**Assignment Cover Sheet**

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| **Module Code:** | **BEE3109** |
| **Candidate Number:** | **650044834** |
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|  | |
| **Do you have an approved Individual Learning Plan (ILP)** | **Yes** |
| **If Yes to above, do you require and have approval for specific learning difficult marking guidelines (as outlined in the link below)?**  <https://www.exeter.ac.uk/media/universityofexeter/wellbeing/documents/Dyslexia_Marking_Guidelines.pdf> | **No** |
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Bitcoin, Money and Trust Assignment

**Introduction: What is Bitcoin?**

Bitcoin is a ‘*breakthrough’*[[1]](#footnote-1) system that allows people to pay each other securely without relying on banks and central banks, and in new forms. It’s anonymous creator Satoshi Nakamoto released a White Paper[[2]](#footnote-2) explaining what Bitcoin is on the 31st October 2009, and subsequently stated he had created Bitcoin for trust reasons as ‘*central banks must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust.*’[[3]](#footnote-3) Bitcoin can be summarised to center upon four key aspects: computer science; cryptography; people, businesses and governments; and economic incentives.

The way bitcoin is ingeniously designed, blocks of bitcoin are mined by competing but co-operative miners. Miners compete to add the latest block of the bitcoin blockchain to receive block subsidies and transaction fees. Miners co-operate because they benefit from sharing information, and checking that each other are following the rules of the game, so that in the case they find the latest block, it is first to be accepted by fellow miners, and so that can start working on adding the latest block to any newly mined block in the blockchain as fast as possible. Pivotally, it is easy to hash the block-header and check that it contains the hash of the past block.

Orphan blocks occur when two miners discover blocks by chance at the same time, but there’s only one winner as there’s a common ‘Nakamoto consensus’ that there can only be one chain, thus the one that quickly becomes the longest chain wins. Satoshi designed Bitcoin so that there is a fixed Supply of 21 million Bitcoins (produced by 2140) and block subsidies (starting at 50 BTC) halve every 210,000 blocks produced, and will be halved 16 times, in order to ensure Bitcoin becomes self-dependent. He wrote (2010) ‘*in a few decades when the reward gets too small, the transaction free will become the main compensation for nodes…there will either be very large transaction volume or no volume.*’[[4]](#footnote-4)

Cryptography secures Bitcoin. The cryptographic hash generator that’s used in bitcoin is the SHA256 (published by NSA in 2001) which turns any messages (not exceeding 2 million terabites) into a 256 bit string. This uses 6 complicated mathematical functions to work and is very secure according to computer scientists, although quantum computers may lead to change. The Sha 256 is an effective hash algorithm as it follows a fixed set of instructions with a low-cost procedure and crucially is pre-image resistant (given output, very hard to guess input) and collision free (almost impossible to find 2 messages that produce the same output).

Digital Signatures are used to make Bitcoin payments as they are authentic, non-repudiated and have integrity. Digital signature uses shar 256 and the elliptic curve digital signature algorithm (ECDSA), so that sender’s private key can create a signature that can be verified by combining two of the sender’s public key, message and signed message.

A screenshot of a cell phone

Description automatically generated[[5]](#footnote-5)

This works as sending public message creates a random private key (that remains always private through wallet software), which then generates a public key, based on the size of your private key. Through the ECDSA the message and the private key then create a signed message that anyone can verify. This is asymmetric Key Encripyption and signifies that it’s remains hard to find a valid block, but easy to check blocks are valid.

Transparency is crucial to Bitcoin. Every transaction is a record of bitcoin inputs from previous transactions linked to a new output, and all this is transparently stored on the blockchain in signed messages pool.



This 1-megabyte bitcoin block image[[6]](#footnote-6) shows that blocks are separated into different parts. The General Information part contains the magic number (file type), block size and version. The Transactions part contains the transaction counter (the count of transactions included within the block) and transaction list. The Block Header contains the all-important summary information of the block: the time stamp, difficulty, nonce, merkle root hash and previous block hash.

Satoshi invented bitcoin to be secure and decentralized through a proof-of work system similar to Adam Beck’s 1997 Hashcash. In his words ‘*proof of work has the nice property that it can be relayed through untrusted middlemen… the proof of work speaks for itself’[[7]](#footnote-7)*.

This system involves miners scanning for a value that when hashed begins with a certain number of zero-bits. The average work required to perform this exponentially increases with the number of zero-bits required, yet this can be verified by executing a single hash. This verification ensures the miner has adjusted the nonce (a number that represents, on average, the time a miner spent on a hash) enough to ensure the hash of this new block header meets the difficulty criteria/ is smaller than the number set by the following difficulty adjustment algorithm:

This algorithm recalculates difficulty every 2016 blocks to a value such that the previous 2016 blocks would have been generated in exactly two weeks had everyone been mining at this difficulty. It is vital in providing stability to Bitcoin as it adjusts difficulty to all collective levels of mining power so that no matter the size of mining power in use it will take always take approximately ten minutes to mine every block and block subsidies always halve every four years.

Merkle roots do not contain a list of transactions, *‘rather a hash of all transactions as a tree structure’*[[8]](#footnote-8). The merkle root makes it is easy to discover if anyone changes any of the information in any transactions, as the Merkle root gets completely changed. This stops individuals from double spending or even trying to re-write the history of the public ledger.

Thus, it isn’t currently feasible for the Bitcoin network to be hacked. An attacker would have to redo the proof of work of the block and all blocks after it, and then catch up with and surpass the work of honest nodes creating future blocks. It would therefore need at least 51% of the mining network or ideally for no-one to be mining in the Bitcoin network. That’s why the Satoshi Consensus to work only on the longest chain is so vital. However, having such a long chain requires immense computer power, is expensive and bad for the environment. Bitcoin currently uses nearly the equivalent amount of energy as Ireland. However, more positively, as well as being a secure, democrotised (decentralised) payment system, bitcoin makes feasible micro-payments, and thus addresses the issue that banks ‘*massive overhead costs make micropayments impossible’*[[9]](#footnote-9).

**Background: Where does Bitcoin fit in the Broad History of Money?**

The invention of Bitcoin might fit in the broad history of Money as a landmark creation, as it could end up marking the genesis of a revolutionary system that changes how future civilizations construe what money is. This would be a natural occurrence, as humans’ interpretation of what ‘money’ is has been revolutionized constantly throughout history. Money is a social technology that facilitates trade and functions well when it is transportable, difficult to fraud, divisible and desirable. Bitcoin appears to satisfy all these criteria. However, money causes problems when it becomes society’s focus and may function better when regulated by democratic governments.

Contrary to the commonly held belief ‘*not a single researcher has been able to find a society, historical or contemporary, that regularly conducted its trade by barter*.’[[10]](#footnote-10) The economy of Yap, a remote and inaccessible inhabited island (unknown to the world until 1869) helps explain why. Yap’s market had only three products -fish, coconuts and sea cucumber, so a bartering system would seemingly have been really viable there. However, Yap had a highly developed system of money, involving fei – **‘***large, solid, thick stone wheels ranging in diameter from a foot to twelve feet’[[11]](#footnote-11)* American adventurer William Furness visited Yap in 1903 and documented *‘the noteworthy feature of this stone currency is that it is not necessary for its owner to reduce it to possession.’[[12]](#footnote-12)* Thus, the monetary system in Yap emphasises how unique and advanced monetary systems can be relative to the markets they serve.

Findings of modern anthropologists discern that money emerged as a system of updating debt and credit (not as a commodity) in Ancient Civilizations. In 3000 BC Mesopotamia, people recorded transfers of commodities on clay tablets, and then developed their monetary system by using symbols. The pioneering city of Uruk flourished in Mesopotamia and has even been described as ‘*the Silicon Valley of the Ancient World’[[13]](#footnote-13)*. This society by 700BC became part of Ancient Greece’s civilization, that formed the world’s ‘*first bureaucratic society – and its first command economy’*[[14]](#footnote-14) and this region has been credited with inventing numeracy, accounting and literacy but not money.

Money arose from multiple cultures mixing, requiring Mesopotamia’s system of accounting and the ‘*idea of a universal scale of value incubated in the barbaric West[[15]](#footnote-15)’* to combine and lead to the final requisite defining Ancient Greece’s money: ‘*the principle of decentralised negotiability.*’[[16]](#footnote-16) This is highlighted by how in 350 BC Aristotle saw money as both a commodity and something that was socially symbolic. He described how *‘it exists not by nature but by convention, and it is in our power to change it and make it useless[[17]](#footnote-17)’* andnoted *‘for the purposes of barter, men made a mutual compact to give and accept some substance… (*as*) a useful commodity, was useful to handle in use for everyday life, iron for instance’[[18]](#footnote-18)*.

In contrast to decentralised Greece, in Ancient China, under the rule of Duke Huan of Qi, monetary theory developed that would ‘*attain near-canonical status in Chinese economic thought for the next two thousand years’[[19]](#footnote-19)*, implementing money as ‘*a tool of the sovereign’*. The cogitation that led to such beliefs have been best summarised by the 113 BC statement of Economist Sang Hongyang - *‘if the currency system is unified under the emperor’s control, the people will not serve two masters.*’[[20]](#footnote-20) This ancient Chinese civilization have been credited with inventing governors who govern the scale of minting permitted.

It can be argued, Bitcoin is therefore a modern swing back to the people, as modern-day monetary system are heavily centralised like in Ancient China, when perhaps society is advanced enough to prosper without interference from central banks, tasked with managing the economies by controlling countries’ money supply. That said, Bitcoin was designed by Satoshi to complement current legal systems and therefore the shift Satoshi envisioned it should provoke might not be that dramatic.

In medieval Europe, the Roman Empire made one denarius (melted silver) worth one day of work. This silver’s symbolic power allowed divergence between intrinsic value and nominal value to be made, and its precious metal content acted as a lower limit to seigniorage. However, as the silver over time became poorer quality and parts of denarius coins were chipped off to make fraudulent coins, eventually inflation occurred (a day of work cost two denarii). Furthermore, the Roman elite engaged in sophisticated borrowing and lending with paper records which unsurprisingly led Rome to experience unstable inflations, deflations and credit crises. Nicolas Oresme, a French philosopher and mathematician stated in 1360 *‘Can any words be too strong to express how unjust, how detestable it is, especially in a prince, to reduce the weight without altering the mark?[[21]](#footnote-21)’*. Thus, Satoshi’s belief that money should be decentralised/free from interference is not a revolutionary idea at all, having been adopted by many contrarians over the past millennium.

The English implemented tally-stick technology, whereby people could record how much was owed to them and by date, through marking notches on sticks (originally bones) and splitting the sticks them in half. The English government began to borrow money with this technology. Linking to this, banks soon emerged in the middle ages, and at the fair of Lyons in the 15th century, principally Italian merchants traded millions, ‘*without a single sou changing hands’[[22]](#footnote-22),* using bills of exchange*.* Merchants historically have been entrepreneurial and created Fractional Reserve Banking is the early 14th century: *‘holding only a small proportion of their assets in coin of the state.’[[23]](#footnote-23)* Central banks emerged soon after Merchant banks. The Bank of Amsterdam was founded in 1609, and the Bank of England (1694) was the first bank whose sovereign and government had bestowed powers permitting it to govern money supply and issue the currency, on the condition that it favorable lent money to them and supported them in tempestuous times.

Synchronisation is the split between how much gold, silver and alloy metal banks kept in store vaults and how many notes (“I owe yous”) were in circulation. As Bonds and debts began to be used, bank’s ‘*maturity gap’*[[24]](#footnote-24) (loans made being paid back far later) began posing problems, as banks had to reassure the public their reserves covered any potential defaulting loans. The British 1925 Gold Standard Act signified all paper currency was worth gold that you could claim from central bank. However, post WW2, banks reverted to fractional reserve banking to boost the economy. Presently, the UK and Australian Banks have ‘*no reserve requirements’*[[25]](#footnote-25).

Nowadays, there are two existing systems that store value: physical and electronic. Most money is electronic and therefore not anonymous, unlike cash. Bitcoin is currently pseudonymous. Of current transactional systems, only physical cash provides cheap instant transactions. Credit/debit cards, PayPal and Bitcoin all either process charges or delay transactions. However, Bitcoin is not a stable store of real value due to speculation, whilst cash and credit/debit cards are stable stores of value, so long as central banks act responsibly. In Venezuela, Bitcoin is infinitely more stable than the fiat currency. Nevertheless, Bitcoin is very similar to credit/debit cards; for instance, pin numbers are like private keys.

Bitcoin genesis block was mined on the 3rd January 2009, right after the 2007 Financial Crisis that led to the August Northern Rock Affair, the September 2008 failure of AIG, Lehman, Merrill, the October 2008 RBS, Lloyds TSB, HBOS 37bn bailout and finally, the February 2009 Obama/Hanksom Fiscal Stimulus Plan (£790bn bailout). The crisis startingly kept bankers rich, but impoverished millions who took their advice.

Prior to Bitcoin, many cryptocurrencies came but failed. Digicash came from the 1983 White paper: *‘blind signatures for untraceable payments’* by David Chaum and was followed by Nick Szabo’s Bitgold (1998), Wei-Dai’s b-money (1998) and Hal Finney’s Reusable Proof of Work System (2003). Crucially, these came before the financial crises and unlike Bitcoin needed support from a trusted 3rd party and did not control inflation nor for double spending. This proves that Bitcoin is a highly advanced digital payment system that may just be the next phenomenon in the history of money.

**If Bitcoin (operating under Satoshi’s vision) was trusted and accepted by the government and society as the most effective means of payment, what key areas of the economy could it revolutionise?**

Bitcoin is an exciting technology, particularly because the way trust flows through society is changing from hierarchical and institutional based trust to a more peer-to-peer and heterarchical trust, a gradual change over centuries in Western Civilisation, that has now accelerated enormously in the last decades as a result of the Internet. Reviews, rating sites, blogs, friends and colleagues are now firmly new sources of trust that the public relies on, whilst on the other hand, the media, government and powerful institutions, such as banks, are now widely and ever-increasingly mistrusted. The 2007 Financial Crisis perfectly illustrates how vulnerable the economy is when powerful institutions make mistakes, and certainly led to a drastic fall in the public’s trust of banks. If Bitcoin were accepted by governments and society as the most effective means of payment and the most common form of payment, the economy would be undoubtedly revolutionised in two fundamental ways: on a macro-level, it would replace monetary policy and facilitate fiscal policy, whilst on a micro-level, it would increase consumer-power and decrease producer-power.

A screenshot of a social media post

Description automatically generatedMany argue that economics needs to radically update with the times and that Bitcoin can revolutionise economics, principally because it’s decentralised and takes away power from institutions that can no longer be trusted. Many condemn Quantitive easing and see it is as a way for pension and insurance funds (those who sell government bonds) and banks to become richer, stock-markets to become more valuable and governments to artificially boost the economy to garner short-term popularity at the cost of increasing public debt to the expense of the everyday citizen. It can be argued, Quantitive easing will in the long-term devalue the currency and thus people’s everyday spending-power. After all, just more money has been ‘created’, but nothing has been produced, thus logically money must be worth less and it’s extremely dubious whether this new wealth in the pockets of the few trickles down to the majority to compensate for their loss in wealth.

However, many argue Quantitive easing is an effective monetary policy that Bitcoin would take away. In March 2009 the Bank of England began to slash interest rates and buy bonds, and since the economy has somewhat recovered: there has been record low levels of unemployment and the UK is growing faster than fellow European Countries. Furthermore, there have even been years of real-wage growth between September 2014 and September 2016 (shown by graph).

The issue is that Quantitive easing is highly ineffective, and rather crudely balloons levels of inequality which are already far too high. Figures show under the UK government’s Quantitive easing scheme, it extraordinarily ‘*takes £375 billion of new money just to create £23-28 billion of extra spending in the real economy’[[26]](#footnote-26)* whilst it has ‘*boosted bond and share prices by around 20%’*[[27]](#footnote-27), which theoretically have made the richest 5% of households ‘*up to £128,000 better off’[[28]](#footnote-28)*. As the crude concept ‘*money makes money’* has overwhelming been proven to be true, the ‘*trickle-down theory’* that Quantitive easing depends upon to justify its use in any situation other than an emergency one, simply doesn’t convince. Thus, the statistics show that the Bank of England simply cannot be trusted to use Quantitive easing sparingly and only in emergency circumstances, and this illustrates that there is a current need for Bitcoin, a de-centralised means of exchange, to revolutionise the system.

Furthermore, UK interest rates have been below 1 percent since 2007. This not only indicates that Quantitive easing has failed, but also that Institutions cannot be trusted to positively affect the economy through monetary policy (due to fear, hidden agendas or lack of understanding of the markets), as if interest rates were to be used effectively they would surely be more versatile and adaptable to the current and future predicted state of the economy. Whilst the UK economy has been relatively stable since 2007, it has certainly gone through notably differing periods of struggle, uncertainty and growth which could have been capitalised or curtailed accordingly by monetary policy. What the interest rates show, is that all that the investors are looking for is a sense of stability, which Bitcoin should be able to provide should it be universally accepted and free from speculation-driven volatility.

Pertinently given the Brexit situation, even those in favor of monetary policy view the crises in Europe to have been at least partially caused by the European Central Bank issuing the same interest rates for countries like Germany and France as for countries like Spain, Portugal and Greece. These countries vary so heavily in monetary needs but have the same currency, the Euro, unbalancing and distorting trade between the EU nations. If it’s revolutionary for trade that people of different countries are able share a universal currency, Bitcoin provides the answer (as long as it doesn’t replace individual national currencies) whilst a single shared currency run by a single shared bank has proven to not be effective in times of crises.

Fiscally, Economics is still heavily centered around Keynesianism. Keynes argued that governments needed mechanisms to appreciate or depreciate the currency as he noted wages were rigid, and that this was a massive factor that caused the great depression of the 1930s, and the 1925 Gold Standard Act led to unemployment and underproduction because it inhibited the governments capabilities. However, modern-day wages are no longer so fixed, as Uber for example proves, so is monetary expansionary/contractionary policy so necessary.

Milton Friedman, a libertarian, predicted e-cash to revolutionise the system in the 90s, as it would prevent the government from collecting taxes so easily on the internet. Opposing Economists of thought believe tax is essential, so that fiscal policy can be implemented in a positive and sustainable manner to society’s benefit. Crucially, Satoshi designed Bitcoin to be pseudonymous, depending on the whether the users reveals his private details, and the fact that transactions on the block-chain should theoretically make it easier for governments to collect tax via bitcoin, and prevent tax fraud. It is widely believed that the CIA/NSA have likely deanonymized most of the bitcoin network to date, and has been estimated by the IRS tax cheats cost the US government $458 billion a year[[29]](#footnote-29). Pertinantly, Satoshi built bitcoin to work within global jurisdictions, not to replace them. Therefore, Bitcoin should potentially be an incredible powerful fiscal tool.

However, the existence of other privacy coins such as Monero means users can still manage to potentially be anonymous in the bitcoin network, if they have converted their bitcoin in a circular way with an effective privacy coin. Furthermore, many powerful people within the Bitcoin Community carry beliefs similar to (or stronger than) Milton Friedman and are lobbying to anonymise/ privatise Bitcoin. These individuals are unlikely to fade away from the Bitcoin scene any time soon.

On a micro level, Bitcoin should provide consumers massive benefits and revolutionise Economics through micro-payments. Websites could begin to require to users to pay micro-transactions of their choice (0 – 1p for instance) through bitcoin cash and tokens, in order to fund their designers and creators in a more ethically and rewarding way than through advertisement. This would be a massive blow to corporations and subtly, massively advance consumer-power. Furthermore, bitcoin would mobilise the work-force, as you can be paid anywhere in bitcoin and not suffer from unfavorable exchange-rates.

Bitcoin was designed by Satoshi to support ‘*a tremendous variety of possible transaction types… Escrow transactions, bonded contracts, third party arbitration, multi-party signature, etc…’[[30]](#footnote-30)* As Bitcoin is still a nascently invented means of exchange, the true possibilities of Bitcoin really cannot be accurately fathomed; all it requires really is for one incredibly benevolent, imaginative and talented individual, or one very malevolent, imaginative and destructive individual, to completely change how we view Bitcoin, as it’s practically irrefutable that Bitcoin technology has the potential to change the world in colossal ways that no-one has thought of or shared yet, on a micro and even possibly macro level because it provides a perfect environment for innovation.

**Appendix: Group Work Learning Log**

On the 17th October, I met my group: Ben, Jack, Karim and Will for the first time at a tutorial. All of them were extremely nice to me, and very easy going as I had the missed the previous tutorial and I had to inform that I was going to be away for a weeks of university term-time. We participated in a quiz, under the name Bitcoin Barons, but didn’t win. Whilst I was away, I sent a few articles via facebook to the others on cryptocurrencies in South America, and they all sent a few different articles to a group chat to.

When I got back to university I got immediately in touch and had to catch up on all the work everyone had done up to that point for the presentation. The group had decided to delegate different areas we were going to cover in the power-point to different people, and to update everyone over what we had done on our areas.

Karim was to introduce of the presentation, presumably as he was a calm person, and briefly cover what the situation in Venezuela was like and what were some benefits of bitcoin/ cryptocurrencies in general. Ben was working on opportunities and threats that bitcoin faced in South America. Jack was doing lessons learnt from South American countries, in particular Peru, Argentina, Brazil as well as Venezuela. Will was doing his on reserves in cryptocurrency and central bank digital currency, and how Venezuela’s central could utilise new cryptocurrency instrument/ tools to help it’s economy.

I was tasked with presenting what were the effects of Bitcoin on Venezuelan society as well as talk about the Petro. This led me to a do a lot of research into Venezuelan society, to understand how educated and optimistic the society was towards bitcoin, and to what extent was Bitcoin a viable alternative to the hopeless fiat currency ‘the bolivar’, US black market dollars and even gold. #

Furthermore, I researched mining, which was very popular in Venezuela because it could provide a decent income and was so cheap to run there, as electricity was free, but at the same was dangerous. decided to do a big slide on the Petro as it was a creation of the Venezuelan government who claimed it was a crypto-currency backed by 30 million barrels of oil, but it was in reality a digital form of debt from a country with no financial credibility backed by an oil company with debts of $45 billion. Overall, I was very happy my slides and topic.

I met up with the group three times, each time updating everyone and making sure the presentation didn’t contain repetitive content. I booked a room for our last meet up on the morning of our presentation so we could practise on the day. We practised twice the presentation. The presentation went well. I could have improved by memorizing more and reading a script less what I wished to say in my three minutes, and by managing my time better in the practices. I managed the time well in the real presentation, but the practices had me more anxious than I would have been if I was better prepared.

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