

## Article

# Which Factors Contribute to the Global Expansion of M-Commerce?

Maria Ciupac-Ulici <sup>1,2</sup>, Daniela-Georgeta Beju <sup>3</sup>, Vasile Paul Bresfelean <sup>3,4,\*</sup>  and Gianluca Zanellato <sup>3</sup><sup>1</sup> Faculty of Finance, Audit and Accounting, IPAG Business School, 75006 Paris, France<sup>2</sup> Faculty of Economic Sciences, Hyperion University, 030615 Bucharest, Romania<sup>3</sup> Faculty of Economics and Business Administration, Babeş-Bolyai University, 400084 Cluj-Napoca, Romania<sup>4</sup> Faculty of Economics and Law, George Emil Palade University of Medicine, Pharmacy, Science, and Technology, 540142 Targu Mures, Romania

\* Correspondence: paul.bresfelean@econ.ubbcluj.ro

**Abstract:** The purpose of this study is to analyze the factors that are contributing to the remarkable growth of the m-commerce sector. The article examines eight variables, including socioeconomic (Internet access, mobile users, mobile Internet penetration rates, card payment transactions, consumer confidence, Internet use: selling goods or services) and macroeconomic (GDP and wage), that are considered to influence global m-commerce growth. The Generalized Method of Moments (GMM) was used to analyze a panel of data that covers the years 2011 through 2020, on a sample of 42 developed and developing countries. The empirical findings show that wages, GDP, consumer confidence index, card payment transactions, mobile users, Internet access and Internet use (selling goods and services) have a positive impact on m-commerce, whereas the mobile Internet penetration rate has a negative impact. Using a sizable and representative panel data set on socioeconomic and macroeconomic indicators, this research advances the state of the art in customer comprehension of these topics. The study's novel contribution is the incorporation of under-researched m-commerce drivers into empirical analysis. Detailed policy recommendations are provided, with an emphasis on practical, implementable measures to enhance the m-commerce industry.

**Keywords:** m-commerce; Internet access; gross domestic product; private final consumption; panel data



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## 1. Introduction

In today's world, the internet is frequently regarded as an indispensable resource in all aspects of life [1]. It has resulted in the creation of new job opportunities and has had a significant impact on the overall business environment [2]. This allows customers to save money and time, which can then be spent on more enjoyable activities [3]. One of the many expanding businesses encouraged by the Internet is e-commerce [4], which is the process of conducting business transactions and exchanges of goods, services, or information through the use of digital technologies, most prominently the Internet [5].

The internalization speed of e-commerce was accelerated by low operating costs, the elimination of intermediaries, and the reduction of physical barriers [6]. As a result, e-commerce has increased developing countries' competitiveness and reduced poverty [7], resulting in a positive impact on GDP per capita [8]. E-commerce has aided social and economic development by providing access to information, expertise, and knowledge, increasing competitiveness and market penetration, improving management efficiencies, learning, increasing labor productivity, and contributing to poverty reduction [9]. The rapid growth of e-sales has enabled businesses to generate significant revenue from this sector [10] and improved the performance of online retailers [11]. The potential for e-commerce to generate more value is greater in emerging economies than in developed economies [12,13]. Furthermore, the expansion of e-sales activities has a positive impact on

labor productivity growth [11,14–16], with smaller firms experiencing the greatest gains in e-commerce [16]. It is remarkable that e-commerce activities have not resulted in a decrease in employment [17].

The introduction of e-commerce in the last few decades has revolutionized the way that businesses are managed. Businesses must embrace e-commerce in order to be successful in the modern information age; otherwise, they risk falling behind competitors who have already embraced this technology [18]. The ease of access to online shopping, as well as technological advances that have resulted in increased productivity and performance, have led the formation of many companies that operate only online, forcing traditional-style sellers to integrate online sales networks with their existing physical ones [11].

In addition to all the benefits and positive effects that can be obtained from online shopping, the implementation of e-commerce is directly influenced by technological, managerial, and environmental factors [19]. While perceived managerial e-willingness is the most important determinant of e-commerce adoption, perceived environmental e-willingness and government's investment in infrastructure improvement also play important roles in e-commerce institutionalization [20].

Customer satisfaction, cost level, infrastructure, expertise, and information are all essential to the success of e-commerce [21]. Slow Internet flow and the lack or poor use of payment cards, inadequate computer skills, and illiteracy in English language could all pose serious barriers to the growth of m-commerce, particularly in developing countries [12,22–24]. Limited Internet availability, a lack of competition in global mobile traffic, a lack of intra-regional infrastructure, and unequal mobile access across areas are all impediments to e-commerce expansion [25]. Adoption of online shopping is also influenced by perceived advantages, technological inclination, and possessors' IT skill and experience [18]. M-commerce, which originated as an extension of e-commerce [26], has emerged as its most important component. Mobile commerce, or “m-commerce”, refers to the practice of buying and selling products and services using a mobile device [27]. Any exchange of goods or services involving the transfer of ownership or the granting of use rights that is initiated and/or completed through the use of a mobile device with access to a computer-mediated network is considered a mobile commerce transaction [28].

The economic literature on e-commerce implementation and diffusion, particularly in developed countries, is quite extensive and diverse. Many accessible studies focus on main general topics as models, strategies, technologies, and social issues [19,29–32], but also deal with specific matters, as security, trust, performance, and privacy [4,33–36]. While the literature on the factors influencing e-commerce is vast and diverse [3,10,12,22,23,37–41], research on the determinants of m-commerce is still quite scarce and unreliable. Furthermore, some variables, such as mobile Internet penetration rate, have not yet been considered as potential influencing factors of online commerce.

The purpose of this paper is to identify the factors that have a significant impact on the growth of m-commerce in a sample of countries around the world. Despite the obvious development of m-commerce in recent years, there has been a lack of studies conducted to pinpoint the specific factors influencing this field. According to the literature review, studies that focus on macroeconomic variables are infrequent. This article is noteworthy because it takes into account eight endogenous indicators chosen by the authors following a thorough literature review. The domestic market size and the population's level of digital skills are two additional m-commerce-impacting factors that have been discussed in economic research [40], but we were unable to retrieve data covering the entire sample and study period. This study is one of the few that examines the variables affecting m-commerce, making a significant contribution to both theory and practice by investigating the factors that contribute to its expansion. From a theoretical standpoint, less studied factors that trigger m-commerce are examined in this study, such as Internet use—selling goods or services, while the penetration rate of mobile Internet is considered as a new determinant of m-commerce. Thus, this study contributes to endogenous growth theory from the perspective of business-to-consumer (B2C) m-commerce growth, which asserts

that a country's principal drivers of growth are domestic [42]. Policy suggestions are presented from a more practical perspective, outlining feasible and reasonable steps to better this market.

This paper is divided into six main sections, as follows. Section 1 serves as an introduction to the domain under investigation. Section 2 presents the theoretical framework and a literature review on the subject. Section 3 illustrates the research methodology and describes the hypothesis development. Section 4 introduces the model. Section 5 discusses the empirical results and policy implications. The final section summarizes the conclusions, limitations of the research, and future research directions.

## 2. Theoretical Background

### 2.1. Literature Review

M-commerce is quickly evolving into Internet-based e-commerce as more devices share the same operating platforms. As a result, distinguishing mobile commerce from other forms of e-commerce is becoming more difficult. Furthermore, a growing number of smartphones and personal data devices are now capable of supporting wireless mobile communications [43]. According to data statistics published in January 2022, 79% of mobile device users made an online purchase using their smartphone in the previous six months [44]. Today, mobile devices are more commonly used for online shopping than laptops or computers [45], with smartphones accounting for approximately half of all e-commerce transactions [44].

The rapid expansion of m-commerce observed on a global scale has been facilitated by advanced mobile technologies that offer enticing and beneficial services, such as mobile payments [46]. Over the last decade, the mobile and wireless services markets have become some of the world's fastest growing, creating significant opportunities for the banking industry to provide value-added services. As a result, mobile banking has emerged as an innovative channel that allows banks to increase competitiveness and improve customer convenience [47]. Customers can perform balance checks, account transactions, and other transaction services on their mobile devices using mobile banking [48]. The use of smartphones to make online purchases has grown in popularity, particularly in the commercial sector [49]. Mobile telephony technologies offer a potentially powerful platform for incredible Internet access and services such as mobile commerce. In basic terms, mobile commerce is defined as "any transaction with a monetary value—either direct or indirect—that is conducted over a wireless telecommunication network" [50].

Favorable conditions, hedonic motivation, habit, and perceived trust all have a favorable and significant impact on consumers' propensity to use mobile commerce services in emerging countries [51]. Utilitarian and hedonic performance expectations, as well as social influence, are significant contributors to m-commerce use intention in these countries [52]. Infrastructure conditions, such as logistic infrastructure and services, Internet penetration, available software, local legislation, education, and consumer propensity for online shopping, are also necessary for the success of the online commerce sector [25,37]. Improvements to the payment system and banking infrastructure, as well as the proliferation of credit cards, are required for the expansion of online shopping [38].

Economic factors such as income, the affordability and availability of ICT products, inadequate development of telecommunications networks, and the limited availability of credit cards all have an impact on the comparative advantages of m-shopping [22]. Existing infrastructure and easy access to physical delivery systems aided the rapid expansion of m-commerce in developed countries [12,53]. Developing countries face difficulties attracting foreign delivery businesses [24], which impedes the adoption of online purchasing systems, whereas developed countries benefit from quick shipment and low or free delivery fees [54].

Global m-commerce is greatly facilitated by culture and the comprehension of cultural differences across nations [33]. Understanding how commercial websites fit into a country's interests and culture is essential for establishing fruitful customer relationships. Websites aimed at a global audience should be simple to use and translated into local languages [55].

Shopping habits are also an important part of a country's culture. Companies in Asian countries, for example, value personal relationships over doing business remotely via the Internet, and personal communication over e-mail messages [56]. Furthermore, shopping in India is regarded as a social activity and a personal relationship, so developing face-to-face connections with merchants is an important part of the shopping perspective [53]. Traditional and religious values are also important for the growth of m-commerce, because males have greater access to Internet-use opportunities in some countries [25].

When m-commerce businesses expand beyond their national borders, they face fewer physical barriers than other types of businesses, and they are also less likely to incur fixed asset costs [57]. The internationalization of e-commerce resulted in more competitive prices as a result of a broader offer, lower transaction costs, a greater diversity of products and more marketing strategies [41]. However, the requirement to comply with the local legislation of other countries is an important factor for the expansion of m-commerce beyond the domestic country [12,58]. Furthermore, consumer trust is an important factor influencing consumer intention for cross-border m-commerce as well as relational commitment [59].

Education has a major role in the development of e-commerce [39,60], together with the technical skills [12], and the advancement of online literacy and the reduction of the digital divide [41]. Unsatisfactory digital skills are partly to blame for the digital divide [61]. Most people in developing countries have inadequate general and financial education, as well as a lack of computer skills, posing a significant barrier to the development of online commerce [23]. Many people in less developed countries who live on a dollar a day are illiterate [24]. Furthermore, English illiteracy is a serious problem, especially among the elderly, because most commercial websites are in English [62]. Demographic factors such as age also influence m-commerce adoption, with younger people more willing to make online purchases [63].

Factors related to the country's economic structure influence the adoption of m-commerce. In developed countries, information-intensive industries (such as finance/banking and IT) and/or internationally competitive businesses drive e-commerce (electronics fabrication, and automobiles production) [62]. In contrast, approximately half of the population in less developed and developing countries lives in rural areas where agriculture predominates, making e-commerce a less appealing business [12]. Online price cuts are greater for goods and services that can be digitalized than for food items [64]. As a result, the rate of urbanization has a significant impact on the development of online shopping [39].

Perceived financial risk and perceived cost have a negative impact on m-commerce technology adoption in developing countries, but ubiquity (in terms of time convenience and accessibility) has a positive impact [65]. Consumers' primary concerns are financial, psychological, and performance risks, and building trust is critical to lowering reducing risk perceptions and stimulating m-commerce behavior [66]. When customers decide to shop online, they carefully consider the website's reputation, convenience, and ease of use [4].

Another clear barrier to m-commerce adoption is organizational unwillingness to change as a result of cultural, financial, technological, and logistical factors [67]. Mobile banking and mobile payments apps are two important elements of mobile information services that offer clients technology-based value-added financial services [68], thereby encouraging m-commerce usage [69]. The perceived value of m-commerce app users influences overall satisfaction and likelihood of repurchasing [35].

Support for mobile shopping comes from a necessary service like mobile payment [70], which secures electronic commercial transactions between companies and individuals [71]. Mobile payments, as defined by [72], are "any payments where a mobile device is used to initiate, activate, and/or confirm a payment" for goods and services. Ref. [73] view mobile payments as "payments for good, services, and bills with a mobile device (such as a mobile phone, smart-phone, or personal digital assistant (PDA)) by taking advantage of wireless and other communication technologies". Although there are several technologies that help to achieve device and platform interoperability, the most well-known are Short

Message Service (SMS) and Near-Field Communication (NFC) [74]. Mobile payments are one of several types of “multihome” [75], as well as one of the innovative fintech components that improve user experience [76] and maximize utility, thereby increasing m-commerce adoption.

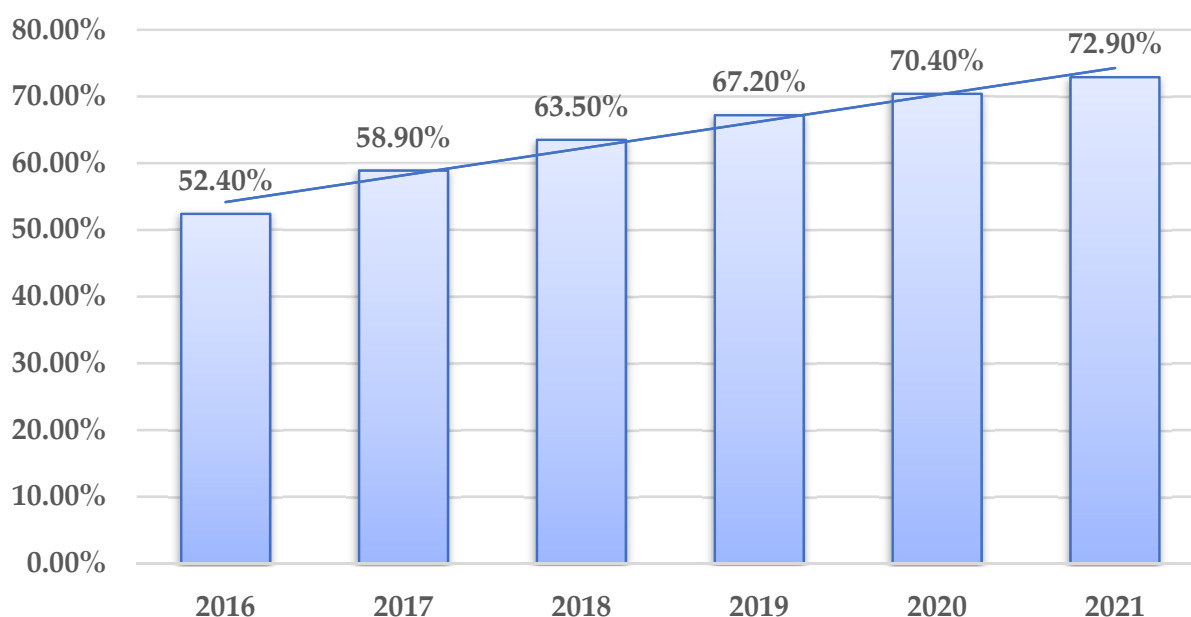
When it comes to pricing and sales, the principle of scarcity of goods is a key driver of market economy that is frequently used in online shopping [77]. The messages posted on e-commerce platforms informing customers of low inventory levels are intended to induce shoppers’ perceptions of scarcity and boost online sales [32]. Customers’ behavioral intention to use m-commerce is also significantly influenced by impulsiveness [78].

Global m-commerce innovation has been fueled in recent years by advancements in digital payment technology and delivery, as well as increased access to the Internet and smartphones. M-commerce applications have enabled online shops to create personalized shopping experiences through user-friendly design and omni-channel integration [35]. Customers prefer m-commerce to other forms of online commerce because it provides them with greater convenience and a faster experience [79]. For example, global retail m-commerce sales in 2021 represent 72.9% of all retail e-commerce sales, up from a modest 52.4% in 2016 [80].

The COVID-19 pandemic led to an increase in online shopping among consumers [40,81]. Their attitudes toward e-commerce have improved as a result of efforts to reduce infection risk while adhering to social distancing and safety regulations [82]. In 2020, for example, 85% of global customers shopped online. South America and Asia ranked first and second, respectively, with 86% of Internet shoppers [83].

The COVID-19 outbreak has intensified the spread of e-commerce to new businesses, consumers, and product categories. Online shopping in many nations has switched from luxury goods to everyday basics that are important to many people [84]. The pandemic appears to have long-term effects on online sales, favoring the shift from brick-and-mortar stores to e-commerce [84]. As a result, it is becoming increasingly important to comprehend the factors affecting the growth of m-commerce.

Due to the fact that m-commerce is currently the most important component of e-commerce (as shown in Figure 1), the study began with a review of the literature on the factors influencing e-commerce, with the goal of analyzing factors that have received less attention in the literature.



**Figure 1.** Worldwide m-commerce evolution (% of e-commerce). Source: Own processing based on Statista Databases (Statista a).



## 2.2. Research Design

### 2.2.1. Dependent Variable

M-commerce has grown in popularity over the past few years and is now an essential component of modern commerce. Because of the rapid growth of online shopping, businesses have been able to earn significant profits from this sector, while customers have enjoyed a more convenient way to shop.

Despite the promising future of m-commerce and the interesting research avenues it offers, more research into the field is required [65]. There is a substantial body of economic research on the impact of various factors on e-commerce, as well as the impact of e-commerce on various economic and non-economic variables. However, few studies look at m-commerce, the most important e-commerce channel, as a dependent or independent variable. Based on current literature, this empirical study investigates the impact of eight variables on m-commerce. Its originality lies in the selection of m-commerce as a dependent variable and the inclusion of less explored variables in the empirical model, i.e., penetration rate of mobile Internet, and Internet use: selling goods or services.

### 2.2.2. Independent Variables

#### a. Wage

Variations in living conditions in a country are reflected in per capita disposable income, which has a significant impact on the growth of m-commerce [39]. Wealth is a major determinant of m-commerce development because it defines consumers' purchasing power as well as their ability to pay for technical devices and Internet access fees [12]. Income is an important factor in most economic decisions, and it has a positive and significant impact on online shopping [61].

M-commerce acceptance is significantly higher in developed countries than in developing countries as a result of competitive pressures on high-wage nations to reduce labor costs [62]. Low incomes in developing economies, on the other hand, are a major impediment to the spread of m-commerce. Low wages, combined with limited Internet access, have a direct impact on how much money the population spends on online shopping [53].

A significant portion of the poor population in countries with unequal income distribution cannot afford to purchase technological equipment or pay for Internet access, limiting the use of m-commerce. A more equitable distribution of income can support m-commerce growth by allowing a larger percentage of the population to use IT to make online purchases [62].

As a result, as wages rise, people's incentives to increase online purchases rise as well.

#### b. Penetration rate of mobile Internet

At the start of 2022, more than 92% of all Internet users used a mobile phone to navigate online at least part of the time. Smartphone users now outnumber computer users in terms of Internet usage, and they are more likely to engage in e-commerce [44]. As mobile devices become more accessible and inexpensive, more people are likely to access the web from their phones. Increasing smartphone penetration is a clear indicator of this upward trend in mobile Internet access, which is most prevalent in developing digital countries. Currently, mobile Internet traffic accounts for nearly 55% of total web traffic worldwide. This percentage is even higher in emerging digital countries, which skipped the desktop Internet step due to poor infrastructure and financial constraints [85].

Despite the fact that mobile Internet connectivity is essential for online purchases, the penetration rate of mobile Internet is not highlighted in the research literature as a driver of m-commerce. Internet access is a factor identified in previous research and also addressed in this study, although it can be used on desktops and laptops as well, whereas mobile Internet is central to the success of m-commerce. The incorporation of this variable into analysis as a potential element that has an impact on the growth of m-commerce is our contribution to the existing theoretical framework.

### c. GDP

In the twenty-first century, information and communication technology (ICT) is regarded as one of the most powerful engines of global economic growth [23,86]. ICT enables more effective and efficient development [9], which increases GDP per capita [8]. A well-implemented ICT that is focused on people's various needs can become a powerful economic and social tool for poverty eradication [7,87]. E-commerce, another ICT-enabled industry, has also been shown to have a significant impact on GDP per capita [88].

Given that national wealth has been identified as the most important enabler of m-commerce, the relationship between e-commerce and economic growth appears to be mutual [89]. GDP per capita has been found to be significantly correlated with the growth of e-commerce [39,58,62]. While the impact of economic growth on ICT and e-commerce has been extensively studied in economic literature, there hasn't been much research on the impact of economic growth on m-commerce, which is a component of ICT. Investigating the impact of m-commerce on GDP will contribute to the advancement of the economic literature on the subject.

### d. Consumer confidence

M-commerce growth is based on retaining online buyers [35,90] and increasing e-trust [41]. When purchasing goods and services online, e-trust implies gaining confidence in the online environment [29]. Consumer trust is more valuable in m-commerce transactions than in offline ones due to the characteristics of online transactions: blind, borderless, non-stop, and non-instantaneous [91].

Online commerce may be severely hindered by cognitive issues like low consumer confidence [12]. This is linked to payment card systems [92], delivery networks [93], and thefts [94], particularly in developing countries. Even if there is an adequate logistic delivery system, a high level of Internet penetration, a well-developed software industry, and payment cards that meet the needs of the clients, the success of online commerce is impossible without a high level of consumer confidence [36]. Customers' trust in sellers and banks is thus one of the major drivers of electronic shopping propensity and its development [38]. Many factors influence trust in m-commerce, including perceived usefulness and ease of use, system quality, information and service, user interface, perceived security and risk [95], design and content [96], profile photo, stated experience, emotional and cognitive trust [97].

The nation's institutional environment is also correlated with consumer confidence. Empirical evidence suggests that the integrity of the institutional environment, especially in terms of "rules of law", is essential for the development of m-payments. Consumer confidence in adequate performance can only be established in an institutional environment governed by integrity [58].

### e. Card payment transactions

In developing countries, the lack of or occasional use of payment cards represents a major issue [12,23,24,33]. The advancement of the payment card market and electronic payment system is a prerequisite for the completion of online shopping [38]. The unwillingness or inability of banking systems in developing countries to facilitate convenient electronic payment systems has stifled the growth of m-commerce [98]. A credible payment system is required to provide security to both the retailer and the consumer. When a credit card is used to make an online purchase, the seller's payment is protected, and the buyer has some sense of security as well, because the buyer can prove the payment and recover the amount in the event of a disputed charge [58].

The use of credit cards varies greatly between countries. The financial infrastructure associated with credit card use is one example of a country's structural conditions [99]. Even though the number of bank cards in circulation has steadily increased globally, only a small proportion of the population in developing countries has used these payment methods due to serious difficulties with authorizations, electronic signature systems, timely transfer of funds, poor card processing integration, and the low safety of Internet payments [100].

While payment cards are not widely used in developing countries, they have become a popular method of payment in developed countries. For example, in January 2019, credit/debit cards were the preferred payment method for 82% of all online shoppers in the United States, 71% in Asia Pacific, and 69% in Europe [101].

f. Mobile users

Mobile device penetration is without a doubt one of the most important determinants of m-commerce diffusion [39]. Today, the number of smartphone subscriptions worldwide exceeds 6 billion, with China, India, and the United States leading the way [102].

Once considered a luxury, mobile devices are now an essential part of many people's lives all over the world. At the beginning of 2022, the global number of people who own a unique mobile phone had reached 5.31 billion. Smartphones now account for nearly four out of every five mobile phones in use worldwide [45].

Following the proliferation of mobile devices came the development of various mobile applications, including retail mobile apps. According to [103], the Amazon smartphone application ranked tenth among mobile applications in 2016 and saw a 43% increase in user numbers over the previous year. Customers' positive attitudes toward the mobile application result in increased mobile purchase frequency via the respective application [104]. Furthermore, the widespread adoption of smartphones has resulted in the development of an innovative method of making payments via mobile devices known as mobile payments [105], which are an extremely convenient and advantageous method of making online purchases [106].

g. Internet access

Customers' willingness to use m-commerce can be influenced by their access to Internet services [15,39]. Internet users with more experience are more knowledgeable about the benefits of online shopping and the Internet, and are therefore more likely to embrace m-commerce [25].

The expansion of online shopping might be seriously hampered by poor Internet usage [37]. Internet access has grown rapidly, with extremely disproportionate international distribution [22]. For example, while more than 99% of Africans and Asians did not use the Internet in 2000 [24], more than half of American adults did [107]. In the same year, 73% of the world's Internet users came from the top 10 nations [108]. Although the situation has improved since then, disparities in Internet penetration continue to exist between countries. Internet and mobile devices have become an essential part of daily life in developed countries [109], with 90% of their total population using the Internet by 2021. In the same year, developing countries accounted for 57% of the total population, while less developed countries accounted for only 27% [110].

The number of Internet users worldwide surpassed 4.9 billion in January 2022 [45], representing approximately 64% of the world's population. The annual growth rate of Internet users was 4%, with the rate being higher in developing countries. The average Internet user spends nearly 7 h per day online [45]. The assumption we make is that as Internet access and time spent on the Internet increase, so will the likelihood of mobile online shopping.

h. Internet use: selling goods or services

The economic and cultural divide affects companies' decisions to sell their products and services online. While retailers in some developing countries are taking the first steps toward selling goods and services over the Internet, this is a common practice in developed countries [33]. Some Asian companies, for example, have noninteractive websites that only provide static information or product brochures [56].

It was discovered that selling products and services has a positive effect on the development of e-commerce, as determined by the proportion of urban residents [40]. Furthermore, one of the most important drivers of online shopping was discovered to be the urbanization rate, defined as the degree of population aggregation to the city [39].



### 3. Research Methodology

Panel data analysis is used as an econometric technique to estimate how various variables would affect mobile commerce in various countries. The study utilized the General Method of Movements. All estimations are run through the EViews software. This study's regressions static panel data are presented as follows:

$$MCOM = c_1 + c_2 * WAGE + c_3 * PEN + c_4 * GDP + c_5 * CCI + c_6 * CARD + c_7 * USE + c_8 * ACC + c_9 * SEL + \varepsilon_t \quad (1)$$

where:

MCOM—m-commerce, growth over the same period of previous year (%)

WAGE—Wage per hour, growth over same period of previous year (%)

PEN—Penetration Rates of Mobile Internet, percent of population (%)

GDP—Gross domestic product, growth over same period of previous year (%)

CCI—Consumer confidence index, point growth over same period of previous year

CARD—Card Payment Transactions, growth over same period of previous year (%)

USE—Mobile users, growth over same period of previous year (%)

ACC—Internet access, percent of households (%)

SEL—Internet Use: Selling Goods or Services, percent of population (%)

$\varepsilon_t$ —error term.

### 4. Data and Results

#### 4.1. Data and Sample

The time frame under consideration ranges from 2012 to 2020. All data is collected annually. All analyzed variables are calculated as an increase over the same period the previous year, which means 9 periods. The sample includes 42 countries from all over the world, totaling 378 observations, and is divided into two subsamples: 21 developing countries (with 189 observations) and 21 developed countries (with 189 observations). The initial sample comprised more than 90 countries, but it was reduced due to a lack of data for various variables. The information comes from international databases such as Euromonitor, Statista, World Development Indicators, and Eurostat.

The main descriptive statistics of the analyzed series are presented in the Appendix A for all samples (see Table A1 for all 42 countries, Table A2 for developing countries, Table A3 for developed countries). According to the Appendix A results, the mean value of the analyzed series is positive for each of the three samples. The studied series do not follow the normal law distribution. A first argument is provided by the value of the Kurtosis coefficient (it has values greater than 3), which indicates that the distribution of the analyzed series is leptokurtic, or much sharper than the normal distribution. There are few exceptions where the value of Kurtosis is less than 3, indicating that the distribution of the analyzed series is platykurtic (in the sample with all countries, there is the variable Internet access, whereas in the sample of developing countries, there are the variables wage, penetration rate, and Internet access). The second argument is given by the value of the asymmetry coefficient (Skewness), whose value is different from zero; in most cases the distribution series exhibit asymmetry to the right (because the value of the coefficient is positive), but there are situations when distribution series exhibit left asymmetry (there are years in which the series values are lower than the average of the values of the analyzed periods), such as Internet access (in all three samples). The third argument, that the distribution series do not adhere to a normal law of distribution, is provided by the value of the Jarque-Bera test.

#### 4.2. Empirical Results

Table 1 shows that the variable wage has a positive, but insignificant effect on m-commerce in all analyzed samples. This result is surprising because the wage was expected to have a positive and significant impact; normally, an increase in wage will increase purchasing power and, consequently, m-commerce sales. These results correspond to those found in the literature review [39,61]. Some countries in the sample (Turkey, Spain,

Greece, Indonesia, Peru, and Vietnam) have experienced wage declines or inflation, which could explain why the impact is not as significant as anticipated (only nominal wages have increased, not the real wages).

**Table 1.** Empirical results.

	All Countries		Developing Countries		Developed Countries	
C	1.850583	***	1.643797	***	3.958108	***
	(0.19772)		(0.260726)		(0.569299)	
WAGE	0.00136		0.002399		0.002541	
	(0.001056)		(0.0014)		(0.001939)	
PEN	−0.00529	***	−0.00371	*	−0.00353	*
	(0.001816)		(0.003495)		(0.002095)	
GDP	0.00299	*	0.01254	*	0.00522	
	(0.007704)		(0.015339)		(0.009112)	
CCI	0.003972	**	0.003998	*	0.00028	
	(0.001966)		(0.002368)		(0.006193)	
CARD	0.00156		0.00015	*	0.0084	
	(0.003765)		(0.00496)		(0.006335)	
USE	0.0000337	*	0.000207	*	−0.00679	*
	(0.000741)		(0.000831)		(0.003577)	
ACC	0.01033	***	0.01359	***	0.03457	***
	(0.003184)		(0.004995)		(0.007561)	
SEL	0.003455		0.006119	**	0.003442	
	(0.003704)		(0.007241)		(0.004083)	

Source: Own processing in EViews. Note: \*\*\*, \*\* and \* represents significance level of 1%, 5%, respectively 10% confidence level. The Std. Error values are in parentheses.

Table 1 shows that mobile Internet penetration rate has a negative and significant impact on m-commerce in all situations. M-commerce will therefore decline as mobile Internet penetration rates rise. Initially, penetration rate was a barrier to m-commerce, but now everyone uses the Internet for various purposes (chats, social networking, entertainment, games, shopping, music, health, fitness, learning). Consequently, social media demand exceeds shopping demand. During the period of the study, many of the analyzed countries already had mobile Internet, which may explain why the penetration rate did not result in an increase in sales.

The findings point to a positive relationship between gross domestic product and m-commerce. The impact is significant for the samples representing all countries and developing countries. Furthermore, in the case of developed countries, the impact is statistically insignificant. Other studies have discovered that GDP has a positive effect [39,58,62,89].

It is possible to estimate the impact of the Consumer Confidence Index on mobile commerce, and a positive impact can be observed in the majority of cases and across all samples. The impact is statistically significant for the samples of 42 countries and developing countries. There is one instance in the sample of developed countries where the impact is insignificant. In the financial literature, there are studies that show the same positive effect of Consumer confidence index on m-commerce [29,36,41,91]. In developed countries, the effect is statistically insignificant, as consumer confidence has already been established. Furthermore, trust in developing countries must be built and strengthened by providing security, better legislation, and lower inflation.

The table also shows the impact of card payment transactions on m-commerce. In developing countries, the impact is positive and statistically significant. The impact is insignificant in developed countries and in the sample of all countries. Financial research by [12,24,33,38,58,98,99] found a positive impact of card payments as well. People in developed countries have become accustomed to using cards, and card payments have been a habit for many years, so no significant relationship has been discovered.

According to the literature review, the mobile users variable was initially an impediment. The results of the first two samples (all 42 countries and developing countries) show that mobile users have a positive and significant effect on m-commerce. Our findings are consistent with those of [39,103–106]. Because most people have two phones, an increase in the number of phone owners does not necessarily lead to an increase in m-commerce in developed countries. These phones are not used for online shopping at the same time because one is usually used for personal purposes and the other for work. As a result, it is no longer a growth factor in developed countries, and the impact of mobile users is negative.

At a 1% threshold, the findings of this study show that Internet access has a positive and significant impact on m-commerce in all three samples. Prior studies found that a lack of Internet access was a barrier to the development of m-commerce and that Internet access had a positive effect on m-commerce [22,25,39,107]. Internet access is now a part of everyday life and is used for a variety of purposes, including electronic mail, file transfer, education, e-commerce, online banking, search engines, and social networking. In addition to payments, it serves a variety of purposes.

The results indicate that the impact of selling goods and services via the Internet is positive and statistically insignificant for the samples of all 42 countries and developed countries. This insignificant impact can be explained, particularly in developed countries, by the fact that the number of people in rural areas who use the Internet and buy products online has increased in comparison to those in urban areas; throughout the pandemic crisis, they purchased more and more online. Furthermore, urbanization rate, defined as the degree of population aggregation to the city, was discovered to be one of the most important drivers of m-commerce [39]. According to [40], selling goods and services, considered as the proportion of inhabitants living in the city, was found to have a positive effect on e-commerce development.

## 5. Discussions and Policy Implications

The income disparity between developed and developing countries is one of the modern economy's concerns. As long as there are countries where people are on the verge of subsistence, neither increased shopping nor m-commerce can be discussed. In low-income countries, serious anti-poverty policies are necessary to increase income levels and, consequently, purchasing power. Furthermore, income growth is influenced by the country's level of development, so GDP growth can have both a positive and negative impact on wage growth. GDP growth is accompanied by an increase in employment and a rise in living standards, which is reflected in an increase in the population's purchases of consumer goods and services. As people's living standards rise, they will demand higher quality and more diverse goods, posing a challenge to m-commerce. Furthermore, economic development encourages the global expansion of m-commerce, and m-commerce, in turn, promotes future economic growth. Besides that, nominal income is affected by inflation, which has become a problem in many countries in recent years, with many monetary authorities still struggling to combat inflation.

The Internet has had a significant impact on the way people learn, communicate, conduct business, and go about their daily lives. The world becomes more connected as the rate of Internet penetration rises. For most people, the Internet has become a necessity, allowing them to communicate and retrieve information like never before. However, it must remain independent of government control and accessible to all users in order for them to reap the benefits it provides. Despite increasing global Internet penetration,

some countries impose restrictions. As part of the political struggle between China and the United States, websites like Wikipedia, Google, and YouTube, among others, may be blocked. By restricting access to various search engines, this could impede the ability to conduct online m-commerce transactions.

Consumer confidence has been shown to have a significant impact on the decision to make an online purchase, which has a positive effect on the growth of m-commerce. However, many individuals are hesitant to buy products online due to privacy and security concerns. Purchasing products on commercial websites, however, requires the use of a payment card. And this is frequently accompanied by a lack of trust and apprehension regarding online payment, as well as a lack of financial education. In this context, an institutionalized legislative framework would be necessary to address the problem of Internet privacy and security in general, and card payment transaction privacy and security in particular. Furthermore, an authority charged with overseeing the m-commerce space, comprised of representatives from both the public and private sectors, as well as a cryptography system, should be established to increase people's trust in online shopping.

An adequate infrastructure must be established in order to enable the capabilities necessary for successful e-commerce endeavors. A solid m-commerce infrastructure is the foundation of m-commerce growth, as it must be able to support constantly evolving and more complex transaction processes. Improving network infrastructure by increasing investment is essential if e-commerce is to continue its rapid growth.

The expansion of m-commerce will be driven by the urbanization and the widespread adoption of mobile devices. With the advent of ultrafast 4G and 5G networks, mobile commerce has entered a new, ground-breaking phase of growth. The fifth generation (5G) of mobile networks is now being deployed in many parts of the world. We call to this hope for environmental sustainability as the promise of green 5G, which is a growing, overarching, dominating expectation on the effects of 5G on the environment. As a result of its potential to reduce carbon emissions, green 5G has shifted the focus away from less environmentally friendly methods and toward those that use technology to make traffic growth sustainable by enhancing energy efficiency. Despite 5G's demonstrated superiority to 4G in terms of energy efficiency, massive rise in mobile data traffic anticipated partially due to 5G have the potential to offset efficiency gains, resulting in a total rise in network power usage. Strong connections to the ecological modernization and Promethean environmentalism discourses are reflected in this technology community's prevailing belief that traffic growth could be made sustainable through technology innovation [111]. A shift toward optimistic views about the potential for technological innovation to make development sustainable increases the urgency with which 5G must be implemented.

The rise of m-commerce has changed overall distribution patterns in middle-mile activities [112]. There is a growing need for storage and fulfillment facilities due to the proliferation of smaller distribution centers utilized by retailers at various stages of the supply chain management (SCM). There has been a shift from truckload to less than truckload (LTL) transportation as a result of fragmented logistics and distribution outings caused by individualized demand and on-time delivery, particularly within and outside urban locations. On-demand fulfillment initiatives and major supporting technologies like as smart devices, social networks, blockchain, and the Internet of Things (IoT) have made it simpler for suppliers and customers to save and retrieve change orders and interact with one another [113]. Innovative retailing practices have evolved from multi-channel to omni-channel integration with the help of these digital technologies.

Most nations are currently undergoing a digitalization process, which is increasing their everyday energy use. As a result, regulating energy usage and delivering massive amounts of electricity present significant difficulties for power networks. Emission of carbon dioxide has been studied extensively because of its importance to the planet's eco-system [114]. Business leaders may reduce their companies' carbon footprint, satisfy environmentally-aware consumers, reduce energy costs, and boost revenue by manufacturing eco-friendly goods.

When dealing with unpredictability, such as that which exists in supply chain management, radio-frequency identification (RFID) technology may be utilized to boost the profits of all participants in the chain. When it comes to deployment, scientists look into the best possible distance between readers while still using an appropriate amount of readers for the most prevalent warehouse geometries [115]. Profitability for the manufacturer could be improved through the use of radio-frequency identification systems by implementing revenue sharing and maintaining the appropriate distance between readers and optimizing energy consumption and costs.

Production industries are making concerted efforts to drastically cut carbon emissions in response to global warming's devastating impact on the environment. Growing public awareness of the negative effects of business operations on the environment prompt a surge in global impact investing, in which investors join in funds or initiatives that tackle environmental or social problems while also making a profit [116]. Nonrenewable energy and technical developments largely contribute to environmental deterioration, whereas globalization and green investment significantly reduce it over time. Environmental stress is also mitigated by the synergistic effect of green investment and globalization. In a similar manner, a country's emission level is significantly lowered by the moderating effect of technological innovation and globalization. In this context, "green investment" refers to government spending on renewable energy sources. When it comes to reducing environmental damage, conserving energy resources, fostering economic expansion, and decreasing carbon emissions, few strategies compare to green investment and technological innovation. Carbon reduction owing to green investment and customer happiness yields a substantial profit margin, according to researchers [117].

## 6. Conclusions

This study investigated the factors that have contributed to the remarkable expansion of m-commerce. Eight variables were analyzed as socioeconomic (Internet access, mobile users, mobile Internet penetration rates, card payment transactions, consumer confidence, Internet use: selling products and services) and macroeconomic (GDP and wage) factors that may affect the global expansion of m-commerce. The generalized method of moments (DPD/GMM) was used to examine annual data from 2011 to 2020. The sample includes 42 developed and developing countries from all over the world. Results from our empirical research show that wages, GDP, consumer confidence index, card payment transactions, mobile users, Internet access and Internet use (selling goods and services) have a positive impact on m-commerce in all three subsamples. However, there is an exception regarding the mobile users variable, which has a negative impact in developed countries. Furthermore, the mobile Internet penetration rate has a negative impact for all subsamples. Our study contributes to the existing literature on these topics from the customer's perspective by utilizing a large and representative panel data collection on socioeconomic and macroeconomic variables. According to the literature review process, studies that consider macroeconomic variables are rarely acknowledged; thus, the authors' consideration of the eight indicators selected distinguishes this research. Furthermore, the study looks to be one of the few that investigates the factors that influence m-commerce.

This study contributes significantly to both theory and practice as a result of its investigation of the factors that contributed to the growth of m-commerce over the course of the past decade. From a theoretical perspective, our contribution entails investigating under-researched aspects that drive m-commerce, such as Internet use: selling goods and services. This article's originality is derived from the inclusion of mobile Internet penetration rate as a potential determinant of m-commerce in the research conducted. This study adds to the body of literature on endogenous growth theory, which, from the point of view of business-to-consumer (B2C) m-commerce growth, asserts that a country's primary growth drivers are domestic. From a practical standpoint, policy recommendations were presented, proposing efficient and acceptable steps to develop the m-commerce sector.



Even though the research is conducted in 42 countries, we propose expanding the sample and analyzing a broader time span that includes the 2007 global financial crisis and the pandemic crisis. In the regression, these two factors will be introduced using dummy variables. A rise in m-commerce is anticipated as a result of the pandemic crisis, as many people were confined to their homes and made purchases using computers and mobile devices. Since we intend to increase the sample size of countries, we wish to include both fixed and random effects. We would like to add new variables, such as the size of the domestic market, cultural factors, and digital skills among the active population, which may have a significant effect on the evolution of m-commerce. It is anticipated that the social and macroeconomic condition of a country, as well as the level of Internet and mobile phone access, will have a significant impact on the growth of the m-commerce market in urban areas. Additionally, its growth is believed to affect the country's environment. To analyze the impact on the environment, we propose adding new variables, such as the mean population exposure to micrograms per cubic meter [40], carbon dioxide from storage and transport, and the proportion of the population exposed to more than 10 micrograms per cubic meter.

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## Appendix A

**Table A1.** Descriptive analyses of 42 countries.

<i>All Countries</i>	MCOM	WAGE	PEN	GDP	CCI	PFC	CARD	USE	ACC	SEL
Mean	0.782132	22.43363	76.95103	5.594523	3.954034	4.936892	12.77714	24.10565	70.85272	17.52284
Median	0.538399	2.791747	78.22481	4.646656	0.366667	3.790241	9.505952	9.532020	77.14579	13.01372
Maximum	8.142857	146.4340	207.4051	50.79930	125.0000	46.55843	99.43500	935.5714	99.70863	76.71424
Minimum	0.078097	−12.41300	1.779044	−8.372776	−49.20000	−10.33345	−22.32679	−33.80455	9.500000	0.147464
Std. Dev.	0.900690	41.49314	36.77922	6.584559	22.58509	6.836188	13.93772	62.91505	22.09863	14.95582
Skewness	4.502526	1.774310	0.385714	2.687615	3.074003	2.278646	1.882397	9.567178	−0.856369	1.726154
Kurtosis	29.30437	4.392773	3.514692	15.15557	14.54995	12.88402	9.375890	124.7587	2.772498	6.470781
Jarque-Bera	12,174.92	228.8872	13.54516	2782.252	2696.388	1865.787	863.5040	239,263.1	47.01730	377.4448
Probability	0.000000	0.000000	0.001145	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	378	378	378	378	378	378	378	378	378	378

Source: Own processing in EViews.

**Table A2.** Descriptive analyses of developing countries.

<i>Developing Countries</i>	MCOM	WAGE	PEN	GDP	CCI	PFC	CARD	USE	ACC	SEL
Mean	0.901099	34.69508	63.43489	6.856649	7.380264	6.115862	15.37895	36.45214	58.10038	12.81871
Median	0.635987	6.716360	61.82578	6.331844	0.033333	6.038337	11.85418	13.33870	59.70000	9.730181
Maximum	7.431018	146.4340	153.7587	29.76588	125.0000	28.97549	99.43500	935.5714	99.70863	66.23478
Minimum	0.098468	−12.41300	1.779044	−6.820871	−49.20000	−8.178667	−22.32679	−19.67416	9.500000	0.147464
Std. Dev.	0.974576	48.38113	33.56429	5.008613	30.32262	5.452626	15.70786	85.73375	23.10866	12.54440
Skewness	3.667652	0.970287	0.111793	1.100232	2.257708	0.638605	1.587563	7.152079	−0.105496	2.414943
Kurtosis	19.94881	2.076196	2.271986	6.864577	7.844995	4.836682	8.220825	68.47540	2.039554	9.707498
Jarque-Bera	2685.918	36.37650	4.567463	155.7439	345.4207	39.41176	294.0402	35,371.64	7.614921	538.0069
Probability	0.000000	0.000000	0.101903	0.000000	0.000000	0.000000	0.000000	0.000000	0.022204	0.000000
Observations	189	189	189	189	189	189	189	189	189	189

Source: Own processing in EViews.

**Table A3.** Descriptive analyses of developed countries.

<i>Developed Countries</i>	MCOM	WAGE	PEN	GDP	CCI	PFC	CARD	USE	ACC	SEL
Mean	0.663166	10.17219	90.46717	4.332396	0.527804	3.757922	10.17534	11.75916	83.60506	22.22697
Median	0.460846	2.197725	86.14945	3.265823	1.033333	2.767947	7.314916	6.566035	85.34979	20.30119
Maximum	8.142857	142.0000	207.4051	50.79930	27.40000	46.55843	73.23150	113.6553	98.00000	76.71424
Minimum	0.078097	−5.396264	16.13209	−8.372776	−36.03333	−10.33345	−10.32603	−33.80455	45.00000	2.000000
Std. Dev.	0.805323	28.45171	34.91046	7.658614	8.934289	7.822382	11.36686	16.75985	10.87714	15.70630
Skewness	5.941726	3.827803	0.718228	3.405659	−0.686231	3.070740	2.152487	3.109414	−1.017915	1.436015
Kurtosis	48.74937	16.53381	4.018220	17.20652	5.778690	15.48976	9.839809	16.48669	3.922819	5.596774
Jarque-Bera	17,594.50	1903.958	24.41391	1954.727	75.63760	1525.481	514.3618	1736.947	39.34505	118.0603
Probability	0.000000	0.000000	0.000005	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	189	189	189	189	189	189	189	189	189	189

Source: Own processing in EViews.

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