# Theory and Evidence…..

# The Economic and Social Implications of Alternative Currencies

by

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**Abstract**

Despite the merits of our current state of money, many alternative currencies have emerged around the world. Alternative currencies are created for a number of reasons and exist in many forms. This research paper seeks to explore the extent to which alternative currencies meet the objectives of their creation, to understand whether they highlight inadequacies in our current money systems or social organizations, and to identify the impact they have on society. To meet these objectives, two case currencies, Bitcoin and Yerdle Reuse Dollars, are introduced and studied. This paper finds that while Bitcoin does not fully meet the objectives of its creation, it is still a valuable technology that challenges the efficiency of how we transact in fiat currency. Similarly, the Yerdle application allows users to acquire goods without incurring the higher financial costs associated with purchasing the same goods in regular markets.

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# 1. Introduction

Adam Smith once argued that money originated as a solution for inefficiencies in the barter system. Under the barter system, an exchange between two parties requires that each possess a good or service that the other requires, and for both to agree on the relative value of each product. However, many products degrade over time, and do not act as an appropriate store of wealth or value.[1] In contrast, money serves three key purposes. First, it is a medium of exchange that is accepted, valued, and trusted by all members of a community. Second, it is a unit used to assign a commonly accepted value to each good and service, as determined by supply of and demand for it. Third, it is a non-perishable, common means for storing wealth. Additional explanations for the emergence of money include the need for an organized and calculable way to collect taxes, and for a unit to account for inter-personal debt.

In addition to the essential functions of money stated above, there are a number of characteristics found in good mediums of exchange. The medium should be inexpensive to transport, handle, and store. It should be fungible, such that each unit holds the exact same value as the next. A good medium of exchange should be distinctive, so that it is difficult to forge, and recognizable, so it won't be confused with another item. It should be easily divided into smaller units, so that the exact amount of a good's value can exchange hands.[2]

Yet despite the virtues of money, alternative mediums of exchange frequently develop and come into use. Many communities across the globe use alternative currencies such as credit

[1] Smith, Adam. 5th ed. 1904. *Smith: Wealth of Nations, Book I, Chapters 1-4*. Library of Economics and Liberty. Web. 29 Oct. 2014.
[2] Lehdonvirta, V., & Castronova, E. (2014). Money. In *Virtual Economics* (p. 312). The MIT Press.

systems and digital currencies in order to exchange goods and services. Some of these currencies can be directly traded with fiat money, while others exist within closed systems of exchange.

Alternative currencies emerge for many reasons. Some arise to provide stability during a weak economy or government regime. For example, the WIR Bank, a mutual credit clearing system, was founded in Switzerland in response to the shortage of currency that resulted from the 1929 stock market crash.[3] Other currencies, such as the Bangla Pesa in Kenya, or the Ithaca Hour in Ithaca, New York, were developed within a small community in order to stimulate the local economy.[4, 5]

To shed light on some of the overarching uncertainties related to alternative currencies, such as the extent to which alternative currencies meet the purpose of their creation, or to which their use reflects shortcomings in our current use of money or social organization, or the externalities they may have on society, this paper will introduce and examine two alternative currencies, Bitcoin and Yerdle Reuse Dollars.

In examining Bitcoin, this paper will consider the following two questions:

1. Is Bitcoin being used as a currency or as a commodity?
2. How decentralized is Bitcoin's ecosystem?

In examining Yerdle Reuse Dollars, this paper will consider the following question:

1. What would cause Yerdle users to prefer conducting a transaction in Yerdle Reuse Dollars instead of fiat currency?

[3] WIR Bank Profile. (2010). Retrieved May 12, 2015, from http://www.americantradesystem.com/WIR_Bank_Profile_2010.pdf
[4] Muthaka, D., & Kimenyi, M. S. (2013, July 17). Bangla-Pesa: Slum Currency and Implications for the Poor in Developing Countries. Retrieved March 20, 2015, from http://www.brookings.edu/blogs/up-front/posts/2013/07/17-bangla-pesa-currency-kimenyi-muthaka
[5] *Ithaca Hours*. Retrieved March 20, 2015, from http://ithacahours.info/

# 2. Case A: Bitcoin

## 2.1 Introduction to Bitcoin

Bitcoin was introduced in 2008 in a paper authored by the alias Satoshi Nakamoto. Responding to the 2008 financial crisis, Nakamoto pointed to the dangers of fractional reserve banking and fiat currency that could be avoided with a technology like Bitcoin. Bitcoin is an open-sourced software that any individual may download onto their computer. The first version of the software was introduced in January 2009. The Bitcoin network is a comprised of all the computers that have downloaded the Bitcoin software. These computers are called nodes and together they support Bitcoin's blockchain.[6]

The blockchain is a public ledger, or record, of every transaction that has ever taken place in Bitcoin. The blockchain is quite literally a chain of blocks, where each block contains a set of approved transactions. A transaction occurs when one user transfers "bitcoins", the currency of the Bitcoin system, from his or her wallet to the wallet of another user. Bitcoins are a kind of digital currency called a "cryptocurrency". Cryptocurrencies use encryption methods for security, making the currency virtually impossible to counterfeit. Wallets that hold bitcoins exist digitally, and have two kinds of "keys". The first kind is a public key, which is used as a public address to send bitcoins to. The second is a private key, used to access the wallet. A common analogy used to describe this system is that a public key is like an email address you share with others, so that they may send you an email. A private key is your email's password, kept secret so that only you may access your email account. With Bitcoin wallets, however, users may generate numerous public keys for the same wallet. These transactions are completely free,

[6] Pagliery, J. (2014). *Bitcoin and the future of money*. Chicago, Illinois: Triumph Books LLC.

unless the sender chooses to offer a token transaction fee so that the transaction is verified faster than usual.

Nodes support the blockchain by grouping and verifying recent transactions and creating, or solving, a new block. New blocks are considered "solved" because, in order to create a new block, the node must use its computer processing power to solve a complex math puzzle. When a new block is solved, it is relayed to the rest of the Bitcoin network. When the network majority approves the new block, it is added to the blockchain. Solving blocks is a competitive practice because the node that solves the block is rewarded with newly created Bitcoins. Thus, these nodes are also referred to as "miners", as they are mining for new currency. A new block is added to the blockchain approximately every 10 minutes, and the current mining reward is 25 bitcoins. The maximum number of bitcoins that can be mined is 21 million, which the network is expected to reach in 2140. After this, it is expected that mining fees will support the network.[7]

There are a few unique features that Bitcoin is well known for. First, there is no central power controlling Bitcoin's money supply. Rather, the money supply is fixed, and control is decentralized across the network. Second, Bitcoin was created as a purely peer-to-peer network. Rather than need intermediaries like banks or PayPal to conduct a transaction, Bitcoin users can send currency directly into one another's wallets, regardless of the transaction amount or of the geographic distance, typically at no cost. Finally, users are able to transact almost completely anonymously. While every transaction is recorded on the public ledger, the ledger only shows the public keys of the sending and receiving wallets. As users may own multiple public keys per a wallet, or even multiple wallets, the nature of activity surrounding a particular individual is difficult to assess.

[7] Pagliery, J. (2014). *Bitcoin and the future of money*. Chicago, Illinois: Triumph Books LLC.

## 2.2 Is Bitcoin Being Used as a Currency or a Commodity?

The question of whether Bitcoin should be considered a currency or a commodity has been debated repeatedly over the last few years. Commodities that are used as a medium of exchange are typically physical items that hold some intrinsic value. The value of a commodity is determined by its supply and demand in the market. Fiat currency, on the other hand, is a legally mandated medium of exchange that holds no intrinsic value. Instead, the currency's issuer determines the currency's supply and value.[8] While neither explanation suits Bitcoin, many have argued that the value of Bitcoin is determined by its demand in the market and thus it is a commodity, pointing to the volatility in Bitcoin's exchange rate.

Perhaps one of the biggest issues in categorizing Bitcoin is that traditional definitions of commodities and currencies were not written to account for cryptocurrencies. Thus, rather than define Bitcoin, this paper seeks to determine whether the use of Bitcoin resembles how we typically use commodities.

### 2.2.1 Methodology

In order to determine whether Bitcoin is being used as a commodity, the following hypotheses will be tested:

1. If the velocity and the exchange rate of Bitcoin are correlated, then Bitcoin is being used as a commodity
2. If the velocity and the exchange rate of Bitcoin are not correlated, then no conclusion will be made

Velocity is a measurement of how quickly currency changes hands within an economy. If Bitcoin were being used as a commodity, then users are likely to decrease how often and how

[8] Lehdonvirta, V., & Castronova, E. (2014). Money. In Virtual Economics (p. 312). The MIT Press.

many bitcoins they exchange when bitcoins are worth less, hoarding coins till the dollar denomination of a bitcoin grows. Thus, when the Bitcoin exchange rate is low, the velocity would also be low. Similarly, users would increase the volume and size of Bitcoin transactions when Bitcoin is worth more. Thus, when the Bitcoin exchange rate grows, the velocity of Bitcoin would also increase. On the other hand, if this relationship cannot be determined, then the no conclusion can be made as to how Bitcoin is being used.

In order to test this hypothesis, data on the estimated output, the money supply, and the exchange rate of bitcoin will be used. This is data is publicly available on blockchain.info, a popular and established website for information on Bitcoin and the blockchain. Data was collected and used for the time period of January 2013 to April 2015.

The velocity of Bitcoin may be measured using the relationship described by the Equation of Exchange (**Equation 1**).[9]

**Equation 1**: The Equation of Exchange

$$MV = PT$$

**M:** Total money supply in the economy
**V:** Velocity of money
**P:** Average price level of goods
**T:** Total volume of transactions

The Equation of Exchange is the key equation used in the quantity theory of money. According to this theory, the velocity of money and the total volume of transactions can be considered constant in the short run. Thus, as money supply is increased, the average price level of goods increases in proportion.

[9] The Equation of Exchange. (2008, April 18). Retrieved from http://www.investopedia.com/exam-guide/cfa-level-1/macroeconomics/equation-exchange.asp

In Bitcoin's economy, the volume of transactions in the short run is by no means constant, and the average price level of goods is difficult to determine. However, the relationship described in the Equation of Exchange can still be used to calculate the velocity of Bitcoin. This calculation is described in **Equation 2**, where the estimated daily output of Bitcoin represents the total amount of Bitcoins that transacted back and forth on the blockchain during the day.

**Equation 2**: Equation Used to Find Bitcoin's Velocity

$$\textbf{Daily Velocity} = \frac{\textbf{Estimated Daily Output}}{\textbf{Total Money Supply}}$$

The daily velocity is calculated using data for Bitcoin's estimated daily output of Bitcoin and total money supply, and then analyzed against the daily exchange rate of dollars per BTC.

### 2.2.2 Findings

At first, the graphs of the weekly average velocity and weekly average exchange rate of Bitcoin (see **Appendix A**) appeared to suggest that Bitcoin's exchange rate and velocity were positively correlated during late 2013, when Bitcoin's exchange rate jumped significantly, through late 2014. This correlation seems to decrease by 2015. However, on graphing the percentage change in the weekly average velocity against the percentage change in the weekly average exchange rate of Bitcoin (see **Appendix B**), it appears that while there are periods where the change in velocity and change in exchange rate seem related, there is no clear correlation after June 2014.

**Table 1: 6-Month Interval Correlations of Bitcoin's Weekly Averages Velocity and Weekly Average Exchange Rate**

| Range | Correlation of Weekly Average Velocity and Exchange Rate | Correlation of % Change Weekly Average Velocity and % Change Exchange Rate |
|---|---|---|
| **Dec 31 2014 - Apr 22 2015** | -0.1851 | -0.3735 |
| **July 2 2014 - Dec 30 2014** | -0.7943 | -0.1993 |
| **Jan 1 2014 - Jul 1 2014** | 0.0999 | 0.0826 |
| **Jul 3 2013 - Dec 31 2013** | 0.2560 | -0.0407 |
| **Jan 2 2013 - Jul 2 2013** | -0.1293 | 0.1522 |
| **Jul 4 2012 - Jan 1 2013** | -0.2241 | 0.3818 |
| **Jan 4 2012 - Jul 3 2012** | -0.1171 | -0.1397 |

In order to assess whether a pattern of periodic or decreasing correlation exists, the correlation between weekly average velocity and weekly average exchange rate was calculated for six-month intervals. The results, presented in **Table 1**, suggest that there is no significant trend in the correlation between the velocity and the exchange rate of Bitcoin. At most, the table indicates a weak positive correlation between weekly average velocity and weekly average exchange rate in late 2013. Thus, the test conducted cannot conclude that Bitcoin is being used as a commodity.

### 2.2.3 Limitations and Suggested Research

There are a number of limitations to this approach that merit consideration in order to determine whether Bitcoin is being used as a commodity. First, on sampling data through the blockchain.info application programming interface (API), the calculated total output found was consistently higher than the estimated daily output provided by the website. Second, there is no

consumer price index that can be applied to Bitcoin, as the prices of goods and services in Bitcoin are translated from fiat currencies all over the world. Thus, the analysis is unable to control for the effect that changes in price levels have on the velocity of Bitcoin when comparing velocity to exchange rate.

Finally, the test assumes that Bitcoin is either being used as a commodity or not being used as a commodity. In reality, given Bitcoins historical exchange rate volatility, there will always be a subset of participants who use Bitcoin as a commodity and speculate on the exchange rate, while others may only use Bitcoin to pay for goods and services. Thus, it could be more useful for a similar analysis to be conducted comparing exchange rates with the volume and value of transactions on exchange sites alone, if that data were made available.

### 2.3 How decentralized is Bitcoin's ecosystem?

The purpose of this question is to understand the extent to which control over bitcoin transactions, production, and storage is truly distributed. When Bitcoin was introduced, one of its objectives was complete decentralization of the currency and its network. Rather than having to use intermediaries such as financial institutions or PayPal to conduct transactions, users would be able to transfer money directly to one another. Yet, as Bitcoin grows more popular, an ecosystem of supplementary services has developed around it. These services include Bitcoin exchange services, where Bitcoin can be traded with fiat currency, wallet services, where users can store bitcoins and conduct transactions, and mining pools, where users can solve for new blocks. These services should be considered intermediaries, as they carry out Bitcoin tasks on behalf of the user, and usually incur the user some fee. Certainly, these products make Bitcoin much more accessible to a larger user base. However, in order to maintain the original ideal of

decentralization, it is important that no such group of intermediaries hold an overwhelming authority over basic Bitcoin user-functions.

Theoretically, every Bitcoin user wishing to support the blockchain should be able to download the Bitcoin mining software and solve for new blocks. However, The difficulty of calculating the solution to this puzzle is continuously increasing, and immense computer processing power is required to mine a single block in a competitive amount of time.[10] Thus, in order to successfully participate in the mining process, users must join mining pools.

Mining pools combine the processing power of individual nodes in order to solve for new blocks. To support group mining, a number of mining pool websites have been established. Mining pools typically pay users a percentage of the mining rewards proportionate to how much processing power the user has contributed. These pools normally earn revenue by either keeping a small percentage of users' earnings, or by keeping the block's transaction fees. As there are only a small number of successful mining pools, it is important to evaluate how concentrated, or centralized, control over the mining market is.

### 2.3.1 Methodology

The concentration of Bitcoin's mining pool market can be assessed using the Herfindahl-Hirschman Index (HHI). HHI measures concentration using the market share of each competitor in the market (see **Equation 3**).[11]

**Equation 3**: The Herfindahl-Hirschman Index Equation

$$\mathbf{HHI} = \boldsymbol{s1^2 + s2^2 + s3^2 + \cdots sn^2}$$

Where s*i* is the market share of each competing firm

[10] Pagliery, J. (2014). *Bitcoin and the future of money*. Chicago, Illinois: Triumph Books LLC.
[11] United States of America, Department of Justice. (n.d.). *Herfindahl-Hirschman Index*. Retrieved from http://www.justice.gov/atr/public/guidelines/hhi.html

HHI can range from 0 to 10,000, where values close to 0 approach a perfectly competitive market, and values close to 10,000 a fully concentrated market. As of 2010, the United States Department of Justice considers markets with an HHI less than 1500 to be unconcentrated, between 1500 and 2500 to be moderately unconcentrated, and more than 2500 to be highly concentrated.[12] On the other hand, the European Commission considers an HHI above 1000 to be cause for market concentration concern regarding possible anti-competitive practices.[13]

In order to find to find the current market concentration of Bitcoin mining pools, four sample data sets were collected during March and April of 2015. These sample data sets were also collected from the website blockchain.info. Each sample contains the number of blocks mined by each active mining pool and successful unknown miner during a 4-day period. Here, the term "unknown miner" refers to blocks where an IP address is listed for the miner who solved the block, rather than the name of a known mining pool. It should be noted that most blocks relayed by unknown miners are still likely to represent a small pool of miners, not an individual node.

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[12] United States of America, Department of Justice. (2010, August 19). *Horizontal Merger Guidelines*. Retrieved May 9, 2015, from http://www.justice.gov/atr/public/guidelines/hmg-2010.html#5c

[13] Verouden, V. (2004, February 19). *The Role of Market Shares and Market Concentration Indices in the European Commission's Guidelines on the Assessment of Horizontal Mergers under the EC Merger Regulation.* (United States of America, Department of Justice). Retrieved May 9, 2015, from http://www.justice.gov/atr/public/workshops/docs/202601.htm

### 2.3.2 Findings

**Table 2: HHI Results for Samples and Cumulative Data of Mining Pools**

| 4-Day Samples | Separate Unknown Miners* | Grouped Unknown Miners** |
|---|---|---|
| **Sample 1** | 1061 | 1352 |
| **Sample 2** | 992 | 1313 |
| **Sample 3** | 992 | 1265 |
| **Sample 4** | 973 | 1306 |
| **Cumulative** | 992 | 1301 |

* Separate Unknown Miners: blocks mined by unknown miners are considered as individual competing miners or unknown mining pools

** Grouped Unknown Miners: blocks mined by unknown miners are considered as a single competitor

The HHI results presented in **Table 2** suggest that the market for Bitcoin mining pools is unconcentrated according to the standards set by the U.S. Department of Justice. However, according to the European Commission's guidelines, the values found are high enough for market concern. Though the market is not highly concentrated, the data also clearly indicates that most blocks are mined through mining intermediaries, and not by individuals, as would be preferred in a decentralized network. In the sampled periods, the cumulative market share of unknown miners is only 17.7%, while the market share of the largest mining pool, F2Pool, is 21.1% (see **Appendix C**).

### 2.3.3 Limitations and Suggested Research

While the findings suggest that the market is not highly concentrated, data should be continuously collected to measure how the market concentration changes over time. As the difficulty in mining Bitcoins continues to increase, it is possible that unknown miners will be less and less able to compete with the computational power of mining pools. If this is the case, then as unknown miners are eliminated from the race for blocks, the market will become increasingly concentrated. This could be a cause for future concern, as a concentrated market could lead to anti-competitive practices by remaining mining pools, such as the price-fixing of higher participation fees.

Additionally, the market share of large pools should be monitored as a mining pool that is used more than by half the Bitcoin network is in a reasonable position to launch a "51% attack". As mentioned in **Section 2.1**, other nodes in the network must approve a new block in order to add that block to the blockchain. However, if one party controls more than 50% of the processing power in the network, it is in a position to manipulate the blockchain. For example, the party could block valid transactions from gaining approval, reverse new transactions such that bitcoins may be double-spent, and even prevent other miners from finding blocks so that any new currency can be mined by the dominant party alone. Such an attack by an individual node would be impossibly expensive, as bitcoin miners have a combined processing power 13,000 greater than the world's largest 500 supercomputers.[14] However, this attack is possible by a mining pool if it can accrue more than half of the network's processing power.

[14] How bitcoin mining works. (2015, January 20). Retrieved May 1, 2015, from http://www.economist.com/blogs/economist-explains/2015/01/economist-explains-11

Finally, this paper specifically analyzes the market for mining. Further research should be conducted to assess the market concentration for other products in the Bitcoin ecosystem in order to truly understand the market that is growing around Bitcoin.

# 3. Case B: Yerdle Reuse Dollars

## 3.1 Introduction to Yerdle

Yerdle is a mobile application-based used goods market based in the United States. Yerdle's mission is to create a 25% reduction in the number of new goods that people need to buy. [15] To accomplish this, the application facilitates barter within the Yerdle market using an alternative currency, the Yerdle Reuse Dollar (YRD). Thus, rather than buy or sell goods with fiat currency, users "win" or "give" goods in exchange for YRD. The YRD only exists digitally and has no intrinsic value, but its exchange rate is set equal to the US dollar, so users can easily value goods on the application.

When the Yerdle app was first created, the Yerdle economy existed as a closed system. Users were given the equivalent of 25 YRD when downloading the app and joining the community. In order to earn more currency, users would have to sell used goods on the app. In January of 2015, however, Yerdle partially opened its economy. Users are still given 25 YRD upon joining the community, but may now also purchase extra YRD with fiat currency in order to complete a transaction. However, users cannot cash out YRD into fiat currency. Instead, all purchased YRD stays within the Yerdle economy.

[15] About Yerdle. (n.d.). Retrieved from https://yerdle.com/mission

### 3.1.1 What would cause Yerdle users to prefer conducting a transaction in Yerdle Reuse Dollars instead of fiat currency?

This section seeks to understand when users would prefer to convert fiat currency into an alternative currency in order to buy a used item.

### 3.1.2 Methodology

To address the proposed question, a binary logistic regression was calculated to determine the circumstances under which a Yerdle user is more likely to purchase extra YRD in order to complete a transaction. Using raw data provided by Yerdle on over 31,000 transactions that took place between January and March of 2015, a series of independent variables and a dependent variable were created.

Independent Continuous Variables:

- "Price": The price of the item bought

Independent Categorical Variables: The following are dummy variables such that true events return a value of 1, and false events return a value of 0.

- "Is Frequent Buyer": The user who bought the item has bought at least 15 items during between January and March of 2015
- "Is Frequent Seller": The use who bought the item has sold at least 15 items during January and March of 2015
- "Is Pro": The user who bought the item is a "Pro". Users are considered Pros if they have successfully sold 25 items since joining the Yerdle community and have successfully shipped at least 85% of items to the product buyers.
- "Is New": The condition of the item was described as either "New" or "Like New", and not "Used".

- "Is Electronic & Games", "Is Baby", "Is Books", "Is Health & Beauty", "Is Hobbies & DIY", "Is Home", "Is Kids", "Is Men", "Is Sports & Outdoor", "Is Tools", "Is Unisex", "Is Women", and "Is Movies & Music": The item belonged to the department described in the variable name.

Dependent, Categorical Variable: The following is a dummy variable such that true events return a value of 1, and false events return a value of 0.

- "Is Purchased": The user purchased extra YRD in order to complete the transaction

The variables "Is Frequent Seller" and "Is Pro" are considered separately because an independent analysis of the two variables indicated that these variables are not correlated. In order to complete a binary logistic regression, one department dummy variable must be omitted to avoid multi-collinearity. Multi-collinearity arises when one variable term can be predicted by other variables. Here, it is certain that each transaction event belongs to one of 13 categories. Thus, if an event is not true for one of 12 department variables, we can predict that it is true for $13^{th}$ department variable. The omitted category becomes the reference category relative to which all other department results should be analyzed. Here, the department "Movies & Music" was omitted because it contained the smallest number of transactions where users purchased additional YRD.

### 3.1.3 Findings

**Table 3. Yerdle Regression Results for dependent variable "Is Purchased"**

| Independent Variable | P-Value | Coefficient | Odds Ratio |
|---|---|---|---|
| **Product Price** | | | |
| Price | 0.008 | 0.000134 | 1.0001 |
| **User Characteristics** | | | |
| Is Frequent Buyer | 0.575 | 0.06 | 1.0621 |
| Is Frequent Seller | <0.001 | -1.165 | 0.3118 |
| Is Pro | <0.001 | -0.677 | 0.5081 |
| **Product Condition** | | | |
| Is New | 0.077 | -0.1531 | 0.858 |
| **Product Department*** | | | |
| Is Electronics & Games | 0.058 | 0.877 | 2.4046 |
| Is Baby | 0.002 | 1.472 | 4.3562 |
| Is Books | 0.042 | 1.006 | 2.7342 |
| Is Health & Beauty | 0.205 | 0.652 | 1.9203 |
| Is Hobbies & DIY | 0.374 | 0.478 | 1.6124 |
| Is Home | 0.184 | 0.637 | 1.8914 |
| Is Kids | 0.04 | 0.968 | 2.6314 |
| Is Men | 0.029 | 1.03 | 2.8009 |
| Is Sports & Outdoor | 0.087 | 0.911 | 2.4869 |
| Is Tools | 0.011 | 1.583 | 4.8677 |
| Is Unisex | 0.288 | 0.577 | 1.7811 |
| Is Women | 0.001 | 1.303 | 3.6803 |

- Product department results relative to omitted department, "Movies & Music"

The regression output presented in **Table 3** indicates a number of statistically significant results. First, an increase in the price of an item does not increase the likelihood of a user purchasing extra YRD. While the result's P-value is significant, the coefficient is close to 0 and the Odds Ratio is almost 1, indicating that price has almost no impact on the dependent variable. Second, it appears that frequent sellers and pro users are very unlikely to purchased extra YRD in order to complete a transaction. Intuitively this seems reasonable, as frequent sellers and pro users have probably earned a significant amount of YRD through sales such that they may shop for items without needing to purchase extra YRD. Finally, relative to the department "Movies & Music", users are much more likely to purchase extra YRD to complete transactions in the following departments: Baby, Books, Kids, Men, Tools, and Women.

In exploring the general distribution of purchases made with bought YRD across departments, it seems that majority of bought YRD purchases are in the departments Electronics & Games (30.95%) and Women (31.91%) (see **Appendix D**). However, when considering the total extra YRD purchased as a percent of the total sum of item prices within a department, we see that 78% of the YRD used to buy Books department were purchased using fiat currency (See **Appendix E**).

### 3.1.4 Limitation and Suggested Research

While the regression output contains some significant findings, the R-Squared value of deviance of the regression is only 6.01%, indicating that the variables considered in the regression only explain 6.01% of the variance in the data. To expand the set of possible explanatory variables, more data could be collected on the demographics of the user base, such as gender, age, and geographic location.

Additionally, Yerdle only recently opened its economy, and more data should be gathered over time to see the long-term impact this change has on the community's behavior. For example, it's possible that the opportunity to purchase extra YRD may help inactive or less active users to reenter the market activity, could shift general product offerings, or could even increase the average price level of goods sold.

# 4. Conclusion

This paper studied two sample currencies, Bitcoin and Yerdle, in order to gain a better understanding of how well alternative currencies serve their intended purpose, of whether they highlight flaws and inefficiencies in our current use of money or social organization, and of the externalities they may have on society.

The scale that Bitcoin has achieved as a cryptocurrency is unprecedented, drawing a lot of attention to and analysis of the technology and the currency's use. While this paper found no conclusive evidence that Bitcoin is being used as a commodity, it argues that Bitcoin is likely to have higher success as a currency if the exchange rate is less volatile. Further, the growing popularity of Bitcoin has led to a budding ecosystem of services that facilitate the currency's use. These services, however, are essentially intermediaries and counterintuitive to the objective of decentralized control and peer-to-peer exchange. Yet, the existence of these services increases the convenience of Bitcoin, which in turn increases the user base.

It should also be noted that while governments cannot regulate Bitcoin, they can and do regulate the ecosystem of services, as most are required to register as money exchanges or commercial entities in their originating country. Thus, this raises the question of how realistically Bitcoin's objective of decentralized authority can be achieved. If these services are inevitable

and do increase accessibility, perhaps the ideal of decentralized control should be refocused to the competitiveness of these services.

Finally, while Bitcoin's current state may not fulfill the purpose of its creation, Bitcoin's technology does successfully compete with modern financial institutions. For example, the technology allows users to transfer any amount of money at no cost almost instantly, and businesses to receive online payments without needing to pay credit card fees. This technology not only highlights the friction suffered when transferring fiat currency, but also challenges intermediaries that handle fiat currency to become less costly and more efficient.

In the case of Yerdle, we see an application that is drawing commerce away from regular markets and into barter markets, where overall, users pay less to acquire the same good. Considering Adam Smiths theory of the evolution of money from barter markets, the use of this application may seem like a regression. Yet, users are willing to trade fiat currency for YRD and take part in this alternative economy. While we may be paying competitive prices for used goods in fiat currency markets, these goods still costs us substantially more than those in Yerdle's alternative market. This suggests that in our evolution of money and subsequent capitalism, the costs saving and decreased waste of simpler exchange markets was lost.

Finally, in considering both Bitcoin and Yerdle, it seems that alternative currencies, like fiat currencies, also evolve. The Yerdle market evolved from a completely closed system economy to one that allowed YRD purchases, so now users can conduct more transactions in the market, and in time the market will probably see an increase in product diversity. The market surrounding Bitcoin has also evolved significantly, and while this market may not support Bitcoin's original objectives, it does support the over all accessibility and use of the currency.

Whether or not these alternative currencies meet their intended objectives, they evolve to meet user needs, and the markets surrounding both currencies are only growing.

## 5. Works Cited


1. About Yerdle. (n.d.). Retrieved from https://yerdle.com/mission

2. How bitcoin mining works. (2015, January 20). Retrieved May 1, 2015, from http://www.economist.com/blogs/economist-explains/2015/01/economist-explains-11

3. *Ithaca Hours*. Retrieved March 20, 2015, from http://ithacahours.info/

4. Lehdonvirta, V., & Castronova, E. (2014). Money. In *Virtual Economics* (p. 312). The MIT Press.

5. Muthaka, D., & Kimenyi, M. S. (2013, July 17). Bangla-Pesa: Slum Currency and Implications for the Poor in Developing Countries. Retrieved March 20, 2015, from http://www.brookings.edu/blogs/up-front/posts/2013/07/17-bangla-pesa-currency-kimenyi-muthaka

6. Pagliery, J. (2014). *Bitcoin and the future of money*. Chicago, Illinois: Triumph Books LLC.

7. Smith, Adam. 5th ed. 1904. *Smith: Wealth of Nations, Book I, Chapters 1-4*. Library of Economics and Liberty. Web. 29 Oct. 2014.

8. The Equation of Exchange. (2008, April 18). Retrieved from http://www.investopedia.com/exam-guide/cfa-level-1/macroeconomics/equation-exchange.asp

9. United States of America, Department of Justice. (n.d.). *Herfindahl-Hirschman Index*. Retrieved from http://www.justice.gov/atr/public/guidelines/hhi.html

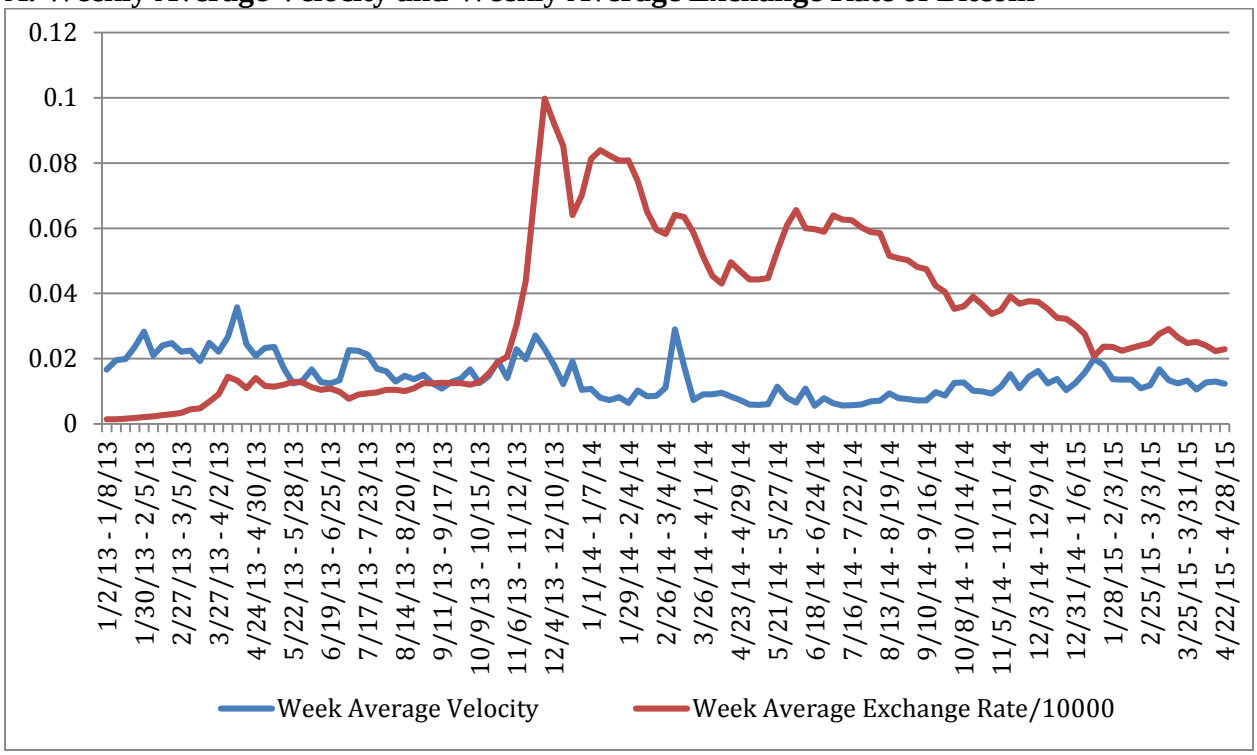
10. United States of America, Department of Justice. (2010, August 19). *Horizontal Merger Guidelines*. Retrieved May 9, 2015, from http://www.justice.gov/atr/public/guidelines/hmg-2010.html#5c

11. Verouden, V. (2004, February 19). *The Role of Market Shares and Market Concentration Indices in the European Commission's Guidelines on the Assessment of Horizontal Mergers under the EC Merger Regulation.* (United States of America, Department of Justice). Retrieved May 9, 2015, from http://www.justice.gov/atr/public/workshops/docs/202601.htm

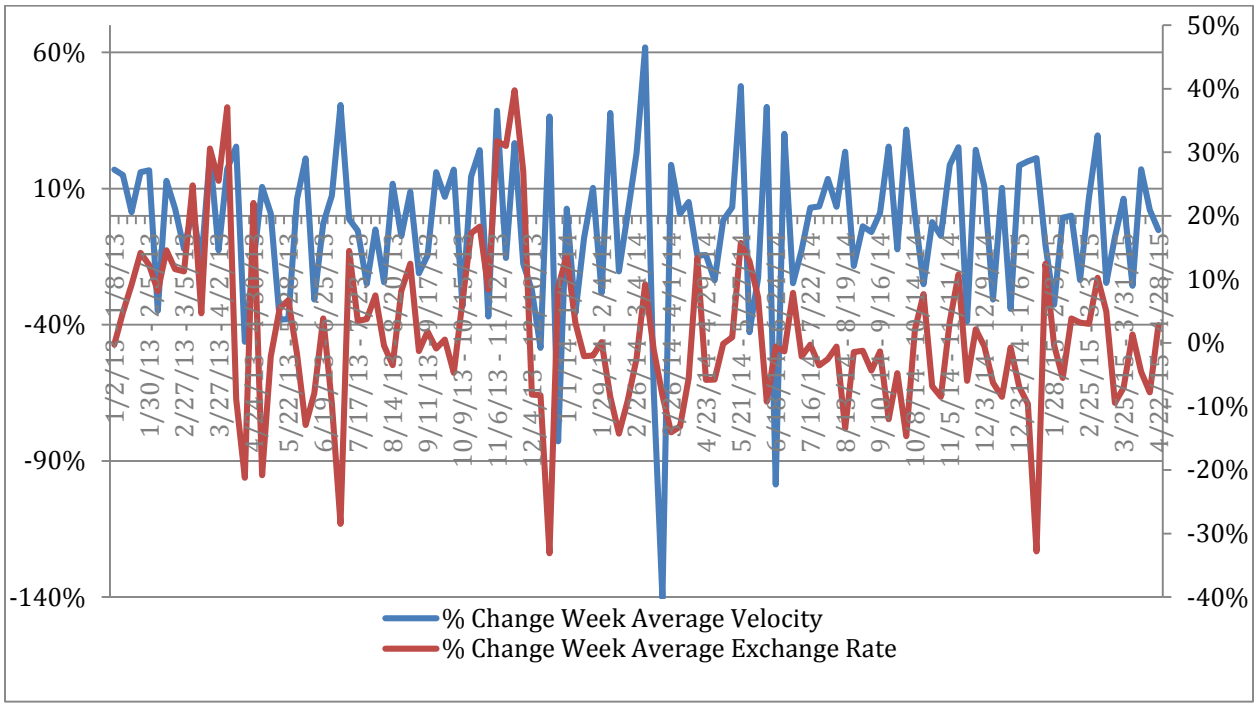
12. WIR Bank Profile. (2010). Retrieved May 12, 2015, from http://www.americantradesystem.com/WIR_Bank_Profile_2010.pdf

# 6. Appendix

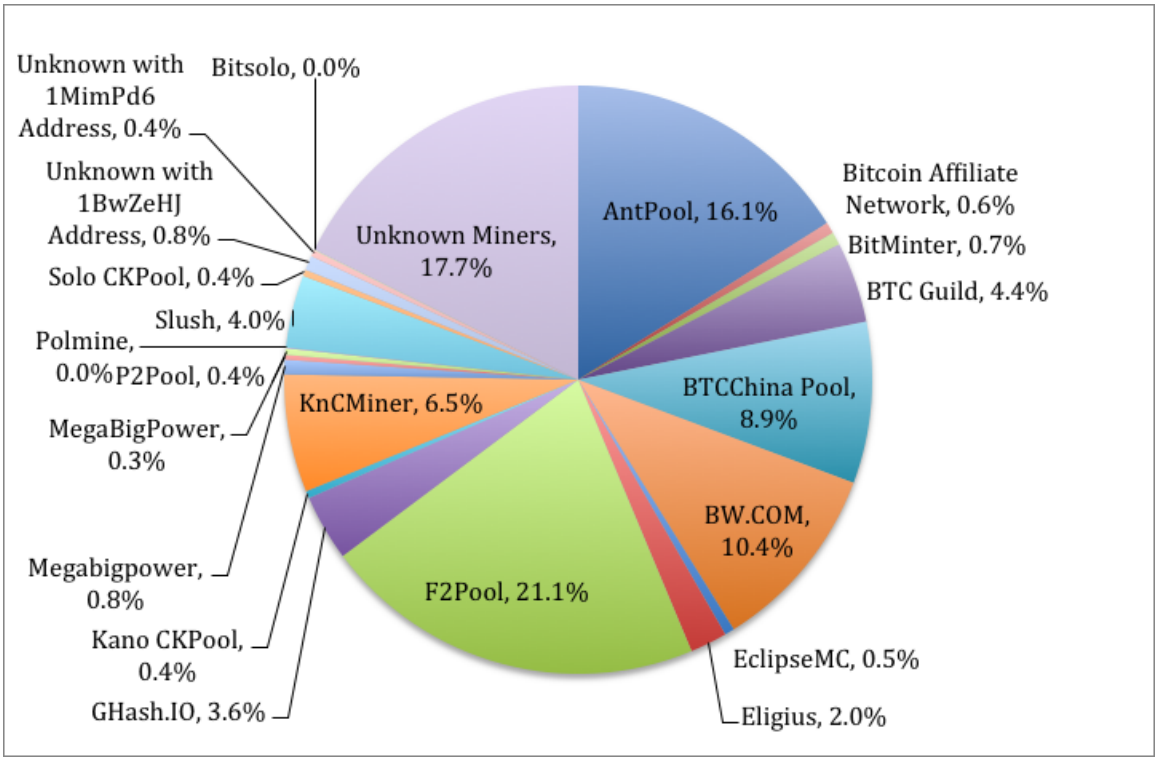
### A. Weekly Average Velocity and Weekly Average Exchange Rate of Bitcoin



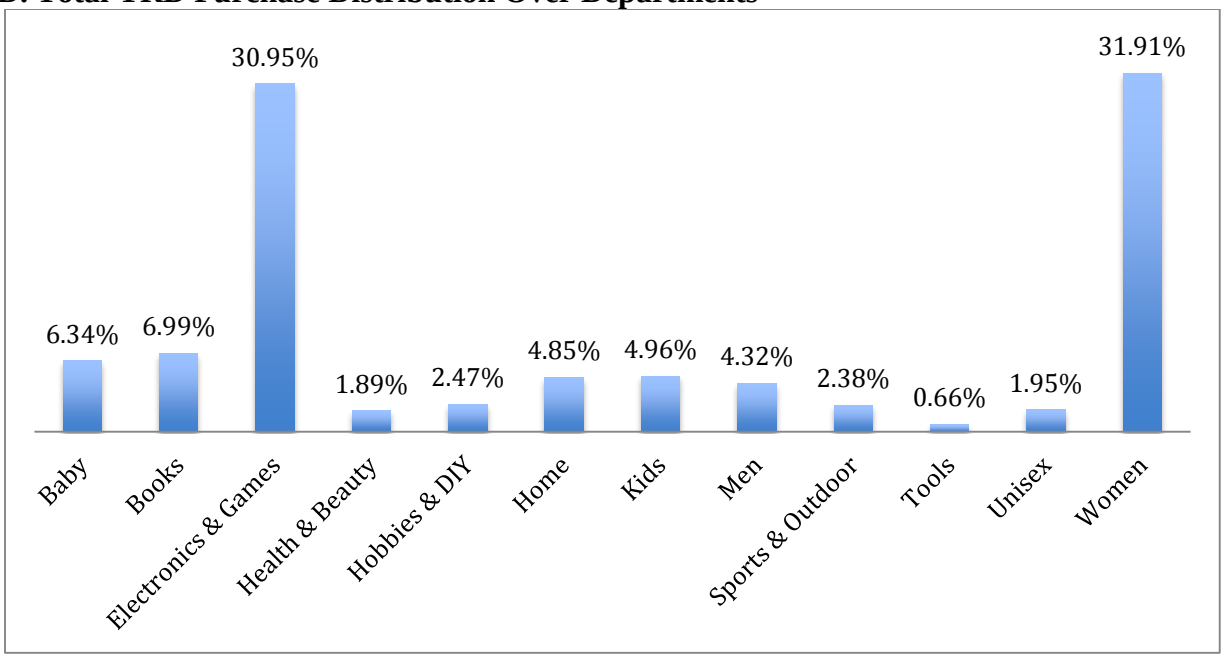

### B. % Change Weekly Average Velocity and % Change Weekly Average Exchange Rate of Bitcoin



**C. Market Share of Active Mining Pools and of Unknown Miners, Grouped**




**D. Total YRD Purchase Distribution Over Departments**



**E. Total Purchased YRD as % of Total Price of Items by Department**