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# U.S. Crop Profitability and Farm Safety Net Payments Since 1975



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## Abstract

*This paper examines the impact of crop safety net payments, including decoupled payments, on the aggregate net return to nine U.S. crops (barley, corn, cotton, oats, peanuts, rice, sorghum, soybeans, and wheat). Net return was calculated using economic cost and thus includes an opportunity cost for unpaid labor and owned land. Crop safety net payments since 1975 have turned an average minus*

*7% annual net return loss into a 4% profit. Largest loss was minus 9% with safety net payments versus minus 36% without safety net payments. Largest loss with safety net payments was similar across farm bills since 1980.*

## INTRODUCTION

A long-standing issue of interest has been the impact that U.S. farm program payments have on the profitability of producing crops. This assessment has become less straightforward due to the evolution to making payments on historical production, not current production (Coppess, 2018; Orden, Paarlberg, and Roe, 1999). Payments not tied to current production mean a crop's payment acres can be planted to the same crop, to a different crop, or to no crop. A crop's planted and payment acres may thus differ. Among current farm program crops, payment and planted acres differ the most for soybeans (53.4 million payment acres versus 83.1 million planted acres) and wheat (63.3 million payment acres versus 44.3 million planted acres) (USDA NASS, 2021; USDA FSA, 2021a).

Two empirical observations, however, suggest a method exists to provide some perspective on the impact that crop safety net payments have had on crop profitability in an era of decoupled payments. First, total program payment acres and total acres planted to program crops overlap substantially. For example, during the 2014 farm bill period, 85% of acres planted to program crops were planted on payment acres and 86% of payment acres planted to a crop were planted to a program crop (USDA FSA, 2020; USDA NASS, 2021). Second, the nine crops for which the USDA reports cost of production (COP) data—barley, corn, cotton, oats, peanuts, rice, sorghum, soybeans, and wheat (USDA ERS, 2021a)—account for almost all payment acres and almost all acres planted to program crops. During the 2014 farm bill, both shares were 98% (payment acre

share was calculated using USDA FSA data; planted acre share was calculated using USDA NASS data). A commodity program payment to one of the COP crops was thus likely made to an acre planted to a COP crop even if it was not planted to the COP crop receiving the payment. Hence, examining the COP crops as a group can provide perspective on the role of crop safety net payments in the profitability of growing program crops as a group even when payments are decoupled from current production.

Decoupled farm payments have attracted considerable research attention. Focus of this research has been on whether payments not tied to current production and/or prices can still impact decisions made by farmers. Starting with Hennessy (1998), a number of potential impacts have been identified, including farm investments, planting decisions, land values, labor choices both on-farm and off-farm, and farm entry and exit (Moro and Sckokai, 2013). However, after reviewing existing empirical studies, Bhaskar and Beghin (2009) concluded that decoupled payments have generally been found to have limited impacts on farm decisions, except for land values. More recent data by Hendricks and Sumner's (2014) empirical study and Chambers and Voica's (2017) theoretical study also supports a conclusion of limited impact on farm decisions.

This study will examine the role of crop safety net payments on the profitability of producing barley, corn, cotton, oats, rice, peanuts, sorghum, soybeans, and wheat as a group. This aggregate approach is taken to accommodate the transformation of commodity programs from coupled to decoupled payments. The procedures and data used to make this calculation are discussed in the next section. Findings are then presented, including that farm safety net payments have, on average, turned market losses into a profit for the nine COP crops as a group. The article ends with a discussion of conclusions and implications.

## PROCEDURES AND DATA

This analysis covers crop years 1975 through 2020. Complete data exist for these crop years on costs and return to production as well as farm safety net payments for the nine COP crops. Spatial area of the analysis is the United States as a whole. Initial year of this study is the first year for which USDA ERS published COP data for field crops and livestock. The 1973 farm bill had authorized collection of COP data, in part to adjust support prices (The National Agricultural Law Center, 2021). Support price adjustments tied to COP were eliminated by the 1981 farm bill (The National Agricultural Law Center, 2021).

## U.S. Costs and Net Returns

An important assumption in this analysis is that the COP calculated by USDA ERS is an accurate measure of the average cost of producing a crop in the United States. The authors believe this assumption is reasonable, but the following discussion—which is based on USDA ERS's (2021b) extensive documentation of procedures and methods—attempts to give each reader the information needed to assess the robustness of this assumption.

The objective of the USDA ERS cost and return data effort is to represent the costs and returns of all resources used in the production of each commodity. The estimates are based on actual costs and returns of all participants in the production process, including farm operators, landlords, contractors, and contractees. Producer surveys are conducted about every 4–8 years for each commodity. The surveys collect detailed information on input use, field operations, and production costs of a given commodity. Field enumerators personally interview farmers. To calculate target population estimates, each surveyed farm's data are weighted by the number of farms with similar attributes represented in the survey sample. Target population for a field crop is all farms producing at least one acre of the crop.

All survey years for a crop are listed in USDA ERS's (2021b) documentation material. The survey year is used as a base for making estimates for subsequent non-survey years. Price and production data from other sources, mainly USDA NASS agricultural prices and crop production publications, are used to adjust survey year data. This procedure essentially fixes the production technology as of a survey year. Reliability of estimates in non-survey years for a crop likely varies with the changes in its production technology since the last survey year. Discontinuities can occur when new survey data replace non-survey estimates.

USDA ERS calculates net return for a planted acre using the following formula:

Net return per planted acre = Gross production value per planted acre – Economic cost per planted acre

Gross production value equals the gross value of the primary product, such as grain, plus gross value of secondary products, such as straw. Production value is determined at the end of the production period using yield per planted acres and average harvest-month crop price for the state in which the surveyed farm is located. Returns and costs from storing the crop are not included. Also not included are payments by government programs, including commodity,

conservation, and livestock programs, as well as indemnities from crop insurance. Insurance premiums paid by farms are not included as a cost.

Economic cost consists of operating costs and allocated costs. Operating costs include seed, fertilizer, chemicals, custom services, fuel, lube, electricity, repairs, purchased irrigation water, and interest on operating capital. Allocated overhead includes hired labor, opportunity cost of unpaid labor, capital recovery of machinery and equipment, opportunity cost of land, taxes, insurance, and general farm overhead. Inclusion of opportunity cost means that a cost is assigned to all production inputs regardless of its ownership or equity position. Opportunity cost is the return foregone from an alternative use of an unpaid resource or the money used to own an unpaid resource. Because opportunity costs are included, USDA ERS costs are referred to as economic costs. USDA ERS's (2021b) documentation material contains detailed discussion of the method used to estimate each cost item individually.

Beginning in 1995, the theoretical basis and accounting methods used to estimate economic costs and net returns per planted acre were adjusted to reflect recommendations of the American Agricultural Economics Association (AAEA) Task Force on Commodity Costs and Returns. USDA ERS's (2021b) documentation material contains a detailed discussion of this task force's recommendations and the changes that were implemented. The changes were largely in the methods used to value a resource, not the addition or removal of cost items. Three of the more important changes were (1) using the wage rate of farm operators working off-farm instead of the state wage rate for agricultural workers to estimate opportunity cost of unpaid labor, (2) using cash rent only instead of a weighted average of cash and share rent to estimate opportunity cost of land, and (3) changing the method used to estimate capital cost incurred in production.

Net return to production of a crop as measured by USDA ERS is a per-planted-acre return to management and risk. It measures the extent to which long-run production costs are covered by production that is valued at average harvest-month prices. Net return to management and risk can be positive or negative (i.e., a loss).

Total economic cost per planted acre and net return per planted acre for each COP crop and year is multiplied by U.S. acres planted to the crop for the year to obtain an estimate of total U.S. economic cost of producing the COP crop in the year and the total net return earned from producing the crop. Total U.S. economic cost and total U.S. net return for each COP crop is summed

across the nine COP crops to obtain aggregate U.S. economic cost and aggregate U.S. net return for the nine COP crops as a group for each crop year from 1975 through 2020. Planted acres for each crop and year are obtained from *Quick Stats* (USDA NASS, 2021).

## U.S. Crop Safety Net Payments

Commodity programs are authorized by Congress in the farm bill. Payments by commodity programs are included in this study if they are available for the COP crops individually or as a group. These commodity programs include Average Crop Revenue Election (ACRE), Agriculture Risk Coverage (ARC), certificate exchange, cotton, cotton ginning, cotton transition, counter-cyclical payment (CCP), direct payment (DP), feed grain, loan deficiency, marketing loan, Price Loss Coverage (PLC), Production Flexibility Contract (PFC), rice, and wheat. ACRE, ARC, cotton transition, CCP, DP, PLC, and PFC made payments decoupled from current production. The transition to making commodity program payments on historical, not current, production started in the 1985 farm bill when crop acreage bases for an individual farm were established as the average of acres planted and considered planted to the crop for harvest on the farm during the preceding five years (Glaser, 1986). Source for payments by the cotton, feed grain, rice, and wheat programs are USDA ERS farm income and wealth data (2021c). Payments by the other commodity programs are from USDA FSA "Commodity Estimates Book and Reports" (2021b) and USDA FSA ARC/PLC Program data (2021a).

Crop safety net payments also include net payments made to farms by crop insurance for a crop and crop year. Net payments equal indemnities paid by crop insurance to a crop for a crop year minus premiums that farms paid to insure the crop for the crop year. Net premiums are calculated using data from USDA NASS (1976–1989) for crop years before 1989. Thereafter, the data are from USDA RMA (2021).

Most ad hoc and emergency farm program payments are not included in this analysis because they are not available by crop. Ad hoc farm payments are payments by programs for farms that are not commodity or crop insurance programs and usually cover current and past, not future, losses. Ad hoc programs included in this analysis because their payments are available by crop are the (1) Market Loss Program for 1998–2001 crops; (2) Oilseed Program for 1999 and 2000 crops; (3) Market Facilitation Program (MFP) for 2018 and 2019 crops, and (4) Coronavirus Food Assistance Program (CFAP) for 2019 and 2020 crops. Market Loss and Oilseed payments were for losses from an unexpected, large decline in farm prices caused in part by a worldwide

financial crisis. MFP payments were for losses related to trade disruptions resulting from a tariff war, whereas CFAP payments were for losses related to the COVID-19 pandemic. Market Loss and Oilseed payments are from USDA FSA “Commodity Estimates Book and Reports” (2021b). MFP and CFAP payments are from USDA Farmers.gov (2021a and 2021b).

Commodity program payments, net crop insurance indemnities, and payments by the ad hoc programs discussed in the previous paragraph made to the nine COP crops were summed across the nine COP crops for each year. While crop insurance and FSA data are reported by crop year, ERS farm income and wealth data are reported by calendar year. Payment data obtained from ERS may thus be for a year after the year in which the crop was grown. This possibility needs to be kept in mind when interpreting the data for years prior to 1996.

Annual acreage set aside, marketing quota, public stock, and nonrecourse loan programs did not make payments to farms but impacted market prices. The first three impacted supply and thus market price while the nonrecourse loan program put a floor under market price. These price impacts should be reflected in the harvest prices that USDA ERS uses to compute gross return to production.

## Summary Statistics

Average economic cost per year to produce a COP crop ranged from \$192 per planted acre for wheat to \$698 per planted acre for peanuts over the 1975–2020 crop years (see Table 1). Average net return per planted acre was positive only for soybeans (see Table 1). Its \$14 average translated into a 5% net return above its average economic cost per planted acre. Using soybeans as example, since gross revenue in this net return calculation is the harvest market value of outputs, the two measures can be thought of as the average market dollar net return per planted acre and average rate of market net return per planted acre to producing soybeans between 1975 and 2020. Cotton had the most negative average market dollar net return of minus \$88 per planted acre. However, cotton’s average rate of market net return (minus 17%) was not the lowest. Sorghum was lowest at minus 30%.

Crop safety net payments averaged \$8.8 billion per year between 1975 and 2020 (see Table 1). Commodity programs accounted for 70% of the payments, with net crop insurance indemnities accounting for 16% and the ad hoc programs included in this study accounting for 14%. The share for ad hoc programs is conservative since ad hoc payments were included in this study only

if reported for the COP crops either individually or as a group. Reflecting the expansion in the crop insurance program over time, its share over the most recent 20 crop years was 24%. Commodity and ad hoc program shares were 59% and 17%, respectively.

Aggregate dollar net return for the nine COP crops as a group averaged minus \$20 per planted acre from the market but \$16 per planted acre when government payments were added to market revenue at harvest (see Table 1). Lowest dollar net return for a year for the COP crops as a group was minus \$100 per planted acre when only harvest time market revenue was used, compared to minus \$28 per planted acre when government payments were included with harvest time market revenue, implying the crop safety net materially reduced the net income risk of producing the COP crops as a group. In contrast, standard deviation was roughly the same for net return with and without crop safety net payments, illustrating that standard deviation may sometimes not be a useful measure of risk.

## FINDINGS

Figure 1 contains by year (1) the aggregate net return for the nine COP crops as a group from the market at harvest relative to aggregate economic COP (hereafter, market net return) and (2) the aggregate net return from the market plus aggregate crop safety net payments for the COP crops as a group relative to aggregate economic COP. Figure 2 contains summary statistics for both net return measures. The summary statistic with the largest difference between the two net return measures is the lowest or minimum net return: minus 36% for market net return versus minus 9% when crop safety net payments were included with market net return. On average, market net return was a loss of minus 7% compared to a profit of 4% when crop safety net payments were included.

Market net return for the nine COP crops as a group was positive in 13 crop years, averaging 12% per year, and negative in 33 crop years, averaging minus 15% per year. The 13 crop years with a positive market net return all fell within two periods of consecutive positive net returns: 1975–1980 and 2007–2013. These two periods are widely recognized as periods of crop prosperity.

In four crop years, market loss exceeded minus 25%. One was 1986, with a market loss of minus 29%. This was the first crop year after the 1985 farm bill was enacted. Congress substantially reduced support prices and thus market prices in an attempt to stimulate demand to reduce large U.S. stocks of most COP crops (Coppess, 2018; Glaser, 1986). The substantial decline

in market prices reduced gross income and net return from the market.

The other three crop years with market losses larger than minus 25% were 1999, 2000, and 2001. Market net return was minus 36% in 1999 and minus 34% in 2000 and 2001. These years were part of a period of low farm commodity prices and net returns from 1998 to 2002 triggered by a worldwide financial crisis that began in Thailand in 1997 (Coppess, 2018).

Net return after including safety net payments was also lowest in 1999–2001. Relative to aggregate economic cost for the nine COP crops as a group, net return was minus 8% in 1999 and minus 9% in 2000 and 2001. Crop safety net payments to the COP crops was \$20 billion, \$19 billion, and \$18 billion, respectively, in these three years, reducing net return loss from minus 34% to minus 36% to minus 8% to minus 9%. Commodity programs accounted for 65% of crop safety net payments in these three years. The ad hoc Market Loss and Oilseed programs accounted for 30% of payments. The remaining 5% were crop insurance net indemnities to the nine COP crops.

Since 2018, payments to farms have attracted attention due to sizable ad hoc MFP and CFAP payments. Crop safety net payments to the nine COP crops as a group averaged \$19 billion per year over these three years, including a new record payment of \$28 billion in the 2019 crop year. The ad hoc MFP and CFAP programs accounted for 61% of crop safety net payments, with crop insurance and commodity programs each accounting for roughly half of the remaining payments. While average crop safety net payments were nearly identical in 2018–2020 as in 1999–2001, ad hoc payments played a much larger role in 2018–2020. Moreover, average market net return relative to economic COP for the 2018–2020 COP crops as a group was minus 10%, 25 percentage points smaller than average market loss in 1999–2001. Average net return after including crop safety net payments was 4% in 2018–2020 versus minus 8% in 1999–2001.

In the 33 years with a market net return loss, crop safety net payments reduced the loss from minus 15% per year to minus 1% per year. For these 33 years, correlation of crop safety net payments with market net return loss for the nine COP crops as a group was minus 0.71. Crop safety net payments were higher in years with the highest market net return loss, implying safety net payments were counter-cyclical to market net return loss.

Despite striking changes in the crop safety net, the largest loss per year has been similar during all but

one of the seven farm bills since 1980 once safety net payments were added in. Largest loss ranged from minus 5% to minus 9% (see Figure 3). The exception was the 2008 farm bill, which had no year with a negative market net return. Changes in the safety net included not only decoupling payments from current production but also eliminating acreage set asides and most public stock programs in the 1996 farm bill (The National Agricultural Law Center, 2021), as well as the evolution of crop insurance from a program paying net indemnities near zero during the 1970s (USDA NASS, 1976–1989) to net indemnities averaging \$2.3 billion per year to the COP crops in 2016–2020 (USDA RMA, 2021).

## CONCLUSIONS AND IMPLICATIONS

Crop safety net payments have been critical to the profitability of producing the nine COP crops as a group. Without safety net payments, economic cost of producing these crops as a group would not have been covered. In other words, revenue from the market resulted in a loss.

Crop safety net payments also substantially reduced downside risk to producing the COP crops as a group. Largest loss was minus 9% with safety net payments versus minus 36% without payments.

Minimum loss was similar across farm bills since 1980 despite major changes to the crop safety net. Capping aggregate loss for the COP crops as a group at minus 10% has been a consistent feature of the U.S. crop safety net since 1980.

Given the preceding findings and since COP crops account for 80% of U.S. principal crop acres, it is not surprising that the aggregate index of crop input prices paid by U.S. farms has declined year over year only four times since 1990, the index's first year (USDA NASS, 2021). The largest decline was minus 3% in 2009. The limited decline in crop input prices has benefited U.S. farm input suppliers by reducing the risk of an adverse change in the price of their products. Limited decline in crop input prices also reduces its role in balancing supply and demand. As a result, other adjustment mechanisms, such as increased productivity, have likely become more important for both the crop sector and individual crop farms.

Since USDA NASS began reporting data in 1997, average price of U.S. cropland declined year over year only in 2009 (minus 4%) and 2017 (minus 0.2%) while average cash rent for U.S. cropland declined only in 2016 (minus 6%), 2007 (minus 3%), and 2020 (minus 1%). The sparsity

of declines is not consistent with an average market net return of minus 8% per year to the nine COP crops since 1997. Such a market loss suggests downward pressure on land values. In contrast, the 5% net return once crop safety net payments are included since 1997 suggests upward pressure on land values. In short, safety net payments have been a primary reason that land has been a good investment.

It is common to associate the crop safety net with commodity programs and crop insurance. This analysis also emphasizes the importance of ad hoc assistance to minimizing losses from producing the COP crops as a group. A potentially important policy question in the next farm bill debate is what the large ad hoc assistance in 2018–2020 means for the future crop safety net. It could mean that current commodity programs and crop insurance have assistance gaps. It also could mean that U.S. society is willing to provide increased assistance for American agriculture. If either or both of these interpretations are correct, is it best to redesign commodity programs and crop insurance, develop entirely new programs, or increase the role of ad hoc assistance in the safety net? Research is needed to understand and answer these questions.

Another issue for future research is to examine whether the crop safety net provides the same level of assistance relative to economic cost of producing the COP crops as a group within the different U.S. farm production regions. Given the importance that regions play in the development of the U.S. crop safety net (Coppess, 2018), this research has the potential to provide useful insights into the design of U.S. crop policy as well as to suggest future directions this policy may take.

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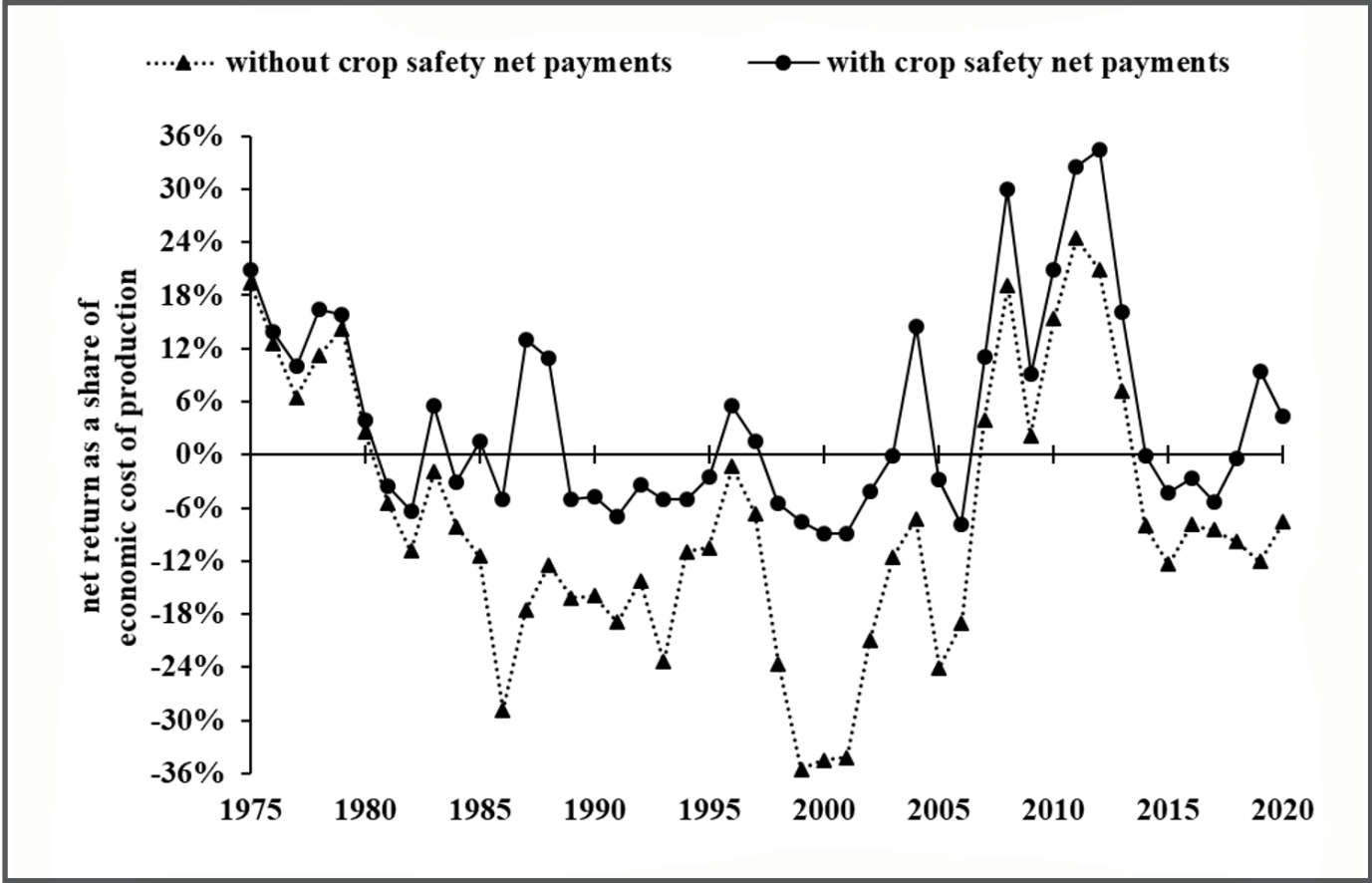


Figure 1. Aggregate net return relative to aggregate economic cost of producing barley, corn, oats, cotton, peanuts, rice, sorghum, soybeans, and wheat, United States, 1975-2020. (Source: Original calculations using data from USDA ERS, 2021a and 2021c; USDA FSA, USDA Farmers.gov, USDA NASS, and USDA RMA.)



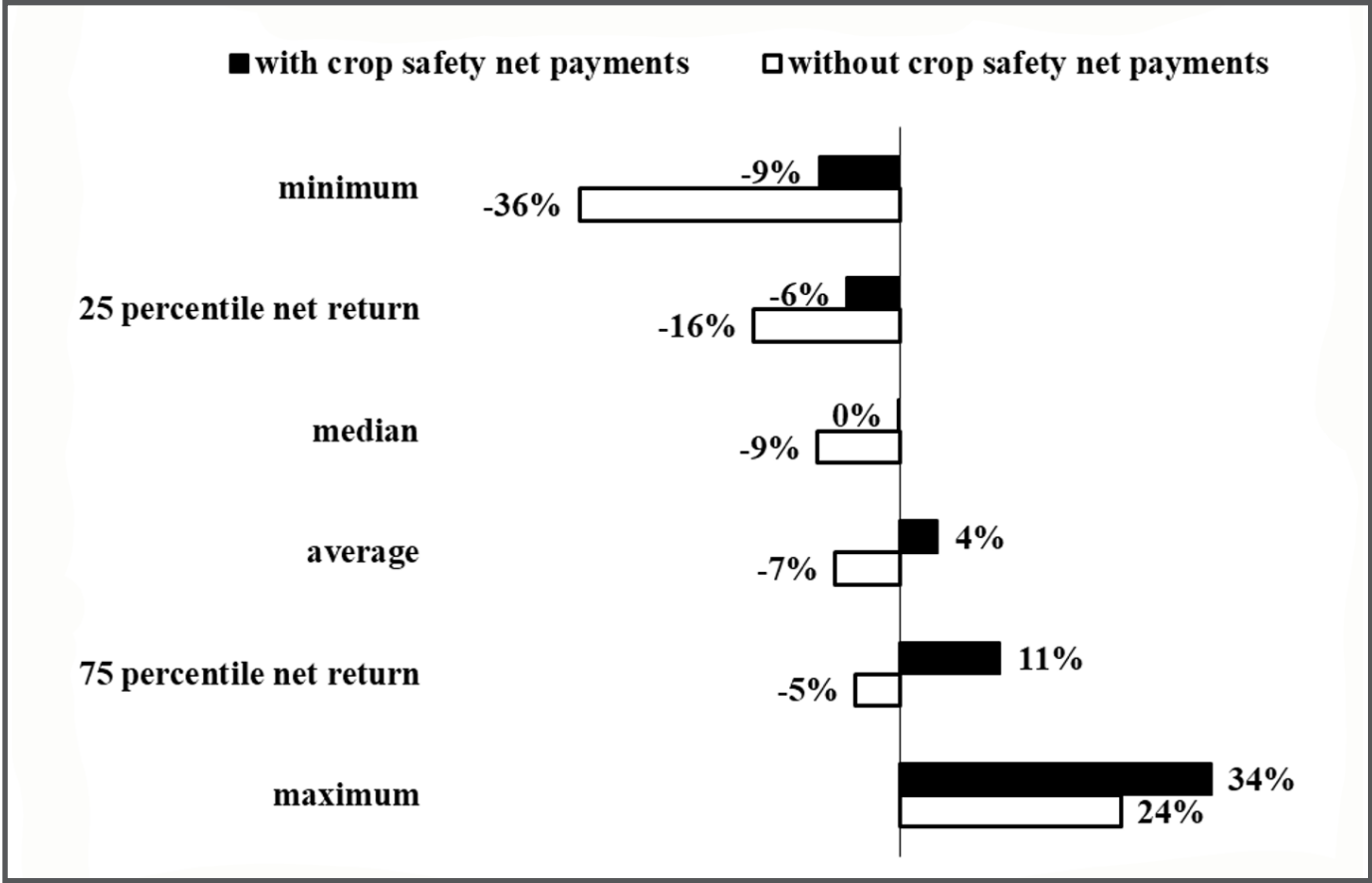


Figure 2. Summary statistics of aggregate net return relative to aggregate economic cost of producing barley, corn, oats, cotton, peanuts, rice, sorghum, soybeans, and wheat, United States, 1975-2020. (Source: Original calculations using data from USDA ERS, 2021a and 2021c; USDA FSA, USDA Farmers.gov, USDA NASS, and USDA RMA.)

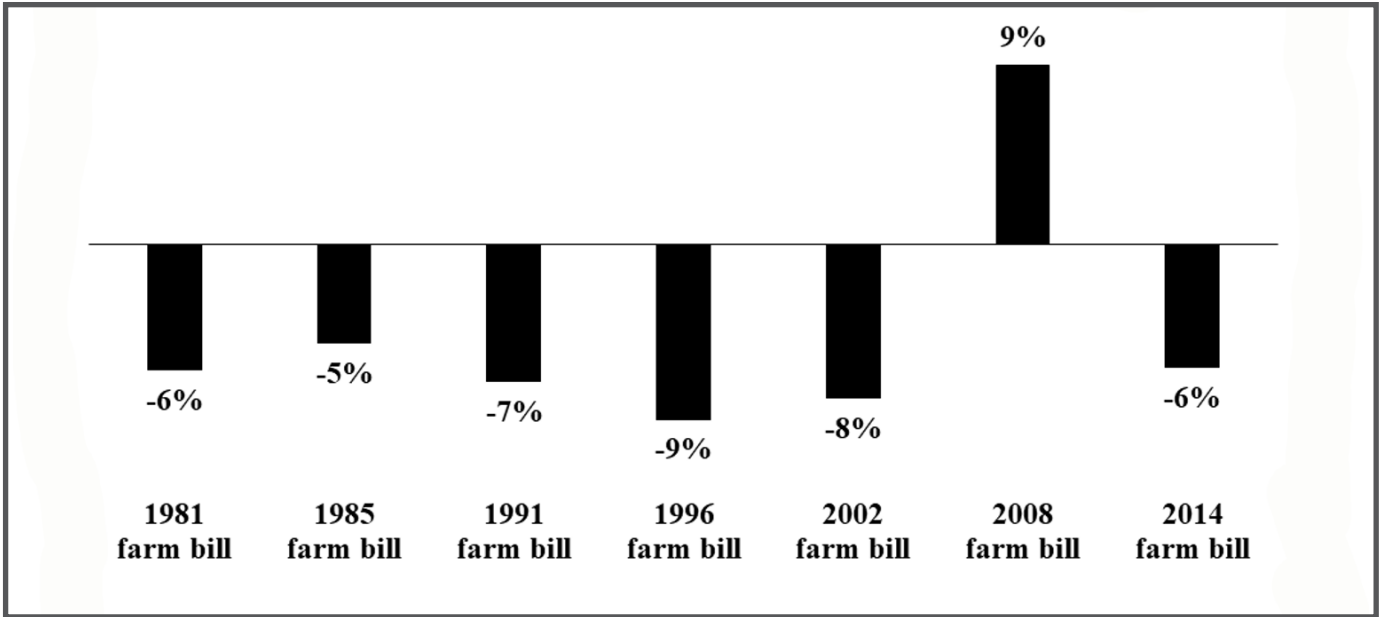


Figure 3. Lowest aggregate net return relative to aggregate economic cost of producing barley, corn, oats, cotton, peanuts, rice, sorghum, soybeans, and wheat when crop safety net payments are included in net return, by farm bill, United States, 1981–2020. (Source: Original calculations using data from USDA ERS, 2021a and 2021c; USDA FSA, USDA Farmers.gov, USDA NASS, and USDA RMA.) Note: The year with lowest net return by farm bill was 1982 (1981 farm bill), 1989 (1985 farm bill), 1991 (1991 farm bill), 2000 and 2001 (1996 farm bill), 2006 (2002 farm bill), 2009 (2008 farm bill), and 2018 (2014 farm bill).

**Table 1. Summary Statistics, Economic Cost per Planted Acre by Crop, Net Return per Planted Acre by Crop, Crop Safety Net Payments per Year by Program Type, and Net Return per Planted Acre for All COP Crops, United States, 1975–2020**

| Variable  | Average | Standard Deviation | Minimum | Maximum |
|---|---------|--------------------|---------|---------|
| <b>USDA ERS Economic Cost per Planted Acre</b>    |         |                    |         |         |
| Barley  | \$238   | \$123              | \$80    | \$448   |
| Corn  | \$398   | \$168              | \$178   | \$690   |
| Cotton  | \$526   | \$161              | \$235   | \$834   |
| Oats  | \$202   | \$112              | \$61    | \$420   |
| Peanuts   | \$698   | \$166              | \$358   | \$991   |
| Rice  | \$646   | \$217              | \$323   | \$1,016 |
| Sorghum   | \$213   | \$73               | \$97    | \$321   |
| Soybeans  | \$270   | \$115              | \$119   | \$504   |
| Wheat   | \$192   | \$77               | \$77    | \$324   |
| <b>USDA ERS Net Return per Planted Acre</b>       |         |                    |         |         |
| Barley  | -\$59   | \$39               | -\$143  | \$17    |
| Corn  | -\$18   | \$69               | -\$134  | \$224   |
| Cotton  | -\$88   | \$94               | -\$268  | \$70    |
| Oats  | -\$45   | \$55               | -\$184  | \$32    |
| Peanuts   | -\$5    | \$133              | -\$216  | \$460   |
| Rice  | -\$35   | \$165              | -\$306  | \$461   |
| Sorghum   | -\$63   | \$47               | -\$132  | \$41    |
| Soybeans  | \$14    | \$52               | -\$85   | \$159   |
| Wheat   | -\$39   | \$34               | -\$97   | \$56    |
| <b>Safety Net Payments per Year (Billion \$)</b>  |         |                    |         |         |
| Ad Hoc Programs                                   | \$1.2   | \$3.3              | \$0.0   | \$16.3  |
| Commodity Programs                                | \$6.2   | \$4.0              | \$0.4   | \$16.1  |
| Crop Insurance                                    | \$1.4   | \$2.4              | -\$0.3  | \$12.7  |
| All Crop Safety Net Payments                      | \$8.8   | \$6.1              | \$0.5   | \$28.4  |
| <b>Net Return per Planted Acre, All COP Crops</b> |         |                    |         |         |
| Without Safety Net Payments                       | -\$20   | \$48               | -\$100  | \$116   |
| With Safety Net Payments                          | \$16    | \$45               | -\$28   | \$177   |

Source: Original calculations using data from USDA ERS, 2021a and 2021c; USDA FSA, USDA Farmers.gov, USDA NASS, and USDA RMA.