

DETERMINANTS OF CRYPTOCURRENCY  
ADOPTION IN DEVELOPING COUNTRIES

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## DEDICATION

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LIST OF ABBREVIATIONS

AML	Anti-Money Laundering
CBDC	Central Bank Digital Currency
DAOs	Decentralized Autonomous Organizations
DeFi	Decentralized Finance
dApps	Decentralized Applications
ETF	Exchange-Traded Fund
FATF	Financial Action Task Force
FE	Fixed Effect
FYP	Final Year Project
GDP	Gross Domestic Product
GNI	Gross National Income
ICO	Initial Coin Offering
IMF	International Monetary Fund
LM	Lagrange Multiplier
LR	Likelihood Ratio

OLS	Ordinary Least Squares
RE	Random Effect
SEC	U.S. Securities and Exchange Commission
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
UTAR	Universiti Tunku Abdul Rahman
VIF	Variance Inflation Factor
WDI	World Development Indicators (World Bank)
WGI	Worldwide Governance Indicators (World Bank)

## PREFACE

In fulfilment of the requirements of Universiti Tunku Abdul Rahman (UTAR) for the award of the Bachelor of Finance (Financial Technology) with Honours, students are required to complete the Final Year Project under the course 'UKFN3026 Research Project for Finance and FinTech'.

This study was motivated by an interest in understanding the determinants of cryptocurrency adoption in developing countries, where adoption remains uneven despite growing global interest. By examining regulatory, technological, economic, and demographic factors using a panel data approach, this research aims to contribute empirical insights that may support more effective and inclusive cryptocurrency adoption in developing economies.

## ABSTRACT

This study investigates the determinants of cryptocurrency adoption in 40 developing countries from 2020 to 2023, focusing on the role of regulatory challenges, perceived risk, technological awareness and trust, financial literacy, population size, and median age. Grounded in the Technology Acceptance Model (TAM), Risk Perception Theory, Institutional Theory, Network Effects Theory and Demographic Transition Theory, the study employs a panel data approach using secondary data. The Global Crypto Adoption Index from Chainalysis (2020–2023) was normalized to construct the dependent variable.

The random-effects model identifies three statistically significant determinants. Technological awareness and trust (proxied by mobile cellular subscriptions) and population size exhibit significant positive effects on adoption, while regulatory challenges (proxied by the inverse of Regulatory Quality) show a significant negative influence, indicating that weaker regulatory environments are associated with lower adoption levels. The remaining variables were not statistically significant. The robustness of the findings is further supported by applying logarithmic transformations to key variables, a standard remedy for skewed distributions and outliers.

These results demonstrate that cryptocurrency adoption in developing countries is primarily driven by structural factors related to digital infrastructure, market scale, and institutional quality. Policy implications emphasize a combined focus on building digital infrastructure, fostering clear and effective regulatory frameworks, and leveraging network effects, rather than relying solely on macroeconomic interventions. Model selection was further supported using the Hausman specification test and the Breusch–Pagan Lagrange Multiplier test for random effects, which confirmed the appropriateness of the Random Effects estimation for this study.

## **CHAPTER 1: INTRODUCTION**

### **1.0 Research Background**

Within the past ten years, cryptocurrencies have actually been identified as a revolutionary digital asset. The virtual currency utilizes cryptography for secure transactions and management of units (Rome Business School, 2024). Cryptocurrencies, unlike fiat currencies, which are managed by national mints, function using blockchain technology - distributed ledgers that promote immutability and resistance to censorship and a single point of failure. This innovation has enabled cryptocurrencies to go beyond being a trial asset and actually be a notable element of the worldwide financial system (Suprayitno et al., 2024).

As the enabling technology, the blockchain is empowering the markets to make transactions in an unbounded, decentralized, and cost-effective way, thereby innovating the realms of payments, investments, and remittances (Aquilina et al., 2025). In point of fact, in developing nations, they have been perceived to act as instruments of financial inclusion, particularly for unbanked customers, as well as for migrant workers who incur the largest costs for such transactions and have very little access to the traditional system (Foster et al., 2021).

However, there are still limited and unequal rates of adoption in developing countries (ResearchFDI, 2022). The key barriers include state intervention, a risk of regulatory responses, and the resultant risks, as well as the technology challenges involved in the sector, and finally, poor financial education. The complexity or volatility of the regulatory environments increases the costs of compliance and reduces confidence in the sector, and the unawareness and mistrust slow the adoption rates of individuals (Forben, 2025).

The majority of the work that has been conducted has been conducted in developed nations with well-established institutions, sophisticated digital infrastructure, and

higher literacy rates, and therefore the specific factors that influence adoption in developing nations must be researched. Such factors influence the control of the hairline of innovation and risk as well as consumer protection.

To give context on the subject matter, countries can be categorized into various groups depending on the Gross National Income (GNI) per capita based on the World Bank (2023) guidelines. These categories include countries that have a GNI of below \$1,145 (lower-income), countries that fall between \$1,146-4,515 (lower-middle-income), countries that fall between \$4,516-14,005 (upper-middle-income), and countries that earn above \$14,005 (high-income). This classification offers a good framework for studying the potential of cryptocurrency adoption in different economic settings.

## **1.1 Definition of Cryptocurrency Adoption**

Adoption of cryptocurrency in this research will mean the application and integration of cryptocurrency in the economic activities of the country and its citizens. The definition of adoption is focused on activity that has economic outcomes and application and not just knowledge and potential of use (Böhme et al., 2015; Bhimani et al., 2022).

This aligns well with the empirical method used in the proposed study. Here, the Chainalysis (2023) Global Crypto Adoption Index is used. This index measures adoption on weighted scales that relate to real-world economic activity. These include the amount of cryptocurrency received on-chain (purchasing power parity per capita), the amount of retail transactions on-chain, and peer-to-peer exchange volume.

This multi-dimensional approach captures the extent and complexity of cryptocurrency integration into the economy of a particular country, going beyond simple yes/no categorization of its use (Gandal & Halaburda, 2014; World Bank, 2022). Through this approach of basing the definition on reality, there is alignment

between the concept and the measuring approach in the study since it focuses on behavior rather than mere intentions.

## **1.2 Evolution of Cryptocurrency Adoption in Developing Countries**

### **1.2.1 Early Phase (2009 - 2014)**

It was in 2009 that the current era of cryptocurrencies started when Bitcoin, the first virtual currency using blockchain, was born. It was considered worthless at first but was used for trade among limited online communities. One of its milestone events occurred in May 2010 when a user paid 10,000 BTC for two pizzas, marking its first use for genuine purchases. (Kraken Learn Team, 2025).

Early markets experienced high volatility, largely due to the absence of liquidity, adoption rates, and the use of weak trading infrastructure. The emergence of Mt. Gox in the year 2010 increased efficiency in the markets and prices, but the markets were still prone to information and technology risks (Kraken Learn Team, 2025). At this stage, there was little adoption in developing countries, but the borderless nature of Bitcoin future-proofed the potential for adoption in the financially excluded. The higher the CON, the higher the adoption rates.

### **1.2.2 Growth Phase (2015 - 2020)**

The introduction of Ethereum in 2015 brought the concept of smart contracts and a general-purpose blockchain, allowing for decentralized apps, tokenizing, and more than mere transactions (Singh, 2025). This gave rise to new innovations such as Initial Coin Offerings (ICOs) and Decentralized Finance (DeFi) but exposed scalability problems and high fees in the process.

A major blow came in 2016 with the DAO hack, which resulted in a loss of about 50 million ETHS due to a coding glitch (The World, 2023; Latorre, 2025). The debate on reversibility and immutability after the hack, which resulted in a split and the creation of Ethereum and Ethereum Classic, is another major issue for Ethereum (Cryptopedia Staff, 2025; The World, 2023).

At the same time, smart contracts started being recognized in law in jurisdictions such as the U.S., Switzerland, Malta, and Estonia, thus encouraging their use (Cohn et al., 2017; Djamane, 2025; Ma, 2023).

DeFi, which provides financial services like lending and trading through blockchain smart contracts without the need for human intermediaries, has advantages that include increased transparency and cost savings (Schär, 2021; Werner et al., 2021; Chen & Bellavitis, 2020). Perhaps the area of greatest hope for developing countries would be the possible decrease in remitting costs and use of financial services through mobile phones (Bakare et al., 2024). It was also a time of heightened awareness of possible dangers, which might include a lack of regulation and instability in cryptocurrencies (Atzori, 2017).

### **1.2.3 Mainstream Phase (2021 - Present)**

In April of 2024, Hong Kong took a step closer in institutionalizing digital assets by allowing the first spot Bitcoin and Ethereum ETFs of Harvest and Bosera respectively under the oversight of Hong Kong's SFC regulations (Alan, 2024). Such an initiative brought Hong Kong closer to its dream of being at the forefront of cryptocurrency hubs in Asia and led to an instant rise of 3% in Bitcoin's price (Ekshian, 2024; Alan, 2024).

However, Chinese mainland investors remain barred. Yet, the Hong Kong

regulated ETF structure is a boost to the legitimacy of crypto in traditional financial systems and provides a template for other countries to follow. This is part of a larger move for conventional integration with crypto assets, promoting transparency (Nguyen, 2024). Such mainstream acceptance has trickled down to developing nations where storing value in crypto is considered a hedge against inflation.

### **1.3 Imperative of Cryptocurrency Adoption in Developing Countries**

The growth of cryptocurrency use in developing countries isn't just about new technology. It can actually change societies and economies. Many people in these places can't get bank accounts, have to pay a lot to send money, and don't have good access to financial services (Ngonyani, 2022). Cryptocurrencies are different because they don't have a central authority. They can work without traditional banks, help people rely less on money that loses value quickly, and let them be part of the world's digital economy (Aggarwal, 2025).

Getting more people connected to finance is a major goal. Around the world, about 1.4 billion adults don't have a bank account, and most live in developing regions (World Bank, 2022). If someone has a mobile phone and the internet, they can use cryptocurrencies to save or send money. They don't need a bank or to show lots of official papers to do this (Davradakis & Santos, 2019).

Another big plus is cheaper money transfers. When workers in other countries send money back home, normal services often charge more than 10% in fees (Ratha, 2014). Using blockchain technology can make this much cheaper, so families receive more of the money (IBM, 2021). This means households have more income and can handle financial problems better.

Cryptocurrencies can also protect savings when a country's own currency is weak. In places with very high inflation, people's cash savings can lose value fast (Ha et

al., 2019). Assets like Bitcoin can sometimes keep their value better, so people's purchasing power is safer (Melki & Nefzi, 2022).

Using digital currencies also encourages new ideas. Things like tiny online payments, smart contracts, and decentralized finance can help small businesses, support community fundraising, and grow local tech industries (Bakare et al., 2024).

But there are still problems. Rules about cryptocurrencies are often unclear or don't exist, many people don't understand how they work, and there are risks of hacking and scams (Abdallah-Ou-Moussa et al., 2025; OECD/KDI, 2021). If governments don't make supportive laws, teach people about digital money, and improve internet access, the good things about cryptocurrencies might not happen (Bhimani et al., 2022; Abdallah-Ou-Moussa et al., 2025).

Overall, using cryptocurrencies could help more people get into the financial system, make sending money cheaper, protect savings from losing value, and create new opportunities. These are all important for making the economies of developing countries stronger and fairer for everyone.

## **1.4 Problem Statement**

The global spread of cryptocurrency offers important benefits, including better financial inclusion and more efficient cross-border payments (Setyawan et al., 2024). However, in developing countries, adoption remains limited and inconsistent (Kyaw, 2025).

Existing literature has understandably focused on key barriers, such as regulatory uncertainty, perceived risk, and low levels of financial and digital literacy (World Economic Forum, 2023; Kyaw, 2025). While these factors are important, this perspective tends to overlook deeper structural and demographic conditions that may fundamentally shape how cryptocurrency is adopted.

Much of the available evidence comes from developed economies with mature financial systems and stable regulations (Park, 2011). This provides limited insight into the distinct realities of developing countries, where adoption dynamics are likely different (Ruch, 2020). Studies often highlight constraints like regulatory gaps and lack of awareness (OECD/KDI, 2021), but pay less attention to macro-level factors such as national population size and age structure.

These broader characteristics matter. A larger population can accelerate adoption through network effects, while a younger median age may correlate with faster technological uptake (Böhme et al., 2015; Gandal & Halaburda, 2016). Ignoring these elements leaves a significant gap in our understanding, as they may be just as influential as institutional or perceptual factors in shaping national adoption patterns.

Therefore, a more complete analytical framework is needed—one that integrates these structural and demographic conditions alongside the more commonly studied institutional and behavioral variables. Only then can we better explain why and how cryptocurrency adoption unfolds in developing economies.

## **1.5 Research Questions**

This study aims to explore following research questions:

1. How do regulatory challenges influence cryptocurrency adoption in 40 selected developing countries?
2. What is the impact of perceived risk on cryptocurrency adoption in 40 selected developing countries?
3. How does technological awareness affect cryptocurrency adoption in 40 selected developing countries?

4. What role does financial literacy play in influencing cryptocurrency adoption in 40 selected developing countries?
5. How does population size influence cryptocurrency adoption in 40 selected developing countries?
6. How does median age influence cryptocurrency adoption in 40 selected developing countries?

## **1.6 Research Objectives**

In accordance with these research questions, this study aims to:

1. To examine the influence of regulatory challenges on cryptocurrency adoption in 40 selected developing countries.
2. To analyze the impact of perceived risk on cryptocurrency adoption in 40 selected developing countries.
3. To explore the effect of technological awareness on cryptocurrency adoption in 40 selected developing countries.
4. To investigate the role of financial literacy in influencing cryptocurrency adoption in 40 selected developing countries.
5. To examine the influence of population size on cryptocurrency adoption in 40 selected developing countries.
6. To analyze the impact of median age on cryptocurrency adoption in 40 selected developing countries.

## 1.7 Hypotheses of the Study

Drawing on established theory and empirical evidence, this study formulates six hypotheses to examine the effects of key challenges and determinants on cryptocurrency adoption in developing countries. Regulatory uncertainty and fragmented compliance frameworks, proxied by the inverse of the World Bank's Regulatory Quality Index, are expected to increase operational risk and reduce investor confidence, thereby negatively affecting adoption (Forben, 2025). Similarly, perceived risk, including volatility proxied by the annual inflation rate, fraud concerns, and weak consumer protection, has been shown to discourage the adoption of new financial technologies (Rodpangtiam, 2022).

In contrast, technological awareness and trust, proxied by mobile cellular subscriptions per 100 people, are expected to enhance user confidence, while financial literacy, proxied by GDP per capita, may improve individuals' ability to evaluate risks and benefits. Countries with larger populations are also expected to exhibit stronger network effects, as a larger potential user base facilitates faster diffusion of cryptocurrencies (Gandal & Halaburda, 2016). Finally, younger populations tend to be more technologically adept and more willing to adopt innovative and risky financial technologies, whereas older populations are generally more risk-averse and slower to adopt (Böhme et al., 2015; Chinn & Fairlie, 2007).

The following hypotheses are thus developed for this study:

H1: Regulatory challenges negatively influence cryptocurrency adoption.

H2: Perceived risk negatively influences cryptocurrency adoption.

H3: Technological awareness and trust positively influence cryptocurrency adoption.

H4: Financial literacy positively influences cryptocurrency adoption.

H5: Population size positively influences cryptocurrency adoption.

H6: Median age negatively influences cryptocurrency adoption.

## **1.8 Significance of the Study**

This study provides contributions in five main areas.

First, theoretical contributions: This study integrates regulatory, technological, behavioral, and financial literacy perspectives into a unified analytical framework to deepening our understanding of cryptocurrency adoption in developing countries.

Second, empirical contribution: Particularly in regions facing unique infrastructure and regulatory challenges, this research fills the gap in current evidence regarding the dynamics of cross-border adoption.

Third, policy implications: This research provides empirical guidance to regulators then help them design frameworks that balance financial innovation with consumer protection and risk mitigation.

Fourth, practical contributions: By identifying barriers to adoption and proposing strategies such as financial literacy programs and trust-building mechanisms, this research provides actionable insights for fintech companies, exchanges, and financial institutions.

Finally, social impact: By examining factors influencing cryptocurrency adoption among low-income households and migrant workers, this research contributes to promoting financial inclusion and reducing the cost of cross-border remittances.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.0 Introduction**

The cryptocurrency adoption issue has emerged as a popular subject in financial technology, but there is a scattered body of literature related to risks and challenges associated with cryptocurrencies that has not yet been explored properly.

The earlier research works highlighted volatility issues in Bitcoins (Guo et al., 2018), security in the blockchain environment (Li et al., 2020), while recent research has highlighted risks in DeFi smart contract applications (Hossain, 2024) and CBDCs (Bibi & Yerzhan, 2025), though in a fragmented manner without a holistic outlook on risks and challenges.

Six major gaps are identified, namely: (1) challenges associated with regulation, (2) risk perception, (3) awareness and trust in technology, (4) financial literacy, (5) size of the population, and (6) median age of the population.

Conclusion

This chapter is arranged as follows: Section 2.1 outlines the theoretical background, Section 2.2 describes the major determinants and difficulties in adoption, Section 2.3 synthesizes the literature and reveals the research gaps, and Section 2.4 develops the research hypotheses.

### **2.1 Theoretical Frameworks and Models**

The deployment of a sophisticated technological innovation such as cryptocurrency does not take place because of a single determinant. In this context, the study is anchored on seven fundamental theories. These theories range from the field of information systems to sociology and psychology. The seven theories offer a multi-dimensional perspective for analyzing the subject. The theories not only outline

why a person might embrace cryptocurrency technology but also provide insight into how society influences the process. The theories cited include Uses and Gratifications Theory, Social Identity Theory, and Institutional Economics Theory.

### **2.1.1 Technology Acceptance Model (TAM)**

A Technology Acceptance Model (TAM) based on the work by Davis (1989) argues that the adoption of the technology is influenced by the perceptions the user has about the value the technology creates for them. This value can be calculated in terms of “the degree to which a person believes that using a particular system would enhance their job performance,” while the other variable that affects it is the perceived ease-of-use, “the degree to which a person believes that using a system would be free of effort” (Davis, 1989; Venkatesh & Davis, 2000; Jiang & Gan, 2025).

In cryptocurrency adoption, TAM is used to understand user behavior. Sagheer et al. (2022) found in their study that both PU and use ease had a significant influence on behavioral intentions, which influences users to adopt digital assets when they believe them to be dependable, efficient, and easier than other methods. Similarly, Islam et al. (2023) found in Bangladesh that attitudes, knowledge, and PU play a crucial role in shaping intentions, and obstacles play a hindering role.

However, the internal focus of TAM on cognitive perceptions of individuals might not account for the influence of the environment that plays an important role in the adoption of cryptocurrencies. These factors of adoption would not be accounted for by TAM (Nguyen et al., 2025). Consider an example: support and perceptions of risks might affect perceived ease of use and perceived usefulness for adoption (Sagheer, 2022). In this regard, it could be stated that even though TAM provides many insights for understanding perceptions of an individual regarding adoption, it should be combined with other theories (Institutional Theory) that could account for adoption of an infant technology such as cryptocurrencies.

### **2.1.2 Diffusion of Innovation Theory (DOI)**

Roger's Diffusion of Innovation theory (1983) highlights five key factors that influence the adoption of new technologies: Relative Advantage, Compatibility, Complexity, Trialability, and Observability. These factors help explain why certain groups or developing countries may be more inclined to adopt cryptocurrencies.

Relative Advantage refers to how much better an innovation is perceived compared to existing options. Cryptocurrencies offer advantages such as lower transaction costs, faster international payments, and improved access to financial services (Gunawan et al., 2025). Compatibility describes how well an innovation fits with users' existing values and experiences. In regions with high mobile phone usage but limited banking infrastructure, cryptocurrencies align well with local habits and technological access (Chaisiripaibool et al., 2025).

Complexity involves how difficult an innovation is to understand and use. Higher levels of digital and financial literacy can reduce this perceived complexity and help users better evaluate risks and benefits (Gunawan & Sangka, 2025). Trialability allows users to test an innovation through small-scale experiences, such as demo accounts or limited transactions, which helps build confidence. Observability refers to how visible the results of using the innovation are to others. When more people in a community use and benefit from cryptocurrencies, it encourages wider adoption (Chaisiripaibool et al., 2025).

Overall, the Diffusion of Innovation framework emphasizes the role of social and behavioral factors in technology adoption, offering valuable insights for promoting cryptocurrency use and financial inclusion in developing countries.

### **2.1.3 Theory of Planned Behavior (TPB)**

The Theory of Planned Behavior reveals how perceptions of control over behaviors, attitude, and subjective norms jointly influence intentions, producing actual behaviors (Ajzen, 1991).

In terms of adoption of cryptocurrencies, these factors include benefits such as speed in performing money transfers and using them for inflation protection in contrast to risks of market volatility and fraud (Rodpangtiam, 2022; Zhou et al., 2024). Subjective norms include environments that favor or facilitate acceptance of cryptocurrencies through government policies, whereas lack of policies or acceptance can hamper its development (World Economic Forum, 2023). Perceived behavior control consists of financial and technological competency for the use of wallets without any threats (Carbó-Valverde et al., 2023).

In summary, TPB indicates that cryptocurrency adoption within developing economies is shaped by factors that include consumer choice as well as government and literacy considerations (Stanciu et al., 2024).

### **2.1.4 Risk Perception Theory**

Risk Perception Theory holds that risk-related choices are determined not only by risk facts, on the one hand, but also with regard to subjective risk perceptions involving dimensions of cognition and emotion (Slovic, 1987). The high volatility and fraud that are rife in the cryptocurrency market make risk perceptions even worse (Rodpangtiam, 2022).

Some of the perceived risks include financial risk due to price variability, security risk in cases where the hacking or scams occur, and operational risk where there could be challenges in cashing out crypto or finding a good platform to use; these risks are especially high in developing nations because

of low financial literacy (Financial Crime Academy, 2025). Even if there are perceived advantages, for instance, reduced costs when remitting funds, the negative attitudes will prevail.

On the whole, Risk Perception Theory explains the possible hesitation of people in developing nations in adopting cryptocurrencies, where the fear and uncertainty that individuals experience have a considerable impact on the process.

### **2.1.5 Institutional Theory**

Institutional Theory states that behavior is shaped by rules, norms, and beliefs (Pinto, 2017). Cryptocurrency adoption thus depends not only on individual choice but also on the regulatory and social environment.

In developing economies, institutional barriers hinder adoption. Regulatory uncertainty and weak consumer protection reduce investor confidence and business engagement (Ganapathy et al., 2025). Normative barriers include distrust in financial institutions and reluctance toward digital finance. Cognitive barriers stem from unfamiliarity with blockchain technology (González-Gallego & Pérez-Cárceles, 2021).

Conversely, supportive institutions can promote adoption by providing legal clarity, building trust, and enhancing digital financial literacy. Ultimately, adoption is contingent on a country's existing institutional structures.

### **2.1.6 Network Effects Theory**

The Network Effects Theory suggests that the value of the product thereby accelerates with each new user adopting the product (Katz & Shapiro, 1985). This kicks in a positive feedback process whereby the more users the product attracts, the more it attracts. The nature of cryptocurrencies makes

them platform-based, with the effect that the more users they attract, the better the security and functionalities (Gandal & Halaburda, 2016).

In developing countries, having a larger population is an important structural feature. A larger population offers a larger size for the network, resulting in a speedy build-up towards critical mass for sustained adoption (Kumar, 2023). This is why adoption can diffuse more quickly in a larger market despite differences in individual characteristics, such as risk perception.

### **2.1.7 Demographic Transition Theory**

The Demographic Transition Theory describes how countries change from being places where birth rates and death rates are high to places where birth rates and death rates are low due to development (Notestein, 1945). While it originates from demography, it has applications concerning economics and technology.

"Youth bulge" countries have more youths compared to other countries. Younger groups are generally more educated, tech-savvy, and accepting of new and potentially disruptive investment opportunities, characteristic of early adopters described by Rogers' (1983) Diffusion of Innovations theory (Chinn and Fairlie, 2007). In the adoption of cryptocurrencies, a younger median age can then be viewed as a macro-proxy for a population that is more technologically inclined and risk-seeking, making mass adoption more probable (Böhme et al., 2015).

## **2.2 Keys Determinants and Challenges**

The adoption of cryptocurrencies in emerging economies is impeded by a total of

six interconnected categories of risk.

### **2.2.1 Regulatory Challenges**

Regulatory gaps and institutional frictions continue to act as the biggest hurdles to crossing-border cryptocurrency transactions (World Economic Forum, 2023). Variations in national strategies on anti-money laundering, consumer protection, licensing, and privacy laws continue to create risks and raise costs with respect to regulatory compliance (Igbinenikaro & Adewusi, 2024). (Igbinenikaro & Adewusi, 2024). The inconsistent application of the Financial Action Task Force guidelines on money laundering lead financial institutions to ‘de-risk’ through the cutting-off of all transactions involving high-risk jurisdictions, with the majority of developing countries being excluded in the process and thus worsening the divide in the financial sector » (World Economic Forum, 2023). The strict enforcement of locational privacy laws clashes with ‘financial laws,’ thus resulting in »greater payment costs and delays (World Economic Forum, 2023; Financial Stability Board, 2024). Non-bank firms continue to suffer frictions in the form of ‘lack of access to payment systems or impracticable licensing regimes,’ leading to high entry costs that reduce the efficiency of financial services (World Economic Forum, 2023). In developing countries, frequent regulatory shifts exacerbate operational risks, compliance costs, and strategic planning difficulties for firms (Adil et al., 2025). Beyond compliance, regulation now shapes strategy: proactive adaptation can yield competitive advantages, while uncertainty weakens investor confidence and may trigger capital outflows (UNCTAD, 2022). Regulatory change is accelerating globally, with agencies like the U.S. SEC and EPA issuing frequent rules on climate, cybersecurity, and AI, making compliance central to corporate governance and competitiveness (KPMG, 2024; Akinsola, 2025). It is important to emphasize that the regulatory barriers discussed above including fragmentation, inconsistent enforcement, and institutional friction reflect deficiencies in regulatory quality and coherence, rather than the intensity or strictness of regulation. In this study, the construct

“Regulatory Challenges” is operationalized accordingly to capture these systemic weaknesses, as detailed in the methodology section.

### **2.2.2 Perceived Risk**

Perceived risk is also an impediment to adoption, including issues of crypto market volatility, fraud, and redemption issues (Financial Crime Academy, 2025). Moreover, crypto market prices fluctuate extremely due to market sentiment, speculation, and an uncertain regime of legislation, failing to provide intrinsic value like stocks or bonds (CGDFS, 2023; Adrian et al., 2022). Stable coins also create doubts in terms of reserves that lack transparency, making it difficult to measure risk (Adachi et al., 2022; CGDFS, 2023). Risks relating to decentralization, such as concentration of control in few large wallets, also exist (CGDFS, 2023). Lack of liquidity or poor management of liquidity also prevents crypt-assets from being considered legitimate in mainstream finance (Financial Stability Board, 2022). There also exist issues of fraud such as “rug pulls” or ponzi schemes that are common in countries lacking adequate regulation or financial literacy (Abdul Basir et al., 2024; Take Five, 2025). These result in costs of capital for investors, in addition to damaging reputation. Another major issue of risk of redemption of crypto-assets also persists, whereby the recipient faces difficulties in converting crypto-assets into fiat money (Gravity Team, 2023). Moreover, banks in emerging countries also face issues of freezing or closing accounts that intend to trade in crypto-assets (Gravity Team, 2023). Hence, it creates an “one-way ticket” situation whereby purchases of crypto-assets from fiat money occur easily but withdrawal or conversion into fiat money faces difficulties (Gravity Team, 2023).

### **2.2.3 Technological Awareness & Trust**

Cryptocurrency adoption faces significant infrastructure challenges in many

developing regions, where unreliable internet access and limited smartphone availability create barriers to entry (Read and Wert, 2022; Kyaw, 2025). User experience also presents difficulties, as non-technical individuals often struggle with managing digital wallets, private keys, and transaction fees (Mai et al., 2020). Technical limitations further hinder adoption. Network congestion frequently slows transaction processing while increasing associated costs, making cryptocurrencies less practical compared to traditional payment methods that offer faster settlement (Blockchain.com, 2023; Werner, 2025). The complexity of interacting with different blockchain networks, tokens, and technical standards also raises the risk of irreversible financial errors for inexperienced users (Werner, 2025). Trust remains another critical issue. Centralized exchanges often lack sufficient security and transparency, while decentralized platforms require technical knowledge that many potential users do not possess (Harwick, 2016; Przywalny, 2024). If these challenges remain unaddressed, cryptocurrency may continue serving primarily as a speculative asset for a limited group rather than achieving its potential as a tool for broader financial inclusion (Koefer et al., 2024; Sirakaya & Erturk, 2025).

#### **2.2.4 Financial Literacy**

A low level of financial literacy has a considerable effect on the adoption and security of cryptocurrencies (Gunawan et al., 2025). A large number of investors consider Bitcoin a "speculative instrument rather than a means of payment," thus exposing them to the risks associated with volatile markets (Msefula et al., 2024). Over-confident investors tend not to possess crucial skills in the administration of private keys, exposing them to the risks of fraud (de Zwaan et al., 2017; Carbó-Valverde et al., 2023). In developing nations, a lack of financial education exposes investors to risks associated with speculative manias and fraud (Global Business and Technology Association, 2019). In Decentralized Finance, low financial literacy exposes investors to the risks associated with fraudulent projects (Bakare et al., 2024; Sood et al., 2024). At the national level, Gross Domestic Product per capita

is widely considered a measure of financial literacy in cross-national studies, especially in the absence of survey data. There is a clear positive correlation between the level of income and the average level of financial literacy among the population of most nations (Klapper et al., 2015; OECD, 2017). Countries that belong to higher income groups normally possess a superior education system and experience more widespread access to the formal financial sector, thereby boosting awareness. In developing countries, with limited micro-data access, Gross Domestic Product per capita is considered a commonly accepted macro-indicator that reflects the financial literacy environment contributing towards the adoption of cryptocurrencies (Bhimani et al., 2022; Ozili, 2022).

### **2.2.5 Population Size**

The total population of any nation is an important structural factor determining the adoption size and rate of cryptocurrencies based on network effects (Nguyen and Nguyen, 2024). As digital network goods, the value of cryptocurrencies is based on their total user base, as postulated by Network Effects Theory (Katz and Shapiro, 1985). A larger total population indicates a broader market potential, thereby ensuring the ease of reaching critical mass for a self-sustaining system (Gandal and Halaburda, 2016). This helps ensure the creation of supporting infrastructure, such as trading and peer-to-peer transfer platforms, ensuring easier and cheaper transaction processes (Mothobi and Kebotsamang, 2024). Additionally, the larger total population of a nation magnifies social learning and informational cascade, ensuring reduced perceived risk based on the prevalence of adoption (Sergio and Wedemeier, 2025). For this reason, total population not only forms part of background variables but also serves as an active contributing macro-factor, either enabling or hindering the adoption of cryptocurrencies in developing nations.

### **2.2.6 Median Age**

The median age of the community constitutes a highly recognized demographic factor in the research on the adoption of technology and financial innovations. A cross-country analysis has shown that the age distribution of countries is still a major macro-factor influencing the speed of technology transfer (Chinn & Fairlie, 2007). In the canvas of digital currencies, median age is brought into the picture through regression models with a great concern for its impact on the adoption of cryptocurrencies (Stupak, 2025; Stanciu et al., 2024). This method is based on Demographic Transition Theory where a younger population means the majority of the people being tech-savvy and attracting others by their willingness to adopt even the most uncertain and risky financial assets (Böhme et al., 2015). This aspect is especially critical in the case of cryptocurrency since its very nature implies sophistication and massive price fluctuations. In the financial technology literature, the youth demographic is seen as a key factor for the acceptance of the fintech and its applications (Gunawan & Sangka, 2025). Thus, countries with younger population groups have the best demographic conditions for the uptake of digital currencies, whereas the older population may face barriers in terms of their predisposition to risk and familiarity with technology (Stanciu et al., 2024).

## **2.3 Synthesis of Literature and Research Gaps**

### **2.3.1 Synthesis: Impact on Adoption**

The literature synthesis demonstrates that the adoption of cryptocurrency in developing nations is a function of multiple variables and does not depend on one sole component; unclear rules and enforcement increase risk and hinder adoption, and a lack of digital literacy and infrastructure make this even more challenging for consumers and businesses alike (World

Economic Forum, 2023; Kyaw, 2025). In addition to the uncharted sector variables already explored, the literature review concludes that key underlying structural factors play a significant role.

The size of the possible market, measured by the proxy of population, could facilitate adoption by network effects and building the ecosystem (Gandal and Halaburda, 2016). Conversely, the technology-driven nature of society, measured by the proxy of lower median age, establishes a demographic structure more open to the intricacies of digital innovation, including cryptocurrencies (Böhme et al., 2015).

In the end, successful adoption is contingent upon a complex of factors that must all come into play: an enabling institutional framework, acceptable level of risk, individual financial and technology preparedness, and an underlying national foundation of a substantial market and a demographically young society.

### **2.3.2 Research Gaps**

Previous literature on the adoption of cryptocurrency is still fragmented on various important fronts, which are targeted by the study at hand. First, the overwhelming trend among analyses considers the determinant related to factors like regulation and risk factors separately and does not holistically capture institutional, technological, behavioral, and structural considerations together (World Economic Forum, 2023; CGDFS, 2023). Second, the literature is heavily tilted towards developed nations that are institutionally sound and technologically developed (Kyaw, 2025; Przywalny, 2024), resulting in limited knowledge on the specifics of developing nations.

However, a crucial and pervasive research gap appears in the neglect of macro-structural and demographic factors. Although the significance of the role of network effects and age demographics has long been acknowledged

within the broader context of technology diffusion studies in general, their particular role in national-level cryptocurrency adoption within the developing world has still been underexamined and hardly ever subjected to quantitative analysis in combination with more common factors such as regulation and risk (Stupak, 2025). From a methodological perspective, there has been a dominance of surveys in single countries and small-scale qualitative research, which have placed boundaries on generalizability, accompanied by a dearth of comparative and longitudinal research on multi-level studies (Msefula et al., 2024).

Thus, a holistic approach that revolves around a framework that captures not only institution-based, technological, and behavioral determinants, but also embeds and considers population structure and age composition roles, grounded in empirical evidence derived from a panel data setting for developing countries, is needed for filling this gap.

## **2.4 Hypotheses Development**

This section extends the hypotheses outlined in Chapter 1 by grounding them in the literature reviewed above. Drawing from existing research, six hypotheses are developed to examine how regulatory challenges, perceived risks, technological awareness and trust, financial literacy, population size and median age shape adoption in developing countries.

### **2.4.1 Regulatory Challenges and Adoption**

Prior research emphasizes that regulatory uncertainty and disintegrated regulatory frameworks are major hindrances to cryptocurrency adoption, as they increase operational costs and undermine confidence for investors (World Economic Forum, 2023). According to institutional theory, coercive regulatory forces are often impediments to the diffusion of innovation in

emergent markets (Pinto, 2017).

**H1: Regulatory challenges negatively influence cryptocurrency adoption.**

#### **2.4.2 Perceived Risk and Adoption**

Perceived Risk Theory highlights how high-perceived risks such as volatility, fraud, and a lack of consumer protection act as deterrents for people embracing new financial technologies (Slovic, 1987; Rodpangtiam, 2022). There have been findings indicating lower adoption levels of cryptocurrencies with a higher perception of risk (CGDFS, 2023).

**H2: Perceived risk negatively influences cryptocurrency adoption.**

#### **2.4.3 Technological Awareness, Trust and Adoption**

As proposed by the Technology Acceptance Model and the Diffusion of Innovations theory, increased awareness and trust in technology help lower perceptions of complexity and change attitudes toward adopting the innovation positively (Davis, 1989; Rogers, 1962; Sagheer et al., 2022). In the context of developing markets, digital literacy and trust-building factors are pivotal for countering infrastructure and security issues (Kyaw, 2025).

**H3: Technological awareness and trust positively influence cryptocurrency adoption.**

#### **2.4.4 Financial Literacy and Adoption**

Studies show that financial literacy improves individuals' ability to evaluate risks, understand investment mechanisms, and avoid fraud, thereby increasing adoption intentions (Carbó-Valverde et al., 2023; Sood et al., 2024). Behavioral finance literature also suggests that higher literacy reduces speculative behaviors common in volatile markets (Msefula et al.,

2024).

**H4: Financial literacy positively influences cryptocurrency adoption.**

#### **2.4.5 Population Size and Adoption**

Prior literature on network effects suggests that a larger population base enhances the value of a network good and accelerates its diffusion by enabling critical mass, improving liquidity, and fostering local ecosystem development (Gandal & Halaburda, 2016; Sergio & Wedemeier, 2025).

**H5: Population size positively influences cryptocurrency adoption.**

#### **2.4.6 Median Age and Adoption**

Demographic and technology adoption studies consistently find that younger populations exhibit higher technological propensity, digital literacy, and risk tolerance, making them more likely to adopt innovative financial technologies like cryptocurrency (Böhme et al., 2015; Chinn & Fairlie, 2007).

**H6: Median age negatively influences cryptocurrency adoption.**

## **CHAPTER 3: METHODOLOGY**

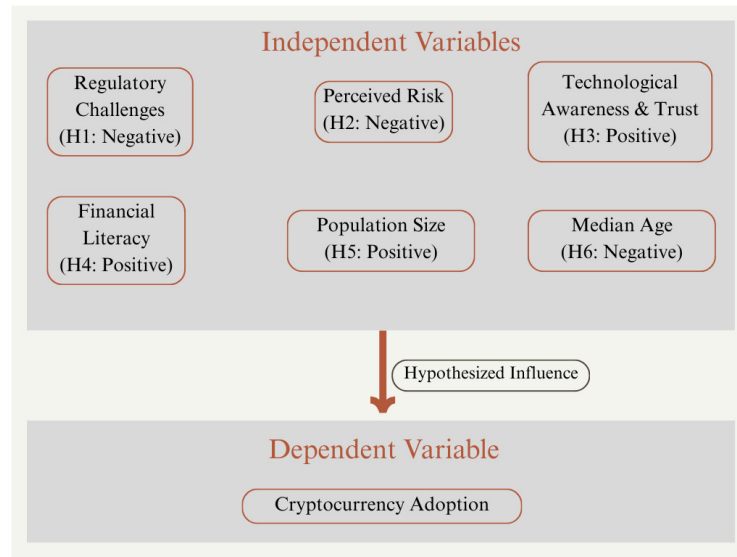
### **3.0 Introduction**

This chapter presents the research methodology employed to empirically investigate the factors influencing cryptocurrency adoption in developing countries, as discussed in the previous chapters. Given the macro-level scope of the research questions and reliance on secondary data, a quantitative cross-sectional design using country-level data is employed. The chapter details the conceptual framework, model specification, operationalization of variables, data sources, and robustness tests conducted to ensure the validity and reliability of the findings.

### **3.1 Conceptual Framework**

The conceptual framework builds on the theoretical foundations outlined in Chapter 2, drawing from the Technology Acceptance Model (TAM), Risk Perception Theory, Institutional Theory, Network Effects Theory, and Demographic Transition Theory. It assumes that cryptocurrency adoption in developing countries is shaped by regulatory, perceptual, technological, and economic factors. The framework illustrates the hypothesized relationships between six independent variables and the dependent variable, as shown below:

Figure 3.1: Conceptual Framework of the Study



*Note: The model incorporates demographic and socioeconomic factors as key independent variables and controls for unobserved country-specific effects through the Random Effects specification.*

### 3.2 Model Specifications

To test the six hypotheses developed in Chapters 1 and 2, a panel data regression model is employed. The use of panel data captures variations across countries and over time within each country, improving the robustness of the findings relative to a single-year cross-sectional analysis.

The baseline econometric specification is expressed as follows:

$$\text{CryptoAdopt}_{it} = \beta_0 + \beta_1 \text{Reg}_{it} + \beta_2 \text{Risk}_{it} + \beta_3 \ln(\text{Tech}_{it}) + \beta_4 \ln(\text{FL}_{it}) + \beta_5 \ln(\text{Population}_{it}) + \beta_6 \text{MedianAge}_{it} + \mu_i + \epsilon_{it}$$

Where:

Term	Definition
Subscripts	

$i$	Country index ( $i = 1, \dots, 40$ )
$t$	Time period ( $t = 2020, 2021, 2022, 2023$ )
<b>Dependent Variable</b>	
CryptoAdopt	Normalized cryptocurrency adoption score for country $i$ in year $t$
<b>Independent Variables</b>	
Regulatory	Regulatory challenges for country $i$ in year $t$ (inverse of Regulatory Quality index)
Risk	Perceived risk for country $i$ in year $t$ (annual inflation rate, %)
Tech	Technological awareness & trust for country $i$ in year $t$ (mobile cellular subscriptions per 100 people)
FL	Financial literacy for country $i$ in year $t$ (GDP per capita, constant 2015 US\$)
Population	Population size for country $i$ in year $t$
MedianAge	Median age of the country population for country $i$ in year $t$
<b>Model Parameters</b>	
$\beta_0$	Intercept / Constant term representing the baseline level of cryptocurrency adoption when all explanatory variables equal zero
$\beta_1 - \beta_6$	Coefficients of the independent variables on cryptocurrency adoption in the panel model
$\mu_i$	Country-specific fixed effect, capturing unobserved time-invariant characteristics unique to each country
$\varepsilon_{it}$	Idiosyncratic Error term

The analysis uses the Random Effects (RE) estimation technique, whereby the correlation between  $\mu_i$  (country effects) and  $X_i$  (independent variables) is assumed to be unrelated. The validity of employing the Random or Fixed Effects model will be determined using the Hausman Test. All estimation will be done using EViews 12 software, utilizing standard errors from the standard Random (RE) model, depending on the logarithmic form of crucial variables to reduce observations affected by outliers.

### 3.3 Variables and Operationalization

#### 3.3.1 Dependent Variable

The dependent variable, cryptocurrency adoption, is operationalized using the Global Crypto Adoption Index published by Chainalysis (2023). The index provides ordinal rankings from 1 to 155, which is highest to lowest adoption. To transform these rankings into a continuous variable suitable for regression analysis, we applied a standard normalization procedure commonly used in economics and social sciences research (e.g., the approach akin to constructing a normalized rank index). The adoption score for each country  $i$  was calculated using the formula:

$$\text{CryptoAdopt}_i = \frac{N - \text{Rank}_i + 1}{N}$$

where  $N$  is the total number of countries (155) and  $\text{Rank}_i$  is the rank of country  $i$ . This transformation yields a score bounded between 0 and 1, where a higher score indicates a greater level of cryptocurrency adoption.

#### 3.3.2 Key Independent Variables

Regulatory Challenges (H1): This is measured as the reverse of the World Bank's regulatory quality index using the transformation  $-1$  multiplied by the index. The index takes into account perceptions of the government's ability to formulate and implement effective policies; a higher score on the index reflects a high level of regulatory quality (Kaufmann & Kraay, 2024). This transformation has strong underlying methodological justification from a statistics and theory of measurement standpoint, in that it reverses the scale of interpretation while maintaining the properties of the data being measured in a procedure recommended in psychometric theory and research methods

(Cohen et al., 2003; Kline, 2015; Straub et al., 2004). This scale interprets a high score as a weak level of regulatory quality in relation to institutional deficiencies like fragmentation and lack of regulatory enforcement.

Perceived Risk (H2): This construct is captured using the annual percentage change of the consumer price index; that is, inflation rate. A macro-economic proxy for perceived economic risk and instability that affects the perceived risk of volatile assets (such as cryptocurrencies) and the financial system (in traditional and by implication, cryptocurrencies) is created by high inflation levels (Agénor and Pereira da Silva, 2013; Chiang and Chen, 2023).

Technological Awareness & Trust (H3): This is captured by the natural logarithm of mobile cellular subscriptions per 100 people. This variable measures the penetration level of the basic digital infrastructure, which is a necessary ingredient for access to the services provided by cryptocurrencies. A higher level implies a population that is more technologically integrated and hence more aware and trusting of digital technology (Kaufmann, Kraay, & Mastruzzi, 2024; Mothobi & Kebotsamang, 2024).

Financial Literacy (H4): This construct is proxied by the natural logarithm of GDP per capita (constant 2015 US\$). The use of this proxy is grounded in established literature which indicates a strong positive correlation between a nation's income level and the average financial literacy of its population (Klapper et al., 2015; OECD, 2017). Higher-income countries typically have better-resourced educational systems, greater exposure to formal financial services, and higher overall economic capability, all of which contribute to enhanced financial awareness and competence. It is important to note that GDP per capita serves as an indirect, macro-level proxy. Direct, cross-nationally comparable micro-data on financial literacy (e.g., from surveys like the OECD/INFE) are not consistently available for all 40 countries across the 2020-2023 period. Therefore, this proxy is employed to capture the underlying economic capacity and correlated financial knowledge that may influence cryptocurrency adoption at the

country level.

**Population Size (H5):** This variable is operationalized by taking the natural logarithm of the total population of a country. Using the natural logarithm of the total population instead of the total population assists in avoiding non-linearity and minimizes the risk of having skewness in the regression model. Larger populations represent larger potential markets with strong potential network effects; these are very important for adopting platform technology such as cryptocurrency (Nguyen & Nguyen, 2024; Gandal & Halaburda, 2016).

**Median Age (H6):** This is calculated as the median age of the whole population. The smaller the median age, the younger the population structure, which is generally characterized by fast adoption of technology as well as the tendency to adopt novel financial solutions like cryptocurrencies (Böhme et al., 2015; Chinn & Fairlie, 2007).

## **3.4 Sampling Design and Data Collection**

### **3.4.1 Sample Selection and Panel Structure**

This study adopts a quantitative research design with a non-probability purposive sampling strategy. The sample consists of 40 developing countries, selected based on data availability for all variables under investigation (see Appendix 3.1 for the full list). These countries are classified as non-high-income economies by the World Bank, which helps maintain the research focus on the structural and institutional contexts typical of developing countries.

The panel data created is balanced, as every country has been considered for four years, ranging between 2020 and 2023, creating a total of 160

observations (40 observations  $\times$  4). The panel data created can analyze both cross-sectional and time series differences of cryptocurrency adoption, thus allowing for robust econometric results through increased analysis depth.

### 3.4.2 Data Sources and Collection

The study will collect all data as secondary indicators for the macro-level, which are credible and recognized internationally to ensure validity and comparability. Consistency in data is confirmed for the entire period of 2020-2023 as a means for maintaining an integrated balanced panel structure.

The secondary sources for the variables are:

Table 3.1: Operationalization of Variables

<b>Variable Name</b>	<b>Measurement</b>	<b>Data Source</b>
<b>Cryptocurrency Adoption</b>	Global Crypto Adoption Index Score	Chainalysis Global Crypto Adoption Index, Statista
<b>Regulatory Challenges</b>	Regulatory Quality (inversed)	World Bank WGI
<b>Perceived Risk</b>	Annual Inflation, Consumer Prices (%)	World Bank WDI
<b>Technological Awareness &amp; Trust</b>	Log of Mobile cellular subscriptions per 100 people	World Bank WDI
<b>Financial Literacy</b>	Log of GDP per capita, constant 2015 US\$	World Bank WDI
<b>Population Size</b>	Log of total population	World Bank WDI
<b>Median Age</b>	Years	UN World Population Prospects

### **3.5 Data Cleaning**

Steps were taken in data cleaning to ensure the correctness, consistency, and validity of the data used in this study to create the balanced panel data. The fact that 40 developing countries took part in this study for a period of four years (2020 to 2023) made it important to complete the time series for this study. Below are the steps to complete the process of data cleaning:

#### **3.5.1 Handling Missing Values**

Each one of the variables was screened for missing data within the four-year time period. Nations were excluded from analysis in the data set based on whether they were missing data on either the dependent variable, independent variable, or control variable because they were required to have balanced data so they could each contribute four data points to the data pool.

#### **3.5.2 Consistency and Unit Standardization**

The macro-economic factors obtained with the help of a variety of sources, World Bank data for World Development Indicators, World Governance Indicators, Population Division in the UN, and Chainalysis were analyzed for common formats. The data for the Inflation rate was found to be measured in terms of the annual percentage change, GDP in terms of per capita constant 2015 USD values, the value of remittances in terms of the percentage contribution to the GDP, while the mobile subscriptions were calculated on the basis of per 100 people.

### **3.5.3 Outlier Detection**

These initial descriptive statistics, z-values, and box plots can then be used to explore for outliers in variables such as inflation rates and remittances, where such outliers can potentially occur. These outliers at this stage are not truncated but are dealt with further when doing robustness analysis by using different model specifications (see Section 3.6).

### **3.5.4 Panel Structure Verification**

The dataset was then validated for the fact that each country provided four successive data points in every year. The data set and the variable names were validated for the fact that the panel data and time indicators were appropriately matched. This validated the data set, making it suitable for fixed effects tests.

With this approach, the final balanced panel dataset consisting of 160 country-year observations (40 countries x 4 years) was derived. With this sample derived through this approach, econometric analysis in Chapter 4 was carried out.

*Note: The list of the 40 developing countries included in the final sample, based on the data available for all the variables, can be found in Appendix 3.1.*

## **3.6 Diagnostic and Robustness Test**

To ensure the validity and reliability of the outcomes from the panel regression, several tests were conducted. The Variance Inflation Factor test showed there were no concerns about multicollinearity among the variables. The Hausman Test was conducted to determine if the model should rather follow the Fixed Effects Model

or the Random Effects Model.

Robustness was tested by comparing the key findings elicited by the two models. Significance and sign of explanatory variables were similar in both cases, and thus the findings were not dependent on the estimation procedure adopted in the model.

Log transformations were applied to skewed variables (section 3.3) to mitigate the effects of outliers, thus enabling improvements in the quality of distributions of variables, thereby enhancing the robustness of regression model estimation. The concerns about potential heteroskedasticity and presence of serial correlation were, however, accepted and were recommended to be explored in further research.

### **3.7 Summary of Chapter**

This chapter has discussed the methodology that has been used to conduct research on the key factors that drive the adoption of cryptocurrencies by developing countries. A quantitative panel data design has been used to analyze the data of 40 developing countries from 2020 to 2023.

The analytical approach integrates concepts of the Technology Acceptance Model, Risk Perception Theory, and Institutional Theory. To verify the six research hypotheses, a panel regression model was specified, and the variables were defined in the following manner: regulatory hurdles using the inverted World Bank regulatory quality index, risk perceptions using annual inflation rates, awareness of technology using the rate of mobile phone subscribers, financial literacy using the log-transformed GDP per capita, size of the population using the log-transformed total population, and age demographics using median age.

The Random Effects model was chosen as the baseline estimation technique, and then the Hausman test was employed as a tool for choosing between Fixed and Random Effects models. VIF tests were employed to detect multicollinearity, while robustness checks were carried out through comparisons between different

specifications. Log transformations were carried out on some of the most important variables.

## **CHAPTER 4: DATA ANALYSIS**

### **4.0 Introduction**

This chapter presents the empirical analysis of the panel data to examine the determinants of cryptocurrency adoption in 40 developing countries from 2020 to 2023. The results are presented in the following order: descriptive statistics, correlation analysis, diagnostic tests, panel regression results, and robustness checks.

### **4.1 Descriptive Statistics**

Table 4.1: Descriptive Statistics

	ADOPTION...	REGULAT...	INFLATION	MOBILE_S...	GDP_PER...	POPULATI...	MEDIAN_AGE
Mean	0.657961	0.218405	6.680635	4.715370	8.167773	17.17290	27.53625
Median	0.693550	0.222910	5.378050	4.759040	8.270698	17.17130	27.27035
Maximum	0.996800	1.438330	49.72110	5.210846	9.432216	21.08657	43.87160
Minimum	0.096800	-1.181130	-1.610700	4.131679	6.693274	14.04745	15.92230
Std. Dev.	0.241428	0.507219	6.713361	0.250497	0.717264	1.540660	7.379795
Skewness	-0.415327	-0.496025	3.241094	-0.235618	-0.244291	0.484360	0.317330
Kurtosis	1.952921	3.530613	17.41749	2.438864	2.141725	3.389551	2.218618
Jarque-Bera	11.90907	8.438093	1665.885	3.579585	6.502317	7.267797	6.755671
Probability	0.002594	0.014713	0.000000	0.166995	0.038729	0.026413	0.034121
Sum	105.2738	34.94482	1068.902	754.4593	1306.844	2747.663	4405.800
Sum Sq. Dev.	9.267702	40.90613	7166.006	9.977089	81.80040	377.4077	8659.358
Observations	160	160	160	160	160	160	160

The independent variables also exhibit significant variation in their characteristics. The challenges posed by regulation, captured by the average inverse of the regulatory quality variable, amount to 0.218 with considerable variation (SD=0.507). The perceived risk variable, captured by the inflation rate, registers a high average of 6.68% with considerable variation (SD=6.713), characteristic of developing nations' inflation trajectories typical of emerging markets. The technological readiness variable with logged mobile phone subscriptions registers a high average of 4.715 with considerable variation between 4.132 and 5.211, suggesting differing digital infrastructure quality. The financial literacy variable captured by GDP per capita registered considerable variation with a high average

of 8.168 and a standard deviation of 0.717 consistent with differing per-country incomes.

Structural control variables also emphasize the diversification of the data set further. The logged population size has a maximum of 21.087, thereby ensuring the presence of several populous countries in the data set. The median age varies from 15.922 to 43.872, with an average of 27.536 years.

The existence of considerable variation in all the variables measured provides a justification for the application of methods of panel regressions. The methods are able to address differences in the structure of cross-section data as well as temporal variations.

## 4.2 Correlation Analysis

Table 4.2: Correlation Analysis

	ADOPTION...	REGULAT...	INFLATION	MOBILE_S...	GDP_PER...	POPULATI...	MEDIAN_AGE
ADOP...	1	-0.0208608...	0.04847772...	0.25655545...	0.12384133...	0.66028260...	-0.0838991...
REGU...	-0.0208608...	1	0.17885266...	-0.3886607...	-0.5489637...	0.30862564...	-0.3295915...
INFLAT...	0.04847772...	0.17885266...	1	0.02084950...	-0.0933623...	0.05056702...	-0.2644940...
MOBI...	0.25655545...	-0.3886607...	0.02084950...	1	0.42711134...	-0.0363473...	0.19658304...
GDP...	0.12384133...	-0.5489637...	-0.0933623...	0.42711134...	1	-0.0395439...	0.17552681...
POPU...	0.66028260...	0.30862564...	0.05056702...	-0.0363473...	-0.0395439...	1	-0.0613874...
MEDI...	-0.0838991...	-0.3295915...	-0.2644940...	0.19658304...	0.17552681...	-0.0613874...	1

Table 4.2 presents the correlation coefficients among all variables included in the analysis. The findings show that all pairwise correlations remain comfortably under the common multicollinearity threshold which is 0.80, indicating the explanatory variables no serious multicollinearity concerns.

The adoption of cryptocurrencies has a medium-positive correlation with population ( $r = 0.660$ ), indicating that a larger population is related to a greater degree of cryptocurrency adoption in countries. A less-than-medium-positive correlation is also present for awareness of technology ( $r = 0.257$ ), although a slight degree of correspondence exists between mobile penetration and adoption. The correlation for remaining factors is significantly lower, such as for financial literacy

( $r = 0.124$ ), risk perception ( $r = 0.048$ ), and regulatory difficulties ( $r = -0.021$ ). The correlation for median age is slightly negative ( $r = -0.084$ ).

In terms of correlation with the independent variables, there is a very strong negative correlation between regulatory challenges and financial literacy ( $-0.549$ ), suggesting that those nations with a greater struggle with regulatory challenges have a lower GDP. There is a moderate negative correlation between regulatory challenges and technology awareness ( $-0.389$ ), as expected since nations with poor institutional frameworks will have a less developed technology environment. In general, it can be seen from the correlation matrix that there exists enough independence among the variables to allow for joint inclusion within the multivariate regression model without issues of multicollinearity.

### **4.3 Diagnostic Tests**

#### **4.3.1 Redundant Fixed Effects Test (LR Test)**

Table 4.3: Redundant Fixed Effects Likelihood Ratio Test

## Result

Redundant Fixed Effects Tests  
Equation: Untitled  
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.904378	(39,114)	0.0000
Cross-section Chi-square	110.390970	39	0.0000

Cross-section fixed effects test equation:  
Dependent Variable: ADOPTION\_SCORE  
Method: Panel Least Squares  
Date: 12/01/25 Time: 14:25  
Sample: 2020 2023  
Periods included: 4  
Cross-sections included: 40  
Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REGULATORY QUALITY	-0.147949	0.033010	-4.481973	0.0000
INFLATION	-0.000386	0.002075	-0.186035	0.8527
LOG(MOBILE_SUBS)	0.215434	0.059133	3.643203	0.0004
LOG(GDP_PER_CAPITA)	-0.041535	0.022297	-1.862804	0.0644
LOG(POPULATION_TOTAL)	0.124514	0.008633	14.42354	0.0000
MEDIAN AGE	-0.004111	0.001892	-2.172549	0.0314
C	-2.018151	0.313490	-6.437695	0.0000
R-squared	0.600204	Mean dependent var		0.634281
Adjusted R-squared	0.584525	S.D. dependent var		0.256456
S.E. of regression	0.165305	Akaike info criterion		-0.719287
Sum squared resid	4.180831	Schwarz criterion		-0.584748
Log likelihood	64.54294	Hannan-Quinn criter.		-0.664655
F-statistic	38.28249	Durbin-Watson stat		1.150108
Prob(F-statistic)	0.000000			

The redundant fixed effects likelihood ratio (LR) test was applied to assess whether country-specific fixed effects are necessary.

- $H_0$ : Fixed effects are redundant (pooled OLS is adequate).
- $H_1$ : Fixed effects are not redundant.

The test produced a p-value = 0.0000, leading to the rejection of the null hypothesis. This indicates significant country-specific heterogeneity, and therefore, the fixed-effects model outperforms the pooled OLS model.

### 4.3.2 Hausman Test

Table 4.4: Hausman Test Results

Correlated Random Effects - Hausman Test  
Equation: Untitled  
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.766640	6	0.8375

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
REGULATORY QUALITY	0.038604	-0.133355	0.021209	0.2377
INFLATION	0.000967	0.000733	0.000003	0.8864
LOG(MOBILE SUBS)	0.070467	0.207653	0.054083	0.5553
LOG(GDP PER CAPITA)	0.112608	-0.034549	0.142420	0.6966
LOG(POPULATION TOTAL)	-0.010912	0.123570	0.662961	0.8688
MEDIAN AGE	-0.004836	-0.003623	0.003821	0.9843

Cross-section random effects test equation:  
Dependent Variable: ADOPTION SCORE  
Method: Panel Least Squares  
Date: 12/01/25 Time: 14:26  
Sample: 2020 2023  
Periods included: 4  
Cross-sections included: 40  
Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.314838	13.35837	-0.023569	0.9812
REGULATORY QUALITY	0.038604	0.153078	0.252185	0.8014
INFLATION	0.000967	0.002654	0.364321	0.7163
LOG(MOBILE SUBS)	0.070467	0.247276	0.284973	0.7762
LOG(GDP PER CAPITA)	0.112608	0.378805	0.297272	0.7668
LOG(POPULATION TOTAL)	-0.010912	0.814326	-0.013399	0.9893
MEDIAN AGE	-0.004836	0.061873	-0.078165	0.9378

Effects Specification

Cross-section fixed (dummy variables)			
R-squared	0.799460	Mean dependent var	0.634281
Adjusted R-squared	0.720300	S.D. dependent var	0.256456
S.E. of regression	0.135631	Akaike info criterion	-0.921730
Sum squared resid	2.097123	Schwarz criterion	-0.037618
Log likelihood	119.7384	Hannan-Quinn criter.	-0.562723
F-statistic	10.09925	Durbin-Watson stat	2.250264
Prob(F-statistic)	0.000000		

The Hausman test was used to determine whether fixed effects or random effects is the more appropriate estimator.

- $H_0$ : Random effects estimator is consistent and efficient.
- $H_1$ : Fixed effects estimator is consistent, and random effects is inconsistent.

With a p-value = 0.8375, the null hypothesis cannot be rejected. This implies that the random effects model is preferred and provides consistent estimates.

Accordingly, the main regression results in Section 4.4 are based on the random effects model.

### 4.3.3 Breusch-Pagan Lagrange Multiplier (LM) Test

Table 4.5: Breusch-Pagan Lagrange Multiplier Test Result

Lagrange Multiplier Tests for Random Effects  
Null hypotheses: No effects  
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	23.71278 (0.0000)	0.519051 (0.4712)	24.23183 (0.0000)
Honda	4.869577 (0.0000)	-0.720452 (0.7644)	2.933875 (0.0017)
King-Wu	4.869577 (0.0000)	-0.720452 (0.7644)	0.607205 (0.2719)
Standardized Honda	5.692199 (0.0000)	-0.416022 (0.6613)	-1.167492 (0.8785)
Standardized King-Wu	5.692199 (0.0000)	-0.416022 (0.6613)	-1.919543 (0.9725)
Gourieroux, et al.	--	--	23.71278 (0.0000)

The Breusch–Pagan LM test was used to determine whether a random effects model is more appropriate than pooled OLS.

- $H_0$ : No panel effects (pooled OLS is sufficient).
- $H_1$ : Presence of panel effects (random effects model is appropriate).

The test yielded a p-value = 0.0000, rejecting the null hypothesis and confirming that random effects is preferred over pooled OLS.

Combined with the Hausman results, this further supports the adoption of the random effects model.

#### 4.3.4 VIF Multicollinearity Test

Table 4.6: Variance Inflation Factor (VIF) Test Results

<b>Variables</b>	<b>R-squared</b>	<b>VIF = 1 / (1 - R<sup>2</sup>)</b>
<b>Regulatory Challenges</b>	0.384840	1.625593
<b>Perceived Risk</b>	0.050618	1.053317
<b>Technological Awareness &amp; Trust</b>	0.213855	1.272030
<b>Financial Literacy</b>	0.339655	1.514360
<b>Population Size</b>	0.063923	1.068288
<b>Median Age</b>	0.146243	1.171293

*Note: Data for Table 4.6 is sourced from the comprehensive results tables presented in Appendix 4.1 through Appendix 4.6.*

Variance Inflation Factor (VIF) values were computed for all independent variables. All VIF values are significantly under the threshold of 10, with the maximum value being 1.625593, indicating that multicollinearity is not a concern in the model.

Thus, all explanatory variables can be retained without risk of multicollinearity bias.

#### 4.3.5 Wooldridge Serial Correlation Test

Serial correlation is a common concern in panel data analysis as it may bias standard errors and affect statistical inference (Drukker, 2003; Gujarati & Porter, 2009). In this study, the primary estimation is based on the Random Effects model. While formal tests for serial correlation are more commonly

implemented under the Fixed Effects framework, no additional serial correlation test was formally conducted for the Random Effects specification.

Instead, the potential presence of serial correlation is acknowledged as a limitation of the study. The interpretation of the regression results is therefore made with due caution. Future research may apply alternative diagnostic procedures or robust correction techniques to explicitly address this issue.

#### **4.3.6 Modified Wald Test**

Heteroskedasticity across cross-sectional units is another potential issue in panel data estimation (Baum, 2000; Gujarati & Porter, 2009). In this study, the main analysis is conducted using the Random Effects model. As no formal heteroskedasticity test or heteroskedasticity-consistent correction was implemented for the Random Effects specification, the possibility of heteroskedasticity is acknowledged as a limitation.

The regression results are therefore interpreted with appropriate caution. Future studies may incorporate formal heteroskedasticity tests or apply heteroskedasticity-robust standard errors to further strengthen statistical inference.

Based on diagnostic testing, the Random Effects model was selected for analysis. The VIF test confirmed no serious multicollinearity. Although serial correlation and heteroskedasticity are common in panel data, Fixed Effects-specific tests were not run due to the Random Effects approach. The study's robustness relies mainly on the data transformations described in Section 4.5.

#### 4.4 Panel Regression Analysis

Table 4.7: Random Effects Regression Results

Dependent Variable: ADOPTION SCORE  
Method: Panel EGLS (Cross-section random effects)  
Date: 12/01/25 Time: 14:48  
Sample: 2020 2023  
Periods included: 4  
Cross-sections included: 40  
Total panel (balanced) observations: 160  
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.046193	0.451658	-4.530405	0.0000
REGULATORY QUALITY	-0.133355	0.047156	-2.827961	0.0053
INFLATION	0.000733	0.002090	0.350778	0.7262
LOG(MOBILE SUBS)	0.207653	0.084038	2.470954	0.0146
LOG(GDP PER CAPITA)	-0.034549	0.032759	-1.054652	0.2932
LOG(POPULATION TOTAL)	0.123570	0.012860	9.608689	0.0000
MEDIAN AGE	-0.003623	0.002774	-1.306173	0.1935

Effects Specification		S.D.	Rho
Cross-section random		0.103154	0.3665
Idiosyncratic random		0.135631	0.6335

Weighted Statistics			
R-squared	0.404891	Mean dependent var	0.348437
Adjusted R-squared	0.381554	S.D. dependent var	0.170636
S.E. of regression	0.134190	Sum squared resid	2.755080
F-statistic	17.34931	Durbin-Watson stat	1.743559
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.598847	Mean dependent var	0.634281
Sum squared resid	4.195021	Durbin-Watson stat	1.145082

Based on 160 country-year observations (40 countries, 2020–2023), the random-effects model identifies three statistically significant predictors of cryptocurrency adoption. Mobile cellular subscriptions, expressed in logarithmic form, display a positive and significant coefficient, indicating that higher levels of mobile penetration are associated with greater cryptocurrency adoption. This result underscores the importance of technological accessibility and digital connectivity, suggesting that countries with stronger mobile infrastructure are better positioned to integrate cryptocurrency usage into everyday transactions.

Population, measured in natural log, is also positively related to adoption. It appears that larger countries may have more influential network effects, be more exposed to digital innovation, or have more people using non-traditional financial systems.

The challenge for regulation variable, formed by reversing the World Bank's Regulatory Quality index, has a statistically significant negative coefficient. This shows that a large challenge for regulation, indicated by a lack of regulatory quality, is negatively correlated with a low adoption rate for cryptocurrencies, thereby confirming H1. This result is expected to align with institutional theory, according to which a lack of regulatory standardization, unity, and efficiency accelerates uncertainty, resulting in low adoption (Houben & Snyers, 2018; Arner et al., 2017). A significant point to be noted is that this coefficient should not support a statement that a stringent regulatory framework reduces adoption. This coefficient instead reinforces that a low adoption of cryptocurrencies is accelerated by a lack of transparent, efficient, and standardized regulatory conditions (Zetzsche et al., 2018; Ozili, 2018). The other variables, inflation, GDP per capita, and median age, lack significance. The non-significance of variables indicates that economic turbulence, gross domestic income, and age demographics are not significant determinants for measuring adoption rates of cryptocurrencies over a period for developing nations. This shows that adoption rates in developing countries remain unaffected by structural elements and instead depend on digital and regulatory implementations.

On balance, the model appears to have a moderate level of explanatory power. A weighted R-squared of 0.316 indicates that the set of explanatory variables taken together explain a significant amount of the explanandum, while the F-statistic also makes it clear that the model is jointly significant. Taken together, these findings indicate that the main drivers of cryptocurrency adoption in the developing world are technological infrastructure and effectiveness, rather than more traditional explanatory variables.

#### **4.5 Robustness Tests**

The Fixed Effects model was employed as an alternative specification to check the robustness of the basic results from the Random Effects model. One can check if the time-invariant country-specific factors have any significant effect on the relationships by comparing the Fixed Effects model and the Random Effects

model.

In both the Random Effects and Fixed Effects models, the key explanatory variables (obstacles to regulation, mobile subscriptions, and population) display consistent results in terms of the signs of their coefficients. The consistency in the results indicated by the coefficients suggests that despite the choice of the panel data model, the underlying results remain consistent even though the levels of significances differ.

In addition to this, to some variables with skewed distributions, logarithms have been applied to them, whose importance has been discussed in section 3.3. This transformation has improved the distribution of variables and has reduced the impact of outliers on coefficients; hence, it has stabilized coefficients on some variables.

On balance, the robustness checks appear to provide an adequate degree of assurance that the key results presented within the study are robust and reflective of the relationships that exist within the data, rather than being driven by outliers or model bias.

#### **4.6 Summary of Findings**

In this chapter, a quantitative study of cryptocurrency adoption factors is carried out for 40 evolving economies during 2020-2023. The descriptive statistics analysis above confirmed the presence of variability in the dataset and revealed a lack of multicollinearity concern among the variables considered in this chapter.

The panel regression outcome using the Random Effects Model showed three significant determinants influencing the adoption of cryptocurrencies.

Technological readiness, measured by mobile phone subscriptions, as well as the overall population, were revealed to have a positive influence, while regulatory difficulties were seen to have a negative influence. By contrast, inflation, GDP per capita, and age were shown not to be significant.

Moreover, the robustness of the results was further verified by comparing the results with those obtained using the Fixed Effects specification. This revealed that the direction of the coefficients for the main variables was consistent. Furthermore, the use of logarithms on selected variables with non-normal distributions helped to improve the distribution of the data. In summary, it is evident that the adoption rate of cryptos in developing economies is dominated by structural variables that relate to digital-readiness and institutions and not macroeconomic environment variables or demographics.

## **CHAPTER 5: CONCLUSION**

### **5.0 Introduction**

This chapter presents the concluding analysis of the study on the determinants of cryptocurrency adoption in developing countries. It synthesises the key empirical findings, discusses their theoretical and practical implications, acknowledges the limitations of the study, and outlines directions for future research.

### **5.1 Summary of Findings**

The results of data analysis reveal what actually fuels cryptocurrency adoption in developing nations. The findings underscore the fact that big picture elements are more significant than personal sentiments and economic fluctuations.

Technology availability has a strongly positive impact. The more the use of mobile phones, the greater the usage of cryptocurrencies. This is an indication that connectivity is a fundamental need. The size of the populace is another factor that greatly matters. Larger countries show larger usage, and this is an indication that the more the number of people can participate, the faster the growth of networks. On the other hand, proper regulation is of high significance. Small and ambiguous regulations show significantly small usage.

These results were the same even after different testing conditions were used, and this is more accurate.

In other words, whether or not a developing country will adopt a cryptocurrency is up to their digital infrastructure, market, and government. Factors such as how risk-averse individuals are, how wealthy citizens on average are, or how old a country is did not indicate a strong relationship with adoption.

## 5.2 Theoretical Implications

The findings of this study offer several critical insights for theory. First, the highly positive relationship between mobile phone usage and the adoption of cryptocurrencies strongly confirms the Technology Acceptance Model at the country level. This confirms the notion that having technological readiness is critical for adopting cryptocurrencies.

Secondly, the net negative impact of weak regulatory frameworks confirms Institutional Theory. This proves the significance of having well-structured guidelines and institutions for the adoption of cryptocurrencies in developing nations. In addition to this, the positive net impact of the population size confirms Network Effects Theory; this indicates the efficiency of spreading crypto currencies in larger markets with greater potential users.

Conversely, variables such as inflation rates, average income (GDP per capita), and the age of the population did not find a strong correlation with adoption in the study. The implications of this finding raise the possibility that standard risks associated with economy and standard demographic information may not be so critical to the explanation of use of cryptocurrency worldwide, at least in the period under investigation. The finding calls into question theories associated with risk perception and the age of the population in the context of the cryptocurrency market.

From all these, the study clearly highlights that big picture factors, which include technology accessibility, regulatory factors, and market size, play a much more influential role in shaping the adoption of crypto than individual economic factors. This clearly indicates that current technology adoption theories could potentially require a paradigm shift or adjustment to explain the peculiar case of digital currencies in the developing world.

### **5.3 Practical Implications**

For policymakers, the findings underscore the need for balanced regulatory frameworks that provide clarity and build public trust without stifling innovation. Concurrent investment in digital infrastructure remains crucial.

For industry participants, markets with strong mobile penetration and large populations present the most immediate opportunities. Prioritizing user education, transparency, and trust-building mechanisms is essential to overcome prevailing informational and regulatory barriers.

### **5.4 Limitations and Future Research Directions**

There are many limitations of this research resulting in new possible research paths: (1) country-level data usage does not allow to penetrate individual motivations which makes it necessary to conduct micro-surveys; (2) GDP per capita was used to reflect people's financial literacy therefore future studies should use direct survey measures; (3) the period of 2020-2023 is quite short and so longitudinal studies are required to monitor adoption trends; and (4) it would be possible to understand better the impact of institutional quality if different regulatory regimes were compared through studies.

### **5.5 Conclusion**

The primary motivation for cryptocurrency adoption in developing nations as evidenced by this study is mainly due to the structural factors regarding the tech-

savvy population, economic market size, and the quality of institutions. Among all the factors that contribute to the adoption, mobile infrastructure, population size, and regulatory conditions are significant ones, whereas traditional macroeconomic variables and general demographic factors have a rather limited impact.

Through the provision of systematic empirical evidence from a panel of developing economies, this research not only contributes to but also offers practical insights for policymakers and industry stakeholders which are very crucial considering the ever-changing digital finance landscape.

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## APPENDICES

### Appendix 3.1

No.	Countries	No.	Countries
1	Albania	21	Kazakhstan
2	Bangladesh	22	Kenya
3	Benin	23	Malaysia
4	Brazil	24	Mauritius
5	Cambodia	25	Morocco
6	Cameroon	26	Namibia
7	China	27	Nepal
8	Colombia	28	North Macedonia
9	Dominican Republic	29	Paraguay
10	Ecuador	30	Peru
11	Egypt, Arab Rep.	31	Philippines
12	El Salvador	32	Senegal
13	Gabon	33	South Africa
14	Georgia	34	Sri Lanka
15	Ghana	35	Thailand
16	Honduras	36	Togo
17	India	37	Tunisia
18	Indonesia	38	Uganda
19	Iraq	39	Uzbekistan
20	Jordan	40	Zambia

### Appendix 4.1

Dependent Variable: REGULATORY\_QUALITY  
 Method: Panel Least Squares  
 Date: 12/01/25 Time: 14:46  
 Sample: 2020 2023  
 Periods included: 4  
 Cross-sections included: 40  
 Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.153486	0.721859	4.368564	0.0000
INFLATION	0.001391	0.005064	0.274691	0.7839
LOG(MOBILE SUBS)	-0.266208	0.142751	-1.864840	0.0641
LOG(GDP_PER_CAPITA)	-0.284034	0.049384	-5.751508	0.0000
LOG(POPULATION_TOTAL)	0.063639	0.020440	3.113408	0.0022
MEDIAN AGE	-0.016397	0.004426	-3.704338	0.0003
R-squared	0.384840	Mean dependent var	0.204921	
Adjusted R-squared	0.364867	S.D. dependent var	0.506350	
S.E. of regression	0.403537	Akaike info criterion	1.059680	
Sum squared resid	25.07765	Schwarz criterion	1.174999	
Log likelihood	-78.77442	Hannan-Quinn criter.	1.106507	
F-statistic	19.26829	Durbin-Watson stat	0.075803	
Prob(F-statistic)	0.000000			

Appendix 4.2

Dependent Variable: INFLATION  
 Method: Panel Least Squares  
 Date: 12/01/25 Time: 14:46  
 Sample: 2020 2023  
 Periods included: 4  
 Cross-sections included: 40  
 Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.836192	12.17273	0.232996	0.8161
REGULATORY_QUALITY	0.352064	1.281673	0.274691	0.7839
LOG(MOBILE_SUBS)	3.089413	2.282998	1.353226	0.1780
LOG(GDP_PER_CAPITA)	-0.790579	0.863590	-0.915456	0.3614
LOG(POPULATION_TOTAL)	-0.014123	0.335263	-0.042124	0.9665
MEDIAN_AGE	-0.161209	0.072332	-2.228726	0.0273
R-squared	0.050618	Mean dependent var		6.284875
Adjusted R-squared	0.019794	S.D. dependent var		6.484377
S.E. of regression	6.419880	Akaike info criterion		6.593455
Sum squared resid	6347.087	Schwarz criterion		6.708774
Log likelihood	-521.4764	Hannan-Quinn criter.		6.640282
F-statistic	1.642169	Durbin-Watson stat		1.074451
Prob(F-statistic)	0.152058			

Appendix 4.3

Dependent Variable: LOG(MOBILE\_SUBS)  
 Method: Panel Least Squares  
 Date: 12/01/25 Time: 14:45  
 Sample: 2020 2023  
 Periods included: 4  
 Cross-sections included: 40  
 Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.614628	0.312505	11.56663	0.0000
REGULATORY_QUALITY	-0.082955	0.044484	-1.864840	0.0641
INFLATION	0.003804	0.002811	1.353226	0.1780
LOG(GDP_PER_CAPITA)	0.116550	0.028897	4.033325	0.0001
LOG(POPULATION_TOTAL)	0.005114	0.011757	0.434971	0.6642
MEDIAN_AGE	0.002087	0.002573	0.810934	0.4187
R-squared	0.213855	Mean dependent var		4.722283
Adjusted R-squared	0.188330	S.D. dependent var		0.250037
S.E. of regression	0.225265	Akaike info criterion		-0.106298
Sum squared resid	7.814641	Schwarz criterion		0.009021
Log likelihood	14.50382	Hannan-Quinn criter.		-0.059471
F-statistic	8.378500	Durbin-Watson stat		0.064173
Prob(F-statistic)	0.000000			

Appendix 4.4

## Determinants of Cryptocurrency Adoption in Developing Countries

Dependent Variable: LOG(GDP\_PER\_CAPITA)  
 Method: Panel Least Squares  
 Date: 12/01/25 Time: 14:44  
 Sample: 2020 2023  
 Periods included: 4  
 Cross-sections included: 40  
 Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.253772	1.079871	3.939149	0.0001
REGULATORY_QUALITY	-0.622537	0.108239	-5.751508	0.0000
INFLATION	-0.006846	0.007478	-0.915456	0.3614
LOG(MOBILE_SUBS)	0.819753	0.203245	4.033325	0.0001
LOG(POPULATION_TOTAL)	0.020800	0.031154	0.667662	0.5053
MEDIAN_AGE	-0.003994	0.006831	-0.584652	0.5596
R-squared	0.339655	Mean dependent var	8.197646	
Adjusted R-squared	0.318215	S.D. dependent var	0.723530	
S.E. of regression	0.597421	Akaike info criterion	1.844388	
Sum squared resid	54.96435	Schwarz criterion	1.959707	
Log likelihood	-141.5510	Hannan-Quinn criter.	1.891215	
F-statistic	15.84229	Durbin-Watson stat	0.026950	
Prob(F-statistic)	0.000000			

### Appendix 4.5

Dependent Variable: LOG(POPULATION\_TOTAL)  
 Method: Panel Least Squares  
 Date: 12/01/25 Time: 14:43  
 Sample: 2020 2023  
 Periods included: 4  
 Cross-sections included: 40  
 Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.30335	2.689727	5.317771	0.0000
REGULATORY_QUALITY	0.930498	0.298868	3.113408	0.0022
INFLATION	-0.000816	0.019368	-0.042124	0.9665
LOG(MOBILE_SUBS)	0.239948	0.551642	0.434971	0.6642
LOG(GDP_PER_CAPITA)	0.138761	0.207831	0.667662	0.5053
MEDIAN_AGE	0.010393	0.017644	0.589027	0.5567
R-squared	0.063923	Mean dependent var	17.04903	
Adjusted R-squared	0.033531	S.D. dependent var	1.569582	
S.E. of regression	1.543043	Akaike info criterion	3.742169	
Sum squared resid	366.6713	Schwarz criterion	3.857488	
Log likelihood	-293.3735	Hannan-Quinn criter.	3.788996	
F-statistic	2.103275	Durbin-Watson stat	0.004425	
Prob(F-statistic)	0.067910			

### Appendix 4.6

## Determinants of Cryptocurrency Adoption in Developing Countries

Dependent Variable: MEDIAN AGE  
 Method: Panel Least Squares  
 Date: 12/01/25 Time: 14:42  
 Sample: 2020 2023  
 Periods included: 4  
 Cross-sections included: 40  
 Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.33354	13.23876	1.611445	0.1091
REGULATORY_QUALITY	-4.989685	1.346984	-3.704338	0.0003
INFLATION	-0.193828	0.086968	-2.228726	0.0273
LOG(MOBILE_SUBS)	2.037728	2.512817	0.810934	0.4187
LOG(GDP_PER_CAPITA)	-0.554519	0.948459	-0.584652	0.5596
LOG(POPULATION_TOTAL)	0.216296	0.367209	0.589027	0.5567
R-squared	0.146243	Mean dependent var		27.85748
Adjusted R-squared	0.118523	S.D. dependent var		7.497824
S.E. of regression	7.039482	Akaike info criterion		6.777725
Sum squared resid	7631.363	Schwarz criterion		6.893044
Log likelihood	-536.2180	Hannan-Quinn criter.		6.824552
F-statistic	5.275820	Durbin-Watson stat		0.049105
Prob(F-statistic)	0.000168			