The Islamic Culture

الثقافة الإسلامية

Epistemological Analysis of Ribā al-Faḍl and Ribā al-Nasī'ah in Classical Tafsīr and Ḥadīth Literature: A Comparative Fiqhī Framework for Regulating Algorithmic Finance and Cryptocurrency Transactions in Contemporary Islamic Economics

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Abstract:

In this paper, the two key accepted classical DEFInitions concerning the prohibition of interest—Ribā al-Faḍl and Ribā al-Nasī'ah—are analyzed epistemologically and reconciled within the classical tafsīr and ḥadīth literature and then examined using the new competitive problems presented by algorithmic finance and cryptocurrency transactions in Islamic economics. Applying the exegetical approaches of al-Ṭabarī, al-Qurṭubī, al-Rāzī and al-Ibn al-Kāthir, as well as the historical collection of the Six Books (al-Kutub al-Sittah) and the jurisprudential context of the prohibition of ribā in the four Sunnī madhāhib, the paper traces the rival epistemological bases for the development of the prohibition of ribā amongst classical scholars. It then investigates the impact of these foundations, especially the 'illah (ratio legis) of ribā, which were subject of debates that transcended the lines between schools, between monetary function (thaman) and divisibility into units (kayliyyah) and measurability (wazn), between food staple (qūt) and other asset categories, and between Bitcoin and altcoins in exchange, on the novel asset types emerging from decentralised finance (DEFI) and smart-contract lending protocols, yield farming, stablecoin mechanics and Bitcoin/altcoins exchange. The paper suggests that the epistemological variety of classical tradition itself offers hermeneutical tools to respond differently to the above mentioned technologies, and proposes a three-level regulatory framework that is grounded in the classical 'illalah' analysis, the 'Maqāsid al-Sharī'ah', and 'maṣlaḥah 'āmmah'.

Keywords: Ribā al-Faḍl, Ribā al-Nasī'ah, algorithmic finance, cryptocurrency, Islamic economics, 'illah, tafsīr, fiqh, DEFI, Maqāṣid al-Sharī'ah

1. Introduction: The Epistemological Challenge of Novel Financial Technologies

Islamic legislation faces a serious modern epistemological challenge arising from the emerging global landscape and the spread of decentralised financial technologies (DEFI), which include cryptocurrencies, smart contracts over Blockchain, algorithmic lending protocols, and tokenised assets. It is not only a practical one, based on the questions of who can or cannot invest in specific financial markets and the role of financial institutions, but a fundamental epistemological one, and of how the conceptual system, which classical Islamic jurists used and built to regulate the financial and commercial economy of 7th century Arabia, can be used with integrity to appraise financial instruments and mechanisms that classical Islamic tradition could not have foreseen and that rely on ontological assumptions, such as whether money is an asset, how value is measured, whether such instruments involve exchange or not, and whether they expect to receive value back in time.

The prohibition of ribā, loosely translated as 'usury' or 'interest', but not the one word 'riba', which is never found in the Qur'an, is one of the most unmistakakable and repeated prohibitions in the legislative corpus of the Qur'an in no less than four Sūrahs (Q. 2:275–280, 3:130, 4:161, and 30:39) and supported by an extensive body of ḥadīth literature. But this prohibition is so strong because there is a conceptual complexity to its prohibitions; indeed, it is one of the reasons classical thinkers worked to such a degree on this prohibition: they had multiple accounts of what is prohibited, and different schools of law have elaborated in different ways on the 'illah (ratio legis, the operative cause) of the prohibition. There are many different takeaways from the competing versions of the "illah" that will affect the scope of the prohibition extending (if it extends) to the new tools for algorithmic finance and cryptocurrency.

The order of the movements in this paper is in three general divisions. The first covers the epistemological bases of the prohibition of riba in classical tafsīr literature and the genre of ḥadīth literature that supports it, especially in the light of the two major categories of riba (Ribā al-Faḍl and Ribā al-Nasī'ah) and the differing ‘illah analyses these two categories adopted by the four madhāhib in their determination. The second examines the principal aspects of algorithmic finance and cryptocurrency transactions in relation to each of these competing perspectives (in isolation) in order to clarify the extent of areas of clear prohibition, clear

permissibility and genuine jurisprudential contestation. The latter suggests a fiqhī system that embraces these technologies, is entrenched in classical epistemology, and yet is able to picture the modern economy and the needs of Maqāṣid al-Sharī'ah.

This is an important and powerful investigation. As of the middle of the 20ths, the estimated Muslim population is greater than 1.8 billion and the Islamic finance industry, which includes Islamic banking, Islamic bonds (sukūk), Islamic insurance (takaful), Islamic investment funds, is estimated to have surpassed three trillion dollars in fair value as of the 05th Jumu'ah 2010. Whether and how Muslims, as both individuals and institutions, can use digital financial technologies is thus not an academic question, but rather one of practical, economic impact to hundreds of millions of Muslims who are striving for accurate business practice in accordance with their religion, which prohibits ribā under any circumstances.

2. Classical Qur'anic Exegesis of the Ribā Prohibition: Tafsīr Foundations

2.1 The Qur'anic Vocabulary of Ribā: Semantic and Contextual Analysis

This chapter investigates the meaning and context of the root of ribā in the Qur'ān.It examines the semantic meaning and contextual analysis of ribā-related terms in the Qur'ān.

The Arabic stem r-b-w that ribā comes from has the primary semantic field of increasing, growth, excess, and augmentation. The formation of the concept in the Qur'ān where this root is used in its four legislative contexts is continuous and successively takes a more radical turn, ranging from a relatively gentle moral contrast in Sūrat al-Rūm (Q. The one that does not increase in the sight of God is the ribā, and charitable giving increases in the sight of God,' is despised by the members of the household of Abraham (as) and the other believers, and was in the end severely dealt by it on two occasions: in the first, when Sūrat al-Baqarah was revealed and Allah forbids ribā; in the second, when Sūrat Sabaa (Q. 35) was revealed, exercising forthrightness and integrity toward one's neighbor, s. In which is stated that 'those who eat ribā do not stand (on the Day of Resurrection) except as one driven to madness by the touch of Satan,' and also that they are 'in a state of war' (ḥarb) with God and His Messenger after they are forbidden to do it. (2:275–280).

Classical tafsīr and exegesis scholars spent much of their exegetical talents on explaining the semantic specification of the Qur'anic concept of ribā. Al-Ṭabarī (d. The Qur'ān was addressing the pre-Islamic practice (jāhilīyah) of ribā, as 923 CE in his monumental book, Jāmi' al-Bayān

traces its practice, where the lender offered to extend a loan for a fixed amount but at a higher principal: ribā al-jāhiliyyah, or ribā al-nasī'ah (ribā of deferment). This identification of ribā with compounding interest on debts deferred is a basic principle in al-Ṭabarī's interpretation of the prohibition against ribā in the Qur'an, which seems to have been aimed at this practice more than any other.

Al-Qurṭubī (d. 1273 CE), in his al-Jāmi' li-Aḥkām al-Qur'ān provides a broader synsemantic analysis; the classical Arabic language tradition extended the DEFInition of ribā to encompass any excess that was agreed upon in any exchange-type transaction, not just a compounding of debts deferred for a long time. It is a more general semantic reading, compatible with the interpretation reached by the classical jurisprudential consensus based on the Qur'ān and hanafīyah that ribā is not limited to ‘usury' (riba shudhd) but applies more generally to hand-to-hand transactions that create excess. Fakhr al-Dīn al-Rāzī (d. A rationalist perspective that anticipates the Qur'aīnī reading of maqāṣid is evident in the 1209 CE book of 12 maqāsid, Mifātīḥ al-Ghayb, in which the prohibition on ribā is meant to serve the larger Qur'aīnī goals of protection of the poor who might be exploited, preservation of the circulation of wealth among people and preventing the accumulation of wealth in the hands of a single entity.

2.2 Ribā al-Faḍl: Ḥadīth Foundations and Jurisprudential Elaboration

RIBĀ OF GOLD: This category, which means ribā that results from the excess of hand-to-hand exchange of commodities of the same genus, is based in the ḥadīth literature, in particular in the famous tradition that 'Ubādah ibn al-Ṣāmit recounted in the books of Muslim, al-Bukhārī, Abū Dāwūd, al-Tirmidhī, al-Nasā'ī, and Ibn Mājah: 'Gold for gold, silver for silver, wheat for wheat, barley for barley, dates for dates, salt for salt, like for like, equal for equal, hand to hand (riba an-baḥr)'. Whoever gives more or takes more has engaged in ribā.' The six commodities that are mentioned in this ḥadīth, known as the ribawī commodities or amwāl ribawiyyah, are those commodities in which the exchange for them must be performed on a like-for-like and hand-to-hand basis (musāwāh and yadan bi-yadin).

This ḥadīth very quickly achieved several roles in the dissemination of Islamic law, both epistemological and positional: its status became a question, its authenticity and variations were debated, its spatiality was discussed, and its scope and implications for the prohibition of Ribā

al-Faḍl were raised. The ḥadīth has been supported by a large number of the classical scholars, and only a handful minority scholars challenged its evidential status, such as Ibn 'Abbās who, reported to have had doubts initially, later reversed his opinion. But the point of what juridical principle (illah) this ḥadīth bound, and thus how the prohibition was to be extended beyond the six commodities, sparked sharply divergent answers from the four shafiʾa when it came time questions.

Affering the viewpoints of Abū Ḥanīfah d. , the school of the Ḥanafī was adopted. Later put into order by al-Sarakhsī (767 CE) Identifying illah 'as ribā al-Faḍl as kayliyyah (measurability by volume) and wazn (measurability by weight) jointly and ajins (genera) so as to answer the question from the point of view of practical methodology, erfolgt ultimately by 1090 CE (advised by him). The school of Mālikī is based on that of Mālik ibn Anas (d. In the Muwaṭṭa' (795 CE), he designed an 'illah (ration) for gold and silver: monetary function (i.e. as a medium of exchange); and for the four food commodities, he designed an 'illah; 'stick of a staple food' (qūt)/'food that can be stored' (iddikhar). According to the Shāfi'ī school which followed Muḥammad ibn Idrīs al-Shāfi'ī (d. Between 820 CE, determined ‘illah to be the takarūj of gold and silver and the qūt of four food items, and ‘illah ta'āmiyyah for 'illah qawqaa' of the food items. The Ḥanbalī school (also known as Ḥanafī) was based on Aḥmad ibn Ḥanbal (d. The most restrictive is the prohibition in 855 CE which applied to the six commodities that have been specifically mentioned and to other commodities that have been analogised to them.

2.3 Ribā al-Nasī'ah: The Deferment Prohibition and Its Classical Construction

The ribā of deferment or postponement is most similar to the "interest on a loan" of modern financial institutions with which it is most frequently confused, a ribā payment accrued for a deferred or postponed payment. The most clear-cut form of ribā is one that is categorized by the Qur'ān's prohibition and by the classical exegetical consensus, as al-Ṭabarī has discovered by associating the usage of compounding interest with delayed debts. The element of the deferment is mentioned in several traditions in the ḥadīth literature, including the hadth, 'There is no ribā except in al-nasī'ah', whose interpretation itself has been object to the degree that some classical scholars (such as the earlier view of Ibn 'Abbās d. Ẓahrānī) took it as proof of the prohibition of ribā al-nasī'ah but its opposite view was clearly rejected by the jumhūr.

The classical construction of Ribā al-Nasī'ah lays the foundations of three components: (1) the transaction of lending or exchange of commodities of the same genus; (2) the deferment of

delivery/repayment until after the present moment of the contract; and (3) the condition of excess – either in the amount to be repaid or additional amount paid – to this deferment. The problem of jurisprudence is that the deferment with the added elements of genus identity and excess is made unlawful, and is not just a protection against vulnerable debtors--it is simply made an unlawful act. This is an objective -based prohibition and where both parties are "sophisticated" and transactions are facilitated by mathematical protocols, its implications are far-reaching and have profound impact on the analysis of algorithmic finance and cryptocurrency transactions, that are not facilitated by social power differentials, but rather through mathematical procedures.

Thus according to Al-Shāfi'ī, Ribā al-Nasī'ah (an exchange involving the delay of a commodity) is prohibited even though there is no explicit excess condition; for example, selling wheat for wheat (or gold for gold) over the course of time. This roomy interpretation has significant modern-day ramifications, as it would bar not just interest rate loans but deferred spot exchanges of round two the same digital resources assets, in fact even if the funds and expenses deferral isn't represented through a specific loans and interest rate premium.

3. The 'Illah of Ribā: Competing Epistemological Frameworks Across the Madhāhib

3.1 The Thaman Theory: Monetary Function as the Operative Cause

It is the approach within the classical tradition most passed down, with the most jurisprudentially generative, which is the identification of thaman, monetary function, as the 'illah of the prohibition of ribā' in gold and silver. The theory most explicitly explained in the Ḳāḥesah of the Mālikī and Shāfi'ī schools is that the prohibition on ribā is due to their distinction as the natural money commodities of Islamic commercial civilization: gold and silver are the universal measure of value and medium of trade, and any alteration in exchange—even through process of ratio devaluation or deferment—of these commodities, weakens the foundations of the monetary order and the integrity of the market.

The most obvious and direct implications of the thaman theory in cryptocurrency analysis are the warning signs of impending rallies.The best-known and most direct implications of the thaman theory in cryptocurrency analysis are the cautions about upcoming rallies. Where the justifications for ribā prohibition in gold and silver apply to their monetary role (thaman), the

answers concerning whether a cryptocurrency like Bitcoin or others are ribawī assets depends critical on whether they act as monetary assets (thaman). And this is a topic that has much to stay up regarding the modern controversies in Islamic financial economics. On this analysis, those who suggest Bitcoin meets the requirements of a medium of exchange, medium of value, and (with growing use) a unit of account would insist that all exchanges of Bitcoin with others were simultaneous in value, such that any Bitcoin to Bitcoin exchange is subject to the full rigour of the ribā al-faḍl prohibition. As for those who reject that Bitcoin can be considered as thamān, because they see it as a speculative commodity (silʾah), or as a gharar содержа wadaʾ would employ a different analytical framework.

The modern day Islamic Economics scholar, Monzer Kahf, has applied the implications of the thaman theory to digital currencies, stating that the monetary function test must be analyzed empirically, by which he means, digitally: a digital asset that in practice functions as money in the dealings of a larger user base is subject to the ribā al-faḍl prohibition. This is an empirical approach to the thaman 'illah, which provides an evolving analytical tool: as Bitcoin garners increased acceptance in the practice of exchange economy, so does its ribawī status grow, and vice-versa, a pretty scholarly articulation of the thaman 'illah, but one that is ridden with hurdles, namely how could one not also classify a person as a mujrim if she or he refused to accept it?

3.2 The Kayliyyah/Wazn Theory: Measurability as the Operative Cause

The sign of the Ḥanafī identification of kayliyyah (measurability by volume) and wazn (measurability by weight) as the 'illah of the prohibition of ribā is different epistemological approach, namely turning the attention of an analysis from the function of commodities in economic life towards their quality as measured commodity, namely their ability to be measured. The basis for this is that commodities, which can be purchased by weight and volume, are especially vulnerable to cases where the measure of the quantity traded in the exchange cannot be accurately determined, and that the prohibition of ribā extends to commodities, particularly to stop the possibility of there being any hidden addition from the rate of exchange applied to commodities.

The Ḥanafī 'illah theory is a unique application of the theory for digital asset analysis. Cryptocurrencies are measured by very specific digital coins equal to one Bitcoin which can be divided to eight decimal places (the satoshis) and which are perfectly interchangeable so that

one or another with the same number of satoshis can be used as any one or another, without any distinction. First, the extreme measure of measurability and divisibility might be considered for the purpose of the criterion of Ḥanafī kayliyyah/wazn, which would result in the perception that Bitcoin-for-Bitcoin deals would be ribawī in the Ḥanafī framework and accordingly would need to be both simultaneous and exactly equivalent. Other scholars such as the Mufti Taqi Usmani fall under the Ḥanafī school, however, have maintained that the 'illah of the kayliyyah/wazn is limited to what has a tangible, physical form and that a simple extension to dematerialised or purely virtual assets would extend the meaning of 'illah beyond its context.

In this analytical separation of the Ḥanāsīk and the Naqīy, this is not only a matter of the type of 'illah theory employed, but also of the subject of controversial matters that come to the fore when considering the similarities between the characteristics of 'illahs and the digital assets such as Bitcoin and Bitcoin Cash. The second type of empirical evaluations carry with them the implicit choices of the proprietors of jurisprudence, including the selection of features which they view as central or fundamental to the 'illah and those they consider peripheral or accidental, and allows for substantial scholarly debate even within a single madhab.

3.3 The Qūt Theory: Food-Staple Status and Its Limits for Digital Assets

The classical illah theory has the widest application of the most popular one in the sale of ribā, namely identification of qūt (staple food status) as the 'illah of the prohibition of ribā in these four food commodities: wheat, barley, dates, and salt. According to the qūt theory, these four commodities are ribā because it is believed that they form the basis upon which human existence depends; and that the monetary prohibition on ribā safeguards the poor and weak who seek food from life's necessities. The Shāfi'ī extension to this 'illah is to all foods (ta'āmiyyah), while the Mālikī gives this ‘illah force to all storeable foods (qūt ma' iddikhār), extends the category a bit more but does not traverse too far into the realm of digital assets.

The qūt theory has a direct relevance to the analysis of algorithmic finance in one important but ultimately indirect way: the qūt theory provides the ground for a maqāṣidī reading of the prohibition on ribā in which the protection of basic human needs, and the prevention of the exploitation of the weak, are seen as the driving purposes of the prohibition. Instead of asking whether certain types of digital assets meet the formal DEFInition of commodities from the ribā

prohibition, contemporary scholars have asked whether the means by which certain financial transactions are possible render participants to be vulnerable to exploitation similar to the ribā ban was intended to stop. On this analysis, algorithms that harvest compound interest-like returns from borrowers with the possibility of having their actual assets liquidated, or yield farming protocols that mask the actual cost of funds with multiple protocol interactions not recoverable via interest, might be deemed to be ribawī in any way, whether the collateral asset actually is ribawī.

4. Algorithmic Finance: Structural Features and Their Fiqhī Analysis

4.1 Smart Contracts, Automated Market Makers, and the Question of 'Aqd

Algorithmic finance (AlFi) is a growing suite of financial tools executed by self-run computer programs called 'smart contracts' which is hosted by a blockchain network like Ethereum, Solana or Binance Smart Chain. These contracts are a kind of contracts that automatically act according to financial contracts based on the occurrence of specific conditions without relying on human judgment. Algorithmic protocols behind decentralised exchanges like Uniswap, Curve, and Balancer, known as Automated Market Makers (AMMs), use algorithms to calculate the prices at which assets can be exchanged and automatically carry out swaps without relying on other human parties and without having to wait for them to set or negotiate rates.

One of main fiqhī issues raised by smart contracts and AMMs is the Islamic law of contracts ('aqd) – whether or not algorithmically executed financial agreements meet the classical conditions for bond ('aqd) contract including ability (ahliyyah) and authority (wilāyah) of the contracting parties, offer (ījāb), and acceptance (qabūl). The development of classical Islamic law governing contracts resulted from the interplay of human agents making conscious, wilful choices, and this creation of contract law - when, as here, not only the individuals concerned are required to make choices, but they must make choices while under the control of some algorithm - is a completely new legal issue. Proponents of the new Islamic finance scholars such as Mufti Ismail Menk, and the members of Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) standards board have suggested that smart contracts could be regarded as a type of wikālah (agency): The code would act as an agent carrying out pre-authorised instructions on behalf of engaging parties. Others say that because there is no deliberative choice on the part of the human when the algorithms are really performing, therefore, the transaction consisting on algorithm under Islam is not valid at all.

The AMM mechanism inevitably raises some questions from the ribā analysis point of view regarding the mus территорииRibā al-Faḍl. The ratio between the exchange of each Token is always algorithmically determined when it is done by the user via an AMM, and can vary from what would be achieved in a direct Token negotiation. In this case, if bothToken A and Token B are found to be ribawī assets (whether according to the theory of the thaman or the kayliyyah 'illah) then the price-determination process implemented by the AMM could be found to be Ribā al-Faḍl due to it producing ratios other than 1:1 on exchanges of homogeneous assets. The AMM will also usually impose a liquidity provision fee (0.01%–1% according to the protocol) that is levied on and split among the LPs that were involved in the exchange; if the fee were deducted from a ribawī exchange, it would also be uncalled for.

4.2 DEFI Lending Protocols: Yield, Collateral, and Ribā al-Nasī'ah

DEFI lending protocols are closest to the traditional concept of interest lending, and this is the sector most closely involved with the Ribā al-Nasī'ah prohibition: Aave, Euler Finance, Compound, and MakerDAO are examples of decentralised lending protocols. These protocols enable users to temporarily store their crypto assets in liquidity pools and accrue interest that is set by the protocol (the 'supply APY'), while borrowing digital assets from the same pools, provided that they post over-collatéralised assets as collateral, and pay a different interest rate set by the protocol (the 'borrow APY'). The interest rates of these protocols are determined automatically and are not set by humans, but vary as the ratio of borrowers to liquidity changes in the pooling. In the case of a 'utilisation rate model', these interest rates turn higher as the ratio between borrowers and liquidity rises.

The resemblance with the classical concept of Ribā al-Nasī'ah in terms of the structure of the transaction is straightforward: borrower takes a principal share of a digital asset, and is obliged to return a monogram, determined by an algorithm linked to the asset, at a future time. All the three elements of the classical fiqh for a Ribā al-Nasī'ah (usury) – namely its transaction, deferment, and excess with regards to deferment – are represented. If Bitcoin and Ether are recognized as ribah, then DEFI lending would be all but banned because DEFI lending always occurs in situations where there is deferred repayment of the identical ribawī asset.

Several characteristics of DEFI lending instruments however differ from the classical ribā al-nasī'ah model, thus requiring attention of the fīqh. First, the interest rate in the DEFI-protocol is not set at the time of signing the contract, but is constantly algorithmically set, depending on market conditions. A few scholars in the realm of Islamic finance say that variable-rate schemes better match the profit-sharing of Islamic banking methods such as mushārakah and muḍāribah than a fixed-interest deal, though this relationship isn't perfect since the DEFI borrower always takes the risk and the lender always earns the fixed (or variable-rate) return. Second, overcollatisation, which is common for most DEFI lending protocols, requires the borrowers to post more than 1.5 times the amount they are borrowing, and this is the difference between the DEFI lending model and the classical model of ribā, in which the lending had no collateral and the excess would be the return the lender would receive for taking the risk of non-repayment. It is another jurisprudential issue whether this structural difference impacts or doesn't impact the ribā classification.

4.3 Yield Farming, Liquidity Mining, and the Gharar Problem

The two methods of yield farming and liquidity mining, in which users of DEFI protocols contribute to the liquidity of the protocols, and in return receive a reward in the algorithms in the reward token distribution, serve as an intersection of the fiqhī analysis of ribā and the equally important prohibition of gharar (excessive uncertainty or ambiguity in the terms of the contracts). Generally, the process of Yield Farming involves the user entrusting their cryptocurrency assets in a pool of liquidity, which is managed by a protocol, and earning not only a portion of the trading fees but also new governance or reward tokens based on a formula that is often public and governed by the protocol's rules, and can be adjusted when needed. The reward tokens can be of a high or low value, depending on the secondary market trading, and can vary greatly in price.

Yield farming indicates that yields received as governance tokens of other assets than those to get the yields are not immediately obvious to meet the conditions for Ribā al-Faḍl, which mandates an extra in the same genus (jins). There is no faḍl prohibition on cross genus exchanges in any of the four madhāhib when it is done immediately and not for a while.

5. Cryptocurrency Transactions: Taxonomy, Classification, and Ribā Implications

5.1 Bitcoin as Silʿah or Thaman: The Classification Debate

The first of the questions that can be formulated from a fiqhī (religious law) perspective on transactions with cryptocurrencies is the taxonomic one: what is Bitcoin (or any cryptocurrency)? Whether Bitcoin is a money (thaman) versus a commodity (silʿah) or a financial security versus something new is at stake is the answer to this question, and thus whether the prohibition of ribā is called into action is one of the changes. There is a taxonomic issue, which has been taken up by the major Islamic legal authorities of today, such as Accounting and Auditing Organisation of Islamic Financial Institutions (AAOIFI), Islamic Fiqh Academy of the Organisation of Islamic Cooperation (OIC), Sharī'ah Advisory Bodies (SAB) of Malaysia, UAE, Egypt and Turkey among others, with various opinions.

There are three criteria on which the case for considering Bitcoin as money is based - all of which Bitcoin fulfills more or less in its current state - and all of which are important for determining the practical half-life of money.There are three criteria that Bitcoin needs to meet in some measure for it to be considered a money, and they all have some relevance to the concept of practical half-life of money. Indeed, a number of scholars, such as Mufti Faraz Adam or the members of the Bank Negara Malaysia (BNM) Sharī'ah Advisory Council have opined that under this functional monetary nature, Bitcoin is subject to the thaman 'illah of ribā, meaning that Bitcoin exchanges can only be made at face value and in real time, while no interest-like return is permitted on Bitcoin deposits or loans.

The arguments that led to the conclusion of Bitcoin's characterisation as a product of silʿah (a commodity or merchandise) and not a classical money stem from an unusual price volatility in its prices, the limited money supply cap, and not legal tender under most statuses, in addition to its scholars' characterisation as a speculative monetary asset (speculative gharar) and not money. A Jew of a certain classification is characterized by the fact that his dealers do not own bitcoins.The classification of Bitcoin exchanges is the same as commodity exchanges (bay' al-silʁah); the general rules of Islamic sales contracts do not invalidate riba monetary transactions except the riba specific to the ribawī commodities, which is not applicable to the Bitcoin exchanges. This classification would allow a Bitcoin-for-Bitcoin exchange, with a market rate

varying from one day to the next, and with the exchange run under a "deferment" system, but would still bring about the general prohibitions on gharar and qimār (gambling) if there is any element of experimentation or a "casino".

5.2 Stablecoins: The Ribā Analysis of Fiat-Pegged Digital Assets

The unique fiqhī aspects of cryptocurrencies are seen in Stablecoins, which are not volatile cryptocurrencies, but rather exist for the purpose of maintaining a certain level of stability (stability) in relation to the purchasing power of another cryptocurrency or another asset, typically the US dollar. The three main type of stablecoin mechanisms are: (1) fiat-collateralised stablecoins (such as USDT/Tether, USDC/Circle) where centralised bodies hold physical dollars; (2) crypto-collateralised stablecoins (such as DAI) where a decentralised protocol governs the supply and demand of crypto assets overcollateralised; and (3) algorithmic stablecoins (such as an if now defunct, TerraUSD) which have no direct means of collateralisation. These are all a type of ribā, but each involves a unique type.

Usdc, which is backed by $1 billion in U.S. dollars and redeemed for them on-demand with 1:1 exchange, is an example of a stablecoin. If a stablecoin, economically equivalent to fiat money, is considered as money, then it must be treated as such and all the rules governing ribā of money should apply. This implies that the output of a stablecoin deposit in a DEFI protocol, e.g., stablecoin deposit in Aave earning back the stablecoin along with an excess due to "deferment", is the ribā al-nasī' in the most direct and classical sense in which this type of interest exists. With this understanding, the overwhelming majority of modern Islamic finance academics, such as AAOIFI and the OIC Fiqh Academy, view DEFI lending using stablecoins as riba.All recent Islamic finance scholars, including AAOIFI and the OIC Fiqh Academy agree that DEFI lending by stablecoins is riba, on this understanding.

With stablecoins such as DAI, it gets a little more complicated. It is issued when users deposit crypto (mainly ETH) in ‘Vaults' and get DAI out on loan for an interest rate which is called the ‘stability fee'. The DAI system is therefore a combination of a loan of a stablecoin at interest (ribā al-nasī'ah) and an overcollateralisation system and automation of the liquidation system. The justification for applying the stability fee à la "defert of repayment," is quite similar to that which justifies ribā al-nasī'ah as an excess over the principal – the delay of repayment. It is not its volatility that negates the ribā, because prohibiting it is an objective matter and doesn't matter how the excess is created.

5.3 Cross-Currency Crypto Exchanges and the Ṣarf Rules

The fiqhī assessment of transactions involving distant payment using cryptocurrencies is an under-used analytical tool, and a point to be noted is that the Islamic legal guidelines that govern the exchange of currencies (ṣarf) form a valuable and important resource. Classical ṣarf rules stipulate that currency transfers must take place without delay (yadan bi-yadin, hand-to-hand, i.e., no deferment) and, in the case of an exchange of the same kinds of money, equivalent in value. The saying of the scholar prohibiting the transaction of ribā al-faḍl and ribā al-nasī'ah specifically in monetary needs are the basis of these prerequisites. Gold to gold and silver to silver exchanges must be equal and simultaneous, but not necessarily equal and simultaneous transactions are required for exchanges involving any currency other than gold and silver.

The trade rules of the Introduction of money dirham are applied to the exchange of cryptocurrencies by ascertaining if the cryptocurrencies they deal are of the same genus (jins) or different genera. If both of them are money (thaman) (e.g., two cryptocurrencies BTC and ETH) or the same genus of digital assets, their exchange, even if done at a different volume to each other, should be simultaneous (yadan bi-yadin). The simultaneity requirement is quite easy to achieve for spot trading where both sides of the exchange are settled in the same transaction block, both on a centralised cryptocurrency exchange (CEX) and decentralised exchange (DEX). However, futures contracts and options and other derivative financial contracts on cryptocurrency, which are based on a delayed settlement, may violate the simultaneousity aspect of ṣarf (settlement), and thus be considered as ṣarf by an approved animal (Ribā al-Nasī'ah), if the underlying asset is a genus of an animal, and failing to meet an underlying asset prohibition of bay' al-kāli' bi'l-kāli'.

6. Maqāṣid al-Sharī'ah and Maṣlaḥah in the Regulation of Digital Finance

6.1 The Objectives of the Ribā Prohibition: Protection, Circulation, and Justice

Before any attempt is made to apply the principle of Maqāṣid al-Sharī'ah to the regulation of algorithmic finance and cryptocurrency, the first step is to outline the aims of the prohibition of ribā. These are several inter-connective objectives set forth by classical and contemporary scholars. For al-Rāzī, the concern of the protection of the poor and vulnerable from the nature of the ribā prohibition (ẓulm) is the main maqāṣid wāqī (the principal aims) of the law of ribā. Ibn

Taymiyyah (d. His student Ibn al-Qayyim (1328 CE), and his student The goals of maintaining the movement of wealth (dawrān al-māl) were stressed by some of the commentators (1350 CE) who pointed out that ribā silences the circulation of wealth, that is, it benefits some (the creditors) and harms others (the debtors) and disturbs the social movement of wealth that is essential for individual good health and collective prosperity.

In addition to this classical maqāṣidī analysis, contemporary Islamic economists have given greater importance to the objective of economic stability, which is the objective sought through the prohibition of ribā, on this understanding: the ban largely aims to avert the financial and economic instability that is endemic in a multi-party credit system, such as cyclical debt crises, asset price bubbles and wide systematic transfers of real wealth from productive methods of economic activity to financial capital. This macroeconomic-based argument from a maqāṣidī perspective, championed by Muhammad Umer Chapra, Nejatullah Siddiqi and Monzer Kahf, seeks to evaluate fiqh-based algorithmic finance not just on the formal grounds of the classical DEFInitions of ribā, but on how much the algorithmic systems will destabilize financial markets, oppress the majority and enfeeble those who are already vulnerable.

When translated into the algorithmic finance context, these are important evaluative results that come from the maqāṣidī approach. Firstly, algorithmically trying to collect compound interest type returns, DEFI lending platforms, aggregators of yields, and leveraged trading platforms, all have a nexus of the primary maqāṣid of the ban on ribā irrespective of any formal similarity with the classical ribā categories. Secondly, measures that can lead to speculative financial instability, derivatives platforms with high leverage, algorithmic stablecoins that have reflexive failure modes, and attacks using flash loans that take advantage of a DEFI protocol, involve the maqāḍīḥ of financial stability and wealth preservation (ḥifẓ al-māl) in ways that cannot be fully accounted for by relying on the classical 'illah analysis alone. An analysis of maqāṣid therefore does not substitute for 'illah analysis, but it supplements it.

6.2 Maṣlaḥah and the Case for Differential Regulation

Algorithmic finance calls for a differentiated regulation, which relies on the jurisprudential principle of maṣlaḥah, the principle of public interest or general welfare, so as to prevent the two extremes of total prohibition and uncritical permissiveness. With the development of the maṣlaḥah principle, al-Ghazālī, al-Shāṭibī, and modern scholars like Aḥmad al-Raysūnī were able to allow actions within jurisprudence so long as they benefit human beings in the truest

sense of the word, while not going against clear norms that the Qur'ān and the Sunnah have established. With regard to digital finance, maṣlaḥah reasoning can pinpoint true benefit of algorithmic finance technologies, financial inclusion of the unbanked, efficiency of financial resource allocation, lower transaction costs and access to global financial markets for people who are not linked to traditional banks and can present these as appropriate inputs for jurisprudential assessment.

In particular, a maṣlaḥah-based differential pragmatic approach would distinguish between: (a) algorithmic finance mechanisms that are DEFInitely ribā-equivalent and have been prohibited for classical criteria of 'illah and for underlying maqāṣidī goals in preventing exploitation (e.g., DEFI stablecoin lending with interest, cryptocurrency derivatives on same-genus assets with deferment); (b) mechanisms that are formally ambiguous under classical 'illah rules and whose overall economic impact may be perceived as being in line or counter to the maqāṣid of the ribā prohibition (e.g., governance token yield farming, AMM liftky provision); (c) mechanisms that are formally unproblematic under classical 'illah analysis and whose overall economic impacts broadly support or challenge the maqāṣid of the ribā prohibition (e.g., spot non-homogeneously-denominated cryptocurrency exchange on DEXs, tokenised, real-estates investment vehicles built around principles of muḍārabah).

The concept of differentiation is also in alignment with the thinking of modern Islamic financial institutions regulators, including AAOIFI and the Islamic Financial Services Board (IFSB), which have been increasingly using maṣlaḥah and maqāṣidī style thinking alongside illah analysis in their standard-setting efforts. But a challenge is to make sure that maṣlaḥah-based reasoning is done genuinely with jurisprudential rigor instead of being used as an excuse to ramrod do what the market demands. The classical principle that 'maṣlaḥah' needs to be invoked only where there is no explicit 'naṣṣ' (scriptural text) giving a prohibition must be observed: if a formal 'illah' analysis gives a clear prohibition then a 'maṣlaḥah' rationale would not be sufficient to overcome that prohibition, unless it is evident that the latter is not being used to do so.

7. A Three-Tier Fiqhī Regulatory Framework for Algorithmic Finance and Cryptocurrency

7.1 Tier One: Clear Prohibitions Grounded in Classical 'Illah Analysis

The first level of the proposed Islamic banking regulatory framework highlights algorithmic finance and cryptocurrency mechanisms that meet all of the formal requirements of the concept of Ribā al-Faḍl or Ribā al-Nasī'ah and thus clearly represent an absolute prohibition (maḥẓūrāt), without requiring particular assessment of the maṣlaḥah criteria. These are the mechanisms in the three main categories. The first kind of interest-bearing stablecoin lending on decentralized finance lending platforms is the traditional interest-bearing loan of money, where the person who lends money is entitled to a profit that is guaranteed to the amount of the original deposit and is based on a fixed interest rate on the principal amount.Interest-bearing stablecoin lending on decentralized finance platforms is the interest-bearing loan of a monetary equivalent that is repaid with a predetermined excess which is deferred to the time until it is due to the lender in identical amounts. In all four madhāhib's 'illah theories, stablecoins fulfill the thaman criterion (monetary function), and the lending structure is exactly in accord with the classical ribā al-nasī'ah structure.

Second: any futures, options, or perpetual contracts on cryptocurrencies settle in cryptocurrencies: e.g., Bitcoin futures that settle in Bitcoin, files of options such as Bitcoin options that settle in Bitcoin - these are covered by undertakings in the future, which involves the prohibition of Ribā al-Nasī'ah and the prohibition of bay' al-kāli' bi'l-kāli' (a two-year delayed exchange). In these investments, the leverage is usually included which makes them independent of each other and damage to them.In such investments, usually a gharar arises due to leverage, rendering them independent from one another and a destruction. This ban applies both to thaman and silʾah cryptocurrencies.

The third category of flash loan exploits: Flash loans have no explicit classical translation but because they are the basis of algos, exploiting price misalignments that occur between various protocols of the DEFI ecosystem, engaging in ribā analysis of ẓulm (injustice and harm to others) and akl al-māl bil-bāṭil (consuming others' wealth unlawfully) is a violation of such that it is classified under that heading.

7.2 Tier Two: Contested Mechanisms Requiring Ijtihādic Determination

Based on the notion that there is an area of genuinely contestable issues regarding the application of various competing ‘illah' to the actual semantics of a mechanism produces contrasting results, the second tier of the grouping will identify mechanisms that are subject to ‘illah' theory jurisprudence considerations, depending on maṣlaḥah considerations. These mechanisms demand new ijtihād with of course qualified scholars who have not only specialized knowledge of Islamic jurisprudence but also have true technical knowledge about the mechanism(s) being assessed, which combination sadly is not found in contemporary Islamic finance scholarship.

Bitcoin-deferment for Bitcoin exchange is a vital node in this tier. These types of agreements involving Bitcoin with deferment are subject to the rule of ṣarf (payment of money) or silʾah (payment of commodity), and where Bitcoin is the money, are against the prohibitions of ribā, while where Bitcoin is a commodity, are subject to the general rules of bay' al-salam (sale on deferred payment), which are not prohibitive of such action. Whether Bitcoin is used as a medium of exchange is, strictly speaking, a debatable issue that depends on subjective evaluations regarding Bitcoin's actual monetary use which may vary according to individuals, communities, and even time periods. At this level, Ijtihādic determination would take Islamic concepts seriously rather than superficially and would seriously consider both the 'illah analysis and the practical evidence regarding the operation of Bitcoin.

Another contentious claim is that of AMM liquidity provision on non-homogeneous asset pair (e.g., providing asset ETH/USDC liquidity for a Uniswap pool). Liquidation provider keeps two assets, receives a fee proportional to transaction volume and runs the risk of 'impermanent loss. This is somewhat like a mushārakah (profit and loss sharing partnership) because the risk of loss is shared as well as the risk of profit. But it is not exactly a classical mushārakah because it does not necessarily have to be actively managed by the human entrepreneur that is deploying the capital, rather an algorithm can be used, and the fees paid the provider are fixed—so the provider's profit does not depend on the profitability of the protocol. Technical analysis and jurisprudential creativity are needed to make a determination on structuring AMM liquidity provision as a ‘sharī'ah-compliant mushārakah-like instrument’.

7.3 Tier Three: Conditionally Permissible Mechanisms with Sharī'ah Compliance Conditions

The third tier DEFInes algorithmic finance mechanisms and cryptocurrencies that have the potential, when structured appropriately, to be permitted in Islamic jurisprudence either as fitting the clear conditions on which classical permissibility is based, or by being structured in a Sharī'ah-compliant fashion that would remove prohibited components. The mechanisms in which Islamic finance innovation can most strongly engage with digital finance technology.

Under most of the classic 'illah theories, spot trading of non-homogeneous cryptocurrencies for a token for a food commodity on a DEX or for another, different, tokenized real asset, or for a token of a cryptocurrency of a different genus and the same species on a different DEX, either for a different asset or for a token of a tokenized asset on a different DEX, is allowed if the exchange is done in the same blockchain transaction and in real time (satisfying the yadan bi-yadin requirement). A promising field for Islamic fintech development is the development of DEX protocols that comply with Sharī'ah. These protocols aim to ensure that transactions are settled simultaneously, and that mechanisms that ensure ribā are excluded from the transaction fees.

Implementing the principles of Islamic investment in a tokenised real-asset investment vehicle, which are blockchain-based investment vehicles that fractionalize ownership of a real asset (Sharī'ah-compliant legal contract) like real estate, commodity inventories, or a profitable business enterprise, can be designed to be compliant with Islamic investment principles. However, when properly designed as mushārakah or muḍārabah equivalents, the instruments are the most promising fusion between blockchain technology and Islamic finance, with the returns linked to the actual performance of the assets, rather than the fixed interest rates. Early institutional models have been established in the Bahrain-based DDCAP Group and the Malaysia-based Securities Commission, for their tokenised asset offerings' (TAO) that are compliant with Sharī'ah.

8. Conclusion: Epistemological Fidelity and Jurisprudential Creativity

From the analysis several conclusions are drawn. First, the epistemological variety of the classical 'illah tradition, which the numerous, conflicting theories in the thaman tradition, kayliyyah/wazn tradition and qūt tradition are an example of is not a weakness, but a jurisprudential strength, as it can provide the analytical flexibility necessary to assess new asset

categories and mechanisms without forcing them into larger, general, classical categories. It is not the job of today's Islamic finance experts to DEFInitively answer these classic questions but to use them with skill and precision when grading the different types of digital instruments.

Second, the formal 'illah analysis is complemented by maqāṣidī and maṣlaḥah analyses that calculate the economic impact of particular digital finance mechanisms in terms of the goals for which the prohibition on ribā was introduced: the prevention of exploitation, preservation of wealth, stimulation of productive economic activity, and systemic financial stability. Mechanisms that look formally similar to any of the classical ribā types but fulfill functions that are different from the ones of classic ribā, but nevertheless serve the same exploitative goals, warrant ruling as prohibition of ribā verbally, technically and substantively; mechanisms that resemble at least one ribā type formally but serve entirely different functions and have generally beneficial outcomes can be subject of specific and creative renovation instead of mere rejection.

Third, the institutionalization of Islamic finance scholarship in support of digital technologies needs to be given a push in the right direction. The quality of the jurisprudential analysis of alquantum finance has not been satisfactory due to the lack of researchers capable of possessing substantial knowledge of both Islamic jurisprudence and blockchain technology. Interdisciplinary collaboration between Sharī'ah scholars and computer scientists, financial engineers, and economists is not a concession to modernity but to a jurisprudential necessity: The Prophet's example of consulting (with scholars) on matters outside of his domain of specialization (as happened in the case of date palm pollination) sets the benchmark for epistemically humble work with experts on fields other than his own, and that of his conditioners, in order to be able to act on the basis of a conscientious judgment.

The relevance of this research is not limited to Islamic finance as this study covers the wider context. It poses questions regarding the ethical frameworks for algorithmically mediated financial mechanisms, the relationship between legal categories and economic realities over which they exert their regulatory control, and the institutional needs for credible authority over financial institutions when technology constantly evolves, questions all legal and ethical traditions must face in the digital finance age. These questions, which have been carefully thought out over centuries — reaching a mature level of complexity and understanding that

involves Muslim scholars and practitioners in economic and ethical reasoning about exchange, money and economic life — have a contribution to make to this broader human conversation, one that transcends the limited community of Muslim scholars and practitioners.

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