

# When Cryptomining Comes to Town: High Electricity-Use Spillovers to the Local Economy

Based on BFI Working Paper 2023-78, [\*“When Cryptomining Comes to Town: High Electricity-Use Spillovers to the Local Economy,”\*](#) by Matteo Benetton, University of California, Berkeley; Giovanni Compiani, Chicago Booth; and Adair Morse, University of California, Berkeley

*Households and small businesses paid an extra \$204 million and \$92 million annually, respectively, in Upstate New York because of increased electricity consumption from cryptominers; while in China, where electricity prices are fixed, rationing of electricity in cities with cryptomining deteriorates wages and investments.*

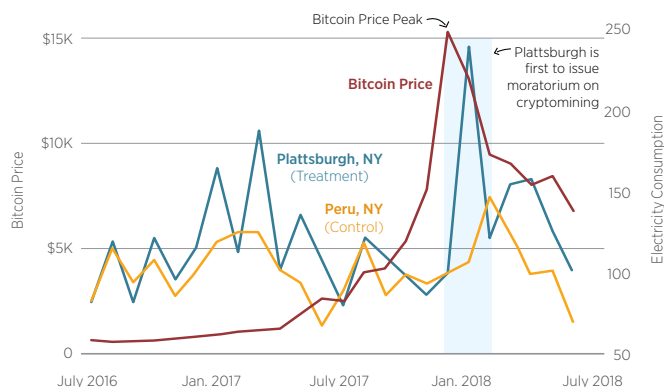
High energy use is increasingly a feature of many technology processing industries, including quantum computing, artificial intelligence, natural language processing, and cryptocurrency mining (cryptomining). For example, data centers and Bitcoin mining alone consume 0.9% and 0.5% of global electricity, respectively.

This electricity consumption results in what economists describe as externalities, or the costs and benefits of an activity to an uninvolved third party. In this case, intensive electricity use can cause two negative externalities. The first is the carbon emission resulting from electricity production of cryptomining, with recent studies estimating that global emissions from Bitcoin mining alone equal the emissions produced by Pakistan.

This paper concerns a second, unstudied externality, the real effects of technology processing on local economies. What, for example, are the spillovers from cryptomining on households and small businesses? How does the interaction of supply and demand impact prices and delivery of electricity to homes and businesses? As we shall see below, cryptomining also has positive externalities in that cryptomines produce local tax revenues, raising questions for the authors about net costs and benefits.

Before describing the authors' methodology and findings, a note about cryptomining, which is the clearing of payment transactions for certain decentralized blockchain-based

**Figure 1 • Bitcoin Prices and Electricity Consumption**



Note: This Figure shows monthly electricity consumption for businesses in the town of Plattsburgh, NY, and the neighboring town of Peru. Before the end of 2017, Plattsburgh and Peru experienced a similar pattern in electricity consumption for businesses. However, in January 2018, when the Bitcoin price peaked, electricity consumption by Plattsburgh businesses increased by almost 150%, whereas almost no change to the seasonal pattern occurred in Peru. The red line shows the average price of Bitcoin each month. The blue line and the yellow line show total electricity consumption by small and industrial businesses in Plattsburgh and Peru, respectively. The authors normalize electricity consumption in each town to 100 in December 2017, which is the month in which Bitcoin prices reached their maximum of around \$15,000. Gray areas denote December, January and February of 2016-2017 and 2017-2018.

payment systems called (proof-of-work) cryptocurrencies. Any person or firm can become a cryptominer, which means solving increasingly complex computational puzzles to verify the validity of transactions. This has led to an arms race among firms who run large cryptomines, essentially warehouses full of specialized computers, crunching

numbers across the world. And the key point here is that these cryptomines need lots of electricity.

The authors analyze the negative externalities of the high electricity use of cryptomining through two channels: prices, and quantity rationing. In the first case, the authors study New York State, specifically Upstate NY, excluding New York City and Long Island, which was an early market for cryptomining in the United States due to its cold climate, cheap electricity, and proximity to large hydropower sources. The region's grid operator employs a marginal supply pricing algorithm, whereby upward pressure on prices from demand gets passed to households and small businesses. The authors combine detailed data on these local electricity prices, electricity usage, and other economic outcomes with hand-collected data on the likely location of cryptominers, to analyze whether and how the use of electricity by cryptominers affects local communities. Their findings include the following:

- When Bitcoin prices are high, the returns from cryptomining are higher in expectation since the reward to miners is paid in Bitcoins. Thus, a higher Bitcoin price increases the demand for electricity by cryptominers.
- There is a statistically significant, negative price elasticity of demand for electricity by the local communities, meaning that as the price of electricity rises, demand falls. These higher prices also lead to larger surpluses for electricity producers.
- There is a positive and significant effect of cryptomining on tax generation. Treated communities experience a relative increase in taxes per capita by \$6 dollars compared to control communities when the price of Bitcoin increases by 100%. To put these numbers in perspective, the price of Bitcoin increased from about \$600 in 2016 to \$7,500 in 2018, which could have led to higher taxes per capita in cryptomining communities by about \$70, or 14% of the average tax revenue per capita.
- Cryptomining leads the average household and small business in New York to pay an extra \$88 and \$168 in their electricity bills per year, respectively. In aggregate, Upstate NY households and small businesses pay \$204 million and \$92 million more annually, respectively.

- When accounting for the differential increase in government revenues, cryptomining towns in Upstate NY generate almost \$40 million in additional government revenues, thus recovering about 14% of the losses. As a result, the authors estimate a net consumer surplus loss of \$257 million in Upstate NY.

As noted, the authors also study the negative externalities of the high electricity use of cryptomining through quantity rationing. To do so, the authors turn to China, which hosted 65-82% of the world's cryptomining during the last decade before a ban in 2021. Other details aside, in a quantity rationing system, when total demand increases, prices do not adjust; rather, the electricity supply is rationed among locations to align with physical infrastructure. The authors study 52 inland China city-areas to find the following:

- After cryptomining enters a city, local fixed asset investments decline annually by 19%, and wage levels decline by 10%, suggesting that cryptomining tends to crowd out other business uses of electricity.
- These results also suggest that the crowded-out industrial uses of electricity would have led to larger investments in the physical and human capital of the local economy in the years following the entry of cryptomining. To put a number on it: Cryptomining entry is associated with a statistically significant drop in local GDP of 8.2%.
- Taken together, these findings suggest that local economies could suffer as a result of crowding out in the electricity market.

**Bottom line:** This paper presents novel empirical evidence of the real effects of cryptomining on local economies. For US policymakers, the optimal response is likely not to ban cryptomining, which would only shift the problem elsewhere and restrict any possible tax revenue gains. Rather, the more optimal response is likely the development of electricity pricing schemes or dynamic quotas that minimize the adverse impact on the local community.

## READ THE WORKING PAPER

NO. 2023-78 · JUNE 2023

### **When Cryptomining Comes to Town: High Electricity-Use Spillovers to the Local Economy**

[bfi.uchicago.edu/working-paper/2023-78](https://bfi.uchicago.edu/working-paper/2023-78)

## ABOUT OUR SCHOLAR



### **Giovanni Compiani**

Assistant Professor of Marketing, Chicago Booth  
[chicagobooth.edu/faculty/directory/c/  
giovanni-compiani](https://chicagobooth.edu/faculty/directory/c/giovanni-compiani)

