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The impact of policy design on payment concentration in Ad-hoc disaster Relief: Lessons from the Market Facilitation and Coronavirus food Assistance programs

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ABSTRACT

This study examines the distributional implications of two recent ad-hoc disaster aid programs, the 2018 and 2019 Market Facilitation Payment (MFP) programs that have distinctly different program designs, and the federal crop insurance program. Farm-level data are used to estimate the relationship between farm size, measured by crop sales, and the distribution of program benefits. Results indicate payments are more concentrated on larger farms that receive higher per acre payments under the 2018 MFP and federal crop insurance programs. Under the Coronavirus Food Assistance Program, with a design similar to the 2018 MFP, payments are also more heavily concentrated on larger farms.

1. Introduction

Many industries in the United States have experienced catastrophic declines in revenues and profits because of the COVID-19 pandemic that to a greater or lesser extent have been mitigated by the provisions of emergency aid through the 2020 Coronavirus Aid, Relief, and Economic Security (CARES) Act. Most of those industries and companies have had limited or no experience with direct federal subsidies through disaster aid and other programs, although many have had extensive experience in lobbying about regulatory issues, tax policy, and other forms of federal support. In contrast, since 1942, agricultural producers have obtained an annual average of 13.3 percent of their real net cash income from direct government payments (Belasco 2020). ¹

Typically, government support payments to farmers in the United States have been linked to shortfalls in yields or relatively low prices for agricultural commodities through programs authorized by successive farm bills. However, since the 1970s, farmers have also regularly received ad-hoc payments to compensate them for losses associated with exceptionally severe droughts, floods, hurricanes, and other natural perils (Goodwin and Smith, 1995; Smith and Glauber, 2012). More recently, in 2018 and 2019, farmers have also received substantial ad-hoc disaster payments through two separate and distinct iterations of the Market Facilitation Program (MFP) to compensate them for losses associated with the Trump Administration’s trade disputes with China, Canada, Mexico, the European Union and other countries. Under the 2018 and 2019 MFPs, US farmers and ranchers were paid $9.6 billion for losses in 2018 and $14.5 billion for losses in 2019. The programs were implemented by the Trump Administration without congressional authorization using unallocated Commodity Credit Corporation funds. They were justified by the Administration as compensation for losses farmers incurred when China introduced higher tariffs on imports of US agricultural commodities in response to new U.S. tariffs on steel, aluminum, and other commodities. ²³ The Coronavirus Food Assistance Program (CFAP), introduced on April 17, 2020 as part of the CARES Act, initially authorized up to $16 billion for payments to compensate farmers for losses linked directly to the COVID-19 pandemic during the 2020 agricultural marketing year. This new ad hoc disaster aid program immediately followed on the heels of the 2018 and 2019 MFPs.

While the two MFPs were associated with the same disruption (loss of access to export markets in China and elsewhere) they were

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² Glauber (2019) and Hendricks and Janzen (2020), among others, have estimated that the 2018 and 2019 MFPs substantially over-compensated producers of many commodities, up to and including soybeans, for any actual losses incurred because of trade dispute related declines in their prices.
³ The MFP payments were also widely viewed by many observers as measures used by the Trump administration to shore up political support for the president and his party among agricultural producers with respect to the 2018 mid-term congressional elections and the 2020 presidential election (Bump 2020; Rappeport 2020).

https://doi.org/10.1016/j.foodpol.2021.102189
Received 4 December 2020; Received in revised form 27 August 2021; Accepted 30 October 2021
Available online 6 November 2021
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implemented in very different ways, providing an opportunity to evaluate how the concentration of benefits among farmers is affected by changes in policy designs. The first MFP payments were limited to a handful of crops and two livestock commodities (hogs and dairy) with commodity specific payment rates directly tied to commodity specific prices and the farm’s production of each eligible commodity. In that respect, the 2018 MFP was similar to the federal crop insurance program which also directly links benefits to the value of a farm’s crop production. The second MFP distributed payments on the basis of total acres planted to all crops eligible for such subsidies at a generic per acre payment rate established on a county wide basis. Comparing the distributional outcomes of these two programs therefore has the potential to provide insights about the distributional impacts of program design relevant for current and future disaster aid declarations, including current and future COVID 19 related emergency aid programs. The CFAP program, which had two phases, used payment rates based on the estimated amount of damage on each eligible commodity that was multiplied by production, which is also similar to the 2018 MFP. However, due to the different estimated damages across commodities, the CFAP program allocated most of the funds to cattle producers, while 2018 MFP payments were allocated primarily to products previously exported to China, including soybeans and pork. Nevertheless, because both the 2018 MFP and CFAP are based on total production levels, they are likely to allocate payments between large and small farm operations in a similar manner. The evidence presented in this paper demonstrates that the distributions of payments under these two programs are surprisingly similar.

This study therefore explores the distribution of the 2018 and 2019 MFP subsidy payments, the CFAP payments and, for comparison purposes, the federal crop insurance program among farm businesses using data from the USDA Agricultural Resource Management Survey (ARMS) and, with respect to the CFAP program, as discussed below, data obtained through Freedom of Information Act (FOIA) requests from the USDA Farm Service Agency. The ARMS is an annual nationally representative survey that provides financial, marketing, production and resource use information at the individual farm level. We then compare the distributions of payments under each of the two MFPs estimated using the ARMS data with the distributions of actual payments, ordered by size of payment to each recipient farm business, using data on those payments obtained from the USDA Farm Service Agency (FSA) under a Freedom of Information Act (FOIA) request submitted by the authors.

We find that for each MFP, the results obtained using the ARMS and FSA data are relatively consistent. In the context of the results from our analysis of the MFPs, we then use further data on payments made under the ad hoc COVID 19 CFAP program, also obtained from the USDA FSA under a separate FOIA request, to examine the distribution of those payments among farms and find those results to be consistent with the results in the MFP analysis.

Several findings are of interest. First, as has been the case for most federal subsidy programs over the past eight decades (Bonnen 1968; Johnson and Short 1983; Key and Roberts 2007; Kramer 1983; Schultz 1971), under both MFPs, the CFAP and the federal crop insurance program, the largest ten percent of farms received around half of all payments. Second, subsidy programs that directly link payments to the on-farm production of specific crops, as opposed to other base or planted acreage, result in payments that are more heavily skewed towards the largest farm businesses. Programs based on production levels include the federal crop insurance program, the 2018 MFP and the 2020 CFAP initiative. As Bekkerman, Belasco and Smith (2019) reported, larger farm businesses tend to receive higher per acre payments, most likely because of higher levels of productivity. Key (2019) provides empirical support for this hypothesis, reporting a positive empirical relationship between farm size and productivity for crop producers raising corn associated with changes in technical efficiencies over time that are utilized more effectively by larger farms because of economies of scale. Sumner (2014) offers an alternative explanation suggesting that as consolidations within agriculture occur farms with higher levels of multifactor productivity tend to expand while those with lower productivity levels tend to exit the industry. The 2019 MFP, which linked payments to areas planted rather than farm level crop specific production, resulted in a payment distribution that is somewhat less skewed to larger farm businesses.

2. Background

Federal agricultural subsidy programs include a wide range of initiatives aimed at protecting and stabilizing farm incomes from impacts of adverse events. They include ad hoc disaster aid programs such as the 2018 and 2019 MFP and 2020 COVID 19 initiatives, and the 2019 Additional Supplemental Appropriations for Disaster Relief Act. As with the MFP initiatives, funding for such programs is sometimes, but not always, obtained by an Administration independently of explicit, narrowly defined annual congressional appropriations that are managed by the USDA Commodity Credit Corporation (CCC). The same pool of CCC funds is also used to support several long-standing or permanent farm income safety net and other programs authorized by Congress. These include Agricultural Risk Coverage, Price Loss Coverage and some conservation programs.

In most years, CCC outlays on such...
programs amount range from about $10 to $15 billion, far less than the $30 billion made available to the CCC each year from 1986 to 2020.

The federal crop insurance program, the most expensive farm safety net initiative through which subsidies are distributed to farms, is not funded through the CCC but directly out of general government funds. Crop insurance is aimed at providing yield and revenue assurance policies to farmers between the planting and harvest season. In contrast, ad hoc disaster aid programs are often used to compensate farmers for one-off events such as floods, hurricanes and supply chain disruptions that generate widespread losses. The 2018 and 2019 Market Facilitation Programs (MFPs) are examples of such disaster programs because they compensated farmers for losses incurred as a result of the trade dispute between the U.S. and China.

Under the 2018 Market Facilitation Program (MFP), payments were commodity specific and based on the estimated differences between the actual prices received by farmers and those they would have obtained in a counterfactual environment in which no counter-veiling tariffs on US agricultural exports were imposed by China and other countries (US Department of Agriculture, Office of the Chief Economist 2018). These payment rates, reported in Table 1, were then multiplied by the amount of total estimated production of each eligible commodity by a farm to determine the payment the farm would receive. The 2019 MFP was substantially redesigned in three important ways.

First, all payments were to be based on a fixed county-level per acre payment rate that applied to all eligible crops. Thus, on a per acre basis, regardless of the eligible crop planted by a farmer, the farmer received the same amount of compensation for each acre dedicated to the crops covered by the 2018 MFP – corn, cotton, grain sorghum, soybeans, and wheat – and also to a wide range of additional crops including alfalfa hay, barley, canola, crambe, dry peas, flaxseed, lentils, long grain and medium grain rice, mustard seed, dried beans, oats, peanuts, rapeseed, safflower, sesame seed, chickpeas, sunflower seed, temperate japonica rice and some fruits, nuts and vegetables. At the county level, payment rates were bounded at an upper limit of $150 per acre and a lower limit of $15 per acre, reflecting the widely different production conditions and crop mixes that obtain in different areas of the United States. Second, payments were based explicitly on the total acres a farm planted to all crops eligible for payments. As a result, any direct links between the prices and farm-level yields of individual crops were largely decoupled from the amount of payments to farmers.

The two programs were therefore substantially different in terms of their potential impacts on the distribution of payments among farms. The 2018 MFP was based on a farm’s actual production of each eligible crop, implying that within and across counties farms with higher per acre yields would receive larger per acre payments. The 2019 MFP made a fixed payment for each eligible crop in which per acre payments only varied across counties. Within each county, average per acre losses were estimated by computing estimated country wide losses for each impacted crop, weighted by the proportion of the total acres planted to those crops in the county allocated to each of them. Thus the differences in country wide payment rates were determined by the differences in county wide yields and shares of those crops and the imputed trade war related losses associated with each crop (for example, under the 2019 MFP, Georgia counties where cotton was raised were likely estimated to have much higher per acre losses than soft red wheat in Western Kansas counties). Second, the 2018 MFP covered losses for only seven crops (cotton, corn, sorghum, soybeans, wheat shelled almonds and sweet cherries) and two livestock products (dairy and hogs) while the 2019 MFP covered estimated losses for 41 crops and some livestock products. Thus, 2019 MFP payments were spread over a wider geographical area and more inclusive group of farms. Finally, the total federal funds available for payments under the 2019 MFP are approximately 50% larger than for payments under the 2018 MFP. The differences in total funding may not have much impact on the proportional distribution of payments under the two programs. However, the differences in the basis for payments, crop production versus area planted to all eligible crops and crop specific payments versus fixed area payments at the county level, are likely to be an important source of any differences in the distributions of payments between the 2018 MFP and the 2019 MFP.

Two recent studies have evaluated the impact of the 2018 and 2019 MFPs on the financial situation at the level of the farm. Paulson, Featherstone, and Hadrich (2020), using farm management association data from Minnesota, Illinois, and Kansas, reported that payments from the 2018 MFP accounted for between 40 and 60% of average net farm income. These payments were found to substantially improve the financial standing of farms in terms of liquidity, solvency, and debt repayment. They also estimated that, absent the 2018 MFP subsidies, 20–45% of farms would have reported negative net farm incomes. Janzen and Hendricks (2020) investigated the extent to which the amount of compensation paid in the 2018 and 2019 MFPs reflected actual losses incurred by the agricultural sector as a result of China’s counter-veiling tariffs on soybeans and other crops. Their results indicate that the MFP payments exceeded the short-run impacts associated with lower market prices, while they note that payments may have under-compensated farms with respect to potential multi-year longer

Table 1

| Commodity     | Payment Rate | Estimated Total Payments (in $M) | 2018 MFP | 2019 MFP | Unit    |
|---------------|--------------|----------------------------------|--------|---------|--------|
| Cotton        | 0.06 0.12 $ Per Pound | 553.8 486.4 987.08 | 2018 MFP | 2019 MFP | Pound   |
| Corn          | 0.01 0.35 $ Per Bushel  | 192.0 143.4 4967.4      | 2018 MFP | 2019 MFP | Bushel  |
| Soybeans      | 1.65 1.25 $ Per Bushel  | 7,259.4 7,238.3 5,484.7 | 2018 MFP | 2019 MFP | Bushel  |
| Sorghum       | 0.86 1.01 $ Per Bushel  | 313.6 297.6 350.2      | 2018 MFP | 2019 MFP | Bushel  |
| Wheat         | 0.14 0.69 $ Per Bushel  | 238.4 272.9 1,336.1      | 2018 MFP | 2019 MFP | Bushel  |

Note: 2018 MFP estimates do not include payments for shelled Almonds ($63.3 M), Dairy ($254.8 M), Pork ($580.6 M), and Sweet Cherries ($111.5 M). The inclusion of these products implies a total estimate of $9.567B for the 2018 MFP.

* Figures are estimated using data from the Agricultural and Resource Management Survey by simulating the program parameters.
* Figures are based on announcement made on 12/17/2018 in press release from the USDA titled ‘USDA Launches Second Round of Trade Mitigation Payments.’

Thus the 2018 MFP payments were directly linked to a farm’s actual production of each eligible crop and therefore, under the terms of the World Trade Organization (WTO) Agreement on Agriculture likely to be reported into the category of production distorting “amber box” payments (Glauber, 2019).

13 The impact of truncating per acre payment rates at the lower and upper bounds has the potential to reduce the variability of per acre subsidies across farms under the 2019 MFP. While the design of the program was likely to result in per acre payments that were relatively similar across farm sizes, these bounds may have further reduced such differences.

14 In the 2019 MFP, eligible crops included alfalfa hay, barley, canola, corn, crambe, dried beans, dry peas, extra-long staple cotton, flaxseed, lentils, long grain and medium grain rice, millet, mustard seed, oats, peanuts, rapeseed, rye, safflower, sesame seed, small and large chickpeas, sorghum, soybeans, sunflower seed, temperate japonica rice, triticale, upland cotton, and wheat as well as the following fruit and nut specialty crops: almonds, cranberries, cultivated ginseng, fresh grapes, fresh sweet cherries, hazelnuts, macadamia nuts, pecans, pistachios, and walnuts. Hogs and milk production were also eligible for payments, as in the 2018 MFP.
run effects, although such impacts would be dependent on the duration of, and terms under which the trade dispute between China and the United States is resolved. The discrepancies between direct government aid and estimated short run damages are identified for a wide range of commodities, but Janzen and Hendricks find them to be the largest in counties that produced cotton and grain sorghum.

The studies by Janzen and Hendricks and Featherstone et al provide interesting insights about the impact of the MFPs on farm financial performance. However, they do not evaluate the distribution of benefits across farms by farm size. In this analysis, we investigate that question with the objective of examining the impact of differences in MFP designs on payment distributions to inform future agricultural policies.

The concentration in farm production can largely be explained by changes in economies and scale and investments in labor-saving technology (MacDonald, Hoppe, and Newton 2018). However, agricultural policy has largely ignored those fundamental changes in agriculture. An ongoing concern with the design of many farm programs is the growing concentration of benefits (Key and Roberts 2007; Kirwain 2016, Mishra, El-Osta, and Gillespie 2009). The concentration of subsidy benefits is of interest for at least two important reasons. First, conceivably, agricultural programs may add to the forces leading to increased concentration of production at the farm level and larger farms. Second, when farm subsidy programs are primarily and overwhelmingly targeted to the largest farms, many of which are the most financially stable agricultural enterprises, then the program is unlikely to have much impact on farm bankruptcy and failure rates.

3. Data and methods

Data for this analysis were obtained from three sources. First, responses from the 2018 Agricultural Resource Management Survey (ARMS) were used to establish farm profiles within and across crop sales quantities. The ARMS is the only nationally representative survey implemented on an annual basis that includes production, financial, and demographic information on agricultural producers. Only farms with more than $1,000 in crop sales are included. Second, individual recipient data were obtained from the Farm Service Agency (FSA) through two separate FOIA requests that provide payment information from the 2018 and 2019 Market Facilitation Programs (MFPs). FSA documentation was also used in order to establish the rules and payment rates associated with each program. Third, crop insurance subsidy rate data were collected from the Risk Management Agency using the county-level Summary of Business data and dividing subsidies by total premiums.

In order to estimate the potential impact of the 2018 MFP, we use the 2018 ARMS data and applied the program specific commodity payments rates reported in Table 1 to production totals reported in the ARMS data for each of the five eligible large acre crops (corn, cotton, grain sorghum, soybeans and wheat). Payments to these five commodities amounted to an estimated $8.6 billion (89% of the estimated total outlays under the 2018 MFP). Data received from USDA FSA indicated that under the 2018 MFP, $8.6 billion had been paid to producers of “Crops”, $0.3 billion had been paid to producers of “Livestock,” and $76.6 million had been paid to producers of other crops (shelled almonds and cherries). Using the 2018 ARMS, 2018 MFP payments to these five crops are estimated to be $8.4 billion, which is 2.3% different from the actual payments received.

To estimate the impacts of the 2019 MFP, we apply the county-level payment rates, illustrated in Fig. 1, to total planted cropland acres for farmers who reported growing eligible crops, as reported in the 2018 ARMS. Using this methodology, payments are estimated to be $15.56 billion in our analysis, which is 7.5% higher than the $14.51 total amount paid out.17

The amounts of crop insurance subsidies received by each farm are computed using the approach developed by Bekkerman, Belasco, and Smith (2019) by computing the average subsidy rate (subsidies/total premium) for the county in which the farm is located using aggregated crop insurance policy data from the Risk Management Agency. The average subsidy rate is computed for each county-crop combination for corn, cotton, grain sorghum, soybeans, and wheat, using data from 2018. The subsidy rate applied to a farm in any given county that produces multiple crops is based on the percentage of acreage devoted to each crop and the county-level average subsidy rate for each of those crops. This subsidy rate, which is weighted by the farm’s allocation of land to each crop, is then applied to the farm’s total federal crop insurance payments, as reported in the ARMS survey, in order to impute the implied subsidies for that farm. By using the county-level average subsidy rate, we are able to account for regional and commodity-specific differences in coverage levels and unit selection differences. For counties in which crop-commodity rates could not be computed, the national average subsidy rate of 62% subsidy rate was assumed to apply (Bekkerman, Belasco, and Smith).

4. Results

The concentration of program payments can be measured in two ways: ordered by size of farm and ordered by size of payment. We first examine the distribution of payments using data from the ARMS across farm size using two different methods, including deciles based on the value of crop sales and farm size categories utilized by the USDA Economic Research Service (ERS), which respectively defines small, midsize, and large farms as having gross farm cash incomes below $350,000; $350,000-$1,000,000; and over $1,000,000. The use of deciles enables us to evaluate distributional impacts across a substantially disaggregated range of farm sizes, while the use of the much more highly aggregated ERS definitions provides sufficient observations from the ARMS data to assess impacts associated with differences in crop specific yields among farms of different sizes. In addition, we examine the distribution of payments among all recipients by size of payment using data obtained from the USDA FSA in order to assess the validity of our procedures for estimating payments using the ARMS.

4.1. Distribution across farm size

Using data from the ARMS and simulating payments made under each of the three policies, Table 2 provides summary information on farm characteristics across farm size based on crop sales farm deciles and gross farm cash income definitions established by the ERS. These characteristics include average values for crop sales, area planted to crops, gross farm income and net worth, as well as average program payments in each decile under the 2018 MFP, 2019 MFP and federal crop insurance programs. In addition, average payments per acre are also reported for each of the deciles under each program. Among all farms (whether or not they received a program payment) the largest ten percent of farms, with average annual gross farm incomes of $2.14 million, received average subsidies of $67,400 under the 2018 MFP, $121,100 under the 2019 MFP, and $42,200 under the 2018 federal crop insurance program, an average total of $230,700 per farm across the three programs. Farms in the 50–60% quantile, relatively small commercial operations with average annual gross farm incomes of $153.7 thousand (about 7 percent

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16 The focus here is on crops, in part because while cattle and some other livestock operations receive crop insurance subsidies under a pasture and range insurance program based on rainfall indexes, payments under other price protection-oriented livestock programs are very modest, amounting to at most $20 million annually relative to total premium subsidies for all products in excess of $6 billion.

17 Payments as of November 2, 2020, reported https://www.farmers.gov/sites/default/files/2020-11/FarmersGov-Manage_Market-Facilitation-Program-Data.pdf
of the average gross farm incomes of the largest decile of farms) received average subsidies of $4,600 under the 2018 MFP, $10,700 under the 2019 MFP and $2,700 under the federal crop insurance program, for a total of $18,000 across the three programs. Very small farm operations in the lowest decile, with average gross farm incomes of $18,100 received almost nothing under the 2018 MFP and the federal crop insurance program and $1,100 under the 2019 MFP. Small crop producing operations, which on average farm about an acre of cropland, received at least some subsidies under the 2019 MFP largely because a much wider range of crops were eligible for payments, including high valued crops such as fruits, nuts and vegetables.

Table 2 also presents information on these variables for the subset of farmers estimated to receive at least $50,000 under each of the three programs. This group represents 14,821 farms for which data were reported the 2018 ARMS survey that, when the ARMS weights are applied, represent 2.3% of all crop farms. Those farms are estimated to have received 23.0% of all payments made under the 2018 and 2019 MSP and crop insurance programs, including 31.5% of all crop insurance subsidy payments, 23.6% of all 2018 MFP payments, and 20.1% of all 2019 MFP payments. While many of the key farm characteristics with this group are similar to those in the top decile, in some areas they are notably larger. For example, the area planted to crops averaged 3,253 acres in this group, nearly twice the size of the average for the largest ten percent of farms (1,712 acres) and nearly 10 times of the average for all farms (254 acres).

The difference in farm size among this group, relative to all other groups, substantially increases the payments they obtain from all three programs. For example, farms in this exclusive category were estimated to receive an average of $134,373 for 2018 MFP, $219,727 for 2019 MFP, and $107,014 in crop insurance subsidies. On a per farm basis,
these payment amounts are 9–14 times larger than the average payment received among the sample of all farms, and at least 1.8 times greater than average payment received by the largest ten percent of farms. At the farm level, MFP payments were not effectively limited and no farm-level payment limits applied to federal crop insurance premium subsidies (Glauber 2019). Thus, while these differences in total subsidy payments among farms are large, they are not surprising and explicitly a result of tying outlays to each farm’s size in terms of acres and value of output.

The extent to which the proportions of total subsidies flow to large and farm businesses and the average size of payments to larger as opposed to smaller farms are other indicators of the extent to which payments are concentrated. Among farms receiving payments under a given program, the largest 10 percent of farms received 49.2% of all program payments under the 2019 MFP, 52.7% under the 2018 MFP and 55.3% under the federal crop insurance program.

In terms of the degree to which the concentration of subsidy payments varies by program, while the range of commodities eligible for payments is of interest, the data on per acre payments presented in Table 3 is of relevance. The design of the 2018 MFP directly linked subsidy payments to a farm’s total level of production for each eligible crop, resulting in higher per acre payments to more productive farms with higher yields. In that respect, the 2018 MFP is similar to the federal crop insurance program, as discussed by Bekkerman, Belasco and Smith (2020) who reported that on a per acre basis larger farms received substantially higher subsidies than smaller farms. As reported in Table 2, under the 2018 MFP per acre payments increased from less than $1 per acre for the smallest decile of farms to $32.5 for farms in the 80–90 percent decile and $28.4 to farms in the largest decile, with an average per acre payment among all farms of $18.9 per acre. Thus, in the 2018 MFP, on a per acre basis, the average payment for all farms was only 66.6% of the payment received by farms in the largest decile. Payments on a per acre basis under the 2018 federal crop insurance program monotonically increased from $0.1 for the smallest decile of farms to $34.5 for the largest decile.

The amount paid on each acre was much less likely to vary substantially by farm size under the 2019 MFP, which provided an identical fixed per acre payment for the area planted to any eligible crop within each county. Under the 2019 MFP, per acre payments did vary to some degree among farms by size of farm. For all farms, on average each farm received a payment of $50.5 per acre, about 90 percent of the average per acre payment $55.4 to farms in the top decile. Farms that received over $50,000 from all three programs received an average of $64.0 per acre. This result which is driven by the crop mix of larger farms tending to also reside in areas that produce cotton and other crops with the largest payment rates. This is illustrated in Fig. 1, which shows that farms in areas where cotton is raised (west Texas and the southern regions) received the largest allowable county-based payments of $150 per acre.

These payments are provided to farms with substantially higher gross farm incomes and net worths than the average farm. As reported in Table 2, the largest ten percent of farms had an average net worth of $6.7 million, 3.5 times larger than the net worth of the average farm ($1.9 million). Similarly, gross farm incomes for farms in the highest decile averaged $2.1 million, over 5 times higher than for the average farm ($339 thousand).

As discussed above, Table 3 reports results for the largest 20 percent of farms and area granular level by also providing information about payments for the largest 20%, 15%, 10%, 5%, 2% and 1% of farms by crop sales. The largest twenty percent of all farms received over 70% of all payments made under the three programs. However, within that group, payments are increasingly heavily concentrated among the largest farms. For example, the top five percent of farms received over 30% of all program payments under each of the three programs. On a per acre basis, these payments were highest under the 2019 MFP at $56.15 per acre, followed by crop insurance at $42.40 per acre, and the 2018 MFP at $27.14 per acre. Average total payments for the largest 5 percent of all farms were $53,726 under the federal crop insurance program, $87,078 under the 2019 MFP and $156,843 under the 2019 MFP.

The growth in payments per acre across crop sales quantiles is even more pronounced when we include all crop sales quantiles, as is shown in Fig. 2. While the 2019 MFP distribution exhibits a relatively flat relationship between crop sales and subsidies per acre across farm size quantiles, a nearly linear positive relationship is found in the 2018 MFP and crop insurance programs. The main source of the divergence between the 2019 MFP and the 2018 and crop insurance is likely to come from the designs of the policies, where 2018 MFP and crop insurance programs-based programs that are effectively based on production, while the 2019 MFP is based on a base number of acres. An important reason for these differences, as discussed above, is that larger farms tend to be more productive than smaller farms (Key 2019; Key and Roberts 2007; Sumner 2014). Thus, larger farms tend to realize higher yields and, as a result, higher subsidies per acre.

To further investigate the potential relationship between yields and payments per acre, we utilize ERS definitions of farm size in order to obtain large enough sample sizes to carry out crop-specific analyses of links between crop yields, farm size, and program payments, for three major crops. In this analysis, we examine farms that are defined as primarily corn, soybeans, or wheat operations, based on the criterion that the largest proportion of planted acres are allocated to that specific crop. Results from this analysis are reported in Table 4. The results indicate that, moving from farms classified as small to midsize to large, as defined by USDA, both yields and payments per acre increase under the 2018 MFP for corn and wheat operations. For soybeans, yields and 2018 MFP per acre payments increased for midsize farms relative to small farms, and both yields and per acre payments slightly decline for large farms relative to midsize farms. In comparison, 2019 MFP per acre payments are relatively stable across the three farm size categories. For example, relative to midsize farms, large corn farms experience a 10% increase in yields and an 8% increase in 2018 MFP payments per acre, while payments under the 2019 MFP were only 3% higher for large scale corn farms relative to midsize farms. One interesting finding is that increases in per acre payments across all farm sizes are larger under the federal crop insurance program for all three commodities, which may be because larger operations purchasing higher coverage levels with larger per acre premiums that, in terms of payments, are more heavily subsidized on a per acre basis. While wheat operations follow the same pattern, soybean operations are found to increase, on a per acre and relative to midsize operations, around 3–4% for yields and both MFPs on large operations, while crop insurance payments increase by 12% for that same group. It is worth noting that many farms defined as primary corn or soybean operations grow both crops primarily and are likely to benefit from payments compensating for corn and soybeans.

Finally, one important feature of these programs is the extent to which payments overlap between the three initiatives among farms and the impact of the overlap on payment concentration. This payment overlap is illustrated in the modified Venn diagrams provided in Fig. 3. The left figure shows the composition of the overlap between payments for farms. To illustrate, 2.5% of the payment amount across all three programs were made to farms that only received payments under 2019 MFP, which comprise 36.7% of all farms (as shown in the right diagram). The largest payment category includes farms that received payments under all three programs. These farms comprise 37.7% of all crop farms and received 81.4% of all payments across the three programs.

4.2. Distribution across recipients

In Fig. 4, empirical cumulative density functions (CDFs), widely referred to as Lorenz curves, are reported for simulated program payments by farm payment amount for the 2018 and 2019 MFP and the federal crop insurance program. The distributions include all farm households in the ARMS, whether or not they received an MFP payment.
The 2019 MFP was a more generous program in terms of numbers of farmers who received payments. Under the 2019 MFP, at least some payments are estimated to have been made to 97% of all crop farms; under the 2018 MFP payments were made to 58% of all crop farmers; and under the federal crop insurance program payments were made to 41% of all crop farms. The expansion of payments under the 2019 MFP was a direct result of the program’s design, under which total funding was substantially increased and payments were made to producers of a much wider range of 41 separate commodities than the eight commodities covered under the 2018 MFP.

However, in both the 2018 and 2019 MFPs, as well as the federal crop insurance program, payments were heavily concentrated among the largest farms, as illustrated by the extreme concavity the Lorenz curves for each program presented in Fig. 4 and the exceptionally high

### Table 3
Summary of key program payments for top crop sales quantiles.

| Percentile | Payments Per Acre ($) | Payments Per Farm ($1,000) | Proportion of Total Payments (%) |
|------------|-----------------------|-----------------------------|----------------------------------|
|            | Insurance Subsidy | 2018 MFP | 2019 MFP | Insurance Subsidy | 2018 MFP | 2019 MFP | Insurance Subsidy | 2018 MFP | 2019 MFP |
| 20         | 27.82     | 30.49 | 56.39 | 28.8 | 48.1  | 85.8 | 75.86 | 75.79 | 70.28 |
| 15         | 29.97     | 29.76 | 56.64 | 33.5 | 55.7  | 99.3 | 66.17 | 65.79 | 60.99 |
| 10         | 34.48     | 28.44 | 55.42 | 42.2 | 67.4  | 121.1 | 55.28 | 52.72 | 49.23 |
| 5          | 42.40     | 27.14 | 56.15 | 53.7 | 87.1  | 156.8 | 35.39 | 34.28 | 32.08 |
| 2          | 46.29     | 23.69 | 57.94 | 72.2 | 108.5 | 198.2 | 19.03 | 17.09 | 16.23 |
| 1          | 58.27     | 17.42 | 55.35 | 83.5 | 113.0 | 220.7 | 10.89 | 8.81  | 8.94  |

### Table 4
Program payments and farm yields by USDA Economic Research Service farm size category and crop.

| ERS Classifications | Average Payments Per Acre | Average Yield | n | Proportional to Midsize |
|---------------------|----------------------------|---------------|---|-------------------------|
|                     | MFP 2018 | MFP 2019 | Crop Insurance | MFP 2018 | MFP 2019 | Crop Insurance | Average Yield |
| **Corn**            |          |          |                |          |          |              |               |
| small               | 20.25          | 56.33                  | 12.52                  | 153.40          | 102,433.54            | 68%          | 100%          | 67%          | 94%          |
| midsize             | 29.78          | 56.25                  | 18.71                  | 163.86          | 45,622.98             | 100%         | 100%          | 100%         | 100%         |
| Large               | 32.04          | 58.17                  | 22.88                  | 179.62          | 21,966.66             | 108%         | 103%          | 122%         | 110%         |
| **Soybeans**        |          |          |                |          |          |              |               |
| small               | 48.38          | 62.06                  | 12.52                  | 47.23           | 127,814.38            | 104%         | 99%           | 66%          | 94%          |
| midsize             | 46.55          | 62.62                  | 19.00                  | 50.41           | 37,921.22             | 100%         | 100%          | 100%         | 100%         |
| Large               | 48.35          | 64.47                  | 21.31                  | 52.62           | 16,112.87             | 104%         | 103%          | 112%         | 104%         |
| **Wheat**           |          |          |                |          |          |              |               |
| small               | 10.60          | 33.78                  | 6.73                   | 46.79           | 33,302.20            | 94%          | 112%         | 63%          | 96%          |
| midsize             | 11.22          | 30.12                  | 10.61                  | 48.92           | 9,618.43              | 100%         | 100%          | 100%         | 100%         |
| Large               | 12.78          | 33.43                  | 16.66                  | 63.52           | 5,301.77              | 114%         | 111%         | 157%         | 130%         |

Note: ERS defines farm size according to gross cash farm income (GCFI), where small farms have GCFI <$350,000; midsize farms have GCFI between $350,000 and $1,000,000; and large farms have GCFI > $1,000,000.
Fig. 3. Distribution of program payments by share of payments and recipients. Note: MFP denotes the Market Facilitation Programs from 2018 and 2019, while CI denotes crop insurance. Other includes MFP 2019 + CI, MFP 2018 + CI, MFP 2018 Only, and CI Only.

Fig. 4. Empirical CDF of program payments, by program and representative population percentile (N = 651,607).
values of the Gini index coefficients associated with each distribution. The results indicate that crop insurance subsidy payments were the most heavily concentrated among large farms, with a Gini index coefficient of 0.849, followed by the 2018 MFP (0.815) and the 2019 MFP (0.756). Thus, in addition to providing subsidies to more farms, the 2019 MFP payments were somewhat less heavily concentrated on the largest farms.

Fig. 5 presents estimated CDFs for the 2018 and 2019 MFP and crop insurance programs using only observations for farms estimated to have received any payments under the programs. Simply because farms receiving no payments have been omitted from the population of interest, the Gini coefficients associate with these CDF for each program are smaller but still large, indicating that payments remain heavily concentrated on the largest farms. The evidence from the CDFs based on payment recipients indicates that the 2018 MFP, with a Gini coefficient of 0.762, resulted in subsidy payments being most heavily concentrated on large farms, followed by followed by the 2019 MFP (0.680) and the federal crop insurance program (0.639). Thus, the fact that a higher proportion of farms received no crop insurance subsidies than no MFP payments is another important reason why, among all farms, payments under that program are most heavily concentrated on large farms. Small-scale operations are less likely to participate in the federal crop insurance program because of fixed costs associated with program participation (Smith and Glauber, 2012).

Data on actual payments to individual farms under the 2018 and 2019 MFP and the CFAP were obtained data from the USDA Farm Service Agency (FSA). These data were also used to compute CDF’s for the 2018 and 2019 MFPs in order to evaluate the extent to which the distributions of payments estimated using the ARMS data are similar, providing some evidence about the extent to which the ARMS based estimates are adequate representations of the distributions of program payments. Unlike the ARMS data, the FSA data do not include information on farm production, market sales, financial or other farm specific characteristics. Thus, the CDF’s for the MFPs simply show the shares of total subsidy payments by quantile in which recipients are ordered from smallest to largest farm payments. Thus, the CDF’s are not directly comparable to the CDF’s based on farm size. However, as shown in Fig. 5, the CDF’s for both the 2018 and 2019 MFPs based on the FSA data (the Lorenz curves with dotted lines) are very similar to those obtained using the ARMS data (the Lorenz curves with solid lines). Gini index values are also very similar for the distributions obtained using the ARMS and FSA data. However, in both the 2018 and 2019 MFPs the values based on the FSA data on actual payments are higher (0.785 as compared to 0.762 for the 2018 MFP and 0.696 compared to 0.680 for the 2019 MFP), suggesting payments may actually be a little more heavily concentrated on larger farms than the simulated distributions based on the ARMS data suggest.

At the farm level, legislative limits on total payments to individual farms were applied under both MFPs. Such payments for all non-specialty crops were to be capped at $250,000 per eligible person or legal entity, with the same total limit applying for all specialty crops and for dairy and hog production. Payments to eligible persons and entities who raised a mix of specialty crops, non-specialty crops and/or hogs and dairy were capped at $500,000. However, such payment limits are widely viewed to be largely ineffective (Smith et al., 2018). To test this hypothesis, using the FSA FOIA information for the MFP on payments to individual entities, we examined whether clustering existed around the legislated payment limits of $250,000 or $500,000. No evidence of such clustering was found, suggesting that payment limits were ineffective.

This lack of effectiveness is likely due to the high levels of the payment limits and the ability of farms to legally avoid such limits through adjusting the legal structures of their operations strategies.

However, the effective use of payment limits is one method by which payments to farms can be limited (Bekkerman, Belasco, and Smith 2019). While per acre payments under the 2019 MFP were fairly stable across all farm sizes, the effective use of payment limits could have substantially mitigated the substantial concentration of payments on large and very large farms under the 2018 MFP. In Table A1 in the Appendix, estimates of the impacts of alternative payment limits of $60 k, $80 k, $100 k, and $120 k are reported with respect to total program expenditures, per acre payments across farm sizes, and the proportion of farms impacted by the payment limits within each USDA farm size category. The incidence of all the payment limits falls almost entirely on large-scale farms, However, all of the payment limits reduce total program expenditures, and moderate differences among farms in average payments on all acres planted to eligible crops because total payments to large farms are much more substantially reduced than total payments to other farms.

4.3. The CFAP program

In order to assess the robustness of the findings on distributional impacts obtained using the ARMS data for the 2018 and 2019 MFPs, and the federal crop insurance program, we also obtained individual recipient data on the CFAP. Payments under the CFAP are based on the amount of farm level production and inventories, and USDA estimates of price damages. Thus it is likely that benefits will be distributed with a pattern of concentration that is more similar to the 2018 MFP than the 2019 MFP. The results in this paper suggest that when payments are based on production, rather than base acreage, they tend to be more heavily concentrated on larger farms.

These findings are consistent with the evidence provided with the Lorenz curves in Fig. 5. The estimated Gini coefficient of 0.782 for the 2020 CFAP payments is almost identical to the Gini Coefficient for the 2018 MFP (0.785) and 12 percent higher than for the 2019 MFP (0.696). A second set of results that support the hypothesis that payments are similar across the 2018 MFP and 2020 CFAP are reported in Table 5. Payments under the CFAP are substantially more concentration than under the 2019 MFP as illustrated by consistently higher proportion of payments being made under CFAP to the highest farm percentiles. About half of all payments under 2020 CFAP and 2018 MFP went to the top 5 percent of recipients, while under the 2019 MFP the top 5 percent of recipients received only 37.9% of those payments. While average payments under the 2019 MFP are substantially larger at every percentile level, the concentration of payments is tempered by the program’s design. In contrast, at the top 5% level of recipients, the CFAP becomes more concentrated than the 2018 MFP, with 25.9% of all payments going to the top 1% of recipients.

5. Policy implications

It is important to understand how disaster program payments flow throughout the U.S. agricultural system and why the distribution of those payments is affected by program design. The issue is especially important if a major purpose of such initiatives is to protect financially vulnerable farms from the adverse consequences of catastrophic events. This study provides insights about the distributional impacts of the 2018 and 2019 MFPs that may inform how of future ad hoc and other subsidy programs could be more effectively targeted, given the objectives of policy makers.

The major findings of this study are as follows. First, payments from both the MFP 2018 and 2019 disaster programs, as well as the federal

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18 Gini coefficients for each distribution were estimated using the method proposed by Gastwirth (1972). A Gini index value of zero implies that each share of the population of interests receives an identical share of the total payments; a value of 1 implies that all payments go to only one group (for example the top one percent of farms by sales) and none to the rest of the population.
crop insurance program, are heavily concentrated on larger farms, with few resources flowing to midsize and small farm operations. The same finding also holds with respect to pandemic relief payments made under the CFAP program. The heavy focus on payments to large scale farm businesses is a direct consequence of the designs of the programs, which determine payments using either the total amount of production for crops affected by the catastrophe (2018 MFP, Federal Crop Insurance Program, and 2020 CFAP) or the number of acres planted to such crops (2019 MFP). To illustrate, the largest 5% of all farms received 34.3% of all 2018 MFP payments and 32.1% of all 2019 MFP payments. On a per farm basis, payments under the 2019 MFP were substantially larger than the 2018 MFP because funding for the 2019 MFP was substantially larger. Payments per farm averaged $12,693 for 2018 MFP and $24,427 for 2019 MFP. Farms within the top decile received payments that were approximately an average of five times more than the average farm payment.

Second, both MFPs gave larger farms higher payments on a per acre basis, but especially under the 2018 MFP in which payments were directly tied to a farm’s total production of a crop, and therefore to per acre yields. Under the 2018 MFP, the average farm received a payment of $19 per acre, but farms within the top decile received average payments of around $30 per acre. The result was that under the 2018 MFP, and under the federal crop insurance and CFAP program that also base payments on farm level production, payments were even more heavily concentrated with large farms than under the 2019 MFP. Under the 2019 MFP, per acre payments received by the average farm ($51) were proportionally much closer to per acre payments received by the largest ten percent of farms ($55). The reason for the much smaller difference in per acre payments was that, within any given county, under the 2019 MFP each farm received the same per acre payment for every acre planted to an eligible crop, regardless of crop yields or crop mix. Further, using the ARMS data and USDA farm size categories, we find new evidence to support that hypothesis that one important cause of higher per acre payments for larger farms when programs tie payments to production is that farm size and crop specific yields tend to be positively correlated. Thus, generally payments were more heavily concentrated on larger farms under the 2018 MFP, the CFAP and the federal crop insurance program than under the 2019 MFP.

Third, as illustrated in Fig. 3, there is a great deal of overlap in payments made under the MFP and federal crop insurance programs. As discussed above, the extent to which benefits are concentrated on large farms within each of these programs has been documented in this analysis. When the extent to which each farm receives benefits under one or more of the three programs are considered, the share of total payments under all three programs is even more heavily concentrated on large farm businesses as compared to midsize and small farm operations. While only 37.7% of all farms received payments under all three programs, those farms received 81.4% of all the total payments across the three programs. In contrast, 36.7% of all farms only received payments under the 2019 MFP, and those payments represented only 2.5% of all federal outlays under the three programs. These findings suggest that the main beneficiaries of the 2018 and 2019 MFPs were already managing risk through federally subsidized crop insurance programs and, in effect, were already being at least partially compensated mainly through revenue insurance coverage for major crops such as corn, cotton, rice, soybeans and wheat. Those crop insurance programs cover losses against revenue losses that derive from decreases in price as well.

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10 Based on the USDA ERS classification system and our corresponding quantiles, small farms roughly correspond to the smallest 70% of farms, while midsize farms correspond to the quantiles 70%-90%, and large farms include the top 10% of farms.
as lower than expected yields. While it may not be good policy to exclude farms that purchase crop insurance from all benefits associated with future agricultural disaster programs, it is worth noting that, as currently designed, such ad hoc programs provide most of their benefits to farm businesses that also the main beneficiaries of other lucrative farm safety net programs authorized by Congress through the 2018 farm bill such as federal crop insurance and the price loss and agricultural risk loss coverage initiatives (Bekkerman, Belasco and Smith, 2019). Small and midsize farm operations are unlikely to receive much, if any financial help from such programs.

These results are also reflected in the distribution of the 2020 CFAP program. Like the 2018 MFP, the CFAP also used farm level crop production and inventories as the basis for making payments to individual farm businesses, rather than simply the area planted to a crop. Under the CFAP, as with the 2018 MFP, payments have been more heavily concentrated on large farm operations than midsize and small operations which received very few benefits from the program. This degree of payment concentration on large and very large farm businesses is problematic if the intent of an ad hoc agricultural disaster aid program is to limit financial bankruptcies and other forms of farm failure such as foreclosures, ensure food security, or stabilize the food system. These payments are not targeted to small and midsize farms that, because of their asset bases, are more likely to rely on a safety net as a result of catastrophic events. For example, as shown by Paulson et al (2020), impacts of the 2018 MFP on the probability of loan defaults and other measures of financial solvency such as capital debt replacement capacity were much lower for smaller and midsize farms than for large farms.

Finally, even though both MFP’s include generous payment limits of between $250,000 and $500,000 per farm, we find no evidence that those payment limits were effective in limiting program payments to large farms. However, if lower payment limits ranging from $60,000 to $120,000 were effectively imposed, such limits would have reduced the total costs of those program to the exchequer, and substantially lowered total payments to many large farms while having very little impact on subsidies paid to small and midsize operations.

CRediT authorship contribution statement

Eric J. Belasco: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. Vincent Smith: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodpol.2021.102189.

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