

Bitcoin in Islamic Banking and Finance

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Abstract

This paper analyzes the compliance of distributed, autonomous block chain management systems (BMS) like Bitcoin—also referred to as 'virtual currencies'—with the requirements of Islamic Banking and Finance. While intended as a narrow financial and economic analysis, and not as an in-depth analysis of the subtleties and nuances of Shari'a as they relate to banking and finance, it shows that a BMS can conform with the prohibition of riba (usury) and incorporate the principles of maslaha (social benefits of positive externalities) and mutual risk-sharing (as opposed to risk-shifting). It concludes that Bitcoin or a similar system might be a more appropriate medium of exchange in Islamic Banking and Finance than riba-backed central bank fiat currency, especially among the unbanked and in small-scale cross-border trade.

Keywords: Islamic Banking, Islamic Finance, Bitcoin, virtual currency

1. Introduction

Ariff (2014) notes that, although the literature on modern Islamic Banking and Finance (IBF) dates back more than a half-century, the practice of IBF is still in its infancy, and some common practices of Islamic banks are "questionably asymmetrical" and "in consonance with the letter rather than the spirit" of Islamic traditions (p.741). He suggests that this is an understandable consequence of the fact that this initial phase of IBF focuses on offering Shari'a-compliant alternatives, and that the next phase should focus on Shari'a-based services that might bear little or no resemblance to conventional banking and financial services. Even with these initial shortcomings, small Islamic banks tend to enjoy lower credit and insolvency risk than their conventional counterparts, and the loan quality of both small and large Islamic banks appears to be less responsive to changes in domestic interest rates than the loan quality of conventional banks operating in the same jurisdictions. (Abedifar, Molyneux & Tarazi 2013) This paper argues that a distributed, autonomous block chain management systems (BMS) like Bitcoin—also referred to as a 'virtual currency'—might find a place within this growing field that is increasingly popular among not only the 20-25% of the world's population who are Muslims, but among many non-Muslims, as well (Abidefar, et al. 2013; El-Gamal 2006; Ghannadian & Goswami 2004; Hasan & Dridi 2010; Imam & Kpodar 2014; M.M. Khan & Bhatti 2008). This paper begins with a brief review of modern IBF literature and background on BMS. It concludes with a discussion of the potential relationship between the two.

2. Islamic Banking and Finance

Although the literature on modern IBF dates back more than a half-century, IBF is still a work-in-progress. Disagreement continues among proponents and outside observers concerning the distinction between what is permitted or required (halal) and what is forbidden (haram) under different interpretations of Islamic Law (Shari'a). Adding to the confusion is the desire of many Islamic banks' executives and customers to integrate those banks into the global banking and financial system, which is governed by international treaties and national statutes and regulations that often are at odds with or even in direct violation of Shari'a.

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(Ariff 2014, 1988) Nonetheless, it is universally recognized that the overriding feature of IBF is the prohibition of usury (riba). Granted, some heterodox Islamic scholars argue for a distinction between exploitative usury and benign time preference in the form of interest on money loans, or for a distinction between consumer debt and commercial debt, but the consensus among IBF scholars is that all transactions should involve the transfer of real goods and services (Ariff 1988), echoing Aristotle's position of seeing money as a facilitator of the trade of real goods and services—not a good in its own right—and holding 'unnatural' money-for-money loans in disdain, especially the most hated sort: the breeding of money from money (Meikle 1994). Readers from the West/Global North who find this position odd are reminded that restrictions on economic activity are common worldwide in the forms of licensing, regulation, patents and copyrights, government franchise, civil forfeiture, and prohibitions of usury (i.e., 'excessive' interest rates), unconscionable contracts, insider trading, front-running, price gouging, Ponzi and pyramid schemes, money laundering, suspected money laundering, etc. In this way, the prohibition of rib should be no more exceptional than, e.g., the prohibition of trade based on knowledge of fact (insider trading, front-running, price gouging), of providing services that are otherwise legal (government franchise, licensing), or of sharing information (patent, copyright). In this spirit, let us look at IBF as it currently is practiced. M.N. Siddiqi's (1988 [1969]) seminal *Banking without Interest* states that a bank should be organized as a *Shirkat-e-Enan*, eschewing riba and earning income from profit-sharing (*mudarabah*) and profit- and loss-sharing (*musharakah*, also known as *shirkah*). In conventional Western/Northern terms, this is essentially a call for the organization of banks as general partnerships that consist of at least two partners, both or all of whom bear unlimited liability, sharing profits and losses in proportion to the relative sizes of their investments. While all partners should have equal rights to participate in the daily operation of the bank, they need not be required to do so. Individuals can elect to be passive—though not limited—partners, who delegate operations to a subset of the partners or to administrators who are not partners, and they can have business interests outside the bank that are unrelated to their participation in the bank.

The primary concern is to avoid principal/agent asymmetries that exist in conventional limited-liability firms, especially in jurisdictions with efficient capital markets that make it trivially easy for shareholders to sell their shares, rather than expend the effort of monitoring board members and officers (executives). Given a choice between monitoring executives on the one hand, calling them to task when they misbehave, and struggling to change their behavior, and simply selling one's shares on the other hand when executives misbehave, shareholders generally opt for the latter, where capital markets are efficient. A very large literature exists on how this principal/agent problem results in executives of publicly traded firms being free to pursue their own interests, which can run contrary to those of the shareholders. (Ariff 2014, 1988; Siddiqi 1988 [1969]) While many modern Islamic banks are organized as conventional limited-liability corporations with passive shareholders, this is generally seen as a shortcoming to be remedied. Something more closely resembling a credit union or a cooperative is preferable, in which members are owners in proportion to the relative sizes of their investments in the venture, and all owners have an incentive to monitor executives actively. This remains an area for future research and exploration. (Ariff 2014, 1988) Choudhury & Hussain (2005) emphasize the centrality of the promotion of the precepts of Shari'ain the practice of IBF, including economic development, human capital, social justice, etc. Ariff (1988) sees this as a secondary concern that derives its rationale from the eschewing of riba. Even so, citing Chapra (1982), he notes that the scope of activities that Islamic banks undertake need not mirror those of conventional banks, and can include a different mix of services with a stronger emphasis on social welfare than profit maximization. Similarly, it is not uncommon in the West/Global North for fiscal policy makers to issue mandates to bank executives to extend credit on the basis of economic development, human capital, and social justice, including guaranteed student loans, subsidized mortgages, sub-market and guaranteed loans to businesses in economic development zones, etc.

While one might see economic development, human capital, and social justice as distractions from profit maximization, Taleb (2012, 2007, 2005) emphasizes that the single-minded focus on profit maximization can lead to excessive financial leverage (gearing) and over-optimization, which can cause losses over short intervals that are greater in magnitude than total profits over the preceding decades. A. Ahmed (2010), Chapra (2010), Hasan & Dridi (2010), M.F. Khan (2010), Matthews & Tlemsani (2010), Seidu (2010), M.N. Siddiqi (2010), Smolo & Mirakhor (2010) echo this point in their analyses of the relatively mild effects of the Crash of 2008 on Islamic banks, as contrasted with its nearly devastating impact on American and European banks. Readers interested in more detailed introductions to IBF are referred to Aghnides (1916), Z. Ahmed, Iqbal & Khan (1983), Ariff (1982), Obaidullah (2005), A. Siddiqi (2006), and M.N. Siddiqi (1988 [1969]).

With regard to the broader, general topic of the influence of religion on economics and finance, Weber (2001 [1905]) describes in detail how the understanding of modern economics in the West/Global North and the very form of capitalism itself are infused with Protestantism and Utilitarianism. This influence of religion on culture and the economic systems that operate within cultures led Weber to publish *The Religion of China: Confucianism and Taoism* (1968 [1915]), *The Religion of India: The Sociology of Hinduism and Buddhism* (2012 [1916]), and *Ancient Judaism* (1967 [1917-1919]); and he was continuing his series with works on early Christianity and Islam, but was cut short by his unexpected death in 1920 from pneumonia as a complication of Spanish flu (Bendix 1977 [1960]). Far from originating in the physical laws of nature—like the need to eat and sleep, the principles of stable public works construction, or the practice of animal husbandry and agriculture—economic organization everywhere and among all peoples originates in custom and tradition, which are influenced by religion (Lavoie & Chamlee-Wright 2000). In this regard, and setting aside theological differences, IBF in practice is different from conventional banking in form, but not necessarily in kind, at this stage of its development. This could change, however, if Islamic bank executives abandoned inflationary riba-backed central bank money (fiat) in favor of something more harmonious with IBF.

3. Virtual Currency Blockchain Management Systems

Conceptually, a blockchain management system (BMS)—the most successful being Bitcoin—is a self-contained system for transferring numerical values from one account to another, such that no value is lost in transit between accounts, and double-spending is impossible.

In this way, a BMS can be seen as an accounting system. BMSs like Bitcoin exist as myriad copies of a piece of software that run on users' computers, communicate with each other over the Internet, and have copies—that are updated approximately every ten minutes—of the history of every transaction that has been completed within the system since its inception. If anyone's transaction history differs from others' it is considered to be incorrect and it is replaced with a copy of the correct record. To subvert the system, one would need to control more than half of the entire network and to corrupt the record in precisely the same way across that majority. (Nakamoto 2008) When discussing Bitcoin, the capitalized term (Bitcoin) refers to the software and the network of users, and the lower-case (bitcoin) refers to the unit of account in the system. Here, XBT—following the standard for currency abbreviations defined by ISO 4217 (International Organization for Standardization 2008)—is used interchangeably with bitcoin. Pluzhnyk & Evans (2014) approach the Bitcoin system as a provider of transaction confirmation services and treat XBT as liabilities of that service provider that are used as a medium of exchange and sometimes as a store of value. Given that the system is self-contained, all of the conventional balance sheet accounts—on the asset side: cash, accounts receivable, inventory, fixed assets; on the liabilities side: accounts payable, notes payable, long-term debt, paid-in capital—are equal to zero. Nonetheless, markets for XBT are active 24/7 with no breaks for holidays, and the market cap for Bitcoin can be calculated from the most recent price and the total amount of XBT in existence. This value currently is measured in the billions of USD. Considering that these XBT liabilities have market value, it holds that the Bitcoin system must hold some asset of equivalent value. Pluzhnyk & Evans (2014) invoke goodwill to describe this intangible asset, and argue that it derives from users' expectations of Bitcoin's usefulness in future transactions. Evans (2014a) notes that the current market value (P) of XBT is driven by users' 'continually updated expectations concerning three factors: the value of future services and cost savings (F) enabled by Bitcoin; the market consensus of the appropriate discount rate (r), which includes ever-changing premiums for myriad sources of perceived risk; and the time (T) until F is realized, such that:

$$P = F / (1+r)^T, \text{ where} \quad (1)$$

- F includes the value of users' ability 1) to transact directly with the billions of individuals worldwide who do not have easy access to efficient banking and money transfer services, but own mobile phones, 2) to buy from online retailers at Chinese or US prices, plus shipping, rather than at the substantially higher local prices that prevail in many parts of the world, 3) to remit any amount to anyone anywhere in the world who has Internet access, 4) to hold value privately, particularly in areas where holders of large bank account balances or recipients of large transfers via Western Union are in danger of being kidnapped for ransom. As realization among market participants of these advantages increases, F increases, putting upward pressure on P .
- r includes premiums for the risks of technical difficulties and security issues related to holding XBT, regulatory uncertainty, price volatility, etc. As uncertainty decreases, r decreases, putting upward pressure on P .

- **T** is the time for useful innovations to come to market. As expectations of the delay until they become available decrease, **T** decreases, putting upward pressure on **P**.

Abidefar, et al. (2013), Ariff (2014, 1988), Choudhury & Hussain (2005), El-Gamal (2006), Obaidullah (2005), and A. Siddiqi (2006), inter alia, remind readers that time value of money calculations, per se, are not haram, so long as the differential between **P** and **F** is associated with the purchase of real assets, and both parties to the transaction share the risk. For example, it is permissible to accept a lower price for the pre-sale of an asset delivered later and paid for now, or to require a higher total amount paid for an installment purchase delivered now and paid for over time, so long as both parties to the transaction share the risk. It is beyond the scope of this paper to explore Bitcoin's compliance with Shari'a as a store of value. If it is seen as an undifferentiated pre-payment for goods and services in the indefinite future that have not yet been identified, this might lead to a different conclusion from the assumption that XBT is a new kind of digital asset that can be used as money. However, if XBT is used as a medium of exchange for transactions completed within very short time spans, then Bitcoin can be seen as a communication protocol, not entirely unlike an order for a bank transfer, a message sent between two hawala agents, or a cheque that is deposited immediately upon receipt. The exploration of these and related questions is a potentially productive wellspring for future research.

3.1 The Regulators and the Elephant in the Room

Regarding the points made immediately above, we are reminded of the story of the Blind Men and the Elephant, in which each blind man generalizes that the elephant in its totality is represented by the part that he feels. To the one blind man touching a leg, and elephant is like a tree; to another near its trunk, it is like a snake; to yet another by its tail, it is like a rope; by its ear, a fan; by its ribs, a wall; etc. In this case, it is not blind men, but regulators confronted with something unfamiliar and innovative. When we encounter new technology, the language that we use to describe it often fails us. We must use existing words in strange ways to describe new concepts associated with the innovation, in the same way that our ancestors had to, when confronted with the 'horseless carriage' (automobile), 'moving picture' (cinematic film), or 'information superhighway' (Internet) (Graef 2010). Today, it is 'virtual currency' (Bitcoin). This leads to our using terms like 'coins' and 'mining' to describe how new XBT units come into circulation, although there are no coins in Bitcoin. Even if there were, coins are not mined; ore is mined, ingots are smelted from ore, and coins are minted from ingots. The terms 'coin' and 'virtual currency' are metaphors. (Evans 2014a) In the USA, to FinCEN (2013) officials, Bitcoin looks like a money transmission system. To Internal Revenue Service (2014) and Commodity Futures Trading Commission (2014) officials, XBT looks like a commodity. To some theorists, including Pluzhnyk & Evans (2014), XBT can be seen as non-voting liabilities of a 'distributed autonomous company' (Larimer 2013).

To the degree to which the Bitcoin system provides the services that Fama (1980, p.39) describes as "the the main function of banks in the transactions industry," to wit: "the maintenance of a system of accounts in which transfers of wealth are carried out with bookkeeping entries, "it is a bank, and XBT are liabilities of that bank. Countless Bitcoin supporters insist that XBT is a community currency (Blanc & Fare 2013; Evans 2014b; Owen 2009; Seyfang & Pearson 2000). Whereas, central bank researchers conclude that XBT looks unlike a currency (European Central Bank 2012; Lo & Wang 2014; Velde 2013). Such broad disagreement is understandable, considering that regulators from specific ministries or regulatory agencies oversee specific subsets of regulated activities—i.e., banking, consumer credit, mortgage lending, equipment financing, venture funding, etc.—and financial innovations often blur the lines dividing one kind of activity from others. This can lead to disagreement over which ministry or regulatory agency has jurisdiction over the innovation, and it is only natural that regulators might prefer to view Bitcoin in terms of some preexisting category (Brito & Castillo 2013). The unlikely alternatives to this would be at the one extreme for regulators to petition legislators to draft, debate, and enact new statutes that create new ministries or regulatory agencies to oversee the use of this financial innovation by the public, or at the other extreme—in this post-9/11, post-USA PATRIOT Act, post-Crash of 2008 world—to disavow responsibility and let market participants sort it all out in a state of *laissez faire* (Zarate 2013). The former is costly and tedious, the latter runs counter to the regulatory instinct, and both dilute the power and influence of the authorities and agents employed by the ministry or regulatory agency shrugging off responsibility. As Brito & Castillo (2013) note, the outcome that we have seen among regulators in OECD member states is a tendency to put Bitcoin-related activities into preexisting regulatory 'buckets'. Within the context of IBF, Shari'a authorities face the same dilemma as Western/Northern regulators. Although narrowly defined aspects of Bitcoin fit into neat categories, the totality of Bitcoin—or any BMS—transcends conventional categories, and it falls on authorities to proclaim which categories take precedence over others.

To see why this could be problematic, consider that Bitcoin-the-software is much more than the XBT bitcoins-the-units. XBT simultaneously can be seen as virtual currency liabilities of a kind of bank or central bank, as non-voting capital shares in the system as a whole, and a new class of commodity. XBT can be used as a medium of exchange and as a store of value. Complicating things further, a programmer in Argentina has developed a way to embed messages into the Bitcoin block chain, as a kind of time stamp that serves a very similar function as 'notarization'(Kirk 2013). Rosenfeld (2012) has created a way to tag specific units of XBT with extra strings of data (colored coins) that give them a unique 'color', that can mark them as proxies for shares of equity, bonds, future or forward contracts, options, leases, annuities, or any other financial assets. And, developers continue to develop cleverer and more surprising uses for this platform that can be reached from anywhere in the world with Internet access, and can be used for all manner of transactions and services that are de jure regulated and now de facto unregulatable.

This situation creates a conundrum for regulators. If officials from several ministries or regulatory agencies within a given jurisdiction—banking, stock exchanges, derivatives markets, money transmission, taxes, consumer protection, etc.—see this metaphorical 'elephant' as being within their specific purviews, then to set it free in an state of laissez faire would call into question the rationale of the regulatory state. If, instead, regulators within specific ministries or regulatory agencies tried to apply existing regulations to this innovative technology that is both a superset of existing categories and oblivious to jurisdictional boundaries, then they would risk chasing it underground, where it would be beyond their reach, and they would create incentives for Bitcoin developers and entrepreneurs to emigrate to more liberal jurisdictions, taking their startup firms—perhaps the next generation's 'Apple', 'Facebook', 'Google', etc.—with them, as appears to be happening in the USA already (Torpey 2014). The response among regulators in OECD member states has been to make peace with virtual currency. In some jurisdictions, particularly within the EU, this has been enthusiastic. In the USA it has been begrudging, with officials at the CFTC (2014), FinCEN (2013), and the IRS (2014) issuing positive signals, while officials at the Department of Justice issue negative signals and officials at the Office of the Comptroller of the Currency issue no signals. This creates enough fear, uncertainty, and doubt among Bitcoin entrepreneurs to keep them from completely outrunning regulators in the short run. Although Shari'a and Anglo-Saxon Common Law are orthogonal to each other, policy makers operating within both legal traditions face the same technical reality. The following observations are offered in this spirit.

3.2 What is Money?

Money, as an institution is as old as civilization. The literature on money dates at least as far back as Aristotle (Meikle 1994; Menger 1892; White 1902), and many variations on the story of the evolution from tribal communism to barter to money have been told over the ages. A commonly accepted definition of money is along the lines of: a commodity that individuals accept voluntarily in exchange for all other goods. Historically, the commodity has tended to be a precious metal, usually gold (dinar) or silver (dirham). Granted, other things have served this purpose in isolated communities, but those are anthropological curiosities more than relevant examples here (Del Mar 1895). However, even in modern times, the drive to reckon in terms of some form of money is so strong that even cigarettes can serve as money, when conventional forms of money are not available (Radford 1945). Historically, money, per se, served four functions: medium of exchange, unit of account, store of value, and measure of value. However, Cronin (2012) and Evans (2014a) demonstrate that these functions are generally separated in practice today, which leads to the conclusion that we might be witnessing the "end of money" (Rahn 1999). Nonetheless, the ideal commodity to serve as money has been understood throughout history to be fungible, portable, scarce, divisible, and durable. Gold and silver qualify in this regard, as proven by history, and—as discussed below—so does Bitcoin, although fiat does not. Which of these qualities takes priority over the others is a matter of perspective. Within the context of IBF, a Hadith of Sahih Muslim (Book 10, Ch. 36) that addresses the use of money and the avoidance of paying or receiving riba, suggests that fungibility is as important as scarcity and durability. It admonishes individuals to exchange of like quantity for like quantity—gold for gold, barley for barley, dates for dates, etc.—and never more for less. This presents an intriguing conundrum for holders of fiat, which tends to lose value over time. On the one hand, when one borrows, e.g., US dollars (USD) in a riba-free environment, one is expected to repay the same amount of USD, no more and no less. On the other hand, when one repays the same quantity of USD after some period of time, the fiat's purchasing power generally has fallen; if the period of the loan is long, then the value might have fallen significantly.

The same number of USD in the future is worth less in terms of the goods and services that it can buy than that number of USD was worth in the past.

The most straightforward way to avoid this conundrum is to prohibit loans of money for more than a very short period. However, it is instructive to note that this specific issue developed only relatively recently with the institution of pure fiat worldwide beginning in the 1970s. Historically, this concern and the concomitant contradictions that it causes were moot. Before the creation of modern, floating central bank money in the early 1970s, economists distinguished between real money and promises to pay, noting that the difference between them is analogous to the difference between a meal and a meal ticket, or a coat and a coat check (White 1902); today, one might compare a valet ticket with a car in this context. Even so, *riba*-backed Federal Reserve Notes (FRN) were declared in 1913 to be legal tender in the USA, after which they traded at parity with gold certificates, and their value was pegged indirectly to the value of gold. In this way, both gold certificates and FRNs served as promises to pay either real money or an equivalent value of other goods and services. In 1933 it became a federal crime for US persons to own USD—then defined as 1/35th of one troy ounce of gold—but the value of gold certificates and FRNs continued to track the value of gold. In 1973 the USD ceased to exist as a fixed quantity of gold and instead has become a promise to pay USD 1.00, backed by a loan from the Federal Reserve with a face value greater than USD 1.00, making USD 1.00 a promise to pay **more than** USD 1.00, itself being a promise to pay. Given that each unit of fiat—whether USD, euros, or any other—is lent into existence and backed by an obligation to repay more than one unit of that same currency in the future, the quantity of fiat must increase indefinitely, in order to avoid defaulting on the loans that backs each unit in circulation. It is a literal impossibility for all of the loans outstanding that back the fiat in circulation at any time to be repaid using fiat. This is similar, at the national level, to an individual who is caught in a spiral of debt that he or she cannot repay, and must borrow increasingly more, in order to make payments on existing debt. Fiat is neither a long-term store of value nor a long-term measure of value. For example, if one had put gold certificates or FRNs with a face value of USD 35.00 into an envelope in the early 1970s, when the ban on gold ownership in the USA was lifted, on the expectation that the USD 35.00 could buy one troy ounce of gold forty years later (i.e., today at the time of this writing), one would have been disappointed. In terms of gold, more than 95% of the value that those USD 35.00 represented has vanished (store of value), and USD 35.00 worth of goods then was substantially more than USD 35.00 worth of goods today (measure of value). Granted, individuals continue to use fiat as a medium of exchange, but demand for cash and cheques is falling in the West/Global North, as individuals rely ever more on debit cards, credit cards, and online banking (Cronin 2012). It is not inconceivable that fiat eventually could serve merely as a unit of account, while other assets and services perform the functions of medium of exchange, store of value, and measure of value. (Black 1970; Fama 1980; Greenfield & Yeager 1983; Hall 1982a, 1982b; Rahn 1999)

3.3 BMS versus Central Bank

If we view a BMS like Bitcoin as a kind of central bank that issues a private currency, we can contrast XBT and fiat within the context of IBF. To appreciate how this can be, it helps to review briefly the process by which XBT are released into circulation. In Bitcoin parlance, mining is an automated and decentralized form of transaction confirmation that maintains a stable and decelerating rate of the release of XBT into circulation. The ultimate supply of XBT is 21 million, hard-coded into the Bitcoin software, and expected to be reached sometime around the year 2040. The terms *miner* and *mining* are somewhat misleading, as they are intended to convey the technical rationale behind Satoshi Nakamoto's (2008) choice of the method by which the XBT are released into circulation, rather than the economic rationale. In the early, experimental days of Bitcoin, all user software mined, however this function has been turned off in later versions of the consumer and merchant software. Now, a minority of users—who have elected to install and operate application-specific integrated circuit (ASIC) chips that are able to perform only the function of confirming Bitcoin transactions—serve the role of miners. Anyone can buy ASICs and set up a mining operation, but because the total computing power of the Bitcoin network is several times as great as that of the top 500 supercomputers in the world combined (Matonis 2014), one would need to invest very heavily in equipment and Internet access in order to compete with existing miners. Approximately every ten minutes the most recent Bitcoin transactions are bundled together automatically by the software network into a block, and all miners commence a race to see who can be the first to confirm the validity of the transactions in the block and then to solve a fiendishly difficult mathematical problem that has a random outcome, the correctness of which is easy to verify. The purpose of this step is to control the rate at which blocks are generated.

When the confirmation rate becomes substantially shorter than ten minutes as miners add more computing power to the network, the software automatically increases the difficulty of the mathematical puzzles, so that the cycle stays as close as possible to one block every ten minutes.

The winner of a given block is decided largely by chance, but over the long run, the likelihood that a miner will be the first to confirm a particular block is in proportion to that miner's investment in ASICs. In this way, reward and cost are symmetrical. The miner that confirms a particular block first is awarded a fixed amount of XBT released by the software. The block is appended to the collection of previous blocks into the block chain, all users who maintain their own copies of the block chain update their copies, and the race begins again. Because miners must pay for electricity, Internet access, and equipment maintenance, they typically sell some of their newly awarded XBT for fiat and keep the remainder as their profit or invest it into new ASICs to expand their operations. Thus, newly released XBT are payment for miners' efforts to maintain the integrity of the network. Miners expend real resources in pursuit of XBT, and they are rewarded in proportion to their investments. If the market price of XBT rises, they gain; if it falls, they lose. Seen the other way around, from the perspective of the Bitcoin system, per se, if the miners collectively win, the system wins, because the incentive for others to become miners increases, which strengthens the system; if the miners collectively lose, the system loses, because the incentive to quit mining increases, which weakens the system. In this way, miners individually and the system, per se, share gains and losses. Users who are not miners can acquire XBT either by buying them with fiat from someone who offers them for sale, or to provide goods or services in exchange for XBT. This is precisely the way that one acquires, e.g., euros if one is outside the Eurozone: buy them or earn them. If one acquires XBT, in order to effect a transaction in the short term, then one bears very little risk; one acquires XBT, uses it as a medium of exchange, and receives the good or service purchased. If, instead, one holds XBT for a long time as a store of value, then one bears the risk of the market price's falling, which is true of gold, silver, land, etc. as a store of value. Once released into circulation, XBT's value derives from users' expectation of its ability to enable transactions more efficiently than conventional alternatives, or that have been hitherto prohibitively expensive or even impossible. Before the release of the first Bitcoin software, if one wanted to transact across national borders with individuals in the Emerging Middle Income Regions of the world—perhaps to buy a container of green coffee beans directly from a small-scale grower in Central America or Sub-Saharan Africa—one had to use the services of a bank or a money transmitter like Western Union. However, the World Bank (2012) estimates that more than 2.5 billion adults in the world do not have bank accounts, and money transmitter fees are often prohibitive. With Bitcoin, anyone who has Internet access via either a computer or a smartphone can transact directly with trading partners worldwide, while communicating in real time as the system confirms the transaction.

3.4 XBT versus Fiat

Contrast the creation of XBT with the creation of fiat:

- XBT is free of riba, whereas fiat is lent into existence in exchange for riba.
- The face value of the goodwill backing XBT is, by definition, exactly equal to the value of the XBT in circulation, whereas the face value of loans backing fiat is, by definition, greater than the value of the fiat in circulation, due to present value discounting; the excess value represents the issuing bank's equity, thereby granting it a perpetual advantage over fiat holders.
- New units of XBT come into circulation in exchange for the expending of real resources to maintain the integrity of the Bitcoin system, whereas new units of fiat come into circulation at the will of individuals who borrow them into existence, whenever they deem it desirable to do so.
- The quantity of XBT in circulation increases at a predictable and decelerating rate until it reaches its ultimate cap of 21 million units in circulation—each divisible to the 1/100 millionth—whereas the ultimate total quantity of fiat is unlimited and can hyper inflate.
- XBT is backed by the expectation that it will enable transactions for real goods and services that hitherto have been prohibitively expensive or even impossible, whereas fiat is backed by debt denominated in itself with a face value greater than the total amount of fiat in circulation.

4. Modest Proposals

Ariff (2014) notes that IBF, as it is practiced today, is still in its infancy, and that the focus still is on mimicking the services of conventional banks, but in a Shari'a-compliant manner. However, Ariff (1988), citing Chapra (1982), notes that Islamic banks need not mirror conventional banks, and in the second phase of the evolution of IBF, they might include a different mix of Shari'a-based services.

In this spirit, the following speculations and hypotheses are offered for discussion:

- The executives of a group of Islamic Banks—either an affiliated group or a loose confederation—could organize a virtual currency exchange under the principal of *musharakah*, in order enable those banks' customers to buy and sell XBT efficiently, in order to transfer value amongst themselves and to bypass the inefficiencies of the status quo banking system. If this exchange maintained a very narrow bid/ask spread and charged no other fees, and restricted access to customers of the member banks, this could create an incentive for Muslims and non-Muslims alike to bank with member banks.
- For non-Muslims who appreciate the greater stability of a banking system that is free of incentives to over-optimize and over-leverage, the set of halal financial services can be approximated with a collection of conventional non-bank financial services. Such an 'Islamic' 'bank' might weather future crises in the conventional fiat banking system relatively unscathed, in similar fashion to how small Islamic banks survived the Crash of 2008 relatively unscathed. These services include trust and escrow, real estate and equipment leasing, venture funding, business brokerage, and potentially a credit union. In many jurisdictions, the startup costs and reserve requirements for each of these services combined can be a fraction, perhaps by even one or two orders of magnitude, of the cost of acquiring a banking license.
- In an ideal world, Bitcoin would not be necessary, and Islamic banks could transact in gold. However, doing so could isolate a gold bank from the global banking system within a financial sandbox, and 'virtual gold' has been created by several groups of entrepreneurs since the 1990s with dubious results. Bitcoin, on the other hand, does not require vaults, guards, custodians, and other very expensive points of failure based on trusted individuals whom one does not know. Also, if one wants to transact using gold across national borders, transportation and security can be prohibitively expensive. If one resorts to *hawala*-style networks with trusted agents at each end, then one winds up where we are today. At the other extreme, one can use the status quo banking system and fiat, which are founded on principals that violate Shari'a. While Bitcoin might not be perfect, one could argue that it is less bad than current alternatives.

5. Concluding Discussion

This paper analyzes the relationship between a distributed, autonomous block chain management systems (BMS) like Bitcoin—also referred to as a 'virtual currency'—and Islamic Banking and Finance (IBF). It shows that a BMS can conform with the prohibition of *riba* (usury)—as Bitcoin does—and incorporate the principles of *maslaha* (social benefits of positive externalities) and mutual risk-sharing (as opposed to risk-shifting). With regard to *maslaha*, the world's unbanked number in the billions and represent the majority of the world's adults. Those among them who have Internet access—especially those who own smartphones—can use Bitcoin to transact as equals in the increasingly integrated global marketplace, bypassing inefficient banks, rapacious money transmitters, and multiple layers of wholesalers, cooperatives, and other intermediaries who extract markups that could accrue to the original producers. Also, if a Bitcoin user takes positive steps to promote its benefits to the world at large, then the value of his or her XBT should increase, thereby benefiting all Bitcoin users collectively. With regard to risk-sharing and cost-sharing, at its foundation Bitcoin operates according to *musharakah*, in which 'miners' operate as general partners in loose confederation, who share the costs and benefits of maintaining the system. The greater in proportion to the total computing power in the system a particular miner's investment is in equipment used to confirm transactions among users, the greater is that miner's proportion of the XBT released by the system. The more miners there are in the system, both in terms of population and computing power, the more secure the system is, and the greater the value of the XBT that they receive for their services. When the origin of a unit of XBT is compared with the origin of a unit of fiat, the contrast is stark. Fiat is born of *riba* and, by definition, not enough exists to repay the loans backing it; it necessarily must inflate without end. With Bitcoin, the quantity of XBT in circulation increases at a predictable and decelerating rate, and the ultimate cap on the quantity is hard-coded into the software at 21 million units. Rather than being lent into existence at the whim of an individual, a new unit of XBT is released in exchange for the provision of services to maintain the security and stability of the Bitcoin network.

Supporters of both IBF and XBT prefer hard money over fiat. Potentially useful things can be achieved, if members of these two very different communities become acquainted.

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