BITCOIN VOLATILITY ANALYZED AND EXPLAINED

I. Introduction:

Bitcoin, the most prominent cryptocurrency, is capable of "volatility in the form of 10x changes in price versus the U.S dollar, in a relatively short period of time" (Barker, 2014). This essay would, thus, elaborate on its behaviors in hope of discovering its driven forces. The essay's approach, however, would treat the bitcoin market as a unique complex system, analyzing its network effects, feedback loops and system dynamics on different levels of analysis. This is not confined to describing but also linking and explaining such factors.

II. Major factors on multiple levels of analysis: [1]

Unlike the stock market, which is one typical example of complex systems, the bitcoin market has different characteristics that may be potential driven forces, resulting into its uncanny behaviors. Thus, it is necessary that we take a look at its background and major "players" before delving into the specifics.

The bitcoin market could be analyzed from different perspectives, or levels of analysis, namely cultural, social, and individual:

- Cultural: the society's perception of the bitcoin market has a drastic impact on the number of people participating in the market and even the price of bitcoin (IGM, 2013). Currently, without the need to use bitcoin in commercial activities, the number of participants in the bitcoin market is still rather scarce (9.5 million users as of October 22 according to Blockchain.com, 2016). thus making it less appealing for big institutions (hedge funds, fintech companies or banks). This may lead to two possible results. First, there may be no major players in the bitcoin market, thus no one to regulate the price to a stable level. Second, there may be discrete major players (criminal gangs for instance) that manipulate the price for specific, personal purposes, thus creating the volatility intentionally. Either way, perception is one factor leading to less transparent regulation in this extremely volatile market.
- Social: In a social level, the interaction of various group agents could give rise to emergent properties, which in turn severely shift the price of the market. As there are numerous groups (much more than the typical stock market), each driven by their own hidden agendas and motivations, emergent properties constantly crop up, resulting in several price changes in the day. The most notable group agents that I would delve into in the scope of this essay are: traders/ speculators, brokers, criminals, hackers and bitcoin commercial services (businesses, legal or illegal, which accept bitcoin as a currency).

[1] #levelsofanalysis: I present the system on different levels of analysis, with various changes from the previous assignment. Specifically, I omit many mutual characteristics between the bitcoin market and the stock market, replacing them with more original ones.

- Individual: As each group has a different motivation, we should analyze each group on an individual level to have a grasp of market dynamics. However, due to the number of words allowed, I decide to focus on the traders as they are the most crowded and impactful in price volatility. While emotions are one obvious emergent property visible in both the stock market and bitcoin market, another important factor would be how one perceives potentials, innovation and the fear-of-missing-out (FOMO). Despite a surprising lack of involvement, many influential people are endorsing bitcoin and blockchain, including the celebrity Mike Tyson, businessman Richard Branson (Khariff, 2015), technology billionaire Bill Gates and Wall Street expert Jim Cramer (Cawrey, 2013). Such good words from respectable people have a huge impact on our perception of bitcoin, making us think of it as a profitable investment and encouraging many to participate without fully understanding its fundamentals. This means that new participants are subject to fraudulent activities. This results in interesting interaction between newbie traders and brokers/ bitcoin commercial services, which would be elaborated in the next sections.

It should be noted that these levels of analysis, as well as its group agents and individuals agents co-exist and a friction from one level may likely result to another in a different level. For instance, a good social perception combined with peer pressure may result in more participants in the market. This, in turn, gives rise to bucket shops (fraudulent brokers) and HYIPs. Basing its arguments on the above levels of analysis, this essay would try to explain the volatility of bitcoin, which may inspire approaches to stabilize it.

III. Network effects:

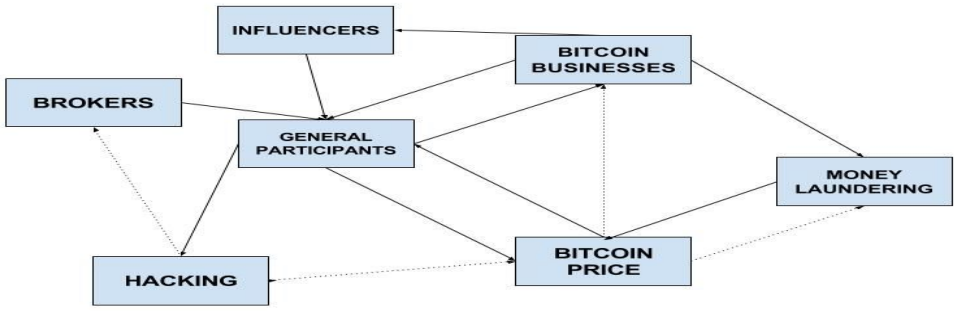

Chart 1: Bitcoin network

It should be noted that general participants are traders, bitcoin users (for commercial activities) and bitcoin miners. These participants use bitcoin for personal purposes, legal or illegal, but not for money laundering.

Taking into account the number of group agents participating in the market, it is necessary that we analyze how they interact as a network. As the above diagram shows, all group agents interact with each other, with prominent feedback loops being the loop among the number of general participants, hacking activities and bitcoin price (a negative feedback loop) and the one among the number of bitcoin businesses, general participants, bitcoin price and money laundering activities (a positive feedback loop). This takes into account an interesting phenomenon that more people start to develop an interest in bitcoin when its price rises. This network also reveal that the general participants have the most important role in determining bitcoin price, depending on their activeness on the market. Other factors that influence their presence are hacking activities, influencers, bitcoin businesses, brokers[2] (depending on their reliability but generally, more brokers would attract more people as they might diversify their investment). Money laundering also indirectly affects the number of market participant as it would generally occur when price lowers and lead to a surge in price. [3]

IV. System dynamics on different levels:

Another interesting finding derived from the above network effect is that emergent properties may link with each other on different levels.[4] The reason for this is the relationship of group agents. An emergent properties in one group leads to a change in another group, which in turn, gives rise to an emergent properties[5], so on and so forth. Another reason is that some group agents could be complex systems on its own; hence a phenomenon could be a critical point, shifting different group-complex systems from one attractor to another. For example, a hacked broker may make its users share its loss (as in the case of Bitfinex, reported by Chen and Nakamura, 2016). This decision may be the critical point, shifting an individual from the phase of high hype and high emotional state to the opposite phase. This, in turn, also shifts the societal perception of bitcoin from the phase of high expectation for bitcoin and . For the main state space that determines bitcoin price, the broker's decision may disrupt the system dynamics, shifting bitcoin from being highly reliable and highly prospective to being unreliable and less prospective. [6]

V. Agent based model:

[2] #multiplecauses: the cause of the fluctuation in the number of market participants are listed. They are categorized as primary (direct) effects and secondary effect (money laundering)
[3] #networks: the network of bitcoin market is discussed, with various effects on different levels analyzed.
[4] #levelsofanalysis: Analyze system dynamics and emergent properties on different levels
[5] #emergentproperties: I link emergent properties not separately but taking into account the interaction of different groups.
[6] #systemdynamics: attractors of the market, its group agents and individual agents presented and analyzed.

After analyzing how different groups interact with each other, it is worthwhile that we zoom in certain groups in different levels to analyze their interaction. To simulate the price volatility of the market, one type of agent is not enough. To closely replicate the bitcoin market, I suggest that we apply the characteristics of different levels of analysis. Thus, I propose a combination of **two agent based-models**.

The first one resembles the bitcoin market on a more societal level with agents belong to different groups namely the trend followers, the contrarians and the hoarders.

- The trend followers: Trend followers enter the market when the price has moved up 3% (to buy long) or moved down 3% (to sell short) and would exit their positions when the price starts to turn around.
- The contrarians: Contrarians would enter the market when price has moved down 7% (to buy long) or moved up 7% (to sell short). In favorable cases, they would wait for the market to revert twice to exit their position. Otherwise, if the market does not revert like they speculate, but continue its trend for another 5% drop (for the long position) or 5% rise (for the short position), they would exit the market.
- The hoarders: The hoarders do not trade bitcoin, but buy them for long term investing purpose, or for commercial use. When the hoarders decide to buy would be determined by the second model.

Another feature of the first model is that the agents could change their roles. A trend follower would turn into a contrarian if it fails to make profit in 3 consecutive trades and vice versa. If a trader (either trend follower or contrarian) fails to make profit in 6 consecutive trades (even after changing its role), it would turn into a hoarder. A hoarder, in turn, would turn into a trader (trend follower or contrarian at random) after the price has either risen or decreased by 20% since the last time it bought a bitcoin.

The second model represents the bitcoin market on a larger but more individual scale. It simulates how one individual turns into a bitcoin hoarder. This model is a big network with **lines representing relationships**. In this model, agents would follow one simple rule. One turns into a hoarder when 50% of people it knows of (people connected with it by a line) talk about bitcoin. One noticeable feature of this model is influencers, which represent leaders of the world (on different fields ranging from politics to technology). Influencers connect to the majority of agents as they are known by most people. [7]

VI. Conclusion:

This essay attempts to explain and simulate the volatility of the bitcoin market on different levels. Considering the potential of bitcoin in both for-profit and nonprofit worlds,

[7] #multipleagents: even though the HCs has been applied in the second part, it is most prominent here as I clarify various points and apply them for an actual ABM.

it is necessary that more light is shed on this phenomenon. Only then could we come up with a viable solution to stabilize bitcoin, turning it into a legit currency for future.

VII. Response to feedback:

I choose to continue this topic as there is still room for improvement and expansion. With the help from professor's feedback, I explore the phenomenon from different levels of analysis, focusing much on identifying the majority of the participants and how they may interact with each other as individual agents AND as group agents. Another significant change in this essay, thanks to the feedback, is the explanation of emergent properties on different levels of analysis. Content-wise, I try to explain more clearly, with reference to diagrams or specific examples. Last but not least, I also improve my presentation, with heading and footing, to closely resemble the APA style.

VIII. Bibliography:

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