

Appendix 3: Updated Economic Data
for
Maricopa County, Arizona
Building Community Networks Through Community Foods

Compiled for
Maricopa County Food Policy Coalition
Food Assessment Coordination Team (FACT)

by Ken Meter, Crossroads Resource Center

Bureau of Economic Analysis Updates Regional Income Data

Note: unless otherwise noted, data cited are from BEA

March 30, 2019

This Appendix 3 to the report, “Building Community Networks Through Community Foods” (www.crcworks.org/azmaricopa18.pdf), was compiled several months after the original report was completed. This new analysis examines updated data released by the Bureau of Economic Analysis on March 6, 2019. While none of this alters the original report’s essential focus on building community networks, nor the core economic conclusions drawn, these new data do temper the analysis, and also suggest that the precision and reliability of the BEA data as reported for Maricopa County may be limited. While our analysis of the long-term economic trends has not been altered, the differences in estimated Cash Receipts issued by BEA run as high as \$100 million (10%) for Maricopa County. Although BEA did not supply us with estimates of the precision of their data, this could mean that BEA data for the County are subject to error of 10% or even more.

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Background on Bureau of Economic Analysis data

Every year, the Bureau of Economic Analysis, a unit of the U.S. Department of Commerce, issues data sets covering a host of economic conditions, reported for each county, state, metro area, and region of the U.S. These have proven invaluable in offering an overview of local economic conditions, especially with regard to personal income earned by residents, including farm income. Access is user-friendly and BEA estimates align well with residents' own experiences. Each data set is prepared using data from a variety of federal and other sources that is then adjusted with computer models to estimate local economic conditions.

BEA updates its computer models every five years, allowing them to produce revised data sets each time. The most recent updates were posted on March 6, 2019. These new estimates differ somewhat from the data that were available to us when the original report was published on June 23, 2018. Our conclusions drew upon the earlier data sets, the best available at the time, and we stand by our analysis. However, the new findings lead to slightly different conclusions.

This Appendix 3 will discuss the differences that appear in the two data sets as reported for Maricopa County. When we speak of the "2016 data set," we refer to the data available to us in 2018, which covered the years 1969-2016. When we discuss the "2017 data set" we will be referring to the data made available on March 6, 2019, covering the years 1969-2017. BEA has its own language, calling these "vintage 2016" and "vintage 2017." Most changes to historical data involved the years 2008 and later.

For those who wish to have a brief summary of our findings based on the new data, here is language that will update the analysis offered starting with paragraph 4 on page 9 of that report.

Updated economic summary for Maricopa County and Arizona

The Net Cash Income for all Maricopa County farmers combined — the amount farmers earned after production costs were subtracted from Cash Receipts for the products they sell — fell from \$225 million in 1969 (in 2016 dollars) to \$133 million in 2016, according to Bureau of Economics data released after our report was written (See Appendices 2 and 3). This is a considerable adjustment from the earlier BEA report of \$6 million of Net Cash Income, using the best data available to us at the time we wrote.

During the years 1969-2017, the Net Cash Income for Maricopa County farmers rose above 1969 levels in only 19 of those 49 years, even though the number of farms increased (Table 1) and farmers more than doubled productivity (USDA Economic Research Service Agricultural Productivity Series). Despite several prosperous years, Net Cash Income averaged \$145 million per year, less than farmers earned in 1969. If one looks only at the years since 1989, following the national farm debt crisis, average Net Cash Income was even lower, only \$83 million per year.

Given the variability of BEA data for Cash Receipts (\$100 million) and Production Expenses (\$30 million) for 2016 (a total of \$130 million), it could be argued that most of the relationships noted above are not statistically different; that is, Net Cash Income of farming has remained near zero for all years since 1969, or as high as \$270 million per year. Yet to do so would eradicate all of the BEA analysis of different economic cycles that have clearly affected Maricopa County farms,

and trends are often more important than specific counts.

Overall sales of crops and livestock by Maricopa County farms are still recorded as peaking at \$2.3 billion in 1973-74. This is still more than double their current value. While our original data set tracked rising Production Expenses, the new data sets show declines from a peak of \$1.1 billion in 2011. This appears to be led by declining feed costs, as shown on Chart 12, and likely reflects declining numbers of cattle raised in Maricopa County.

Moreover, while it is still true that the steadiest source of net income for farmland owners is to rent out their land, the new figures for Net Cash Income show more promise than they did in the 2016 data set. Yet in Maricopa County, as our interviews found, considerable farmland has been lost to development. Several farmers work under short-term lease arrangements because land costs are higher than a farm can pay back. Developers who own this farmland are happy to lease land at low rates to collect agricultural tax advantages on land they hope to develop in the future.

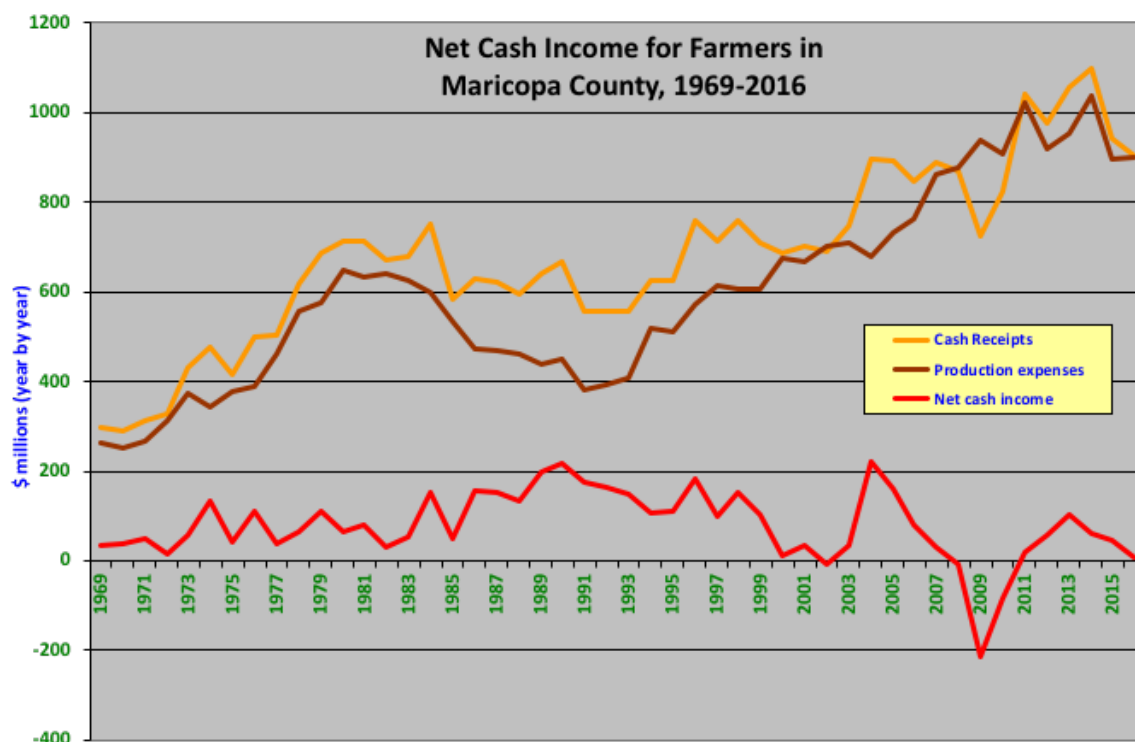
The new data set further shows that SNAP benefits continued to decline in 2017, to \$678 million, as Chart 14 shows. Yet this figure still is 2.5 times the Net Cash Income for farming of \$277 million, shown on Chart 2 below.

The analysis behind this summary

Our analysis begins by examining Chart 5 of the original Appendix 2 (page 75) with the same data provided in the 2017 data set. As before, the orange lines show Cash Receipts for all farms in the County, as reported by BEA. The maroon line shows Production Expenses, and the red line shows Net Cash Income of farming (Cash Receipts less Production Expenses). We use this as a measure of the financial returns for selling crops and livestock by County farmers, to address the question, to what extent does selling crops and livestock pay for the costs of producing them?

Chart 1: Net Cash Income for Farmers in Maricopa County, 1969 – 2016

(Chart 5 from page 75 of original report)



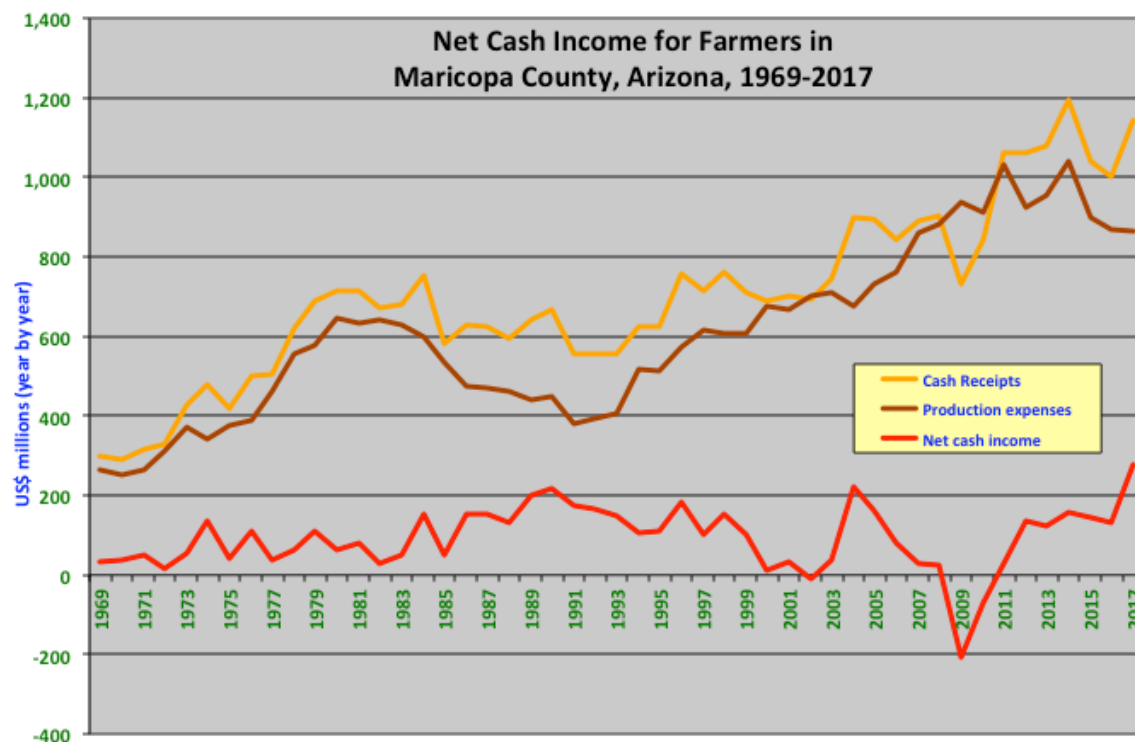
Source: Bureau of Economic Analysis Regional Income data, using 2016 data set, viewed on April 25, 2018. This was presented as Chart 5 on page 75 of the original report.

This compilation of data showed an overall decline of Net Cash Income of farming from 1990 on, although returns peaked in 2004 to levels near those of 1990. County farmers experienced negative returns in 2009 and 2010, positive returns from 2011 to 2013, then a decline to \$6 million of Net Cash Income in 2016, or 0.6% of sales.

However, as Chart 2 below shows, the updated BEA data set shows a higher Net Cash Income for the years 2012 – 2016, followed by a significant increase for 2017. Although Net Cash Income was reported as \$133 million in 2016, according to the updated data set, this still fell below levels reported for 1990 and 2004.

The Net Cash Income reported for 2017, of \$277 million, was the highest recorded during the years shown on these charts.

Chart 2: Net Cash Income for Farmers in Maricopa County, 1969 – 2017

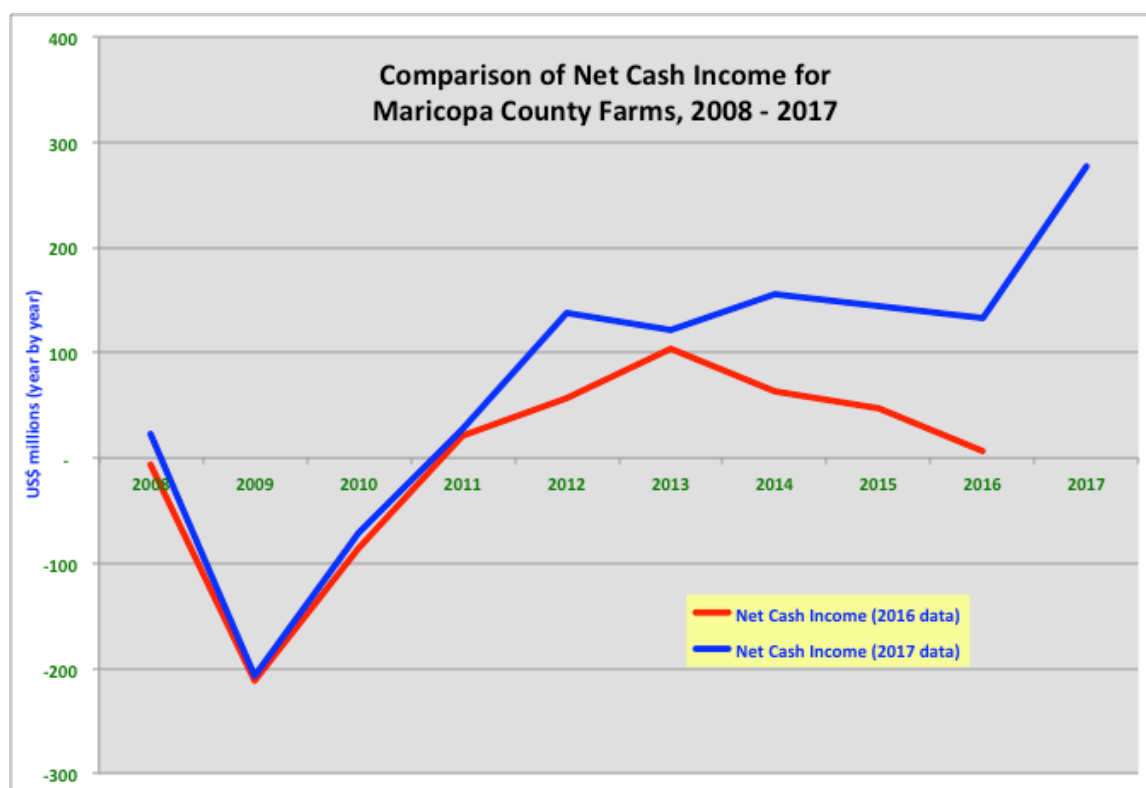


Source: Bureau of Economic Analysis Regional Income data using the 2017 data set released March 6, 2019.

To examine more closely the specific changes between the two data sets, we present Charts 3-5, showing how the two results compare. These narrow in on the years 2008 to 2017, because the two data sets are essentially identical for the years 1969-2007.

Chart 3 shows the differences in estimates of the Net Cash Income between the two data sets. For clarity, the newer data set (2017) is shown in blue, although both were originally shown in red on Charts 1 and 2. As can readily be seen, results are very similar until 2012. At that point the newer data set presents considerably higher Net Cash Income for Maricopa County farmers.

Chart 3: Comparison of Net Cash Income for Maricopa County Farms, 2008 – 2017

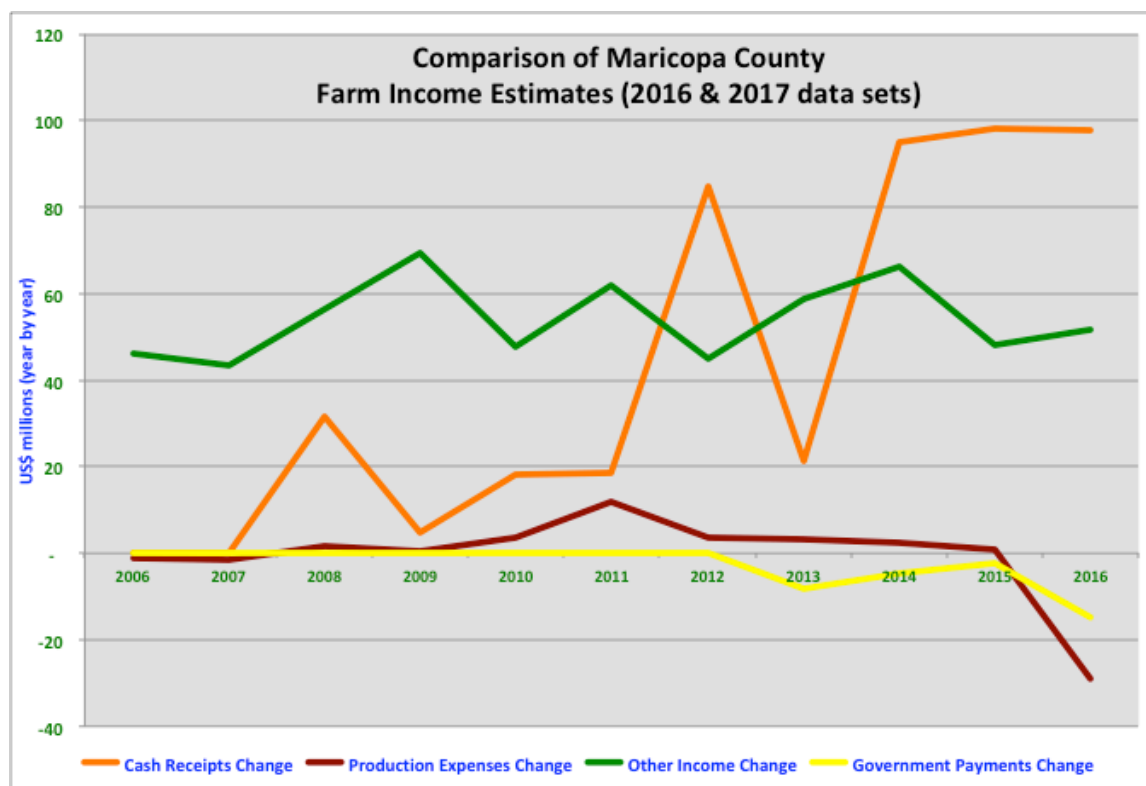


Source: Bureau of Economic Analysis Regional Income data using both the 2016 and the 2017 data sets.

Behind these differences are revised estimates of Cash Receipts and Production Expenses, the two components used in calculating Net Cash Income. These are shown on Chart 4, along with Government Payments, and Imputed and Other Farm Income. Cash Receipts, the orange line, shows the largest change, increasing \$31 million in 2008, vacillating up and down, and ending at \$98 million above the earlier estimates. Production Expenses (maroon line) mostly reflect the original data set, but rise \$12 million in 2011, and decline considerably, by \$29 million, in 2016.

While not central to this specific comparison, two other indicators are also included in this Chart. Government Payments (yellow line) are nearly the same in the two data sets, but also decline somewhat in the new data set. Estimates of Imputed and Other Income (green line) run \$40 million to \$60 million higher than in the earlier data set. These estimates will prove important later in this Appendix when looking at Chart 13, showing the three types of net income.

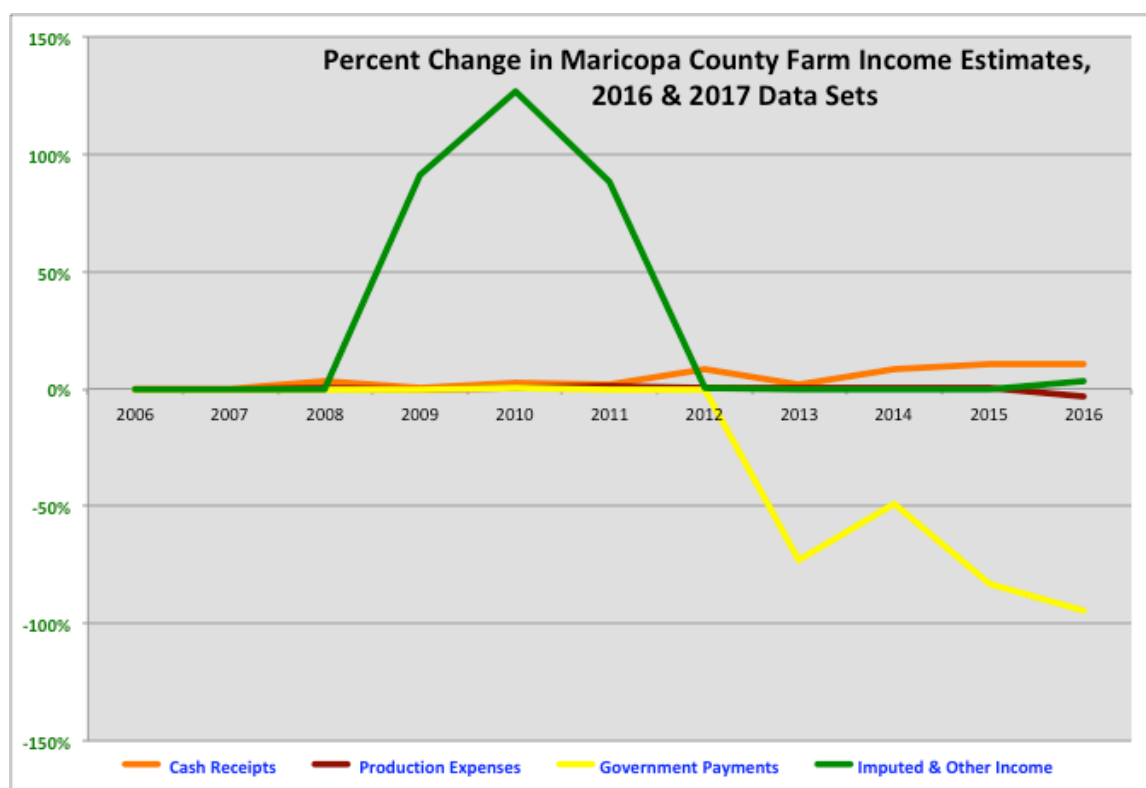
Chart 4: Comparison of Maricopa County Farm Income Estimates (2016 & 2017 data sets)



Source: Bureau of Economic Analysis Regional Income data using both the 2016 and the 2017 data sets. A positive number means data reported for 2017 were larger than data originally reported for 2016. Estimates for 2017 itself are excluded because no comparisons could be made.

Chart 5 shows the same differences in the two data sets, expressed as a percentage of the original 2016 estimates. While most changes are small in percentage terms, significant percentage changes do occur. Estimates for Imputed & Other Income increased as much as 127% (\$48 million to \$69 million, with the lowest change in income making up the highest percentage change) during the years 2009-2011. Estimates of government payments fell by 49% to 94% (\$5 million to \$15 million lower), making the readjustments loom larger than they appeared when expressed as changes in dollar values.

Chart 5: Percent Change in Maricopa County Farm Income Estimates, 2016 & 2017 Data Sets



Source: Bureau of Economic Analysis Regional Income data using both the 2016 and the 2017 data sets. A positive number means data reported for 2017 were larger than data originally reported for 2016. Estimates for 2017 itself are excluded because no comparisons could be made, since 2017 figures appear only in the newer data set.

How to explain the discrepancy?

Note: Charts 15 to 23 below show BEA estimates for Arizona as a whole. These will be useful in tracking the discussion below.

BEA staff (see memos, p. 21 below) told us that the estimates published for Maricopa County are derived from Arizona statewide data. Staff added that the 2017 data set was the first time BEA had been able to incorporate data from the 2012 Census of Agriculture into their models, and their modeling process also incorporated smaller modifications that had been made since 2008.

Given the ups and downs reported for Cash Receipts, our best guess is that the discrepancy can be best explained by the extreme variability of sales in the Arizona vegetable industry (this category also includes melons, potatoes, and sweet potatoes). The primary vegetable-producing county in Arizona is Yuma County, where leafy greens are grown for the entire U.S. (See Table 1 below, and Chart 18). Three factors seem to be key:

- (1) Vegetable sales by Arizona farms peaked in 2007 the year the Census of Agriculture collected production data (these data appear to have been used by BEA in making the original estimates for the 2016 data set we used) and fell to a low level in 2012. This means that to modelers, sales appeared to be trending downward from 2007 to 2012.
- (2) Newer data for vegetable sales (Chart 18) show great variability, including a rapid increase in sales since 2014 totaling \$900 million in three years. The more recent 2017 data set appears to have incorporated these rising sales. We still await release of the 2017 Census of Agriculture, which may add further detail.
- (3) BEA staff offered no additional information on specific changes that were made when modeling the Maricopa County data.

Vegetable sales in Arizona

The Census of Agriculture reports that Yuma County ranks as the number one vegetable growing county in Arizona. Maricopa County ranks second. Together, the two counties account for 88% of all vegetable sales made by Arizona farmers.

Yuma County also ranked third in the U.S. in 2007 for vegetable sales, and fourth in 2012, the Census of Agriculture reported.

Table 1: Vegetable Sales by Yuma and Maricopa Counties and the State, 2007 & 2012

| Sales in millions | 2007 | 2012 |
|--------------------------|-------------|-------------|
| Yuma County | 673 | 579 |
| Maricopa County | 93 | 101 |
| Arizona | 865 | 764 |

Source: USDA NASS Census of Agriculture, 2007, 2012

As Table 1 shows, Yuma County recorded \$673 million in vegetable sales in 2007. This fell to \$579 million in 2012, but appears to have skyrocketed to well over \$1 billion since 2014, as explained above (See Chart 18). Maricopa County farmers sold \$93 million of vegetables in 2007, and \$101 million in 2012. Overall, Arizona farmers sold \$865 million of vegetables in 2007; and \$764 million in 2012.

Modeling the Maricopa County farm economy

This would suggest that to modelers at BEA, Maricopa County emerged as a more important producer of vegetables from 2007 to 2012, since sales in Maricopa increased \$8 million while statewide sales fell \$101 million. So when statewide vegetable sales were tracked as rising from 2014 to 2017, after these census were taken, Maricopa may have been weighted more heavily in allocating its share of this increase.

Our interviews with farmers in 2018, moreover, did not suggest there had been substantive increases in vegetable production in Maricopa County. In fact at least one farm moved considerable production to other locations. Yet tracking vegetable production completely was

not our purpose in the interviews. We simply do not have accurate counts at this point to know what actual sales were. But there exists a strong possibility that more vegetable sales were allocated to Maricopa County by modelers than would be warranted by conditions on the ground.

Trends in Maricopa County agriculture

Trends in the Maricopa County farm economy as discussed in our original report still hold true. Table 2 shows some of the significant changes that have occurred in Maricopa County during the years tracked by BEA in the charts we present. Interestingly, the number of farms in Maricopa County has actually increased 31%, from 1,888 to 2,479, even though the acres farmed has nearly been halved. Acres of vegetables in production has fallen considerably. Cattle, sheep, and hog inventories have declined significantly. The dairy industry has become more important.

Table 2: Comparison of Maricopa County Farms in Two Censuses, 1969 & 2012

| Maricopa County Farms | 1969 | 2012 |
|------------------------------|-------------|-------------|
| Farms (number) | 1,888 | 2,479 |
| Vegetables (acres) | 32,981 | 12,623 |
| Cattle & calves (inventory) | 384,556 | 181,835 |
| Milk Cows (inventory) | 37,401 | 104,295 |
| Hogs & Pigs (inventory) | 19,210 | 3,357 |
| Sheep & Lambs (inventory) | 98,048 | 3,121 |
| Poultry (inventory) | 339,027 | (D) |

Source: USDA National Agricultural Statistics Service, Census of Agriculture, 1969, 2012. The symbol (D) means data were suppressed by USDA in an effort to protect confidentiality of individual farms.

Overall trends for Arizona agriculture

Charts 17 through 23, below, help illuminate similar trends for the state of Arizona as a whole. Chart 17 separates Cash Receipts shown on Chart 16 into sales of Crops and Livestock. This chart shows that crop sales held relatively steady from 1969 to 2017, once adjusted for inflation, with some cycling up and down. Livestock sales have declined from a peak in 1973. There has been a slight upward trend since 1995, but current sales of \$1.7 billion are well below that peak of \$4 billion.

We consider crops in more depth first. Chart 18 shows the extraordinary variability of vegetable sales, and also shows the rapid increase experienced by Arizona farms from 2014 to 2017. Greenhouse and ornamental product sales have held close to \$500 million since 2008. Chart 19

shows that wheat sales have hovered near \$750,000 for Arizona farmers since 1982. Cotton sales now hover near \$200 million each year, well below a peak of \$1.5 billion in 1979, as shown on Chart 20. Fruit sales by Arizona farms (Chart 18) had a modest rise from 2014 to 2017, but could not account for the rise depicted in Maricopa County.

Regarding livestock, Chart 21 shows that cattle and calf sales have hovered around \$750 million per year for Arizona farmers since 1994, standing well below the peak of \$3.5 billion in 1973. In many regions of the U.S. cattle sales are rising in recent years as prices have risen, so this suggests that fewer cattle are being raised on Arizona farms. Dairy sales increased steadily from \$200 million in 1969 to \$800 million in 2017, but again, not fast enough to account for the dramatic rise in Maricopa County farm Cash Receipts reported by BEA.

Unfortunately, the sales figures reported above reflect only Cash Receipts, and not profitability, since Production Expense data are not reported at a county level for specific products. The data we do have for Arizona farms' Production Expenses, shown on Chart 22, indicate that the decline in Production Expenses statewide was led by falling feed and livestock purchases, and augmented by lower fertilizer purchases.

Conclusions

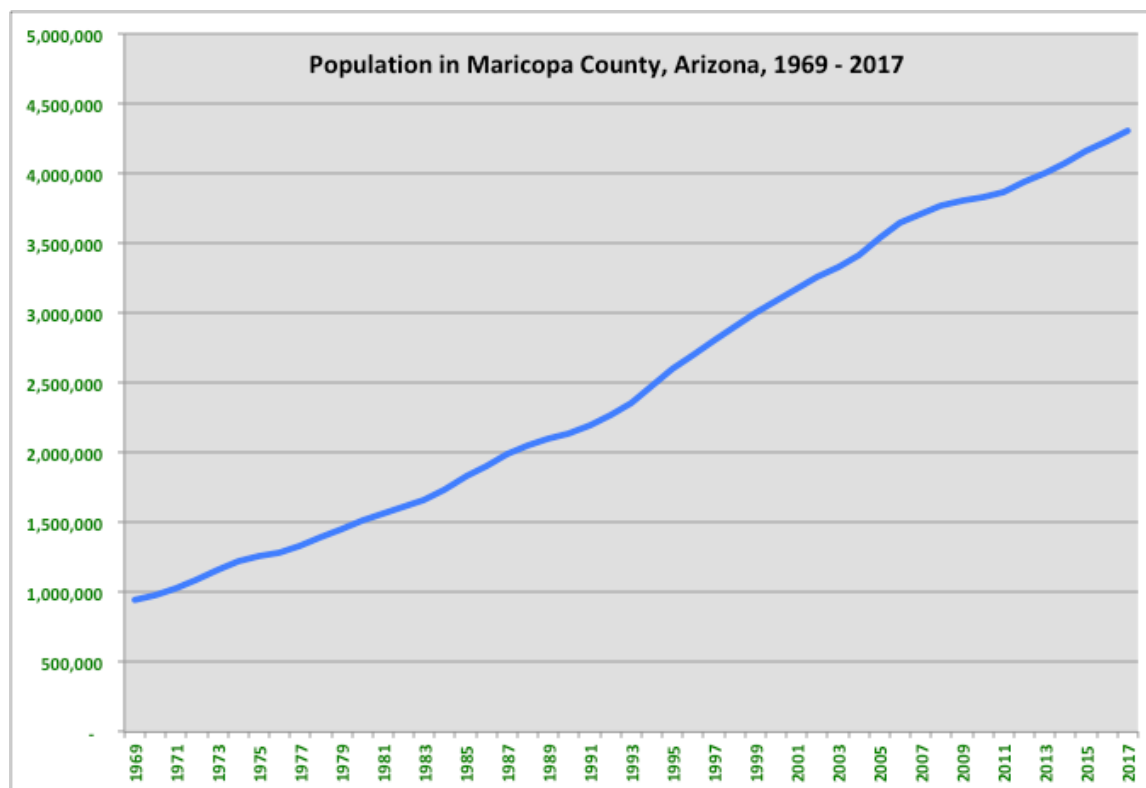
None of this analysis is conclusive, of course. There could be other dynamics revealed in the BEA data that are only visible to agency researchers, and there may be bureaucratic considerations for revisions in the data. Lacking a more complete response from BEA staff, the best estimate we can make, by combining results from our interviews with the public data sets we can access, is that increased sales reported for Maricopa County are related to increased sales of vegetables for the entire state of Arizona, perhaps apportioned too generously to Maricopa County because of anomalous results in the previous two censuses. While it is certainly possible that the new BEA numbers are accurate, we cannot verify that from the interviews we made.

The rest of this report summarizes the new data set, references memos to and from the BEA, and adds statewide data that were not shown in the original report.

Updated Data Maricopa County

Data shown in Charts 6 – 14 show results from the 2017 data set released on March 6, 2019. These may be compared with original data sets compiled for Appendix 2 of our original report. In all charts presented in this Appendix 3, financial data are adjusted for inflation using 2016 dollars as in the original Appendix 2, to make comparisons easier. All reported values are in 2016 dollars, unless otherwise stated.

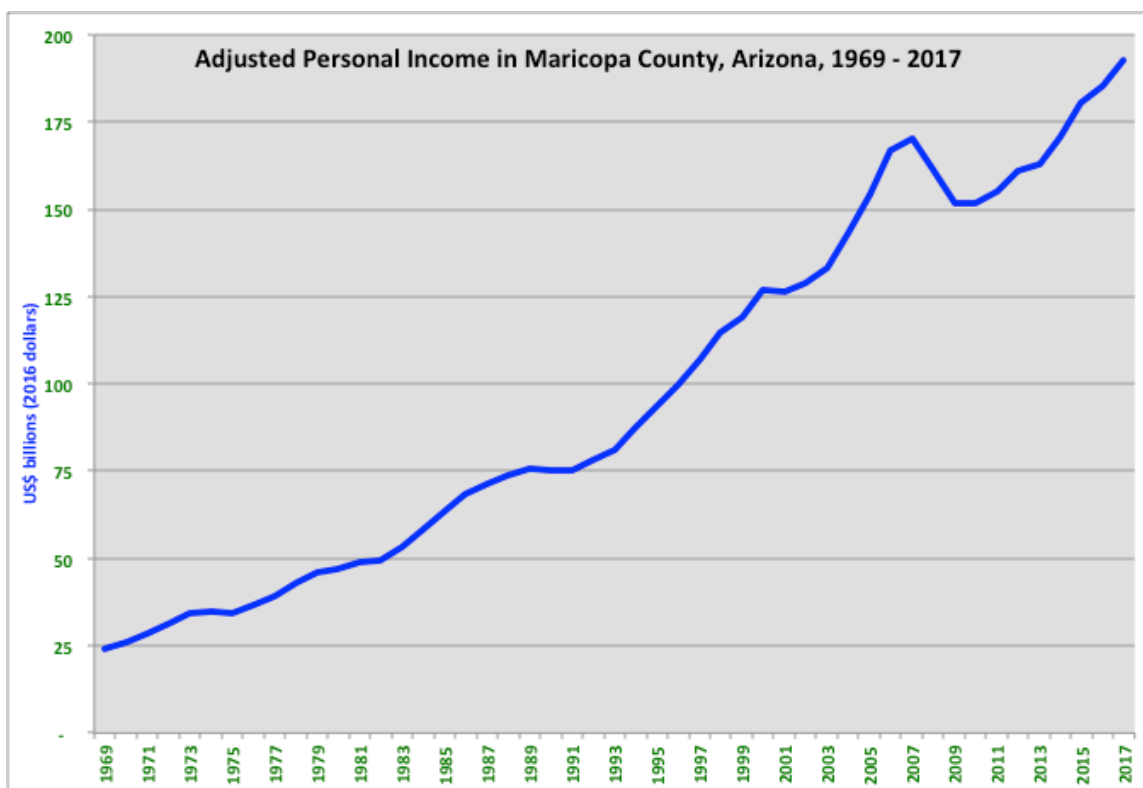
Chart 6: Maricopa County Population, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data

Population in Maricopa County more than quadrupled, from just under 1 million to more than 4.3 million, during the years 1969 to 2017.

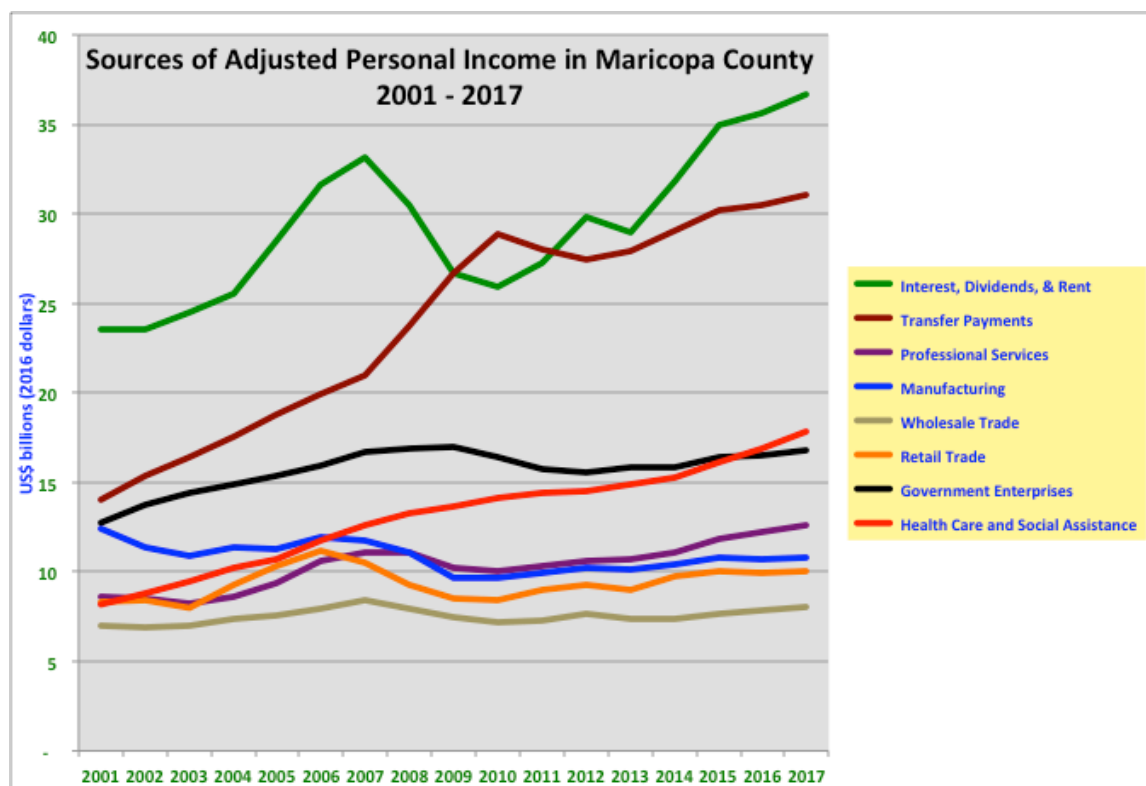
Chart 7: Adjusted Personal Income in Maricopa County, Arizona, 1969 – 2017



Source: Bureau of Economic Analysis Regional Income data

Personal Income for Maricopa County Households increased much faster than population, an 8-fold increase from \$24 billion to \$193 billion over the years 1969 to 2017 (in 2016 dollars).

Chart 8: Sources of Adjusted Personal Income in Maricopa County, 1969 - 2017

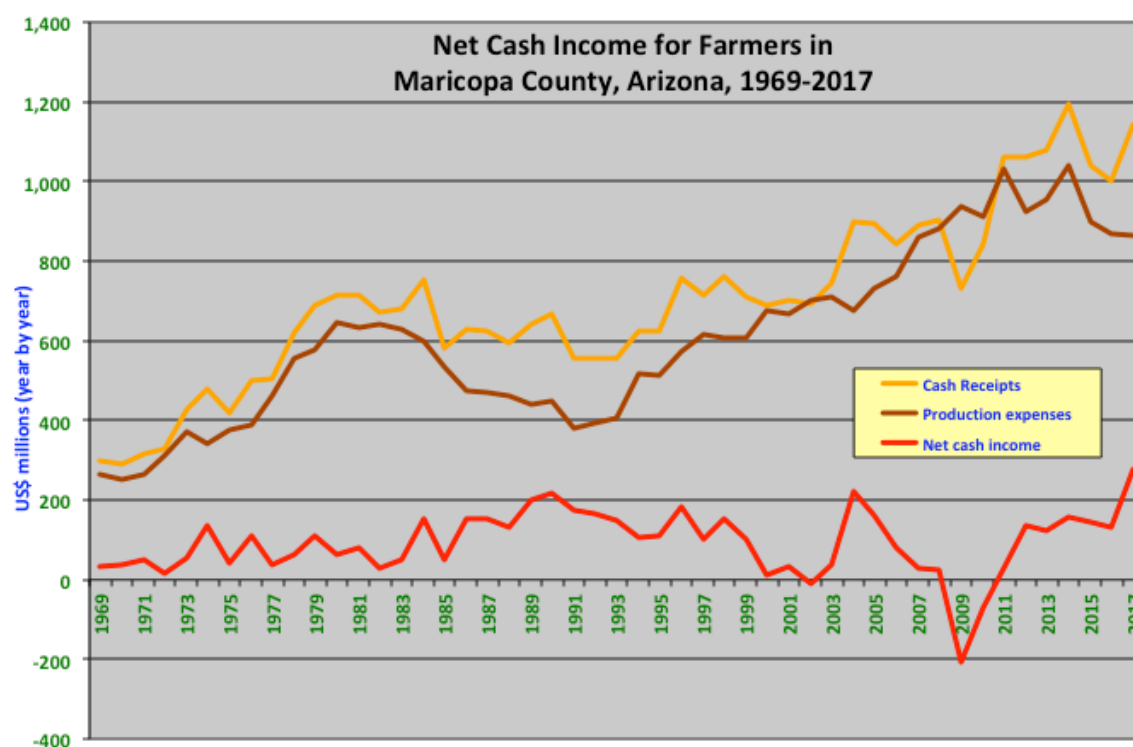


Source: Bureau of Economic Analysis Regional Income data

Note that 25% of all personal income comes through public programs, including transfer payments and government jobs. Interest, Dividends, and Rental income accounted for the largest share of personal income, followed by Transfer Payments, then Health Care worker income, then Government employee income including educational institutions.

Chart 9: Maricopa County Net Cash Farm Income, 1969 – 2017

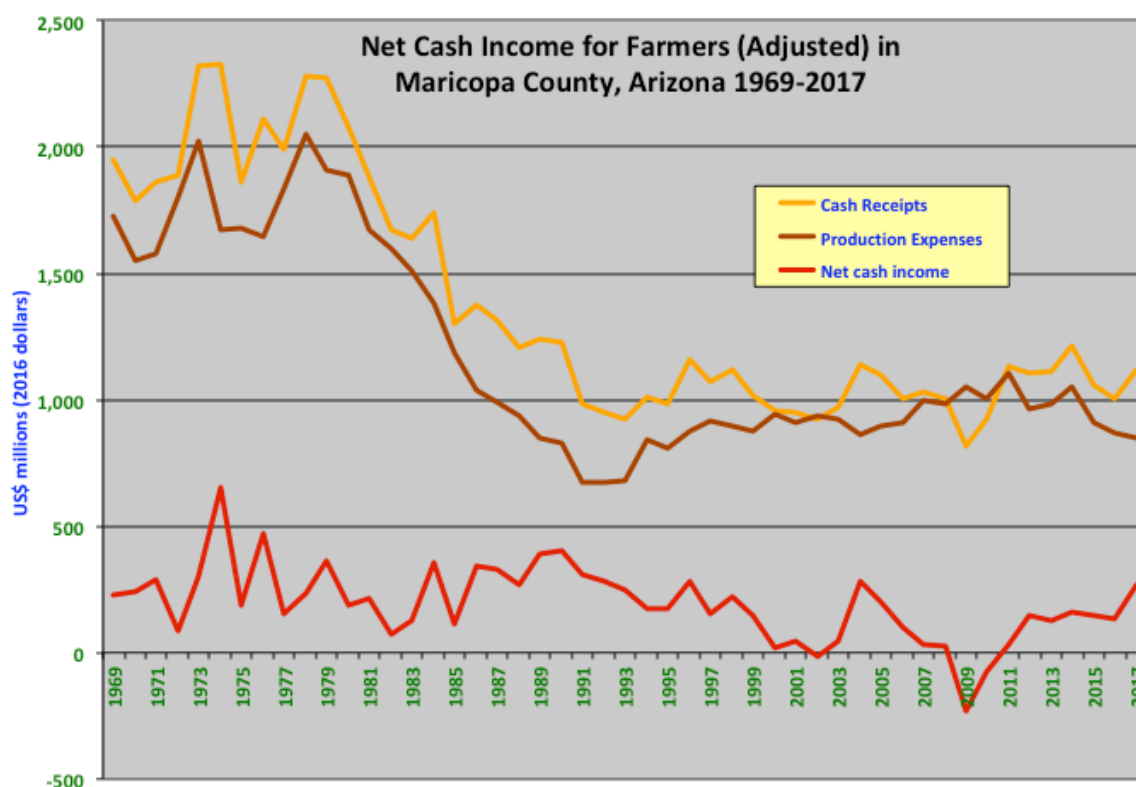
Note: Chart 9 is the same as Chart 1 above, but is repeated to facilitate comparisons with Chart 10, below.



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

Chart 6 shows the updated data set for farm income, including Cash Receipts (orange line), Production Expenses (maroon line), and Net Cash Income (Cash Receipts less Production Expenses). This is a measure of whether farmers earned money by growing and selling crops and livestock. Before data were adjusted for inflation, BEA data show that Net Cash Income rose from \$39 million in 1969, to \$277 million in 2017 (at the values that dollars held for each year depicted on the chart). Yet Net Cash Income also fell to negative \$200 million in 2009.

Chart 10: Net Cash Farm Income for Farmers in Maricopa County (Adjusted), 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

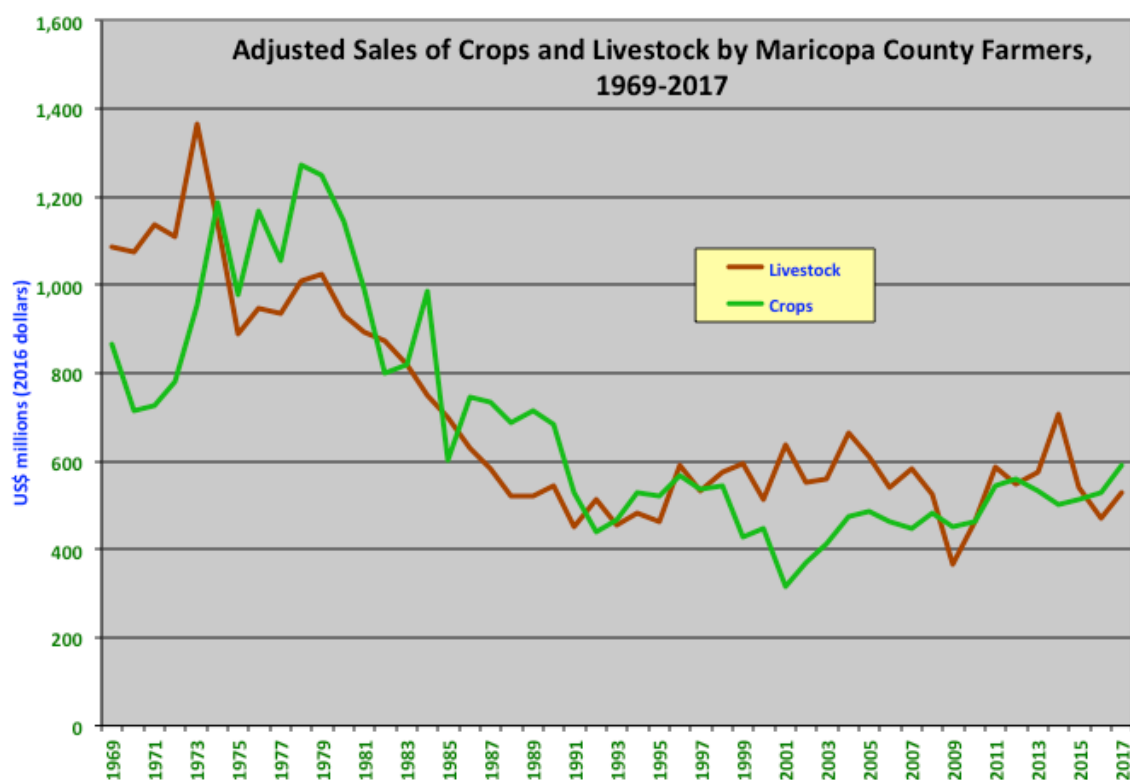
After adjusting for inflation, the Net Cash Income for all Maricopa County farmers combined — the amount farmers earned after Production Expenses were subtracted from Cash Receipts for the products sold — fell from \$225 million in 1969 (in 2016 dollars) to \$133 million in 2016, according to the 2017 data set by Bureau of Economics data released after our original report was written. This is a considerable adjustment from the earlier figure of \$6 million of Net Cash Income, using the best data available to us at the time we wrote.

During the years 1969-2017, the Net Cash Income for Maricopa County farmers rose above 1969 levels in only 19 of those 49 years, even though the number of farms increased (Table 1) and farmers more than doubled productivity (USDA Economic Research Service Agricultural Productivity Series). Despite several prosperous years, Net Cash Income averaged \$145 million per year, less than farmers earned in 1969. If one looks only at the years since 1989, following the national farm debt crisis, average Net Cash Income was even lower, only \$83 million per year.

Given the variability of BEA data for Cash Receipts (\$100 million) and Production Expenses (\$30 million) for 2016 (a total of \$130 million), it could be argued that most of the relationships noted above are not statistically different; that is, Net Cash Income of farming has remained near zero for all years since 1969, or as high as \$270 million per year. Yet to do so would eradicate all of

the BEA analysis of different economic cycles that have clearly affected Maricopa County farms, and trends are often more important than specific counts.

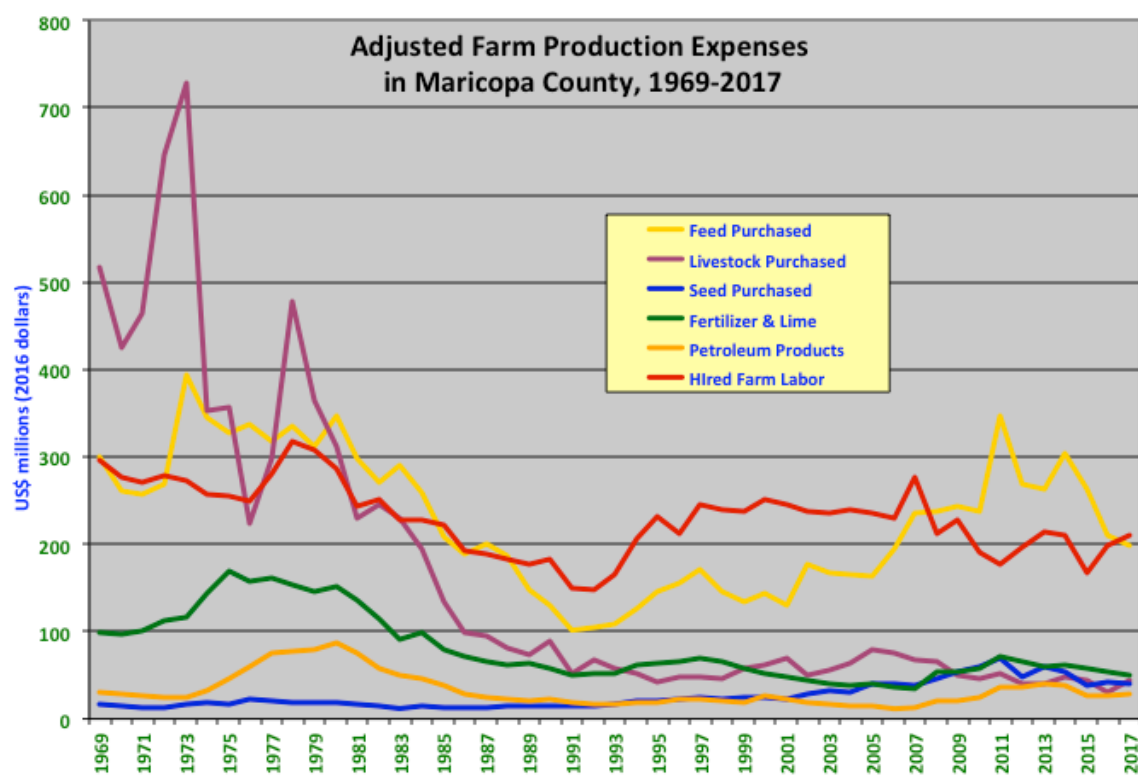
Chart 11: Adjusted Sales of Crops and Livestock by Maricopa County Farmers, 1969 – 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

Sales of livestock and livestock products held fairly steady in Maricopa County from 1991 to 2017, while crop income fell to its lowest level in 2001 and has rebounded since then. However, current sales figures for both are well below those for the 1970s.

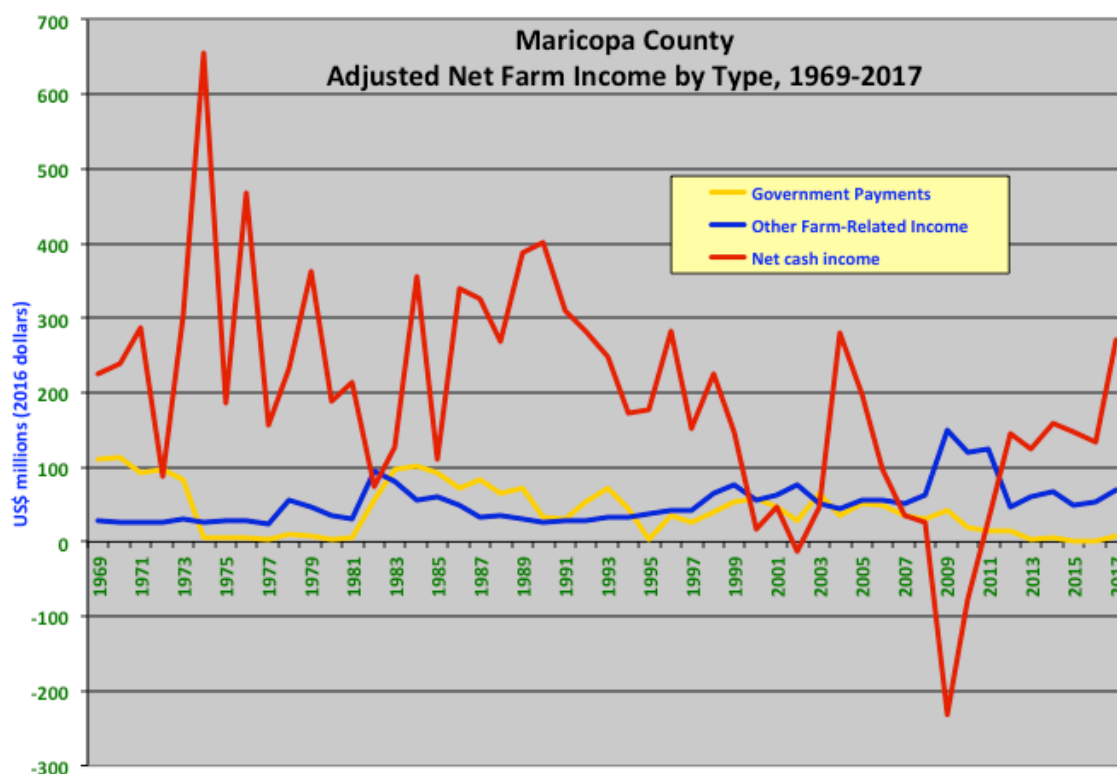
Chart 12: Adjusted Farm Production Expenses in Maricopa County, 1969 – 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

Falling Production Expenses appear to be led by declines in feed purchasing after a peak in 2011, with small declines in both fertilizers and seeds purchased. Labor costs have slowly declined since 2000, with one exception in 2007.

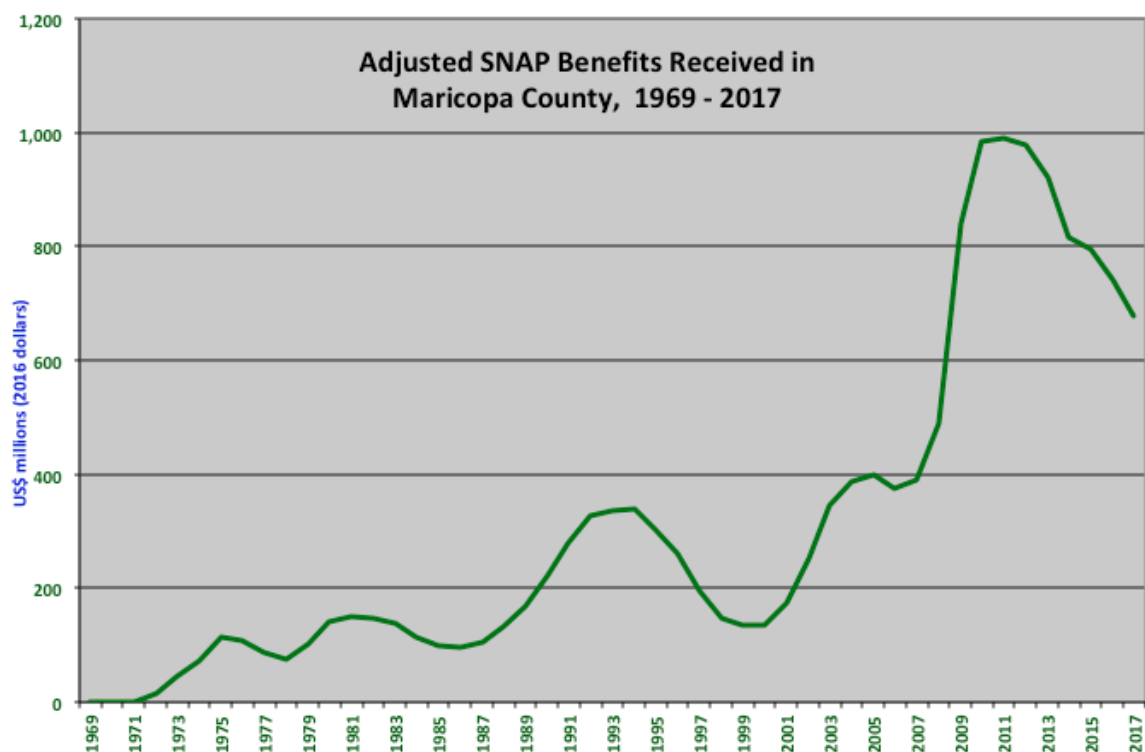
Chart 13: Maricopa County Adjusted Net Farm Income by Type, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

The steadiest source of net income for farmland owners is to rent out their land. Still, the new figures for Net Cash Income for farmers show more promise than they did in the 2016 data set. Yet in Maricopa County, as our interviews found, considerable farmland has been lost to development. Several farmers work under short-term lease arrangements because land costs are higher than a farm can pay back. Developers who own this farmland are happy to lease land at low rates to collect agricultural tax advantages on land they hope to develop in the future.

Chart 14: Adjusted SNAP Benefits Received in Maricopa County, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

SNAP benefits (food assistance) received by Maricopa County residents fell to \$678 million in 2017 after peaking at \$990 million in 2012 during the height of the global housing finance crisis.

Correspondence with Bureau of Economic Analysis Staff

Original Query to BEA:

From: Ken Meter <kmeter@crcworks.org>
Sent: Tuesday, March 12, 2019 5:48 PM
To: REIS <REIS@bea.gov>
Cc: Ken Meter <kmeter@crcworks.org>
Subject: Query on the recent update to Regional Income data

Dear BEA folks,

I rely extensively on BEA data as I work with local governments and their constituents. I was very happy to see the 1969-2000 data reappear on the BEA web site on March 6, since I had been unable to perform research for several clients while the truncated data set was all that was available.

Yet one client has drawn my attention to the fact that the new data sets (1969 - 2017; retrieved this month) differ substantially from the old (1969-2016; retrieved April 25, 2018), at least in one county where I have made use of regional income data.

I attach a spreadsheet [*Charts 4 and 5 in this Appendix*] that shows both original data sets and also offers comparisons between the two data sets. This covers farm income data only.

As you will see, the numbers do differ in ways that are unusually large in my experience — considerable changes in Cash Receipts for farms, Production Expenses declining while sales increase, Government Payments declining (and this is a number that it is difficult to understand why any changes would occur in the 5-year renewal of the data set, since I would assume these numbers are known to BEA fairly accurately each year); as well as Imputed and Other Income rising significantly.

The changes range from as much as \$100 million, and as much as 127% from estimates given a year earlier.

These changes are causing considerable consternation with my clients who are wondering to what extent they can trust either set of BEA data.

Could someone please address the following questions?

1. What were the essential changes in modeling from 2016 data to 2017 data? I assume this newer data set draws upon new data from the Census of Agriculture, and I understand there have been efforts in the past to harmonize BEA estimates with CofA measures. Were any other major factors at work?
2. If we are forced to select one of these data sets to report to the public, on what basis would we take the position that one set is more reliable than the other, at the points when they are not consistent with each other?

3. How is it possible that the amount of Government Payments could be measured as decreasing in a new cut of data from the same years in previous cuts?

4. What else do we need to know in order to interpret these changes accurately?

Ken Meter

BEA Reply:

From: Melissa.Braybrooks@bea.gov

Sent: March 13, 2019; 2:38 pm

To: kmeter@crcworks.org

Subject: Query on the recent update to Regional Income data

Mr. Meter,

Thank you for your interest in BEA's regional farm estimates. Please see responses to your questions in blue below.

1. What were the essential changes in modeling from 2016 data to 2017 data? I assume this newer data set draws upon new data from the Census of Agriculture, and I understand there have been efforts in the past to harmonize BEA estimates with CofA measures. Were any other major factors at work?

Each year BEA conducts an annual estimate cycle.

- In a normal cycle we open up three years of data that includes one newly estimated year, and revisions to the two prior years. In this case we're limited to how we can incorporate source data, and often have to use the change in the source data to extrapolate BEA farm estimate because revisions to source data to a wider span of data than our open revision window. This was the case in the vintage of 2016 data, released in the fall of 2017.
- However, once every 5 year BEA conducts a comprehensive update which opens all years of estimates for purposes of incorporating best level source data, methodology updates, etc. This was the case for the vintage of 2017 data, released in the fall of 2018. In doing so it was our first opportunity to incorporate the 2012 Census of Agriculture, and all associated revisions back to 2008, from ERS's state farm income estimates. All of BEA's county estimates derive out of the state data, so to a large extent the revision to the state controls impacts the revisions to the county estimates. Additionally, the county source data that we use to allocate the state controls to the county estimates were also subject to revision.

2. If we are forced to select one of these data sets to report to the public, on what basis would we take the position that one set is more reliable than the other, at the points when they are not consistent with each other?

The 2017 vintage released in the fall of 2018. This reflects BEA's comprehensive update.

3. How is it possible that the amount of Government Payments could be measured as decreasing in a new cut of data from the same years in previous cuts?

Two factors could impact revisions to Maricopa government payments.

- A revision to the state. County estimates derive from the state data, so a downward revision to the state means that the sum of the counties must be adjusted down to control to the new level. In this case a downward revision to the Arizona government payments occurred between 2018 and 2017 vintages.
- Additionally, during the comprehensive benchmark we introduced a new methodology to better account for government payments related to conservation. A few years ago one of our analysts identified that the FSA county payments that we had used to allocate state government payments to counties did not include conservation payments. During the comprehensive update we introduced a revised allocation of state government payments to counties using a combination of FSA and NRCS data to better capture *all types* of government payments. This methodology was pulled back to 2013, when the NRCS data became available. It is very possible that adjusting our county allocator to include conservation payments means that other counties in Arizona took a larger share of the state total, which would have to be balanced/offset with downward revisions to other counties.

4. What else do we need to know in order to interpret these changes accurately?

Please let me know if there is something unanswered from the above responses.

Thank you,

Melissa Braybrooks
Farm Proprietors' Income and Employment
Bureau of Economic Analysis

Follow-up Questions:

After receipt of this message, we asked Ms. Braybrooks on March 13 if it would be possible to offer more specific details about Maricopa County. To date we have received no response.

Melissa,

Many thanks for your thoughtful and rapid response to my queries. I think your answers go a long way to helping me understand the revision process that BEA uses for each year, and for the five-year revisions.

At the same time, it would be very useful to have more specific answers for this particular county, since my clients wish to be assured that the data I am offering them reflect actual conditions on the ground, rather than reflecting modeled data that may not be sensitive to local conditions. So if it is possible to dig more deeply into this matter, and consider the Maricopa County data more specifically, the statements in my first message also lend themselves to questions that could be answered by referring to Arizona and Maricopa County data sets.

Having seen many revisions of BEA data for over 20 years of working with it, I have never experienced such large changes, where the magnitudes of the changes are so high and where positive numbers turn into negative ones, or vice versa. While I understand that a variance of more than 100% indicates that the original number was small, differences ranging from \$60 million to \$100 million are difficult to explain to a farm population that is experiencing considerable trauma.

1. In the case of Cash Receipts data, there are substantial ups and downs that are not reflected in the Arizona data or the US data that I have used from ERS. I have not yet examined the state-level data for Arizona, but it is also true that a substantial part of the farm production in the state is in Maricopa County, so while I can see that county-level trends might be highly impacted by changing state dynamics, it is also true that county-level data should reflect statewide Cash Receipts fairly closely — and yet I have not seen these variations in Arizona data I have reviewed so far.

2. In the case of Production Expenses data, the 2017 “vintage” data suggests, according to your answers, the concept that for Arizona farms, Production Expenses declined, even while sales increased. This does certainly not conform to the interviews I held with Maricopa County farmers — admittedly, mostly farmers raising food for local markets rather than commodity growers, but also in many cases commodity growers themselves who have reported rising Production Expenses and falling prices. This is tempered somewhat in Maricopa County by the fact that several farms have gone out of business because the economic context was so challenging, and also because there are developers eager to purchase land. So while declining Production Expenses may have a justification, it is difficult to see how — at either a state level or a county level — this could happen while Cash Receipts are rising. Given that we are facing a rebirth of farm foreclosures in the Midwest with bankruptcies, and so forth, and generally low commodity prices, it is difficult to imagine that Maricopa County farmers are insulated from these dynamics.

3. In the case of Government Payments, while I understand the explanation you have offered, the argument seems to be that BEA incorporated even more FSA payments into its estimation models, yet the actual level of Government Payments decreased. Certainly, as you state, this may well be related to how these conservation payments were reallocated to different counties in Arizona — yet this argument does not come with evidence that this is actually what resulted in the reapportionment. Any further detail you could offer in this regard would be most useful.

4. Your answers do not put forward any evidence that would show why the value of Imputed and Other Income might have risen so much in the 2017 vintage. Once again, I can imagine reasons for this — for example, many Maricopa County landowners are housing developers who are not actively farming, and may be drawing more income from renting out land than they had previously. Yet this might be expected to show up in the models as increased Production Expenses for certain working farmers working that land. And the fact that I have to rely on imputed income estimates to gauge farm income is somewhat disconcerting, because it is difficult to explain to my clients, who often wonder if the data reflects actual conditions, or more the assumptions made by modelers. This discussion is a good example — while one can speculate about certain conditions that MAY have led to the changes we notice in this county’s data, it is more useful to know what actual measures contributed to the new estimates. For one

thing, I notice that there appears to be a correlation between the curves of the percentage change modeled for Government Payments and the percentage change modeled for Imputed and Other Income, and while this of course is not to say there is a causal relationship between these curves, it further leads people to wonder how accurate the modeling process is.

If it is simply impossible to dive down into the county level estimates to know how estimates were apportioned for what purposes, I will understand, but that will also make it difficult for my clients to trust that the data covers the conditions they experience. Any further clarification you may be able to provide would be most welcome.

Ken Meter

And one further follow-up, later the same day:

One further thought occurred to me as I considered this. One possible response to the changes in the data would be to issue confidence limits for the data sets at the county level. The difference in the 2016 and 2017 vintages would suggest, for example, that the Cash Receipts for Maricopa County farms might be considered accurate within \$100 million, or 11% of receipts, but of course that is only a rough range of results and not a satisfying estimation of modeling error.

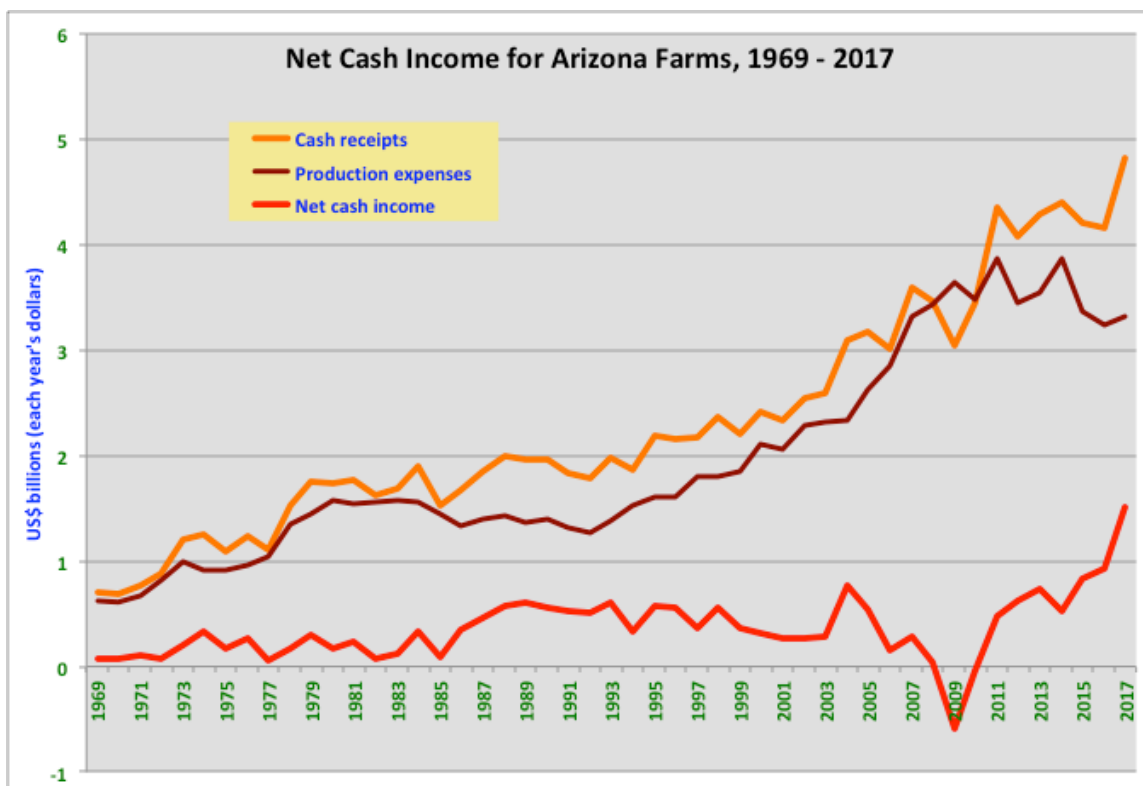
This would allow members of the public who use the data to understand the limits of what can be concluded from the estimates that are given.

Ken Meter

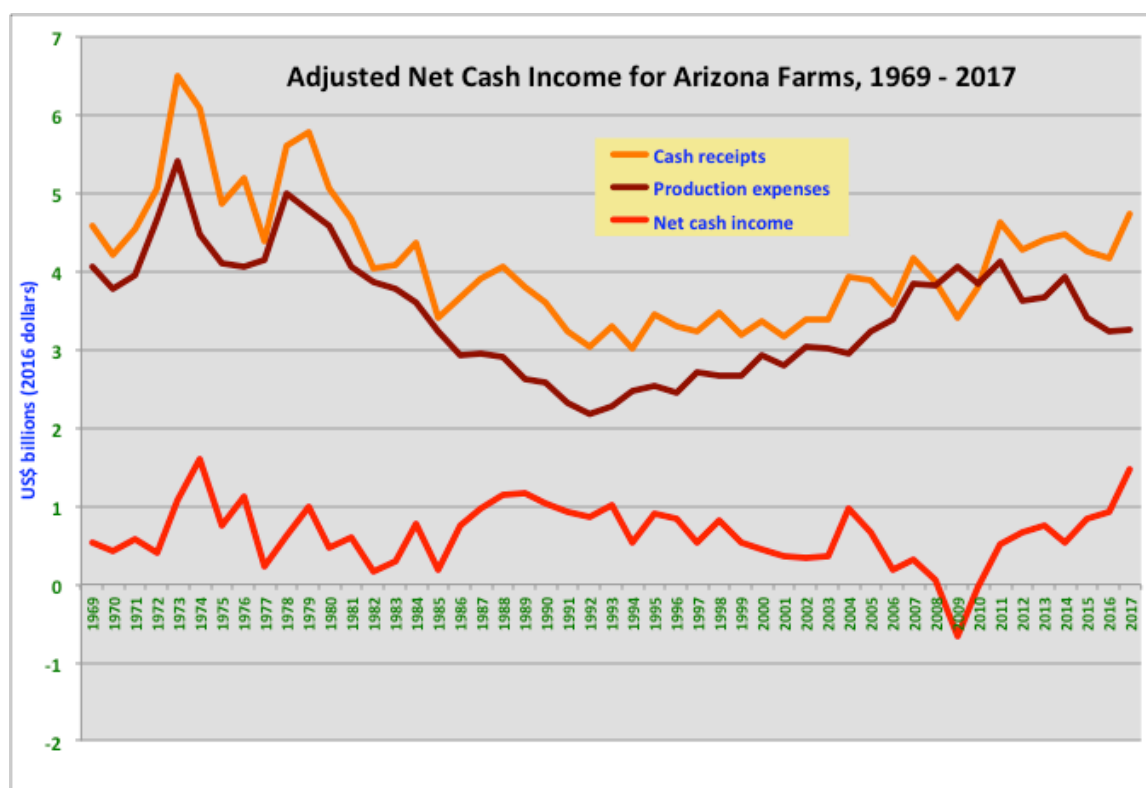
Arizona Statewide Data

To explore this matter further, we explored the BEA data for the state of Arizona, since staff stated that statewide data were central to the projections made for Maricopa County.

Chart 15: Net Cash Income for Arizona Farms, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data.

Chart 16: Adjusted Net Cash Income for Arizona Farms, 1969 - 2017

Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

Reviewing the Net Cash Income data for the entire state of Arizona, as shown on Chart 16, it is clear that trends in Maricopa County, as reported by the BEA, closely reflect statewide trends. This is not surprising, since Maricopa County is one of the three counties in Arizona that account for 80% of all product sales by Arizona farmers. Maricopa itself makes up one quarter of the state's farm economy. This is shown in Table 3, below:

Table 3: Cash Receipts for Farms in Arizona Counties, 2017

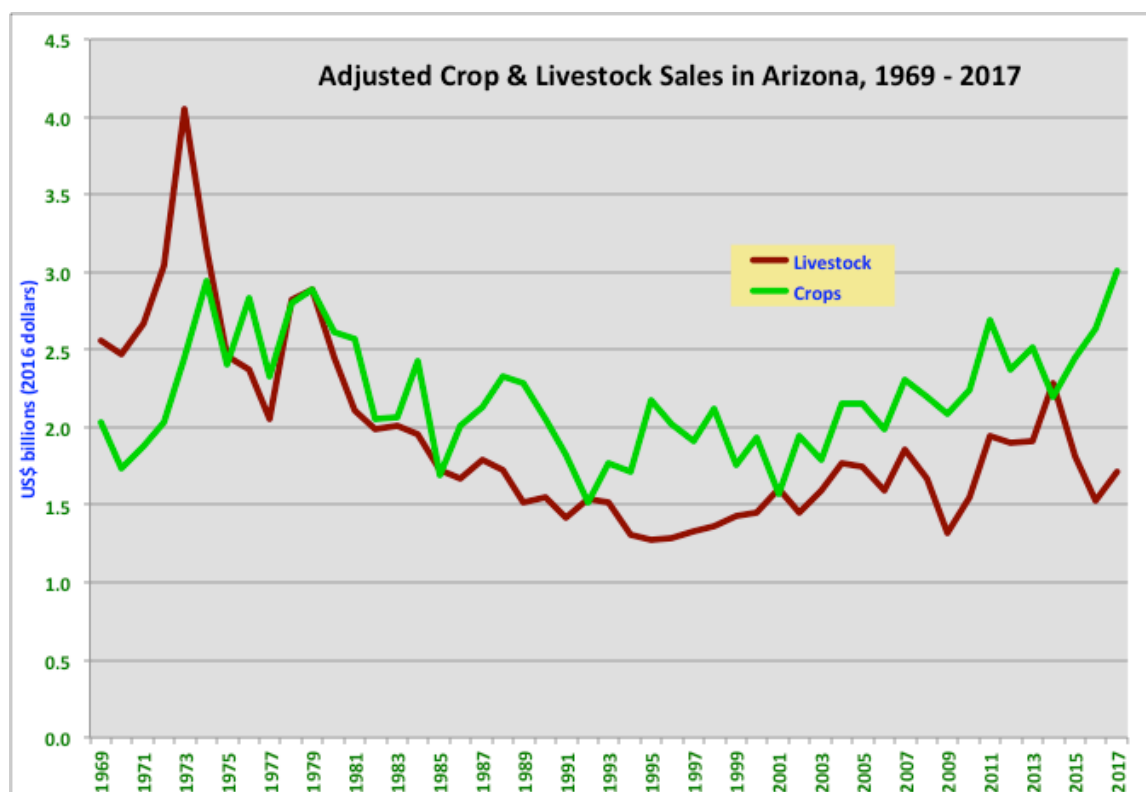
| County | \$ millions | Percent of Arizona |
|----------|-------------|--------------------|
| Yuma | 1,688 | 35% |
| Maricopa | 1,142 | 24% |
| Pinal | 1,017 | 21% |
| Graham | 228 | 5% |
| Cochise | 212 | 4% |
| La Paz | 157 | 3% |
| Pima | 131 | 3% |
| Navajo | 65 | 1% |
| Yavapai | 52 | 1% |

| | | |
|------------|----|----|
| Apache | 37 | 1% |
| Coconino | 31 | 1% |
| Mohave | 29 | 1% |
| Santa Cruz | 17 | 0% |
| Greenlee | 11 | 0% |
| Gila | 4 | 0% |

Source: Bureau of Economic Analysis, Regional Income data

Yet the increase in Net Cash Income for Arizona farms is certainly larger for Arizona than in Maricopa County. To gain a closer view of sales estimates shown on Chart 16, consider Chart 17, showing the Cash Receipts of Arizona farmers broken down into Crop sales and Livestock sales. Chart 17 shows quite clearly that the increase in sales for state farmers is due to an increase in crop sales, while sales of livestock and related products peaked in 2014 and have fallen significantly since then, with only a slight rise in 2017.

Chart 17: Adjusted Crop & Livestock Sales in Arizona, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

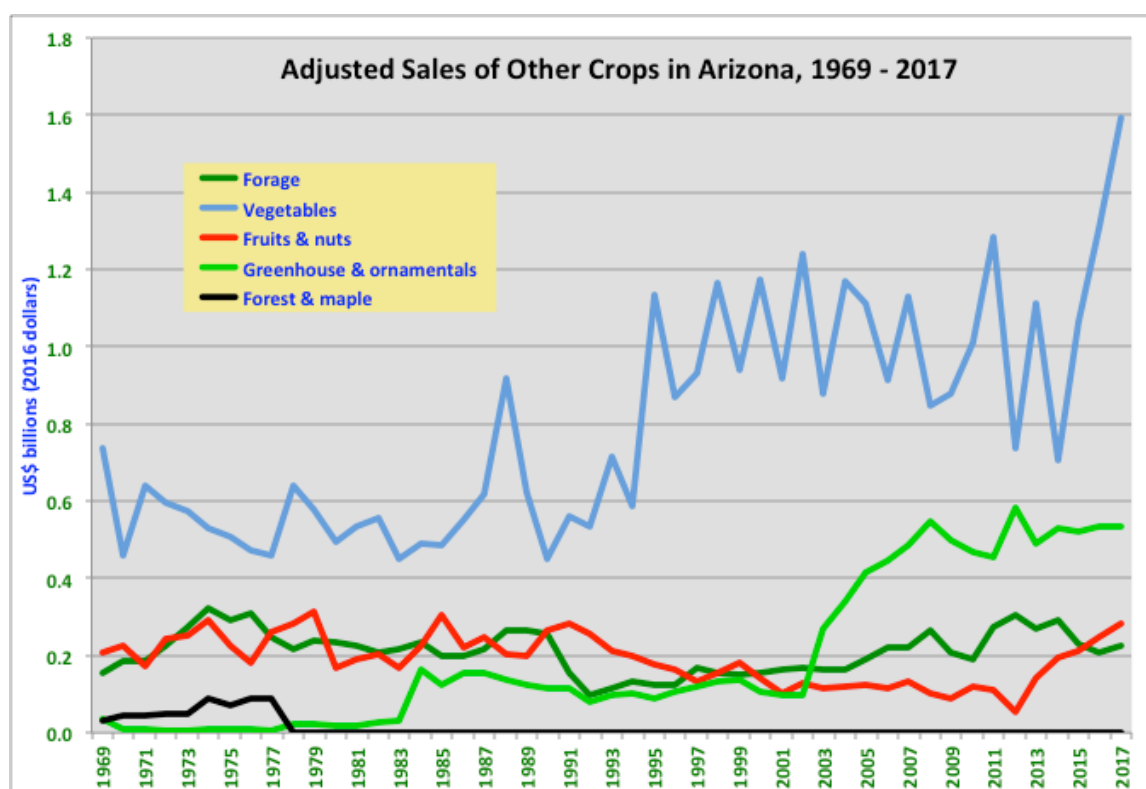
Chart 17 shows that crop receipts rose \$817 million from 2014 to 2017, while livestock income fell \$567 million.

Chart 18 zeros in on the sales of specific crops with rising sales statewide. This includes sales of vegetables, presumably led by growth in sales from Yuma County, which supplies much of the U.S. with fresh greens. This rise in vegetable sales is enough to account for most of the increase in crop sales by Arizona farms.

Farmers have also enjoyed increased sales of Greenhouse Crops and Ornamentals, and there has been a still smaller rise in sales of fruits and nuts. Forage, an important crop in Maricopa County, has held steady.

BEA data also show that sales of wheat, corn, and other grains (Chart 19) have been far smaller than sales of crops shown in Chart 18, and have held relatively steady. So it appears that the increase in crop sales in Arizona is primarily due to increased sales of vegetables. The \$887 million increase in vegetable sales reported from 2014 to 2017 seem to account for all of the growth in crop sales reported for the state as a whole (\$817 million).

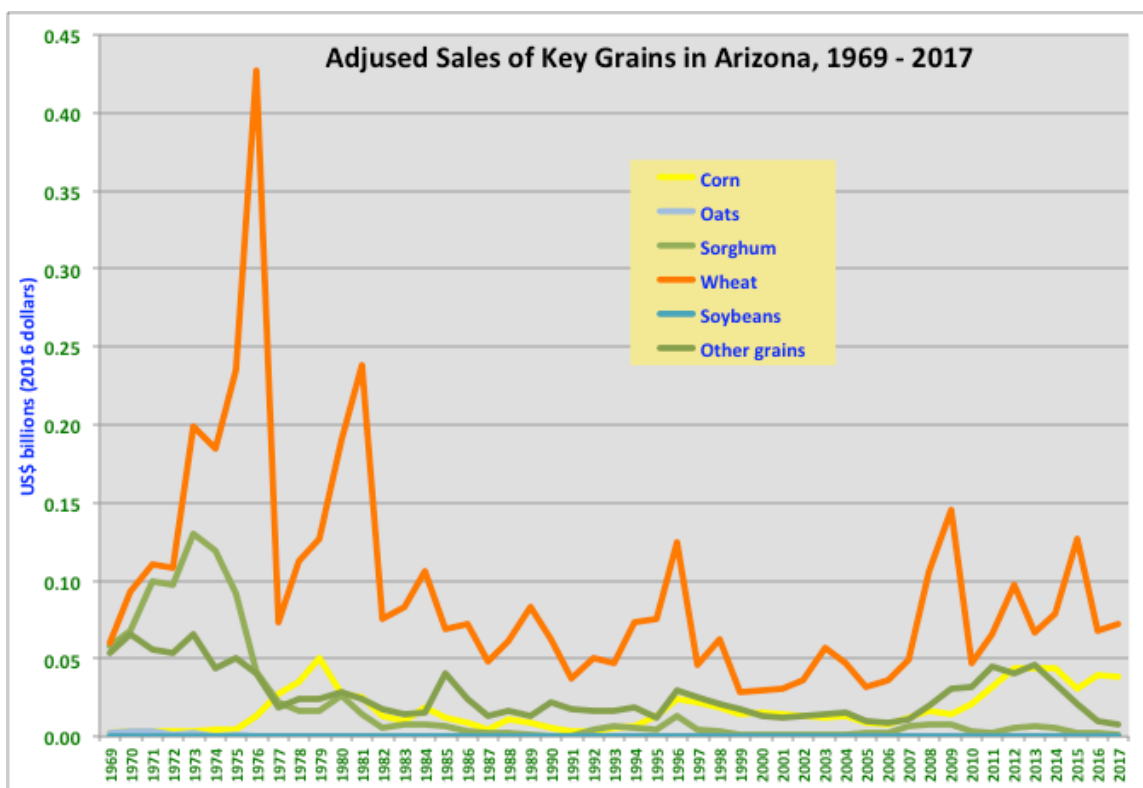
Chart 18: Adjusted Sales of Other Crops in Arizona, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

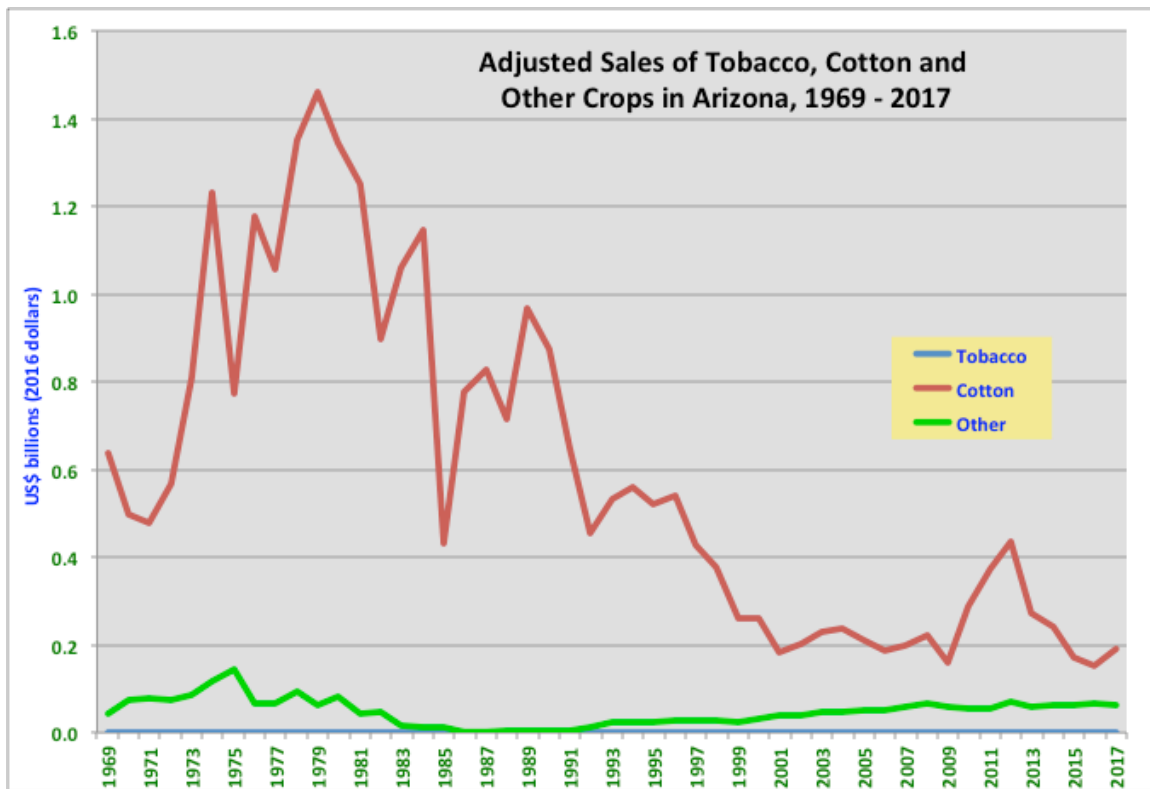
Chart 22 shows the Production Expenses shouldered by Arizona farmers. This chart shows that the decline in Production Expenses is led by falling costs for livestock feed, commensurate with declining livestock sales. Labor costs have also been reduced slightly. Costs for fertilizers, seeds, and fossil fuels have fallen off even more slowly, most likely because of a reduction in the number of farms.

Chart 19: Adjusted Sales of Key Grains in Arizona, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

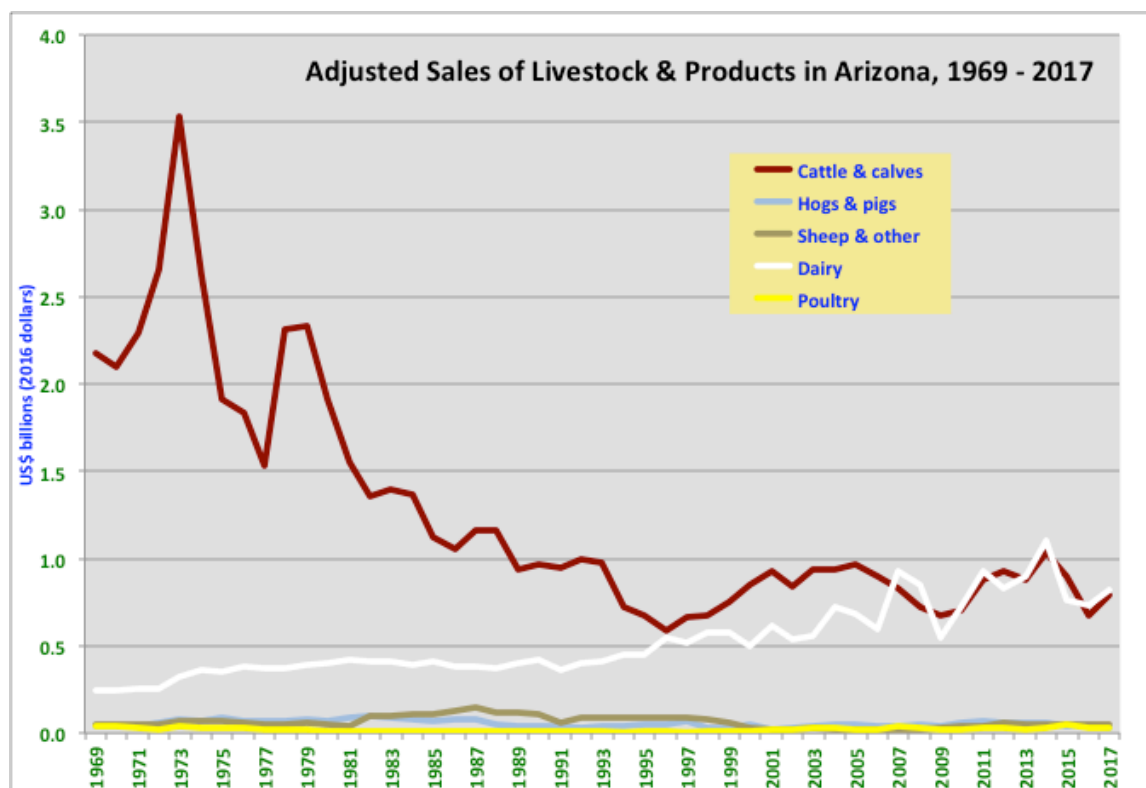
Chart 20: Adjusted Sales of Tobacco, Cotton, and Other Crops in Arizona, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

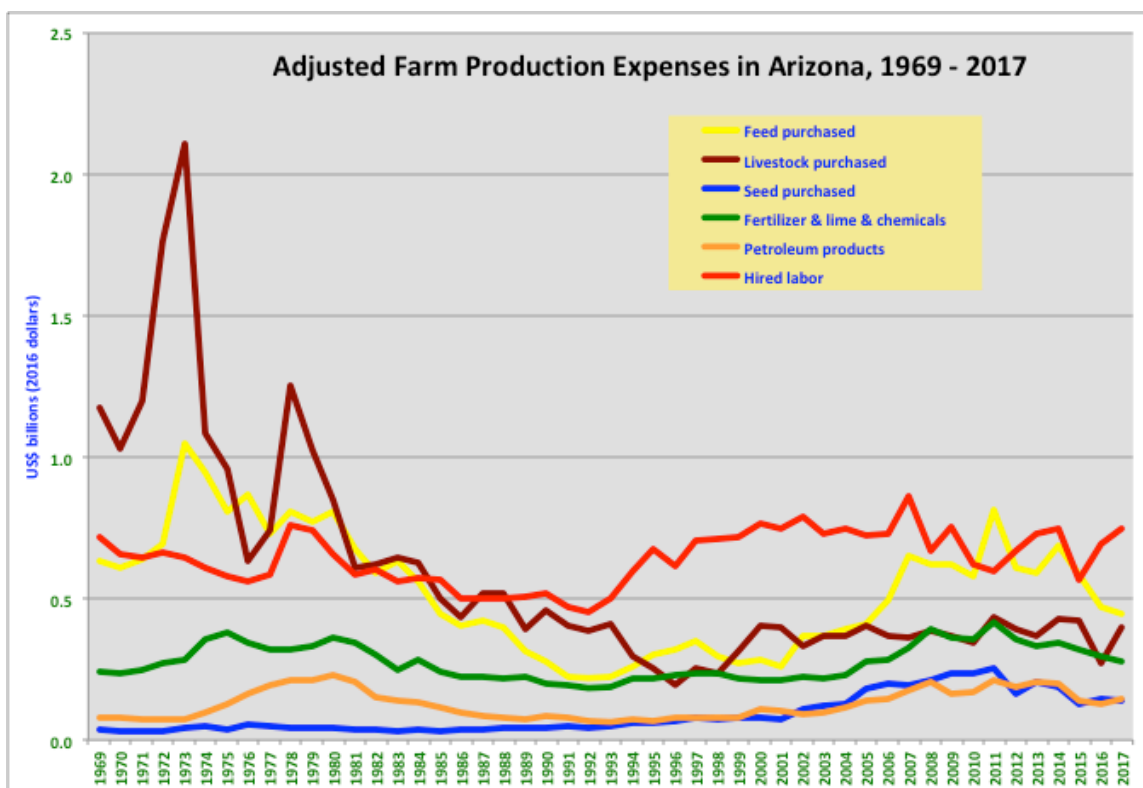
Cotton production, which was once important in Maricopa County, has declined significantly since 1992. Arizona cotton sales peaked at \$1.5 billion in 1979, but now stand at about \$200 million per year for the entire state.

Chart 21: Adjusted Sales of Livestock & Products in Arizona, 1969 - 2017



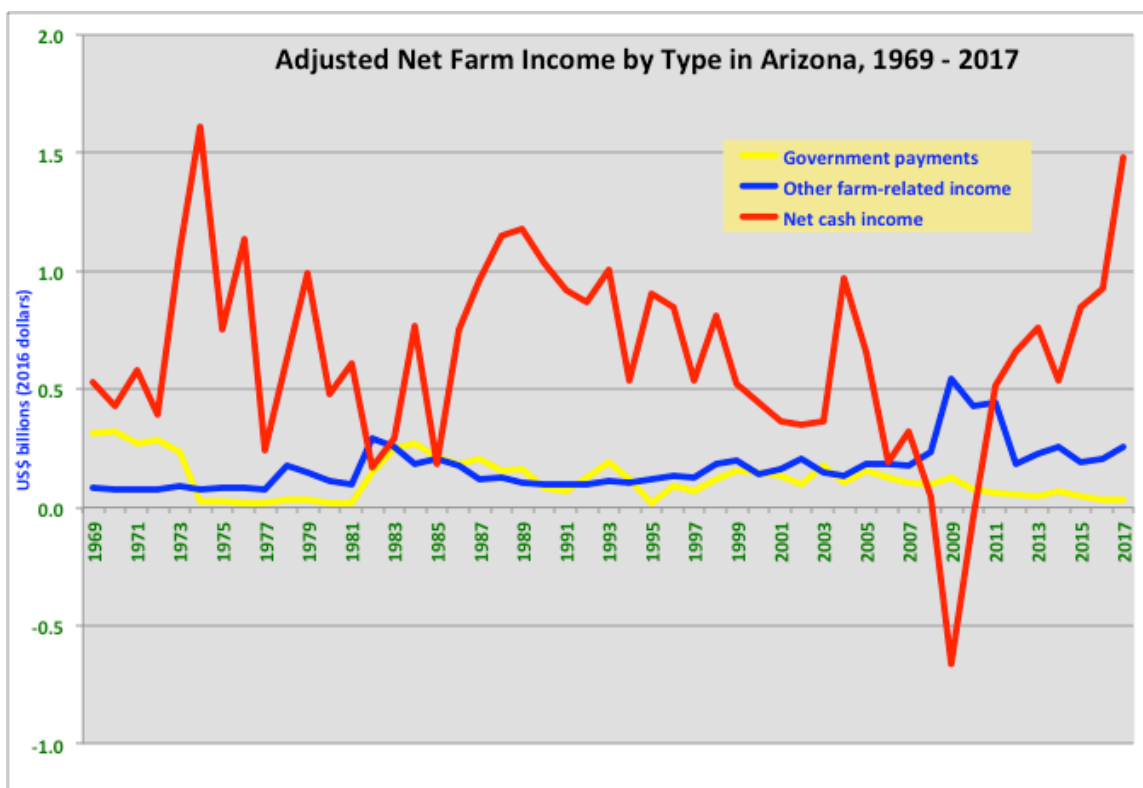
Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

Chart 22: Adjusted Farm Production Expenses in Arizona, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

Chart 23: Adjusted Net Farm Income by Type in Arizona, 1969 - 2017



Source: Bureau of Economic Analysis Regional Income data. Adjusted for inflation using 2016 dollars.

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