

Prompt 2

Farmer Age and Agriculture Production

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HDSI Agri Datathon

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Background Info:

Farm producers are the backbone of the agricultural sector, which is crucial for ensuring food security in the United States and around the world. These dedicated individuals work to sustain our growing populations, which rely on the efficiency and production of farms across the country. According to NASS reports, the average age of farmers has been steadily rising, now reaching 58.1 years old as of the latest Agricultural Census. This trend, evident in each census year since 2002 (see graphic below), prompts important questions about the future of food production in different regions and the potential challenges we may face as the current generation of farmers approaches retirement. Learn more [here](#).

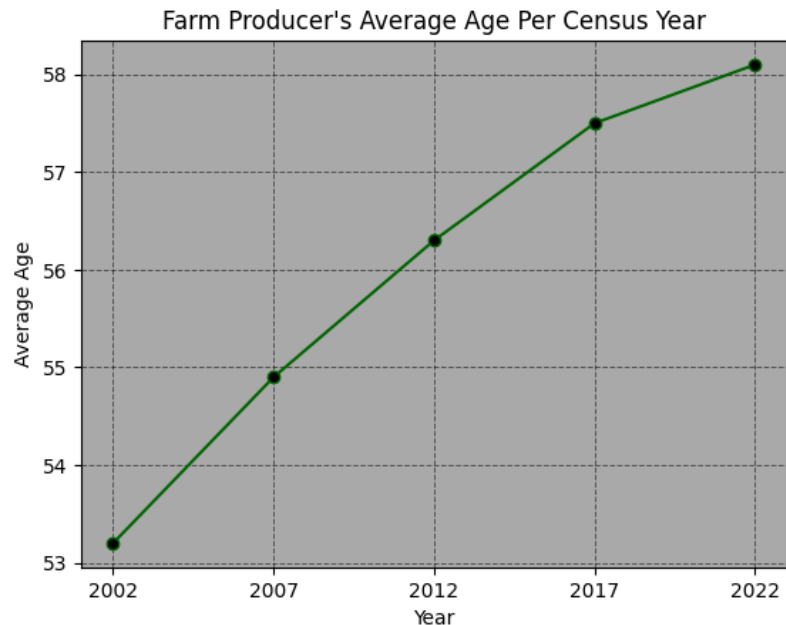


Image 1 above: increasing trend in ages

Image 2 below: elder farmer working the field



Agriculture production and agriculture productivity are distinct concepts. Production refers to the total output, while productivity encompasses more—it measures the efficiency of production by considering output relative to the cost of all inputs, such as land, labor, and capital. When agricultural economists speak of "productivity," they are referring to the value of the output (production) minus the costs of these inputs. We will be focusing on production in terms of sales in this prompt.

Important Note: Producer and Operator Data from the Census of Agriculture

In 1997 and previous censuses, demographic data were collected for one person per farm. From 2002 to 2012, the Census of Agriculture collected demographic data on up to three persons per farm: the principal operator and two other persons, referred to as operators in the published data. The data series was updated because it was recognized that many farming operations involved multiple people, for example, a husband and wife, two sisters, or family members from different generations, such as a father and a son. Respondents were asked to report details on up to three persons per farm who were involved in making day-to-day decisions for the farming operation. On the report form, the person listed first was designated as the principal operator.

Prior to the 2017 Census of Agriculture, data users reached out to NASS to request an update in how demographic data were collected, to better measure the participation of all persons involved in decision-making for farming operations. In particular, data users expressed concern that the role of women in farming was being undercounted in the published statistics. NASS convened an expert panel to review the method of demographic data collection and recommended updates to several items. The primary change was to collect demographic data for persons involved in making decisions for the farm (removing the "day-to-day" language from the questionnaire) and to collect detailed data for up to four persons per farm, one more than in the 2002, 2007, and 2012 Census of Agriculture.

This change in the way data were collected and published impacts data analysis. For 2002-2012 data, the metadata uses the word "operator" in the demographic data items. For 2017 and 2022, the word "producer" is used instead. Additionally, for 2002-2012, publicly available data at the county level are generally available only for the principal operator. For 2017 and 2022, data are available for all producers.

The change did not impact all demographic data in the same way. Certain producer attributes were much likelier than others to experience significant changes. As expected, the new data collection methodology increased the number of women counted, both as a share of all farm producers and in absolute numbers. While the count of all producers increased by almost 7%, the count of female producers rose by 27%, while the number of male producers decreased by 2%, similar to the change in the total number of farms, which was down 3%. The increase in the number of female producers was primarily caused by the large rise in farms reporting more than one person involved in making decisions for the farming operation.

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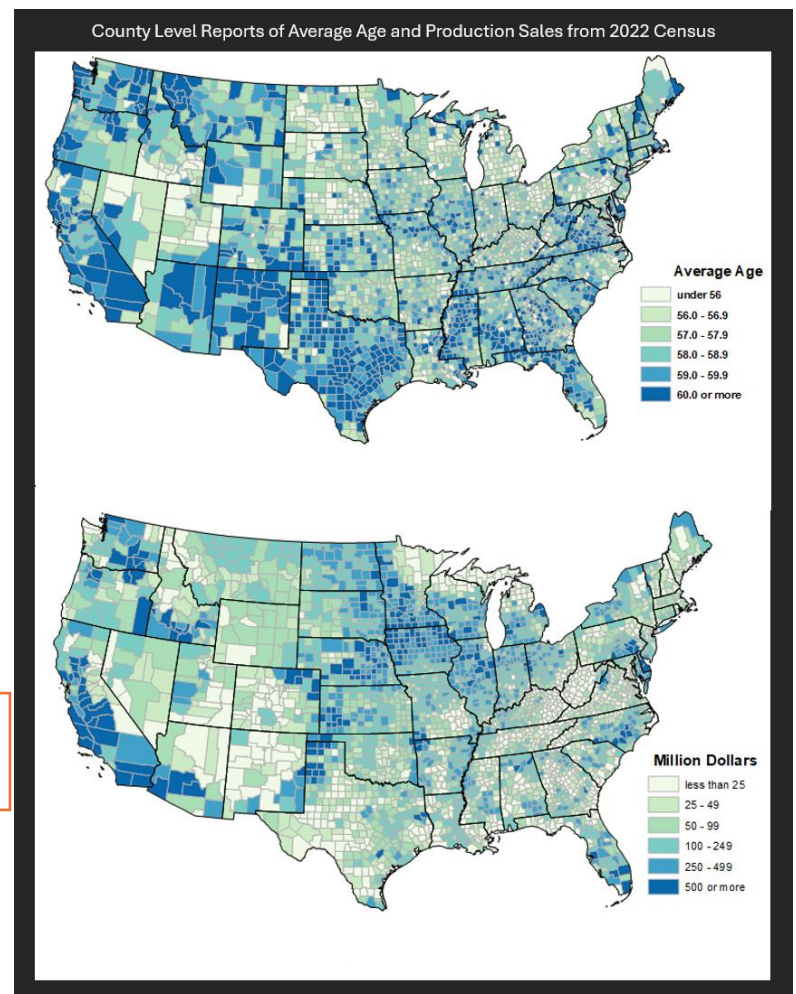
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How to Complete this Prompt:

The goal of this challenge is to explore the relationship between **farmer age demographics** and **farm production across different regions** of the contiguous United States. Teams will:

- Read the provided Toolkit for notes about FIPS code, special characters, and inflation adjustment
- analyze NASS demographic, land totals to examine county and state-level trends in farmer age
- adjust the economic data for inflation and analyze NASS crop sales data to examine county and state-level trends
- develop a team plan to accommodate the “operator” and “producer” distinction
- use any appropriate model, of your team’s choice, to investigate if these age trends correlate with farm production via sales data
- include any other variables you see fit from the files
- assess the potential impacts on the agricultural economy

Image 3: Snapshots of the average age and production sales from the 2022 Ag Census.



In order to do this, teams must select **at least one question** from **each of the categories** listed below.

Spatiotemporal Trends in Farmer Age:

1. How has the average age of farmers evolved over time across county, states, and nation in the United States, from 1997 onwards?
2. Are there statistically significant regional deviations from the national trend? From the census years of 2002-2022? For instance, are certain counties experiencing a more rapid aging of their farming population or a more pronounced decline in average age? Or which regions show a stabilization of age demographics compared to the national trend?

Regional Variations and Economic Impact:

1. What are the trends in average age for the most productive counties in the U.S., as measured by the dollar value of agricultural production? What about the lowest productive counties in the U.S.?
2. At the state level, how does the average age of farmers correlate with the economic scale of farms? Specifically, do larger, more economically significant farms exhibit a more pronounced aging trend?
3. In counties where agricultural production is declining, are there underlying demographic patterns in terms of farmer age?

Inflation Adjustment and Sales Analysis:

1. When analyzing farm production and economic impact, how does the use of an inflation adjustment measure for the value of agricultural products affect the analysis?
2. Does adjusting for inflation reveal different trends in the relationship between farmer age and farm production?

What your team has: 5 files in total

1. prompt2_demos_landtotals_county.csv -- A csv of demographic data (including age distributions) and land totals by *county*, census years 1997-2022
2. state_level_2002_2007_2012_2017_2022.xlsx -- An excel of age distributions and production sales by *state*, census years 2002-2022
3. prompt2_prompt3_sales.csv -- A csv of crop sales by *county*, census years 1997-2022
 1. Along with a quick guide csv
4. inflation_GDP_price_index.xlsx -- An inflation adjustment excel (see Toolkit for clear inflation adjustment instructions)

Viz Hints:

To create your team's final visualizations, it will be beneficial to map your values across the counties of the contiguous United States. **A choropleth map is a type of map that uses color to represent data across geographic areas. The term comes from the Greek words choros (region) and plethos (multitude).** Using a tool like Python Plotly's choropleth maps can enhance your visual analysis. For more information and examples, visit [Plotly's choropleth map](#) documentation and ways to create [USA County Choropleth Maps in Python](#).