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DIGITAL ADOPTION AND CORRUPTION ON STOCK MARKET DEVELOPMENT

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Abstract

In the field of finance, stock markets are recognized as pivotal drivers of economic development, with their ability to channel savings and capital towards efficient sectors. This study examines the relationship between digital adoption, corruption perception, and stock market development across 55 countries. Using panel data modelling techniques, we examine the impact of the Digital Adoption Index and Corruption Perceptions Index on Stock Market Development in high-income, upper-middle, and lower-middle-income countries. The corrected Random Effects estimation shows a significant positive relationship between the Digital Adoption Index and the Corruption Perceptions Index with Stock Market Development across all countries. In addition, increasing digital adoption and decreasing corruption perception can positively impact stock market development, and the strength of this relationship varies across different country income groups. However, a negative association between the Digital Adoption Index and Stock Market Development has been observed for lower-middle-income countries. These findings suggest that the impact of the Digital Adoption Index and Corruption Perceptions Index on Stock Market Development may differ across different countries' income levels highlighting the importance of tailored strategies for fostering economic growth and offers critical insights for stakeholders.

Keywords: Corruption Perception Index, Digital Adoption Index, Stock Market Development

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1. Introduction

In the field of finance, the importance of stock markets in promoting financial development is widely acknowledged by practitioners, academics, and policymakers. However, despite the well-established benefits of stock markets, much remains to be done to ensure that financial markets are fulfilling their potential to drive economic growth and prosperity. With the potential to mobilize savings and direct capital toward the most efficient and profitable economic sectors, financial markets have emerged as one of the most crucial channels for economic growth and development (Murinde, 2012).

The theory of diffusion of innovation (Rogers, 2003) can be applied to understand the adoption and diffusion of digital technologies in the economy. It can be seen as the awareness stage of the theory, where people become aware of the potential benefits of digital technologies in the economy. Previous studies (Ding, 2020; Gong & Wang, 2019; Jing & Sun, 2019) shows that as the world becomes more digitally connected, the digital economy, with its potential for technological innovation, industrial integration, and market expansion, has emerged as a critical driver of high-quality economic growth and development across multiple levels, including the macro, meso, and micro levels. Scholars have studied the various fields impacted by the digital economy, ranging from the influence of digital technologies on inclusive growth (He et al., 2019) to the complex relationship between the Internet and economic growth (Czernich et al., 2011; Mallick, 2014). In addition, policymakers and business leaders have recognized the importance of digital adoption in promoting economic development and have taken steps to leverage digital technologies to drive innovation and growth.

The relationship between Information Communication Technology (ICT) and stock market development has been widely studied in recent years, focusing on industrialized, emerging, and high-income economies. Most of the research has focused on the stock market development of developed countries and emerging markets, including those with high-interest rates (Okwu, 2015). According to Petros (2012), stock markets play a vital role in controlling the growth of economies by facilitating investments between individuals and providing means for organizations to finance their investments. The relationship between ICT and stock market development will likely become even more critical as the world becomes increasingly digitized. Maiti et al. (2020) highlight that faster ICT adoption has the potential to enhance productivity, promote economic efficiency, improve the delivery of public services and welfare programs, reduce corruption, connect remote areas with urban centres, and increase democratic engagement.

The impact of digital adoption on economic growth and stock market development has gained significant attention in recent years. While the benefits of digitalization are widely recognized, its effects on financial markets vary across income levels. In high-income economies, digital adoption is positively linked to economic growth and potentially benefits stock market development, such as improving productivity and innovation. However, in upper-middle-income economies, the impact on stock market development is more complex due to the risk of cyber threats and financial instability. Finally, in lower-middle-income economies, the effects of digital adoption on economic growth and stock market development are more nuanced and depend on significant investments in infrastructure, education, and regulatory frameworks. In this article, we review the literature on the impact of digital adoption on

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economic growth and stock market development across income levels and discuss the implications for policymakers and investors.

As the world continues to grapple with issues related to governance and corruption, it has become increasingly evident that these factors also have significant implications for economic growth and development. The "sand the wheels" hypothesis suggests corruption obstructs efficient production and innovation, leading to decreased economic growth. Empirical evidence supports this claim, particularly in countries with low investment rates and low-quality governance. Studies conducted by Hodge et al. (2011), Huang (2016), Tsanana et al. (2016), and Chang and Hao (2017) have all reported similar findings, indicating that corruption is a significant burden to economic progress in many parts of the world.

Empirical evidence suggests that corruption has a negative impact on economic growth, and this relationship has been explored through several transmission channels. One of these channels is the effect of corruption on physical capital accumulation, which is negatively correlated with trade and economic growth (Sahakyan & Stiegert, 2012). Additionally, corruption can adversely affect capital formation, income distribution, and resource allocation, which may lead to increased costs of doing business and reduced productivity (Lambsdorff, 2003).

Corruption is a widespread issue affecting economies worldwide, with varying impacts across countries of different income levels. High-income economies typically experience subtle and sophisticated forms of corruption, while upper middle-income economies often encounter more visible and overt corruption. In lower middle-income economies, corruption tends to be systemic and pervasive, hindering economic growth and exacerbating income inequality. Corruption undermines investor confidence, distorts competition, and impedes market development, reducing productivity and competitiveness. The negative impact of corruption on economic growth and stock market development is universally acknowledged, but its effects differ depending on the stage of economic development.

The development of a country's economy is strongly linked to the development of its stock market. As the primary hub of the financial market, the stock market plays a crucial role in driving economic growth (Levine & Zervos, 1999). Its main functions are facilitating equity fundraising for listed companies and stock trading between participants. Consequently, investors, researchers, and financial organizations closely monitor the stock market's performance. Although the stock market index is often used as a benchmark for its performance, its success can be evaluated regarding returns, development, and liquidity. In addition, according to Ayaydin and Baltaci (2013), the stock market development significantly impacts the development of the financial system.

This study examines the impact of the Digital Adoption Index (DAI) and Corruption Perception Index (CPI) on Stock Market Development (SMD) across high-income, upper, and lower-income countries. The diffusion of innovations and productivity theory suggests that digital adoption can positively affect economic growth and development by increasing productivity, creating new markets, and improving efficiency. However, corruption and weak governance can undermine these benefits by reducing investor confidence, distorting markets, and increasing transaction costs. Therefore, we hypothesize that countries with higher DAI and higher CPI scores will have more developed stock markets, as measured by higher market capitalization on GDP. To test this hypothesis, we will use data

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from a sample of countries over several years and employ a range of econometric techniques to analyze the relationship between the DAI, CPI, and stock market development.

This study has important implications for policymakers and investors, highlighting the role of digital adoption and governance in promoting economic development and stock market performance. We can better understand the conditions necessary for sustained economic growth and prosperity by identifying the key factors that drive stock market development.

2. Research Methods

The analysis in this study is focused on 55 countries during the years 2014 and 2016 due to data constraints. The variables used in the study include the following:

i. Stock Market Development (SMD) is the market capitalization ratio divided by Gross Domestic Product (GDP). Market capitalization equals the total value of all listed shares. Data was collected and provided by the World Bank.

ii. The Digital Adoption Index (DAI) is a composite index measurement developed by the World Bank Group (2016) that assesses the extent and scope of digital technology adoption in businesses, governments, and people. The DAI comprises three sub-indices, each carrying equal weight and covering different sectors. For most countries, data are available for two observation years: 2014, which applies the updated data and methodology to the original DAI dataset, and 2016, the most recent year with available data.

iii. The Corruption Perceptions Index (CPI) is a composite measure that assesses the perceived level of corruption in the public sector of a country, based on the opinions of experts and business people. At least three data sources, derived from 13 different corruption surveys and assessments, are used to generate a score for each country. Scores range from zero to 100, with a lower score indicating a higher perceived level of corruption and a higher score indicating a lower perceived level. The CPI is published on an annual basis by Transparency International.

Using panel data modelling techniques provides several benefits when investigating the association between the DAI and CPI on SMD across 55 sample countries over two years. By incorporating both time-series and cross-sectional dimensions, panel data analysis allows us to control for unobserved country-specific heterogeneity and potential endogeneity issues that could arise in time-series analysis and enhances the robustness and reliability of the empirical results.

The panel data modelling takes the form:

$$SMD_{it} = \alpha + \beta_1(DAI_{it}) + \beta_2(CPI_{it}) + e_{it}$$

SMD_{it} = Stock Market Development country $_i$ at time $_t$
DAI_{it} = Digital Adoption Index country $_i$ at time $_t$
CPI_{it} = Corruption Perceptions Index country $_i$ at time $_t$

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3. Findings

Table 1 presents a statistical summary of the samples, providing a snapshot of the key variables under investigation.

Table 1. Descriptive Statistic

	Mean	Minimum	Maximum	Standard Deviation	Skewness	Kurtosis
All Income countries (55 countries)						
SMD	61.4090	4.7702	293.9935	51.9192	2.0833	8.3175
DAI	0.6532	0.3690	0.8706	0.1262	-0.1317	2.1363
CPI	53.6818	25.0000	91.0000	18.8266	0.3534	1.8411
High-Income countries (31 countries)						
SMD	67.2736	9.7539	239.1070	49.0694	1.5773	5.8591
DAI	0.7333	0.5172	0.8706	0.0879	-0.3000	2.2406
CPI	66.3387	35.0000	91.0000	14.7770	-0.2468	1.9663
Upper Middle-Income countries (13 countries)						
SMD	70.1255	10.3757	293.9935	67.2408	2.1517	7.1677
DAI	0.6041	0.4431	0.7441	0.0695	-0.3202	2.7670
CPI	40.1154	27.0000	54.0000	7.9061	0.1166	2.1272
Lower Middle-Income countries (11 countries)						
SMD	34.5801	4.7702	88.0186	25.7905	0.8624	2.4857
DAI	0.4857	0.3690	0.5730	0.0558	-0.4015	2.2375
CPI	34.0455	25.0000	41.0000	5.1221	-0.4643	1.8122

Referring to Table 1, the descriptive statistics of the Stock Market Development (SMD), Digital Adoption Index (DAI), and Corruption Perception Index (CPI) for 55 countries reveal that the mean SMD score is 61.4, with a minimum of 4.8 and a maximum of 294. The mean DAI score is 0.65, ranging from 0.37 to 0.87, and the mean CPI score is 53.68, with a minimum of 25 and a maximum of 91. When considering income level, high-income countries (31 countries) have the highest mean SMD score of 67.27 and DAI score of 0.73, while upper middle-income countries (13 countries) have the highest mean CPI score of 40.12. Meanwhile, lower-middle-income countries (11 countries) have the lowest mean SMD score of 34.58 and DAI score of 0.49. Each variable's skewness and kurtosis values suggest some deviation from a normal distribution. The descriptive statistics offer insights into the variation and distribution of SMD, DAI, and CPI scores across different income levels. The mean, minimum, maximum, and standard deviation were computed for each variable. The results indicate that high-income countries have the highest mean values for SMD, DAI, and CPI, followed by upper and lower-income countries.

The normality of the data was confirmed by assessing the values of skewness and kurtosis. According to Hair et al. (2010) and Byrne (2016), data is considered to be normally distributed if its skewness falls between the range of -2 to +2, and its kurtosis falls between the range of -7 to +7.

The next step is to investigate the relationship between the variables. The Pearson coefficient of correlation measured the relationship intensity between variables.

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Table 2. Pearson Correlation

Variable	SMD	DAI	CPI
SMD	1.0000		
DAI	0.3551	1.0000	
CPI	0.4027	0.7586	1.0000

The correlation coefficients between the variables of Stock Market Development (SMD), Digital Adoption Index (DAI), and Corruption Perception Index (CPI) were analyzed, as displayed in Table 2. The results indicate moderate positive correlations between SMD and DAI (0.3551), SMD and CPI (0.4027), and DAI and CPI (0.7586). The levels of multicollinearity are in the safe zone as long the correlation coefficient is below 0.8 (Farrar & Glauber, 1967; Yoo et al., 2014).

Table 3. Regression for Pooled-OLS, Random Effect, Fixed Effect, and Corrected Estimation for Stock Market Development

Variable	Pooled OLS		Random Effect		Fixed Effect		Corrected Estimation Random Effect	
	Coeff.	(t-value) sig level	Coeff.	(t-value) sig level	Coeff.	(t-value) sig level	Coeff.	(t-value) sig level
All-Income (55 countries)								
DAI	48.1262	0.86	65.2362	1.94 **	64.3911	1.58 *	65.2362	2.34 **
CPI	0.8659	2.32 **	0.7272	2.34 ***	0.5830	1.01	0.7272	2.60 ***
BP LM test		51.05						
p-value		0.0000						
Hausman Test				0.13				
p-value				0.9353				
High-Income (31 countries)								
DAI	164.5099	2.26 **	128.4771	2.55 **	67.0296	1.06	128.4771	3.50 ***
CPI	1.1761	2.72 ***	0.8130	2.07 **	-0.0345	-0.06	0.8130	2.15 **
BP LM test		28.22						
p-value		0.0000						
Hausman Test				3.39				
p-value				0.1838				
Upper Middle-Income (13 countries)								
DAI	153.6443	0.82	175.4363	2.07 **	177.3311	1.91 *	175.4363	1.69 **
CPI	3.5271	2.14 **	3.2634	2.34 ***	3.1049	1.73	3.2634	2.32 **
BP LM test		12.13						
p-value		0.0002						
Hausman Test				0.03				
p-value				0.9875				
Lower Middle-Income (11 countries)								
DAI	-91.0963	-1.04	-63.4643	-2.03 **	-61.3245	-1.84 *	-63.4643	-2.20 **
CPI	2.9096	3.06 ***	2.0387	2.82 ***	1.7242	1.97 *	2.0387	2.95 ***
BP LM test		10.05						
p-value		0.0008						
Hausman Test				0.42				
p-value				0.8096				

Notes: ***,** and * denote a significance level at 1%, 5% and 10%, respectively.

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Based on the regression analysis in Table 3, it can be seen that the Digital Adoption Index (DAI) and Corruption Perception Index (CPI) have a significant impact on Stock Market Development (SMD) in all countries (55 countries). The Breusch-Pagan Lagrange Multiplier (BP LM) test indicates heteroscedasticity in the data, and the Random Effect model is preferable to the Pooled OLS. The Hausman test also shows that the Random Effect model is preferable to the Fixed Effect model, as the p-value is greater than 0.05, indicating that the null hypothesis of no systematic differences between the two models cannot be rejected.

The corrected estimation Random Effect shows that the Digital Adoption Index (DAI) and Corruption Perception Index (CPI) have significant positive relationships with Stock Market Development (SMD) across all countries (55 countries), as indicated by the coefficients of 65.2362 (t-value of 2.34 and sig level of **) and 0.7271827 (t-value of 2.6 and sig level of ***), respectively. This pattern is consistent among high-income countries (31 countries) and upper-middle-income countries (13 countries), where both DAI and CPI have significant positive relationships with SMD. However, the relationship between DAI and SMD is negative for lower-middle-income countries (11 countries), with a coefficient of -63.46431 (t-value of -2.2 and sig level of **). At the same time, CPI still has a significant positive relationship with SMD, with a coefficient of 2.038734 (t-value of 2.95 and sig level of ***). These findings suggest that the impact of DAI and CPI on SMD may differ across different countries' income levels.

3.1. Diagnostic Check

Based on the VIF values for Digital Adoption Index (DAI) and Corruption Perception Index (CPI), as presented in Table 4, there is no significant multicollinearity issue in the regression analysis. The mean VIF for both independent variables is 2.36, indicating that the independent variables are not highly correlated. Therefore, it can be concluded that the regression results are reliable and accurate.

Table 4. Diagnostic Check for Multicollinearity

Variable	VIF	1/VIF
DAI	2.36	0.4245
CPI	2.36	0.4245
Mean VIF	2.36	

4. Conclusion

Based on the results presented in the table, we can conclude that both DAI and CPI have a statistically significant impact on SMD across all country income groups. The findings suggest that increasing digital adoption and decreasing corruption perception can positively impact stock market development, and the strength of this relationship varies across different country income groups. These results provide valuable insights for policymakers and investors to make informed decisions on promoting stock market development in different country contexts.

One of the interesting findings is that in lower-middle-income countries, digital adoption has a negative relationship with stock market development, suggesting that as digital adoption increases, stock

market development decreases in these countries. The finding is somewhat unexpected and may require further investigation. Possible explanations for this negative relationship could be that in lower-middle-income countries, the infrastructure necessary for digital adoption may not yet be fully developed, or there may be other barriers to entry for businesses trying to enter the stock market. Alternatively, it could be that in these countries, traditional financing methods, such as banks or government loans, are preferred over stock markets.

Evidence suggests that low levels of financial literacy could contribute to the negative relationship between digital adoption and stock market development in lower-middle-income countries. According to the Global Financial Literacy Survey conducted by Standard & Poor's in 2014, only 27% of adults in lower-middle-income countries were considered financially literate, compared to 33% in upper-middle-income countries and 57% in high-income countries. This low level of financial literacy could hinder individuals' ability to understand and navigate the stock market, leading to a preference for traditional forms of financing, such as bank loans. It also could contribute to a lack of trust in digital financial services. Therefore, in addition to promoting digital adoption, policymakers and stakeholders must also focus on improving financial literacy levels in lower-middle-income countries to increase individuals' comfort and trust in digital financial services and encourage greater engagement with the stock market.

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