Every Crypto breath in the world: The current global position of the Cryptocurrency market and future prediction

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ABSTRACT

This study was motivated by the breakthrough of cryptocurrencies in 2018. The other main reasons behind the motivation are the total market capitalisation of one trillion-dollar diversification possibilities and the lack of preceding scientific research to identify the portfolio diversification possibilities of cryptocurrencies from many angles.

Four empirical studies were conducted to provide a holistic view of cryptocurrency as an investment tool. The first study investigated the portfolio diversification possibilities between cryptocurrencies and traditional financial markets. A quantitative method was employed with Cointegration, ARDL bound testing approach, causality, and co-movement testing. Applying Modern portfolio theory to identify the diversification possibilities between the aforementioned markets enabled the study to highlight how investors can reap the benefits of cryptocurrencies.

The second study extended the investigation of the portfolio diversification possibilities of cryptocurrency by including precious metals and cryptocurrencies in the same investment basket. Investors switch from traditional investment assets, such as equity and debt market instruments, to precious metal markets to reap benefits. Therefore, this study investigates how cryptocurrency can be an alternative source of investment to include in an investment portfolio. The daily precious metal and cryptocurrency data from 2017 to 2022 was utilised through an ARDL framework to obtain the Cointegration between cryptocurrency, precious metal and across cryptocurrencies. Modern portfolio theory is used to identify the diversification possibilities in this study with different portfolio diversification strategies.

The third study clarified the cryptocurrency stakeholders to identify the global perception of cryptocurrency investments. A qualitative method was employed with sentiment analysis, followed by data extractions from the global databases using machine learning algorithms. The study identified the percentage of stakeholder groups' positive, negative, and neutral perceptions of cryptocurrency. The main obstacles hindering cryptocurrency investment growth are the fear of current scams, lack of definitional issues and the absence of a legal framework in some countries.

The fourth study included the findings from the first, second and third studies to develop a cryptocurrency predictive model by factoring in macroeconomic variables. Panel data regression with fixed and dynamic effects was employed to analyse the data from 2017 to 2002. The findings

suggest the impact of each macroeconomic variable selected in the study for the cryptocurrency price changes while adding more significance to technological variables.

The overall findings provide strong support for the portfolio diversification possibilities of cryptocurrencies. Inclusions of the wide range of investment classes, exploring stakeholder perception and highlighting the macroeconomic variables' influence on the cryptocurrency price prediction generate new insights and valuable comparisons about cryptocurrency markets for academia, crypto issuers, investors, government, policymakers, and fund managers to use as an investment and decision-support tools.

Keywords: Cryptocurrency, ARDL, Financial Markets, Cointegration, Causality, Portfolio diversification, Precious Metals, Predictive model,

STATEMENT OF AUTHORSHIP

This work has never been submitted to a college or university for credit towards a diploma or diploma. Furthermore, according to my best knowledge and belief, the thesis contains not previously published or written material by another author unless adequately cited within the thesis.

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ABBREVIATIONS

ABS	Asset Backed Securities
ACT	Australian Capital Territory
ADCCA	Australian Digital Currency Commerce Association
ADF	Augmented Dickey-Fuller
AI	Artificial Intelligence
AIC	Akaike Information Criterion
ANN	Artificial Neural Networks
API	Application Programming Interface
APT	Arbitrage Pricing Theory
ARDL	Auto-Regressive Distributional Lag
ARFIMA	Autoregressive Fractionally Integrated Moving Average
ASX	Australian Securities Exchange
ATM	Automated Teller Machine
AUD	Australian Dollar
BBI	Bloomberg Barclays bond index
BGCI	Bloomberg Galaxy Crypto Index
BIC	Bayesian Information Criterion
BL	Black–Litterman
BLX	Bitcoin Liquid Index
BM	Naive Bayes
BRL	Brazilian Real
BS	Bayes Stein
BSA	Business stakeholder analyzer
BTC	Bitcoin
CAPM	Capital Asset Pricing Model
CASSP	Crypto Asset Secondary Service Providers
CCI	Cryptocurrency Composite Index
CDB	Conditional Diversification Benefits

CFTC	Commodity Futures Trading Commission
CMBS	Commercial Mortgage-Backed Securities
CNBC	Consumer News and Business Channel
COMEX	Commodity Exchange
CRIX	Closely Tracks the total market Index
CRM	Customer Relationship Management
CUSUM	Cumulative Sum
CVaR	Conditional Value at Risk
DCC	Dynamic Conditional Correlation
DFE	Dynamic Fixed Effects
DFFNN	Deep Forwards Neural Network
DJIA	Dow Jones Industrial Average
DLT	Distributed Ledger Technology
DV	Dummy Variables
ECM	Error correction model
EOS	Electro-Optical System
ES	Expected Shortfall
ETF	Exchange-Traded Funds
ETH	Ethereum
EU	European Union
EURONEXT 100	The blue-chip index of the pan-European exchange
EWMA	Exponentially Weighted Moving Average
FCA	Financial Conduct Authority
FD	first Difference
FE	Fixed Effect
FIGARCH	Fractionally Integrated Generalized Autoregressive Conditionally Heteroskedastic
FSB	Financial Stability Board
FTSE	Financial Times Stock Exchange
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GCD	Granger causality in distribution

GDP	Gross Domestic Product
GFC	Global Financial Crisis
GJR	Glosten, Jagannathan, and Runkle Model
GMM	Generalized Method of Moments
GRU	Gated Recurrent Unit
GST	Goods and Services Tax
GSV	Google Search Volume
GT	Google Trends
HDR	Higher Degree Research
ICO	Information Commissioner's Office
IFRS	International Financial Reporting Standards
IIoT	Industrial Internet of Things
IRS	Internal Revenue Service
IXIC	Nasdaq Composite symbol
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
LM	Lagrange Multiplier
LR	Linear Regression
LSTM	Long Short-Term Memory
MAPE	Mean Absolute Percentage Error
MB	Megabyte
MBS	Mortgage-Backed Securities
ML	Machine Learning
MPT	Modern Portfolio Theory
MS	Money Supply
MV	Minimum Variance
NASDAQ	National Association of Securities Dealers Automated Quotations
NLP	Natural Language Processing
NN	Nearest Neighbors algorithm
NY	New York
NYSE	New York Stock Exchange

OCR	Optical Character Recognition
OLS	Ordinary Least Squares
OTC	Over the Counter
PBoC	People’s Bank of China
PCM	Precious & Crypto Markets
PETA	People for the Ethical Treatment of Animals
POW	Proof-of-Work
PPLT	Physical Platinum Shares
PSO	Particle Swarm Optimisation
Q1	Quarter 1
RE	Random Effect
RF	Random Forest
RL	Reinforcement Learning
RMSE	Root Mean Square Deviation
RNN	Recurrent Neural Networks
RQ	Research Question
S&P500	The Standard and Poor's 500 Index
SBC	Schwartz Bayesian Criterion
SIC	Standard Industrial Classification
SSE Composite	Shanghai Stock Exchange Composite Index
SVM	Support Vector Machines
SVM	Support Vector Machine
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
TAM	Technology Acceptance Model
TBML	Trade-based Money Laundering
TFEU	treaty on the functioning of the European Union
TVP	Time Varying Parameter
UKDCA	UK Digital Currency Association
URL	Uniform Resource Locators
USD	United States Dollar

VAR	Vector Autoregression
VEC	Vector Error Correction
VIX	Volatility Index
WBRE	Within-Between Random Effects
XRP	Ripple

GLOSSARY OF TERMS

Term	Meaning
Altcoins	Altcoins are typically understood to be all cryptocurrencies besides Bitcoin (BTC). However, some people define altcoins as all cryptocurrencies other than Bitcoin and Ethereum (ETH) because most cryptocurrencies are forked from one of these (Giungato, Rana, Tarabella, & Tricase, 2017).
Cointegration	Cointegration explains the long-term relationship between two variables, especially in analysing time series data. Moreover, cointegration justifies the presence of constant statistical properties between the variables in a given time frame (Gregory & Hansen, 1996; Voronkova, 2004).
Cryptocurrency	Cryptocurrency is a peer-to-peer digital exchange system that generates and distributes money units using cryptography (King & Nadal, 2012; Nelson, 2018; Smith & Kumar, 2018).
FinTech	Fintech, a portmanteau of "financial technology," refers to companies that use new technology to compete with conventional financial methods in providing financial services. FinTech's "ABCD" includes artificial intelligence, blockchain, cloud computing, and big data (Silvennoinen & Thorp, 2013; Trabelsi, 2020).
Portfolio diversification	The practice of spreading out investments across several different categories of assets to reduce overall vulnerability to the performance of any variety of support is known as diversification. This strategy's goal is to bring the portfolio's volatility down to a more manageable level over time. One way to strike a healthy balance between the potential for loss and the potential for gain in an investment portfolio is to diversify holdings. (Markowitz, 1959; Shawky, Kuenzel, & Mikhail, 1997).

Proof of stake	Proof-of-stake protocols are a consensus mechanism for blockchains that pick validators proportionally to their holdings of the corresponding cryptocurrency. This is done to circumvent the computational expense associated with proof-of-work techniques (King & Nadal, 2012).
Safe-haven assets	A financial instrument is considered to be a safe-haven asset if there is a reasonable expectation that its value will either remain stable or even rise during times of economic instability. These assets have either no correlation with the economy at all or a negative correlation with it. Because of this, in the event that there is a crisis in the market, their value can skyrocket. Moreover, these assets are either uncorrelated to the economy or have a negative correlation with it; the value of these assets could potentially surge in the case of a market crisis. (Kliber, Marszałek, Musiałkowska, & Świerczyńska, 2019; Selmi, Mensi, Hammoudeh, & Bouoiyour, 2018)

CHAPTER 1: INTRODUCTION

1.1 Introduction

The first cryptocurrency, Bitcoin, was created in January 2009. In the decade since its inception, cryptocurrency has flourished and performed debatably. Satoshi Nakamoto pioneered *Bitcoin* and spurred the creation of thousands of cryptocurrencies, known as altcoins. Cryptocurrencies were initially introduced as virtual currencies; however, the blockchain technology used in the cryptographic process has been applied to many new areas. Most cryptocurrencies were developed to solve existing weaknesses in the cryptocurrency ecosystem. For example, an algorithm was developed by Ethereum to address the 21 million limited supply of bitcoins (Chuen, Guo, & Wang, 2017).

The volatility and cryptographic properties of cryptocurrencies continue to attract new investors worldwide. However, most new and existing investors have experienced difficulties with their crypto investment strategies. This is unsurprising, as most people do not understand how cryptocurrency works. Moreover, cryptocurrency is a new technology and completely different from conventional investments. As a result, rumours began spreading across the world about cryptocurrency; most were negative, creating an adverse impact on new investors' decisions. However, some investors reaped benefits from cryptocurrency and started making higher profits due to the volatility of cryptocurrencies and cryptography.

When an investor is confronted with the choice between traditional investment instruments and cryptocurrencies, there is no method available to determine whether investing in cryptocurrencies alone or both is worthwhile. This is due to the lack of empirical evidence indicating how cryptocurrency and other financial instruments are related. Investigating this association to achieve the benefits of portfolio diversification is crucial. The advantages of mixing cryptocurrencies with traditional portfolios to reduce the risk-return profile of the latter have been demonstrated (Chuen et al., 2017) but not the other way.

In addition to having portfolio diversification possibilities, cryptocurrencies have become a political, economic and cultural phenomenon in most developed countries (Zhang, Wang, Li, & Shen, 2018). Moreover, the adoption of cryptocurrencies has been widely discussed in most developed countries, and some countries have had to amend or issue new legislation to embrace the new crypto evolution (Ulyanava, 2018). Supporting the above arguments, in a recent publication, it is stated that*:*

Money is a collective agreement. If enough people come to the same agreement, what they agree upon becomes secondary, whether it be farm animals, gold, diamonds, paper, or simply a code. History proves all these cases to be true. Who knows what the future is going suggest to us as money, once we see digital currencies as ordinary? (Darlington III, 2014, P . 1)

Therefore, this research investigates the investability of cryptocurrencies. Most cryptocurrencies' market capitalisation is in the millions or billions, and the transaction cost is lower than other investment assets. The variety of new cryptocurrencies is still increasing, providing more diversification possibilities across cryptocurrencies (Corbet, Meegan, Larkin, Lucey, & Yarovaya, 2018). Moreover, this enables a new interconnected asset class disconnected from traditional financial assets. This allows new and traditional investors to change their perception of investment strategies. This also provides a strong interconnection with the growing fintech phenomenon. The change of the conventional systems of investments can be taken place at any time as Elon Musk started space travel, and in the near future, most of the conventional habits and investment patterns will be replaced with new fintech systems and investment options. This research enables us to fill that gap and provide a sound approach to all investor types. This research identifies the application of cryptocurrency investment strategies and uncovers the diversification possibilities of cryptocurrencies. In addition, this research focuses on stakeholders' attitudes towards cryptocurrencies. The findings will enable policymakers and governments to redirect their approach and build or reshape cryptocurrency policies, supporting the investment arena.

This provides more options to new investors, and traditional investors change their perception of the investment strategies and provide a strong interconnection with the growing fintech phenomenon. The change of the traditional systems of investments can be taken place at any time

as Elon musk started space travels, and in the near future, most of the conventional habits and investment patterns will be replaced with new FinTech systems and investment options. Therefore, this research enables us to fill that gap and provide a sound approach to all investor types to identify the application of cryptocurrency investment strategies to uncover the diversification possibilities of cryptocurrencies. Furthermore, and as a separate area, this research focuses on exploring the stakeholder perception of cryptocurrencies. This enables to support the policymakers and governments to redirect their opinion to build or reshape the cryptocurrency policies to support the investment arena.

New technology has enabled significant advancements in everyday life, such as smartphones and automated vehicles. These new technologies have also revolutionised money. There is currently a breakthrough in the cryptocurrency market, and it is growing more significant than ever, with the 'bubble' continuing to balloon. People generally fear what they do not understand. It makes sense to learn all you can about the subject you are afraid of. There is currently no research or way to identify the best investment strategies that minimise risk for investors. The lack of research works to transmit the stakeholder perception to crypto companies and government regulations and legislation. Therefore, this proposed research aims to investigate two major research issues in the global cryptocurrency market:

i. Cryptocurrencies are jeopardised by the lack of public awareness. It is imperative to identify the critical factors for the successful development of a cryptocurrency from a stakeholder perspective.

ii. Current literature provides no evidence of a dynamic relationship between cryptocurrencies and other traditional financial assets in obtaining portfolio diversification benefits. Hence, it is worthwhile to establish short and long-running relationships and causality patterns between digital currency and conventional asset markets. This may offer portfolio diversification benefits for investors.

1.2 Background and motivation

Cryptocurrency has been described as an "innovative payment network and a new kind of money" (Abramaowicz, 2016, p. 2) and simultaneously a new finance source. Giving added value to the concept, the cryptocurrency market has grown in a revolutionary manner, as it provides low

transaction cost, anonymity, decentralisation, faster payment transactions, inflation-free currency inflation and global inclusiveness (Chuen et al., 2017). The cryptocurrency mentioned above properties enables investors to develop and implement a sound investment strategy to reap the benefits. Furthermore, all the cryptocurrency market capitalisations are at million and billion levels, which extends the option for investors to benefit more through the market volume. Therefore, it is arguably justified that this area has potential diversification benefits. However, as it's an under-researched area, there is a genuine need to research the above areas to unlock the cryptocurrency diversification possibilities.

Moreover, cryptocurrency is an alternative to the conventional banking system and is even a potential threat to it (Bugbee, 2019). The decentralised cryptocurrency network has already created the self-managing ability, where crypto users can handle many of their day-to-day payment needs without interacting with banks. Furthermore, clients can shift from bank investments towards the peer-to-peer network with the speculation perception. Parallelly, the cryptocurrency phenomenon has created their client's security through cryptography, which is used to secure the transactions from unauthorised third parties (Kliber, Marszałek, Musiałkowska, & Świerczyńska, 2019)

Anonymity and decentralisation are two other properties of cryptocurrencies like Bitcoin, as was pointed out by Herrera-Joancomartí (2014). A detailed description of cryptocurrency and its status have been given by Nelson (2018). According to Hileman and Rauchs (2017), cryptocurrency exchanges play an essential role by offering a wide range of marketplaces for investment, liquidity, trading and exchange. A recent survey by Hileman and Rauchs (2017) revealed that approximately a thousand forehanded cryptocurrencies and one hundred and fifty cryptocurrency companies are located in thirty-eight countries over all regions. Nevertheless, according to the Bloomberg data terminal's recent statics, three thousand cryptocurrencies and twenty thousand crypto companies are located worldwide with a $249 billion market capitalisation (Bloomberg Data Terminal, 2022). The survey conducted by Hileman and Rauchs (2017) highlighted the different types of cryptocurrency users, blurring of sectorial divisions, various exchange centres, wallets, payments, and mining studied, using online web-based surveys to highlight the current statistics of the world cryptocurrency market. These underlying properties of cryptocurrencies provide a sound financial background to identify

The decentralised nature of many cryptocurrency systems is achieved through the utilisation of blockchain technology. The blockchain is a public ledger that is distributed across multiple locations. (Albeshr & Nobanee, 2020; Eyal, 2017). The blockchain is a growing list of records, referred to as blocks, in which the block is the digital information storing unit in a chain of databases. Hash function/ tag enables cryptography in a blockchain transaction where each block has the previous block's hash function to rectify the transactions (Haldenby, Mahadevan, Lee, Chan, & Del Vecchio, 2017). Hashtag provides the facility to store the amount, time and date of purchases or services. Besides, information about the transaction participants is also stored in the form of a unique signature like a username. No identification is involved here. Each block stores specific information with a unique hash code. Even tightly timed purchases of the same items from the same seller appear in two different blocks. However, a single block can store up to 1 MB of data. There are many components in the system to ensure secure transactions and conceal the identity of the participants.

Recent developments in machine learning (ML) and neuroscience, in addition to an increase in data and a new generation of computers, are currently ushering in a new era of artificial intelligence (AI). This is currently being ushered in by the advent of a new era of artificial intelligence (AI) (AI). Deep Reinforcement Learning (RL) encompasses a collection of powerful techniques that are gaining increasing interest among AI researchers. The fact that both biological and artificial entities need to accomplish goals to survive and be useful is crucial to the success of deep reinforcement learning. This type of goal-oriented behaviour distinguishes RL. Such behaviour is based on acquiring actions that maximise rewards and minimise losses or punishments.

Furthermore, RL depends on agent-environment interactions. The agent must choose actions based on a set of inputs, which define the environmental states. The agent attempts to maximise the rewards or punishments that result from these actions over time. While this make-up can be found in nature, and biological systems, it has also shown to be of great value in the realm of artificial agents. In reality, deep RL's versatility stems from combining representation learning with goal-oriented behaviour.

The genesis block for the blockchain-based cryptocurrency, Bitcoin, was made public Bitcoin was launched in 2009 under a pseudonym, Satoshi Nakamoto. By October 2019, bitcoin's total capitalisation was around $167 billion, and there were over 18 million currencies with 0.74%

growth (Bloomberg Data Terminal, 2022). The average demand and supply are the main reason for the Bitcoin price movements. Bitcoin has the highest value in the crypto market, mainly due to the limited supply of 21 million Bitcoins (Sahoo, Sethi, & Acharya, 2019). It fluctuated from 19000 USD per Bitcoin in December 2017 to 94000 USD per bitcoin in late 2021. Cryptocurrencies can be used both for legally valid and nefarious transactions using their highly secure, and interference-free nature. Now alternatives to Bitcoins, altcoins, have emerged. Litecoin, NameCoin, Peercoin, Ethereum, EOS, and Cardano are some of these. There are also more individual Bitcoins like Dash, Zcash and Monero. Out of the total crypto market capitalisation, Bitcoin represents 60%, which is more than half of the total market.

The importance of diversification is discussed at length. Stock prices seem to be highly connected, particularly during a financial crisis. Andrikopoulos, Angelidis, and Skintzi (2014) look at the interrelationships between stocks in the three primary financial hubs of the world. New York, London, and Tokyo were the world's three most important financial centres before and throughout the recent financial crisis. Using multiple regressions, Andrikopoulos et al. (2014) show that there was a tighter bond between the three equity markets during the crisis. The idea that stock market correlations grow during financial crises is supported by a large body of research conducted across a wide range of methodology and geographical areas. (Cont & Wagalath, 2013; Junior & Franca, 2012; Kumar & Deo, 2012). Based on the guidelines proposed by Silvennoinen and Thorp (2013) claims that as stock markets get more correlated, so do the correlations between them. Between the stock, bond, and commodities markets and only the stock and bond markets. Particularly during the years 2007 to 2009. Even though this was not their primary goal, Forbes and Rigobon (2002) confirm the significant association. When comparing the stock market to the bitcoin market, Forbes and Rigobon (2002) investigate if there is contagion or just interdependence. They do not, however, discover any proof of contagion, demonstrating the importance of market interconnectedness. As the markets increase, they discover a persistently high correlation between them.

The spectacular growth of bitcoin over the past year has prompted media speculation that bitcoin is the modern hedge or haven. Dutch media reported on bitcoin as a potential investment hedge throughout Brexit and the 2016 U.S. presidential election (FD, 2016). According to Shaffer (2017) of CNBC, Bitcoin will soon rival gold as a safe haven, while bitcoin, according to Ford (2013) of

Bloomberg speculates that bitcoin will be the last safe haven. Recent studies have found that bitcoin has some of the same properties as a hedge or safe haven.

According to Bouri, Molnár, Azzi, Roubaud, and Hagfors (2017), Bitcoin is a weak hedge and should be used only for diversification. Except in the most extreme weekly downtrends, Bitcoin is not a particularly reliable safe haven. Dyhrberg (2016a) claims that bitcoin can be used as a short-term hedge against the U.S. dollar and a long-term hedge against the FTSE. Specifically, Dyhrberg (2016b) finds that bitcoin can be helpful for risk management when a negative shock is expected. Bitcoin's safe-haven quality, as described by Kliber et al. (2019), is dynamic and has historically been weak both in the short and long term.

Therefore, Investors could use any of the crypto assets to diversify the risk of their existing portfolio. However, what is lacking here is the established academic literature on how an investor can reap diversification benefits by investing in crypto markets, what relationship patterns are in the short and long run and the perception of the investors. In light of the above facts, this is the research gap addressed in this proposal research, as per the following details.

1.3 Research Objectives and Questions

1.3.1 Research Objectives, problem statement and research questions

The primary motive of this study is to investigate how investors can benefit from cryptocurrencies by identifying the ideal investment basket using traditional investment assets. The rapid growth of cryptocurrency has led many to believe it can become a new investment asset category (Chuen, Guo, & Wang, 2017). However, the cryptocurrency market's high volatility, anonymity and speculative nature can adversely affect financial stability (Yarovaya, Brzeszczyński, & Lau, 2016). There is increasing research being undertaken to improve the predictability of the cryptocurrency market, including examining the return–volume relationship (Corbet, Meegan, Larkin, Lucey, & Yarovaya, 2018; Sahoo, Sethi, & Acharya, 2019), safe-haven properties (Bouri, Gupta, Tiwari, & Roubaud, 2017), spillover risks (Luu Duc Huynh, 2019) and market efficiency (Bariviera, 2017). The volatility, risks and regulatory complexities in the crypto arena have caused researchers to analyse significant cryptocurrencies' behaviour and compare them with other financial markets (Vishik et al., 2017). Thus, assessing whether there are any long-term or short-term relationships

between traditional investment assets, such as debt and equity instruments and precious metals, and the cryptocurrency market is crucial. This would inform strategic decisions on investment portfolio diversification.

This research aims to explore and present a precise understanding of the current global position of the cryptocurrency market. It will suggest future possibilities of mixing cryptocurrencies and traditional investing instruments in an investment portfolio with optimal returns and the least risk. Moreover, formulating an optimised investment basket with cryptocurrency assets is still in the initial stage. Therefore, this requires an empirical study by providing strong input (perception) from the stakeholder groups engaging with cryptocurrency. The perception of stakeholders is required as a foundation to identify the optimised investment portfolio, and this thesis attempts to fill this gap.

Diversification is advantageous according to modern portfolio theory because it reduces the portfolio's total risk. This is because securities from different countries should have lower correlations than combined nationwide securities. Correlations, on the other hand, have short-term implications because traditional investment markets can diverge in the short term before resuming their long-term equilibrium. Furthermore, if markets are cointegrated, the benefits of diversification for long-term investors may be exaggerated. This study argues that the most important task for investors seeking diversification is to identify which countries do not cointegrate with one another and invest in those nations. The thesis will employ cointegration techniques to identify portfolio diversification possibilities. Understanding cryptocurrency's portfolio diversification benefits and resiliency during economic downturns requires measuring its spillover to other financial markets. Preciously, how much of an impact cryptocurrency has on the Japanese Yen, British Pound, Swiss Franc, Euro, Australian Dollar, and Canadian Dollar varies. For the Swiss franc, the euro, and the pound, cryptocurrency has served as a hedge, while for the Australian dollar, the Canadian dollar, and the Japanese yen, it has served as a diversifier (Urquhart and Zhang 2019). There is a distinction between different cryptocurrency denominations in terms of volatility, arbitrage, hedging, and portfolio diversification. This motivates an empirical investigation into whether the currency denomination of a cryptocurrency mitigates the benefits of portfolio diversity.

This thesis investigates the broader problem of how to scale up cryptocurrency investments to reap benefits. The key research problem has been broken down into three primary research questions, which are in keeping with the primary research objectives. This has been done to improve clarity and offer a sound academic background. This thesis initially focuses on investment diversification possibilities to provide insight for investors. It then explores the complex and well-researched econometric process, providing more clarity on the outcomes. The thesis then links stakeholder perceptions and explains how other stakeholders perceive cryptocurrencies. The final part of the thesis predicts cryptocurrency prices to provide forecasting reliability for investors. Therefore, this study offers real-world insights for existing or new cryptocurrency users to benefit from their investments.

Three objectives and the questions have been outlined for this scholarly work's output. They are as follows:

1. To explore the portfolio diversification possibilities and examine the relationship between the cryptocurrency market and

a. financial market (equity and debt markets),
b. precious metal market,
c. across cryptocurrencies.

The first research question (RQ1) is as follows:

RQ1: Is there a relationship between the cryptocurrency market and other traditional investments, such as equity shares, bonds, precious metals and across cryptocurrencies for portfolio diversification?

Exploring diversification possibilities through a cointegration framework attracts more investors and other stakeholders. It provides a scientific outcome to reap cryptocurrency diversification benefits. Numerous academics have analysed various portfolio diversification opportunities using econometric and statistical methods and concepts. For instance, Shawky, Kuenzel, and Mikhail (1997) and Campbell, Huisman, and Koedijk (2001) examined the correlation structure between global financial markets. In addition, Voronkova (2004), Gilmore and McManus (2002) and Syriopoulos (2007) analysed cointegration between international financial markets using cointegration methodology to identify a long-running relationship. However, linking debt markets,

precious metals and cryptocurrencies in the same portfolio basket makes the present study unique and potentially fills the research gap in cryptocurrency academic literature. Consequently, the second research objective is:

2. To explore the distinct perceptions among stakeholders about current trends and potential future insights into the cryptocurrency market.

The second research question (RQ2) is as follows:

RQ2: How do different stakeholders perceive the current status and future potential of cryptocurrencies?

Stakeholders' perceived value of cryptocurrency was impacted by infrastructural, structural, individualistic and cultural factors, with investor attitudes having the most substantial effect (Pakrou & Amir, 2016). For most stakeholders, the perceived ease of use was very low, although different user groups expressed varying degrees of perceived usefulness. The future potential of cryptocurrency as a payment method was rated high by three types of stakeholders, consumers, e-commerce merchants and Bitcoin exchange interviewed by A. W. Baur, Bühler, Bick, and Bonorden (2015). Due to the transparency of its platforms and data, the underlying blockchain technology was seen as a potentially revolutionary move towards a more just society. Exploring stakeholder perceptions can encourage new investors and other interested parties to visualise the majority perception to make strategic investment decisions. This study employs the perception of stakeholders to develop a predictive model for cryptocurrencies. As such, the third research question (RQ3) is as follows:

3. To construct a predictive model to ascertain to what extent macroeconomic and other variables influence the returns of the cryptocurrency market.

The third research question (RQ3) is as follows:

RQ3: Is it possible to develop a predictive crypto model incorporating macroeconomic and other variables?

Using macroeconomic variables, a model for predicting the price of cryptocurrencies provides insight for cryptocurrency stakeholders. In the existing literature, machine learning algorithms predict the indicated movements of cryptocurrencies (Basher & Sadorsky, 2022; Huang, Huang, & Ni, 2019). As a result of recent structural modifications to cryptocurrencies and blockchains, the concept of proof-of-stake has already been implemented in the blockchain ecosystem for cryptocurrency mining. However, price fluctuations are highly dependent on the cryptocurrency stake or holding percentage (King & Nadal, 2012). In addition, depending on the size of the network, investors must acquire a minimum quantity of the native token of the cryptocurrency to qualify as validators. Theoretically, individuals must be wealthy or earn sufficient funds to purchase a network stake, resulting in a blockchain exclusive to the wealthy. Therefore, the price forecast is not entirely accurate; however, including macroeconomic variables in the predictive model enables a better understanding of their significance and influence on cryptocurrency price movements.

1.4 Research Design

This section outlines the research design and methodology. The research methods, such as the nature of data, participant recruitment, data collection and analysis, are described. In order to address the research issues, this thesis combined quantitative and qualitative approaches to data collection and analysis. A qualitative research method was used to examine stakeholders' perspectives about current trends and future breakthroughs in the cryptocurrency market. This allowed for the collection of multiple perspectives, providing a detailed description of participants' feelings, opinions and experiences (Khan and Rahman, 2016). Qualitative research was employed to analyse subjective meaning (Flick, 2014). Obtaining more in-depth insights into stakeholder perspectives of the cryptocurrency market, including the future possibilities and current trends, required a qualitative approach. Stakeholder perceptions of the current trends and future possibilities are under-researched. Thus, interviews allowed for an in-depth understanding of different stakeholders and their perceptions of current trends in cryptocurrencies and future possibilities. Qualitative research strategies and methods included case studies, grounded theories and focus group research. This study used sentiment analysis as the primary research method to evaluate stakeholder perceptions (Creswell, Plano Clark, Gutmann, & Hanson, 2003).

A quantitative research approach is necessary when the quantification of data is required (Bryman & Cramer, 2012). This method identifies any patterns or regularities in the data instead of finding and interpreting research as used in a qualitative approach (Divecha, Drach, and Stefek (1992). A quantitative research approach was integrated to examine the presence of causality between the financial market and the cryptocurrency market. Quantitative findings generalise the data to a larger population. Within this context, a questionnaire survey and a semantic analysis were conducted to obtain the qualitative data, while quantitative data were obtained from secondary sources (Bloomberg Terminal). Figure 2 shows the overall research design, and an overview of the data collection methods is provided in Table 1.

Table 1.1: Overview of the data collection methods.

Objective	**Data Collection Tool**	**Research Approach**	**Analysis**	**Description**
1	Secondary data from Bloomberg Terminal	Quantitative	ARDL approach, Toda Yamamoto causality test and modern portfolio theory (MPT)	The presence of cointegration, unidirectional, bidirectional and no causal relationships will be investigated to diversify the portfolio risk.
2	Document analysis and data extraction	Qualitative	Sentiment analysis	Perceptions will be explored. The most discussed topics will be identified in technological/exchange/ developments/legal areas based on different stakeholders.
3	Secondary data from Bloomberg Terminal	Quantitative	Panel data regression analysis	Exploiting inherent information in crypto prices will be investigated to

				formulate a crypto predictive model.

These three standalone studies enabled this thesis to address the gaps in the extant literature and display a holistic view of the cryptocurrency market.

1.5 Contribution of the Thesis

This section outlines the study's contribution to the existing knowledge, empirical research and practical applications of cryptocurrency. The findings of this thesis will be helpful to various stakeholders particularly investors in this market in evaluating the potential returns and risks of cryptocurrency investments. The contribution of this thesis is threefold. First, this study contributes to a richer understanding of the evolving world of cryptocurrencies by establishing a more nuanced understanding of how market forces and cryptocurrencies interact and influence each other, how future growth can be predicted, and how relevant stakeholders perceive these factors.
This section outlines the addition to the existing knowledge on the global cryptocurrency market.

Table 1.2: Contribution of the Thesis.

Academia	•This research will be the first to explore global stakeholder perceptions of digital currency as a medium of exchange and as an alternative investment strategy. •The research findings will establish a causal effect between the crypto market and other conventional asset markets, which are absent in prior studies. •The study will create a predictive model that can be used to conduct further research on the global cryptocurrency market.
Crypto Issuers and Investors	•This research will provide a better insight into global stakeholder perceptions on critical success factors to upscale the cryptocurrency market. Simultaneously, it raises awareness of incentives and barriers to entry and exit from the cryptocurrency market.

Governments, Policymakers, and Regulators	•The findings of this research will inspire market regulators and policymakers to pay more attention to and promote investing in cryptocurrency as a solution to current exchange rate issues due to government inefficiencies and minimise intermediary costs. •As this research will provide insights into stakeholder perceptions about the current and future crypto markets, the government could use this knowledge to formulate 'cryptocurrency principles' and regulate the current cryptocurrency market.

1.6 Significance of the Study

This section highlights the originality of the thesis and shows the value of pursuing research in the global cryptocurrency market. Bitcoin surpassed a fundamental level of resistance, prompting investors to anticipate further gains. Rising inflation and the possibility of additional stimulus continue to compel individuals to purchase safe-haven assets. Increased adoption of payment applications such as PayPal will increase the number of individuals with easy access to cryptocurrency. By transcending international borders, digital currency offers flexibility and economic expansion. Additionally, it would be inexpensive, straightforward and quick. Moreover, digital currencies can increase trade and provide countries with numerous opportunities to improve their financial health.

To put it plainly, diversification means "do not put all your eggs in one basket" (Winton, 1999). The risks and potential gains of investing can be mitigated through the use of a diversified portfolio and careful asset allocation within it. Therefore, portfolio diversification is crucial for investors. The goal is to strike a balance between an investment portfolio's potential risks and benefits. Based on the aforementioned studies' findings, striking this equilibrium entails assembling a collection of assets (a portfolio) that can help you reach your financial goals while staying within your comfort zone regarding the level of risk you're willing to take. This concept chooses certain investment assets (stocks, bonds, commodities, and cryptocurrencies) while developing a balanced portfolio to earn passive returns and safeguard against market volatility. This thesis addresses the

first research issue by presenting a rigorously researched econometric procedure for choosing the best investment in order to reap the benefits of portfolio diversity.

This thesis explores stakeholder perception by analysing globally published stakeholders' opinions, attitudes, suggestions, and beliefs in a highly technological way. In doing so, it aims to provide more apparent transparency to risk-moderate, risk-takers and risk-averse investors, as the increasing volatility of the cryptocurrency market and capitalisation provides safe-haven portfolio diversification possibilities. The following are some of the reasons why it is essential to investigate how stakeholders feel about cryptocurrencies: first, cryptocurrencies have the potential to disrupt the current economic structure; as a result, additional research is required to determine how this affects consumer trust; second, access to cryptocurrencies is becoming easier. For instance, many investment firms now offer Bitcoin services to facilitate financial transactions such as stock trading and exchange-traded funds (Mendoza-Tello, Mora, Pujol-López, & Lytras, 2019).

Therefore, additional research on the government's effect on the attitudes of consumers regarding bitcoin investments is essential. As a result, the second research question aims to find a solution to the problems by conducting an empirical investigation of the perspectives held by stakeholders on cryptocurrencies.

The third research question addresses the impact of macroeconomic and financial variables on cryptocurrency prices. The development of predictive models enables investors to monitor macroeconomic variables, and based on the direction closely, investors can manage their investment portfolio. Accurate forecasts can aid cryptocurrency investors in making prudent investment decisions, which may result in increased profits. Furthermore, policymakers and financial experts can use price prediction to understand the dynamics of bitcoin marketplaces better. Nevertheless, predicting the price of cryptocurrencies is difficult due to their chaotic and highly complex natures. This thesis employs past studies and research to identify the effects of macroeconomic factors on cryptocurrency price predictions. Moreover, this study gathers the most recent data from reliable sources, and the thesis findings will generate new insights for future studies on the cryptocurrency market.

1.7 Delimitations of the Study

This study examines the global cryptocurrency market comprehensively. However, the scope of the study is limited to cryptocurrencies recorded in the Bloomberg Terminal database from 2007 to 2017. In addition, this study does not examine country-specific, firm-specific, or government-specific issues separately; it examines the global market as a whole. In addition, the quantitative analysis of this study investigates the cointegration of cryptocurrencies but does not consider the total number of cryptocurrencies within the crypto ecosystem. The third study in the thesis restricts its scope to cryptocurrency trading and disregards any governmental legal frameworks or restrictions. The qualitative analysis of the thesis is limited to identifying different market participant perceptions of the cryptocurrency market and highlighting the obstacles impeding the market's development. This research does not intend to develop a definition of cryptocurrencies or a framework for investing and trading in cryptocurrencies. Instead, this study investigates and reports on the factors regulators must consider when streamlining existing definitions and frameworks. Employing sentiment analysis and the use of e-data bases only for data extraction is a barrier to capturing the whole stakeholders' perception. Moreover, using machine learning techniques to categorise stakeholders and explore perceptions entails inherent system limitations.

1.8 Structure of the Thesis

The rest of the thesis organised according to the importance and how the study employed methodologies to obtain the significance findings. This study is important mainly, where particularly in an inflationary economic condition it's hard to find any correlation patterns among investment opportunities. Especially in a stagflation condition combining alternative sources to minimise the price risk is also questionable and required more research attention to finding alternative options. As an investor, maximising profit while diversifying the risk identifies as a main aim where this study employed cryptocurrency to diversify the portfolio risk. And currently cryptocurrency acting as a major source of investment in not only developed countries but as well as in developing countries.

Capital markets, with a global value of USD 178 trillion, are one of the most important generators of economic growth and wealth creation. A well-developed domestic capital market helps governments and businesses to access long-term credit in local currency, raises investments in innovation, and encourages long-term growth with more job possibilities for a growing middle-

class. Capital markets are set to play an increasingly larger role in the next years, supporting the mobilisation of additional private finance into crucial areas such as infrastructure, housing, SME, and climate action financing. Capital markets are developing over the period and multiple source of investments are required for a smooth operation in capital markets. Cryptocurrency as a source of investment can be considerable if research can prove the low covariance between different financial assets.

The purpose of the study is to investigate the low level of covariance or absent of a covariance between cryptocurrency and capital markets (finance market, precious metal and among cryptocurrency). The thesis employs a cointegrated approach with structural breaks in causal framework. The findings of not having a covariance enables to diversify the portfolio risk to obtain maximum profits. And then the finding supported by investigating the cryptocurrency perception of the crypto stakeholders and as the last section a predictive crypto price model develops to identify the cryptocurrency price movement for future investments.

Following the introduction of the thesis, the other chapters are organised according to the following arrangement. Chapter 2 investigates the relationships between cryptocurrency and financial markets to explore portfolio diversification possibilities. This chapter explores long-term and short-term relationships by employing the cointegration approach with an error correction model (ECM). The analysis primarily focuses on understanding the suitable statistical properties of the cryptocurrency and financial market datasets to fit the daily data into modern portfolio theory (MPT), identifying the optimal portfolio. Moreover, exploring the optimal portfolio enables existing and potential investors to reap benefits and make strategic decisions to avoid the inherent risk in cryptocurrency.

Chapter 3 presents the same research design and methodology from Chapter 2 to investigate the relationships between cryptocurrency, the precious metal industry and across cryptocurrencies. This chapter introduces the portfolio's use of precious metals and cryptocurrencies and addresses the first research question. The main aim of this study is to investigate the statistical properties to discover long-term, short-term and causal patterns to expand investors' investment portfolios while holding precious metals and cryptocurrencies in the same investment basket.

Chapter 4 explores stakeholder perceptions using a quantitative approach. The different types of investors hold different investment decision criteria. This study explores their perception by

addressing the second research question. The chapter begins with a literature review and then develops a hypothesis and describes the sample selection process. This chapter provides evidence from the extant literature to support the framework in the Chapter 4 study. The exploration and study of stakeholder perceptions is an existing research gap. An extant literature review enables the thesis to develop a suitable empirical model to explore stakeholder perceptions. Hypotheses were developed as per the past studies, and global data collection and extraction were performed to ascertain stakeholder perceptions. In addition, sentiment analysis explores each stakeholder's perception using positive, neutral, and negative machine learning algorithms.

Chapter 5 examines the third research question and develops a cryptocurrency price prediction model. Macroeconomic and financial indicators were employed as per the Barro (1979) model of gold standards. The chapter begins with a literature review and develops hypotheses based on these past studies. Cryptocurrency market literature is new in academic literature; this thesis supports the methodology using strong evidence from past studies. All the hypotheses, models and methods are based on the reviewed literature. In the final analysis stage, this thesis performs a cross-sectional panel analysis and a fixed effect and dynamic fixed effect model to explore price predictions. Finally, the findings based on the hypotheses are discussed.

Chapter 6 concludes and summarises the thesis. This chapter reviews the thesis's principal findings and contributions. In addition, it demonstrates the essential findings and contributions of each empirical study individually. In this chapter, the most prominent policy implications are discussed. The chapter wraps up with a discussion of the limitations of the thesis and some suggestions for additional research.

CHAPTER 6: CONCLUSION

6.1 Introduction

This thesis has investigated the benefits of portfolio diversification, from the perspective of a cryptocurrency investor, as the initial stage of a comprehensive study. It concludes that superior risk-adjusted portfolios can be constructed by combining cointegration techniques with MPT techniques compared to portfolios constructed solely using MPT techniques. The thesis has examined portfolios of cryptocurrency, the financial market, and precious metal investments. In each case, the combination of cointegration and MPT outperforms solely MPT-based optimisation strategies in a CVaR framework.

We suggest that investors seeking to diversify internationally must be cautious about their chosen investment assets, as cryptocurrency diversification is only beneficial if other markets (asset) is not cointegrated with the cryptocurrency market. When markets cointegrated, the advantages of portfolio diversification are diminished. Before portfolios can be optimised, our findings suggest that cointegration analysis must be performed, ensuring that only nations who do not have common long-term equilibrium relationships are included in the optimisation process. Following this, our research analyses the cointegration between cryptocurrency, financial markets, precious metal market and across cryptocurrencies using an ARDL approach. After considering the causality and co-movement between cryptocurrency and other markets, this thesis employed the CVaR framework to optimise asset allocation. Moreover, it was identified that holding cryptocurrencies in a portfolio increases the monthly cumulative returns.

This thesis explored stakeholder perception of cryptocurrencies using a scientific approach and machine learning techniques. Individual stakeholder groups were identified based on past studies, and individual stakeholder perceptions were examined in each category. Lack of trust in cryptocurrency investments was identified as a significant reason for the reluctance to invest in the cryptocurrency market. A comprehensive stakeholder perception examination addressed this issue. As a result, this thesis identified a more positive perception of cryptocurrencies worldwide. The unpredictability of crypto prices and their volatility was also identified as a central issue in Chapter 1. The predictive model introduced by this thesis has provided a price prediction based on macroeconomic variable changes. No previous studies have comprehensively used an extensive

dataset to investigate cryptocurrency investments in a quantitative and qualitative framework. The present study's findings consistently suggest that a cryptocurrency with high volatility offers portfolio diversification possibilities. Moreover, the results support portfolio diversification in cryptocurrency and provide new insights and valuable comparisons between cryptocurrency and financial markets for academia, crypto issuers, investors, government, policymakers and fund managers to use as an investment and decision-making tools.

6.2 Review of Major findings

6.2.1 Portfolio diversification possibilities of cryptocurrency and financial markets

This study is a preliminary step in evaluating the portfolio diversification potential of cryptocurrencies. It has assessed the cointegration, causation and co-movement between six financial markets and the cryptocurrency market. Based on Markowitz's (1952) MPT, our findings indicated that investors could diversify risk by including cryptocurrencies alongside stock and debt market instruments from the United States, Europe, Australia, China and Japan. We added structural breaks into both unit root tests and determined that the statistical features were consistent across all series. Even though Gregory and Hansen (1996) found no cointegration at the breakpoints, we used the ARDL model to capture short-run and long-run cointegration. We discovered that none of the equities and debt markets is cointegrated with the global cryptocurrency market. These results highlight the benefits of diversification for both short and long-term investors.

Toda and Yamamoto's (1995) causality tests were used to examine portfolio diversification potential empirically. A unidirectional causality was discovered between Europe and China and the Bitcoin industry. We also studied the causality between the six selected financial markets and discovered a bidirectional causal link between the United States, Australia, China, and Japan equities markets. In addition, this suggests that, due to the lack of interdependence between the remaining markets, an investor has no prospects to generate additional profits. Finally, we used an R-squared statistic and CVaR approach based on Markowitz's (1952) MPT to determine the tendency for stock and debt market values to co-move (in the same direction).

This study has investigated the portfolio diversification possibilities of cryptocurrencies by analysing the cointegration, causality and correlation between the cryptocurrency market and six financial markets. Based on the current portfolio theory of Markowitz (1952), our findings support the notion that investors may diversify their risk by including cryptocurrencies alongside equities and debt market instruments from the United States, Europe, Australia, China and Japan in their portfolios. Structure breaks were incorporated into both unit root tests, and statistically consistent characteristics were identified in all series across all tests. To demonstrate the validity of our findings, we analysed the correlations between Bitcoin and other financial markets; the results revealed moderate positive and negative links. We then employed the ARDL model to represent short-run dynamics and long-run cointegration, even though experiments conducted by Gregory and Hansen (1996) revealed that breakpoint cointegration did not exist. There is no correlation between the global cryptocurrency market and the equity and debt markets, indicating that investors with both short- and long-term investment objectives may benefit from diversification.

This result suggests a higher correlation between the equity markets of the United States, Australia and Japan. The resumption of diversification opportunities between cryptocurrencies and financial markets resulted from the lower-level co-movement. To establish the validity of our findings, we examined the unconditional correlations between cryptocurrencies and other financial markets; the results reveal weak positive and negative relationships. In the last stage, the mean CVaR diversifies the portfolio, identifies more benefits of holding financial assets, and justifies that not having a cointegration and unidirectional causal links lead to diversification possibilities.

6.2.2 Portfolio diversification possibilities of cryptocurrency, precious metal and across cryptocurrencies

This study analysed the short-term and long-term portfolio diversification opportunities between cryptocurrency and precious metals. To do this, we investigated the cointegration, causation and co-movement patterns between the cryptocurrency and precious metal markets. Our data concluded that diversifying an investor's portfolio to include cryptocurrency and precious metals is advantageous. Initially, we employed unit root tests to determine the constant statistical features of all series. Then, we integrated structural breakdowns using a residual-based test developed by Gregory and Hansen (1996) to examine the cointegration at the breakpoints. Finally, due to its

absence at the breakpoints, we applied the ARDL model to capture the short-run and long-run cointegration.

The ARDL model uncovered a short-term correlation between the cryptocurrency and precious metal markets. According to Markowitz's (1952) MPT, these two markets are not cointegrated on a long-term investment horizon, indicating possible diversification benefits. In addition, the causality test Toda and Yamamoto (1995) conducted revealed a unidirectional causal link between the gold and cryptocurrency markets. The lack of a bidirectional or unidirectional causal link between the other precious metals and cryptocurrencies enhances the statistical case for portfolio diversification. This study examined the likelihood of a correlation between precious metal commodities and cryptocurrencies across various market circumstances. We found that extreme negative, normal and extreme positive return distributions correspond to bearish, normal and bullish market conditions.

We proceeded to the next step, beginning with the quantile unit root test, which emphasises the relevance of utilising several quantiles when analysing a connection. According to the results of our cross-spectral research, diversification benefits in the short-, medium- and long-term are lowered by positive correlation within groups—for both cryptocurrencies and precious metals—under normal market conditions. In contrast, we observed a negative correlation between assets for cryptocurrency and precious metals, which suggests more significant diversification advantages under extreme negative returns. When market returns are exceptionally favourable for both assets, this study explored whether the portfolio selection theory assisted the Bitcoin market. It did so by analysing its investment potential and the significance of market diversity.

Diversification among cryptocurrencies has been proven to increase the Sharpe ratio and utility. An analysis of out-of-sample performance shows that the MV model has the lowest maximum drawdown, whereas the maximum utility model delivers the highest return and utility. Furthermore, when assessed against the Sharpe ratio criterion, none of the models outperformed the simple 1/N rule. These findings can help investors make better-informed decisions. However, the complexities of the Bitcoin industry are by no means comprehensive. For instance, the conclusions of this study imply that estimation errors in mean and covariances may undermine optimal diversification advantages. This poses the question of how to correctly estimate

cryptocurrencies while taking into consideration their stylised qualities. This discussion of risk estimation should be explored in future research.

Based on the cointegration and causation patterns between portfolio assets demonstrated in these findings, investors can pick which assets to include in their portfolios. In addition, investors can examine the relationship between assets in a portfolio when deciding which and how much to include. Our results, which vary across periods and return distributions, indicating that investors in today's unpredictable markets must be receptive to various investment methods. Overall, the results indicate that including precious metals and cryptocurrencies in a portfolio is beneficial. In this way, investors can mitigate the idiosyncratic risks of the cryptocurrency market and benefit from portfolio diversification (Especially in an inflation or economic crisis condition).

6.2.3 Stakeholders' perceptions of cryptocurrency

Cryptocurrencies represent the most innovative advancement in financial technology to date. Blockchain technology is the most widespread and essential technology that enables the production of cryptocurrencies. In addition, blockchain technology is one of the most promising technologies that can alter the global work structure in multiple industries and businesses over the coming years. Depending on location, cryptocurrencies can be a secure form of payment, money transfer and value storage. However, due to the extreme price volatility of cryptocurrencies, it is improbable that they will serve as a unit of account, one of the core functions of national currency. Therefore, it is implausible to consider cryptocurrencies as fully-fledged currencies.

Numerous studies have been conducted and published to understand Bitcoin stakeholders' perspectives better, even though cryptocurrency is still relatively young. Cryptocurrency stakeholders include end-users, investors, retailers, regulators, researchers, developers and market facilitators. This thesis determined that each Bitcoin stakeholder's region's political and economic atmosphere significantly impacts their viewpoints. However, cryptocurrency end-users in politically and economically unstable regions actively use it due to the secure transfer of money and asset stored. Hence, these users require a more stable cryptocurrency. In contrast, end-users in stable regions utilise Bitcoin primarily out of appreciation and curiosity for the technology and social and other reasons.

The perspective of retailers is comparable to that of end-users in terms of the stability of the region in which they operate; nonetheless, most businesses in regions with stable economies accept bitcoin. This guarantees that they make the most out of their sales and that they can convert their earnings based on cryptocurrencies into fiat cash within a few days, mitigating the risk of price volatility. Investors in cryptocurrencies are the most involved set of stakeholders in monitoring developments and analysing patterns in the market. Price volatility is the primary means through which short-term investors generate profits, whilst long-term investors concentrate on generating profits throughout a more extended period and invest in more stable cryptocurrencies. Authorities overseeing the financial sector are among the most influential Bitcoin stakeholders.

The authority to regulate and control their countries' financial stability lies primarily with their governments and central banks, and this responsibility is exercised primarily through fiscal policy and the maintenance of price stability. They are also responsible for exerting influence on any behaviour that poses a risk to the nation's financial stability. Cryptocurrencies have a minor impact on a region's ability to maintain its financial stability while the national currency of that region is steady. Consequently, the governments and central banks in these areas do not usually take immediate and severe action; instead, they try to regulate the activities associated with cryptocurrencies in a roundabout way. However, cryptocurrencies present a massive threat to the financial stability of regions already in a precarious position. On top of their financial instability, the governments and central banks in these places have limited capacity to wait and supervise the development of cryptocurrencies, so they employ authoritarian power to prohibit transactions related to cryptocurrencies. Cryptocurrency is a term that refers to digital currency that can be created and traded online.

After reviewing the relevant literature, this thesis determines that the perspective of those who invented cryptocurrencies and those who facilitate cryptocurrency markets on the future of cryptocurrencies is the least investigated topic in this field. This indicates that researchers ought to widen their research beyond the scope of particular projects and investigate developers' forecasts for the future of bitcoin in general.

6.2.4 Predictive model for cryptocurrency prices

The last ten years have introduced both cryptocurrencies and blockchain technologies. They have been featured in the media, social media, schools and conferences for the past few years. There have been many investigations into their inner workings and potential future impacts. In addition, they have appeared in public and private announcements by the central bank. Multiple examples have been explored in this thesis. The most popular cryptocurrency-related query is a variation on the following: 'why are their prices so volatile? What factors affect them? Are their price swings predictable?' This thesis has examined the factors that affect the pricing of cryptocurrencies and has sought to answer these concerns. The data indicates that the price fluctuations cannot be solely attributed to foreseeable influences like Brexit, US elections, or US news articles.

This demonstrates that cryptocurrency prices are highly volatile. This is shown by first-differences models, which remove nonstationary variables. This thesis not only analysed the potential of widespread future acceptance of virtual currencies but also examined the elements that determine the pricing of virtual currencies and anticipate them. This thesis leads the way for further study of blockchains and cryptocurrencies in the future.

It is possible to broaden this thesis's scope by using the copious amount of data on Bitcoin prices. Future research will allow for more explanatory variables and currency pair additions to the model, such as regional electricity costs, mining activity, capital control policies and regulatory shifts in different countries. It is essential to incorporate lagging values for not just the dependent variable but also the explanatory factors. The results of our models support the claim that our factors influence the price deviation in the manner outlined. However, as mentioned in Pieters and Vivanco (2015), the premiums will likely be underestimated by the local price disparities because they are calculated using daily official exchange rates. A skewed estimate of actual exchange rates is likely to result from incorporating nations with black market exchange rates, such as Argentina, which deviates the most from the BLX.

Despite the significant risk associated with Bitcoin, the capacity to limit exposure to financial uncertainty and the willingness to pay a premium seems economically rational. Furthermore, the risk of a declining cryptocurrency price is substantially reduced if the Bitcoin network is only utilised for foreign money transfers. There is also evidence that the local price of cryptocurrency

differs from the worldwide market price depending on monthly inflation, 10-year government bond rates, and degrees of corruption. Although we were able to estimate a benchmark model for analysing internal changes, it was not adept at forecasting the local price deviation since it failed to account for how the data were created. The observed autocorrelation problem was resolved by incorporating a lag into the regional price deviation. Due to the relatively stable inflation coefficient, the dynamic fixed effects model revealed that our earlier estimates were biased. In addition, the significance of some coefficients increased, and the signs of all coefficients continued to be standard with a consistent propensity to pull in the same direction.

In addition, regulators should hesitate before banning cryptocurrency exchanges. Doing so would increase the volume of unregulated trading and make it harder to monitor the market. More OTC trading means more opportunities for criminals to transfer Bitcoins into fiat currency. It is preferable to work closely with Bitcoin exchanges and help them enhance anti-money laundering measures. Bitcoin and blockchain technology simplify sending money to developing countries with high corruption rates and offers a safer way to secure value in times of significant financial uncertainty. This finding established a basis for future research in this area.

The findings of this study can also be utilised to predict the price of cryptocurrencies based on a variety of additional essential characteristics. In addition, this study assists investors and crypto investment firms in formulating their long-term goals while focusing on macroeconomic variables that influence asset allocation. Finally, this research can serve as the foundation for the next phase of artificial intelligence algorithm development, as current models do not incorporate macroeconomic aspects into their projections. In particular, the findings of this chapter aid investors in monitoring their investment portfolios while benefitting from Bitcoin diversification.

6.3 Academic Contribution

This thesis contributes to the scholarly literature in multiple ways. This thesis consists of four empirical chapters contributing to the academic study of cryptocurrency. This study's theoretical and knowledge contributions include an extension of current studies and a new perspective on cryptocurrency diversification.

The thesis is the frontrunner in exploring stakeholders' perception of cryptocurrency as a contemporary source of investment and diversification benefits. Moreover, this study is the first to investigate causality links between debt and cryptocurrency markets. This thesis attempts to create a predictive model for cryptocurrency returns, which considers macroeconomic and other variables while controlling liquidity and crypto supply. The thesis extends previous research and explores new areas of study. Further, this study contributes to a richer understanding of the evolving world of cryptocurrencies. In particular, it provides a more nuanced understanding of how market forces and cryptocurrencies interact and influence each other, how future growth can be predicted, and how relevant stakeholders perceive these factors.

This research is the first to explore global stakeholder perceptions of digital currency as a medium of exchange and an alternative investment strategy. The findings have established a causal effect between the crypto market and other conventional asset markets, which have not been adequately explored in past studies. In addition, the thesis introduced a predictive model that can be used to conduct further research on the global cryptocurrency market. This research provides a clearer insight into global stakeholder perceptions on critical success factors to upscale the cryptocurrency market. Simultaneously, it raises awareness of incentives and barriers to entry and exit from the cryptocurrency market. The outcome of this research should inspire market regulators and policymakers to focus on promoting investments in cryptocurrency as a solution to current exchange rate issues—many of which are due to government inefficiencies—and minimise intermediary costs. As this research provides insights into stakeholder perception about the current and future crypto markets, governments should formulate 'cryptocurrency principles' and regulate the current cryptocurrency market.

6.4 Research Implications

Cryptocurrency markets, as described by De Santi (1993), Harvey (1995), and Bekaert and Harvey (2002), are characterised by high risks, high returns, low correlations, predictability, and non-normal distributions. The outcomes of this study are significant for investors. They have to decide how much they are willing to risk, establish their level of risk tolerance, and determine what market conditions need to be met before entering a particular market or geographical group. When investing in a country with a free market economy, investors must be aware of whether or not the

government adheres to a traditional rule of law. It is essential to have a history of property rights, particularly for equity stockholders who make up a minority.

Furthermore, it is essential to be aware that the treatment of crypto investors differs drastically from one rising region to the next, which must be acknowledged. The aggregate liquidity, aggregate market capitalisation, and concentration levels in a country are the primary factors that decide the maximum value of assets that can be legitimately invested and traded in that nation. These metrics are necessary for gaining an accurate knowledge of the costs associated with investing. Other essential aspects are the agency risk, which refers to the degree to which agents have been entrusted with responsibility, and the trading mechanism, which refers to the type of exchange and the trade norms in place.

Regulatory implications are mainly influencing on the most of the research works related to cryptocurrency as legal inference will change the structure the market and attract more investments. Most of the countries legalised cryptocurrencies, such as Japan, Denmark, Switzerland, and United Kingdom and others who didn't impose legal guidelines issued tax and investment related legal requirements to monitor the cryptocurrency investment and investment related activities. In Australia crypto is legal and considering as a property. The Financial Stability Board started monitoring crypto asset markets, issued a set of principles to govern regulatory handling of global stablecoins, and is now creating advice for a broader range of crypto assets, including unbacked crypto assets. Other standard-setters are following suit, with work on the application of principles for financial market infrastructures to systemically important stablecoin arrangements and the prudential treatment of banks' exposures to crypto assets. A worldwide regulatory framework will serve to restore order to markets, build consumer trust, define the boundaries of what is permitted, and create a safe environment for meaningful innovation to continue.

6.5 Limitations of the study

The limitations faced during the research period were identified as follows. First, the covid-19 pandemic creates constraints to contact and obtained the primary data mainly from questionnaire surveys and focus group discussions. Although the author made several attempts to contact institutes, companies, and individual investors, they did not respond to the initial queries regarding the primary data collection methods. Moreover, the government restrictions and barriers lead to

switching to secondary data for the research. Therefore, the perception analysis of this thesis mainly explores using the secondary data in the global content. Second, the regulatory framework and guidelines were not apparent in most of the countries in the world. Some countries were in the early stage of cryptocurrency adoption, and some countries restricted cryptocurrency use. Therefore, the diversification possibilities and predictive model developed in this thesis are affected by government guidelines. Third, crypto whales and sudden market and economic events are uncontrollable events in cryptocurrency. Therefore, the study controlled those events by factoring in structural break tests.

6.6 Future Research

Analysts predict the global cryptocurrency market will triple by nearly $5 billion by 2030. Investors, businesses, and brands cannot ignore the rising tide of cryptocurrency for long, regardless of whether they want to invest in it. Nevertheless, cryptography appears incapable of escaping paradoxes. Despite their belief in regulation, investors are concerned about many of its potential consequences. They are environmentally conscious, but crypto has a massive carbon footprint. Understanding overall consumer sentiment and predicting consumer behaviour concerning the highly uncertain future of cryptocurrency requires a deep dive into these nuances. Cryptocurrencies are a new asset class that offers many possibilities for study in financial econometrics. For instance, there has been tremendous development in studying the dynamics of cryptocurrency trading, pricing, and volatility forecasting.

However, we will be concentrating on such topics as network architecture, public opinion, and valuation; monetary systems and financial development; institutions; adoption, price discovery, and high-frequency data; index construction, portfolio diversification, bubbles, alternative capital-raising strategies, and the role of energy in consensus mechanisms. Blockchain-based monetary systems, such as cryptocurrencies, could impact the macroeconomy because they contradict the historical functions of banks. When confidence in the stability of the monetary authority is low, cryptocurrencies may provide an attractive alternative to traditional fiat currencies. Nonetheless, the underlying technology of cryptocurrencies has the potential to enhance the operations of central banks and can serve as a foundation for them to develop their coins. Venezuela's petromondea (petro) is an early example of what is now known as central bank digital currencies (CBDC). There is a chance that this technology might be used to bring the unbanked into the modern financial

system, which would open up new markets and encourage the creation of new firms. Since cryptocurrencies are set to replace conventional methods of investing and trading money worldwide, further research could be done to determine how to incorporate additional asset classes into the mix.

6.7 Chapter Summary

The last chapter of this thesis provided a summary of the three empirical studies conducted in this thesis (portfolio diversification between cryptocurrency, financial markets and precious metals, stakeholder perception towards cryptocurrency, and predictive model for price forecasting). The interconnection and the link between each chapter are critically evaluated in this chapter and explain the significant findings in each chapter. Finally, the three studies' academic contributions and research implications were outlined while illustrating the limitations of the thesis and providing future research directions.

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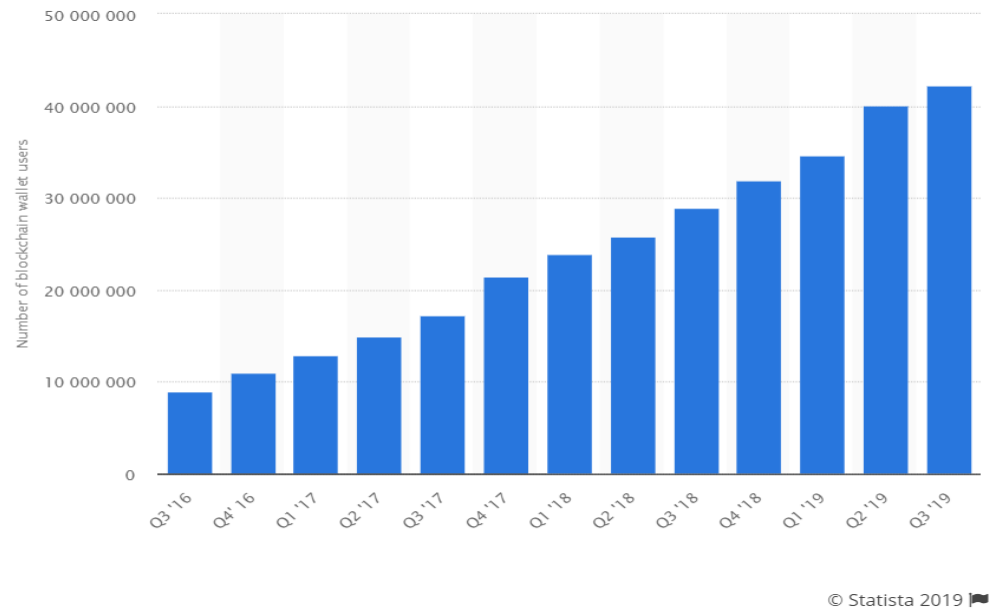
APPENDIX A

Appendix A.1: Capitalization

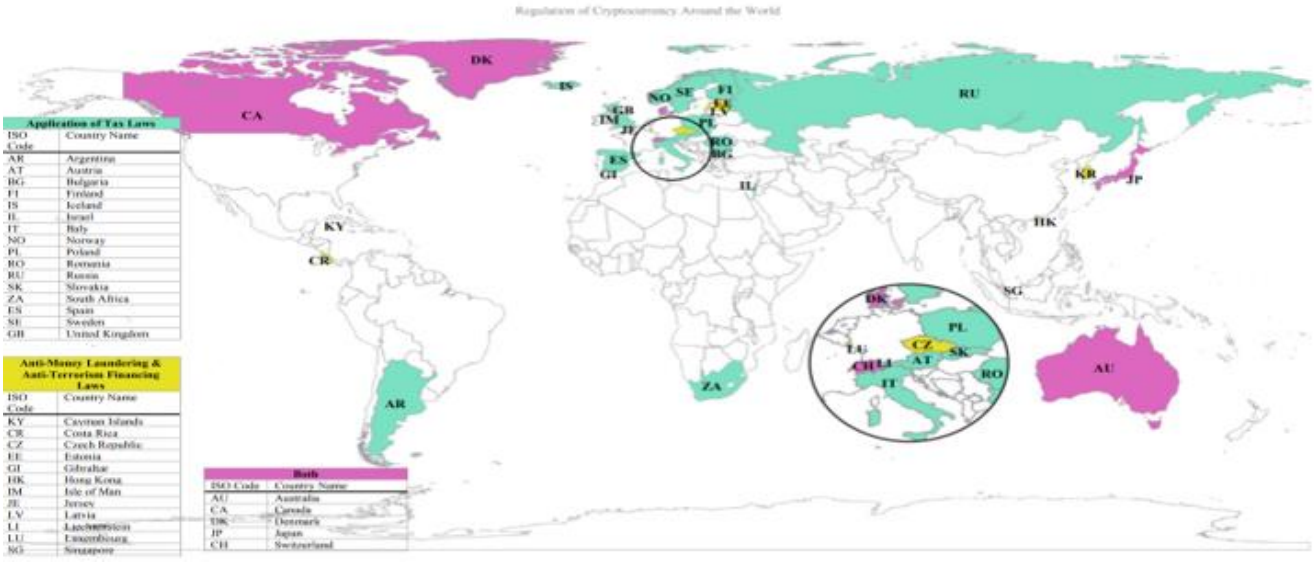
Source- *Coin market cap (2022)*

Appendix A.2: Wallet users



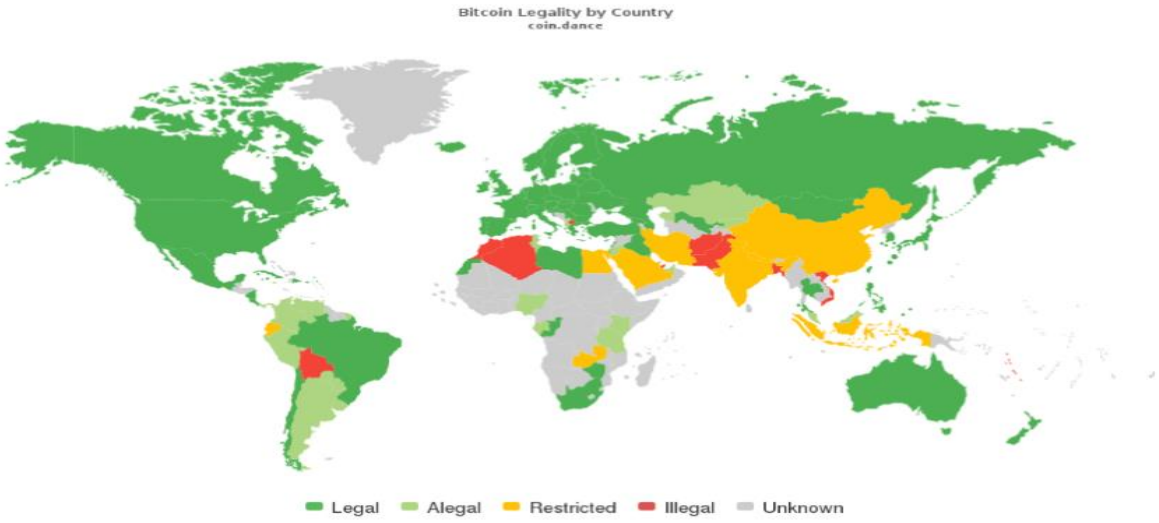
Source- *Statista (2019)*

A.3: Application of Tax Laws, Anti-Money Laundering/Anti-Terrorism Financing Laws



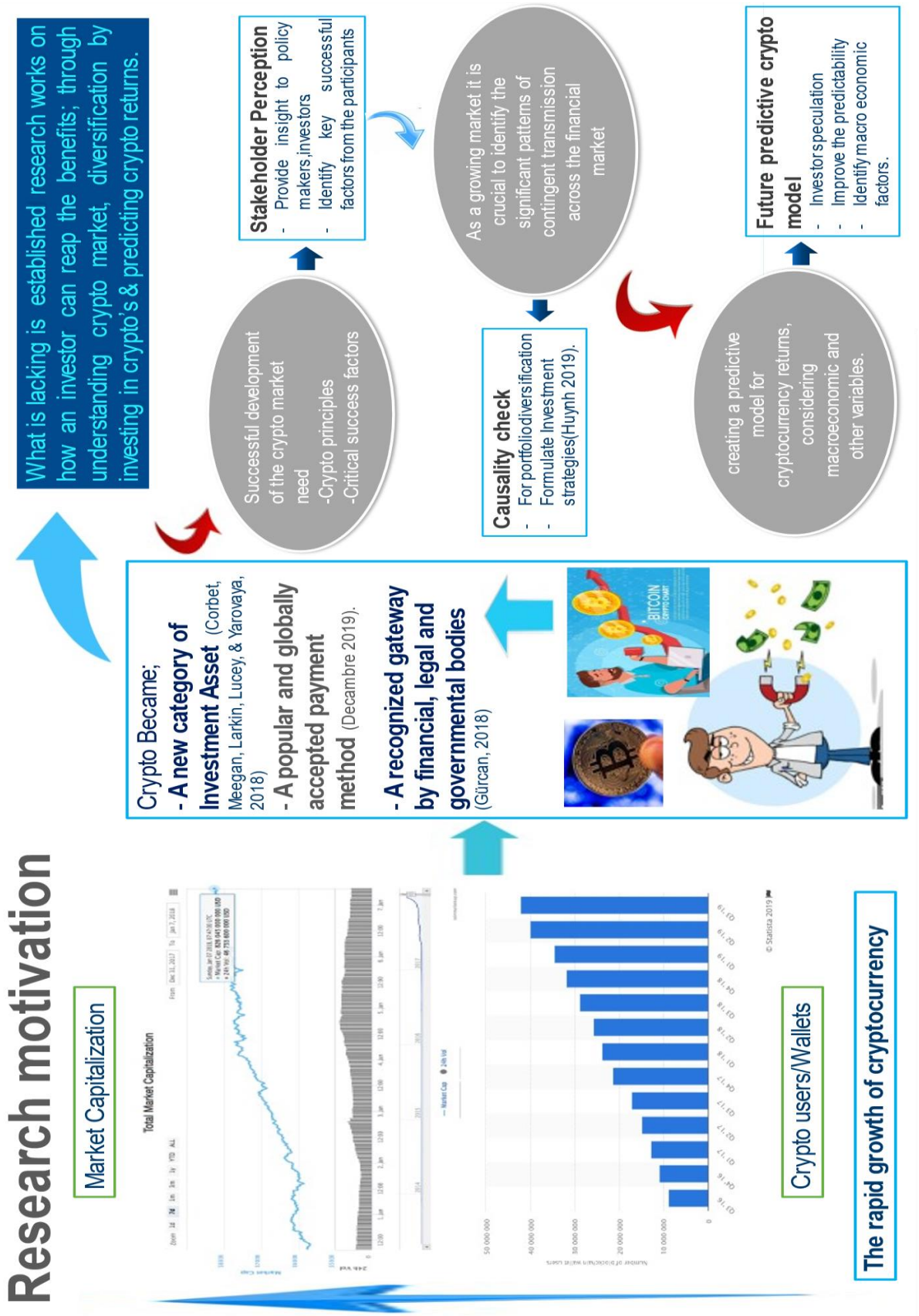
Source-*The Law Library of Congress, Global Legal Research Center, USA*

A.4: Legal and illegal countries - 2020



Source-*The Law Library of Congress, Global Legal Research Center, USA*

A.5: Research motivation -



APPENDIX B

Appendix B.1 Individual stakeholder perception findings

	Qty			%			
	Positive	Negative	Neutral	Positive	Negative	Neutral	**Total**
#Cryptocurrency	71,413	5,503	31,881	66%	5%	29%	108,797
#Cryptocurrency + #Investor	2,666	340	3,307	42%	5%	52%	6,314
#Crypto Currency + #Governm	108	15	81	53%	7%	40%	203
Cryptocurrency	145,249	16,273	80,267	60%	7%	33%	241,789
Cryptocurrency Price	48,039	7,145	36,689	52%	8%	40%	91,874
#Ethereum	42,842	10,030	36,511	48%	11%	41%	89,384
#Ethereum + #Investor	1,400	251	1,855	40%	7%	53%	3,507
#Ethereum + #Government	673	74	887	41%	5%	54%	1,635
Simple Ethereum	108,277	19,972	74,685	53%	10%	37%	202,933
Ethereum Price	35,141	7,116	38,932	43%	9%	48%	81,188
#Bitcoin	53,883	9,439	38,093	53%	9%	38%	101,414
#Bitcoin + #Investor	3,851	503	4,308	44%	6%	50%	8,661
#Bitcoin + #Government	269	44	177	55%	9%	36%	491
Bitcoin	148,345	29,410	121,054	50%	10%	41%	298,810
Bitcoin Price	116,086	38,775	146,304	39%	13%	49%	301,165
Bitcoin Market	149,773	32,576	116,746	50%	11%	39%	299,095
#XRP	94,167	17,235	86,124	48%	9%	44%	197,525
#XRP + #Investor	7,028	1,435	4,211	55%	11%	33%	12,674
#XRP + #Government	4,174	976	4,050	45%	11%	44%	9,200
XRP Price	143,633	11,095	37,092	75%	6%	19%	191,821
crypto brokers	942	89	468	63%	6%	31%	1,499
crypto issuers	404	44	242	59%	6%	35%	690
crypto investor	44,593	6,509	91,319	31%	5%	64%	142,421
Crypto academia	27	-	32	45%	0%	55%	59
	1,222,982	214,852	955,315	51%	9%	40%	2,393,149

APPENDIX C

Appendix C.1 Unconditional correlation matrix with cryptocurrency

	BGCI	GL	SI	CP	PL	PT	Nc	BTC	ETH	BC	XRP	LTC
BGCI	1											
GL	0.0432	1										
SI	0.074	0.728	1									
CP	0.1082	0.6796	0.2653	1								
PL	0.0347	0.0512	0.203	0.2048	1							
PT	0.0656	0.0492	0.2463	0.4318	0.3754	1						
Nc	0.0123	0.0879	-0.001	-0.0502	-0.0218	-0.0017	1					
BTC	0.013667	0.097667	-0.00111	-0.05578	-0.02422	-0.0019	-0.024	1				
ETH	0.015185	0.108519	-0.00123	-0.06198	-0.02691	-0.0021	-0.027	-0.02691	1			
BC	0.016872	0.120576	-0.00137	-0.06886	-0.0299	-0.0023	-0.03	-0.0299	-0.03364	1		
XRP	0.018747	0.133973	-0.00152	-0.07651	-0.03323	-0.0026	-0.033	-0.03323	-0.03738	-0.03021	1	
LTC	0.02083	0.148859	-0.00169	-0.08501	-0.03692	-0.0029	-0.037	-0.03692	-0.04153	-0.03356	-0.0623	1

Appendix C.2 Unconditional correlation matrix with cryptocurrency

	BGCI	GL	SI	CP	PL	PT	Nc	BTC	ETH	BC	XRP	LTC
BGCI	1											
GL	0.0432	1										
SI	0.074	0.728	1									
CP	0.1082	0.6796	0.2653	1								
PL	0.0347	0.0512	0.203	0.2048	1							
PT	0.0656	0.0492	0.2463	0.4318	0.3754	1						
Nc	0.0123	0.0879	-0.001	-0.0502	-0.0218	-0.0017	1					
BTC	0.073708	0.055281	0.276742	0.485169	0.421798	1.1236	1.26	1				
ETH	0.01382	0.098764	-0.00112	-0.0564	-0.02449	-0.0019	1.12	0.111266	1			
BC	0.082818	0.062113	0.310946	0.545133	0.47393	1.2625	1.42	0.069976	0.350306	1		
XRP	0.015528	0.110971	-0.00126	-0.06338	-0.02752	-0.0021	1.26	0.125018	-0.00142	-0.0714	1	
LTC	0.093054	0.06979	0.349377	0.612509	0.532506	1.4185	1.59	0.078625	0.393602	0.690042	0.599911	1