

Cambridge Judge Business School

BEHIND THE SCENES:

A CRITICAL ASSESSMENT OF THE BITCOIN SUSTAINABILITY DEBATE

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UNIVERSITY OF
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Bitcoin's environmental footprint in the spotlight

We need to ban Bitcoin now. Before it burns the world up ~ GQ Magazine (14/05/2021)



Bitcoin requires so much computing activity that it eats up more energy than entire countries. One of the easiest and least disruptive things we can do to fight the [#ClimateCrisis](#) is to crack down on environmentally wasteful cryptocurrencies.



Prof. [@lawrencegbaxter](#)'s op-ed in [@thehill](#) calls on regulators to address the escalating environmental impact of cryptocurrency. They should "stop the counterproductive growth of this industry, no matter how potent their lobbying forces have become."

Wood's ARK Says Bitcoin Mining Can Be Good for the Planet ~ Bloomberg (22/04/2021)

Bitcoin is Key to an Abundant, Clean Energy Future ~ Square (21/04/2021)

...

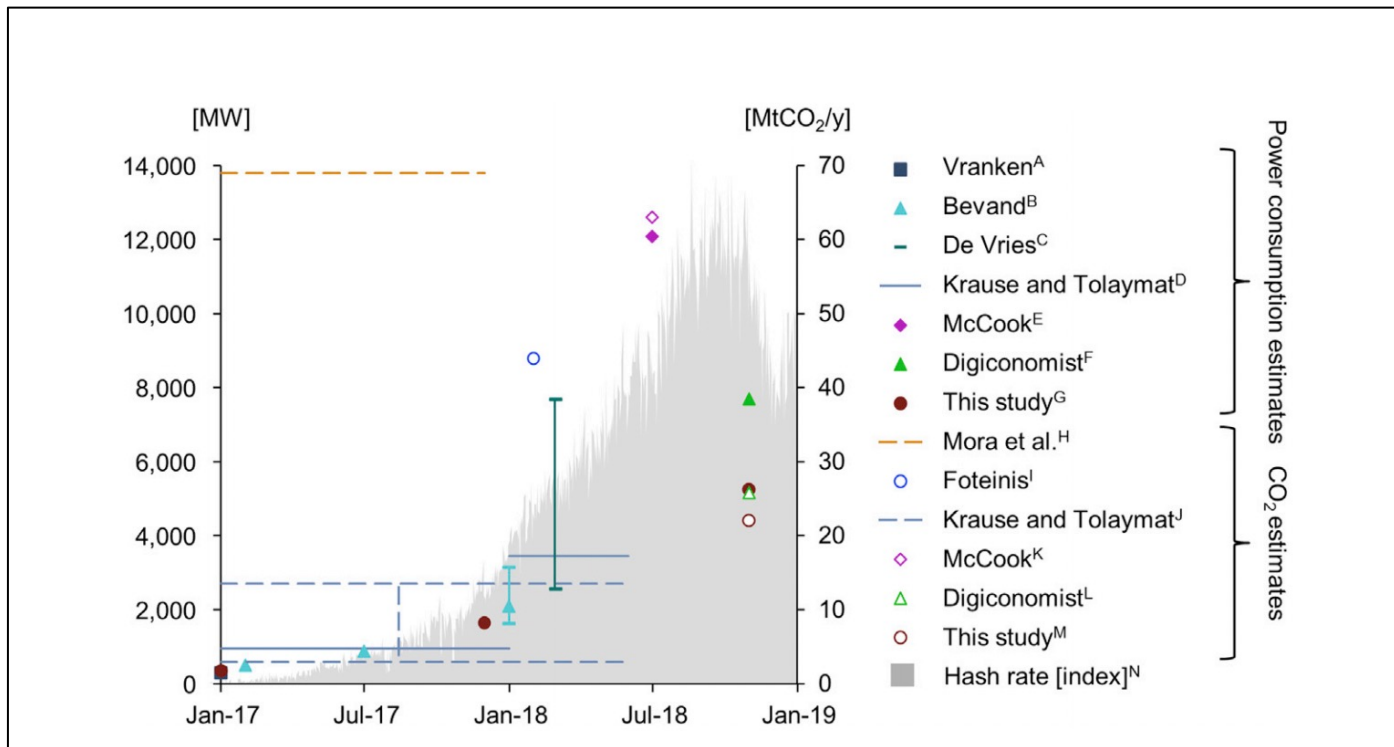
BITCOIN WILL SAVE OUR EARTH

~ Bitcoin Magazine (25/03/2021)

What does the data say?



... it depends on the study design.



Source: Stoll, Christian; Klaaßen, Lena & Gellersdörfer, Ulrich (2019). The Carbon Footprint of Bitcoin. Joule. 3. 10.1016/j.joule.2019.05.012.

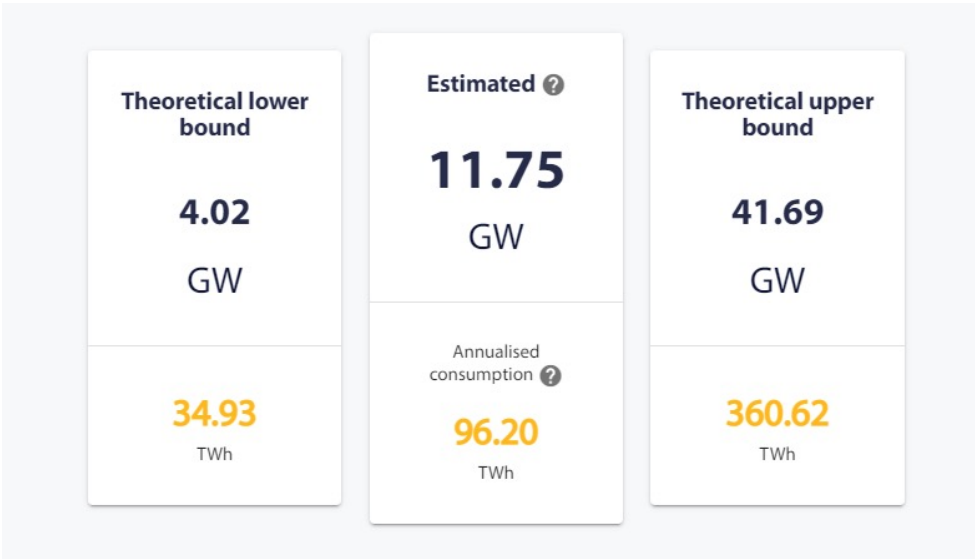
Limitations of the model

Every model is an incomplete representation of reality that relies on specific assumptions, some of which may be debatable. As a result, every model has limitations that need to be discussed. In particular, the current CBECI model exhibits the following limitations (the list is non-exhaustive):

- **Strong dependence on electricity cost estimate:** electricity costs can significantly vary from one country, region, and provider to another. Prices are generally dynamic and adjustable, often according to seasonal circumstances, the quantity of electricity consumed, and other factors. Modifying the default electricity cost assumption can substantially change the model output.
- **Ignoring other cost factors:** other potential factors that influence the decision of miners to switch off and/or replace existing equipment have not been incorporated into the model (e.g. maintenance and cooling costs).
- **Simplistic weighting of profitable hardware:** assuming that all profitable equipment is equally distributed among miners is unrealistic given that not all hardware is produced in equal quantities and readily available. The exact market share is unknown, although existing data suggests that a few large manufacturers dominate the market. The lack of reliable longitudinal market share data impacts all bottom-up approaches.
- **Hardware selection:** we may not be aware of new and more efficient hardware that is not yet available on the market. Some have argued that manufacturers are using proprietary equipment to their own benefits before public release.⁵
- **Hardware specifications may not correspond to real performance:** hardware manufacturers often advertise the performance and energy efficiency of their products using best case scenarios. Furthermore, miners may decide to overclock or underclock their machines for various reasons, which the model does not take into account.
- **Short switching periods:** it is unlikely that miners are able to react as quickly to short-term changes in the profitability threshold. While we attempt to smoothen the effect of short-term hashrate variations and price volatility, applying a moving average of 14 days (profitability threshold), may not be sufficient.

While most limitations do not have a major impact on the performance of the model, we are aware of its imperfections. The CBECI is an ongoing project that is maintained on a continuous basis. The model will be refined in response to changing circumstances, with all changes being transparently highlighted in the [Change Log](#).

CBECI I: Power consumption



Source: CBECI (13/09/2021)

Bitcoin electricity consumption, TWh (annualised)

Select an area by dragging across the lower chart



Source: CBECI (13/09/2021)

But where does the power come from?



2.31 million
metric Tonnes



78.88 million
metric Tonnes

VS

Assumptions:

- (1) Electricity consumption: 96.20 TWh
- (2) Emissions: 24 gCO₂eq/kWh*

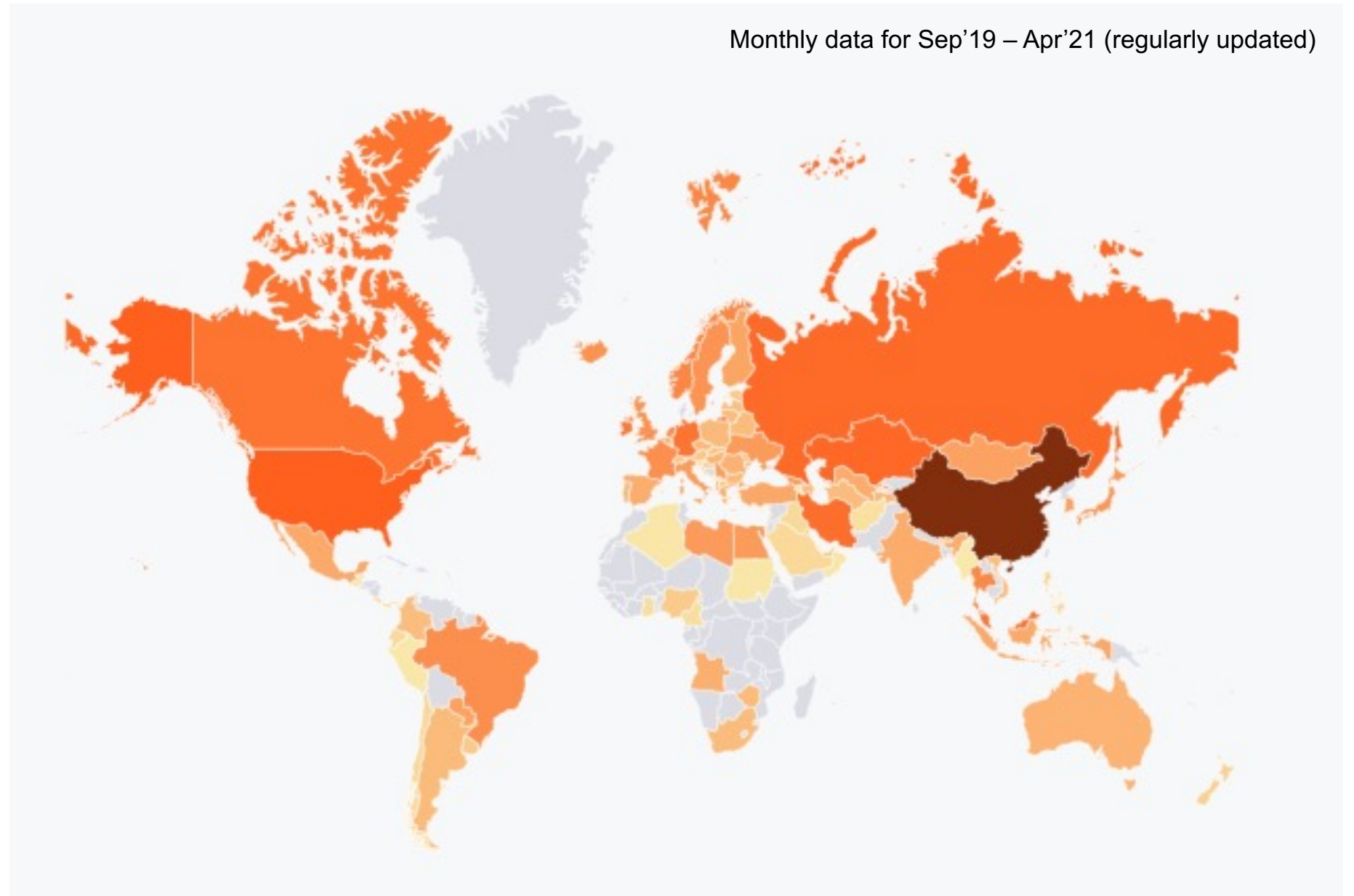
Assumptions:

- (1) Electricity consumption: 96.20 TWh
- (2) Emissions: 820 gCO₂eq/kWh*

CBECI II: Geographic hashrate distribution



... beware the model limitations!



BTC.com

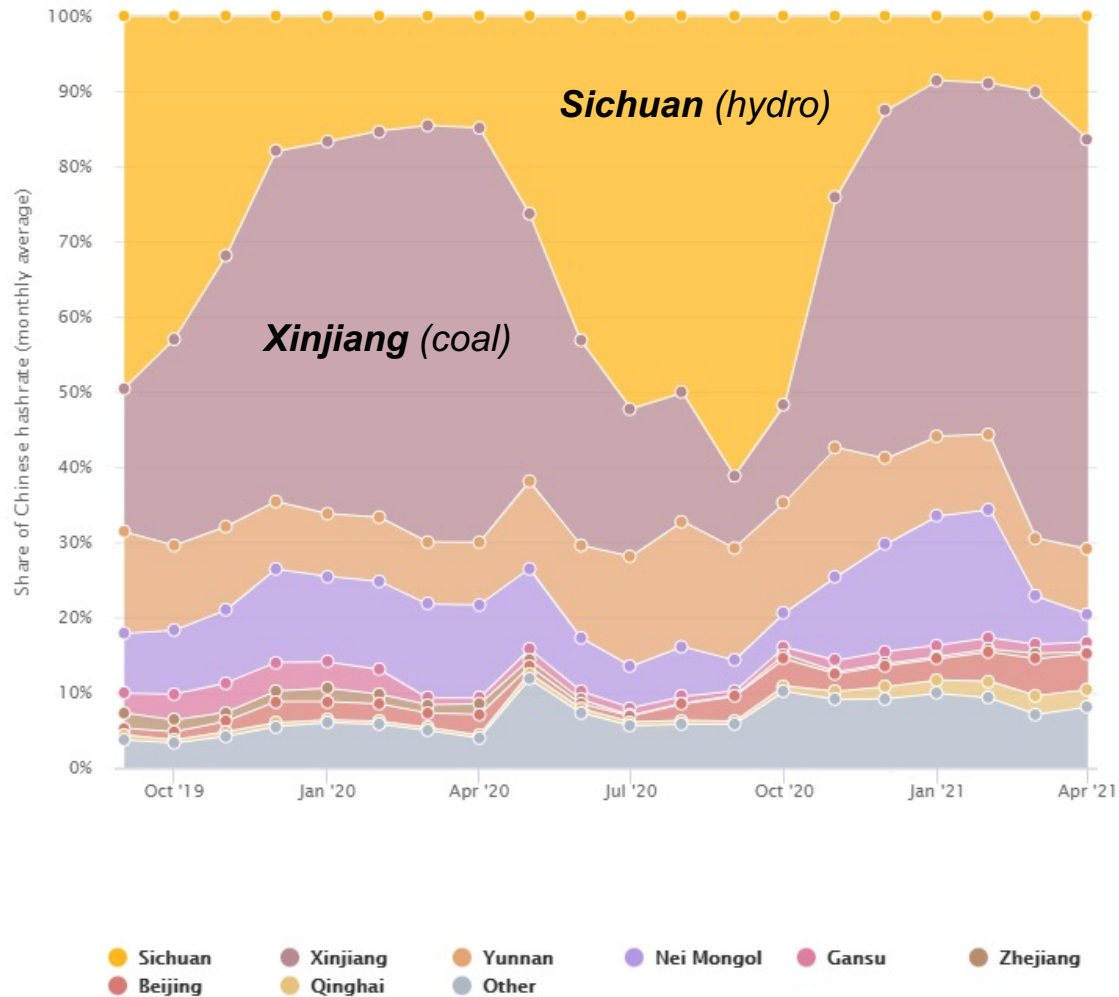
Poolin

ViaBTC

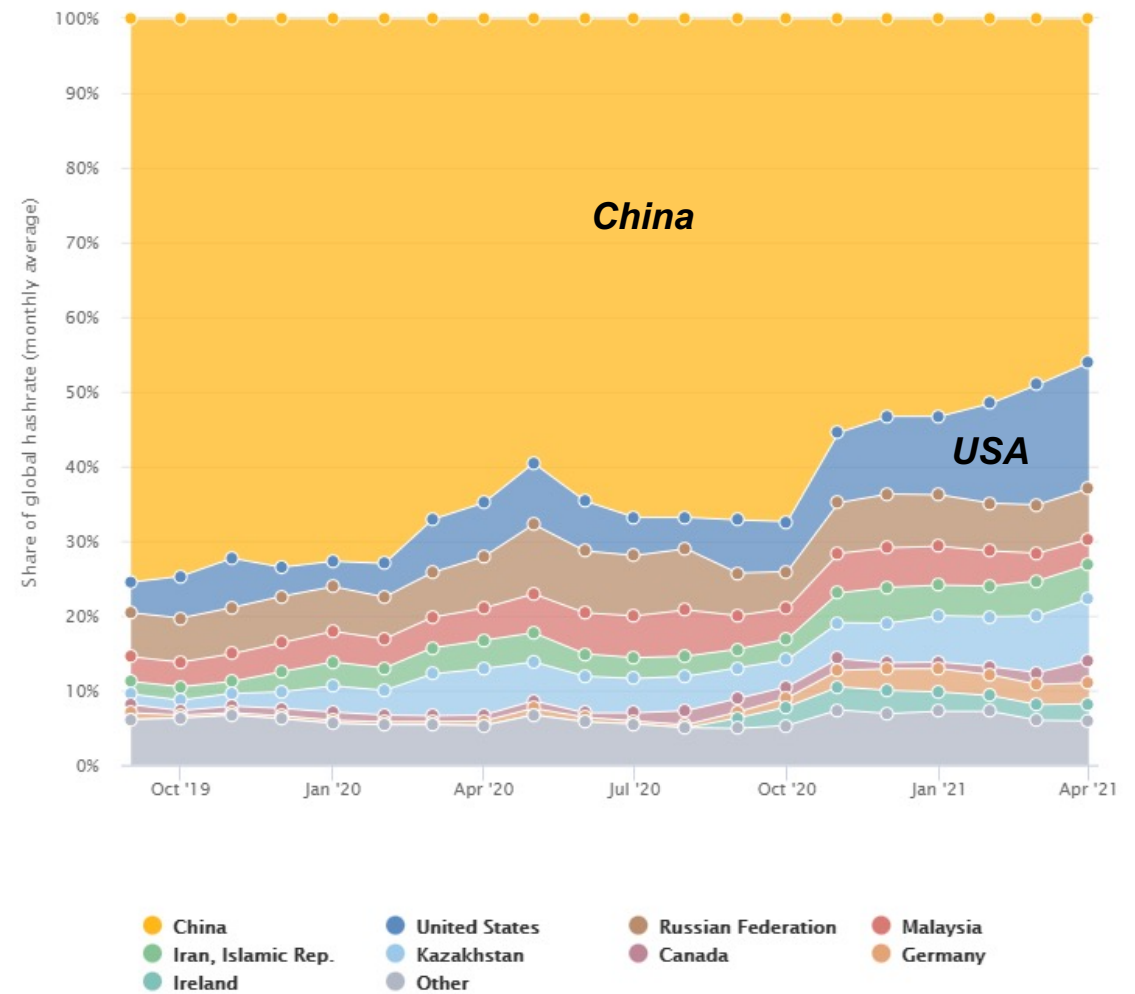
foundry

Additional complexity through miner migrations

Evolution of Chinese provinces share



Evolution of country share



Where do we draw the line?



Mining equipment e-waste



Hardware supply chain



Scope III emissions

Quo vadis?



Bitcoin ETF Pledges to Reduce Carbon Footprint by Planting Trees

~ Bloomberg (27/08/2021)

Europe's largest bitcoin ETP moves carbon neutral as investors ramp up demand for ESG

~ ETF Stream (07/07/2021)

Bitcoin mining comes to Pennsylvania coal country—and raises tough questions

~ Fortune (19/08/2021)

Bitcoin Miners Are Giving New Life to Old Fossil-Fuel Power Plants

The lofty prices of cryptocurrencies have investors sinking money into electricity generation, risking a backlash

~ THE WALL STREET JOURNAL (21/05/2021)



One of a kind



...Bitcoin is many things to many people.



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