

## Submitted Article

# Distributional Impacts of the Tax Cuts and Jobs Act Using Farm Household Microdata

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**Abstract** *This paper uses ten years of USDA's Agricultural Resource Management Survey data to evaluate the impact of the Tax Cuts and Jobs Act (TCJA). We simulate income tax returns at the household level using the survey's detailed financial and demographic information. We find that farm households in the top 10% of the income distribution realize 71% of the total tax cuts from the TCJA, while families in the bottom 20% of the distribution experience a slight increase in their income tax liabilities. Consequently, the TCJA reduces the progressivity of the tax code, particularly over years with lower farm household income.*

**Key words:** Tax reform, Taxation, Tax rate, Farm household well-being, Progressive taxation.

**JEL codes:** H25, Q1, Q14.

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In late December of 2017, the first major rewrite of US tax code in several decades, the Tax Cuts and Jobs Act (TCJA), became law. The TCJA modified the US tax code in several aspects beyond simple changes to marginal tax rates and tax brackets. Since farm households, as well as farm businesses, exhibit a high degree of heterogeneity, the tax code changes have the potential to affect these households differently. This article uses household-level data to estimate the impact that the TCJA would have had on the farm sector had it been in effect in 2007–16, with a focus on the asymmetric impacts across income groups of farm households.

We estimate that the TCJA decreases aggregate tax liabilities for farm households by \$80 billion (in 2016 dollars) over ten years; however, farm households in the lowest quintile of the income distribution experience a small increase in tax liabilities. Tax savings are concentrated at the top of the income distribution, with over 70% of savings accruing to farm households in the top 10% of the

income distribution. Unsurprisingly, we find that the TCJA results in a less progressive tax code, as measured by the Stroup index, than the previous law. The progressivity gap between the two tax regimes decreases on years with higher farm household income and increases in years with lower incomes.

To obtain our results, we simulate individual income tax returns using farm household level data. The tax calculations account for critical items of the individual income tax, such as the alternative minimum tax, capital gains taxation, itemized deductions, earned income credit, child credits, various business deductions and other features of the income tax code. The computation is performed at the household level since almost all farm businesses are structured as pass-through entities (“pass-throughs”) rather than C corporations.<sup>1</sup> Pass-throughs distribute the untaxed net profits to their owners where it is taxed at the individual level along with the household’s other income. We only estimate the direct impacts of the tax reform as our calculations assume that agents would not have changed their decisions as a response to the tax code changes.<sup>2</sup> Saez et al. (2012) provides a review of the importance of indirect effects for tax policy analysis, but the measurement and modeling of these effects are beyond the scope of this article.

The data come from the USDA’s annual Agricultural Resource Management Surveys (ARMS) and provides a detailed picture of farm households’ demographic and financial characteristics, which determine the applicability and impact of particular tax code provisions. For example, households with equal levels of income and identical demographic characteristics can end with different tax bills because different types of income (such as wages, pass-through business, retirement) are taxed under separate provisions of the tax code. The sources of income is one of many examples that illustrates the need for detailed household-level data to produce a better assessment of the impacts arising from the tax changes enshrined in the TCJA.

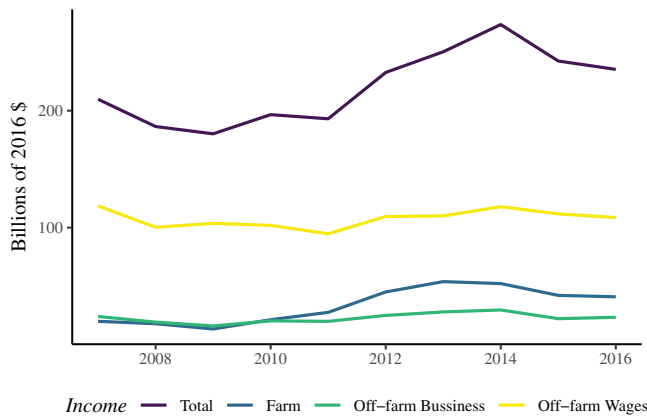
Estimating the tax impacts over multiple years allows us to see if the effects from the TCJA are consistent across years; hence, we use the ARMS for years 2007 to 2016 to simulate the impacts of tax policy over a decade of actual economic activity, inclusive of external and internal shocks. To our benefit, the sample period includes a plethora of shocks (e.g., the Great Recession and posterior recovery, US droughts, low and high fuel prices, etc.) that affect farm households’ income through impacts on their farm and off-farm income. Figure 1 shows the first half of the sample period (2007–11) is characterized by lower total farm household income relative to that of the latter half (2012–16). Wages from farm and off-farm sources are the predominant income source for farm households and account for over half of the income in any year. Farm business income accounts for around 10% of income during the first half of the time period and about 20% of income over the latter half of the sample period.

Our paper contributes to the literature on distributional analysis of the TCJA. Studies on the TCJA have focused on its impact to economic growth (see, e.g., Mertens 2018) with only few reports assessing the effects of the changes across different household groups. In work closely related to our analysis, a Tax Policy Center (TPC) report used microsimulations to estimate the impact of the income tax code changes across different income groups for

<sup>1</sup>C corporations, often just referred to as corporations, are those entities that are broadly guided by the provisions of chapter 1, subchapter C of the Internal Revenue Code. C corporations, unlike pass-through entities, are taxed separately from their owners and subject to corporate income taxes.

<sup>2</sup>For example, changes to tax credits for biofuels production may affect farm households through its effect on commodity prices.

**Figure 1** Aggregate farm household income and sources. Data from ARMS surveys of 2007 to 2016, excluding C-corporation farms. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



the year 2018. Our results are consistent with the TPC report findings except they estimate a 0.3% decline in aggregate tax liability for the bottom income quintile, while we estimate a small increase in every year. However, differences are to be expected as the TPC report provides estimates for the full US population of taxpayers, while our data is representative of farm households only. Literature concerning previous tax reforms, in particular involving tax cuts, have also found differential impacts across different income groups. Auten and Carroll (1999) showed that the Tax Reform Act of 1986, a tax reform with multiple income tax rate cuts, is a driver of the increased income inequality that followed.

The remainder of the paper is organized as follows. The next section provides a brief background of Federal income taxation and the changes brought by the TCJA. Section 2 describes the data employed in the analysis. Section 3 presents the results of the tax simulations and the estimated effective tax rates, and section 4 supplements these results with tax progressivity index calculations. Section 5 presents our conclusions.

## Taxation of Farm Household Income: The Federal Income Tax

The legal organization of farms determines how its income is taxed. Farms organized as sole proprietorships, partnerships, or Subchapter S corporations are pass-through entities, meaning any profit or loss from them is passed to the owner/partner/shareholder, and tax is paid on their individual income tax returns. Farms may choose to organize as Subchapter C corporations, in which case the farm itself is liable for corporate income taxes and any dividends paid to shareholders may be subject to individual income taxes as well.<sup>3</sup>

Farms are overwhelmingly constituted as pass-throughs; therefore, we limit our discussion to changes in the Federal individual income tax code, including its business tax provisions. Data from ARMS show that pass-through entities are the predominant form of legal organization for US family farms.<sup>4</sup> In 2016,

<sup>3</sup>In addition to the previously mentioned business forms, farms may choose to form a hybrid-type business structure known as a limited liability company (LLC). LLCs are registered by individual States and regulated by State statutes.

<sup>4</sup>A family farm is any farm that is owned in its majority by the operator and individuals related to the operator. In 2016, 99% of farms in the United States were family farms and accounted for 90% of farm production (Hoppe 2017).

**Table 1** Main Modifications of the Tax Cuts and Jobs Act to the Individual Income Tax Code

	Previous Law (2017)	Tax Cuts and Jobs Act
Ordinary income	Seven brackets: 10, 15, 25, 28, 33, 35, and 39.6%	Seven brackets: 10, 12, 22, 24, 32, 35, and 37%
Long-term capital gains and dividends	0, 15, 20% depending on the taxpayer's ordinary income tax bracket. High-income taxpayers are assessed a 3.8% Net Investment Income Tax.	Unmodified
Personal exemptions	\$4,050 per individual; phases out for individuals with an adjusted gross income of at least \$261,500 (\$313,800 for married individuals)	Eliminates
Standard deduction	\$6,350 for single filers \$12,700 for married individuals	\$12,000 for single filers \$24,000 for married individuals
Itemized deductions	Limited by adjusted gross income.	Eliminates several miscellaneous itemized deductions and modifies others. Repeals phaseout of deduction for high-income individuals.
Credits	Mix of refundable and nonrefundable credits	Maintains previous law Earned Income Tax Credit and expands Child Tax Credit to \$2,000 per child, \$600 nonrefundable. Raises phaseout to \$200,000 (single)/ \$400,000 (married).
Alternative minimum tax	Applies to individuals with taxable incomes above \$187,800 (\$93,900 for married individuals filing separately)	Maintains same rates but applies to taxable incomes above \$1 million (\$500,000 for married individuals filing separately)
Domestic Production Activities Deduction (section 199)	The deduction is applied to the percentage of income from qualifying DPA activities and is the lesser of 9% of that income or 50% of the	Eliminates

(Continues)

**Table 1** Continued

	Previous Law (2017)	Tax Cuts and Jobs Act
Business interest expense	wages paid for the activities (must pay W-2 wages). Interest paid on indebtedness for business purposes is generally deductible; however, there are limitations that apply to investment interest	Limits deduction to no more than business interest income plus 30% of adjusted taxable income for the taxpayer (no carryforward). Limit does not apply to producers with less than \$25 million of gross receipts. Farms are not subject to the \$25 million limit as long as they use the alternative depreciation system to depreciate property in the farming business with a recovery period of 10 years or more.
Deduction for qualified business income of pass-through entities (section 199A)	N/A	Allows individuals to deduct up to 20% of “domestic qualified business income” (QBI) earned through a pass-through business. The deduction may also be limited by wages paid to farm labor that is directly hired (excluding contract labor).
Expensing provisions	Section 179 maximum amount \$5100,000; investment limit of \$2,030,000 before deduction phases out.	Increases the maximum amount to \$1,000,000; investment limit is \$2,500,000 before deduction phases out. 100% bonus depreciation.

98% of family farms organized as pass-throughs and accounted for 91% of the agricultural output of family farms. The remainder of this section provides a brief discussion of the major individual income tax provisions that were modified, eliminated, or introduced by the TCJA and that we include in our model. For readers interested in an expanded discussion with accompanying analysis, we refer them to Williamson and Bawa (2018) and, for those wishing to skip the discussion altogether, table 1 provides a brief side-by-side comparison of changes from the TCJA included in our model.

## Business Deductions

The TCJA modified two sections of the tax code that, when used in conjunction, allow most businesses to fully deduct the cost of depreciable capital investments in the year of purchase. Section 179 allows businesses to deduct depreciable capital costs, up to a limit amount, in the year of purchase rather than spreading the costs over the asset's useful life. In 2017, the limit was \$510,000, and the TCJA raised it to \$2 million. Section 168(k) allows businesses with investments above the section 179 limit to take an additional first-year depreciation deduction, known as "bonus depreciation," on a set percentage of the investment amount above the section 179 expensing limit. The previous law allowed for 50% bonus depreciation and the TCJA expanded the rate to 100% for 2018 through 2022; after that, the rate is reduced by 20 percentage points annually.<sup>5</sup> Since businesses are now allowed to take 100% of the difference between their investments and the section 179 limit, the TCJA effectively allows for a full deduction during the year of the investment.

Allowing for the full expensing of investments is not likely to have a substantial effect on the farm sector as most farms were not bound by the previous section 179 (k) limit amount. Since 2009, less than 0.75% of farms had investments exceeding the expensing limit of section 179(k).<sup>6</sup> Therefore, the full expensing of capital investments brought by the TCJA will impact a minimal number of farms. Previous studies have found a positive effect of tax incentives on farm investments (e.g., Hanson and Bertelsen 1987; Halvorsen 1991; LeBlanc et al. 1992; Bierlen and Featherstone 1998; Williamson and Stutzman 2016), but there is no consensus regarding the magnitude of the effect. For example, Cummins et al. (1996) and Chirinko et al. (1999) use the same data set but arrive at a different conclusion, with the former finding a strong effect of tax incentives on investment and the latter a much smaller, almost insignificant, effect. (Williamson and Stutzman 2016) find that the effect of bonus depreciation increases is only significant for farms that had investments close to or above the section 179(k) limit.

The TCJA eliminated the Domestic Activities Production deduction (section 199), a provision that benefited an estimated 7% of farms. The deduction was limited to the lesser of 9% of adjusted gross income from domestic production activities or 50% of wages paid to produce such income. While the wages-paid provision limited the applicability of the deduction for many smaller farms that hire little or no labor, larger farms do have significant labor expenses. The average deduction for eligible farm households – those with labor expenses and income from qualified production activity – was \$5,669.

In place of the repealed section 199, the TCJA creates a new deduction for pass-through business income (section 199A) that is generally equal to 20% of "qualified business income" (QBI). Effectively, section 199A reduces the marginal tax rate on pass-through business income since a portion of this income is not subject to taxes.<sup>7</sup> In 2016, farm households had a total of \$68.2

<sup>5</sup>The TCJA expanded the definition of capital assets that qualify for bonus depreciation to include used assets.

<sup>6</sup>See figure 4 in Williamson and Bawa (2018).

<sup>7</sup>Originally, the TCJA included an additional deduction for "qualified cooperative dividends" received, which included patronage dividends, per-unit retain allocations, or written notice of allocations, and was generally equal to 20% of the gross value of business between the farm and the cooperative (section 1388 of the Internal Revenue Code defines qualified cooperative dividends). Under the TCJA, these cooperative dividends were excluded from qualified business income. Subsequent to the TCJA, the Consolidated Appropriations Act of 2018 (Public Law 115-141), which became law in March 2018 and applied retroactively to January 1, 2018, modified the newly created section 199A by eliminating the extra deduction for qualified cooperative dividends.

billion in income from farms organized as pass-throughs, inclusive of cooperative dividends.

## **Individual Income Tax Brackets**

The TCJA retains the same number of income tax brackets while reducing most marginal tax rates. Under the TCJA, marginal tax rates range from 10% to 37% compared to the previous range of 10% to 39.6%. The TCJA decreased the 15%, 25%, 28%, and 33% brackets to 12%, 22%, 24%, and 32%, respectively.<sup>8</sup> The previous 35% bracket remains, but the bracket's taxable-income range expands by decreasing the lower income bound and increasing the upper income bound. Finally, the TCJA reduced the top bracket rate to 37%, from a previous 39.2%, and increased the income threshold.

## **Deductions and Credits for Households**

The TCJA doubled the standard deduction amount but eliminated the personal exemption; therefore, the net effect on taxpayers is relatively small and even negative for some. Single individuals can claim a \$12,000 standard deduction, up from \$6,350 in the previous law, while married filers can claim \$24,000, up from \$12,700. Previous law also included the personal exemption, which allowed the tax filer an exemption of \$4,050 per filer and dependents. Given the elimination of the personal exemption, the net tax savings of doubling the standard deduction are around \$4,000 for taxpayers without dependents and, an overall negative effect for households with two or more dependents.<sup>9</sup>

The TCJA eliminates most itemized deduction items but retains and modifies some important ones.<sup>10</sup> The mortgage interest deduction now applies to mortgage indebtedness up to \$750,000, down from the \$1 million limit under the previous law. After 2025, the limit returns to \$1 million. State, local, and property taxes (SALT) were fully deductible under the previous law, but the TCJA caps them at a combined maximum of \$10,000.<sup>11</sup> Medical expenses above 7.5% of adjusted gross income (AGI) can be itemized under the TCJA through the end of 2018, after which the limit is scheduled to return to 10%. For the charitable donations deduction, the percentage limit for cash donations by an individual taxpayer increases from 50% to 60% of the taxpayer's contribution base.<sup>12</sup>

The TCJA repeals the phaseout of itemized deduction amounts for high-income taxpayers. Previously, married taxpayers with AGI greater than \$311,300 (\$259,400 for single taxpayers) would have their itemized deduction

<sup>8</sup>The new brackets are temporary and apply for taxable years beginning after December 31, 2017, and before January 1, 2026.

<sup>9</sup>For example, a married household with two children could deduct under the previous law  $4 \times \$4,050 + \$12,000 = \$26,200$  which is greater than the \$24,000 that they would be allowed under the TCJA.

<sup>10</sup>Examples of some of the itemized deductions items eliminated by the TCJA: unreimbursed employee expenses, tax preparation fees, theft and personal casualty losses, and other miscellaneous deductions. For farmers, the casualty loss deduction could be large in cases where natural disasters or disease outbreaks strike and losses exceed the insured amount.

<sup>11</sup>The limit on SALT deductions is temporary and applies for taxable years beginning after December 31, 2017, and before January 1, 2026.

<sup>12</sup>The contribution base is the taxpayer's AGI calculated without regard to any net operating loss (NOL) carryback to the taxable year.

reduced by an amount that increases with the difference between AGI and the phaseout income threshold.

The TCJA increased the Child Tax Credit to \$2,000 with a refundable portion capped at \$1,400. The credit phaseout thresholds were also increased to AGI above \$400,000 (\$200,000) for married (individual) taxpayers. To qualify for a child tax credit refund, the taxpayer must have earned at least \$2,500 in income. The Child Tax Credit under previous law was \$1,000 per qualifying child, and the phaseout began for married (single) taxpayers with AGI above \$110,000 (\$75,000). The credit was refundable for taxpayers in the 10% tax bracket with at least \$3,000 in earned income.

## Long-Term Capital Gains

The TCJA retains the preferential tax treatment of long-term capital gains over other sources of income, including short-term capital gains. For many taxpayers, the long-term capital gains tax rate is 15% but taxpayers in the 10% or 12% ordinary income tax bracket face a 0% tax rate on their long-term capital gains. Taxpayers in the top tax bracket (37%) face a 20% tax rate on their long-term capital gains. The TCJA retains the Net Investment Income Tax, which is a surtax of 3.8% on capital gains for high income taxpayers.<sup>13</sup>

Reduced capital gains rates are especially significant for farmers because farmers realize a greater share of their income from capital gains than the average taxpayer. In 2016, USDA survey data suggest about 36% of all family farms reported some capital gains or losses, while IRS data indicate the average individual taxpayer is far less likely to report a capital gain or loss (13.6%). Farmers may have capital gains (or losses) from sales or exchanges of depreciable business property and capital assets not subject to depreciation.<sup>14</sup> Some or all of the proceeds from the sale or exchange of depreciable business property may be treated as a capital gain and taxed at the lower long-term capital gains rate (or in the case of a loss, treated as an ordinary loss).

## Alternative Minimum Tax

The alternative minimum tax (AMT) may apply to some taxpayers with high incomes and significant deduction amounts. Under the AMT rules, individuals may have to recalculate their taxes in such a way that many of the tax benefits that help to offset tax liability are forgone. In some cases, these tax benefits are added back into the taxpayer's AGI, thus increasing it and creating a new measure of taxable income known as alternative minimum taxable income.

The TCJA retains the previous law AMT tax rates but steeply increases the exemption amounts and the phaseout thresholds. The AMT exemption is raised from \$84,500 to \$109,400, for married households, and from \$54,300 to \$70,300, for single households. The exemption phaseout threshold AGI is

<sup>13</sup>The Net Investment Income Tax (NIIT) was instituted in January 2013 and affects high-income individuals that have net investment income (interest, dividends, capital gains, rental income, and other gains from financial instruments) and whose modified adjusted gross income exceeds \$250,000 (married filing jointly), \$200,000 (single filer). The threshold values are not indexed to inflation.

<sup>14</sup>Gains and losses from sales or exchanges of depreciable business property are covered under Internal Revenue Code section 1231.



set to \$1 million (\$500,000) for married (single) households, a steep increase from the previous law threshold of \$187,800 (\$93,900).

## **Data**

We use farm-household level data from the ARMS surveys for years 2007 to 2016. The surveys are a representative sample of the farm population in the United States and provide information about the farm businesses operation, as well as financial and demographic data of the respondent household. We convert all nominal values to 2016 dollars using the annual Consumer Price Index. Observations with missing data for total household income or farm business income were dropped. For observations missing data on dividends received, capital gains, and household expenses; we input a zero.<sup>15</sup>

We drop the observations of farm households operating farms constituted as Internal Revenue Code Subchapter C corporations due to a lack of information to accurately calculate their income tax liabilities. Specifically, we cannot identify the type of income received from the corporation, be it wages, dividends, profit sharing, or other forms of compensation. The number of observations dropped is minimal, as subchapter C-corps make up make a little over 1% of the weighted sample for any given year.

Table 2 reports averages for total farm household income and its main components. In each year but 2016, the dataset covers over 2 million farms (weighted frequency) through approximately 20,000 yearly observations. Average household income for farmers is well above that of the general population with wages making up the greatest portion of income. Farm households receive business income from off-farm and farm sources. Business income is evenly split between these sources during the first half of the sample period (2007–11), but farm business income overtakes off-farm business during the latter half of the time period (2012–16). Capital gains are, on average, a minimal source of income.

## **Tax Simulations**

We simulate the federal income tax returns for each farm household in the dataset. The detailed information contained in ARMS allows us to calculate nearly all of the items found in the individual income tax return (IRS Form 1040), including associated forms, worksheets and, schedules that are required to determine the dollar amounts for certain items on Form 1040. These associated forms include Schedule F which is used to determine the farm business profit or loss, net of all credits, deductions, and special business provisions; farm profit or loss is passed onto the farm household to be taxed with the rest of their income. We also compute important tax provisions such as the alternative minimum tax, long-term capital gains, itemized deductions, child tax credits, earned income credit, and other tax provisions.

We compute taxes under two tax regimes: previous law and the TCJA. The previous law tax regime uses the regulations, rates and thresholds that were in effect for the calendar year 2016.<sup>16</sup> The TCJA uses the rules, rates, and

<sup>15</sup>As a robustness check, we perform the analysis using only observations with no missing data; the results are not qualitatively different.

<sup>16</sup>As a reminder, all nominal variables in the data set were converted into 2016 dollars using the annual CPI as a deflator.

**Table 2** Average Farm Household Income and Income Levels at Selected Quantiles.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Farms (000s) <sup>2a</sup>	2,086	2,103	2,105	2,120	2,090	2,011	2,023	2,025	2,007	1,996
Total income	100,555	88,644	85,585	92,730	92,356	115,669	123,722	135,144	120,787	117,881
Wages	56,849	47,664	49,221	48,049	45,295	54,427	54,346	58,199	55,656	54,405
Off farm buss.	11,487	9,107	7,539	9,535	9,478	12,369	13,769	14,589	11,006	11,658
Farm income <sup>3b</sup>	11,183	10,439	7,300	12,536	14,988	25,116	30,470	30,499	24,352	24,277
Farm buss.	9,516	8,447	6,299	10,016	13,145	22,338	26,585	25,734	20,932	20,449
Capital gains										
Off farm	11,158	399	624	522	1,015	1,314	856	1,361	1,090	1,307
Farm	11,606	948	1,045	653	780	1,707	1,512	1,902	1,420	1,055
Income percentiles <sup>4c</sup>										
Percentile										
20th	25,647	22,751	23,819	24,963	25,821	30,896	35,362	36,719	35,483	34,140
40th	51,827	46,290	47,384	49,262	50,158	58,329	62,997	68,683	63,755	62,083
60th	78,618	72,505	73,528	75,748	75,691	89,074	93,158	102,936	94,109	94,241
80th	123,906	119,215	122,275	122,838	122,064	140,334	144,117	161,504	147,557	146,254
90th	187,007	175,405	176,582	183,824	181,189	206,127	216,232	244,721	216,503	218,118
99th	997,893	795,997	702,396	738,553	724,414	1,031,481	1,122,078	1,025,838	886,932	935,707

Data: ARMS of 2007 to 2016 without farms organized as C-corporations. Values in 2016 \$ except for the number of farms.

<sup>a</sup>Weighted counts.

<sup>b</sup>Includes farm business income plus other sources of compensation from farm activities such as rental income from farm land.

<sup>c</sup>Based on the weighted frequency of farm households' total income.

**Figure 2** Estimated federal income tax liabilities and alternative income tax liabilities under the previous law and the TCJA. Estimates based on tax simulations using data from the ARMS surveys of 2007–16, excluding C-corporation farms. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



thresholds as passed in the law, but we include the amendment, passed in the Consolidated Appropriations Act of 2018, that fixed the “grain glitch.”

The tax filing simulations required us to make a couple of assumptions described in this paragraph. We assume married households file taxes under the “married filing jointly” status. While joint filing is tax advantageous for most married taxpayers, there are certain special situations in which filing separately might minimize tax liability. One of the more valuable items eligible for the itemized deductions is the interest paid on mortgages up to \$1 million under previous law, or \$750,000 under the TCJA. ARMS provides the mortgage interest paid by the household on that year but does not identify the mortgage amount or the number of years under repayment; therefore, we take the minimum of the reported paid interest and the maximum yearly interest paid on a \$1 million (\$750,000) mortgage at a 4.59% interest rate, which is the average thirty-year mortgage rate between January 2007 to December 2016. The implicit assumptions are that

all mortgages are in their first year of repayment and that all mortgages had the same interest rate.

## Aggregate Tax Liabilities

We estimate that the TCJA would decrease aggregate federal income tax liabilities from farm households by \$80 billion over a decade. The decrease in tax revenues is driven by a reduction in personal income taxes, as self-employment taxes decrease but only by an estimated \$16 million over the ten-year period. In figure 2, we can appreciate that the decrease in tax liabilities occurs in every year. The gap between previous law and TCJA tax liabilities widens during the second half of the sample, which is the period of higher aggregate and average farm household income. The average yearly difference between tax liabilities is \$6.44 billion, over the lower income period (2007–11), and \$8.96 million over the higher income period (2012–16).

We estimate that the TCJA changes to the Alternative Minimum Tax (AMT) account for 6.9% of the decrease in aggregate federal income taxes. Panel B of figure 2 shows the estimated AMT liabilities under both tax regimes. The average yearly decrease in AMT liabilities is \$547 million with a maximum in 2014, the year of peak farm income, of \$726 million. The time series also shows that AMT liabilities, under both tax regimes, are positively correlated with aggregate and average farm household income.

The decrease in AMT liability comes from the extensive margin, though average AMT liability decreases slightly. Table 3 reports the estimated number of farm households with and without an AMT liability as well as their average income, wages, and AMT liability. Even under previous law, the percentage of farm households with an AMT liability was fairly small and had an average AMT liability below \$10,400. For 2014, the year of peak farm income, we estimate that the previous law AMT affected 6% of farm households for an average AMT liability of \$9,425. Under TCJA, the number of farm households with an AMT liability is a half or less than under previous law, and the average AMT liability decreases by \$1,000. The steep decline in the number of farm households with AMT liability is a result of substantial increases to the AMT exemption amount and the income threshold that triggers the phaseout of the exemption.

The AMT has historically fallen on high-income households, and the TCJA shifts AMT liability further up the income ladder. Under the previous law, average household income for the group with AMT liabilities is well above the 90th percentile income threshold reported in table 2.<sup>17</sup> Under the TCJA, average household income for the group owing AMT was, for many years, over \$100,000 higher than the comparable group under previous law.

## Allocation of Tax Breaks

We showed that, in aggregate, the TCJA results in lower tax liabilities for farm households; naturally, the question that follows is: How are these tax savings allocated across income groups? To answer this question, we group households based on their location in the income distribution and then estimate the aggregate tax savings for each group. Table 4 reports the group's aggregate tax savings as a percentage of aggregate tax savings for all farm households.

<sup>17</sup>All references to the distribution of income refer to the pre-tax distribution unless otherwise noted.

**Table 3** Average Income, Wages and Estimated Alternative Minimum Tax Liability.

Year	Owe AMT	N <sup>6a</sup>	AMT	Total Income <sup>7b</sup>	Current Law		AMT	Total Income <sup>7b</sup>	N <sup>6a</sup>	AMT	Total Income <sup>7b</sup>	TCJA Wages
					Wages	N <sup>6a</sup>						
2007	No	1,989,133		88,573	53,998			93,756	2,038,002	8,466	93,756	55,023
2007	Yes	97,119	9,654	370,834	115,249			437,777	48,250	8,466	437,777	133,993
2008	No	2,019,307		77,553	45,309			82,634	2,064,597		82,634	46,131
2008	Yes	84,002	8,646	365,247	104,283			430,839	38,712	6,904	430,839	129,430
2009	No	2,018,638		74,200	46,646			78,102	2,061,361		78,102	47,465
2009	Yes	86,992	10,315	364,886	108,980			463,713	44,269	10,221	463,713	131,006
2010	No	2,024,407		80,711	44,868			85,562	2,075,718		85,562	46,453
2010	Yes	95,856	9,021	358,106	115,214			451,595	44,545	7,030	451,595	122,406
2011	No	1,987,265		78,884	42,411			84,518	2,042,273		84,518	43,590
2011	Yes	103,290	8,903	372,099	100,776			467,860	48,281	8,720	467,860	117,410
2012	No	1,898,523		100,074	51,693			105,130	1,951,360		105,130	52,937
2012	Yes	113,172	9,445	400,637	100,293			500,337	60,334	8,212	500,337	102,631
2013	No	1,903,954		109,066	51,703			114,144	1,963,506		114,144	53,108
2013	Yes	119,692	8,732	371,329	96,377			465,214	60,140	7,418	465,214	94,751
2014	No	1,884,953		118,339	53,253			124,328	1,952,172		124,328	55,269
2014	Yes	140,123	9,425	380,884	124,740			462,580	72,904	8,149	462,580	136,673
2015	No	1,895,512		107,560	52,374			112,704	1,952,733		112,704	53,716
2015	Yes	112,134	9,272	363,905	111,124			448,096	54,913	8,347	448,096	124,643
2016	No	1,886,651		103,761	51,140			109,815	1,946,187		109,815	52,722
2016	Yes	109,769	8,619	384,341	110,535			482,315	50,233	8,747	482,315	119,642

Notes: Based on authors' tax simulations using ARMS data from 2007 to 2016 without C-corporations. All values, except for number of households (N), are weighted averages in 2016 \$.

<sup>a</sup>Weighted count.

<sup>b</sup>Includes capital gains or losses.

**Table 4** Allocation of the Estimated TCJA Aggregate Tax Saving across Different Income Groups

	0–20 <sup>a</sup>	20–40	40–60	60–80	80–90	90–99	Income Percentile Top 1%
2007	-2.00	0.82	5.16	10.08	12.12	44.43	29.39
2008	-2.02	0.73	4.55	9.98	11.00	45.55	30.21
2009	-2.31	1.04	4.73	10.38	12.40	47.01	26.74
2010	-1.73	1.26	5.28	11.31	12.78	46.90	24.41
2011	-1.26	1.27	4.83	10.11	11.20	45.69	28.16
2012	-0.40	1.90	4.73	9.45	10.07	42.46	31.80
2013	-0.46	2.02	5.13	9.77	10.05	42.62	30.87
2014	-0.47	1.67	4.42	9.50	10.42	41.14	33.33
2015	-0.45	2.47	5.28	9.89	10.84	38.03	33.95
2016	-0.82	1.86	5.28	11.00	11.57	41.15	29.96

Note: Reported numbers are percent of the aggregate tax savings amount that accrue to a particular income group. Results based on authors' tax simulations.

<sup>a</sup>Negative numbers represent an estimated increase in tax liability under the Tax Cuts and Jobs Act.

Farm households in the top 10% of the income distribution capture about three out of every four dollars of the total reduction in tax liability from the TCJA, a stark contrast to the increase in tax liabilities for households in the bottom 20% of the distribution. Table 4 reports negative values for households in the bottom quintile which means that, under the TCJA, their estimated federal income tax liabilities increase. The yearly tax increases for this income group represent between 0.4% and 2.31% of the aggregate tax savings. In contrast, the households in the 90th to 99th percentile of the distribution received over 40% of the aggregate tax savings in all years but 2015. The concentration of tax savings is even more pronounced for the top 1% of income earners, those who receive close to 30% of the estimated total tax savings from TCJA.

### Average Effective Tax Rates

Effective tax rates, rather than the marginal rates, are a better measure of the of the actual tax burden borne by the taxpayer. We follow the literature at large and use the following definition for average effective tax rates:

$$\text{Average Effective Tax Rate} = \frac{\sum_{i=1}^N T_i \times \omega_i}{\sum_{i=1}^N M_i \times \omega_i} \tag{1}$$

where  $N$  is the number of subjects in the group,  $T_i$  is tax liability (positive or negative),  $M_i$  is total household income (inclusive of capital gains or losses), and  $\omega_i$  is the sample weight of observation  $i$ .<sup>18</sup>

Computation of the effective tax rate using equation 1 allows us to circumvent interpretation issues for observations with non-positive income.

<sup>18</sup>Devereux et al. (2002) provides an analysis of different methods to measure effective average tax rates and effective marginal tax rates.

**Table 5** Average Effective Tax Rates (%) for All Farm Households and by Income Group

Year	Previous Law	TCJA	Change	Year	Previous Law	TCJA	Change
2007	15.48	12.23	3.25	2007	21.14	16.27	4.87
2008	14.31	11.05	3.26	2008	20.13	15.16	4.97
2009	14.66	11.40	3.26	2009	19.70	14.64	5.06
2010	14.10	10.79	3.31	2010	20.57	15.32	5.25
2011	14.14	10.67	3.47	2011	20.20	14.89	5.31
2012	16.94	12.98	3.96	2012	22.41	16.74	5.67
2013	16.90	12.91	3.99	2013	22.41	16.63	5.78
2014	17.98	14.11	3.87	2014	23.04	17.30	5.74
2015	16.75	13.19	3.56	2015	21.52	16.44	5.08
2016	16.22	12.75	3.48	2016	21.35	16.10	5.25
			Income group: All households				Income group: 90–99 percentile
2007	2.31	1.35	0.96	2007	32.10	26.70	5.40
2008	1.69	0.86	0.83	2008	30.70	24.64	6.06
2009	1.88	1.03	0.85	2009	31.38	26.04	5.34
2010	1.86	0.83	1.03	2010	30.52	25.16	5.36
2011	2.06	1.07	0.99	2011	30.23	24.06	6.17
2012	3.66	2.36	1.30	2012	31.50	25.15	6.35
2013	4.27	2.87	1.40	2013	32.18	25.55	6.63
2014	4.83	3.65	1.18	2014	32.93	26.75	6.18
2015	4.68	3.38	1.30	2015	32.92	26.88	6.04
2016	4.40	3.23	1.17	2016	32.17	26.39	5.78
			Income group: 0 to 90 percentile				Income group: Top 1 percent

Note: Average effective income tax rate equals the ratio of the group's estimated aggregate federal income tax liability (net of credits) over aggregate household income.

Consider the example of a farm household whose farm business losses are greater than all of its other income and, after filling its taxes, receives a tax refund thanks to some tax credits. The effective tax rate for this farm household is positive since it is the ratio of two negative numbers: income and tax liability. The positive effective tax rate would be interpreted as a tax burden, which is incorrect. Thus, if we were to take the average of individual effective tax rates, it could result in an overestimate of the actual aggregate effective tax rate, especially for households at the bottom of the income distribution.

Table 5 presents the estimated average effective tax rates (AETR) under both tax regimes. The AETRs under previous law varied between 14.10% and 17.98%. The TCJA lowers these rates by 3.25 to 3.99 percentage points, with the biggest reductions in years of higher farm income (2012–16). In concordance with the progressive nature of the income tax code, the AETRs under both tax regimes exhibit a positive relationship with aggregate farm household income.<sup>19</sup>

Examining AETRs by income group shows declines for farm households in the top 10% of the income distribution that are 1.5 times greater than the decline for the overall sample. Average effective tax rates decrease by more than 5 percentage points for households in the upper decile of the income distribution. The percentage point decline in AETRs for the top 1% and the 90th through 99th percentile group is similar; however, the AETR under the previous law for the top 1% is about 10 percentage points higher. The remaining farm households, those below the 90th percentile of the income distribution, experience about a percentage point decline in their AETRs.

### **Characteristics of Farm Households by Their Tax Change**

Table 6 provides the means of several income and expense variables by households who received a tax break and those who did not. Farm households that benefited from the TCJA had a much higher total income average, including wages. In all years, the average total income for the households benefiting from the TCJA was over \$100,000 in excess of the comparable figure for households whose tax liabilities did not decrease from TCJA. Wages for the benefited group were above \$60,000 for all years, while that of the unbenefited group never surpassed \$27,135.

Average business income differs significantly between households that received a tax break and those who did not, which suggests that the new pass-through business income deduction is a crucial determinant of whether households received a tax break from TCJA. Farm households whose liabilities did not change or went up had, on average, a farm loss. Over the ten-year period, the loss ranged from about \$16,000 to almost \$26,000. On the other hand, farms whose tax liability declined reported positive farm income on the range of \$22,905 to \$47,164. These farm households also had more income from off-farm businesses than the other household group—close to seven times as much. The differences in business income underscore the ability of some farms to use the new Section 199A provision in the tax code, which allows for a deduction worth up to 20% of “qualified business income” (QBI); however, QBI must be positive to take advantage of the provision.

The value of average expenses that qualify for an itemized deduction show significant differences between the households groups. Medical expenses

<sup>19</sup>A progressive tax code means that effective tax rates increase with income.



**Table 6** Weighted Average of Selected Income and Expense Variables for Farm Households Whose Simulated Tax Liabilities Did Not Decrease under the TCJA versus Those Who Did.

Year	Income					Real Estate Tax
	Total	Wages	Farming Business	Off-Farm Business	Medical Expense	
Panel A. Tax liabilities did not decrease under TCJA						
2007	31,124	22,758	-16,382	2,133	1,297	2,322
2008	28,383	19,938	-18,583	1,945	837	2,872
2009	22,259	20,323	-18,498	-1,394	797	2,564
2010	30,196	18,307	-15,989	1,959	1,254	2,887
2011	28,044	19,436	-20,324	2,801	1,453	3,928
2012	29,112	26,021	-25,896	2,726	1,786	12,704
2013	35,563	25,624	-21,036	2,932	2,017	9,872
2014	40,405	27,135	-20,822	2,951	4,307	11,517
2015	38,874	25,168	-19,373	2,046	1,670	8,087
2016	38,534	23,749	-17,272	2,170	1,895	8,178
Panel B. Tax liabilities decreased under TCJA						
2007	141,391	76,012	24,073	16,744	127	1,771
2008	130,333	66,537	26,847	13,982	124	1,573
2009	129,034	68,574	22,905	13,521	153	1,772
2010	130,848	65,782	25,521	14,053	182	1,889
2011	134,388	61,531	34,159	13,670	254	1,815
2012	158,237	67,764	44,982	16,897	953	3,135
2013	163,046	66,758	47,164	18,452	1,360	2,885
2014	183,783	73,482	48,638	20,315	334	3,584
2015	161,360	70,158	40,103	15,268	326	3,404
2016	157,686	69,038	38,453	16,186	226	3,106

Note: Values reported in 2016 \$.

Figure 3 Stroup index (Stroup 2005) and Gini coefficient

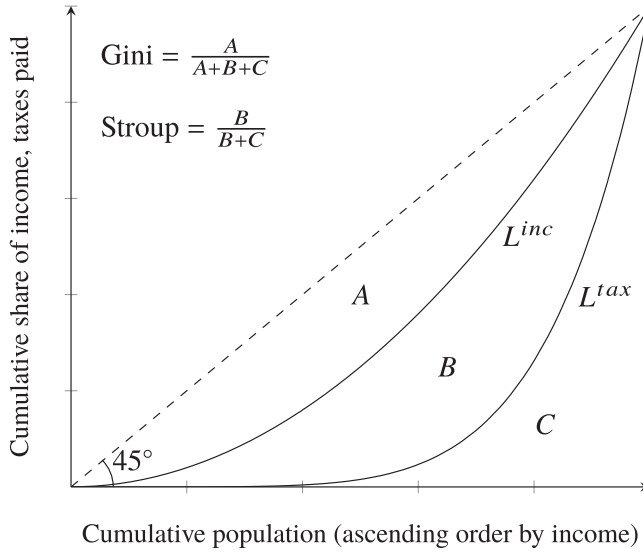
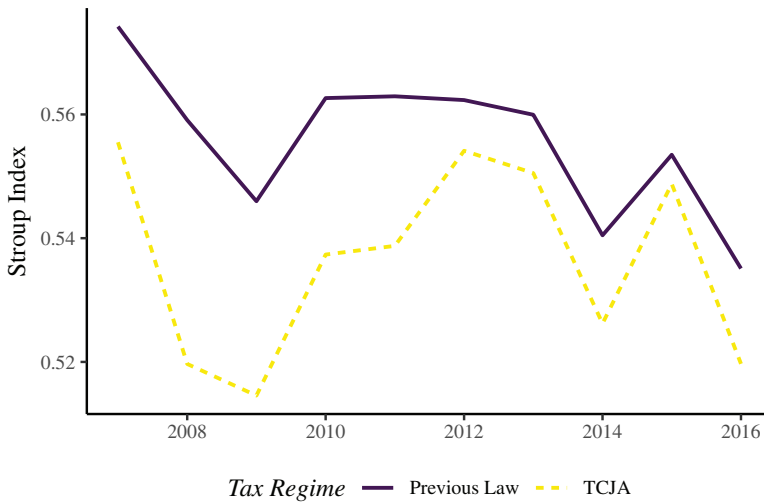


Figure 4 Stroup index for the simulated farm households' federal income tax liabilities, net of credits. Index calculations include observations with for household with negative income and/or negative tax liability [Color figure can be viewed at wileyonlinelibrary.com]



could be deducted under the itemized deduction if such expenses were at least 7.5% of AGI, under previous law, and 10% of AGI, under the TCJA. Consequently, medical expenses for the group that did not receive a tax break under TJCA are between two and ten times as large as households that did receive a tax break. State and local taxes (including real estate taxes) were, under previous law, fully deductible but the TCJA capped these deductions to a combined maximum of \$10,000. Those whose tax liability did not decline reported, on average, higher real estate taxes, and in two years of the study their reported taxes surpassed the \$10,000 cap set by the TCJA.

## Progressivity

We showed that higher income households receive most of the tax savings from the TCJA; however, this does not necessarily imply that the tax code under the TCJA is less progressive than the previous law. As an example, imagine a simple tax reform that decreased all marginal tax rates by 10%; assuming nothing else changed—including the distribution of pre-tax income—taxpayers with higher income would receive a bigger portion of the aggregate tax savings, but the progressivity of the tax code will be unchanged, because the distribution of tax liability does not change.

To examine the progressivity of the tax code, both under previous law and the TCJA, we use the tax progressivity index developed in Stroup (2005), henceforth Stroup index, because it accounts for the underlying pre-tax income distribution—a critical feature since farm households exhibit a high degree of income inequality.<sup>20</sup> From figure 3, the Stroup index is the area between  $L^{inc}$ , the Lorenz curve for pre-tax income, and  $L^{tax}$ , the Lorenz curve for taxes paid, divided by the area under  $L^{inc}$ . The area between the curves represents the difference between the percent of total pre-tax income held by  $x\%$  of the population, sorted by income, and the percentage of the total taxes paid by them. By using  $L^{inc}$  as the baseline rather than the 45° line, the index accounts for the underlying pre-tax income distribution. In a flat rate tax system, with no other intricacies, the Stroup index is zero because  $L^{inc} = L^{tax}$ . An index value of 1 indicates a tax system in which the richest person pays all of the taxes. Around 5% of observations report a negative pre-tax income, so we compute the index using the formula developed in Berrebi and Silber (1985), which is itself a generalization of Chen et al. (1982), to compute the Gini coefficient for data that includes negative income observations.

Based on the Stroup index, the TCJA results in a less progressive income tax system relative to previous law. As illustrated by figure 4, the index values for the TCJA are below those for the previous law in every year in the study.<sup>21</sup> The previous law index starts the time series at its highest value highest value (around 0.58) and finishes at its lowest value. While this points to a downward trend, the line is pretty stable in between. On the other hand, the index values for the TCJA also start the series at its highest value but exhibit a much greater variance due to more pronounced dips in the index value. The difference between indexes becomes more pronounced during the period of lower farm income (2007–11) and then narrows considerably during the latter half of the sample period which is characterized by higher farm household income.

## Conclusion

This paper showed that the Tax Cuts and Jobs Act reduces aggregate income tax liabilities for farm households considerably, but households in the bottom quintile of the income distribution see an increase in their tax liabilities. We estimated that the TCJA decreases tax liabilities, relative to the 2016 tax code, by \$80 billion over a ten- year period with an average yearly

<sup>20</sup>The Gini coefficient for pre-tax income in our sample ranged from 0.56 to 0.59. For comparison, the Gini coefficient for the US population over the same years ranges from 40.4 to 41.5 per the World Bank.

<sup>21</sup>Index values for total taxes, individual plus self-employment taxes, were also constructed. The dynamics of both time series are similar but with lower index values when using income taxes plus self-employment taxes (SE). Lower index values are a consequence of the regressive nature of the self-employment taxes, due to the limit placed on the amount of wages/salaries that are subject to SE taxes.

decrease of over \$6 billion. The lion's share of the tax savings goes to households in the top 10% of the income distribution, as they captured over three-quarters of the aggregate amount. In contrast, households in the lowest quintile of the income distribution experience, as a group, an increase in their tax liabilities amounting to 0.4% to 2.3% of the aggregate tax savings.

In general, farm households benefiting from the TCJA had higher total incomes, coupled with higher than average farm and off-farm business income, while at the same time they had lower expenses that could be claimed as an itemized deduction. Average total income for the households benefiting from the TCJA was over \$100,000 in excess of the comparable figure for households whose tax liabilities did not decrease from TCJA. Farm households benefiting from the TCJA report an average farm business income on the range of \$22,905 to \$47,164, while the other group reports losses in every year. The stark difference in business income is not surprising as only farms with positive income can take advantage of the new section 199A deduction, worth up to 20% of "qualified business income."

The TCJA is, across all years, a less progressive tax code than the previous law. The progressivity of the tax codes is measured using the Stroup index, which accounts for underlying pre-tax income inequality in the sample therefore, any difference in progressivity is due to the tax code and not shifting pre-tax income inequality. The TCJA is a less progressive system in every year and the progressivity difference widens during the first half of the sample period (2007–11), characterized by lower aggregate and average farm household income.

Our analysis was limited to the direct impacts of the individual income tax changes but the TCJA also significantly reduced the corporate income tax rate. In 2017, only 2.2% of farms were organized as C-corporations but their share of agricultural production, in value, ascends to 12.6% (Burns and MacDonald 2018). Thus, the TCJA corporate income tax cut will have an impact on a small number of farms that produce over a tenth of the agricultural output in the United States. Based on previous research, the effects of the corporate tax cut could be complementary to our results: concentration of tax savings at the top of the income distribution while negative or no discernible impact for most households. In particular, Nallareddy et al. (2018) show that state corporate tax cuts lead to higher income inequality as only households at the top of the income distribution saw an increase in their income. We also do not account for the possibility that farmers might respond to the tax code changes by switching the legal organization of their business from pass-through entities to C corporations, or vice versa. The corporate tax cut provides an incentive to switch the business into a C-corporation; however, the TCJA also created a new deduction for pass-through income (section 199A), which provides an incentive to remain or switch the business into a pass-through entity.

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## References

- Auten, G., and R. Carroll. 1999. The Effect of Income Taxes on Household Income. *The Review of Economics and Statistics* 81: 681–93.
- Berrebi, Z.M., and J. Silber. 1985. The Gini Coefficient and Negative Income: A Comment. *Oxford Economic Papers* 37: 525–6.
- Bierlen, R., and A.M. Featherstone. 1998. Fundamental q, Cash Flow, and Investment: Evidence from Farm Panel Data. *The Review of Economics and Statistics* 80: 427–35.
- Burns, C., and J.M. MacDonald. 2018. America's Diverse Family Farms: 2018 Edition. EIB-203, USDA - Economic Research Service.
- Chen, C.-N., T.-W. Tsaur, and T.-S. Rhai. 1982. The Gini Coefficient and Negative Income. *Oxford Economic Papers* 34: 473–8.
- Chirinko, R.S., S.M. Fazzari, and A.P. Meyer. 1999. How Responsive Is Business Capital Formation to Its User Cost?: An Exploration with Micro Data. *Journal of Public Economics* 74: 53–80.
- Cummins, J.G., K.A. Hassett, and R.G. Hubbard. 1996. Tax Reforms and Investment: A Cross-Country Comparison. *Journal of Public Economics* 62: 237–73.
- Devereux, M.P., R. Griffith, and A. Klemm. 2002. Corporate Income Tax Reforms and International Tax Competition. *Economic Policy* 17: 449–95.
- Halvorsen, R. 1991. The Effects of Tax Policy on Investment in Agriculture. *Review of Economics and Statistics* 73: 393–400.
- Hanson, G.D., and D.R. Bertelsen. 1987. Tax Reform Impacts on Agricultural Production and Investment Decisions. *American Journal of Agricultural Economics* 69: 1013–20.
- Hoppe, R.A. 2017. America's Diverse Family Farms. EIB-185, USDA - Economic Research Service.
- LeBlanc, M., R.D.J. Hrubovcak, and R. Conway. 1992. Farm Machinery Investment and the Tax Reform Act of 1986. *Journal of Agricultural and Resource Economics* 17, 66–79.
- Mertens, K. 2018. The Near Term Growth Impact of the Tax Cuts and Jobs Act. Research department working papers, Federal Reserve Bank of Dallas.
- Nallareddy, S., E. Rouen, and J.C. Suárez Serrato. 2018. Do Corporate Tax Cuts Increase Income Inequality? Working Paper 24598, National Bureau of Economic Research.
- Saez, E., J. Slemrod, and S.H. Giertz. 2012. The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review. *Journal of Economic Literature* 50: 3–50.
- Sammartino, F., P. Stakkwirth, and D. Weiner. 2018. *The Effect of the TCJA Individual Income Tax Provisions across Income Groups and across the States*, Washington DC: Tax Policy Center.
- Stroup, M.D. 2005. An Index for Measuring Tax Progressivity. *Economics Letters* 86: 205–13.
- Williamson, J.M., and S.G. Bawa. 2018. Estimated Effects of the Tax Cuts and Jobs Act on Farms and Farm Households. ERR-252, USDA - Economic Research Service.
- Williamson, J.M., and S. Stutzman. 2016. Tax Policy and Farm Capital Investment: Section 179 Expensing and Bonus Depreciation. *Agricultural Finance Review* 76: 246–69.