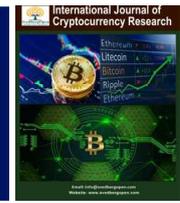




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Cryptocurrency and Global Finance: Intersections of International Security, Terrorist Financing, and Financial Development

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Abstract

Cryptocurrency has a dual nature, serving as both a tool for financial inclusion and resilience, as well as a security threat. Research on cryptocurrency adoption and market dynamics in Central and Southern Asia, Sub-Saharan Africa, and Latin America from 2019 to 2024 reveals significant adoption driven by financial needs, with the market expected to reach \$13.19 billion by 2030. However, the study also highlights the risks associated with cryptocurrency, including its use by terrorist organizations, which raised \$193 million during the study period. To mitigate these risks, the study recommends implementing robust regulatory measures. This includes Know Your Customer (KYC) protocols for cryptocurrency exchanges, international tracking standards for cross-border transactions, and advanced blockchain analytics to monitor suspicious activities. Additionally, public-private partnerships are essential for striking a balance between innovation and security. The Paper underscores the need for informed regulatory frameworks that promote innovation while addressing risk management. By adopting a balanced approach to cryptocurrency regulation, policymakers and industry stakeholders can harness the potential of cryptocurrency to transform the international financial landscape while minimizing its risks. Ultimately, this study's findings can inform policy decisions and industry practices, promoting a more secure and innovative financial system.

Keywords: *Cryptocurrency, Financial innovation, Emerging markets, Blockchain, International security, Regulatory challenges, Financial development*

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1. Introduction

The World has been compressed into a single global village: as such Globalization has makes Cryptocurrency to challenge state Sovereignty. Cryptocurrency is a type of an electronic or virtual money which can be considered as one of the brightest creations in the contemporary world of finance. As we shall see, it has effectively challenge fiat money, as well as the centralized banking systems that have been in operation for years. The key

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distinction of cryptocurrency is its build on the principles of blockchain technology. It is created to make the record of the transaction, free from tampering, open to everyone and can be controlled by anyone without the help of a third party – a bank or an authority. This makes the decentralized nature of cryptocurrencies, a fundamental pillar in the establishment one of the major reasons that its influence is steadily increasing in the world economy. Bitcoin is the world's largest and was created in the year 2009 by a person or a group of people by the name Satoshi Nakamoto. Bitcoin was and is meant to be a new type of currency to compete with government money, which offers an independent form of payment that is not mediated by any authority. After the emergence of Bitcoin, thousands of additional cryptocurrencies, referred to as altcoins such as Ethereum, Ripple (XRP), Litecoin, Monero and Tether, each of which has its own functions, for example, smart contracts (Ethereum), anonymity (Monero), or stability (Tether, or stablecoin).

Crypto currency has challenged the conventional financial systems since it offers a decentralized or P2P way of transacting funds. Conventional banking which is also known as third party cheques has various transactions involving a sequence of entities including banks, credit card companies and clearing houses all of which charge transaction costs as well as time. Cryptocurrencies eliminate these middlemen since they enable people to transfer funds to any location in the world, with reduced fees and in real-time using blockchain. For instance, where one user wants to transact with another cross border, say from America to Japan, it can be done within minutes and for a much lower cost than that of wire transfers or such services as Western Union (Nakamoto, 2009). This has significant development implications especially for the international financial system especially in the areas of trade and transaction, migration and money transfers, and access to finance. With cryptocurrency, cross-border transactions which are usually characterized by their slow and high cost due to some intermediaries and regulatory measures, are facilitated. Cryptocurrencies are gradually turning into a more suitable replacement for more conventional methods of transferring money across borders or using international payment services because in many countries people are unable to use services from a well-established financial institution. In areas like Sub-Saharan Africa and Latin America the use of cryptocurrencies is undertaken to make remittance payments across borders and avoid costly processes (World Bank, 2020).

One of the main signs of the cryptocurrency role in the global economy is the possibility to increase the number of people with access to the financial systems. There are still 1.7 bn individuals globally who do not use banking accounts, credit, or savings-well referred to as 'unbanked' – as per the World Bank (2020). It is more evident in developing nations where there is little or no financial formal, and people rely on cash and non-sanctioned financial companies. Because of their decentralized and digital characteristics, cryptocurrencies can help unbanked population by giving them another way of storing value, transferring money and accessing a number of other financial services without the need of using more common physical bank account. For example, considering the fact that the mobile money systems such as M-Pesa have become regular methods of operations in countries such as Kenya – cryptocurrencies are able to act as a complimentary or even a replacement for such schemes, a particularly with regard to international operations (Pisa and Juden, 2020). In those areas which are burdened with high inflation rates local to their respective zones, cryptocurrency solutions such as Bitcoin or stablecoins anchored to the fiat money (like the USD) are more reliable instruments for storing value. For example, in Venezuela where, inflation rates were very high individuals invested in cryptocurrency to safeguard against rapid erosion of value on their money (BBC, 2021).

Cryptocurrencies have brought novelty in the sort of investment and financial assets with the help of Initial Coin Offerings (ICOs) and Decentralized Finance (DeFi). The progression of Initial Coin Offerings made it possible for start-ups to tap capital markets through selling own digital money or tokens within their organized token offerings as an alternative to the conventional sources of funds, such as venture capital. While ICO became a popular method of fraudster and get-rich-quick schemes during 2017-2018, ICO proved that cryptocurrencies can radically transform the approach of companies to capital formation. Likewise, there has been a rise of DeFi, a new financial system that is based on blockchain platforms. With the help of DeFi participants can exchange assets, borrow or lend assets, participate in insurance, and other forms of getting a profit or protection without involving third parties like banks or brokerage companies. This democratization of finance has helped to open capital markets to those who were locked out or under-banked by the conventional system extolled before (Zhang and Xie, 2021). Cryptocurrency has grown so fast, and has also raised a lot of questions on the current legal systems in the world. It is to note that the issuance and use of cryptocurrencies,

primarily, still happen with limited regulatory oversight in a number of nations, which has led to issues that relate to money laundering as well as tax evasion and even to the financing of terrorism. Cryptocurrencies pose concerns due to their openness and the fact that they work through networks that are complex, thus hard to regulate with standard banking rules mainly because most cryptocurrencies operate past a level of *pseudonymity* or even anonymity.

Few governments and regulatory agencies have thus far been quick to adapt to cryptocurrency due to the fact that this technology is predominantly decentralized and borderless. The Financial Action Task Force (FATF) and others have provided policy frameworks which aim to address the shortcomings of cryptocurrencies by using methods that check Anti-Money Laundering (AML)/Counter-Terrorism Financing (CTF) standards. But it has been revealed that legal approaches have been country-specific in nature. Some have developed sound legislation and regulatory environment for cryptocurrency trading platforms like Japan while other's like China sought to ban cryptocurrency trading and mining in its entirety (FATF, 2021). Cryptocurrency and the concept of decentralization has also been instrumental in changing regional and economic balance. At times, cryptocurrencies have been viewed as an option through which eligible countries can go round the world to get sanctions. According to Chainalysis, Iran and North Korea have been known to use cryptocurrency in circumventing the effects of sanctions by using cryptocurrency to conduct their business outside the usual financial system. This has led to increased worry about the state of cryptocurrency especially their influence towards the instability and insecurity of the global financial structures. Further, beginning the use of the Bitcoin as legal currency in 2021, El Salvador showed how countries could incorporate crypto currencies into their economies. The use of Bitcoin along with the U.S. dollar was an attempt at El Salvador's part to lower the cost of transfers and bring its population better financial solutions (BBC, 2021). But this step has also raised questions about the possibility of national authorities using such unstable and unstandardized assets as components of official national currencies.

1.1. Statement of the Problem

The core problem this study seeks to address is the dual nature of cryptocurrency: Even though it can promote financial development to the maximum level, it helps effectively in threatening activities including terrorism financing and organized crime. That is the issue governments and financial regulators are now grappling to solve how to regulate cryptocurrency so as to reduce risk involved without over regulating in a way that hinders economic development. Cryptocurrency's anonymity and global acceptance means regulators have a very hard time attempting to monitor and eradicate its utilization in unlawful incidents. The regulation of cryptocurrencies is another interesting point; while recognized financial systems actors have strict AML/CTF measures in place, cryptocurrency networks are often not fully regulated in many countries, thus they may remain open to malicious actors. Fund transfer by terrorist organizations for instance, involves the use of the cryptocurrencies due to their anonymity and the fact that they can be easily converted into fiat currencies in countries where these cryptocurrencies go unregulated.

At the same time, such objective realities as the possibilities offered by cryptocurrencies for providing access to basic financial services in those countries and regions where the basic infrastructure of a financial sector is either underdeveloped or nonexistent cannot be denied. Cryptocurrencies as means for improving finance inclusion can contribute to the fight against poverty, promote economic stability, and create new ways for generating income and doing business in the developing countries settings. Hence the main question is to determine the right approach to regulating the technology, for a situation where it is abused for wrong doings but is a potential tool for world financial breakthrough when adopted rightly.

1.2. Significance of the Study

This study is significant because it tackles a critical contemporary issue in global finance: how the cryptocurrency is likely to revolutionise the financial world as well as being a threat to international security. As this paper will move through an analysis of the impact that cryptocurrency has brought to the society, both its pessimistic and optimistic aspect, the hope will be to help the regulators, policy makers, and financial institutions formulate measures that will help improve the security of these systems without compacting the growth of innovation. In

this perspective, the findings of this study will be valuable to national governments, global organizations, and cross-national financial controlling apparatuses.

1.3. Research Objectives

1. To analyze the role of cryptocurrency in international security, with a focus on terrorist financing.
2. To examine the impact of cryptocurrency on global financial development.
3. To assess the regulatory challenges and opportunities presented by cryptocurrency in the international financial system.
4. To propose recommendations for balancing security concerns with financial innovation.

1.4. Research Questions

1. In what regard does cryptocurrency affect international security, especially with respect to terrorist financing?
2. What has been the influence of cryptocurrency to global financial development?
3. What are the key regulatory concerns and possible futures for cryptocurrency in the international financial system?
4. What measures can be taken in order to achieve a kind of synthesis between security and financial creativity in the sphere of cryptocurrencies regulation?

1.5. Theoretical Framework

The study utilizes two theoretical lenses: First, there is the Financial Innovation Theory and second there are the International Relations theories, specifically the Realism Theory and the Liberal Institutionalism Theory.

1.6. Financial Innovation Theory

According to Financial Innovation Theory the article explains us how the need of developing new financial technologies and instruments occur. Due to its characteristics of decentralized, transparent, and secure method, cryptocurrency from the frontier of financial technology could effectively challenge the traditional bank. These impacts include circuiting new ways of financial inclusion, reducing costs of transactions and promoting cross border business. In their study, Beck *et al.* (2018) defined financial innovations as the application of an innovative new technique to utilize traditional financial services in order to serve clients' needs more effectively and efficiently, for example, through the use of cryptocurrency to avoid regulatory restraints. But this theory also recognises that such innovations, as well as useful for the intended aims, also have a problematic by-product on the intended goals, including regulation and its use in unlawful purposes including terrorism financing. Cryptocurrency is a good example where financial innovation lubricates legitimate economic activity but put in place paths for illegitimate use as well.

1.7. Realism and International Relations

Realism is one of the theories in International Relations that puts much of its focus in the state/self-interest and involving power. According to Realists, states have to do something in order to secure them in world that is anarchical and filled with threats ranging from other states, through increasing non-state actors such as terrorists (Walt, 2018). When applied to the sphere of Crypto currency, Realism assist to understand why it matters to governments to regulate possible negative uses in something like financing of terrorisms acts. The reliably anonymous nature of cryptocurrencies makes them ideal for use by criminals and extremists which is a serious problem for the state. In the minds of Realists, Cryptocurrency has to be regulated to ensure state power and security in times when decentralized financial technologies do not fit into a state's control structure.

1.8. Liberal Institutionalism

Liberal Institutionalism gives focus on the cooperation and institutions in relation to responses to global problems. Hence, in contrast to Realism, which is based on the notions of states' power and confrontation. The Liberal Institutional assert that states should seek to cooperate all the time because the collective benefits

outweigh the cost especially in management of international problems like financial regulation Keohane and Nye (2019). Just to moderate the risks of Cryptocurrency and enhance the importance of the innovation, multi-jurisdictional regulation is obligatory since Cryptocurrency works beyond borders of a state. International bodies such as the Financial Action Task Force (FATF) set example of such an approach to deliver global blueprint for anti-money laundering and terrorist financing regulation in cryptocurrencies. So Liberal Institutionalism argue that global governance institutions are important in order to support the role of cryptocurrency in the financial development without threat the international security.

2. Literature Review

2.1. Currency and International Security

Cryptocurrency uses a block chain as a technology platform, which makes it possible to record all the transactions in the system without having to go through a central processor. Safeguarding this technology lies in cryptographic protocols that enable reversibility of transactions making it very difficult to tamper with records. However, there is one primary and infamous feature of many cryptocurrency projects, especially Bitcoin and such offerings as Monero and Zcash—*pseudonymity* and, in some instances, complete anonymity. The anonymity that Bitcoin provides where the public ledger of transactions is actually associated with cryptographic hashes and not the users, has been dual faced. As it helps in protecting the users' authenticity or secrecy, provides anonymity in P2P transactions, no intermediaries, these also make it insecure and vulnerable to act as a mask for organized criminal groups, terrorists, or fraudsters (Foley *et al.*, 2019). Other cryptocurrencies such Monero take it a notch higher by applying special features such as stealth addresses and ring signatures whereby the transactions are almost unmatched in tracks (Noether and Mackenzie, 2016). These privacy enhancing features are of great importance to police forces around the world, because it offers the mafia a way of concealing their transactions from law enforcement agencies.

It has been shown in a number of cases that cryptocurrency is gradually being used for unlawful purposes, including financing terrorism, as well as ransomware assaults. Consequently, a report from the U.S. Department of Justice in 2020 established that agents such as al-Qaeda and Hamas use Bitcoin and other cryptocurrencies to make their appropriations. These groups depend on the decentralized and anonymous feature of cryptocurrency to circumvent legal and banking norms and restrictions (U.S. Department of Justice, 2020). Furthermore, more and more ransom seeking attacks which involve payments in cryptocurrencies has been witnessed in the recent past. There is no better example than in the WannaCry ransomware attack in May 2017 which sought to extort Bitcoin from its victims to unlock their files. Examples of these ransomware attacks include situation showing how cryptocurrency can be used for unlawful purposes and avoid notice (Europol, 2021). The blockchain analytics company Chainalysis estimated that in 2021 more than \$ 602 million were paid to ransomware attackers (Chainalysis, 2022).

There is also a trend of new approaches to the application of cryptocurrency in financing of terrorism. Al-Qaeda and ISIS in particular have been involved in seeking to fundraise through digital assets online from supporters all over the globe. An example is the Al-Qassam Brigades, a branch of Hamas, which the activity of the organization and the use of Bitcoins is public, it is clearly wanted by the leaders of the organization that people will contribute to them online. While it might have been possible to disrupt and freeze some of the wallets of the group in question, the concept of cryptocurrency equals a decentralized asset, which does not allow to completely eliminate such a business.

Due to increased instances of crime involving cryptocurrencies, global financial regulatory authorities have waded into the issue through regulation. The foremost organization to spearhead this task is the Financial Action Task Force (FATF) which has developed new measures that demand that the provision of digital currency trading platforms and wallets, must follow KYC and AML regulation (FATF, 2019). These standards aim at achieving a goal of enforcing users' identity check by the cryptocurrency service providers, monitoring of the suspicious activities and reporting of the instances of violation to the appropriate enforcement agencies. Other developed countries such as United States, Japan and most developing countries that make up the members of European Union have put in place clear structures and measures of implementing the regulation and the level of compliance and enforcement differ greatly across the world. For example, Japan Payment

Services bills that make the Cryptocurrency and particularly exchange subjugate to licensing procedures and requires that they meet KYC and AML standards as per Nishikawa (2020). On the other hand, countries with less regulatory scrutiny, such as Venezuela and Nigeria, the cryptos are still used for the same purposes.

Moreover, newer cryptocurrencies like Monero that provide extra layer of anonymity to the transactions, have come under the regulatory radar. Some exchanges have dumped anonymity coins because they can allegedly be used for unlawful purposes (Europol, 2021). However, all these regulatory efforts have shown some degree of success and are still, not without their blunders. Due to cryptocurrency use outside the control of national or global governments and in its decentralized setting, the actors involved can just switch jurisdictions where their actions will not be restrained or can begin using DeFi platforms that do not have intermediaries.

2.2. Financial Development and Crypto Currency

Cryptocurrency can be seen as a revolutionary element in the global monetary systems since it is still an attempt to bypass central banks and associations for finance. Blockchain technology has seen the emergence of Decentralized Finance DeFi, which offers different models of financial service that do not require a middleman or intermediary of any kind – banks, payment providers, etc. DeFi presents users the opportunity of performing various financial transactions directly with other individuals without involving intermediary institutions at significantly lower rates than would be expected with conventional services (Zhang and Xie, 2021). Cryptocurrency has also raised interest in the international monetary system especially due to its potential to offer almost instantaneous, cheap and digitally based cross-border transactions using its underlying technology. For example, Ripple Company's XRP network claims to be faster and cheaper than the System for Worldwide Interbank Financial Telecommunication (SWIFT) in cross-border transfers. Cryptocurrencies and block chain have an opportunity in reducing trade costs in the international market remittances which would greatly benefit developing economies which have a lack of banking system (Bouveret, 2019). Nonetheless, the phenomenon of cryptocurrency has brought some issues for the traditional financial sector. Especially, central banks have raised many concerns regarding the emerging dominance of cryptocurrencies as mediums for monetary policy as well as financial frameworks. As a result, central banks are considering adoption of Central Bank Digital Currencies (CBDCs) to offer a legal tender digital currency and avoid cryptocurrencies (BIS, 2021).

The use of cryptocurrency has the potential to help the unbanked population have access to basic financial services; this is especially in the developing world where access to of financial services is nearly impossible. A recent survey conducted by the World Bank shows that over 1.7 bn of the population of adult people have no access to the banking services throughout the world, the majorities of whom reside in the developing world (World Bank, 2020). Cryptocurrency, being decentralized and easily accessible is an exquisite solution for the people with no access to traditional financial systems. For instance in Sub-Saharan Africa, the use of cryptocurrency has been very popular. For instance, as a result of a higher level of Bashes and inflation rates in Nigeria, the use of cryptocurrency has increases since it is an effective way of avoiding the restrictive monetary policies. There are many Nigerians who have embraced the use of cryptocurrencies for cross border remittances, savings, and investments and the traders such as the Paxful have recorded enhanced transaction volumes from the Nigerian market. Likewise, Kenya's mobile payment platform also includes an element of cryptocurrency, M-Pesa has provided chances for people in rural areas to get access to the financial sector. Fiat-backed cryptocurrencies, also referred to as stablecoins, are far less volatile than highly erratic currencies such as Bitcoin. These stable digital currencies are especially beneficial in nations with an unstable economy where inflation as well as the depreciation of local currency erodes the local money purchasing power. For instance, Tether and USD become famous in locations like Argentina and Venezuela, where citizens use them to protect themselves against spikes in inflation (Auer and Tercero-Lucas, 2021).

Cryptocurrencies are decentralized and anonymous in most of their use cases, which present a major problem for the accounting and auditing professions. The high fluctuations in value of cryptocurrencies, combined with the absence of Generally Accepted Accounting Principles (GAAP), which guide the reporting of such assets, also pose a challenge. There is also difficulty in how auditors confirm that such assets belong to the owner as well as their existence since cryptocurrencies are records on the blockchain (Ernst and Young,

2021). They are commonly done in decentralized finance contracts that make auditing even more challenging. Self-executing contracts written directly into blockchains eliminate the need for middlemen but come with brand-new possibilities of associated threats. Cryptocurrency auditors went from simply auditing transaction evidence to auditing code for smart contracts, making audits even more complicated for auditors (Verrückt, 2021). Furthermore, existing international accounting standards have not been developed to meet the growing advancement in technologies such as cryptocurrency. Even the IASB and other such regulatory bodies have begun to debate the right way to categorize and report such currencies, but decisions have not yet been made. This lack of clarity poses a challenge to companies and auditors, to be able to ensure that standards regarding traditional financial reporting are being met (Ernst and Young, 2021).

2.3. Global Regulatory Landscape

Many countries have implemented policies concerning the use of crypto currencies owing to differing levels of official endorsement and existing attitudes towards the possible pitfalls of the form of currency. One of the world's most elaborate systems for regulating cryptocurrencies has been implemented in Japan. According to PS Act, all the cryptocurrency exchanges need to obtain the registration with Japan's FSA and necessarily have to follow the common policies of KYC/AML making cryptocurrency transactions more accountable and transparent (Nishikawa, 2020). On the other hand, China has tread a much harder line, outlawing cryptocurrency usage and mining completely. The People's Bank of China has complained about the destabilization of the fiat currency system by the decentralized system and the possible control of capital flight through cryptocurrencies (People's Bank of China, 2021). However, some countries such as El Salvador have gone a step forward by making Bitcoin legal tender due to aims of increasing financial usage and charger lower cost for remittance (BBC, 2021).

Nowadays, global cooperation plays a crucial role in regard to the cryptocurrency that contributes to the global challenges. The Financial Action Task Force (FATF) has taken the leading role in terms of coordinating the process of establishing the international standards for regulation of cryptocurrencies. One of its recommendations published in 2019 expects countries to regulate VASPs under the of KYC/AML (FATF, 2019). However, enforcement is still partial because many countries do not have the equipment or procedural framework to properly enforce these standards. There is a growing maturity signaled by different regional organizations such as the European Union, with their innovations on the regulation of cryptocurrency. The Markets in Crypto-assets (MiCA) came into force in 2020 by the European Union, which sets rules designed to provide a legal framework for virtual assets to protect consumers and maintain market integrity (EU, 2020). However, this has still remained a challenge due to the multiple jurisdiction approach to cryptocurrency regulation by different countries in the world.

However, there is still a considerable degree of untouched ground when it comes to unregulated cryptocurrency, especially in the world of DeFi. The decentralized platforms of the DeFi industry creates challenges for regulators since they operate independently of middlemen, such as central banks. Due to the fact that most of these platforms are not associated with conventional financial institutions, they are frequently excluded from the existing regulatory affirmation (Zhang and Xie, 2021). Furthermore, the anonymity of parties in decentralized finance make it almost impossible for regulatory authorities to demand KYC/AML compliance. Another area of regulation deficiency is the variability of standards being employed in different countries. While some countries have well-structured rules that regulate Cryptocurrencies, others have no rules at al so that it presents a chance at Regulatory Arbitrage. Opportunistic bad players can take advantage of such weakness and transfer their operations to the next region, thereby frustrating global fight against money laundering, terrorist financing, and other unlawful activities (FATF, 2021).

3. Methodology

This study employed a systematic approach to the analysis of cryptocurrency adoption patterns worldwide, market dynamics, and regional variations in cryptocurrency usage. The methodology adopted combines quantitative analysis of blockchain data with geographic segmentation to provide holistic insights into the fast-evolving cryptocurrency ecosystem. The main analytical tool used in this report is the Global Crypto Adoption Index, which aggregates four separate sub-indices measuring on-chain value across different

dimensions of cryptocurrency use. To that end, the research will apply a varied dashboard of metrics to analyze cryptocurrency market dynamics and adoption patterns. First, market capitalization in USD will be used to indicate the size and value of the market at large. Daily output values are also used in assessing transaction volumes and market liquidity. Finally, MVRV is the advanced metric applied in assessing market conditions and crypto over/undervaluation across different regions. Accordingly, data collection is a process involving constant monitoring of the blockchain networks and cryptocurrency exchanges, where data on transactions are aggregated and analyzed daily. The research gathers market metrics from reliable cryptocurrency data providers namely, blockchain.com and cross-references them to ensure accuracy. The methodological framework should allow understanding the patterns of cryptocurrency adoption, market dynamics, and differences in regional usage. The combination of quantitative metrics, geographic analysis, and market indicators allows for a multi-faceted examination of the cryptocurrency ecosystem, providing valuable insights for researchers, market participants, and policymakers.

4. Results and Findings

4.1. Market Metrics and Transaction Analysis

4.1.1. Transaction Pattern Evolution

Analysis of market metrics reveals several significant patterns in cryptocurrency adoption and usage. The data shows a consistent upward trend in daily confirmed transactions, indicating growing mainstream adoption of cryptocurrency for legitimate financial activities. This increase in transaction volume has occurred despite significant market volatility, suggesting robust underlying demand for cryptocurrency services.

4.2. Market Capitalization and Volatility

4.2.1. Global Cryptocurrency Market Cap Charts

The global cryptocurrency market cap today is \$2.46 tn, a -4.6% change in the last 24 hours and 82.1% change one year ago. As of today, the market cap of Bitcoin (BTC) is at \$1.39 tn, representing a Bitcoin dominance of 56.47%. Meanwhile, Stablecoins' market cap is at \$177 bn and has a 7.18% share of the total crypto market cap (Figure 1).

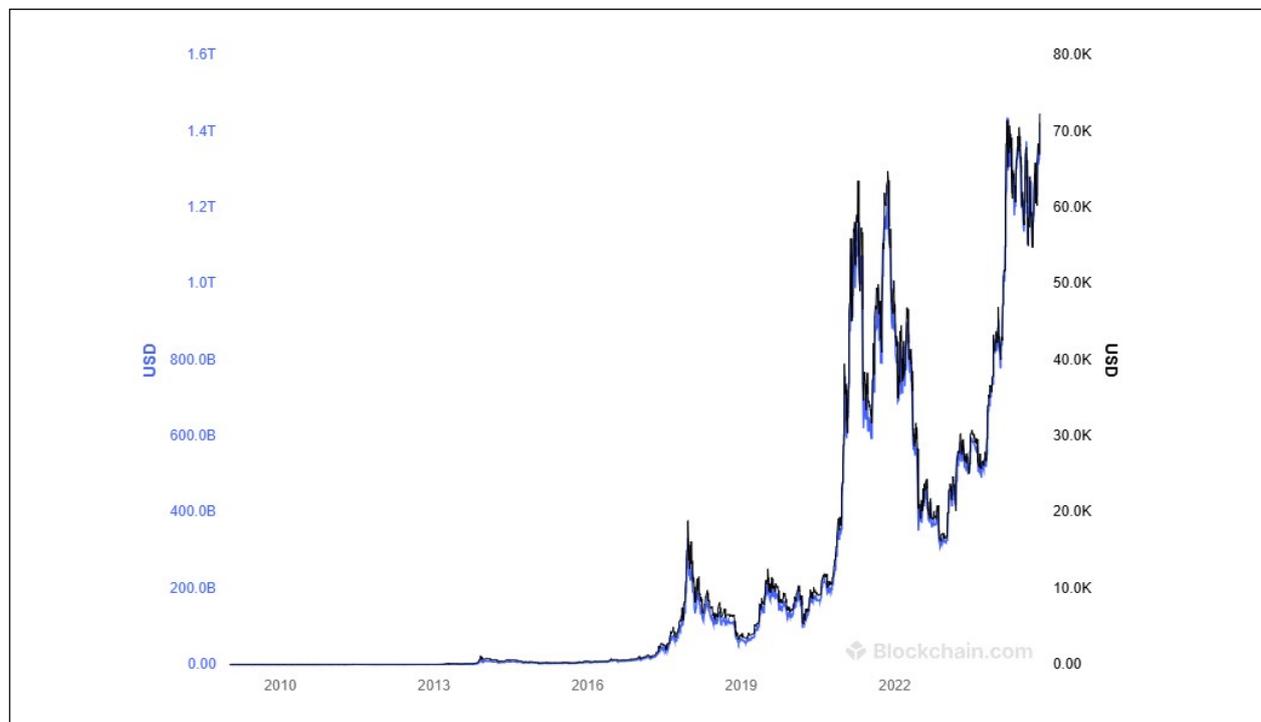


Figure 1: Global Cryptocurrency Market Cap Charts

Source: Blockchain.com

4.2.2. Confirmed Transactions per Day

The study documents substantial growth in market capitalization, though marked by significant volatility. The data reveals periodic cycles of expansion and contraction, with market capitalization showing resilience in maintaining long-term growth trends despite short-term fluctuations. This pattern suggests maturing market dynamics, where periodic volatility does not fundamentally disrupt the overall growth trajectory (Figure 2).

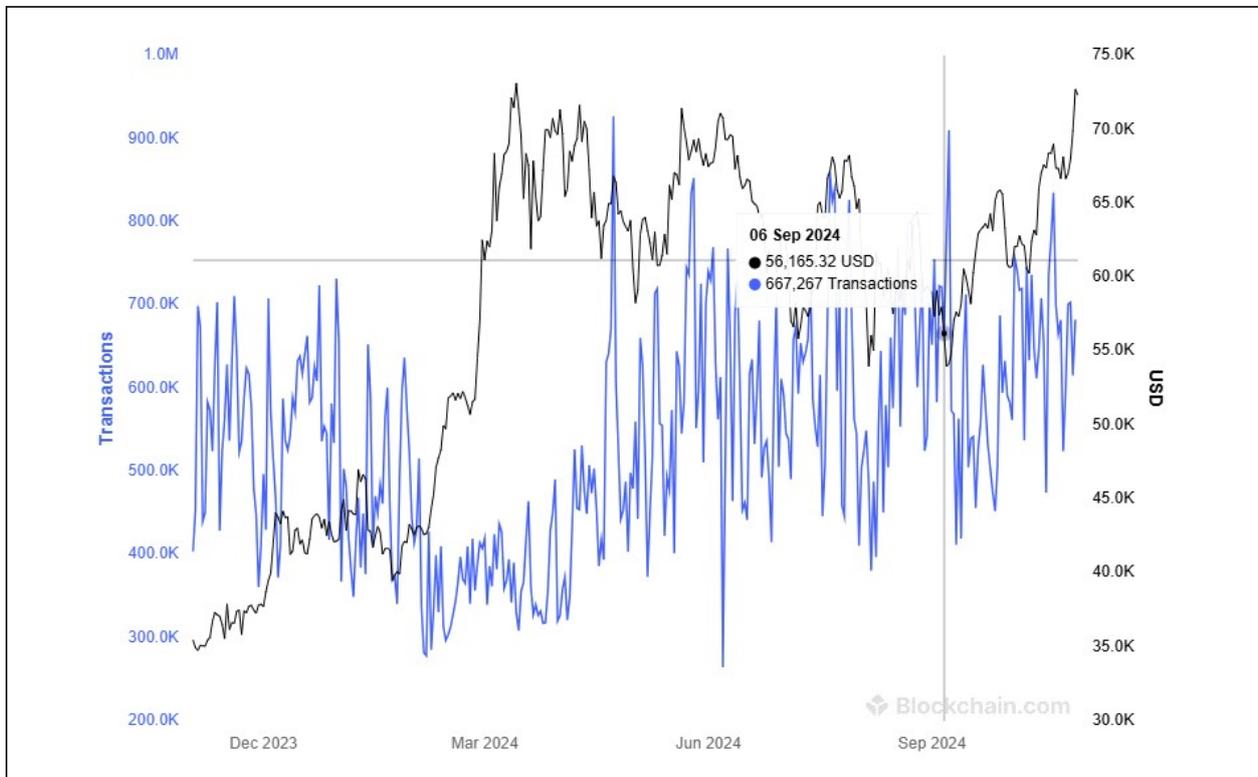


Figure 2: Confirmed Transactions per Day

Source: Blockchain.com

4.2.3. Value Transfer Patterns

Analysis of daily output values shows significant variations, reflecting the dynamic nature of cryptocurrency markets. The research identifies patterns in value transfer that correlate with both market events and broader economic conditions. These variations provide insights into how cryptocurrency markets respond to external stimuli and internal market dynamics.

4.2.4. MVRV Analysis

The Market Value to Realized Value (MVRV) ratio analysis reveals distinct market cycles, providing valuable insights into market psychology and investor behavior. The findings show that MVRV fluctuations often precede significant market movements, serving as a potential indicator of market transitions. The data indicates that these cycles have become more pronounced as the market has matured, suggesting increasing sophistication in market participants' behavior.

These findings highlight the dual nature of cryptocurrency adoption: while showing promise for legitimate financial innovation and inclusion, it also presents significant security challenges requiring robust regulatory responses. The market metrics analysis suggests a maturing ecosystem, characterized by increasing transaction volumes and more sophisticated trading patterns, despite ongoing security concerns and regulatory challenges.

4.2.5. Global Adoption Patterns and Regional Leadership

Global cryptocurrency market experienced steady growth in 2021 even though declining in 2023. In 2024 was shown relief and later growth trajectory is projected to continue robustly, with the market forecasted to surge

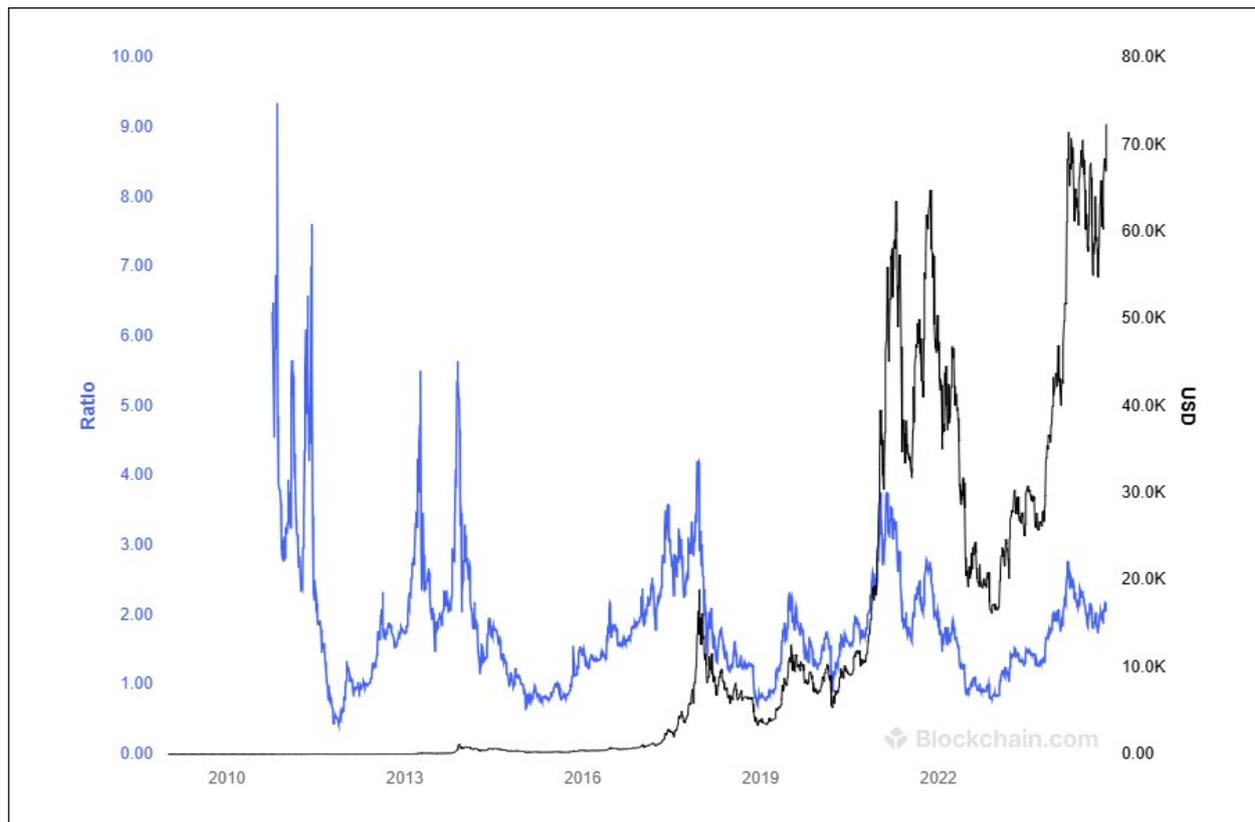


Figure 3: Global Cryptocurrency Adoption Index by Region

Source: Chainalysis.com

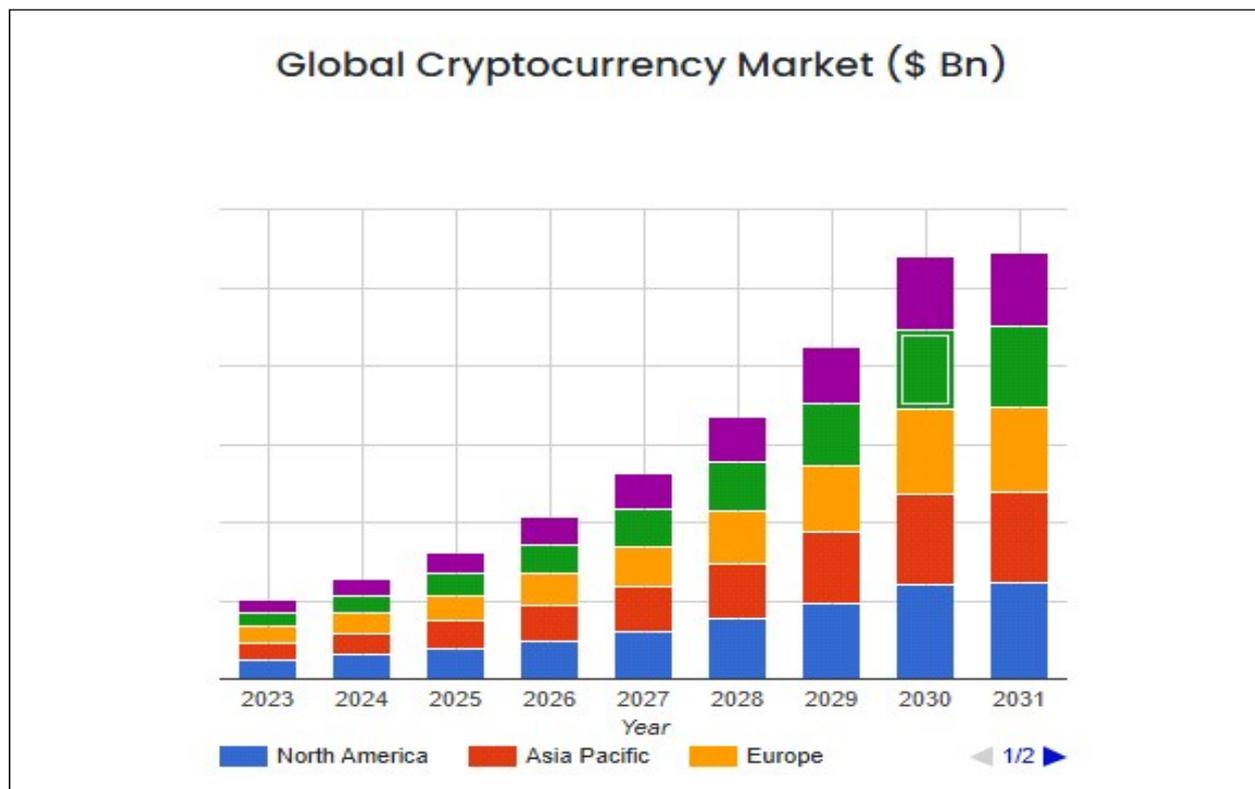


Figure 4: Market Share of Stablecoins

Source: CoinMarketCap.com

to USD 13.19 bn by 2030, indicating a Compound Annual Growth Rate (CAGR) of 12.5% during the forecast period spanning from 2024 to 2030 (Figure 4).

The 2024 Global Crypto Adoption Index reveals a strong presence of Central & Southern Asia and Oceania, with India, Indonesia, Vietnam, the Philippines, Pakistan, Thailand, and Cambodia together making up 35% of the top 20 ranked countries. India, leading overall, ranks first in both centralized service and retail centralized service value received, while Indonesia tops in DeFi value received. Sub-Saharan Africa’s Nigeria, holding 10% of the list, ranks second overall and performs strongly across all categories. North America’s United States and Canada represent another 10%, with the U.S. holding a notable position in centralized service values. Latin America follows with 20%, including Brazil, Venezuela, Mexico, and Argentina, underscoring this region’s rising role in crypto adoption amidst economic instability. Eastern Europe (Ukraine and Russia) and Eastern Asia (South Korea and China) each contribute 10%, while Türkiye in the Middle East & North Africa and the United Kingdom in Central, Northern & Western Europe each account for 5%, indicating a broad but varied global engagement with crypto across economic and regulatory landscapes.

Recent analysis underscores the significant regional variations in global cryptocurrency adoption, with emerging markets now leading the way (Chainalysis, 2024). Countries such as India, Nigeria, and Indonesia illustrate this trend, showing high levels of engagement across retail and decentralized finance (DeFi) services, driven in part by economic challenges and gaps in traditional financial infrastructure (Chainalysis, 2024; Bozhko et al., 2024).

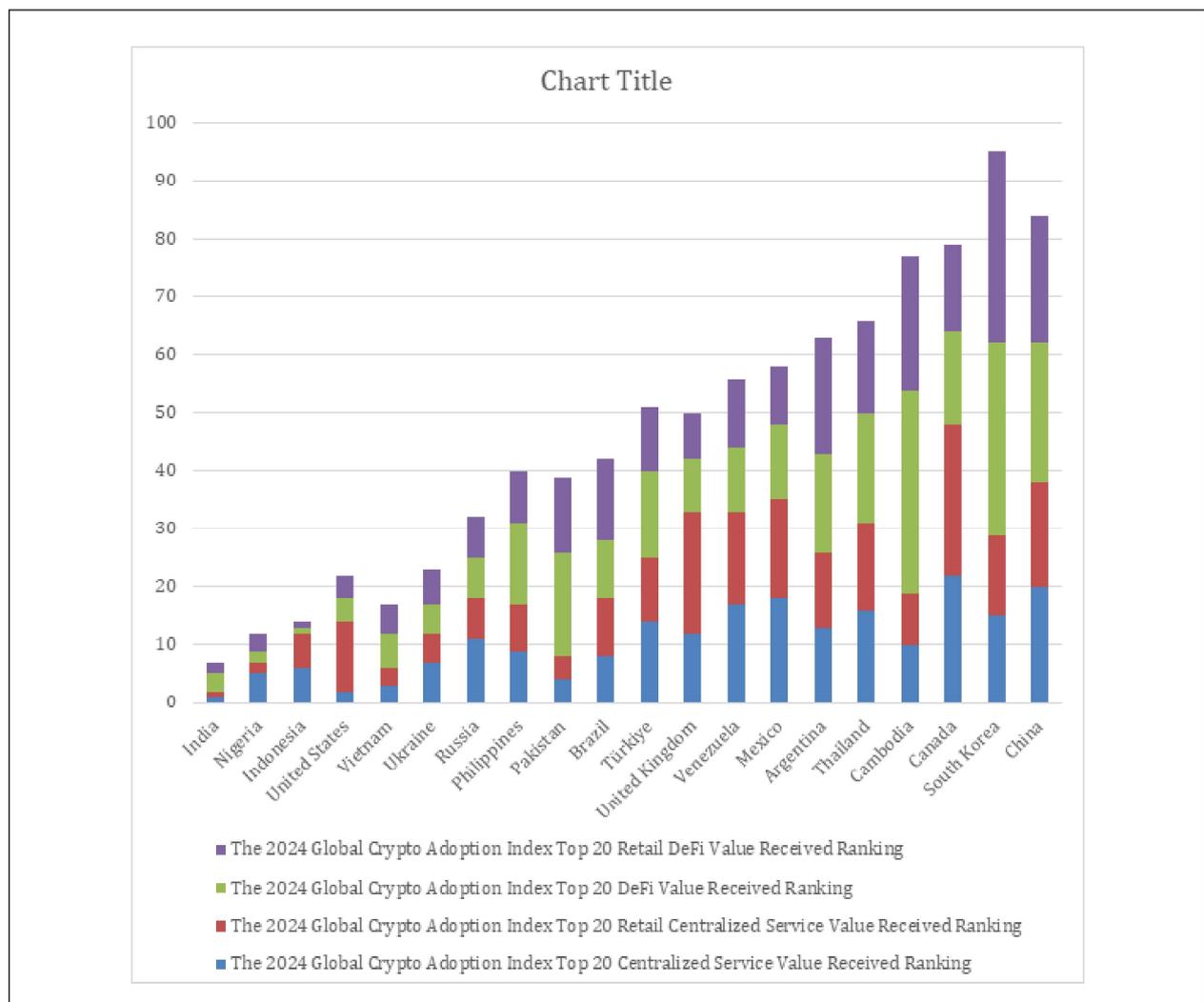


Figure 5: Regional Breakdown of Top 20 Countries by Crypto Usage

Source: Regional Breakdown of Top 20 Countries by Crypto Usage

India has taken the global lead, achieving the top position in the overall adoption index. Its strong engagement spans both retail and institutional levels, reflecting a highly integrated cryptocurrency ecosystem. Notably, India ranks first globally in centralized service value, showing dominant usage of traditional exchange platforms. Additionally, its third-place ranking in DeFi value highlights substantial interaction with decentralized platforms, marking India as a robust player in the digital financial landscape (Chainalysis, 2024).

Nigeria follows closely, ranking second overall and standing out in grassroots adoption. Its high rankings in retail centralized service usage and DeFi value suggest a balanced, mature engagement across both centralized and decentralized services. This pattern of adoption likely stems from the country's demand for remittance solutions and alternative financial services, pointing to cryptocurrency's role in addressing practical needs beyond speculative investments (Bozhko *et al.*, 2024; Kavaloski, 2024).

Indonesia ranks third globally, with a particularly strong performance in DeFi adoption. It leads in both DeFi value and retail DeFi value metrics, demonstrating a deep-rooted understanding of decentralized financial tools at both individual and institutional levels. This suggests that Indonesia's market is not only large but also sophisticated, utilizing advanced cryptocurrency applications to meet various financial needs (Chainalysis, 2024).

The growing presence of Asian and African nations at the forefront of cryptocurrency adoption underscores a shift in the global landscape, where digital assets are increasingly relevant in regions with limited traditional financial services (Nakhle, 2022). The findings suggest that in these markets, cryptocurrency serves essential financial functions from transaction facilitation to complex financial services addressing unmet needs and fostering financial inclusion (Bozhko *et al.*, 2024).

4.3. Security Concerns and Illicit Usage Patterns: Analysis of Terrorist Financing Activities

The increasing reliance of terrorist organizations on cryptocurrency for fundraising poses significant challenges to international security, particularly in the realm of terrorist financing. Between 2019 and 2023, there has been a notable uptick in the use of cryptocurrencies by groups such as Hamas and the Palestinian Islamic Jihad (PIJ), which reportedly raised over \$100 mn and \$93 mn, respectively, through digital donations (Torres, 2023). The Qassam Brigades, Hamas' military wing, initiated Bitcoin fundraising campaigns in 2019, prompting a robust response from U.S. authorities who seized approximately 150 cryptocurrency accounts and related websites (Torres, 2023). This crackdown was mirrored by Israeli efforts to confiscate crypto addresses associated with PIJ, illustrating a coordinated international response aimed at curtailing terrorist financing (Torres, 2023).

The sophistication of fundraising strategies employed by terrorist entities has evolved significantly. Groups such as Al-Qaeda and ISIS have adopted advanced tactics that exploit the pseudonymous nature of digital currencies. They utilize various cryptocurrencies and complex transaction layering techniques to obscure the origins of their funds, complicating traditional tracking methods (Leuprecht *et al.*, 2023). This adaptability highlights an emerging trend where these organizations navigate the less regulated landscape of cryptocurrency to enhance their financial capabilities (Rosenquist *et al.*, 2024).

Recent regulatory actions underscore the urgent need for an international framework to address these threats. In 2023, the U.S. Treasury imposed a \$4 billion fine on Binance for failing to prevent transactions linked to Hamas, while state-sponsored actors from nations like Russia and North Korea have exploited cryptocurrencies to evade sanctions and fund military operations. Notably, North Korea's Lazarus Group has financed missile development through cyberattacks targeting cryptocurrency exchanges (Farber and Yehezkel, 2024). These developments highlight a pressing need for stringent global regulations to mitigate cryptocurrency's role in facilitating terrorism and political violence (CRS Reports, 2023; Levitt, 2023).

This Study, therefore, Aims to Address Research Question 1 (RQ1): What role does cryptocurrency play in international security, with a particular focus on terrorist financing? By examining the intersection of cryptocurrency and illicit financing, the study seeks to provide insights into how these digital assets contribute to security challenges and to inform policy frameworks that balance financial innovation with security imperatives.

4.4. Cryptocurrency Use Cases and Implementation in Financial Development

4.4.1. Financial Necessity and Cryptocurrency Adoption in Emerging Markets

The study reveals that cryptocurrency adoption in emerging markets is largely driven by financial necessity rather than speculative interest, especially in regions where traditional banking infrastructure is limited (Chainalysis, 2024; Setyawan *et al.*, 2024; Maulia and Kamil, 2024). Data indicates that countries across Latin America and Sub-Saharan Africa lead in adoption rates, having developed advanced cryptocurrency ecosystems tailored to meet local financial needs where conventional services fall short (Chainalysis, 2024; Wójcik-Czerniawska, 2019).

A prominent trend is the growing reliance on stablecoins as a hedge against inflation in economically unstable countries. Argentina, for example, has seen a surge in stablecoin adoption in response to inflation and currency devaluation, with spikes in usage closely following policy changes and economic volatility. This pattern underscores stablecoins' role in value preservation within uncertain economic environments (Chainalysis, 2024).

Nigeria exemplifies the potential of cryptocurrency to promote financial inclusion in regions with limited access to traditional banking. As a leading country in DeFi adoption within Sub-Saharan Africa, Nigeria has shown how cryptocurrency can deliver essential financial services otherwise unavailable. Notably, stablecoins account for 40% of Nigeria's cryptocurrency inflows, illustrating a preference for stable digital assets in daily transactions. This trend reflects the practical benefits of stablecoins in volatile economies, where they serve as reliable alternatives to national currencies (Chainalysis, 2024; Lawal *et al.*, 2023; El Hajj and Farran, 2024).

The study also highlights the impact of cryptocurrency on remittance systems, showing that cryptocurrency-based remittances can reduce transaction costs by up to 90% compared to traditional methods. This cost efficiency is especially beneficial for migrant workers and families, who typically face high fees for international transfers. Such reduced costs emphasize cryptocurrency's role in providing affordable cross-border financial solutions (Chainalysis, 2024; Diyorbek *et al.*, 2024).

In emerging markets, the adoption patterns suggest that users leverage digital assets to access essential financial services, preserve value, and conduct cross-border transactions – services that are often inaccessible or prohibitively costly through traditional banking systems. This practical use of cryptocurrency highlights its function as an alternative financial system, providing vital economic support where conventional services are inadequate (Chainalysis, 2024; Setyawan *et al.*, 2024).

These findings suggest that cryptocurrency adoption in emerging markets is more than a passing trend; it represents a transformative shift in financial service accessibility. High adoption rates in regions with minimal banking infrastructure underscore cryptocurrency's unique ability to meet critical financial needs that traditional systems have failed to address.

Thus, this Study Seeks to Answer Research Question 2 (RQ2): What impact does cryptocurrency have on global financial development? By exploring its role in emerging economies, the study aims to illuminate how cryptocurrency contributes to financial inclusion and economic resilience, redefining financial development in underserved regions.

4.5. Regulatory and Enforcement Responses to Cryptocurrency

4.5.1. Regulatory and Enforcement Responses to Illicit Cryptocurrency Use

This study explores the heightened regulatory and enforcement measures targeting the misuse of cryptocurrency, particularly in relation to terrorist financing. Recent data reveals a marked escalation in efforts by law enforcement and regulatory bodies to monitor and intercept illegal cryptocurrency transactions, such as the U.S. government's seizure of approximately 150 cryptocurrency accounts associated with Hamas. This operation underscores an expanding law enforcement capacity to trace and act on illicit crypto flows, which has become increasingly critical as cryptocurrencies gain popularity in global markets and their potential misuse rises (CRS Reports, 2023; Cumming *et al.*, 2024).

A pivotal regulatory milestone involved Binance, one of the largest cryptocurrency exchanges, which agreed to a record-setting \$4 bn settlement with U.S. authorities over money-laundering allegations (CRS Reports, 2023). This case is significant not only for its unprecedented scale but also for its implications: it highlights the essential responsibility of major exchanges in implementing effective Anti-Money Laundering (AML) protocols, as these platforms have been used for money laundering and other illicit financial activities. Consequently, the quality and rigor of enforcement directly impact market behavior and contribute to regulatory compliance across jurisdictions (Uzougbo *et al.*, 2024).

International collaboration is proving instrumental in curbing cryptocurrency misuse, as illustrated by Israeli authorities' successful seizure of crypto assets linked to the Palestinian Islamic Jihad. This action demonstrates a trend toward stronger global partnerships in tracking illicit crypto transactions and dismantling terror financing networks (Nakhle, 2022). Research underscores that transnational coordination is vital to prevent these digital assets from destabilizing security and financial integrity in vulnerable regions (Xiong and Luo, 2024).

The U.S. regulatory framework for countering terrorism financing through cryptocurrency builds on the long-established Bank Secrecy Act (BSA) of 1970, bolstered by the USA PATRIOT Act's measures post-9/11. These expanded regulations include sanctions on digital currency addresses tied to terrorist activities, providing the foundation for Virtual Asset Service Providers (VASPs) in the U.S. to comply with AML and Counter-Financing of Terrorism (CFT) requirements (Arnone, 2024). However, enforcement remains challenging, especially with foreign entities transacting with U.S. clients (Koriahina, 2024).

Recent U.S. legislative efforts, such as the proposed National Defense Authorization Act for Fiscal Year 2024, further reflect a heightened focus on AML and CFT standards for cryptocurrency. This proposed legislation seeks to standardize AML/CFT examinations within financial institutions handling digital assets, highlighting the delicate balance between regulatory rigor and the need for financial innovation. The study emphasizes that this evolving regulatory landscape is critical to addressing cryptocurrency's role in financing terrorism and illicit activities while maintaining a framework that supports technological progress (Arnone, 2024; Yan, 2024).

Ultimately, this Study Aims to Address Research Question 3 (RQ3): What are the key regulatory challenges and enforcement responses surrounding cryptocurrency's role in illicit financing, particularly in terrorism?

5. Regional Economic Impact in Emerging Markets

Central and Southern Asia and Oceania lead in cryptocurrency adoption, representing 35% of the countries surveyed (7 countries), followed by Latin America at 20% (4 countries). Eastern Asia, Eastern Europe, and North America each account for 10% (2 countries each), reflecting moderate adoption levels. Meanwhile, Central, Northern & Western Europe, the Middle East & North Africa, and Sub-Saharan Africa each contribute 5% (1 country each), indicating more selective interest in these regions (Figure 6).

The study's findings illuminate the diverse economic impact of cryptocurrency across emerging markets, particularly in Venezuela, Argentina, and Nigeria. Each country's experience with cryptocurrency adoption is shaped by its unique economic challenges and regulatory environments, leading to distinct patterns of use.

5.1. Venezuela: Cryptocurrency as an Economic Tool

In Venezuela, the adoption of cryptocurrency is deeply intertwined with government policy, economic sanctions, and the pursuit of monetary stability. Research indicates that cryptocurrency has become a vital instrument for bypassing economic sanctions, with both citizens and government entities leveraging digital assets to sustain international trade. Notably, the Venezuelan government has begun using cryptocurrency in oil trade, marking a pioneering effort by a national government to utilize digital currencies to navigate international financial restrictions (Almeida *et al.*, 2024; Chainalysis, 2024).

Analysis of adoption patterns reveals a strong correlation between cryptocurrency use and periods of hyperinflation, with increased activity observed during significant devaluation events of the bolívar. This trend indicates that citizens increasingly rely on cryptocurrency as a store of value and medium of exchange

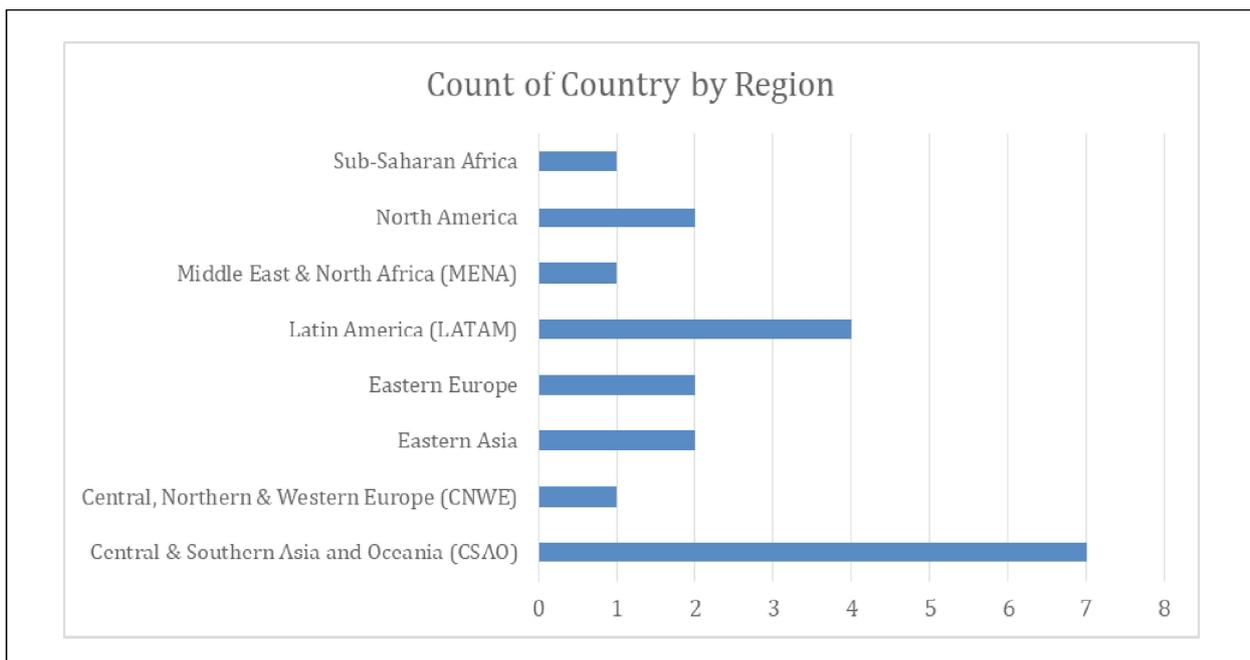


Figure 6: Nigeria’s Stablecoin Remittance Trends

Source: Bozhko et al. (2024)

amid domestic currency instability. The findings suggest that cryptocurrency has evolved into an essential mechanism for preserving economic value and facilitating transactions, both domestically and internationally, during times of severe monetary upheaval (Niyitegeka and Zhou, 2023; Chainalysis, 2024).

5.2. Argentina: Stablecoins and Economic Stability

In Argentina, the study highlights a distinctive pattern of cryptocurrency adoption characterized by the widespread use of stablecoins in response to economic instability and persistent currency devaluation. The analysis shows a significant increase in stablecoin usage among Argentinians, particularly during periods of peso devaluation. Adoption rates tend to spike following key economic policy announcements and currency interventions, reinforcing the perception of stablecoins as a reliable hedge against domestic volatility (Setyawan et al., 2024; Chainalysis, 2024).

Moreover, the research documents notable increases in trading volumes and the creation of new wallets during economic downturns, indicating that Argentinians are increasingly viewing cryptocurrency as a critical tool for financial planning and value preservation. This reliance on stablecoins reflects the broader sentiment that cryptocurrency can provide a safeguard against the risks posed by economic instability in the Argentine context (Maulia and Kamil, 2024; Chainalysis, 2024).

5.3. Nigeria: DeFi Innovation and Financial Inclusion

Nigeria presents a compelling case study in Decentralized Finance (DeFi) adoption and financial innovation. The research illustrates Nigeria’s leadership in DeFi, with sophisticated usage patterns suggesting an advanced understanding of decentralized financial systems. Significant growth in the utilization of DeFi platforms, especially for lending and trading, is evident, marking Nigeria as a forerunner in this rapidly evolving financial landscape (Bozhko et al., 2024; Chainalysis, 2024).

One of the transformative aspects of Nigeria’s cryptocurrency adoption is the rise of stablecoin-based remittance systems. The analysis indicates that these systems have gained popularity among Nigeria’s extensive diaspora, providing a more cost-effective means of cross-border value transfer compared to traditional remittance channels. This trend underscores the role of cryptocurrency in enhancing financial inclusion by offering access to financial services for previously underserved populations (El Hajj and Farran, 2024; Chainalysis, 2024).

Furthermore, the development of innovative cryptocurrency-based financial products tailored to Nigeria's market conditions illustrates a maturing ecosystem that responds to local needs. This adaptability highlights how cryptocurrency is not merely adopted in its standard form but is modified to address specific financial challenges within the region (Panigrahi, 2023; Chainalysis, 2024).

The findings from this research demonstrate that cryptocurrency adoption in emerging markets is driven by distinct economic pressures and opportunities unique to each region. While cryptocurrency serves as a common tool for tackling economic challenges, its implementation and usage patterns differ significantly based on local conditions and needs. This variation indicates that cryptocurrency's role is evolving beyond simple value transfer, becoming an integral part of local financial ecosystems adapted to address specific regional economic issues (Wójcik-Czerniawska, 2019; Chainalysis, 2024). The implications of these findings are vital for policymakers and stakeholders as they navigate the complexities of integrating cryptocurrency into existing financial frameworks while fostering economic stability and inclusion across emerging markets.

6. Implications for Financial Innovation

Crypto has been a transformative force in financial innovation, especially in areas where access to traditional banking is limited or too costly. Establishing an alternative financial ecosystem, cryptocurrencies give way to financial inclusion for the underserved communities in an easy way to transact and store value (Chainalysis, 2024; Nakhle, 2022). This effect would be more pronounced in Sub-Saharan Africa and Latin America, where the adoption of stablecoins provides much-needed stability in the face of high inflation. In economies with unstable fiat currencies, like Argentina and Venezuela, stablecoins act as a very important mechanism to protect the asset from value erosion and enable citizens to preserve their wealth while fleeing from risks related to their national currencies' volatility (Almeida *et al.*, 2024; Setyawan *et al.*, 2024; Chainalysis, 2024).

Furthermore, Decentralized Finance (DeFi) platforms enhance financial empowerment by reducing dependency on traditional financial intermediaries. These platforms provide lower transaction costs and enable broader participation, supporting a more inclusive financial environment. DeFi has, therefore, created new opportunities for financial growth and inclusion, helping individuals and communities to engage in a diversified financial landscape where traditional banking infrastructure is minimal or nonexistent, mainly in developing countries (Bozhko *et al.*, 2024; Maulia and Kamil, 2024; Chainalysis, 2024). This course gives cryptocurrency a unique role in the development of economic resilience and financial independence for emerging markets, helping to drive an evolution in how people interact with and benefit from financial services.

Security Challenges While a core part of their allure, the decentralized and anonymized nature of cryptocurrencies has brought with it significant security concerns. Terror groups such as Hamas and ISIS have leveraged these characteristics to bypass traditional financial controls in an effort to garner funding, most recently problematic for regulatory bodies. In response, international standards have been promoted by the Financial Action Task Force (FATF) and similar organizations to mitigate such risks.

The challenge, however, lies in monitoring such decentralized platforms, especially within the DeFi sector, and the variability of regulations across different jurisdictions. Such gaps show that there is a need for balanced regulation that can curtail illicit activities without killing the innovation cryptocurrency brings along.

Implications for Economic Development Cryptocurrency has been gaining much consideration in contributing to economic development. In this regard, cross-border transactions are executed much faster and at a lower cost with cryptocurrencies, mainly for the benefit of low-income and underserved communities. Secondly, in economically volatile areas, cryptocurrency protects against the risks of inflation through increasing the resilience and stability of the financial system.

El Salvador's recognition of Bitcoin as legal tender shows the economic potential – it is trying to increase financial inclusivity and lower remittance costs. Although cryptocurrency could help democratize financial services, there is need for international cooperation to handle the risks associated with it, and cryptocurrency can be maintained in the long run to advance economic development.

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Appendix

Country	Region	Overall Index Ranking	Centralized Service Value Received Ranking	Retail Centralized Service Value Received Ranking	DeFi Value Received Ranking	Retail DeFi Value Received Ranking
India	Central & Southern Asia and Oceania (CSAO)	1	1	1	3	2
Nigeria	Sub-Saharan Africa	2	5	2	2	3
Indonesia	Central & Southern Asia and Oceania (CSAO)	3	6	6	1	1
United States	North America	4	2	12	4	4
Vietnam	Central & Southern Asia and Oceania (CSAO)	5	3	3	6	5
Ukraine	Eastern Europe	6	7	5	5	6
Russia	Eastern Europe	7	11	7	7	7
Philippines	Central & Southern Asia and Oceania (CSAO)	8	9	8	14	9
Pakistan	Central & Southern Asia and Oceania (CSAO)	9	4	4	18	13
Brazil	Latin America (LATAM)	10	8	10	10	14
Türkiye	Middle East & North Africa (MENA)	11	14	11	15	11
United Kingdom	Central, Northern & Western Europe (CNWE)	12	12	21	9	8
Venezuela	Latin America (LATAM)	13	17	16	11	12
Mexico	Latin America (LATAM)	14	18	17	13	10
Argentina	Latin America (LATAM)	15	13	13	17	20
Thailand	Central & Southern Asia and Oceania (CSAO)	16	16	15	19	16
Cambodia	Central & Southern Asia and Oceania (CSAO)	17	10	9	35	23
Canada	North America	18	22	26	16	15
South Korea	Eastern Asia	19	15	14	33	33
China	Eastern Asia	20	20	18	24	22

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