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Comments at *Cambridge Center for Alternative Finance, July 2019*
based on new working paper:

"CryptoMining: Energy Use and Local Impact"

by Matteo Benetton, Giovanni Compiani, Adair Morse

Motivation:

- Cryptomining uses tremendous amount of electricity, making electricity a scarce resource for local economies
- We wanted to know why local governments allow / lobby for cryptomining

Setting 1: Total consumption of electricity is large

Digiconomist:

- Current use: **0.3% world energy**
- Could power **6.3M US households**

De Vries (2018) in *Joule*

- ST Projection: **0.5%world energy**
- Implication:**10.5M US households**

Bitmain IPO , Cambridge (2018)

- Manufacturer – market share 67%:
- Recent sales: 4.2 million machines
- Energy use of these machines > Digiconomist estimate

Transactions inference

- 1 transaction cleared by bitcoin uses the equivalent daily energy of 15 U.S. households
- To clear the daily transactions of VISA Card would require the equivalent electricity of **2.16 billion U.S. households**

Why does bitcoin so much energy use?.....

Setting 2: *Proof of work* to clear transactions

Why people like it?

- *Proof of Work* is the only completely democratized system now in place without a central agents (banks, government) to keep account and prevent fraud

Why does it use so much energy? *Cryptominers* (firms with computing power) compete to clear a block of transactions (winner takes all rewards).

- Requires quintillions of searches to find a solution to win
- Result: Cryptominers have a arms race in computing power

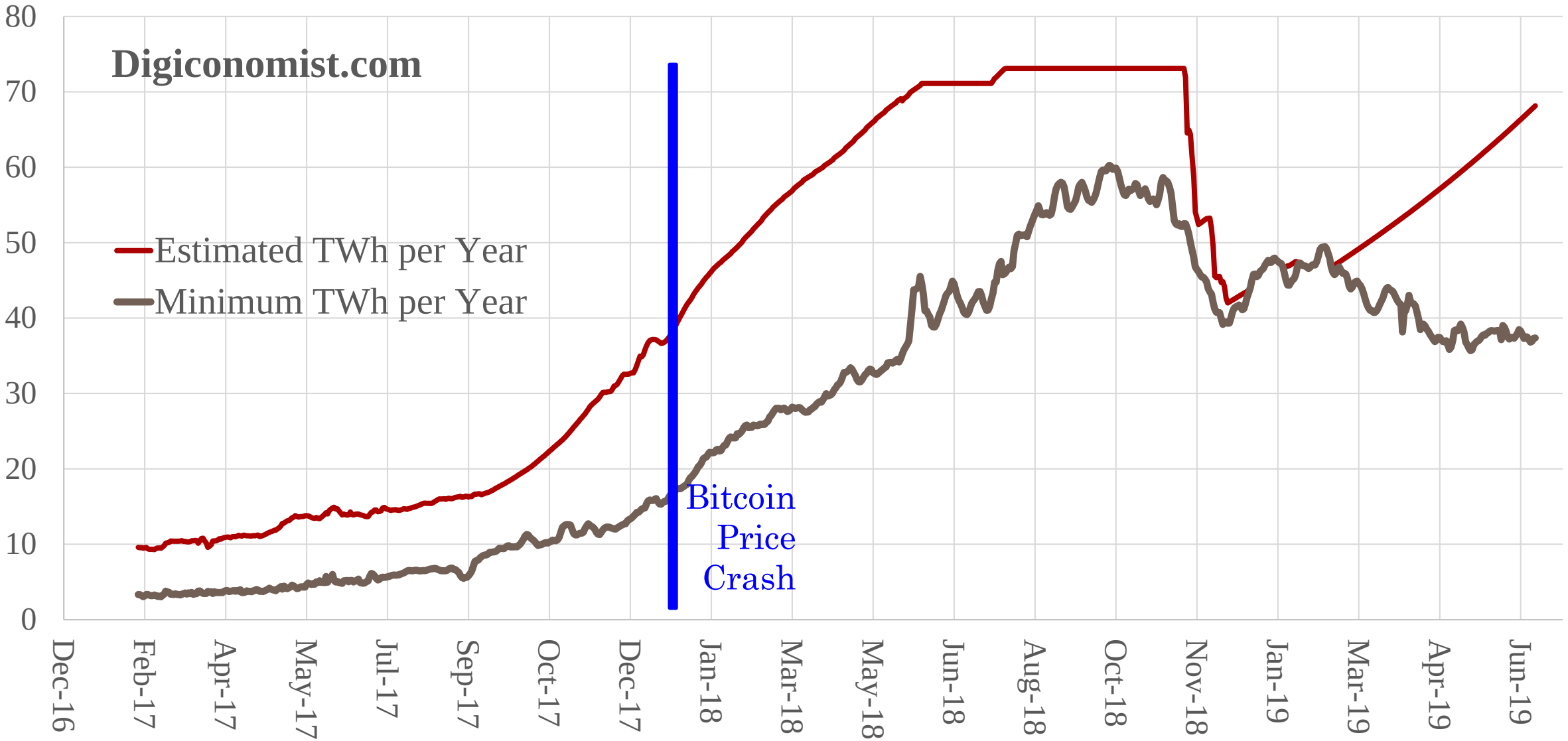
Why can't problem be simplified or transactions be bundled for energy efficiency?

- Need scarcity in ultimate number of coins. System relies on a block being validated successfully only every ten minutes (on average).
- Need automatic ***Difficulty Adjustment*** to keep miner marginal profit (and thus amount of mining) in line with 10 minute goal.

Setting 3: Scaling-up under proof of work is environmentally infeasible

- **1 transaction cleared by bitcoin uses the equivalent daily energy of 15 U.S. households.**
- **To clear the transactions of VISA would require the equivalent electricity of 2.16 billion U.S. households**
  - Cannot be a system to clear “daily life” payments system
  - New stablecoin digital currencies do not use proof of work validation.

Setting 4: Energy consumption did not crash with price of Bitcoin



Local Government Motivations & Unintended Consequences

Collected news stories from local media…

<u>What governments say:</u>

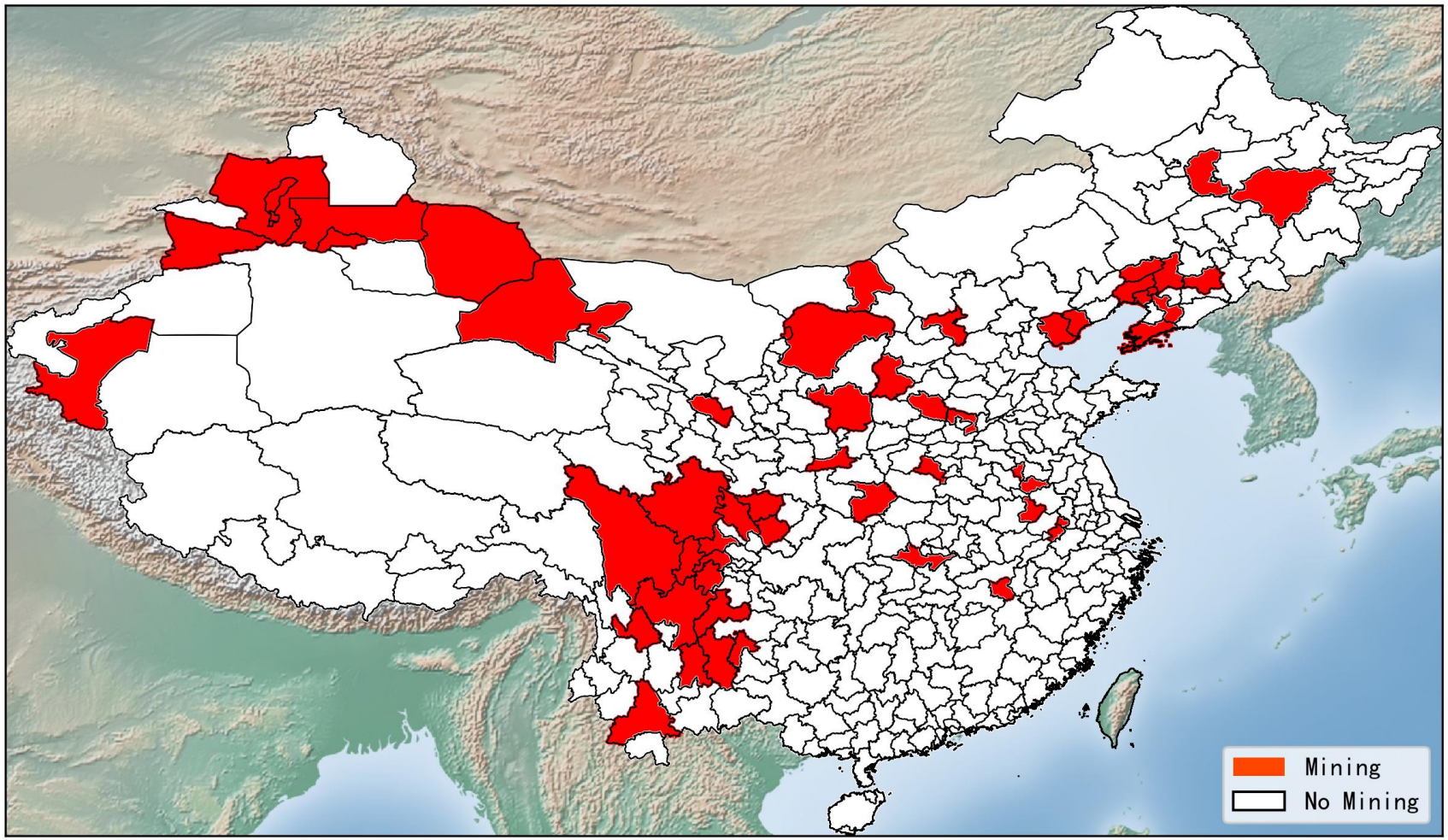
- Anecdotes from China, Caucuses: Tax Revenues
- Anecdotes from Caucuses, Canada, U.S. and Scandinavia: Local Economy Spillovers to workers and consumers

<u>Unintended consequences:</u>

- Anecdotes from Montana, Australia, Texas: Re-opening coal mines or forestalling closure
- Anecdotes from Caucuses, Venezuela: Blackouts
- Anecdotes from Oregon, NYState: Rising energy costs for businesses because utilities having to buy electricity from other counties to provide to industry

Where are cryptomines?

For each city-seat in inner provinces in China, we conducted local news searches (focusing but not exclusively on local newspapers) in Baidu and Google to find evidence of cryptomining facilities



A similar picture is found in: 2018, Cambridge Center for Alternative Finance, 2nd Global Cryptoasset Benchmarking Study with a punchline:
"The majority [globally]... use some share of renewable energy … in their energy mix"

Summary of Results

Contributions:

1. Estimate that 47%-60% or worldwide cryptomining comes from fossil-fuel (39-48% from coal)
2. What are the local economy outcomes to cryptomining?
   - What governments say: Positive spillovers
     i. Taxes – FIND: Governments get 10% more business taxes per GDP from cryptomining than other uses of energy
     ii. Wages / Consumption – FIND: No positive spillovers to households, if anything since cryptomining uses little labor, wages decline
   - Unintended consequences
     iii. Pollution – FIND: cryptomining increases energy consumption in fossil-fuel powered cities by 10%
     iv. Other industries – FIND: Negative impact on fixed asset investment => crowding out