

Mining cryptocurrencies in Georgia: Estimation of economic relevance

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Summary

- **Goal of study:** assessment of relevance of crypto-mining for Georgian economy
- **How?** Own estimation, given insufficient recording of mining in public data
- **Starting point:** estimation of mining-related energy consumption in 2017; 569,400 MWh or 6% of total consumption in Georgia (excl. Abkhazia)
- **Based on this:** estimation of mining turnover in 2017 = **USD 311 m**
- **Labour cost:** only USD 3 m in wages, very limited impact on labour market
- **Profits and taxation:** profits of USD 178 m in 2017, but practically no taxes
- **Contribution to GDP:** USD 181 m or 1.2%; quite significant
- **For comparison:** mining and quarrying 1.1%, manufacture of alcoholic beverages 1.1%, restaurants, bars, canteens and catering 1.6%
- **Balance of payments:** overall positive impact, but only partially recorded

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1. Introduction

- **Currently:** intensive discussion on cryptocurrencies world-wide
- **Main focus** of discussion: cryptocurrencies in the financial sector
- **But:** biggest cryptocurrencies (Bitcoin, Ethereum) have to be produced (“mined”) using economic resources

→ **Mining cryptocurrencies also has a relevance for the real sector**

- **Georgia:** very topical issue, given that the country is one of the largest miner of cryptocurrencies world-wide

Objective in this briefing

- Business perspective: estimation of turnover, costs and profits
- Sectoral analysis: impact of crypto-mining on electricity and labour market
- Economic perspective: contribution to GDP, relevance for tax revenues and balance of payments

2. Some facts about crypto-mining in Georgia

Why mining in Georgia?

- Low electricity costs: ca. USD-cent 5/kWh for industry
- Business climate: ranked 9th in the WB Doing Business Report
- Tax exemptions: much of the mining is located in a free industrial zone

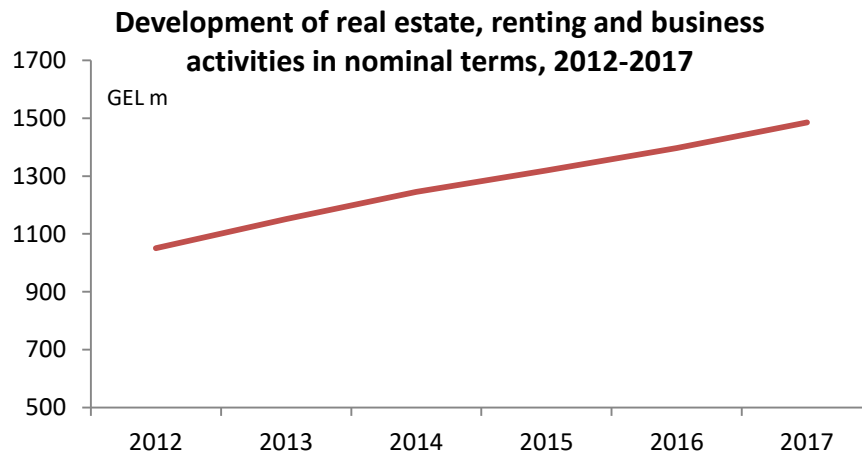
Mining facilities and market structure

- Estimated combined facilities in Georgia (2017): 65 MW
- Largest company: Bitfury, with a 40 MW facility near Tbilisi
- Many other companies are active in mining or are running mining facilities; e.g. Spotcoin and Golden Fleece
- Furthermore: many households active in mining
- Outlook: several new facilities under construction or planned

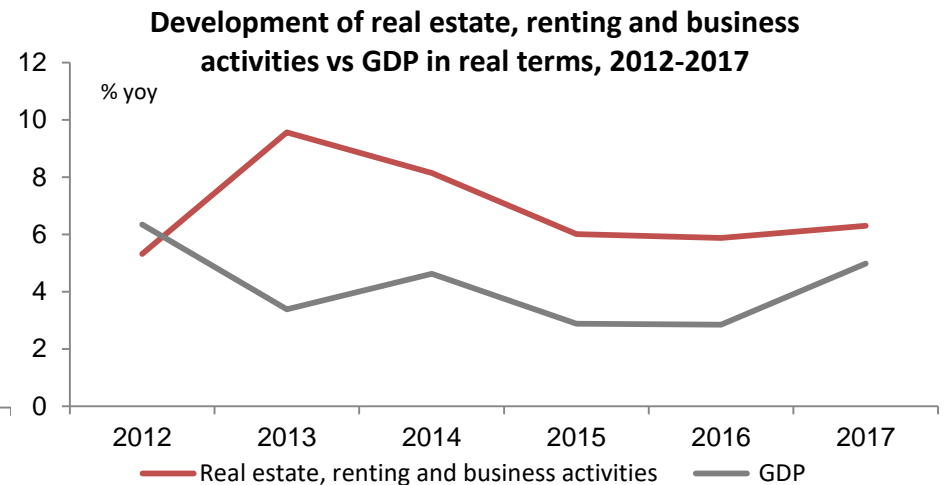
Mining statistics

Official statistics (GeoStat)

- Crypto-mining part of “real estate, renting & business activities”; no separate reporting



Source: GeoStat



Source: GeoStat

- Category „real estate...” features higher real growth rates than GDP
- But: no clear increase since intensification of crypto-mining at around 2014/2015
- As it seems: crypto-mining activities not or only partially recorded in official statistics

→ **Need for own estimation**

3. Mining-related turnover: own estimation

Challenges for estimation and how we deal with them

- Challenge: different cryptocurrencies are mined
- Assumption: only bitcoins (BTC) are mined in Georgia
- Challenge: practically all key variables change dramatically over time
- Examples: price of BTC, performance needed to mine 1 BTC, power of processors, electricity consumption necessary to mine 1 BTC
- Here: estimation for year 2017 using average values

Method: rough estimation in 3 steps

- i. Estimation of mining-related electricity consumption in 2017
- ii. Estimation of number of BTC mined in Georgia in 2017
- iii. Estimation of mining turnover in 2017

i. Estimation of mining-related electricity consumption

Mining facilities

- Own estimation of mining facilities in 2017 = **65 MW**
- Estimation based on interviews with industry and literature review

Electricity consumption in 2017

- $65 \text{ MW} * 24\text{h} * 365 \text{ days} = \mathbf{569,400 \text{ MWh}}$
- % of total electricity consumption in 2017 = **6%** (excl. Abkhazia)

Plausibility check

- Since May 2018: ESCO collects data on direct contracts with miners
- May/Jun 2018: 96,347 MWh; year = 576,500 MWh; similar to our estimation
- On the one hand: May 2018 data includes new facilities of ca. 5-10 MW
- On the other hand: May 2018 excludes small miners and households

→ **Own estimation for 2017 seems plausible**

ii. Estimation of number of BTC mined in Georgia*

How much hash is needed to produce 1 BTC?

- 303,500,112 TH/BTC

How much electricity is needed for producing 1 BTC?

- 8.43 MWh/BTC

BTC per year mined in Georgia (excluding fees)

- $569,400 \text{ MWh/year} \div 8.43 \text{ MWh/BTC} = 67,544 \text{ BTC/year}$

BTC per year due to transactions fees

- 10,293 BTC/year

BTC per year mined in Georgia (incl. fees)

- $67,544 \text{ BTC/year} + 10,293 \text{ BTC/year} = \mathbf{77,837 \text{ BTC/year}}$

* See Annex for a more detailed estimation

iii. Estimation of mining turnover

Mining in Georgia 2017: 77,837 BTC/year

Average price 2017: 4,001 USD/BTC

Turnover 2017: 77,837 BTC/year * 4,001 USD/BTC ≈ USD 311 m/year

4. Cost of electricity

Estimation of mining-related electricity consumption

- 569,400 MWh/year
- 6% of total electricity consumption (excl. Abkhazia)

Electricity cost

- Price for electricity of miners not publically available
- Assumption: USD-cent 5/kWh or USD 50/MWh
- Cost = 569,400 MWh/year * USD 50 USD/MWh ≈ **USD 28 m/year**

Impact on electricity market and balance of payments

- Assumption: electricity generation independent from mining
- Implication: full impact of mining on trade/services balance
- Concretely: mining implies lower exports and higher imports over the year

→ **Electricity cost = USD 28 m/year [= impact on trade/services balance]**

5. Labour cost

Bitfury

- Bitfury statement: “180 employees, average monthly salary GEL 2,500”

Mining sector

- Bitfury: 40 MW out of combined facilities of 65 MW
- Number of sector employees excl. Bitfury: $180 * 25/40 = 113$
- Average wage in sector excl. Bitfury: 1,500 GEL

Labour cost

- Wage sum Bitfury 2017= $180 * \text{GEL } 2,500 * 12 = \text{GEL } 5.4 \text{ m}$ or USD 2.16 m
- Wage other firms 2017= $113 * \text{GEL } 1,500 * 12 = \text{GEL } 2.0 \text{ m}$ or USD 0.81 m
- Labour cost of mining 2017= USD 2.97 m \approx **USD 3 m**

Impact on labour market

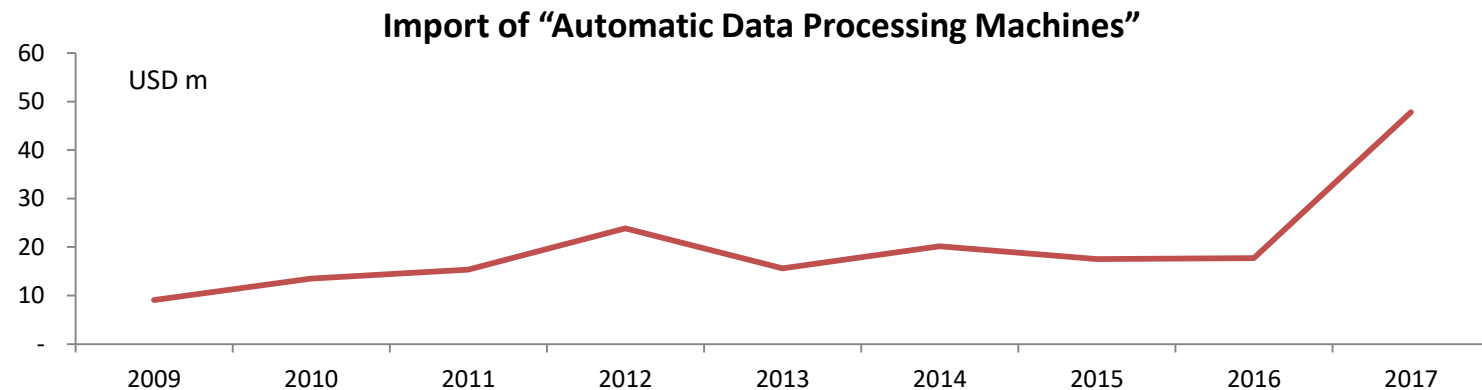
- Less than 300 employees earning ca. USD 3 m per year; quite negligible

6. Cost of processors

Total number of processors in the industry

- 1 MW facility needs 740 processors (Antminer S9 or equivalent)
- Thus: 65 MW * 740 processors/MW = 48,100 processors
- Cost of processor (2017): ca. USD 3,000
- Economic life of processor: 2 years
- Cost per year: $48,100 * \text{USD } 3,000 \div 2 = \text{USD } 72 \text{ m}$

By the way: imports of this size not recorded on trade balance



Source: GeoStat, own calculations

7. Profits of mining

Profits in 2017

Item	USD m
Turnover	311
Cost of electricity	-28
Labour cost	-3
Cost of equipment	-72
Other cost (renting of sites, finance costs, cooling, etc.)	-30
Profits	178

Rough estimation of mining profits in 2017 = USD 178 m

8. Contribution of mining to GDP (only partly recorded in official data)

Item	USD m
Turnover	311
Electricity	-28
Processors	-72
Other inputs	-30
Contribution to GDP	181
GDP Georgia 2017	15,139
% of GDP 2017	1.2%

Other sectors for comparison (before taxes)

- Mining and quarrying: 1.1%
- Manufacture of alcoholic beverages = 1.1%
- Restaurants; bars; canteens and catering = 1.6%

Sizeable impact of crypto-mining on GDP

9. Taxation of profits from mining

Profit tax

- No payments from companies in free industrial zones (e.g. Bitfury)

Input VAT

- No input VAT in free industrial zones
- Neither for electricity nor for imported processors

Import tariffs

- No import tariffs in case of location in free industrial zone

Conclusions

- Practically no tax revenues from mining
- Quite remarkable, given estimated profits of USD 178 m in 2017

10. Impact on balance of payments

Impact on trade and service balance in 2017 (partly unrecorded)

Item	Impact on balance, USD m
Exports of bitcoins	+311
Net-imports of electricity	-28
Imports of processors	-72
Imports of other goods (assumption: 1/3 of “other cost” imported)	-10
Net impact	+201

- Actual impact on BOP is positive and equivalent to 1.3% of GDP
- Exports of bitcoins: significant part not recorded
- Imports: partly not recorded, especially processors
- **Thus:** an accurate recording of this sector in the BOP would lead to a sizeable reduction of the current account deficit by 1% to 2% of GDP

11. Policy implications

Official statistics

- Crypto-mining has a sizeable impact on GDP and on the balance of payments
- To be checked: possible to better capture this sector in official statistics?

Electricity market

- Mining accounted for 6% of electricity consumption in 2017 and has thus a strong impact on the electricity market
- Research advisable to study the impact of crypto-mining on the market

Positive external effects / cluster development

- The strength of mining could be used for attracting IT companies to Georgia
- Potential to be evaluated; results used for FDI attraction/cluster development

Taxation

- Very low taxation of a sector with estimated profits of USD 178 m is remarkable
- To be checked: higher tax revenues from the sector possible?

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Annex: estimation of BTC mined in Georgia (1/2)

How much hash is needed to produce 1 BTC?

- World hash rate, average 2017: 6,322,919 TH/s
- Constant production: 12.5 BTC per 600s
- $6,322,919 \text{ TH/s} * 600\text{s} \div 12.5 \text{ BTC} = 303,500,112 \text{ TH/BTC}$

How much electricity is needed for producing 1 BTC?

- Mining hardware used in 2017: Antminer S9
- Antminer S9: 13.5 TH = 1,350 Ws \rightarrow 1TH = 100 Ws
- $303,500,112 \text{ TH} = 30,350,011,200 \text{ Ws}$
- $30,350,011,200 \text{ Ws} / 3,600\text{s} = 8,430,559 \text{ Wh} = 8.43 \text{ MWh/BTC}$

BTC per year mined in Georgia (excluding fees)*

- $569,400 \text{ MWh/year} \div 8.43 \text{ MWh/BTC} = 67,544 \text{ BTC/year}$

*569,400 MWh/year of electricity consumption could originate from mining other cryptocurrencies than BTC. In our estimation we assume this amount is entirely used for mining BTC, given its dominant position world-wide and in Georgia.

Estimation of BTC mined in Georgia (2/2)

Transaction fees

- Total transaction fees worldwide in 2017: 100,155 BTC/year
- Total BTC mined worldwide in 2017: $12.5 \text{ BTC} * 6 * 24 * 365 = 657,000 \text{ BTC/year}$
- Ratio transactions fees to total BTC mined:
 $100,155 \text{ BTC/year} \div 657,000 = 15.24\%$
- Total transaction fees in Georgia in 2017:
 $15.24\% * 67,544 \text{ BTC/year} = \mathbf{10,293 \text{ BTC/year}}$

Mining in 2017 (incl. fees)

- $67,544 \text{ BTC/year} + 10,293 \text{ BTC/year} = \mathbf{77,837 \text{ BTC/year}}$