T.C.
ISTANBUL AYDIN UNIVERSITY
INSTITUTE OF GRADUATE STUDIES

THE IMPORTANCE OF BLOCKCHAIN TECHNOLOGY AND CRYPTOCURRENCIES FOR FINANCIAL MARKETS AND INSTITUTIONS

MASTER'S THESIS

Aurdriene Njomeni TIENCHEU

Department of Business
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(Y1912.130033)

Department of Business
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Thesis Advisor: Asst. Prof. Dr. Cüneyd Ebrar LEVENT

AUGUST, 2022

ONAY FORMU

DECLARATION

I hereby declare with the respect that the study “The Importance of Blockchain Technology and Cryptocurrencies for Financial Markets and Institutions”, which I submitted as a Master thesis, is written without any assistance in violation of scientific ethics and traditions in all the processes from the project phase to the conclusion of the thesis and that the works I have benefited are from those shown in the Bibliography. (01/08/2022)

Aurdriene Njomeni TIENCHEU

FOREWORD

I would like to express deepest gratitude to my thesis mentor Dr. Cüneyd Ebrar LEVENT, his support and expertise had played a great role in the success of this research. Without him I would not complete my thesis and Master's degree.

I would like to thank all teachers who taught me at Istanbul Aydin University in my MBA course especially Dr. Cüneyd Ebrar LEVENT who showed me the vision of this degree.

At the last, I would like to thank all my family, friends and university teachers who helped me to complete in this whole Master's course.

August, 2022 Aurdriene Njomeni TIENCHEU

THE IMPORTANCE OF BLOCKCHAIN TECHNOLOGY AND CRYPTOCURRENCIES FOR FINANCIAL MARKETS AND INSTITUTIONS

ABSTRACT

Blockchain is a decentralized public record that can be used to register, inventory, and transfer any sort of asset, not just financial ones. Using encryption and consensus methods, Blockchain refers to a form of distributed ledger technology. This means that instead of keeping data in one place, it is kept in many places. Bitcoin public blockchain became the first generally known application of blockchain.

When blockchains first came out, they were used for things like decentralization, encryption, consensus and immutability. There have since been many different types of blockchains that have been used for different things. Banking and finance professionals utilize blockchain technology to settle transactions and create digital currencies, and also in supply chain applications to assist people in resolving disputes swiftly and efficiently.

A “centralized database” managed by one authoritative source is common in the traditional financial system. Instead, blockchain technology enables the establishment of a distributed database that can handle an ever-growing number of entries while also ensuring that the ledger is constantly synchronized and updated across multiple networks.

In this context, this thesis aims to determine the relationship between cryptocurrencies and financial markets, which emerged as a development of blockchain technology. In the research, cryptocurrencies were represented by the two most important ones, Bitcoin and Ethereum. In financial markets, Dow Jones, S & P and NASDAQ indices representing stock markets; Gold and Brent Oil were used to represent commodities and the Dollar Index was used to represent currencies. In accordance with the purpose, 20 linear regression models were established. It has been found that the return performances of Dow Jones, S&P and NASDAQ indices have a statistically significant effect on the return performance of cryptocurrencies. The direction of this effect is positive in both Bitcoin and Ethereum. Gold prices also affect the value of

cryptocurrencies statistically positively. In the case where Gold and Dow Jones index are included in the same model, the effect on cryptocurrencies is also positive and significant.

Bivariate analysis indicates that, Brent Oil has a positive effect on the return of cryptocurrencies, but also positively with Gold in the same model.

The most striking result was seen in the dollar index, that is, in all four models in which the dollar index was included as an independent variable, it was determined that the dollar index had a negative and significant effect on the value of cryptocurrencies. In other words, when the value of the dollar appreciates against other currencies, the value of cryptos is negatively affected. The results of this research show that cryptocurrencies targeting decentralized and independent finance are actually influenced by traditional financial instruments (stock market indices, precious metals such as gold, commodities such as brent and currencies such as dollar index).

Keywords: Blockchain Technology, Cryptocurrencies, Financial Markets, Bitcoin, Ethereum

FİNANSAL PİYASALAR VE KURUMLAR İÇİN BLOKZİNCİR TEKNOLOJİSİNİN VE KRİPTO PARALARIN ÖNEMİ

ÖZET

Blockzincir, yalnızca finansal varlıkları değil, her türlü varlığı kaydetmek, envanterini çıkarmak ve aktarmak için kullanılabilecek merkezi olmayan bir kamu kaydıdır. Şifreleme ve konsensus yöntemlerini kullanan Blockchain, bir tür dağıtık defter teknolojisi anlamına gelir. Bu, verilerin tek bir yerde tutulması yerine birçok yerde tutulması anlamına gelir. Bitcoin zinciri, blokzincirin genel olarak bilinen ilk uygulaması oldu.

Blokzincirler ilk ortaya çıktığında merkezi olmama, şifreleme, konsensus ve değişmezlik gibi şeyler için kullanılıyorlardı. O zamandan beri, farklı şeyler için kullanılan birçok farklı blokzinciri türü olmuştur. Bankacılık ve finans uzmanları, işlemleri halletmek ve dijital para birimleri oluşturmak için ve ayrıca insanların anlaşmazlıkları hızlı ve verimli bir şekilde çözmelerine yardımcı olmak için tedarik zinciri uygulamalarında blokzinciri teknolojisini kullanmaktadır.

Tek bir yetkili kaynak tarafından yönetilen bir "merkezi veri tabanı" geleneksel finansal sistemde yaygındır. Bunun yerine, blokzinciri teknolojisi, sürekli artan sayıda girişi işleyebilen dağıtılmış bir veritabanının kurulmasını sağlarken, aynı zamanda defterin birden çok ağda sürekli olarak senkronize edilmesini ve güncellenmesini sağlar.

Bu bağlamda bu tez, blockchain teknolojisinin bir gelişimi olarak ortaya çıkan kripto para birimleri ile finansal piyasalar arasındaki ilişkiyi belirlemeyi amaçlamaktadır. Araştırmada kripto para birimleri, en önemli ikisi olan Bitcoin ve Ethereum ile temsil edilmektedir. Finans piyasaları ise, hisse senedi piyasalarını temsil eden Dow Jones, S&P ve NASDAQ endeksleri; emtiaları temsil etmek için Altın ve Brent Petrol; para birimlerini temsil etmek için Dolar Endeksi kullanılmıştır. Tezin amacına uygun olarak 20 adet doğrusal regresyon modeli kurulmuştur. Dow Jones, S&P ve NASDAQ endekslerinin getiri performanslarının kripto paraların

getiri performansı üzerinde istatistiksel olarak anlamlı bir etkiye sahip olduğu tespit edilmiştir. Bu etkinin yönü hem Bitcoin hem de Ethereum'da pozitiftir. Altın fiyatları da kripto para birimlerinin değerini istatistiksel olarak pozitif yönde etkilemektedir. Altın değişkeni ve Dow Jones endeksinin aynı modele dahil edilmesi durumunda kripto para birimleri üzerindeki etkisi de pozitif ve anlamlıdır.

İki değişkenli analiz sonuçları, Brent'in, kripto para birimlerinin değeri üzerinde pozitif bir etkiye sahip olduğunu ve aynı modelde altın ile de pozitif bir etkiye sahip olduğunu göstermektedir.

En çarpıcı sonuç dolar endeksinde görülmüştür; dolar endeksinin bağımsız değişken olarak dahil edildiği dört modelin hepsinde dolar endeksinin kripto paraların değeri üzerinde negatif ve anlamlı bir etkisinin olduğu belirlenmiştir. Diğer bir ifade ile doların değeri diğer para birimlerine karşı değer kazandığında kriptoların değeri olumsuz etkilenmektedir. Bu araştırmanın sonuçları, merkezi olmayan ve bağımsız finansı hedefleyen kripto para birimlerinin aslında geleneksel finansal araçlardan (borsa endeksleri, altın gibi değerli metaller, brent gibi emtialar ve dolar endeksi gibi para birimleri) etkilendiğini göstermektedir.

Anahtar kelimeler: Blokzincir Teknolojisi, Kripto Paralar, Finansal Piyasalar, Bitcoin, Ethereum

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ABBREVIATIONS

BTC **:** Bitcoin

DOLINDX **:** Dollar Index

DOW **:** Dow Jones Industrial Index

ETH **:** Ethereum

NASQ **:** NASDAQ Index

SP **:** Standard & Poor's 500 Index

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I. INTRODUCTION

The financial market is a marketplace for the buying and selling of financial instruments and assets. (Saunders et al., 2012). Financial institutions serve as a conduit, directing funds from surplus units to loans or investments for deficit units. Bond and stock markets, for example, are critical for enhancing economic efficiency by channeling money away from those who do not need it and toward those who do. Robust financial markets are a prerequisite for fast economic development, and dysfunctional financial markets are one of the reasons why many nations throughout the globe remain destitute.. Financial market activities have an effect on individual wealth, business and consumer behavior, and the economy's cyclical performance (Mishkin, & Eakins 2018).

Blockchain technology can be considered as a way to increase this efficiency. Blockchain is a decentralized public record that can be used to register, inventory, and transfer any sort of asset, not just financial ones. This includes votes, software, health data, and ideas. (Swan, 2015). Using encryption and consensus methods, Blockchain refers to a form of distributed ledger technology. This means that instead of keeping data in one place, it is kept in many places (often immutable and sequential transaction records).

Cryptocurrency, which is one of the first products of this technology, increases financial inclusion on the one hand, and on the other hand, it significantly challenges the traditional financial system and related regulations. Cryptoassets, which enable the digital representation of unique assets, are causing a significant transformation in finance, increasing access globally and leading to the emergence of new business models by eliminating traditional intermediaries.

Although blockchain technologies inspired by the launch of Bitcoin in 2009 have been around for a long time in terms of financial markets, their adoption is still in its infancy. Every day, innovative solutions with a potential social impact are being researched and developed. In light of the recent decline in consumer

confidence in the financial sector, blockchains may be a way to restore this belief. Until recently, blockchains were mainly used to strengthen cryptocurrencies. However, nowadays it has also started to be used in very different fields.Another debate is whether cryptocurrencies, a product of the blockchain, interact with financial markets.

The research part of this thesis explores this issue. In this context, the main purpose of this thesis is to statistically reveal the effect between cryptocurrencies and financial markets. Of course, the concept of financial markets is very broad and cannot be fully explored in this thesis or any research.

Similarly, there are currently more than 20,000 cryptocurrencies, which are impossible to deal with completely. Therefore, some limitations are made in the thesis. Cryptocurrencies are represented by Bitcoin and Ethereum, while financial markets are represented by major indices and major commodities and Dollar Index.

At the beginning of the study, first of all, the theoretical framework of the study is created. In the theoretical framework, financial markets and institutions, blockchain technology and cryptocurrencies are theoretically examined. Then, the applications of blockchain technology in the field of finance are given. For this purpose, academic resources such as books, articles, researches, conference papers, theses and reports are used. In the next stage, the research part is carried out.

II. FINANCIAL MARKETS AND INSTITUTIONS

A. Financial Markets: Definitions and Concepts

The financial market is a marketplace for the buying and selling of financial instruments and assets. (Saunders et al., 2012). Financial institutions serve as a conduit, directing funds from surplus units to loans or investments for deficit units. Bond and stock markets, for example, are critical for enhancing economic efficiency by channeling money away from those who do not need it and toward those who do. Robust financial markets are a prerequisite for fast economic development, and dysfunctional financial markets are one of the reasons why many nations throughout the globe remain destitute.. Financial market activities have an effect on individual wealth, business and consumer behavior, and the economy's cyclical performance. (Mishkin, & Eakins, 2018) The financial purpose of an individual is to make payments on time and to handle cash efficiently until they are needed. (Burton et al., 2015)

A market is any location where products and services are exchanged, and several marketplaces exist depending on a variety of circumstances. The term "financial market" refers to a location where financial instruments are traded or exchanged. (Lane, 1991). Markets, in fact, is in different forms and sizes, depending on the location and mode of contact between buyers and sellers. Buyers and sellers can meet in person (at a physical location) or virtually (through advanced communication means). It is entirely up to both parties. Another sort of market exists in which buyers and sellers work through intermediaries such as agents, brokers, clearing houses, investment banks, investment or financial consultants, and so on to achieve their objectives. Demand and supply dynamics dictate the market's prices for goods and services. While demand can be defined as the number of products and services that customers are ready and eager to purchase, supply is defined as the number of commodities that sellers can sell (Barwell, 2017). Market prices are set at the point of intersection between demand and supply, and it is the price at which buyers are prepared to pay and suppliers are willing to receive.

A financial market, according to (Henning et al., 1975), is merely a venue or a mechanism for the exchange of assets. Financial markets are made up of both homogeneous groupings of financial institutions (FIs) and diverse groups of FIs that aren't commercial banks, referred to collectively as non-bank financial institutions (NBFIs) (Hanson, 1983). A financial market is a real or virtual marketplace where financial assets such as government and private bonds, debentures, stocks, currencies, and other financial assets are created and traded. Any prosperous company 'castle' will be attacked repeatedly by competitors due to the forces of capitalism.

As a result, long-term success requires surmounting significant obstacles, such as being a low-cost producer or possessing a strong global brand. (Baigozhin, 2013)

Due to the technology's promise in the financial industry, money markets in the United States and China are actively implementing and creating expertise in blockchain technology (Cole, et al., 2019). The United States and China are an especially fascinating pair to evaluate due to the degree of divergence in the depth of their financial markets, and perhaps more intriguingly, across multiple variables. (Olaniyi, 2018).

B. The Role of Financial Markets in the Financial System

The structural approach identifies three critical components of an economy's financial system:

1) Markets financiers

2) Intermediaries in Finance (Institutions)

3) Intermediaries in the Institutions

4) Intermediaries in the Financial Sector

5) Financial regulators.

Each component serves a distinct economic purpose. According to the functional approach, financial markets facilitate the movement of capital for enterprises, governments, and individuals to finance investment. Financial institutions are significant actors in financial markets because they operate as

middlemen and thereby influence the movement of currency. Financial regulators are responsible for monitoring and regulating the financial system's participants. Financial markets offer investors with a place to sell financial products, resulting in liquidity. (Butler et al., 2005). The existence of buyers and sellers that are ready to make a trade is referred to as "liquidity." When conditions compel investors to sell financial object, this is a desirable trait. Without liquidity, an investor is obliged to keep a financial instrument until (1) certain conditions permit its sale or (2) Returns are contractually required by the issuer. (Sarr & Lybek 2002)

This occurs when a debt instrument matures; conversely, In the event that a stock investment does not mature, and instead is a perpetual security, this occurs when the firm is liquidated, either knowingly or unknowingly. Liquidity exists in all financial markets. On the other hand, liquidity is a distinguishing trait of diversified financial markets (Gromb & Vayanos 2010).

Regardless of their importance, financial market's role in regards to promoting the efficient distribution of cash between those with money to invest and those in need of money do not often work as intended and as a result, when conditions prevent direct interaction between lenders or investors and fund borrowers in financial markets, financial systems have recognized the necessity of specific form of financial organization known as a financial intermediary (Allen & Gale, 2004).Some examples of financial intermediaries are non-deposit-finance firms, banks, and insurance companies that must adhere to government regulations. They all work with money. Financial intermediaries work to get better deal terms for lenders and investors and borrowers than they could get on their own in the financial market.

This is done in two steps by people who work with money:

1. Getting money from lenders or investors

2. Lending or investing the money they borrow to people who need money

On the financial claim, which may be the financial intermediary's debt or equity participants? A financial intermediary's assets are the funds it lends or invests. Consider the following two examples involving financial intermediaries. (Guzik, 2011):

The first of these is the Commercial Banking Institution. Commercial banks

are a sub-category of depository institutions. Banks are well-known for accepting deposits from the public, businesses, and governments. Those who put money in the account of a commercial bank are called lenders. The monies received by the commercial bank becomes for-profit financial institution liabilities. In turn, a bank lends these funds through the issuance of loans or the acquisition of assets. The commercial bank's assets are comprised of loans and securities. (Machiraju, 2008).

The second is Mutual Funds. Mutual funds are a subcategory of regulated investment companies. A mutual fund receives contributions from investors in exchange for mutual fund shares. Those monies are then invested in a portfolio of financial products by the mutual fund. The mutual fund shares reflect an equity stake in the portfolio of financial instruments, which are the mutual fund's assets (Sharpe, 1996).

In essence, this strategy enables a financial intermediary to transform financial assets that are less appealing to a sizable portion of the investing public into more universally accepted financial assets, such as their own liabilities. This asset transformation accomplishes at least one of the following three economic functions

1. Maturity intermediation.

2. Diversification reduces risk.

3. Cost savings in contracting and data processing.

C. Functions of Financial Markets

1. Setting of the Price of Securities

This concept is also called "financial instruments." To put it another way, securities are claims on a company's future income or assets that can be traded (property or a financial claim susceptible to ownership). Issuers are companies that raise money by creating and selling securities to investors. Companies or corporations can be issuers, and they often raise funds by selling shares or debentures to investors. Local governments, government agencies, and supranational organizations can all offer debentures to investors as issuers (Simmons, 2002).

The Efficient Market Hypothesis assumes that markets are efficient. there are a lot of rational, profit-seeking investors in the market who act quickly when new

information comes out. As more information about stocks comes out, investors rethink the value of the stock and change the price accordingly. So, at any given time, a stock's price is an honest reflection of all the available information and is the best way to figure out what the stock is worth.

Investors want to make money with their stocks and bonds. Unlike goods and services, the law of supply and demand (Shiller et al., 2008) does not affect the price of securities. Instead, the market sets the price of securities (Yen & Lee, 2008).

Setting security pricing means that the price of an item traded in a financial market is based on the amount of money being traded. Also, investors decide how much money they need to put into the market. Investors' need for a high rate of return motivates people looking for money (deficit units). Using financial markets, investors and borrowers alike can see how their money will be distributed and how it will be raised by selling financial products. (Darškuvienė, 2010)

2. Putting Savings to Better Use

The second function of financial markets is better use of savings. If there were no financial markets, individuals, institutions, in short, savers would have problems in finding the right means to invest their savings. In this respect, this function of financial markets is critical for the formation of a fair and efficient market.

3. Providing Liquidity of Financial Assets

The liquidity function indicates how easy it is for investors to sell a financial instrument at any time at its fair market value (Nyborg & Östberg, 2013). A lack of liquidity would force an investor to hold on to a financial instrument until a suitable opportunity to sell arose or the issuer decided to return the money owed to them. Debt instruments can only be sold after the company reaches the requisite age of eight years, but equity instruments can be sold either freely or involuntarily. Liquidity exists in all financial markets to some extent. Investors in liquid markets consider a number of advantages, including as greater allocation and information efficiency, as desirable. (Sarr & Lybek, 2002). The level of liquidity, on the other hand, is what separates different financial market instruments. It doesn't matter when people want to buy or sell their stocks or other things. As they see fit, they can use

financial markets to sell or invest their stocks and bonds.

4. Providing Information and Reducing the Cost of Transactions

A lot of information about securities in financial markets can be accessed and discovered without paying any fee. The transaction cost reduction function is in effect when financial market players are charged and/or compensated for the expenses associated with trading a financial instrument. (Adams, 1995). Transaction costs in a market economy are the motivation for the presence of institutions and gadgets. In the long term, low-cost institutions and tools will prevail. (Darškuvienė, 2010). Search charges and information costs make up the bulk of business expenses. When it comes to the expenses of searching, there are two types: explicit and hidden costs.

For people who want to sell or acquire a financial item to be known, explicit expenses include fees. There are expenses referred to as "implied costs" when searching for a buyer or seller for a trade. The time spent seeking for a business partner is included in these costs. Finding things is made simpler by the existence of a regulated financial market. There are fees associated with learning how to invest in an asset class. In a price-efficient market, prices reflect the amount of information available to each participant (Fabozzi & Drake, 2009).

5. Other Functions

Financial markets make a lot of things possible, like the following: Financial markets create a place where everyone, from investors to debtors, is treated fairly and appropriately, no matter how big or small they are. They give money to people, businesses, and the government. Because there are so many jobs, financial markets help to lower the unemployment rate.

D. Financial Markets by Nature of Claim

Investors refer to their claim on a company or organization's assets as the sort of market they have invested in. The two primary categories of claims that individuals can make are fixed and residual claims. There are two distinct sorts of claims markets, based on the nature of the claim. Claim markets are classified into two groups. (Becketti, & Gordon, 1989)

1. Debt Market

This is a market in which instruments such as debentures, bonds, and other debt instruments are traded. Certain funds in a firm can only be accessed by instruments with fixed claims, such as these. Many of these instruments have a fixed interest rate known as a "coupon" or "coupon rate." (Shleifer, 2003).

2. Equity Market

Equity instruments are available for purchase in this market. Due to equity's residual claim, whatever money is left in the company after paying off fixed obligations is allocated to equity shareholders, regardless of how much they bought for their shares. Equity is the money invested by the company's owners. (Bekaert & Harvey, 1997).

E. Financial Markets by Maturity of Claim

When making an investment, it is critical that the amount of money invested depends on how long it is planned to be held. How long it has been since the investment was made affects the risk profile of the investment. Short-term investments carry a lower level of risk than long-term ones. There are two types of markets based on the age of the claim: These are money markets and capital markets.

1. Money Market

The money market is a market in which individuals can swap easily exchangeable short-term financial assets. Short-term investing is the focus of this kind of market. When you buy something that has the same value as money, you buy it in the money market. Liquid assets that can be transformed into cash quickly and with low danger of loss are traded in this marketplace. It's not common to use the term "money market" to designate a specific location or object.

The money market is used for short-term investments, where investors make a deal for less than a year. Treasury bills, commercial paper, and certificates of deposit are some of the products available in this market. All of these instruments must grow for a year before they can be used. Due to the short duration of these assets, they are less risky and offer investors a high rate of return, which is typically in the form of interest (Fabozzi & Drake, 2009).

The following are the three main characteristics of money market securities: (Mishkin & Eakins, 2018)

- They are typically sold in huge amounts.
- They have a minimal risk of default
- The mature in one year or less from the date of issue

Transactions in the money market do not happen in one place, like in a bank or a shopping mall. Instead, traders often set up deals for people to buy and sell things over the phone and then finish them online. As a result, money market assets frequently have a robust secondary market. This means that once a security has been sold, it is extremely easy to locate buyers in the future. Money market assets can be used to address short-term financial needs due to the secondary market's high volume of activity. (Mishkin & Eakins, 2018)

- If someone wishes to purchase short-term financial assets that behave like money, he/she can do so in this market. All of the securities traded in the money market are extremely simple to buy and sell. They range in maturity from one day to one year.
- Money market is not just one place, but a group of places where people buy and sell things
- The money market is made up of all businesses and institutions that trade in short-term financial assets that can be sold or bought quickly.
- A wholesale market for short-term instruments that doesn't need brokers is called that. It's done over the phone and there are no brokers.
- There are a lot of short-term instruments traded in this market. They have a duration of one year or less.
- The money market is critical for resolving short-term liquidity crises in the market because it transfers money from those with excess funds to those in need.
- In this case, the market is driven by the amount of money people want and the amount of money they have.

Another thing that makes money markets unique is that they are wholesale markets. A lot of private investors can't participate in the money markets because of the size of what they buy and sell in these markets. Customers are instead brought together by people who work in the trading rooms of big banks and brokerage firms. (Mishkin & Eakins, 2018)

2. Capital Market

Long and short-term financial instruments can be traded on the "capital market," which refers to a market for both. On a daily basis, here is where the most money is exchanged. A number of equity capital and preference share capital raising strategies allow investors to participate in a company's stock ownership and earnings. (Beaver, 2002).

It is the primary function of the capital market to efficiently and economically channel capital between those who have excess money and those who need it. A developed society values this function because it enables individuals to split their income over a longer period of time, for as by saving money for a pension, or by investing their money in the stock market. The capital market can provide companies with the resources they need to invest. Companies in need of additional funding might turn to a variety of sources, including bank loans, the sale of existing assets, the sale of company stock, or the issuance of debt securities to attract investors' capital (Simmons, 2002). Securities include both shares of ownership and debentures. The capital market's efficiency has improved because of the rise in the number of investment options available.

F. Financial Markets by Timing of Delivery

Along with the previously mentioned factors, such as time frame, claim type, and so on, there is another factor that has polarized markets, namely the timeliness of security delivery. This concept dominates the secondary market, also known as the stock market. Markets are classified into two types according to their delivery schedules. These are the cash and futures markets.

1. Cash Market

Trading takes place instantly, and investors must pay the full amount of their investment, either by themselves or by borrowing capital, referred to as margin, which is permitted on the account's current holdings. (Chan, 1992)

2. Futures Market

In this market, a security or commodity is settled or delivered at a later time. Most purchases in these markets are made with cash rather than delivery. Trading in the futures market does not need paying the whole asset value up front; instead, a margin of up to a defined percentage of the asset value is sufficient. (Sutherland, 1968).

G. Financial Markets by Organizational Structure

Additionally, markets are characterized by their structure, or the way in which transactions take place in the market.

1. Exchange Traded Market

A controlled market which follows pre-determined and specified protocols is known as an exchange-traded market. The buyer and seller are strangers in this market. Transactions are facilitated by intermediaries, who are responsible for guaranteeing the completion of transactions between buyers and sellers (Górka, 2016). In such a market, standard products are traded; there is no demand for unique or customized products. (Ben-David et al., 2017).

2. Over the Counter Market

The decentralized market allows customers to buy and sell customized products depending on their individual preferences. In these circumstances, buyers and sellers exchange information. Foreign currency and commodity exposure hedging is a common use of over-the-counter market transactions. No exchange-traded contracts exist since the maturity dates of different enterprises' debts do not always coincide with the settlement deadlines (Friewald & Nagler, 2019).

Financial markets have grown in importance over time, serving as a source of financing for businesses as well as investment opportunities for individuals in the

country. Pricing information on the financial markets is readily available to the public, strong liquidity, and fraud and malpractice protection for investors.

H. Primary and Secondary Markets

Aside from the differences between stock and debt, capital markets are often classified into two types, As a starting point, in primary markets, companies issue stocks and bonds directly to investors, enterprises, and other entities, often through underwriting. An issuer's first public offering of securities, or an existing issuer issuing further securities, are referred to together as the "primary market." The company and its stockholders can do business with each other on this market. Shareholders make a cash payment to the company as part of the initial issuance. Initial public offerings (IPOs) and further public offerings (FPOs) make up the primary market (FPO) (Braun, 2016).

Once listed, a company's stock can be traded on a stock exchange by individuals who are interested in investing in it. The stock market, or the secondary market, is a market that facilitates this trade. To put it another way, it's a regulated marketplace where investors can trade securities. Individuals, merchant bankers, and others could be investors. Without the company's involvement, investors arrange the receipts or payments for such exchanges; hence the cash flow situation of the corporation is unaffected by transactions on the secondary market (Lee & Whang, 2002).

İ. Financial Institutions

Financial institutions are companies that lend, deposit, and invest money that has been borrowed from individuals and businesses alike. The most prevalent forms of financial institutions include financial institutions, investment firms, investment banks, brokerage firms or investment dealers, insurance firms, and asset management funds. Examples of these institutions are credit unions and financial firms. In order to govern the market's money supply and protect consumers, financial institutions are subject to regulation. (Benston, 1972).

Banking and financial institutions contribute to the country's economic growth by collecting and channeling people's savings into productive channels (Wai,

1972). According to Wai, (1972), savings units accumulate financial claims on investments or financial intermediaries: "Effective financial intermediation helps in the development process in three major ways: by allocating additional savings, by the allocative function, and by redistributing the benefits of higher returns in capital investment."

J. Classification of Financial Institutions

1. Central Banks

The English word "bank" has the same connotation in the rest of the world. For centuries after the eleventh century, the Bank's beginnings have been a mystery and speculation. There are writers who claim that the word "bank" is derived from the medieval European money-lenders' and money-changers' bench, "banco," "bancus," "banque," or "banc.". (Bernanke, 2010)

In everyday language, the term "bank" refers to a commercial bank and the services it provides. The Central Bank is a different body with distinct responsibilities. A bank's role is to collect deposits from the general public and then lend those monies to assist in the expansion of agriculture, industry, commerce, and trade. The bank charges depositors reduced interest rates and earn higher interest rates on loans and advances from them. The bank fulfills a range of distinct duties in modern banking, including the generation of debts and money, the transfer of money across countries, the expansion of foreign trade, and the safekeeping of assets. As a result, the bank generates revenue through a range of operations.

The government organization in charge of policies affecting a country's money and credit supply is referred to as the "central bank." Open market operations, discount window lending (Haslag & Hein, 1995), and adjustments in reserve requirements are some of the monetary policy tools a central bank can employ to impact short-term interest rates and the monetary (Sayinzoga & Simson, 2006) base in order to achieve important policy objectives.

The Central Bank is the institution in charge of banking and the money market. A central bank's major job is to aid the government in creating economic policy, controlling and running the money market, and regulating bank lending. Different definitions have been offered by professional bankers, economists, and

thinkers (Goodhart, (2011).

Maintaining the international monetary standard is the primary responsibility of a central bank. The central bank's first and most important role is to produce notes and coins in response to public demand as well as business and commerce requirements. Notes are issued in compliance with the rules against gold, silver, and foreign currency. (Morris & Shin, 2005).

In the case of a commercial bank's financial crisis, the central bank serves as a “lender of last resort’, lending against first-class securities, bills of exchange, and other assets. Foreign Currency Reserves are maintained by the Central Bank. The following criteria contribute to foreign currency control: a) For the issuing of notes; b) For the payment of liabilities; and c) For the payment of debts.

2. Commercial Banks

Commercial banks were established with the express purpose of conducting commerce. Commercial banks are credited with inventing modern banking. Commercial bank is described as "a financial institution that deals in money and its equivalents with the intent of profiting."

A commercial bank's principal responsibility is to accept and collect deposits from the general public in a variety of accounts, including current, savings, and term deposits. Current accounts do not pay any interest, while savings accounts pay a lower rate and fixed deposits pay a higher rate. As a result, the customer base of the commercial bank grows. An interest rate premium is charged by commercial banks in order to make money by lending money at a higher interest rate than deposit rates. In order to grow their business and keep it running smoothly, the borrower is given working capital. In a similar manner, a commercial bank aids the development of agriculture and industry. Entrepreneurs are given financial assistance by the government in order to rehabilitate sick and aging industries. A commercial bank also delivers social services to the general population as a result of its operations. (Heise,1992).

Additionally, commercial banks establish up client loan deposits in addition to accepting and lending money from the general public. If the terms of the sanction require that the loan money be placed into a borrower's bank account, then so be it. It is not permissible for the borrower to withdraw all of the money at once. The leftover

balance in the account is what generates the loan deposits. (Ruan & Li, 2009).

When it comes to printing money, only the Federal Reserve Bank has the authority. Checks are an example of a medium of exchange issued by a commercial bank, as opposed to currency printed by the government. In banking transactions, checks are used in the same way as banknotes. Trade and currency exchange, such as imports and exports, are primarily dependent on commercial banks. Exports and imports both benefit from it, and the federal government also reaps the financial benefits of it. Commercial banks lends money to businesses and industries in order to help them flourish.

3. Internet Banks

It is evident that as the Internet has grown in popularity and adoption, Financial and banking services are increasingly being provided over the Internet. Numerous studies utilized the phrases Ecommerce, Internet commerce, and E-business interchangeably (Stockdale & Standing, 2006). (Ramsey et al., 2003) use the terms "electronic business," "E-commerce," and "Internet commerce" conversely to refer to a business's Internet activities and processes.

In comparison to traditional bank offices, customers may do financial transactions online at any time and from any location at a lower cost and faster rate (Sayar & Wolfe, 2007). As a result, the internet's power and reach have been used by banks in order to stay up with the rapid changes in business environments. Banks view internet banking as one of the most affordable ways to provide financial services (Pikkarainen et al., 2004). Internet banking gives you immediate access to your financial data and the capacity to make transactions without ever having to set foot in a bank. (Rotchanakitumnuai & Speece, 2003). As a result, financial services are no longer geographically or temporally constrained.

E-banking is "web-based banking." Financial transactions carried out through the Internet are known as "e-banking." Internet banking is more precisely the delivery of commercial banking services over the Internet (Hertzum et al., 2004). Individual and corporate clientele are served. It include financial transactions, payments, and settlements, documentary collections and credits, corporate and residential loans, and credit card activity.

4. Credit Unions

Credit unions are distinguished from other financial institutions by five distinct characteristics. Credit unions are non-profit and serve a public purpose by providing basic financial services to low-income individuals. Membership is restricted to individuals who share a common bond, governance is based on the principle of one member, one vote, and directors are unpaid volunteers (McKillop et al., 2007). When all of these characteristics are considered, credit unions are defined as not-for-profit financial cooperatives led by volunteers with the primary goal of assisting their members. A common tie's significance cannot be overstated. It exists to ensure that the credit union's loan committee is aware of the member seeking credit's character and personal history, and thus can conduct a swift credit evaluation based on the applicant's reputation and savings profile, rather than their income and assets (McKillop et al., 2007). Credit unions may offer several services for free or at a reduced cost to their members, many of whom are low-income. Small loans, low-balance share accounts, and financial coaching and counseling are all available (McKillop et al., 2007).

5. Savings and Loan Associations

A savings and loan association is formed to keep members' assets in the form of dividend-paying stock and to invest mostly in home mortgage loans. Most at times, they function as self-help groups where individuals borrow while others borrow to reinvent and repay with interest. (Nicols,1967).

6. Brokerage Firms

These firms acts as a middleman by linking a customer's buy order to a third party's sell order (Carleton, et al., 1998). Brokerage firms are compensated by commissions or fees levied once a transaction has been completed successfully (Fasli, 2007). The consumer or the exchange may be responsible for this fee. Money management, tax assistance, and financial consulting are just a few of the additional services that brokerage firms frequently provide to their clients. Stock quotes and economic and market research are also provided on a regular basis.

7. Insurance Companies

Throughout the eighteenth century, insurance firms matured globally. In

1948, a British insurance business history was created by an actuary named Raynes (Westall, 1995). It is impossible to provide a concise, precise, and comprehensive definition of insurance. There are a variety of definitions that may be found in the insurance literature, although they are generally lengthy and complicated, and one can usually discover some type of insurance definitions that does not fully meet the description. (Borch, et al., 2014) discussed insurance as a contract of tow specific elements (P and X). With P been the amount of primum to be paid by the insures person and X been the compensation paid to the insured if certain circumstances occur while the contract is in effect. The objective of insurance is to look at the relation of how between the two elements.

8. Mortgage Companies

A mortgage company is essentially different from a bank in every way possible. Banks are "extraordinary" because they serve both businesses and consumers (Demyanyk & Loutskina, 2016). Mortgage banking involves all facets of loan origination, a secondary mortgage market for the acquisition and sale of loans. If a mortgage lender makes or acquires a loan through an associate, they have the choice of either maintaining or selling it. Additionally, the bank has the option of maintaining or selling loan servicing. Banks can do any of these processes through mortgage banking.

Residential real estate purchase and refinancing are the main responsibilities of a mortgage lender. By lending to homeowners and buyers, lenders originate mortgages in the primary mortgage market. Principal mortgage loans are bought and sold in the “secondary mortgage market” by lenders and investors. On the secondary market, lenders and investors can purchase and sell securities backed by pooled home loans.

A bank produces two commodities when it makes a mortgage loan: the loan itself and the right to service the debt. On the secondary market, banks can sell loans with or without service. Servicing is incorporated in the majority of lending assets; it is only legally separable from the underlying lending assets that it becomes a distinct asset or liability. In one of two ways, a mortgage bank can distinct servicing from a loan: 1) by selling the debt but retaining servicing; or 2) by acquiring or taking over servicing from a third party.

Effective management information systems (MIS) are critical for effective mortgage banking operations because they enable the precise assessment of the value created and expenses incurred in the manufacturing and servicing of various mortgage products. The largest mortgage servicing companies make significant investments in technology to control and execute vast volumes of individual mortgage loans with different ways to receive money, escrow requirements, and investor payout dates. Customer service, collections and default management referrals are all handled by these corporations' sophisticated call centers. Banks require a robust technical infrastructure to manage big and quickly growing portfolios profitably.

9. Other Financial Institutions

Other non-banks institutions are called market makers. These are broker-dealer firms that disclose both the cost of purchasing and selling an item they hold in stock. Individuals can own equities, government, corporate debt, and foreign currencies, and other assets, such as foreign currencies. When a market maker receives an order, it either sells something from its stock or purchases something to offset the stock loss. Since buyers and sellers are ready to exchange items for different prices, the market maker generates money by exploiting this spread. A market maker can increase the liquidity of any asset in their portfolio. The World Bank gives money to countries throughout the world.

Sectorial financiers are individuals whose specialization is in a single company and provide a restricted selection of financial services to that business, such as loans and credit cards. Leasing companies, for example, give money to individuals seeking to purchase equipment. Lenders of real estate make loans to those seeking to purchase a home. On the other hand, leasing firms frequently have two advantages over other specialists in their industry. They are partially insulated from the danger of not repaying the money they lent because they own the leased equipment as part of their collateral arrangement. In addition, leasing corporations benefit from preferential tax treatment when they acquire new equipment. (Hopt, 2013).

Other individuals that assist people with their money include brokers, management consultants, self-help groups, and financial advisors. They operate on a fee-for-service basis. Frequently, financial service providers enhance the information

efficiency of the individual seeking to invest in them. Brokers, on the other hand, facilitate the sale of an investor's existing assets. (Hopt, 2013).

III. THEORETICAL FRAMEWORK OF BLOCKCHAIN TECHNOLOGY

A. Blockchain and Blockchain Technology Concepts

Blockchain is a decentralized public record that can be used to register, inventory, and transfer any sort of asset, not just financial ones. This includes votes, software, health data, and ideas. (Swan, 2015). Using encryption and consensus methods, Blockchain refers to a form of distributed ledger technology. This means that instead of keeping data in one place, it is kept in many places (often immutable and sequential transaction records). (Nakamoto, 2008).

Blockchains are peer-to-peer software networks that use encryption to securely handle programs, store data, and permit the movement of digital assets that are based on real-world currencies (McPhee, & Ljutic, 2017). In 2009, the Bitcoin public blockchain became the first generally known application of blockchain.

When blockchains first came out, they were used for things like decentralization, encryption, consensus and immutability. There have since been many different types of blockchains that have been used for different things. Banking and finance professionals utilize blockchain technology to settle transactions and create digital currencies, and also in supply chain applications to assist people in resolving disputes swiftly and efficiently. When blockchains were first introduced, they were utilized for a variety of purposes, including decentralization, encryption, consensus, and immutability. There have since been many different types of blockchains that have been used for different things. For the settlement of transactions and the creation of digital currencies, as well as in supply chain applications to assist consumers rapidly settle disputes, the banking and finance business uses blockchain technology. Additional use cases are being developed.

Even though block chain technologies, which were inspired by the introduction of Bitcoin in 2009, have existed for more than six years, their adoption is still in its infancy. Every day, innovative solutions with potential societal influence

are being investigated and developed. In light of the recent decline in consumer trust in the banking sector, block chains may be a way to restore that faith. Until recently, block chains were mostly employed to power crypto currencies. By designing a general programmable block chain that is suitable to a broad number of applications, the Ethereum Foundation has sparked new growth in this area. In this way, blockchain technology can be used in many applications than just economic systems. This is because blockchain technology is trustless, transparent, and highly secure.

Because blockchain technology is a promising technology that we may see more of in the future, and because it is now flying under the radar of many companies in the financial sector, it is worthwhile to investigate the realm of new possibilities it offers.

Blockchains occur in a variety of configurations but all share four fundamental characteristics: a distributed ledger of transaction records that is not held in a single location. To ensure the data's security, encryption, immutability, and a consensus process are used. There are many different ways that blockchains can be used to save encrypted data in peer-to-peer networks, but the most common method is to connect "blocks" of information into "chains." (Houben & Snyers, 2018). On the blockchain, all transactions are recorded in a common database. Consensus mechanisms make sure that the data in this decentralized network stays the same and doesn't change. Additionally, they discourage users from contributing to the ledger without the approval of the network. Additionally, due to the way the blockchain is configured, earlier data on the chain is not editable or erased, as doing so would jeopardize the decentralized ledger's integrity.

B. Historical Development of Blockchain Technology

Satoshi Nakamoto is commonly thought to be the inventor of current blockchain technology. In 2008, a person or group of persons identified as Nakamoto published a paper titled "Bitcoin: A Peer-to-Peer Electronic Cash System," (Nakamoto, 2008) which came out with a proposal on direct online payment between two persons without the use of a middleman.

Prior to the 1970s, encryption was mostly used secretly by military or intelligence agencies. However, everything changed with the publishing of the Data

Encryption Standard by the US government and the first publicly available treatise on public-key cryptography, "New Directions in Cryptography," (Zhang et al., 2020).

Dr David Chaum published numerous articles in the 1980s on themes such as unknown digital cash and pseudonymous reputation systems, which he outlined in his article "Security without Identification: Transaction Systems to Make Big Brother Obsolete."

Nick Szabo, a computer scientist, created “bit gold” in 1998, and Stefan Konst publishes his theory of cryptographic protected chains, along with implementation ideas, in 2000. Only in 2008, under the “pseudonym Satoshi Nakamoto”, did engineers publish a white paper detailing the blockchain model. Finally, Nakamoto develops the first blockchain in 2009, which serves as the public ledger for bitcoin transactions. Since 2014, blockchain technology has been separated from currency and applied to various financial and inter-organizational activities. The phrase "blockchain 2.0" was coined to refer to non-currency uses. Ethereum's blockchain technology integrates computer programs that represent financial instruments such as bonds. This is referred to as a smart contract. (Komalavalli et al., 2020)

As an information management approach, blockchain technology has been applied to many industries, ranging from information technology to healthcare to energy. The blockchain market has grown fast over the last three years, and the important players fall into three categories that correspond to the three types of blockchains: public, private, and consortium.

The majority of public blockchains provide platform-as-a-service (PaaS), which enables users to create decentralized apps. These DApps vary in maturity, with the most frequently deployed concentrating on gaming, commerce, and payments. Public blockchains may also be used to develop cryptocurrencies and they are typically in the form of coins, utility tokens, or security tokens (tokens that represent a digital security). While public blockchains have generated much of the recent blockchain buzz and Initial Coin Offerings (ICOs), they may introduce significant legal and regulatory complications. Rather of utilizing the blockchain technology itself, many "users" of public blockchains, in particular, use them to

speculate on speculative investments. Ripple Labs (creators of the Ripple protocol), the Ethereum Foundation, and block.one are all well-known organizations dedicated to public blockchains (Endemann et al., 2016)

SaaS and infrastructure as a service are the most common models for private blockchains, which can be used for general-purpose services (such as network administration) or for industry-specific ones (such as blockchain network management). There are many advantages to using private blockchains over public ones, including lower energy costs, increased consensus efficiency, faster processing times, and more privacy. Public blockchains are the source of many private blockchain hard forks. Amazon, IBM, Microsoft, MasterCard and JP Morgan are some of the most prominent corporations that use blockchain technology. In banking and finance, supply chain, and energy applications, consortium blockchains are most commonly employed. Traditional networks have a number of drawbacks, the most prominent of which is a higher cost of transactions. (Endemann et al., 2016)

1. The Cypherpunk Movement

As recently as 1992, there were no regular meetings for cryptologists in the San Francisco Bay area to discuss their work and related topics. A great deal of work needs to be done in the area of cryptography as a result. After meeting frequently, they formed the Cypherpunk mailing list, where they discussed a wide range of ideas, including those that eventually led to the creation of Bitcoin. A “Cypherpunk's Manifesto” was published by Eric Hughes, one of the movement's founding members, in late 1992. A portion of The Manifesto of the Cybrpunks reads as follows:

"For an open society, privacy is essential in the digital era. The two terms "privacy" and "secrecy" should not be used interchangeably. Secret matters are those about which an individual desires to remain anonymous, whereas private matters are those about which the individual does not wish to have their existence made known to anyone. People who value privacy are those who can choose how they want others to see them and how they want to be seen." (Beltramini, 2021).

Cryptography is also required for privacy in an open society. If I say something, I want just the targeted audience to hear it. My right to privacy is violated if the content of my speech is made public. Encrypting conveys a desire for privacy,

but using insecure cryptography conveys a lack of desire for privacy.

If we expect to have any, we must ensure that our privacy is protected. Anonymous transactions must be made possible by a group effort. Whispers, shadows, envelopes, closed doors, secret handshakes, and messengers have been used by people for millennia to protect their private. Electronic technologies, on the other hand, place a high value on privacy, while earlier technologies did not. Anonymity is a top priority for our collective of Cypherpunks. Its privacy is protected by cryptography, mail forwarding, digital signatures, and e-currency.

2. DigiCash

DigiCash Inc. was founded in 1989 by David Chaum as an electronic money corporation. The originator of DigiCash devised a variety of cryptographic algorithms that allowed transactions to be completely anonymous. DigiCash declared bankruptcy in 1998 and transferred its assets to E-Cash Technologies, a company that was acquired by Info Space on February 19, 2002.

DigiCash was a ground-breaking electronic payment system that needed user software to retrieve notes from a bank and pick appropriate encryption keys before transmitting them to a receiver. Through the development of public and private key cryptography, electronic payments can become untraceable by the issuing bank, the government, or a third party. Through the provision of encrypted keys, this Blind Signatures method enhanced security for its users, preventing third parties from obtaining personal information during online transactions.

3. Bitgold

Bitgold, created in 1998 by blockchain pioneer Nick Szabo, was one of the first attempts at decentralized virtual money. Although Szabo's bit gold concept never materialized, it is widely regarded as the forerunner of Satoshi Nakamoto's bitcoin system. Indeed, the bit gold and bitcoin protocols are so similar that some have speculated that Szabo is Satoshi Nakamoto, the enigmatic developer of bitcoin (although Szabo has denied this).

Using a combination of encryption and mining, Bit gold is decentralized. Time-stamped blocks in a title registry and proof-of-work (PoW) strings are among these characteristics. Szabo suggested a "securely stored, transmitted, and tested with

a minimum of trust" decentralized proof-of-work function.

Bitcoin and bit gold share many characteristics, the first and foremost of them being the technology used to process transactions and safeguard the decentralized network. A user's computational power must be applied to resolving a cryptographic challenge within the bit gold structure. All solved issues are distributed via a Byzantine Fault Tolerant (BFT) peer-to-peer network and are associated with the solver's public key. A title register keeps track of the specifics of a transaction (analogous to a blockchain in the consensus system because it offers an immutable record of and order for transactions that have taken place).

4. Electronic Cash System Peer-to-Peer and Satoshi Nakamoto

An electronic cash system that doesn't require a bank to complete the transaction would allow for direct internet payments between parties. Even though digital signatures are necessary for the solution to work, a trustworthy third party is still required to stop duplicate spending. The use of a network of peers, Satoshi Nakamoto came up with a solution to the issue of double-spending, which he dubbed Bitcoin. The network creates an immutable record by hashing transactions into a continuous chain of hash-based proofs of work, which then timestamps each transaction. (Nakamoto, 2008)

There are a number of digital signatures that make up electronic money. By digitally signing the preceding transaction's hash and attaching it to the end of the coin, each owner transfers the currency to the next. The chain of ownership can be verified by the payee by checking signatures.

The difficulty is that the payee cannot prove that one of the owners did not spend the money two times. Establishing a trustworthy central authority, or mint, that validates all transactions for double spending is common. Each transaction requires the coin to be returned to the mint for reissue, and only mint-issued coins are guaranteed not to be replicated. The trouble with this setup is that the minting company controls the whole money system, and all transactions go via them, much like a bank.

The payee must be informed that the preceding proprietors did not sign earlier transactions. The earliest transaction counts, and later attempts to double-spend are irrelevant. To demonstrate the absence of a transaction, all transactions must be

known. In the mint-based paradigm, the mint tracked all transactions and prioritized them. To avoid depending on a trusted third party, transactions must be made public and participants must agree on a single history of receipt sequence. The payee must show that the transaction was received first by a majority of nodes (Nakamoto, 2008).

Decentralized and trustless electronic transactions were important to Satoshi Nakamoto. Coins based on digital signatures provide great ownership control, but without a means to prevent double spending, Satoshi established the standard structure of coins. When the bulk of CPU power is in the hands of the honest nodes, an attacker would find it extremely difficult to alter the public transaction history of the peer-to-peer network based on proof-of-work (Shiller et al., 2008).The network is strong because of its unstructured nature. There is little cooperation required between nodes. In the absence of a specified location where communications can be routed, they do not need to be acknowledged. Nodes may quit and rejoin the network at any moment, taking the proof-of-work chain as proof. By extending legitimate blocks and refusing to work on wrong blocks, they vote with their CPU power. This consensus mechanism enables the enforcement of any necessary rules and incentives.

C. Blockchain 1.0, 2.0, 3.0

It is common to divide the advancement of blockchain technology into three distinct phases:

- “Blockchain 1.0: Cryptocurrency”
- “Blockchain 2.0: Smart Contract-Based Ledgers”
- “Blockchain 3.0: Enterprise & Institutional Blockchains”

Blockchain 1.0: Cryptocurrency: There are several blockchains in development now, all of which revolve around decentralized, anonymous peer-to-peer transactions using a currency that is not owned by a single entity. The Bitcoin blockchain is one of the first, and it was built on the obscure work of 1980s and 1990s E-Cash (electronic cash) schemes that were floated around. (Swan, 2015).

A Blockchain Core for each cryptocurrency (which allows any computer to start a node), wallet software, mining equipment, and mining software are all

common Blockchain 1.0 technological components. This stage is still developing, with early Blockchain 2.0 advances taking place at the same time. (Swan, 2015).

Blockchain 2.0: Smart Contract-Based Ledgers: It is through Ethereum's meteoric rise that Blockchain 2.0, and hence smart contracts, have been heralded. This led to the birth of Ethereum because Vitalik Buterin was concerned about the Bitcoin Blockchain's absence of a general-purpose programming language. (Miraz, & Ali, (2020).

A number of components have yet to come into play during this early stage of development: (Mendoza, 2020)

- “Smart Contracts”
- “Smart Property”
- “Decentralized Applications”
- “Decentralized Autonomous Organizations”
- “Decentralized Autonomous Corporations”

Blockchain 3.0: Enterprise & Institutional Blockchains: At this stage of Blockchain's history, the technology will have fully matured, making it the most useful. As use-cases differ in terms of transactional throughput, security, generalizability, and so on. It's highly unlikely that "one chain will rule them all." Rather, the merging of independent Blockchains or Distributed Ledgers that are market leaders in their respective fields are more likely to succeed in the long run than those that are not. (Mendoza, 2020) For example, the throughput and scalability requirements for an Internet-of-Things (IoT) oriented ledger are considerably different from those for a financial services ledger (currently, vanilla Blockchains are not built for such requirements). Healthcare, Cybersecurity, Internet-of-Things, Web Services, Voting, and Supply Chains are some examples of Blockchain 3.0 applications.

Although the industry has come a long way since its humble beginnings in 2008, when an unknown author(s) published an initially cryptic whitepaper, there is little doubt that the full benefit of this technology has yet to be realized (Mendoza, 2020).

D. Blockchain and Blockchain Technology Concepts

1. Peer-to-Peer (P2P)

It is possible for two persons to communicate directly with each other via a peer-to-peer (P2P) service. Peer-to-peer (P2P) services are used by buyers and sellers to conduct commerce. The P2P platform can help you with things like search, screening, rating, payment processing, and escrow. (Hayes, 2017). These are the things that peer to peer are all about: People utilize peer-to-peer services to avoid using a third-party intermediary to handle problems like trust, enforcement, and information asymmetry that have previously been managed by relying on third-party intermediaries.

People who use their services benefit from services like as payment processing, buyer and seller information, and quality assurance.

2. Distributed Ledger Technology

It refers to data that has been entered into the database run by a lot of different people, on a lot of different computers. DLT, or “distributed ledger technology”, is a way to keep track of things like transactions. The transactions are signed with a cryptographic signature called a hash. The transactions are connected together considering that each new block includes a hash of the preceding one. This is why distributed ledgers are sometimes called "blockchain."

A “distributed ledger” is referred to as a database that is dispersed over multiple locations or that is used by a many people (Barolli et al., 2018). On the other hand, most businesses use a single database that is kept in one location. With a central database, there is almost always one point of failure in every system.

A distributed ledger, for example, is not centralized, which implies that no single person or group is responsible for processing, validating, or authenticating transactions for everyone. It is common for businesses to make use of distributed ledger technology when processing transactions like product sales and purchases and other kinds of data exchanges. The majority of the time, these entries are only retained in the ledger if all parties concerned agree to do so.

Following that, each file in the distributed ledger receives its own digital signature. The distributed ledger operates in this manner. Everyone on the distributed

ledger has access to all of the records that are being discussed. The software keeps track of all the data on that dataset in a way that can be validated and audited.

The most important thing to keep in mind is that distributed ledgers such as blockchain are not the sole option. In spite of the fact that the blockchain is a sequence of blocks, distributed ledgers do not need one. Traditional ledgers, on the other hand, demand proof of labor, which can slow down the growth of distributed ledgers. Because there is no third party involved, distributed ledger technology is attractive. When it comes to a distributed ledger vs. a blockchain, there is no need to have data blocks. There are many places, areas, or individuals where a distributed ledger can be found. (Van Fossen et al., 2006).

A "distributed ledger," on the surface, sounds similar to a blockchain. Despite the fact that blockchains are “distributed ledgers”, not all distributed ledgers are called "blockchains." There are several components that make up a wider system than the blockchain alone. A distributed ledger provides users complete control over their data and transactions, which makes it easier for individuals to keep track of what's happening. Transactions may be completed in a matter of minutes and are processed 24 hours a day, allowing corporations to save billions of dollars. Additionally, technology aids in back-office efficiency and automation.

Distributed ledger technologies, like as the blockchain, are extremely beneficial for producing money. They minimize operational waste (which ultimately saves money). Also, because they aren't centralized, they provide more security. This is because the ledgers can't be changed.

3. Cryptography and Cryptology

Cryptography is used to ensure confidentiality through encryption technologies. “The message or file that a user wishes to communicate to another person can be safeguarded using cryptography against eavesdroppers or intruders attempting to obtain information about the content of the transfer. Cryptography is also employed to assure integrity, which means that the message sent during the transaction is not changed. Another purpose for the usage of cryptography is to confirm that the communication is transmitted from the correct user” (Delfs et al.,2013).

Many Internet services, such as online banking and shopping, are currently highly security-sensitive. As a result, the Internet has become a major application arena for cryptography, particularly one type of cryptography known as “public-key cryptography” (Buchmann et al., 2013). The premise behind “public-key cryptography” is that it uses a pair of keys: a public key for encryption that is accessible to everyone and a private key for decryption that is only accessible to the owner. In order to decrypt a communication, a private key must be used, whereas a public key must be utilized. In other words, when a communication is sent, the sender uses the receiver's public key to encrypt the message. The full content of the encrypted message can only be decoded using the ciphertext shown.. The receiver then decrypts the message with the use of a private key and is able to read it

4. Cryptographic Hash Function

Internet security is bolstered by cryptographic hash functions, which serve as the internet's backbone today. An algorithm called CHF helps users authenticate themselves and secure their data from anyone attempting to get access through hacking or other unethical ways. Encrypted data generated by the system and unique to each user's input data is used in this method. Subsequent access is authenticated when a match is found in the user input data. (Preneel, 1994)

Data of any sort can be encoded using a Cryptographic Hash Function. It is often used in cryptocurrencies to check the accuracy of transaction data. To create an entirely new string of data, the input data is hashed using an algorithm that cannot tell what the original data was. Data security is aided by hashing, a key component of cryptography. It is sometimes referred to as the "backbone" of the blockchain technology, which uses cryptography. (Preneel, 1994)

5. Merkle Tree and Merkle Root

It is called a hash tree. The bottom nodes of a merkle tree are transaction hashes that ascend, generating the combined hashes of each child's node along the way, until they reach the top, which is the block. Because it is a digital stone, we can add but not erase info. It is an immutable database that is distributed.

Merkle tree, or hash tree, is a data structure that, as the name implies, contains all hash values (Wang et al., 2018). A Merkle tree's leaves are the hash

values of data blocks. A non-leaf node is a hash of the string it corresponds to concatenated from its child nodes (Sun & Zhang, 2020).

“The primary distinction between the Merkle tree and the hash list is that we may download and validate a branch of the Merkle tree instantaneously” (Mao, et al., 2017). “Because the file can be broken into small data blocks, we merely re-download the corrupted data block. When a file is large, it is difficult for the Merkle tree and hash list to check all the data simultaneously, but the Merkle tree can be downloaded one branch at a time and then verified quickly” (Andreeva et al., 2016). The data can be validated if the branch is verified. Verification of the hash list is only possible after obtaining the whole hash list.

6. Consensus Mechanisms

When a valid fingerprint is found on a block candidate, every miner who gets it adds it to their own copy of the Bitcoin Blockchain. When all Bitcoin miners are contributing valid blocks to their own copies of the Bitcoin Blockchain, this is known as a Nash equilibrium in game theory. If a miner feels that all other miners are behaving in the same manner, then adding a valid block candidate to his or her own copy of the Bitcoin Blockchain is the optimal course of action. Making a divergence in the Bitcoin Blockchain that is not commonly accepted would be a waste of time and resources. Finding blocks in a chain that no one else accepts is worth nothing. Miners have a strong motivation to follow this rule, even though no one is enforcing it and they may do anything they want with their copies of the Blockchain. These rules guarantee that everyone on the Bitcoin network knows who owns each and every unit of the currency.

Computing requires a lot of power and is growing more dependent on highly specialized gear, which makes mining more expensive. Valid block candidates, on the other hand, can only be found via a process of trial and error. As a consequence, "proof of work" is the name given to the consensus approach. There are times when it is necessary to do costly calculations in order to identify a block candidate's fingerprint, and this proves that the miner has done so. Any calculations that were performed on the block candidate were wasted because of the inclusion of incorrect information (such as fraudulent transactions). So finding a valid fingerprint is proof of the miner's involvement in maintaining the Bitcoin system.

As a distributed system, a fault-tolerant state-machine replication challenge may be used to describe the problem of maintaining the canonical blockchain state. the author, (Raynal, 2010). For each consensus node, a local copy of the blockchain is maintained (i.e., a view). In the case of Byzantine/arbitrary failures, consensus nodes are meant to find agreement (i.e. consensus) on the block chain's unique common view. Erroneous nodes in blockchain networks might act erratically due to Byzantine failures, leading to hostile assaults and collusions. (Conti et al., 2018), and node errors (e.g., unexpected block chain fork owing to software incompatibility). (Correia, et al.,2006). We can generally define the blockchain state as the sequence of blocks, and the confirmation of a transaction results in a blockchain state transition.

Consensus protocols vary significantly amongst blockchain networks. Due to the fact that permissioned blockchain networks allow for tighter control over consensus node synchronization, they can use conventional Byzantine Fault-Tolerant (BFT) protocols (cf. the primitive algorithms described in (Sun & Duan 2014) and (Schwartz et al., 2014), to achieve the required consensus properties. A example implementation of such protocols is seen in the Ripple network (Schwartz et al., 2014), in which a group of synchronized Ripple servers expands the blockchain via a voting mechanism.

E. Smart Contracts

The phrase "Smart Contract" is ambiguous. They are not "smart," and they are not a "contract," as that term is commonly used to refer to a legal document. "Smart Contracts", a phrase coined by cryptography expert Nick Szabo in 1994, are scripts or software codes produced by developers and stored on a blockchain.

The development of smart contracts on the blockchain might be considered a significant step forward (Ream et al., 2016). When a smart contract was first presented in the 1990s (Szabo, 1997), it was envisioned as a computerized transaction protocol that would implement the contractual conditions of an agreement. When a given circumstance is met, smart contracts' contractual stipulations will be automatically enforced. Smart contracts are becoming enabled by blockchains. Blockchains are used to implement smart contracts. Executable computer programmes are created from the contractual provisions that have been

accepted. Additionally, the contractual provisions' logical links have been kept as logical flows in programmes. (Zheng et al., 2020).

Each contract statement's execution is permanently recorded in the blockchain as an immutable transaction. Access control and contract enforcement are guaranteed by smart contracts. Developers, in particular, have the ability to grant or deny access to each contract function. Whenever a condition in a smart contract is met, the triggered statement will automatically perform the appropriate function in a predetermined manner. (Zheng et al., 2020).

F. Blocks and Block Structure in Blockchain

In academics, Bitcoin-NG is a well-known project that pioneered the concept of adding microblocks between key blocks to expedite block processing, potentially reducing block generation time from ten minutes to ten seconds. However, as the "Impossible Trinit" said, security performance will reportedly decline by half to a third due to the fork occurring more often than the prototype.

The original digital unit of the Bitcoin network, the bitcoin (BTC), is tracked in a decentralized public ledger sustained by the network itself. The term blockchain refers to a chain of data blocks that are added sequentially to the network as transactions occur, aggregating transaction data into blocks.

The blocks that make up the block chain's transaction sequence should be essentially similar. In order for the network to work properly and to transmit money, each block have a block header and transaction data. The network must be able to identify, validate, and add each block to the blockchain.

The following elements are always present in a Bitcoin block's overall structure:

This 4-byte field is always present with the value “0xD9B4BEF9”, showing that the file format complies to the Bitcoin network's data structure. The blocksize parameter, which is four bytes in length, specifies the maximum amount of data which is stored in a single block. A Bitcoin block cannot exceed one megabyte in size (MB).

This 80-byte field is composed of six unique components. There are between one and nine bytes used in a Bitcoin block's transaction counter to represent the transactions in the block, a positive integer. Transactions: “This variable size field stores a list of all transactions in the block, which is generally filled with enough transactions to meet the 1MB Bitcoin block size limit”.

Fundamentally, the “Bitcoin network” is based on a “decentralized network” of nodes that collectively sustain the “distributed public ledger” of bitcoin transactions. Additionally, network nodes may engage in a process called “mining”, which helps protect the network and verifies the authenticity of new blocks and the transactions included within them. Because miners are in charge of adding new blocks to the blockchain, their role in ensuring the integrity of the data included within a proposed block is critical. Bitcoin's block duration is 10 minutes (on average), which means that around six new blocks are added to the blockchain per hour”. The block header is 80 bytes long and contains cryptographically verified data.

G. Blockchain Technology and Cryptocurrencies

Technically speaking, a blockchain is a distributed, secure database of transactions that is based on decentralized nodes. Decentralization, persistency, anonymity, and auditability are all characteristics of the blockchain. Decentralization implies that each transaction must be certified, but not by a central trusted agency (e.g., a central bank), but by a consensus mechanism that ensures data consistency in a dispersed network (Zheng, 2017). Persistence implies that once a transaction is incorporated in the blockchain, it cannot be deleted or reversed. However, because incorrect transactions may be found instantly, the persistency attribute is not a significant disadvantage in general. Anonymity refers to the fact that each user can communicate with the blockchain using a randomly created address without disclosing their true identity. Finally, auditability refers to the fact that any the transaction must refer to an unused portion of a prior transaction (Nakamoto, 2008). As a result, transactions can be confirmed and traced easily.

1. What is Cryptocurrency?

Numerous academic disciplines have investigated the idea of a crypto-currency including economics, sociology, political science, and the arts (Swan, 2015). In an effort to define this concept, the European Parliament has recently published a document that categorizes definitions provided by various organizations, such as the European Central Bank, the IMF, the Committee on Payments and Market Infrastructures, the European Banking Authority, and the World Bank. “There is no universally acknowledged and regulated definition of cryptocurrency, according to these many institutional opinions. The majority of these nations, on the other hand, see cryptocurrencies as a subset or a kind of virtual currencies, also known as digital currencies (Ertz & Boily, 2019).

At its most fundamental level, bitcoin digital currency or virtual currency is a medium of exchange that behaves similarly to money (that is, it can be exchanged for goods and services) but is unrelated to and independent of national boundaries, central banks, sovereigns, or fiat currencies. Cryptocurrencies are purely digital in nature. For this reason, and because the term "digital currency" carries a neutral meaning, it is often chosen over "virtual currency." Indeed, the term "virtual" indicates negative since it refers to something that is "apparently real" but not quite "real," such as a currency held in a "digital" or "electronic register".

Cryptocurrency is a process enabled by cryptographic principles that enables secure and verifiable transactions. “Cryptocurrencies are traded on global exchanges (for example, Coinbase) and are based on the peer-to-peer trading premise. While some cryptocurrencies may be used as a means of payment or exchange, they are not considered legal money and are not issued by a government or central bank” (Hileman, & Rauchs, 2017). Bitcoin is the most well-known cryptocurrency. It continues to dominate the digital currency market since it is the most expensive digital money available to date. Typically, this type of digital cash is traded when a participant initiates a transaction or creates a node in a distributed ledger, or blockchain, software (Ertz & Boily, 2019). As a result, the transaction involves no financial institution.

2. Working Principles of Cryptocurrencies

Digital currency known as cryptocurrency has been in use for a while now and is widely used for electronic payments. The following are some of its fundamental principles and characteristics: Adaptive scaling In order for cryptocurrencies to function properly at various scales, a set of rules must be followed. Based on how many blocks are mined in the given period of time, for example, the Bitcoin mining algorithm is adjusted. The time of the offer is limited, and the mining incentive is lowered if certain requirements are met (when mining grows in volumes significantly). (Madaan et al., 2020).

Cryptography. The number of created coins may be controlled and transactions on exchanges and settlements can be carried out thanks to a particular data encryption mechanism used by cryptocurrencies. (Madaan et al., 2020).

Decentralization. Only a few organizations are responsible for the development and supervision of fiat money. The core of cryptocurrency is peer-to-peer networks, which make it difficult for a single node to affect the block chain.

This is a computer-created individual. It's impossible to hold a physical currency, such as bitcoin, in your hands. In exchange for commodities and other forms of money (such as US dollars, Euros, or WebMoney), cryptocurrency can be exchanged, however it is only available online.

The evidence of efforts. The proof of work process is used by the majority of cryptocurrencies, including Bitcoin. To verify the formula, a captcha must be used, and this needs a significant amount of processing power.

Anonymity. It is possible to access a cryptocurrency wallet using a unique identification that is not linked to the owner's identity or real personal data. Although the details of each transaction are available to the public, the data has been anonymized to protect the privacy of bitcoin owners.

Price. The price of a cryptocurrency is determined by the amount of work required to mine tokens, the shortfall of coins, and the demand for coins. Proof of work is the name given to this price-determination method. In addition, the miner's amount of coins serves as a basis for the proof-of-stake algorithm. (Madaan et al., 2020).

Public Ledgers: A public ledger records all confirmed transactions going back to the birth of a cryptocurrency. Additional cryptographic measures are employed to sustain the integrity of the record-keeping process. The ledger enables "digital wallets" to precisely determine their spendable amounts by linking them to each other. It is also possible to look at new transactions to verify that the spender is only utilizing coins that are currently in his or her possession. The "transaction block chain" is the Bitcoin term for this public ledger.

Transactions: Digital wallets exchange money in a transaction. In order to verify this transaction, it must be entered into a public ledger. Encrypted electronic signatures are used for transactions. Cryptographic signatures are encrypted strings of data that serve as mathematical proof that the transaction originated from the wallet's holder. Consensus-building takes time while "miners" are at work (ten minutes for bitcoin). In the public ledger, mining verifies and adds transactions.

Mining: The process of mining is the validation and addition of transactions to a public ledger, which is known as mining. The "miner" must solve a growing number of increasingly difficult computational tasks to a transaction to the ledger (Gimenez-Aguilar et al., 2021) (like a mathematical puzzle). Anyone can check the transaction because mining is open source. Transactions are recorded in a "block" when a miner solves the puzzle and adds them to the ledger. That no one person can quickly add or edit a block on the public blockchain record is ensured by a complex interplay between transactions, blocks, and the blockchain. All linked transactions become permanent once a block is added to the ledger, and the miner is charged some small transaction fee as a result (along with newly created coins). What makes a coin valuable is its mining process, which is known as a proof-of-work method.

H. Advantages of Blockchain Technology

Because all system nodes are kept up-to-date with the same ledger at the same time, it is possible to decentralize, “blockchain technology” can improve data security With encryption, this prohibits anyone from obtaining access to or tampering with data ledgers (Lee-Jae, 2019).

There are many ways that blockchain technology assists in assuring and validating that all data stored on a blockchain has been approved by the consensus

process (i.e. no external unwanted data inserted). According to the data and architecture, the validity of a transaction can also be validated by blockchains.

In a blockchain, all transactions and data are encrypted and visible to the network. Identity management, e-voting, and utility pricing could all benefit from greater openness as a result of this new technology

Inclusion and accessibility: Blockchain technology can help rural populations securely connect to digital infrastructure in a variety of areas, including microfinance, access to accurate market prices and information, and verification of humanitarian assistance.

İ. Disadvantages of Blockchain Technology

It is difficult for blockchain to keep track of who owns what information because the information is distributed and can't be changed. The right to be forgotten and the permanence of data on the blockchain are two examples of blockchain qualities that appear to be at odds with current legislation, while others, such as identity verification, are not consistently implemented across blockchains.

The validity and legality of smart contracts must be reconciled with traditional conceptions of contract law because they are one of the most extensively used blockchain technology. Because blockchain allows the transfer of ownership of digital products and information, it’s important to have suitable laws and governance structures in place to manage ownership transfers.

At the moment, one of the key applications of blockchain technology is in the sphere of cryptocurrencies and tokens, and more confidence is needed in this area (such as for trading of securities-equivalents, tokenization of assets, taxation of crypto currencies, etc.).

Current blockchain tools and smart contracts rely heavily on code, which is problematic for non-coders who cannot verify the declared function of the code. In addition, there is a lack of public education about blockchain, which has led to a false view of the technology in the minds of the general people.

There are self-regulation issues with decentralized platforms, much more so than with centralized platforms, in areas such as data stewardship, remediation, and

user rights.

Cybersecurity, data reversibility, and code faults are just a few of the issues that blockchains are still grappling with in terms of implementation technology.

As a result of both transaction speed limitations and energy costs/sustainability limits, some blockchain systems may be unable to grow. There are new consensus algorithms that address the scalability, sustainability, and scalability challenges of public and completely distributed blockchains.

Immutable Blockchain Security: Encrypted data on an immutable blockchain may become susceptible in the future as processing power and decryption techniques develop.

Blockchain technology has the potential to worsen monopolistic or other societal power imbalances depending on who is engaged in establishing and enforcing blockchain regulations and who is permitted access to participate in the blockchain. (Longstaff, 2019)

IV. APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN FINANCE

Daily, the global financial system moves trillions of dollars, serves billions of people, and underpins a global economy valued at more than $100 trillion. The global financial services industry is currently confronted with a variety of challenges: It is antiquated, built on decades-old technology that is incompatible with today's rapidly expanding digital world, resulting in it being frequently slow and unreliable on a consistent basis. It is exclusive, denying billions of people worldwide access to critical financial instruments, resulting in poverty. As a result, it is susceptible to data leaks, other attacks, and failure. Additionally, it is monopolistic, thereby stifling innovation. On this robust platform, inventors and entrepreneurs have devised novel methods of value creation. As a result, financial transactions require the use of block chain technology.

There are six primary reasons why blockchain technology will disrupt the finance system, allowing individuals and organizations to have full control over how money is created and managed. There are several reasons for this, including authentication; cost; speed; risk management; value innovation; and open source.

Blockchain technology, a relatively new approach that has sparked broad anxiety across all sectors of society, particularly financial institutions and high-tech enterprises, has sparked widespread concern. (Casino et al., 2018). Satoshi Nakamoto first devised blockchain technology in 2008, when he attempted to design a decentralized electronic cash transaction system to overcome the problem of double payment and increase the security of information verification. (Zhao et al., 2016). As a result, blockchain technology is swiftly gaining traction in the financial sector. At the same time, the advantages of blockchain technology, such as openness, autonomy, tamper-resistant information, and anonymity, can help commercial banks lower their operating costs and enhance capital usage efficiency to some level. Blockchain technology has become one of the most significant core technologies in Bitcoin transactions as the currency has grown in popularity. Despite the fact that

Bitcoin has piqued the public's interest, it remains a highly contentious topic in both academia and the real world due to its monetary status. Bitcoin is well-known for its ability to be used to trade goods and services in some, but not all, markets. (Boucher et al., 2017).

A. Cryptocurrencies

There is a very real risk that many traditional functions in finance could disappear because of the rise of cryptocurrencies. Cryptocurrencies use a "peer-to-peer" system that eliminates the "middle man," which could be a bank. For example, you don't need a bank account or credit card to buy or sell things in the world of cryptocurrencies. Indeed, a cryptocurrency "wallet" does the same thing as a bank vault. It keeps money safe. With a smart phone and the internet, there is a lot of room for a big change in financial inclusion, because over two billion people don't have a bank account (GlobalFindex, 2017; World Bank, 2017).

When referring to a system that uses encryption to enable for the secure transfer and exchange of digital tokens in a distributed and decentralized manner, the word cryptocurrency is employed. At the current market rate, these tokens can be traded for fiat currencies. Bitcoin was the first cryptocurrency, and it was launched in January 2009, making it the first cryptocurrency in the world. Since then, a slew of different cryptocurrencies have emerged, each building on the same breakthroughs as Bitcoin while tweaking some of the finer points of their governing algorithms to suit their needs. Bitcoin's two major contributions, which allowed for the formation of cryptocurrencies, were solutions to two long-standing computer science problems: the double-spending problem and the Byzantine fault. Apart from bitcoin, there are already more than ten thousand cryptocurrencies in circulation worldwide; nevertheless, the most important and extensively used cryptocurrencies will be described next section.

B. Major Cryptocurrencies Traded in Markets Other than Bitcoin

1. Ethereum (ETH)

Ethereum is the first Bitcoin alternative to consider. In the cryptocurrency world, the phrase "Ethereum" can refer to three different things (Dannen 2017): the

Ethereum protocol, the Ethereum network generated by computers that have implemented the protocol Dannen and the Ethereum project that is supporting the development. Following in the footsteps of Bitcoin, Ethereum has emerged as a microcosm of its own, attracting enthusiasts and technologists from a wide range of industries. Many of civilization's most vexing flaws could be addressed by the blockchain's killer applications, and the Ethereum protocol (which was taken from Bitcoin and further developed) is widely regarded as the network on which these "distributed" applications will emerge. There has never been a better opportunity for developers, designers, and product managers) to start prototyping apps for the Ethereum network (Dannen 2017).

In a nutshell, “open source blockchain networks such as Ethereum and Bitcoin are kits that enable the instantiation of an economic system in software, complete with account management and a native medium of exchange for transferring funds between accounts”. Although these native units of exchange are referred to as coins, tokens, or cryptocurrencies, they are identical to tokens in any other system in that they are a type of money (or scrip) that is exclusively valid within that system. Blockchains operate similarly to “mesh networks or local area networks”; they are simply connected to other computers known as "peer" machines that run the same software. “To make one of these peer-to-peer (P2P) networks accessible via a web browser, you must use specialized software libraries such as Web3.js to connect an application's front end (the graphical user interface seen in a browser) to its back end using JavaScript APIs (the blockchain)”. With Ethereum, it may be taken this concept a step further by composing financial contracts with other system users. These financial contracts are referred to as smart contracts. (Dannen, 2017).

2. Litecoin (LTC)

Litecoin is a digital currency that is decentralized. It started on October 7, 2011, as a follow-up to Bitcoin, which debuted on January 3, 2009. Anyone desiring to transfer money between the physical and virtual worlds can do it discreetly using virtual currencies. Consider the case below: Someone attempting to conceal money; speculators; someone attempting to purchase illegal goods via the internet; someone attempts to conceal a goods or money transaction.

Litecoin is one of the most financially beneficial cryptocurrency speculations. Purchasing crypto currency is now difficult for the average person. (Lee, 2021). Charlie Lee started the company. Litecoin uses the "scrypt" proof-of-work method, which can be decoded by consumer-grade CPUs. Litecoin is comparable to Bitcoin in many ways, except it creates blocks quicker, allowing transactions to be verified faster. Litecoin is now accepted by retailers as well as developers.

3. Cardano (ADA)

Cardano is a research-based "Ouroboros proof-of-stake" cryptocurrency established by engineers, mathematicians, and cryptography professionals. Charles Hoskinson, a co-founder of Ethereum, co-founded the project. Dissatisfied with Ethereum's path, he quit and helped build Cardano. Cardano's blockchain was developed after considerable study and testing. The project's specialists have produced over 90 papers on blockchain technology. Cardano's success is based on research.

As a result of this stringent method, Cardano appears to distinguish out among proof-of-stake peers and other major cryptocurrencies. Cardano has also been branded the "Ethereum killer" due to its more powerful blockchain than Ethereum's. While it now has more proof-of-stake consensus than Ethereum, it is still a long way from decentralized financial applications.

Cardano aims to become the world's financial operating system by creating decentralized financial products similar to Ethereum and addressing challenges including chain interoperability, voter fraud, and legal contract tracing.

4. Polkadots (DOT)

Polkadot is a new proof-of-stake coin that aims to make interoperability between blockchains easier. Its protocol integrates permissioned and permissionless blockchains, as well as oracles, allowing systems to work together in one place. Polkadot's relay chain is a key component that permits interoperability between different networks. It also allows for the establishment of "parachains," or secondary blockchains with their own native currency, for particular applications.

Polkadot differs from Ethereum in that developers can create their own blockchain while still benefiting from Polkadot's security. Developers can create new

blockchains with Ethereum, but they must integrate their own security methods, leaving new and smaller projects vulnerable to attack because larger blockchains are more secure. This strategy is known as shared security in Polkadot.

5. Bitcoin Cash (BCH)

Because it was one of the first and most successful hard forks of the original Bitcoin, Bitcoin Cash (BCH) is noteworthy in the history of alternative currencies. As a result of disputes and disagreements between developers and miners, the bitcoin sector splits. Significant changes to the code backing the token or coin in issue must be accepted by general consensus due to the decentralized nature of digital currencies; the mechanism for this process varies every cryptocurrency.

When competing organizations are unable to reach an agreement, the digital currency is split, with the previous chain remaining true to its original code and the new chain beginning as a new version of the previous coin, complete with code alterations. In August 2017, one of these splits resulted in the creation of BCH. The debate that led to the creation of BCH was over scalability; the Bitcoin network's maximum block size is one megabyte (MB). The block size in BCH is increased from one to eight megabytes, with the premise that larger blocks can contain more transactions, resulting in faster transaction speeds.

6. Stellar (XLM)

Stellar is a decentralized blockchain network that was developed to connect financial institutions in order to undertake large-scale transactions. Massive transactions between banks and investment firms that used to take days, included a lot of intermediaries, and cost a lot of money can now be done in a matter of seconds, with no intermediaries and at a low cost to the parties involved.

Stellar was founded by Jed McCaleb, a co-founder of Ripple Labs and the inventor of the Ripple protocol. He later left Ripple to co-found the Stellar Development Foundation after stepping down from his position there.

While Stellar is marketed as a business blockchain for institutional transactions, it is still an open blockchain that anybody can use. Cross-border transactions in nearly any currency are possible using the technology. The native currency of Stellar is the Lumen (XLM). StellarLumens(2021). Users must keep

Lumens in order to conduct transactions on the network.

7. Chainmail (LINK)

Chainlink was co-created by Sergey Nazarov and Steve Ellis. Chainlink is a decentralized oracle network that connects Ethereum-based smart contracts to external data. Blockchains lack the ability to securely connect to third-party programs. Chainlink's decentralized oracles allow smart contracts to interact with external data, allowing contracts to be executed using information that Ethereum does not have access to.

The Chainlink blog covers a wide range of applications for their system. Monitoring water supplies for pollution or illegal siphoning in specific cities is one of the many applications described. Sensors might be put to monitor company usage, water table levels, and adjacent bodies of water. a chain of links. This data might be monitored by a Chainlink oracle and fed straight to a smart contract. The smart contract might be set up to execute fines, give flood warnings to cities, or invoice businesses who consume an excessive quantity of a city's water using the data from the oracle.

8. Binance Coin (BNB)

Binance Token is a utility coin that is used to pay for Binance Exchange trading fees. Those that pay with the token get a discount on their trades. Binance's decentralized exchange is built on top of the Binance Coin network. Changpeng Zhao founded the Binance exchange, which is one of the most popular in terms of trade volume in the world.

On the Ethereum network, Binance Coin launched as an ERC-20 token. It finally went live with its own mainnet. The network is based on a proof-of-stake consensus model.

9. Tether (USDT)

Tether was one of the first and most widely used stablecoins, which are cryptocurrencies whose market value is tied to a currency or other external reference point to reduce volatility. Tether and other stablecoins try to smooth out price swings in order to attract users who might otherwise be apprehensive due to the fact that the

majority of digital currencies, especially huge ones like Bitcoin, have seen recurrent episodes of high volatility.

The price of Tether is directly proportional to the value of the US dollar. Users can transfer funds from other cryptocurrencies to US dollars more easily and swiftly via this approach than they could by converting to ordinary money.

Tether is a "blockchain-enabled platform aimed to ease the digital use of fiat currency," according to its website, which was launched in 2014. This coin effectively allows people to transact in traditional currencies using a blockchain network and similar technologies, while avoiding the volatility and complexity that digital currencies can bring.

10. Monero (XMR)

Monero is a cryptocurrency that is untraceable, secure, and private. This open-source cryptocurrency was created in April 2014 and has swiftly acquired popularity among cryptography professionals and enthusiasts. This coin's development is fully sponsored by donations and community participation. Monero was designed with decentralization and scalability in mind, and it uses a process known as "ring signatures" to achieve absolute secrecy.

This method produces a set of cryptographic signatures, each of which contains at least one genuine participant, but the genuine one cannot be identified because they all appear to be legitimate. Monero has a bad reputation due to its advanced security features, which have been linked to illegal activities all around the world. While Monero is a good alternative for anonymous unlawful transactions, its secrecy also benefits dissidents of authoritarian countries around the world.

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C. Exchanges of Cryptocurrencies

By separating the medium of exchange from the unit of account, cryptocurrency brings back some seminal studies from the 1970s and 1980s by economists like Fischer Black, Eugene Fama, Robert Hall, and Neil Wallace. Traditional monetary economics, according to these authors, is strongly based on legal and institutional arrangements; under laissez-faire, explicit or implicit pricing on mediums of exchange, as well as a blurring of the border between money and other financial assets, would be seen.

Market services (equity, fixed income, and derivatives trading and management), corporate services and licensing are all frequent exchange activities (data or index licensing). In a number of critical areas, The business operations of exchanges might be greatly improved by blockchain technology. Reduced trading fees, along with faster settlement and clearing, offer the potential to save costs and enhance operations. A blockchain network's public, distributed ledger may be utilized to improve anti-money laundering compliance and match or confirm deals. The blockchain's public ledger might help with “data verification", access rights management, and, in the best-case scenario, more effective trade activity warning systems.

Because of the better asset servicing capabilities enabled by asset digitization, new financial products and derivatives may be developed. As a result, new main or secondary markets may be created by merging blockchain technology with new digital assets and securities, resulting in an increase in the liquidity of certain assets. To understand crypto currency trading, one must first understand the differences between centralized and decentralized exchange.

D. Centralized and decentralized exchanges

Many people assume that because digital currencies are decentralized, cryptocurrency stock exchanges must be decentralized as well. Despite the fact that Binance just introduced a decentralized platform, the trading volume on these exchanges accounts for only a small portion of the entire crypto market volume. (Amber & Wu, 2020). When there is no one to keep an eye on it, it operates on an open protocol based on the consensus principle. This is how a decentralized

exchange (DEX) works: Without the use of a mediator, trading takes place between two people. As a result, the exchange is less vulnerable to hacking and users have more control over their funds. Customers typically pay lower costs, but due to the poor liquidity of these exchanges, this gain is insufficient to compensate.

A centralized exchange is operated by a third-party operator. They function as a middleman in trades, attempting to connect the participants in the market. The central regulating body ensures a steady trading environment, keeps track of trades, and controls the order book. Traditional stock exchanges are also included in the group. The majority of well-known digital currency exchanges are centralized, and this paper examines how they operate and how to assess them. (Szepesi, 2020).

Investors interested in trading digital assets for fiat or other digital currencies can use crypto currency exchanges (CCEs) to offer the necessary market infrastructure. The interaction of buyers and sellers determines the market price of an object. The services provided by exchanges are not restricted to marketplaces; they can cover the complete financial market transaction process chain. This covers pre-trading (data), trading, and post-trading services (settlement, custody, and collateral). Market services (such as transaction fees and data provision) and corporate services make up the majority of their revenue (information services, index licensing). The majority of exchanges provide a 24-hour support line, a mobile app, and an easy-to-use Application Programming Interface (API) for integrating trading tools like Trading View. Other services differ by exchange provider and could include finance or conversion services for cryptocurrency retailers. As previously stated, only a few exchanges provide margin trading and short selling. Profitability is highly dependent on trading activity and is cyclical. During difficult times, exchanges witness more trading activity, resulting in substantially higher revenues than usual. The halving of BTC and its impact on its volatility are two examples. (Haig, 2020)

E. Settlement, Clearing and Settlement Cycle in Exchanges

Clearing can be defined as the process of reconciling accounts and coordinating money and security transfers. Exchange of assets is referred to as settlement. “Smart contracts” are programmed to match payments to off-chain financial transfers and cryptocurrencies. They can use a number of settlement models to accommodate the market's risk tolerance and liquidity requirements, including

“atomic settlement", postponed settlement, and deferred net settlement.

Trading — the buying and selling of financial assets – can happen on either centralized exchanges or decentralized over-the-counter (OTC) marketplaces in financial markets. Transactions in exchange-traded marketplaces are routed via a central intermediary that matches buyers and sellers. OTC marketplaces, on the other hand, contain many middlemen (such as dealers) competing to connect buyers and sellers (Bech et al., 2020).

The settlement cycle is the time between a trade's execution and its ultimate settlement (Babich et al., 2022). Most securities are now settled on a rolling cycle, which means that deals are conducted on day T and settled at a later date (typically one to three days later) (Bech et al., 2020).

F. Infrastructure and post-trade services in Exchanges

"Post-trade services" refers to all the activities and people involved in settling a trade after a security's price has been agreed upon, up to the final settlement of the transaction. All parties must have received, accounted for, and reported all outstanding items related to the transaction of a certain security in order for settlement to be declared complete (Ross et al., 2019). It is the central securities depositories (CSDs) that enable most of the securities trade, working with a variety of auxiliary institutions and third-party facilitators. In the post-trade cycle, CSDs serve as regulated middlemen, providing a slew of mandatory services. (Ross et al., 2019).

G. Blockchain Technology and Capital Markets

The worldwide markets are expanding on a daily basis all over the globe, and everyone is seeking for a technology that will allow transactions to be completed without the need for a centralized authority between the dealer and the buyer, among other things. Capital is an extremely important component of the economy since it is utilized to generate economic products. In the capital markets, there are primary markets and secondary markets (Sinsu & Abdul, 2018).

Primary markets are made up of new securities such as stocks and bonds that are issued and sold to investors, while secondary markets are made up of the trading

of existing assets. Capital markets are markets that are primarily used for the purchase and sale of equity and debt instruments, which are securities in the global marketplace, or, in other words, marketplaces that enable the purchase and sale of financial products. The capital markets encompass the issuance of stocks, which are known as equity securities, as well as the issuance of bonds, which are known as debt securities, for medium- and long-term periods of time. It includes various participants as the individual investors, municipalities, governments, companies, organizations, banks and financial institutions. As the blockchain acts as a catalyst for the evolution of various new applications and is a next-step from computing architectural concepts needs to take care of five key concepts blockchain, decentralized consensus, trusted computing, smart contracts and proof of work or stake. (Sinsu & Abdul 2018).

Capital markets play an important role in financial mobilization and provide an effective means of getting long-term finance. (Chalise, 2020). The “capital market” has been conducting business online for many years. However, businesses in the industry rely on a variety of manual and paper-based data transmissions. The continued usage of the conventional paper-based system is due to a variety of factors, including customer opposition and regulatory restrictions (Mulligan & Gordon, 2002).

As is typically the case when a new technology is introduced, it's still early days for blockchain technology, and it's uncertain how it will effect capital markets in future. The many facets of blockchain technology's implementation in the capital markets will be examined.

The basic role of the capital market is to efficiently and cost-effectively mediate capital between those who have an excess of money and those who have a deficit of it.

This is an important function in a developed culture because it allows people to divide their income across time, for as by putting money aside for retirement. Businesses can receive the necessary resources for investment through the capital market.

Borrowing money from banks, selling a section of their current business, selling a portion of their ownership in the company, or borrowing money from

investors (by issuing debentures) are all options for businesses in need of extra capital to invest (Simmons, 2002). Both shares of ownership and debentures are considered securities. As a result of the development of investment options, the capital market's efficiency has improved.

In general, there are four types of market players in capital markets who can profit from blockchain-based solutions: For issuers, fund managers, investors, and regulators. Blockchain benefits issuers by allowing them to access money more quickly, “cheaply, and efficiently through programmable digital assets and securities”. New securities may be created in minutes, with all associated rights and obligations “encoded and automated”. This allows new issue issuers and facilitators to speed up the fundraising process.

H. Blockchain Technology and Investors

Blockchain technology makes it much easier to make new assets or financial products. With less money and faster speed, “Issuers will be able to customize new securities” to meet the specific demands of each investor. It could have a big impact on how investors and issuers work together because tailored digital instruments now have the ability to be more specific about what investors want in terms of return, time horizon, and risk tolerance. This could make it easier for investors and issuers to connect. (Wyman & Euroclear 2016)

Investors try to keep their risk as low as possible while still having a good chance of making money. One of the main risks is not having enough money. This is because “digital assets and financial instruments can be programmed”, which lowers transaction costs, increases asset liquidity, and makes it easier to manage risk. Investors will be able to get more liquidity and lower capital costs when they work with more connectivity and efficiency in the capital markets. Also, the blockchain's open and distributed ledger will give more powerful insights into the quality of assets, which will speed up the due diligence process.

İ. Blockchain Technology and Issuance

Issuance is the process of raising capital from investors through the selling of securities or other investment assets. Blockchain technology allows the creation of

digital representations of existing traditional securities as well as wholly new digital assets that are brought to market via tokens. With the usage of blockchain-based issuance platforms, “securitization of financial instruments and securities will become more tailored and faster”. Issuance can be updated at any time over the life of an asset, including at the time of incorporation or for the numerous assets held. With the inclusion of programmable features, traditional security-backed assets may be digitized to generate tokens representing specific securities. (Sinsu & Abdul, 2018)

It is possible to raise cash more efficiently and more fairly by using decentralised crowdfunding models supported by the blockchain, which allows for the creation of new business models such as decentralised crowdfunding. Additionally, because cap tables are properly documented on a single distributed ledger using blockchain technology, it becomes easier and more transparent to administer them.

J. Using Blockchain in Asset Management

In the past, fund subscriptions and asset lifecycle management were handled by a small group of middlemen. Often performed in silos, these operations require frequent data reconciliation and are prone to human mistake and fraud. Fragmented fund administration leads to excessive subscription fees and a bad investor experience. Overall, the financial services business is gradually accepting the benefits and opportunities that technology may provide. But the rise of blockchain also poses a risk. Through it, participants to a transaction may communicate directly without having to go through a middleman, saving time and money.

This is how the asset management industry has changed over the last few decades: It has grown both in terms of size, as well as complexity. The number of fund structures and the types of assets they invest in has grown to meet the needs of investors who want a wide range of global products. To serve this global product set, the industry makes a lot of use of service companies that act as intermediaries between them and the clearing and settlement infrastructure. These service companies are called intermediaries. Blockchain distributed ledgers have piqued the interest of a lot of buy-side firms because they can cut costs, cut down on delays, provide more timely and accurate data, and improve reporting accuracy.

(PricewaterhouseCoopers LLP, 2016)

Fund managers should use blockchain to improve data and identity security, operational efficiency, and regulatory compliance and reporting functions as digital transformation continues to impact the asset management business. They risk falling behind. To capitalize on new opportunities created by blockchain, such as crypto asset management, STOs, and asset tokenization, innovative firms are already working to carve out a niche. Codefi centralizes security lifecycle events. It maintains a single source of truth for all platform activity and eliminates manual reconciliation. This simplifies a wide range of company actions, from dividend and proxy voting to splits, rights and warrants, takeovers, and swaps. The digital lifespan improves network governance, investor relations, and cap-table management. The business logic is written to avoid human errors, remove third-party asset servicing, increase efficiency, and lower expenses.

Blockchain eliminates the requirement for data reconciliation by offering a single source of truth for all digital asset data. This means we provide trusted, machine-readable data sets. This improves the experience for issuers, investors, custodians, and other stakeholders.

To purchase or sell stocks, debt, or commodities, you need to know who owns what. The financial markets of today accomplish this through a sophisticated network of brokers, exchanges, central securities depositories, clearinghouses, and custodian banks. These separate parties rely on an archaic paper ownership structure that is inefficient, inaccurate, and prone to fraud.

K. Payment and Money Transfer

Bitcoin is primarily used as a means of exchange rather than a unit of account; transactions are denominated in dollars or another currency, but are settled in bitcoins.

It is possible to securely and cost-effectively transmit payments without the need for third-party verification and dramatically cut the processing time associated with traditional bank transfers, thanks to blockchain technology.

Almost 90% of European Payments Council members believe that blockchain technology will have a dramatic impact on the industry by the end of the decade.

Sluggish payments and excessive fees waste trillions of dollars every day in an antiquated system.

L. Banking and Lending

Traditional banks and lenders employ a credit reporting system to determine whether a loan is worth making. Individuals can obtain loans from one another using peer-to-peer (P2P) technology, complicated loans such as mortgages or syndicated loans can be structured, and the loan procedure is generally faster and more secure as a result of blockchain technology.

It's critical for a bank to determine the likelihood that you may default on a loan. How they do it is as follows: They consider your credit score, debt-to-income ratio, and house ownership. Experian, TransUnion, and Equifax are the three major credit reporting companies. They must obtain this information by examining your credit record from one of them. When banks charge fees and interest on loans, they factor in the risk of borrowers defaulting.

Alternative lending powered by blockchain technology is more affordable, efficient, and secure than traditional lending. It can be used to extend personal loans to a larger number of people. Individuals could apply for loans based on their global credit score using a cryptographically secure, decentralized record of prior payments.

M. Using Blockchain in Trading

Trade finance is used to mitigate risk, extend credit, and facilitate international trade between exporters and importers. There are several instances when the global financial system relies on outdated manuals and written documents that are no longer relevant. For businesses and their lenders, blockchain technology has the ability to save billions of dollars in the process of trade financing.

When it comes to trade programs, blockchain technology has been becoming more common for a few years now. However, it is only recently that its primary role in bills of lading and credit has begun to take root in these programs.

For years, the trade finance sector has struggled with logistical issues caused by outmoded, inefficient manual paperwork methods. This isn't unique to the trade finance market. Letters of credit, which are written by one party's bank and sent to

the other party's bank, are still used to make sure that the other party will get paid.

In the future, blockchain technology may enable exporters and importers to share more information about the shipments passing through their pipelines and instill greater trust in each other's ability to deliver on time.

Due to a lack of confidentiality and a lack of control over the flow of goods and documents, the danger of fraud is increased. A commodity trade financing bank may write it off as a cost of doing business because it occurs frequently enough that it is not a source of concern.

Payments between importers and exporters could be made in the form of tokens based on when products are delivered or transferred using blockchain technology. Importers and exporters might use smart contracts to establish rules that ensure payments are made on time and minimize missed, expired, or repeated mortgages..

Trade finance might become more secure if blockchain technology is used. This could result in increased trust between trading partners, more international trade, and the capacity to conceal sensitive information such as price and trade secrets when appropriate.

Contract, and they can also provide services comparable to those offered by traditional financial institutions. Additionally, it would provide customers with a better understanding of where their items originate and when they were sent. A lot of the time, this information isn't complete in traditional systems. A blockchain, on the other hand, could let people know what's going on at every step of the trade, which would help people trust and be more transparent.

N. Smart Contracts in Finance

There have been many different things called "smart contracts" over the years. In the 1990s, a cryptographer named Nick Szabo invented the phrase, describing it as "a collection of promises, written down in digital form, and accompanied by mechanisms ensuring that the parties follow their promises."

When Bitcoin was created in 2009, the concept of "smart contracts" underwent a significant transformation. This is because decentralized blockchain

platforms were made possible by the invention of Bitcoin. A smart contract isn't a smart contract or a legal contract, but the term has stuck because people use it. The term "smart contract" is used in this book to describe immutable computer programs that run deterministically on the Ethereum Virtual Machine, which is part of the Ethereum network protocol. This is the world computer of the Ethereum network. (Antonopoulos & Wood, 2019)

Once a client’s identity is confirmed and their account is set up, the client is free to start placing orders. These requests can be uploaded to the blockchain, which will initiate a smart contract. A smart contract is a piece of computer code that describes the terms and circumstances of a desired transaction and automates the approval and clearing processes. If the client's request fits the smart contract's parameters, the system may securely transfer documents like a transaction confirmation and arrange funds for the new investment position using automated payment channels.

All of this may be accomplished in minutes, rather than the hours or days that an asset manager would require. Financial smart contracts are self-executing computer code agreements that enable the enforcement of financial regulations without the intervention of a central authority. Fintechs and financial institutions may integrate smart contracts into their operations at scale using Algorand's blockchain. In 1994, Nick Szabo, a cryptographer, proposed the use of computer code to record contracts.

While the notion failed to gain traction at the time, the advent of blockchain technology enabled it over a decade later. Szabo's notion was based on the potential time and cost savings associated with automating contract enforcement through the use of a computer program. This technique to contract fulfillment automates the process, removing the need for a third-party mediator to validate the procedure. While the technology was not yet accessible, Szabo's 1996 article on smart contracts discussed the technology's potential for performing core tasks such as money transfer. For more disruptive uses, such as reducing fraud and enforcing contract terms, such as digital cash and smart property. Smart contracts are a logical extension of the blockchain's ability to facilitate frictionless global commerce.

A computer program's if/then Function operates in the same way that smart contracts do. If the contract's criteria are met, the contract's action (or acts) occur. If

they are not met, no transaction occurs.

For instance, if the buyer pays a specified sum of money by a specified date, the purchased products are released on that date. If, on the other hand, the funds are not deposited or the items are not available by the agreed upon day and time, the contract is null and void.

These contracts are made possible by the fact that blockchain transactions are irreversible. Due to the fact that these transactions are recorded on a large number of distinct network nodes, they cannot be altered after the fact.

Traditionally, when two strangers desire to conduct business, a trusted third party is enlisted to ensure the transaction is completed. Due to the fact that smart contracts and the data they generate are encrypted and maintained on a shared ledger, users who do not know one another can rely on the blockchain rather than a trusted third party.

Smart contracts have facilitated the formation of agreements between strangers. This has increased the number of individuals eligible to participate in digital transactions. For instance, decentralized applications (DApps) consist of a large number of smart contracts that collaborate to offer a service, and they typically feature a user experience that resembles that of a standard application. (Antonopoulos & Wood, 2019)

Smart contracts have been applied in a variety of industries, including real estate, insurance, healthcare, credit authorization, real estate, legal processes, and online games. Smart contracts, on the other hand, are more likely to be employed in global finance.

V. RESEARCH

A. Aim and Importance of the Research

A blockchain can be defined as a decentralized master data book that is securely shared. Blockchain technology allows a collective group of selected participants to share data. With blockchain cloud services, transaction data from different sources can be easily collected, integrated and shared. The data is divided into shared blocks, which are chained together with unique identifiers in the form of cryptographic hashes. It can be said that the blockchain eliminates data replication and increases security by providing data integrity with a single source of accuracy.

It is this that also inspired this thesis work. Fraud and data interference are prevented in a blockchain system. Because the data cannot be changed without the permission of the majority of the parties. Blockchain records can be shared but cannot be changed. If someone tries to change the data, all participants will be alerted and they will find out who made this attempt. In this aspect, the encounter with the interest of the financial markets should also be considered as normal.

Although blockchain technologies inspired by the launch of Bitcoin in 2009 have been around for a long time in terms of financial markets, their adoption is still in its infancy. Every day, innovative solutions with a potential social impact are being researched and developed. In light of the recent decline in consumer confidence in the financial sector, blockchains may be a way to restore this belief. Until recently, blockchains were mainly used to strengthen cryptocurrencies. However, nowadays it has also started to be used in very different fields.

Another debate is whether cryptocurrencies, a product of the blockchain, interact with financial markets. The research part of this thesis explores this issue. In this context, the main purpose of this thesis is to statistically reveal the effect between cryptocurrencies and financial markets.

B. Scope of the Research

The research part of the thesis aims to determine the relationship between cryptocurrencies and financial markets, which emerged as a development of blockchain technology. Of course, the concept of financial markets is very broad and cannot be fully explored in this thesis or any research.

Similarly, there are currently more than 20,000 cryptocurrencies, which are impossible to deal with completely. Therefore, some limitations are made in the thesis. Cryptocurrencies are represented by Bitcoin and Ethereum, while financial markets are represented by major indices and major commodities and Dollar Index. These variables, the details of which will be explained in the methodology section, constitute the scope of the research.

Another important issue in research is the time period. The time dimension of the research covers the years between January 1, 2018 and May 31, 2022.

To explain from the general scope of the thesis, in addition to the main branch of "Business", there are sub-branches of finance, stock markets, cryptocurrency markets, commodity markets and money markets.

At the beginning of the study, first of all, the theoretical framework of the study was created. In the theoretical framework, financial markets and institutions, blockchain technology and cryptocurrencies are theoretically examined. Then, the applications of blockchain technology in the field of finance are given. For this purpose, academic resources such as books, articles, researches, conference papers, theses and reports are used. In the next stage, research was carried out, the methodology of which will be described below.

C. Hypothesis Development

In the research part of the study, its effects on financial markets and cryptocurrencies are examined. The main method used in the thesis is the quantitative research method. In this context, the main hypotheses are:

$H1_0$: There is no relationship between financial market variables and cryptocurrencies.

$H1_A$: There is a relationship between financial market variables and

cryptocurrencies.

Based on this main hypothesis, 20 sub-hypotheses are formed and their methodology is explained below.

D. Data and Methodology

Quantitative research method is used in this research, which aims to determine the relationship between cryptocurrencies and financial markets. In this section, the data and methodology of the research are explained in detail.

In this quantitative study, both financial market variables and cryptocurrency variables were included in the analysis with their return performances, not their close values. The reason for this is that if these variables were included with their original values, the autocorrelation problem would arise due to the time series properties and the resulting relationships would present spurious and biased results. Therefore, return performances are calculated for each day and for each variable individually.

Return performances, on the other hand, are not calculated by dividing the current day's closing value by the difference from the previous day's closing by the previous day's closing. Instead, the return performance method, whose natural logarithm is taken, is preferred. ($Rt=\ln(Pt/Pt-1)$)

As stated above, the time dimension of the research covers the years between January 1, 2018 and May 31, 2022. Data from investing.com was used as the data source, but this data was checked to ensure other alternative data sources.

The main analysis method used in the research is linear regression. Before proceeding to the analysis, the basic assumptions of linear regression were investigated, detailed analyzes were made especially against the possible multi-collinearity problem, and the models were established in such a way that no contradictions would occur.

There is no need for an "Ethics Committee Report" since no extra information, documents, reports are requested from companies, and questions, surveys and interviews are not made to companies, employees and other officials. Because all data is collected from publicly available sources, freely available to researchers and "investors".

The variables used in the research are:

Bitcoin (BTC): It is the first dependent variable of the research.

Ethereum (ETH): It is the other dependent variable of the research, it is included as the dependent variable in other models without BTC.

Dow Jones Industrial Index (DJI): The Dow Jones Industrial Average (DJIA), also known as the Dow 30, is a stock market index that tracks 30 large, publicly-owned blue-chip companies trading on the New York Stock Exchange (NYSE) and Nasdaq. It is used as the independent variable as the most basic stock market index.

Standard & Poor's 500 Index (SP): SP is a market-capitalization-weighted index of 500 leading publicly traded companies in the U.S. It is an independent variable.

Nasdaq Composite Index (NASQ): The Nasdaq Composite Index is a market capitalization-weighted index of more than 3,700 stocks listed on the Nasdaq stock exchange. It is used as an independent variable.

Gold (GOLD): Another independent variable of the research, ounce gold value is used.

Brent Oil (BRENT): Brent is the leading global price benchmark for Atlantic pressure crude oils. It is used as an independent variable.

Dollar Index (DOLINDX): The U.S. dollar index is a measure of the value of the U.S. dollar relative to a basket of foreign currencies. The Dollar Index was established by the U.S. Federal Reserve in 1973 after the dissolution of the Bretton Woods Agreement. It is used as an independent variable in the research.

These variables are analyzed in 20 models established.

In Model 1, BTC is the dependent variable, DOW is independent variable. In this model, bivariate regression method is used.

In Model 2, ETH is the dependent variable, DOW is independent variable. In this model, bivariate regression method is used.

In Model 3, BTC is the dependent variable, SP is independent variable. In this model, bivariate regression method is used.

In Model 4, ETH is the dependent variable, SP is independent variable. In this

model, bivariate regression method is used.

In Model 5, BTC is the dependent variable, NASQ is independent variable. In this model, bivariate regression method is used.

In Model 6, ETH is the dependent variable, NASQ is independent variable. In this model, bivariate regression method is used.

In Model 7, BTC is the dependent variable, GOLD is independent variable. In this model, bivariate regression method is used.

In Model 8, ETH is the dependent variable, GOLD is independent variable. In this model, bivariate regression method is used.

In Model 9, BTC is the dependent variable, BRENT is independent variable. In this model, bivariate regression method is used.

In Model 10, ETH is the dependent variable, BRENT is independent variable. In this model, bivariate regression method is used.

In Model 11, BTC is the dependent variable, DOLINDX is independent variable. In this model, bivariate regression method is used.

In Model 12, ETH is the dependent variable, DOLINDX is independent variable. In this model, bivariate regression method is used.

In Model 13, BTC is the dependent variable, DOW and GOLD are independent variables. In this model, multiple regression method is used.

In Model 14, ETH is the dependent variable, DOW and GOLD are independent variables. In this model, multiple regression method is used.

In Model 15, BTC is the dependent variable, GOLD and BRENT are independent variables. In this model, multiple regression method is used.

In Model 16, ETH is the dependent variable, GOLD and BRENT are independent variables. In this model, multiple regression method is used.

In Model 17, BTC is the dependent variable, DOW and BRENT are independent variables. In this model, multiple regression method is used.

In Model 18, ETH is the dependent variable, DOW and BRENT are independent variables. In this model, multiple regression method is used.

In Model 19, BTC is the dependent variable, DOW and DOLINDX are independent variables. In this model, multiple regression method is used.

In Model 20, ETH is the dependent variable, DOW and DOLINDX are independent variables. In this model, multiple regression method is used.

It should also be emphasized that the ideal is to include as many independent variables as possible into linear regression models. However, before the analysis, it was seen that there was a multicollinearity problem when all variables were included in the model. For example, although DOW, SP and NASQ show different performances during the day, they are correlated with each other in the long run. Therefore, financial market variables are analyzed with cryptocurrency variables first as bivariate, and then as pairwise, they are investigated in multiple regression. The research results are given in the next section.

E. Research Findings

In Model 1 as showed on Table 1, the dependent variable is BTC and the independent variable is DOW. The result of the F test (Appendix 1) shows that the model as a whole is significant. After this finding, linear regression analysis was applied. The results of the analysis indicate that the DOW index has a statistically positive effect on the value of BTC ($P<0.05$).

Table 1 Linear Regression Analysis Results of Model 1

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% conf. Interval)
DOW	.7897572	.226412	3.49	0.001	.3455131
_cons	.0003489	.0012995	0.27	0.788	1.234001
					-.0022008
					.0028986

In Model 2 as showed on Table 2, the dependent variable is ETH and the Independent variable is DOW. The result of the F test (Appendix 2) shows that the model as a whole is significant. The results of the analysis indicate that the DOW index has a statistically positive effect on the value of BTC. ($P<0.05$).

Table 2 Linear Regression Analysis Results of Model 2

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% conf. Interval)	
DOW	1.085567	.2682334	4.05	0.000	. 5592651	1.
_cons	-.000862	.0016359	-0.53	0.598	61187 -.0040719 .0023479	

In Model 3 as showed on Table 3, the dependent variable is BTC and the independent variable is SP. The result of the F test (Appendix 3) shows that the model as a whole is significant. The linear regression analysis results shows that SP and BTC have a positive relationship and SP is statistically significant on BTC (P<0.05).

Table 3 Linear Regression Analysis Results of Model 3

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
SP	.8862055	.2235219	3.96	0.000	.447632
_cons	.0002068	.0013011	0.16	0.874	1.324779 -.0023462 .0027598

In Model 4 as showed on Table 4, the dependent variable is ETH and the independent variable is SP. The result of the F test (Appendix 4) shows that the model as a whole is significant. Based on the application of the linear regression analysis, the findings recommends that SP and ETH have a positive relationship and SP is statistically significant on ETH (P<0.05)

Table 4 Linear Regression Analysis Results of Model 4

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
SP	1.203594	.2637233	4.56	0.000	.6861407
_cons	-.0010516	.0016357	-0.64	0.520	1.721047 -.004261 .0021578

In Model 5 as showed on Table 5, the dependent variable is BTC and the independent variable is NASQ. The result of the F test (Appendix 5) shows that the model as a whole is significant. The finding of linear regression analysis best stipulates that NASQ and BTC have a positive relationship and NASQ is significant on BTC (P<0.05) based on statistics.

Table 5 Linear Regression Analysis Results of Model 5

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
NASQ	.8319694	.1712494	4.86	0.000	.4959601
_cons	.000135	.0012903	0.10	0.917	1.167979
					-.0023967
					.0026667

In Model 6 as showed on Table 6, the dependent variable is ETH and the independent variable is NASQ. The result of the F test (Appendix 6) shows that the model as a whole is significant. The finding of linear regression analysis best stipulates that NASQ and ETH have a positive relationship and NASQ significant on ETH (P<0.05) based on statistics.

Table 6 Linear Regression Analysis Results of Model 6

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
NASQ	1.107865	.20156	5.50	0.000	.7123833
_cons	-.001138	.0016244	-0.70	0.484	1.503347
					-.0043253
					.0020493

In model 7 as showed on Table 7, the dependent variable is BTC and the independent variable is GOLD. The result of the F test (Appendix 7) shows that the model as a whole is significant. The linear regression analysis demonstrates that GOLD and BTC are both related positively and GOLD based on statistics is significant on BTC (P<0.05).

Table 7 Linear Regression Analysis Results of Model 7

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
GOLD	.4683976	.2089497	2.24	0.025	.0584163
_cons	.0003942	.0013344	0.30	0.768	.8783788
					-.002224
					.0030125

In Model 8 as showed on Table 8, the dependent variable is ETH and the independent variable is GOLD. The result of the F test (Appendix 8) shows that the model as a whole is significant. The linear regression analysis demonstrate that GOLD and ETH are both related positively and GOLD based on statistics is significant on ETH (P<0.05).

Table 8 Linear Regression Analysis Results of Model 8

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
GOLD	.5676612	.2615553	2.17	0.030	.054462
_cons	-.0007737	.0016936	-0.46	0.648	1.08086
					-.0040966
					.0025493

In Model 9 as showed on Table 9, the dependent variable is BTC and the independent variable is BRENT. The result of the F test (Appendix 9) shows that the model as a whole is significant. After applying the linear regression analysis, the outcome points out that BRENT and BTC are both related positively and BRENT based on statistics is significant on BTC (P<0.05).

Table 9 Linear Regression Analysis Results of Model 9

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
BRENT	.1435049	.0620858	2.31	0.021	.021686
_cons	.0004773	.0013254	0.36	0.719	.2653238
					-.0021232
					.0030779

In Model 10 as showed on Table 10, the dependent variable is ETH and the Independent variable is BRENT. The result of the F test (Appendix 10) shows that the model as a whole is significant. After applying the linear regression analysis, the outcome points out that BRENT and ETH are both related positively and BRENT based on statistics is significant on ETH (P<0.05).

Table 10 Linear Regression Analysis Results of Model 10

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
BRENT	.1806956	.0762373	2.37	0.018	.03111 .3302812
_cons	.0006766	.001684	-0.40	0.688	-.0039807 .0026276

In Model 11 as showed on Table 11, the dependent variable is BTC and the independent variable is DOLINDX. The result of the F test (Appendix 11) shows that the model as a whole is significant. Applying the linear regression analysis on model reflects a negative outcome implying DOLINDX and BTC have a negative relationship and DOLINDX statistically has negative significant effect on BTC (P<0.05).

Table 11 Linear Regression Analysis Results of Model 11

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOLINDX	-1.088548	.5003081	-2.18	0.030	-2.070205 - .1068906
_cons	.0006564	.0013058	0.50	0.615	-.0019058 .0032186

In Model 12 as showed on Table 11, the dependent variable is ETH and the independent variable is DOLINDX. The result of the F test (Appendix 12) shows that the model as a whole is significant. Applying the linear regression analysis on model reflects a negative outcome implying DOLINDX and ETH have a negative relationship and DOLINDX statistically has negative significant effect on ETH (P<0.05).

Table 12 Linear Regression Analysis Results of Model 12

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOLINDX	-1.396972	.6067712	-2.30	0.022	-2.587521 - .2064233
_cons	-.0004487	.0016599	-0.27	0.787	-.0037055 .0028081

In Model 13 as showed on Table 13, the dependent variable is BTC and the independent variables are DOW and GOLD. The result of the F test (Appendix 13) shows that the model as a whole is significant. Multiple linear regression results indicate that both DOW and GOLD have a significant and positive effect on BTC.

Table 13 Linear Regression Analysis Results of Model 13

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOW	.7775426	.2215158	3.51	0.000	.3429049
GOLD	.4212266	.1780806	2.37	0.018	1.21218
_cons	.0002083	.0013031	0.16	0.873	.0718133 .7706398 -.0023484 .0027651

In Model 14 as showed on Table 14, the dependent variable is ETH and the independent variables are DOW and GOLD. The result of the F test (Appendix 14) shows that the model as a whole is significant. Multiple linear regression results indicate that both DOW and GOLD have a significant and positive effect on ETH.

Table 14 Linear Regression Analysis Results of Model 14

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOW	1.070991	.26391	4.06	0.000	.5531709
GOLD	.5026876	.2224884	2.26	0.024	1.58881
_cons	-.0010297	.0016381	-0.63	0.530	.661415 .9392337 -0.042438 .0021843

In Model 15 as showed on Table 15, the dependent variable is BTC and the independent variables are GOLD and BRENT. The result of the F test (Appendix 15)

shows that the model as a whole is significant. Multiple linear regression results indicate that both GOLD and BRENT have a significant and positive effect on BTC.

Table 15 Linear Regression Analysis Results of Model 15

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
GOLD	.4288409	.2002588	2.14	0.032	.3302623
BRENT	.1286438	.0593049	2.17	0.030	.8217701
_cons	.0003389	.0013364	0.25	0.800	.0122811
					.2450064
					-0.0022831
					.002961

In Model 16 as showed on Table 16, the dependent variable is ETH and the independent variables are GOLD and BRENT. The result of the F test (Appendix 16) shows that the model as a whole is significant. Multiple linear regression results indicate that both GOLD and BRENT have a significant and positive effect on ETH.

Table 16 Linear Regression Analysis Results of Model 16

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
GOLD	.5176147	.2528773	2.05	0.041	.0214422
BRENT	.1627581	.0730977	2.23	0.026	1.013787
_cons	-.0008436	.0016964	-0.50	0.619	.0193325
					.3061836
					-.0041721
					.0024848

In Model 17 as showed on Table 17, the dependent variable is BTC and the independent variables are DOW and BRENT. The result of the F test (Appendix 17) shows that the model as a whole is significant. Multiple linear regression results indicate that DOW has a significant and positive effect on BTC. On the other hand, BRENT has no statistically significant effect on BTC (P>0.05).

Table 17 Linear Regression Analysis Results of Model 17

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOW	.7782039	.2282962	3.41	0.001	.3302623
BRENT	.0167205	.0497742	0.34	0.737	1.226145
_cons	.000343	.0013001	0.26	0.792	-.0809419
					.1143828
					-.002208
					.002894

In Model 18 as showed on Table 18, the dependent variable is ETH and the independent variables are DOW and BRENT. The result of the F test (Appendix 17) shows that the model as a whole is significant. Multiple linear regression results indicate that DOW has a significant and positive effect on ETH. On the other hand, BRENT has no statistically significant effect on BTC (P>0.05).

Table 18 Linear Regression Analysis Results of Model 18

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOW	1.082581	.2698474	4.01	0.000	.5531112
BRENT	.0043223	.0639295	0.07	0.946	1.61205
_cons	-.0008635	.0016386	0.53	0.598	-.1211142
					.1297589
					-.0040786
					.0023516

In Model 19 as showed on Table 19, the dependent variable is BTC and the independent variables are DOW and DOLINDX. The result of the F test (Appendix 19) shows that the model as a whole is significant. Multiple linear regression results indicate that DOW has a significant and positive effect on BTC (P<0.05). DOLINDX has no effect on BTC at the 5% significance level, but an effect is detected at the 10% level (P<0.10). However, it should be emphasized that the effect of the Dollar index on BTC is negative.

Table 19 Linear Regression Analysis Results of Model 19

Variables BTC	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval)
DOW	.7665186	.2205519	3.48	0.001	.3337721
DOLINDX	-.7909878	.422179	-1.87	0.061	1.199265
_cons	.0004293	.0012912	0.33	0.740	-1.619348
					.0373727
					- .0021043
					.0029628

In Model 20 as showed on Table 20, the dependent variable is ETH and the independent variables are DOW and DOLINDX. The result of the F test (Appendix 19) shows that the model as a whole is significant. Multiple linear regression results indicate that DOW has a significant and positive effect on ETH (P<0.05). DOLINDX has no effect on BTC at the 5% significance level, but an effect is detected at the 10% level (P<0.10). However, it should be emphasized that the effect of the Dollar index on ETH is negative.

Table 20 Linear Regression Analysis Results of Model 20

Variables ETH	Coef.	Robust Std. Err	t	P>|t|	(95% Conf. Interval
DOW	1.056576	.2627989	4.02	0.000	.5409359
DOLINDX	-.9868131	.5198987	-1.90	0.058	1.572215
_cons	-.0007617	.0016274	-0.47	0.640	-2.00691
					.033284
					-0.0039549
					.0024315

The results obtained in 20 models are interpreted in the results section.

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VI. CONCLUSION

The aim of this research was to investigate and highlight the importance of blockchain technology in financial markets and institutions, as well as to look into the application of blockchain technology in finance and its role in financial transactions. Entire communities are now focused on blockchain technology. More research institutions are focusing on developing the blockchain infrastructure and lowering the entry barrier. One of the truths about blockchain is that new applications are being developed all the time; they are being integrated into our daily life. Most sectors are currently utilizing Blockchain technology to make their processes faster, more efficient, transparent, safe, and secure in our modern day. Blockchain technology is being used in different applications.

The primary difficulty with blockchain technology is transaction security, which encompasses all forms of online and offline transactions. As a result of the lack of an appropriate conduit, a considerable amount of sensitive information has been stolen through a variety of illegal operations. Furthermore, many firms are still uninformed of the Blockchain's potential applications and benefits. “Blockchain technology” is a relatively new and cutting-edge technology that is soon becoming the driving force behind the growth of a variety of enterprises.

Blockchain is already well-known for financial transactions, and it is already being used by many banks and other institutions to secure their daily financial operations. However, there are still certain issues with the technology.

As a result, users of the networking system who have been granted sufficient authorization can browse and share the entire collection without relying on any authority or intermediary. Aside from its various benefits, blockchain technology is connected with a number of concerns and challenges, the most notable of which are: a longer process, increased energy consumption, scaling difficulty, immutable data, self-maintenance, interoperability, and integration.

A “centralized database” managed by one authoritative source is common in

the traditional financial system. Instead, blockchain technology enables the establishment of a distributed database that can handle an ever-growing number of entries while also ensuring that the ledger is constantly synchronized and updated across multiple networks.

In this context, this thesis aimed to determine the relationship between cryptocurrencies and financial markets, which emerged as a development of blockchain technology. In the research, cryptocurrencies were represented by the two most important ones, Bitcoin and Ethereum. In financial markets, Dow Jones, S & P and NASDAQ indices representing stock markets; Gold and Brent Oil were used to represent commodities and the Dollar Index was used to represent currencies. The research covered the period between January 1, 2018 and May 31, 2022, and the return performance was calculated logarithmically.

In this direction, 20 linear regression models were established. In summary, the findings are as follows:

It has been found that the return performances of Dow Jones, S&P and NASDAQ indices have a statistically significant effect on the return performance of cryptocurrencies. The direction of this effect is positive in both Bitcoin and Ethereum.

Gold prices also affect the value of cryptocurrencies statistically positively. In the case where gold and Dow Jones index are included in the same model, the effect on cryptocurrencies is also positive and significant.

Brent Oil alone has a positive effect on the value of cryptocurrencies, but also positively with gold in the same model. However, when Brent is included in the same model as the Dow Jones index, the effect is still positive but not statistically significant.

The most striking result was seen in the dollar index, that is, in all four models in which the dollar index was included as an independent variable, it was determined that the dollar index had a negative and significant effect on the value of cryptocurrencies. In other words, when the value of the dollar appreciates against other currencies, the value of cryptos is negatively affected. What happened in the markets in 2022 confirms this.

The results of this research show that cryptocurrencies targeting decentralized and independent finance are actually influenced by traditional financial instruments (stock market indices, precious metals such as gold, commodities such as brent and currencies such as dollar index). Future researchers are advised to expand this thesis by adding more financial market variables.

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APPENDIX

Appendix 1: Linear Regression Analysis Results of Model 1

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	12.17
Prob > F	=	0.0005
R-squared	=	0.0625
Root MSE	=	.04268

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	.7897572	.226412	3.49	0.001	.3455131	1.234001
_cons	.0003489	.0012995	0.27	0.788	-.0022008	.0028986

Appendix 2: Linear Regression Analysis Results of Model 2

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	16.38
Prob > F	=	0.0001
R-squared	=	0.0732
Root MSE	=	.05389

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	1.085567	.2682334	4.05	0.000	.5592651	1.61187
_cons	-.000862	.0016359	-0.53	0.598	-.0040719	.0023479

Appendix 3: Linear Regression Analysis Results of Model 3

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	15.72
Prob > F	=	0.0001
R-squared	=	0.0752
Root MSE	=	.04239

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	.8862055	.2235219	3.96	0.000	.447632	1.324779
_cons	.0002068	.0013011	0.16	0.874	-.0023462	.0027598

Appendix 4: Linear Regression Analysis Results of Model 4

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	20.83
Prob > F	=	0.0000
R-squared	=	0.0860
Root MSE	=	.05352

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
SP	1.203594	.2637233	4.56	0.000	.6861407	1.721047
_cons	-.0010516	.0016357	-0.64	0.520	-.004261	.0021578

Appendix 5: Linear Regression Analysis Results of Model 5

Linear regression

Number of obs	= 1,111
F(1, 1109)	= 23.60
Prob > F	= 0.0000
R-squared	= 0.0890
Root MSE	= .04207

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NASQ	.8319694	.1712494	4.86	0.000	.4959601	1.167979
_cons	.000135	.0012903	0.10	0.917	-.0023967	.0026667

Appendix 6: Linear Regression Analysis Results of Model 6

Linear regression

Number of obs	= 1,111
F(1, 1109)	= 30.21
Prob > F	= 0.0000
R-squared	= 0.0978
Root MSE	= .05317

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NASQ	1.107865	.20156	5.50	0.000	.7123833	1.503347
_cons	-.001138	.0016244	-0.70	0.484	-.0043253	.0020493

Appendix 7: Linear Regression Analysis Results of Model 7

Linear regression

Number of obs	= 1,111
F(1, 1109)	= 5.03
Prob > F	= 0.0252
R-squared	= 0.0105
Root MSE	= .04384

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOLD	.4683976	.2089497	2.24	0.025	.0584163	.8783788
_cons	.0003942	.0013344	0.30	0.768	-.002224	.0030125

Appendix 8: Linear Regression Analysis Results of Model 8

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	4.71
Prob > F	=	0.0302
R-squared	=	0.0096
Root MSE	=	.05571

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOLD	.5676612	.2615553	2.17	0.030	.054462	1.08086
_cons	-.0007737	.0016936	-0.46	0.648	-.0040966	.0025493

Appendix 9: Linear Regression Analysis Results of Model 9

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	5.34
Prob > F	=	0.0210
R-squared	=	0.0087
Root MSE	=	.04388

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
BRENT	.1435049	.0620858	2.31	0.021	.021686	.2653238
_cons	.0004773	.0013254	0.36	0.719	-.0021232	.0030779

Appendix 10: Linear Regression Analysis Results of Model 10

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	5.62
Prob > F	=	0.0180
R-squared	=	0.0086
Root MSE	=	.05574

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
BRENT	.1806956	.0762373	2.37	0.018	.03111	.3302812
_cons	-.0006766	.001684	-0.40	0.688	-.0039807	.0026276

Appendix 11: Linear Regression Analysis Results of Model 11

Linear regression

Number of obs	=	1,111
F(1, 1109)	=	4.73
Prob > F	=	0.0298
R-squared	=	0.0090
Root MSE	=	.04388

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOLINDX	-1.088548	.5003081	-2.18	0.030	-2.070205	-.1068906
_cons	.0006564	.0013058	0.50	0.615	-.0019058	.0032186

Appendix 12: Linear Regression Analysis Results of Model 12

Linear regression

Number of obs	=	1,111				
F(1, 1109)	=	5.30				
Prob > F	=	0.0215				
R-squared	=	0.0092				
Root MSE	=	.05572				

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOLINDX	-1.396972	.6067712	-2.30	0.022	-2.587521	-.2064233
_cons	-.0004487	.0016599	-0.27	0.787	-.0037055	.0028081

Appendix 13: Linear Regression Analysis Results of Model 13

Linear regression

Number of obs	=	1,111
F(2, 1108)	=	6.39
Prob > F	=	0.0017
R-squared	=	0.0710
Root MSE	=	.0425

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	.7775426	.2215158	3.51	0.000	.3429049	1.21218
GOLD	.4212266	.1780806	2.37	0.018	.0718133	.7706398
_cons	.0002083	.0013031	0.16	0.873	-.0023484	.0027651

Appendix 14: Linear Regression Analysis Results of Model 14

Linear regression

Number of obs	=	1,111
F(2, 1108)	=	8.35
Prob > F	=	0.0003
R-squared	=	0.0807
Root MSE	=	.0537

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	1.070991	.26391	4.06	0.000	.5531709	1.58881
GOLD	.5026876	.2224884	2.26	0.024	.0661415	.9392337
_cons	-.0010297	.0016381	-0.63	0.530	-.0042438	.0021843

Appendix 15: Linear Regression Analysis Results of Model 15

Linear regression

Number of obs	=	**1,111**
F(2, 1108)	=	**3.48**
Prob > F	=	**0.0312**
R-squared	=	**0.0175**
Root MSE	=	**.04371**

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOLD	**.4288409**	**.2002588**	**2.14**	**0.032**	**.0359117**	**.8217701**
BRENT	**.1286438**	**.0593049**	**2.17**	**0.030**	**.0122811**	**.2450064**
_cons	**.0003389**	**.0013364**	**0.25**	**0.800**	**-.0022831**	**.002961**

Appendix 16: Linear Regression Analysis Results of Model 16

Linear regression

Number of obs	=	1,111
F(2, 1108)	=	3.75
Prob > F	=	0.0238
R-squared	=	0.0165
Root MSE	=	.05554

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOLD	.5176147	.2528773	2.05	0.041	.0214422	1.013787
BRENT	.1627581	.0730977	2.23	0.026	.0193325	.3061836
_cons	-.0008436	.0016964	-0.50	0.619	-.0041721	.0024848

Appendix 17: Linear Regression Analysis Results of Model 17

Linear regression

Number of obs	=	**1,111**
F(2, 1108)	=	**6.10**
Prob > F	=	**0.0023**
R-squared	=	**0.0626**
Root MSE	=	**.04269**

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	**.7782039**	**.2282962**	**3.41**	**0.001**	**.3302623**	**1.226145**
BRENT	**.0167205**	**.0497742**	**0.34**	**0.737**	**-.0809419**	**.1143828**
_cons	**.000343**	**.0013001**	**0.26**	**0.792**	**-.002208**	**.002894**

Appendix 18: Linear Regression Analysis Results of Model 18

Linear regression

Number of obs	=	1,111
F(2, 1108)	=	8.19
Prob > F	=	0.0003
R-squared	=	0.0732
Root MSE	=	.05392

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	1.082581	.2698474	4.01	0.000	.5531112	1.61205
BRENT	.0043223	.0639295	0.07	0.946	-.1211142	.1297589
_cons	-.0008635	.0016386	-0.53	0.598	-.0040786	.0023516

Appendix 19: Linear Regression Analysis Results of Model 19

Linear regression

Number of obs	=	1,111
F(2, 1108)	=	6.44
Prob > F	=	0.0017
R-squared	=	0.0672
Root MSE	=	.04259

BTC	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	.7665186	.2205519	3.48	0.001	.3337721	1.199265
DOLINDX	-.7909878	.422179	-1.87	0.061	-1.619348	.0373727
_cons	.0004293	.0012912	0.33	0.740	-.0021043	.0029628

Appendix 20: Linear Regression Analysis Results of Model 20

Linear regression

Number of obs	=	1,111
F(2, 1108)	=	8.64
Prob > F	=	0.0002
R-squared	=	0.0777
Root MSE	=	.05379

ETH	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
DOW	1.056576	.2627989	4.02	0.000	.5409359	1.572215
DOLINDX	-.9868131	.5198987	-1.90	0.058	-2.00691	.033284
_cons	-.0007617	.0016274	-0.47	0.640	-.0039549	.0024315

RESUME

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