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State Level Revenue Analysis of the Market Facilitation Program

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Abstract

To compensate the US producers affected by the “trade war” with China, the United States Department of Agriculture (USDA) offered direct payments to producers using 2018 production levels under the Market Facilitation Program (MFP). Results of the revenue efficiency analysis of the MFP payments show the average producers in 12 out of 14 major corn and soybean producing states were compensated such that their 2018 per acre revenue was more than their 2017 per acre revenue. Conversely, an average producer in those states that experienced drought was under-compensated, as their total per acre revenue after the MFP payment was less than their 2017 revenue. Use of the 2018 yield, instead of a three-year average, resulted in a net positive gain for most producers.

Introduction

The 2016 presidential election in the United States brought a lot of interest and attention in the outsourcing of (primarily) manufacturing jobs and high trade deficits (negative balance of payments) of the United States with its trade partners. In particular, then-candidate Donald Trump was especially vocal about the United States’ high and growing trade deficit with China. US importation of goods and services from China for 2017 was about \$523 billion and exports of goods and services, for the same year to China, were slightly more than \$187 billion resulting in a net trade deficit of \$336 billion (U.S. Census Bureau, 2018). After winning the presidential election in July of 2018, the Trump administration levied the first round of tariffs on Chinese products. The 25% tariff was mostly imposed on electronics and high-tech equipment such as computer hard drives, electronics, LED panels and motor vehicles (Giri et al., 2018b). This first round of tariffs were imposed on roughly \$34 billion worth of imports.

In response to US tariffs, China retaliated with its own tariffs, matching the magnitude of the tariff rate and the volume of trade. They mainly targeted US agricultural imports – more specifically US soybean products. In August of 2018, the Trump administration responded by placing tariffs on an additional \$200 billion worth of goods (Bradsher, 2018). China, for its part, levied tariffs on an additional \$60 billion worth of imports from the US (due to the imbalance in imports, China was unable to match the dollar amount for tariffs in the second round). The majority of the tariffs levied by China were on American agricultural imports (soybean products saw a 25% tariff). This resulted in a sharp decline in prices for agricultural commodities in the domestic US market.

The year 2018 was good for production, and because there is a negative correlation between price and supply, prices were already expected to decrease. The so called “trade war” with China depressed commodity prices even further. Multiple studies estimated that the price of soybeans would decline anywhere from 4% to 16 %. Taheripour and Tyner (2018) estimated a decrease of 4%, Swanson et al. (2018) estimated a decrease of 9%, Zheng et al. (2018) estimated a decrease of 3.9%, and Balistreri et al. (2018) estimated a decline in prices anywhere between 10% and 16.25%.

To help producers affected by the trade war, the Trump Administration announced a relief program. On Aug 27, 2018, the United States Department of Agriculture (USDA) announced details of three programs under a relief package worth \$12 billion. One of these programs was the Market Facilitation Program (MFP), encompassing \$4.7 billion (USDA, 2018a). This program set a rate for major agricultural commodities per bushel (\$1.65/bu for soybean, \$.001/bu for corn, etc.) or per head (\$8/head hogs) as payments to producers based on their 2018 production or inventory (USDA, 2018a). Initially, the payments were to be made at a

rate identified by the USDA as only 50% of production; however, it was announced in December that there would be a second payment for the same amount, essentially covering the total value of 2018 production (USDA, 2018b). MFP payments were capped at \$125,000 per producer or legal entity, even if the calculated payment based on the rate and yield would have warranted a higher payment. Furthermore, there were restrictions on eligibility: producers needed be in compliance with conservation requirements and the average annual adjusted gross income from the farm enterprise between 2014 and 2016 had to be less than \$900,000 (USDA, 2018 a).

Purpose and Motivation

There have been multiple studies that have investigated if the MFP has been able to compensate for lost revenue due to the decline in prices. Giri et al. (2018b) found that, at the state level, MFP payments were able to offset the projected price decrease due to the trade war. Swanson et al. (2018), using the Gardner Farm Income and Policy Simulator (GFIPS), found that for 2018, MFP payments enabled farmers to build capital, but uncertainties still loom for 2019. No studies focus solely on a revenue comparison with figures from 2017. Furthermore, there is no study that compares MFP payments based on 2018 yield to a three-year average yield. The majority of crop insurance indemnity payments are based on the yield and price coverage of the producer. The yield coverage depends on the Actual Production History (APH), which is a function of the yield and the area of the producer. However, the MFP only used the one-year static yield as a basis for its payments.

In this study, we analyze the difference in revenues based on a comparison of the three-year average yield with the 2018 yield and a comparison based on 2017 revenues. Because MFP payments were based on state-level figures for 2018 production, producers based in states that experienced drought were not compensated as well as their counterparts who did not experience

drought. Similarly, producers that experienced record yields due to good weather were better compensated. In essence, producers in regions unfortunate enough to have experienced drought in 2018 received lower MFP payments than they would have in any other “normal” year.

Producers in states fortunate enough to have experienced good weather and, consequentially, better yields, received more in payments than they would normally have received.

This study may encourage policy makers to conduct “equitability and efficiency policy analyses” of the MFP program. An equitability analysis allows researchers to evaluate if producers of the same crop in different states received the same or similar magnitude of payments. It also helps answer an important question – did different commodities producers get compensated at the same rate? It is important to note that MPF payments are at different rates for different commodities, arguably, because the magnitude of price decline for different commodities was different due the trade war.

The efficiency policy analysis determines if the MFP payments were made at appropriate levels for crop producers. The USDA recently announced the possibility of further MFP payments for this year (USDA, 2019). The following analysis should help policy makers use tax dollars more effectively as they help the affected producers.

Methodology

The first step was comparing the actual per acre revenue, including MFP payments, of an average producer to the counterfactual case, wherein the same producer’s returns were calculated based on average yield for past three years (2018, 2017 and 2016). We calculated the total per acre revenue by multiplying the average yield of the past three-year times the MFP payment rate for corn and soybeans and added the revenue received (price received per bushel for 2018) for producers of both crops. Instead of using the average yield, we used 2018’s yield to obtain the

actual total revenue producers in each state received. The difference in the two total revenues allowed us to identify the “winners” and “losers” consequent of using a single year’s (2018) yield as the baseline.

They were calculated as:

$$TR_{cf} = Y_{\mu} \times (P + \beta)_i \quad (1)$$

$$TR_{ac} = Y \times (P + \beta)_i \quad (2)$$

$$\text{Difference in Revenue} = TR_{cf} - TR_{ac} \quad (3)$$

Where TR_{cf} is state level counterfactual revenue; TR_{ac} is state level actual revenue; P is price per bushel for 2018; β is MFP per bushel; Y_{μ} is the three-year average yield; Y is actual 2018 yield and i represents commodity corn and soybeans.

We also compared the total revenue received per acre for 2017 with total revenue received for 2018 by producers of each state for corn and soybeans. Total revenue in 2017 per acre for producers was calculated by multiplying the yield for 2017 times the price received for 2017. 2018’s total revenue per acre for producers was calculated by multiplying the yield for 2018 times the price received plus the MFP payment rate times the yield for 2018. The comparison of total revenues per acre for 2017 and 2018 revealed whether or not MFP payments were able to offset the revenue loss per acre due to price decrease from the trade war. It is noteworthy to state that the objective of the MFP payment was to restore farm revenue to the levels prior to the tariffs (USDA, 2018c).

In order to have a benchmark for comparison, we used 2017 per acre revenues. This is important, as some price loss could have been offset by the increase in yield in 2017. As stated

previously, the outlier state producers who experienced drought could expect lower revenues compared to 2017 after MFP payments.

It is true, however, that producers in some states might have had drought in 2017 so their 2017 yield compared to 2016 or a moving average of certain years was lower. This would mean that revenue comparisons set a lower bar for those producers. However, since 2017 was the most recent year before the trade war, we compared the revenues after MFP payments to 2017 per acre revenues.

Mathematically,

$$TR_{\alpha} = Y_i \times (P + \beta)_i \quad (4)$$

$$TR_{\gamma} = Y_i \times P_i \quad (5)$$

$$\text{Difference in Revenue} = TR_{\alpha} - TR_{\gamma} \quad (6)$$

Where TR_{γ} is 2017 revenue and TR_{α} is 2018 revenue and other notations are same as equations 1, 2 and 3 except for P_i which is 2017 price whereas P is 2018 price.

State Dataa

Data for average state yields was obtained from the National Agricultural Statistics and Survey (NASS) of the United States Department of Agriculture (USDA). The top fourteen corn and soybean producing states for 2017 were analyzed for this study. The selected states were Arkansas, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Texas, and Wisconsin. Annual national prices for corn and soybeans were obtained from NASS of USDA.

Summary Statistics

Table 1 represents the total planted and harvested acres, total production, and percentage of total US production of corn and soybeans for the fourteen states. The fourteen states combined produced 90 and 86 percent of total US corn and soybeans respectively. Furthermore, these same states also account for 87 and 86 percent of total planted acres for corn and soybeans respectively. Therefore, analyzing the results for a producer with average yield in these fourteen states covered a majority of the producers harmed by the trade war and subsequent price reduction.

Table 1: 2017 Planted, Harvest Acres, and Production of corn and soybeans for 14 major US states

State	Corn				Soybean			
	Planted Acres	Harvested Acres	Production (bushels)	% of Total US Production	Harvested Acres	Planted Acres	Production (bushels)	% of Total US Production
ARKANSAS	620,000	595,000	108,885,000	1%	3,500,000	3,530,000	178,500,000	4%
ILLINOIS	11,200,000	10,950,000	2,200,950,000	15%	10,550,000	10,600,000	611,900,000	14%
INDIANA	5,350,000	5,200,000	936,000,000	6%	5,940,000	5,950,000	320,760,000	7%
IOWA	13,300,000	12,900,000	2,605,800,000	18%	9,940,000	10,000,000	566,580,000	13%
KANSAS	5,500,000	5,200,000	686,400,000	5%	5,110,000	5,150,000	191,625,000	4%
MICHIGAN	2,250,000	1,890,000	300,510,000	2%	2,270,000	2,280,000	96,475,000	2%
MINNESOTA	8,050,000	7,630,000	1,480,220,000	10%	8,090,000	8,150,000	384,275,000	9%
MISSOURI	3,400,000	3,250,000	552,500,000	4%	5,910,000	5,950,000	292,545,000	7%

NEBRASKA	9,550,000	9,300,000	1,683,300,000	12%	5,670,000	5,700,000	326,025,000	7%
NORTH DAKOTA	3,420,000	3,230,000	448,970,000	3%	7,050,000	7,100,000	243,225,000	6%
OHIO	3,400,000	3,150,000	557,550,000	4%	5,090,000	5,100,000	251,955,000	6%
SOUTH DAKOTA	5,700,000	5,080,000	736,600,000	5%	5,610,000	5,650,000	241,230,000	5%
TEXAS	2,450,000	2,240,000	313,600,000	2%	185,000	210,000	6,845,000	0%
WISCONSIN	3,900,000	2,930,000	509,820,000	3%	2,140,000	2,150,000	101,650,000	2%
TOTAL FOR 14 STATES	78,090,000	73,545,000	13,121,105,000	90%	77,055,000	77,520,000	3,813,590,000	86%
% OF US TOTAL	87%	89%	90%	90%	86%	86%	86%	86%
US TOTAL	90,167,000	82,733,000	14,609,407,000	100%	89,542,000	90,162,000	4,411,633,000	100%

Data source: NASS, 2018

Iowa was the leading producer of corn, producing 18% of the total production. Iowa was followed by Illinois (15%), Nebraska (12%) and Minnesota (12%), states that produced more than 10% of the total production for 2017. Illinois (14%) and Iowa (13%) were the only two states that produced more than 10% of the total soybean production for 2017.

The analysis proposed in the methodology section was sustained at the state level for the fourteen states. Using 2018 prices (\$3.41 per bushel for corn and \$8.37 per bushel for soybeans) and only the 2018 yield, total revenues per acre including MFP payments based on only the 2018 yield were calculated for producers of each state. Using the average yields of the past three years for MFP payments and 2018 prices and yields, total revenue was calculated for the counterfactual case. Using 2017 price (\$3.15 per bushel corn and \$9.22 per bushel soybeans), total revenue per acre for 2017 was determined.

Table 2 shows per acre revenue under three scenarios for corn producers of the fourteen states. If three-year average yield was used instead of the 2018 yield for the MFP payments, six

states would have come out ahead. This also means that the producers of the remaining eight states would have come out behind given the 2018 yield. However, had producers in each state achieved higher yields than the three-year average, every state would have come out ahead. In other words, it was not a zero sum game. The converse was also true, i.e. had there been country wide drought and reduction in yield, each state's producers would have fallen behind. Since the aggregate sum of the differences is positive, this means that overall welfare was positive for the producers, i.e. in aggregate there was a net positive gain in producer surplus by using 2018 yield. Average corn producers in Minnesota received \$63 more per acre, followed by Ohio (\$43), Indiana (\$29), Nebraska (\$29), Illinois (\$25), South Dakota (\$16), North Dakota (\$10) and Arkansas (\$9) due to the use of 2018 yield instead of a three-year average.

Corn producers in 12 out of 14 states saw their average revenue per acre for 2018 increase compared to 2017 after the MFP payments. Corn producers in South Dakota were the biggest "winners" as, on average, their 2018 revenue was more by \$90 per acre compared to that of 2017 revenue. Producers in seven states, including South Dakota, had on average more than \$50 per acre revenue increase compared to 2017. The other six states were Nebraska (\$86), Illinois (\$85), North Dakota (\$85), Ohio (\$82), Indiana (\$79), and Minnesota (\$56).

Average corn producers in two states, Missouri and Texas, saw their total revenue decrease even after the MFP payments compared to 2017 revenues. Producers in Texas and Missouri had their 2018 revenue per acre decrease by \$72 and \$57 respectively, compared to 2017 even after the MFP payments. This is because of drought in these two states, which resulted in a significant decrease in 2018 yield compared to that of 2017. Producers in Texas had a 32 bushel (23%) per acre decrease in yield and producers in Missouri had a 30 bushel (18%) decrease per acre in yield compared 2017.

Table 2: State level per acre revenue comparisons for three scenarios for corn

	Yield Per Acre				Total Revenue per acre				
				Three year average yield	Using 2018 yield plus MFP payments	Using three year average yield plus MFP payments	2017 Total revenue w/o MFP payments	Difference (2018 received- three year average)	Difference (2018 received - 2017)
State	2018	2017	2016						
ARKANSAS	181	183	171	178	\$619.02	\$609.90	\$576.45	\$9.12	\$42.57
ILLINOIS	210	201	197	203	\$718.20	\$693.12	\$633.15	\$25.08	\$85.05
INDIANA	189	180	173	181	\$646.38	\$617.88	\$567.00	\$28.50	\$79.38
IOWA	196	202	203	200	\$670.32	\$685.14	\$636.30	-\$14.82	\$34.02
KANSAS	129	132	142	134	\$441.18	\$459.42	\$415.80	-\$18.24	\$25.38
MICHIGAN	153	159	157	156	\$523.26	\$534.66	\$500.85	-\$11.40	\$22.41
MINNESOTA	194	193	140	176	\$663.48	\$600.78	\$607.95	\$62.70	\$55.53
MISSOURI	140	170	163	158	\$478.80	\$539.22	\$535.50	-\$60.42	-\$56.70
NEBRASKA	192	181	178	184	\$656.64	\$628.14	\$570.15	\$28.50	\$86.49
NORTH DAKOTA	153	139	158	150	\$523.26	\$513.00	\$437.85	\$10.26	\$85.41
OHIO	187	177	159	174	\$639.54	\$596.22	\$557.55	\$43.32	\$81.99
SOUTH DAKOTA	160	145	161	155	\$547.20	\$531.24	\$456.75	\$15.96	\$90.45
TEXAS	108	140	127	125	\$369.36	\$427.50	\$441.00	-\$58.14	-\$71.64
WISCONSIN	172	174	178	175	\$588.24	\$597.36	\$548.10	-\$9.12	\$40.14

Data source: NASS, USDA, 2018 and authors' estimates

Table three shows the results for soybean producers. If the three-year average yield was used instead of the 2018 yield, nine states would have come out ahead. However, again, as was the case with corn producers, the aggregate sum of the differences is positive. This means that net changes benefitted producers, i.e. in aggregate, there was a net positive gain in producer surplus by using 2018 yield. Average soybean producers of Illinois received \$43 more per acre followed

by Ohio (\$40), Indiana (\$18), Arkansas (\$13), Michigan (\$10), Kansas (\$5), and Minnesota (\$5) due to the use of 2018 yield instead of a three year average.

Soybean producers in twelve out of fourteen states also saw their average revenue per acre increase compared to 2017 after the MFP payments. Soybean producers of Ohio were the biggest “winners,” as on average their 2018 revenue was more by \$125 per acre compared to that of 2017 revenue. Producers in nine states, including Ohio, had on average more than \$50 per acre revenue increase compared to 2017. The other eight states were Illinois (\$117), Kansas (\$90), Michigan (\$89), Indiana (\$88), and Minnesota (\$68), South Dakota (\$64), Nebraska (\$61), and Wisconsin (\$53).

Soybean producers in two states, Missouri and Texas, saw their average per acre revenue decrease, even after MFP payments, compared to 2017 revenues. This is again because of drought in these two states, which resulted in a decrease in 2018 yield compared to that of 2017. Texas had a 5 bushel (13%) per acre decrease in yield compared to 2018 and Missouri had a 5 bushel (10%) decrease per acre in yield compared to 2018. This resulted in producers in Texas and Missouri’s 2018 revenue having a per acre loss of \$21 and \$6 respectively, compared to 2017, even after the MFP payments.

State level per acre revenue comparisons for three scenarios for soybeans

State	Yield Per Acre				Total Revenue per acre				
	2018	2017	2016	Three year average yield	Using 2018 yield plus MFP payments	Using three year average yield plus MFP payments	2017 Total revenue w/o MFP payments	Difference (2018 received - three year average)	Difference (2018 received - 2017)
ARKANSAS	51	51	47	50	\$511.02	\$497.66	\$470.22	\$13.36	\$40.80
ILLINOIS	65	58	59	61	\$651.30	\$607.88	\$534.76	\$43.42	\$116.54

INDIANA	58.5	54	57.5	57	\$586.17	\$567.80	\$497.88	\$18.37	\$88.29
IOWA	57	57	60	58	\$571.14	\$581.16	\$525.54	-\$10.02	\$45.60
KANSAS	43.5	37.5	48	43	\$435.87	\$430.86	\$345.75	\$5.01	\$90.12
MICHIGAN	48	42.5	50.5	47	\$480.96	\$470.94	\$391.85	\$10.02	\$89.11
MINNESOTA	50.5	47.5	52	50	\$506.01	\$501.00	\$437.95	\$5.01	\$68.06
MISSOURI	45	49.5	49	48	\$450.90	\$479.29	\$456.39	-\$28.39	-\$5.49
NEBRASKA	59	57.5	61	59	\$591.18	\$592.85	\$530.15	-\$1.67	\$61.03
NORTH DAKOTA	35.5	34.5	41.5	37	\$355.71	\$372.41	\$318.09	-\$16.70	\$37.62
OHIO	58	49.5	54.5	54	\$581.16	\$541.08	\$456.39	\$40.08	\$124.77
SOUTH DAKOTA	46	43	49.5	46	\$460.92	\$462.59	\$396.46	-\$1.67	\$64.46
TEXAS	32	37	31	33	\$320.64	\$334.00	\$341.14	-\$13.36	-\$20.50
WISCONSIN	49	47.5	55	51	\$490.98	\$506.01	\$437.95	-\$15.03	\$53.03

Data source: NASS, USDA, 2018 and authors' estimates

Conclusions, Policy Implications and Discussion

Analysis shows that except for producers in two states, Missouri and Texas, producers of corn and soybeans were overcompensated when compared to their 2017 revenues. The “equitability cost” comparison shows the same finding. Furthermore, results show that there was a net positive effect of the MFP payments for corn and soybean producers by using the 2018 yield instead a three-year average. However, producers in some states would have gained if a three-year average yield was used instead of 2018 yield. The magnitude of gains was less than the losses other producers would have incurred, which suggests that this was a Kaldor-Hicks improvement. (Kaldor (1939) and Hicks (1939) criterion analyze possible outcomes based on the maximization of wealth or money (revenue for this case)).

The findings of this study can be used by policy makers in the future if another trade war occurs (or if the current situation extends beyond this year) to make payments more “equitable” across different commodity producers in different regions. Policy makers should internalize weather factors, such as drought and past revenues, if and when they have to come up with similar aid packages in future.

The trade war seems to be ongoing and based on news reports it may continue indefinitely. Indeed, there has been an announcement by the USDA of another Market Facilitation Program for 2019. We hope the methodology proposed in this paper be used to make more equitable payments to American producers.

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