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Emerging Market Dynamics

Transformative Trends and Sustainable
Development in Global Markets

Edited by Abdul Rauf



Emerging Market Dynamics - Transformative Trends and Sustainable Development in Global Markets

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Contributors

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Prof. Choudhry holds a BSc degree in Economics from the University of Iowa, as well as a Masters and Ph.D. in Applied Economics from Clemson University, USA. In January 2006, he became a Professor of Finance at the University of Southampton Business School. He was previously a Professor of Finance at the University of Bradford Management School. He has over 80 articles published in international finance and economics journals. His research interests and specialties include financial econometrics, financial economics, international economics and finance, housing markets, financial markets, among others.

Meet the Volume Editor



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Preface

Emerging markets have shed their peripheral status to become the world's primary engines of growth, living laboratories of innovation, and epicenters of geopolitical and technological transformation. However, these markets operate at the intersection of contradictory forces: digital disruption and cultural flows, strategic rivalries and financial experimentation, alongside persistent exclusion from formal capital systems. Navigating such complexity demands more than isolated case studies – it requires an integrative framework that ties transformative trends directly to the practical imperatives of sustainable development.

This book, *Emerging Market Dynamics – Transformative Trends and Sustainable Development in Global Markets*, offers exactly such a synthesis. It brings together five original contributions that move from broad conceptual foundations to applied policy analysis. The volume is organized into two coherent sections. Section I – *Transformative Trends and Geopolitical Dynamics in Emerging Markets* establishes the macro-level landscape. It opens with an integrative framework for understanding emerging market dynamics, then examines how the digital economy reshapes international cultural trade, and finally confronts the Thucydides Trap in trade, where uncertainty and asymmetric cooperative attitudes create friction between rising and established powers. Section II – *Sustainable Development through Financial Innovation and Inclusion* shifts focus to the mechanisms of inclusive growth. It analyses the macroeconomic implications of FinTech in Nigeria as a case study of transformative finance, and concludes with a rigorous examination of financial inclusion and access to capital, the bedrock of sustainable development.

Readers will find that the sequence is deliberate. The first three chapters diagnose the broader currents of change and conflict. The last two chapters demonstrate how financial innovation, properly channeled, can translate those dynamics into lasting, broad-based prosperity. Together, the chapters affirm that technology alone is insufficient; sustainable development requires deliberately designed systems that reach the underserved and empower broad participation in global markets. This volume is intended for a wide audience: academic researchers and students of international business, development economics, and political economy; policymakers in emerging market governments and international development institutions; and practitioners in finance, trade, and sustainable development who seek both conceptual clarity and applied insights.

The editor extends sincere gratitude to everyone who contributed to this project. Special thanks are due to Elena Vračarić (Commissioning Editor) and Iva Horvat (Publishing Process Manager) for their unwavering support, persuasion, and guidance – without them, this book would not have become a reality. First and

foremost, the editor thanks each of the authors: Ming Ma, Len-Kuo Hu, Terver Audu, Almir Muhović, Marko Katanić, and Marija Gavrilović for their time, expertise, and distinctive perspectives.

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Section 1

Transformative Trends and Geopolitical Dynamics in Emerging Markets

Introductory Chapter: An Integrative Framework for Understanding Emerging Market Dynamics and Sustainable Development

Abdul Rauf

1. Introduction

Emerging markets are shifting rapidly because of artificial intelligence (AI), globalization, and digital innovation. The economic integration on the regional level is a move to enhance trade, investment, and collaboration among nations [1]. The trade policies have a powerful influence on the development of the emerging markets. The open trade helps these countries to develop through boosting exports, enhancing technology, job creation, and investment. It also assists employees to shifting out of low-productivity industries to more productive industries. Nonetheless, trade openness may also contribute to the growth of pollution and environmental pressure as long as it is not handled properly. Good governance, strong institutions, and rules support digital trade, and this contributes to the success of trade policies. In general, new markets require a set of trade policies that can contribute to their development and, at the same time, safeguard the environment and promote long-term development [2].

Transformative trends are very critical in influencing the economic landscapes as they lead to core changes in the way relationships of the economies develop, adopt, and maintain developments. Landscape and land-use change is one of the key transformative forces, particularly in areas such as tropical Latin America, where economic development and climate change overlap. Since the agribusiness is growing, traditional agriculture is becoming modernized, and the novel agro-extractive economies are undergoing change; such changes modify the balance between economic growth and environmental protection. They redefine local socioeconomic realities and need subtle policy inputs to ensure that development goals are in tandem with the efforts to mitigate climate change, indicative of the complexity of interaction between economic operations and sustainability. Other natural resources like tourism and hydroelectricity may lead to significant economic and social transformation in special regions like the mountainous areas. Such developments can cause population changes, urbanization, and strains on conventional lifestyles. The knowledge of this is of significance when developing just and sustainable developmental frameworks that do not conflict with economic growth, environmental, and social requirements [3].

In the emerging markets, sustainable development implies the development of the economy while preserving the environment and raising the living standards of people. Such countries usually have issues, such as a lack of resources, ineffective infrastructure, and social inequality, and require effective policies and emerging technologies. Some key solutions are the use of renewable energy, recycling, reusing resources, and better farming practices. Businesses can also work better, reduce pollution, and create jobs with the help of digital tools, including artificial intelligence. Financial assistance, non-discriminative institutions, and the input of female entrepreneurs are also major contributing factors in the development of equitable, strong, and sustainable development.

Emerging markets are changing quickly because of globalization and digital innovation. They are becoming more connected to global financial systems, even though there are political and institutional problems. Technologies like AI, blockchain, and fintech are making financial services more accessible, efficient, and innovative, all while promoting sustainable development. But problems like the digital divide and the risk of cyber-attacks still exist. To deal with the effects of technological change, we need strong institutions, policies that include everyone, and strong ethical frameworks.

2. Overview of emerging market dynamics in global markets

Emerging markets are evolving rapidly due to globalization, technology, and digital and political revolutions. In the late twentieth century, rich nations had to invest heavily in them. Their financial markets grow more globalized, heightening volatility and exposure to global economic movements. Most major emerging stock markets followed global market patterns in the mid-1980s to early 1990s, integrating into the global financial system [4]. The markets suffer cultural differences, weak institutions, and political dangers. Digitization alters emerging markets; mobile, internet, e-commerce, and online payment systems are changing global South business, government, and consumption. This digital revolution allows underprivileged communities access to financial services, markets, and information, but cybersecurity, privacy, and the digital divide limit their economic participation and profit [5]. Chinese and Indian companies are becoming more independent and dominating markets, especially in electronics and cars, helping them compete globally by leveraging advancements in technology and adapting to local consumer needs [6].

Low resources, price-sensitive clientele, political situations, cultural differences, and poor institutions hinder corporate expansion in these places, decreasing local entrepreneurs' gains from global value chains and new technology. Despite economic restraints, entrepreneurs in Brazil, Russia, and Mexico are increasing service franchising by using new technology to fulfill local market needs. Brazilians, Russians, Indians, Chinese, and South Africans revolutionized agriculture, geopolitics, and economy. Like emergent economies, they shift pricing dynamics, boost resource competitiveness, and promote sustainable agriculture in commodity markets, supply networks, and environmental management [7]. The digital revolution is transforming global economies, especially post-pandemic. This helps companies respond to disruptions, improve customer experiences, and make data-driven decisions, boosting resilience and growth. Although difficult, rapid digital technology adoption increases organizational agility, creativity, and long-term competitiveness across industries, enabling businesses to adapt more effectively to market changes and consumer

demands. Economic incentives have changed Ethiopian smallholder farmers' land allocation and agriculture, leading to more efficient use of resources and improved crop yields. Macro-level human decisions affect ecological restoration and local economics. Understanding these behavioral traits can help create policies that allow economically lucrative and environmentally sustainable land use, altering landscapes through economic incentives and environmental care [8].

Financial instruments and digital banking enhance Nigeria's varied economy by financing small firms, simplifying transactions, and boosting savings and investment. Innovative technology, policy, and institutions are making finance a viable economic engine in complicated emerging nations. Agile work improves customer satisfaction and corporate response in unpredictable times through flexibility and iterative development. Competitiveness in the unpredictable corporate environment requires organizational change [9].

3. Historical perspective

State-controlled, foreign-invested, or corporate-dominated emerging markets may hinder growth. China and India invest considerably in expansion. Finance growth has supported these markets. Better banking infrastructure, digital finance, and other financial advances have increased money supply, helping businesses grow and attract international investment [10]. Foreign investors in politically and economically unstable countries must evaluate local economies and regulations to understand the risks and opportunities associated with their investments. Asia has seen many new markets in recent decades. Savings, exports, cheap labor, and natural resources drove growth. They struggle to compete and attract foreign investment because of global markets, inadequate financial institutions, and economic shocks. Stable institutions, low inflation, and open trade fuel progress. Long-term development prioritizes social and environmental sustainability to steady the economy and reduce international market volatility [11].

The 1970s oil crisis, global money system instability, and market financial crises altered trade and investment patterns. As China rejoined the global economy, there were significant changes in manufacturing, exports, supply chains, and commerce [5]. Financial instruments and transactions connect people globally. It brought wealth, disasters, and complicated taxes and regulations, which have created both opportunities and challenges for businesses and governments worldwide. Social and environmental developments have altered the global economy. The COVID-19 pandemic demonstrated the interconnectedness of health, politics, the environment, and the economy, while climate change necessitates sustainable government policies. Commerce, social, political, and environmental stability drive global growth, according to trends [12]. Mobile technology, Internet penetration, online commerce, and online payments change the paradigm to boost economic participation and effectiveness. Local digital business capacity, platform monopolies, and infrastructure impede emerging nations' digital strategies to develop and integrate into the global market, limiting their ability to compete effectively and benefit from global economic growth. Digital transformation improves green innovation, productivity, and sustainability in emerging economies by enabling businesses to adopt eco-friendly practices, enhance operational efficiency, and access new markets that prioritize sustainability. Small- and medium-sized enterprises (SMEs) in emerging countries must adopt technology and sustainable marketing practices to ensure business continuity and hygiene during

the COVID-19 pandemic. Post-pandemic growth and sustainability depend on apps and blockchain. SMEs struggle to implement and benefit from digital transformation projects due to digital literacy, infrastructure, and internal resistance, which can hinder their ability to adapt to new technologies and compete effectively in the market. AI, blockchain, and cloud computing have changed financial reporting and duties in this growing company, leading to improved accuracy, efficiency, and compliance with regulatory requirements. Transparency, fraud reduction, real-time data analytics, and international standards boost stakeholder trust and decision-making [13].

Digital banking promotes client adoption and happiness through security, trust, and risk. Digital banking boosts financial inclusion, but data security and cybersecurity can hurt confidence, leading to potential hesitance among users to fully engage with digital banking services. IoT, AI, blockchain, and big data transform logistics and energy for operational excellence, sustainability, and innovation through integrated strategic frameworks, which can lead to improved efficiency, reduced costs, and enhanced decision-making capabilities for businesses and communities. Automation and AI increase business and community productivity. The areas impacted by AI include recruitment, training, customer service, fraud prevention, health, finance, and marketing. AI improves risk management, cost reduction, service quality, product development, finance, and healthcare. Technology can bring job losses, unjust system assumptions, privacy issues, and ethical issues, which can lead to unfairness and dissatisfaction if neglected. Therefore, we must establish strong rules and engage in rigorous problem-solving to prevent AI from benefiting unequally or generating social and economic concerns. Fintech accelerates and simplifies finance. Blockchain, AI, mobile banking, and digital wallets serve individuals and small companies.

4. Shifting geopolitical dynamics and technological innovation

The dynamic growth models show that openness to trade promotes structural change in the economy, including labor mobility to productive manufacturing and service sectors. Trade policies also interact with the quality of the governance structure in influencing the growth outcome. The quality of regulation, such as that of regulatory quality, has a positive influence on economic growth in the emerging markets, as it provides a favorable environment to integrate trade and investment. The impacts of the rule of law, on the contrary, are more complicated based on the income levels and institutional matters, which portray the delicate aspects of a combination of governance and trade policies.

In the present digital economy, trade policies with digital trade specifications will boost the bilateral digital trade flows substantially [2]. Trade agreements that incorporate special digital regulations make it easier to trade in digital products and services, and domestic digital trade barriers, in particular, the ones that have been enforced by foreign countries, limit the flow of trade. This dynamic area emphasizes the need to change trade policies by the emerging markets to take advantage of the opportunities and deal with obstacles in digital trade. In general, trade policies have complex impacts on emerging markets, leading to economic development through openness, export promotion, and technology propagation, yet necessitating their harmonization with environmental sustainability and governance enhancement. To promote inclusive and sustainable development, policymakers have to trade off liberalization and supportive institutional reforms with environmental protection

and digital trade preparedness. The trade policies exert significant influence on the economic growth and development patterns of the emerging market.

The COVID-19 pandemic is one of the recent developments that has affected the global market environment, with some of the effects including the adverse effects it has had on the stock market returns in China and increased uncertainty in the economic policy. This epidemic made the financial markets across the world unstable, which was compounding the volatility and letting markets recognize that the financial markets are sensitive to unexpected black swan events. The pandemic also brought out the relevance of diversifying and managing the risks of participants in the market. The 2022 Russia-Ukraine conflict is another important geopolitical event that has transformed the connectedness in major global financial markets by intensifying the interdependencies in the markets as well as altering the routes of risk transmission. The effect of this conflict was felt in stock, foreign exchange, and commodity markets, and differences between its various phases, reiterating the fact that geopolitical tensions continue to affect the stability of the markets and how investors are going to act.

The history of energy transitions and the global energy crisis are the reasons that influence the development of the financial markets, especially in the areas of clean energy investments and fluctuating commodity prices. The increase in the price of energy commodities during economic downturns has intensified the interdependence between the indices of clean energy and the metal markets. These complicated market dynamics are critical to the understanding of investors and policymakers in matching policies with sustainable energy transitions and financial security. The financial market behaviors, such as the movements in price of various assets, market efficiency, and the significance of information, have also been modified following historical market occurrences. Such behavioral biases as herd mentality are opposing the traditional hypotheses of efficient markets, pointing to the existence of market inefficiencies. In addition, the growing importance of information enhanced through technological development, like algorithmic trading and social media, has affected investment decision-making and market performance. These changes underscore the importance of investor education, openness, and regulatory supervision toward fair and robust financial support. Lastly, the technological innovations that have enabled financial inclusion, like mobile banking, digital wallets, and blockchain, have transformed something that was not possible in the emerging markets, especially during the last decade.

In summary, the historical occurrences such as financial innovations, pandemics, geopolitics, energy crises, and technological advancements have all resulted in the development of the existing market environments through their influence on financial inclusivity, market interdependence, regulation development, and investment practices. Knowledge of such occurrences can give important lessons to policy makers, investors, and other market players on how to handle complexity and risk, and how to create sustainable development of the market.

5. Conclusion

The key emphasize of the discussion is the transformative role of technological innovation, policy intervention, and inclusive financial developments in advancing sustainable development in emerging markets. Educational technology stands out as a critical facilitator, broadening fair access to quality education and increasing the

pace of achievement of Sustainable Development Goals by building on stakeholder participation and public-private collaboration. Digital forces contribute greatly to sustainable entrepreneurship and environmentally friendly innovation through the development of ecosystems of collaboration in response to local challenges and worldwide market integration, where critical uncertainties govern future directions. The artificial intelligence, IoT, and renewable energy sources are process optimization technologies that can enhance the efficiency of operations, social equity, and environmental results, but demand supportive policies and the expansion of financial access to the necessary resources to address barriers in implementation. In the meantime, the introduction of AI in the financial markets improves efficiency, access, and inclusivity. The combination of these transforming trends shows that the key drivers of an emerging market change are digitalization, sustainability-oriented innovation, and inclusive economic models. Financial inclusion has been digitized by digital financial technologies such as mobile banking and blockchain that have broken the traditional barriers and facilitated the ability to respond resiliently to economic shocks.

Overall, the emerging markets have been found to be making visible strides toward sustainable development by integrating technological development, new forms of governance, and inclusive financial systems in multiple dimensions. Although there are difficulties in the form of regulatory inconsistencies, infrastructural shortages, and socioeconomic inequalities, the emerging economies exhibit adaptive strengths through the unique models of innovation, creation of collaborative ecosystems, and participation in strategic policy changes. This development can be said to be a continued shift to environmentally friendly, socially integrative, and economically dynamic paradigms of development that resonate with global sustainability goals.

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Chapter 2

Perspective Chapter: Digital Economy and International Cultural Trade

Ming Ma

Abstract

This research explores how the digital economy is transforming international cultural trade, examining both its opportunities and challenges. The digital economy is reshaping the value chain of international cultural trade, creating a new pattern of “global production, digital transmission and subscription, global consumption.” While digital platforms expand trade through scale advantages, their algorithms can threaten cultural diversity and data security. The research starts by explaining the digital economy’s concept and nature from various angles. Then, it looks at how digital technology cuts costs, increases trade, yet creates a diversity paradox in cultural trade. Through case studies like Myth of Black Monkey, K-pop, and NT Live digital performances, it identifies challenges such as the digital restructuring of cultural intermediaries, blurred cultural identity, data security issues, and uneven discourse power in trade rules. Finally, the research suggests that governments work together to build a multilateral and inclusive digital cultural trade framework, support digital cultural industries in the developing nations, strengthen data governance, ensure cultural security, and unify statistical standards for digital cultural trade.

Keywords: digital economy, digital trade, international cultural trade, cultural goods and services, digital platform

1. Introduction

The digital economy is profoundly transforming the ways cultural products and services are produced, consumed, and traded. Technologies such as artificial intelligence (AI), cloud computing, and big data have optimized the allocation of cultural resources and provided innovative tools for cultural production. Meanwhile, digital platforms, virtual reality (VR), and augmented reality (AR) have further expanded consumption spaces and scenarios, creating immersive and interactive experiences for global audiences. This chapter aims to explore how the digital economy affects international cultural trade and the challenges this impact poses to cultural diversity and fair competition. The core of this study is to analyze how digital technologies restructure the production, distribution, and consumption of cultural goods, while also assessing the resulting challenges. Unlike previous works that focused solely on

economic metrics, this chapter integrates cultural economics, cultural studies, and international trade theory, attempt to provide a multidisciplinary perspective.

In 2015, *The Three-Body Problem* by Chinese writer Liu Cixin won the Hugo Award at the 73rd World Science Fiction Convention held in Spokane, the United States, and was widely praised and sought after overseas. In 2022, Tor Books of the United States completed the copyright renewal of the English version of the *Three-Body Problem* for \$1.25 million, creating a new record for overseas copyright trade of Chinese literary works. By the end of 2023, this book has been exported to 35 languages, and the foreign edition has sold more than 3.5 million copies. In 2024, Netflix's "Three-Body Problem" series topped 79 countries and regions in its first week of broadcast, reaching 81.7 million hours of global viewing and 11 million viewers in four days.

In early February 2025, as China celebrated the Lunar New Year of the Snake, *Deepseek* and the animated film *Ne Zha 2* emerged as focal points of public and media attention. By March 1, the film's domestic box office had soared to nearly 14.1 billion yuan, while its overseas earnings surpassed 150 million yuan, with figures continuing to rise. Based on its current global performance, *Ne Zha 2* has secured a place among the top seven highest grossing films in cinematic history, becoming the first Asian non-Hollywood production to achieve this milestone. Although the film set records for Chinese-language cinema in North America, New Zealand, and Australia, its theatrical release in North America was limited to just over 900 screens—a stark contrast to the tens of thousands of screens typically allocated to Hollywood blockbusters. This disparity underscores the formidable challenges posed by Hollywood studios' entrenched monopolistic market power in production and distribution, which continues to stifle international competition.

It is evident that *The Three-Body Problem* and *Nezha 2* are merely the tip of the iceberg in showcasing the global influence of cultural products and services in the digital economy era. For instance, K-pop, epitomized by Bangtan Sonyeondan (BTS), has achieved historic milestones with multiple consecutive albums topping the Billboard 200 chart, while their single *Dynamite* became the first Korean-language track to reign atop the Billboard Hot 100. Similarly, the Korean dystopian thriller *Squid Game* shattered records as Netflix's most-watched series globally, dominating streaming rankings in over 90 countries. Meanwhile, Japan's animated blockbuster *Demon Slayer: Mugen Train* grossed over \$500 million worldwide, claiming the title of the highest grossing film of its release year. These achievements unfold against the backdrop of U.S. streaming titans Netflix and Disney+ collectively commanding 60% of the global subscription market, underscoring how digital platforms are redefining the boundaries of global cultural exchange. In short, cultural products and services are flowing around the world at an unprecedented speed, and international cultural trade is undergoing a new round of reshaping and change.

1.1 How to better understand the digital economy?

When Tapscott [1] initially introduced the concept of the digital economy, he believed that the digital economy would make enterprise executives and managers pay more attention to using advanced information technology to change business processes and product forms. The early meaning of digital economy mainly refers to the economic impact of the adoption of Internet technology. Since then, the conceptual boundary and connotation of the digital economy have been constantly expanding. Bukht and Heeks [2] sorted out and analyzed the definition of the digital economy

in a more comprehensive way. They believed that digital economy in a broad sense refers to the use of information and communication technology (ICT) in all economic fields. And true digital economy means that part of economic output is derived solely or primarily from digital technologies with a business model based on digital goods or services. It consists of the digital sector (the ICT sector producing foundational digital goods and services) plus emerging digital and platform services (p. 1).

There are also some differences in how governments define the digital economy. The Bureau of Economic Analysis (BEA) of the US considers the digital economy to include three parts: digital-enabling Infrastructure, E-Commerce, and Digital Media [3]. The Office for National Statistics (ONS) of the UK believes that the digital economy includes two parts: e-commerce and supporting infrastructure. China defines digital economy as an economic form that is not limited to industries such as ICT but also includes parts of digital transformation in other industries. The Japanese Ministry of Internal Affairs and Communications believes that the evolution of ICT centered on the Internet and mobile phones has brought digital economy, and the future will move toward a Society 5.0 with a high integration of cyberspace and physical space [4].

According to the existing research results, the current explanation of the digital economy is mainly from the following three perspectives [5]: business operation, technology impact, and categorization and measuring (see **Table 1**). In 2016, a broad consensus was reached on the definition of the digital economy at the G20 Summits, which refers to a broad range of economic activities that include using digitized information and knowledge as the key factor of production, modern information networks as an important activity space, and the effective use of information and communication technology (ICT) as an important driver of productivity growth and economic structural optimization [9].

Perspectives	Main points	Researcher
Business operation	The digital economy is changing the forms of trading of goods and services, driving changes in e-commerce and business organization, referring specifically to electronic transactions using the Internet. Emphasis on changes to business models, transaction costs, and methods.	Lane [6]
Technology impact	Digital reform of existing economic sectors using ICT refers to both digital access to goods and services and the use of digital technologies to enable enterprise technological innovation; the foundations of the digital economy involve digital technologies, digital devices (hardware, software, and communication devices) and are a convergence of several general-purpose technologies (GPTs) that encompass physical infrastructure (broadband lines, routers), access devices (computers, smartphones), applications, and the functionality provided (IoT, data analytics, cloud computing).	Dahlman et al. [7]
Categorization and measuring	The digital economy encompasses both the core digital sector and the broader range of extensive digital activity, and can be divided into digital industrialization (ICT field) and industrial digitization (digital transformation of traditional industries). Measuring the digital economy faces challenges of fuzzy boundaries, poor data quality, different national standards, and invisibility of much digital activity.	Carlsson [8]; Bukht and Heeks [2]

Table 1.
The definition of the digital economy.

In the last 20 years, the world has experienced a profound and transformative digital revolution, with mobile Internet booming, digital technology advancing rapidly, traditional industries upgrading, and consumer experiences transforming. Research reports by major international organizations have confirmed the trend of global digitization. For example, The International Telecommunication Union (ITU) reports that the global Internet user base has grown exponentially, leaping from 1 billion in 2005 to 5.4 billion in 2023, accounting for 68% of the world's population [10]. The information and communications technology (ICT) sector grew about three times faster than the total economy in the Organization for Economic Cooperation and Development (OECD) countries during the past decade. In 2023, the ICT sector reached new heights, growing 7.6% on average in the OECD [11]. 5G coverage has increased to reach 51% of the world population in 2024 [9], almost all OECD countries have deployed 5G networks and are starting to shift to “beyond 5G” or “6G” research [10]. Between 2015 and 2023, global venture capital (VC) investment in AI star ups increased from 3.1 billion to 98 billion. Since mid-2019, China published more AI research than the United States or the European Union [10]. Global patent publications in computer technology soared 27-fold between 1980 and 2021; global employment in IT services quadrupled from 8 million in 2000 to 32 million in 2022 [12].

If these macro-data are not easy to personally experience the changes of the digital economy, then the consumption behavior of individuals is more real. In 2019, BCG's interviews with 15,000 consumers in cities such as Shanghai, Rio de Janeiro, and Nairobi confirmed that whether these countries are in the digital awakening stage (e.g., Kenya, Morocco, South Africa), the digital shaping stage (e.g., Indonesia, Brazil, India), or the digital maturity stage (e.g., U.S., U.K., China). The digital economy affects the consumer's consumption behavior to varying degrees. By 2022, 3 billion consumers in emerging markets will be Internet users, with digitalization impacting \$3.9 trillion in spending [13]. Social media is the main channel for consumers to obtain consumption information. For example, NYX, a Thai makeup brand, promotes its products on Facebook and Instagram. Online shopping and payments are growing rapidly the penetration rate of mobile payment in China has reached 85%. In the field of cultural industry, which is dominated by the consumption of intangible content of text, the impact of the digital economy is more obvious. Digital drama, online e-books, streaming TV series and movies, and online games all affect the public's cultural consumption behavior.

The genesis and evolution of the digital economy can be largely attributed to the relentless innovation in two pivotal digital technologies: computing and the Internet. As big data, cloud computing, AI, and block-chain technology have increasingly become universal technologies, they have furnished the necessary technical underpinnings to transform data into a key production factor. This transformation, in turn, has led to a restructure the relationship between production and consumption, thereby enhancing overall social productivity.

Reflecting on the practical outcomes of the digital economy development in the recent years, it has emerged with several distinct and notable characteristics. (1) Data as a core factor of production. This underscores the importance of data in the modern economy, not only as a carrier of information, but also as a foundation for decision-making, innovation, and value creation. (2) Broad application and penetration of digital technology. The popularization and deeply application of digital technology is changing the operation of various industries, from manufacturing to

cultural industries, and from artistic to audiences, digital technology is playing a crucial role in shaping these fields. (3) Integration and cross-border promotion of industrial upgrading. The digital economy has promoted the integration of different industries, and this cross-border cooperation has provided new impetus for industrial upgrading and innovation and promoted the development of new business forms and new models. (4) Intelligent platform enterprises. By constructing an open ecosystem, platform enterprises use digital technologies to provide intelligent services and promote the optimal allocation of resources and the improvement of efficiency.

1.2 Research on digital economy and international cultural trade

Firstly, defining the framework of cultural trade. The multifaceted nature of “culture” complicates the delineation of cultural trade research boundaries. The United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS) provides a classification, based on the “Harmonized System” in 2005. UNESCO analyzes data from various sources, regularly tracks the trade in global cultural products and services, and thus better monitors the progress of the Sustainable Development Goals and the Convention on the Protection and Promotion of the Diversity of Cultural Expressions. For instance, the UIS report, “The Globalization of Cultural Trade: A Shift in Consumption--International Flows of Cultural Goods and Services, 2004-2013,” shows that South-South trade in cultural goods remains limited, with most trade flows occurring between the North and South. Despite these efforts, the intangible nature of digital cultural services (e.g., streaming media, online gaming) challenges traditional classification frameworks, necessitating methodological innovation.

Secondly, the evolving theoretical landscape. Traditional trade theories, particularly comparative advantage, struggle to explain digital cultural trade dynamics. Classical models emphasize resource endowments and production costs, yet digital products—characterized by near-zero marginal replication costs and platform-driven distribution—defy these assumptions. Initial researchers’ existing studies on international cultural trade focus on trade—influencing factors, like how economic development, geographical and cultural factors, and the trade institutional environment affect cultural product exports [14, 15]. Empirical studies on cultural trade determinants further highlight this disconnect. Since Freund and Weinhold examined digital economy’s impact on service trade, scholars have increasingly focused on its influence on international trade [16]. Felbermayr and Toubal analyzed data from 22 countries between 1975 and 2003 to explore the connection between cultural proximity and trade. Their research indicates that, when other factors are held constant, neighboring countries see a 41% rise in bilateral trade volume. This suggests that geographical proximity significantly and positively influences trade [17]. However, such findings primarily reflect pre-digital trade patterns. The empirical results show that cultural differences have significant influences on the trading decision and volume of music traded in addition to the traditional determinants of trade [18]. Recent scholarship suggests that digital platforms may attenuate geographic constraints: Hellmanzik and Schmitz measured cultural distance and Internet development using bilateral and two-way website link data. They found that the smaller the Internet development gap between two countries, the greater the bilateral trade volume of audio-visual services [19].

Thirdly, digital disruption of cost reduction and new paradigms. The digital economy's cost-optimizing effects have reshaped cultural trade. Most research shows that the digital economy positively impacts the scale and quality of international trade [20]. Goldfarb and Tucker [21] identify five cost categories reduced by digitalization: information acquisition, replication, transportation, tracking, and verification [21]. Empirical evidence supports this: Lendle et al. [22] show that eBay's platform reduces export costs by 60%, enabling SMEs to reach 85% more markets than traditional channels. Nevertheless, this transformation introduces paradoxes [22]. While algorithmic recommendation systems expand access to diverse cultural products (e.g., Spotify's localized playlists), they may also homogenize consumption patterns through "winner-takes-all" dynamics [23]. Moreover, the rise of platform monopolies—Netflix controls a large proportion of global television markets—raises concerns about cultural imperialism masked as market efficiency [24]. In addition, all kinds of virtual media supported by digital technology have become an important trading place for international cultural trade. A group of new sciences due to the regulation of commercial relations in a cross-border virtual space (above the border disciplines) appeared [25]. In terms of analytical frameworks, researchers tend to adopt a comprehensive approach by selecting multiple relevant explanatory variables and constructing stochastic frontier gravity models for regression analysis to investigate the impact of the digital economy on cultural product exports. For instance, the primary explanatory variable is the level of digital economic development in a country, while control variables include factors such as the degree of digital economic development, economic freedom, geographical distance, cultural distance, and the real effective tariff rates of trading partner countries.

Current cultural trade research has three recurring methodological limitations. Firstly, existing empirical studies mostly focus on exogenous factors like geographical proximity, digital infrastructure differences, and cultural distance measures, but they ignore the big impact of digital economic ecosystems on the whole cultural value chain. This includes production digitization (e.g., AI-generated content), distribution platformization (e.g., algorithmic recommendation systems), and consumption dematerialization. Secondly, the research field has strong English-speaking bias and pays little attention to non-Western language and institutional settings. There are especially a lack of studies on East Asian cultural economies, despite China's rising web literature exports, Korea's dominant K-content, and Japan's anime industry complex. Thirdly, even though people realize the comparative advantage theory is becoming less relevant, the suggested alternatives are not well-implemented. Few studies have tested these new frameworks using large-scale longitudinal data or cross-regional comparisons.

1.3 The impact of the digital economy on international cultural trade

Trade, as a key link in the allocation of resources in economic activities, is also undergoing profound changes in digitalization. On one hand, the traditional domains of trade, which have been primarily focused on the exchange of goods and services, are experiencing a metamorphosis and enhancement due to the pervasive influence of digital technology. For instance, leading e-commerce giants like Amazon and SHEIN are leveraging big data technologies to enhance various aspects of their operations, including product selection optimization, user preference prediction, logistics

optimization, and payment methods. On the other hand, digital technologies provide new content for products and services in international trade. For example, theater production companies rely on streaming media live platforms to provide online theater in overseas theaters or on the Internet. Notable examples include the National Theater Live (NT Live) from the UK and the MET: Live in HD from the United States' Metropolitan Opera, showcasing how digital innovation is enriching the global trade landscape with new forms of cultural exchange.

The digital economy's transformation within the trade sector has garnered significant attention from governments and researchers alike, particularly concerning digital trade. As a broad and encompassing concept, the definitions of digital trade vary somewhat among different countries and organizations. In 2017, the US International Trade Commission (USITC) defined as the delivery of products and services over either fixed-line or wireless digital networks [26]. This narrow definition excludes things like online shopping and digital counterparts (CDs or DVDs). In 2017, G20 Members acknowledge challenges in measuring digital trade, including such technical and complex issues as the definition and scope of digital trade, the reliable data, appropriate accounting frameworks, and the classification [27]. In 2023, the Congressional Research Service (CRS) of US reported that digital trade refers to all forms of commerce conducted by electronic means and includes trade in both goods and services [28]. The EU has a similar definition of digital trade, which refers to commerce enabled by electronic means—by telecommunications and/or ICT services—and covers trade in both goods and services. In 2023, the OECD, IMF, UNCTAD, and WTO collaboratively released the second edition of the Handbook on Measuring Digital Trade. Within this publication, digital trade is statistically delineated as “all international trade transactions that are digitally ordered and/or digitally delivered” [29]. The Chinese government defines digital trade as the trade with data as the key production factor, digital services as the core, and data ordering and delivery as the main characteristics, including digital goods trade, digital technology trade, digital service trade, and cross-border data flow trade [30]. The 2018 Trade White Paper released by Japan's Ministry of Economy, Trade and Industry emphasized the importance of considering the broader concept of digital trade, when deliberating on digital trade regulations within the context of trade agreements and international frameworks [31]. At present, the concept of digital trade has not yet formed a unified definition. The concept of digital trade appears in policy strategies issued by different countries, rules, and standards issued by international organizations and scholars' research literature, presenting a variety of expressions.

However, as a form of “esthetic consumption,” cultural products and services have emerged as a vital component of the digital trade. Case in point: Spotify's streaming music, Netflix's feature films, Disney+'s original series, TikTok's viral short videos, and more. These diverse contexts are being exchanged and consumed globally through digital platforms. “Digital ordering and delivery exacerbate some of the known measurement challenges involved in recording international transactions” [32], so OECD, WTO, and IMF improve the measurement of international trade in general in 2023. By this measure, types of digital trade include digitally ordered (a subset of total e-commerce), digitally delivered, digital intermediation platforms (DIPs). Incorporating a selection of prevalent cultural products and services into this framework (as shown in **Table 2**) will facilitate a clearer comprehension of cultural activities within the realm of digital trade.

The product (What)	The nature of the transaction (How)			The actors engaged (Who)	Description	Example of transaction
	Digitally ordered	DIP	Digitally delivered			
Cultural goods	Y	Y	N	B2B	An enterprise in Country A makes a purchase from a supplier in Country B <i>via</i> a DIP.	A publish firm purchases coated paper used its production from a non-domestic supplier in Alibaba.
Cultural goods	Y	Y	N	B2C	A consumer in Country A makes a purchase from a supplier in Country B <i>via</i> a DIP located in Country B.	A consumer orders a book from a third-party seller <i>via</i> Amazon.
Cultural goods	Y	Y	N	C2C	A consumer in Country A makes a purchase from a consumer in Country B <i>via</i> a DIP.	A consumer purchases books from a non-domestic <i>via</i> eBay.
Cultural service	Y	Y	Y	B2B	An enterprise in Country A purchases a service from a resident supplier in Country B <i>via</i> a DIP.	A firm orders a logo design from a non-domestic designer <i>via</i> DIP for graphical designers.
Cultural service	Y	Y	Y	B2C	A consumer in Country A purchases a service from a non-domestic supplier <i>via</i> a DIP located in Country B; service is delivered digitally.	A consumer purchases a music service from a non-resident supplier <i>via</i> Spotify.
Cultural service	Y	Y	Y	C2C	A consumer in Country A purchases a service from a consumer in other countries <i>via</i> a DIP; service is delivered digitally.	A consumer orders online education services from non-domestic resident consumer <i>via</i> Zoom.

Table 2.
Cultural goods and services under the OECD-WTO-IMF digital trade framework.

2. New features of international cultural trade

Although since the 1940s, scholars represented by Adorno and Horkheimer have been criticizing the negative impact of industrialization on culture and artistic production and introduced the concept of the culture industry, this critique has not been able to influence the rapid development of the culture industry in the global

economy. Particularly in the past two decades, globalization and commercialization have placed the masses in an era of “crowd” cultural consumption, where digital technology’s capabilities in exploring, generating, storing, allocating, and utilizing cultural resources have surpassed any historical period. This has led to a significant increase in the production efficiency of the cultural industry and a more diverse range of cultural products and services. Taking performing arts as an example, traditional music and theater rely on live performance and physical presence as important symbolic distinctions. The later emergence of storage media such as CDs and DVDs allowed for a wider dissemination of performing arts, also fostering popular culture. Nowadays, digital technology has turned audio and video into digital files shared on the Internet. The concepts of time and space in traditional performing arts have been disrupted, and cross-media art has emerged. An Asian viewer no longer needs to go to New York to enjoy a live stream of the Metropolitan Opera on a streaming platform. Visual arts have evolved from manual drawing to photography and videography, and then to creative reconstruction through digital technology, also confirming the changes digital technology has brought to cultural production and circulation. These changes all indicate that the cultural industry has indeed entered the digital age, and international cultural trade has also undergone many changes.

2.1 Digitalization of trade content: Global flows of cultural goods and services

Since the beginning of the twenty-first century, the application of digital technology in cultural production has expanded in both depth and breadth, and the digitization of cultural products such as books, music, and films has begun to enter a commercial phase. In 2002, George Lucas’s “Star Wars Episode II: Attack of the Clones” became the first Hollywood production film to use digital technology not only in the filming process but also to be screened digitally worldwide. In 2003, Apple launched the iTunes Music Store; in 2004, Sony released the Libre e-book reader; and in 2006, Hollywood first released the film “Brokeback Mountain” in digital format. These continuous innovations in production technology and business models have provided significant experience for the development of digital cultural trade.

The globalization of cultural products has given rise to many new cultural symbols, such as the Marvel film “The Avengers,” the science fiction novel “The Three-Body Problem,” HBO’s “Game of Thrones,” and Luis Fonsi’s musical work “Despacito.” In 2016, Michael Fuhr, the executive director of the World Music Center at the University of Hildesheim in Germany, published the book “Globalization and Popular Music in South Korea: Sounding Out K-Pop,” which prompted us to reconsider the cross-border flow of cultural symbols under the tide of globalization. According to the import and export trade statistics from the Korea Customs Service, the export value of Korean recorded music reached 243.814 million US dollars in 2023. K-Pop initially entered China and Japan and quickly completed its earliest accumulation through the “Hallyu” wave. Currently, among the countries to which South Korea exports records, the United States has surpassed China to become the second largest, ranking only behind Japan. The Korean singer Jimin became the first artist in K-Pop history to enter and top the US Billboard “Hot 100” chart. Although the success of K-Pop is backed by various factors such as cultural policies, conglomerate funding, international trade, and ideologies, the “virtual platform” built by digital technology is indeed the foundational medium that allows these factors to interact effectively.

Today, digital content forms of cultural products and services have become a new choice for consumers in many countries. People are increasingly enthusiastic about reading e-books on Kindle, listening to music on Spotify, watching TV series on Netflix, and viewing live theater performances on Internet streaming platforms. The statistics in this area can be quite surprising, although they may not be entirely accurate due to commercial confidentiality or trade regulations. For instance, the global e-reader market value reached 7.36 billion US dollars in 2024. As of the end of 2023, Spotify's monthly active users reached 602 million, with 236 million of them being paid subscribers. Netflix's global paid user base stood at 260.28 million, while Disney+ had 149.6 million users. With audiences interacting on mobile phones or devices, cultural product services can flow globally.

2.2 Digital platforms are reshaping international cultural trade

Digital technology enables the information required for cultural production to be captured, recorded, stored, transmitted, and fed back with unlimited extension in terms of time and space, significantly reducing the transaction costs brought about by information barriers. The hierarchical authority established by traditional cultural organizations is evolving toward a flatter structure. Essentially, digital platforms are ecosystems built through Internet technology that connect users with content and services. They facilitate the efficient circulation and intelligent matching of information through data-driven approaches, creating personalized experiences for users while empowering creators, merchants, and other participants. This drives industrial innovation and value creation, thereby promoting the global flow of cultural products and services.

Amazon is a prime example of a digital platform, and its development history well illustrates the evolution of trading platforms. (1) Online Bookstore Phase (1994–1999): Jeff Bezos founded Amazon with the goal of leveraging the Internet's convenience to revolutionize traditional book sales. With its extensive range of books, convenient online shopping experience, and standardized book sales operations, it quickly attracted a large customer base and became the largest online bookstore in the United States. (2) Comprehensive E-commerce Phase (1999–2005): Amazon expanded its product line to include music, DVDs, and electronics, and introduced a third-party seller platform, allowing other merchants to sell goods on its platform. It also established localized websites in countries like the UK, Germany, France, and Japan, gradually evolving into a global comprehensive online retail platform. (3) Digital Technology-Driven Innovation Phase (2005–2010): Amazon launched Amazon Web Services (AWS), offering cloud computing services, and began transitioning into a technology company. In 2007, Amazon released the Kindle e-book reader, which not only changed the way people access and read books but also transformed the book trade. (4) Intelligent Development Phase (2010–Present): Amazon continues to increase its investment in technological innovation and research and development, promoting the application of big data, artificial intelligence, healthcare, and the Internet of Things across various business areas. For example, it uses IoT platforms to help manufacturing companies manage their devices online and employs big data technology and algorithms to recommend products to users. The focus of this chapter is not to discuss the monopolistic position or impact of trading platforms, but to emphasize the astonishing speed and scale of the development of digital platforms. The Internet originated from the idea of disintermediation, which involves obtaining content directly from the source. This approach

has reduced entry barriers for producers and lowered costs for consumers. In fact, new intermediaries have emerged to meet the demand for high-quality content from selectors [33].

3. The digital economy's impact on international cultural trade

In recent years, digital trade has become an essential issue for researchers exploring the mobility of cultural products and services from perspectives such as international economics, cultural economics, and cultural policy. Although the concept of culture often seems too broad for many empirical studies, focusing on specific areas like music, film, online games, and creative design reveals how the digital economy has transformed the production methods, creation processes, transaction media, and trade patterns of cultural products and services.

3.1 Reducing transaction costs and barriers

In both theoretical analysis and practical application, the digital economy's effectiveness in reducing trade costs is undeniable. A report from the WTO indicates that between 2014 and 2018, digitalization significantly improved trade costs in 58 economies. This improvement included better access to information, lower transaction costs, reduced need for business travel, more efficient customs and logistics, and easier communication [34]. Researchers estimate that a 10-percentage point increase in digital connectivity is associated with approximately a 2 percent reduction in trade costs for both goods and services. "A 1% increase in bilateral digital connectivity increases domestic trade by 2.1% and international trade by 1.5%" [35].

An OECD research report has also reached similar conclusions. For cultural trade, the reduction in costs may be even more significant, as many cultural products and services have low marginal delivery costs, making it easier to achieve economies of scale. Digitalization also reduces information search costs, marketing costs, and payment costs for cultural enterprises. As mentioned at the beginning, when the content value of the science fiction novel "The Three-Body Problem" is recognized and loved by audiences across borders, the conversion costs such as text translation and visual presentation become much lower compared to the substantial expected returns.

3.2 Expanding the types and scale of trade

The Creative Economy Outlook 2024, released by UNCTAD, indicates that in 2022, global exports of creative services reached \$1.4 trillion, marking a 29% increase from 2017. Meanwhile, exports of creative goods amounted to \$713 billion, showing a 19% rise over the same period. The most exported creative services in 2022 were software services, accounting for 41.3%, followed by research and development services at 30.7%. Other significant categories included advertising, market research, and architecture (15.5%), audiovisual services (7.9%), information services (4%), and cultural, recreational, and heritage services (0.6%). Taking the music industry as an example, in 2023, traditional physical sales accounted for only 17.8 percent of the total revenue. Meanwhile, the share of streaming revenues increased by 10.4 percent, representing more than two-thirds (67.3 percent) of the global market [36]. AI-supported recommendation algorithms and faster data transmission have enriched cross-border music streaming activities.

The digital economy has eliminated geographical barriers in traditional trade, enabling cultural products and services to reach a broader audience. For instance, digitalization has propelled TV dramas, web novels, and video games to become the “new trinity” of China’s digital cultural exports, serving as a window for mutual understanding and cultural exchange between China and ASEAN countries. The Chinese TV drama “Qing Yu Nian” topped the list of TV dramas on Thailand’s video platform MONOMAX in July 2024. OTT platforms such as iQIYI, WeTV, and Xiaohongshu are gaining widespread popularity in Southeast Asia, especially among young people. In the field of online gaming, these changes are particularly evident. In September 2020, the online game “Genshin Impact,” developed by miHoYo, was officially launched. Since its release, it has performed exceptionally well, especially gaining significant traction in overseas markets and even driving the development of the entire anime-style gaming category. Reports from Sensor Tower show that since its launch, Genshin Impact has generated monthly revenue of 3 billion yuan globally, with 30% contributed by Chinese players and the remaining 70% coming from outside China. Additionally, Genshin Impact won the prestigious TGA (The Game Awards) for Best Mobile Game in both 2020 and 2021, an accolade often referred to as the Oscars of the gaming industry.

3.3 Changing cultural production methods and trade patterns

Over the past century, significant technological innovations have profoundly influenced the methods of cultural production and the patterns of trade. From silent films to sound films, then to color and digital films, advancements in film production technology have greatly enriched the expressive forms and artistic effects of movies. Computer-generated imagery (CGI) technology has enabled the creation of realistic special effects, propelling the development of science fiction and fantasy films. Similar transformations have occurred in other fields, from analog to digital recording, from live theater performances to digital theaters, and from print books to e-books. This is not merely a simple medium conversion. For instance, digital theaters are not just about broadcasting live performances online; the more significant aspect is the use of VR or AR technologies that have changed traditional linear production methods, allowing more creative technical personnel to participate and gradually blurring the boundaries between audiences and creators. These changes have also subtly influenced the trajectory of global value chain (GVC) trade operations and posed new challenges to existing trade rules and patterns.

From the perspective of the subjects and methods of cultural products and services trade, the trade patterns are also undergoing changes. Taking the film industry as an example, the traditional trade phase was characterized by a “one country produces, global sales” model. After the 1980s, driven by globalization and international market interests, it evolved into a “global production, global sales” model, which led to the success of many Hollywood multinational film companies such as Disney and Paramount. In the digital trade era, the spatial dispersion of production, procurement, logistics, research and development, consumption, and after-sales service has been further amplified, leading to exponential growth in value chain trade [37]. Due to the continuous decline in transmission and communication costs, coupled with the increasing integration capabilities of digital platforms, many film groups have established highly autonomous studios under large corporate groups to maintain better textual innovation and encourage creativity, such as Pixar Animation Studios and Lucasfilm. The trade pattern has evolved into a “global production, digital transmission and subscription, global consumption” model.

4. Textual stories in international cultural trade

In the arena of international cultural trade, the United States continues to play a dominant role. However, under the influence of cultural policies such as UNESCO's Declaration on Cultural Diversity, France and Canada's "cultural exception," and China's "going global" cultural initiatives, the advocacy for cultural diversity has been sustained. Nevertheless, in the digital trade era, concerns arise in other countries. This is because, "The American cultural and digital industries enjoy a strong competitive advantage. At the same time, the United States insists on the absence of restrictions in digital networks, through which cultural contents are to be increasingly distributed and accessed" [38]. Next, let us explore the more vibrant stories of international cultural trade. These examples are telling the world that the digital economy is transforming international cultural trade, and global culture is entering a new era of fusion and interaction.

4.1 Video game: "Black Myth: Wukong," steam, and PS5

"Black Myth: Wukong" is a meticulously crafted single-player game developed by Game Science Company, drawing inspiration from the classic Chinese literary masterpiece "Journey to the West." The development team focused on presenting a unique Eastern fantasy style, emphasizing technological innovation and substantial time investment. They employed advanced techniques such as real-world scanning and photography to meticulously create scenes and characters. After 6 years of refinement, with a development cost of over 20 million yuan per hour of gameplay and a total investment exceeding 300 million yuan, the game was primarily launched on the Steam platform, with support for PlayStation 5 (PS5) and PC platforms. By October 2024, it had sold over 21.3 million copies on Steam, generating a total revenue of more than 1 billion US dollars. Based on the 140,000 reviews on the PS5 platform, it is estimated that the game will sell between 7 million copies. "Black Myth: Wukong" has received high praise from global players and the industry, ranking at the top of various charts.

While many gamers, cultural critics, and analysts highly praise this game, it is essential to recognize the importance of platforms such as Steam and PS5. Firstly, Steam, as the world's largest digital game distribution platform, has a vast user base, providing a broad market for the game. Secondly, Steam's mature community functions help enhance the game's reputation and user retention. Additionally, Steam's marketing pages and recommendation mechanisms are crucial. As Trump is poised to become President again, one wonders if he will continue to engage in intense trade wars with China. Considering the challenges faced by TikTok, a digital platform, in the US Congress, future international cultural trade is likely to become even more competitive.

4.2 Pop music: K-pop, Spotify, and YouTube

In 2012, PSY's "Gangnam Style" gained immense popularity on YouTube, surpassing 1 billion views. This can be considered the beginning of K-pop's global expansion. Prior to this, Korean pop culture had already achieved notable success in China, Japan, and other parts of East Asia. According to the report by the International Federation of the Phonographic Industry, in 2002, Korea was ranked only as the 19th largest music industry. However, after two decades, by 2022, it had risen to 7th place,

surpassing countries like Canada, Brazil, and Australia [39]. The success of K-pop lies in its cultural hybrid-type and innovation. It combines elements of traditional Korean culture with Western pop music to create a unique musical style [40]. According to a survey by the Korea Foundation and Ministry of Foreign Affairs, the number of Hallyu fans worldwide totaled 225 million last year—up from 9.26 million in the first survey in 2012. There are 1748 Hallyu fan clubs across 119 countries. As per the report, about 68% of fan clubs focus on K-pop.

The success of K-pop is closely linked to platforms like Spotify and YouTube. These platforms have a vast global user base and offer simple and convenient subscription and payment methods. Spotify collaborates with K-pop artists to include their popular songs in global playlists and conducts worldwide promotional activities, thereby accelerating the trade of Korean cultural products and services. According to the data from the streaming service, K-pop streams increased by 362 percent in the global market and 182 percent in the United States in 2023 compared to 2018. In Southeast Asia, where K-pop is particularly popular, streaming surged by an impressive 423 percent during the same period [41]. Well-known recent examples are the Oscar-winning movie ‘Parasite’ (2019), the Netflix-topping ‘Squid Game’ (2021), etc. Squid Game is an example of a successful K-drama introduced abroad through Netflix in 2021, which topped the global series viewership charts in many countries.

4.3 Performing arts: The met live in HD and NT live

While the expansion of video games and pop music on digital platforms can be seen because of mass entertainment frenzy, for the highbrow-performing arts, the digital economy has accelerated their global circulation and trade in a more profound way. As early as the beginning of the twentieth century, the Metropolitan Opera in the United States had already attempted to broadcast its opera performances live. “Since the beginning of the twenty-first century, LST, HD-Met and NT Live, have opened up the application of digital technology in performing arts institutions. In 2020, the outbreak of Covid-19 in the world has objectively forced more art institutions and festival organizers to launch online performances” [9].

In 2006, the Metropolitan Opera in New York City launched the “The Met: Live in HD” initiative, aiming to stream its opera performances in high definition through digital platforms, either live or as recorded broadcasts. Each season, the Met selects approximately 10 operas for these high-definition broadcasts. This approach not only allows audiences to enjoy world-class opera performances at relatively lower ticket prices but also utilizes advanced visual and audio technologies to preserve the authentic experience of watching opera live. According to its annual reports, from the fiscal years 2018 to 2020, the revenue from high-definition opera performances accounted for 9.6%, 7.9%, and 6.7% of the total income, respectively. To date, more than 150 live performances have been screened in cinemas worldwide, selling over 30 million tickets. Similarly, the National Theater Live (NT Live) project initiated by the National Theater in the UK in 2009 is also a classic example of the digitalization of performing arts. This project aims to present the finest theatrical works on the world stage to a global audience through high-definition screenings. For instance, during the 2021-2022 season, five titles were screened 2941 times in the UK to audiences of 98,256; internationally, 22 titles were screened 640 times to 51,563 people [42]. Indeed, the COVID-19 pandemic has accelerated the integration of performing arts with digital technology, as many performances could not take place in theaters and had to shift to online channels.

5. Looking ahead: Opportunities and challenges

Under the influence of the digital economy, the global circulation of cultural products and services from various countries has significantly accelerated, with their production, subscription, delivery, and transmission methods exhibiting new characteristics. As an important aspect of the soft power competition among nations, international cultural trade faces numerous challenges.

5.1 Digital restructuring of cultural intermediaries

Pierre Bourdieu introduced the terms “new professions” and “cultural intermediaries” to describe the occupational groups that produce symbolic value between cultural production and consumption. These intermediaries rely on their cultural capital to guide consumer preferences. However, today’s cultural intermediaries are no longer limited to traditional roles such as critics, bloggers, tweeters, and stylists. The field of cultural inter-mediation is undergoing a process of “restructuring” driven by digital technology and platforms. Traditional art and cultural critics are being replaced by short-video bloggers; celebrities are no longer the first choice for corporate advertising, as many influencer bloggers now have a reach that far exceeds that of movie stars. Digital intermediary platforms, characterized by technology, agency, and automation, have largely dismantled information barriers and gaps, allowing intermediary activities to be directly embedded in various segments of the cultural chain, such as between artists, producers, and potential consumers.

5.2 Cultural identity ambiguity threatens cultural diversity

Digital cultural products can easily cross-national borders for circulation and dissemination, which may affect the recognition of cultural identity. For example, K-pop is accepted and loved by audiences in many countries, but this does not mean that these audiences truly understand and identify with South Korea’s cultural identity. It can only be said that the digital economy provides more potential consumers with shortcuts to approach cultural identities. Furthermore, in the vast sea of digital platforms, on the one hand, certain cultural products may be widely spread and imitated, leading to cultural homogenization; on the other hand, the encounter of numerous cultural products on digital platforms is more likely to trigger more disputes and competition. Moreover, driven by commercial interests, many cultural products and services have strayed far from their original “spiritual content” and values. Therefore, advocates of cultural exceptionism, such as France and Canada, still worry about losing the ability to “tell their own stories.” And thus restrict the import and circulation of foreign digital cultural products.

5.3 Data security controversies persist

In digital trade, data security faces challenges from multiple fronts, including the risk of data breaches, data misuse, differences in laws and regulations, technological challenges, and national security issues. Data breaches can lead to the exposure of personal information and corporate trade secrets, while data misuse can infringe upon individual privacy and corporate rights. However, these issues often serve as a convenient platform for national competition and strategic games. For instance, the U.S. Congress has required TikTok executives to attend hearings to answer questions

about user data security. Some senators' illogical and absurd questions to TikTok's Singaporean CEO have turned digital security into a guise for suppressing competition. Over time, TikTok has faced numerous criticisms from the U.S. government and media on grounds of data security and national security, with strict demands made regarding data localization and privacy protection. As researchers have noted, cultural products and services often carry "invisible" values or ideologies, making the already complex issue of data security even more severe in the context of cultural trade.

5.4 The struggle for discourse power in trade rules

The current international digital trade rules have formed a development pattern dominated by the "American model" and the "European model," with other models coexisting. The "American model" has gradually been disseminated to countries such as Mexico, Australia, and Japan through agreements like TPP and USMCA. It emphasizes a free framework for cross-border data flows to maintain its leadership in the global digital market. European countries, on the other hand, hope to rely on the TIPP agreement to strengthen the regulation and protection of personal privacy data, thereby forming a "single digital market." Many developing countries, including China, India, Brazil, and Russia, remain in a very passive state. Even though they may sign FTAs with other countries, their discourse power is relatively insufficient, facing the risk of being marginalized by the developed countries.

Although in 2005, UNESCO passed the Convention on the Protection and Promotion of the Diversity of Cultural Expressions to defend vulnerable cultural expressions, progress has been slow. The convention's contracting parties acknowledge the special nature of cultural activities, products, and services in conveying cultural characteristics, values, and meanings, and reaffirm the right of each country to maintain them within its territory. However, the failure of the 2008 Doha talks left the cultural policy under the WTO framework that is still unclear. In recent years, cultural content has always been a focus in the digital economy cooperation negotiations. FTAs signed by the EU with Japan, Vietnam, New Zealand, and other countries also involve cultural content. For example, in the agreement with Japan, Chapter 18 states, "Nothing in this Section shall affect the right of a Party to define or regulate its own levels of protection in pursuit or furtherance of its public policy objectives in areas such as: cultural diversity..." The Digital Economy Partnership Agreement, signed online by Singapore, New Zealand, and Chile on June 12, 2020, is the world's first digital economy-specific agreement. It emphasizes the importance of cultural identity and diversity, encouraging the promotion of the spread of information, knowledge, technology, culture, and arts. For governments of various countries, the particularity of cultural trade makes it difficult for international trade norms to be well compatible. Coupled with the new changes in the digital economy, achieving cultural trade norms from an international perspective is indeed an insurmountable task.

6. Conclusion and policy suggestion

Throughout human history, cultural exchange and trade have been vital for fostering understanding and learning among nations. In the era of the digital economy, various digital technologies drive the rapid global flow of cultural data and textual stories. Digital technology is no longer merely a medium or tool; it is profoundly

transforming the value chain of cultural production, creation, trading, and delivery. This poses unprecedented challenges to the theory, practice, and policy regulation of cultural trade. The public has become significant cultural producers and consumers, with online bloggers replacing film stars. The rapid growth of various streaming platforms has accelerated the closure of physical bookstores and cinemas. After the COVID-19 pandemic, we reexamine the relationship between the digital economy and international cultural trade, where opportunities and challenges coexist. The main conclusions of this research are as follows:

First, the digital economy is reshaping the value chain of international cultural trade. Digital technologies are driving the transformation of the entire cultural production-consumption chain, creating a new model of “global production, digital transmission and subscription, global consumption.” This not only changes the way cultural products are produced but also reshapes the role of trade intermediaries and consumer habits. For example, in the production phase, AI-assisted design tools enable artists and writers to quickly generate and refine creative ideas. Blockchain technology introduces new mechanisms for copyright protection and revenue distribution in the cultural industry. Traditional trade intermediaries, such as physical distributors and agents, are increasingly being replaced by digital platforms. On the consumption side, consumers can access a wide variety of cultural products anytime, anywhere through online platforms, while VR, AR, and other digital technologies are expanding new consumption scenarios and interactive experiences.

Second, the Scale-Diversity Paradox in Cultural Trade driven by the economies of scale of digital platforms, cultural products and services are consumed by global audiences at lower transaction costs. However, the algorithmic recommendation systems that power these platforms often prioritize popular content, leading to a “winner-takes-all” dynamic, which poses a significant threat to cultural diversity. This creates a paradox: While digital platforms democratize access to cultural products, they also risk flattening and homogenizing cultural landscapes by favoring a narrow range of dominant text narratives and styles. Similarly, this paradox is reflected in the evident imbalance in the formulation of global digital trade rules, where developed countries such as the United States and Europe dominate, while developing nations are left in a relatively passive position. For instance, the United States-Mexico-Canada Agreement (USMCA), led by the United States, actively promotes rules such as cross-border data flow, emphasizing the openness and utilization of data to consolidate its leading position in the global digital economy. Meanwhile, the European Union has established high standards for personal privacy and data security through the implementation of the General Data Protection Regulation (GDPR), aiming to set a global benchmark for data protection. Developing countries, with their weak digital infrastructure, lack of leading enterprises, and insufficient digital skills and regulatory frameworks, appear to have no choice but to follow the digital trade rules already established by the developed nations.

Finally, data breaches and misuse pose significant threats to the integrity of cultural trade, as sensitive information—ranging from user preferences to proprietary content—can be exploited for malicious purposes. A prominent example is TikTok’s scrutiny in the United States, where concerns over data privacy and potential access by foreign governments led to congressional hearings and calls for stricter regulations. This case underscores the vulnerability of digital platforms to geopolitical tensions and the potential for data security issues to disrupt cultural exchange. Moreover, digital cultural products often carry embedded values and ideologies, which can inadvertently or intentionally influence the beliefs and behaviors of global audiences. The intersection of data security and ideological influence creates a complex challenge for

policymakers. On the other hand, digital platforms must be held accountable for the cultural and ideological content they disseminate. For example, some countries have implemented data localization requirements to safeguard national security.

Technological innovation always has two sides. For governments navigating the wave of the digital economy, addressing the opportunities and challenges of digital cultural trade will be a critical issue in the future. This study suggests that the following pathways are worth considering:

First, build consensus among more countries to establish inclusive digital trade rules. In the context of deepening globalization and digital integration, it is particularly important to develop a set of inclusive, multilateral digital trade rules. Currently, digital trade rules are predominantly shaped by a few developed countries, leaving developing nations in a passive position. To address this, the international community should strive to build broader consensus, especially by formulating more inclusive rules within multilateral frameworks. For example, the model of the Digital Economy Partnership Agreement (DEPA) can be referenced, with flexible clause designs to balance the interests of different countries.

In this process, the inclusion of cultural exception clauses is a critical issue. Cultural products and services are not merely economic commodities but also carriers of cultural identity and values. Therefore, digital trade rules should allow countries to autonomously set their levels of cultural protection based on their unique cultural characteristics and developmental needs. The EU-Japan Economic Partnership Agreement (FTA) provides valuable experience in this regard. Chapter 18 of the agreement explicitly states that each country has the right to define or adjust its protection levels to achieve public policy objectives, such as cultural diversity. This flexible design respects cultural sovereignty while creating space for the healthy development of digital trade. Furthermore, many developing nations face challenges in digital infrastructure, technological capabilities, and regulatory systems, making it difficult for them to fully adapt to the high-standard rules dominated by the developed countries. Therefore, multilateral frameworks should incorporate mechanisms for technical assistance and capacity building to help these countries enhance their digital capabilities, enabling them to participate more equitably in global digital trade.

Second, support the development of local digital cultural industries and strengthen data governance and cultural security. The development of local digital cultural industries is not only a crucial engine for economic growth but also key to preserving cultural diversity. Governments should take proactive measures to support the digital transformation of local cultural enterprises, particularly small- and medium-sized ones. For example, drawing on the successful experience of South Korea's K-content industry policy, special funds could be established to provide financial support, technical training, and market promotion services for small- and medium-sized cultural enterprises. This would help enhance their digital capabilities, better address the cultural homogenization caused by digital platform monopolies, and create internationally competitive cultural products.

At the same time, as cultural products and services become increasingly digitalized, data has become a core production factor in the cultural industry. However, the cross-border flow of data also brings security risks, especially for core data related to national cultural security and ideology. Countries should establish tiered rules for cross-border data flow, implementing localized storage and management of core cultural data to ensure its security and controllability. For non-sensitive data, greater openness and sharing can be encouraged to promote international cooperation and cultural exchange.

Furthermore, the lack of a unified standard for statistical measurement in digital cultural trade has led to significant challenges. Different international organizations, agreements, manuals, statistical systems, and research reports adopt varying approaches to classifying and disclosing information on international cultural trade, resulting in inconsistent judgments about the categories involved in cultural trade and creating statistical dilemmas. Governments should actively work to improve statistical and evaluation systems by collaborating with international organizations such as the OECD and WTO. Drawing on the methodological framework of the Handbook on Measuring Digital Trade and considering the unique characteristics and needs of cultural trade, a comprehensive and detailed statistical standard for digital cultural trade should be developed. This standard should cover the entire chain of digital cultural product production, transmission, and consumption, and differentiate between various transaction modes, such as digitally ordered and digitally delivered services, to ensure the comprehensiveness and comparability of data.

Conflict of interest

The authors declare no conflict of interest.

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Chapter 3

Thucydides Trap in Trade: Uncertainty and Asymmetric Cooperative Attitude

Len-Kuo Hu

Abstract

This study provides a theoretical framework to explore the potential formation of a Thucydides Trap that could jeopardize the trade relationship between the U.S. and China. The rapid acceleration of China's economic growth, driven by its Reform and Open Up policy, has enabled it to catch up with its major trading partner, the U.S., inadvertently fostering mutual mistrust regarding each other's willingness to cooperate in trade. This study highlights that the exacerbation of asymmetric cooperative attitudes could significantly undermine the desire for trade between partners and trigger a rise in anti-globalization sentiment. Furthermore, a country's time preference, as well as its degree of risk tolerance—shaped by inherited culture and social mechanisms—can affect its cooperative attitude toward trading partners and facilitate the formation of the Thucydides Trap. Ultimately, I propose a concept of externally imposed cooperation inspired by Laozi's Dao De Jing, advocating that humans should act in accordance with the natural order, embodying the virtues of harmony and mutual understanding, with the hope of alleviating the looming trade crisis between the U.S. and China.

Keywords: Thucydides trap, Laozi's Dao De Jing, cooperation strategy, international trade with uncertainty, the U.S. and China relationship

1. Introduction

The escalating tension in the trade dispute between the U.S. and China has raised fears of falling into the Thucydides Trap, which could lead to miscalculations and ultimately war, even if neither side desires it. This concept [1], originating from the Greek historian Thucydides, who chronicled the Peloponnesian War between Athens and Sparta, has been applied in modern international relations to describe the dynamics between a dominant power (like the United States) and a rising power (like China). Such dynamics can create apprehensions and misgivings about a potentially destructive confrontation. This study aims to provide a theoretical framework for examining the origins and consequences of the Thucydides Trap in trade.

At the core of this trap is the mistrust of a trading partner's intentions to foster mutually beneficial trade. In addition to the escalating competitive

environment in the global economy, the uncertainty surrounding the future consequences of trade is a significant factor contributing to this detrimental relationship. Furthermore, a country's time preference as well as its degree of risk tolerance—shaped by inherited culture and social mechanisms—can affect its cooperative attitude toward trading partners and facilitate the formation of the Thucydides Trap.

Throughout history, the interplay between an individual's free choice and a government's authoritative rule is stunning and constant. In modern times, bottom-up approaches like democracy and capitalism seem to have the upper hand over top-down systems such as totalitarianism or communism, though the latter has gradually shifted toward socialism or "capitalism from above." However, these dynamics could change or evolve over time if we examine our economic systems over a longer period. Douglass North, in his 1981 book [2], argues that the key to human evolutionary change lies in the intentions of the players. Therefore, the shifts in these systems are largely deliberate, shaped by individuals' perceptions of their actions' consequences.

For the majority of human history, individuals challenging inherited norms, beliefs, and preferences faced difficulties in creating more efficient alternatives. Cultural wisdom and tradition were respected for their role in survival, and with limited understanding of their benefits, questioning their validity was seen as evolutionarily risky. Consequently, most societies have been resistant to rapid cultural changes that come with major technological, philosophical, and scientific advancements, instead cherishing the prudence of ancient ancestors with nostalgia and idealism [3].

The oscillation of political systems between socialism and capitalism has challenged the cohesion of domestic societies and global stability. The U.S.-China relationship is particularly volatile, lying on a fault line of cultural misunderstandings, historical grievances, and ideological differences. According to Rudd [4], if these two powerhouses cannot find a way to coexist, respecting their core values (socialism with Chinese characteristics versus market capitalism underpinned by liberal democracy) within the bounds of managed strategic competition, they might be on a path to a conflict that could redefine the future of both nations and the global landscape.

This paper aims to explore the economic effects of interactions, such as trade, between individuals or countries with differing cultural backgrounds and value systems. Here the regime choice of an economic system is defined as an individual's distinct cooperative attitude toward their trading partner. On one extreme, we have completely self-interest-driven liberal capitalism, while on the other, perfect socialism emphasizes absolute equality over efficiency.

I will first discuss how uncertainty in trade arises, paying special attention to the differing perspectives on its origins between the West and the East. Next, I will construct a mathematical model to explore how one's choice of economic regime or cooperative attitude toward trade can be influenced by this uncertain environment. This framework will allow for an analysis of how intense competition in the global economy, along with an individual's time preference and risk tolerance, affects the volume and terms of trade. Finally, I will present a concept of externally imposed cooperation from the *Dao De Jing* by Laozi, which emphasizes that humans should align their behavior with the natural order, promoting harmony and mutual understanding. I will conclude with remarks aimed at shedding light on the imminent trade crisis between the U.S. and China.

2. The origin of uncertainty in international trade

The uncertainty inherent in our economic decisions should be considered either entirely exogenous or endogenously determined due to insufficient or asymmetric information. Even without the complications arising from human manipulation of information, we cannot ignore the fundamental existence of uncertainty that originates in the natural world. However, scientists and economists in the West and East hold diverse views regarding the origins of the world and the existence of uncertainties we face in daily life.

Science, and in particular physics, offers one model of the world but is not alone in its claim to offer us a system for making sense of the universe. Every culture, every religion, offers its own world model. The main problem with many nonscientific world models is the vigor with which they insist upon their rightness. Throughout his life, Einstein opened the door to modern physics, yet he remained perpetually perplexed by the elusive and ambiguous phenomena of uncertainty inherent in quantum physics. He firmly believed that God would never play dice with human fate. In fact, had he encountered Laozi to discuss the Dao earlier, many of his doubts might have been alleviated.

The Dao serves as the foundation of Laozi's philosophy and can be summarized in three key aspects. First, the Dao represents an intangible and formless nothingness, the source of uncertainty. As Laozi notes, "The Dao as a thing is only vague and elusive," and "the form of the formless and the image of the unimageable is called vague." Second, Dao is the mother of all things and the ultimate destination. "All things in the world arise from being, and being arises from nothing," with "the Dao gives birth to one, one gives birth to two, two gives birth to three, and three gives birth to all things," with all things ultimately returning to nothingness. Third, the Dao is the principle that governs the operation of all things in heaven and earth: "Man follows the earth, the earth follows heaven, heaven follows the Dao, and the Dao follows nature."

This study aims to explore how an individual's uncertainty-driven attitudes toward their trading partner affect the degree of openness in global trade, particularly in light of the escalating trade disputes between the U.S. and China.

3. Economic modeling of international trade with diverse cooperative attitudes or regime choice

In the following sections, I will use a mathematical model to capture the complex influence of regime choice on economic behavior. Specifically, I will examine how international interactions through trade can either mitigate or intensify the confrontations arising from a country's economic regime choice. Here the regime choice of an economic system is defined as an individual's distinct cooperative attitude toward their trading partner. On one extreme, we have completely self-interest-driven liberal capitalism, while on the other, perfect socialism emphasizes absolute equality over efficiency.

The model simplifies the scenario to two countries (or individuals, say A and B) trading two goods (say, X and Y), focusing on how economic regimes shape individual economic decisions and cooperative behaviors. To emphasize the primary nature and merit of trade through comparative advantage principle, I construct my model with a simplification of complete specialization as in a Ricardian economy. Each individual or country is characterized by her productivity in X and Y. For instance, individual A (B) can produce α_X^A (α_X^B) amount of X good and α_Y^A (α_Y^B) of Y good per unit of labor input.

At time zero, individual A possesses a comparative advantage and specializes in producing good X, while individual B has an advantage and specializes in producing good Y. This can be expressed as: $\frac{\alpha_X^A}{\alpha_Y^A} > \frac{\alpha_X^B}{\alpha_Y^B}$.

Each individual is differentiated by the formation of their value function (denoted as $V(t)$ at time t), which is significantly influenced by the culture in which they are raised or the economic regime they inhabit. As discussed earlier, an individual's utility over their lifetime is shaped by their perception of satisfaction derived from personal consumption, alongside a paternalistic concern for the well-being of their own community or their trading partner in another country. This altruistic behavior, exemplified by individual A at time t , is characterized by a parameter η_t^A (where $0 \leq \eta_t^A \leq 1$). To calculate individual A's overall satisfaction from current consumption for both individuals (or countries) at time t (i.e., $U^A(t)$), individual A assigns a weight of $\eta_t^A/2$ to the consumption satisfaction of their trading partner, compared to their own, which is weighted at $1 - \eta_t^A/2$. It is assumed that the welfare of others cannot exceed one's own.

Using a logarithmic Cobb-Douglas utility function characterized by parameter β for the preference on X good (and $1 - \beta$ for good Y), and with S_t^A denoting the allocation share of product X to individual A (and $1 - S_t^A$ for individual B), while S_t^B represents the allocation share of product Y to individual B (and $1 - S_t^B$ for individual A), we can express individual A's direct utility level at time t as follows:

$$U^A(t) = (1 - \eta_t^A/2) * [\beta * \ln(\alpha_X^A(t) * S_t^A) + (1 - \beta) * \ln(\alpha_Y^B(t) * (1 - S_t^B))] + \frac{\eta_t^A}{2} * [\beta * \ln(\alpha_X^A(t) * (1 - S_t^A)) + (1 - \beta) * \ln(\alpha_Y^B(t) * S_t^B)]. \quad (1)$$

In light of Einstein's puzzle and the principles of Laozi's Tao, uncertainty surrounding future production outcomes, represented as $\tilde{\alpha}_X^A(t+1)$ and $\tilde{\alpha}_Y^B(t+1)$, is inevitable. I assume a distribution function for $\tilde{\alpha}_X^A(t+1)$ with a mean of $\mu_A \alpha_X^A(t)$ (where μ_A is the growth rate of individual A's production) and a variance that is directly proportional to the difference between η_t^A and η_t^B on one hand, and the inherent natural risk σ on the other. The latter risk σ is intrinsic to our natural world, as described by Einstein's theories and Laozi's Dao, and cannot be mitigated by human efforts. The former reflects the risks stemming from asymmetric information regarding the trading partner's strategy. A more harmonious trading environment between two countries sharing a similar cooperative attitude can help mitigate these risks.

Consequently, we can express the certainty equivalent value of $\tilde{\alpha}_X^A(t+1)$ as $\alpha_X^A(t+1) = \mu_A \alpha_X^A(t) - \gamma * (|\eta_t^A - \eta_t^B| + \sigma)$ where γ represents an individual's degree of risk aversion. For simplicity, we assume $\eta_t^A > \eta_t^B$, leading to $\alpha_X^A(t+1) = \mu_A \alpha_X^A(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]$. Similarly, we can express $\alpha_Y^B(t+1) = \mu_B \alpha_Y^B(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]$. Here we assume that individuals A and B share the same risk attitude γ .

Therefore, the net present value of all the utilities from trade for individual A can be expressed as:

$$V^A(0) = \sum_{t=1}^{\infty} \delta^t U^A(t) = \sum_{t=1}^{\infty} \delta^t \left\{ (1 - \eta_t^A/2) * [\beta * \ln(\alpha_X^A(t) * S_t^A) + (1 - \beta) * \ln(\alpha_Y^B(t) * (1 - S_t^B))] + \frac{\eta_t^A}{2} * [\beta * \ln(\alpha_X^A(t) * (1 - S_t^A)) + (1 - \beta) * \ln(\alpha_Y^B(t) * S_t^B)] \right\}, \quad (2)$$

where δ denotes the individual's time preference.

There are essentially two forces interacting within each individual's mind: one is the internal self-satisfying force, and the other is the accommodating force in relation to the outer world. The former encompasses activities driven primarily by self-interest, including the pursuit of social status, control rights, and satisfaction from material consumption. In the context of international trade, this force represents the culmination of domestic political maneuvers aimed at pursuing a country's self-interest. The latter reflects our interaction with others, deriving utility from harmonious relationships with the external environment or peaceful coexistence with trading partners.

The internal self-satisfying force motivates activities that distinguish individuals from one another, contributing to innovation and the uniqueness of the real world. Conversely, the outer accommodating force explains our social tendencies and cooperative behaviors. The interaction between these two forces influences the dynamic adjustment of η_t^A and η_t^B between zero and one. For simplicity I will focus on the dynamic evolution of η_t^A and η_t^B , which reflects the degree of individuals' or countries' cooperative attitudes toward establishing a more harmonious relationship, treating δ and γ as exogenously given.

4. Optimal decision on the cooperative strategy in trade

Before deciding the optimal choice of altruistic attitude and corresponding cooperative strategy η_t^A and η_t^B for individuals A and B, we need to resolve the allocation schemes for products X and Y for both A and B, specifically S_t^A and S_t^B . If the product allocation scheme (S_t^A) is entirely determined by the capitalist market mechanism, i.e., if liberal capitalism prevails, then S_t^A will be determined by the proportion of person A's contribution to total output value, which also corresponds to her consumption and expenditure share of total production. Thereby we arrive at the following equation $S_t^A = p_t * \alpha_X^A(t) / [p_t * \alpha_X^A(t) + \alpha_Y^B(t)]$ where p_t represents the relative price of good X to good Y at time t. Similarly, we can express S_t^B as: $S_t^B = \alpha_Y^B(t) / [p_t * \alpha_X^A(t) + \alpha_Y^B(t)]$. It follows that the relationship ($S_t^A + S_t^B = 1$) holds true.

In line with the ultimate goal of utopian socialism, total social welfare should ideally be distributed based on the "need" of each member of society, rather than solely on individual "production contribution." In other words, the consumption share of good X should be determined entirely by its intrinsic value β rather than its production value $p * \alpha_X$. Currently, the product allocation mechanism in prevailing socialist systems is a compromise between a market-driven production value scheme (i.e., based on $p * \alpha_X / (p * \alpha_X + \alpha_Y^B)$) and a need-based preference share (i.e., β).

Idealistic socialists are strong proponents of John Rawls's concept of justice and fairness. This notion—which Rawls referred to as "fair equality of opportunity" in his book "A Theory of Justice (1971)" [5] —is not merely about preventing discrimination; it is about providing everyone with a truly equal chance to develop and utilize their talents and abilities. The second part of this principle, known as the difference principle, emphasizes that these opportunities should benefit the least advantaged members of society. For Rawls, economic justice involves not only ensuring fair competition for different positions—such as income, wealth, and social prestige—but also promoting opportunities that enhance the life chances of those who are less well-off.

Building on Raws's concept of equality or fairness, I will characterize the degree of socialization by using the same weight (η) to simultaneously reflect considerations for the needs of the least well-off, the so-called "need-based" allocation, denoted as γ , and the degree of altruism or cooperative attitude toward trading partners. Accordingly, we can derive the expenditure allocation share of good X for person A at time t (i.e., S_t^A) which deviates from the value share of person A's production, i.e., $\frac{p_t * \alpha_X^A(t)}{[p_t * \alpha_X^A(t) + \alpha_Y^B(t)]}$, as follows:

$$S_t^A = (1 - \eta_t^A) * \frac{p_t * \alpha_X^A(t)}{[p_t * \alpha_X^A(t) + \alpha_Y^B(t)]} + \eta_t^A * \beta. \quad (3)$$

Similarly, S_t^B can be derived as follows:

$$S_t^B = (1 - \eta_t^B) * \frac{\alpha_Y^B(t)}{[p_t * \alpha_X^A(t) + \alpha_Y^B(t)]} + \eta_t^B * (1 - \beta) \quad (4)$$

Once the expenditure share is no longer equal to production share, the sum of S_t^A and S_t^B may not necessarily equal to one, i.e., $S_t^A + S_t^B \neq 1$.

The primary focus of this study is on a country's regime choice regarding its degree of socialism or cooperativeness, characterized by the parameter η . According to the Euler equation, we can derive the first order condition for individual A's optimal cooperative strategy choice as follows:

$$\delta * \frac{dU^A(t+1)}{d\eta_t^A} + \frac{d(U^A(t))}{d\eta_t^A} = 0. \quad (5)$$

By examining Eq. (2), we understand that the impact of η_t^A on $U^A(t+1)$ primarily occurs through its indirect effect on the evolution of output $\alpha_X^A(t+1)$, which can be expressed as $\alpha_X^A(t+1) = \mu_A \alpha_X^A(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]$. Hence, we find that $\frac{d\alpha_X^A(t+1)}{d\eta_t^A} = -\gamma$. Consequently,

$$\frac{dU^A(t+1)}{d\eta_t^A} = \frac{\beta}{\alpha_X^A(t+1)} \frac{d\alpha_X^A(t+1)}{d\eta_t^A} = \frac{-\beta\gamma}{\mu_A \alpha_X^A(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]}.$$

The impact of η_t^A on $U^A(t)$ includes both direct and indirect effect through the term S_t^A . From Eq. (3), we can derive

$$\frac{dS_t^A}{d\eta_t^A} = \beta - \frac{p_t * \alpha_X^A}{[p_t * \alpha_X^A + \alpha_Y^B]}$$

Thus, we obtain

$$\begin{aligned} \frac{dU^A(t)}{d\eta_t^A} &= \left(\beta - \frac{p_t * \alpha_X^A}{[p_t * \alpha_X^A + \alpha_Y^B]} \right) * \left(\frac{(1 - \eta_t^A/2) * \beta}{S_t^A} - \frac{\eta_t^A/2 * \beta}{1 - S_t^A} \right) + \frac{\beta}{2} * \ln \frac{(1 - S_t^A)}{S_t^A} \\ &\quad + \frac{(1 - \beta)}{2} * \ln \frac{S_t^B}{1 - S_t^B} \end{aligned}$$

The optimal η_t^A can be derived from Eq. (5) that satisfies the following condition:

$$\frac{\beta\gamma\delta}{\mu_A\alpha_X^A(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]} = \left(\beta - \frac{p_t * \alpha_X^A}{[p_t * \alpha_X^A + \alpha_Y^B]} \right) * \left(\frac{\left(1 - \frac{\eta_t^A}{2}\right) * \beta}{S_t^A} - \frac{\frac{\eta_t^A}{2} * \beta}{1 - S_t^A} \right) + \frac{\beta}{2} * \ln \frac{(1 - S_t^A)}{S_t^A} + \frac{(1 - \beta)}{2} * \ln \frac{S_t^B}{1 - S_t^B}. \quad (6)$$

Similarly, η_t^B can be derived as follows:

$$\frac{(1 - \beta)\gamma\delta}{\mu_B\alpha_Y^B(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]} = \left(1 - \beta - \frac{\alpha_Y^B}{[p_t * \alpha_X^A + \alpha_Y^B]} \right) * \left(\frac{\left(1 - \frac{\eta_t^B}{2}\right) * (1 - \beta)}{S_t^B} - \frac{\frac{\eta_t^B}{2} * (1 - \beta)}{1 - S_t^B} \right) + \frac{1 - \beta}{2} * \ln \frac{(1 - S_t^B)}{S_t^B} + \frac{\beta}{2} * \ln \frac{S_t^A}{1 - S_t^A}. \quad (7)$$

As for the optimal choices of S_t^A and S_t^B , they should satisfy $\frac{d(U^A(t))}{dS_t^A} = 0$ and $\frac{d(U^B(t))}{dS_t^B} = 0$, which yield $S_t^A = 1 - \eta_t^A/2$ and $S_t^B = 1 - \eta_t^B/2$. By substituting $S_t^A = 1 - \eta_t^A/2$ and $S_t^B = 1 - \eta_t^B/2$ into Eqs. (6) and (7), we can solve for the optimal cooperative strategies η_t^A and η_t^B for individuals A and B, respectively. These strategies are expressed as:

$$\frac{\beta\gamma\delta}{\mu_A\alpha_X^A(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]} = \frac{\beta}{2} * \left[\ln \frac{\eta_t^A}{2} - \ln \left(1 - \frac{\eta_t^A}{2}\right) \right] + \frac{(1 - \beta)}{2} * \left[\ln \left(1 - \frac{\eta_t^B}{2}\right) - \ln \frac{\eta_t^B}{2} \right], \quad (8)$$

$$\frac{(1 - \beta)\gamma\delta}{\mu_B\alpha_Y^B(t) - \gamma * [(\eta_t^A - \eta_t^B) + \sigma]} = -\frac{\beta}{2} * \left[\ln \frac{\eta_t^A}{2} - \ln \left(1 - \frac{\eta_t^A}{2}\right) \right] - \frac{(1 - \beta)}{2} * \left[\ln \left(1 - \frac{\eta_t^B}{2}\right) - \ln \frac{\eta_t^B}{2} \right] \quad (9)$$

By examining the relationship between Eqs. (8') and (9'), we can derive the difference in cooperative strategies between individual A and B as follows:

$$\eta_t^A - \eta_t^B = \frac{\mu_A\alpha_X^A(t) - \beta(\mu_A\alpha_X^A(t) - \mu_B\alpha_Y^B(t))}{\gamma} - \sigma = \frac{(1 - \beta)\mu_A\alpha_X^A(t) + \beta\mu_B\alpha_Y^B(t)}{\gamma} - \sigma \quad (10)$$

The implication of Eq. (10) can be summarized in the following proposition:

Proposition I: *Generally, an increase in either country's production level or its associated growth rate (i.e., an increase in $\mu_A\alpha_X^A(t)$ or $\mu_B\alpha_Y^B(t)$) will intensify bilateral trade competition to the extent that the gap in cooperative attitudes between the countries widens, meaning $\eta_t^A - \eta_t^B$ becomes larger. When one country's GDP, in terms of output level or growth rate, exceeds that of its trading partner (i.e., when $\mu_A\alpha_X^A(t) > \mu_B\alpha_Y^B(t)$), the*

narrowing of the trading partner's GDP level and growth rate relative to the home country (i.e., $\mu_A\alpha_X^A(t) - \mu_B\alpha_Y^B(t)$ becomes smaller) or an increased preference for imported goods (i.e., an increase in $1 - \beta$) will further widen the gap in cooperative attitude, leading a larger $\eta_t^A - \eta_t^B$. Moreover, an elevation in one's risk aversion (i.e., an increase in γ) and unavoidable natural risk (i.e., an increase in σ) will promote the synchronization of cooperative attitudes between the two countries, resulting in a smaller $\eta_t^A - \eta_t^B$.

As for the precise analytical solutions for η_t^A and η_t^B in Eqs. (8') and (9'), they become exceedingly complicated. To simplify the derivation, I will assume that $\beta = 0.5$ without loss of generality. Let $w \equiv \eta_t^A - \eta_t^B = \frac{\mu_A\alpha_X^A(t) - \beta(\mu_A\alpha_X^A(t) - \mu_B\alpha_Y^B(t))}{\gamma} - \sigma$ and $z \equiv \frac{\beta\gamma\delta}{\mu_A\alpha_X^A(t) - \gamma * [\eta_t^A - \eta_t^B] + \sigma} = \frac{\gamma\delta}{\mu_A\alpha_X^A(t) - \mu_B\alpha_Y^B(t)}$. Then the exact solution for η_t^A in the Eq. (8') satisfies the following condition: $(\eta_t^A)^2 - (2 + w)\eta_t^A + \frac{2w}{1 - e^{-4z}} = 0$. From this, we can express η_t^A as $\eta_t^A = (2 + w) \mp \sqrt{(2 + w)^2 - 8w(1 + \frac{1}{e^{4z} - 1})}$.

Given our assumption that $0 \leq \eta_t^A \leq 1$ and $w > 0$, the solution for η_t^A simplifies to:

$$\eta_t^A = (2 + w) - \sqrt{(2 + w)^2 - 8w\left(1 + \frac{1}{e^{4z} - 1}\right)}. \quad (11)$$

An increase in (w) or a reduction in (z) will enhance individual A's cooperativeness, leading to an increase in η_t^A . Since $\eta_t^A - \eta_t^B = w$, we obtain η_t^B as

$$\eta_t^B = \eta_t^A - w = 2 - \sqrt{(2 + w)^2 - 8w\left(1 + \frac{1}{e^{4z} - 1}\right)}. \quad (12)$$

An increase in (w) or (z) will consequently reduce individual B's cooperativeness, resulting in a decrease in η_t^B .

We can summarize the impact of (w) and (z) on η_t^A and η_t^B in the following proposition:

Proposition II: Factors that widen the gap in country A's cooperative attitude relative to trading partner B, as presented in proposition I, also directly enhance country A's cooperativeness. Specifically, an increase in (w) (where $w = \eta_t^A - \eta_t^B$) leads to an increase in η_t^A and a decrease in η_t^B . Furthermore, if country A's GDP, in terms of output level or growth rate, exceeds that of its trading partner (i.e., when $\mu_A\alpha_X^A(t) > \mu_B\alpha_Y^B(t)$), a reduction in this GDP advantage, i.e., $\mu_A\alpha_X^A(t) - \mu_B\alpha_Y^B(t)$ becomes smaller, will diminish the cooperative attitude of both countries (resulting in a decrease in both η_t^A and η_t^B). Additionally, an elevation in risk aversion (i.e., a higher γ) will enhance a country's cooperative attitude (increasing η_t^A or η_t^B) while narrowing the gap in cooperative attitudes between the two countries (making $\eta_t^A - \eta_t^B$ smaller). Similarly, a greater preference for the present over the future (i.e., a higher δ) will dampen a country's cooperative attitude.

Since the relative price p_t is defined so that the selling value of good X exported (or not consumed) by person A to person B, given by $p_t * \alpha_X^A(t) * (1 - S_t^A)$, must equal to the purchase value of good Y imported by person B represented as $\alpha_Y^B(t) * (1 - S_t^B)$, we establish the following equation for the terms of trade (TOT):

$p_t = \frac{\alpha_Y^B(t) * (1 - S_t^B)}{\alpha_X^A(t) * (1 - S_t^A)} = \frac{\alpha_Y^B(t) * \eta_t^B}{\alpha_X^A(t) * \eta_t^A}$. This can be further expressed by substituting Eq. (11) for η_t^A and Eq. (12) for η_t^B :

$$TOT_t = p_t = \frac{\alpha_Y^B(t) * \eta_t^B}{\alpha_X^A(t) * \eta_t^A} = \frac{\alpha_Y^B(t)}{\alpha_X^A(t)} \frac{2 - \sqrt{(2+w)^2 - 8w(1 + \frac{1}{e^{4z}-1})}}{(2+w) - \sqrt{(2+w)^2 - 8w(1 + \frac{1}{e^{4z}-1})}}. \quad (13)$$

Regarding the volume of trade (VOT), it can be defined in two ways: as the size of import, $\alpha_Y^B(t) * (1 - S_t^B) = \alpha_Y^B(t) * \frac{\eta_t^B}{2}$, or the value of export, $p_t * \alpha_X^A(t) * (1 - S_t^A) = p_t * \alpha_X^A(t) * \frac{\eta_t^A}{2}$ for country A. This can be simplified as follows:

$$VOT_t = \alpha_Y^B(t) * \frac{\eta_t^B}{2} = \alpha_Y^B(t) * \left(1 - \sqrt{(2+w)^2 - 8w \left(1 + \frac{1}{e^{4z}-1} \right)} \right). \quad (14)$$

From the expressions in Eqs. (13) and (14), we can derive the driving forces behind the exchange rate (TOT) and the volume of trade (VOL) as follows:

Proposition III: *The terms of trade (TOT) for the export versus import goods improve when the production of import goods increases relative to the export goods, i.e., when $\frac{\alpha_Y^B(t)}{\alpha_X^A(t)}$ increases. Additionally, if the trading partner adopts a more cooperative attitude than the home country, indicated by a decrease in $\eta_t^A - \eta_t^B$, this also enhances the TOT. Furthermore, an increase in the cooperative attitude of either the home or foreign country (i.e., a greater (η_t^A) or (η_t^B)) will unequivocally enlarge the volume of trade (VOT).*

5. The implications of natural uncertainty and asymmetric cooperativeness on trade

From the theoretic derivation of the model above, we can summarize the policy implications of natural uncertainty and asymmetric cooperative attitude on trade as follows:

1. The impact of natural uncertainty (σ) or an individual's degree of risk aversion (γ) on the volume of trade (VOT) mainly operates through its influence on the cooperative attitude of a country's trading partner (η_t^B). A greater σ or γ will foster a more harmonious cooperative atmosphere, reducing the divergence of cooperative attitudes between the two countries (i.e., a smaller $\mathbf{w} \equiv \eta_t^A - \eta_t^B$ as shown in Eq. (10)). This particularly leads to an increased willingness to cooperate from the trading partner (i.e., a greater η_t^B in Eq. (12) and thereby bringing in a larger amount of import and VOT (see Eq. (14)).
 2. The aggravated asymmetry in cooperative attitudes affecting bilateral trade (an enlarged $\mathbf{w} \equiv \eta_t^A - \eta_t^B$) has severely damaged the volume of trade (VOT), as indicated in Eqs. (12) and (14). Growing economic development, especially when the trading partner catches up with the home country, will exacerbate this situation (see Proposition I).
- 41The home country's relative price or terms of trade (TOT) will rise when trading partner's GDP or her cooperative attitude improves relative to the home country (see Eq. (13)).

4. When a country becomes more myopic (δ increases), the willingness of cooperation would be subdued (see Proposition II).

The recent escalation of trade conflicts between the U.S. and China [6], along with the rise of anti-globalization sentiments fueled by rapid economic growth and inconsistent cooperative attitudes [7], seems to support Graham Allison's argument that the U.S. and China cannot escape Thucydides' trap and are destined for conflict. Unless we develop a stronger awareness of the natural uncertainties we face and enhance our sense of risk aversion, the discrepancies in cooperative attitudes between countries will likely persist, making the reestablishment of free global trade challenging.

6. Economics of Dao

Another approach to fostering cooperation is to fundamentally shift our mentality toward the welfare of humanity by embracing the principles of Laozi's philosophy, as illuminated in his "Dao De Jing." The main ideas can be summarized as follows [8]:

Laozi believed that everything exists in a state of opposing interdependence. "Being and non-being give rise to each other, difficulty and ease complement each other, long and short shape each other, high and low incline toward each other, sound and silence harmonize with each other, and front and back follow each other." He noted that "misfortune relies on good fortune, and good fortune hides within misfortune," which is why it is said that "reversal is the movement of Dao." Consequently, he advocated for a way of living that values gentleness, non-competition, contentment, and non-action: "Bending leads to preservation, twisting leads to straightness, hollowness leads to fullness, worn-out leads to renewal, and having less leads to gaining." "Only by not competing can one be unmatched in the world." Water, the softest substance, benefits all without competing, exemplifying the idea that "the highest good is like water." By practicing non-action, the world will naturally align itself.

The straightforward interpretation of the "Dao De Jing" suggests that we should behave in accordance with the principles of Dao (nature) and strive to be individuals of De (virtue). The essence of Dao is harmony and peace, devoid of excessive desire and violence. We must cultivate an appreciation for the messages of nature and recognize that as human beings, we partake in its many hidden harmonies. The world before us is filled with wonderful symmetry and uniformity. Learning to understand and appreciate these harmonies is akin to deepening our acquaintance with a great and meaningful piece of music—truly one of life's greatest gifts.

By applying the concept of Laozi's Dao De Jing, we can exogenously impose the value of a country's cooperative attitude as $\eta_t^A = \eta_t^B = 1$ in our model above. It turns out that

$$VOT_t = \alpha_Y^B(t) * \frac{\eta_t^B}{2} = VOT_t = \alpha_Y^B(t)/2$$

$$TOT_t = p_t = \frac{\alpha_Y^B(t) * \eta_t^B}{\alpha_X^A(t) * \eta_t^A} = \frac{\alpha_Y^B(t)}{\alpha_X^A(t)}$$

Where a country's volume of trade and her economic welfare arrive at optimum while the exchange resumes its long-term stability, which is solely determined by a country's intrinsic economic strength.

7. Discussion and concluding remarks

This study aims to provide a theoretical foundation for the likely formation of the Thucydides Trap. By focusing on the role of cooperative attitudes toward trading partners, it examines the causes and consequences of disparities in mutual trust and cooperativeness in trade. In particular, when a country's manufacturing production and associated growth rate catch up with its trading partners such as the economic relationship between China and the U.S., along with the varied cultural backgrounds and social mechanisms that shape distinct time preferences and degrees of risk tolerance, it could exacerbate the asymmetry of bilateral cooperative attitudes, thereby triggering the threat of a Thucydides war.

Adam Smith, the father of modern capitalism, argued that free markets require participants to share a common moral framework. However, the United States and many other liberal democracies found themselves intertwined in major trade relationships with countries that operated under different moral and economic frameworks—ranging from Russia and various petrostates in the Middle East to numerous Latin American dictatorships, and notably, China, the largest trading partner of all.

The “Reform and Opening Up” initiative marked the transition of China's economic system from a “planned economy” to a “socialist market economy,” a framework that was enshrined in the Constitution of the People's Republic of China in 1993. This policy was initially proposed and launched by Deng Xiaoping [9] at the Third Plenary Session of the 11th Central Committee of the Communist Party of China on December 18, 1978. After extensive discussion and deliberation among party members, these principles were solidified as the fundamental national policy for China in 1992, following Deng Xiaoping's southern tour. Over time, “Reform and Opening Up” evolved into a key component of socialism with Chinese characteristics.

Following this policy, Mainland China joined the World Trade Organization (WTO) in 2001, embarking on an extraordinary path of economic growth. By 2010, its GDP had surpassed Japan's, establishing China as the world's second-largest economy. By 2020, the number of Fortune Global 500 companies in China matched that of the United States. Per capita GDP soared from \$115 in 1978 to \$12,551 in 2021, reaching an income level classified as upper-middle-income. Meanwhile, the quality of life for citizens has significantly improved, prompting some scholars to propose the “China Model” as a viable development pathway.

China's rapid GDP growth and its economic size, which is steadily catching up to that of the U.S., have caused considerable anxiety in America. As Robert Lighthizer argues in his book, “No Trade is Free” [7], “Now China poses the greatest threat to the American nation and its system of Western liberal democratic government since the American Revolution ... China is a militaristic, autocratic, Communist country with the second-largest economy in the world, which could soon surpass our own. It is committed to becoming the dominant country globally and to spreading its anti-American, anti-democratic, communist ideology.”

The acceleration of China's economic growth, propelled by its Reform and Open Up policy, has quickly positioned it alongside its major trading partners, inadvertently fostering mutual mistrust in trade relations. This study highlights that such asymmetric cooperative attitudes significantly undermine the desire for trade among partners and contribute to the rising sentiment of anti-globalization. Furthermore, political myopia, characterized by short-sighted policies, tends to stifle cooperation and diminish trade opportunities.

In recent decades, we have witnessed the deterioration of our natural environment and the increasing threats posed by technological advancements. These factors have heightened uncertainties and elevated risk aversion, which should ideally lead to a greater awareness of crises and an enhanced mutual cooperative attitude, ultimately resulting in increased trade. However, the slow progress of the Paris Agreement in addressing climate change has not fostered the necessary spirit of cooperation or trade.

Instead of pursuing the maximization of individual utility while considering diverse cultural and social influences, there is an alternative approach to directly promote wholehearted altruism and cooperation based on the principles of Laozi's Dao De Jing. A straightforward interpretation of nature's message reveals that we are part of many hidden harmonies. The world, as we perceive it, is characterized by remarkable symmetry and uniformity. By learning to recognize and appreciate these harmonies, we will be encouraged to collaborate earnestly with our trading partners, maximizing trade and promoting economic welfare for all.

Additional information

JEL: A10, C71, F10

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Section 2

Sustainable Development through Financial Innovation and Inclusion

Macroeconomic Implications of FinTech in Nigeria

Terver Audu

Abstract

This study investigates the short-run macroeconomic implications of FinTech in Nigeria using quarterly time series data from 2009 to 2021. Anchored on the Schumpeterian creative destruction theory, new growth theory and neo classical growth theory, the study employs the Autoregressive Distributed Lag (ARDL) model to assess the impact of FinTech proxies such as ATM, Point of Sale (POS), and online (WEB) transactions on selected macroeconomic variables, including Gross Domestic Product (GDP) growth, unemployment, financial sector performance, and interest rate. The short-run estimates show that ATM, POS, and WEB have a significant positive impact on unemployment (UNE). ATM and POS show a positive but insignificant impact on the financial sector's performance (FIEI). Conversely, WEB reveals a significantly negative impact on FIEI. The findings reveal a negative, insignificant relationship between ATM and interest rate (ILR), while POS, WEB (−1) and Inflation Rate (INFL) show a significant positive impact on interest rates. The results show that GDP growth can be significantly influenced by ATM innovations in Nigeria, however, POS and WEB show significantly negative impact on GDP growth. The study concludes that the impact of FinTech on selected economic variables depends on the type of innovation and the enabling infrastructure. Despite the growth of FinTech, transaction and lending costs remain high, with the potential to impede inclusion, real sector lending, and growth in the short term. Additionally, automation of services shows potential to impact employment growth. The study recommends promoting digital investment growth, enhancing skills, increasing internet penetration, and offering incentives for cost reduction to boost lending in the real sector, encourage inclusion, employment, and growth.

Keywords: FinTech, innovations, creative destruction, inclusion, unemployment, economic growth

1. Introduction

Technology is not a new phenomenon to humanity. Since the 1700s, every half century or so, the patterns of industrial activity and economic organization undergo fundamental changes due to the emergence of a set of interrelated technological innovations dubbed as “techno-economic paradigm” [1]. Technological advancements have led to the emergence of new industries (FinTech) that have altered the operational structure of established industries (traditional banks) and sparked the development of new organizational forms that are better suited to take advantage of the new affordances produced by the technologies [1].

The connection between FinTech and traditional financial institutions has long existed, with studies such as Arner et al. [2] dating this relationship back to the nineteenth century. The origin of the word FinTech remains difficult to tell; however, Arner et al. [2] dates it back to the 1990s when it was first used to refer to “Financial Services Technology Consortium,” a project launched by Citigroup to encourage efforts aimed at technological cooperation. A different account offered by Scheuffel [3], notes that the term was first used in academics in 1972 and subsequently used as “an acronym which stands for financial technology.”

The term “FinTech” lacks a universally accepted definition. Arner et al. [2] describes FinTech as the application of technology to provide financial solutions, while Wolbers [4] views FinTech as encompassing technological advancements such as internet banking, blockchain, peer-to-peer financing, and cloud computing. Similarly, Chen [5] describes FinTech as the use of technology to distribute financial products. This study, however, defines FinTech as any technology that enhances financial inclusion and promotes efficiency in financial service delivery.

Nigeria’s FinTech sector has experienced rapid growth and diversification, establishing itself as one of the leading FinTech hubs on the African continent. Although it is still emerging when compared to more mature FinTech ecosystems in countries such as the United Kingdom, Singapore, Australia, Sweden, and India, Nigeria demonstrates considerable potential. Despite accounting for approximately 40% of Africa’s impoverished population, Nigeria’s large population, exceeding 200 million, offers a substantial and diverse market. This presents significant opportunities for FinTech innovation and expansion across various consumer segments, particularly among small and medium-sized enterprises (SMEs), the affluent class, and increasingly, the broader mass market [6, 7].

As of 2024, Nigeria hosts over 500 standalone FinTech companies, with several prominent firms, such as Flutterwave, Opay, and Interswitch, achieving unicorn status by surpassing a valuation of US\$1 billion. The emergence of these key players, along with a growing pipeline of soon-to-be unicorns, has elevated Nigeria from its former position as Africa’s third-largest FinTech ecosystem in 2020, behind Kenya and South Africa, to the continent’s leading FinTech hub [8]. Investment in Nigeria’s FinTech sector surged by 409.51% between 2019 and 2024, increasing from US\$240.8 million in 2019 to US\$1.06 billion in 2021, and further to US\$1.23 billion by 2024, with most of the investment originating from international sources [8]. This sustained influx of capital is expected to drive improvements in employment, financial inclusion, cost efficiency, and overall living standards, alongside broader macroeconomic benefits. However, some studies indicate persistent structural challenges: over 28.9 million Nigerians remain financially excluded, and approximately 113 million individuals are classified as multidimensionally poor, facing significant barriers to affordable financial services [9].

Studies by Athoillah [10], Jiang [11], Appiah-Otoo, and Song [12], Sadigov et al. [13], Kammoun et al. [14], Khiewngamdee and Yan [15], and Claessens et al. [16] reveal a positive correlation between FinTech and a nation’s economic expansion, productivity, financial sector performance, and poverty reduction. Contrary to these findings, Yoshino and Sahoko [17] studied the macroeconomic effects of FinTech on the Japanese economy and found that FinTech may not always have a positive impact on macroeconomic agents. Using quarterly data spanning from 1999 to 2019, a previous study Udo et al. [18] investigated the influence of financial technology on Nigeria’s economic development. The findings indicated that FinTech contributes positively to economic growth and financial inclusion by helping to reduce poverty

and income inequality. SEC [19] posits that the underlying benefits of FinTech can be better harnessed if FinTech can foster financial inclusion. Economic agents are better equipped to launch and grow enterprises, invest in their children's education, and withstand financial shocks when they have a greater financial system participation rate [20].

FinTech has completely changed Nigeria's financial ecosystem; however, very few studies have examined how this technological disruption has affected Nigeria's macroeconomic performance. This study examines the impact of FinTech on the performance of selected macroeconomic variables in Nigeria.

2. Theoretical review

There is no unifying theory in the literature that explains the growth implications of FinTech, especially due to the complexities of FinTech [18]. The creative destruction theory popularly attributed to Joseph Alois Schumpeter (1883–1950) notes the crucial role of novel and inventive methods of doing things that endogenously destroy, transform, and replace outdated ones [11, 21]. FinTech innovations have revolutionized the way financial products and services are delivered, including savings, investing, payments, and business models, among others, ultimately leading to increased competition with traditional banks, lower transaction costs, greater inclusion, efficiency, and growth [22–24].

The neoclassical growth model assumes that a typical economy is endowed with capital (K), labor (L), and knowledge or technological change (A), which are the crucial factors necessary to drive growth in the economy at any point in time [25]. The model assumes an exogenously determined level of technology. Kanga et al. [26] reasons that technological diffusions, such as those in the financial sector of a country, are an essential determinant of productivity. The Neoclassical model emphasized that technological advancement leads to sustainable growth, but there is no presumption as to where technological advancement originates [27].

The “new growth theory” was developed as an alternative to the neoclassical growth models' premise of external technological change [28]. The new growth theory posits that internal forces, such as faster innovation and investment in human capital, mainly drive improvements in productivity. Knowledge and technological innovation are considered crucial in the development of the financial sector and as a driving force in achieving economic growth.

3. Methodology and data

In assessing the macroeconomic impact of FinTech in Nigeria, the framework for this study is therefore based on the endogenous growth model employed in studies such as Narayan [29] and Adesete et al. [30]. The model takes the general form;

$$\frac{Y(t)}{L(t)} = f\left(\frac{K(t)}{L(t)}, A(t)\right) \quad (1)$$

From the above model;

$\frac{Y(t)}{L(t)}$ = output per worker

$\frac{K(t)}{L(t)}$ = capital per worker

$A(t)$ = technological progress

This study considers FinTech to be part of the technology factor. Linearizing Eq. (1) to account for the effect of FinTech gives the following form equation.

$$\ln \frac{Y(t)}{L(t)} = \beta_0 + \beta_1 \ln \left(\frac{K(t)}{L(t)} \right) + \beta_2 \text{FINTECH} + \beta_2 \alpha_t + \varepsilon_t \quad (2)$$

From the above model,

β_0 , = intercept

β_n = parameters where; $n = 1, 2, 3 \dots, k$

$\frac{Y(t)}{L(t)}$ = output per worker

FINTECH = Financial Technological innovations (ATM, POS, WEB)

α_t = sources of technology/control variables

ε_t = error term, respectively.

The study uses quarterly data obtained from various sources (see **Table 1**) from 2009Q1 to 2021Q4. The start and endpoint were selected to reflect the availability of reliable data.

Four models have been employed in other to capture the study objectives. The econometric or stochastic form model are expressed as:

$$UNE_t = \beta_0 + \beta_1 ATM_t + \beta_2 POS_t + \beta_3 WEB_t + \beta_4 INFL_t + e_i \quad (3)$$

$$FIEI_t = \beta_0 + \beta_5 ATM_t + \beta_6 POS_t + \beta_7 WEB_t + \beta_8 INFL_t + e_i \quad (4)$$

$$ILR_t = \beta_0 + \beta_9 ATM_t + \beta_{10} POS_t + \beta_{11} WEB_t + \beta_{12} INFL_t + e_i \quad (5)$$

$$GDP_t = \beta_0 + \beta_{13} ATM_t + \beta_{14} POS_t + \beta_{15} WEB_t + \beta_{16} INFL_t + e_i \quad (6)$$

where

UNE_t = Unemployment rate in period t

ILR_t = Interbank lending rate in period t

GDP_t = Gross Domestic Product in period t

Variable	Type	Proxy	Definition	Source
UNE	Dependent	Unemployment	Percentage of unemployed labor force.	NBS ILO
FIEI	Dependent	Financial sector performance	Index of level of profitability and stability of financial institutions.	IMF
ILR	Dependent	Interest rate	Lending rate of deposit money banks.	CBN
GDP	Dependent	Economic growth	Value of economic growth at 2010 constant prices.	CBN
ATM	Independent	FinTech	Value of automated teller machine transactions.	CBN
POS	Independent	FinTech	Value of point-of-sale machine transactions.	CBN
WEB	Independent	FinTech	Value of internet transactions.	CBN
INFL	Control	Inflation	Rate of rise in general price levels.	CBN

Source: Authors' compilation.

Table 1.
Summary of variables adopted for the study.

$FIEI_t$ = Financial institutions efficiency in period t

ATM_t = Automated Teller Machine Transactions in period t

POS_t = Point of Sale Machine Transactions in period t

WEB_t = Internet Transactions in period t

$INFL_t$ = Inflation rate in period t

$\beta_1 - \beta_{16}$ = Coefficient of independent variables

β_0 = Intercepts of the model

e_i = error term at time t

Different approaches have been employed in assessing the link between FinTech and several economic variables, such as 2SLS by Deng et al. [31] and Muganyi et al. [32] in China. Khiewngamdee and Yan [15] used a combination of quantile regression (QR) and the Generalized Estimating Equation (GEE) approach to examine if FinTech e-payment has an impact on economic development in Asia-Pacific Economic Cooperation (APEC) nations.

This study employed the Autoregressive Distributed Lag (ARDL) estimation technique in assessing the short run impact of FinTech on Nigeria's macroeconomic performance as employed in previous studies such as Okoye [23] and Adesete et al. [30]. According to Pesaran et al. [33], ARDL is preferred since the dynamic model allows for testing for cointegration where a combination of $I(0)$ and $I(1)$ series are being modeled. The ARDL model for this study is of the form:

$$\begin{aligned} \Delta \ln UNE_t = & \alpha_0 + \alpha_1 \ln UNE_{t-1} + \alpha_2 \ln ATM_{t-1} + \alpha_3 POS_{t-1} + \alpha_4 \ln WEB_{t-1} + \alpha_5 \ln INFL_{t-1} \\ & + \sum_{i=1}^p \eta_i \Delta \ln UNE_{t-i} + \sum_{i=0}^q \theta_i \Delta \ln ATM_{t-i} + \sum_{j=0}^r \delta_j \Delta \ln POS_{t-j} + \sum_{r=0}^s \mu_r \Delta \ln WEB_{t-r} \\ & + \sum_{r=0}^t z_r \Delta \ln INFL_{t-r} + \varepsilon_t \end{aligned} \quad (7)$$

$$\begin{aligned} \Delta \ln FIEI_t = & \alpha_0 + \alpha_1 \ln FIEI_{t-1} + \alpha_2 \ln ATM_{t-1} + \alpha_3 POS_{t-1} + \alpha_4 \ln WEB_{t-1} + \alpha_5 \ln INFL_{t-1} \\ & + \sum_{i=1}^p \eta_i \Delta \ln FIEI_{t-i} + \sum_{i=0}^q \theta_i \Delta \ln ATM_{t-i} + \sum_{j=0}^r \delta_j \Delta \ln POS_{t-j} + \sum_{r=0}^s \mu_r \Delta \ln WEB_{t-r} \\ & + \sum_{r=0}^t z_r \Delta \ln INFL_{t-r} + \varepsilon_t \end{aligned} \quad (8)$$

$$\begin{aligned} \Delta \ln ILR_t = & \alpha_0 + \alpha_1 \ln ILR_{t-1} + \alpha_2 \ln ATM_{t-1} + \alpha_3 POS_{t-1} + \alpha_4 \ln WEB_{t-1} + \alpha_5 \ln INFL_{t-1} \\ & + \sum_{i=1}^p \eta_i \Delta \ln ILR_{t-i} + \sum_{i=0}^q \theta_i \Delta \ln ATM_{t-i} + \sum_{j=0}^r \delta_j \Delta \ln POS_{t-j} + \sum_{r=0}^s \mu_r \Delta \ln WEB_{t-r} \\ & + \sum_{r=0}^t z_r \Delta \ln INFL_{t-r} + \varepsilon_t \end{aligned} \quad (9)$$

$$\begin{aligned} \Delta \ln GDP_t = & \alpha_0 + \alpha_1 \ln GDP_{t-1} + \alpha_2 \ln ATM_{t-1} + \alpha_3 POS_{t-1} + \alpha_4 \ln WEB_{t-1} + \alpha_5 \ln INFL_{t-1} \\ & + \sum_{i=1}^p \eta_i \Delta \ln GDP_{t-i} + \sum_{i=0}^q \theta_i \Delta \ln ATM_{t-i} + \sum_{j=0}^r \delta_j \Delta \ln POS_{t-j} + \sum_{r=0}^s \mu_r \Delta \ln WEB_{t-r} \\ & + \sum_{r=0}^t z_r \Delta \ln INFL_{t-r} + \varepsilon_t \end{aligned} \quad (10)$$

The above models are given in vector form as:

$$\begin{aligned} \Delta \ln Y_t = & \alpha_0 + \alpha_1 \ln Y_{t-1} + \alpha_2 \ln X_{t-1} + \alpha_3 Z_{t-1} + \alpha_4 \ln N_{t-1} + \alpha_5 \ln T_{t-1} + \sum_{i=1}^p \eta_i \Delta \ln Y_{t-i} \\ & + \sum_{i=0}^q \theta_i \Delta \ln X_{t-i} + \sum_{j=0}^r \delta_j \Delta \ln Z_{t-j} + \sum_{r=0}^s \mu_r \Delta \ln N_{t-r} + \sum_{r=0}^t z_r \Delta \ln T_{t-r} + \varepsilon_t \end{aligned} \quad (11)$$

where

$\ln$ = natural logarithmic form

Δ = the first difference operator drift parameter

α_0 = drift parameter

$\alpha_1 - \alpha_5$ = long run parameters

$\eta_i, \theta_i, \delta_j, \mu_r, z_r$ = short run parameters

Y = vector of dependent variables

X, Z, N, T = vector of independent variables

If a long-run co-integrating relationship exists, the error-correction model (ECM) is specified thus:

$$\begin{aligned} \Delta \ln Y_t = & \gamma_0 + \gamma_1 \ln Y_{t-1} + \gamma_2 \ln X_{t-1} + \gamma_3 Z_{t-1} + \gamma_4 \ln N_{t-1} + \gamma_5 \ln T_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln Y_{t-i} \\ & + \sum_{i=0}^q \theta_i \Delta \ln X_{t-i} + \sum_{j=0}^r \delta_j \Delta \ln Z_{t-j} + \sum_{r=0}^s \mu_r \Delta \ln N_{t-r} + \sum_{r=0}^t z_r \Delta \ln T_{t-r} + \lambda \text{ECT} + \varepsilon_t \end{aligned} \quad (12)$$

where ECT is the error-correction term (ECT), and λ is the speed of adjustment parameter.

4. Presentation and analysis

4.1 Unit root test

To prevent spurious regression results, the stationarity of the time series data is assessed using unit root tests. This study applies both the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. The outcomes of these tests indicate a mixed order of integration among the variables, thereby justifying the adoption of an autoregressive estimation approach (Table 2).

Variables	ADF		PP		Decision
	Level	First diff	Level	First diff	
UNE	-1.12	-8.42***	-0.80	-8.55***	I(1)
FIEI	-2.08	-3.15**	-1.18	-3.15**	I(1)
GDP	-2.91	-3.15**	-3.64**	-7.62**	I(0)
ILR	-1.33	-4.72***	-1.31	-4.75***	I(1)
ATM	2.233	-11.20***	0.74	-11.79***	I(1)
POS	3.74	-7.12***	0.25	-3.57**	I(1)

Variables	ADF		PP		Decision
	Level	First diff	Level	First diff	
WEB	−1.30	−9.24***	−1.09	−9.31***	I(1)
INFL	−2.71*	−4.15***	−1.98	−4.08***	I(1)

*Represent significance at 0.1.

**Represent significance at 0.05.

***Represent significance at 0.01.

Source: Researcher's computation via EViews 10.

Table 2.
Unit root test.

4.2 Cointegration test

The result of the bound cointegration test indicates a long-run relationship between FinTech and economic growth, interest rates, and unemployment, but no cointegration between FinTech and financial sector performance (**Table 3**).

	UNE	FIEI	ILR	GDP
F-stat	3.62*	1.23	10.37***	6.80***
I(1)	3.52	4.01	4.01	4.01
I(0)	2.45	2.86	2.86	2.86
K	4	4	4	4

*Represent significance at 0.1.

**Represent significance at 0.05.

***Represent significance at 0.01.

Source: Researcher's computation via EViews 10.

Table 3.
Bound cointegration test.

4.3 Short-run ARDL estimates

The empirical results for the short-run estimates in panel I reveal that a unit increase in ATM, POS, WEB, and INFL significantly increases unemployment (UNE) by 6.01, 6.78, 3.65, and 0.51 units, respectively, at the 5% level of significance. Deng et al. [24] Opines that the impact of FinTech on the rise of unemployment could indicate a structural shift in the labor market due to automation. Disequilibrium in the previous period is corrected at the speed of 59.9%, as given by the coefficient of the ECT.

Panel II of the study finds that a unit change in ATM and POS results in a positive but insignificant FIEI by 4.34 and 3.47 units, respectively. This suggests that the development of FinTech as a means of payment is a close substitute for banknotes, thereby enhancing cashless transactions. Conversely, a unit change in WEB reveals a significantly negative change in FIEI by 1.23 units. This implies that the rise in WEB has not necessarily been backed by a similar growth in the efficiency and performance of the Nigerian financial sector, as a large population remains excluded [9]. The result

reveals an approximately 19.01% speed of adjustment. This indicates that the model undergoes a quarterly self-correction of approximately 19.01% in response to any external shock.

The short-run estimates from Panel III suggest that a unit change in ATM insignificantly changes the interest rate (ILR) by 1.33 units. Conversely, a unit change in POS, WEB (−1), and INFL significantly increased ILR by 1.76, 1.52, and 0.04 units, respectively, at a 5% significance level. WEB reveals a positive, albeit insignificant, relationship with ILR. The foregoing is an indication of the existence of high transaction and lending costs in Nigeria despite growth in FinTech innovations in Nigeria [34]. The self-correcting coefficient of the estimated model revealed that deviations in ILR will be corrected quarterly at a rate of 40.57%.

Panel IV short-run estimates reveal the significant potential impact of FinTech on growth in Nigeria. Similar to findings by Kammoun et al. [14], which shows that FinTech drives growth by facilitating easy access to cash and boosting consumer spending. This study finds that a unit rise in ATM will drive significant GDP growth improvement by 33.25 units. Conversely, a unit increase in POS and WEB will significantly reduce growth by 21.84 and 1.21 units, respectively, at the 1% level of significance. Udo et al. [18] attributes the negative growth impact of these FinTech proxies may be attributed to high real sector lending activities, poor banking network and low internet penetration in Nigeria. INFL shows a significant positive impact on growth performance in Nigeria. The self-correcting coefficient, significant at about 5% level of significance, shows that deviations in GDP are corrected quarterly at a rate of 37.16%. The model is fitted well, as suggested by the R-squared value, indicating that the FinTech variables explain about 98.74% of the variation in economic growth (Table 4).

Models	Panel IV	Panel III	Panel II	Panel I
Exogenous variable	Log (GDP)	ILR	FIEI	UNE
GDP (−1)	0.784*** (0.159) [0.000]			
ILR (−1)		0.808*** (0.148) [0.000]		
FIEI (−1)			1.571556*** (0.097) [0.000]	
UNE (−1)				0.401** (5.810) [0.011]
FinTech				
ATM	33.25*** (8.033) [0.000]	−1.33 (1.660) [0.431]	4.34 (1.270) [0.0015]	6.91** (2.850) [0.019]

Models	Panel IV	Panel III	Panel II	Panel I
ATM (−1)	−32.957 ^{***} (10.774) [0.004]			
POS	−21.840 ^{***} (6.360) [0.002]	1.760 ^{***} (4.780) [0.001]	3.470 (6.740) [0.6098]	6.78 ^{***} (2.310) [0.0053]
POS (−1)	−13.164 (6.919) [0.068]	−1.180 ^{**} (3.25) [0.042]	−1.410 (8.030) [0.0856]	
WEB	−1.208 ^{***} (0.263) [0.000]	1.520 (5.530) [0.7845]	−1.230 ^{***} (3.800) [0.0023]	3.650 ^{***} (1.130) [0.0024]
WEB (−1)	1.172 ^{***} (0.373) [0.004]	−2.560 ^{***} (6.750) [0.001]		
Control variable				
INFL	82353.8 ^{***} (276259.2) [0.006]	0.040 ^{**} (0.019) [0.049]	−0.001 (0.0004) [0.156]	−0.508 ^{**} (0.213) [0.021]
INFL (−1)	1294039.0 ^{**} (491578.5) [0.014]			
Constant	5,811,306. (2,524,380.) [0.029]	8.256 (1.812) [0.000]	39.96 (10.31) [0.005]	20.296 (5.692) [0.001]
CointEq (−1)	−0.3716 (0.180) [0.049]	−0.4057 (0.08) [0.000]	−0.1901 (0.05) [0.000]	−0.5989 (0.152) [0.003]
Goodness of fit	48	48	50	51
R ²	0.987	0.991	0.987	0.802
Adj R ²	0.979	0.987	0.985	0.780
F-stat	115.733 ^{***}	244.573 ^{***}	465.228 ^{***}	36.358 ^{***}

^{*}Represent significant at 0.1.

^{**}Represent significant at 0.05.

^{***}Represent significant at 0.01.

Standard error in bracket () and probability value in parenthesis [].

Source: Researcher's computation via EViews 10.

Table 4.
ARDL short-run estimates.

Models	Panel IV	Panel III	Panel II	Panel I
Exogenous variable	Log (GDP)	ILR	FIEI	UNE
Normality (Jarque-Bera test)	0.439 [0.803]	1.215 [0.545]	6.657 [0.036]	42.973 [0.000]
Serial correlation (Breusch-Godfrey Serial Correlation LM test)	0.506 [0.937]	0.804 [0.665]	1.289 [0.279]	0.346 [0.882]
Stability (CUSUM and CUSUM of Squares)	Stable	Stable	Stable	Stable

Probability values in parenthesis [].
Source: Researcher's computation via EVIEWS 10.

Table 5.
Diagnostic test.

5. Diagnostic test

The study employed several diagnostic tests to evaluate the model assumptions, including the Jarque-Bera test for normality, the Breusch-Godfrey Lagrange multiplier (LM) test for serial correlation, the Breusch-Pagan-Godfrey test for heteroscedasticity, and the Cumulative Sum Control Chart (CUSUM) and CUSUM of squares tests for stability. The Jarque-Bera test results indicate that the Unemployment-FinTech and Financial Sector Performance-FinTech models satisfy the normality assumption at the 5% significance level. In contrast, the interest rate model, as well as the FinTech-GDP model, do not exhibit normal distribution. All models demonstrated stability and showed no evidence of serial correlation in their residuals. Furthermore, the Breusch-Pagan-Godfrey test results suggest the absence of heteroscedasticity in the residuals across all estimated models, as indicated by the insignificance of the F-statistics at all tested levels (Table 5).

The results for the CUSUM and CUSUM sum of squares are presented in the appendix for each model on panels I to IV (see Figures 1–4), respectively. All the models demonstrate stability at a 5% level of significance.

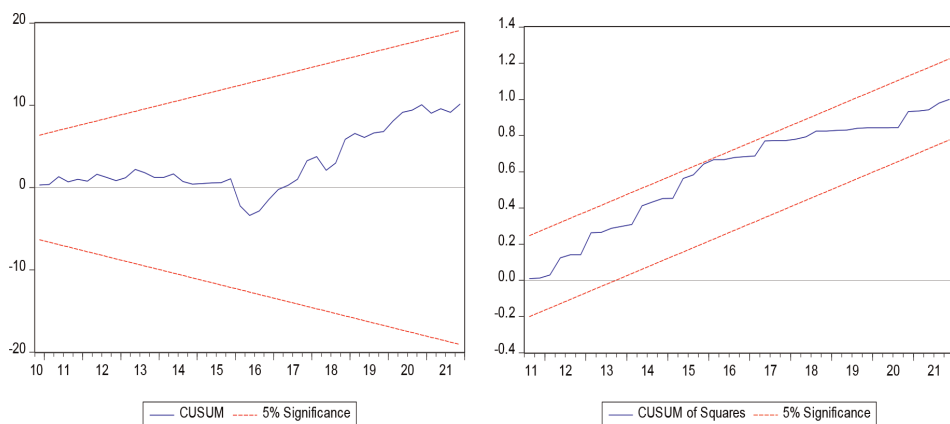


Figure 1.
Stability test for unemployment model. Source: Author's construction using Eview 10.

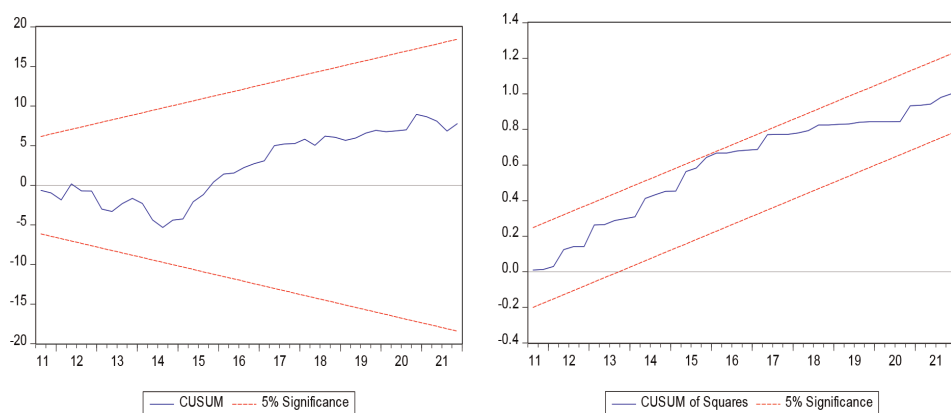


Figure 2.
Stability test for financial sector performance (FIEI) model. Source: Author's construction using Eview 10.

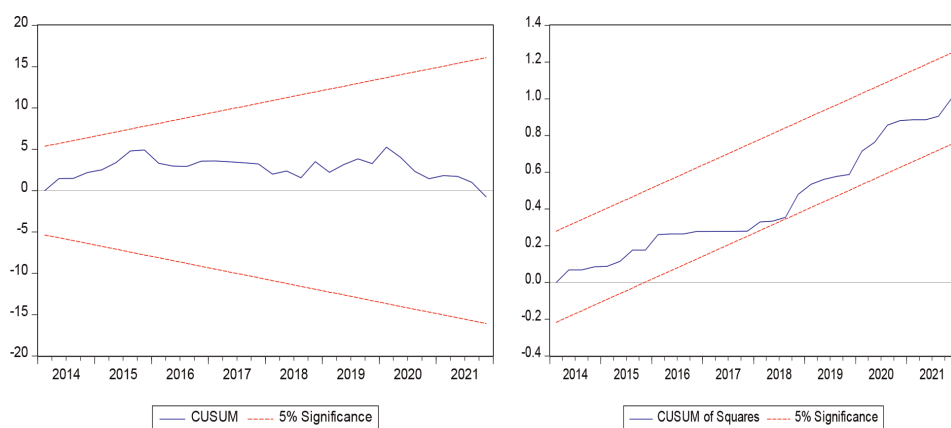


Figure 3.
Stability test for interest rate (ILR) model. Source: Author's construction using Eview 10.

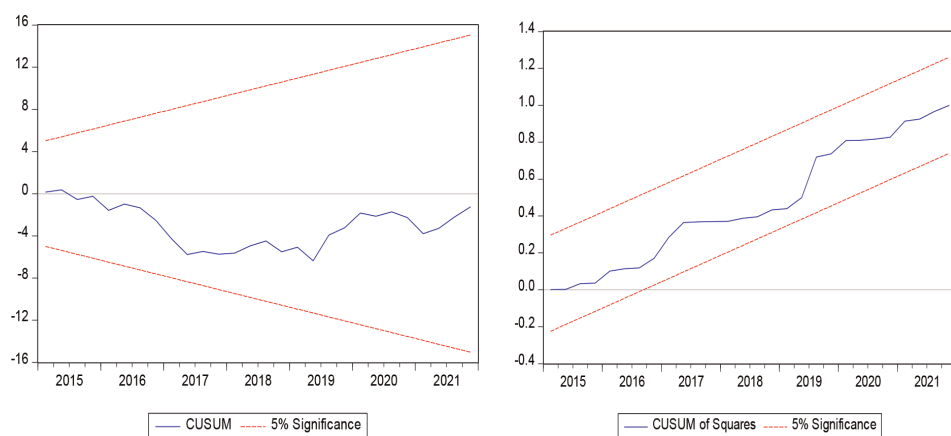


Figure 4.
Stability test for economic growth model. Source: Author's construction using Eview 10.

6. Conclusion

This study empirically examined the effects of financial technology (FinTech) on key macroeconomic indicators in Nigeria. The specific objectives included analyzing the short-term influence of FinTech on unemployment, assessing its impact on financial sector performance, exploring the relationship between FinTech and interest rates, and evaluating the extent to which FinTech contributes to economic growth. The study concludes that the impact of FinTech on selected economic variables depends on the type of innovation and the enabling infrastructure. The study reveals that, despite the expansion of FinTech innovations and investment in Nigeria, transaction costs and lending remain high, potentially impeding inclusion, real sector lending, and growth. The positive relationship between ATM innovations and unemployment suggests possibilities of unemployment growth due to the automation of services in the financial sector in Nigeria. Based on these findings, the study recommends training, reskilling, and job opportunities in response to the rise of technological shifts. Investment expansion and leverage of cost-saving technologies to drive inclusion, and internet infrastructure, as well as regulatory provisions to check FinTech lending activities. The study contributes to the empirical literature on FinTech in Nigeria, concurrently serving as a baseline for policy recommendations and further research on the long-run implications of FinTech innovation on Nigeria's macroeconomic landscape and impact of macroeconomic variables on FinTech landscape dynamics in Nigeria.

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Chapter 5

Financial Inclusion and Access to Capital

Almir Muhović, Marko Katanić and Marija Gavrilović

Abstract

Financial inclusion serves as a fundamental catalyst for economic development in emerging markets, enabling individuals and businesses to participate fully in the formal economy. The rapid proliferation of digital banking, microfinance, and FinTech innovations has significantly expanded access to financial services, particularly among previously unbanked populations. By providing affordable, efficient, and scalable financial tools, these technologies empower small businesses, foster entrepreneurship, and contribute to poverty reduction. Simultaneously, improved access to capital—through foreign direct investment (FDI), venture capital, and public-private partnerships—has played a critical role in fostering infrastructure development, technological innovation, and economic diversification. These financial inflows have driven growth in key sectors such as renewable energy, manufacturing, and digital technology, while supporting sustainable development initiatives. This chapter explores the interplay between financial inclusion and access to capital, demonstrating how these mechanisms reshape emerging markets by driving transformative socio-economic progress. By creating more inclusive financial ecosystems and promoting resilience, these advancements contribute to more equitable, sustainable, and dynamic economies globally. The study also provides policy recommendations to enhance financial inclusion and capital accessibility, emphasizing the need for a balanced approach that integrates technological innovation, regulatory frameworks, and inclusive economic policies.

Keywords: emerging markets, financial inclusion, sustainable development, digital transformation, capital access, green growth, global trade dynamics

1. Introduction

1.1 Problem statement and research objectives

Financial inclusion is recognized as a key driver of economic empowerment, social stability, and sustainable development in emerging markets. Despite its importance, millions of individuals and businesses remain excluded from formal financial systems, limiting their ability to save, invest, and access credit [1–6]. This exclusion is particularly prevalent among marginalized populations, including low-income groups, rural communities, and women [7].

Access to capital is equally crucial, as it facilitates infrastructure development, business growth, and technological innovation. However, capital inflows often remain concentrated in urban centers, leaving rural and underdeveloped regions underserved [8]. FDI, venture capital, and PPPs have the potential to bridge this gap, yet barriers such as regulatory inefficiencies, financial illiteracy, and inadequate infrastructure hinder their full effectiveness [9].

The primary objectives of this chapter are:

- To analyze the role of financial inclusion in fostering economic growth and social mobility in emerging markets [10].
- To assess the impact of capital access, particularly FDI, venture capital, and PPPs, on financial stability and economic diversification [11].
- To identify key barriers preventing effective financial inclusion and capital access [12].
- To propose policy recommendations and innovative solutions for enhancing financial accessibility and ensuring equitable economic development [13].

By addressing these objectives, this chapter aims to contribute to the existing literature on financial inclusion and capital access while providing actionable insights for policymakers, financial institutions, and development practitioners [14].

1.2 Literature review

Literature on financial inclusion has evolved significantly over the past two decades, highlighting the role of technological advancements, policy frameworks, and institutional interventions in expanding financial access [15]. Recent studies emphasize the transformative potential of digital financial services, particularly in developing economies [16].

Access to formal financial services is directly correlated with improved socio-economic outcomes, including higher savings rates, increased entrepreneurial activity, and reduced income inequality [17]. The role of mobile banking and digital wallets is crucial in bridging financial gaps for unbanked populations in sub-Saharan Africa [18].

Financial inclusion enhances overall financial stability by increasing the deposit base of financial institutions, thereby reducing liquidity risks, and improving banking sector resilience [19]. Research indicates that financial inclusion leads to greater economic participation, especially in developing regions where informal financial systems prevail [20]. Financial literacy and digital banking adoption are key drivers of financial inclusion, particularly for small businesses and female entrepreneurs [21].

The relationship between financial inclusion and foreign investment flows suggests that economies with more inclusive financial systems tend to attract higher levels of foreign capital due to increased investor confidence [22]. Research supports the idea that financial security through inclusion reduces social inequalities and promotes broader economic participation [23].

By integrating these diverse perspectives, this literature review underscores the multidimensional benefits of financial inclusion and access to capital. The findings highlight key areas where financial innovation, policy reforms, and targeted interventions can maximize the impact of financial inclusion on economic growth and stability [24].

1.3 Financial inclusion as a driver of economic empowerment

By enabling previously excluded populations to participate in the formal economy, financial inclusion contributes to social mobility and poverty reduction. For individuals, financial inclusion allows access to basic financial services, thereby reducing the need for informal and often exploitative financial systems. As [1] argue, the availability of financial services is associated with improved socio-economic outcomes, as it facilitates savings, entrepreneurship, and access to credit, all of which support individual and community development.

Moreover, financial inclusion enables small businesses to thrive by offering them access to essential tools for growth, such as microloans, payment systems, and insurance products. This is particularly relevant in emerging markets, where small businesses constitute a sizable portion of the economy. By connecting businesses to formal financial systems, financial inclusion fosters entrepreneurship, drives innovation, and promotes long-term economic resilience. As [4] note, financial inclusion is central to achieving sustainable development goals, including poverty alleviation and the promotion of economic stability in vulnerable regions.

1.4 Barriers to financial inclusion

Despite the clear benefits, three barriers persist that hinder the full realization of financial inclusion in emerging markets. *Financial illiteracy* is one of the most significant obstacles, as most individuals lack the knowledge and confidence to engage with formal financial systems. According to [8], targeted financial education programs, particularly for marginalized communities, can improve understanding and trust in financial systems, which are essential for broadening financial inclusion.

Infrastructure deficiencies also play a critical role in limiting access to financial services, especially in rural areas. [2] emphasize that without adequate banking infrastructure or technological connectivity, reaching underserved populations becomes increasingly difficult, preventing them from participating in the benefits of financial inclusion. Moreover, *gender disparities* further exacerbate these issues. Women in emerging economies encounter cultural, financial, and systemic barriers that limit their access to credit and financial services. [6] highlight that gender inequality in financial access is a persistent issue that requires specific policy interventions to address the underlying social and economic factors.

1.5 Social and environmental impacts of financial inclusion

Beyond its economic benefits, financial inclusion also has significant *social and environmental impacts*. For example, financial inclusion can empower individuals to make long-term investments in health, education, and housing, contributing to a reduction in inequality. [9] reports that financial inclusion is associated with better health outcomes and increased educational attainment, particularly for women and children in low-income households.

In terms of *environmental sustainability*, financial inclusion facilitates investments in green technologies and climate-resilient infrastructure. [5] argue that access to financial products tailored for sustainable developments such as green bonds and carbon credit plays a crucial role in supporting environmental initiatives in emerging economies. Moreover, as noted by [10], the ability to finance renewable energy

projects and environmentally friendly businesses ensures that emerging markets can pursue growth without compromising their environmental responsibilities.

1.6 Linking financial inclusion and access to capital

Financial inclusion and access to capital are mutually reinforced. As financial systems become more inclusive, access to capital, in the form of *foreign direct investment (FDI)*, *venture capital*, and *public-private partnerships (PPPs)*, increases. The relationship between these two elements is critical for economic diversification, infrastructure development, and fostering innovation. Foreign investments, particularly in technology and renewable energy, have been instrumental in driving growth in emerging markets. As noted by [7], countries with more inclusive financial systems tend to attract more investment, as investors perceive a lower level of risk and a more stable economic environment.

Access to capital plays a vital role in accelerating infrastructure projects and supporting innovation in emerging markets. [4] discuss how financial literacy training, combined with access to capital, is key to improving business sustainability and driving innovation in small and medium enterprises (SMEs). These enterprises, often the backbone of emerging economies, can access larger markets and create jobs when they have sufficient access to both capital and financial services. Furthermore, public-private partnerships (PPPs) are utilized to finance large-scale infrastructure projects, such as clean energy systems and digital infrastructure, which are essential for long-term economic sustainability.

Financial inclusion is not only a tool for driving economic growth but also a fundamental enabler of sustainable development in emerging markets. As financial services become more accessible, individuals and businesses can participate more fully in the formal economy, driving innovation, entrepreneurship, and social inclusion. The complementary relationship between financial inclusion and capital access forms a dynamic engine for economic development, as both elements are essential for fostering long-term growth and stability. While significant barriers remain, ongoing innovations and targeted policy interventions have the potential to unlock the full benefits of financial inclusion, contributing to more resilient and inclusive economies in the global landscape.

2. Digital banking and financial inclusion

Digital banking and FinTech have fundamentally reshaped the financial landscape in emerging markets. These innovations enable financial service delivery at a scale and speed unimaginable through traditional banking methods, especially in regions where formal banking infrastructure is either non-existent or insufficient. Digital tools, such as mobile money platforms, peer-to-peer (P2P) lending systems, and blockchain-based financial solutions, are breaking barriers of accessibility, affordability, and usability, thereby expanding the reach of financial inclusion (**Table 1**).

2.1 The transformative role of technology in financial inclusion

FinTech lending has emerged as a transformative force in financial inclusion by reducing transaction costs and streamlining credit approval processes. [13] highlights that digital lending platforms have successfully provided credit to borrowers traditionally excluded from the formal banking sector. By leveraging alternative

Country/ Region	Accounts ownership (% population)	Mobile money usage (% population)	Access to credit (% population)	Key initiatives
Sub-Saharan Africa	55	33	20	Mobile banking platforms like M-Pesa [4, 11]
South Asia	67	15	25	Aadhaar-enabled payment systems [5]
Southeast Asia	73	22	30	FinTech integration and agent banking [10, 12]
Latin America	68	18	35	Digital wallets and microfinance programs [13]

Source: Authors, compiled from references [4, 5, 10, 13].

Table 1.
Financial inclusion metrics across selected emerging markets (2020–2025).

data sources, FinTech lenders can assess creditworthiness without relying solely on traditional credit scores, which benefits individuals with limited banking histories.

However, concerns have been raised regarding algorithmic biases in digital lending models. [11] argue that machine learning-based lending decisions may unintentionally discriminate against minority groups and low-income borrowers due to the reliance on historical lending data, which may contain systemic biases. This highlights the need for regulatory oversight and ethical AI practices to ensure FinTech solutions remain genuinely inclusive.

Since, technology has become a cornerstone in advancing financial inclusion, overcoming traditional barriers, and creating opportunities for underserved populations to access essential financial services. By addressing both supply-side and demand-side challenges, digital innovations have reshaped how financial systems operate, expanding their reach to rural and urban areas alike.

Digital banking has been pivotal in this transformation, significantly reducing reliance on physical branch networks. This shift enhances accessibility for underserved populations, particularly in remote regions where traditional banking services were historically unavailable. A prime example is Kenya’s M-Pesa, which revolutionized financial inclusion by enabling secure, cashless transactions through mobile phones. Launched in 2007, M-Pesa demonstrated how mobile money systems could empower rural communities, allowing them to transfer money, pay bills, and save without requiring a bank account [2, 4]. Its success has since inspired similar initiatives globally, setting a benchmark for financial innovation.

Similarly, platforms such as China’s Alipay and WeChat Pay have leveraged the ubiquity of smartphones and QR code technology to foster an inclusive digital financial ecosystem. By integrating digital payment solutions with e-commerce and social media platforms, these services provide seamless access to credit, savings, and investment products. Their widespread adoption across rural and urban areas exemplifies how technology can bridge financial gaps, fostering greater participation in formal economic systems [12].

Mobile wallets have further expanded financial inclusion by offering safe, convenient payment options alongside access to savings and credit. Platforms like India’s Paytm have democratized financial services, transitioning millions from cash-based

economies to digital systems. Through partnerships with banks and financial institutions, mobile wallets also function as gateways to more advanced financial products, such as loans and insurance. This dual functionality empowers individuals to manage their finances more effectively while supporting small businesses with quick access to working capital [10, 11].

Blockchain technology has introduced a new dimension to financial inclusion by addressing issues of transparency, security, and cost. Its decentralized nature ensures tamper-proof transactions, making financial services accessible even in politically or economically unstable regions. Blockchain platforms like Bit Pesa in Africa have revolutionized cross-border remittances, reducing costs and transaction times. Beyond remittances, blockchain facilitates the development of smart contracts and microinsurance products, offering tailored solutions to underserved populations while bypassing traditional intermediaries [5].

Peer-to-peer (P2P) lending platforms and alternative credit scoring systems have also emerged as transformative tools in financial inclusion. P2P platforms connect borrowers and lenders directly, enabling individuals and businesses lacking formal credit histories to access affordable loans. Platforms like Funding Circle and Lending Club have gained traction in emerging markets, providing small businesses with much-needed capital [13]. Meanwhile, alternative credit scoring systems analyze non-traditional data—such as mobile phone usage, utility payments, and social media activity—to assess creditworthiness. This innovation fills a critical gap in emerging economies, where individuals who were excluded from formal financial systems due to a lack of conventional credit histories [6].

FinTech has made significant inroads into rural and underserved communities by leveraging mobile networks and agent banking systems. Services such as Airtel Money and MTN Mobile Money have extended financial services to populations beyond the reach of traditional banks. These platforms enable millions of users to conduct basic financial transactions, fostering economic inclusion in regions [12].

Despite its transformative potential, technology-driven financial inclusion faces challenges. Limited digital literacy and the excessive cost of mobile devices remain significant barriers, particularly in rural areas. Additionally, concerns about data security, fraud, and misuse of digital platforms highlight the need for robust regulatory frameworks to safeguard users. Governments, financial institutions, and technology providers must work collaboratively to address these issues, creating a secure and inclusive environment for digital financial services [5].

Looking to the future, emerging technologies such as artificial intelligence (AI) and the Internet of Things (IoT) promise to further enhance financial inclusion. AI-powered solutions, such as chatbots providing localized customer support, can help bridge communication barriers, while IoT devices could extend financial services to even the most isolated areas. These innovations, combined with ongoing efforts to improve infrastructure and digital literacy, have the potential to create a more inclusive financial ecosystem [5, 12].

In conclusion, technology has revolutionized financial inclusion by providing scalable, cost-effective solutions that break down barriers to access. Digital platforms like mobile wallets, blockchain systems, and P2P lending models have brought financial services to underserved populations, enabling them to participate more fully in formal economies. However, realizing the full potential of these innovations requires addressing infrastructural gaps, enhancing digital literacy, and fostering collaboration among stakeholders. With concerted efforts, technology can continue to serve as a catalyst for a more equitable and inclusive global financial system.

3. Empowering financial inclusion through microfinance institutions (MFIs)

Microfinance Institutions (MFIs) have emerged as pivotal players in advancing financial inclusion, transforming access to financial services for populations excluded from traditional banking systems. By offering small loans, savings products, and insurance to underserved individuals and small businesses, MFIs address the marginalized groups who have historically lacked access to formal financial services. These institutions empower communities by fostering economic independence and providing the tools necessary to improve livelihoods.

The modern microfinance movement, inspired by Muhammad Yunus and the Grameen Bank, demonstrated how microloans can foster entrepreneurship and help lift communities out of poverty. By providing collateral-free credit to women and small business owners, the Grameen Bank inspired a global proliferation of MFIs, positioning microfinance as a cornerstone of financial inclusion strategies [4, 11]. Today, MFIs operate worldwide, addressing systemic inequalities and enabling millions of individuals to engage with the formal economy.

Recent technological advancements have amplified the impact of MFIs, particularly in remote and rural areas. In sub-Saharan Africa, the integration of mobile banking with microfinance platforms like Airtel Money and MTN Mobile Money has bridged geographic barriers, allowing rural populations to access essential financial services [12]. These mobile solutions enable MFIs to operate in regions where physical branch networks are not economically viable, ensuring that even the most isolated communities can benefit from financial inclusion.

Beyond expanding their reach, MFIs have embraced digital tools to enhance their efficiency and sustainability. Blockchain-based platforms, for example, provide transparency and security in financial transactions, minimizing fraud and operational errors [5]. Digital wallets and mobile applications streamline loan disbursements and repayments, reducing administrative costs and improving customer experience. These innovations not only make microfinance services more accessible but also enable MFIs to scale their operations and serve a broader range of clients.

One of the most transformative aspects of MFIs is their role in empowering women. Women-focused microfinance programs have led to measurable improvements in household income, health, and education outcomes, particularly in regions like South Asia and Africa [4, 11]. By providing women with access to capital, MFIs support the creation of small enterprises, which contribute to local economic development and promote gender equity. This focus on women has far-reaching effects, fostering social and economic progress within communities.

Despite their successes, MFIs face persistent challenges. High-interest rates, driven by the operational costs of small-scale lending, can limit the accessibility of microfinance services for low-income borrowers [2]. Over-indebtedness is another significant issue, often resulting from inadequate credit assessment tools and a lack of financial literacy among borrowers [13]. Regulatory constraints also pose barriers, with underdeveloped or overly restrictive frameworks hindering innovation and growth in many regions [2].

To address these challenges, MFIs are adopting innovative strategies and forging partnerships with FinTech companies. Advanced credit scoring tools and customer engagement technologies are helping MFIs better assess borrower risk and improve service delivery [12]. Financial literacy programs are educating borrowers about

responsible fiscal management, reducing the likelihood of over-indebtedness and improving repayment rates [11]. Diversifying funding sources through collaborations with social impact investors and development banks is also critical to reducing reliance on high-interest lending and ensuring financial sustainability [13].

Looking ahead, emerging technologies such as artificial intelligence (AI) and big data analytics are set to revolutionize microfinance. AI-driven credit assessments and predictive analytics can enable MFIs to make more informed lending decisions, while big data insights allow them to identify underserved markets and tailor services to specific needs [5]. These advancements are expected to drive the next phase of microfinance, helping MFIs scale their operations and expand their reach to new demographics.

By leveraging technological innovations and addressing systemic challenges, MFIs remain at the forefront of financial inclusion efforts. Their work contributes significantly to poverty alleviation, gender equity, and economic empowerment, fostering a more inclusive and equitable global financial system. As they continue to evolve, MFIs will play an increasingly vital role in creating sustainable economic opportunities for underserved populations worldwide.

4. Access to capital for economic growth and diversification

Access to capital is a fundamental drive for economic growth and diversification in emerging markets, enabling countries to invest in infrastructure, develop key industries, and reduce reliance on traditional economic activities such as agriculture and low-value manufacturing. Among the most significant sources of capital in these markets is foreign direct investment (FDI), which not only provides financial resources but also facilitates the transfer of technology, expertise, and access to international markets. Countries like Vietnam and Ethiopia have leveraged FDI to establish industrial zones, develop technology hubs, and create globally competitive manufacturing sectors. These investments have spurred job creation, improved productivity, and strengthened exports, transforming their economies into regional powerhouses (Table 2) [4, 5].

FDI's impact extends beyond economic metrics; it also drives significant social and technological advancements. Investments in renewable energy infrastructure have enabled several emerging markets to transition toward cleaner, more sustainable energy systems. Such projects reduce dependence on fossil fuels, aligning these economies with global sustainability goals. Similarly, partnerships between multinational corporations and local enterprises foster the exchange of technical skills and managerial expertise, creating ripple effects throughout the workforce. For example, investments in technology-focused industries in Southeast Asia have equipped workers with advanced skills, boosting their employability and fostering a more resilient economy [10, 12].

At the same time, emerging markets are increasingly seeking to attract diverse forms of capital beyond FDI, including venture capital and public-private partnerships (PPPs). Venture capital has fueled the growth of startups in sectors such as digital technology and e-commerce, while PPPs have enabled governments to develop critical infrastructure projects, such as transportation networks and healthcare facilities, without overburdening public budgets. These forms of capital not only diversify funding sources but also promote innovation and entrepreneurship, critical components for long-term economic sustainability [5, 11].

Type of capital	Volume (Billion USD)	Key sectors	Primary benefits	Example countries
Foreign Direct Investment (FDI)	850	Manufacturing, Renewable Energy	Job creation, infrastructure development	Vietnam, Ethiopia [5, 12]
Venture Capital	300	Technology, FinTech	Innovation, startup growth	India, Indonesia [10]
Public-Private Partnerships (PPPs)	250	Infrastructure, Energy	Risk-sharing, large- scale projects	Kenya, Philippines [11, 13]

Source: Authors, compiled from references [5, 10–13].

Table 2.
Capital inflows by type and impact on emerging market economies (2020).

Despite its transformative potential, access to capital also presents challenges. Over-reliance on foreign investors can create vulnerabilities, as economic shifts or geopolitical tensions may lead to capital outflows. Moreover, FDI tends to be concentrated in urban or economically developed regions, leaving rural areas underserved. Environmental and social concerns, such as resource depletion and community displacement, may also arise when investments are not aligned with sustainable development goals. Policymakers must therefore balance the pursuit of capital with strategies to ensure equitable distribution of benefits and adherence to environmental standards [13].

In conclusion, access to capital plays a pivotal role in the economic evolution of emerging markets by driving infrastructure development, technological progress, and diversification. Governments must craft strategies to attract high-quality investments that align with national priorities while mitigating risks. By leveraging a mix of FDI, venture capital, and PPPs, emerging markets can position themselves as competitive and sustainable participants in the global economy [5, 13].

4.1 Challenges in attracting capital

Emerging markets face persistent challenges in attracting consistent capital inflows, which are crucial for infrastructure development and economic diversification. One of the primary obstacles is *perception risks*, where potential investors view these markets as high-risk due to economic volatility, weak regulatory frameworks, and limited transparency. Political instability, including sudden policy changes, corruption, and conflicts, further exacerbates these risks, deterring both foreign direct investment (FDI) and venture capital [11].

Another significant challenge is the prevalence of *weak legal protections* for investors. Inconsistent enforcement of contracts, inadequate property rights, and limited recourse mechanisms make investments in these markets less secure. These factors increase the cost of doing business, dissuading long-term commitments from international investors [4, 13].

Additionally, emerging markets often suffer from *infrastructure gaps*, which hinder the smooth operation of businesses. Inadequate transportation networks, unreliable energy supplies, and limited digital connectivity create operational inefficiencies, making these regions less attractive to global capital [12]. Financial sector

underdevelopment, including limited access to banking and credit services, further constrains the ability of local businesses to absorb and utilize foreign investments effectively.

Governance reforms and transparency initiatives can significantly mitigate these challenges. Strengthening institutions, improving regulatory frameworks, and ensuring the rule of law create a more stable and predictable investment climate. For instance, implementing international standards such as those advocated by the *Financial Action Task Force (FATF)* helps reduce money laundering and corruption, thereby building investor confidence [5]. Moreover, fostering public-private partnerships (PPPs) can attract investment into infrastructure projects, leveraging private sector expertise while sharing financial risks [10].

Lastly, addressing these challenges requires targeted policy interventions to enhance macroeconomic stability and create favorable conditions for investors. Incentives such as tax breaks, investment guarantees, and simplified bureaucratic procedures can attract capital while aligning investments with national development priorities. By proactively addressing these barriers, emerging markets can unlock their full potential and position themselves as competitive destinations for global capital.

4.2 Social and economic impacts of financial inclusion and capital access

Financial inclusion and access to capital are powerful tools for addressing socio-economic challenges in emerging markets. By enabling individuals to save, invest, and access credit, financial inclusion directly contributes to poverty alleviation and economic empowerment. Studies in Ghana demonstrate that access to formal financial services enhances household resilience, particularly during economic shocks, while also supporting micro-entrepreneurship. These financial services enable individuals to allocate resources toward productive activities, such as small business ventures, education, and healthcare, thereby fostering long-term economic stability [4, 5].

Moreover, financial inclusion promotes gender equality by empowering women entrepreneurs, who often face systemic barriers to accessing formal financial systems. For example, targeted microfinance programs have significantly increased women's participation in business activities, resulting in improved household incomes and community development [8]. Such programs contribute to broader social progress, including higher school enrollment rates and better health outcomes for children (**Table 3**).

Capital access, particularly through mechanisms like foreign direct investment (FDI) and venture capital, complements financial inclusion by driving infrastructure development and job creation. For instance, public-private partnerships (PPPs) in the renewable energy sector have not only enhanced energy access but also created employment opportunities, particularly in rural areas. These investments align with the goals of sustainable development by reducing reliance on traditional energy sources while promoting economic diversification [12].

At the societal level, financial inclusion fosters a sense of security and stability. Households with access to savings accounts and insurance products are better prepared to manage risks, such as medical emergencies or crop failures, which disproportionately affect low-income populations. As Srivastava (2024) highlights, financial security strengthens social cohesion and reduces inequality by narrowing the gap between formal and informal economies [5].

Barrier	Description	Proposed solutions
Financial Illiteracy	Lack of understanding of formal financial systems	Financial education campaigns targeted at rural areas [11]
Infrastructure Gaps	Limited physical/digital access to banking services	Expansion of mobile banking networks [4, 12]
Gender Inequality	Cultural and systemic barriers limiting women's access	Gender-focused financial programs [5]
Regulatory Complexity	Fragmented policies that discourage innovation and adoption	Streamlined, inclusive regulatory frameworks [10, 13]

Source: Authors, compiled from references [5, 10–13].

Table 3.
 Barriers to financial inclusion and proposed solutions.

While the benefits are clear, achieving widespread financial inclusion and equitable capital access requires addressing persistent barriers, such as financial illiteracy, limited infrastructure, and gender disparities. Governments and private institutions must collaborate to implement targeted policies that promote inclusion while ensuring the sustainability of financial ecosystems.

4.3 Building inclusive and sustainable economies

Financial inclusion plays a crucial role in promoting inclusive and sustainable economies by addressing both environmental and social dimensions of development. By ensuring that individuals and businesses have access to financial tools, such as savings, credit, and insurance, financial inclusion supports economic empowerment while aligning with sustainability objectives. Initiatives such as *green finance*, which include green bonds, climate-friendly investments, and carbon credits, enable emerging markets to pursue economic growth that is environmentally sustainable. These tools help finance renewable energy projects, energy-efficient infrastructure, and conservation efforts, reducing the carbon footprint of development activities [4, 5].

The empowerment of women through financial inclusion further accelerates social development. Access to financial services enables women to start businesses, invest in their families' education and health, and actively participate in the formal economy. This inclusion not only improves household incomes but also fosters intergenerational benefits, as studies have shown that women's financial empowerment leads to higher school enrollment rates and better health outcomes for children [11].

Moreover, financial inclusion enhances social resilience by providing low-income populations with access to insurance and savings mechanisms, which are essential for managing risks such as climate-related disasters. By integrating environmental goals with inclusive financial strategies, emerging economies can build robust systems that address vulnerabilities while promoting long-term sustainability. For instance, microfinance institutions that focus on financing clean energy solutions, such as solar lighting and energy-efficient cookstoves, demonstrate how financial access can drive environmental and social change simultaneously [12].

To fully maximize these benefits, governments and financial institutions must adopt a comprehensive approach that integrates financial education, infrastructure development, and regulatory support. This ensures that financial inclusion initiatives are equitable, scalable, and aligned with broader sustainability objectives.

5. Analytical framework and methodology

This research employs a multidimensional framework and methodology designed to comprehensively evaluate financial inclusion and access to capital as mechanisms for socio-economic transformation in emerging markets. The framework integrates insights from digital banking, microfinance institutions, regulatory frameworks, and capital inflows, linking them to social and economic outcomes. By combining quantitative and qualitative approaches, this methodology ensures a balanced and actionable understanding that aligns with global development goals.

The *analytical framework* incorporates three key dimensions:

1. *Financial inclusion metrics*: Indicators such as account ownership, adoption, and credit utilization rates assess inclusion levels among underserved populations. These metrics provide a comparative understanding of how digital banking and microfinance systems improve access to financial services across diverse geographies [4, 5].
2. *Capital access indicators*: Metrics such as foreign direct investment (FDI) inflows, venture capital funding, and the prevalence of public-private partnerships (PPPs) evaluate how capital supports infrastructure development, sectoral growth, and economic diversification. These indicators highlight the transformative potential of external and domestic financial resources in building inclusive and resilient economies [11, 13].
3. *Development outcomes*: This dimension focuses on social and environmental impacts, including poverty alleviation, job creation, gender empowerment, and the adoption of green finance initiatives. By aligning financial inclusion and capital access with sustainable development goals, this framework emphasizes the broader societal benefits of inclusive financial systems [11, 12].

This research employs a multifaceted methodological approach that integrates both quantitative and qualitative techniques to provide a comprehensive analysis of financial inclusion and capital access in emerging markets. The study used three key methodological pillars: quantitative data analysis, qualitative case studies, and policy framework evaluation.

The quantitative component of this study leverages secondary datasets from global financial databases such as the World Bank's Global Findex Database, the IMF's International Financial Statistics, and the UNDP's Human Development Reports. Statistical models, including regression analysis and correlation metrics, applied to assess the impact of financial inclusion on economic growth, poverty alleviation, and business expansion. This approach allows for the identification of key trends, disparities, and the effectiveness of various financial inclusion strategies across different regions.

The qualitative aspect includes case studies from selected emerging markets, focusing on the role of digital finance, microfinance institutions, and capital inflows in driving financial inclusion. These case studies provide a deeper contextual understanding of how financial systems function in different regulatory and socio-economic environments, helping to identify the best practices and key challenges. Interviews with financial sector professionals, policymakers, and beneficiaries

further enrich this analysis by offering firsthand perspectives on the barriers and enablers of financial inclusion.

Additionally, a policy framework is conducted to assess the effectiveness of financial regulations, government interventions, and private sector initiatives in expanding financial access. By reviewing financial policies across multiple areas, the study identifies regulatory bottlenecks and recommends actionable strategies to enhance financial accessibility and capital mobilization.

By integrating quantitative data analysis, qualitative insights, and policy evaluations, this methodological framework ensures a holistic and data-driven assessment of financial inclusion. It allows for a robust examination of financial accessibility trends and provides actionable recommendations for policymakers, financial institutions, and development practitioners seeking to bridge financial gaps in emerging markets.

6. Conclusion and recommendations

6.1 Conclusion

This study has highlighted the critical role of financial inclusion and access to capital in driving socio-economic development, infrastructure growth, and sustainability in emerging markets. The integration of digital banking, FinTech innovations, microfinance institutions, and capital flows has demonstrated significant potential to uplift underserved populations, foster entrepreneurship, and support economic diversification. Metrics such as mobile money usage, FDI inflows, and gender-specific microfinance initiatives have underscored the transformative power of inclusive financial systems. However, persistent challenges remain, including infrastructural gaps, financial illiteracy, regulatory inconsistencies, and unequal access to resources. Addressing these barriers is essential to fully harness the potential of financial inclusion and access to capital.

The analysis confirms that financial inclusion is not only an economic tool but also a driver of social and environmental transformation. By linking financial services with sustainability objectives, emerging markets can build resilient and inclusive economies. The study's framework and methodology provide a globally adaptable blueprint for policymakers, investors, and development practitioners, emphasizing the importance of coordinated efforts in expanding financial access while maintaining financial stability.

The findings further illustrate that digital banking and mobile financial services have dramatically improved accessibility, particularly in rural areas, reducing reliance on traditional banking systems. Meanwhile, microfinance institutions continue to bridge financial gaps for small businesses and low-income individuals. Foreign direct investment and venture capital have played a critical role in financing large-scale infrastructure projects, technological advancements, and industrial growth, demonstrating the complementary relationship between financial inclusion and capital access.

This chapter has explored the crucial role of financial inclusion and access to capital in shaping the socio-economic development of emerging markets. The analysis highlighted how digital banking, FinTech innovations, microfinance institutions, and capital inflows—such as foreign direct investment (FDI) and venture capital—have

the potential to drive sustainable economic growth, poverty alleviation, and social inclusion. It also underscored the significant impact of financial inclusion on improving household resilience, supporting micro-entrepreneurship, and empowering marginalized communities, particularly women.

Despite these advancements, barriers such as regulatory limitations, financial illiteracy, and gender disparities persist, requiring targeted policy interventions. Ensuring the effectiveness of financial inclusion initiatives necessitates continuous investment in infrastructure, financial education, and regulatory reforms. Future research should explore the evolving role of financial technologies, the impact of alternative credit scoring models, and innovative policy mechanisms that can further expand financial accessibility.

Additionally, the chapter presented a comprehensive analytical framework and methodology, combining quantitative and qualitative approaches to assess financial inclusion's impact across regions. The methodology emphasized the importance of global perspectives, recognizing that while regional contexts vary, the solutions to enhancing financial inclusion and access to capital often share common themes and challenges.

In conclusion, financial inclusion and capital access are fundamental to fostering resilient, sustainable, and inclusive economies [25]. Strengthening regulatory frameworks, expanding digital infrastructure, and promoting equitable access to financial services are crucial steps toward maximizing their impact [26]. Emerging markets must adopt a comprehensive and adaptive approach that aligns financial inclusion strategies with long-term development goals, ensuring that economic growth is both inclusive and sustainable [27].

6.2 Recommendations

This study has highlighted the critical role of financial inclusion and access to capital in driving socio-economic development, infrastructure growth, and sustainability in emerging markets. The integration of digital banking, FinTech innovations, microfinance institutions, and capital flows has demonstrated significant potential to uplift underserved populations, foster entrepreneurship, and support economic diversification. Metrics such as mobile money usage, FDI inflows, and gender-specific microfinance initiatives underscore the transformative power of inclusive financial systems. However, persistent challenges remain, including infrastructural gaps, financial illiteracy, regulatory inconsistencies, and unequal access to resources. Addressing these barriers is essential to fully harness the potential of financial inclusion and capital access.

Finally, financial inclusion and capital access are fundamental to fostering resilient, sustainable, and inclusive economies. Strengthening regulatory frameworks, expanding digital infrastructure, and promoting equitable access to financial services are crucial steps toward maximizing their impact. Emerging markets must adopt a comprehensive and adaptive approach that aligns financial inclusion strategies with long-term development goals, ensuring that economic growth is both inclusive and sustainable.

Conflict of interest

The authors declare no conflict of interest.

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