

Improving human development in West African countries: do cryptocurrencies matter?

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Abstract. *This study examines the relationship between cryptocurrencies and human development. To analyze data from nine West African countries between 2016 and 2023, we used the generalized method of moments (GMM) in the system to assess the impact of the trading volume of all cryptocurrencies and the value of Bitcoin and Ethereum on the human development index (HDI). Our results show a positive and significant link between these indicators and the HDI, even after applying the Newey–West and Driscoll–Kraay standard error robustness tests. In light of these results, we recommend that policymakers establish a clear and appropriate regulatory framework while being vigilant to the risks inherent in cryptocurrencies.*

Keywords: blockchain technology, cryptocurrencies, Bitcoin, Ethereum, IDH.

JEL Classification: E42, G21, O15.

1. Introduction

Cryptocurrencies are a new form of electronic money based on blockchain technology. This technology enables secure and transparent transactions without the need for a trusted third party (Nakamoto, 2008). The blockchain is a decentralized digital ledger that securely and immutably records transactions, grouped into "blocks" linked together via cryptographic techniques (Tripathi et al., 2023). Bitcoin was the first cryptocurrency to offer an innovative concept of decentralized electronic money. Since its launch in February 2009, many cryptocurrencies have emerged, each with specific characteristics (Agu, 2020). The cryptocurrency industry has grown considerably, with the emergence of new currencies and an increase in the value of older currencies (Kamau, 2022). However, Bitcoin and Ethereum remain the two most dominant cryptocurrencies, accounting for more than 70% of the market's total market capitalization (CoinMarketCap, 2024).

The potential of blockchain technology and cryptocurrencies is attracting increasing interest from businesses and governments alike. Indeed, blockchain is of particular interest in traditional sectors of the economy because of its wide range of applications, well beyond its initial use, and its ability to foster a more inclusive society and a transparent and accountable digital economy (Maupin, 2017). Cryptocurrencies are rapidly transforming markets and societies, decentralizing interactions between consumers, businesses and policymakers (Desmond et al., 2019). People adapt digitally and create new business practices in response to changing economic needs (Morkunas et al., 2019; Yun et al., 2016). Today, cryptocurrencies are gaining mainstream acceptance, with many people using them to make online payments, invest in or diversify their wallets. This growing adoption has led to an increase in the popularity of crypto assets since 2017 (Joebges et al., 2024).

The use of this new technology could play a crucial role in the socioeconomic development of developing countries. Indeed, the introduction of new technologies can have a significant effect on improving living conditions in these countries (Schmidt & Sandner, 2017). Blockchain, in particular, offers promising solutions to many of the challenges faced by developing countries (Swan, 2015), and West Africa, with its immense cryptocurrency potential, could take full advantage. This region, characterized by a young population and growing internet penetration, is particularly conducive to cryptocurrency adoption. Between 2010 and 2017, the number of mobile subscribers in West Africa doubled, with a compound annual growth rate (CAGR) of 9.5% (GSMA, 2019). In addition, many countries in the region have limited financial infrastructures, making cryptocurrencies particularly attractive as alternatives to traditional financial services. The high concentration of banking in urban areas, to the detriment of rural and peripheral areas, as well as the difficulties in accessing financial services for the most vulnerable populations, reinforce this appeal (Avom & Bobbo, 2018). Finally, the economic challenges facing West Africa, such as inflation, corruption and currency instability, make cryptocurrencies attractive as a means of preserving the value of money. Given the current context, further research into the socioeconomic implications of cryptocurrencies in this region is essential.

This study aims to examine how the use of cryptocurrencies can potentially improve the human development index (HDI) in West African countries. This work contributes to the literature in several ways. First, this study is, to our knowledge, one of the first to thoroughly examine the effects of cryptocurrencies on the HDI in the specific context of West African countries. Second, despite the vast literature on cryptocurrencies, few studies have addressed the effects of these digital assets from a human development perspective. Most existing studies have focused on more technical or financial aspects, such as the effects of cryptocurrencies on energy consumption (Schinckus et al., 2020), market volatility (Uzonwanne, 2021), their role as safe havens (Jeribi et al., 2021), the threats they pose to financial stability (Panigrahi, 2023), or the critical evaluation of cryptographic innovations (Shin & Rice, 2022). Finally, this research uses robust econometric methods to ensure the reliability of the results.

The rest of the study is structured as follows: the second section presents a review of the literature, the third section details the methodology employed and the data used, the fourth section presents the results and their discussion, and finally, the fifth section concludes the study and proposes policy implications.

2. Literature review

2.1. Cryptocurrency: Concepts and evolution

In view of the remarkable development of cryptocurrencies, it seems pertinent to clarify the concept of cryptocurrency and analyze its evolution. The term "cryptocurrency" refers to a decentralized digital currency secured by cryptographic techniques such as the blockchain (Chey, 2023). This technology has enabled communities to emerge around shared values and interests, fostering the emergence of new, more sustainable and responsible forms of social relations (Shin & Rice, 2022). Today, the number of cryptocurrencies continues to grow, and some cryptocurrencies are now recognized by governments and accepted by major corporations (Fang et al., 2022).

Historically, cryptocurrencies date back to 2009 with the invention of Bitcoin, in the wake of the global financial crisis, by a person or group of people using the pseudonym Satoshi Nakamoto. It is a "peer-to-peer electronic payment system", whereby online payments can be sent directly from one party to another, without the intermediary of a central body, via blockchain technology (Nakamoto, 2008). The blockchain concept was introduced as the foundation of bitcoin cryptocurrency, a new electronic money system that relies on no trusted third party. Since then, many other cryptocurrencies have emerged, such as Ripple, Litecoin, Monero and Ethereum. Today, the cryptocurrency market is growing rapidly, attracting the attention of investors worldwide.

The most striking attribute of cryptocurrencies, which sets them apart from traditional currencies, is their decentralized nature. Unlike traditional centralized financial systems, which rely on a central authority (such as a central bank), cryptocurrencies operate on

decentralized networks, where no single individual or entity controls the entire system. This decentralization significantly reduces the risks associated with manipulation by a central authority and offers users a greater degree of control over their transactions (Chey, 2023).

2.2. Instability and risks associated with cryptocurrencies

In addition to the spectacular growth in the popularity of cryptocurrencies, the market for these digital assets is characterized by high volatility. Cryptocurrency prices fluctuate considerably in a very short space of time, making their use as a medium of exchange, unit of account or store of value complex. As a result, they are often perceived as speculative assets, particularly attractive to investors in search of quick gains.

Bitcoin, the first cryptocurrency created, is a perfect illustration of this volatility. After peaking at \$69,000 in November 2021, it lost almost half its value in just a few months, stabilizing at approximately \$35,000. This trend continued with further significant fluctuations, reaching \$47,000 in February 2022, before dropping to less than \$20,000 in June of the same year (Chey, 2023). Giudici et al. (2020) noted that investors in the cryptocurrency market are mainly individuals and that the fundamental value of these assets remains difficult to assess. In addition, the authors highlight the high risk associated with these investments. Fantazzini and Zimin (2020) confirm this analysis, showing that the price of a cryptocurrency can collapse due to events such as scams or hacks, leading to a loss of liquidity and a significant depreciation in the asset's value.

2.3. Cryptocurrency and human development

There is no clear consensus on the socioeconomic effects of cryptocurrencies. Although a great deal of research has been devoted to cryptocurrencies and associated variables over the past decade, studies specifically focusing on their impact on human development are relatively recent, and their conclusions are divergent. For example, Ebelogu et al. (2019) conducted a qualitative study exploring how cryptocurrencies could be used as tools to stimulate the Nigerian economy. The authors suggest that cryptocurrencies could eventually replace fiat currencies and contribute to the country's economic development. Similarly, Miśkiewicz et al. (2022) reported that cryptocurrency trading has stimulated economic growth, attracting investment in innovative and environmentally friendly technologies, which could help reduce the carbon footprint associated with this growth.

According to Chuen et al. (2018), economic growth and value creation can be stimulated by digital financial systems such as cryptocurrencies and regulated exchanges. Jati et al. (2022) confirm this idea by demonstrating that the stock market, financial innovation and cryptocurrencies are positively correlated with long-term economic growth in Indonesia.

According to Leonard and Treiblmaier (2019), cryptocurrencies could become a key driver of economic growth. Indeed, they are gradually becoming part of everyday life in both developed and developing countries, reshaping economic landscapes and stimulating trade, transactions and financial activities. In so doing, they contribute to economic growth and greater financial inclusion (Jaja et al., 2023). These new forms of currency have opened up

investment opportunities for millions of people and facilitated international money transfers while also offering new savings options. The potential of cryptocurrencies is immense, and their adoption is accelerating, promising sustained economic growth and more inclusive development.

Hazard et al. (2016) highlighted that digital currencies contribute to economic growth by reducing transaction costs. This conclusion is corroborated by Aiello et al. (2023), who highlighted the significant impacts of cryptocurrencies on the real economy, notably by stimulating consumption and investment. From a corporate perspective, wider and easier access to credit encourages entrepreneurship and the emergence of new businesses in the market (Klapper & Love, 2004). On a macroeconomic scale, an inclusive financial system, facilitated by cryptocurrencies, enables more resources to be mobilized for investment, particularly in SMEs (Kim et al., 2018). This strengthens a country's financial stability and reduces the risk of poverty (Morduch & Haley, 2002), as cryptocurrencies offer an alternative to traditional banking systems and enable wider access to decentralized financial services.

More recently, Astini et al. (2023) explored the links between cryptocurrency trading, environmental degradation, economic growth and energy consumption in the top 10 Asian economies between 2012 and 2020. The authors used the ARDL method and Granger causality test to analyze these relationships. Their results revealed a bidirectional association between cryptocurrency trading and carbon emissions on the one hand and energy consumption on the other hand. They also reported a causal relationship running from cryptocurrency trading to economic growth and from carbon emissions to economic growth. The authors conclude that strong growth in cryptocurrency trading boosts economic growth as measured by GDP. These results are in line with those of Miśkiewicz et al. (2022) and Mohsin et al. (2023).

Despite the advantages of cryptocurrencies, they also present disadvantages for economies (Agu, 2020). Using panel data from developing countries between 2010 and 2017, Sadraoui et al. (2021) reported a positive correlation between exchange rates and bitcoin prices but a negative and significant relationship between the bitcoin price and financial openness. According to Hunter and Kerr (2019), bitcoin could complicate monetary policies and limit the development of a stable economy. Conlon et al. (2020) argue that cryptocurrencies are not safe havens for economic growth and stock markets. Abdeldayem and Aldulaimi (2020), meanwhile, consider cryptocurrency investments to be riskier than those made on the stock market. The work of Bojaj et al. (2022), meanwhile, has highlighted an acceleration in economic growth owing to bitcoin. However, shocks to the cryptocurrency market can influence investment decisions, disrupt traditional markets and worsen macroeconomic indicators.

This literature review highlights the lack of in-depth analysis of the contribution of cryptocurrencies to human development in Africa, particularly in West African countries. We propose to fill this gap by examining how cryptocurrencies can help West African economies take full advantage of the opportunities offered by this new technology.

3. Analysis methodology and presentation of data used

3.1. Methodology

The aim of this study is to examine the impact of cryptocurrencies on the human development index. To do so, the study relies on the following estimation model, inspired by Matekenya et al. (2021). The relationship is expressed as

$$HDI_{it} = F(FINCLU_{it}, X_{it}) \quad (1)$$

where $IDHi$ represents the human development index, $FINCLU_i$ represents financial inclusion and X_i represents a set of control variables. The index i represents the i th country. Unlike the work of Matekenya et al. (2021), this article replaces financial inclusion with cryptocurrencies.

The estimable form of equation (1) is specified in equation (2) as follows:

$$HDI_{it} = \delta_1 + \delta_2 HDI_{i(t-1)} + \delta_3 TRADE_{it} + \delta_4 \log ACCEL_{it} + \delta_5 SPEND_{it} + \delta_6 INF_{it} + \delta_7 DEBT_{it} + \delta_8 UN_{it} + \delta_9 Credit_{it} + \delta_{10} \log Crypto_{it} + \varepsilon_{it} \quad (2)$$

where i and t represent countries and time (years), respectively, ε is the error term, δ_i ($\delta_1 - \delta_{10}$) are parameters or coefficients to be estimated, and \log is logarithmic notation. The rest of the terms are described below.

HDI refers to the human development index used to capture the level of human development (Nguea, 2023). Indeed, the ranking of nations according to the HDI has enriched the debate on human development, and the HDI is now used as a composite indicator for measuring development. A nation's development is now measured not only in terms of per capita income but also in terms of health and education outcomes. The more conventional HDI is an index measuring the quality of life of populations, with values ranging from 0-1, and is based on three distinct components: (i) longevity, measured by life expectancy at birth. It reflects the capacity of populations to lead long, healthy lives. (ii) Education, represented by a weighted average of literacy and school enrollment rates. It is an approximation of the capacity of individuals to acquire knowledge, train and inform, and participate in community life. (iii) Standard of living, represented by real per capita income (GDP/head) adjusted for purchasing power. It represents people's access to the resources they need to improve their quality of life.

Crypto here refers to cryptocurrency-related metrics, namely, the total market capitalization volume of all cryptocurrencies active on exchange platforms, the change in value of Bitcoin (the leading cryptocurrency in terms of market dominance), and the change in value of Ethereum (the second-largest cryptocurrency in terms of market dominance). These two cryptocurrencies remain the world's largest in terms of market capitalization and price (Hicks, 2023).

Concerning the control variables, TRADE represents trade openness, ACCEL represents the percentage of the urban population with access to electricity, SPEND represents the

share of expenditure devoted to consumption as a percentage of GDP, Inf represents the inflation rate, DEBT represents external debt as a percentage of GDP, UN represents the unemployment rate, INF is inflation, and Crédit represents the share of domestic credit granted to the private sector.

3.2. Data

This article aims to examine the effect of cryptocurrencies on the HDI. Our study focuses on the West African region, covering the nine main countries in the region that use cryptocurrencies: Nigeria, Ghana, Ivory Coast, Togo, Mali, Benin, Senegal, Burkina Faso and Cape Verde. We used secondary data covering the period from 2016-2023 from sources including the World Bank.

(WDI), the United Nations Development Program (UNDP) and CoinMarketCap.

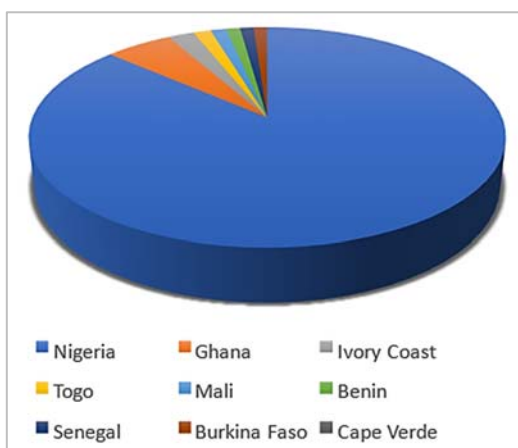
4. Results presentation and discussion

This section is divided into three parts. The first presents the results of the study. The second section discusses the results obtained via the generalized method of moments-system (GMM-System). Finally, the third part analyzes the robustness of the results via the standard error methods of Driscoll and Kraay (1998) and Newey and West (1987).

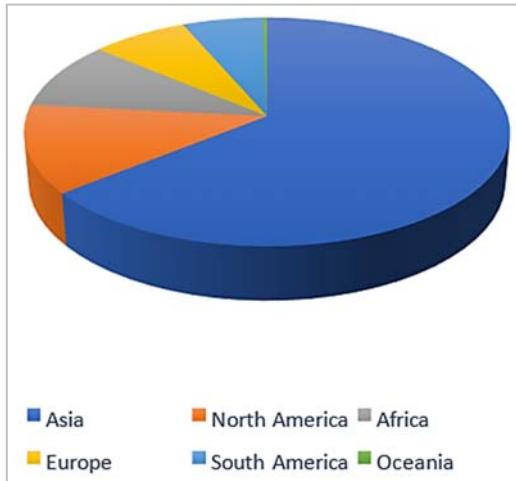
4.1. Presentation of results

An analysis of Figure 1 reveals that Nigeria is the West African country with the largest number of cryptocurrency holders. In 2022, with 22.33 million holders (or 10.34% of its population), Nigeria accounted for a significant share of the 55 million cryptocurrency holders counted in Africa (Vedie, 2022).

Figure 1. Ranking of the main holding countries cryptocurrencies West Africa in 2022



Source: Author.

Figure 2. Continental ranking in terms of cryptocurrencies in 2022

Source: Author.

In contrast, Figure 2 highlights the dominance of Asia, which boasts the largest number of cryptocurrency holders in the world, far ahead of the other continents. Oceania, meanwhile, boasts the lowest adoption rate.

Table 1. Descriptive statistics

Variables	Moy	Er.type	Min	Max
Inequality-adjusted human development index	0.423	0.051	0.319	0.512
Trade openness	32.980	13.246	2.684	60
Access to electricity	84.490	12.658	51.700	99.700
Consumer spending	1.930	0.031	1.849	2.008
Inflation	5.178	7.701	-3.230	38.110
External debt	3.929	3.895	0.369	19.490
Unemployment rate	3.462	1.963	0.690	7.292
Domestic credit to the private sector	26.080	13.187	9.963	68.460
Cryptocurrency market capitalization	11.340	0.915	9.746	12.270
Bitcoin value	4.104	0.548	2.915	4.732
Ethereum value	2.908	0.522	2.110	3.534

Source: Author.

Table 1 shows the descriptive statistics for the variables used in the model. Table 2 shows the correlation matrix between these variables, enabling us to assess the existence of linear links between them. Notably, all cryptocurrency metrics are positively correlated with the human development index (HDI). However, this correlation, although positive, is not strong enough to generate a significant multicollinearity problem, as the correlation coefficients are all less than 0.8. According to Kennedy (1985), a correlation coefficient greater than 0.8 between two explanatory variables may indicate a multicollinearity problem, requiring specific tests. The significance of these correlations will be examined in greater detail in the GMM-system analysis.

Table 2. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) HDI	1										
(2) TRADE	-0.169	1									
(3) ACCEL	-0.016	0.206	1								
(4) SPEND	-0.150	0.065	0.170	1							
(5) INF	0.144	-0.391	0.230	0.171	1						
(6) DEBT	-0.281	0.109	-0.300	-0.271	-0.070	1					
(7) UN	-0.264	-0.010	0.580	0.359	0.152	-0.340	1				
(8) Credit	-0.374	0.760	0.220	0.255	-0.412	0.002	-0.047	1			
(9) LogCapiboursm	0.179	0.028	0.220	-0.019	0.214	0.031	-0.041	0.018	1		
(10) LogVBitcoin	0.170	-0.003	0.210	-0.002	0.250	0.006	-0.056	0.049	0.610	1	
(11) LogVethereum	0.173	-0.001	0.230	-0.007	0.258	0.019	-0.060	0.051	0.600	0.940	1

Source: Author.

Table 3. Effects of cryptocurrencies on human development based on system-GMM estimates

Variables	HDI		
	(1)	(2)	(3)
Lagging human development index (-1)	-0.538*** (0.134)	-0.572*** (0.133)	-0.563*** (0.129)
Trade openness	0.002*** (0.000)	0.002*** (0.000)	0.002** (0.000)
Access to electricity	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Consumer spending	0.340*** (0.102)	0.330*** (0.098)	0.347*** (0.105)
Inflation	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
External debt	-0.003** (0.001)	-0.003*** (0.001)	-0.003** (0.001)
Unemployment	-0.015*** (0.001)	-0.015*** (0.001)	-0.015*** (0.001)
Domestic credit to the private sector	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Total cryptocurrency market capitalization (log)	0.010*** (0.002)		
Bitcoin value (log)		0.022*** (0.004)	
Ethereum value (log)			0.023*** (0.005)
Constant	-0.094 (0.227)	-0.010 (0.229)	-0.027 (0.227)
Wald χ^2	707.33	1587.80	4269.62
Prob $>\chi^2$	0.000	0.000	0.000
AR (1) (p value)	0.008	0.008	0.009
AR (2) (p value)	0.357	0.384	0.427
Hansen test (p value)	0.197	0.213	0.216
Observations	64	64	64
Number of countries	9	9	9

Source: Author.

4.2. Discussion of results

This section presents the empirical results of the study. Table 3, which reports the results of the generalized method of moments system (GMM system) estimation, presents the coefficients of the variables as well as the diagnostic test statistics. These results satisfy the various assumptions of the GMM model, and the Wald statistic is highly significant, confirming the overall quality of the model. Furthermore, the probabilities of the AR

autocorrelation test (1) are all less than 1%, whereas those of the AR autocorrelation test (2) are greater than 10%. On the other hand, the probabilities of the Hansen test are all above 10%, confirming the absence of instrument overidentification and serial correlation. The instruments used in the estimations are therefore valid. These encouraging results allow a thorough analysis of the effects of the different variables on the dependent variable.

The results of the econometric estimations show that the coefficient of the lag term of the human development index (HDI) is negative in all the models, suggesting a process of convergence toward a common stationary state in human development. This means that West African countries with a low initial HDI tend to grow faster than those with a high initial HDI.

The results show that the impact of cryptocurrencies on the HDI is significantly positive at the 1% threshold in all the models estimated. Specifically, an increase in total cryptocurrency market capitalization, the Bitcoin price and the Ethereum price is associated with an improvement in the HDI. These results are in line with the findings of Kim et al. (2018) and Morduch and Haley (2002), who demonstrated that an inclusive financial system promotes greater availability of resources for investment, particularly in SMEs. This result could be explained by the fact that cryptocurrencies can stimulate human development through several channels. Indeed, they can play a crucial role in financial inclusion by offering decentralized financial services to unbanked populations, strengthening their financial autonomy and enabling them to manage their funds more independently. Moreover, cryptocurrencies can give citizens direct control over their funds without financial intermediaries. Furthermore, providing financial services to disadvantaged individuals and communities can promote access to quality education and health services, which are essential for human development. Finally, cryptocurrencies can facilitate international transactions by reducing the costs and delays associated with money transfers, thus stimulating trade and economic cooperation between different regions of the world.

The effect of trade openness on human development is positive and highly significant. The results indicate that an increase in trade openness improves the HDI. Indeed, trade openness can contribute to improving human development by promoting economic growth, creating jobs, increasing people's incomes and improving access to new products and services in markets, which can significantly increase citizens' well-being and quality of life. In terms of consumer spending as a percentage of GDP, the results show a strong positive effect of consumption on the human development index, with a statistically significant coefficient at the 1% level. Thus, an overall increase in consumer spending is associated with a higher human development index. Indeed, spending on goods and services could promote the well-being of citizens by contributing to the satisfaction of basic social needs, the improvement of individual health and physical well-being, the creation of happiness, and the stimulation of the economy in general. On the other hand, the results reveal that external debt has a negative relationship with the level of human development. An increase in external debt leads to a decrease in the HDI. Indeed, a very high level of debt could limit

investment in key sectors of the economy, such as education, health and social services, exacerbating economic disparities and inducing financial instability, thus failing to promote inclusive and equitable human development. The results are in line with those of Adeve and Karabou (2022), who also reported a negative and significant relationship between public debt and the sustainability of development in the economies of the countries of the West African Economic and Monetary Union (WAEMU). Similarly, the effect of unemployment on human development is negative and statistically significant in all estimations. An increase in unemployment leads to a decrease in the HDI. Indeed, a very high level of unemployment can exacerbate poverty, which can have adverse effects on people's well-being by reducing their quality of life. These results are in line with the work of Datta and Singh (2019), who argued that the lower the level of poverty is, the higher the level of human development. Finally, domestic credit to the private sector also has a negative and statistically significant effect on human development in all specifications. An increase in domestic credit to the private sector leads to a decrease in the HDI. This is explained by the fact that excessive domestic credit can lead to an increase in the general price level of goods and services, which can reduce consumers' purchasing power and negatively affect their living conditions.

4.3. Robustness analysis

Table 4 presents the robustness results for the effects of cryptocurrencies on the HDI, obtained via the techniques of Newey and West (1987) and Driscoll and Kraay (1998).

Table 4. Robustness analysis using Newey–West and Driscoll–Kraay standard errors

Variables	Newey–West			Dscoll–Kraay		
	1	2	3	4	5	6
Trade openness	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0001)
Access to electricity	0.255*** (0.075)	0.244*** (0.076)	0.250*** (0.074)	0.255*** (0.059)	0.244*** (0.058)	0.250*** (0.061)
Consumer spending	0.220* (0.126)	0.218* (0.126)	0.225* (0.124)	0.220 (0.246)	0.218 (0.249)	0.225 (0.242)
Inflation	-0.0008 (0.0004)	-0.0007 (0.0004)	-0.0008* (0.0004)	-0.0008 (0.0006)	-0.0007 (0.0006)	-0.0008 (0.0006)
External debt	-0.005*** (0.0010)	-0.005*** (0.0009)	-0.005*** (0.0009)	-0.005*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)
Unemployment	-0.018*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)
Domestic credit to the private sector	-0.003*** (0.0004)	-0.003*** (0.0004)	-0.003*** (0.0004)	-0.003*** (0.0003)	-0.003*** (0.0003)	-0.003*** (0.0003)
Total cryptocurrency market capitalization (log)	0.006* (0.003)			0.006** (0.002)		
Bitcoin value (log)		0.012** (0.005)			0.012* (0.005)	
Ethereum value (log)			0.013** (0.005)			0.013** (0.005)
Constant	-0.442*** (0.288)	-0.397 (0.289)	-0.408 (0.281)	-0.442 (0.396)	-0.397 (0.411)	-0.408 (0.396)
R-squared				0.544	0.547	0.548
p value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	72	72	72	72	72	72

Source: author

Overall, the results in Table 4 confirm those in Table 3. The effects of cryptocurrencies on human development remain positive and statistically significant. An increase in cryptocurrency trading volume, measured by total market capitalization, Bitcoin and Ethereum value, is associated with improved human development in West African countries. Furthermore, the results underline the importance of trade openness, access to electricity and consumer spending for human development. Conversely, inflation, the stock of external debt, unemployment and credit to the private sector have negative effects on the HDI. Rising inflation, coupled with high indebtedness, high unemployment and excessive domestic credit, worsens the well-being of populations.

5. Conclusion and policy implications

The Human Development Index (HDI) classifies sub-Saharan African countries as "low human development countries". These countries have significantly lower levels of human development than other regions of the world do. Despite sustained economic growth since the 2000s, particularly in West Africa, the region continues to face persistent challenges such as poverty, unemployment and inequality. By democratizing access to new blockchain technologies, cryptocurrencies could provide a major lever for improving people's living conditions.

This study assessed the impact of cryptocurrencies, measured by their total market capitalization, the value of Bitcoin and Ethereum, on the human development index (HDI) in the nine main West African countries using these digital assets. The data analyzed cover the period from 2016-2023. Using an in-system generalized method of moments (GMM) estimation approach, our results highlight a positive association between cryptocurrencies and human development. Furthermore, we find a positive relationship between trade openness and human development, on the one hand, and between consumer spending as a percentage of GDP and human development, on the other hand. Conversely, foreign debt, unemployment and credit to the private sector have a negative influence on the HDI.

In view of these findings, this study suggests that African policymakers should establish a clear regulatory framework conducive to the development of cryptocurrencies while ensuring consumer protection against the risks inherent in their volatility. Investment in digital infrastructure, particularly in rural areas, is essential to foster the adoption of cryptocurrencies. In addition, public authorities should encourage startups and innovative initiatives in this field to stimulate the emergence of solutions tailored to local specificities. These recommendations could accelerate the adoption of cryptocurrencies in Africa and thus contribute to improving people's standard of living.

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