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Factors Affecting the Adoption of Cryptocurrency

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Abstract: This paper examines factors affecting the adoption of cryptocurrency across 158 countries worldwide. To this end, we collected cryptocurrency adoption data from Chainalysis's reports and macroeconomic data from the World Development Indicators platform. We find that greater import volumes, larger population size, more sufficient levels of the labor force, higher unemployment rate, and a higher level of electricity access are associated with a greater level of cryptocurrency adoption. On the other hand, a higher level of government spending and a greater level of domestic savings are associated with a lower level of cryptocurrency adoption. In addition, we also find that the population size and level of the labor force have a negative impact on the three subcomponents of the cryptocurrency adoption index including (i) centralized service value received (CeFi); (ii) the volume of exchange trading (P2P); and (iii) the received DeFi value (DeFi). We find that while the import volumes and level of electricity access have an opposite relationship with the centralized service value received and the DeFi value received, GDP has a negative effect on the DeFi value received. Meanwhile, greater government spending and higher domestic savings are associated with a greater level of exchange trade volume P2P. In terms of urbanization, whereas it shows a positive impact on the exchange trade volume P2P, it has the opposite effect on the DeFi value received.

Keywords: Cryptocurrency adoption, factors, World Development Indicators.

1. Introduction

In the wake of the evolution of the Industry 4.0, the global financial system has been witnessing remarkable changes. This has allowed innovative ideas to be generated to stimulate progress toward traditional financial activities. For example, in the field of payment, methods of currency exchange and transaction are becoming more and more innovative and bustling thanks to the emergence of cryptocurrencies. Arguably, cryptocurrencies can bring significant benefits, including fast, effective, and low-cost transactions, increased transparency, higher security, and more privacy, and therefore, they are expected to bring about a major revolution in the economic and financial system (Chohan, 2021; Nadeem et al., 2021; Majid et al., 2022).

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Currently, there are a large number of cryptocurrencies in circulation including Bitcoin (BTC), Ethereum (ETH), Ripple (XRP), Litecoin (LTC), Tether (USDT), Cardano (ADA), and Binance Coin (BNB). According to CoinMarketCap and TokenInsight (2022), by the third quarter of 2022, the global cryptocurrency market reached about $934.85 billion. At present, the region with the highest cryptocurrency adoption rate is Central, Northern, and Western Europe (CNWE) accounting for 21.9%; followed by North America (19%), Central, South Asia, and Oceania - CSAO (15.8%) and East Asia (12.9%) (Chainalysis, 2022). The largest share of cryptocurrency mining belongs to the Asia-Pacific region (50%), then North America; meanwhile, the largest share of crypto-wallet storage (42%) belongs to Europe, followed by North America (39%). Europe has the largest number of crypto exchanges (37%), followed by Asia-Pacific (27%) and North America (18%) (Hileman et al., 2017).

Despite the fact that the cryptocurrency trading and investment markets remain popular and attract attention worldwide, they also have a number of potential downside effects. There has been a concern that individuals and organizations can take advantage of the security holes of cryptocurrencies to carry out illegal activities including tax evasion, money laundering, extortion and data theft (Stark, 2013; Folkinshteyn et al., 2016; Bloomberg, 2017; Conti et al., 2018). In addition, some drawbacks of cryptocurrencies also relate to exchange rate fluctuations, lack of liquidity, regulations, government controls or inadequate financial knowledge of users, thereby shaking customers' trust and intentions to use cryptocurrency (Arias-Oliva et al., 2019).

Given the positive-negative tradeoff of cryptocurrency to the economy, understanding which factors might affect the adoption of cryptocurrencies is of crucial importance. However, limited empirical studies have discussed the impact of specific economic factors on cryptocurrency adoption. Therefore, in this paper, we contribute to the literature by examining economic factors that can affect the level of cryptocurrency adoption.

To estimate the economic determinants of cryptocurrency adoption in each country, we collect cryptocurrency data from Chainalysis's reports as well as macroeconomics data from the World Development Indicators platform. Overall, we find that greater import volumes, larger population size, more sufficient level of the labor force, higher unemployment rate, and a higher level of access to electricity are associated with a greater level of cryptocurrency adoption. Meanwhile, higher government expenditure and a greater level of domestic savings have the opposite effect.

Further, our additional analysis shows that the population size and the level of labor force have a negative impact on the three sub-components of the cryptocurrency adoption index, including Centralized service value received, P2P exchange trade volume and DeFi value received. While the import volumes and level of electricity access have a reverse relationship to the centralized service value received and the DeFi value received; GDP has a negative effect on the DeFi value received. The larger government expenditure and higher domestic savings are related to a greater level of exchange trade volume P2P. Regarding the level of urbanization, whereas it shows a positive impact on the exchange trade volume P2P, it has the opposite effect on the DeFi value received.

2. Literature review

2.1. The birth of cryptocurrency

With the emergence of revolutionary new concepts of blockchain technology and decentralized currency, cryptocurrencies are attracting more national attention. Cryptocurrency is one of the popular forms of digital currency. According to the World Bank (WB), cryptocurrencies are classified as digital currencies and are defined as "the electronic representation of value, transaction accounts recorded in their units of payment and different from other forms of electronic money (e-money) – are conventional digital payment mechanisms, representative, recorded, paid in fiat currency" (Houben et al., 2018). This type of money also does not require an intermediary as a third party, so the owner can manage it independently and transactions can be conducted instantly across countries.

Overall, cryptocurrencies can be understood to have the following main characteristics: (1) Expression of cryptocurrency market of value; (2) Not going through third parties; (3) Not issued by the Central Bank or any state management agency; (4) Not valid in any region or country, even if it has certain functions of money such as a medium of exchange, a means of payment and a store of value; (5) Prices are determined by supply and demand; (6) Not centrally managed, and (7) Nearly impossible to counterfeit or double-spend.

The arrival of prominent cryptocurrencies, such as Bitcoin and Ethereum, has aroused curiosity and attention, leading to widespread awareness of the concept with varying degrees of tolerance and different acceptance. Cryptocurrencies are a subset of digital currencies that are primarily decentralized or peer-to-peer transactions that do not depend on any financial institution. At the same time, the innovative aspect of decentralization, security, efficiency or transparency largely influences the attractiveness of cryptocurrencies; however, reluctance towards these currencies or unwillingness to use them is mainly due to price fluctuations, ignorance or participation in illegal activities (Chen et al., 2021).

2.2. Factors affecting the adoption of cryptocurrencies

Parino et al. (2018) provide a new look at Bitcoin adoption by country and document a positive relationship between Internet penetration rate, trade freedom, GDP per capita (PPP), and human development index (HDI) on cryptocurrency adoption. Examining the intention of Chinese individuals to use Bitcoin, Nadeem et al. (2021) show that perceived ease of use and perceived usefulness have a positive relationship with the intention to use Bitcoin, while security and control show a negligible impact on perceived usefulness and intention to use this coin. This is compatible with the result of Shahzad et al. (2018) when they also show a positive relationship between perceived usefulness and perceived ease of use to people's intention to use Bitcoin.

Investigating the role of legal, criminal, financial, and social factors in crypto infrastructure adoption, Saiedi et al. (2021) show that crypto infrastructure adoption is driven by low trust in banks and the financial system, the loss of confidence in central bank-issued currencies and the fear of a national inflationary crisis. Reddick et al. (2019) examine the factors influencing a country's blockchain adoption and show cybersecurity, government efficiency and political stability are important predictors of blockchain adoption.

Studying the influence of factors on cryptocurrency mining including the price of energy, how that energy is generated, temperature, regulatory constraints, human capital, and relationship development (RDI), Alonso et al. (2021) posit that a high level of cryptocurrency mining belongs to countries with sustainable development, strong investment in RDI, and human resources such as Denmark, Germany, Sweden, and South Korea. In contrast, jurisdictions with the worst environmental impact such as South American countries (i.e. Bolivia, Venezuela and Suriname) and the Caribbean (Cuba) recorded the least sustainable cryptocurrency mining.

Investigating factors affecting behavioral intention to use cryptocurrencies during the COVID-19 pandemic in Pakistan, Jariyapan et al. (2022) show that the factors of financial literacy, subjective norm, anxiety about computers, computer efficiency, perceived usefulness, perceived ease of use and experience influence behavioral intentions of investors and business graduates using cryptocurrencies; however, perceived risk has the opposite effect. Alnoor et al. (2022) state that cryptocurrency adoption has a positive relationship with education level, human development index, network readiness, level of Gini index, democracy, regulatory efficiency, and gross domestic product (GDP). In contrast, the corruption perception and the economic freedom have a negative relationship with cryptocurrency adoption.

Having analyzed the factors affecting the intention to use cryptocurrency from the perspective of consumer behavior in Spain, Arias-Oliva et al. (2019) show that while perceived risk, financial literacy, and social influence had no effect on the intention to use cryptocurrencies, performance expectations, effort expectations, and facilitating conditions are statistically significant and positively affect

intention to use. Similarly, examining the factors in India for bankers' blockchain technology adoption, Jena et al. (2022) show initial trust, expected performance, facilitating conditions, perceived risk, and government regulation are all statistically important predictors which affect positively the intention to use cryptocurrency. In addition, Almajali et al. (2022) show that subjective norm, attitude, perceived risk, perceived usefulness, perceived enjoyment, perceived ease of use and trust have a positive effect on the intention to use cryptocurrency. This is quite similar to the results of Shahzad et al. (2018), Arias-Oliva et al. (2019), Nadeem et al. (2021), Jena et al. (2022) and Jariyapan et al. (2022). However, facilitating conditions have a negative effect on the study, which is opposite to the results of Shahzad et al. (2018), Arias-Oliva et al. (2019) and Jena et al. (2022).

3. Methodology

3.1. Model development and sample selection

To examine the impacts of several economic factors on cryptocurrency adoption, we use the following panel regression model:

$$CA_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GE_{it} + \beta_3 IM_{it} + \beta_4 LF_{it} + \beta_5 UP_{it} + \beta_6 TP_{it} + \beta_7 TU_{it} + \beta_8 EA_{it} + \beta_9 DS_{it} + Fixed\ Effects + \varepsilon_{it} \quad (1)$$

In this model, CA is the dependent variable, capturing the level of cryptocurrency adoption in country *i* at year *t*. To measure CA, we use the Cryptocurrency Adoption Index provided by the Chainalysis's reports. The higher the value of the index implies the higher the level of cryptocurrency adoption in the country.

We also incorporate into the model a number of macroeconomic variables that may affect the level of cryptocurrency adoption across countries. Inheriting variables from previous literature in determining the economic factors that influence blockchain adoption and Bitcoin usage, we propose that factors such as GDP, import goods and services, total population, unemployment, and access to electricity, labor force, domestic saving, urban population, and government expenditure may affect the level of cryptocurrency adoption.

ε_{it} is the robust standard error.

3.2. Control variables

3.2.1. GDP level

According to the growth principle, GDP increases through per capita rise due to the switching of payment instruments thereby helping to promote saving and investment. Much of the rate of cryptocurrency adoption in the early stages is determined by a country's level of economic development or, in other words, economic size (Chen et al., 2021). While most developed countries are at risk of debt, facing high inflation and low GDP, they tend to prioritize basic needs such as money transfer and savings over the use of cryptocurrencies due to high upfront implementation costs, research investment, and building blockchain-based systems (Chainalysis, 2022). Thus, we expect that higher GDP is associated with a higher level of cryptocurrency adoption. In this paper, we use the natural logarithm of GDP as a measure of GDP level.

3.2.2. Import volumes

From a trade perspective, the faster the volume of import transactions is conducted, the quicker the disbursement speed as well as the economic operation will be. In other words, the fast and inexpensive transactions that take place in international trade will further make cryptocurrencies an early recognized instrument of exchange. Not having to go through any intermediary financial institutions will contribute to increasing the efficiency of the economy (Chen et al., 2021; Shahzad et al., 2018; Majid et al., 2022). In contrast, regulatory hurdles, institutional barriers, and price volatility will result in lower cryptocurrency adoption in import trade. In this paper, we measure import volumes using the ratio of imports of goods and services to GDP.

3.2.3. Labor force

Adoption costs and additional factors such as human capital make cryptocurrency adoption slower in emerging economies than in advanced economies (Bhimani et al., 2022). Being involved in the job market help workers accumulate income, thereby creating an incentive for the adoption of cryptocurrencies in each country. In this paper, we measure the labor

force level using the ratio of the labor force to the total population.

3.2.4. Total population

Countries with high population density will be more likely to adopt cryptocurrencies (Parino et al., 2018). According to Saiedi et al. (2021), the population is concentrated in the group of adults with financial income, who are aware of the potential of cryptocurrencies and can access digital trading platforms and banks will increase the adoption of cryptocurrencies. In this paper, we use the natural logarithm of the total population as a measure of population size.

3.2.5. Unemployment rate

Increasing competition in the labor market has been leading to certain difficulties for a large part of workers (Bojaj et al., 2022). With a highly developed economy accompanied by a rapid change in technology, employees who are not qualified, skilled, and knowledgeable enough, are vulnerable to rejection, thereby increasing the unemployment rate (Bojaj et al., 2022; Ozili et al., 2023). The lack of sufficient accumulation or low disposable income as a result of unemployment will reduce the adoption of cryptocurrencies in each country. In this paper, we measure the unemployment rate using the ratio of total unemployment to total labor force.

3.2.6. Access to electricity

Electricity provides most of the energy in all economic activities. The more the economy develops, the higher the demand for electricity, which in turn causes significant impacts on the environment. With the increasing awareness of people and businesses about environmental protection and sustainable development, the greater the level of access to and use of electricity is likely to make cryptocurrency adoption lower in countries (Mahmoud et al., 2019; Badea et al., 2021). Furthermore, according to Badea et al. (2021) and Alonso et al. (2021), a high or low cryptocurrency adoption level also depends heavily on geographic location; typically remote areas and city suburbs where cryptocurrency mining operations can utilize the performance of electrical infrastructure with renewable energy inputs. While some of the countries most likely to implement sustainable cryptocurrencies are Europe (Denmark, Sweden, Germany, Finland, Austria, Switzerland, and the United Kingdom) and Asia (Korea and Japan) with a temperate climate and a favorable location for mining; some other countries that have difficulty achieving sustainable mining results are South America (Bolivia, Venezuela and Suriname), the Caribbean (Cuba), Africa (Libya, Sudan and Nigeria) and the Middle East (Pakistan and Iraq). In this paper, we measure access to electricity using the ratio of electricity access to the total population.

3.2.7. Urbanization

Geographical location plays an important role in cryptocurrency access (Badea et al., 2021). Cryptocurrency mining is incentivized to be done in locations where it is feasible to utilize the system of sustainable renewable energy sources such as wind or water; but a different location where cryptocurrency payment transactions are equally advantageous is in major cities. According to Parino et al. (2018), interest in cryptocurrencies is strongest in the best financial development locations that facilitate businesses participating in the cryptocurrency ecosystem to simplify the process of use. It is also suitable for people in helping them to more easily access banking products and services integrated into popular communication technologies, typically the Internet and mobile phones. In this paper, we measure urbanization using the ratio of urban population to total population.

3.2.8. Government expenditure

The impact of government expenditure on cryptocurrency adoption is a complex issue that depends on several factors. On one hand, increased government spending on technology and infrastructure can promote the adoption of cryptocurrency by improving the overall digital economy and making it easier for people to access and use cryptocurrencies. On the other hand, governments may also take actions that could discourage cryptocurrency adoption, such as implementing regulations or taxes that limit or discourage the use of cryptocurrencies. If governments are hostile towards cryptocurrencies and spend resources on cracking down on their use, it can create a negative perception of them in the public eye and stifle adoption. Additionally, if government spending is focused on traditional financial systems, it can make it more difficult for

cryptocurrencies to compete and gain traction. In this paper, we measure government expenditure using the ratio of general government final consumption expenditure to GDP.

3.2.9. Domestic savings

Domestic savings can have a notable impact on cryptocurrency adoption. When people have more savings, they may be more inclined to invest in alternative assets like cryptocurrencies. This is because cryptocurrencies offer a potential opportunity for high returns, which can be appealing to those looking to grow their savings. Furthermore, as more people invest in cryptocurrencies, it can lead to greater mainstream adoption and legitimacy for the technology. However, the opposite can also be true. If people have limited savings or are hesitant to invest, they may be less likely to explore cryptocurrencies as an option. Additionally, if traditional financial institutions offer more attractive savings options, it can limit their adoption. In this paper, we measure domestic savings using the ratio of gross domestic savings to GDP.

Table 1: Variables description in the research model

Dependent variables			
Cryptocurrency Adoption	CA	The global crypto adoption index C, ranks countries on a scale of 0 - 1. The closer the score is to 1, the higher the rank (Chinalysis, 2020).	Shahzad et al. (2018), Reddick et al. (2019), Chen et al (2021), Bojaj et al. (2022), Alnoor et al (2022), Nadeem et al., 2021), Arias-Oliva et al (2019), Jariyapan et al. (2022), Almajali et al. (2022)
Independent variables			
General government final consumption expenditure	GE	The ratio of general government final consumption expenditure to GDP	Folkinshteyn et al. (2016), Seetharaman et al. (2017), Ammous (2018), Chen et al. (2021)
Imports of goods and services	IM	The ratio of imports of goods and services to GDP	Shahzad et al. (2018), Chen et al. (2021), Majid et al. (2022)
Labor force	LF	The ratio of labor force to total population	Saiedi et al. (2021), Bhimani et al. (2022)
Urban population	UP	The ratio of urban population to total population	Parino et al. (2018), Badea et al. (2021)
Total population	TP	The natural logarithm of the total population	Saiedi et al. (2021), Chen et al. (2021), Parino et al. (2018)
Total unemployment	TU	The ratio of total unemployment to total labor force	Bojaj et al. (2022), Ozili et al. (2023)
Access to electricity	EA	The ratio of access to electricity to total population	Mahmoud et al. (2019), Badea et al. (2021), Alonso et al. (2021), Saiedi et al. (2021)
Gross domestic savings	DS	The ratio of gross domestic savings to GDP	Mahmoud et al. (2019), Chen et al. (2021)
Gross domestic product	GDP	The natural logarithm of GDP	Li et al. (2017), Parino et al. (2018), Reddick et al. (2019), Vo et al. (2021), Chen et al. (2021), Bhimani et al. (2022), Saiedi et al. (2021), Holtfort et al. (2022).

Source: Authors compilation.

3.3. Data collection

The study is panel-based with crypto data collected on the Global Cryptocurrency Adoption index from Chainalysis between 2020 and 2022. We use The Global Crypto Acceptance Index (CA), which ranks countries on a scale of 0-1 for cryptocurrency adoption. The closer the score is to 1, the higher the rank (Chainalysis, 2022). We collect all macroeconomic data from the World Development Indicators from 2019 to 2021 for 158 countries.

4. Empirical results

4.1. Descriptive statistics

Table 2 shows descriptive statistics of the research variables. The table presents a detailed statistical description of the variables used including the number of observations, the mean value, the standard deviation, and the minimum and maximum values of the variables.

According to Table 2, CA has a mean of 14.2% with a standard deviation of 16.8%. The minimum value is 0 and the maximum value is 1. CeFi has a mean value of 74.7 with a standard deviation of 43.44, the minimum value is 1 and the maximum value is 157. The mean of RCeFi is 74.69 with a standard deviation of 43.45; the smallest and largest values are obtained as 1 and 156 respectively. Similarly, the mean owned by P2P variable is 75.9, with a standard deviation value of 75.2; a minimum level is 1 and the maximum value is 1338. The mean of DeFi is 73.81 and the maximum value is 291.27. RDeFi variable has a mean of 73.93 and its maximum value is 297.74.

In addition, GDP, GE, IM, TP, UP, LF, TU, DS, and EA have average values of 61.62, 41.25%, 16.22, 1.18, 44.87%, 7.65, 22.10, and 89.52 respectively with big difference. While DS is the variable with the smallest value (-21.66), GE records a maximum value of 1771.6. Next, the study will conduct a correlation test in the model to ensure the reliability of the regression results as well as the results of other estimates.

Table 2: Descriptive statistics

Variables	Obs	Mean	Std.Dev	Min	Max
CA	395	0.142	0.168	0	1
CeFi	420	74.702	43.442	1	157
RCeFi	420	74.692	43.454	1	156
P2P	412	75.905	75.237	1	1338
DeFi	404	73.812	44.979	1	291.276
RDeFi	405	73.939	45.679	1	297.749
GDP	421	25.180	1.892	20.906	30.766
GE	419	61.620	207.599	0	1771.615
IM	419	0.412	0.304	0	1.991
TP	422	16.228	1.790	11.064	21.068
UP	422	1.181	6.506	0.171	78.208
LF	422	0.448	0.099	0	0.763
TU	416	7.654	5.375	0.1	33.559
DS	378	22.104	13.100	-21.669	64.761
EA	281	89.528	20.984	11.2	100

Source: Authors compilation.

4.2. Correlation matrix

Table 3 shows the correlation matrix among the variables. More specifically, the results of Pearson correlation analysis show that the independent variables are all correlated with each other when the Sig coefficient is < 5%, which shows that the correlation between the variables is statistically significant. While CA with the variables GE, IM, UP, TU, and DS has a positive negative correlation, the variables GDP, TP, LF, and EA show a strong negative correlation through Pearson's coefficient 0.488, 0.532, 0.125 and 0.08 respectively. In addition, according to Gujarati (1995), the absence of multicollinearity can be found if the correlation coefficient is less than 0.8. Therefore, we confirm that there is no multicollinearity in our regression analyses.

Next, we also perform the VIF test to test for any possible multicollinearity problem. The test result is presented in the last column of Table 3. The VIF index less than 10 shows that the pairwise correlation between the independent variables is weak, so there is no multicollinearity in the model.

Table 3: Correlation matrix

	CA	GDP	GE	IM	TP	UP	LF	TU	DS	EA	VIF
CA	1.000										
GDP	0.488	1.000									6.20
GE	-0.029	-0.005	1.000								1.14
IM	-0.159	-0.102	-0.074	1.000							1.48
TP	0.532	0.720	0.169	-0.373	1.000						6.27
UP	-0.033	-0.005	-0.028	-0.043	-0.061	1.000					1.03
LF	0.125	0.329	-0.001	0.144	0.048	0.046	1.0000				2.01
TU	-0.102	-0.191	-0.070	-0.101	-0.169	0.040	-0.430	1.000			1.46
DS	-0.012	0.306	0.019	0.194	-0.027	0.011	0.294	-0.248	1.000		1.45
EA	0.080	0.289	-0.070	0.235	-0.197	0.058	0.190	0.029	0.129	1.000	1.98

Source: Authors compilation.

4.3. Baseline results

Table 4 presents the results of the baseline model (1) to examine the factors affecting the adoption of cryptocurrency.

The analysis results show that the population size is statistically significant and positively influences cryptocurrency adoption. This result is similar to the research results of Parino et al. (2018) and Saiedi et al. (2021). This shows that cryptocurrency adoption rates will be seen higher in densely populated countries where a majority of mature people have adequate disposable income and are easily able to access banks and electronic payment services.

The labor force variable is statistically significant and positively influences cryptocurrency adoption. This result is consistent with the results of Bhimani et al. (2022) and Saiedi et al. (2021). A large number of employed workers will help them increase their disposable income, reduce income inequality, and increase participation in financial activities, thereby promoting the adoption of cryptocurrencies in each country.

The electricity access variable has a positive and statistically significant impact on cryptocurrency adoption. As expected, this result is consistent with the study of Alonso et al. (2021). The adoption of cryptocurrency is highly dependent on geography and electricity infrastructure as well as people's perception of sustainable development. In fact, two regions that are considered potential in accepting cryptocurrencies are Europe and East Asia where they have standard temperatures, mild climates, feasible cost of access, and advanced infrastructure suitable for the exploitation of sustainable green renewable energy sources.

Table 4: The factors affecting cryptocurrency adoption (CA)

Variables	**OLS**	**GLS**
	(1)	(2)
GDP	-0.003	-0.002
	[-0.33]	[-0.59]
GE	-0.000**	-0.00007***
	[-2.33]	[-9.42]
IM	0.055*	0.050***
	[1.65]	[4.10]
TP	0.056***	0.042***
	[5.05]	[10.47]
UP	-0.0001	-0.00009
	[-0.16]	[-0.76]
LF	0.377***	0.262***
	[3.00]	[6.57]
TU	0.002	0.001***
	[1.55]	[4.20]
DS	-0.0008	-0.0005***
	[-1.24]	[-3.85]
EA	0.0007	0.0005***
	[1.42]	[3.47]
Cons	-1.001***	-0.848***
	[-8.00]	[-15.07]
N	250	250
R-sq	0.322	

Note: t statistics in brackets *p < 0.1, **p < 0.05, ***p < 0.01.
Source: Authors compilation.

Import volumes are statistically significant and positively impact cryptocurrency adoption. However, this result is contrary to the study of Chen et al. (2021). This implies that businesses

operating in the commodity import trade tend to adopt cryptocurrencies since they are aware of transaction speed and cost-saving benefits. This will increase the commercial advantage for the participants, speed up the process of trade disbursement, contribute to creating liquidity for the market, and increase economic efficiency.

Similarly, the unemployment rate also show a positive effect on cryptocurrency adoption which is opposite to the result of Bojaj et al. (2022). Despite being unemployed, individuals are still able to manage financially, accumulate disposable income and reduce income inequality. Those who are unemployed do not see this as arduous, instead, as an opportunity for them to improve their knowledge and skills to keep up with the changing nature of the profession. As a result, this has increased the adoption of cryptocurrencies by unemployed individuals in each country. According to Almajali et al. (2022), young people with a lack of job opportunities can seize new opportunities in the digital field through YouTube or gaming. Some unemployed individuals can even earn well through trading or investing in these currencies while they are taking a gap year to acquire knowledge of cryptocurrency.

Government spending and domestic savings are statistically significant and show a negative impact on cryptocurrencies. The more they are aware of the cryptocurrencies' perceived risks, the more countries tend to increase savings, reduce spending and augment investment in other safe and sustainable financial sources. As a result, this will cause cryptocurrency adoption to decline in countries. Instead of risky investments in volatile value cryptocurrencies, countries will strengthen their existing financial foundations such as fiat money systems and banks to maintain people's trust. In addition, this study has not found empirical evidence or conclusive results on the impact of GDP level and urbanization on the adoption of cryptocurrency.

5. Additional analysis

To obtain more insights into the factors that affect the adoption of cryptocurrency, we conduct additional analyses by decomposing the Cryptocurrency Adoption Index into its three subcomponents, including: (i) centralized service value received (CeFi); (ii) the volume of exchange trading (P2P); and (iii) the received DeFi value (DeFi).

Firstly, CeFi centralized exchange reflects the total number of cryptocurrency trading activities on this exchange. The goal of this component is to estimate the value of the common currency in that country and the wealth of individuals per transaction. To examine the impacts of several economic factors on CeFi, we use the following panel regression model. The same set of variables is used as in the baseline model (1).

$$CeFi_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GE_{it} + \beta_3 IM_{it} + \beta_4 LF_{it} + \beta_5 UP_{it} + \beta_6 TP_{it} + \beta_7 TU_{it} + \beta_8 EA_{it} + \beta_9 DS_{it} + Fixed\ Effect + \varepsilon_{it} \quad (2)$$

Secondly, we examine the volume of exchange trading (P2P). The peer-to-peer (P2P) platform provides solicitation, exchange, and transaction services between buyers and sellers. To examine the impacts of several economic factors on P2P, we use the following panel regression model. The same set of variables is used as in the baseline model (1).

$$P2P_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GE_{it} + \beta_3 IM_{it} + \beta_4 LF_{it} + \beta_5 UP_{it} + \beta_6 TP_{it} + \beta_7 TU_{it} + \beta_8 EA_{it} + \beta_9 DS_{it} + Fixed\ Effect + \varepsilon_{it} \quad (3)$$

Finally, we evaluate the received DeFi value (DeFi). DeFi services focus on increasing transaction volumes and widespread adoption of cryptocurrencies in developed countries, and countries that have adopted it significantly, especially among traders and institutional investors (Chainalysis, 2021). To examine the impacts of several economic factors on DeFi, we use the following panel regression model. The same set of variables is used as in the baseline model (1).

$$DeFi_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GE_{it} + \beta_3 IM_{it} + \beta_4 LF_{it} + \beta_5 UP_{it} + \beta_6 TP_{it} + \beta_7 TU_{it} + \beta_8 EA_{it} + \beta_9 DS_{it} + Fixed\ Effect + \varepsilon_{it} \quad (4)$$

The first two columns of Table 5 show the economic factors that influence the centralized service value received (CeFi). Most variables are not statistically significant when the P-value > α

= 5% except for the import volumes, population size, level of labor force, and electricity access level. However, these variables have a negative impact on CeFi. This result implies that modesty of conditions, economies of scale, mining infrastructure, regulatory barriers, and income inequality or exchange rate fluctuations may be plausible explanations for the decline of cryptocurrency adoption in centralized markets.

Regarding the factors that affect the exchange trade volume ranking (P2P) (Table 5): most variables are statistically significant when P-value = 0.000 < α = 5%, except for the import volumes and the unemployment rate. While GDP, government expenditure, domestic savings, and electricity access level have a positive effect on P2P, the rest have the reverse relationship. Emerging countries are believed to concentrate a significant proportion of P2P trading volume in all cryptocurrency activities. This is also an area with a large concentration of countries of medium economic size, with high public spending and high attention towards environmental sustainability. The difficulties of accessing centralized exchanges make P2P cryptocurrency exchanges a vibrant cryptocurrency mining hub. In addition, the devaluation of traditional currencies has also increased the trend of people buying cryptocurrencies on the platform to preserve their savings. Others are made for international transactions and commercial activities.

Table 5: The factors affecting subcomponents of cryptocurrency adoption

Variables	CeFi		P2P		DeFi	
	OLS	**GLS**	**OLS**	**GLS**	**OLS**	**GLS**
GDP	-4.231**	-0.578	7.262**	7.993***	-9.096***	-9.193***
	[-2.32]	[-0.14]	[2.11]	[3.57]	[-3.78]	[-20.37]
GE	0.007	0.018	0.0386***	0.0391***	0.00171	-0.000294
	[1.07]	[0.93]	[3.03]	[8.09]	[0.19]	[-0.18]
IM	-27.17***	-30.41**	-6.028	-2.488	-33.40***	-30.83***
	[-4.57]	[-2.44]	[-0.54]	[-0.34]	[-4.31]	[-11.49]
TP	-20.03***	-25.82***	-9.533**	-10.74***	-14.11***	-14.08***
	[-9.89]	[-5.75]	[-2.51]	[-4.51]	[-5.32]	[-21.44]
UP	0.149	-0.148	-0.316	-0.297***	0.435*	0.453***
	[0.74]	[-0.32]	[-0.85]	[-2.59]	[1.69]	[4.63]
LF	-56.28**	-95.30**	-87.54**	-111.9***	-58.15*	-55.19***
	[-2.46]	[-1.96]	[-2.00]	[-3.53]	[-1.94]	[-6.12]
TU	0.028	-0.347	-0.104	-0.184	0.0551	-0.000231
	[0.09]	[-0.48]	[-0.18]	[-0.50]	[0.13]	[-0.00]
DS	0.642***	0.185	0.551**	0.535***	1.018***	0.989***
	[5.03]	[0.78]	[2.27]	[4.74]	[6.10]	[16.34]
EA	-0.466***	-0.510**	0.204	0.216**	-0.369***	-0.411***
	[-4.92]	[-2.42]	[1.12]	[2.04]	[-2.85]	[-7.36]
Cons	572.0***	538.6***	54.74	64.70**	584.1***	588.2***
	[25.39]	[11.37]	[1.28]	[2.38]	[19.69]	[57.33]
N	259	256	253	253	246	246
R-sq	0.754		0.132		0.646	

Note: t statistics in brackets *p < 0.1, **p < 0.05, ***p < 0.01.

Source: Authors compilation.

In terms of the economic factors that influence the DeFi value received ranking (DeFi) in Table 5: most variables are statistically significant when the P-value < α = 5% except for government expenditure and the unemployment rate. While the urbanization and domestic savings variables have a positive effect on DeFi, the remaining variables have a negative impact. DeFi volume is most concentrated in North America, accounting for 37%, followed by Western Europe (31%) and the least in Sub-Saharan Africa (13%) (Chainalysis, 2022). Developed countries have many of the largest cryptocurrency projects based on infrastructure,

advanced technology systems, and favorable geography. They look for highly speculative trades to make a profit. A large amount of money was drawn by investors mainly to save and hedge the perceived risks from the pandemic in the first months of 2021. Conversely, the second half of 2021 and 2022 saw new investment yield opportunities on decentralized exchanges and attracted large amounts of money.

6. Conclusion

Our study contributes to reinforcing the shortcomings of the academic research gap by objectively assessing the economic factors affecting cryptocurrency adoption in each country. At the same time, we also provide additional analysis relating to three subcomponents of the cryptocurrency adoption index to examine factors that influence each of those.

Research results show that greater import volumes, larger population size, more adequate levels of the labor force, higher unemployment rates, and the level of access to electricity have a positive effect on cryptocurrency adoption. Meanwhile, government spending and domestic savings reduce adoption across countries.

Cryptocurrency adoption is higher in populous countries with a proportion of adults with income, conditional access and participation in cryptocurrency transactions. The increase in the number of people entering the workforce to increase disposable income as well as seizing opportunities to monetize cryptocurrency transactions during unemployment is also important to assess adoption. At the same time, cryptocurrency adoption will also be high in countries as import volumes are high when importers understand the openness, savings, convenience and speed of cryptocurrency payments. Besides, the infrastructure, favorable location, and interest in sustainability development show that the level of access to electricity is also one of the important factors for evaluating cryptocurrency adoption. Additionally, due to the perceived risks of cryptocurrencies, cryptocurrency adoption in each country may decrease as government spending and domestic savings increase.

In relation to our additional analyses, the results show that population size and level of the labor force has a negative impact on the three subcomponents. While urbanization has a positive impact on the P2P exchange trade volume, the opposite effect is observed in the DeFi value received. In addition, greater government expenditure and higher domestic savings are associated with P2P exchange trade volume. Finally, while GDP has a negative impact on the DeFi value received, the import volumes and the level of electricity access also received the same trend for the centralized service value received and the DeFi value received.

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