

## Economics Losses Due to Meat Processing Plants Shutdown/Slowdown

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### U.S. Livestock Supply Chain

In general, U.S. livestock are raised on farms, and sent to feeding (cattle) or finishing (hogs) yards where they consume a special diet to gain weight; once they reach market weight, they are sent to slaughter at processing or packing plants (Figure 1). Poultry are raised on the farms and directly transported to processing or packaging plants. The processed meat is either exported or transported to retail stores and restaurants. At the beginning of the COVID-19 pandemic, the bottleneck in the supply chain was in the processing plants. Due to the close proximity of workers in meatpacking plants, the probability of disease transmission was high, causing many workers to be infected and forcing processing plants across the country to be shut down (McCarthy and Danley, 2020; Bagenstose and Chadde, 2020; Cromartie et al., 2020). In 2018, there were 835 livestock and 2,979 poultry federally inspected slaughter and processing plants (NAMI, 2020). There were an additional 3,773 plants that processed meat but did not slaughter (NAMI, 2020).

On May 8, 2020, more than 50 plants (McCarthy and Danley 2020) were either partially or completely closed after the start of the COVID-19 pandemic. The first plant to cut production was the JBS USA facility in Souderton, Pennsylvania, on March 31 (McCarthy and Danley 2020). The shutdown or reduction in production happened in less than 5 percent of the total plants. However, because many producers rely on one plant for slaughter and processing, even a small number of plant shutdowns or operation at lower capacity can impact many producers. Reduction in production and shutdown also affects consumers by increasing retail prices of meat and occasional meat shortages.

In response to the shutdown of processing plants, President Donald Trump issued an executive order on

April 29, 2020, to keep meat processing plants open using the Defense Production Act (DPA).<sup>1</sup> The closure and/or shutdown of meat processing plants resulted in euthanasia or depopulation of animals, primarily hogs and chickens (Hughlett and Belz, 2020; Olberding, 2020) because the capacity constraints of feedlots (for hogs) and barns (for chickens) would be overwhelmed if the animals currently being fed cannot be moved to packing plants and slaughterhouses as other animals in the supply chain continue to arrive. Keeping the animals alive beyond the time required for them to be finished would incur feed costs, and their weight would exceed the threshold for equipment in the processing plants. In the short run, producers can and do adjust by shifting feed to a maintenance diet as well as limiting or culling (chicks or eggs) animals in the supply chain. Understanding the life cycle of a market animal can help better understand why animals are euthanized when the processing plants are shut down or operate at less than full capacity.

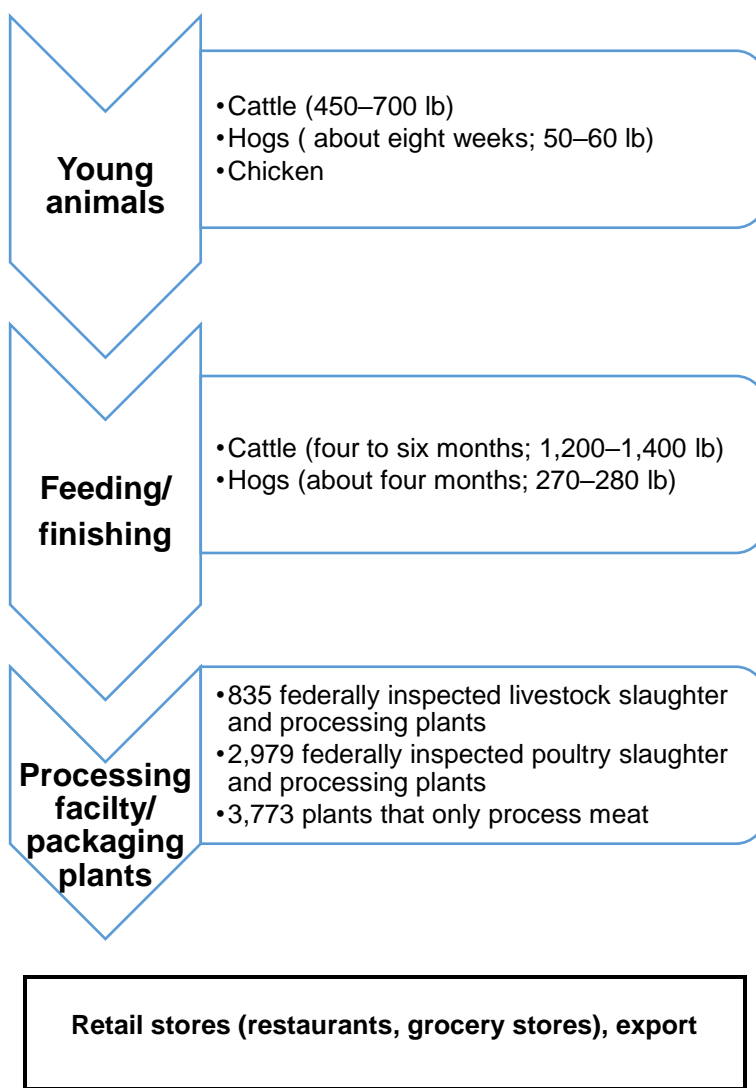
### Life Cycle of a Market Pig, Cattle, and Chicken

Gestation (pregnancy) is about three months or 114 days for gilts and sows (Hoar and Angelos, 2015). In 2012, a gilt or sow gave birth to an average of 11 piglets per litter. Piglets are weaned in about 21 days (13–15 lb) and moved to the nursery where they remain for 42–56 days (50–60 lb) (U.S. Department of Agriculture, 2020c). After the nursery, pigs are moved to the finishing barn, where they consume 6–10 lb of feed every day and remain for 115–120 days (280 lb), after which they are sent to the processing/packing plant. Pigs above 120 pounds and raised for slaughter are called hogs (Hoar and Angelos, 2015).

<sup>1</sup> Daily updates on meat processing plant closures and openings can be found at

<https://www.meatpoultry.com/articles/22993-covid-19-meat-plant-map>.

**Figure 1. U.S. Livestock Supply Chain**



According to the Pennsylvania Beef Council (2020), a newborn calf weighs about 60–100 lb, is weaned at about 6–10 months (450–700 lbs), and thereafter sold at an auction market. Cattle slightly older than a year are sent to feedlots, where they spend four to six months eating at feed bunks (Pennsylvania Beef Council, 2020). Cattle are ready for processing at about 1,200–1,400 lb for a steer or cow and between 900–1,400 lb for a heifer and are then sent to the processing/packing plant (Pennsylvania Beef Council, 2020). There is increased flexibility in terms of how long cattle can be in the feedlots. Producers can decrease the feed to decrease average daily weight gain and raise it to slightly longer, even if the weight exceeds 1,400 lb. This flexibility is important as it provides cattle producers more time to adjust compared to hog producers.

The life cycle of a chicken is different than those of pigs and cattle. According to the Penn State Extension (2012), it takes 21 days for eggs to hatch in the hatchery. Then, the broiler chicks, the most popular and

common commercial chicken breed, are processed (vaccinated and differentiated by gender) and sent to growers, where chicks are placed in floor rearing houses (Penn State Extension, 2012). Broiler chicks spend seven weeks growing, until they weigh about six pounds, when the animals are transported to processing/packaging plants for harvest (MacDonald, 2014).

Usually, chickens, hogs, and cattle must be processed once they reach the intended market size. If processing plants are closed, producers have few options other than to euthanize the animals due to lack of space and the costs of keeping them alive. For example, the poultry processor Allen Harim euthanized 2 million chickens in Maryland and Delaware because fewer than half of the processing employees showed up for work (Mavity, 2020).

## Euthanasia

Table 1 shows all the methods used to depopulate cattle, hogs, and chickens. The most humane way to depopulate a flock of chickens is to use carbon dioxide (CO<sub>2</sub>). In this method, high concentrations of CO<sub>2</sub> are released in the barn, which results in alterations in blood chemistry to depress breathing centers; as a result, the chickens become unconscious and die due to lack of oxygen (Poultry Industry Council, 2016). Use of CO<sub>2</sub>, gunshot, and penetrating captive bolt are the preferred methods to depopulate hogs on farms (American Association of Swine Veterinarians, 2020). For cattle, non-inhalants, injectable barbiturates or barbiturate derivatives, penetrating captive bolt, and gunshot are acceptable methods for depopulation (American Veterinary Medical Association, 2013).

## Economic Cost of Euthanasia

There are two potential losses for a livestock producer when they have to euthanize an animal on the farm. The first is the loss of revenue that would have resulted from the sale of the euthanized animal. The second is the additional cost incurred to euthanize the animal. In some cases, specifically for poultry producers, there is also an associated opportunity cost. When a flock of adult chickens is euthanized in the commercial chicken barns, it takes a longer time to clean the barn and make it ready for the next flock of chicks. On average, a U.S. chicken

producer raises six flocks each year. The number of flocks raised can be reduced by up to two if it is necessary to euthanize an adult flock in the barn. Furthermore, for independent growers and integrators there is also the additional cost of feed every day the animal is not euthanized and is on the farm.

(1) *Total economic loss (TEL) = Value of lost production + additional feed cost + euthanasia cost + opportunity cost (for poultry) + fixed costs;*

(2) *Value of lost production = price received by producer × weight of animal.*

Table 2 shows estimates of the partial economic loss due to euthanasia for hogs, cattle, and chicken producers (and integrators) based on different sizes of operation, weight of the animal, and price. Except for the case of an independent producer without any contract, the losses could be shared. It is again important to note that this partial economic loss does not include the incurred additional feed cost every day animals are kept on the farm, opportunity costs, and other fixed costs. These estimates, therefore, should be seen as lower-bound estimates.

Prices and costs used in Table 2 are estimates based on USDA data and consultation with industry experts and producers; the cost of depopulation is not readily

**Table 1. Euthanasia and Mass Depopulation Methods for Hogs, Cattle, and Chicken**

Hogs	Cattle	Chicken
Gunshot (Nursery pigs or older)	Gunshot	Mechanical cervical dislocation (all birds)
Non-penetrating captive bolt (pigs less than 70 lb)	Captive bolt	Nonpenetrating captive bolt (all birds)
Electrocution, head only (pigs over three days of age)	Electrocution (difficult and dangerous)	Manual cervical dislocation (smaller birds)
Veterinarian-administered anesthetic overdose (all ages)	Injectable anesthetics (non-inhalants)	Decapitation (all birds)
CO <sub>2</sub> (all ages but pigs over 70 lb)	Injectable barbiturates or barbiturate derivatives	CO <sub>2</sub> (all birds)
Penetrating captive bolt (pigs greater than 12 lb)		Penetrating captive bolt (all birds)
Manual blunt-force trauma (pigs up to 12 lb)		Blunt-force trauma (all birds)
Electrocution, head-to-heart (pigs over three days of age)		

Source: American Association of Swine Veterinarians; Poultry Industry Council, and Animal and Plant Health Inspection Service (APHIS), USDA.

**Table 2. Partial Economic Loss Due to Euthanasia**

Producer Type (1)	No. of Animals/ Size of Operation (flocks for chicken) (2)	Weight per Animal (from ideal market weight) (3)	Price per Pound (4)	Lost Production Value/ Revenue (5)= (2)x(3)x(4)	Estimated Cost per Animal or per Flock to Euthanize (6)	Total Cost of Euthanasia (7) = (6)x(2)	Partial Economic Loss (8) = (5)+(7)
Hog	1,000	280 lb	\$0.50	\$140,000	\$45	\$45,000	\$185,000
Cattle	100	1,400 lb	\$1.50	\$210,000	\$250	\$25,000	\$235,000
Chicken	30,000	6 lb	\$0.45	\$81,000	\$4,000	\$4,000	\$85,000

available because this scale of depopulation is new to the industry. The pandemic did not lead to mass scale depopulation of cattle. Prices and costs are estimates and can vary by location. Flock size (number of animals per operation) is just for illustrative purposes and not an industry standard or average. Price for chicken is the price received by chicken integrators as the poultry industry is highly vertically integrated.

## Who Bears the Cost When Animals Are Euthanized?

Depending on the type of grower and enterprise (livestock or poultry), the economic costs of euthanasia may be either borne solely by the producers or shared by the producers, processing plants, and/or downstream contractors. The type of contract determines whether the producer or the contractor bears the cost when an animal is euthanized.

Livestock are raised either by independent producers or by contract growers. There are two types of contracts: marketing contracts and production contracts. Under a marketing contract, ownership of the animals remains with the farmer during production. The contract sets a price (or a pricing formula), product quantities and qualities, and a delivery schedule. With production contracts, the contractor owns the animal during production and the farmer is paid a fee for services rendered. The contract specifies farmer and contractor responsibilities for inputs and production practices. The contractor often provides specific inputs and services, production guidelines, and technical advice. In livestock contracts, for example, contractors typically provide feed, veterinary services, transportation, and young animals. The contract is finalized before production of the commodity. Many producers incur the upfront costs of building housing for the animals. Building livestock housing is a large investment for producers to raise either poultry or hogs.

One of the reasons a production contract is chosen is that it reduces the income risk caused by fluctuations in commodity prices. Under normal circumstances, contracts also provide a guaranteed outlet for the

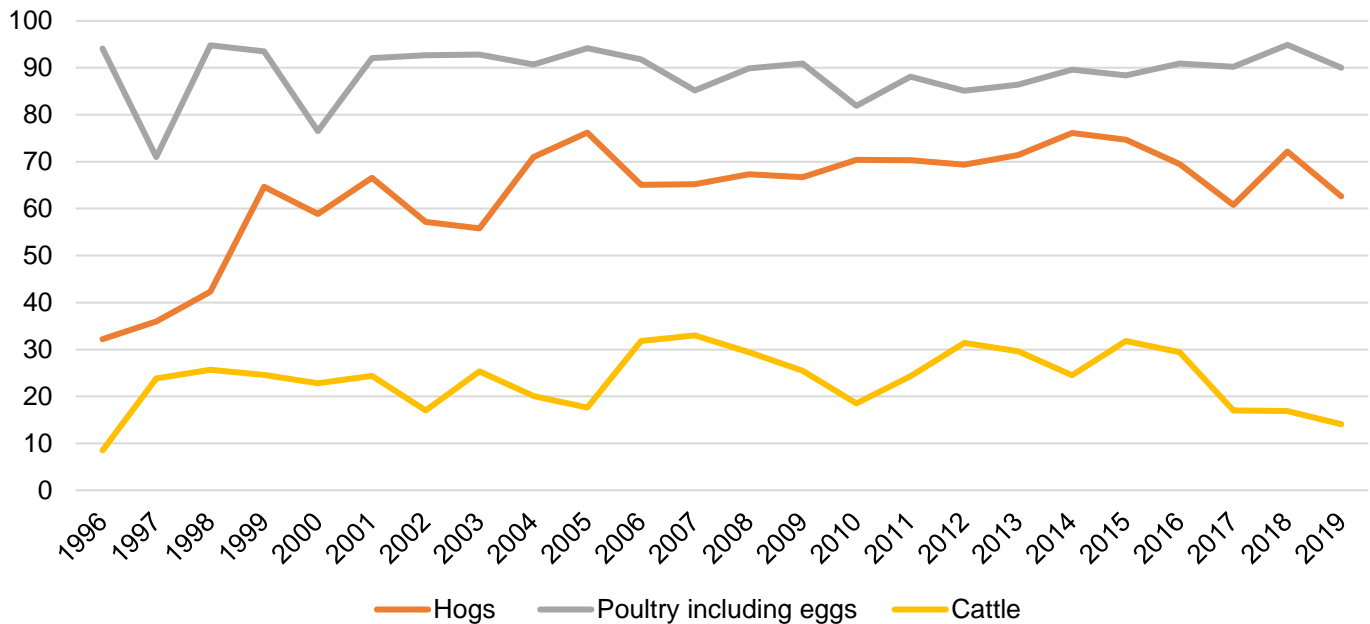
producer's output. In hog and poultry production contracts, the fees paid are tied to animal attributes so producers who can produce animals to specific standards receive higher returns (Macdonald and Korb 2011).

The poultry and hog industries rely heavily on production contracts. The top five poultry contractors are Tyson, Pilgrim's Pride, Sanderson Farms, Perdue, and Koch Foods (Souza, 2019). In 2019, around 90% of poultry production and about 63% of hog production was carried out under production contracts (Figure 2). In this situation, if there is a need to euthanize animals, the contractors bear the costs since they still own the animals. However, producers lose the fees paid for raising the animals because they are generally paid a fee for each animal delivered under a production contract. After the animals are euthanized, producers need time to sanitize the facilities, which delays the initiation of subsequent production cycles. This means farmers are also losing potential income they would have earned raising the animals.

Contracts are not widely used in the beef industry. About 14% of production is produced under contract (Figure 2). As with poultry and hog producers working with production contracts, beef producers do not bear the cost if the cattle are euthanized. However, the other 83% of producers without a production contract might have incurred the total cost of euthanizing the animals if they had euthanized their cattle. As stated earlier, it is important to note that no large-scale cattle depopulation was reported.

In 2019, small farms (operations with less than \$350,000 in gross cash farm income) and midsize farms (operations with gross cash farm income between \$350,000 and \$999,999) produced about 92% of poultry, including eggs, under contract (Figure 3). The distribution of hog production under contract is slightly different than that of poultry production. Large (operations with gross cash farm income over \$1 million dollars), midsize, and small farms produce fairly equal shares of the total contract hog production. Cattle production is vastly different from hog or poultry

**Figure 2. Percentage of the Value of Production Under Contract for Hogs, Poultry Including Eggs, and Cattle**



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2019 Agricultural Resource Management Survey (ARMS).

production. Small family farms generally have cow-calf and stocker operations and account for 26% of beef production, while large-scale family and nonfamily farms account for 60% of production and are more likely to operate feedlots, which are big enterprises (Whitt, Todd, and MacDonald, 2020). Although a small percentage of cattle is produced under contract, nonfamily farms (any farm where an operator and persons related to the operator do not own a majority of the business), and large-scale farms account for 41% and 32% of contract cattle production, respectively (Figure 3). Only 19% and 8% of production is produced by small and midsize farms, respectively.

## Government Support

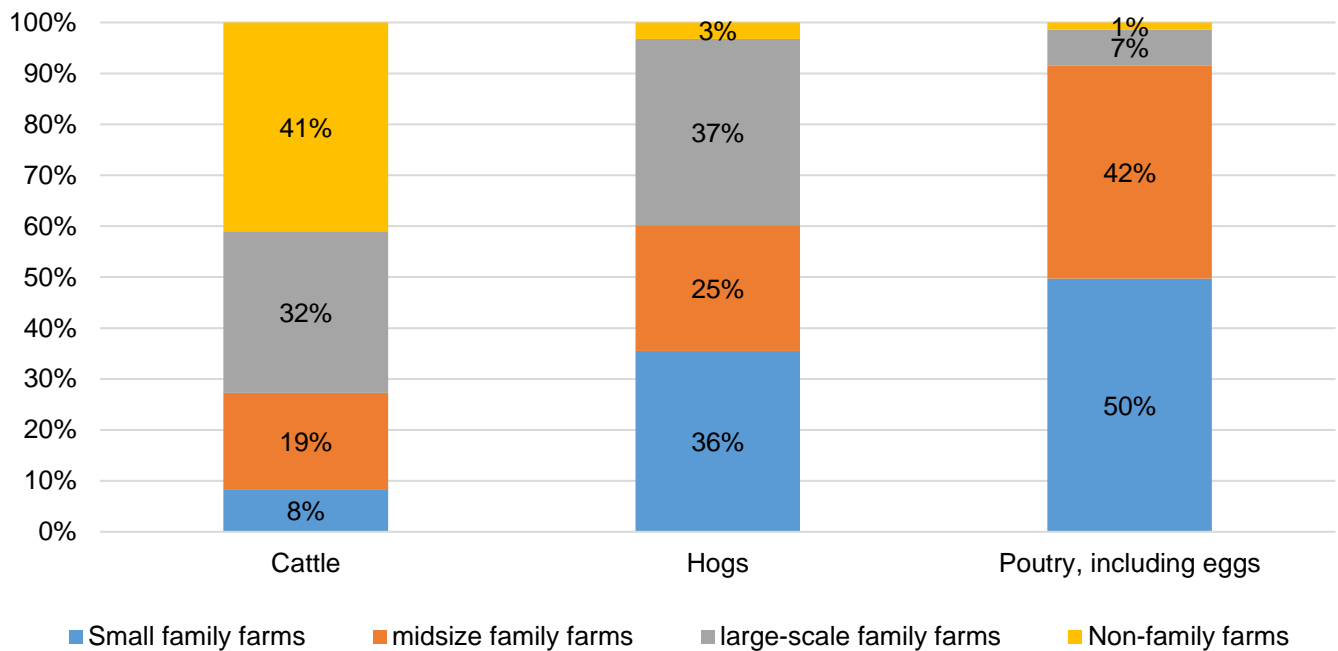
U.S. agricultural producers affected by the COVID-19 pandemic are eligible to receive benefits from multiple programs. Some of these programs are administered by the USDA, while others are administered by other federal departments. The programs administered by the USDA are the Coronavirus Food Assistance Program 1 (CFAP 1) and the Coronavirus Food Assistance Program 2 (CFAP 2), both authorized under the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which was passed by the U.S. Congress and signed into law by President Trump on March 27, 2020. Agricultural producers are also eligible for assistance from the Economic Injury Disaster Loan (EIDL) and the Paycheck Protection Program (PPP). CFAP 1 and CFAP 2 provide direct payments. PPP provides loans that will be forgiven if loan funds are used for eligible expenses. EIDL has two parts: loan advance and the loan. The advance does not have to be repaid, but EIDL

loan assistance must be repaid, albeit at a reduced interest rate. Not all programs directly provide support to producers who euthanized their livestock. The following sections provide review the various support programs (excluding CFAP 2, as it was announced in September after the euthanasia of animals due to the pandemic-related supply chain disruptions had ended). There are additional funds to the producers who had to depopulate in 2020 in the Consolidated Appropriations Act of 2021. This study does not include those funds.

## The Paycheck Protection Program (PPP)

The Paycheck Protection Program (PPP) is administered by the Small Business Administration (SBA) through commercial lenders such as banks or credit unions and is intended to help small businesses, including agribusinesses and farms, keep employees on the payroll and/or bring laid off employees back to work (U.S. Treasury, 2020). PPP offers SBA-guaranteed loans to businesses affected by the COVID-19 pandemic which will be forgiven if loans are used to cover payroll costs, most mortgage interest, rent, and utility costs over the 24-week period after the loan is made. The initial rule was that the PPP loan had to be disbursed within eight weeks after the loan was made and 75% of the loan had to be used for payroll for it to be forgiven, though the amount that must be used for payroll has subsequently been reduced to 60%. Additional requirements for loan forgiveness include the stipulation that employee compensation levels be maintained, that the employees' primary residence be the United States, and that other administrative requirements be met (U.S. Department of the Treasury, 2020).

**Figure 3. Value of Production for Operations with Contracts for Cattle, Hogs, and Poultry including Eggs by Farm Type, 2019**



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2019 Agricultural Resource Management Survey (ARMS).

The PPP is generally available to companies with 500 or fewer U.S. employees. Businesses can borrow up to 2.5 times their monthly payroll costs, with a cap of \$10 million (U.S. Department of the Treasury, 2020). This program does not directly support producers for euthanasia and lost value of production. Implicitly, it does help cover some of the costs, mainly labor, for farm operations that had to euthanize livestock. The last day to apply for the PPP was August 8, 2020, for those producers who had to depopulate in 2020. The SBA is accepting new applications from all producers as new funds have been allocated to the program under the Consolidated Appropriations Act of 2021.

## Coronavirus Food Assistance Program 1 (CFAP 1)

On April 17, 2020, U.S. Secretary of Agriculture Sonny Perdue announced the Coronavirus Food Assistance Program 1 (CFAP 1), a new program to assist producers and consumers affected by the COVID-19 pandemic (U.S. Department of Agriculture, 2020d). CFAP 1 provides \$19 billion in relief to producers and entities throughout the food supply chain through two programs: Direct Support to Farmers and Ranchers (\$16 billion) and **USDA Purchase and Distribution (\$3 billion)** (U.S. Department of Agriculture, 2020d). The purpose of the program is to pay producers for losses resulting from price decreases and/or supply chain disruptions. CFAP 1 payments are also made to producers who had to

depopulate their livestock based on the number of livestock depopulated as they were part of the inventory used to determine the payment.

## Economic Injury Disaster Loan (EIDL)

Small businesses—including **U.S. agricultural businesses** with fewer than 500 employees—can apply for these loans and, if approved, can receive a forgivable loan advance and up to \$150,000 in low-interest loans (SBA, 2020). The loans are meant to provide economic relief to businesses who experience temporary loss of revenue (SBA, 2020). These businesses can also request an advance available in three business days of up to \$10,000 (\$1,000 per employee), which is forgivable if certain conditions are met. This is the first time that agribusinesses have been eligible to apply for these loans (U.S. Department of Agriculture, 2020b). This program does not directly support producers for euthanasia and lost value of production. Just as with the PPP loans, the EIDL implicitly helps cover labor costs for farm operations that depopulated animals.

## Depopulation Support through Emergency Animal Mortality Management Program

The Natural Resources Conservation Service (NRCS) supported hog producers by providing payments to compensate for the additional costs incurred to euthanize and dispose of animals under the Emergency Animal Mortality Management (EAMM) program. Only

hog producers were eligible for this program. To receive payments, hog producers were required to file an Environmental Quality Incentives Program (EQIP) application in their local NRCS field office (U.S. Department of Agriculture, 2020a). In order to be eligible for payments, producers must have established records with the Farm Service Agency (FSA) and meet eligibility requirements (swine mortality certification by a veterinarian or animal health specialist, approved early start waiver, and other administrative requirements). Payments were based on the number and weight of animals euthanized, the type of disposal used, and whether the producer is a member of a minority group. Based on the administrative data provided by the NRCS, the total payments made for depopulation under this program were \$429,250 in 2020. It is important to note that not all payments were made to hog producers who had to depopulate exclusively due to closure and/or reduced operation of a plant.

## Methodology

We analyze economic losses using a modified version of the partial budget model, which allows us to incorporate additional revenues and losses. The government payments are the streams of new revenue and the opportunity cost and lost value of production are the lost revenue. The generic model itself allows for addition of other revenue sources if new ones are introduced in the future and the inclusion of additional sources of support at state or local levels. There has been some additional support at the state level; however, we do not attempt to include that support in the model as state support is highly variable and not all states have support programs. Algebraically, the net change in revenue (NCR) is calculated as:

$$(3) NCR_j = \sum_{i=1}^n G_{ij} - TEL_j, \text{ for all } j = 1, \dots, J,$$

where  $G$  is the expected financial support from a government program (e.g., CFAP, EQIP, etc.),  $i$  is the type of government program,  $j$  is the type of enterprise (cattle, hog, and chicken), and  $TEL$  is the total economic loss incurred by enterprise  $j$  as calculated using equation (1). Specific components of new streams for each type of producer are analyzed in subsequent sections.

## Revenue for Hog Producers

Hog producers received one CFAP 1 payment from two sources: Cares Act Payment 1 (CAP 1) and the Commodity Credit Corporation (CCC). Both payments are differentiated by the size of the hogs. Payments from CFAP 1 were made on animals that were sold from January 15 to April 15 and the rate was \$18/head for hogs weighing more than 120 lb. Producers received a single payment calculated as the sum of the number of livestock sold between January 15 and April 15 and the highest number of livestock inventory between April 16 and May 14 multiplied by the payment rate per head (U.S. Department of Agriculture, 2020a). The inventory

payment made by the CCC was \$17/head for hogs weighing more than 120 lb. For this analysis, we assume hog producers who had to depopulate hogs received CFAP 1 as depopulated hogs would have been part of the inventory. Furthermore, because the majority of hogs being depopulated had to be market size hogs, we use the rates for the market size hog, 120 pounds or more. In order to receive the payments, producers had to provide total sales of eligible hogs and the highest inventory during the specified time (U.S. Department of Agriculture, 2020a).

Only hog producers were eligible for depopulation support. Cattle producers (and hog producers) may have been eligible for depopulation compensation from other sources such as the Federal Emergency Management Agency (FEMA). As stated before, there were no reports of cattle depopulation at large scale. Cattle and lamb producers were also eligible for the CFAP 1 payments. There are different rates of payment for disposal, burial, carcass disposal other than burial, incineration, and disposal at landfills or rendering. Furthermore, there is also a small premium for historically underserved producers for each type of disposal. For this paper, we use the incineration payment model, which comes out to be about \$62.50 per market hog. This is the highest payment received among the payments for different disposal methods. More details about the payment types and rates can be found here ([https://www.farmers.gov/sites/default/files/documents/EQIP\\_Livestock\\_Mortality\\_Initiative\\_Factsheet-v2.pdf](https://www.farmers.gov/sites/default/files/documents/EQIP_Livestock_Mortality_Initiative_Factsheet-v2.pdf)).

## Revenue for Cattle Producers

Payments per head of cattle were also differentiated by class/type and weight under the CFAP 1 program. An eligible cattle producer received a CFAP 1 payment of \$247, which is the highest combined payment rate among the different types/classes of cattle. Details about the payment rate differentiated by type/class and size can be found here (<https://www.farmers.gov/cfap/livestock>).

## Analysis

Poultry producers do not receive any financial support for euthanasia or from CFAP 1 and, therefore, poultry are not included in the analysis below. Table 2 reports economic losses for chicken producers. Because most poultry production is done under contract with integrators, poultry producers may have received compensation for losses from downstream contractors.

We also did not include cattle in our analysis as there is no evidence of cattle being depopulated. Furthermore, since processing and packing plants are now fully operational, it is unlikely that cattle will be depopulated. Cattle producers also have more production flexibility compared to hog and chicken producers. Table 2 reports economic losses for cattle producers.

**Table 3. Economic Loss and Partial Federal Government Compensation to Hog Producers**

No. of Animals/ Size of Operation	Weight per animal	Support for Euthanasia per Animal	Total Euthanasia Support	Support per Head through CFAP 1	Total CFAP Support	Total Government Support (euthanasia support + CFAP 1 payment)	Partial Economic Loss (from Table 2)	Difference or Actual Loss (loss minus total govt. support)
1,000	280 lb	\$62.50	\$62,500	\$18	\$18,000	\$80,500	\$185,000	\$104,500

To account for the revenues and losses more explicitly, we expand our condensed partial budget model. This includes estimating the total government support and difference or actual loss (i.e., change in net revenue). We use following formulations to calculate government support for animal and potential loss:

(4) *Total government support per animal = euthanasia and disposal support + CFAP 1;*

(5) *Difference or actual loss = Partial economic loss – Total government support.*

Table 3 reports the results of these calculations for hogs. In our analysis, we do not account for any state-level support or support from other federal sources, including the PPP and EIDL loan advance. Furthermore, there are additional funds in the Consolidated Appropriations Act of 2021 for hog producers that had to depopulate. We did not consider those in this analysis as the details have not yet been released by the USDA. The estimated net loss after federal payment from only CFAP 1 and euthanasia support per euthanized hog seems to be

around \$105. When additional assistance is added, it appears that the losses incurred were most likely offset.

## Conclusion

Remarkably, hog slaughter volumes at the national level recovered in about two months. The total amount paid (less than \$500,000) by the NRCS in 2020 to producers who had to depopulate also suggests that the problem was not extensive and that not many producers had to depopulate. Based on the type of contract, some of the losses may have been shared between the producers and the processing/packaging plants and downstream firms. The contractor could also have redirected the contract producers to a different plant in response to a certain plant being closed or having reduced capacity. For those independent producers that might have had to depopulate, aid from several other sources might have helped minimize total loss. For example, state-level funding, like Iowa providing \$40/hog depopulated, with some limitations (Freese, 2020); the Consolidated Appropriations Act of 2021, which is not incorporated in this analysis; and indirect assistance from the PPP and EIDL.

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