Government Program Participation's Impact on Adopting Contracts

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Introduction

Agricultural producers face various price risks, some of which can be mitigated through competition among commodity buyers and federal policies. Competition among buyers provides producers access to production and marketing contracts and the ability to participate in futures commodity markets. Agricultural contracts facilitate vertical coordination between farmers and processors, allowing producers to manage risk and reduce transaction costs (Katchova, 2013). The importance of these contracts was drastically highlighted during the COVID-19 pandemic. For livestock producers, 2020 tested the resilience of the supply chain, particularly the challenges faced by producers without contracts who struggled to take their livestock to processing plants. Reports indicated cases where producers, lacking contracts along the vertical supply chain, had to resort to the depopulation of animals, despite only a small share of processing plants being closed or operating at less than full capacity. This was especially problematic because many producers relied on a single plant for slaughter and processing (Giri et al., 2021; Hughlett and Belz, 2020; Olberding, 2020).

For crop commodities, there was a sharp decline in futures prices in mid-2020, prompting the USDA to design Coronavirus Food Assistance Program (CFAP). The first round of CFAP used the decline in commodity prices as a basis for payment rates and made payments specifically to those without marketing contracts for their commodities.

Objective

This paper aims to better understand participation in government programs and engagement in contracts among producers, differentiated by commodity specialization, before and after

COVID-19. Previous studies have typically examined this issue in a dichotomous way: a) either a firm-level perspective, focusing on the competitiveness of processors and the exercise of market power, or b) a farm-level perspective, analyzing producer characteristics associated with engaging in contracts. However, none have explicitly examined, especially in the context of post-COVID, the impact of participation in government programs on producers' engagement in contracts.

Literature Review

Prior research has identified several factors influencing producers' engagement in contracts. Studies have highlighted additional factors, including the producer's age and education (Katchova and Miranda, 2004) and the scale of farm production (Key, 2004), that affect the likelihood of adopting contracts. Paulson et al. (2010) found that, prior to COVID, characteristics such as the use of crop insurance and farm size influenced producers' likelihood of engaging in contracts.

U.S. agricultural policies are designed to provide a safety net for producers against various risks, including price and yield risks, as well as disasters that could result in the complete loss of an agricultural commodity (Baldwin et al., 2023). Prager et al. (2020) emphasize that risks such as pests, weeds, excessive heat or cold, drought, and flooding can adversely affect crop yields, while diseases, extreme weather, and other pressures can negatively impact livestock production. Prager et al. (2020) and Harwood et al. (1999) categorized the risks faced by farmers and ranchers into six types: 1) price risk (uncertainty about prices), 2) production (yield) risk (uncertainty during the growth process), 3) market risk (uncertainty in finding a buyer), 4) institutional risk (uncertainty in government policies), 5) financial (repayment) risk (uncertainty due to changes in interest rates and credit availability), and 6) human risk (health or personal

relationship issues of the operators). Generally, farm operations experience only a few of these risks simultaneously, and Farm Bill programs, particularly those under the latest Agriculture Improvement Act of 2018 ("2018 Farm Bill"), are designed to protect participating producers from most of these six categories of risk. For example, Agricultural Risk Coverage (ARC) provides protection from significant revenue loss, Price Loss Coverage (PLC) offers protection from significant price reductions in commodities, and yield protection insurance policies and the noninsured disaster assistance program provide protection in cases of significant yield loss (Turner et al., 2023).

Government Payments During COVID-19

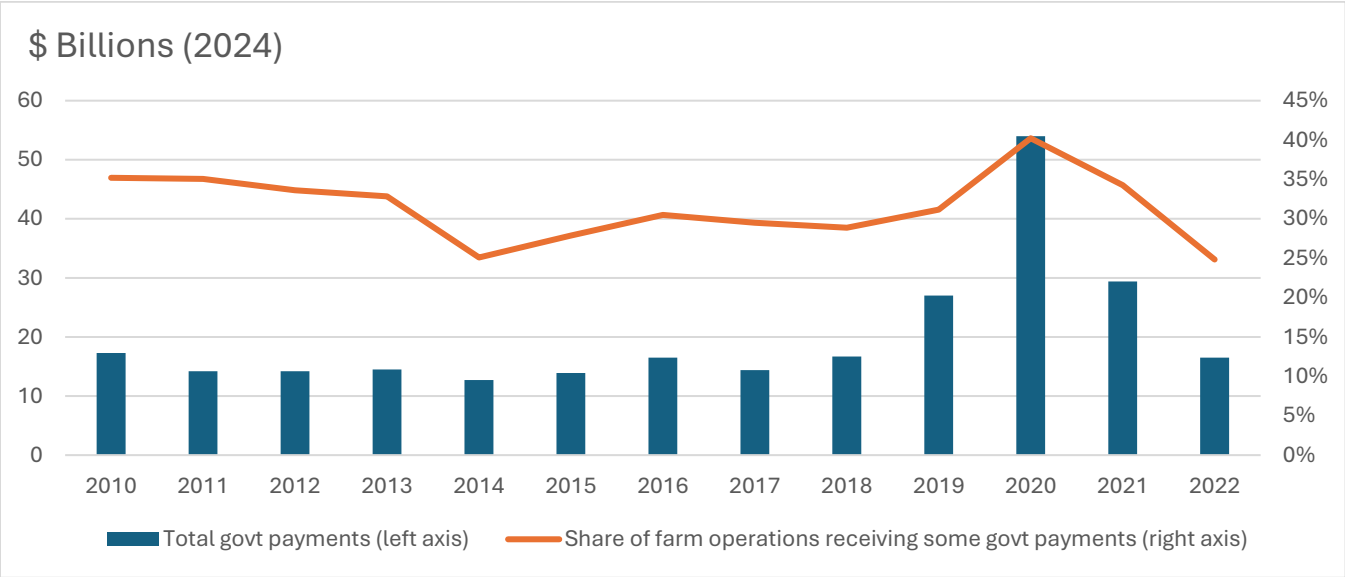
Despite these protections, there have been recent instances when Farm Bill programs were insufficient to address the challenges faced by producers. During such times, the USDA has used its authority to make payments to producers through new non-farm bill programs. One of the most recent examples is the Market Facilitation Program (MFP), which made payments to U.S. producers impacted by retaliatory tariffs from China (Gir et al., 2020). The MFP began making payments in 2018 and, by 2023, had disbursed over $23 billion. At the onset of the COVID-19 pandemic in 2020, the U.S. Congress passed several bills to provide assistance across various economic sectors. Utilizing authority granted by the CARES Act, the USDA created the Coronavirus Food Assistance Program (CFAP), specifically targeting farm operations (Giri et al., 2021). By 2024, CFAP had distributed over $31 billion in payments.

CFAP was implemented in two rounds. The first round, CFAP 1, provided payments based on a per-unit payment rate, compensating producers for losses due to price declines and additional marketing costs incurred by most eligible commodity producers (U.S. Department of Agriculture, 2020a). The second round, CFAP 2, offered flat-rate payments (per head or per acre)

to eligible commodity producers (U.S. Department of Agriculture, 2020b). A key difference between these rounds was that CFAP 1 payments were only available to producers with unpriced inventory. The program was designed to compensate producers who had not marketed their commodities, thus reducing price risk as categorized by Prager et al. (2020) and Harwood et al. (1999).

Figure 1 shows that the total government payments and share of farm operations receiving some government payments peaked in 2020. Over $54 billion dollars in inflation adjusted terms, primarily boosted by new CFAP, was disbursed in 2020 and 40 percent of all farm operations received some government payments because COVID payments were comprehensive. Giri et al. (2021) estimate that 97 percent of commodities measured by cash receipts were eligible to receive CFAP payments. The share of operations receiving some government payments (34 percent of all operations) and total government payments (over $29 billion) decreased in 2021 but were still higher than 2019 and 2022. In 2019, less than one-third of farm operations received some payments and the total government payment disbursed was $27 billion. Similarly, only a quarter of farm operations received some government payment in 2022 and total payments were $16.5 billion.

Figure 1: Government payments and share of farm operations receiving some payments, 2010-2022



Data sources: USDA, Economic Research Service calculations using the USDA, Farm Income and Wealth Statistics data, February 7, 2024, and ARMS webtool.

Motivation and Research Questions

This study seeks to understand the role of government payments in producers' marketing decisions considering one COVID program specifically designed to mitigate price risk. Specifically, it aims to determine whether the share (percentage) of the value of products without price risk increased or decreased in 2020 and 2021 compared to 2019, and to assess the number of producers who chose to eliminate price risk for some of their products. The comparison of 2020 and 2021 with 2019 is critical, as the first round of CFAP made payments to producers with unpriced inventory post-2019 harvest amid significant price volatility in 2020. If producers believed in the continuity of such policies or anticipated new programs providing payments for unpriced inventory, they might have lacked incentives to engage in contracts to minimize price risk.

While questions related to participation in forward or futures contracts would ideally address these issues, there has been no national survey since 2016 that asked producers about their participation in such contracts. Prager et al. (2019) used data from the 2016 Agricultural Resource Management Survey (ARMS) and found that more than 156,000 farms used marketing contracts, while over 47,000 farms utilized futures or options contracts. Furthermore, they noted that although only about 10% of corn and soybean farmers traded in futures contracts, those who did covered a substantial portion (over 40%) of their production. Similarly, while only 20-25% of corn and soybean farmers used marketing contracts, those who did covered over 40% of their production with these contracts. The study also revealed that larger corn and soybean farms were more likely to use agricultural futures and options, with farm operator age and education being associated with the use of these risk management tools (Prager et al., 2019).

Data and Methods

This study utilizes data from the USDA's nationally representative Agricultural Resource Management Survey (ARMS) on the value and number of producers engaged in marketing and production contracts for various commodities. The ARMS collected annual data on the value of commodities produced under these contracts from 2019 through 2021. The Economic Research Service (ERS) of the USDA defines a marketing contract as one in which the farmer retains ownership of the commodity during production, with the contract specifying the price (or pricing formula), product quantities and qualities, and delivery schedule. In contrast, a production contract is defined as one where the contractor typically owns the commodity during production, and the farmer is paid a fee for services rendered. The contractor often provides specific inputs, services, production guidelines, and technical advice. In both cases, when a producer engages in

a production or marketing contract, the price risk is effectively eliminated for the producer. Regardless, engaging in either of the contracts or both eliminates price risks.

For this analysis, we calculate the share (percent) of the total value of production under both production and marketing contracts. To estimate the effects of participation in government programs on the use of contracts, we employ a Difference-in-Differences (DID) model. Additionally, we use a Poisson regression model within the DID framework to assess the impact of government payments on the number of producers utilizing production and marketing contracts. A farm operation is defined as participating in a government program if it received any government payment. The DID approach allows us to estimate the causal effect of treatment by comparing changes in outcomes between treated and non-treated (control) groups for the pre and post-COVID period. Specifically, we estimate the effect of government payments on contract engagement in 2020 and 2021 relative to 2019. Three separate models are estimated: one for the share (percent) of total production value under production contracts, one for marketing contracts, and one for either type of contract.

The functional form of the DiD model is expressed as follows:

$$y_{it} = \alpha + \beta_1 Post_i + \beta_2 Government\ programs_i + \beta_3 (Post_i * Government\ programs_i) + \varepsilon_{it} \quad (1)$$

where

y_{it} is the outcome variable (share or percent of value of production under contract) for producer i in year t.

α is the intercept.

$Post_t$ is an indicator (binary) variable, equal to 1 in the post period (2020 and 2021), 0 otherwise (for 2019). β_1 captures the changes in outcomes over time (equally affects treated and untreated

groups). In our case, it captures the changes in share (percent) of value of production under contract in 2020 and 2021 relative to 2019.

$Government\ programs_i$ is an indicator (binary) variable, equal to 1 if producers participated in government programs, 0 otherwise. β_2 measures the pre-treatment effect, it is the difference between treated and untreated groups prior to the treatment.

$Post_t * Government\ programs_i$ is the interaction term between the post and government programs participation variable. β_3 is the DiD estimator, which captures the causal effect of the treatment (difference-in-difference effect). In our case, it captures the effect of government programs participation on share (percent) of value of production under contract.

ε_{it} is the error term.

To estimate the effect of government program participation on the number of producers engaged in contract production, we apply a Poisson regression model within the DiD framework. Given that the outcome variable is a count variable, the Poisson regression model is appropriate for estimating how government program participation influences the number of producers involved in contract production. We estimate three separate models for producers engaged in: 1) production contracts only, 2) marketing contracts only, and 3) either type of contract.

The functional form of the Poisson regression model is as follows:

$$y_i = \exp(\beta_0 + \beta_1 Post_i + \beta_2 Government\ programs_i + \beta_3 (Post_i * Government\ programs_i) + \boldsymbol{\beta X'}_i) + \varepsilon_i \quad (2)$$

where,

y_{it} is the expected number of producers under each type of contract production for year t.

β_1 captures the changes in the log counts of number of producers under contract for the 2020-2021 relative to 2019.

β_2 captures the effect of participation in government programs in pre-period (2019).

β_3 captures the additional effect of participation in government programs on the number of contracts in the post period (2020-2021) relative to 2019.

$\boldsymbol{\beta}$ represents the parameter vectors for other control variables ($\boldsymbol{X}$) in the model.

Results and Discussions for Production Value under Contracts

We employed a Difference-in-Differences (DiD) model to assess the effect of participation in government programs on the share (percent) of production value under production contracts, marketing contracts, and either contract type, using three separate models**.** We use an interaction term post # government program participation (post=1 for the year 2020 and 2021; and post=0 for the year 2019) to estimate the additional effects of participation in government programs in 2020 and 2021. We ran the models on all the same commodities analyzed by Prager et al. (2019) but do not report results for commodities where we did not find any statistically significance of the independent variables. The summary statistics of variables used in our study are presented in appendix table A1. Our data indicates that 10%, 11%, less than 1%, 45%, and 48% producers are involved in either production or marketing contracts for corn, soybean, cattle, hogs, and poultry, respectively. Further, 76%, 65%, 28%, 36%, and 21% of operations specializing in corn, soybean, cattle, hogs, and poultry, respectively, participated in government programs.

Results for major row crops (corn and soybean)

Our findings indicate that the interaction term is statistically significant for the share (percent) of corn value under production contracts. Specifically, participation in government programs increased the share of corn production value under contract by an additional 0.005 percentage points in 2020 and 2021, relative to producers who did not participate in these programs. However, we did not observe statistically significant effects of government program participation

on the share of corn production value under marketing contracts or either contract type (Table 1). Additionally, we found that certain producer characteristics were positively associated with an increased share of corn production value under production contracts. These characteristics include being a male operator, an older operator, having off-farm income, being married, having a college education, holding insurance, and operating a large farm (in terms of acreage). On the other hand, primary operators with annual incomes exceeding $900,000 and those with debt obligations were negatively associated with the share of corn production value under production contracts.

Table 1: Corn and soybean contracts

	Corn			Soybean[1]
Variables	Production	Marketing	Total	Marketing
Dependent variable:	Share (percent) of value of contract			
Govt. payment (yes=1)	-0.001	3.487	3.485	2.929
	(0.001)	(2.689)	(2.689)	(2.100)
Post (yes=1)	-0.000	-1.955	-1.956	9.617*
	(0.001)	(2.491)	(2.491)	(5.097)
Post#Govt. payment	0.005**	2.674	2.679	11.157***
	(0.001)	(2.661)	(2.660)	(3.638)
Age_60(above 60 years=1)	0.006***	-3.862***	-3.856***	-3.541
	(0.002)	(0.846)	(0.846)	(2.470)
Gender (female=1)	0.003*	1.728	1.731	-10.873
	(0.002)	(1.683)	(1.683)	(11.243)
Married (yes=1)	0.004***	2.394*	2.398*	5.134
	(0.001)	(1.336)	(1.336)	(4.411)
Education (above college=1)	0.006***	3.192***	3.199***	2.148
	(0.002	(0.977)	(0.977)	(3.239)
Off-farm (yes=1)	0.006***	-0.511	-0.517	-6.838
	(0.002	(1.137)	(1.138)	(4.795)
Income (>$900k=1)	-0.018***	8.898**	8.880**	11.999
	(0.006)	(3.740)	(3.744)	(10.617)
Debt (yes=1)	-0.001**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Insurance (yes=1)	0.002**	4.370***	4.372***	3.846
	(0.001)	(0.847)	(0.847)	(4.740)
Acres	0.000***	0.001**	0.001**	0.002
	(0.000)	(0.000)	(0.000)	(0.002)
Constant	-0.012***	1.107	1.095	11.301
	(0.003)	(3.247)	(3.246)	(12.091)
Obs	4,379	4,379	4,379	1,896
Population	365,398	365,398	365,398	231,241

R-square	0.000	0.046	0.046	0.025

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01. [1] we do not report for total and production contract as the sample size did not meet the disclosure requirements for production contract.

For soybeans, we found a statistically significant effect of government program participation on the share (percent) of production value under marketing contracts. The results suggest that participation in government programs increased the share of soybean marketing contract value by an additional 11.2 percentage points during the post-treatment period (2020 and 2021) compared to producers who did not participate in these programs. We did not find statistically significant effects of other control variables on the share of production value under marketing contracts.

Results for major livestock enterprises (Cattle, Hogs, and Poultry)

The interaction term is weakly statistically significant for the share (percent) of cattle production value under production contracts, indicating that participation in government programs reduces the share of cattle production value under contract by an additional 0.75 percentage points in 2020 and 2021 compared to producers who did not participate in government programs. No statistically significant effect of government program participation was found on the share of hogs and poultry production value under contracts in 2020 and 2021 (Table 2).

Other control variables have mixed effects on the share of cattle and poultry production value under contracts (Table 2). Older operators and those with a college education are negatively associated with the share of cattle production value under contract. Conversely, larger operators (those with higher sales) and those with debt obligations are positively associated with the share of cattle production value under contract. For poultry, female primary operators and those with a

college education are negatively associated with the share of production value under contract, while larger operators (with higher sales) are positively associated.

Table 2: Cattle, Hogs, and Poultry production contracts

Variables	Cattle	Hogs	Poultry
Dependent variable: Share (percent) of value of production under production contract			
Govt.program(yes=1)	-0.532	-3.679	-14.363
	(0.368)	(8.586)	(9.176)
Post (yes=1)	-0.146	-0.211	-6.866**
	(0.205)	(5.275)	(2.503)
Post #Govt.program	-0.744*	-9.917	-4.348
	(0.370)	(6.735)	(6.444)
Age_60(above 60 years=1)	-0.362***	5.677	-3.623
	(0.129)	(7.048)	(3.987)
Gender(female=1)	-0.118	-2.372	-8.784*
	(0.092)	(7.510)	(4.534)
Married(yes=1)	0.175	-7.209	2.673
	(0.138)	(7.369)	(5.092)
Education (above college=1)	-0.420**	0.226	-8.578*
	(0.188)	(7.710)	(4.783)
Off-farm(yes=1)	-0.023	7.326	-0.332
	(0.150)	(5.637)	(4.522)
Debt(yes=1)	0.000*	0.000**	0.000
	(0.000)	(0.000)	(0.000)
Ln(sales)	0.589***	13.456***	11.472***
	(0.153)	(1.000)	(0.583)
Constant	-4.564***	-102.679***	-58.503***
	(0.155)	(15.755)	(8.756)
Obs	8,660	832	1,731
Population	1,727,628	40,915	139,525
R-square	0.038	0.587	0.763

Standard errors in parenthesis.

* p<0.10, ** p<0.05, *** p<0.01

Results and Discussions for Number of Contracts

We also analyze the total number of production, marketing, and overall contracts, treating them as count-dependent variables. A Poisson regression model is used to estimate the effects of government program participation on the number of contracts.

Results for row crops (corn and soybean)

Results indicate that government program participation increases the number of corn contracts by an additional 1.9 times in the post-treatment period (2020 and 2021) (Table 3). Similarly, participation in government programs increases the number of soybean contracts by an additional 17.4 times for 2020 and 2021. Other control variables show mixed effects on the total number of corn and soybean contracts. Primary operators with a college education, annual income over $900,000, insurance coverage, and large farm size (in acres) are positively associated with a higher number of corn contracts. However, older primary operators are negatively associated with an increase in the total number of corn and soybean contracts.

Table 3: Corn and Soybean total number of contracts (production and marketing)

Variables	Corn	Soybean
Dependent variable	Total number (counts) of contracts	
Govt.program(yes=1)	0.836**	2.104**
	(0.327)	(0.200)
Post(yes=1)	-0.090	2.496**
	(0.368)	(0.932)
Post#Govt.program	0.650*	2.858***
	(0.341)	(0.859)
Age_60(above 60 years=1)	-0.461***	-0.461*
	(0.080)	(0.251)
Gender (female=1)	0.403	-0.796
	(0.286)	(0.689)
Married (yes=1)	0.127	0.471
	(0.128)	(0.317)
Education (above college=1)	0.302**	0.326

	(0.090)	(0.250)
Off-farm (yes=1)	-0.063	-0.422
	(0.102)	(0.262)
Income (>$900k=1)	0.232*	0.448
	(0.122)	(0.420)
Debt (yes=1)	0.000	0.000
	(0.000)	(0.000)
Insurance (yes=1)	0.546***	0.604
	(0.123)	(0.365)
Acres	0.000***	0.001
	(0.000)	(0.000)
Constant	-3.067***	-4.194**
	(0.500)	(1.592)
Obs	4,379	1,896
Population	365,398	231,241

Standard errors in parenthesis.
* p<0.10, ** p<0.05, *** p<0.01

Results for major livestock enterprises (cattle, hogs, and poultry)

Number of production contracts

We find a reduction in the number of hog and poultry production contracts due to government program participation (Table 4). The results indicate that participation in government programs reduce number of hog production contracts by an additional 20% in the post-treatment period (2020 and 2021). Similarly, government program participation reduces number of poultry production contracts by an additional 14% in 2020 and 2021. No statistically significant effect of government program participation was found on the number of hog production contracts.

Other control variables also show mixed effects on the number of production contracts. Older primary operators, those with off-farm income, and those with larger farm sizes (measured by sales) are positively associated with an increased number of hog production contracts. In contrast, married primary operators and those with a college education are negatively associated with an increased number of hog production contracts. For number of poultry production

contracts, larger farm size (measured by sales) is positively associated with an increase in the number of contracts, while having a college education is associated with a decrease.

Title 4: Cattle, Hogs, and Poultry – number of production contracts

Variables	Cattle	Hogs	Poultry
Dependent variable	Number (counts) of production contracts		
Govt.payment(yes=1)	3.002**	-0.148	-0.260**
	(1.359)	(0.117)	(0.107)
Post(yes=1)	-0.908	-0.018	-0.138**
	(0.794)	(0.157)	(0.251)
Post#Govt.payment	1.547	-0.218*	-0.153*
	(0.971)	(0.109)	(0.089)
Age_60(above 60 years=1)	-0.361	0.183*	0.075
	(0.308)	(0.105)	(0.072)
Gender (female=1)	1.405*	0.304	-0.012
	(0.814)	(0.589)	(0.084)
Married (yes=1)	0.031	-0.236*	0.104
	(0.762)	(0.132)	(0.124)
Education (above college=1)	0.267	-0.216**	-0.171***
	(0.565)	(0.080)	(0.050)
Off-farm (yes=1)	-0.654	0.335***	0.070
	(0.427)	(0.113)	(0.83)
Ln (sales)	-0.187	0.507***	0.457***
	(0.376)	(0.045)	(0.035)
Debt (yes=1)	-0.000	-0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Constant	-4.775	-7.522***	-6.521***
	(2.860)	(0.872)	(0.509)
Obs	8,700	832	1,731
Population	1,737,520	40,915	139,525

Standard errors in parenthesis.
* p<0.10, ** p<0.05, *** p<0.01

Number of marketing contracts

We also estimate the effects of government program participation on the number of marketing contracts. Our results show that government program participation increases the number of cattle marketing contracts by 7.8 times (exponential coefficient of 2.053) in 2020 and 2021 (Table 5). Additionally, primary operators with a college education are positively associated with an increase in the number of cattle marketing contracts. No statistically significant effects of government program participation were found for hog and poultry marketing contracts.

Table 5: Cattle, Hogs, and Poultry- number of marketing contracts

Variables	Cattle	Hogs	Poultry
Dependent variable	Number (counts) of marketing contracts		
Govt.payment(yes=1)	3.131***	4.327	-17.732***
	(1.121)	(13.152)	(2.805)
Post(yes=1)	-0.099	4.295	0.111
	(0.775)	(13.414)	(0.899)
Post#Govt.payment	2.053***	4.260	0.345
	(0.725)	(13.152)	(0.880)
Age_60(above 60 years=1)	-0.433	-1.043	-0.306
	(0.367)	(0.757)	(0.533)
Gender (female=1)	0.900	-0.166	1.718
	(0.787)	(16.359)	(16.992)
Married (yes=1)	-0.003	1.191	-0.841
	(0.545)	(15.253)	(0.553)
Education (above college=1)	0.924**	3.080	-0.807
	(0.417)	(2.388)	(0.237)
Off-farm (yes=1)	-0.604	-1.535	0.409
	(0.386)	(0.950)	(0.735)
Ln (sales)	-0.225	0.303	0.171***
	(0.266)	(0.185)	(0.062)
Debt (yes=1)	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Constant	-4.472**	-15.108	-7.050
	(1.918)	(33.758)	(16.972)
Obs	8,700	832	1,731
Population	1,737,520	40,915	139,525

Standard errors in parenthesis.
* p<0.10, ** p<0.05, *** p<0.01

Either Production Contract or Marketing Contract or Both

We find that participation in government programs decreases the total number of hog and poultry contracts (Table 6). The results indicate that government program participation reduces the total number of hog contracts by an additional 17% and the total number of poultry contracts by an additional 12% in the years 2020 and 2021. Other control variables show mixed effects on the total number of hog and poultry contracts. Off-farm income and large farm size (measured by sales) are positively associated with an increase in the total number of hog contracts, whereas only large farm size is positively associated with an increase in the total number of poultry

contracts. However, primary operators with a college education are negatively associated with the total number of both hog and poultry contracts.

Table 6: Total number of contracts: Cattle, Hogs, and Poultry

Variables	Cattle	Hogs	Poultry
Dependent variable	Total number (counts) of contracts		
Govt.payment(yes=1)	1.852*	-0.127	-0.284**
	(0.998)	(0.115)	(0.108)
Post(yes=1)	-0.403	-0.002	-0.128**
	(0.588)	(0.158)	(0.050)
Post#Govt.payment	1.004	-0.191*	-0.128**
	(0.655)	(0.103)	(0.050)
Age_60(above 60 years=1)	-0.531*	0.164	0.064
	(0.306)	(0.101)	(0.052)
Gender (female=1)	0.676	0.289	0.024
	(0.669)	(0.461)	(0.067)
Married (yes=1)	0.145	-0.218	0.061
	(0.495)	(0.131)	(0.074)
Education (above college=1)	0.349	-0.181**	-0.187***
	(0.410)	(0.082)	(0.041)
Off-farm (yes=1)	-0.460	0.299**	0.082
	(0.337)	(0.117)	(0.053)
Ln (sales)	0.206	0.504***	0.442***
	(0.257)	(0.044)	(0.033)
Debt (yes=1)	-0.000	-0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Constant	-7.203***	-7.463***	-6.276***
	(7.025)	(0.851)	(0.484)
Obs	8,700	832	1,731
Population	1,737,520	40,915	139,525

Standard errors in parenthesis.
* p<0.10 ** p<0.05, *** p<0.01

Conclusion

This study contributes to the literature by examining the effects of government program participation on the engagement of agricultural producers in production and marketing contracts, differentiated by commodity specialization, during and after the COVID-19 pandemic. Using a Difference-in-Differences (DiD) model and a Poisson regression model within DiD framework, which is a somewhat novel approach for such analyses, we find mixed effects of participation in government programs on contract engagement for different commodities.

Our findings show that government program participation reduces the share of production contracts for cattle, hogs, and poultry producers, while increasing the number of marketing contracts for row crops, corn and soybeans. These results partially align with previous studies by Paulson et al. (2010) and Prager et al. (2020), which emphasized the roles of farm size, education, and age in influencing contract adoption. However, unlike earlier studies, our research specifically examines the post-COVID environment and the role of government support programs. Future research could further explore the dynamic relationship between government policy, market conditions, impact of changes in prices (on a monthly or annual basis) and contract adoption among different types of producers.

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Appendix Table A1: Summary statistics of variables used in this study

Variables	Corn (Obs=4,379; Population Size= 365,398)		Soybean (Obs=1,896; Population size=231,241)		Cattle (Obs=8,660; Population size=1,727,628)		Hogs (Obs=832; Population size=40,915)		Poultry (Obs=1,730; Population size=139,453)	
	Mean	Std.err	Mean	Std.err	Mean	Std.err	Mean	Std.err	Mean	Std.err
% Production contract	0.003	0.003			0.308	0.073	44.204	4.444	46.670	4.568
% Marketing contract	10.116	0.641	11.143	2.021	0.421	0.107	0.793	0.258	1.539	0.908
% Total contract	10.119	0.641	11.143	2.021	0.730	0.123	44.996	4.430	48.209	4.809
% Government program participation (yes=1)	0.757	0.017	0.649	0.039	0.283	0.008	0.360	0.044	0.206	0.029
% Age_60(above 60 years=1)	0.528	0.020	0.546	0.029	0.543	0.014	0.249	0.040	0.405	0.033
% Gender (female=1)	0.964	0.006	0.972	0.007	0.892	0.007	0.876	0.041	0.713	0.047
% Married (yes=1)	0.812	0.010	0.769	0.025	0.815	0.009	0.871	0.027	0.810	0.032
% Education (above college=1)	0.596	0.023	0.583	0.033	0.568	0.015	0.628	0.063	0.548	0.057
% Off-farm (yes=1)	0.586	0.016	0.603	0.031	0.640	0.010	0.752	0.037	0.639	0.036
% Debt (yes=1)	0.512	0.021	0.421	0.031	0.276	0.010	0.611	0.054	0.409	0.046
% Income (>$900k=1)	0.021	0.003	0.009	0.002	N/A	N/A	N/A	N/A	N/A	N/A
% Insurance (yes=1)	0.672	0.013	0.514	0.028	N/A	N/A	N/A	N/A	N/A	N/A
Acres	683.764	25.670	448.117	28.190	N/A	N/A	N/A	N/A	N/A	N/A
ln (sales)	N/A	N/A	N/A	N/A	9.277	0.029	11.488	0.338	10.539	0.360

Data source: Agricultural Resource Management Survey (ARMS), 2019-2022, Economic Research Service (ERS), USDA
Note: N/A indicates those variables were not included in the econometric models and, hence, summary statistics for those respective variables are not reported.