



# Climate Change and Wine Production

Group 1

Amanda Derdiger, Andrew Koller, Mustafa Ayter, Lindsay McFayden



# Research Questions

Does climate change affect global wine production?

Is there a correlation between average temperature and wine production?

Is there a correlation between rising temperatures and the creation of new wine industries in regions previously unfit for wine production?

Which geographical regions can expect to see an increase in wine production and which regions can expect to see a decrease in wine production given the expected rise in temperature?

# Datasets



## Wine Production

Crops and livestock products database from the Food and Agriculture Organization of the United Nations (FAO).

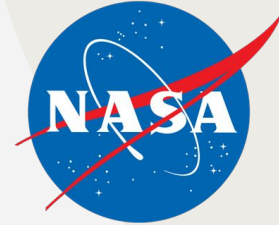
Dataset / API used to measure wine production by country by year.



## Temperature

Global Historical Climatology Network - Daily (GHCN-Daily), Version 3 from the NOAA National Climatic Data Center.

Dataset / API used to measure daily weather temperature indices by country by year.

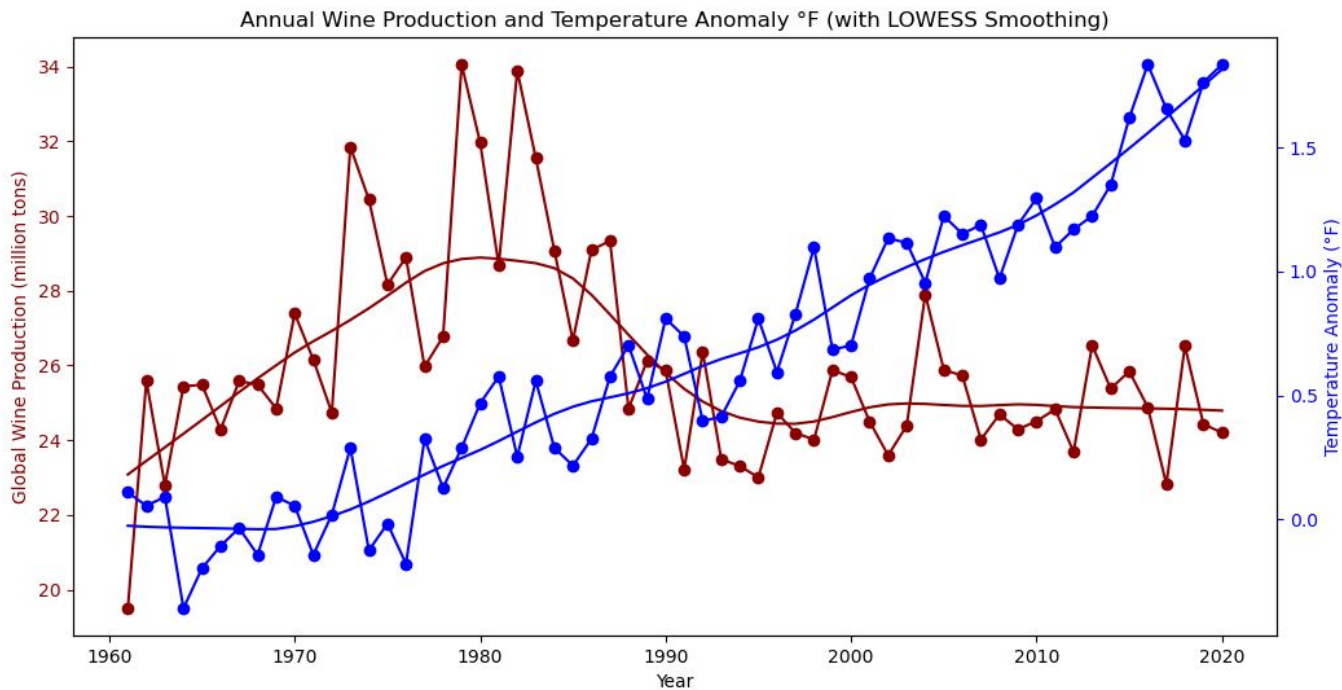


## Global Temperature Anomaly

GISS Surface Temperature Analysis from the NASA Goddard Institute for Space Studies.

Index used to find global annual mean temperature change.

# Global temperatures are rising. Does climate change affect global wine production?

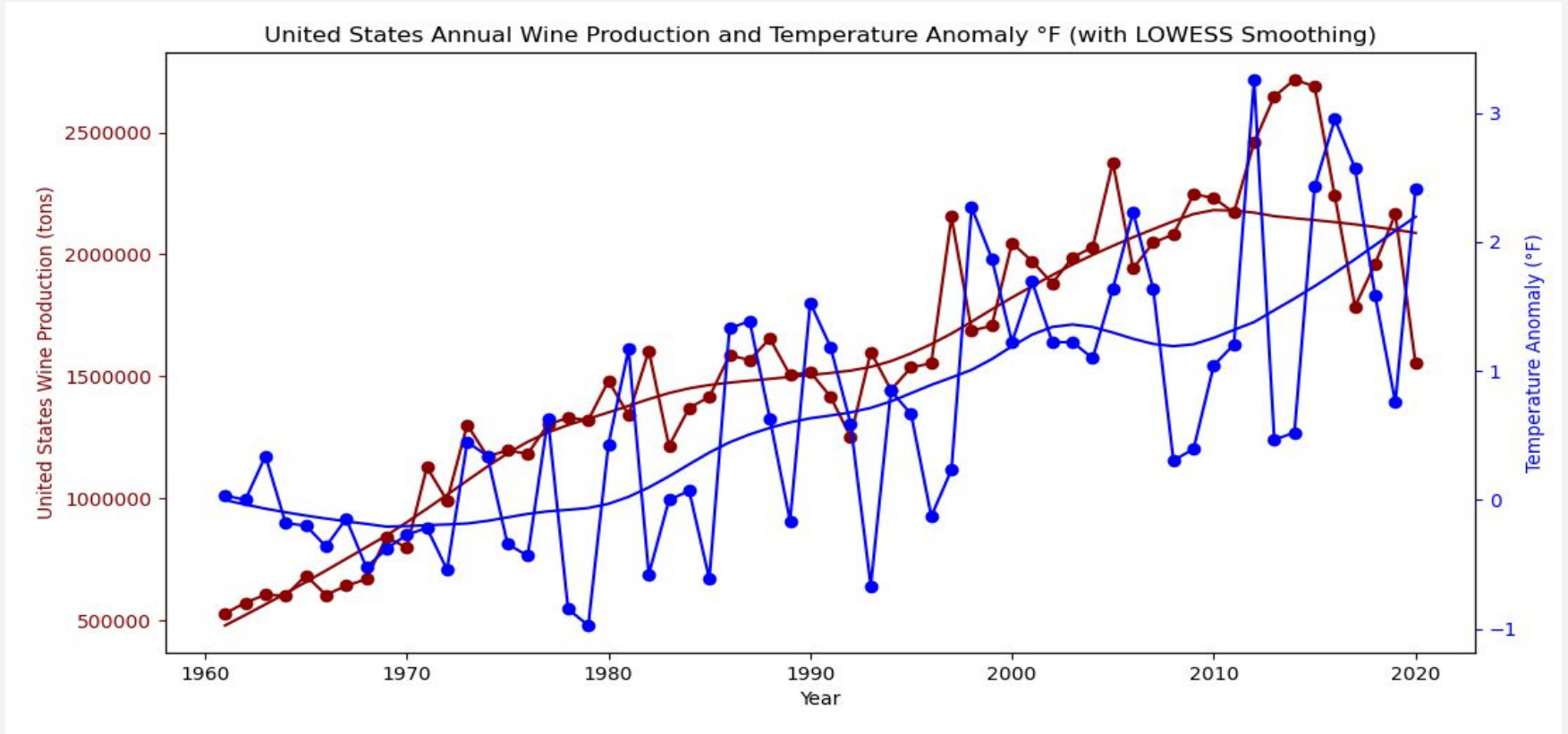


Earth's temperature has risen by 2° F since 1880 (an average of 0.14° F per decade).

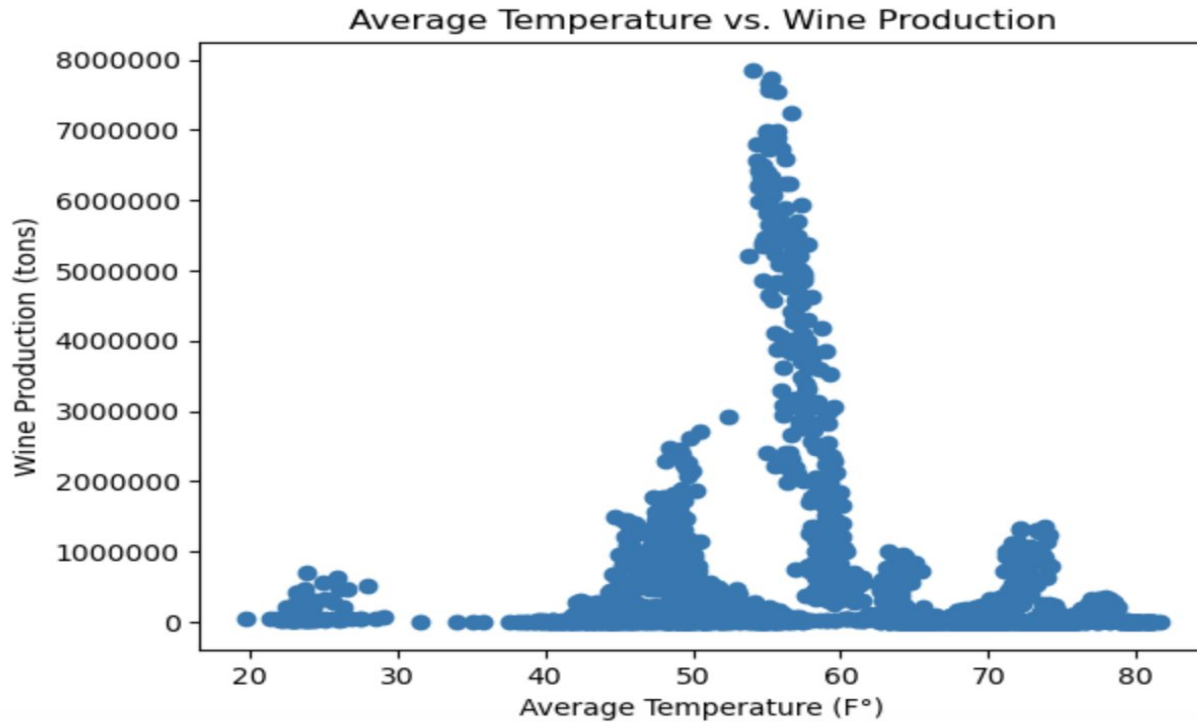
The 21st century is marked by slow growth in global wine production.

A 3.6° F rise in temperature could shrink wine-growing regions by more than half. (National Academy of Sciences, 2020)

# United States.

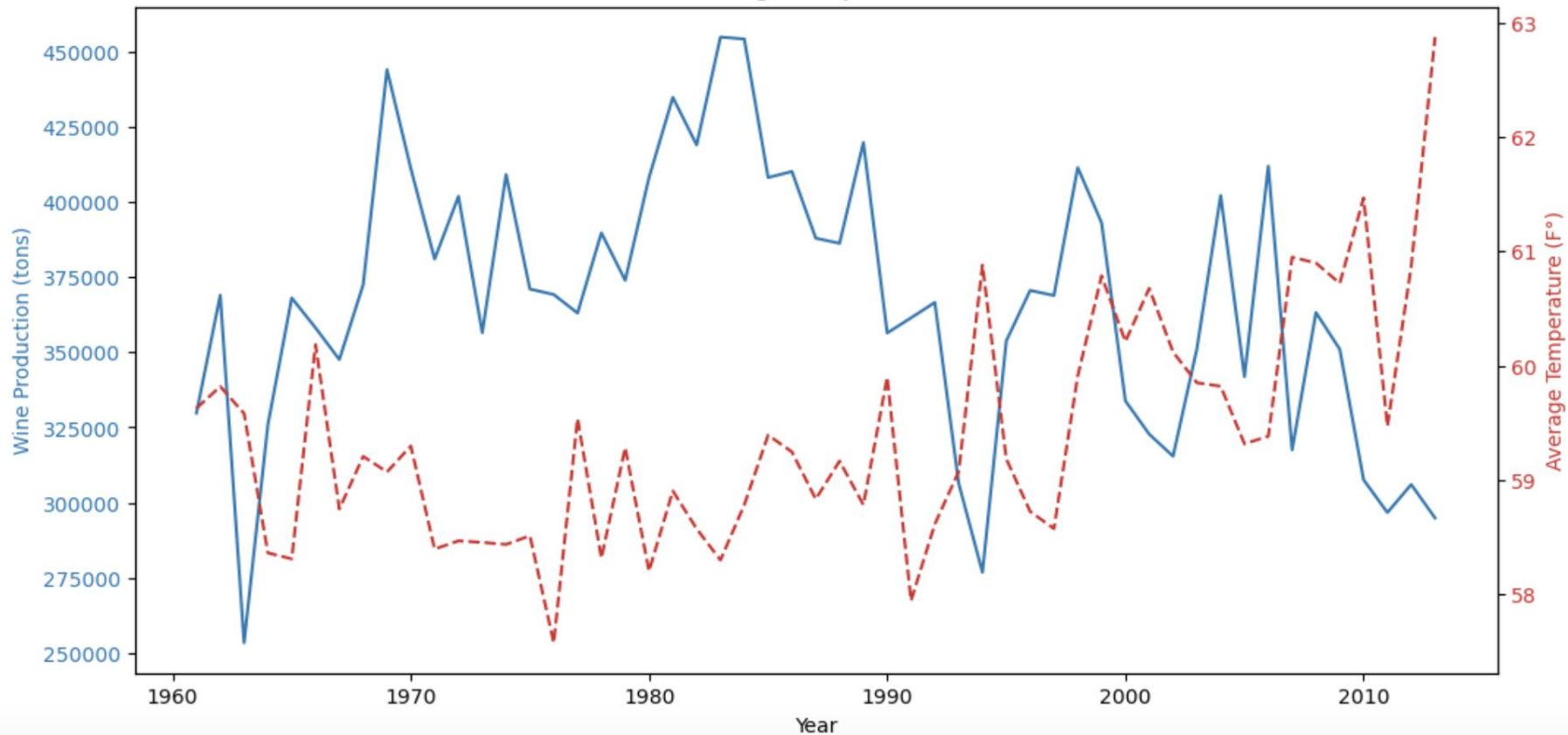


Is there a correlation between rising average temperatures and wine production?



# Greece

Wine Production and Average Temperature in Greece Over Time

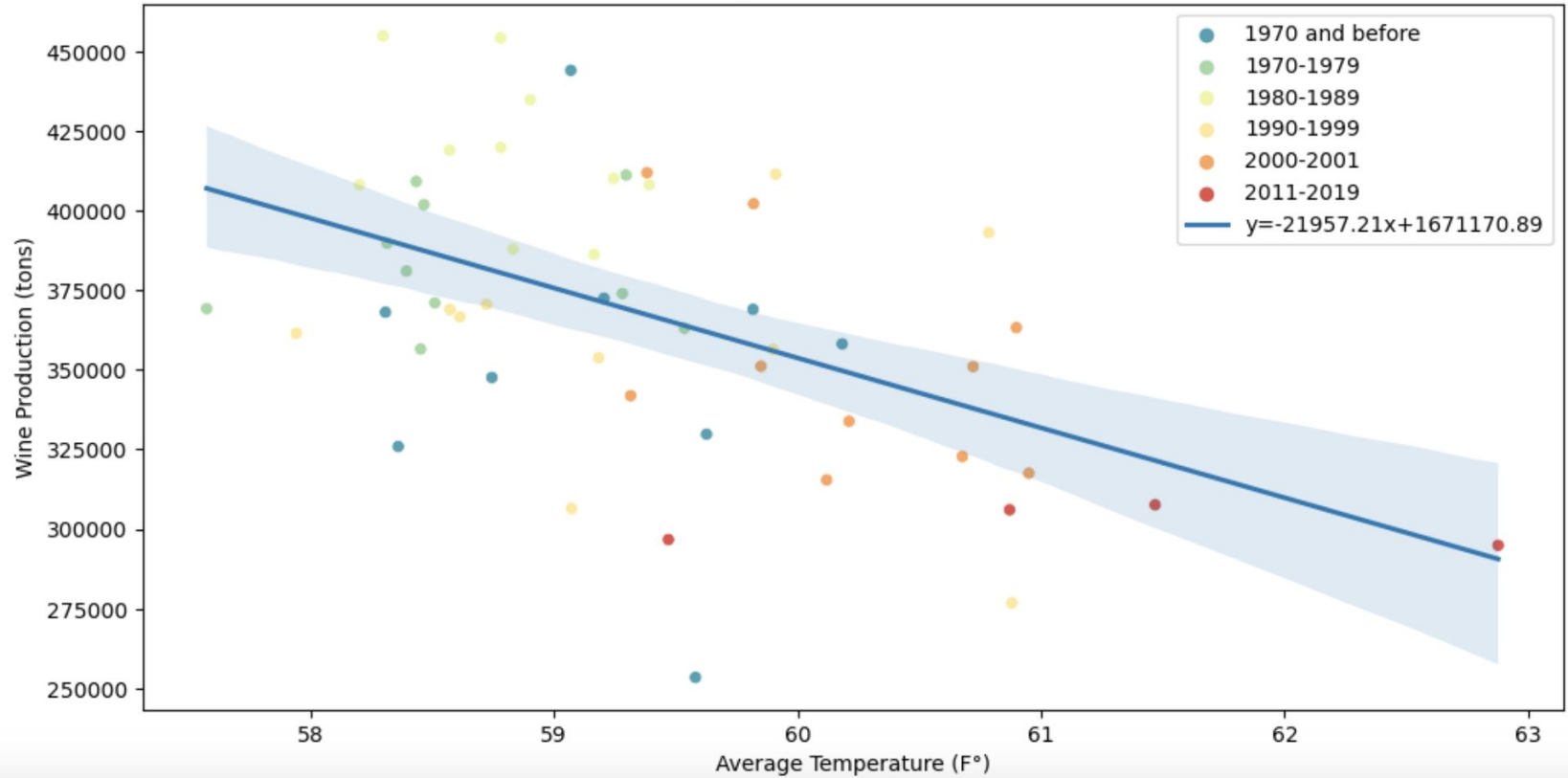


# Greece

Temperature vs. Wine Production in Greece

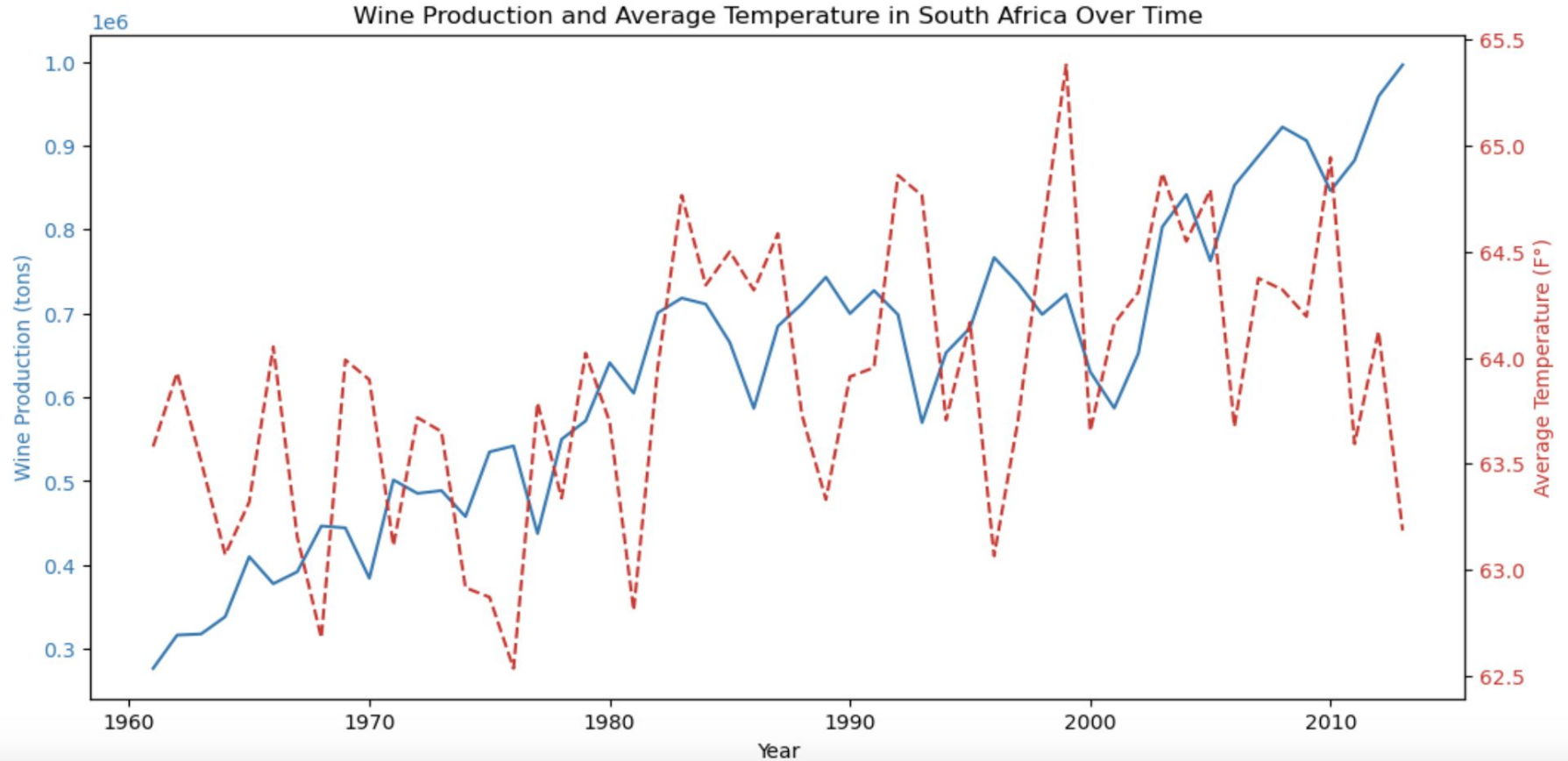
r-value = -0.5004

p-value = 0.0001





# South Africa

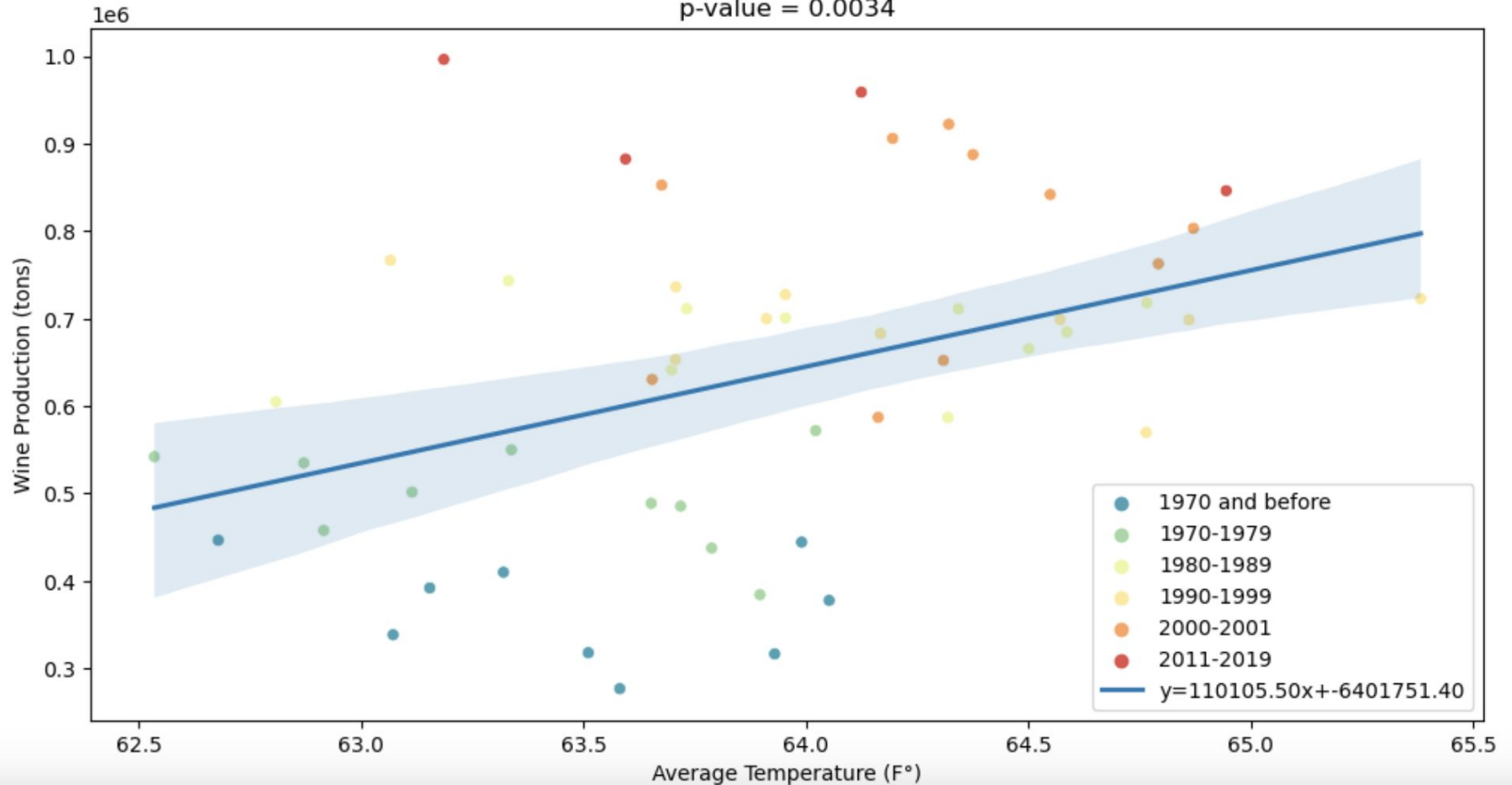


# South Africa

Temperature vs. Wine Production in South Africa

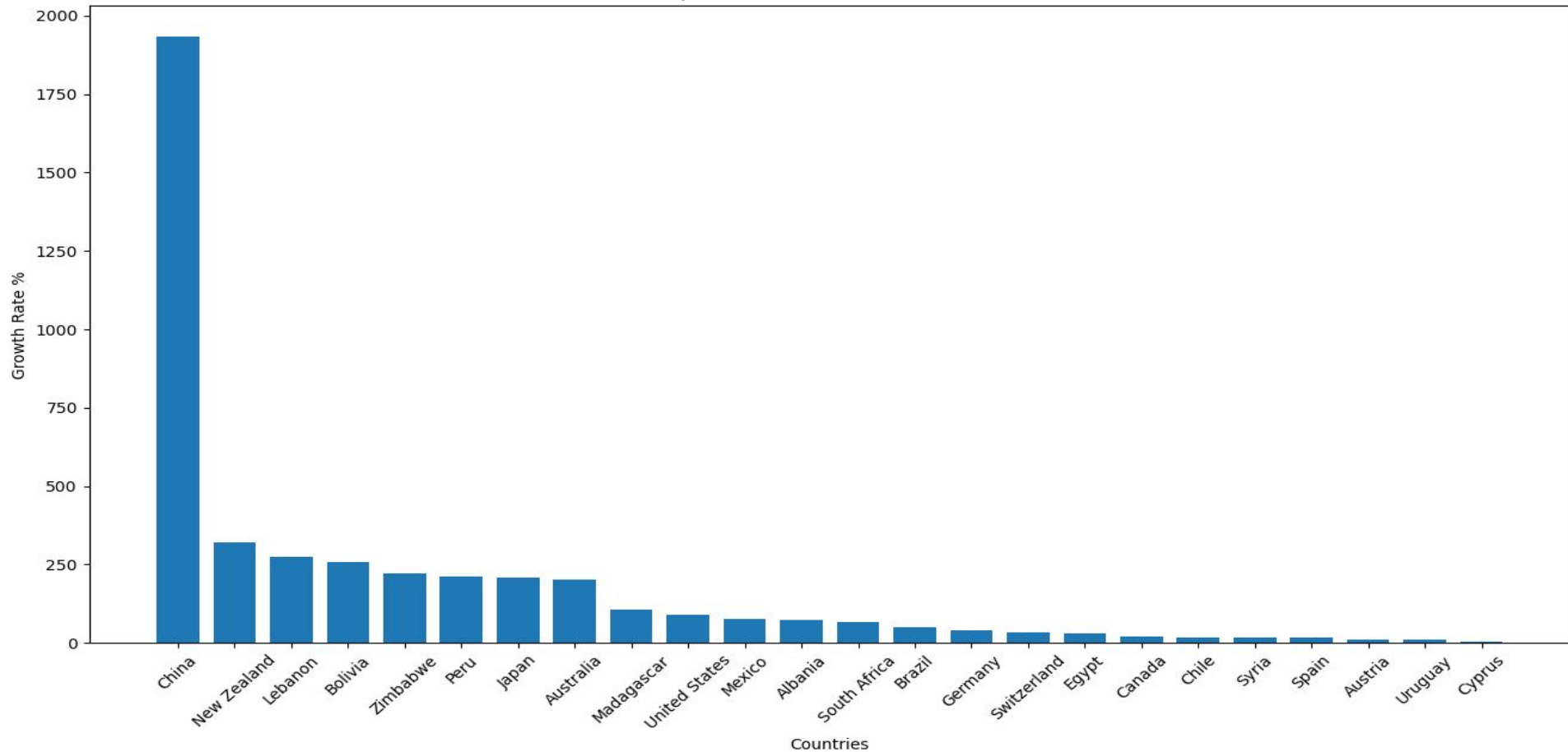
r-value = 0.3947

p-value = 0.0034

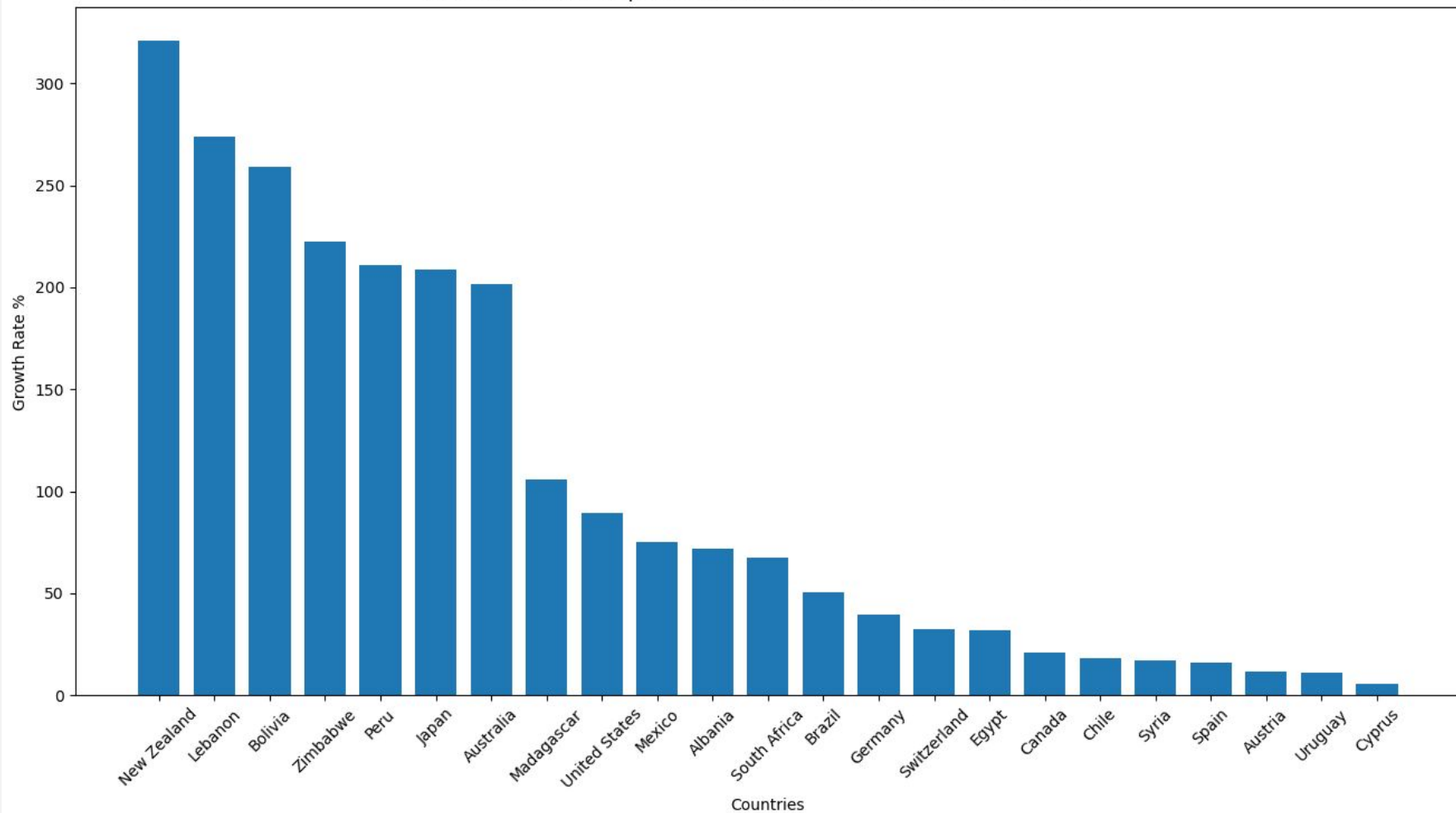


# The Development of New Industry?

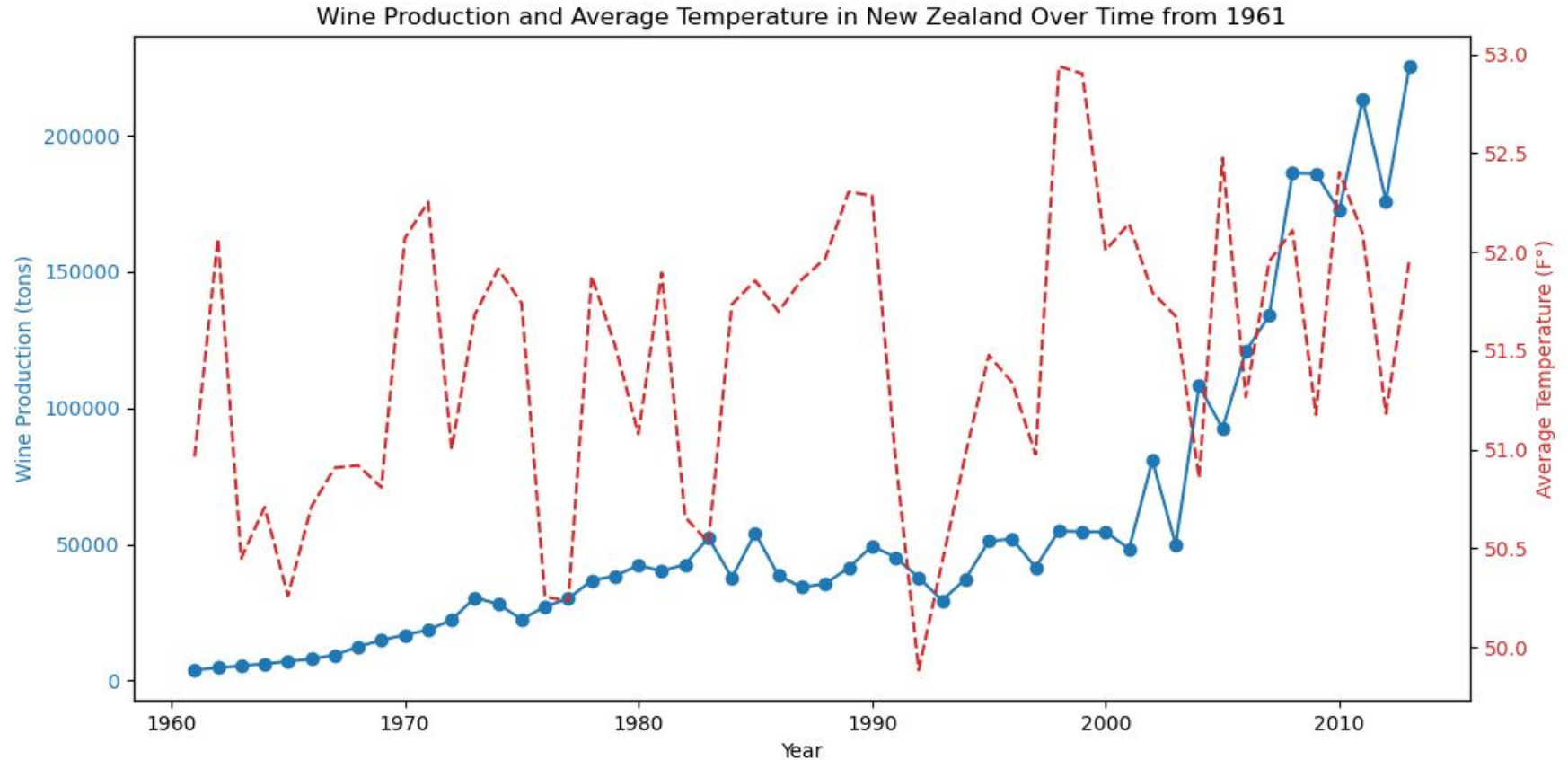
Countries with a Sharp Increase in Wine Production from 1990 to Present



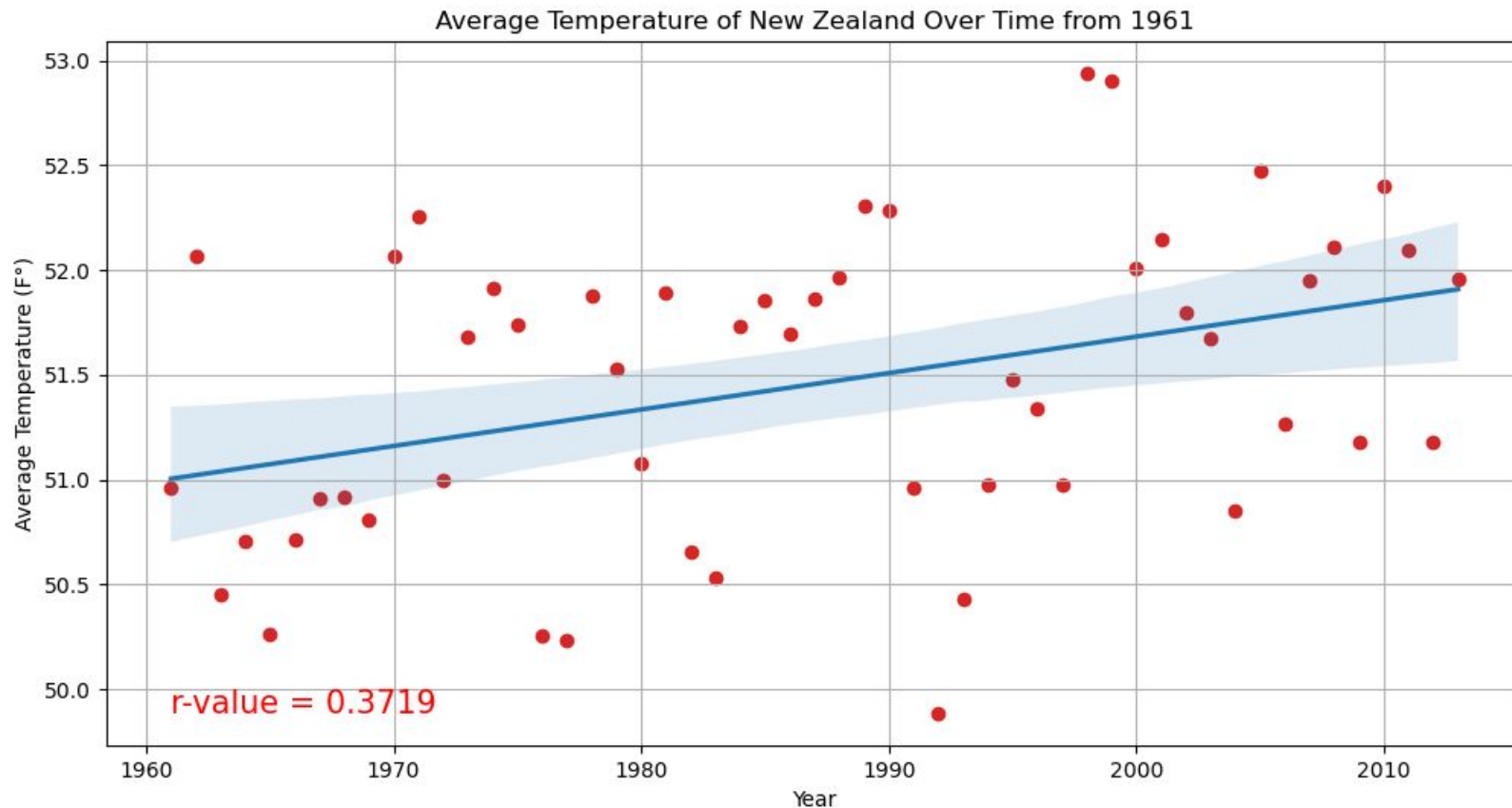
Countries with a Sharp Increase in Wine Production from 1990 to Present



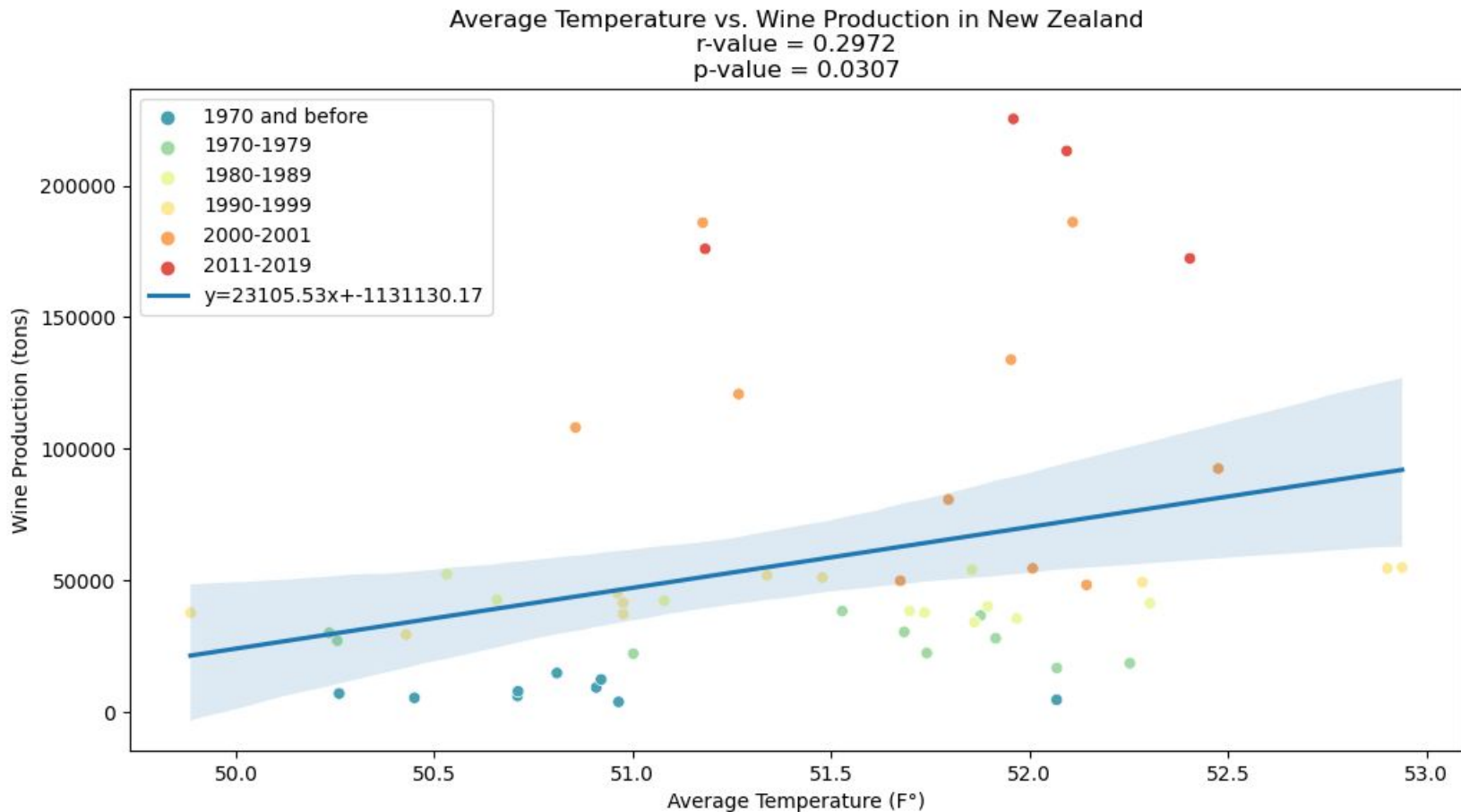
# New Zealand Wine Production from 1961



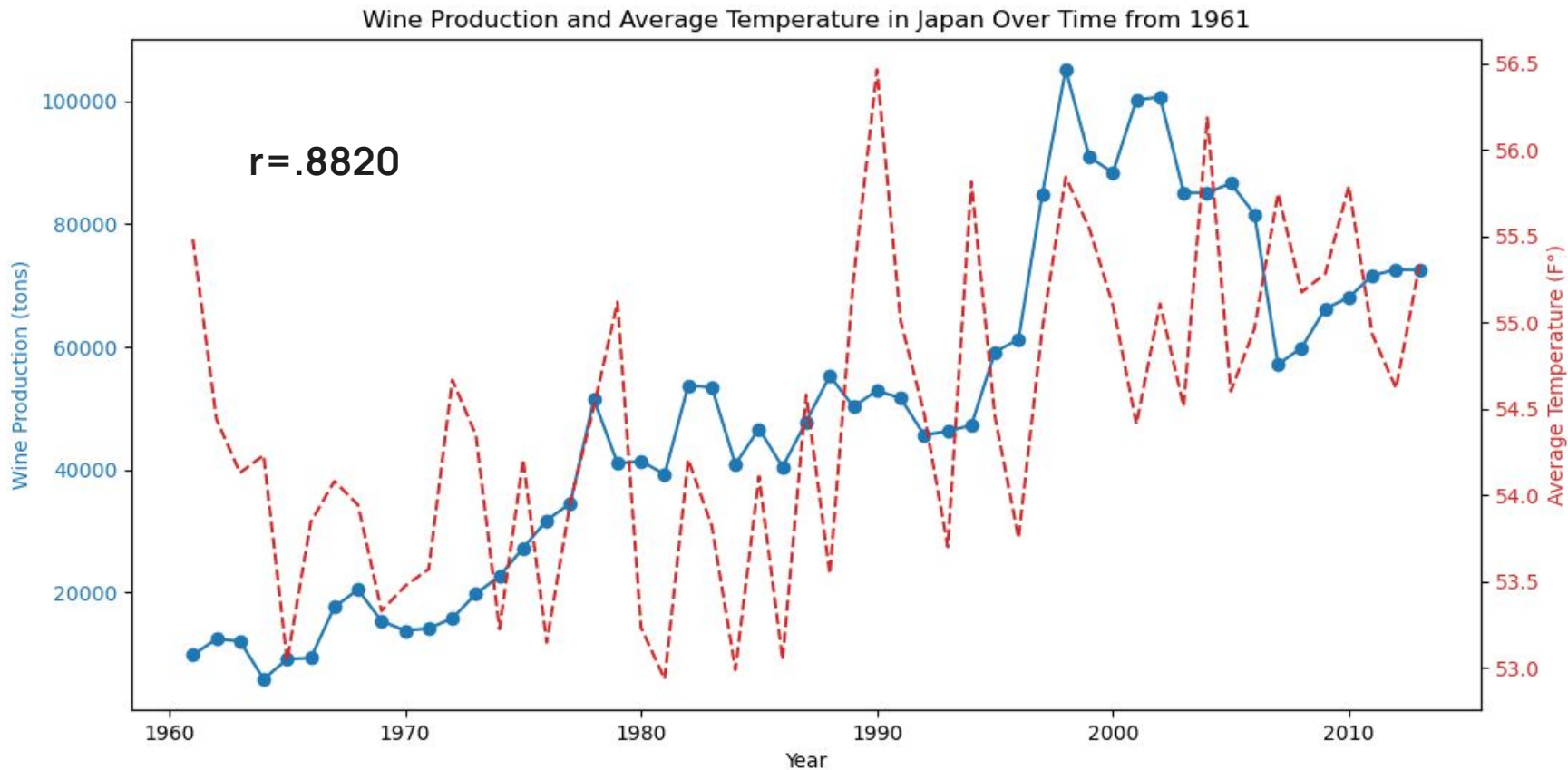
# New Zealand Temperature over time from 1961



# New Zealand Wine Production vs. Avg. Temp. 1961

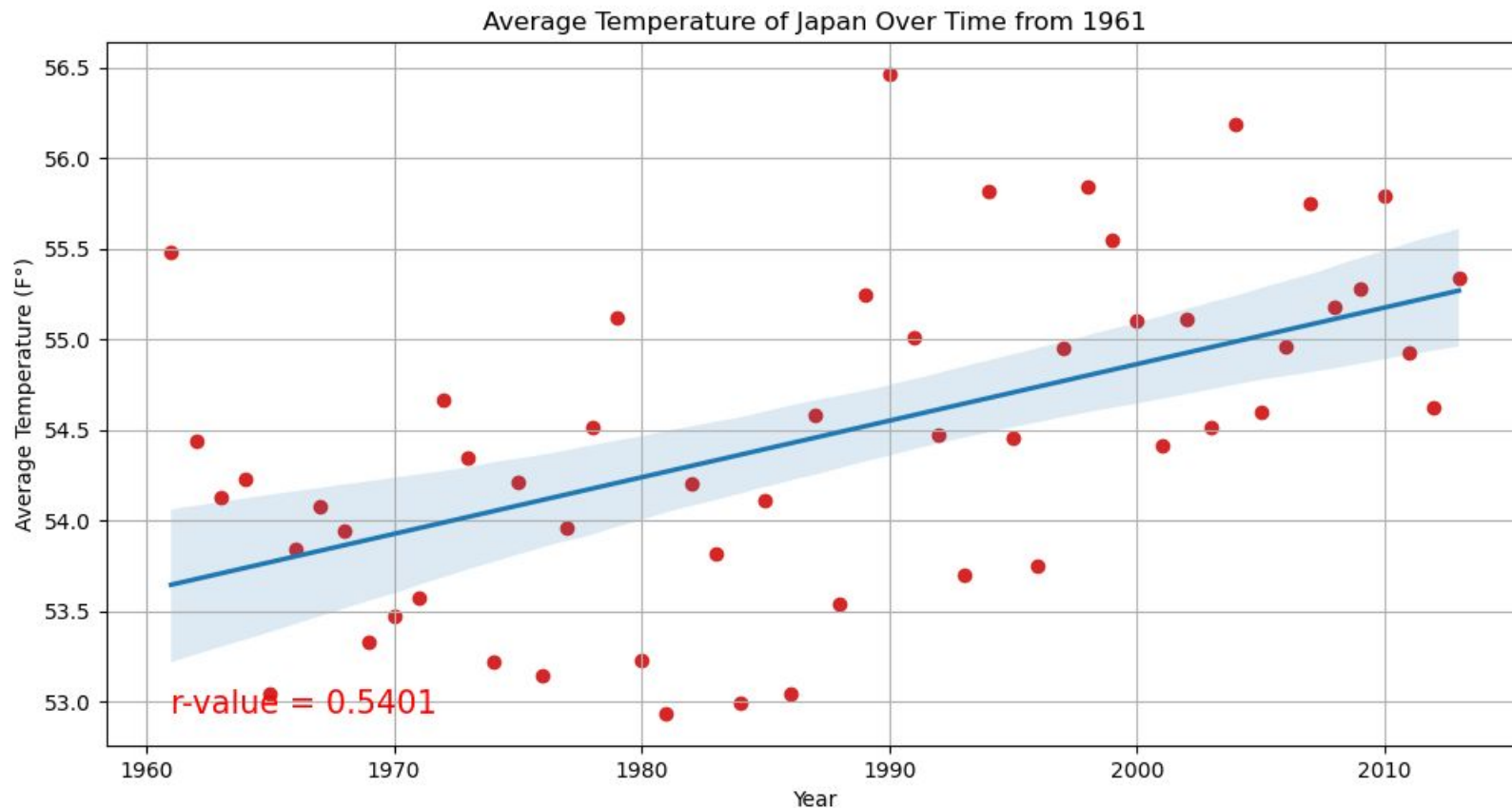


# Japan Wine Production from 1961

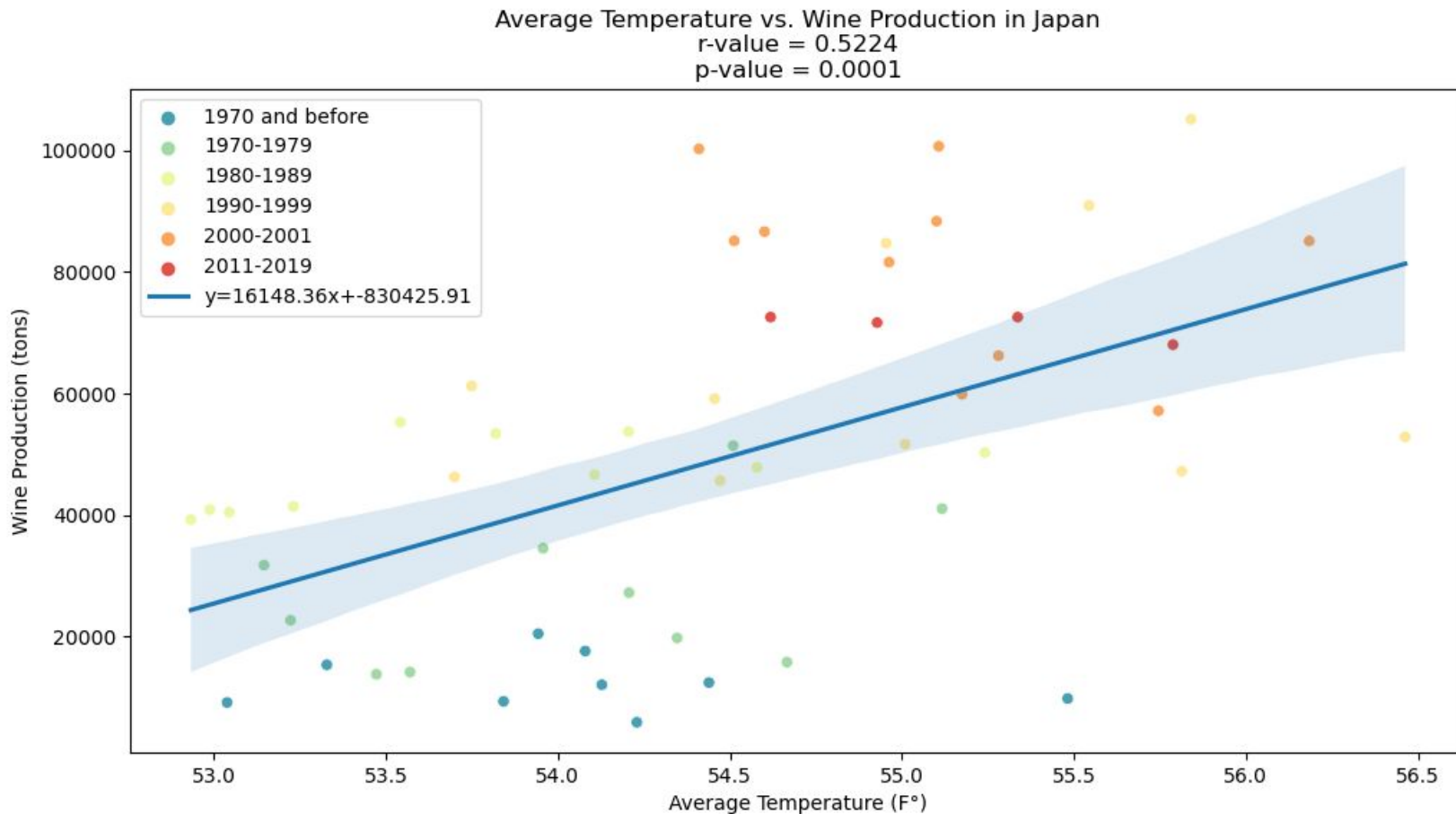




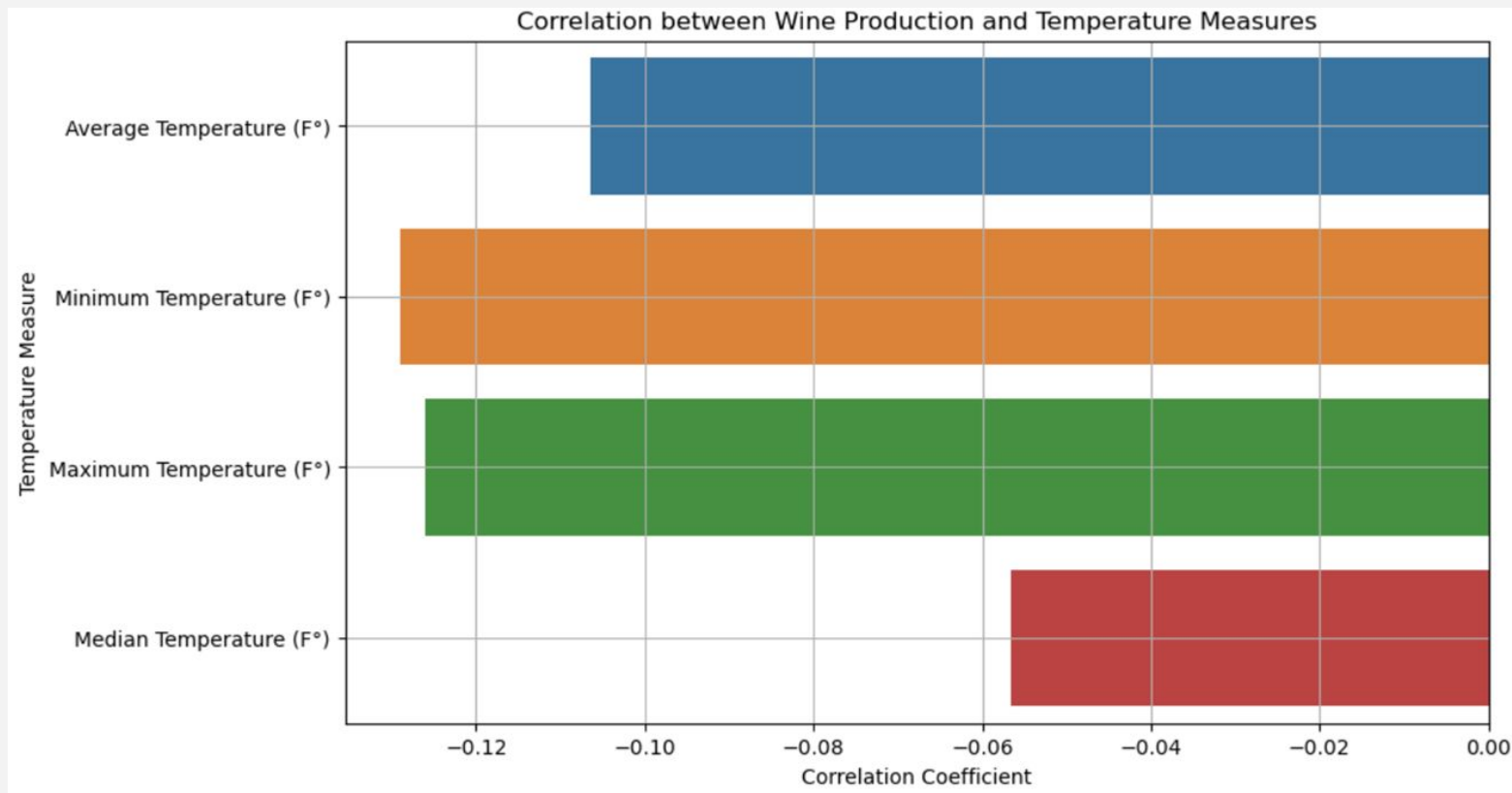
# Japan Temperature over time from 1961



# Japan Wine Production vs. Avg. Temp. from 1961



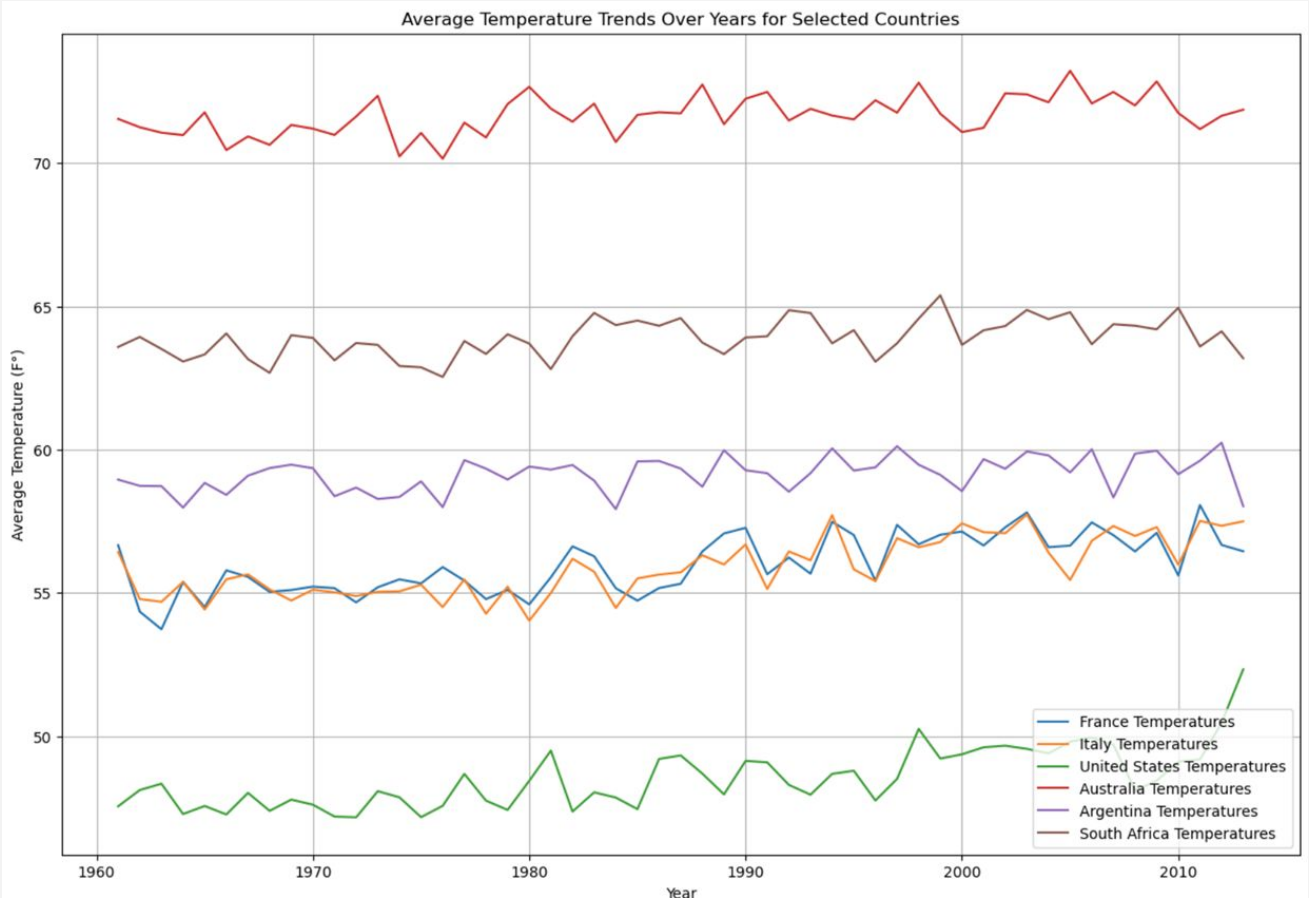
# Correlation between Wine Production and Temperature Measures



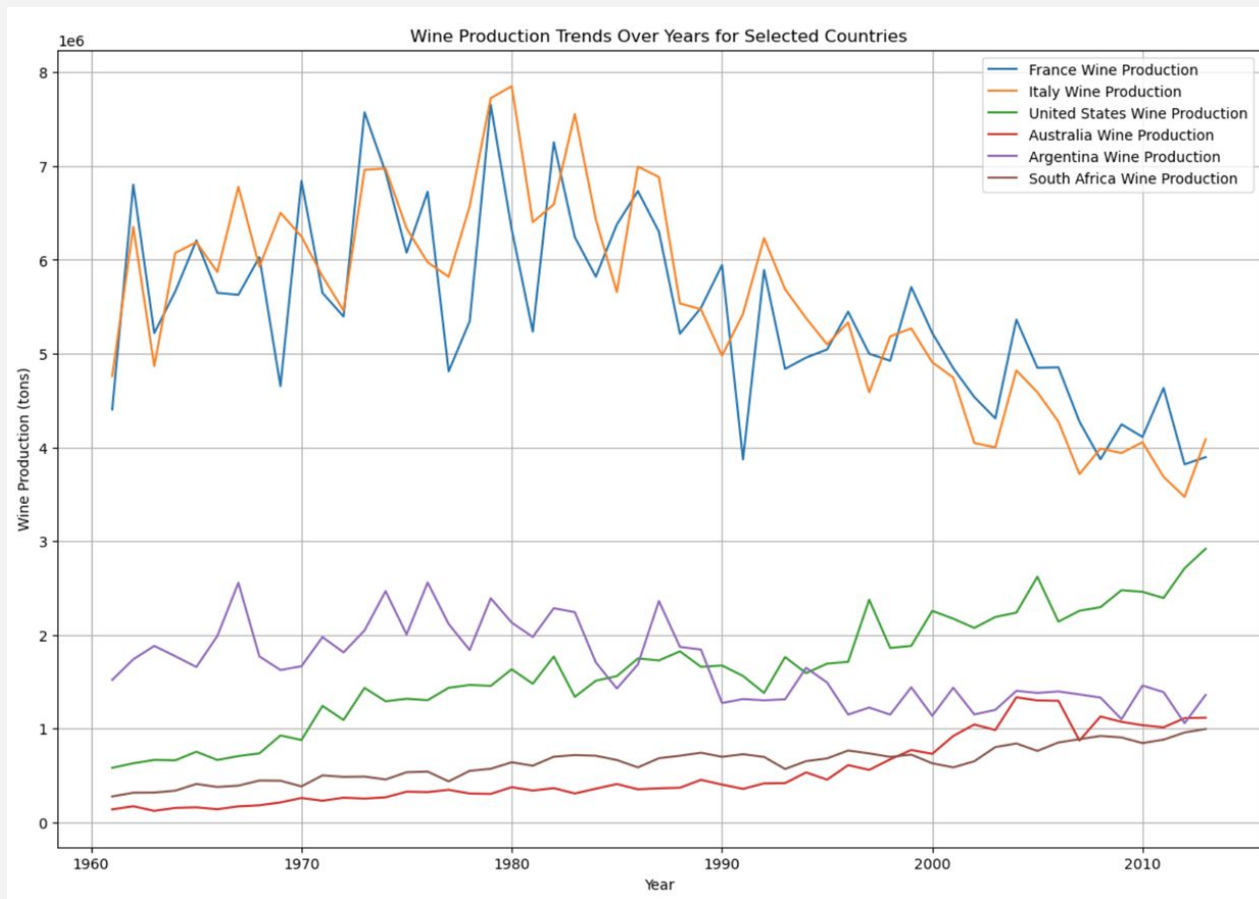
+ 1 indicates a strong positive correlation.  
- 1 indicates a strong negative correlation.

Country ▼	Wine Production over Time r-value ▼	Wine Production & Avg Temp r-value ▼	Avg Temp over Time r-value ▼
China	0.985579355	0.672636254	0.660453752
United States	0.953659126	0.731321388	0.733238543
South Africa	0.927332778	0.394676349	0.47468303
Australia	0.906228221	0.479278575	0.516950086
Japan	0.882033263	0.522426789	0.540057523
Madagascar	0.718339689	0.460039298	0.726527229
Lebanon	0.715645564	0.301678289	0.544691032
Brazil	0.715581469	0.415872405	0.751851197
Turkmenistan	0.544352828	0.608186404	0.568089906
Canada	0.479559711	0.403027147	0.646235079
Egypt	0.428123626	0.423866516	0.634768066
Germany	0.423625575	0.489154258	0.582010557
Switzerland	0.421496304	0.409395396	0.680843218
Romania	-0.305194115	-0.35027299	0.541367009
Panama	-0.394233469	-0.343192959	0.686003597
Azerbaijan	-0.496991505	-0.593077266	0.638046951
France	-0.585813266	-0.469879806	0.714267777
Armenia	-0.610041619	-0.699961418	0.588166942
Argentina	-0.654926456	-0.365813148	0.422380263
Portugal	-0.667351726	-0.409719057	0.658414308
Kyrgyzstan	-0.679054231	-0.47304902	0.506738224
Italy	-0.694110013	-0.724033343	0.754419471
Israel	-0.717155962	-0.61534307	0.569772489
Bulgaria	-0.761971814	-0.608897719	0.563176292
Morocco	-0.778076506	-0.42663944	0.701228299
Reunion	-0.804087314	-0.612311971	0.727920628
Tunisia	-0.817640053	-0.556478972	0.800559348
Algeria	-0.825537438	-0.516540448	0.765803882
Tajikistan	-0.906330595	-0.614039957	0.520220653
Libya	-0.927166056	-0.586175131	0.727026124

# Average Temperature Trends Over Years for Selected Countries



# Wine Production Trends Over Years for Selected Countries



# Conclusion – Results

## **Varied Impact Across Regions:**

Climate change impact on wine production varies significantly across different regions.

France, Italy, the United States, Australia, Argentina, and South Africa show differing trends in temperature changes vs. wine production.

## **Temperature-Wine Production Relationship:**

Temperature fluctuations are related to changes in wine production BUT relationship's strength and direction vary by region.

Some exhibit comparably a more positive correlation, suggesting increased wine production with rising temperatures, while others show a more negative correlation, indicating a potential decrease in production.

# Conclusion Limitations

## **Soil Type**

- Impact on grape growth of different soil types  
*Soil composition, drainage, and pH levels play crucial roles in viticulture*
- Adaptation to Climate Change  
*Resilience of certain soil types to climatic changes*

## **Government Investment in the Wine Industry**

- Research and development:  
*Government funding on viticulture practices that improve resilience to climate change*
- Support policies  
*Subsidies, grants, and other forms of government support to help mitigate climate change effect*

## **Water Availability**

- Water availability and irrigation practices

## **Pest and Disease Pressure**

- Distribution of pests and diseases that affect vineyards via new climate patterns

## **Technological Advancements**

- New technologies in wine production to help cope with climate change

## **Consumer Demand and Market Trends**

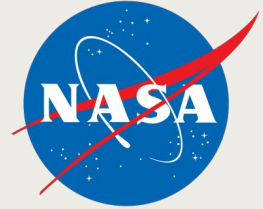
- Consumer preferences, global market dynamics



# Citations

## Global Temperature Anomaly Data

- GISTEMP Team, 2023: GISS Surface Temperature Analysis (GISTEMP), version 4. NASA Goddard Institute for Space Studies. <https://data.giss.nasa.gov/gistemp/>.
- Lenssen, N., G. Schmidt, J. Hansen, M. Menne, A. Persin, R. Ruedy, and D. Zyss, 2019: Improvements in the GISTEMP uncertainty model. J. Geophys. Res. Atmos., 124, no. 12, 6307-6326, doi:10.1029/2018JD029522.



## Wine Production Data

- Food and Agriculture Organization of the United Nations (FAO). License: CC BY-NC-SA 3.0 IGO. Production / Crops and livestock products - Metadata. March 24, 2023. Extracted from: <https://www.fao.org/faostat/en/#data>.



## Temperature Data

- Menne, Matthew J., Imke Durre, Bryant Korzeniewski, Shelley McNeill, Kristy Thomas, Xungang Yin, Steven Anthony, Ron Ray, Russell S. Vose, Byron E. Gleason, and Tamara G. Houston (2012): Global Historical Climatology Network - Daily (GHCN-Daily), Version 3.. NOAA National Climatic Data Center. doi:10.7289/V5D21VHZ.

