The Corinthian

Volume 20 | Article 2

November 2020

Does Bitcoin Use Affect Crime Rates?

Kevin Keane
Georgia College & State University

I. Introduction

In 2013 Ross Ulbricht was arrested for creating an online marketplace named “silk road”. From February 2011 to July 2013, $1.2 billion of transactions occurred on “silk road”. 70% of items listed for sale on “silk road” were drugs, but every item listed for sale was illegal. After his arrest, chat logs on Ulbricht’s computer revealed he was using Bitcoin to hire contract killers. Despite these chat logs, no money trail was found, and Ulbricht was convicted on several conspiracy charges. He was sentenced to 2 life sentences in prison without parole and forfeited $183 million. Although this indicates Bitcoin can be detected by law enforcement, Ulbricht was caught because of chat logs on his computer. Top sellers on “silk road” have not been found as their identities are unknown.

In 2014 the Securities and Exchange Commission stated, “Because Bitcoin can be used as money to purchase goods or services and also can be exchanged for conventional currencies, Bitcoin is in fact a currency or form of money” (SEC v. Shavers). Bitcoin’s anonymity and fungibility have increased its price and ability to be viewed a form of money.

Controlling for state fixed effects and the type of crime, I use state arrest data from the Uniform Crime Reports and Bitcoin ATM data from the blockchain to analyze the impact of Bitcoin on crime rates. As the number of Bitcoin transactions increases the number of untraceable transactions does as well, therefore, I expect crime rates to decrease as Bitcoin use increases.

II. Literature Review

Studies on the fungibility of a cryptocurrency have found that anonymity and fungibility are highly correlated due to the use of cryptocurrency in illegal activities. Berg (2018) observed that cryptocurrencies' fungibility and anonymity are highly correlated, causing cryptocurrencies that offer the most anonymity to be the most used. Bohr and Bashir (2014) found the primary users of Bitcoin were young people outside of the United States. They also found that 57% of Bitcoin users in the United States identified as Libertarians.

Becker (1968) shows the marginal cost and marginal benefit of criminal activity. He explains that while many people do not commit crimes because of their ethical standards, criminals simply commit crimes because the marginal benefit exceeds the marginal cost. Becker observes that criminals are utility maximizing individuals.

Cryptocurrency can be cheaply traded across continents, but there are still costs associated with transporting goods far distances. Norbutas (2018) examines the impact geography has on drugs purchased using cryptocurrencies, finding that crypto markets are typically domestic. This is likely not only because of shipping costs, but also the risks of shipping far distances. Using *Silk Road* as an example, Morelato, et al. (2018) study the impact local supply has on crypto market demand. They found crypto market drug supply was negatively correlated with the local supply of a drug.

Criminals are using cryptocurrency to evade law enforcement. Levin, et al. (2014) show the link between crime and anonymous cryptocurrencies by citing cases of Bitcoin being used for money laundering, trading in illegal goods and services, financing terrorism, fraud, and tax evasion. Since neither the sender or receiver is easily identified, Bitcoin is favored over traditional currencies for money laundering activities. Mabunda (2018) discusses the process of money laundering with Bitcoin is not different than other currencies, however, Bitcoin poses the most challenges to authorities because of its anonymity, security, and decentralized network. She also discusses that if the price of Bitcoin crashes, it may still be used for money laundering.

The anonymity of cryptocurrencies decreases the risk that drug dealers face. Martin, et al. (2018) studied drug prices in Australia, finding drugs purchased through from Australian crypto market vendors are lower than street prices. This is contributed to a “risk premium” drug dealers charge for transactions outside of the crypto market.

Law enforcement is aware of the unique problems Bitcoin poses but has not found a way to fix them. Brown (2016) discusses the opportunities that Bitcoin has for criminals and the difficulties that law enforcement is facing with Bitcoin compared to other currencies. Brown also describes the opportunities that less popular cryptocurrencies give criminals.

Schoenberg and Robinson (2018) studied the use of Bitcoin ATMs for money laundering. finding that Bitcoin ATMs are primarily located in areas with high crime and poverty. They also observed Bitcoin ATM revenue is correlated with crime rate. Although Bitcoin ATMs require users to give identification, people are using fake IDs, social security numbers, etc., to avoid being identified.

In summary, the papers included above study the use of cryptocurrency in illegal activity, as well as who the primary users of cryptocurrencies are. Expanding on the work of Morelato, et al. (2018) I can show the impact Bitcoin use has on crime rates, analyzing crime rate changes across states with different numbers of Bitcoin ATM locations.

III. Theory

By making it more difficult for law enforcement to detect crime, Bitcoin lowers the number of crimes detected. While the number of crimes committed may not have changed since

Bitcoin has gained popularity, the difficulty of detecting crimes involving Bitcoin may lower reported crime.

Becker (1968) says criminals are utility maximizing individuals. Using Bitcoin for illegal activity does not increase the punishment a criminal would face had they used other currencies, however, it does reduce the risk of being caught. Since Bitcoin decreases the marginal cost of crime, it should increase crime. Despite the increase in crime, the reported crime should decrease with an increase in Bitcoin use, because of the difficulty in identifying who is involved in Bitcoin transactions.

Bitcoin was created to act as a completely free-trade market. It can do this through its decentralized network that creates anonymity for people involved in transactions. Bitcoin's anonymity also makes detecting crimes involving Bitcoin very difficult for law enforcement. This gives criminals a less risky way of interacting.

The "risk-premium" in illegal transactions is negatively correlated with the anonymity of the currency used. This also decreases transaction costs of illegal transactions. Since the "risk-premium" reflects the likelihood of crimes being detected, criminals view cryptocurrencies as having a lower risk of detection than other currencies.

In 2014 the Securities and Exchange Commission stated, "Because Bitcoin can be used as money to purchase goods or services and also can be exchanged for conventional currencies, Bitcoin is in fact a currency or form of money" (SEC v. Shavers 2014). Bitcoin's anonymity and fungibility have increased its price and ability to be viewed a form of money. These qualities are also why Bitcoin has become a preferred currency for criminals, lowering crime rates by making crime less detectable.

IV. Model and Data

Equation (1) is empirical model to observe the effect of Bitcoin on total crime rates:

$$TOTAL_{ST} = B_0 + B_1 ATMS_S * POST2009_T + B_2 POST2009_T + \delta \Pi_{st} + \lambda_S + E_{ST} \quad \textbf{(1)}$$

Equation (2) is empirical model to observe the effect of Bitcoin on drug crime rates:

$$DRUG_{ST} = B_0 + B_1 ATMS_S * POST2009_T + B_2 POST2009_T + \delta \Pi_{st} + \lambda_S + E_{ST} \quad \textbf{(1)}$$

To see how crime rates are impacted by Bitcoin, I use two OLS regressions. In equation (1), the dependent variable, $TOTAL_{ST,}$ measures crimes committed per 100,000 people in state *S* and year *T*. Most illegal Bitcoin transactions involve drug trade. In equation (2), $DRUG_{ST}$ measures drug crimes committed per 100,000. Equation (2) is used to observe the impact of Bitcoin specifically on drug crime rates.

The independent variable $ATMS_S$ is the number of Bitcoin ATMs located in state *S*. $POST2009_T$ is a dummy variable which equals 1 for every year after 2009, and zero otherwise. Π_{st} is a vector of crime factors: poverty, median income per capita, and population density in state *S* and year *T*. $\lambda_{S\ is}$ used to control for state fixed effects. This data includes 41 states and spans from 1995-2017 for all variables except *ATMS,* which includes the number of Bitcoin ATMs 41 states for only 2017. The 41 states used are the same for all variables. Summary statistics are listed in Table 1 of the appendix.

Bitcoin was created in late 2009, and Bitcoin ATMs are being used to launder money, and are typically located in high-crime, low-income areas (Martin, et al. 2018). To observe the impact of Bitcoin, use on crime rates, I use Bitcoin ATMs as a proxy for which states use Bitcoin the most. The number of ATMs in a state is multiplied by the dummy $POST2009_T$ to control for years where Bitcoin was not yet created.

To control for time trends in crime rates I use the dummy variable, $POST2009_T$. Total crime rates consistently decrease with time, while drug crime rates do not have a linear relationship with time.

Brown (2016) observed that population density and socioeconomic welfare are the strongest indicators of crime. To observe the impact of welfare and population density on crime rates I use the vector, Π_{st} ,which includes: percent of people living in poverty, median income per capita, and population density (per sq. mile).

V. Results

To estimate the impact of Bitcoin on crime rates I use two OLS regressions with total crime rates per 100,000 people, and drug crime rates per 100,000 people as dependent variables.

Table 2 of the appendix shows Bitcoin ATMs significantly impact drug arrests per 100,000, but not total arrests per 100,000. An increase of 1 Bitcoin ATM decreases drug crimes per 100,000 by 0.395 and is significant at the 1% level. This result is consistent with my hypothesis, as difficulty in detecting Bitcoin related drug crime is causing a decrease in reported drug crime rates.

Poverty significantly impacts total and drug arrests per 100,000. A 1 percentage point increase in poverty increases total arrests per 100,000 by 63.07 and is significant at the 1% level. A 1 percentage point increase in poverty increases drug arrests per 100,000 by 3.58 and is significant at the 5% level. This result is consistent with previous studies as higher poverty causes more crime and more drug use.

Population density significantly impacts total arrest rates but does not significantly impact drug crime rates. An increase of one person per square mile decreases total arrests per 100,000 by 15.14 and is significant at the 1% level.

The R^2 for equation (1) is .797, indicating my independent variables explain 79.7% of variation in total arrests per 100,000. The R^2 for equation (2) is .899, indicating my independent variables explain 89.9% of variation in drug crime rates.

VI. Conclusions and Limitations

Previous literature provides robust evidence that Bitcoin is being used for criminal activity but does not analyze Bitcoin's impact on crime rates. I find that Bitcoin use significantly impacts drug crimes per 100,000 but does not significantly impact total crimes per 100,000. If drug arrests per 100,000 are decreasing solely because of Bitcoin, this creates cause for concern. This would indicate that crime rates are not decreasing from less crime occurring, but crime rates are decreasing because of problems detecting Bitcoin.

Endogeneity from measurement error occurs from weighting Bitcoin use by Bitcoin ATMs. Previous literature has found that Bitcoin ATMs are primarily placed in high-crime areas and used for money laundering. Thus, weighting Bitcoin use based on Bitcoin ATM concentration serves as a proxy for Bitcoin use in illegal activity, but also captures Bitcoin ATMs that are not used for illegal activity.

Using only one year of Bitcoin ATMs to represent Bitcoin use in a state causes endogeneity from omitted variables. This assumes the number of Bitcoin ATMs in a state has increased linearly with the states Bitcoin use. This may be true, but it cannot be proven since only one year of Bitcoin ATM data is available.

The anonymity of Bitcoin motivated this paper. However, if Bitcoin can be truly undetectable, then omitted variable and measurement error problems will be difficult to solve. Analyzing the impact of Bitcoin using city-level Bitcoin ATM and crime data may help increase precision. Further research on the anonymity of Bitcoin is necessary to observe the impact anonymous currencies have on crime.

Appendix

Table 1. Summary Statistics

Variable (Years 1995-2017)	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Bitcoin ATMs	41	56.571	13.454	1	487 (California)
Post 2009	943	0.348	0.477	0	1
Poverty	943	12.596	4.214	2.5 (Mass 2015)	24.7 (Louisiana 2017)
Median Income	943	58170.33	8987.384	36816 (Miss 2014)	82948

per Capita					(New Jersey 2006)
Population Density (per sq. mile)	943	217.248	270.043	9.3 (North Dakota)	1231.41 (New Jersey)
Total Arrests per 100000	943	4103.024	1339.993	566.431 (New Hampshire 1996)	8838.92 (Arizona 2017)
Drug Arrests per 100000	943	401.446	151.146	43.2884 (Illinois 2017)	861.995 (New York 2000)

Table 2. Regression Results

Variable	Total Arrests Per 100000	Drug Arrests Per 100000
	Coefficient	Coefficient
Number of Bitcoin ATMs in a State	1.06	-0.395***
	(-0.574)	(-0.069)
Post 2009	-352.23***	0.759
	(-66.47)	(-9.11)
Poverty	63.07***	3.58**
	(-10.72)	(-1.51)
Median Income Per Capita	0.0053	-0.000968
	(0.0085)	(0.000946)
Population Density	-15.14***	-0.0116
	(2.6)	(-0.9)
Constant	5636.43***	284.11***
	(491.3)	(62.47)
State Fixed Effects	yes	yes
Observations	943	943
R-squared	0.797	0.899
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1	

Bibliography

Becker, Gary (1968). Crime and Punishment: An Economic Approach, *Journal of Political Economy*, 76, 169-217

Berg, Alastair. (2018). The Identity, Fungibility, and Anonymity of Money. *SSRN Electronic Journal*. 46(3):85-91

Bohr, Michael (2014). Who Uses Bitcoin? An exploration of the Bitcoin community, *2014 Twelfth Annual Conference on Privacy, Security and Trust.*

Brown, S (2016). Cryptocurrency and criminality: The Bitcoin opportunity. *The Police Journal: Theory, Practice and Principles* 89(4) 327–339.

Cunliffe James., Martin J., Decary-Hetu D. and Aldridge J. (2018). An island apart? Risks and prices in the Australian cryptomarket drug trade. *International Journal of Drug Policy* 50(1): 64-73.

Federal Reserve Economic Data. FRED. St. Louis Fed. FRED, Federal Reserve Bank of St. Louis, 2018, fred.stlouisfed.org/.

Levin R., O'brien A. and Osterman S. (2014). Dread Pirate Roberts, Byzantine Generals, and Federal Regulation of Bitcoin. *Journal of Taxation & Regulation of Financial Institutions* 27(4), 5–19.

Mabunda, Sagwadi. (2018). Cryptocurrency: The new face of cyber money laundering.*2018 International Conference on Advances in Big Data, Computing and Data Communication.*

Morelato M., Grazia J., Tahtouh A., Esseiva A. and Roux C. (2018). Forensic drug intelligence and the rise of cryptomarkets. Part II: Combination of data from the physical and virtual markets. *Forensic Science International* 288(5): 201-210.

Norbatas, Lukas (2018). Offline constraints in online drug marketplaces: An exploratory analysis of a cryptomarket trade network. *International Journal of Drug Policy* 56(3):92-100.

Schoenberg, Tom, and Robinson, Matt (2018). Bitcoin ATMs May Be Used to Money Launder, *Bloomberg*, www.bloomberg.com/features/2018-bitcoin-atm-money-laundering/.

Ucrdatatool.gov. (2014). *Uniform Crime Reporting Statistics*. [online] Available at: http://www.ucrdatatool.gov/abouttheucr.cfm [Accessed 25 Jan. 2019]