

## Do rising temperatures impact economic growth?



Seasonal temperatures, particularly summer temperature, have significant and systematic effects on the U.S. economy, both overall and across a wide range of sectors.



Seasonal temperature affects output growth by changing labor productivity rather than employment.



The effect of summer temperature is strongest in Southern states, where baseline summer temperature is already high.

### CONTEXT

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Research on the effects of temperatures in developed countries has focused on the detrimental effects of higher temperatures on agriculture. Unless other sectors are considered, though, previous findings could be viewed as suggesting that industrialization can insulate economic growth from the effect of rising temperatures. Considering data from multiple sectors in the United States, one of the world's most developed countries, allowed us to examine whether the negative effect of rising temperatures extends beyond agriculture to other sectors and reduces overall output growth.

### THE PROJECT

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We explored the relationship between temperatures and economic growth with weather data from the National Oceanic and Atmospheric Administration and economic data from the U.S. Census Bureau, the U.S. Department of Commerce's Bureau of Economic Analysis, and the Bureau of Labor Statistics. In particular, we considered random fluctuations in average seasonal temperature across years and U.S. states.

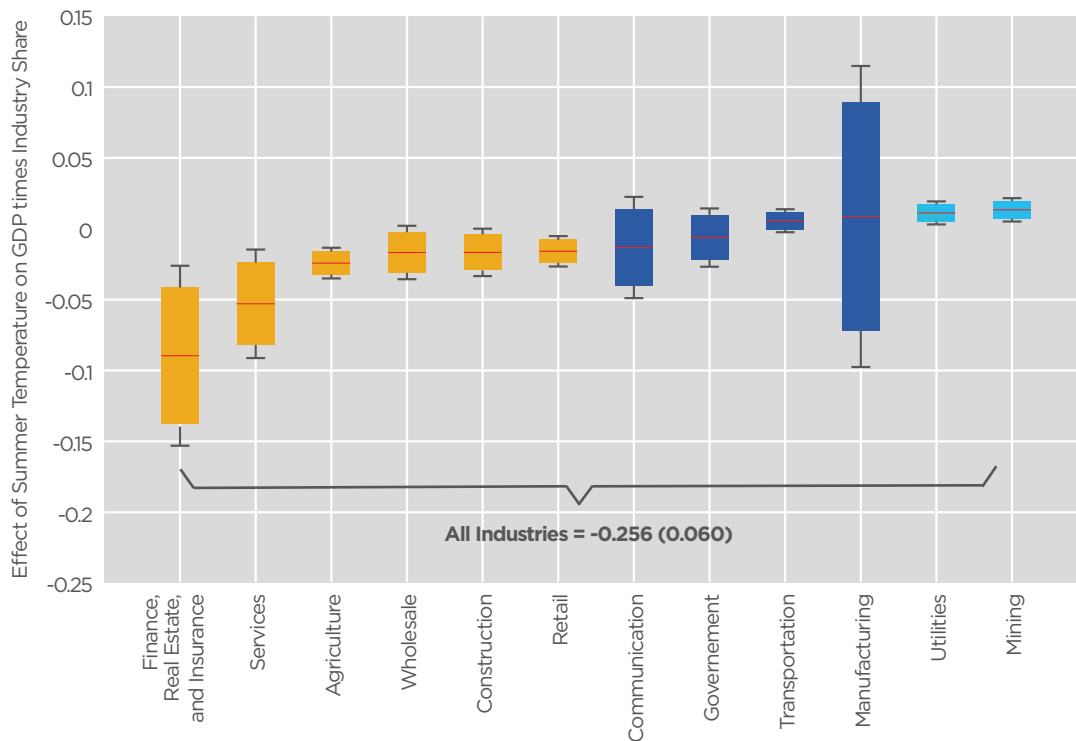
## RESULTS

The results indicate that summer and fall temperatures have opposite effects on economic growth.

1. An increase in average summer temperature reduces state-level GDP growth, while higher average fall temperatures increase growth, although to a lesser extent. The summer effect has been greater than the fall effect in the years studied, and more so in recent years, so that the net effect of rising temperatures has been negative—and large. This implies that the U.S. economy is still sensitive to temperature despite the use of air conditioning and other adaptive technologies.
2. The effect of summer temperature on GDP is particularly strong in states with relatively high summer temperatures, most of which are in the U.S. South. This finding does not appear to be driven by the relatively less developed states of the region.

3. Temperature affects a broad cross-section of economic sectors. In particular, summer temperature reduces the growth rate in many large sectors of the economy. These include finance, services, retail, wholesale, and construction. Only a limited number of sectors, such as utilities—which represents only 1.8 percent of national GDP—benefit from an increase in average summer temperature.
4. Temperature may affect economic activity through its impact on labor productivity. An increase in average summer temperature decreases the annual growth rate of labor productivity, while an increase in average fall temperature has the opposite effect.

## The Effect of Summer Temperature on Economic Growth by Industry



## POLICY IMPLICATIONS

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These results have several implications for policymakers.

1. Expected increases in U.S. temperature are likely to reduce growth rates.
2. In a *business-as-usual* scenario, where no additional mitigation is undertaken and the estimated effects of temperature on growth do not change over the long term, the projected increase in summer and fall temperatures could reduce the growth rate of annual nominal GDP by up to 1.2 percentage points—nearly a third of the historical average of 4 percent.
3. Overall effects on growth, as well as impacts varying across locations and sectors, are likely to present challenges in a wide range of policy areas.

Key concept



### BUSINESS AS USUAL

A baseline case, which assumes that future development trends follow those of the past and no changes in policies will take place.



### FULL STUDY

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[Colacito, R., Hoffmann, B., and Phan, T. Temperature and Growth: A Panel Analysis of the United States](#)

## DEPARTMENT OF RESEARCH AND CHIEF ECONOMIST

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