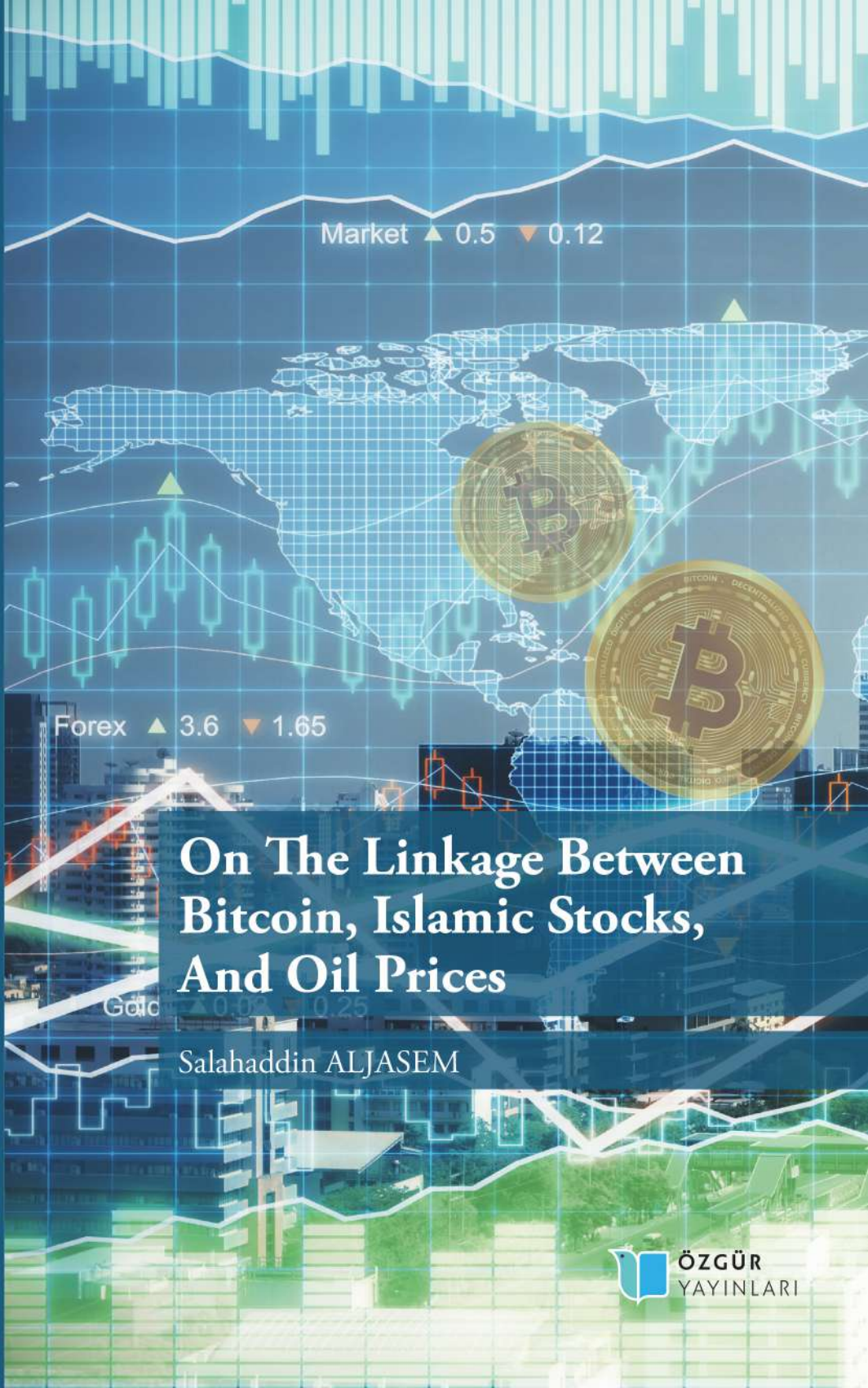

On The Linkage Between Bitcoin, Islamic Stocks, And Oil Prices

Salahaddin ALJASEM

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Abbreviations

AAOIFI:	Accounting and Auditing Organization for Islamic Financial Institutions
BTC:	Bitcoin
BDS:	Brock, Dechert, and Scheinkman statistic
CBDCs:	Central Bank Digital Coins
CCs:	Cryptocurrencies
DJIM:	Dow Jones Islamic Stock Market Index
EMH:	Efficient Market Hypothesis
EWI:	Equal-Weighted Index
IID:	Independent and Identically Distributed
IPO:	Initial Public Offering
OTC:	Over-The-Counter
PBT:	Portfolio Balance Theory
PWI:	Price-Weighted Index
VaR:	Value at Risk
VWI:	Value-Weighted Index
VIX:	Volatility Index
WTI:	West Texas Intermediate

Introduction

A. Subject and Problem of the Study

Due to the obvious growth of modern asset classes as well as the severity of health, economic, and geopolitical crises, it is critical for investors to diversify their investments across various global markets and asset categories. Scholars, investors, and policymakers are paying greater attention to cryptocurrency markets and Islamic stock markets. However, the question of whether Islamic stock and crypto markets provide portfolio diversification options relative to traditional investment instruments has not been well addressed in the relevant literature.

The portfolio's purpose is to decrease investment risks by evaluating the linkages and covariation between its instruments, as well as its efficacy in responding to pertinent information. Baur and Lucey (2010) defined diversification as an asset that has an imperfectly positive relationship to other assets on average, and they divided safe-haven assets into two categories based on their relationship with other assets or portfolios during crises: the strong safe haven asset that correlates negatively with other assets, and the poor safe haven whose correlation with other assets is zero. Besides oil as an asset utilized in diversifying investment portfolios, Islamic stocks and, later, cryptocurrencies have emerged as alternative investment instruments that have been shown beneficial via several studies.

As a result of religiously prohibited acts like as Riba, Gharar, Qimar, and the absence of an ethical dimension that prevail in the global capitalistic financial system. The Sharia-compliant financial industry has evolved to meet its primary aim of economic stability and fair wealth distribution (Hanif, 2011, p. 18). Two methodologies are used to develop the Islamic financial Industry (Force et al., 2004, p. 5). The first strategy is to find current conventional products that are acceptable to Islam, then change or remove any banned aspects to conform with Shariah standards. The second one entails using Shariah principles to support the creation and innovation of new services. The Islamic financial services industry increased from $2.44 trillion to $2.70 trillion, endorsed by 26.9% growth in the Islamic capital markets sector versus 4.3% in the Islamic banking sector during the period from 2019 to 2020 (IFSB, 2021, p. 3). Moreover, Islamic stocks performed better than their conventional equivalents (Mirza et al., 2022, p. 2). Minimal financial leverage was one of the important factors that made a superior success of Islamic investments during the pandemic period (Ashraf et al., 2020, p. 2).

In 2008, the world suffered one of the worst financial crises as a consequence of financial firms' recklessness and the involvement of large investment banks, credit rating agencies, and other government regulators. As a result, the theory controlling the global economic system was put at stake by this catastrophe. Interestingly, the launch of the first cryptocurrency, Bitcoin, coincided with the outbreak of that crisis tragedy. Since the central banks didn't foresee and avert it, investors' need for new assets and honest regulators has clearly risen. This motivated Satoshi Nakamoto to employ blockchain technology to develop the first electronic system for remittances that is decentralized and does not need government or third-party involvement. During the Corona epidemic, Bitcoin shared some of the benefits of gold in terms of diversification, hedging, and safe haven. Simultaneously, humanitarian groups boosted their reliance on cryptocurrencies by starting efforts to seek alternative and complementary funding sources

to traditional sources. Moreover, multiple cryptocurrencies have developed since bitcoin's inception. According to CoinMarketCap (2022) data, there were over 9500 cryptocurrencies with a capitalization of around 1.91 trillion dollars on March 1, 2022, with bitcoin accounting for 43% of the overall market. Bitcoin is intangible encoded numbers that don't have any physical existence and, in contrast to the large majority of many other forms of currencies, it cannot be obtained via banks and don't reliant on the strength of the countries' economy or on central bank regulation. Several researches have been conducted to estimate the benefits of diversification and hedging for Bitcoin. Selmi et. al. (2018) resulted that Bitcoin may work as a hedge, a safe haven, and a diversifier against excessive oil price changes, as well as a hedge and a safe haven for oil price declines. Hasan et.al. (2021) demonstrates that Bitcoin may act as a safe haven for US equities during severe downturns. Shahzad et. al. (2019) found that Bitcoin serves as a poor safe haven asset against the global stock market index.

Oil is the world's most vital strategic commodity. Despite the growing importance of alternative energy sources, oil remains the most essential source of energy. The petroleum products prices are determined not only by supply and demand, but also by geopolitical turbulence, government policies, speculative activities, producer equities. So, any change in oil prices will have an impact on global stocks and economic activities. Some researches have recently emerged to investigate the nature of the link between oil and other assets such as stocks, gold, and cryptocurrencies. Hadhri (2021) proved that in the long term, the drop in oil prices leads to an increase in Islamic stock prices. Furthermore Tuna & Tuna (2019) found that commodity like energy and golden serve as safe haven for Islamic stocks. In the same vein, Chang et. al. (2020) concluded that in bearish situations, a rise in oil prices has a negative impact on the DJI index. Additionally, Jin et. al. (2019) resulted that the flexible linkages among gold and oil are practically positive, whereas are almost negative between Bitcoin (BTC) and oil. During the Corona epidemic, oil has been highly volatile. Ac-

cording to Brent crude oil data, the price of a barrel of oil reached below $23 in the third month of 2020. then, worldwide prices began to grow again in October 2021, hitting $84. As a result, the investment risks associated with this asset sparked panic in the worldwide market. So, investors have boosted their demand for safe haven assets that mitigate the risks associated with excessive volatility in the oil prices.

B. Purpose and Importance of the Study

This thesis aims to compare Bitcoin's role as either a diversifier, hedge, or safe haven against oil fluctuations to the similar role of Islamic stocks, by determining the nature of the movement between Islamic stocks and oil price changes, and then comparing the results to the Bitcoin-oil pair.

Individual investors, portfolio managers, and researchers might benefit greatly from this thesis. Examining the relationship between Bitcoin, Islamic equities, and oil returns can assist investors and portfolio managers in constructing an optimal basket. Further, this thesis will contribute to enriching the literature related to the development of alternative investment tools, and the extent to which individuals, institutions, and countries adopt Bitcoin as a medium of exchange and as legal tender.

C. Methodology of the Study

In the first part, the stock market is discussed in broad detail. Each of the financial instruments and entities that comprise the financial sector of the economy are shown graphically. In addition, the procedure for issuing shares and the distinction between shares, bonds, and sukuk were described. A concise overview of the secondary market's function, its many types, and its impact on the economy were also mentioned. In addition, the notions of financial market efficiency and stock market risks were further upon. The discussion then shifted to a concise explanation of hedging, diversification, safe havens, and stock market index calculation.

This chapter concludes with an explanation of the link between the stock market and other economic indicators.

In the second chapter of the first part, the benefits of Islamic finance, its underlying regulations, and its distinction from conventional finances are discussed. Then, references were made to the Accounting and Auditing Authority's rulings on the issuing and selling of shares.

In the third chapter of the first part, the concept of cryptocurrencies, their emergence, their growth, and the intentions of people, organizations, and nations to recognize them as a medium of exchange and as an official currency are discussed. Simultaneously, the varieties of crypto-assets and the system for storing and trading bitcoins were explained. In addition, we discussed the pros and cons of Bitcoin, its source of value, its link to other economic indicators, and the legitimacy of Bitcoin transactions.

In the fourth Chapter of part One, previous studies examining the link between oil, the stock market, and cryptocurrencies were listed.

In the second Part, the data and technique used to reach the thesis's objective were elucidated, as data were gathered on Islamic stock markets, oil, and bitcoin throughout the time period from August 18, 2011, to December 10, 2021.

In the second Chapter of Part two, to meet the analytical requirements, the unit root, Vector Autoregressive (VAR), Brock et al.(1996), and nonparametric Causality-in-Quantiles tests were being used.

Finally, the findings were examined, and some suggestions were offered for researchers, investors, and investment portfolio managers.

CHAPTER 1

Theoretical Framework

1.1. Stock Markets

In any country, the economy can be divided into two classifies: The real sector and the financial one. The real economy concentrates on tangible outputs that are financed by the financial sector (Rizvi et al., 2016, p. 46). The key role of the financial market is to shift the funds from surplus institutions or individuals to deficits ones. As a result, direct access to funding sources is the capital market's distinctive trait (de Haan et al., 2020, p. 12). Liquidity, transaction cost reduction, and price discovery are the major economic functions of financial markets (Darškuvienė, 2010, p. 7). Based on the maturity of securities, the financial market can be divided into the Money market and the Capital market (Omar et al., 2013, p. 9,12).

Financial instruments are certificates that represent either debt or ownership of capital between both surplus and deficit financial units. On the other hand, there are two kinds of financial securities: Debt and Ownership. Debt securities guarantee a defined amount to a creditor for a given duration and at a certain periodic interest rate. This sort of paper is issued by both government and commercial entities. Treasury bills, mortgage-backed securities, commercial paper, bearer and registered bonds, negotiable certificates, banker's acceptances, and mortgage-backed securities are the most important of these instruments. The shares that comprise

the company's capital are represented by property securities. These shares were issued when the firm was founded or when it was expanded. There are two kinds of stocks: common and preferred.

Derivatives are financial instruments that values are determined by the underlying assets' prices. These assets maybe, commodities, bonds, shares, or foreign exchanges. They are commonly utilized to speculate on future predictions or to lower the risk of a security portfolio.

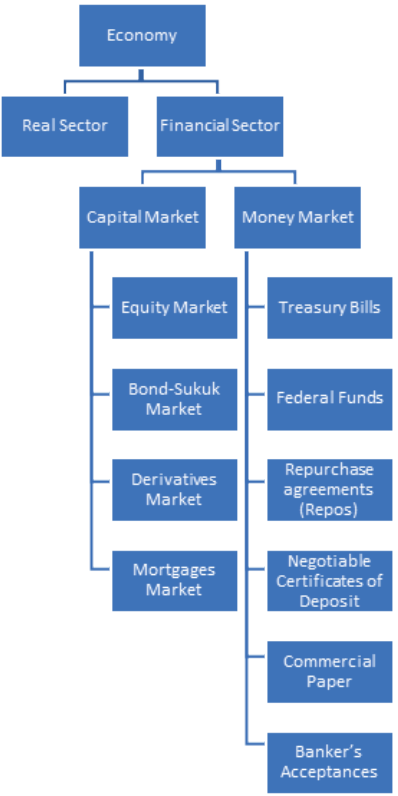

Figure 1- Economy Sectors

Source: *(Mishkin and Stanley G. Eakins, 2012, p.15-16)*

Despite the possibility of stocks and bonds to secure direct funding for units seeking financing, financial institutions play a vital role in the transfer of cash between investors and financing demanders. Without these intermediary institutions, the flow of funds would be very limited for the following reasons: (Saunders and Cornett, 2012, p. 11,12) (i) Investors' inability to monitor and evaluate their investments. (ii) Financing providers' desire to hold cash in underdeveloped financial markets for reasons of liquidity. (iii) Risks and transaction costs between different financial markets. Commercial banks, mutual funds, Insurance companies, investment banks, and Pension funds are the most prominent institutions operating in the financial market.

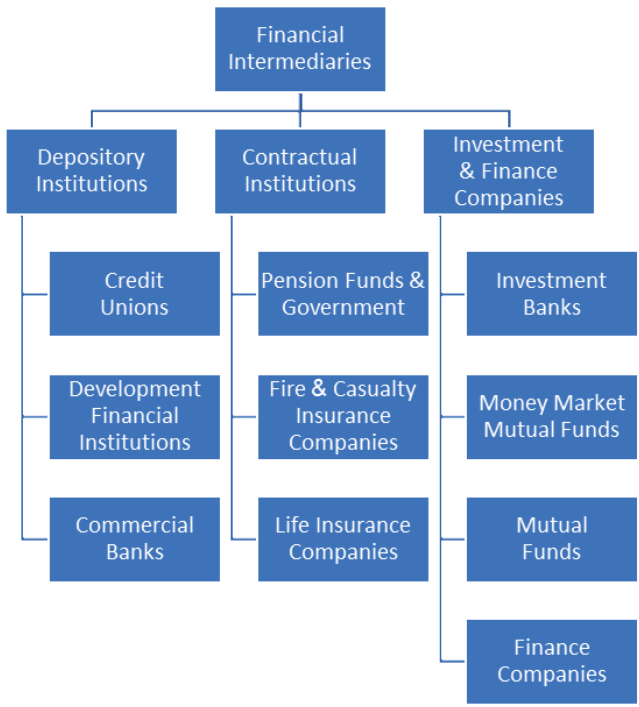

Figure 2- Financial Institutions

Source: *(Madura, 2014, p. 292).*

Equity markets ease stock investments into companies and transfer equity funds between financial units (Madura, 2014, p. 249). Stock exchanges enable fund suppliers to deliver equity money to public firms in an efficient and cost-effective manner (Saunders and Cornett, 2012, p. 244). As mentioned above, the property securities represent the shares that comprise the company's capital. These shares are issued to establish the company or to expand it.

1.1.1. Common stocks and Preferred stocks

There are two types of shares: common stocks and preferred stocks. Ordinarily, only common stockholders have the right to vote on crucial items affecting the company, including the election of the management board, the permission to issue new common shares, the approval of revisions to the charter, and the ratification of bylaws. Many common stocks share the following characteristics: (Saunders and Cornett, 2012, p. 247,249). Ordinary shareholders do not have any guaranteed profits; the size of these profits is defined by the board of directors. Moreover, common stockholders don't have the legal right to claim dividends. Unfortunately, common stockholders are taxed twice: at the corporate level and at the personal income level. Despite the advantage of limited liability, in the case of bankruptcy, ordinary investors have little priority right on the firm's assets. Finally, because most partners do not attend business meetings, most firms provide shareholders with proxy voting rights.

Preference stockholders have the same company as regular shareholders and are thus reimbursed only when earnings are created. Since preferred stock distributions may be skipped, according to the issued company, the risks connected with them are fewer than those of bond issuance (Madura, 2014, p. 252). However, Preferred stock varies from ordinary stock in numerous fundamental aspects (Mishkin and Stanley G. Eakins, 2012, p. 303): (i) Because preferred investors get a set dividend, it is similar to a bond as it is to common stock. (ii) Because of the consistency

of the return, the preferred stock price seems to be relatively stable. (iii) Preferred investors usually do not vote until the company fails to pay the declared dividends. (iv) Preferred stockholders' claim rights fall midway between common stockholders and bondholders. (v) Dividends of Preferred stocks are not deductible for tax purposes. However, issuing preferred shares typically costs the company more than issuing debt.

1.1.2. The Differences between Bonds, Sukuk, and Stocks

Although the Sukuk share the same goal with the bonds, increase finance, there are critical differences between them (Omar et al., 2013, p. 80):

Table 1- The Differences between Bonds, Sukuk, and Stocks

Item	Stocks	Bonds	Sukuk
Nature	Ownership	Debt	Possession of certain asset
Asset-Backed	Not required	Not Required	Underlying asset
Claim	Claim ownership of the firm	Both time and amount are fixed	Claim to owner-ship of the asset and its flows
Security	Unsecured	Generally Unsecured	Guaranteed by ownership the asset
Return	Not guarantee	Fixed and known income	No guarantee in returns
Purpose	For any purposes	Unrestricted	Islamic-compliant purposes
Holders Respon-sibility	Restricted to the level of owner-ship	No liability for the bond issuer	Restricted to de-gree of one's in-volvement in issue

Source: *(Omar et al., 2013, p. 80).*

1.1.3. The Issuing Process and Primary Market

The primary market, also known as the issue market, is the market where securities are initially made available to the community. The initial public offering (IPO) is the procedure through which a private firm sells stocks to the general audience in a new stocks issue. The investment bank is the most visible entity at this stage. It is an intermediary institution that offers financial guarantees, marketing campaigns, and other advisory services to issuing corporation. However, it purchases stock from the corporation and then resells it to the public. Sometimes the investment bank requests assistance from other banks in order to get access to a bigger number of investors and to spread risks connected with issuance in accordance to each bank's competence. The name given to this collection of institutions is called the syndicate. The originating house is the syndicate's lead bank that has the greatest portion of the stocks and directly negotiates with the issuing firm. The net proceeds are the price at which the investment bank purchases stocks from the issuing firm, while the gross proceeds are the price at which it sells these shares. The difference between these two rates is known as the underwriter's spread; it also represents the profit received by the investment bank.

In general, the first issuing of securities involves the following stages (Madura, 2014, p. 251,256; Saunders and Cornett, 2012, p. 254,257):

1.1.3.1. Following the meeting with the company's owners, the board of directors makes the decision to go public. This decision also involves whether or not to issue shares to the general public or to a specialized group of investors.

1.1.3.2. Some statutes and company charters empower existing shareholders' pre-emption rights, which means that the new equities must be given to the company's present owners at a price lower than the market price. So, they can keep their relative ownership of the corporation by using pre-emptive rights. However, the corporation avoids the costs of an underwritten offering.

1.1.3.3. The issuer and the lead investment bank must receive clearance from the Securities and Exchange Commission for an IPO. So, the registration statement must include comprehensive and accurate information about the company, its financial status, and the benefits and risks associated with the issuance.

1.1.3.4. The firm represented by the investment bank releases the preliminary prospectus, often referred to as the red herring prospectus, in order to provide important information about the company to prospective investors prior to the IPO.

1.1.3.5. If the Securities and Exchange Commission does not seek any revisions to the registration statement, the business releases the formal prospectus marking the beginning of the public offering of shares.

1.1.4. Secondary Market

The secondary market is the marketplace through which security holders may sell their assets to new investors. Bankers and dealers are the primary players in this market. Profits from each sale are distributed to the selling investors, not to the corporation that marketed the shares. Further, the prices in this market are governed by the supply and demand mechanism. Secondary markets provide two critical functions (Mishkin and Serletis, 2011, p. 20,21): First, they increase the liquidity of financial instruments. As a result, these instruments become more attractive as a result of their increasing liquidity. Second, they set the price at which the issuing business sells the securities in the main market.

Secondary markets could be divided into two forms (Saunders and Cornett, 2012, p. 256,257): (i) Organized markets or Stock exchanges where asset traders (or their intermediaries) congregate in a defined area to transact. (ii) over-the-counter (OTC) market, where transactions are executed in decentralized places, and trad-

ing is often conducted electronically. On the other hand, secondary markets, according to trading procedures, are categorised as follows (Darškuvienė, 2010, p. 89):

1.1.4.1. Cash and forward markets: Cash markets are marketplaces in which equities are exchanged in cash and transactions must be completed within a predetermined number of days. But in forward markets, all agreements are settled on a fixed date, e.g., the end of a 30-day period. Moreover, a price is determined at the time of the transaction and stays constant regardless of market price movements by the time of settlement.

1.1.4.2. Continuous and auction markets: In continuous markets, the transactions occur continuously throughout the day. So, market makers provide liquidity at all times. In the auction market, supply and demand for assets are directly linked, and the price is determined by the equilibrium price.

1.1.4.3. Order-driven and quote-driven markets: A market structure that is order-driven enables buyers and sellers to enter orders via their broker, who forwards these orders to a centralized place where they are compared and the transaction is completed. Market structures that are quote-driven are those where market makers and dealers quote the price where the general market participants trade. Profits are earned by market makers and dealers on the difference between two quotations and on the volume of shares traded.

1.1.4.4. Hybrid market: are those in which quote-driven as well as order-driven market systems coexist.

1.1.5. Stock Market Efficiency

Eugene Fama's (1970) Efficient Market Hypothesis (EMH) postulates that in any time, prices completely represent all news related to a certain share or market (Fama, 1970, p. 383). Fama also

outlines the following essential criteria for capital market efficiency: (i) There have been no transaction expenses through trading securities. (ii) All market participants have unrestricted access to all information. (iii) They all agree on the significance of recent data for every security's present price and the distribution of future prices. However, the level of equity market efficiency is generally measured using three metrics (weak form, semi-strong form, and strong form), the measurements vary in terms of the sort of information or content that is included into equity prices (e.g., public vs private, historic versus non-historic) (Saunders and Cornett, 2012, p. 273):

- According to **weak-form efficiency**, investors cannot earn more than the equitable (needed) rate of return when utilizing historical price changes as information. Thus, previous price and volume patterns are useless for forecasting future price fluctuations (technical analyses have no value as a trading plan).
- According to **semi-strong form market efficiency**, when public information comes out about a corporation, its share price is incorporated into it right away. Thus, if an investor speaks to his broker right when the earnings news is released, that investor can't make a lot of money because the stock's value will rise or fall right away if the company makes news about how it will make money in the future.
- According to **strong-form market efficiency**, share prices completely reflect all publicly available information about the business. This means that although private information may be utilized to generate abnormal returns, once the private or inside knowledge is made public, abnormal return is no longer possible. Since private information may be exploited to generate abnormal profits, rules prevent investors from dealing on the basis of confidential knowledge (insider trading), while they can trade on the basis of publicly accessible information about the business, just like any other investor.

1.1.6. Stock Market Risks

Market risk is the risk to an investment portfolio caused by changes in market prices like equities prices, currency exchange rates, interest rates, and commodities prices (Christoffersen, 2012, p. 4). A stock's risk shows the uncertainty around potential returns and may be quantified using its price changes, beta, and value-at-risk model (Madura, 2014, p. 292):

1.1.6.1. Stock's Volatility

Volatility may be used as a risk indicator for a stock since it might show the level of uncertainty around the company's potential returns. Volatility is sometimes defined as total risk since it represents all variations in stock prices, not simply those caused by stock market changes. Furthermore, Standard Deviation, Volatility Patterns, Implied Volatility, and the Volatility Index (VIX) can be used to estimate stock price volatility. On the other hand, equity market participants often invest in a group of equities instead of an individual stock. The volatility of a portfolio is determined by the volatility of the equities in it, the relationships between their returns, and the percentage of the total money invested in each share.

1.1.6.2. Stock's Beta

The beta of a stock indicates its susceptibility to investment yields. This technique is often employed by investors who seem to have diversified investments in equities and think that diversifying the portfolio eliminates the portfolio's unsystematic risk. In the same vein, portfolio risk is often quantified in terms of beta or volatility (standard deviation). High-beta equities are considered to be more volatile than other types of stocks due to their increased sensitivity to market returns over time. Similarly, low-beta stocks are projected to be less volatile than high-beta equities due to their reduced sensitivity to investment returns.

1.1.6.3. Value at Risk (VaR)

The term "value at risk" refers to a calculation that determines the maximum predicted loss on a certain investment position at a specified degree of confidence. It is meant to alert investors about the possibility for a maximum loss. This statistic may be calculated in a variety of ways, including using historical data, co-variance, or Monte Carlo simulations.

1.1.7. Hedging, safe-haven, and portfolio Diversification

The portfolio's purpose is to decrease investment risks by evaluating the linkages and covariation between its instruments, as well as its efficacy in responding to pertinent information. When investors diversify their portfolios in order to mitigate losses, the intensity of shocks diminishes, thus boosting capital market stability. To differentiate between a safe-haven, a hedge, and a diversifier asset, it should be categorized as follows (Baur and Lucey, 2010, p. 219):

- Diversifier is an asset that has an imperfectly positive relationship with other assets on average. Due to the fact that the correlation feature is only needed to hold on average, the diversifier does not have the special property of minimizing losses under really poor market circumstances.
- Hedge is an asset that is uncorrelated or has a negative correlation with every other tool or portfolio on average. Moreover, hedge does not possess the unique feature of mitigating losses during moments of market turbulence, since the asset may demonstrate a positive correlation during such times and a negatively correlated during times of stability, with a negative association on average.
- Safe-haven is an asset that is not associated or negatively associated with the other assets in the portfolio, during volatility periods. Safe-haven assets have also been divided into two categories, based on their relationship with other assets or portfolios during crises: Strong safe-haven asset that cor-

relates negatively with other assets. And, Poor safe-haven whose correlation with other assets is zero.

1.1.8. Stock Indexes

An equity index is the aggregate value of a collection of traded equities on the secondary market (Saunders and Cornett, 2012, p. 266). These indexes vary in terms of the companies used in the index and also the methodology used to calculate the index's value (Dağli, 2000, p. 189). The overall change of the stock market is typically assessed by indexes composed of clusters of equities that are meant to reflect the actual stock market or specific sectors of it. By examining the average behaviour of a set of equities, investors may acquire insight into the performance of a broader group of equities.

Three techniques of weighting are often employed in the computation of market indices: Price-Weighted Index (PWI), Value-Weighted Index (VWI), and Equal-Weighted (EWI) (Dağli, 2000, p. 189):

1.1.8.1. Price-Weighted Index (PWI)

This index is calculated by splitting the total of the stock price by the index's total number of stocks (Parasuraman and Ramudu, 2014, p. 177). As a result, this is merely the average price inside a specific index. This measure suffers significantly from the notion that stocks with considerable price movements over 2 days have a disproportionate influence on the index, even if the movement is modest in terms of percentage. As a result, it is accused for being more slanted on highly-priced assets. Dow Jones Industrial Average (DJIA) index is an example of a PWI.

1.1.8.2. Value-Weighted Index (VWI)

The theoretical underpinning for VWI indices as an investment benchmark is supplied by (Lintner, 1965; Sharpe, 1964) Capital Asset Pricing Model (CAPM) and (Fama, 1970) Effi-

cient Market Hypothesis (EMH). VWI has really been proposed to properly reflect the transacted market value of a stocks (Parasuraman and Ramudu, 2014, p. 177). However, VWIs are calculated on a free float methodology rather than on a gross capitalization one. The free float is the number of stocks that are purchasable, instead of the total number of stocks (Darškuvienė, 2010, p. 102). Standard and Poor's 500 (S&P 500) index is an example of a VWI.

1.1.8.3. Equal-Weighted Index (EWI)

EW is an index that invests an equal size of money in each of the index's constituent companies (The Economic Times, 2022). The behavior of each firm's stock is equally significant in calculating the index's overall worth. There is also no irrational focus on a few companies or sectors. It's more diverse and less dangerous. The nifty 50 index is an example of an EWI.

1.1.9. Macroeconomic Factors' Influence on Stock Market Returns

Economic, market, and firm-related factors influence equity prices (Madura, 2014, p. 286,291); economic growth is supposed to enhance demand for companies' goods and services, hence increasing cash flows. The bulk of the yearly market gains come in January. So, this behavior exerts upward pressure on tiny equities, leading to the January effect (Haug and Hirschey, 2006, p. 78). Stock values are not only affected by economic and market circumstances but also by corporation-specific considerations. As a result, shareholders track industry sales estimates, new competitors' entrance, and product price adjustments. Further, rising dividends, expected earnings growth, divestitures, and acquisitions. All of these variables have a direct impact on share prices.

1.1.9.1. Interest Rate and Stock Returns

Fiscal and monetary policy are significant factors affecting stock values. The equilibrium interest rate is the rate at which the to-

tal quantity of funds provided equals the total quantity of funds sought (Saunders and Cornett, 2012, p. 40). However, interest rate changes have a direct effect on the bond markets but an indirect effect on the equity markets (Madura, 2014, p. 29). When the central bank reduces interest rates, bond yields fall and stock prices rise. Additionally, a reduction in interest rates is anticipated to boost the economy, resulting in a somewhat greater growth rate of earnings (Mishkin and Serletis, 2011, p. 146). Moreover, interest rates and equity markets may have a shifting connection over time (Madura, 2014, p. 287), but in general, the research on the interest rate–stock link suggests that there is a negative connection between them (Eldomiaty et al., 2020, p. 3). According to debt markets, bond prices and interest rates are inversely related: as interest rates increase, bond prices come down (Mishkin and Stanley G. Eakins, 2012, p. 47).

1.1.9.2. Inflation and Stock Returns

Inflation has become a significant worry for policymakers and the public. The initial conclusions concerning the link between inflation and share returns were made on the basis of Irving Fisher's 1930 hypothesis, which forecasts a positive association between anticipated nominal yields and expected inflation (Gultekin, 1983, p. 49). Nevertheless, Fama (1981, p. 563) resulted that the relationship between inflation and share returns is inverse, this conclusion is reached for the following reasons:

- Inflation increases consumer spending, which results in a decline in savings and investment. As a result, demand for shares and other financial instruments declines, resulting in a decline in share prices.
- Additionally, rising inflation has a negative effect on company earnings through increasing input prices, interest payments, and demand pressures. This results in another decline in stock values as a result of poor company performance.

- Moreover, a boost in inflation causes the discount rate in the share valuation method to increase, resulting in lower share values.
- Increased inflation also encourages monetary and fiscal measures aimed at reducing the money supply, raising interest rates, and restricting economic growth. This would have a negative impact on growth rates, company performance, and stock returns once again.

1.1.9.3. Taxes and Stock Returns

Stock returns are negatively linked with the corporation income tax rate (Susan and Winarto, 2021, p. 84); Reduced corporation taxes may result in lower company expenses, which can result in increased profit. As a result, investors are anticipated to respond positively.

1.1.9.4. Exchange Rate and Stock Returns

Due to the activities of investors who seek the advantages of global portfolio diversification by investing in nations with lower to greater stock returns, the Portfolio Balance Theory (PBT) supposes that the exchange rate and share returns are inversely related (Salisu and Vo, 2021, p. 138) Granger causality can represent the direction of causation between the stock market and the exchange rate, but it cannot forecast the sign of association (Wong, 2017, p. 282). In all developed market economies, there is unidirectional correlation among the stock and currency markets, but there are no persistent causal relationships in developing economies (Ajayi et al., 1998, p. 248).

1.2. Islamic Finance

1.2.1. Principles of the Islamic Finance

Islam is more than just morality, rituals, and worship; it is a comprehensive approach to all elements of political, economic, and social aspects. Obedience to God is necessary not just in worship but also in economic activity, and if there is a conflict

between individual and societal interests, the priority is to put society's interests ahead of the person's. Similarly, while developing and passing financial laws, it is impossible to overlook both the overall goals and the partial legislations that Islam provided. Islam has subjected a wide range of activities to human rational judgment. Moreover, it has limited people's behaviours to a set of everlasting rules that are applicable for all times and places and cannot be broken under the guise of an expiry date or incompatibility with a group of people.

1.2.2. The Differences between Conventional and Islamic Finance System

The sources of Islamic legislation are divided into primary and secondary sources: The primary sources are limited to the Qur'an, Sunnah, Qias (Analogy), and Ijma (Consensus). The secondary sources vary between Istislah (Public interest), Istihsan (Preference), Ijtihad (Legal reasoning), and Urf (Customs). All Islamic jurisprudence volumes feature a separate chapter related to commercial jurisprudence, which is the legislation regulating corporations and individuals activities belonging to financial and economic aspects (Alwazna, 2016, p. 68; Hassan, 1982, p. 251,254).

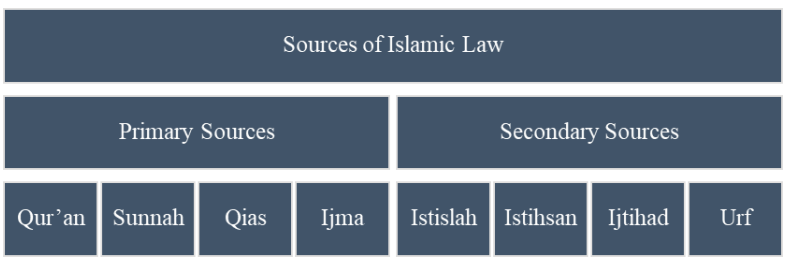

Figure 3- The Sources of Islamic Legislation

Source: *(Alwazna, 2016, p. 68).*

In general, all Shariah-compliant commercial activities and contracts share common principles. Furthermore, these five foundations distinguish the Islamic financial from other systems (Rizvi et al., 2016, p. 66).

1. The Islamic aqidah is the basic criteria for all commercial and financial actions. On the other hand, every individual is responsible for his transactions.
2. According to Sharia, there is integration between the individual and society's interests. Moreover, spiritual and moral values, along with other material values, play a complementary and vital role.
3. In various financial and commercial transactions, the standards of justice, truth, acceptance, transparency, and clarity must be satisfied.
4. All contractual assets must be real, have effective outputs, and not be detrimental to society's interests.
5. Profits cannot be gained without taking risks.

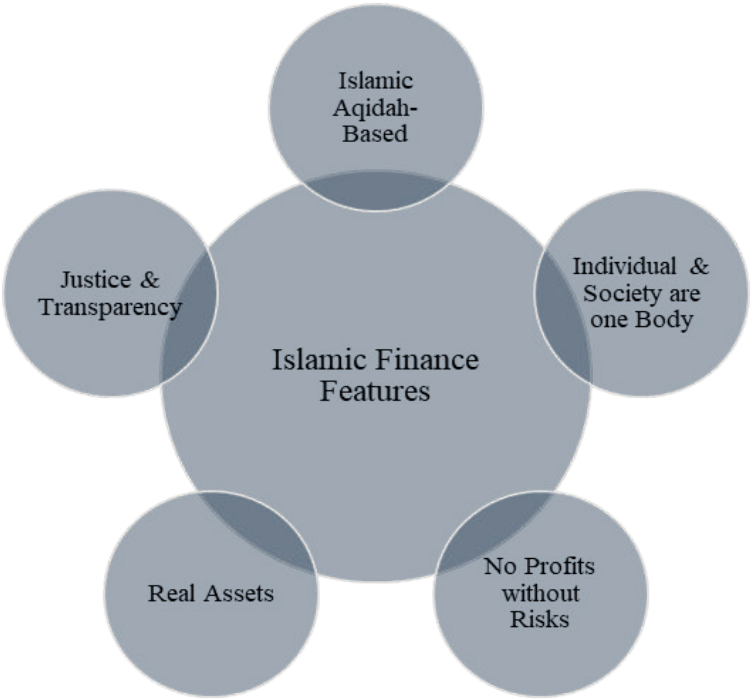

Figure 4- Islamic Finance Features

Source: *(Rizvi et al., 2016, p. 66).*

Thus, the significant difference between permissible compensation, and prohibited Riba and Gharar is often the most essential differentiating element of Islamic finance (El-Gamal, 2006, p. 46,49).

1.2.3. How do firms and stocks satisfy Islamic Sharia standards?

AAOIFI addressed the following general requirements in Standard No. 21 regarding the issuing, trading, mortgage, lending, and investing of shares (AAOIFI, 2017, p. 560,567):

1.2.3.1. Stock Issuance Standards

1.2.3.1.1. The issuing of shares is acceptable provided the firm's aims are permissible under Shari'ah. If the corporation's purposes are deemed to be prohibited, consequently the issuing of shares is also deemed to be prohibited.

1.2.3.1.2. It is permitted to add a predetermined percentage to the equity's value during the period of subscription in order to pay issuance expenditures, provided that the percentage is considered to be an acceptable amount.

1.2.3.1.3. It is permitted for a corporation to release new equities in order to expand its capital if the new equities' prices are equal to the value of the existing equity, which is determined by experts or market value, whether at a premium or a discount price.

1.2.3.1.4. It is permitted to underwrite the issue without compensation. It is an obligation by the investment company to subscribe at the nominal value to the equity that remains unsubscribed. Nevertheless, the underwriter may be compensated for certain services, such as feasibility analysis or stock marketing.

1.2.3.1.5. It is allowed to divide the stock's value into payments at the moment of subscription, with one instalment paid immediately and the remainder postponed. Payments apply to all stocks and the company's responsibility is limited to the value of the stock subscribed for.

1.2.3.1.6. It is not authorized to issue preferred stock with unique financial characteristics that result in the giving of priority to these stocks during liquidation or dividend pay-outs. It is permissible to

award specific shares with procedural or administrative characteristics.

1.2.3.1.7. Tamattu shares cannot be issued. These are stocks that provide remuneration to investors in place of their shares, the value of which is redeemed throughout the company's life. Tamattu shares confer on them all of the rights associated with capital stocks, with the exception of the entitlement to earnings and the division of assets upon winding up.

1.2.3.1.8. A stock certificate is a document that serves as proof of the stockholder's ownership of his undivided stock in the firm's assets. It is permissible for this certificate to be in the owner's name, on his command, or for the bearer.

1.2.3.2. Regulations Governing the Trading of Stocks

1.2.3.2.1. A stock represents an undivided share in a firm's capital, just like it reflects an undivided part in the assets. During the trading, the contract's subject matter is this undivided share.

1.2.3.2.2. It is possible to purchase and sell corporate stocks on a spot or delayed basis, provided that the firm's operation is permitted.

1.2.3.2.3. Participation or trade is permissible for conversion objectives for those who have the power to effect converting via the adoption of a Shari'ah-compliant resolution at the first annual assembly.

1.2.3.2.4. The basic principle is that subscriptions to and exchanges in the stocks of companies that occasionally engage in Riba and many other forbidden is forbidden activities although when their main activity is allowable; however, subscriptions and

exchanges are unforbidden if the following criteria are satisfied:

1.2.3.2.5. The firm's partnership agreement makes no mention of dealing in Riba or in forbidden commodities or materials.

1.2.3.2.6. The interest on the loan doesn't really surpass 30% of the firm's market cap.

1.2.3.2.7. The aggregate amount of interest-bearing deposits must not surpass 30% of the total stocks market value.

1.2.3.2.8. The revenue produced by the forbidden component doesn't really surpass 5% of the firm's total revenue, regardless of whether the revenue is earned by engaging in non-sharia-compliant conduct, owning a forbidden asset, or in any other manner.

1.2.3.2.9. These proportions are to be determined using the most recent budget or confirmed financial status.

1.2.3.2.10. It is mandatory to remove non-sharia-compliant revenue associated with the stock that is merged in with the firm's profits.

1.2.3.2.11. It is not allowed to buy shares with the use of Riba-bearing loans raised via a broker or some other party (margin sales), also it is prohibited to mortgage the stocks for this loan.

1.2.3.2.12. It is forbidden to sell stocks in which the seller has no ownership (short sale).

1.2.3.2.13. It is allowed for the purchaser of a share to engage in dealings in it via the sale of the stock to another after the fulfillment of the procedures of the sale and transfer of obligation to him, even if the final settlement has not been performed.

1.2.3.2.14. To protect legitimate interests, it is allowed for specialized government agencies to arrange trading in certain stocks in such a way that it can only be conducted via specialist brokers or those permitted to conduct the activity.

1.2.3.2.15. It is forbidden to lend firm stock.

1.2.3.2.16. Mortgages on Shari'ah-compliant stocks are acceptable regardless of whether the firm's assets are currency, physical assets, or loans, or a mix of them.

1.2.3.2.17. Salam's contract is forbidden in stocks.

1.2.3.2.18. It is prohibited to get into futures trading for stocks.

1.2.3.2.19. It is prohibited to get into options for stocks.

1.2.3.2.20. Swap arrangements involving stocks and their yields are not allowed.

1.2.3.2.21. Renting stock is not permitted.

1.2.3.2.22. Lending of stocks is permissible. Nonetheless, the borrower has no authority to sell stocks except to satisfy the mortgage's conditions.

1.2.3.2.23. Trading in a firm's stock is not permitted if the firm's assets are entirely cash.

1.2.3.2.24. It is not permitted to trade in a firm's shares if the firm's entire asset base is made up of debts, only if the regulations for trading in debts are followed.

1.2.3.2.25. If a firm's assets include physical property, intangible property, currency, and debts, the trading rules for its stock will vary according to the firm's aim and normal activities. If the firm's aim and primary operation is the trading of gold or currencies, it is required to engage in stock trading in accordance with Sarf standards.

1.3. Cryptocurrencies

1.3.1. Overview of Cryptocurrencies

A cryptocurrencies (CCs) assets are intended to enable the trading of electronic cash while ensuring the security of money, transactions, and the generation of new funds via the use of strong encryption (Elrom, 2019, p. 6). A cryptocurrency is a way of creating virtual "money" and securing their possession and transaction via the use of a cryptographic puzzle (Harwick, 2016, p. 570). Cryptocurrency is a digital currency wherein exchanges are validated and data is kept by a decentralized system utilizing encryption instead of a central authority (Oxford University Press, 2022).

The use of cryptocurrencies is increasingly accepted by a wide spectrum of individuals and institutions as a medium of payments, digital asset, and measure of value (Mensi et al., 2020). Interestingly, among the most significant economic developments in the second half of 2021, El Salvador announced the adoption of the Bitcoin currency as a legal currency, which may be used for payments alongside the local currency and the dollar. In addition, the ProShares Bitcoin Strategy ETF (BITO) was launched in the U.S as the first exchange-traded fund for Bitcoin, reinforcing forecasts for increased demand for cryptocurrencies. Furthermore, the Chicago Mercantile Exchange (CME) and Chicago Board Options Exchange (CBOE) included BTC on their futures contract exchanges (Liu et al., 2020). Additionally, it must be overlooked that several massive corporations accept cryptocurrency as a form of payment and procurement of goods. According to (Chainalysis, 2021, p. 24,106), regarding the cryptocurrency economy around the world during the period between July 2020 and June 2021:

1. Central, Northern, and Western Europe is the world's largest cryptocurrency economy, acquiring over $1 billion in cryptocurrency, or 25% of worldwide activity.

2. North America has the world's second-largest cryptocurrency market, with over $750 trillion in cryptocurrency transactions, accounting for 18.4% of worldwide activity.
3. Eastern Asia is the world's third biggest cryptocurrency economy, actually obtaining $591 trillion in cryptocurrency or 14% of worldwide activity.
4. Southern and Central Asia and Oceania is the 4th cryptocurrency economy, receiving $572.5 trillion, or 14% of the worldwide activity.
5. Eastern Europe is the region's fifth-largest cryptocurrency market, receiving over $422 billion in cryptocurrency.
6. Latin America is home to the world's 6th-largest cryptocurrency market, having received $352.8 trillion in cryptocurrency activity.
7. The Middle East has the world's 2nd-smallest cryptocurrency market, receiving $271.7 trillion in cryptocurrency, accounting for 6.6 percent of worldwide activity.
8. Africa's cryptocurrency market is the smallest, receiving $105.6 billion in cryptocurrency.

1.3.2. Regulation of cryptocurrencies

The crypto field is continuously developing, and staying current with the legislation in several worldwide jurisdictions is challenging. As the shift of crypto assets from volatile markets to stable coins in a diversified portfolio progress, governments worldwide remain split on the best way to regulate them. Numerous nations are already researching or exploring the possibility of generating their national cryptocurrency. The majority of governments, on the other hand, want to observe, control, and tax this sector. The following table summarizes how various governments regulate cryptocurrencies and exchanges, as well as the legal recognition of cryptocurrencies in several countries around the world (Atlantic Council Research, 2022; Complyadvantage, 2022; Khanna, 2022).

Table 2- Regulation of Cryptocurrency and Statue of CBDC around the World

Country	Legal tender	Exchanges	Own CBDC
United States	Not legal tender	Legal	Research
China	Not legal tender	Illegal	Pilot
Japan	Legal tender	Legal	Development
UK	Not legal tender	Legal	Research
India	Not legal tender	Being considered	Development
Canada	Not legal tender	Legal	Development
Russia	Not legal tender	Legal	Pilot
Brazil	Legal tender	Legal	Development
Turkey	Not legal tender	Legal	Development

Sources: *https://www.atlanticcouncil.org/cbdctracker/*

https://complyadvantage.com/insights/cryptocurrency-regulations-around-world/

https://news.bloombergtax.com/daily-tax-report-international/cryptocurrencies- and-other-digital-assets-take-center-stage-in-2022-part-2

Date access: 13.05.2022.

1.3.3. Crypto Assets Types

The majority of people are unfamiliar with crypto assets, much alone the enormous variety of currencies and tokens available. To assist visualize these elements, let us divide crypto assets into three categories (Abojeib, 2021, p. 6; Elrom, 2019, p. 14):

1.3.3.1. Cryptocurrency or Payment Token: it is intended to function as a medium of payment, a store of value, and a unit of account. It can be classified into three types:

- Non-stable cryptocurrencies: like Bitcoin.

- Stable cryptocurrencies: include those that are backed by a fiat currency, commodity, or other cryptocurrencies.
- Central Bank Digital Currencies CBDCs: which are issued by government authorities. This type has several characteristics that distinguish it from other cryptocurrencies.

1.3.3.2. Utility Token: These types enable the users to carry out specified actions on a particular network.

1.3.3.3. Asset and Security Tokens: The primary distinction among utility and security tokens seems to be that security ones confer on a corporation ownership rights. Security tokens are similar to decentralized digital stock. Security tokens are similar to decentralized digital shares of stock. *(Abojeib, 2021, p. 6; Elrom, 2019, p. 14)*.

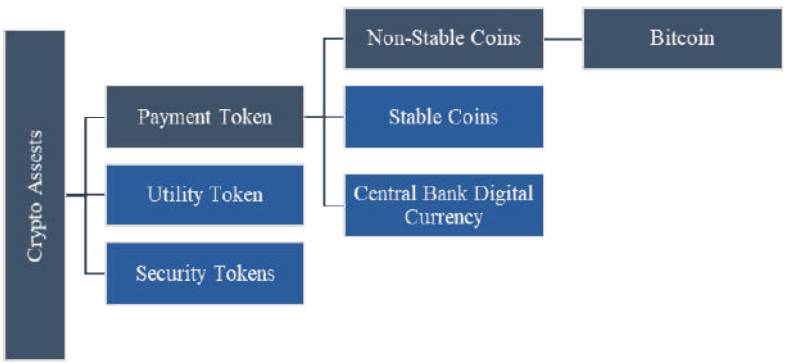

Figure 5- Cryptoassets Types

Sources: *(Abojeib, 2021, p. 6; Elrom, 2019, p. 14)*.

1.3.4. What is Bitcoin?

Bitcoin is a digital asset whose possession is logged on a virtual ledger which is updated frequently by a network of independently run computers connected to one another. This ledger is referred to as the Bitcoin blockchain (Lewis, 2018, p. 150). Bitcoin is a decentralized agreement network that permits the creation of a payment system. It is also the world's first decentralized peer-to-peer payment network, driven entirely by its users and without the intervention of a central authority or middleman (Bitcoin.org, 2022). Bitcoin is a digital payment system that uses cryptographic evidence rather than trust to enable any two willing individuals to interact directly with each other with no need for a trusted intermediary (Nakamoto, 2008, p. 1). Bitcoin's "blockchain" is a database that keeps track of the flow of its main currency, called bitcoin [1] (Burniske and Tatar, 2018, p. 13).

Blockchain isn't Bitcoin, but it is the underlying technology, or the heart, of bitcoin and, indeed, all cryptocurrencies (Elrom, 2019, p. 8). The material saved on the blockchain's nodes, as well as the actions conducted by the many users on the blockchain networks, may be regulated based on (1) how the blockchain is built and (2) how it is anticipated to execute the intended business function (Seth, 2021). There are two types of blockchain: public and private (Burniske and Tatar, 2018, p. 21). The public blockchain, like Bitcoin's blockchain, allows anyone to contact and contribute to all functions on the blockchain's network. On the other hand, anyone can read, publish, and monitor the public blockchain network's updated actions that helps the blockchain preserve its self-governing character (Lai and Lee Kuo Chuen, 2018, p. 153). Public blockchains are a very advantageous alternative in terms of completely decentralized, democratic, and authority-free functioning (Seth, 2021).

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1 Bitcoin capitalized B is the abbreviation for the software that enables the transfer and custody of bitcoin, the cryptocurrency that begins with a lowercase b.

1.3.5. Storing bitcoin

Like bank accounts, a Bitcoin wallet can be used to receive, store or transfer bitcoin or any other cryptocurrencies. While platforms store the coins they trade, that isn't always the perfect location to keep them in the long run. Moreover, a wallet is very important in cryptocurrencies to remunerate miners for creating blocks and also to make and execute transactions (Elrom, 2019, p. 105). The term "store a cryptocurrency" relates to storage of a private key that permits the owner to transfer the cryptocurrencies to some other private key owner (Burniske and Tatar, 2018, p. 221). That's means the users store the private key not a bitcoin because all bitcoins are recorded on Bitcoin's blockchain. Bitcoin software wallets serve at least one of these functions (Lewis, 2018, p. 218): (1) Make new Bitcoin addresses and save the private keys. (2) Show the addresses to everyone who wants to transfer money. (3) Show how many cryptocurrencies you have. (4) Make cryptocurrencies payments. Cryptocurrencies are kept in either a hot or cold wallet (Burniske and Tatar, 2018, p. 221): If the users can access their cryptocurrencies directly through any machine that is linked to the internet, like a smartphone or computer, that means it's a hot wallet. A cold wallet, on the other hand, means the devices that store the cryptocurrencies are not linked to the Internet.

1.3.6. The value of bitcoin

Money's value is determined by the people's acceptance of it as a medium of exchange. As well as, the importance of people's trust in central banks cannot be underestimated. Thus, governments that restrict cryptocurrencies undermine confidence, which leads to a drop in individual intentions to adopt them as a form of money. Further, consumer demand, net transactional advantages, and perceived accessibility of crypto-payments all influence online merchants' intentions to use cryptocurrency (Jonker, 2019, p. 1). It can also rely on herding, prospect, and heuristic theories to determine the factors that may affect investors adopting cryptocurrencies (Al-mansour, 2020, p. 166). Moreover, the community as-

signs two types of value to any type of cryptoasset: utilitarian value and speculative value (Burniske and Tatar, 2018, p. 176): Utility value relates to the usage of the cryptoasset to acquire access to the digital resource and is determined by supply and demand factors. The benefit of bitcoin is that it can move value to anybody, wherever in the world, in a secure, speedy, and efficient manner. However, investors own a big portion of bitcoin. Because they are speculators, such investors do not intend to sell their bitcoin for some time. Instead, they are presumably long-term balances held by companies based on their expectations of bitcoin's future utility value. Speculative value can be conceived of as future utility value. The intention to utilize cryptocurrency is significantly associated with awareness, perceived ease of use, and perceived utility (Shahzad et al., 2018, p. 38). In the same vein, (van Alstyne, 2014, p. 30,32) identified the factors that make cryptocurrencies valuable: (1) The technological value of Bitcoin is in resolving the double payment problems. (2) The transactions cost draws near $0. (3) Because every transaction involves public verification by buyers and suppliers, Bitcoin detects fraud more effectively than credit cards. (4) Bitcoin is valuable because it is accepted by people, just like any other form of money.

1.3.7. Pros and Cons of Bitcoin

Bitcoin has the benefit of not charging transaction fees, as banks and credit card firms do. Additionally, speed and great privacy are two of the most essential properties of it, since they make it impossible to monitor purchasing and selling activities and therefore lower government influence over the monetary system. Due to the fact that bitcoin is not geographically bound, it may be utilized as a local currency. As a result, no one is authorized to seize or confiscate it. Further, since each transaction is recorded in the blockchain, everyone can see how many units a wallet holder has and how many transactions have been performed via it. Finally, Bitcoin technology (protocol and encryption) is one of the coun-

try's greatest secure distributed computing initiatives, making it very difficult to forge or re-clone.

Some of Bitcoin's downsides are mixed in with certain of its virtues. First, while secrecy is a benefit, it also has a negative side since it aids criminal activities such as money laundering and weapons and drug trafficking. Second, the difficulty of mining is one of the primary impediments to bitcoin adoption due to the complexity of the gear, software, and mathematical calculations required. Third, the extreme volatility of bitcoin poses a fundamental issue for its dealers, as it may restrict their spread and adoption as a means of exchange. Fourth, bitcoin can be hacked, cyberattacked, or manipulated because it is stored in a digital wallet. Fifth, Bitcoin has a dangerous impact on the environment. For instant, Bitcoin mining generates around 30 kt of electronic waste every year (Bitcoin Electronic Waste Monitor, 2022). Finally, regulatory hazards and concerted resistance from the globe's central banks seem to be the main barriers to bitcoin adoption.

1.3.8. Bitcoin and Economic Indicators

Central bank policies regarding the degree of inflation boost both the amount of trade and interest in bitcoin, due to the fears prompt the public to invest in decentralized currencies (Marmora, 2022, p. 2). Moreover, bitcoin may act as a hedge against economic policy uncertainty shocks; but this result is just valid for a certain period of time (Wu et al., 2021, p. 2). By contrast, there is no strong evidence that bitcoin has any inflation-hedging potential during periods of rising future expected inflation (Conlon et al., 2021, p. 1). There is no evidence to support the hypothesis that a fall in the Open Market Operations rate correlates with a rise in bitcoin yields (Nguyen et al., 2019, p. 336).

1.3.9. Bitcoin in the Islamic Jurisprudence

During the life of the Prophet Muhammad, people continued to utilize Byzantine dinars and Persian dirhams until the age of Umar, who partly changed their shapes. Then, in the Umayyad

era, Abd al-Malik ibn Marwan was the first sultan who minted the Islamic golden dinar and silver dirham (Abdullah, 2020, p. 5). From an Islamic standpoint, the currency is only utilized as a means of exchange for goods and services, neither for speculation nor for gaining profits from money trading by itself (Siswantoro et al., 2020, p. 4). On the other hand, money in Islam is generated through trading and investing in halal projects. Thus, money must be stable, secure, and effective in order to satisfy the characteristic of a means of trade in Islamic doctrine (Siswantoro et al., 2020). As a result of the many discussions that have taken place over the last years, Sharia ruling's influential features have been summarized into determined points such as: ignorance of the issuer, lack of governmental oversight, excessive volatility, and unlawful activities (IEC, 2021, p. 46). However, there are three main opinions on cryptocurrencies:

1.3.9.1. The official fatwa bodies in Turkey, Iran, Saudi Arabia, Egypt, Algeria, and many more Islamic nations, forbid any forms of trading with Bitcoin (Dar al-Iftaa Al-Missriyyah, 2017; T.C. Cumhurbaşkanlığı Diyanet İşleri Başkanlığı, 2022).

1.3.9.2. The International Islamic Fiqh Academy suggested greater investigation into cryptocurrencies to collect additional information regarding the nature of cryptocurrencies and whether Shariah considers them to be real-valued property and tradeable items. Hence, they did not provide a definitive decision on them (IIFA, 2021, p. 590).

1.3.9.3. The Islamic Economics Club issued a fatwa approving Bitcoin as a currency. Since it is a type of money that fulfills the functions of currency and is legally valued, as well as there is no mandatory statement that the currency must be created by a government entity (IEC, 2021, p. 47).

1.4. Literature Review

In keeping with the study's objective, studies that investigate the link between Bitcoin, oil, conventional and Islamic stocks, and their benefits in diversifying portfolios, as well as their abilities as a safe haven and hedging asset, will be highlighted in this part.

1.4.1. Bitcoin's interaction with the stock markets

Shahzad et al. (2019) tried to find out the best asset as a safe haven between gold, bitcoin and commodities, by employing Heterogeneity between quantiles. They find that BTC, gold, and commodity have comparable poor safe-haven characteristics for the global stock market indices. Chkili et al. (2021) used DCC-FIGARCH method to estimate the role of BTC and gold as a hedge and diversifier to Islamic stocks. They suggested that Islamic investors could rely on BTC to diversify and hedge their portfolios through the health crises. DCC-GARCH model was utilized by Wang et al. (2021) to compare Bitcoin to commodities and USD from 2016 to 2021. The result was that adding Bitcoin to the portfolio increases the importance of comparing its volatility with other assets. QS approach enabled (Maghyereh and Abdoh, 2021) to prove that in particular, Bitcoin returns are highly dependent on global and US stocks. Moreover, Bouri et al. (2020) advise investors and portfolio managers to include cryptocurrencies, such as BTC and ETH, in their portfolios that contain stocks, especially in Japan and Southeast Asia. Ahmed, (2021) utilized QR methodology among Bitcoin and Islamic equities from 2014 to 2021 to conclude that in emerging and developed markets, investors can use Islamic stocks to hedge a portfolio when Bitcoin prices tend to rise, and to diversify if Bitcoin prices are falling. Furthermore, Mensi et al. (2020) examined the movements between Bitcoin and Sukuk, as well as regional and international Islamic equity markets. They concluded that the advantages of diversifying the portfolio via BTC and Islamic equities change with time and frequency. (Caferra and Vidal-Tomás (2021) benefited from Markov tests to highlight that in the majority of situations, cryptocurrencies were

sending out bullish signals. Whereas, Bouri et al. (2017) concentrated on the relationship between Bitcoin and S&P GSCI energy by employing ADCC model. they resulted that Bitcoin could act as a strong safe haven for energy commodity index. (Urquhart and Zhang (2019) focused on the correlation between crypto and tangible currencies using ADCC equations, to show that Bitcoin acts as a hedge during the day for some currencies such as the EUR, and GBP, and as a diversification tool for some other currencies such as the AUD, and CAD

1.4.2. Bitcoin's interaction with the Commodity market

Selmi et al. (2018) studied the connectedness among Bitcoin, oil, and gold with QQR method. They concluded that Bitcoin reduce the risk of oil portfolios. The same variables, but under MVGARC model, were analyzed by Jin et al. (2019) who resulted that oil has a positive relationship with gold, and almost negative one with Bitcoin. Wen et al. (2022) applied time-varying parameter VAR to compare the dynamic spillover effects of gold and BTC prices on the oil markets during the COVID-19 outbreak. They stated that, in contrast to gold, Bitcoin's response is the inverse, rejecting the safe haven feature. In the same vein, by utilizing copula approach Syuhada et al. (2022) concluded that Gold significantly decreases the downward risk of a portfolio that includes any proportion of gold and energy commodities, demonstrating its safe-haven potential. BTC's safe-haven functionality, on the other hand, is unreliable. Dutta et al. (2020) used ADCC-GARCH model to investigate the safe haven features of Bitcoin and gold to oil prices during COVID-19 outbreak. They revealed that gold exceeds Bitcoin as a safe haven asset. To discover the link between BTC, oil, gold, and a variety of indices, Bhuiyan et al. (2021) by employing a wavelet approach, revealed that both BTC and gold may be utilized as diversifiers and safe havens during periods of fluctuating oil prices. In terms of diversity of Chinese investments, Bitcoin is comparable to gold by Pho et al. (2021). They proposed Copula model during 10 years to conclude that to Chinese inves-

tors, gold is a superior portfolio diversifier than BTC. Li et al. (2022) Used the Granger causality test to investigate the extreme risk transmission between BTC and the crude oil market. They validated the presence of severe asymmetry in the oil-Bitcoin correlation and that the asymmetry is related to the magnitude of both price changes. Charfeddine et al. (2020) compared the advantages of CCs to oil, gold and S&P 500 using Copula and GARCH models and discovered that combining Bitcoin with other observed asset offers better diversification advantages for the investors. Jareño et al. (2021) employed NARDL methodology to check the relation between Bitcoin, 10 major CCs and oil price shocks. The analysis resulted that oil risk shock has a negative connection with Bitcoin returns, but has a least connection with Tether. Mensi et al. (2019) concluded that Bitcoin has been shown to give more diversification advantages than precious metals.

1.4.3. Stock's interaction with the Commodity market

Rahman et al. (2021) benefited from Quantilogram mechanism to investigate the dependence relations among conventional and Sharia-compatible stocks. They emphasized that in normal situations, the combination of Islamic and non-Islamic stocks achieves the advantages of diversification in the portfolio. Bugan et al. (2021) also wondered about the characteristics of diversification and the safe haven for conventional ones amid unstable circumstances, offer results that Islamic finance tools give limited safe havens during financial crises. Hasan, Mahi, et al. (2021) utilized co-movements models to check the effect of COVID-19 crisis on the two types of stock markets. They suggested that the strong link between Islamic and conventional equities disproves the notion of Islamic stocks being a distinct financial choice. Naeem et al. (2021) measured the connectedness between stocks and gold with QQ technique to conclude that gold prices can be relied upon as a measure to predict the performance of Islamic stocks. By sing time-varying Granger-causality tests in mean and variance, Cevik et al. (2018) investigate the Granger-causal linkages between

oil price changes and worldwide stock returns. They found that only during specific time periods, particularly following the global financial crisis, were there causal links between oil prices and global stock market returns. Tuna et al. (2021) employed Asymmetric causality tests to determine the interactions between observed time series. They resulted that oil prices can be relied upon as a measure to predict the performance of Islamic and non-Islamic stocks. With similar series but different model (Chang et al., 2020) urged investors to invest in the healthcare and telecommunications industries to gain better diversification benefits in the case of a spike in oil prices. Hadhri (2021) studied the effect of oil shocks on both Islamic and conventional equities by utilizing ARDL test to prove that the benefits of diversifying the oil portfolio with Islamic stocks will outweigh the benefits of diversification with conventional ones. Moreover, they resulted that in the long run, the negative oil price shock leads to an increase in Islamic stock prices. Zaighum et al. (2021) researched on how energy prices interact with global stocks? They used QARDL approach to be able to advise investors to include Islamic stocks in their portfolios that contain crude and heating oil, as they will have better diversification characteristics. Hasanet al. (2021) intended to ensure that assets retained their diversity and hedging capacities throughout financial and health crises. They used the characteristics of the regression equations to demonstrates that during the recent crisis, Islamic stocks were a strong safe haven for the US stocks. As contagion in the shock situations indicates a loss in diversification features, (Martín- Barragán et al., 2015) employed Wavelet-based correlations to emphasized that Correlation among developed equity markets tends to grow when there is an oil shock.

CHAPTER 2

Data and Methodology

2.1. Data

This thesis aims to investigate the causal relationship between Bitcoin (BTC), Islamic Stock Markets (ISMs), and Oil prices. To this end, I consider the Dow Jones Islamic Stock Market Index (DJI) as a measure of the Islamic stock market. For the oil market, I use the West Texas Intermediate (WTI) daily price movements, and the order-level USD/BTC trading data of Bitstamp for BTC. All data was obtained from DataStream. The sample period for the thesis is from August 18, 2011, to December 10, 2021, which gives us a total of 2,690 daily data observations.

Table 3 displays the descriptive statistics for all series returns. In the sample, the mean returns for DJI and BTC are positive, but negative for WTI. While Bitcoin has the highest mean return, WTI has the lowest mean return. Furthermore, as assessed by the standard deviation, BTC has the most volatility, followed by WTI and lastly, DJI. Finally, according to the Jarque-Bera normality test, all return series display substantial negative skewness and excess kurtosis, indicating that the normal distribution assumption for the return series is rejected at the 1% level.

Table 3- Descriptive Statistics for Return Series

	DL(DJI)	DL(WTI)	DL(BTC)
Mean	0.00043	-0.00006	0.00311
Median	0.00065	0.00000	0.00248
Maximum	0.07916	0.25874	0.48478
Minimum	-0.09639	-0.41786	-0.66395
SD	0.00893	0.02809	0.05683
Skewness	-0.93241	-0.96992	-1.06834
Kurtosis	19.00942	41.59751	23.00465
JB	29106.10***	167337.70***	45349.03***
N	2689	2689	2689

Note: **** indicates that variables are significant at 1% level.*

As shown in Fig 6, Bitcoin began the year 2017 strongly, rising to $1035, but the largest climb occurred in the year 2021, when its price reached more than $67,000 in November, indicating a substantial increase in demand for it in comparison to other assets.

The returns of the Islamic stock market were steadily moving upward throughout the study period, but with the start of the year 2020, a significant decline was observed that coincided with the emergence of the Corona pandemic. However, they completed their upward path and achieved higher values.

Regarding oil returns, it is notable that there were two periods in which prices fell to extremely low levels: the first one began in the middle of 2014 and continued into the beginning of 2016, accompanied by the emergence of an increase in crude supply, due to increased production and an economic downturn, which reduced countries' daily consumption. The second one was accompanied by the spread of the Corona epidemic, as the price of a barrel hit about $12, the lowest price throughout this study period.

Figure 6- Time series for the three variables

2.2. Methodology

2.2.1. Stationarity Test

If the time series is nonstationary, we can study its behavior only for the time period under consideration. Each set of time series data will therefore be for a particular episode. In consequence, it cannot be generalized to other various periods. Therefore, such (nonstationary) time series may be of little use for forecasting purposes.

There are three conditions must be met in order to say that time series are stationary: its mean, variance, and autocovariance (at various lags) remain the same no matter at what point we measure them; that is, they are time-invariant.

Let Y_t be a stochastic time series where t = 1.....; n is time index, Y_t stationary if:

- Mean: $E(yt) = \mu$ is fixed (same for all t)
- Variance: $var\ (yt) = E(yt - \mu)2 = \sigma\ 2$
- Covariance: $E\ ((yt - \mu)\ (yt-k - \mu)) = \gamma k$ (same for all t)

Where γk, the covariance (or autocovariance) at lag k, is the covariance between the values of Yt and Yt-k, that is, between two Y values k periods apart.

2.2.1.1. Augmented Dickey-Fuller (ADF) test

The ADF test is estimated in three different forms to determine the stationarity of the variables:

$$\Delta y_t = \gamma y_{t-1} + \sum_{j=1}^{p} \delta_j \Delta y_{t-j} + \mu_t \quad (2.1)$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^{p} \delta_j \Delta y_{t-j} + \mu_t \quad (2.2)$$

$$\Delta y_t = \alpha + \beta\tau + \gamma y_{t-1} + \sum_{j=1}^{p} \delta_j \Delta y_{t-j} + \mu_t \quad (2.3)$$

Where: t is the time index, α is an intercept constant called a drift, β is the coefficient on a time trend, γ is the coefficient presenting process root, i.e., the focus of testing, p is the lag order of the first-differences autoregressive process, μ_t is an independent identically distributes residual term.

The difference between these three equations is that the first one doesn't contain trend or drift, the second contains just a drift, and the third one contains both trend and drift. The hypothesis of ADF tests are as following:

- H_1: γ < 0, The series doesn't have a unit root: Y_t is stationary.
- H1: γ < 0, The series doesn't have a unit root: Yt is stationary.

2.2.1.2. Philips Perron (PP) test

the asymptotic distribution of the PP test is the same as the ADF test statistic, however the fundamental difference between them is The ADF test extends the DF test to take care of any serial correlation in the error terms by adding the lagged difference

terms of the regressand. Phillips and Perron employ nonparametric statistical approaches to take care of the serial correlation in the error terms without introducing delayed difference terms.

The power of the ADF test is reduced by too large a number of lagged differences. On the other hand, too small a number of lags has the effect that the test is no longer correctly applicable due to the autocorrelation of the estimated residuals. Firstly, for the nonparametric tests, the number of lags has no impact on the estimated parameters, and, secondly if the autocorrelation coefficients tend towards zero they have, at best, a small impact on the estimated variance. The increase of m does not reduce the sample size of the estimated equation. Thus, one should assume that nonparametric tests are better suited to cope with the autocorrelation of the residuals.

2.2.2. Vector Autoregressive (VAR) Model

VAR model is one of the most common multivariate time series models used by economists. This model applies when each variable in the system does not only depend on its own lags, but also the lags of other variables. Multivariate time series models primarily focus on the joint modelling of the vector series Y_t. For 2 time series Y_t *and* X_t, VAR model uses the following equations:

$$y_t = \alpha + \sum_{j=1}^{k} \delta_j y_{t-j} + \sum_{j=1}^{k} \beta x_{t-j} + \mu_{1t} \qquad (2.4)$$

$$x_t = \alpha' + \sum_{j=1}^{k} \theta_j y_{t-j} + \sum_{j=1}^{k} \beta x_{t-j} + \mu_{2t} \qquad (2.5)$$

where the μ's are the stochastic error terms, called impulses or innovations

or shocks in the language of VAR.

Prior to estimating equations (2.4) and (2.5), the maximum lag length k must be determined. Incorporating an excessive number of lagged components will waste degrees of freedom and introduce the probability of multicollinearity. Incorporating insufficient lags will result in specification mistakes. Using a criterion such as the Likelihood Ratio (LR) statistics, Final Prediction Error (FPE), Hannan-Quinn (HQ), Schwarz (SIC), or Akaike Information Criterion (AIC), and selecting the model with the lowest values for these criteria is one technique to answer this issue.

2.2.3. The Brock, Dechert, and Scheinkman (BDS) statistic

The BDS statistic is derived from the correlation integral and has its origins in the recent work on deterministic nonlinear dynamics and chaos theory. According to (Jeong et al., 2012; Packard et al., 1980) the method of delays can be used to embed a scalar time series fixing; $\{x_i\}$, $i=1, 2, \ldots N$ into an m-dimensional space as follows:

$$\vec{x} = \left(x_i, x_{i+1,\ldots,} x_{i+(m-1)t}\right), \vec{x} \in R^m \tag{2.6}$$

where t is the index lag. Under the Independent and Identically Distributed (IID) hypothesis, the BDS statistic for m > 1 is defined as:

$$BDS(m,M,r) = \frac{\sqrt{M}}{\sigma}\{C(m,r) - C^m(1,r)\} \tag{2.7}$$

where N is the size of the data sets, $M = (N-1)_t$ is the number of embedded points in m-dimensional space.

It has a limiting standard normal distribution under the null hypothesis of IID as $M \to \infty$ and obtains its critical values using the standard normal distribution.

2.2.4. Nonparametric Causality-in-Quantiles Test

By building on the framework of (Nishiyama et al., 2011) and (Jeong et al., 2012), we use the methodology as advanced by Balcilar et al. (2016) et al. This method is useful in detecting nonlinear causality through a hybrid approach.

Denote x_t, y_t, two series, following (Jeong et al., 2012), the quantile-based causality is defined as follows:

x_t does not cause y_t in the θ-quantile with respect to the lag-vector of $\{y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}\}$ if

$$Q_\theta(y_t y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}) = Q_\theta(y_t y_{t-1}, \dots, y_{t-p}) \quad (2.8)$$

x_t is a prima facie cause of y_t in the θ-th quantile with respect to $\{y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}\}$ if

$$Q_\theta(y_t y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}) \neq Q_\theta(y_t y_{t-1}, \dots, y_{t-p}) \quad (2.9)$$

where Q_θ (y_t-) is the θ-th quantile of y_t depending on t and $0 < \theta < 1$.

Let $Y_{t-1} = (y_{t-1}, \dots, y_{t-p})$ $X_{t-1} = (x_{t-1}, \dots, x_{t-p})$ $Z_t = (X_t, Y_t)$ and

$F_{y_t} | Z_{t-1}(y_t | Z_{t-1})$ and $F_{y_t} | Y_{t-1}(y_t | Y_{t-1})$ denote the conditional distribution function of y_t given Z_{t-1} and Y_{t-1} respectively. The conditional distribution $F_{y_t} | Z_{t-1}(y_t | Z_{t-1})$ is assumed to be absolutely continues in yt for almost all Zt-1. If we denote $Q_\theta(Z_{t-1}) \equiv Q_\theta(y_t | Z_{t-1})$ and $Q_\theta(Y_{t-1}) \equiv Q_\theta(y_t | Y_{t-1})$, we have $F_{y_t} | R_{t-1}\{Q_\theta(Z_{t-1}) | Z_{t-1}\} = Q_\theta)$ with probability one. Consequently, the hypotheses to be tested based on the definition of Eqs. (2.8) and Eqs. (2.9) are:

$$H_0: P\left\{ Fy_t | Z_{t-1} \{Q_\theta (Y_{t-1}) | Z_{t-1}\} = Q_\theta \right\} = 1 \quad (2.10)$$

$$H_1: P\left\{ Fy_t | Z_{t-1} \{Q_\theta (Y_{t-1}) | Z_{t-1}\} = Q_\theta \right\} < 1 \quad (2.11)$$

$\hat{Q}_\theta(Y_{t-1})$ is an estimate of the θ-th quantile of yt given Yt-1. We estimate it using the nonparametric kernel method as

$$\hat{Q}_\theta(Y_{t-1}) = \hat{F}^{-1}_{y_t|Y_{t-1}}(\theta Y_{t-1}) \qquad (2.12)$$

where $\hat{F}_{y_t|Y_{t-1}}(y_t Y_{t-1})$ is the Nadarya-Watson kernel estimator given by:

$$\hat{F}_{y_t|Y_{t-1}}(y_t Y_{t-1}) = \frac{\sum_{s=p+1,s\neq t}^{T} L\left(\frac{Y_{t-1}-Y_{s-1}}{h}\right) 1(y_s \leq y_t)}{\sum_{s=p+1,s\neq t}^{T} L\left(\frac{Y_{t-1}-Y_{s-1}}{h}\right)} \qquad (2.13)$$

with $L(\cdot)$ denoting the kernel function and h the bandwidth. In an extension of the Jeong et al. (2012) framework. To this end, we use the nonparametric Granger-quantile-causality approach by Nishiyama et al. (2011). In order to illustrate the causality in higher-order moments assume that:

$$y_t = g(Yt_{-l}) + \sigma(X_{t-l})\, c_t \quad (2.14)$$

where c_t is the white noise process, and g(.) and $\sigma(.)$ are unknown functions that satisfy certain conditions for stationarity. However, this specification does not allow for Granger-type causality testing from x_t to y_t, but could possibly detect the "predictive power" from x_t to y^2_t when $\sigma(\cdot)$ is a general nonlinear function. Hence, the Granger causality-in-variance definition does not require an explicit specification of squares for X_{t-1}. We reformulate Eq. (2.14) into a null and alternative hypothesis for causality in variance as follows:

$$H_0: P\left\{F_{y_t^2|Z_{t-1}}\{Q_\theta(Y_{t-1}) \mid Z_{t-1}\} = \theta\right\} = 1 \qquad (2.15)$$

$$H_1: P\left\{F_{y_t^2|Z_{t-1}}\{Q_\theta(Y_{t-1}) \mid Z_{t-1}\} = \theta\right\} < 1 \qquad (2.16)$$

To obtain a feasible test statistic for testing the null hypothesis in Eq. (2.15), we replace y_t in (Eq. 2.13) with y^2_t. Incorporating the Jeong et al. (2012) approach we overcome the problem that

causality in the conditional 1st moment (mean) imply causality in the 2nd moment (variance). In order to overcome this problem, we interpret the causality in higher-order moments using the following model:

$$y_t = g(X_{t-1}, Y_{t-1}) + \varepsilon_t \quad (2.17)$$

Thus, higher- order quantile causality can be specified as:

$$H_0: P\left\{F_{y_t^k 1 Z_{t-1}}\{Q_\theta(Y_{t-1}) \mid Z_{t-1}\} = \theta\right\} = 1 \text{ for } k = 1,2,\dots,K \quad (2.18)$$

$$H_1: P\left\{F_{y_t^k 1 Z_{t-1}}\{Q_\theta(Y_{t-1}) \mid Z_{t-1}\} = \theta\right\} < 1 \text{ for } k = 1,2,\dots,K \quad (2.19)$$

Integrating the entire framework, we define that x_t Granger causes y_t in quantile θ up to the *K-th* moment utilizing Eq. (2.18) to construct the test statistic for each k. However, it can be shown that it is not easy to combine the different statistics for each $k = \dots 1, 2, , K$ into one statistic for the joint null in Eq. (2.18) because the statistics are mutually correlated (Nishiyama et al. 2011). To efficiently address this issue, we include a sequential testing method as described by Nishiyama et al. (2011) with some modifications. Firstly, we test for nonparametric Granger causality in the 1st moment ($k = 1$). Failure to reject the null for $k = 1$, does not automatically lead to noncausality in the 2nd moment and, thus, we construct the tests for $k = 2$. Finally, we can test for the existence of causality-in-variance, or the causality-in mean and variance successively.

CHAPTER 3

Findings and Discussion

3.1. Unit Root Tests

In this thesis, the stationarity of the variables has been examined by means of the classical unit root and stationarity tests, which are as follows: The Augmented Dickey-Fuller (ADF) test, and the Philips Perron (PP) test. The null hypothesis in the two unit-root tests (ADF and PP) is that the variables have a unit root. However, the results of the ADF and PP tests reveal that the logarithms of Bitcoin, Islamic stocks, and Oil returns are stationary in their first difference form. In all three choices of the ADF and PP tests, the null hypothesis that they have a unit root should be rejected even at a 1% significance level. It is possible to deduce that these three variables are I(1).

Table 4- ADF and PP Tests-First Difference Form

ADF and PP Tests-First Difference Form				
Variables	Test type	None	Intercept	Trend and Intercept
DL(BTC)	ADF	-54.4615*	-54.6210*	-54.6122*
	PP	-54.4640*	-54.5532*	-54.5449*
DL(WTI)	ADF	-17.9994*	-17.9966*	-18.0012*
	PP	-54.6716*	-54.6622*	-54.6569*
DL(DJI)	ADF	-16.9061*	-17.0730*	-17.0961*
	PP	-51.0737*	-51.1635*	-51.1623*

Note: ** indicates that variables are significant at 1% level.*

Two major findings are achieved by running ADF and PP. First, it is clear that the data is non-stationary. If there is no cointegration among the variables, non-stationary data cannot be included in the model. Second, the initial criteria for looking for cointegration among variables is that they all have the same order of integration. The ADF and PP tests, however, demonstrate that this is not the case. As a result, there is no cointegration link between the three variables. Given that the variables lack a cointegrating vector, one method for investigating their connection is to make nonstationary variables stationery. Fig 7 clearly depicts how the three series stationared the first differences.

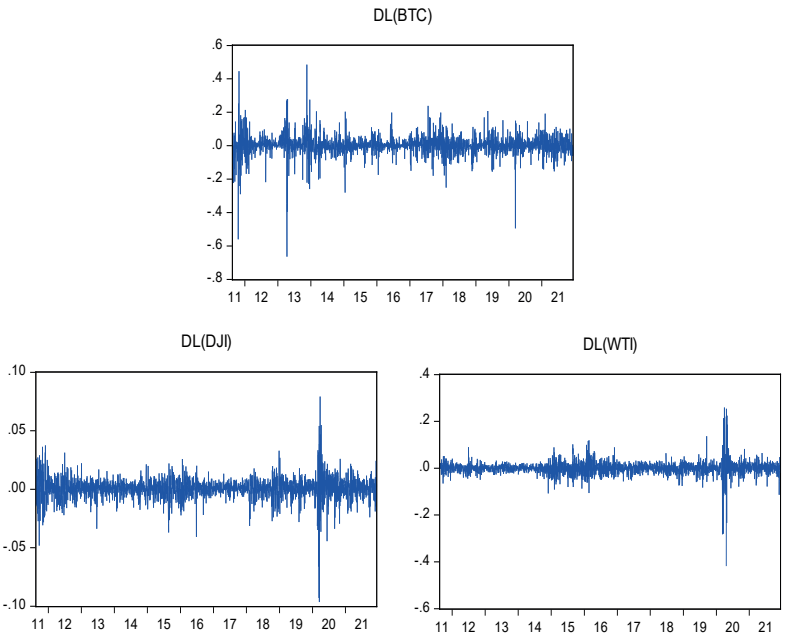

Figure 7- First differences of logarithm of the series

3.2. VAR Model Estimation

Table 5- Nonlinearity VAR Models - Brock et al. (1996) Test

VAR(dependent~ independent)		**m = 2**	**m = 3**	**m = 4**	**m = 5**	**m = 6**
DL(DJI)~ DL(WTI)	*Res_Dep*	10.89***	15.52***	18.37***	21.10***	23.72***
	Res_Ind	11.56***	14.63***	17.14***	18.97***	20.92***
DL(BTC)~ DL(WTI)	*Res_Dep*	11.13***	13.77***	15.82***	17.85***	19.43***
	Res_Ind	12.91***	15.45***	17.96***	19.90***	21.93***
DL(DJI)~ DL(BTC)	*Res_Dep*	10.46***	15.05***	18.00***	20.86***	23.63***
	Res_Ind	11.34***	13.79***	15.93***	17.99***	19.49***

Notes: *"m" represents the embedding dimensions while *** and ** indicate the rejection of the null hypothesis of* **i. i. d.** *residuals at the 1% level of significance based on the bootstrapped p-values obtained with 5000 repetitions. "Res_Dep" and "Res_Ind" indicate, respectively, residual of dependent and independent variables. Values in the cells represent BDS z-statistic.*

Table 5 presents the results of the BDS test, which provide considerable evidence of failure to accept the null hypothesis of IID for residuals of VAR (1) processes at various levels of embedded dimensions. Thus, the phenomenon of nonlinearity is present in the relationship between Islamic stocks, Bitcoin, and oil. Hence, the linear Granger causality test is susceptible to misspecification error probabilities, which justify the applicability of the causality-in-quantile approach.

3.3. Nonparametric Causality-in-Quantiles Test[2]

Fig. 8 illustrates the results of causality in quantiles in mean and variance series between DJI returns and the WTI.

2 This figure plots the estimates of the nonparametric causality tests at various quantiles. The x-axis plots the quantiles, while the y-axis represents the test statistics. The dashed line represents the critical value, whereas the two red and blue lines represent Causality in-mean and in-variance, respectively

It reports causality in quantile results for variance series from DJI returns to WTI. In extreme lower quantiles, we see no significant relationship that subsequently becomes significant in median and higher quantiles. However, the relationship remains across all the quantiles. For causality in variance, again, we witness significant causality running from WTI to DJI returns across all the quantiles.

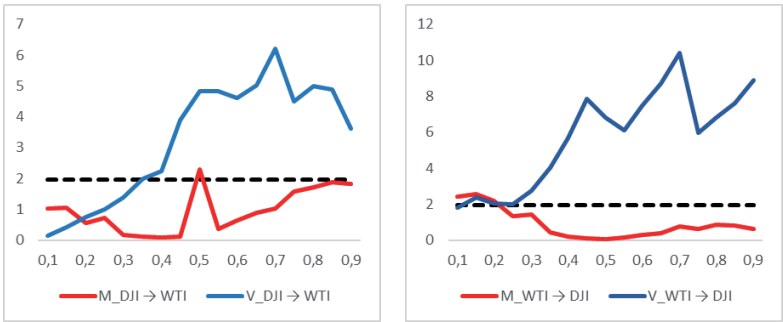

Figure 8- Causality in mean and variance between DJI and WTI

In terms of causality-in-mean between DJI returns and the WTI, there is significant causality from DJI to WTI only in the median quantiles and significant causality from WTI to DJI just in the lower quantiles.

These results tell us that including Islamic stock with oil in the same portfolio will lead to double losses for investors, because of the high predictive power of both oil and Islamic stock.

Fig. 9 illustrates the results of causality in quantiles in mean and variance series between WTI returns and the BTC.

In extreme lower quantiles, we see no significant relationship that subsequently becomes significant in median and higher quantiles from BTC to WTI. In Fig. 9 the strength of the causality rises in the normal market conditions, but it's weak in at the beginning and end the quantiles from WTI to BTC.

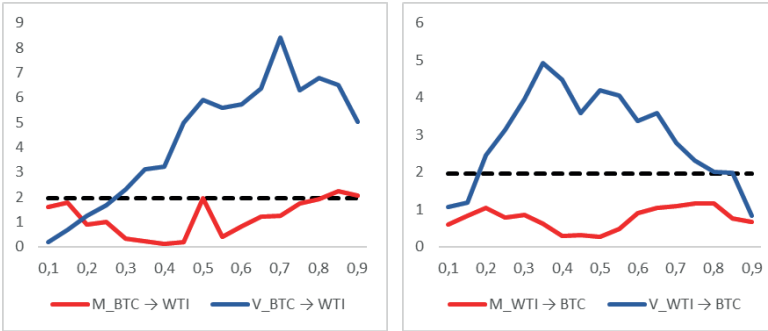

Figure 9- Causality in mean and variance between WTI and BTC

According to causality-in-mean between BTC returns and the WTI, although there is no significant causality from WTI to BTC, Fig. 9 reports significant one-way causality from BTC to WTI only in upper quantiles.

The significant link between Bitcoin and oil may indicate that major investors have examined Bitcoin as an investment opportunity. Furthermore, the data reveals that Bitcoin's hedging and safe-haven features are nearly the same in extreme negative and upward swings. This shows that the December 2013 Bitcoin meltdown resulted in significant adjustments in the behavior of Bitcoin and oil. That is, both Islamic Stocks and Bitcoin do not provide the advantages of diversification and a safe haven for oil

Fig. 10 illustrates the results of causality in quantiles in mean and variance series between DJI returns and the BTC. It reports two-way causality-in-variance between DJI and BTC, which appear not significant in lower and upper quantiles from DJI to BTC and very weak in lower quantiles from BTC to DJI.

In terms of causality-in-mean between DJI returns and the BTC, although there is no significant causality from DJI to BTC, Fig. 10 reports significant causality from BTC to DJI only in upper quantiles.

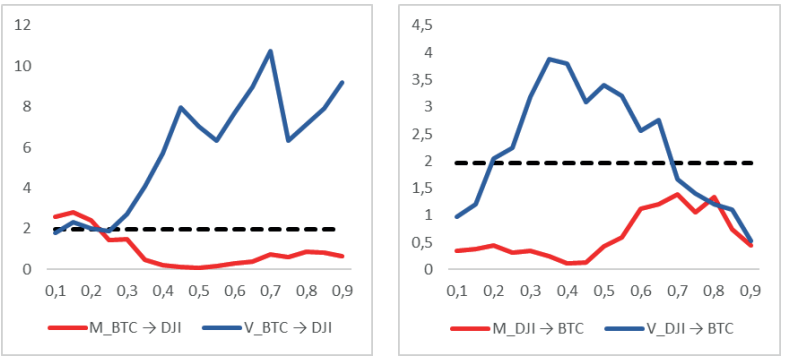

Figure 10- Causality in mean and variance between BTC and DJI

BTC's unattractiveness as a diversifier may be simply due to the fact that it might not be subject to any official authorities and, unlike money, is not supported by a central bank. So, we can confirm that, this strong correlation between the two variables (Bitcoin and Islamic stocks) will increase the risk of the portfolio, thus rejecting the diversification and safe haven hypothesis for Energy Market.

Conclusion and Recommendations

This thesis investigates the causal relationships between the order-level USD/BTC trading data of Bitstamp for Bitcoin (BTC), Dow Jones Islamic Stock Market Index (DJI), and the West Texas Intermediate (WTI) daily oil price movements, by means of the Nonparametric Causality-in-causality-in-mean and causality-in-variance tests. The analysis uses daily data covering the period from August 18, 2011, to December 10, 2021, which gives us a total of 2,690 daily data observations.

Results show that the total return and volatility spillover are relatively high for the BTC, WTI, and DJI. Evidence of volatility spillovers indicates Islamic markets provide limited safe havens during distress periods with some contagion between Islamic stock returns, Bitcoin, and oil. Results from both the nonlinearity VAR Model and the nonparametric Causality-in-Quantiles show there are positive and significant correlations between BTC, WTI, and DJI, which implies limited portfolio diversification benefits afforded by Islamic stock and crypto markets.

Unlike Bhuiyan et al. (2021), Bouri et al. (2017, 2020), Chkili et al. (2021), Selmi et al. (2018), Zaighum et al. (2021), our results provide limited evidence that Islamic finance and Bitcoin serve as alternatives to existing financial tools in terms of potential diversification and safe haven benefits.

Our results have evidence that both Islamic stock and crypto tools provide little safe havens and diversification features. These results are more in line with those of Maghyereh and Abdoh (2021), Shahzad et al. (2019), Wang et al. (2021) who studied the interaction between BTC and Islamic and Conventional markets and whose results found that BTC and Islamic stocks provide little safe havens and diversification features. Our results also broadly corroborate work by Dutta et al. (2020) and Pho et al. (2021) who compared gold and BTC as a safe haven or diversifier tools for oil. They resulted that gold was more effective than BTC. Additionally, positive and significant correlations between Islamic and conventional markets was investigated by Bugan et al. (2021) and Hasan et al. (2021).

These findings emphasize the significance of oil in determining the desirability of bitcoin and Islamic stocks as investments. Oil is a factor that has an influence on the actual economy's performance. As a result, oil volatility should be considered when developing performance expectations for investment and basket forming. When the price of oil is likely to rise, investors should buy Islamic stocks and bitcoin. Alternatively, when the price of oil is predicted to fall, investors should shun crypto and Islamic stock markets in favor of more traditional sectors such as consumer and strategic goods. These findings can be utilized to develop good hedging strategies. Because Islamic stock and cryptocurrency markets are not completely immune to financial and health catastrophes, traders must also be aware of the impact of a downturn on their investment in Islamic securities.

This thesis can help in development of better diversification and risk management strategies. At the same time, the identification of the correlation between markets can help policy makers and regulators in developing better policies as well adopting a progressive approach toward the functioning of the capital market.

Overall, the findings of this thesis could be useful (i) for investors and portfolio strategists in managing their portfolios of com-

modity, cryptocurrency, and Islamic stocks, and (ii) for the policy-makers in the development of stabilizing economic policies.

The study presented here is limited to Islamic stocks. As a result, the public should be aware that the outcomes may not be applicable to conventional equity markets. Another disadvantage of this analysis is that it does not distinguish between the influence of oil prices on Islamic stocks in oil-exporting and oil-importing nations.

Finally, it would be interesting to add whether gold and other commodities provide a safe haven or diversification for returns of oil, Islamic stock and crypto markets. These would add to the body of evidence regarding the interrelationships between Islamic, commodities, and crypto markets.

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