13.51	$10.75	$0.00	$9.18	$30.59
State Average	$47.70	$33.51	$10.35	$25.14	$0.00	$10.40	$34.65
Soybeans							
CRD1	$18.37	$6.99	$0.00	$0.00	$0.00	$0.00	$0.00
CRD2	$19.78	$1.26	$0.00	$0.00	$0.00	$0.00	$0.00
CRD3	$19.43	$23.99	$0.00	$4.23	$0.00	$0.00	$0.00
CRD4	$2.13	$9.63	$0.00	$0.00	$0.00	$0.00	$0.00
CRD5	$17.54	$23.88	$0.00	$3.47	$0.00	$0.00	$0.00
CRD6	$4.63	$31.88	$0.00	$7.98	$0.00	$0.00	$0.00
CRD7	$3.65	$16.51	$0.00	$1.44	$0.00	$0.00	$0.00
CRD8	$2.78	$13.03	$0.00	$2.95	$0.00	$0.00	$0.00
CRD9	$1.60	$16.15	$0.00	$1.05	$0.00	$0.00	$0.00
State Average	$10.19	$15.68	$0.00	$2.26	$0.00	$0.00	$0.00

is per base acre of corn and soybeans. ISU Extension and Outreach developed several tools to help farmers calculate their expected payments by county, commodity, and program (available on the Ag Decision Maker website at *https://www.extension.iastate.edu/agdm/info/farmbill.html*). A visual tool showing the dispersion of ARC-CO and PLC payments per base acre across all 99 counties in Iowa is available on the CARD website at *http://card.iastate.edu/tools/farm-bill/arc-plc/*.

Table 3 lists the simple average ARC-CO and PLC payments per base acre for each crop reporting district (CRD) and for the state (after 6.8 percent sequestration). Crop reporting districts are numbered from west to east, and north to south (i.e., CRD1 is the northwest district, and CRD8 is the south-central district). The averages hide substantial variability across counties, but are indicative of the overall trends. For 2014/15 and 2015/16, official FSA prices and county yields are used in the calculation of actual county revenues. Comparing ARC-CO payments versus PLC payments for each year (horizontally in Table 3), it becomes apparent that ARC-CO payments per base acre were generally higher than PLC payments in 2014/15 and 2015/16 (except for some counties with exceptionally high corn yields in 2015 concentrated in CRD8). Comparing across covered commodities (vertically in Table 3), corn payments exceed soybean payments within each program for 2014/15 and 2015/17 in all CRDs (only four counties had higher payments per base acre for soybeans than for corn in 2014/15, and 17 counties in 2015/16).

Two scenarios are projected for ARC-CO payments in 2016/17, based on different yield projections. In scenario A, yields in 2016/17 are projected as 2015/16 county yields times the ratio of 2016-to-2015 yields for the state of Iowa (1.06 for corn, and 1.07 for soybeans). In scenario B, yields in 2016/17 are projected equal to the highest of yields in 2014/15 or 2015/16. The marketing year average prices for 2016/17 correspond to the midpoint of USDA's projections as of January 12, 2017: $3.40 for corn and $9.50 for soybeans. Both scenarios are unrealistic per se, but provide a reasonable projection of the range of possible payments. The visual tool available on the CARD website includes updated price and yield projections. As official county yield estimates and new price projections become available from USDA, the tools in the CARD website and the Ag Decision Maker website will continue to be updated.

Under both scenarios, ARC-CO payments for corn and soybeans in 2016/17 are projected lower than in 2015/16 for most counties (only nine counties under scenario A and 22 counties under scenario B are projected to have higher ARC-CO payments per corn base acre). The main reason behind the projected decline in ARC-CO payments is the decline in Olympic average prices (-9.5 percent to $4.75 for corn, and -3.3 percent to $11.87 for soybeans) due to the roll-out of 2010/11 prices from the Olympic average and the roll-in of the much lower 2015/16 prices. Note that the Olympic average price is multiplied by the Olympic average yield to calculate the ARC-CO revenue guarantee. At the state level, the Olympic average yield increased by 5.2 percent for corn and 1.8 percent for soybeans in 2016/18. The ARC-CO revenue guarantee declined, on average, by 5.3 percent to $706 per corn base acre, and 1.6 percent to $521 per soybean base acre.

PLC payments in Iowa are expected to become significant for the first time since the inception of the Farm Bill. In other states, such as Arkansas and Texas, PLC payments for peanuts, wheat, and rice base acres have been significant since 2014/15.

PLC payments per corn base acre are projected to surpass ARC-CO payments in most Iowa counties (only six counties under scenario A and 33 counties under scenario B are projected to have higher ARC-CO payments). However, due to the small proportion of base acres elected into PLC in Iowa, the overall impact of these higher payments will be minor.

In conclusion, ARC-CO and PLC payments have funneled a considerable amount of resources to the agricultural sector in times of low profit margins. In particular, ARC-CO has been instrumental in cash flowing operations in Iowa counties where payments were triggered. However, corn payments were not triggered in 23 counties in 2014/15 and 16 counties in 2015/16, and soybean payments were not triggered in 50 and 33 counties, respectively. For 2016/17, ARC-CO is expected to provide payments in fewer counties, and at substantially lower levels. Due to the rolling nature of the Olympic averages, the revenue guarantee for corn and soybean base acres is expected to decline further in 2017/18 and result on a shrinking safety net for Iowa farmers. ■

Motorists' Willingness to Pay for E85 versus E10

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IN NOVEMBER 2016, the Environment Protection Agency (EPA) released the final rule for biofuel volumes under the Renewable Fuel Standard (RFS) for 2017. The total renewable fuel volume requirement for 2017 is 19.28 billion gallons, up from 18.11 billion gallons in 2016. Of the total renewable fuel volume, 15 billion gallons may be met with conventional biofuel, establishing the implied mandate for ethanol. This ethanol mandate was 14.5 billion gallons in 2016. Much has been written about the blend wall and how difficult it is for ethanol consumption to exceed the volume that can easily be blended in regular gasoline (E10), which contains no more than 10 percent ethanol. There are many ways to break the blend wall, but it appears that greater sales of gasoline blends that contain more than 10 percent ethanol will play a major role. In two recent studies, we examine the demand for E85, which contains between 70 and 75 percent ethanol.

Past E85 sales volumes have been relatively small for three main reasons. First, while E10 is offered at virtually all of the 110,000 fuel stations in the United States, E85 is offered at less than 3,000 fuel stations. A recent grant program of the United States Department of Agriculture (USDA) aims at increasing the number of stations that offer high-ethanol blends of gasoline. Thus, the number of fuel stations that offer E85 is expected to increase in the next year and become less of a bottleneck in the expansion of E85 sales.

The second reason sales volumes have been small is that E85 can only be used by flexible-fuel vehicles (FFVs). The number of FFVs in the United States is currently less than 10 percent but growing steadily.

We found that 13 percent of motorists who fueled with E10 did not know their vehicle was an FFV that could use E85. Among those who knew their vehicle was an FFV, 62 percent had never fueled with E85, and 26 percent did not know that the fuel station where they were interviewed offered E85.

The third reason E85 sales volumes have been relatively small is that the majority of motorists who are able to both use and access E85 have not been fueling with it. Our research focused on US motorists with FFVs (flex motorists), their attitudes toward E85, and why they choose the fuel they choose. We conducted a survey of flex motorists at fuel stations offering E85 in Arkansas, California, Colorado, Iowa, and Oklahoma. The retail model was slightly different at the stations we visited in California, and there were other confounding factors. In the interest of brevity, we omit the California data from the following summary of our findings.

We approached flex motorists at fuel stations immediately after they began fueling with either E10 or E85, and we asked a few questions to assess their knowledge and preferences. Ignorance about E85 appears to be one of the reasons why more motorists do not fuel with E85. Table 1 shows survey responses from motorists who fueled with E10. We found that 13 percent of motorists who fueled with E10 did not know their vehicle was an FFV that could use E85. Among those who knew their vehicle was an FFV, 62 percent had never fueled with E85, and 26 percent did not know that the fuel station where they were interviewed offered E85.

Table 2 summarizes responses to opinion questions about which fuel is better, either ethanol (E85) or gasoline (E10). First, observe that many motorists could not correctly answer several of our questions, signaling lack of information about the two fuels, especially among motorists who selected E10. As expected, motorists who fueled with E85 tended to have a better opinion of ethanol than those who fueled with E10. Whether ethanol is actually better than gasoline for the environment, the economy, and national security is not established with certainty, and responses to these questions may reflect flex motorists' sources of information. However, for the questions about which fuel is better for their engine and which fuel yields the most miles per gallon, the facts are established. Car manufacturers are clear that E10 and E85 are equally as good for the engine, but small proportions of E10 and E85 flex motorists responded that there is no difference. It is also a fact that gasoline yields more miles per gallon than ethanol. Of the E10 motorists, 69 percent answered correctly, and 61 percent of the E85 motorists answered correctly.

We find that prices for E10 and E85 are the most important factors in flex motorists' decisions to fuel with E10 or

Table 1. Responses from Flex Motorists who Fueled with E10

	Yes	No /Don't know	Total
Is your vehicle flex-fuel capable of using E85?	368 (87%)	56 (13%)	424
Have you ever fueled with E85?	140 (38%)	228 (62%)	368
Did you know this station sells E85?	273 (74%)	95 (26%)	368

Table 2. Responses to Fuel Opinion Questions

	Ethanol	Gasoline	No difference	Don't know
Flex motorists who fueled with E10 (424 responses)				
Which fuel is better for the environment?	63%	11%	15%	12%
Which fuel is better for your engine?	21%	51%	15%	13%
Which fuel is better for the economy?	49%	28%	10%	12%
Which fuel is better for national security?	38%	22%	18%	22%
Which fuel yields more miles per gallon?	11%	69%	5%	15%
Flex motorists who fueled with E85 (226 responses)				
Which fuel is better for the environment?	72%	4%	16%	9%
Which fuel is better for your engine?	40%	31%	16%	13%
Which fuel is better for the economy?	73%	12%	9%	6%
Which fuel is better for national security?	55%	14%	11%	20%
Which fuel yields more miles per gallon?	21%	61%	5%	12%

E85. If flex motorists only cared about the cost per mile driven, they would fuel with E85 when its price is less than 75 percent of the price of E10. However, other considerations enter into a motorist's decision, including the opinions discussed above. We find, after controlling for opinions, that the average flex motorist switches from E10 to E85 when the price of E85 is between 53 and 63 percent of the price of E10. This means that the average flex motorist discounts E85 by 20–25 percent more than the 75-percent price ratio that corresponds to cost-per-mile equivalency. With the price of E10 currently at about $2.40 per gallon, E85 would need to sell at less than $1.39 per gallon for a majority of flex motorists to fuel with E85.

Our studies show that motorists are still quite uneducated about high-ethanol gasoline blends such as E85 and that motorists considerably discount E85 compared to E10. Sales of E85 will be important for meeting the 2017 renewable fuel volume requirement. Increasing sales of E85 enough for compliance will require significantly lowering the E85 price and better educating flex motorists. ■

ADVANCING SUSTAINABILITY
College of Agriculture & Life Sciences

CALS Sustainability Symposium
April 13, 2017, Scheman Building, Iowa State University, Ames, Iowa

The day's activities at Scheman Building will begin at 9 a.m. with a presentation by Catherine Woteki, former under secretary of the USDA's Research, Education and Economics mission area and its chief scientist, about sustainability efforts at the federal level.

Catherine Woteki, a past CALS dean, will speak about the federal government's sustainability efforts. There also will be a poster session and panel discussions about sustainability in the college.

The symposium is being organized by the CALS Sustainability Task Force. The task force was formed last year to begin a college-wide dialogue on sustainability to consider how the college can focus and more fully engage in sustainability across our research, education and extension and outreach missions.

You can find out more about its work at the CALS Sustainability Task Force website.

www.card.iastate.edu/sustainability

International Trade Has Been Major Source for Strengthening Prices

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OVER THE past few months, crop and livestock prices have worked their way higher despite record production across the board. Those large supplies have been met by strong demand for agricultural products. International demand has increased significantly and that has allowed prices to rise. Recent policy discussions, such as the potential for the US to impose import taxes, have heightened concerns that export demand may retreat. However, currently, the international marketplace is providing a surge of support to the US farm economy. Protein demand globally seems to be driving export growth for both livestock (direct meat demand) and crops (feed grain demand to raise more livestock and meat). All export data shown is as of Feb. 4, 2017.

For the beef industry, most of the export surge has come from the Pacific Rim. Japan and South Korea have accounted for most of the double digit growth in beef exports. Japan has re-established itself as the top market for US beef after a multi-year setback in trade following the discovery of bovine spongiform encephalopathy (BSE) in the United States in 2003. Roughly 25 percent of all US beef exports now enter Japan. In 2016, South Korea emerged as our second-largest market, taking 17 percent of our beef exports. As the policies in the US-Korea Free Trade Agreement have come into effect, US beef exports to South Korea have grown significantly. Rounding out our top five beef export markets are Mexico, Canada, and Hong Kong. Mexico and Canada are our partners in the North American Free Trade Agreement (NAFTA), so trade agreements have factored heavily in beef trade. The United States' withdrawal from the Trans-Pacific Partnership (TPP) has dampened the outlook for US beef export growth, as the TPP agreement was projected to expand US beef exports by roughly 8 percent in the partner countries (estimate from the US International Trade Commission), with most of the growth originating from Japan and Vietnam. However, despite that setback, current USDA export projections for 2017 show beef exports growing by 6 percent.

Pork exports have also increased over the past several months. China has been the major source of the surge, doubling pork purchases from the United States. While Japan has traditionally been our top market for pork, Mexico took over the top spot in 2015 and continues to be our largest pork market, capturing 30 percent of US pork exports, and Japan is now second with 24 percent. Canada, China, and South Korea each absorb roughly 10 percent of US pork exports. Therefore, as with beef, most major pork export markets are also partners in trade agreements. USDA's current projections show pork exports increasing by 5 percent in 2017, continuing the growth from the past year.

Corn export sales this marketing year have consistently exceeded our export pace for the last few years. As

Table 1. US Beef Exports Changes, Jan.-Nov. 2016

	Year-to-Date	
Country	1,000 lbs	Percent
Japan	98,130	19%
South Korea	110,764	38%
Mexico	27,796	8%
Canada	-18,363	-6%
Hong Kong	-17,692	-6%
China (Taiwan)	23,042	23%
Netherlands	-4,269	-12%
Chile	1,871	8%
Philippines	-6,846	-23%
Vietnam	4,920	45%
Dominican Republic	-4,239	-21%
United Arab Emirates	1,150	8%
Italy	-3,000	-18%
Guatemala	3,010	33%
Other Countries	9,881	9%
Total	226,153	11%

Source: USDA-ERS

Table 2. US Pork Exports Changes, Jan.-Nov. 2016

	Year-to-Date	
Country	1,000 lbs	Percent
Mexico	16,874	1%
Japan	-55,946	-5%
Canada	5,774	1%
China (Mainland)	234,167	100%
South Korea	-92,915	-21%
Australia	9,041	6%
Hong Kong	25,740	23%
Colombia	32	0%
Philippines	3,603	5%
Honduras	10,307	18%
Dominican Republic	7,538	13%
Chile	4,245	11%
Guatemala	2,252	6%
Panama	2,728	11%
Other Countries	-13,794	-8%
Total	159,646	3%

Source: USDA-ERS

harvest began, the export market had already purchased over 600 million bushels of US corn, roughly doubling the advance sales from the 2015 crop. Since then, another billion bushels have been sold to international buyers. Mexico is our largest customer, buying just over a quarter of all corn exports. Japan is second with 15 percent. South Korea, Colombia, and Taiwan round out the top five corn export markets. Just behind Taiwan in corn exports is Peru. Within the past few years, Colombia and Peru signed trade agreements with the United States, and effects of those agreements are now showing up in increased corn demand from both countries. Current USDA projections indicate by the end of the marketing year (August 31, 2017), the United States will export 2.225 billion bushels of corn. That computes to a 17 percent growth in US corn exports; and given the record 15 billion bushel corn crop this past fall, export growth was definitely needed to stabilize prices.

The growth in soybean exports has not been as dramatic as for corn this year, but then again, soybean exports have set records for the past five years in a row. Exports are a vital portion of the US soybean market, as roughly half of all of the soybeans produced in the United States will be shipped to other countries. For comparison, approximately 12 percent of all US corn and beef and 20 percent of all US pork is exported. China is by far the dominant export destination for soybeans. So far this marketing year, China represents two-thirds of all soybean export sales. Currently, the annual growth in China's soybean demand from the United States is 300 million bushels, nearly the size of Indiana's total soybean production. However, we have also seen growth in soybean demand from the European Union, Japan, and Indonesia. The only weak spot in soybean export demand has been Mexico, as sales are off by over 25 percent. USDA's projections have soybean exports finishing above two billion bushels for the first time ever with the 2016/17 marketing year.

Across all of these commodities, export demand has surged at a crucial time. US agricultural production has been incredibly strong for the past few years. The record meat, corn, and soybean supplies have significantly reduced prices. Without the export boost, that trend would have continued. However, with exports growing, crop and livestock prices have recovered enough to improve farm cash flows and provide some profit opportunities. The political rhetoric over the past few weeks has created a great deal of uncertainty about US trade policy. US agriculture has benefited significantly from trade agreements that have lowered tariffs and other trade barriers. With the re-opening of some of those agreements and the talk of new border taxes, US agriculture could see a reversal of some of those gains. ■

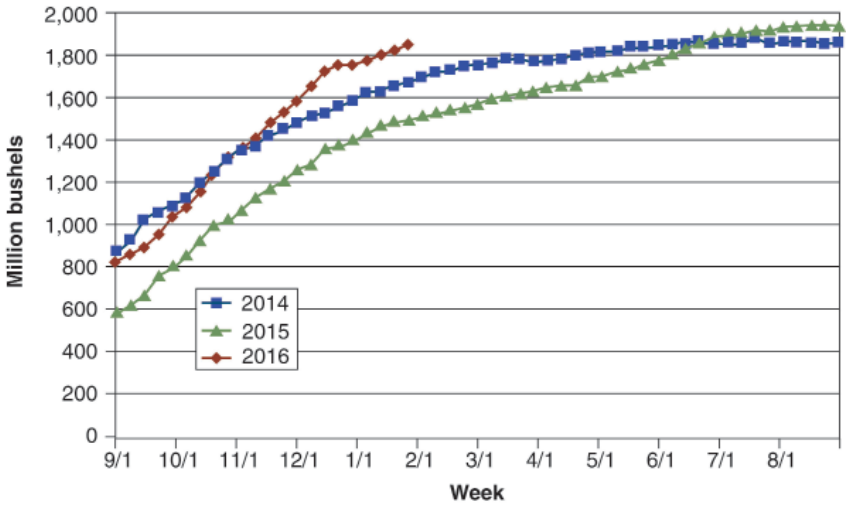

Figure 1. US Corn Export Sales
Source: USDA-FAS

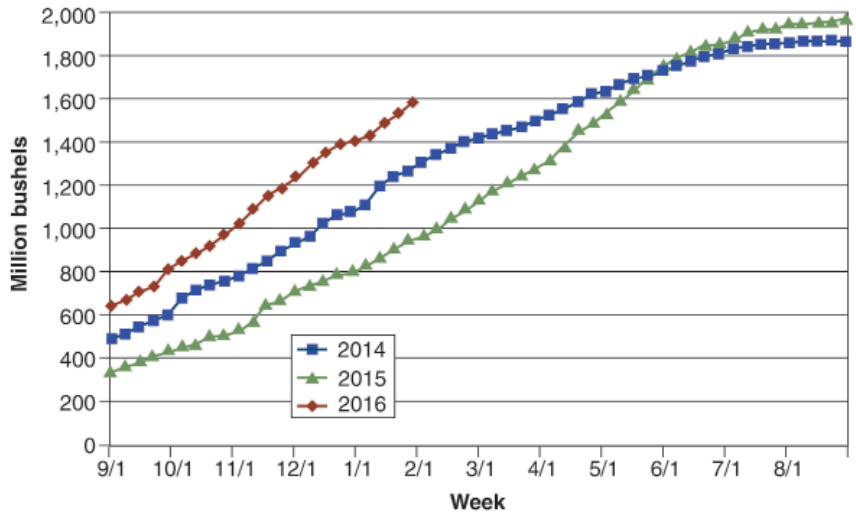

Figure 2. US Soybean Export Sales
Source: USDA-FAS

Hospital Closure and Hospital Choice: How Hospital Quality and Availability will Affect Rural Residents

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THE POPULATION shift from rural to urban regions has decreased the population density around hospitals in small towns and rural areas. At the same time, the availability of improved road systems that lower travel times, an improved ability to deliver health services via the Internet, and larger urban-rural gaps in access to the latest medical technologies may make urban hospitals more attractive for rural patients. Following a pattern of decline that started in the 1970s, these factors have led to a steady decrease in the number of rural hospitals over the last two decades—since 1990, the number of rural hospitals has decreased 20 percent while the number of urban hospitals has only decreased 3.5 percent (Figure 1).

To help stop the decline in the number of rural hospitals, in the 1990s Medicare enacted the Critical Access Hospital program. With rural hospitals being particularly dependent on publicly subsidized healthcare—almost 60 percent of their revenue comes from Medicare and Medicaid—the program was devised to prop up hospitals in isolated areas where residents had few other healthcare options.

Under its original rules, these hospitals had to be located at least 35 miles away from any other hospital, which means only about one-third of the nation's 1,300 Critical Access Hospitals would have qualified under the original rules. However, the law was amended to allow states to designate "necessary provider" hospitals, which lessened or removed proximity restrictions.

More recently, federal budgetary constraints have led to renewed interest in re-imposing the more stringent rules, which would lead to further closure of rural hospitals in Iowa and elsewhere.

This study estimates how rural patients make tradeoffs between hospital quality and distance in deciding whether to choose the nearest hospital or to travel farther for an alternative. We base our analysis on an empirical model that estimates the sensitivity of rural choice of local, urban, or specialized research hospitals on distance to, and quality of, each of the three hospital options. We derive estimates of hospital choice for inpatient visits, for outpatient visits, separately for the most commonly diagnosed illnesses, and for emergency or nonemergency admissions. We use these estimates to simulate how potential hospital closings will alter hospital choices made by rural Iowa patients. We illustrate how two hospital closing scenarios: (*a*) closing 25 percent of the lowest quality rural hospitals; and, (*b*) closing 15 percent of the least-used rural hospitals in Iowa, affect the average distance to, and quality of, the chosen hospital.

Few studies have evaluated the role of hospital quality in patient choices; however, this is likely to be a key factor explaining the incentives to bypass rural hospitals. Liu et al. (2007) surveyed 647 hospital inpatients for their assessments as to why patients would bypass a local hospital. Following the lack of local specialists, the second-most common reason cited for bypassing a local hospital was poor reputation or quality of local care.

Health Grades, Inc. compiled the data on hospital quality. There are significant quality differences between hospitals, exemplified by the company's simple one-to-five-star rating system. To avoid missing data, we used the two most common ailments, heart failure and pneumonia, to measure

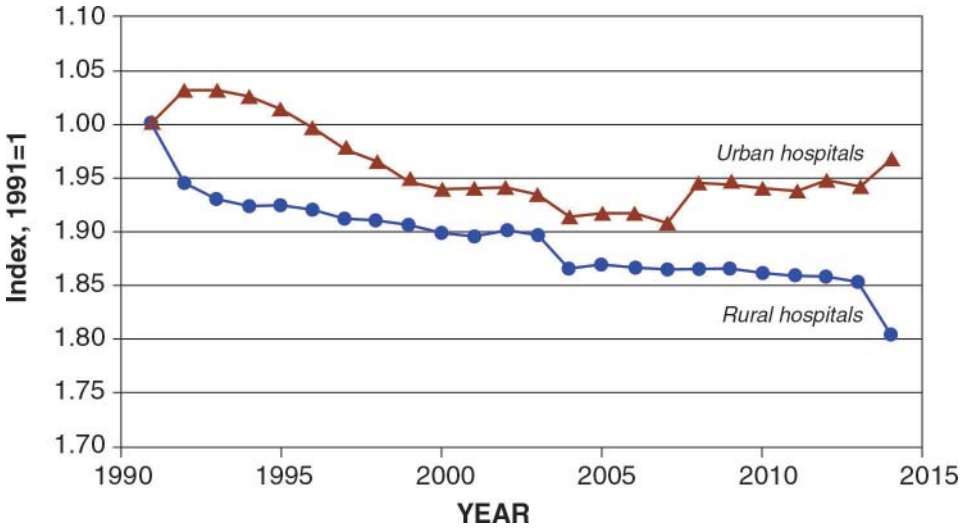

Figure 1. Urban and rural community hospitals in the United States, 1991-2014

Note: Index = 1 in 1991, series adjusted for change in data series in 2004

hospital quality.[1] Table 1 illustrates a pronounced rise in quality when comparing rural hospitals to urban or research hospitals, with urban hospitals actually marginally outperforming research hospitals.[2]

To estimate the tradeoffs between the two factors in hospital choice we were granted access to the Iowa Hospital Association recorded visits for all Iowa hospitals occurring between January 1, 2002 and December 31, 2002. The database includes 209,687 inpatient records for patients treated and discharged during this period and 138,685 outpatient records. Inclusion in the outpatient database does not require admission or release from the hospital, but only that the patient received treatment at an Iowa hospital. We then divided hospitals into rural, urban, and research groups. Rural hospitals are designated by the population density of the hospital county. Urban hospitals reside in counties containing a metropolitan statistical area. The research hospitals are located in Des Moines and Iowa City.

Our focus is on the determinants of hospital choice for rural patients—defined as those whose residence is in a zip code region listed as rural by the US Census in 2000. Distance was calculated as the straight line distance from the latitude and longitude of the patient's home zip code to the latitude and longitude of the nearest rural, urban, and research hospital even if none of those hospitals were chosen.

As shown in Table 1, hospital choices do not differ much between inpatient and outpatient treatments. Almost 70 percent of rural residents choose a rural hospital for inpatient and outpatient service. Urban hospitals serve 12 percent of rural residents and 18 percent are served by research hospitals. The average rural patient lives about five miles from a rural hospital, but lives 51 miles from the nearest urban hospital and 71 miles from the nearest research hospital.

The results of our model of inpatient and outpatient hospital choice are presented in Table 2. The key variables of interest are distance to and quality of the nearest hospital of each type. Distance is the single largest driving factor in the choice of hospital. At sample means, a 10 percent increase in distance lowers the probability of choosing that hospital type for inpatient services by 12.9 percent. Hospital choice is less sensitive to quality, although a tradeoff between distance and quality is apparent. A 10 percent improvement in quality increases likelihood of choosing that hospital by 2.3 percent for an inpatient procedure. Hospital demand for outpatient services is also sensitive to distance, but not quality. Our findings suggest that women, older patients, and patients who do not pay through insurance are more distance sensitive.

We expect that patients with severe or time-sensitive needs might be more sensitive to distance and less sensitive to quality. For inpatient hospitalizations, the three admission codes—ordered from most to least critical—are emergency, urgent, and elective. Consistent with our expectations, emergency and urgent admissions are much more sensitive to distance than elective (Table 3). A 10 percent increase in distance leads to a 17.5 percent and 16.1 percent reduction in the probability of choosing a hospital for emergency and urgent patients respectively, while

Table 1. Mean Values of Variables by Hospital Location and Inpatient/Outpatient Status

	Inpatient					Outpatient			
	Total	Rural	Urban	Research		Total	Rural	Urban	Research
Hospital Choice (Share)		0.69	0.12	0.19	Hospital Choice (Share)		0.70	0.12	0.18
Distance/100	0.43	0.05	0.51	0.71	Distance/100	0.42	0.05	0.51	0.70
Quality	3.3 2	2.45	3.84	3.66	Quality	3.28	2.46	3.79	3.60
Age/10	5.45				Age/10	5.57			
Male	0.41				Male	0.44			
Insurance	0.3 5				Insurance	0.45			
Self-pay	0.036				Self-pay	0.020			

[1]We were able to get information on hospital quality based on heart and pneumonia deaths for 117 of the 119 hospitals in Iowa. Quality measures based on other criteria were missing for at least 31 percent of the hospitals.

[2]This is consistent with reported hospital infection rates for the University of Iowa Hospitals, which were higher than for urban hospitals, possibly because the research hospitals treat more complicated cases.

it only leads to a 8.3 percent drop for elective procedures. Choice of where to receive emergency and urgent care is also sensitive to quality, while choice of hospital for elective procedures is virtually unaffected by quality. For patients with insurance, quality is more important for both emergency and elective procedures.

A notable finding of this paper is that the quality of a health institution is an important factor in hospital choice, and that patients assess tradeoffs in distance and quality when deciding where to get hospital services. The tradeoff is most salient for inpatient treatments and for emergency or urgent care. Proximity largely drives hospital choice for elective procedures and outpatient services. Our results are consistent with previous research that concludes patients with severe or complicated issues will seek out higher quality care, while people with time-sensitive conditions and the elderly are more distance sensitive. Our findings also illustrate that patients with insurance coverage are more sensitive to quality.

Our simulations show that closing 15 percent of the least-used rural Iowa hospitals results in a marginal increase in distance (around 1.8 miles) and a small decrease in quality, while closing 25 percent of the lowest quality hospitals results in a marginal increase in distance (around 2.9 miles) and a significant increase in quality.

To analyze differential impacts, we separate the analysis by inpatient-outpatient, admission type, and diagnosis. Closing the 15 percent least-used hospitals have more pronounced effects on expected quality and distance for outpatient admissions over inpatient, while closing the 25 percent lowest-quality hospitals have similar magnitudes for both.

When segregating by type of admission (emergency, urgent, or elective), we found that closing the 15 percent least-used hospitals increased expected distance the most for elective procedures. The reductions in quality were largest for the urgent and emergency patients who originally chose a closed hospital.

On the other hand, closing the 25 percent lowest-quality hospitals resulted in a substantial rise in expected quality coupled with only a slightly greater increase in expected distance. For the elective admission type, there is no significant change in expected distance with patients still benefiting from the higher quality. For emergency and urgent admission types, the increased distance is partially offset by large gains in expected quality. As a result, closing the lowest quality hospitals is a better policy prescription, providing a substantial increase in quality with only a marginally higher increase in distance. ■

Table 2. Conditional Logit Estimation of Rural Resident Hospital Choice by Inpatient and Outpatient Status, Hospital Quality and Hospital Distance, 2002

	Inpatient (N=209,687)		Outpatient (N=138,685)	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Distance	-2.7882 (-45.38)	-0.5136 (-51.22)	-0.3790 (-4.86)	-0.0612 (-4.97)
Age x Distance	-0.0625 (-11.06)	-0.0115 (-11.03)	-0.3151 (-42.28)	-0.0508 (-38.93)
Male x Distance	0.8086 (28.78)	0.1490 (28.37)	0.3088 (9.21)	0.0498 (9.18)
Insurance x Distance	0.1031 (2.95)	0.0190 (2.95)	-1.1152 (-28.44)	-0.1799 (-27.39)
Selfpay x Distance	-0.9014 (-10.56)	-0.1661 (-10.54)	-1.0127 (-9.22)	-0.1634 (-9.19)
Quality x Distance	-0.3380 (-24.04)	-0.0623 (-21.47)	-0.4145 (-23.16)	-0.0669 (-19.80)
Quality	0.1381 (11.95)	0.0254 (11.53)	-0.0170 (-1.06)	-0.0027 (-1.06)
Age x Quality	0.0008 (.58)	0.0002 (.58)	0.0099 (4.90)	0.0016 (4.89)
Male x Quality	0.0240 (3.65)	0.0044 (3.65)	0.0209 (2.56)	0.0034 (2.56)
Insurance x Quality	0.0659 (7.85)	0.0121 (7.86)	0.1031 (10.51)	0.0166 (10.51)
Selfpay x Quality	0.0995 (4.84)	0.0183 (4.83)	0.3127 (10.04)	0.0505 (9.97)
Pseudo R2	.39		.40	
Log likelihood	-141234.9		-91638.0	
Elasticities				
Distance	-1.29 (-245.1)		-1.30 (-202.9)	
Quality	0.23 (28.1)		-0.06 (-5.38)	

Notes: Dependent Variable is Choice of Rural, Urban or Research Hospital.
t-statistics are in parentheses.

Table 3. Conditional Logit Estimation of Rural Inpatient Hospital Choice by Admission Type, Hospital Quality and Hospital Distance, 2002

	(1) Emergency (N = 52,096)	(2) Urgent (N = 68,648)	(3) Elective (N = 71,012)
Distance	-3.3225 (-20.26)	-3.6244 (-28.24)	0.0689 (0.77)
Age x Distance	-0. 2022 (-12.68)	-0.1605 (-12.79)	-0.2084 (-23.17)
Male x Distance	0. 6823 (9.61)	1.3675 (23.51)	1.0127 (25.90)
Insurance x Distance	0.0067 (0.07)	-0.0288 (-0.40)	-0.3434 (-7.24)
Selfpay x Distance	-0.0406 (-0.24)	-1.6524 (-8.44)	-0.7508 (-6.12)
Quality x Distance	-0.2006 (-5.90)	-0.2297 (-7.98)	-0.5444 (-28.26)
Quality	0.1794 (5.87)	0.2060 (8.56)	0.0265 (1.33)
Age x Quality	0.0011 (0.31)	0.0019 (0.64)	0.0127 (4.96)
Male x Quality	0.0297 (2.08)	-0.0313 (-2.39)	0.0373 (3.62)
Insurance x Quality	0.0986 (5.12)	0.0154 (0.92)	0.1047 (8.08)
Selfpay x Quality	0.0010 (0.02)	0.1152 (2.55)	0.0364 (1.09)
Pseudo R2	0.49	0.48	0.26
Log Likelihood	-29241.0	-39575.4	-57785.5
Elasticities			
Distance	-1.75 (-122.0)	-1.61 (-144.6)	-0.83 (-127.7)
Quality	0.47 (26.0)	0.38 (24.0)	-0.024 (-1.87)

Notes: Dependent Variable is Choice of Rural, Urban or Research Hospital.
t-statistics are in parentheses.

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