Applied Economics and Finance; Vol. 10, No. 1; 2023
ISSN 2332-7294 E-ISSN 2332-7308
Published by Redfame Publishing

The Distribution of Income among U.S. Self-Employed Farm Households: A Close Look Before and During COVID-19's Recession

Hisham S. El-Osta[1]

[1] Independent Researcher, United States

Correspondence: Hisham S. El-Osta, Independent Researcher, United States.

Received: December 14, 2022 Accepted: January 14, 2023 Available online: January 19, 2023

doi:10.11114/aef.v10i1.5822 URL: https://doi.org/10.11114/aef.v10i1.5822

Abstract

This paper examines the distribution of 'money' income of self-employed farm households in the U.S. using multiple inequality measures and multi-year data from Current Population Survey. Special emphasis is given to 2016 and 2020, which portray total household income before and during the onset of the COVID-19's recession. The two selected years, respectively, characterize low and high farm income years, with their likely divergent impact on the well-being of self-employed farm households. Using the Gini index measure of inequality, findings show that money income was just as unequally distributed in 2020, the year of the COVID-19's recession, as in 2016. Adopted decomposition method of the Gini index showed income from off-farm wages and/or salaries, in comparison to the other components of total income, with the strongest equalizing marginal impact on the overall distribution of money income in 2016 and with a much lesser impact in 2020. Considering that off-farm income from wages and/or salaries is the dominant income source of self-employed farm households, macroeconomic factors are likely to continue to influence the distribution of income among self-employed farm households.

Keywords: COVID-19's recession, current population survey, income inequality, inequality decomposition

1. Introduction

The infectious coronavirus disease (COVID-19), which was identified in 2019, had a significant adverse impact worldwide, among others, on labor supply, on incomes and living expenditures of vulnerable households due to increases in the production and delivery costs in the food supply chains, and on savings and investment (Laborde *et al.*, 2021). The introduction of social distancing across countries to slow the spread of the coronavirus and to reduce its human and longer-term financial costs was a major contributor to the 2020 COVID-19 global recession which was deeper than the recession of the 2008-2009 global financial crisis (Swinnen and Vos, 2021). As noted by the International Labour Organization (2021), 8.8 percent of global working hours in 2020 were lost relative to the fourth quarter of 2019; a loss equivalent to 255 million full-time jobs, which amounts to approximately four times greater than the loss during the global financial crisis in 2008-2009. The COVID-19 pandemic, as stated by Adarov (2022), has raised global income inequality, and in part, has undone the improvement in inequality that was achieved over the preceding two decades.

In the U.S., the 2020 COVID-19 induced recession was short lived as it lasted from February 2020 to April 2020 (Kochhar and Sechopoulos. 2022). While the recession had an immediate impact on the labor market as by the end of April 2020, more than 22 million jobs were lost which created higher rates of unemployment (at 14.7%), the corresponding effect on hourly wage rates (at $30.01) was unexpected as the growth in wages compared to earlier months had accelerated instead of exhibiting a marked slowdown (Howard *et al*., 2021; Faberman *et al*., 2022). This inconsistent growth in the hourly wages was largely due to what economists refer to as the 'composition effects' where the adverse economic impact of the COVID-19 pandemic had triggered a substantial change in the structure of the work force where millions of relatively low-paid workers disproportionately lost their jobs, while relatively high-paid workers stayed employed (Chetty *et al*., 2022; Howard *et al.*, 2021; Rouse and Gimble, 2021).[1] With off-farm income

[1] In response to the adverse impact of the COVID-19's pandemic on businesses and individuals, Congress enacted in March 2020 the Coronavirus Aid, Relief and Economic Security (CARES) Act. This Act offered, among other things, one-time stimulus checks for individuals, extended unemployment insurance (UI) benefits, and the Paycheck Protection Program (PPP) for small-business loan forgiveness (Falcettoni, and Nygaard, 2021). As part of the $2.2 trillion bill passed under the CARES Act, funds were appropriated in 2020 to states for implementation of the Pandemic

being the main contributor to the income of many farm households (Ahearn *et al*., 1993 and 2006; Mishra *et al*., 2002), along with its attending importance in reducing income variability (Mishra and Sandretto, 2002) and income inequality (Boisvert and Ranney, 1990; El-Osta *et al*., 1995; Mishra *et al*., 2009, Mishra *et al*., 2010), both the unemployment levels and the growth in wage rates are hence likely to impact both the levels and the distribution of income of these households. This paper examines the distribution of 'money' income of self-employed farm households using 2016-2020 income data from the 2017-2021 Annual Social and Economic Supplements [U.S. Census Bureau, Current Population Survey (CPS ASEC)].[2] Special emphasis is given to 2016 and 2020, which portray total household income before and during the onset of the COVID-19's recession with its attending impact on unemployment and wage rates (see figure 1, top and bottom panels), and consequently on off-farm earnings. In addition, these selected years characterize low and high farm income years, with their likely divergent impact on the well-being of self-employed farm households.[3]

Income is an important indicator of the economic well-being of farm households as it provides the primary means for paying living expenses and financial savings. How this measure of economic well-being is distributed among farm households is of interest to policy analysts, farm investors, and lenders. The paper uses a variety of inequality measures to examine the distribution of income and utilizes an inequality decomposition technique to assess the contribution of the components of total money income to the inequality in its distribution.

Unemployment Assistance (PUA) program where individuals who were not eligible for regular unemployment compensation and were unable to continue to work because of COVID-19, such as self-employed workers, became qualified for PUA benefits. A consequence of the more than $400 billion in stimulus checks was to considerably increase family income and to lift, at least temporarily, 11.7 million people out of poverty based on the Supplemental Poverty Measure (SPM) estimates by U.S. Census Bureau (Han et al., 2020; Falcettoni, and Nygaard, 2021; Burns et al., 2021; Sherman et al., 2022).

[2] Self-employed people, as defined by CPS, are those who work for profit or fees in their own unincorporated business, profession, trade, or farm (U.S. Bureau of Labor Statistics, 2021). In CPS, people who own a business or farm solely for investment purposes, and who do not participate in its management or operation, are not considered employed based on this ownership stake, and therefore are not included in the estimates of self-employed. Also, household 'money' income, as collected by CPS, is the sum of all pre-tax incomes earned by all members of the household in the calendar year preceding the date of the survey (U.S. Census Bureau, 2021). The 2021 CPS ASEC data, compared to other U.S. income data sources [e.g., U.S. Census Bureau's American Community Survey (ACS)], provided the first detailed information about income received in 2020 during the pandemic (VanOrman, 2021).

[3] The low farm income year in 2016 was primarily a result of the significant decline in most farm commodity prices which had occurred since 2013 (Schnepf, 2017). The high farm income year in 2020 was primarily due, without considering the substantial increase in direct government payments and the record government farm assistance to farmers because of the COVID-19 pandemic which the CPS data did not directly capture, to higher farm prices for major commodities (e.g., corn, soybeans, wheat, and cotton). The higher farm prices of these commodities were induced primarily by lower expectation for surplus stocks and by increasing international demand (Congressional Research Service, 2021). The article also utilizes data from the 2022 CPS (ACS) to briefly present a comparison of some of the main findings regarding the inequality in the distribution of income among self-employed farm households in 2021, which is another COVID-19 pandemic year and is a year with high farm income, relative to the reference year 2016.

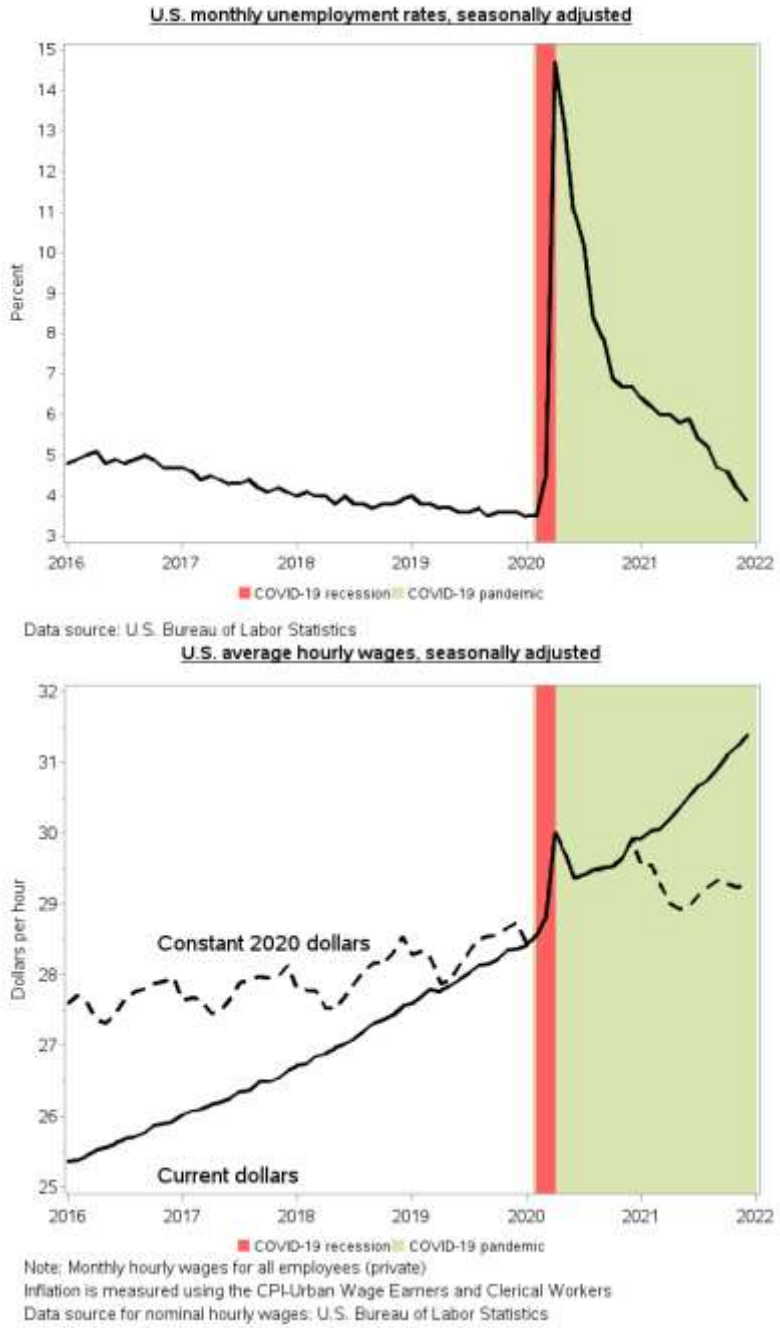

Figure 1. U.S. unemployment rates and average hourly wages: 2016-2021

2. Literature Review

Inequality in the distribution of income has been present in the U.S. since early in the 20th century when it was reported that approximately 15%-18% of the nation's income went to the richest top 1 percent (see King, 1915; Piketty and Saez, 2003). Rising inequality in the distribution of income, which the U.S. has witnessed since the late 1970s (Hoffmann *et al*. 2020; Clemens, 2022), tends to have an adverse impact on economic development and other economic and social outcomes (Galor and Zeira, 1993; Neckerman and Torche, 2007; Stiglitz, 2012 and 2015; and Corak, 2013; Polacko, 2021). Several studies have concluded that a significant effect from a rise in income inequality is through a downward pressure on demand growth (Bivens, 2017; Bivens, and Banerjee, 2022). Economic inequality has implications related to savings and wealth-building, upward socioeconomic mobility, prospects of land and/or home ownership, secure retirement, and social cohesion. The study by Corak (2013) notes that income inequality is often accompanied by economic deprivation and inequality of opportunity as poorer households tend to face difficulty in investing in adequate education, which limits the next generation's employment and earning prospects. The study by Cingano (2014) finds higher income inequality as being a major contributor to lower economic growth in countries belonging to the

Organization of Economic Cooperation and Development (OECD), this in addition to the finding that efforts to reduce inequality may advance social justice and contribute to increased economic prosperity.

In the case of agriculture, inequality in income is also tied to concerns about access to credit, which is a critical factor in farm profitability and is likely to be limited among households in the lower parts of the income distribution. In reviewing the literature, Mishra *et al*. (2009) note that income inequality adversely impacts technology adoption by farmers, agricultural productivity at the farm and sector level, and growth of the agricultural sector. Since farm households are also consumers in the wider economy, the economic disparity between high- and low-income farm households not only affects outcomes in the farm sector, but also impacts the overall demand for goods and services in the general economy.

3. Data Description

The definition of total farm household 'money' income used in this paper follows that of the Current Population Survey (CPS) Annual Social and Economic Supplement, which is conducted in March by the Bureau of the Census, and which is the official source of U.S. poverty data in addition to annual data on a variety of national social and economic indicators (U.S. Bureau of Labor Statistics, 2021). Table 1 shows the number of self-employed farm households in 2017 and 2021 at about 2 million, which accounted, in the respective years, to about 1.5 percent of all households in the United States.[4] The corresponding share of income held by these households in 2016 and 2020, the calendar years preceding the dates of the 2017 and 2021 surveys, in comparison to all other households, was at about 2.5 percent.

Table 1 also shows the 2016 and 2020 average values of total money income of self-employed farm households along with the average values of the corresponding income components. In 2020, average farm household income was about $173,000, compared to a significantly lower average in 2016 of about $137,000 (in 2020 inflation-adjusted dollars).[5] The average incomes from off-farm wages and salaries and from farming, compared to the other income sources of total income, were the largest in both years.

Table 1. Income of self-employed farm households

	2017		2021
		Number	
Sample size	1,140		954
Number of self-employed farm households	1,921,343		1,803,063
	2016		2020
		Average ($2020)[1]	
Total income[@]	137,217*		172,726
Self-employment net farm income[2]	21,625		19,887
Off-farm wages and/or salaries	86,847*		111,537
Self-employment non-farm income	10,234		16,084
Interest and dividends income	5,116*		8,106
Social Security income	4,030		4,355
All other income[3]	9,365		12,757

Source: U.S. Census Bureau, Current Population Survey, 2017 and 2021 Annual Social and Economic Supplements (CPS ASEC).
Note: Household income, as collected by CPS, is the income earned by the household in the calendar year preceding the date of the survey.
[1] All 'before-tax' nominal values in this paper were adjusted for price changes using the Consumer Price Index for All Urban Consumers and are expressed in constant 2020 dollars.
[2] The 'Self-employment net farm income' component of total income, computed as gross receipts minus operating expenses, includes income received as cash (e.g., from products sold, government crop loans, money received from the rental of farm equipment to others, and incidental receipts from the sale of wood, sand, gravel, etc.), but excludes the nonmoney income items of crops grown for home consumption. The definition of this income component departs from a strictly cash concept by deducting depreciation, a noncash business expense, from income.
[3] The 'All other income' component of total income is the sum of many other sources of income to the household such as, among other things, retirement annuities, pension income, unemployment compensation, and veteran payment (for a detailed list, see U.S. Census Bureau, 2021).
* Indicates estimates of corresponding items in 2016 and 2020 are statistically different at the 5% level of significance ($P \leq 0.05$).
@ Total household income and all its components have coefficient of variation (CV) of less than 20.00 percent [CV = (Standard Error/Estimate), with CVs ranging from low levels of 4.00 percent and 5.00 for total household income in 2016 and 2020, respectively, to a high level of 18.00 percent for self-employment non-farm income in both 2016 and 2020.

[4] According to the CPS-ASEC data used in this paper, the number of U.S. households in 2017 and 2021 were, respectively, at 126.27 million and 129.93 million.

[5] The reported estimates in this section and in the rest of the paper are the survey estimates using full-sample weights. Standard errors used in the computation of *t*-statistics of difference between two means were computed based on variance estimation method with full-sample weights and with 160 replicate sample weights (see Zimmerman, and Robison. 2018; U.S. Census Bureau, 2019). Furthermore, significance tests of differences in estimates between 2016 and 2020 in Table 1 and in other tables are based on $P \leq 0.05$ (see corresponding footnote in the table).

To the extent that variation in the characteristics of self-employed farm households and of their farm operators are likely to exist at various locations of the income distribution, table 2 presents measurements of such characteristics by income quartiles, both between and within the 2016 and 2020 time periods.[6] In 2020, and in comparison to 2016, farm operators in the bottom income quartile were, on average, much younger (44 years vs. 48 years), had a much higher proportion with a college degree or beyond (45.7% vs. 33.2%), and a much lower share who identified their race as white (73.8% vs. 89.6%). Self-employed farm households who were in the bottom income quartile in 2020, in contrast to their counterparts in 2016, had a significantly higher average household income, respectively, at $44,000 compared to $32,000. These operators in the bottom quartile in 2020, in comparison to 2016, had less of their household income earned from farming (13.3% vs. 22.5%) and more from off-farm wages and salaries (66.6% vs. 56.1%), and tended to have lower proportion of its population in poverty (14.7% vs. 24.9%). Correspondingly, farm operators in the top income quartile in 2020, in comparison to those operators in the same income group in 2016, had nearly identical demographic characteristics based on their reported age, educational attainment, and racial makeup. In 2020, self-employed farm households in the top income quartile had similar household characteristics as their counterparts in 2016, except in their significantly higher average household income ($409,000 vs. $309,000), and in the lower percentage of the household income that was earned from farming (10.5% vs. 17.7%).

Table 2. Characteristics of self-employed farm households and of their farm operators by income quartiles[1], 2016 and 2020

Item	Bottom quartile (a)	Middle two quartiles (b)	Top quartile (c)	All households
2016				
Operator characteristics:				
Age (average)	47.9*	48.2	49.0	48.0
Age: younger than 35 (%)	28.5*	23.7	21.7	24.4
Education: college degree or beyond (%)	33.2*, a, b, c	51.5b, c	66.5	50.7
Race: white (%)	89.6*	86.1	85.7	86.9
Household characteristics:				
Total income (average)	32,015*, a, b, c	103,725*, b, c	309,212*	137,217*
Components of total income (%):				
Self-employment net farm income[1]	22.5*, a, b	11.8	17.7*	15.8*
Off-farm wages and/or salaries	56.1*, a, b	69.6b, c	59.8	63.3
Self-employment non-farm income	2.5a, b, c	4.9b, c	9.7	7.5
Interest and dividends income	1.3a, b, c	3.2	4.3	3.7
Social Security income	8.6a, b, c	4.2b, c	1.5	2.9
All other income	9.0	6.2*	7.0	6.8
Total	100.0	100.0	100.0	100.0
In poverty (%)	24.9*, a, b, c	1.1b, c	0.0	6.8*
Presence of health insurance coverage (%)	86.2a, b, c	94.4b, c	98.9	93.5
2020				
Operator characteristics:				
Age (average)	43.7a, b, c	47.8b, c	51.4	47.7
Age: younger than 35 (%)	38.7a, b, c	29.3b, c	13.5	27.7
Education: college degree or beyond (%)	45.7a, c	53.3b, c	69.3	55.4
Race: white (%)	73.8a, b, c	85.6	88.1	83.3
Household characteristics:				
Total farm household income ($)	44,488a, b, c	118,446b, c	409,325	172,726
Components of total income (%):				
Self-employment net farm income[1]	13.3	12.9	10.5	11.5
Off-farm wages and/or salaries	66.6	64.8	64.2	64.6
Self-employment non-farm income	3.7a, c	4.9b, c	12.5	9.3
Interest and dividends income	1.4a, b, c	4.7	5.1	4.7
Social Security income	7.0a, c	4.2b, c	1.1	2.5
All other income	8.1	8.6	6.6	7.4
Total	100.0	100.0	100.0	100.0
In Poverty	14.7a, b, c	1.3b, c	0.0	4.3
Presence of health insurance coverage (%)	86.6a, b, c	97.0	98.9	94.9

Source: Author's calculations based on U.S. Census Bureau, Current Population Survey, 2017 and 2021 Annual Social and Economic Supplements (CPS ASEC).

Note: Household income, as collected by CPS, is the income earned by the household in the calendar year preceding the date of the survey. All income dollar values are in 2020 inflation-adjusted dollars.

[1] Income quartiles are the three income levels that divide the income distribution into four equal intervals.

* Indicates estimates of corresponding items in 2016 and 2020 are statistically different at the 5% level of significance.

a, b, c Indicate pairwise estimates of corresponding items in 'Bottom quartile', versus estimates in 'Middle two quartiles' and 'Top quartile' groups [e.g., pairwise estimates in column (a) versus column (b); and in column (a) versus column (c)], are statistically different at the 5% level of significance.

[6] Income quartiles are the three income levels that divide the sorted income distribution into four equal intervals.

Table 2 shows farm operators of self-employed farm households who were in the bottom income quartile in 2016, compared to those farm operators who were in the top income quartile in the same year, with a significantly lower proportion amongst their ranks with a college degree or beyond (33.2% vs. 66.5%). As expected, self-employed farm households located in the bottom income quartile, in contrast to those located in the top income quartile in 2016, averaged a significantly lower level of farm household income. While farm households in this bottom income quartile, compared to those in the top income quartile, had lower shares of their income from self-employment non-farm income sources (2.5% vs. 9.7%) and from interest and dividends (1.3% vs. 4.3%), these households earned higher shares of their income from social security (8.6% vs. 1.5%). Self-employed farm households located in the bottom income quartile in 2016, in comparison to their counterparts in the top income quartile, had a significantly lower reported health insurance coverage (86.2% vs. 98.9%).

In 2020, the year of the COVID-19 recession in the U.S., and as shown in Table 2, farm operators of self-employed farm households who were in the bottom income quartile were, in comparison to those farm operators in the top income quartile, much younger (44 years vs. 51 years), had a much lower proportion with a college degree or beyond (45.7% vs. 69.3%), and a much lower proportion of those who self-identified as white (73.8% vs. 88.1%). As in 2016, and as expected, self-employed farm households located in the bottom quartile of the income distribution, in comparison to those farm households with incomes in the top quartile of the distribution, had a significantly lower average farm household income. Farm households in this bottom income quartile, compared to those in the top income quartile, had lower shares of their income from self-employment non-farm income sources (3.7% vs. 12.5%) and from interest and dividends (1.4% vs. 5.1%). The share of income earned by these lower income self-employed households from social security, compared to their higher income counterparts, was significantly higher (7.0% vs. 1.1%). Also, the extent of reported health insurance coverage by these farm households with lower incomes, in contrast to those households with higher incomes, was much lower (86.6% vs. 98.9%).

Figure 2 shows the composition of the average total income of self-employed farm households by income component, for those who were in the bottom income quartile (top panel), and for those who were in the top income quartile (bottom panel), for the 2016-2020 time period. Both panels demonstrate the importance of income from off-farm wages and salaries, and to a lesser extent, of income from farming, to the total income of self-employed farm households. The importance of off-farm labor earnings to U.S. farm operator households, regardless of their location in the distribution of income, and unlike in the case of the general population where the share of wage income is a declining function of total income (Piketty and Saez, 2003), has been demonstrated by many studies as a source of both income growth and as a contributor in lessening inequality (Findeis, and Reddy, 1987; Boisvert and Ranney, 1990; El-Osta *et al*., 1995; Mishra *et al*., 2002; Mishra *et al*., 2009 and 2010).

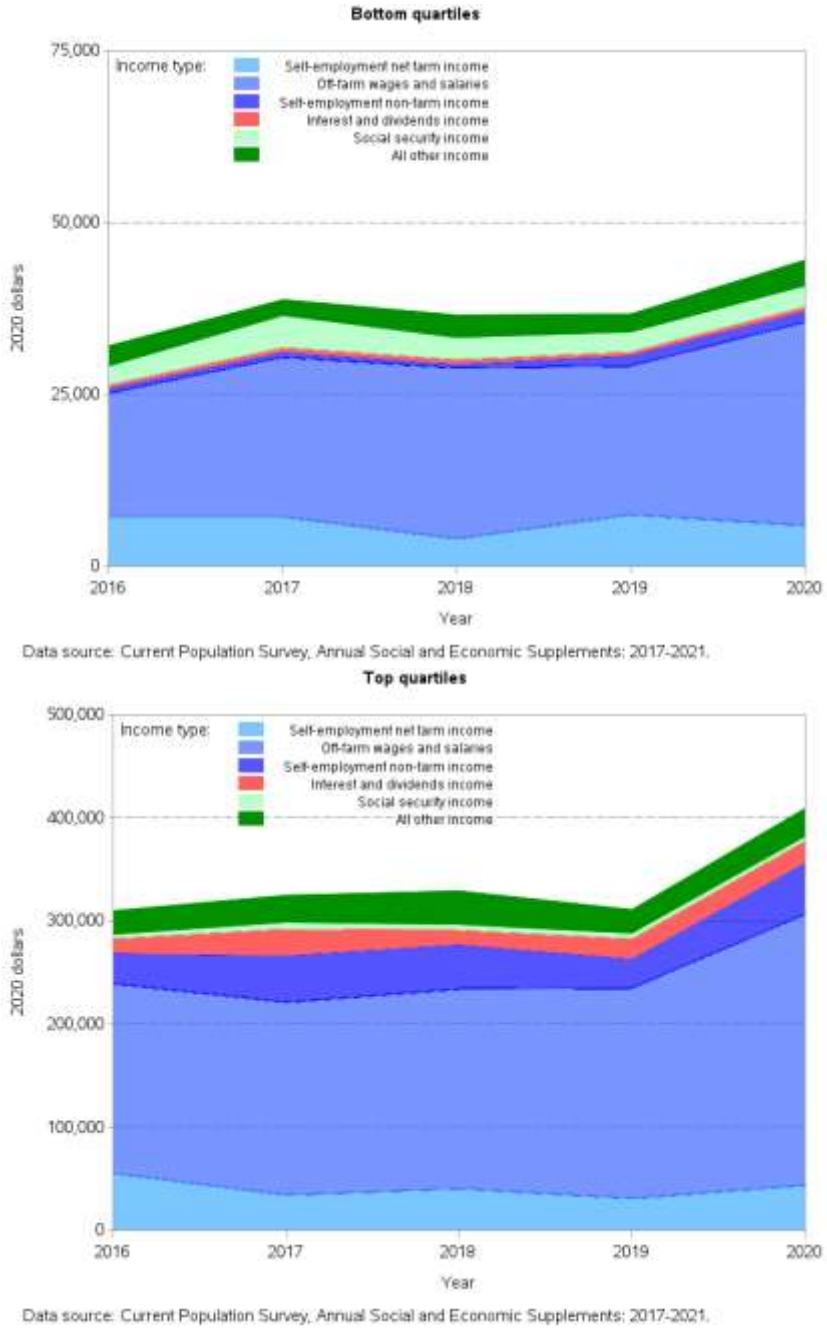

Figure 2. Components of average total income for self-employed farm households in the bottom and top quartiles of the income distribution: 2016-2020

4. Methodology

The main measure used in this paper to assess the inequality in the distribution of income (Y) among self-employed farm households is the Gini index [$G(Y)$]. This measure of the ranked economic indicator Y with k number of contributing sources is computed as (Stuart, 1954):

$$G(Y) = 2\,\mathrm{Cov}[Y, F(Y)]/\overline{Y} \tag{1}$$

where $\overline{Y}$ is the weighted mean of Y; $F(Y)$ is the cumulative distribution, and Cov(.) is the covariance between Y and $F(Y)$.

The Gini index of indicator *Y* as described in (1) can be decomposed into parts based on the contribution to inequality by the *K* components of *Y*. The decomposition procedure starts by computing the Gini index of the *k*th source [$G(Y_k)$; also known as 'pseudo' Gini index] of economic indicator *Y* as in (see Pyatt *et al*., 1980; Lerman and Yitzhaki, 1985; Lerman and Yitzhaki,1989; Giorgi, 2011):[7]

$$G(Y_k) = 2\,\mathrm{Cov}[Y_k, F(Y_k)]/\overline{Y_k} = [2/n\overline{Y_k}][\mathrm{Cov}(Y_k, \rho(Y_k))], \quad (2)$$

where $\overline{Y_k}$ is the mean of Y_k ; $F(Y_k)$ is the cumulative distribution, $\rho(Y_k)$ is the rank of Y_k, n is sample size, and Cov(.) is the covariance between Y_k and $\rho(Y_k)$. Equation (1) can alternatively be estimated as in:

$$G(Y) = \sum_{k=1}^{K} G(Y_k) R_k \phi_k \,,\ 0 \le G(Y) \le 1, \quad (3)$$

where,

$$R_k = \frac{\mathrm{Cov}\,[Y_k, \rho(Y)]}{\mathrm{Cov}\,[Y_k, \rho(Y_k)]},\ -1 \le R_k \le 1 \quad (3a)$$

$$\phi_k = \frac{\bar{Y}_k}{\bar{Y}}. \quad (3b)$$

In (3a), R_k is the "Gini correlation" between the *k*th source and the rank of *Y*, and it will take the value of 1 when $\rho(Y) = \rho(Y_k)$, which will indicate that Y_k is an increasing function of *Y*. The Gini correlation R_k equals the Pearson correlation coefficient when both *Y* and Y_k are normally distributed. R_k will be positive (negative) when Y_k is an increasing (decreasing) function of *Y*, and will be equal to zero when Y_k and *Y* are independent. In (3b), ϕ_k is the share of the *k*th component of *Y*.

The "relative contribution" to inequality by the *k*th source of *Y*:

$$P_k = \frac{G(Y_k) R_k \phi_k}{G(Y)}. \quad (4)$$

Equation (4), referred to interchangeably in the literature as 'proportional contribution', indicates that the larger is the product of $G(Y_k)$, $R(Y_k)$, and ϕ_k the larger is the contribution to inequality in *Y* by the *k*th source of *Y*.

The relative marginal effect M_k of a small change (ε_k) in economic source *k* (all other components of *Y* remaining unchanged), as developed by Lerman and Yitzhaki (1985; p.154), and as noted by Wodon and Yitzhaki (2002):

$$M_k = \frac{\left[\frac{\partial G(Y)}{\partial \varepsilon k}\right]}{G(Y)} = \frac{\phi_k [R_k G(Y_k) - G(Y)]}{G(Y)} = P_k - \phi_k,\ \ \sum_{k=1}^{K} M_k = 0. \quad (5)$$

As was pointed out by Lerman and Yitzhaki (1989), estimation of $G(Y_k)$ when the underlying data are based on a

[7] The description provided here for the method of decomposing the Gini index by factor component follows closely the description provided by El-Osta *et al*. 1995 and by Mishra *et al*. (2009 and 2010).

survey with replicate weights, as in the CPS, is done with Y_k being ranked first in a non-decreasing order, and then being estimated not just as the cumulative distribution of Y, but rather, as a mid-interval of $F(Y_k)$ as in:

$$\hat{F}_i(Y_k) = \sum_{j=0}^{i-1} w_j + w_j/2 \quad \text{where } w_0 = 0. \tag{6}$$

In equation (6), w_j is the inverse of the sampling weight for the *i*th self-employed farm household such that:

$\sum_{i=1}^{n} w_i = 1 \quad (i = 1, \ldots, n)$.

The Gini index for Y_k in the context of survey data is:

$$G(Y_k) = 2\left[\sum_{i=1}^{n} w_i (Y_{ik} - \overline{Y_k})(\hat{F}_i(Y_k) - \overline{F}(Y_k))\right]/\overline{Y_k}, \tag{7}$$

where Y_k is the *k*th source of economic indicator Y for the *i*th self-employed farm household, $\overline{Y_k}$ is the weighted mean of Y_k, $\overline{F}$ is the weighted mean of the estimates of F_i, and [.] is the weighted covariance between Y_k and $F(Y_k)$. Once $G(Y_k)$ is estimated based on (7), its value is then used in the computation of the relative contribution to inequality and of the marginal effects as described in (4) and (5). This approach of measuring inequality in the distribution of economic indicators and of measuring the role of contributing components has been widely used in numerous studies, both in the U.S. (e.g., Ahearn *et al*., 1985; Findeis and Reddy, 1987; Boisvert and Ranney, 1990; Gould and Saupe, 1990; El-Osta *et al*., 1995; Mishra *et al*., 2009 and 2010) and internationally (e.g., El Benni and Finger, 2013).

Considering the varied sources from which self-employed farm households earn their incomes, the contributions of those sources (or components) to inequality in income are likely to vary by the components themselves and, by the referenced survey-year. A comparison of marginal impacts of the various sources of 'money' income could allow assessment of the effectiveness of different policies/strategies in reducing income inequality. Considering the differences in the livelihood strategies among self-employed farm households, and how these households might react to macroeconomic conditions and to market conditions, it is expected that the influence of marginal changes in income sources on inequality will differ by the type of the income source and the extent of the self-employed farm household's dependence on each income source.

5. Results

A variety of approaches are used in this paper to assess income inequality, including, among others, income shares of income received by self-employed farm households by quartiles; income quartile share ratios; and Gini indices. Table 3 shows a significantly higher growth in mean income, in comparison to median income of self-employed farm households between 2016 and 2020, at 26 percent and 11 percent, respectively. Figure 3 shows the mean and median income of self-employed farm households over the 2016-2020 time period.[8] The figure also demonstrates the significant spike of 20 percent in mean income in 2020 (at $173,000), the year of the COVID-19 recession, from its level in the previous year (at $144,000).

Considering the shares of income earned at various points along the income distribution as shown in table 3 and in figure 4 (top panel), self-employed farm households in the bottom quartile of the distribution earned about 6 percent of the income of all self-employed farm households in 2016 and 2020. In both 2016 and 2020, self-employed farm

[8] The survey-based standard errors used in the computation of the 95% confidence intervals in this figure, and other figures in the rest of the paper, were based on the variance estimation method, with CPS (ASEC) full-sample weights, and with 160 replicate sample weights.

households in the top quartile of the income distribution earned about 60 percent of all income earned by self-employed farm households.[9]

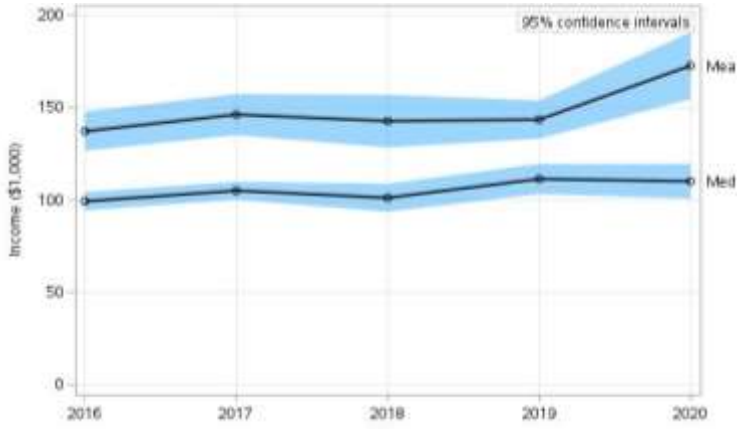

Figure 3. Mea and med income of self-employed farm households: 2016-2020

Table 3. Inequality measures: income of self-employed farm households: 2016 and 2020

Item	2016	2020	Relative change (%)
		($2020)	
Mean income	137,217*	172,726	25.88
Median income	99,282*	110,117	10.91
Income inequality measures:			
Income quartile shares[1]:			
Bottom quartile (S25)	5.8	6.4	15.51
Top quartile (S75)	56.3	59.3	5.32
Central tendency and income quartile share ratios:			
Mean-to-median	1.38	1.57	13.77
Income quartile share (S75/S25)[2]	9.7	9.3	-4.12
Summary measure of the entire income distribution:			
Gini index	0.456	0.479	5.04

Note: All dollar values are in 2020 inflation-adjusted dollars.

Source: Author's calculations based on income data from: U.S. Census Bureau, Current Population Survey, 2017 and 2021 Annual Social and Economic Supplements (CPS ASEC).

[1] Income quartiles are the three income levels that divide the income distribution into four equal intervals.

[2] This is the ratio of total income received by the top 25% of the self-employed farm households with the highest income (top quartile) relative to that received by the corresponding 25% households with the lowest income (bottom quartile).

* Indicates estimates of corresponding row items in 2016 and 2020 are statistically different at the 5% level of significance.

[9] While the exact shares of income earned by self-employed farm households in the top quartiles of the income distributions in 2016 and 2020 were 56.3% and 59.3%, the estimated shares between the two years were not statistically different at the 5% level of significance ($P \leq 0.05$). Also, while the shares of income received by the top earners of a given income distribution are useful in the delineation of the extent of inequality in income (see Wolff 2014), use of these statistics alone in the measurement of inequality can be limiting. This is because these concepts of inequality measurement do not account for the supply and demand for skills of individuals including skill-based technological change, and for the heterogeneity in the economic behavior of households across the full spectrum of the income distributions (Alessie *et al*., 1997; Mankiw, 2013; Acemoglu and Robinson, 2015).

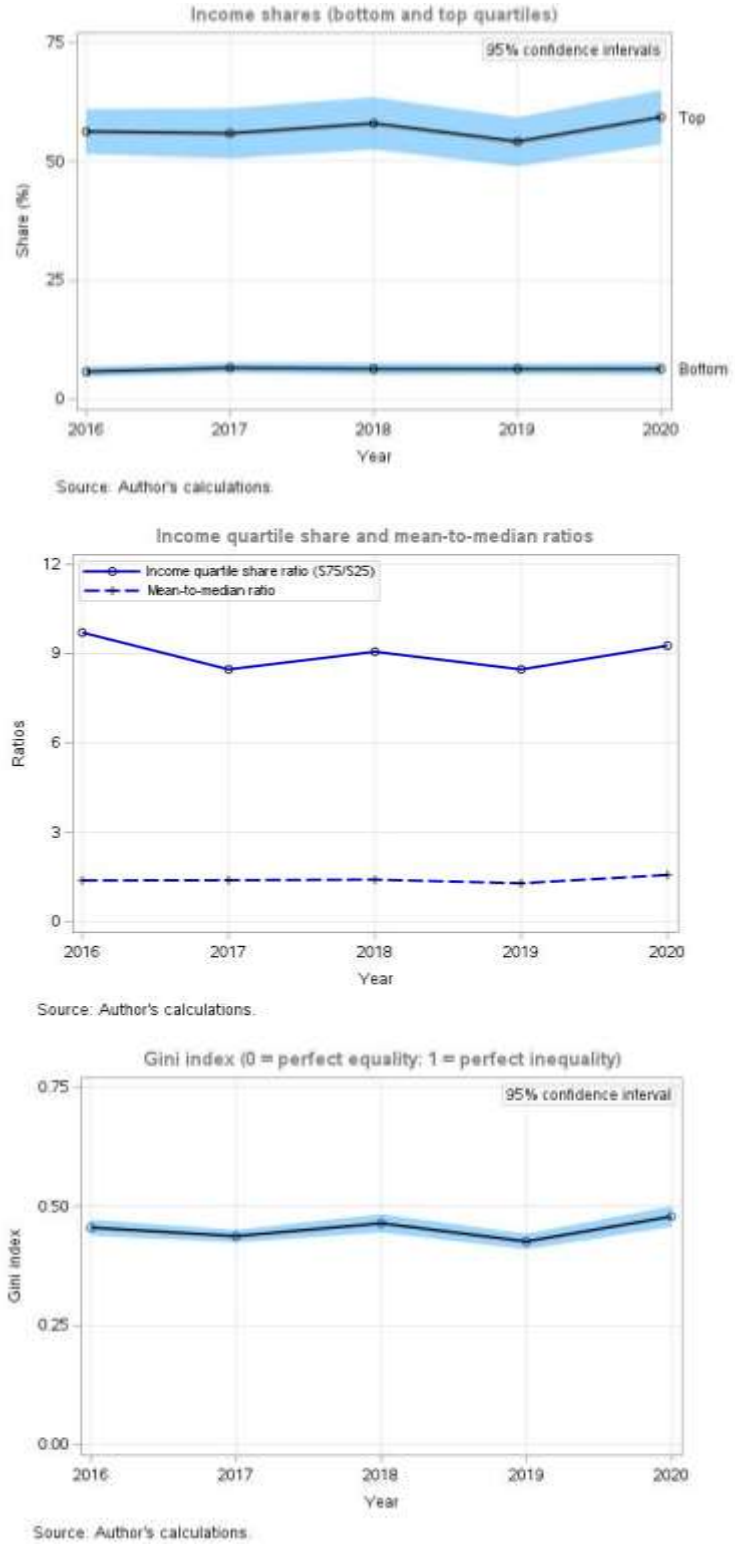

Figure 4. Indicators of income inequality among self-employed farm households: 2016-2020

One straightforward indicator of inequality in the income distribution is the ratio of the mean (or average) income to the median income. Since the median income is the middle-income level when all households are ranked by their income, this ratio will take the value of 1 when the income is distributed evenly across all self-employed farm households with each household earning the same income. In 2016, the mean income level was 1.38 times the median income in 2016, and in 2020, the mean income level was 1.57 times its corresponding level of median income (table 3; fig. 4, middle

panel). To the extent that these values in both 2016 and 2020 exceeded 1, they signify that the income distributions in both years, and more so in 2020, were skewed to the right, with more than 50 percent of all self-employed farm households receiving incomes that were below the 2016 and 2020 averages. Another indicator of inequality is the ratio of the share of income received by self-employed farm households at differing quartiles of the distribution, such as the ratio of the share of income received by those in the top quartile of the income distribution, relative to the share of income received by those in the bottom quartile (i.e., S75/S25). In both 2016 and 2020, that ratio was about 10, meaning that self-employed farm households in the top income quartile earned, in total, about 10 times more of the accumulated income of all farm households than those households in the bottom quartile of the distribution (table 3; fig. 4, middle panel).

The Gini index [$G(Y)$; eq. 3] is also commonly used to measure inequality in the distribution of income on a scale of 0 to 1, with 0 reflecting perfect equality and 1 reflecting perfect inequality. As shown in table 3, the Gini index for income in 2016 was 0.456, indicating a high level of inequality in income for self-employed farm households.[10]. The Gini index for income in 2020 was 0.479, which constituted, although insignificantly, a rise by nearly 5 percent relative to its level in 2016 (table 3; fig. 4, bottom panel).[11]

5.1 Distributional Effects of Different Sources of Income

Self-employed farm households in the United States are heterogeneous in the manner they earn their incomes. While the households of operators of large farms, who produce the largest share of total U.S. farm output and hold large amounts of assets, depend mainly on farm income for their livelihood, many others, particularly smaller farms, depend mainly on income from off-farm wages and/or salaries and from non-farm self-employment (Ahearn et al. 1993; Mishra et al., 2002).

In any farm production year, due to the vagaries of the weather or to poor market conditions, the amount earned from farming by farm households of any farm type, on average, may be small or even negative. Over the time period examined, and as shown in figure 5, the percent of self-employed farm households with a reported negative farm income ranged from a high of 17 percent in 2018 and 2019 to a nearly comparable low of 16 percent in 2016, 2017, and 2020. Similarly, and due to poor management or risk-taking behavior by the farm operator, or use of outdated technology, and/or due to adverse market and macroeconomic conditions, the amount earned from non-farm self-employment in any farming year may also be small and/or negative. Figure 5 shows the percent of self-employed farm households with a reported negative self-employment non-farm income ranged from a high of 8 percent in 2020 to a low of 3 percent in 2018. Correspondingly, the percent of farm households with a reported negative total household income ranged from a high of 0.6 percent in 2016 to a low of 0.4 percent or less over the course of the 2017-2020 time period.

[10] While there are no worldwide-defined standard cut-off values, it is generally noted that a Gini index of disposable household income below 0.3 is reflective of low inequality, 0.3-0.4 of relatively moderate inequality, 0.4-0.5 of high-income inequality, and of 0.5 or higher of severe income inequality (see: https://www.unicef.cn/en/figure-27-national-gini-index-20032017 and https://wol.iza.org/uploads/articles/495/pdfs/measuring-income-inequality.pdf?v=1). Also, an inherent limitation of the Gini index is that it is more sensitive to changes in the middle of the distribution of a given indicator than to changes at the extremes. As suggested by Piketty (2014; p. 266) and by Osberg (2017), this paper uses other tools in addition to the Gini index to measure the inequality in the distribution of income of self-employed farm households. Another limitation of this index is that in the presence of negative observations in the distribution of the utilized economic indicator, its value can become overstated, and potentially in the presence of large number of observations with negative values, it can take a value greater than one (see Chen *et al*., 1982). To the extent that only 0.6% in 2016 and 0.1% in 2020 of the self-employed farm households had negative total household income, with the contributors being farm households who had reported negative incomes from self-employment net-farm and non-farm income sources in both years, the potential for an overstated Gini indices for total income for these two years was barely measurable. Specifically, estimation of the Gini indices with these negative observations of total household income being deleted have yielded values of Gini indices for total household income, in 2016 and 2020, of 0.452 and 0.478, respectively. In comparison, the values of the Gini indices for these two respective years when the negative observations of self-employment income were included in the estimation, as reported in table 4, were at 0.456 and 0.479.

[11] The estimated Gini indices between the 2016 and 2020 years were not statistically different at the 5% level of significance. Appendix A extends the inequality measures as described in table 3 to 2021, with the results of the estimated Gini indices pointing towards lower inequality in the distribution of income in 2021 when the COVID-19 was still considered a pandemic relative to 2016; although the drop in these estimates of about 3% (from 0.456 to 0.444) was not statistically different at the 5% level of significance.

Figure 5. Shares of self-employed farm households with reported negative net farm income, negative self-employment non-farm income, and negative total household income: 2016-2020

Table 4 presents the results of the income inequality decomposition by sources of total household income in 2016 and 2020, where inequality was captured by estimates of Gini indices of 0.456 and 0.479, respectively. Income from self-employment non-farm income in both years, with corresponding values of pseudo-Gini indices of 0.96 and 0.93, was the most unevenly distributed income source. Similarly, income from self-employment net-farm income in 2016 and 2020, with corresponding values of pseudo-Gini indices of 0.90 and 0.88, was the second most unevenly distributed income source. The presence of many farming operations with reported losses from self-employment net-farm and non-farm incomes, are contributing factors to the high inequality in the distribution of these two income sources (see fig. 5).[12] One of the main contributing factors for the high level of inequality in this farm-related income source, as was noted by Findeis and Reddy (1987), is related to the dichotomy that exists among U.S. farm households in terms of the levels of their earned farm incomes. A study by El-Osta *et al*. (1995) asserted this dichotomy by noting that while nearly 75 percent of farm households, based on U.S. Department of Agriculture's data from the 1991 Farm Costs and Returns Survey, had earned less than $10,000 in farm income, only around 6 percent of all households had farm income of at least $50,000. A more recent study by Hoppe *et al*. (2010) had stated a closely related dichotomy as while about 90 percent of farms were classified as small based on their small-gross cash farm income (GCFI) of less than $250,000, about 60 percent of these small farms were very small considering that they were generating GCFI of less than $10,000. The contribution of net-farm income to inequality in 'money' income was significantly greater in 2016 (18%) than in 2020 (10%).[13] The larger share of self-employment net-farm income in total household income in 2016 than in 2020 (16% and 12%, respectively), plus its higher level of inequality as measured by the pseudo Gini index (0.90 and 0.88), are factors that accounted for the higher contribution of this income source to the inequality in the distribution of total household income in 2016 in comparison to 2020 (18% and 10%). Yet another reason for the higher contribution to inequality of net-farm income in 2016 was its higher level of correlation (R_k) between the distribution of this income source and the distribution of total household income in 2016, compared to its level in 2020 (58% and 47%, respectively).[14]

[12] In the presence of excessive number of observations with negative values in any *k*th income source, G(Y_k) can become overstated, and in some cases, it can even exceed unity. The appropriateness of using this method to decompose the inequality of an economic indicator into contributing components in the presence of negative observations by some of the components remains valid, as was noted by Pyatt *et al.* (1980), if the average values of these components remain positive for the entire sample, which is the case here for self-employment farm and non-farm income sources (see table 1).

[13] The estimated pseudo-Gini indices of this income component between the two years, as in the case with the other income components and with the other relevant aspects of the Gini decomposition method with an attached asterisks next to the estimates in the table (i.e., columns 1, 3,4, and 5), were statistically different at the 5% level of significance.

[14] The size of the contribution to the overall inequality of income (Y) by income source *k*, as noted in equation (4) is determined by the magnitude of the product of $G(Y_k)$, R_k, and ϕ_k (i.e., "Gini index" of the kth component of *Y*, "Gini

Among all the sources of income, income from off-farm wages and salaries had the largest effect on the inequality in the distribution of income in both 2016 and 2020, with such an effect being significantly larger in 2020 than in 2016 (64% and 59%, respectively). This income component represents sizeable share of total income, and hence it has a significant impact on the measure of inequality. The higher impact of this income source, in 2020 compared to 2016, is also affected, respectively, by its higher level of inequality in its distribution and to its relatively higher correlation with total income.

Table 4. Inequality decomposition by sources of total farm household income: 2016 and 2020

Income Components	Share of Total Income (ϕ_k)	Pseudo-Gini Index (G_k)	Correlation with Total Income (R_k)	Relative Contribution to Inequality (P_k)	Relative Marginal Effect (M_k)[1] [95%CI][2]
		2016			
Self-employment net farm income	0.1576*	0.9013*	0.5786*	0.1804*	0.0228* [0.0047 0.0409]
Off-farm wages and/or salaries	0.6329	0.5298*	0.8067*	0.5938*	-0.0391* [-0.0588 -0.0194]
Self-employment non-farm income	0.0746*	0.9565*	0.7035	0.1102	0.0356 [0.0214 0.0498]
Interest and dividends income	0.0373*	0.8729*	0.6355	0.0454	0.0081 [0.0039 0.0124]
Social Security income	0.0294*	0.8704	0.0981	0.0055	-0.0239 [-0.0273 -0.0205]
All other income	0.0683	0.8662*	0.4985	0.0647	-0.0036 [-0.0134 0.0063]
Total income	1.0000	0.4555	1.0000	1.0000	0.0000
(Std. dev.)[2]		(0.0085)			
		2020			
Self-employment net farm income	0.1151	0.8756	0.4741	0.0999	-0.0153 [-0.0260 -0.0045]
Off-farm wages and/or salaries	0.6458	0.5616	0.8448	0.6400	-0.0057 [-0.0202 0.0088]
Self-employment non-farm income	0.0931	0.9312	0.7590	0.1375	0.0444 [0.0345 0.0543]
Interest and dividends income	0.0469	0.8531	0.6586	0.0551	0.0082 [0.0041 0.0122]
Social Security income	0.0252	0.8661	0.0757	0.0035	-0.0218 [-0.0248 -0.0187]
All other income	0.0739	0.8281	0.5015	0.0641	-0.0098 [-0.0182 -0.0014]
Total income	1.0000	0.4787	1.0000	1.0000	0.0000
(Std. dev.)[2]		(0.0109)			

Source: Author's calculations based on income data from: U.S. Census Bureau, Current Population Survey, 2017 and 2021 Annual Social and Economic Supplements (CPS ASEC).

Note: Household income, as collected by CPS, is the income earned by the household in the calendar year preceding the date of the survey. All dollar values of underlying income estimates are in 2020 inflation-adjusted dollars.

[1] This measure captures the relative marginal effect of a marginal increase in a particular income source (e.g., Off-farm wages and/or salaries) on overall income inequality. A negative (positive) sign thus indicates the effect is to decrease (increase) inequality. Standard deviations and confidence intervals are based on variance estimation method with full sample weights and with 160 replicate sample weights.

* Indicates estimates of corresponding items in 2016 and 2020 are statistically different at the 5% level of significance.

The impact of marginal changes in the components of total income on overall inequality is reported in table 4. Specifically, estimated marginal effects of income sources on the inequality of income were measured as the difference between the relative contribution to overall inequality and the share of total income for each of the six income sources (see eq. 5). In 2016, income from an off-farm wages and/or salaries, in comparison to the other income sources, had the largest equalizing impact on the distribution of total household income, where a 1 percent increase in in this income source would have reduced income inequality the most, by 4 percent. In 2020, the year of the COVID-19's recession, a 1 percent increase in this income source would have reduced the Gini index of income by a significantly lesser amount, by 1 percent.[15] Income from social security had an equalizing impact on income inequality in both 2016 and 2020, where a 1 percent increase in this income source would have decreased income inequality in both years by 2 percent. Income from 'other sources' had an equalizing impact on income inequality in 2020 but not in 2016, where a 1 percent

correlation" between the kth source and the rank of Y , and "share" of the kth component of Y, respectively; as shown in columns 2, 3, and 1, respectively, in the table). A higher value in any or in all these terms in comparison to corresponding values by other income sources, the higher is the contribution by the k^{th} income source to overall inequality.

[15] Since the 95% confidence interval for the marginal effect for off-farm wages and/or salaries in 2020, based on the variance estimation method with full sample weights and 160 replicate sample weights (last column, table 4), did include zero, the null hypothesis that the level of the marginal impact of this income source on the inequality in total income is zero is not rejected at the 5% level of significance ($P \leq 0.05$). In contrast, the estimated equalizing impact of this income source in 2016, based on an estimated confidence interval that did not contain zero, the null hypothesis that the level of the marginal impact of this income source on the inequality in total income is zero is rejected at the 5% level of significance.

increase in each of this income source would have decreased income inequality by 2 percent. In contrast, self-employment non-farm income in both 2016 and 2020 had the largest inequality increasing impact on the distribution of total household income, where a 1 percent increase in this income source would have increased income inequality in both years by 4 percent. Next in importance in terms of the impact on increasing inequality by an income source was the influence of self-employment net farm income, where a 1 percent increase in this income source, considering its high levels of inequality and correlation with total income and its relatively large share to total income [i.e., $G(Y_k)$, R_k, and ϕ_k, respectively], would have increased income inequality in 2016 by 2 percent. The inequality increasing marginal impact of net farm income in 2016 stands in accordance with findings by other studies [e.g., Findeis and Reddy (1987); El-Osta *et al*. (1995); Mishra (2009 and 2010); among other]. In 2020, the year of the COVID-19's recession, the impact of this income source on inequality was nearly identical to that of 2016 but with an opposing direction; namely, a 1 percent increase in this income source would have decreased inequality in the distribution of total income of self-employed farm households by about 2 percent.[16]

6. Discussion and Conclusions

This paper documents the inequality in the distributions of 'money' income among U.S. self-employed farm households for two time periods, 2016 and 2020. In selecting 2016 as a point of reference when farm incomes were low, and in selecting 2020 when farm incomes were high and when ad hoc assistance was significant because of COVID-19's recession, the paper sheds lights on the likely divergent impact of these factors on the well-being of self-employed farm households. A variety of methods were used to reach inferences about the existence of high inequality among farm operator households, including straightforward descriptive measures that categorized households into quartiles of income, from low to high. For example, in 2016 and 2020, self-employed farm households in the top quartile of money income were found to earn 56 percent and 59 percent of money income, respectively. Using the Gini index measure of inequality, findings show that money income was just as unequally distributed in 2020, the year of the COVID-19's recession, as in 2016. The disparity in the distribution of money income in both years is related, although indirectly, to the age and education of the farm operator.[17] Regarding age, farm operators of self-employed farm households who were in the top rather than in the bottom quartile of the distribution were significantly older. Similarly, a higher proportion of operators in self-employed farm households in the top quartile of the income distribution had a college education or beyond.

Self-employed farm households have a variety of income sources, both from earned and unearned income sources. The income sources analyzed in terms of their potential impact on inequality include five specific types of income in addition to one broad income category: farm-related income, income from two off-farm sources, interest and dividends income, social security income, and income from all other remaining sources. Income from off-farm wages and/or salaries, in comparison to the other income sources, had the largest effect on the inequality in the distribution of income in both 2016 and 2020, with such an effect being significantly larger in 2020 than in 2016 (64% and 59%, respectively). Next in importance was self-employment non-farm income, with such an effect on income inequality in 2016 being nearly identical to its effect in 2020 (11% and 14%, respectively). Such a higher impact by these two income sources on the inequality in the distribution of income in 2020 is in accordance with the expectation based on a study by Gardner (1969). Specifically, when the non-farm economy is short on high quality labor, as was the case during the COVID's 19 recession in 2020, highly skilled labor in agriculture will be relatively more attracted to non-farm employment, and consequently, its relative price will rise. This type of economic change, as pointed by Gardner, will cause the income of farm households whose operators have the highest levels of human capital, as was shown to be the case for those households in the top quartile of the income distribution, to increase, thereby causing income inequality to increase as well. Yet another leading income source in terms of its impact on the inequality in the distribution of total income of self-employed farm households was that of net farm income, with such an effect in 2020, being nearly half of its effect level in 2016 (10% compared to 18%).

Of the income components considered, income from off-farm wages and/or salaries had the strongest equalizing marginal impact on the overall distribution of money income (column 5; table 4), in 2016, but not in 2020 --the year of

[16] Appendix B shows that in 2021, the year after when COVID-19's recession had occurred and while it was still considered a pandemic, a 1 percent increase in this income source would have decreased inequality in the distribution of total income of self-employed farm households by about 3%, which stands in contrast to the marginal increase in inequality in 2016 of about 2%.

[17] A study by Mincer (1958) pointed out that income inequality tends to increase, among others, with age and education. Chiswick (1968) noted the positive relationship between average level of schooling and income inequality, with a similar finding, particularly in advanced economies, by Coady and Dizioli (2017).

COVID-19's recession-- where the largest inequality reducing income source was social security income.[18] With income from off-farm wages and/or salaries of self-employed farm households being the main contributor to total money income (about 65% in both 2016 and 2020), macroeconomic factors, whether under an economic expansion or recession, are likely to continue to influence the distribution of income among self-employed farm households.

References

Acemoglu, D., & Robinson, J. A. (2015). The rise and decline of general laws of capitalism. *Journal of Economic Perspective, 29*(1), 3-28. https://doi.org/10.1257/jep.29.1.3

Adarov, A. (2022). *Global income inequality and the COVID-19 pandemic in three harts*. World Bank. Retrieved from https://blogs.worldbank.org/developmenttalk/global-income-inequality-and-covid-19-pandemic-three-charts

Ahearn, M., J. Johnson, & Strickland, R. (1985). The distribution of income and wealth of farm operator households. *American Journal of Agricultural Economics, 67*(5), 1087-1094. https://doi.org/10.2307/1241378

Ahearn, M. C., J. E. Perry, & El-Osta, H. S. (1993). *The economic well-being of farm operator households, 1988-90.* AER-666, U.S. Department of Agriculture, Economic Research Service.

Ahearn, M. C., H. El-Osta, & Dewbre, J. (2006). The Impact of coupled and decoupled government subsidies on off-farm labor participation of U.S. farm operators. *American Journal of Agricultural Economics, 88*(2), 393-408. https://doi.org/10.1111/j.1467-8276.2006.00866.x

Alessie, R., A. Lusardi, & Aldershof, T. (1997). Income and wealth over the life cycle: evidence from panel data. *Review of Income and Wealth, 43*(1), 1-32. https://doi.org/10.1111/j.1475-4991.1997.tb00198.x

Bivens, J. (2017, December 12). *Inequality is slowing US economic growth faster*: *Faster wage growth for low- and middle-wage workers is the solution.* Economic Policy Institute. Retrieved from https://www.epi.org/files/pdf/136654.pdf

Bivens, J., & Banerjee, A. (2022, May 24). *Inequality's drag on aggregate demand*: *The macroeconomic and fiscal effects of rising income shares of the rich.* Economic Policy Institute. Retrieved from https://files.epi.org/uploads/248892.pdf

Boisvert, R. N., & Ranney, C. (1990). Accounting for the importance of nonfarm income on farm family income inequality in New York. *Northeastern Journal of Agricultural and Resource Economics, 19*(1), 1-11. https://doi.org/10.1017/S0899367X00000118

Bricker, J., S. Goodman, K. B. Moore, & Volz, A. H. (2020, September 28). *Wealth and income concentration in the SCF*: *1989-2019, FEDS Notes*. Washington: Board of Governors of the Federal Reserve System. https://doi.org/10.17016/2380-7172.2795

Brueckner, M., & Lederman, D. (2015, July 28). *Effects of income inequality on aggregate output*. Policy Research Working Paper 7317. World Bank Group. https://doi.org/10.1596/1813-9450-7317

Burns, K., D. Wilson, & Fox, L. E. (2021, September 14). *Two rounds of stimulus payments lifted 11.7 million people out of poverty during the pandemic in 2020*. The U.S. Census Bureau. Retrieved from ttps://www.census.gov/library/stories/2021/09/who-was-lifted-out-of-poverty-by-stimulus-payments.html

Chen, C., T., Tsau, & Rhai, T. . (1982). The Gini coefficient and negative income. *Oxford Economic Papers, 34*(3), 473-478. https://doi.org/10.1093/oxfordjournals.oep.a041563

Chetty, R., J. N. Friedman, N. Hendren, M. Stepner, & the Opportunity Insights Team. (2022). *The Economic impacts of COVID-19*: *Evidence from a new public database built from private sector data*. *NBER Working Paper* w27431. https://doi.org/10.3386/w27431

Chiswick, B. R. (1968). The average level of schooling and the intra-regional inequality of income. A clarification. *American Economic Review, 58*(3), 495-500.

Cingano, F. (2014). *Trends in income inequality and its impact on economic growth*. OECD Social, Employment and Migration Working Papers, No. 163, OECD Publishing.

Clemens, A. (2022, January 27). *The U.S. economy is in its fourth decade of rising inequality amid the need for more*

[18] As noted in equation 5, estimated marginal effects of income sources on the inequality of income are measured as the difference between the relative contribution to overall inequality (P_k) and the share of total income (ϕ_k) for each of the six income sources. A given income source will have an equalizing marginal impact on the distribution of income if its share relative to total income exceeds its relative contribution to overall inequality, which is the case here for income from off-farm wages and/or salaries.

accurate data on its consequences. Washington Center for Equitable Growth. Retrieved from ttps://equitablegrowth.org/the-u-s-economy-is-in-its-fourth-decade-of-rising-inequality-amid-the-need-for-more-accurate-data-on-its-consequences/

Coady, D., & Dizioli, A. (2017). *Income inequality and education revisited*: *Persistence, endogeneity, and heterogeneity.* International Monetary Fund-WP/17/126. https://doi.org/10.5089/9781475595741.001

Congressional Research Service. (2021). *U.S. farm income outlook*: *December 2020 Forecast*. CRS Report R46676.

Corak, M. (2013). Income inequality, equality of opportunity, and intergenerational mobility. *Journal of Economic Perspectives, 27*(3), 79-102. https://doi.org/10.1257/jep.27.3.79

El Benni, N., & Finger, R. (2013). The effect of agricultural policy reforms on income inequality in Swiss agriculture - An analysis for valley, hill and mountain regions. *Journal of Policy Modeling, 35*(4), 638-651. https://doi.org/10.1016/j.jpolmod.2012.03.005

El-Osta, H. S., G. A. Bernat, Jr., & Ahearn, M. C. (1995). Regional differences in the contribution of off-farm work to income inequality. *Agricultural and Resource Economics Review, 24*(1), 1-14. https://doi.org/10.1017/S1068280500003567

Faberman, R., A. I., Mueller, & Sahin. A. (2022). *Has the willingness to work fallen during the Covid pandemic*? National Bureau of Economic Research. Working Paper 29784. https://doi.org/10.2139/ssrn.4114632

Falcettoni, E., & Nygaard, V. (2021, February 24). *Acts of Congress and COVID-19: A literature review on the impact of increased unemployment insurance benefits and stimulus checks*. FEDS Notes. Washington: Board of Governors of the Federal Reserve System. https://doi.org/10.17016/2380-7172.2848

Findeis, J., & Reddy, V. (1987). Decomposition of income distribution among farm families. *Northeastern Journal of Agricultural Economics, 16*(2), 165-173. https://doi.org/10.1017/S0899367X00001495

Galor, O., & Zeira, J. (1993). Income distribution and macroeconomics. *Review of Economic Studies, 60*(1), 35-52. https://doi.org/10.2307/2297811

Gardner, B. L. (1969). Determinants of farm family income inequality. *American Journal of Agricultural Economics, 51*(4), 753-769. https://doi.org/10.2307/1237772

Giorgi, G. M. (2011). The Gini inequality index decomposition. An evolutionary study. In J. Deutsch, & J. Silber (Eds.), *The measurement of individual well-being and group inequalities*: *Essays in memory of Z.M. Berrebi* (pp.185-218). Abingdon (GB): Routledge.

Gould, B., & Saupe, W. (1990). Changes in the distribution of income and wealth of farm households: Evidence from Wisconsin panel data. *North Central Journal of Agricultural Economics, 12*(1), 31-46. https://doi.org/10.2307/1349356

Han, J., B. D. Meyer, & Sullivan, J. X. (2020). *Income and poverty in the COVID-19 pandemic*. Brookings Papers on Economic Activity. https://doi.org/10.1353/eca.2020.0007

Hoffmann, F., D. S. Lee, & Lemieux, T. (2020). Growing income inequality in the United States and other advanced economies. *Journal of Economic Perspectives, 34*(4), 52-78. https://doi.org/10.1257/jep.34.4.52

Hoppe, R., J. MacDonald, & Korb, P. (2010). *Small farms in the United States: Persistence under pressure*. EIB-63, U.S. Department of Agriculture, Economic Research Service. https://doi.org/10.2139/ssrn.1557208

Howard, S., R. Rich, & Tracy, J. (2021, February 9). *Pandemic pushed the U.S. into recession … and hourly wages rose?* Federal Reserve Bank of Dallas. https://www.dallasfed.org/research/economics/2021/0209.aspx

International Labour Organization. (2021, January 25). ILO monitor: *COVID-19 and the world of work. Seventh edition- Updated Estimates and Analysis*. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_767028.pdf

King, W. I. (1915). *The wealth and income of the people of the United States*, pp. 231-232. Macmillan, NY.

Kochhar, R., & Sechopoulos, S. (2022, April 20). *COVID-19 pandemic pinches finances of America's lower- and middle-income families*. Pew Research Center. Retrieved from https://www.pewresearch.org/social-trends/2022/04/20/covid-19-pandemic-pinches-finances-of-americas-lower-and-middle-income-families/

Lerman, R., & Yitzhaki, S. (1985). Income inequality effects by income source: A new approach and applications to the United States. *The Review of Economics and Statistics, 67*(1), 151-56. https://doi.org/10.2307/1928447

Lerman, R., & Yitzhaki, S. (1989). Improving the accuracy of estimates of Gini coefficients. *Journal of Econometrics,*

42(1), 43-47. https://doi.org/10.1016/0304-4076(89)90074-2

Laborde, D., Martin, W., & Vos, R. (2021). Impacts of COVID-19 on global poverty, food security, and diets: Insights from global model scenario analysis. *Agricultural Economics,* 52(3), 375-390. https://doi.org/10.1111/agec.12624

Mankiw, N. G. (2013). Defending the one percent. *Journal of Economic Perspectives, 27*(3), 21-34. https://doi.org/10.1257/jep.27.3.21

Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy, 66*(4), 281-302. https://doi.org/10.1086/258055

Mishra, A. K., H. S. El-Osta, M. Morehart, J. Johnson, & Hopkins, J. (2002). *Income, wealth, and well-being of farm operator households*, AER-812, U.S. Department of Agriculture, Economic Research Service.

Mishra, A. K., & Sandretto, C. L. (2002). Stability of farm income and the role of nonfarm income in U.S. agriculture. *Review of Agricultural Economics, 24*(1), 208-221. https://doi.org/10.1111/1058-7195.00014

Mishra, A. K., H. S. El-Osta, & Gillespie, J. (2009). Effect of agricultural policy on regional income inequality among farm households. *Journal of Policy Modeling, 31*(3), 325-340. https://doi.org/10.1016/j.jpolmod.2008.12.007

Mishra, A. K., H. El-Osta, & Shaik, S. (2010). Agricultural policy reform and Its impact on farm households income inequality. *Journal of Income Distribution, 19*(1), 75-95. https://doi.org/10.25071/1874-6322.16182

Neckerman, K. M., & Torche, F. (2007). Inequality: causes and consequences. *Annual Review of Sociology, 33,* 335-357. https://doi.org/10.1146/annurev.soc.33.040406.131755

Osberg, L. (2017). On the limitations of some current usages of the Gini index. *Review of Income and Wealth, 63*(3), 574-584. https://doi.org/10.1111/roiw.12256

Piketty, T., & Saez, E. (2003). Income inequality in the United States, 1913-1998. *Quarterly Journal of Economics,* 118(1), 1-39. https://doi.org/10.1162/00335530360535135

Piketty, T. (2014) *Capital in the twenty-first century*. Harvard University Press, Cambridge. https://doi.org/10.4159/9780674369542

Polacko, M. (2021). Causes and consequences of income inequality-An overview. *Statistics, Politics and Policy*, *12*(2), 341-357. https://doi.org/10.1515/spp-2021-0017

Pyatt, G., C. Chen, & Fei, J. (1980). The distribution of income by factor components. *Quarterly Journal of Economics, 95*(3), 451-473. https://doi.org/10.2307/1885088

Rouse, C. C., & Gimbel, M. (2021). *The pandemic effect on measured wage growth*. The White House. Retrieved from https://www.whitehouse.gov/cea/written-materials/2021/04/19/the-pandemics-effect-on-measured-wage-growth/

Schnepf, R. (2017, October 4). *U.S. farm income outlook for 2017*. CRS Report R46676. Retrieved from https://sgp.fas.org/crs/misc/R40152.pdf

Sherman, A., D. Trisi, & Lukens, G. (2022, September 8). *What to know about next week's poverty, income, and health insurance figures for 2021*. Center on Budget and Policy Priorities. Retrieved from https://www.cbpp.org/research/poverty-and-inequality/what-to-know-about-next-weeks-poverty-income-and-health-insurance

Stiglitz, J. (2012). *The price of inequality: How today's divided society endangers our future*. New York: W. W. Norton and Company.

Stiglitz, J. (2015). *Rewriting the rules of the American economy*: *An agenda for growth and shared prosperity*. New York: W. W. Norton and Company.

Stuart, A. (1954). Correlation between variate-values and ranks in samples from a continuous distribution. *British Journal of Statistical Psychology, 7*(1), 37-44. https://doi.org/10.1111/j.2044-8317.1954.tb00138.x

Swinnen, J., & Vos, R. (2021). COVID-19 and impacts on global food systems and household welfare: Introduction to a special issue. *Agricultural Economics, 52*(3), 365-374. https://doi.org/10.1111/agec.12623

U.S. Bureau of Labor Statistics. 2021. *Labor force statistics from the current population survey-concepts and definitions*. Retrieved from https://www.bls.gov/cps/definitions.htm

U.S. Census Bureau. (2019, October). *Design and methodology*: *current population survey-America's source for labor force data.* Technical Paper 77. Retrieved from https://www2.census.gov/programs-surveys/cps/methodology/CPS-Tech-Paper-77.pdf

U.S. Census Bureau. (2021). *Table of contents*: *Current population survey-2021-- Annual social and economic (ASEC)*

supplement. Retrieved from https://www2.census.gov/programs-surveys/cps/techdocs/cpsmar21.pdf

VanOrman, A. (2021, October 27). *How can we measure U.S. social and economic trends during the pandemic?* Population Reference Bureau (PRB). Retrieved from https://www.prb.org/articles/how-can-we-measure-u-s-social-and-economic-trends-during-the-pandemic/

Wodon, Q., & Yitzhaki, S. (2002). *Evaluating the impact of government programs on social welfare*: *The role of targeting and the allocation rules among program beneficiaries*. *Public Finance Review, 30*(2), 102-123. https://doi.org/10.1177/109114210203000202

Wolff, E. N. (1994). *Household wealth trends in the United States, 1912-2013: What happened over the great recession*? National Bureau of Economic Research, Working Paper No. 20733.

Zimmerman, T. S., & Robison, E. (2018). *Current population survey state variances and design effects*. Bureau of Labor Statistics, Washington, DC. Retrieved from https://www.bls.gov/osmr/research-papers/2018/pdf/st180070.pdf

Appendix A

Inequality measures: income of self-employed farm households: 2016 and 2021*

Item	2016	2021	Relative change (%)
		($2020)	
Mean income	137,217	142,880	4.13
Median income	99,282	105,651	6.42
Income inequality measures:			
Income quartile shares[1]:			
Bottom quartile (S25)	5.8	6.5	12.07
Top quartile (S75)	56.3	55.7	-1.07
Central tendency and income quartile share ratios:			
Mean-to-median	1.38	1.35	-2.17
Income quartile share (S75/S25)[2]	9.7	8.6	-11.34
Summary measure of the entire income distribution:			
Gini index	0.456	0.444	-2.63

Note: All dollar values are in 2020 inflation-adjusted dollars.

Source: Author's calculations based on income data from: U.S. Census Bureau, Current Population Survey, 2017 and 2022 Annual Social and Economic Supplements (CPS ASEC). Household income, as collected by CPS, is the income earned by the household in the calendar year preceding the date of the survey.

[1] Income quartiles are the three income levels that divide the income distribution into four equal intervals.

[2] This is the ratio of total income received by the top 25% of the self-employed farm households with the highest income (top quartile) relative to that received by the corresponding 25% households with the lowest income (bottom quartile).

* None of the estimates of the corresponding row items in 2016 and 2021 are found to be statistically different at the 5% level of significance.

Appendix B

Inequality decomposition by sources of total farm household income: 2016 and 2021

Income Components	Share of Total Income (ϕ_k)	Pseudo-Gini Index (G_k)	Correlation with Total Income (R_k)	Relative Contribution to Inequality (P_k)	Relative Marginal Effect (M_k)[1] [95%CI][2]
		2016			
Self-employment net farm income	0.1576*	0.9013*	0.5786*	0.1804*	0.0228* [0.0047 0.0409]
Off-farm wages and/or salaries	0.6329	0.5298	0.8067	0.5938	-0.0391 [-0.0588 -0.0194]
Self-employment non-farm income	0.0746	0.9565	0.7035	0.1102	0.0356 [0.0214 0.0498]
Interest and dividends income	0.0373*	0.8729	0.6355*	0.0454*	0.0081* [0.0039 0.0124]
Social Security income	0.0294	0.8704	0.0981*	0.0055*	-0.0239* [-0.0273 -0.0205]
All other income	0.0683	0.8662	0.4985	0.0647	-0.0036 [-0.0134 0.0063]
Total income (Std. dev.)[2]	1.0000	0.4555 (0.0085)	1.0000	1.0000	0.0000
		2021			
Self-employment net farm income	0.1188	0.8702	0.3961	0.0922	-0.0266 [-0.0386 -0.0145]
Off-farm wages and/or salaries	0.6584	0.5179	0.8298	0.6372	-0.0212 [-0.0410 -0.0014]
Self-employment non-farm income	0.0742	0.9391	0.6553	0.1028	0.0287 [0.0182 0.0391]
Interest and dividends income	0.0550	0.8842	0.7510	0.0823	0.0273 [0.0201 0.0345]
Social Security income	0.0271	0.8768	0.2098	0.0112	-0.0159 [-0.0192 -0.0126]
All other income	0.0665	0.8768	0.5652	0.0742	0.0077 [0.0016 0.0139]
Total income (Std. dev.)[2]	1.0000	0.4440 (0.0095)	1.0000	1.0000	0.0000

Source: Author's calculations based on income data from: U.S. Census Bureau, Current Population Survey, 2017 and 2022 Annual Social and Economic Supplements (CPS ASEC).

Note: Household income, as collected by CPS, is the income earned by the household in the calendar year preceding the date of the survey. All dollar values of underlying income estimates are in 2020 inflation-adjusted dollars.

[1] This measure captures the relative marginal effect of a marginal increase in a particular income source (e.g., Off-farm wages and/or salaries) on overall income inequality. A negative (positive) sign thus indicates the effect is to decrease (increase) inequality. Standard deviations and confidence intervals are based on variance estimation method with full sample weights and with 160 replicate sample weights.

* Indicates estimates of corresponding items in 2016 and 2021 are statistically different at the 5% level of significance.