The Effect of E-Commerce on International Trade: Case Study of Mali

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Final International University
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by

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APPROVAL

Title: The effect of E-Commerce on International trade: Case study of Mali

We certify that we approve this thesis submitted in partial fulfillment of the requirements for the degree of Master in Business Administration.

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To my father, Alhadj Namouon Coulibaly for his love and support.

ETHICAL DECLARATION

I, Omou Coulibaly, hereby, declare that I am the sole author of this thesis and it is my original work. I declare that I have followed ethical standards in collecting and analyzing the data and accurately reported the findings in this thesis. I have also properly credited and cited all the sources included in this work.

Oumou Coulibaly

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ABSTRACT

The study examine the effect of E-commerce on international trade in Mali, utilizing data from the World Development Indicator spanning from 1996 to 2022. The study aims to determine the relationship between e-commerce and Mali's international trade. The widespread e-commerce deployment is hindered by a lack of a strong digital infrastructure that includes reliable internet access and electronic payment systems. Limited financial inclusion, poor digital literacy, and the lack of regulatory frameworks explicitly developed for this industry are additional obstacles to the development of e-commerce. The study uses secondary data, which data were sourced from the World Development Indicator from 1996 to 2022, and the data was analyzed using Eview12. The analysis demonstrated a significant and positive short-run impact of trade openness and GDP growth on international trade. The study found a negative and statistically insignificant impact of mobile cellular telephone subscriptions on international trade. The analysis found a negative and insignificant effect of individuals using the Internet and access to electricity on international trade in the long run. The analysis revealed a significant positive effect of trade openness and GDP growth on international trade in the long run. The study found a negative and insignificant influence of mobile cellular telephone subscriptions, access to electricity, and individuals using the Internet on international trade in the long run. The findings, which underscore the significance of the study, provide insight to the government of Mali to improve e-commerce in the country by providing more digital infrastructure that supports online transactions, such as internet speed and chapter data. The study recommends policy changes to reduce tariffs, simplify, and also participating in regional trade agreements, like the AFCFTA, which can enhance economic relations with neighboring nations and increase market access for Malian enterprises. Strategic

investments in manufacturing, technology, and tourism are also proposed to diversify the economy and enhance Mali's global trade competitiveness. Investments in renewable energy and digital infrastructure are also emphasized to support long-term economic growth and facilitate greater participation in digital trade and e-commerce also promoting the creation and implementation of novel technical solutions can further enhance efficiency and competitiveness by simplifying and lowering the cost of trade procedures.

Keywords: International trade, Trade openness, Mali.

ÖZ

Çalışma, Mali'de e-ticaretin uluslararası ticaret üzerindeki etkisini, 1996'dan 2022'ye kadar uzanan Dünya Kalkınma Göstergesi verilerini kullanarak inceliyor. Çalışma, e-ticaret ile Mali'nin uluslararası ticareti arasındaki ilişkiyi belirlemeyi amaçlıyor. Yaygın e-ticaret dağıtımı, güvenilir internet erişimi ve elektronik ödeme sistemlerini içeren güçlü bir dijital altyapının bulunmaması nedeniyle engellenmektedir. Sınırlı finansal katılım, zayıf dijital okuryazarlık ve bu sektör için açıkça geliştirilen düzenleyici çerçevelerin eksikliği, e-ticaretin gelişmesinin önündeki ek engellerdir. Çalışmada 1996'dan 2022'ye kadar olan Dünya Kalkınma Göstergesi'nden veriler elde edildi ve veriler Eview12 kullanılarak analiz edildi. Analiz, ticari açıklığın ve GSYİH büyümesinin uluslararası ticaret üzerinde kısa vadede anlamlı ve olumlu bir etkisi olduğunu ortaya koydu. Çalışma, mobil cep telefonu aboneliklerinin uluslararası ticaret üzerinde olumsuz ve istatistiksel olarak anlamsız bir etkisi olduğunu buldu. Analiz, bireylerin interneti kullanmasının ve elektriğe erişiminin uzun vadede uluslararası ticaret üzerinde olumsuz ve önemsiz bir etkisi olduğunu buldu. Analiz, uzun vadede ticari açıklığın ve GSYİH büyümesinin uluslararası ticaret üzerinde önemli bir pozitif etkisi olduğunu ortaya koydu. Araştırma, mobil cep telefonu aboneliklerinin, elektriğe erişimin ve interneti kullanan bireylerin uzun vadede uluslararası ticaret üzerinde olumsuz ve önemsiz bir etkisi olduğunu buldu. Çalışmanın önemini vurgulayan bulgular, Mali hükümetine internet hızı ve bölüm verileri gibi çevrimiçi işlemleri destekleyen daha fazla dijital altyapı sağlayarak ülkedeki e-ticareti iyileştirme konusunda fikir sağlıyor. Çalışma, tarifeleri azaltmak, basitleştirmek ve ayrıca komşu ülkelerle ekonomik ilişkileri geliştirebilecek ve Malili işletmelerin pazar erişimini artırabilecek AFCFTA gibi

bölgesel ticaret anlaşmalarına katılmaya yönelik politika değişiklikleri öneriyor. Ekonomiyi çeşitlendirmek ve Mali'nin küresel ticaret rekabet gücünü artırmak için imalat, teknoloji ve turizm alanlarındaki stratejik yatırımlar da öneriliyor. Yenilenebilir enerji ve dijital altyapıya yapılan yatırımların, uzun vadeli ekonomik büyümeyi desteklemek ve dijital ticarete ve e-ticarete daha fazla katılımı kolaylaştırmak için de vurgulandığı gibi, maliyetleri basitleştirerek ve düşürerek verimliliği ve rekabet gücünü daha da artırabilecek yeni teknik çözümlerin oluşturulmasını ve uygulanmasını teşvik etmek de vurgulanıyor. ticaret prosedürleri.

Anahtar Kelimeler: Uluslararası ticaret, Ticari açıklık, Mali.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
AIC	Akaike Information Criterion
ATE	Access to electricity
B2B	Business-to-Business
BEPS	Base Erosion and Profit Shifting
COVID-19	Coronavirus Disease 2019
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
EU	European Union
EUGDPR	European Union's General Data Protection Regulation
FPE	Final Prediction Error
GDP	Gross Domestic Products
GDPR	General Data Protection Regulation
INT	International Trade
IoT	Internet of Things
IPR	Intellectual Property Rights
IRP	Intellectual property rights
ITC	International Trade Centre
IUI	Individuals using the Internet
LM	Lagrange Multiplier
LR	Likelihood Ratio
MCT	Mobile cellular telephone subscriptions
OECD	Organisation for Economic Co-operation and Development
SMEs	Small and Medium-sized Enterprises

TON	Trade Openness
USMCA	United States-Mexico-Canada Agreement

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Online trade of products and services is known as electronic commerce, or simply e-commerce (Jain et al., 2021). Modern businesses rely on it heavily; it has changed traditional trade methods and reimagined how companies interact with customers all over the globe. With the advent of e-commerce, businesses now have more opportunities than ever to reach customers worldwide, regardless of their physical location (Amit & Zott, 2017). Businesses can reach a diverse audience with their products and services showcased on online platforms, removing barriers to entry and allowing for unprecedented market penetration.

The role of online shopping in modern business processes cannot be overstated. Digital technology has democratized the marketplace, allowing businesses of all sizes, from startups to multinational conglomerates, to compete on a level playing field (Sussan & Acs, 2017). The accessibility of online shopping empowers customers to make purchases at their convenience, from any device. E-commerce technologies enable businesses to streamline their supply chains, enhance customer experiences, and simplify operations (Dhanalakshmi & Supriya, 2020). In the interconnected world of today, e-commerce offers a wealth of resources, including online shops, digital payment systems, personalized marketing campaigns, and data-driven insights, to foster development and innovation.

More than just a means of trading goods and services, electronic commerce represents a sea change in how businesses communicate with their clients and conduct business (Helms et al., 2018). The impact of e-commerce goes far beyond individual transactions; it has a significant effect on the future of trade and is driving economic growth in this digital age, as is becoming clear from research on its transformative power. As a primary engine of national wealth creation, international trade is paramount in promoting economic growth and development (Acharyya & Kar, 2014). Countries like Mali rely on trade to sustain their economy and improve living

circumstances; thus, international commerce is crucial. In order to make their goods and services more efficient and competitive, countries can take advantage of their comparative advantages in international trade (Hu et al., 2022). This includes their unique resources, skills, and abilities. Countries like Mali might benefit from international trade because it opens their doors to a wider variety of products, technologies, and resources that would not be readily available at home. As a result, creativity, diversity, and productivity are all boosted.

According to Amir and Riaz (2023), international trade helps countries' economies work together, forming partnerships that benefit both parties and promote stability, prosperity, and peace. Collaboration and mutual economic growth can be fostered when governments like Mali use trade agreements and partnerships to form alliances and improve diplomatic relations with business counterparts. Because of its limited natural resources and infrastructure, the West African landlocked nation of Mali relies heavily on international trade to propel its economy forward. Through selling commodities like cotton, gold, and cattle, Mali can generate much-needed revenue for essential services, infrastructure projects, and social programs to reduce poverty and promote human development (Zamudio, 2016).

However, new technologies and the rise of online shopping are rapidly altering the dynamics of international trade (Williams, 2019). The rise of e-commerce and other digital platforms has given Malian businesses unprecedented opportunities to tap into global markets and reach customers far beyond their borders. There are now fewer barriers to entry for businesses of all sizes thanks to the rise of e-commerce, which has given Malian entrepreneurs a global platform to showcase their wares (Friederici et al., 2020). Through e-commerce platforms, Malians may access international markets, build direct relationships with customers worldwide, and cut out intermediaries, which means lower transaction costs and higher profit margins.

Countries like Mali rely heavily on global trade. In light of e-commerce's continuing influence on international trade, Mali's government, businesses, and other stakeholders must embrace digital technologies, adapt to changing market conditions, and harness the transformative power of e-commerce to boost the country's economy, create jobs, and improve people's lives.

1.2 Problem Statement

Agricultural production, mining, and service provision are the backbone of Mali's diverse economy (World Bank, 2018). The country is situated in western Africa. The wealth of agricultural products and natural resources, such as gold, significantly impact the region's economic potential. Despite these advantages, Mali encounters many challenges in the international market. Restrictions in infrastructure, particularly in transportation and telecommunications, hinder effective trade and connection on a global and domestic scale (Nordïs & Piermartini, 2004). Due to its inadequate infrastructure, it is difficult for the country to use its economic resources and engage in international trade effectively.

The World Bank (2018) reports that a large majority of Mali's population engages in subsistence agriculture, indicating a low level of industrialization in the country. Though it is vital to Mali's economy, agriculture leaves the nation vulnerable to bad weather and unpredictable commodity prices. Reliance on traditional industries and a lack of economic diversification challenge long-term growth and adaptability to global economic swings.

Geographical limits worsen Mali's trading challenges. Because of its landlocked location, the nation depends on its neighbouring countries for seaport access and access to international markets. Relying on transit routes through neighboring nations affects the competitiveness of Malian goods in international markets, adding complexity and expense to commercial activities.

With the rise of online shopping, Mali's economy has two bright spots. Banga et al. (2021) state that Mali businesses can expand their reach beyond their physical locations by utilizing e-commerce. Mali business owners may reach customers all around the globe through online marketplaces, cutting off intermediaries and traditional trade lines. The proximity to global markets greatly enhances improving exports, attracting foreign investment, and driving economic expansion.

Online shopping in Mali is still in its early stages and faces many challenges. Nazir and Roomi (2020) state that widespread e-commerce deployment is hindered by a lack of a strong digital infrastructure that includes reliable internet access and electronic payment systems. Limited financial inclusion, poor digital literacy, and the

lack of regulatory frameworks explicitly developed for this industry are additional obstacles to the development of e-commerce.

Despite the country's great economic potential, Inadequate infrastructure, low industrialization, and geographical limits are some of Mali's major challenges in the global market (Rotberg, 2013). There is hope for overcoming these challenges and boosting economic progress with the rise of e-commerce, which increases innovation and opens up new markets. Mali must address major challenges, such as a lack of adequate digital infrastructure and regulatory frameworks, ensure that all citizens have equal access to digital technologies, and foster an environment that encourages the growth of e-commerce if it is to realize its potential in e-commerce fully.

1.3The Aim of the Study

This study's primary goal is to investigate electronic commerce's influence on global trade, with a particular emphasis on comprehending the prospects and obstacles it poses for enterprises and trade connections in Mali. This study seeks to examine e-commerce's transformative capacity in enabling cross-border transactions, broadening market reach, and promoting economic development. Its objective is to offer valuable insights into the changing dynamics of global trade in the era of digitalization.

1.4 The Objectives of the Study

- Evaluate the impact of trade openness on international trade.
- Examine the influence of mobile cellular telephone subscriptions on international trade.
- Assess the impact of individuals using the internet on international trade.
- Determine the effect of GDP growth on international trade.
- Ascertain the effect of access to electricity on international trade.

1.5 Research Questions

- What is the impact of trade op trade openness on international trade?
- What is the influence of mobile cellular telephone subscriptions on international trade?

- What is the impact of individuals using the Internet on international trade?
- What is the effect of GDP growth on international trade?
- What is the effect of access to electricity on international trade?

1.6 Research Hypothesis

- H1: Trade openness has a significant influence on international trade.
- H2: Mobile cellular telephone subscriptions have a significant influence on international trade.
- H3: Individuals using the Internet have a significant influence on international trade.
- H4: GDP growth has a significant influence on international trade.
- H5: Access to electricity has a significant influence on international trade.

1.7 The Significance of the Study

This extensive study aims to shed light on the intricate relationship between various key elements and global trade dynamics. This research provides businesses, policymakers, and stakeholders with practical insights by analyzing the effects of trade openness, mobile cellular telephone subscriptions, internet usage, GDP growth, and energy access on international trade. Understanding international commerce's underlying mechanisms and drivers can lead to more effective policy and strategy formulation for boosting trade performance, encouraging economic growth, and promoting sustainable development.

In addition, the findings can shed light on investment decisions, infrastructure development, and technological advancement, which can impact the economic framework of countries and regions. By illuminating the critical elements that impact global trade, the study adds to the body of knowledge on the subject and makes evidence-based decisions possible. This study is significant because it can offer concrete answers and suggestions to help improve trade facilitation, strengthen economic resilience, and promote inclusive development on a global and local scale.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

E-commerce and its relation to global trade are covered extensively in this chapter. Highlighting its benefits and addressing its drawbacks, it delves into the expansion and relevance of online commerce in international trade. It also delves into the changing governmental and regulatory landscape that controls digital trade and how e-commerce has affected globalization. A discussion of future trends and their implications for the e-commerce landscape and international trade dynamics follows using empirical studies and case examples to highlight essential themes.

2.2 Introduction to E-Commerce and International Trade

An important force in the evolution of international trade, e-commerce (or electronic commerce) has changed the way businesses conduct transactions and interact with customers worldwide (Met et al., 2020). The practice of buying and selling goods and services via the Internet, or "e-commerce," has expanded rapidly in the last several years. Innovations in technology, improvements in internet access, and changes in customer behaviour have all contributed to this expansion (Jain et al., 2021).

The early stages of the internet's development are responsible for the rise of e-commerce as a significant part of global trade. Concurrent with the advent of the World Wide Web in the 1990s, firms investigated the potential of online platforms for economic activity (Kim et al., 2013). The creation of safe payment methods and improvements in logistics, along with the rise of e-commerce platforms, have ushered in a new age of global trade.

E-commerce platforms serve as online marketplaces to enable transactions between businesses and customers regardless of their physical locations (Vulkan, 2020). Online markets, auction houses, business-to-business (B2B) portals, and online stores are all part of this broader category of platforms. Famous e-commerce platforms

like Shopify, Alibaba, eBay, and Amazon are well-known for catering to different global market parts.

E-commerce platforms enable cross-border transactions, enabling businesses to quickly reach customers in numerous nations and regions (Qi et al., 2023). Companies using digital technology and internet marketing strategies can circumvent traditional barriers to international trade, such as physical distance, language barriers, and cultural differences. For small and medium-sized enterprises (SMEs), e-commerce platforms provide a level playing field where they may compete with larger companies globally (Amornkitvikai et al., 2022).

E-commerce platforms also make shopping easier for customers by connecting them with a wide variety of items and services from all over the world (Chiguvi, 2023). By providing services like online payment gateways, safe transactions, and personalized recommendations, e-commerce platforms make it easier for customers to shop for various products and encourage the expansion of international trade.

There have never been more exciting times for businesses and consumers than with the growth of e-commerce, which has revolutionized international trade (Williams, 2019). Online trade's continued development and growth are expected to increase its impact as a driver of global economic integration and growth, shaping the future of trade in the digital age.

2.3 Growth and Significance of E-Commerce in International Trade

International trade and the expansion of online shopping have grown more interdependent in recent years, changing the face of established industries and creating new opportunities for cross-border trade. The following points explore the data, patterns, and important advancements that highlight the growing importance of online trade in global trade:

2.3.1 Expansion of Online Marketplaces

As online marketplaces where businesses and consumers worldwide may transact business, e-commerce platforms have proliferated in recent years. The overall value of worldwide e-commerce sales hit $4.28 trillion in 2020, with a forecast

increase to approach $5.4 trillion by 2022, according to Statista, citing research by (Olumekor & Polbitsyn 2022). This growth is fueled by the emergence of e-commerce platforms such as Alibaba, eBay, and Amazon, which have expanded their reach to international markets and offered a wider variety of products.

2.3.2 Cross-Border E-Commerce Transactions

As more and more companies and individuals engage in trade that transcends geographical boundaries, the prevalence of cross-border e-commerce transactions has grown significantly. According to eMarketer's estimates, international online sales reached $4.29 trillion in 2020, accounting for nearly 20% of all online sales worldwide (Ganyaupfu, 2022). Increased customer trust in online purchases, more streamlined payment processes, and better logistics are the main factors propelling this development.

2.3.3 Proliferation of Digital Trade Agreements

Governments across the globe have recognized the importance of e-commerce in boosting economic growth, which has led to initiatives to encourage digital trade through trade agreement talks (Fefer, 2020). The agreements at hand cover a wide array of topics about electronic commerce, including data security, protecting the rights of online consumers, and securing intellectual property rights. Digital trade agreements include several global treaties, including the CPTPP, USMCA, and the EU's Digital Single Market proposal.

2.3.4 Adoption of Digital Technologies

Incorporating digital technologies such as blockchain, AI, and mobile commerce has accelerated the growth of online shopping in international trade. Since more and more people make online purchases through their smartphones and tablets, mobile commerce has grown substantially. EMarketer said mobile commerce accounted for 53.9% of all e-commerce purchases globally in 2020. This statistic highlights the increasing role of mobile devices in enabling online transactions (Ray & Zou, 2022).

2.3.5 Impact of the COVID-19 Pandemic

Due to the COVID-19 pandemic's lockdowns and social distancing procedures, customers have been forced to depend on online platforms for their buying needs, hastening the shift towards electronic commerce. According to Adobe's study (Gea et al., 2022), global e-commerce sales will reach $4.2 trillion in 2020. This is a substantial 40% growth from 2019. This rapid growth exemplifies the resilience of online shopping in times of uncertainty and its adaptability to changing customer preferences. Online marketplaces, cross-border transactions, digital trade agreements, and technological breakthroughs are some of the elements driving the undeniable increase and significance of e-commerce in international trade. Businesses and governments alike will need to adapt their plans in response to the ever-changing nature of e-commerce to reap the benefits of this game-changing trend in international trade.

2.4 Advantages of E-Commerce for International Trade

E-commerce has emerged as a powerful enabler of international trade, offering numerous advantages to businesses, consumers, and economies alike. The literature highlights several key benefits of e-commerce for international trade, including:

2.4.1 Enhanced Market Access for SMEs

When it comes to reaching customers all over the globe, small and medium-sized businesses (SMEs) have it made with e-commerce platforms (Tu & Shangguan, 2018). The elimination of geographical barriers brought about by e-commerce has enabled SMEs to showcase their wares to a global audience at significantly reduced costs. Research conducted by the International Trade Centre (ITC) indicates that e-commerce-using SMEs are more resistant to economic downturns and have larger export volumes compared to their offline competitors (Foya & Garikayi, 2021).

2.4.2 Reduced Transaction Costs

By eliminating brick-and-mortar stores, large distribution networks, and traditional forms of advertising, e-commerce significantly reduces the costs associated with international trade (Kim et al., 2017). Businesses can save time and money by

using e-commerce to automate mundane tasks, improve supply chain optimization, and simplify operations. Compared to more traditional forms of trade, studies show that online purchases often have lower transaction costs across the board, including shipping, handling, and inventory management.

2.4.3 Increased Efficiency in Supply Chains

E-commerce allows supply chain participants to work together, exchange data, and converse in real-time, which boosts efficiency and responsiveness (Lin et al., 2022). E-commerce platforms also help companies save time and make customers happier by coordinating manufacturing, inventory management, and order fulfilment. Improvements in supply chain transparency and traceability made possible by blockchain and the Internet of Things (IoT) inspire trust and reduce the possibility of fraud and counterfeiting.

2.4.4 Broader Consumer Reach

Through e-commerce, businesses can reach new demographics and markets, expanding their customer base and revenue possibilities. The rise of e-commerce and social media has allowed companies to reach certain demographics with tailored ads (Anshari et al., 2019). In addition, internet commerce makes customization of goods, services, and materials to match the preferences and cultural nuances of different markets easier, increasing customer engagement and loyalty.

2.4.5 Access to Data and Analytics

Companies gain priceless insight for strategic planning and market research from the mountain of data generated by online sales regarding customer tastes, habits, and trends (Rosário & Raimundo, 2021). By analyzing e-commerce data, organizations can learn about emerging trends in online shopping, adjust their pricing strategies, and adapt their product lines to meet customers' evolving tastes. The use of data-driven analytics also helps businesses evaluate the success of their marketing campaigns, improve their customer segmentation, and increase their global competitiveness.

2.5 Challenges and Barriers

While e-commerce offers numerous advantages for international trade, its integration is not without challenges and barriers. The literature highlights several key obstacles that businesses and policymakers encounter in leveraging e-commerce for cross-border transactions

2.5.1 Regulatory Disparities

Inconsistencies in national regulatory frameworks and standards severely impede international electronic commerce. Companies in multiple jurisdictions may struggle to comply with all applicable laws and regulations regarding data privacy, taxes, customs, and consumer protection (Selby, 2017). Establishing conditions favorable to cross-border electronic commerce requires regulatory harmonization and the promotion of global collaboration.

2.5.2 Digital Infrastructure Limitations

One of the main challenges to expanding e-commerce in many parts of the world, particularly in developing countries, is the unreliable and inconsistent digital infrastructure. Businesses and customers are hesitant to join the online market due to poor broadband coverage, slow internet speeds, and excessive data rates, which hinder the adoption of e-commerce platforms (Nazir & Roomi, 2020). Investing in broadband networks and digital literacy programs is crucial to reducing digital infrastructure gaps in international trade and maximizing the potential of e-commerce.

2.5.3 Cybersecurity Concerns

Ransomware, phishing, and data breaches are cybersecurity hazards to which online platforms and transactions are vulnerable (Liu et al., 2022). The growing complexity of cyber-attacks highlights the importance of strong cybersecurity measures to protect intellectual property, financial transactions, and sensitive customer data. Organizations should invest in cybersecurity solutions, staff training, and incident response procedures to ensure the security of online transactions and lessen cyber risks.

2.5.4 Cross-Border Payment Complexities

It is still challenging for online business operations to ensure the security and efficacy of foreign payments. Currency conversion costs, foreign exchange volatility, and cross-border transaction fees can make international trade more expensive and complicate pricing strategies for businesses (Gopinath, 2015). Differences may also hinder the efficient processing and settlement of payments in payment infrastructure, banking regulations, and systems across countries. Domingo et al. (2023) emphasizes the importance of enhancing digital payment innovation, fostering collaborations among financial institutions, and improving interoperability among payment networks to tackle the difficulties of cross-border payments.

2.5.5 Logistics and Fulfilment Challenges

Logistics and order fulfilment procedures are crucial to the success of online stores, especially those dealing in international trade. Tlhoeli (2021) argues that complicated import/export processes, unpredictable transportation costs, and lengthy customs clearance times can potentially harm supply chains and customer satisfaction. Improving logistical infrastructure, streamlining customs procedures, and encouraging cooperation between logistics providers and e-commerce platforms are critical to resolving logistics and fulfilment challenges in international e-commerce.

2.6 Impact on Globalization

E-commerce has emerged as a transformative force reshaping traditional notions of globalization. Through digital platforms and online marketplaces, e-commerce has facilitated the integration of businesses, consumers, and economies on a global scale, challenging conventional paradigms of trade and commerce. The impact of e-commerce on globalization can be analyzed through several key dimensions:

2.6.1 Democratization of Global Trade

Ahi et al. (2023) assert that e-commerce platforms have levelled the playing field regarding access to global markets, enabling SMEs and other firms of varying sizes to participate in international trade. Online marketplaces and digital technologies

have helped SMEs overcome traditional barriers to market entry, such as high startup costs, limited market penetration, and logistical challenges. Entrepreneurs can gain influence and promote economic inclusion through democratizing commerce, which opens up options for growth and extension outside national boundaries.

2.6.2 Levelling the Playing Field

By lowering entry barriers and encouraging healthy competition, e-commerce has the potential to level the playing field in global trade. Unlike brick-and-mortar stores, online businesses do not need a physical presence in every region to reach customers worldwide (Mustakallio, 2015). A more level playing field for new entrants and developing market players to compete with long-standing incumbents has been created, suitable for innovation, efficiency, and customer choice. Therefore, e-commerce promotes market dynamism and disrupts traditional business structures, increasing market diversity and accessibility.

2.6.3 Expansion of Cross-Border Commerce

The broad use of e-commerce platforms, which have simplified and expedited business participation in international trade, has aided an increase in cross-border commerce. International buyers and sellers can easily connect, transact, and exchange goods and services using digital marketplaces (Misra et al., 2020). Increased international trade volumes and greater economic interdependence between states are the results of global economic integration made possible by the elimination of geographical barriers in e-commerce.

2.6.4 Empowerment of Consumers

Online purchasing gives customers more agency because of the variety of products available, low prices, and ease of use (Gupta et al., 2020). Customers can research products and services from all over the world, read reviews, compare costs, and ultimately make more educated selections because of the abundance of information available on online marketplaces. The increased agency of consumers has major effects on globalization since it encourages cross-border trade, opens doors to

cross-cultural exchange, and helps global trends and preferences proliferate (Dwyer & Cavlek, 2019).

2.6.5 Transformation of Supply Chains

E-commerce has dramatically improved traditional supply chains' efficiency, efficacy, and responsiveness to changing market demands (Li et al., 2018). Improved product flow efficiency and reduced lead times are the results of digital technology that make inventory management, demand forecasting, and order fulfilment easier and faster. Thanks to digital supply chains, companies now have an easier time sourcing, producing, and distributing goods abroad. Their ability to take advantage of savings and new opportunities in many countries' markets directly results from this (Lund et al., 2019).

2.7 Policy and Regulatory Frameworks

The integration of e-commerce into international trade has prompted policymakers worldwide to develop and adapt regulatory frameworks to address the unique challenges and opportunities presented by digital commerce. The literature highlights ongoing debates and developments in key areas of e-commerce regulation:

2.7.1 Data Privacy

Regulations about data privacy have a substantial impact on how online merchants secure customers' private data. European Union's General Data Protection Regulation (GDPR) and other comprehensive data protection laws have set the worldwide benchmark for data privacy standards (Rustad & Koenig, 2019). However, the absence of a universal data governance framework makes it all the more difficult to achieve regulatory uniformity and alignment across states. While establishing robust data protection mechanisms and obtaining user agreement, policymakers must balance protecting privacy rights and facilitating data flows for e-commerce.

2.7.2 Consumer Protection

Concerns about jurisdictional oversight and consumer remedies in disputes or misleading practices have arisen due to the international nature of e-commerce

platforms (Aade et al., 2022). Lawmakers are looking further into several options to safeguard consumers in the context of international online trade. The enforcement of fair-trading standards, the distribution of consumer rights education, and dispute resolution procedures are all part of these measures. Consumer advocacy groups, industry stakeholders, and regulatory agencies must collaborate more closely to boost faith in online shopping (Lui & Lamb, 2018).

2.7.3 Taxation

The intricacy of determining tax liabilities in numerous jurisdictions and the lack of physical borders in online transactions provide complicated challenges for e-commerce taxation (Agbo & Nwadialor, 2020). The absence of a unified plan for taxing online sales has led to discussions about tax havens, online tax avoidance, and how to account for digital goods and services properly. Lawmakers are now considering several potential tax policy changes. These include taxing digital services, implementing value-added taxes on online purchases, and forming international cooperation partnerships like the OECD's Base Erosion and Profit Shifting (BEPS) framework.

2.7.4 Intellectual Property Rights (IPR)

Encouraging creativity and innovation in the digital economy relies heavily on protecting intellectual property rights. Concerns about copyright infringement, counterfeiting, and piracy have arisen because e-commerce platforms enable digital content distribution (Farrand, 2018). Policymakers are now faced with the challenge of balancing the needs of copyright holders with the necessity to ease access to digital commodities and information. In order to address these challenges, Perel and Elkin-Koren (2015) have highlighted continuing efforts to strengthen the enforcement of intellectual property rights (IPR), enhance digital rights management systems, and encourage content providers, platforms, and law enforcement authorities to work together voluntarily.

2.7.5 Cross-Border Data Flows

The smooth operation of online purchases depends on the free flow of data across national borders. Nevertheless, governments are considering regulating actions to oversee international data flows in light of worries regarding data security, data sovereignty, and data localization (Mitchell & Mishra, 2019). Data localization regulations, which mandate the storage and processing of data within national borders, have sparked debate in the academic community. These mandates profoundly impact information policy, commercial liberalization, and technological advancement. Interoperable data protection frameworks and mutual recognition agreements are among the alternative data governance solutions that policymakers are exploring. These methods attempt to find a middle ground between protecting individuals' right to control their data and using the benefits of international data flows, especially in e-commerce and economic growth (Burri, 2017).

2.8 Empirical Studies

He et al. (2011) investigated the influence of e-commerce on international trade and concluded that it impacts various aspects, such as output, prices, merchandise trade imports and exports, global merchandise trade, and enterprise profits.

Wang et al. (2017) explored the impact of cross-border e-commerce on China's international trade using data spanning from 2011 to 2015. They sourced their data from China's Foreign Trade and Economic Social Development Database and other relevant sources. Their findings indicated a positive correlation between cross-border e-commerce and China's international trade growth across the studied years. However, the study noted that this positive effect did not exhibit significant growth over time, possibly due to the limited implementation of favourable trade policies and a downturn in global trade.

2.9 Future Trends and Implications

Because they open doors to previously inaccessible global markets and customers, cross-border e-commerce platforms are dramatically altering international trade. Among the most interesting new developments in international e-commerce is

the proliferation of online markets facilitated by digital payment systems and logistical networks. The growth of international online trade has prompted lawmakers to look for ways to streamline cross-border trade by harmonizing regulatory frameworks, streamlining customs procedures, and improving cross-border infrastructure.

2.9.1 Blockchain Technology

Implementing blockchain technology can revolutionize international trade by making supply chains and trade financing more efficient, transparent, and secure (Bogucharskov et al., 2018). Blockchain technology can reduce the likelihood of counterfeit goods and increase trust between trading partners by allowing for the verifiable tracking of items along the entire supply chain. Reduced transaction costs and improved efficiency in trade paperwork are outcomes of automating trade procedures using blockchain technology in smart contracts. As blockchain technology becomes more widely used, lawmakers are considering new legislative frameworks to manage digital assets, smart contracts, and DeFi platforms. Two of their goals are to lessen blockchain technology's dangers and promote innovation (Ozili, 2022).

2.9.2 Artificial Intelligence (AI)

Increasingly, e-commerce platforms integrate AI technology to enhance the consumer experience, personalize product recommendations based on individual tastes, and simplify supply chain procedures (Rajeshwari et al., 2023). Chatbots are virtual assistants powered by artificial intelligence that improve online shoppers' communication and interaction and provide instant customer service. Algorithms powered by artificial intelligence sift through mountains of data in search of trends, patterns, and consumer behaviour patterns. International trade is greatly aided by AI-enabled predictive analytics, which let firms proactively anticipate demand variations, optimize inventory management, and effectively alleviate supply chain interruptions (Jibrin, 2022). Data privacy, algorithmic transparency, and the moral use of AI in decision-making processes are just a few of the areas that policymakers are looking at as they consider the regulatory and ethical ramifications of artificial intelligence (AI).

2.9.3 Trade Policies and Global Economic Dynamics

Trade rules are evolving in response to new e-commerce and international trade developments. In order to address the difficulties brought up by trade digitization, officials are reportedly re-evaluating trade agreements and laws (Kelsey et al., 2020). The digital economy presents several problems, including data governance, digital taxes, and IP rights. To promote equitable and sustainable trade practices, close digital disparities, and harness the promise of digital technology for economic development, trade policies have evolved in response to integrating e-commerce into global supply chains. Building a cooperation framework among governments, businesses, and international organizations is critical to fostering innovation, competitiveness, and economic growth in the digital age (Hanna, 2018).

2.10 Mali's Economic Structure

Mali's economic structure is marked by a combination of sectors, with agriculture occupying a major position in employment and livelihoods (World Bank, 2018). In addition, mining, namely the extraction of gold, substantially contributes to export earnings. The significance of the services industry, encompassing tourism and telecommunications, is increasing as part of the endeavour to expand the economy beyond agriculture. Mali's trade is shaped by its strategic geographical location and historical connections. The country's primary commercial partners consist of neighboring West African states, European countries, and emerging markets (Kowalski et al., 2015). Notable exports from this country include gold, cotton, livestock, and agricultural items. On the other hand, imports mainly consist of machinery, petroleum products, and consumer goods.

Mali's infrastructure encounters obstacles, particularly in remote regions, which affect transportation, energy availability, and internet connectivity (Mafusire et al., 2017). Enhancing infrastructure is crucial for enabling commerce, enticing investment, and bolstering economic activity throughout the nation. The macroeconomic statistics of Mali demonstrate a combination of both favorable prospects and difficulties. Although the country has witnessed economic progress due to agriculture and mining, it still faces significant challenges, such as high poverty rates and susceptibility to climate shocks (Azzarri & Signorelli,

2020). Economic authorities continue to prioritize the management of inflation, unemployment, and budgetary stability.

Mali's economic framework faces challenges due to its heavy dependence on agriculture, inadequate industrial diversification, and susceptibility to external shocks (López-Cálix, 2020). Nevertheless, there are possibilities for the establishment of value-added agribusiness, the advancement of renewable energy, and the promotion of sustainable tourism. To harness Mali's economic potential, it is vital to address infrastructure bottlenecks and promote inclusive growth. Mali has enacted policies to foster the growth of the private sector, enhancing governance and enticing foreign investment (World Bank, 2018). Current endeavors involve the implementation of infrastructure projects funded by international collaborators and the enhancement of regulatory frameworks to bolster economic diversity and competitiveness.

2.11 Theoretical Framework

The gravity model of trade offers a sturdy foundation for comprehending the influence of e-commerce on global trade. Initially formulated by Jan Tinbergen in 1962, the concept states that the amount of trade between two countries is directly correlated with their economic sizes, often measured by GDP, and inversely correlated with the geographical distance separating them (Capoani, 2023).

E-commerce profoundly impacts the gravity model, leading to a substantial transformation in distance. Conventional trade is characterized by the geographical separation between trading partners, which impacts transportation expenses, delivery duration, and the capacity to sustain supply networks. E-commerce platforms enable digital transactions that effectively mitigate the influence of geographical distance (Yan et al., 2023). Consumers and businesses can engage, bargain, and complete deals online, avoiding numerous logistical obstacles to conventional global trade.

E-commerce minimizes transaction expenses, such as searching for products, obtaining information, negotiating prices, and ensuring compliance. E-commerce platforms facilitate the discovery of merchants by buyers through search engines, online marketplaces, and digital catalogues (Vulkan, 2020). The decrease in search costs facilitates the connection between buyers and suppliers, augmenting the international trade level. Online reviews, comprehensive product descriptions, and

real-time communication capabilities diminish the information imbalance between customers and sellers, promoting confidence and streamlining transactions. Utilizing digital negotiation tools and standardized pricing models enhances the efficiency and expediency of the bargaining process. E-commerce platforms commonly provide integrated methods for resolving disputes, ensuring payment security, enforcing contracts, and mitigating the risks and expenses of international transactions.

E-commerce facilitates global market access for enterprises, irrespective of their physical dimensions. Small and medium-sized firms (SMEs), who may have limited resources for traditional international trade, can utilize e-commerce platforms to market and sell their products and services worldwide. Expanding the market reach can result in higher trade volumes when enterprises access broader markets previously out of reach. E-commerce allows enterprises to reach a worldwide customer base, which helps them benefit from economies of scale. Increasing the scale of production can reduce the average cost of goods, hence enhancing the competitiveness of products in global marketplaces. This can lead to increased levels of trade, as forecasted by the Gravity Model.

2.12 Chapter Summary

E-commerce has emerged as a transformative force in international trade, revolutionizing the way businesses operate and interact with consumers globally. Despite its numerous advantages, e-commerce faces challenges such as regulatory disparities and cybersecurity concerns. However, its impact on globalization, coupled with emerging trends like blockchain and AI, points to a future where digital commerce continues to reshape trade dynamics. Policymakers must adapt regulatory frameworks to foster innovation while addressing key issues to ensure the sustainable growth of e-commerce in the global marketplace.

CHAPTER 3

METHODS

3.1 Introduction

This section will outline the methodology undertaken to complete the study, including the research design, data types and structure, the selected country for the study, dependent and independent variables, research model, empirical settings, and data analysis tools.

3.2 Research Design

Research design encompasses the comprehensive framework that directs the procedures for gathering and analyzing data in a research investigation (Tomaszewski et al., 2020). The document delineates the techniques and methodologies employed to tackle the research issues or objectives. The selection of research design is crucial as it dictates the nature of the data gathered, the methodology employed for collection, and the credibility of the study's conclusions.

The study utilized a quantitative research strategy. Quantitative research gathers and examines numerical data to comprehend occurrences, relationships, or trends (Mohajan, 2020). This approach uses statistical analysis to derive findings and formulate generalizations based on numerical evidence. Utilizing quantitative tools in research is crucial for multiple reasons. This method permits the assessment and quantification of variables, enabling meticulous examination and data comparison. Additionally, it facilitates statistical inference, aiding researchers in identifying patterns, associations, or causal relationships within the data. Moreover, it yields replicable and objective outcomes, enhancing the findings' reliability and validity (Ahmad et al., 2019; Mulisa, 2022).

3.3 The Selected Country

Mali was chosen as the research country to investigate the influence of e-commerce on international trade. Mali is a landlocked nation situated in West Africa,

sharing borders with seven neighboring nations, namely Senegal, Mauritania, Algeria, Niger, Burkina Faso, Côte d'Ivoire, and Guinea (Turner, 2013). The capital of Mali is Bamako. Mali's advantageous geographical position in West Africa renders it a compelling subject for analyzing the influence of e-commerce on global business. Mali, a country without sea access, is highly dependent on trade partnerships with its surrounding countries and worldwide partners to promote business (Esterhuyse & Moctar, 2014). Examining e-commerce in Mali can provide insights into how digital technologies are changing regional trade dynamics, enabling cross-border transactions, and influencing economic growth.

Mali's economy is diverse, with agriculture, mining, and services industries playing prominent roles (Mainguy, 2011). Gaining a comprehensive understanding of how e-commerce is incorporated into various industries and its impact on global trade can offer significant knowledge for policymakers, businesses, and researchers interested in utilizing digital platforms to promote economic growth and expand trade in Africa.

3.4 Data Types and Structure

The data used in this study was secondary data, which refers to data that was acquired, organized, and published by prior researchers, organizations, or agencies for purposes other than the current study (Rassel et al., 2020). Collecting secondary data is frequently more economical and efficient in terms of time than primary data collection methods. In addition, the providers of this tool frequently offer access to extensive datasets, enabling thorough analysis and broad generalization (Najafabadi et al., 2015). Furthermore, it enables researchers to analyze patterns and modifications over time without collecting longitudinal data.

The secondary data included in this study consisted of time series data, a powerful tool that refers to a collection of observations or measurements gathered at consistent intervals over a period of time. Time series data not only allows for the detection of trends, patterns, and seasonality in data over a period of time (Dagum & Bianconcini, 2016) but it can also be used to predict forthcoming values by analyzing past patterns and trends and to investigate cause-and-effect interactions between variables over a period of time, which is sure to intrigue our audience.

The data used in this analysis was acquired from the World Development Indicator from 1996 to 2022, including a 27-year timeframe. This dataset offers a thorough and expansive period for examining the influence of e-commerce on global trade in Mali.

3.5 Dependent and Independent Variable

This section discusses the dependent and independent variables utilized in the study, as presented in Table 1. When analyzing the impact of e-commerce on international trade using the Gravity Model of Trade, exchange rates were not given significant attention for various reasons.

The primary objective is to understand the influence of e-commerce on trade by reducing transaction costs and overcoming geographical barriers. This aligns with the Gravity Model's emphasis on economic size and distance. E-commerce significantly reduces non-tariff barriers, fostering global business connectivity and trade, while also mitigating the impact of physical distance.

Furthermore, the impact of currency rates on trade is extensively recorded and influenced by other factors that are not directly related to e-commerce, such as monetary policy and economic stability. Integrating exchange rates would add intricacy and may obscure the precise influence of e-commerce on trade volumes.

In addition, e-commerce platforms frequently offer tools to minimize the effects of exchange rate swings, such as currency conversion services, thereby lowering the immediate impact on transactions. The pragmatic nature of this component diminishes the significance of exchange rates in the analysis of e-commerce's impact on trade.

3.5.1 Dependent Variable

The study utilized international trade as the dependent variable. International trade refers to the transfer of products and services between countries (Meltzer, 2015). It is vital in the worldwide economy by enabling specialization, improving economic efficiency, and fostering growth and development.

3.5.2 Independent Variable

3.5.2.1 The Study utilized five Independent Variables to measure E-commerce:

3.5.2.1.1 Trade Openness (TON) This indicator quantifies the extent of a country's involvement in global trade. The calculation involves adding the total value of exports and imports and comparing it to the Gross Domestic Product (GDP).

Trade openness is a measure of a country's involvement in global markets, which is crucial for e-commerce as it reveals the degree of integration into worldwide trade networks (González & Ferencz, 2018).

3.5.2.1.2 Mobile Cellular Celephone Subscriptions (MCT) This metric denotes the number of mobile cellular subscriptions per 100 individuals in a given population. The ubiquity of mobile phones allows for greater accessibility to e-commerce platforms and services, easing online transactions and communication (Taneja, 2021). It is calculated as

3.5.2.1.3 Individuals using the Internet (% of the population) (IUI) This variable represents the proportion of a nation's populace that has connectivity to the Internet. There is a direct relationship between higher rates of internet penetration and increased e-commerce activities. This is because internet access is crucial for online buying, communicating, and executing commercial transactions (Apăvăloaie, 2014). It is calculated as

3.5.2.1.4 GDP per Constant Gross Domestic Product (GDP) is adjusted for inflation or changes in prices in order to ensure a consistent comparison throughout time. GDP, or Gross Domestic Product, quantifies the monetary worth of all commodities and services generated inside a nation (Onuoha et al., 2015). This modification facilitates the analysis of economic productivity in actual terms, providing valuable insights into the economic performance pertinent to e-commerce activities.

3.5.2.1.5 Access to Electricity (% of population) (ATE) This indicator denotes the proportion of the population that can use electricity. A dependable energy supply is crucial for facilitating e-commerce operations, as it allows individuals and

organizations to participate in online transactions and utilize electronic gadgets vital for e-commerce (Oláh et al., 2018). It is calculated as

Table 1

Operationalization of the variables

Index	Variable	Abbreviation	Source of data
	Dependent variable:		
1	International Trade	INT	World Development Indicator
	Independent Variables:		
2	Trade Openness	TON	
3	Mobile cellular telephone subscriptions (%)	MCT	World Development Indicator
4	Individuals using the Internet (% of population)	IUI	World Development Indicator
5	GDP per constant	GDP	World Development Indicator
6	Access to electricity (% of population)	ATE	World Development Indicator

3.6 Research Model

This study is unique in its use of specific characteristics to examine the influence of E-commerce on international trade, as no previous research has utilized these variables. Although these variables have been used to analyze effects on economic growth and other factors, their precise impact on international commerce has not been thoroughly investigated. Hence, this study proposes an innovative method to fill this void in the existing body of knowledge and enhance our comprehension of the correlation between E-commerce and global trade.

$$\mathrm{INT}_t = \mathrm{f}(\mathrm{TON}_t + \mathrm{MCT}_t + \mathrm{IUI}_t + \mathrm{GDP}_t + \mathrm{ATE}_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.6)$$

$$\log\mathrm{INT}_t = \beta 1\mathrm{TON}_t + \beta 2\mathrm{MCT}_t + \beta 3\mathrm{IUI}_t + \mathrm{Log}\beta 4\mathrm{GDP}_t + \beta\mathrm{ATE}_t + \varepsilon_t \ldots\ldots (3.7)$$

Where "Ɛ" denotes error term and "t" denotes years

3.7 Empirical Settings

This section presents the various diagnostic tests carried out.

3.7.1 Unit Root Test

Unit root tests are statistical tests that assess whether a time series dataset displays a unit root, indicating non-stationarity (Adewuyi et al., 2020). Stationarity refers to the condition where the statistical characteristics of a time series, such as its average and variability, stay consistent and unchanging throughout time. A unit root indicates that the series is not stationary, implying that it displays trends or cycles that have the potential to skew statistical analysis (Hunter et al., 2017).

The null hypothesis (H0) for a unit root test posits that the time series exhibits a unit root, dictating non-stationarity:

H0: Series has a unit root

The alternative hypothesis (H1) is that the time series is stationary:

H1: Series is stationary

In this study, the unit root tests of the variables were performed using the Augmented Dickey-Fuller (ADF) test and the Dickey-Fuller (DF) test. These tests are commonly employed to examine the presence of unit roots in time series data and determine the stationarity of variables used in econometric analysis.

3.7.2 Johansen's Test of Cointegration

Johansen's Test of Cointegration is a statistical procedure employed to ascertain the presence of cointegration relationships among various variables in time series data (Jalil & Rao, 2019). Cointegration is the word used to describe a stable and long-lasting link between variables that are not stationary and have a regular pattern of movement over time (Polanco-Martínez, 2019). Johansen's Test determines if a group of variables have a shared stochastic trend. This helps analyze the connections and dynamics of economic variables (Megaravalli & Sampagnaro, 2018).

The null hypothesis (H0) for Johansen's Test posits that there is an absence of cointegration relationships among the variables, meaning that the rank of the cointegration matrix is zero.

H0: There is no cointegration link.

The alternative hypothesis (H1) posits the existence of cointegration links among the variables, meaning that the rank of the cointegration matrix is greater than zero.

H1: There is a cointegration relationship.

The presence of cointegration among the variables in this study was determined using the Trace Statistic and Max-Eigen Statistic, which are methods applied within Johansen's Test framework for cointegration testing. These statistics aid in evaluating the number of cointegrating vectors, offering valuable information on the enduring connections between the variables in the dataset.

3.7.3 Heteroskedasticity Test

The heteroskedasticity test is a statistical test that determines if the variance of the errors (residuals) in a regression model exhibits systematic variation across the values of the independent variables (Kaufman, 2013). Heteroskedasticity is detected by examining whether the variability of the error terms remains constant across data. A Heteroskedasticity Test aims to evaluate if the assumption of homoscedasticity, which assumes a constant variance of errors, is broken in a regression model (Astivia & Zumbo, 2019). Heteroskedasticity can result in biased and inefficient estimations of the model coefficients, hence impacting the reliability and interpretability of regression results.

The null hypothesis (H0) for a Heteroskedasticity Test is that the errors are homoscedastic (constant variance):

H0: Errors are homoscedastic

The alternative hypothesis (H1) is that the errors are heteroskedastic (varying variance):

H1: Errors are heteroskedastic

The Breusch-Pagan test was employed to assess the presence of heteroskedasticity. These tests assess the relationship between the independent variables and the variance of the residuals in a regression model, which can reveal any problems with the model's assumptions.

3.7.4 Serial Correlation

Serial correlation, or autocorrelation, is the correlation between a regression model's error terms (residuals) at successive time periods (Chen, 2016). Autocorrelation is present when the residuals display a consistent pattern of correlation across time, which goes against the notion of independence among the error factors. The goal of conducting serial correlation testing is to assess whether there is a correlation between the error terms in a regression model over some time (King, 2018). Serial correlation can introduce bias into the estimated coefficients, which can subsequently impact the efficiency and reliability of the regression analysis. Identifying and rectifying serial correlation is essential for ensuring the validity of statistical inference and model interpretation.

The null hypothesis (H0) for a test of serial correlation is:

H0: No serial correlation (errors are independent over time)

The alternative hypothesis (H1) is:

H1: Serial correlation is present (errors are correlated over time)

The Breusch-Godfrey Serial Correlation LM Test is a statistical test used to identify the presence of serial correlation in regression models. This test expands upon the Durbin-Watson test by enabling the identification of higher-order serial correlation. It is appropriate for analyzing time series or panel data. The evaluation determines if there is a notable relationship between the residuals at various time lags, offering insights into the autocorrelation pattern of the model's residuals.

3.7.5 Normality Test

Normality tests evaluate whether a dataset or residuals from a statistical model adhere to a normal distribution. Normality tests assess if the data can be appropriately

believed to follow a normal distribution, a crucial assumption in various statistical methods and models (Knief & Forstmeier, 2021).

The null hypothesis (H0) for a normality test is:

H0: The data/residuals are normally distributed

The alternative hypothesis (H1) is:

H1: The data/residuals are not normally distributed

The Jarque-Bera test is a widely employed statistical test that evaluates the normality of data or residuals. The function assesses the asymmetry and peakedness of the data distribution and generates a test statistic that conforms to a chi-squared distribution, assuming the null hypothesis of normality. The Jarque-Bera test is crucial for verifying the assumptions of statistical methods and models that necessitate data to follow a normal distribution (Khatun, 2021). They assist in guaranteeing the dependability and precision of statistical analyses by detecting deviations from normalcy that could impact inference and interpretation.

3.7.6 Ramsey RESET Test

The Ramsey RESET (Regression Specification Error Test) is a diagnostic tool to identify probable nonlinearities or omitted variables in a regression model (Anyanwu et al., 2017). This assessment aims to determine if the provided linear regression model accurately represents the underlying relationship between the dependent variable and the independent variables.

The null hypothesis (H0) for the Ramsey RESET test is:

H0: The specified linear regression model is correctly specified

The alternative hypothesis (H1) is:

H1: The specified linear regression model is Misspecified and requires additional terms or transformations

The Ramsey RESET test analyses the residuals of a model to identify any significant patterns or nonlinear interactions that have not been accounted for in the defined model. If the test fails to accept the null hypothesis, it indicates there may be

errors in the model, and modifications or alterations to the model structure may be required.

The Ramsey RESET test is commonly conducted by expanding the initial regression model with supplementary terms, such as squared or interaction terms, and subsequently evaluating the statistical significance of these terms to ascertain if they enhance the model's fit (Adedeji & Ahuru, 2016). The test aims to verify if regression models are correctly stated and accurately represent the genuine underlying relationships between variables.

3.8 Estimation Method

The study employed the Vector Error Correction Model (VECM) as the estimation approach. This model was selected based on its exceptional ability to analyze the interrelationships and fluctuations of various cointegrated time series, both in the short term and the long term. The VECM model enables the analysis to capture both the long-term equilibrium relationships and the short-term changes required to restore equilibrium in the event of deviations (Rostom, 2016).

The VECM model is suitable for this study due to various factors. Firstly, it allows for examining the enduring correlation between e-commerce and international trade, considering the impact of additional economic factors such as GDP and distance. Furthermore, the VECM can distinguish between short-term variations and long-term patterns, offering a more comprehensive comprehension of the influence of e-commerce on trade over time (Fahim et al., 2023). Most importantly, given the presence of non-stationarity and cointegration in the data, the VECM model is robust and appropriate for producing accurate and dependable findings by addressing any possible imbalances among the variables.

3.9 Data Analysis

All the results acquired in this study were analyzed using EViews 12. The decision to utilize this software was driven by its strong statistical features, specifically for analyzing time series data and conducting econometric modeling. EViews is highly

suitable for managing economic and financial data, making it an excellent choice for studying international trade and E-commerce variables.

The analytical findings were presented in tables and thoroughly examined in this paper's following chapter. EViews was instrumental in conducting a thorough analysis and interpretation of the data, providing valuable insights into the influence of e-commerce on foreign trade in Mali throughout the stipulated timeframe.

CHAPTER 4

RESULTS AND DISCUSSION

Table 2 displays the descriptive statistics of the variables used in this investigation, together with their corresponding units of measurement. The mean value of INT ($12.114) after applying a logarithmic transformation signifies the country's typical level of international trade activity. This data indicates that Mali participates in international trade to a significant extent, demonstrating economic connections with overseas markets (Desai & Hines, 2003). Applying a logarithmic adjustment to this variable improves the stability of its distribution, making it more appropriate for statistical study.

The trade openness of 38.780 units per unit indicates a significantly high level of openness in Mali's economy. This indicator represents a significant proportion of commerce related to the size of the economy, reflecting Mali's involvement in global trade networks. Enhanced trade openness can stimulate economic growth by facilitating greater market access and fostering a wider range of economic activity. (Ajayi & Araoye, 2019).

Mali's mobile cellular telephone subscriptions, with an average of 6.087%, indicate a moderate degree of mobile phone usage among the population. These findings indicate that a significant portion of Mali's population can use mobile communication services, which helps to improve connectivity and communication throughout the country (Briceño-Garmendia et al., 2011).

The internet usage rate in Mali is currently 7.411%, suggesting a gradual but comparatively lower level of internet usage among the population. This figure emphasizes the potential for increasing internet access and digital connection to improve communication, access to information, and involvement in the digital economy (Myovella et al., 2020).

The GDP growth rate of Mali, averaging 12.531 per unit, demonstrates a favourable trajectory in economic performance throughout the research. The growth rate mentioned indicates an increase in Mali's economy and its capacity for progress

and investment (Vitale, 2017). Maintaining GDP sustainably leads to improved quality of life and overall economic prosperity.

The current electricity access rate in Mali, which averages 26.132%, reflects the continuous endeavors to enhance infrastructure and extend energy coverage throughout the nation. Enhanced electrical accessibility facilitates economic endeavours, improves the quality of life, and fosters social progress (Ferriss, 2010).

The variables INT, MCT, and GDP displayed platykurtic distributions, characterized by flattened or shorter tails compared to a normal distribution (Boylan & Cho, 2012). The INT data exhibited a slight negative skewness, suggesting a somewhat skewed distribution to the left, with a greater concentration of data points towards the higher end of the scale. MCT also exhibited a negative skewness, indicating a skewed distribution to the left, with a clustering of data points towards the lower values. Similarly, the GDP exhibited a slight negative skewness, indicating a distribution slightly skewed to the left, with a greater concentration of data points towards higher values.

However, TON, IUN, and ATE exhibited leptokurtic distributions, characterized by fat tails and a larger peak than a normal distribution (Bagnato et al., 2017). The variables had positive kurtosis, suggesting a higher concentration of data around the mean and a possible presence of more outliers in the distribution. TON, IUN, and ATE exhibited positive skewness, indicating a distribution with a longer tail on the right side, where data points are more densely clustered towards the lower end of the scale.

The Jarque-Bera test evaluates the adherence of the data to a normal distribution by using the measures of skewness and kurtosis. The results demonstrate that the IUN data significantly differs from a normal distribution, indicating non-normality in its distributional form. Nevertheless, the Jarque-Bera test does not reveal any substantial departure from normality at the standard significance level ($\alpha = 0.05$) for the variables INT, MCT, TON, and ATE. This suggests that these variables are close to conforming to a normal distribution, as indicated by their skewness and kurtosis values.

Table 2

Descriptive statistics

	INT ($)	TON (unit per unit)	MCT (%)	IUN (%)	GDP (per unit)	ATE (%)
Mean	12.114	38.780	6.087	7.411	12.531	26.132
Maximum	12.404	54.052	7.412	34.490	12.758	53.380
Minimum	11.739	30.890	3.074	0.002	12.250	4.289
Std. dev	0.212	6.490	1.475	10.537	0.156	15.454
Skewness	-0.177	0.840	-0.801	1.275	-0.236	0.354
Kurtosis	1.645	2.720	2.132	3.202	1.926	1.949
Jarque-Bera (probability)	2.207 (0.332)	3.265 (0.195)	3.737 (0.154)	7.360 (0.025)	1.548 (0.461)	1,807 (0.405)
Observations	27	27	27	27	27	27

Table 3 displays the matrix correlation analysis, which investigates the connections between the studied variables. The correlation coefficient (r = 0.838) between INT and TON indicates a strong and positive relationship, suggesting a meaningful association between these two variables. Moreover, MCT exhibits a highly significant positive connection with INT (r = 0.946) and TON (r = 0.714). The GDP demonstrates a highly significant positive connection with international trade, with a correlation coefficient 0.974. This suggests a close and direct relationship between international commerce and economic growth.

The correlation coefficient (r) between IUI and MCT is 0.609, indicating a moderately positive association between internet usage and mobile phone subscriptions. ATE exhibits a positive correlation with all other variables in the matrix. The correlations vary from moderate to strong, with values ranging from 0.655 to 0.696. This indicates a clear association between electricity access and the other factors.

Table 3

Matrix Correlation Analysis

	1	2	3	4	5	6
(1) INT	1					
(2) TON	0.838***	1				
(3) MCT	0.946***	0.714***	1			
(4) IUN	0.753***	0.454***	0.609***	1		
(5) GDP	0.974***	0.694***	0.654***	0.607***	1	
(6) ATE	0.938***	0.655***	0.672***	0.795***	0.696***	1

**** p<.01, ** p<.05, * p<.1*

Table 4 displays the essential lag selection criteria for conducting Johansen cointegration tests and Granger causality studies. These tests cannot be efficiently completed without establishing the ideal delays. The results suggest that the lag was optimized at 1, as denoted by the asterisks (*) adjacent to the related statistics in the table. The selection was made by maximizing the log-likelihood (LogL) and minimizing several information criteria, such as the Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn (HQ) criterion, and Schwarz (SC) criterion.

The modified LR test statistic (LR) at lag 1 is statistically significant at the 5% level, indicating that the chosen lag provides valuable insights into the relationships among the variables in the analysis. The selection of the most suitable lag criterion is essential to ensure the dependability and accuracy of future studies, such as cointegration and causality tests.

Table 4

Optimal Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HD
0	-90.693	N/A	6.850	7.438	7.728	7.522
1	52.864	209.815 *	1.900 *	-0.836 *	1.197 *	-0.250 *

LR: sequential modified LR test statistic (each test at 5%level)

AIC: Akaike information criterion

FPE: Final prediction error

HQ: Hannan-Quinn information criterion

SC: Schwarz information criterion

Table 5 displays the unit root tests performed to evaluate the presence of stationarity in the variables. These tests aim to ascertain if the variables demonstrate non-stationary behavior at their original values and after taking their first differences (Cheng et al., 2015). Two techniques were used to conduct the unit root tests: the Augmented Dickey-Fuller (ADF) and Dickey-Fuller (DF) tests. The null hypothesis (H0) for both tests posits that the variable exhibits a unit root, suggesting non-stationarity. The alternative hypothesis (H1) posits that the variable exhibits stationarity.

All variables in the ADF test at the given level have test statistics that are lower than the crucial values at the 1% significance level. This suggests that the null hypothesis (non-stationarity) cannot be rejected. All variables in the ADF test at the first difference exhibit significant test statistics (***), indicating rejection of the null hypothesis of stationarity. Similarly, when conducting the DF test at the original level, all variables demonstrate non-rejection of the null hypothesis, indicating non-stationarity. However, when the variables are differenced once, all variables exhibit significant test statistics, leading to rejecting the null hypothesis and indicating stationarity. The results indicate that all variables achieve stationarity after

differencing, implying that they are integrated of order one (I(1)), which makes them acceptable for subsequent cointegration and time series analysis.

Table 5

Unit Root Tests

Variable	ADF test		DF test	
	At level	1st difference	At level	1st difference
INT	-1.363	-6.222 ***	-0.170	-6.327 ***
TON	-1.606	-6.104 ***	-1.375	-5.205 ***
MCT	-1.537	-3.930 ***	-0.853	-4.150 ***
IUN	-1.408	-3.846 ***	-1.311	-5.507 ***
GDP	-1.683	-6.074 ***	-0.098	-6.205 ***
ATE	-1.487	-4.371 ***	-0.092	-3.353 ***

**** p<.01, ** p<.05, * p<.1. C-critical for ADF at 1% (-3.721), 5%, (-2.896) and 10% (-2.633) and c-critical for AD tests at 1% (- 2.657), 5% (-1.954) and 10% (-1.609)*

Table 6 displays Johansen's cointegration test, which investigates a persistent connection between the variables. The test employs two methodologies: the Trace Statistic and the Max-Eigen Statistic. The null and alternative hypotheses for Johansen's test of cointegration are as stated below:

The null hypothesis (H0) posits that there are no cointegrating relationships among the variables, implying the absence of cointegration. Conversely, the alternative hypothesis (H1) suggests the presence of cointegrating correlations among the variables.

The alternative hypothesis (H1) posits that cointegrating correlations exist among the variables.

The Trace Statistic evaluates the count of cointegrating equations about various potential cointegrating equations. According to the Trace Statistic, the test statistic surpasses the crucial value of 5% for a maximum of three cointegrating equations, demonstrating a long-term relationship among the variables.

The Max-Eigen Statistic is a statistical test that determines the number of cointegrating equations by analyzing the maximum eigenvalue of the estimated matrix. When there is one cointegrating equation, the test statistic surpasses the critical value at the 5% significance level, suggesting the presence of a long-term link.

The Trace Statistic (three stars) and the Max-Eigen Statistic (one star) provide compelling evidence of a long-term link between the dependent variable (INT) and the independent variables (TON, MCT, IUN, GDP, and AET). This discovery suggests that these variables exhibit a long-term correlation, indicating the possibility of simultaneous movement and interconnection between the variables over time.

Table 6

Johansen's Test of Cointegration

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% critical value	Max-Eigen Statistic	5% critical value
None	0.775	122.231 **	95.754	37.236	40.078
At most 1	0.740	84.994 **	69.819	34.676 **	33.877
At most 2	0.653	51.318 **	47.856	26.430	27.584
At most 3	0.450	24.888	29.769	14.946	21.132
At most 4	0.283	9.942	15.495	8.301	14.265
At most 5	0.064	1.641	3.841	1.641	3.841

**** p<.01, ** p<.05,*

Table 7 presents the results of various diagnostic tests conducted to assess the reliability and validity of the regression model.

Table 7

Diagnostic Tests

Types of tests	Method	F-statistics	Probability
Heteroskedasticity Test	Breusch-Pagan Godfrey	1.220	0.035
Serial Correlation	Breusch-Godfrey Serial Correlation LM Test	5.398	0.308
Normality Test	Jarque-Bera	1.252	0.545
Ramsey RESET test	(OLS) regression	8.790	0.777

Heteroskedasticity Test (Breusch-Pagan Godfrey): This test assesses the constancy of the residuals' variance, also known as homoskedasticity. The F-statistic of 1.220 and a probability of 0.035 indicate insufficient evidence to reject the null hypothesis of homoskedasticity. Thus, the findings suggest that the model does not exhibit homoskedasticity.

Serial Correlation Test (Breusch-Godfrey Serial Correlation LM Test): This test examines the residuals' serial correlation, also known as autocorrelation. The F-statistic of 5.398 and a probability of 0.308 indicate no evidence to reject the null hypothesis of no serial connection. Therefore, the findings suggest no notable autocorrelation in the residuals.

Normality Test (Jarque-Bera): This test evaluates the residuals' normal distribution. The Jarque-Bera statistic of 1.252 and a probability of 0.545 suggest that the residuals conform to a normal distribution, validating the model's assumption of normality.

Ramsey RESET Test (OLS Regression): This test evaluates the adequacy of the model specification. The F-statistic of 8.790 and a probability of 0.777 indicate insufficient evidence to reject the null hypothesis, which states that there are no omitted variables in the model. Hence, the findings suggest that the model specification is sufficient.

Figure 1

Cumulative Sum Tests

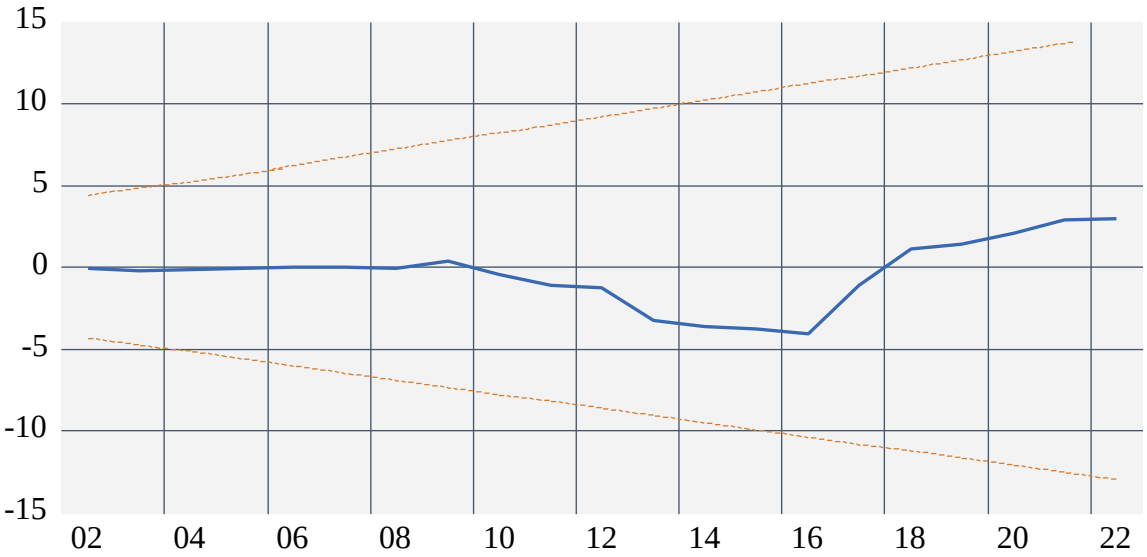

Figure 1 displays the CUSUM (Cumulative Sum) tests. The test is a statistical technique employed to identify structural changes in a dataset of time series data. When the blue line of the CUSUM test stays within the red level at the 5% significance level, it indicates no substantial evidence of a major structural change in the data at that confidence level (Arif et al., 2017). The data does not exhibit a statistically significant deviation from what is expected based on the presumed model or conditions. This result suggests that the data does not show a significant deviation or change over time that would be regarded as statistically important based on the CUSUM analysis at the set significance level. The stability of the data might be regarded as a persistent pattern or trend within the observed time series. The diagnostic tests validate that the regression model fulfills the essential assumptions and conditions for generating dependable and accurate outcomes. The results confirm the model's assumptions regarding homoskedasticity, absence of serial correlation, normality of residuals, and sufficiency of model specification.

The table 8 presents the regression results demonstrating the impact of E-commerce on international trade in Mali in the long run. The analysis revealed a significant positive effect of trade openness on international trade in Mali in the long run (B = 0.101, t = 50.50, $p < 0.01$). The study found a negative and insignificant influence of mobile cellular telephone subscriptions on international trade in Mali in the long run (B = -0.095, t = -1.504, $p > 0.05$). Similarly, the analysis revealed that individuals using the internet had a negative and insignificant effect on international trade in Mali in the long run (B = -0.378, t = -0.821, $p > 0.05$). The study found a significant positive relationship between GDP Growth and international trade in Mali in the long run (B = 0.982, t = 14.735, $p < 0.01$). Access to electricity demonstrated a negative and insignificant effect on international trade in Mali in the long run (B = -0.012, t = -0.635, $p > 0.05$).

The R-square explains the percentage in which the independent variables explain the dependent variable. R-square of 99.9% indicates that the independent variables explain 99.9% variation in the long run in the dependent variable.

Table 8

Regression Analysis (Long Run Effect)

Variables	Coefficient (B)	Standard error	t-tests	Prob
CONSTANT	-1.497	0.790	1.895	0.072
TON	0.101	0.002	50.50	0.000
MCT	-0.014	0.050	-0.280	0.773
IUI	-0.011	0.041	-0.268	0.781
GDP	1.056	0.066	16.00	0.000
ATE	-0.623	0.563	1.107	0.865
C	-1.497	0.790	1.895	0.072
R-square		0.999		
F - statistic		11374.13 (0.000)		

*** p<.01, ** p<.05, * p<.1

Table 9 presents the results of Pair-wise Granger Causality Tests.

TON ⇏ INT (INT ⇏ TON): There is no causal relationship between Trade Openness (TON) and International Trade (INT) in either direction. This is supported by the F-statistics of 0.687 and 0.607, with corresponding probabilities of 0.416 and 0.444, respectively.

MCT ⇏ INT (INT ⇏ MCT): The F-statistics indicate values of 3.900 and 5.280, with corresponding probabilities of 0.060 and 0.031, respectively. These results demonstrate that there is a unidirectional causality from Mobile Cellular Telephone Subscriptions (MCT) to International Trade (INT).

IUI ⇏ INT (INT ⇏ IUI): The F-statistics for the relationship between Individuals Using the Internet (IUI) and International Trade (INT) are 0.010 and 4.805, with associated probabilities of 0.755 and 0.039, respectively. These results indicate a one-way causal relationship between IUI and INT.

GDP ⇏ INT (INT ⇏ GDP): The F-statistics for testing causality between GDP Growth (GDP) and International Trade (INT) in both directions are 0.706 and 1.416, with associated probabilities of 0.409 and 0.246, respectively. These results indicate no causal relationship between GDP Growth and International Trade.

AET ⇏ INT (INT ⇏ AET): The F-statistics for the relationship between Access to Electricity (AET) and International Trade (INT) are 0.856 and 3.964, with corresponding probabilities of 0.364 and 0.059, respectively. These results indicate no causal relationship between AET and INT in either direction.

Additional examinations: Other pair-wise Granger Causality tests yield similar interpretations. The results suggest either no causal relationship or a one-way causal relationship between the variables, as determined by the F-statistics and related probability.

Table 9

Pair-wise Granger Causality Tests Results

Null Hypothesis	Obser	F-statistics	Prob.	Causality flow
TON ⇏ INT	26	0.687	0.416	No causality
INT ⇏TON		0.607	0.444	
MCT ⇏INT	26	3.900	0.060	Unidrectional
INT ⇏MCT		5.280	0.031	
IUI ⇏INR	26	0.010	0.755	Unidrectional
INT ⇏ IUI		4.805	0.039	
GDP ⇏INT	26	0.706	0.409	No causality
INT ⇏GDP		1.416	0.246	
ATE ⇏INT	26	0.856	0.364	No causality
INT ⇏ ATE		3.964	0.059	
MCT ⇏TON	26	2.211	0.151	No causality
TON ⇏MCT		3.679	0.068	
IUI ⇏TON	26	0.053	0.821	Unidrectional
TON ⇏IUI		4.511	0.045	
GDP ⇏ TON	26	0.579	0.455	No causality
TON ⇏GDPs		1.594	0.220	
ATE ⇏TON	26	0.593	0.449	No causality
TON ⇏ ATE		0.191	0.666	
IUI ⇏MCT	26	2.684	0.115	No causality
MCT ⇏IUI		2.553	0.124	

Table 9 (Continued)

Pair-wise Granger Causality Tests Results

Null Hypothesis	Obser	F-statistics	Prob.	Causality flow
GDP ⇏MCT	26	1.488	0.235	No causality
MCT ⇏GDP		0.080	0.780	
ATE ⇏MCT	26	2.311	0.142	No causality
MCT ⇏ ATE		2.986	0.097	
GDP ⇏ IUI	26	3.632	0.069	No causality
IUI ⇏GDP		0.088	0.769	
AET ⇏IUI	26	4.084	0.055	No causality
IUI ⇏AET		0.284	0.599	
ATE ⇏ GDP	26	0.538	0.471	Unidirectional
GDP ⇏ ATE		10.427	0.004	

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

5.1 Conclusion

The study aimed to examine the influence of e-commerce on international trade in Mali. The study sourced data from the World Development Indicator from 1996 to 2022. The hypothesis was to determine if Mali's e-commerce influences its international trade. The analysis demonstrated a significant and positive short-run impact of trade openness and GDP growth on international trade.

The study found a negative and statistically insignificant impact of mobile cellular telephone subscriptions on international trade. The analysis found a negative and insignificant effect of individuals using the Internet and access to electricity on international trade in the long run.

The analysis revealed a significant positive effect of trade openness and GDP growth on international trade in the long run. The study found a negative and insignificant influence of mobile cellular telephone subscriptions, access to electricity and individuals using the Internet on international trade in the long run.

5.2 Discussion of the Results

The analysis demonstrated a significant and positive impact of trade openness on international trade in Mali, consistent with the findings of Tahir and Azid (2015). The results imply that if trade openness were increased by 1%, international trade would increase by 0.101%. The results also support the study's hypothesis, leading to the acceptance of the alternative hypothesis, which specifies a significant relationship between trade openness and international trade. This finding indicates that a rise in trade openness is linked to a proportional increase in international trade activity. The statement suggests policies encouraging trade liberalization and openness can enhance trade expansion in Mali's economy. This, in turn, would facilitate greater cross-border transactions and promote market integration (Pitigala & Lopez-Calix, 2021).

The study found a negative and statistically insignificant impact of mobile cellular telephone subscriptions on international trade. The result implies that if cellular telephone subscription use in Mali increases by 1%, international trade will fall by 0.014%. The results do not support the hypothesis, indicating an insignificant relationship between international trade and cellular telephone subscriptions. Therefore, the null hypothesis failed to be rejected. The absence of relevance suggests that fluctuations in mobile phone subscriptions do not have a discernible direct influence on international trade in Mali. Factors contributing to this outcome may involve the requirement for broader mobile connectivity and the use of mobile technologies in trade operations (Aker & Mbiti, 2010).

Similarly, the analysis revealed that individuals using the internet had a negative and insignificant effect on international trade in Mali, supporting the alternative hypothesis. This implies that if individuals using the internet in Mali increases by 1%, international trade will go down by 0.011%. This suggests that long-term fluctuations in internet usage rates among individuals have a limited impact on Mali's international trade dynamics. Possible causes that could contribute to this discovery may include inadequate internet infrastructure, low levels of digital literacy, or the challenges associated with incorporating internet-based commerce activities into Mali's economic framework (Franda, 2002).

The study found a significant positive relationship between GDP Growth and international trade in Mali in the long run. These results are consistent with the findings of (Purnama & Yao, 2019) and (Singh, 2010). The result supports the alternative hypothesis and also implies that an increase in GDP growth by 1% would contribute to an increase in international trade by 1.056%. The outcome emphasizes the long-lasting influence of economic growth on the advancement of trade, emphasizing the crucial function of continuous economic expansion in promoting trade collaborations and market integration over some time (Khan & Ahmed, 2022).

Access to electricity demonstrated a negative and insignificant effect on international trade in Mali. The results do not support the alternative hypothesis, leading to the failure to reject the null hypothesis. This implies that when electricity is increased by 1%, international trade will decrease by 0.623. This implies that fluctuations in power accessibility do not have an enduring effect on Mali's global

trading patterns. Possible reasons for this discovery encompass the necessity for further electrification endeavours and more extensive infrastructure advancement to facilitate enduring commerce operations (Lewis & Severnini, 2020).

5.3 Policy Implication

Reducing tariffs, doing away with non-tariff obstacles, and encouraging regional trade agreements are all policy changes that the government should emphasize in order to increase trade openness. Simplifying customs procedures and lowering tariffs can facilitate international trade by lowering costs and minimizing firm delays. Participation in regional trade agreements, like the AfCFTA, can enhance economic relations with neighboring nations and increase market access for Malian enterprises. This can lead to increased export opportunities, job creation, and economic growth. New markets can be opened, and trade partnerships can be strengthened through bilateral trade agreements with important trading partners.

Creating and implementing export promotion initiatives can be a strategic move by the government to empower local companies to explore and enter new markets. The establishment of trade information centres that compile statistics on global marketplaces, including demand patterns, regulatory requirements, and competitive analyses, can be a game-changer for our enterprises. Identifying promising niches and markets for Malian products and providing financial aid in the form of export credits, insurance, and subsidies can further alleviate the financial and risk burdens of exporting. To enhance the competitiveness of Malian firms on a global scale, organizing overseas trade missions and providing financial support for their participation in trade fairs and expos can be effective.

It is imperative for the government to steer the economy away from its heavy reliance on agriculture and mining and into other sectors like manufacturing and services. To attract investment in these sectors, the development of industrial zones with the necessary infrastructure and offering incentives can be a strategic move. Enhancing the export value of primary products can be achieved by fostering agro-processing enterprises, which can add value to more traditional sectors such as agriculture. The economy can be further diversified by supporting emerging sectors like technology and tourism. Developing the tourism industry can allow Mali to

leverage its cultural and natural attractions, while investments in innovation hubs and technology parks can foster the growth of start-ups and high-tech enterprises.

A key driver of economic growth might be the investment in procedures and technology that enhance efficiency and productivity across several sectors. Businesses can improve their operational efficiency by encouraging the adoption of digital technologies. For instance, the use of cloud computing can streamline data management, while automation can reduce human error and increase production speed. The implementation of technological advancements such as precision farming and enhanced irrigation systems can improve agricultural output. A trained workforce that can adapt to an increasingly diverse industry can be created through expanded access to vocational training programs and better educational opportunities. Executives and company owners can further improve their abilities by participating in programs that teach them management and leadership techniques.

Access to power and internet usage may have a small but detrimental effect on foreign trade, as it can lead to higher production costs and limited market reach. However, these elements are important for economic development as a whole, so we shouldn't ignore them. A reliable and sustainable power supply is crucial for industrial and economic activity. In order to achieve this, it is necessary to invest in renewable energy projects and expand the electricity grid. The expansion of broadband infrastructure has the potential to enhance internet access and connectivity, opening up new prospects for digital trade and e-commerce. To increase participation in online services and monetary growth, it is necessary to implement digital literacy programs.

5.4 Strategic Recommendations

These are the strategic recommendations to the government of Mali:

Simplifying customs procedures and reducing bureaucratic impediments will facilitate businesses' engagement in international trade. Active participation in regional and international trade agreements will unlock new markets and improve commercial relations. The best way to boost the economy is to find promising new areas to invest in and then offer incentives to companies operating in those areas so that they can develop and flourish. Financial assistance, training, and market access

are critical ways to support small and medium-sized businesses (SMEs), vital to GDP growth.

To guarantee energy security in the long run, investing in dependable and environmentally friendly power infrastructure, particularly one that uses renewable energy sources, is important. A more connected telecommunications network will benefit other economic activities and company operations. Training programs that aim to enhance workforce skills, focusing on areas that contribute to economic growth and commerce, can achieve a more competent and productive workforce. Market research, financial management, and training on export readiness are all services that can help businesses prosper in global markets.

Local businesses can reach a wider audience by advocating for using digital trade platforms and e-commerce to link them to global marketplaces. Promoting the creation and implementation of novel technical solutions can further enhance efficiency and competitiveness by simplifying and lowering the cost of trade procedures.

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APPENDICES

APPENDIX A

Variables with logs

Years	International trade	Trade openness	Mobile cellular telephone subscriptions	Individuals using the Internet (% of population)	GDP	Access to electricity (% of population)
1996	11.74	30.89	3.074	0.002	12.250	6.20
1997	11.78	32.05	3.454	0.010	12.270	4.29
1998	11.84	34.16	3.651	0.020	12.302	6.07
1999	11.85	33.55	3.805	0.061	12.326	7.84
2000	11.86	34.44	4.017	0.143	12.326	9.63
2001	11.94	35.65	4.380	0.186	12.388	10.80
2002	11.92	32.70	4.663	0.227	12.401	13.04
2003	11.95	32.63	5.393	0.310	12.439	14.74
2004	11.95	32.28	5.609	0.433	12.446	16.44
2005	11.98	32.42	5.882	0.507	12.473	18.16
2006	12.03	34.33	6.180	0.730	12.493	16.60
2007	12.05	34.64	6.403	0.810	12.508	21.65
2008	12.11	37.98	6.536	1.570	12.528	23.43
2009	12.08	34.18	6.649	1.800	12.548	24.03
2010	12.18	41.03	6.872	2.000	12.571	27.01
2011	12.21	42.33	7.034	2.200	12.585	28.82
2012	12.19	40.74	7.165	2.800	12.581	25.60
2013	12.28	48.82	7.296	3.500	12.591	32.42
2014	12.31	49.04	7.371	7.000	12.621	34.22
2015	12.36	51.70	7.356	10.330	12.647	37.60
2016	12.40	54.05	7.306	14.000	12.671	38.80
2017	12.35	45.14	7.343	18.900	12.694	34.78
2018	12.31	39.14	7.342	21.400	12.714	50.90
2019	12.33	39.72	7.360	22.311	12.734	47.85
2020	12.32	38.58	7.403	27.857	12.729	50.64
2021	12.37	42.57	7.386	34.490	12.742	53.38
2022	12.38	42.02	7.413	26.514	12.758	50.63

Years	International trade	Trade openess	Mobile cellular telephone subscriptions	Individuals using the Internet (% of population)	GDP	Access to electricity (% of population)
1996	548823281200	30.89	1187	0.002	1776645862000	6.20
1997	596939949900	32.05	2842	0.010	1862440523100	4.29
1998	684338327100	34.16	4473	0.020	2003458329500	6.07
1999	710518000000	33.55	6387	0.061	2117674360000	7.84
2000	728866940700	34.44	10398	0.143	2116386073400	9.63
2001	870387446500	35.65	23997	0.186	2441806663900	10.80
2002	823169695700	32.70	45974	0.227	2517656705800	13.04
2003	896557405100	32.63	247223	0.310	2747242878100	14.74
2004	900741623000	32.28	406861	0.433	2790099830200	16.44
2005	963626659200	32.42	761986	0.507	2972426681700	18.16
2006	1067988549700	34.33	1512948	0.730	3111006768400	16.60
2007	1115144198800	34.64	2530891	0.810	3219693423900	21.65
2008	1281162615700	37.98	3438568	1.570	3373374062200	23.43
2009	1208591237500	34.18	4460543	1.800	3535509290900	24.03
2010	1527682700000	41.03	7440383	2.000	3723383966400	27.01
2011	1626687233000	42.33	10821930	2.200	3843021274400	28.82
2012	1552384413000	40.74	14612835	2.800	3810865384500	25.60
2013	1903345582000	48.82	19749371	3.500	3898327347500	32.42
2014	2047311204500	49.04	23505559	7.000	4174511516700	34.22
2015	2291347260600	51.70	22698915	10.330	4432154019500	37.60
2016	2535880835900	54.05	20217697	14.000	4691536933700	38.80
2017	2230080919200	45.14	22034110	18.900	4940444365400	34.78
2018	2025221359000	39.14	21955565	21.400	5174941782900	50.90
2019	2153470480200	39.72	22925482	22.311	5421070335800	47.85
2020	2065394799200	38.58	25315598	27.857	5354095698100	50.64
2021	2349025177300	42.57	24334901	34.490	5517535549900	53.38
2022	2405035797215	42.02	25869010	26.514	5723188982505	50.63

APPENDIX B

SIMILARITY REPORT

The Effect of E-Commerce on International trade. Case Study of Mali

ORIGINALITY REPORT

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