What Night Lights Reveal about the Impact of the U.S.-China Trade War on China’s Economy


Starting in early 2018, the U.S. and China engaged in a series of high-profile tariff actions that escalated over the next two years. At the height of the trade war, U.S. tariffs affected 14.2% of the value of China’s total exports, or 74.7% of China’s exports to the U.S. in 2017. In response, China enacted retaliatory tariffs on goods from the U.S. that accounted for 5.6% of the value of China’s total imports, or 66% of imports from the U.S. in 2017. Existing research has tended to focus on the impact of the trade war on the U.S. economy. Much less is known about its impact on China due to limited data availability. This research rectifies the gap by identifying and quantifying the effects on per capita income and employment growth across China resulting from both the U.S. tariffs imposed on goods from China and from retaliatory tariffs imposed by China on goods from the U.S.

**INSIGHTS**

- This study finds that following the onset of the U.S.-China trade war in 2018, a 1 percentage point increase in local exposure to U.S. tariffs in China was associated with a 0.59% reduction in nighttime luminosity, representing a 0.28% decrease in income per capita and a 0.18% decrease in manufacturing employment.

- The negative effects of the tariffs were particularly skewed across locations. Up to 70% of China’s population experienced close to zero exposure to the U.S. tariffs. But for the 2.5% of China’s population living in areas with the heaviest exposure, there was an estimated 2.52% decrease in income per capita and a 1.62% decrease in manufacturing employment.

**The data.** Human-generated night lights are known to be brighter in locations with higher concentrations of population or economic activity. Satellite readings of nighttime luminosity have emerged as a widely used proxy for local economic performance, owing to its strong correlation with conventional metrics such as real GDP per capita. Researchers compiled high-resolution readings from nearly 100,000 11km-by-11km grid cells across mainland China from the VIIRS-DNB satellite image dataset and conducted analyses on night light trends from the fourth quarter of 2017 to the fourth quarter of 2019.

Researchers also gathered information from an earlier analysis (Bown 2021) on the timing, definition, and scope of products subject to the tariff hikes associated with U.S.-China trade from January 2018 through September 2019, prior to the Phase One Trade Agreement. They complemented these tariff data with information from Most Favored Nation tariff schedules compiled by China’s General Administration of Customs to account for any discretionary changes made by China’s authorities since 2017.

To determine each grid cell’s exposure to the tariffs, researchers examined China’s 2016 customs data and pinpointed the geo-location of each trading firm in China using Google Maps AP and Amap geo-coordinates (maintained by the Alibaba Group). Using this location data, they calculated the baseline level of export and import activities in each grid cell.

Lastly, researchers collected the prefecture-level GDP per capita and manufacturing employment data from various years of the China City Statistics Yearbook and linked these economic outcomes to local nighttime luminosity prior to the trade war. They then ascertained the changes in night lights luminosity across grid cells after the start of the 2018 tariff war and used the ratio derived from the pre-trade war data to estimate the changes in local GDP per capita and manufacturing employment implied by the observed changes in luminosity.
**INSIGHTS**

- 2.5% of China’s population in areas hit with the largest U.S. tariff shocks were located in close to two-thirds of China’s prefectures (203 prefectures) spread across the country.

- Researchers found no significant effects from the retaliatory tariffs China levied on imports from the U.S. on the intensity of China’s night lights.

**Nighttime luminosity adversely affected by tariffs.** Researchers identified a negative correlation between increased tariffs imposed by the U.S. on China and nighttime luminosity in China from September 2017 to December 2019. Each 1 percentage point increase in the exposure of a grid location to U.S. tariffs was associated with a 0.59% reduction in nighttime luminosity. This translated into a decrease in income per capita of 0.28% and a fall in manufacturing employment of 0.18%.

**Differential impacts of U.S. tariffs on income per capita and manufacturing employment.** The researchers also found that there were differential impacts across grids in the severity of exposure to the U.S. tariffs. Up to 70% of China’s population experienced close to zero or minimal exposure to the U.S. tariffs. At the other end of the spectrum, 2.5% of the population located in grids with the largest U.S. tariff shocks saw an estimated 2.52% decrease in income per capita and a 1.62% decrease in manufacturing employment relative to unaffected grids. These grids that experienced the largest U.S. tariff shocks, furthermore, were located in close to two-thirds of China’s prefectures (203 prefectures) spread across the country.

Researchers also suggest that these calculations are most likely lower-bound estimates of the full adverse impact on per capita income and manufacturing employment in China. According to their analysis, even grids with no direct U.S. tariff exposure were probably impacted by negative spillovers from economic interactions with impacted firms located in other parts of China.

**China’s retaliatory tariffs result in no significant effects.** Although China’s retaliatory tariffs levied on imports from the U.S. could have exerted a drag on China’s local economy by raising the cost of inputs from the U.S., researchers found no significant effects on China’s night lights intensity from China’s retaliatory tariffs.

**China’s economy adversely impacted by U.S. tariffs.** By using satellite readings on nighttime luminosity, this study offers one of the few existing analyses of the impact of the U.S.-China tariff war on China’s economy. According to this research, the U.S.-China trade war exerted downward pressures on China’s income per capita and manufacturing employment in areas directly exposed to the U.S. tariff shocks. Moreover, researchers found that negative impacts of U.S. tariffs on night lights continued into 2020, suggesting that the tariff war could have been a contributing factor in the overall contraction of China’s local economic activity during the early months of the COVID-19 pandemic.