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# FACTORS AFFECTING E-COMMERCE TRANSACTION VOLUME BASED ON A MULTIPLE REGRESSION MODEL (CASE OF TURKEY)

Kurtuluş MERDAN[1]

## Abstract

The widespread use of the internet in the 21st century, thanks to the developments in information technologies, has affected not only daily life but also economic activities. With the spread of the internet, business owners have turned to internet marketing system instead of traditional marketing. Additionally, purchase and sale transactions have been moved from the real world to the virtual world, and the increase in the number of users in the electronic environment has made the sales process popular for businesses and the purchasing process for consumers. This study discusses the development process of e-commerce and the factors affecting e-commerce with a time series analysis. In this context, first, the historical development of e-commerce and then the situation of e-commerce in Turkey and in the world are presented using numerical data. Lastly, the factors affecting e-commerce are discussed. The scientific dimension of the study was created by bringing together the findings obtained from domestic and foreign literature. In this study, factors such as Per Capita Gross Domestic Product (PCGDP), the number of internet users, social media prevalence, inflation, and the Covid-19 pandemic, which may affect the e-commerce transaction volume in Turkey, were put forward for the years 2010-2021. By creating a multiple linear regression model in which these factors are independent variables, the degree of effectiveness of the factors affecting the e-commerce volume has been presented and interpreted. This study aims to fill the gap in the literature and guide future research on similar issues.

**Keywords:** E-commerce, Turkey, Traditional Commerce, Consumer, Entrepreneurship

**JEL Codes:** B21, C01

# ÇOKLU REGRESYON MODELİNE GÖRE E-TİCARET İŞLEM HACMİNİ ETKİLEYEN FAKTÖRLER (TÜRKİYE ÖRNEĞİ)

## Öz

21. yüzyılda bilgi teknolojilerinde yaşanan gelişmelere bağlı olarak internetin yaygınlaşması sadece günlük hayatı değil aynı zamanda ekonomik faaliyetleri de etkilemiştir. İnternet kullanımının yaygınlaşması, işletme sahiplerini geleneksel pazarlama yerine internet yoluyla pazarlama sistemine yöneltmiştir. Bununla birlikte alım ve satım işlemleri gerçek dünyadan sanal dünyaya taşınmış, elektronik ortamda kullanıcı sayısının artmasıyla birlikte işletmeler açısından satış işlemi, tüketiciler açısından ise alış işlemi popüler hale gelmiştir. Bu çalışmada e-ticaretin gelişim süreci ve e-ticarete etki eden faktörler bir zaman serisi analizi ile ele alınmıştır. Bu kapsamda ilk olarak e-ticaretin tarihsel gelişimi, ardından e-ticaretin Türkiye'de ve dünyadaki durumu sayısal verilerle ortaya konulmuştur. Son olarak da e-ticareti etkileyen faktörlere yer verilmiştir. Çalışmanın bilimsel boyutu yerli ve yabancı alan yazınından elde edilen bulgular bir araya getirilerek oluşturulmuştur. Bu çalışmayla; 2010-2021 yılları arası Türkiye'de e-ticaret işlem hacmini etkileyeceği düşünülen, Kişi Başı Gayri Safi Yurtiçi Hasıla (KBGSYH), internet kullanıcı sayısı, sosyal medya yaygınlığı, enflasyon ve Covid-19 pandemi süreci gibi faktörler ortaya konulmuştur. Bu faktörlerin bağımsız değişken olarak tanımlandığı çoklu doğrusal regresyon modeli oluşturulmuş ve sonuçlar e-ticaret hacmini etkileyen faktörlerin etkinlik dereceleri ortaya konularak yorumlanmıştır. Bu çalışmayla alan yazınında eksik olan boşluğu doldurmak ve gelecekte benzer konularda çalışma yapmayı düşünen araştırmacılara yol gösterici olmak amaçlanmaktadır.

**Anahtar Kelimeler:** E-ticaret, Türkiye, Geleneksel Ticaret, Tüketici, Girişimcilik

**JEL Kodları:** B21, C01

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## INTRODUCTION

The rapid technological transformation has brought innovation and change into many fields. The biggest innovation in the commercial field has been the e-commerce industry. As the internet, which is a wide communication network, became a business environment, shopping has become an activity that can be done from anywhere. The increase in the mobile phone usage along with the increase in the internet usage rate, has enabled the consumers to reach the manufacturers 24 hours a day, 7 days a week. The way of doing business based on a face-to-face registration system between economic units in traditional commerce has been moved to digital platforms thanks to social networks, internet portals and other online-based programs. Since the mid-1990s, companies have been able to do business with a limited budget, due to the development of the internet and mobile technologies and the radical transformations in the world of digital technology on a global scale (Elibol and Kesici, 2004, p. 304). With the 2000s, e-commerce became a key factor where technological developments that facilitate the flow of information are gradually accelerating. With globalization and liberalization in trade, e-commerce has assumed a structure that can connect with all countries in the world. The intensive use of the internet in telephone, computer, electronic data exchange and transfer systems has further accelerated the development of e-commerce. Technological developments and the worldwide spread of the internet have led businesses to set up websites for processes such as the sale of goods and products, advertising, and product promotion. This enabled consumers to easily purchase any product they like over the internet at any time of the day (Merdan, 2021, p. 27).

The increasing interest in e-commerce on the global platform enables the development of new business lines. While e-commerce causes a decrease in jobs with low qualification and skill level, it further increases the need for a highly skilled and qualified workforce in the globalizing economy. The global nature of e-commerce accelerates the integration process of world economies, allows individual manufacturers to enter world markets and enables consumers to have information about the products offered to the market, regardless of location and time. This creates an opportunity for growth in product range and to have the best quality products in the market at the most affordable price. Therefore, e-commerce increases the product quality as well as the options. The competition among businesses operating in various branches of industry in the global conjuncture requires utilizing the power of the internet (Merdan, 2021, p. 27-28).

E-commerce has many advantages for both producers and consumers. The advantages of e-commerce include increasing business income, reducing costs, improving brand image and customer loyalty, providing accurate and easy access to information, improving customer relations, saving time, reducing transaction costs, offering 24/7 shopping opportunities, encouraging competition, and increasing employment. Besides

its advantages, e-commerce also has disadvantages. Among these are security concerns, issues that stem from low connection speed and infrastructure deficiencies on a corporate basis (Arıcı, 2000, p. 12; Kalaycı, 2008, p. 142).

The spread of e-commerce to large masses also brings dynamism to global trade. E-commerce is a huge time saver for companies that supply products and make purchases. For instance, transactions such as collecting information, price research, stock control, ordering, request approval, waybill issuance, delivery confirmation, and payment options are all carried out quickly (Yılmaz and Bayram, 2020, p. 39). Moreover, the branding process in e-commerce is also very short, having been reduced to nearly 2 years. This has enabled businesses engaged in e-commerce activities to grow in a short time. Internet usage rate, alternative payment options, population size, and advanced logistics support systems have had significant effects on the rapid development of e-commerce. Additionally, the easy adaptation of the young population to new technologies, logistics services, and the banking sector have all accelerated this process (Demirdöğmez, Gültekin and Taş, 2015, p. 2218).

Interest in e-commerce has increased considerably in recent years, making e-commerce an integral part of commercial life. This study will first discuss the conceptual framework of e-commerce, then compare e-commerce with traditional commerce, present the current state of e-commerce in Turkey and the world, and finally, try to present and interpret the effectiveness of the factors affecting e-commerce.

## E-COMMERCE: CONCEPTUAL FRAMEWORK AND HISTORICAL DEVELOPMENT

Dating back to the 1980s, e-commerce started its activities with catalog sales made through telephone and television. The use of the internet in e-commerce started in the mid-1990s. During this period, e-commerce further accelerated the development of the internet. At that point, e-mail and web applications had the greatest impact. The use of the internet to sell commercial products was initially limited to a number of trials. But over time, examples such as Amazon, Yahoo, Suning, Dixons quickly became giant companies selling products over the internet. Trials and risks taken have further fueled the competition between those companies and their global counterparts. Commercial activities on the internet have shown constant development and the world has become a global e-commerce center (Erbaşlar and Dokur, 2016, p. 3).

The rapid development of the internet and the unlimited markets it offers have made e-commerce even more prevalent (Küçükgörkey, 2002, p. 3). The development of e-commerce has moved along parallel to the development of the internet, and the internet has been regarded as an integral part of e-commerce. The concept of e-commerce is used synonymously with concepts such as e-market and e-business, and covers transactions such as buying, selling, and bartering of goods and services through computers and

computer networks (Turban, Lee, King and Chung, 2000, p. 4). E-commerce is the subject of research in many disciplines such as law, marketing, computers, finance, economics, and management.

The concept of e-commerce, which has been rapidly growing as a new area of debate today, is defined in various ways due to its versatility. While OECD defines e-commerce as the conduct of commercial activities concerning individuals and organizations over computer networks, Japan Electronic Commerce working group (ECOM) defines e-commerce in a broader context as the conduct of all commercial activities related to the design, promotion, and development of products over computer networks. The United Nations, on the other hand, defines e-commerce as all information used in the fulfillment of management and production activities between producers, consumers and service providers through electronic means (Öztürk and Başar, 2002, p. 16-17). Yet another definition interprets e-commerce as a product of technological developments that facilitate information processing and communication (İnce, 1999, p. 4; Elibol and Kesici, 2004, p. 308). In addition to commercial transactions made over the internet, e-commerce also includes transactions made with private electronic shopping systems (Bozkurt, 1999). In a more general framework e-commerce can be described as the process of processing, storing and transmitting data, digitized via certain systems, on electronic platforms. The e-commerce operation process includes customers collecting information, doing research, ordering goods and services, the delivery of goods to the customer, the processing of payment, and after-sales support services. E-commerce includes all activities such as training, advertising, promotion, etc., that not only change business processes but also affect and support all commercial transactions. This definition shows that a very large group of people is a party in e-commerce (Coşkun, 2004, p. 245). E-commerce is founded on customer satisfaction-based, solution-oriented, comprehensive, competitive, technical, and legal infrastructures (Özsağır and Civelek 2019, p. 2). In addition to these definitions, there are two basic types of e-commerce; the first is from business-to-consumer (B2C), where consumers buy goods and services from producers, and the second is from business-to-business (B2B), where producers buy and sell among themselves. This allows businesses to increase productivity, fast communication, and job security through process automation (Shim, Pendyala, Sundaram and Gao, 2000, p. 40).

## COMPARATIVE OVERVIEW OF E-COMMERCE

In the past, all commercial activities were carried out through traditional trading, also known as classical trade methods. This process has caused loss of time, issues around and security and communication. Along with the development of the internet, these problems have brought up the concept of electronic commerce. With the rapid spread of electronic commerce, traditional commerce has begun to lose momentum. E-commerce has produced numerous innovations in traditional commerce. In that respect,

e-commerce has many characteristics that sets it apart from traditional commerce. Table 1 presents a comparison between e-commerce and traditional commerce according to certain variables. Magazines, catalogs, and advertisements are required for the collection of information in traditional commerce, whereas in e-commerce it is possible to access that information via websites. While transactions are carried out through banks in traditional commerce, they are carried out over the internet in e-commerce. Payments are made through banks in traditional commerce and via internet banking in e-commerce. Fewer sales personnel are needed in e-commerce, and price research is done online. In traditional commerce, on the other hand, there is a bigger need for sales personnel, and price research is carried out in writing (Table 1).

**Table 1:** Comparison of e-commerce and traditional commerce

| Variables | E-Commerce | Traditional Commerce |
|---|---|---|
| Shopping | Quicker | Time-consuming |
| Collecting information | Through websites | Through magazines or ads, and in person |
| Price research | Online | In writing |
| Payment | Via online banking | Via banks/with cash |
| Sales Personnel | Fewer | More |

**Source:** Siliafis, 2007; Rigby, 2011; Ionita, 2017

Ionita (2017) and Rigby (2011) compared the advantages of e-commerce and traditional commerce. They listed the advantages of e-commerce as rich product information, customer reviews and tips, editorial content and recommendations, social contact and two-way dialogue, wide range of alternatives, easy and fast payment, price comparison and special discounts, and access from anywhere and at any time. They listed the advantages of traditional commerce, namely physical stores and shops, as having the opportunity to try and test products, personal assistance from salespeople, easy returns, easy access to products, ease of assembly and repair, instant satisfaction of all senses, and regulated varieties. In another study, Siliafis (2007) emphasized the difference between e-commerce and traditional commerce, primarily due to the fact that e-commerce takes place entirely on online platforms. Another difference noted by the same study was the lack of face-to-face communication between the buyer and the seller in e-commerce and the absence of geographical borders (Siliafis, 2007, p. 143; Gedik, 2021, p. 185).

The increase in internet usage in parallel with technological developments accelerates the spread of e-commerce. This provides companies with many benefits. While processes such as collecting information, demand research, invoicing, stock control, ordering, and payment take up a significant amount of time in

traditional commerce, companies can now carry out these transactions quickly, thanks to e-commerce. With e-commerce, companies have the opportunity to respond to the changing demands of customers in a short time. E-commerce offers business employees the opportunity to form working groups on electronic platforms regardless of their location (Elektronik Ticaretin Etkileri ve Faydaları, n.d.). E-commerce activity increases the competition between companies and reduces the overall cost level. The decrease in costs reflects positively on product and service prices.

For the consumer, online shopping saves time and provides a shopping environment away from the pressure of sales personnel. Consumers can access all kinds of information about products at any time of the day, regardless of location, and can compare different products, and in this way, e-commerce offers the opportunity to place orders via online shopping (Güven, 2020, p. 265).

## OVERVIEW OF E-COMMERCE STATISTICS IN THE WORLD AND IN TURKEY

The world population has increased by 1.1% annually since 2000, while the number of internet users has increased by approximately 13.2% each year. By 2022, the world population has reached 7 billion 924 million. Statistical data show that 3.4 billion of the world's population uses the internet, which corresponds to about half of the world's population (46%). Users aged 16-64 around the world spend an average of 6 hours and 54 minutes on the internet. The increase in internet usage time is also reflected in e-commerce sales. The e-commerce volume, which grew by 18% annually worldwide, exceeded expectations with Covid-19 and reached record levels (Mukaddes, 2022).

**Table 2:** Top 10 countries by 2018-2019 retail e-commerce sales worldwide ($ billion) of e-commerce and traditional commerce

| Countries | 2018 | 2019 | % Change |
|---|---|---|---|
| China | 1,520.10 | 1,1934.78 | 27.3 |
| USA | 514.84 | 586.92 | 14 |
| England | 127.98 | 141.93 | 10.9 |
| Japan | 110.96 | 115.40 | 4 |
| South Korea | 87.60 | 103.48 | 18.1 |
| Germany | 75.93 | 81.85 | 7.8 |
| France | 62.27 | 69.43 | 11.5 |
| Canada | 41.12 | 49.80 | 21.1 |
| India | 34.91 | 46.05 | 31.9 |
| Russia | 22.68 | 26.92 | 18.7 |

**Source:** Lipsman, 2019

China ranked first among the world countries in retail e-commerce sales. China increased its e-commerce sales from 1.520.10 billion dollars in 2018 to 1.1934.78 billion dollars in 2019. The USA ranked second with an increase of 14% compared to 2018. The USA increased its e-commerce sales from 514.84 billion dollars in 2018 to 586.92 billion dollars in 2019. The third ranking country is England, which showed an increase of 10.9%. E-commerce sales, which were 127.98 billion dollars in 2018, increased to 141.93 billion dollars. After England, the countries with the highest e-commerce sales were Japan, South Korea, Germany, France, Canada, India, and Russia, respectively (Table 1).

E-commerce statistics indicate that there are 3.5 billion media users worldwide and 2.8 billion people shop online. 68.5% of the world's population aged 15 and over has a bank account, and approximately 52% of this population uses digital payment methods. About 73% of the UK population, 70% of the German population, 65% of the US population, 59% of the Japanese population, 49% of the Turkish population, and 46% of the Chinese population shop online (2022 Yılı E-ticaret Verileri ve İstatistikleri, 2022). In 2020, 44.5% of e-commerce payments worldwide were made with a digital wallet. In 2024, payments to be made with digital wallets are expected to be around 51.7% (Deloitte, 2022).

In Turkey, the e-commerce sector started in the 1990s with the establishment of e-commerce sites, and saw rapid transformation with the launch of marketplaces in the early 2000s and the spread of private shopping sites after 2006. Due to the increase in consumer demands, the transaction volume reached through private shopping sites has grown in areas such as people, technology, and customer experience.

Table 3 shows the prominent companies in e-commerce in Turkey and their e-commerce starting dates. Amway was the first company established on the basis of e-commerce activities. It was later followed by many other companies and this process continued as their numbers increased (Table 3). Popular websites such as sahibinden.com, gitgidiyor.com, Trendyol, N11, and Hepsiburada.com have had a significant impact on the remarkable development of e-commerce in Turkey. The development of telephone technologies, financial and logistical advances, the perception of affordable prices, time constraints, and change in consumers' lifestyles have further fueled the interest in e-commerce.

**Table 3:** Prominent companies in e-commerce in Turkey and their e-commerce start dates

| Company Name | E-Commerce Start Date |
|---|---|
| Amway | 1994 |
| Migros Sanal Market | 1997 |
| Hepsiburada.com | 1998 |
| Sahibinden.com | 1998 |
| Gittigidiyor.com | 2001 |
| Yemek Sepeti | 2001 |
| Ets Tur | 2003 |
| Limango | 2007 |
| Markafoni | 2008 |
| Trendyol | 2010 |
| Grupanya | 2010 |
| N11 | 2013 |
| Getir.com | 2015 |
| Letgo | 2016 |

**Source:** Ertemel and Çelik, 2016

The volume of the online retail market alone in Turkey reached 10.4 billion TL in 2018. In 2018, the retail market volume increased by approximately 3 billion TL compared to the previous year. This category was followed by multi-channel online retail (4.8 billion TL) and specialized internet shopping sites (4.4 billion TL) (Sabanoğlu, 2020). The e-commerce report published by TÜSİAD and Deloitte in 2019 supports these developments. The report showed the potential power of internet/mobile services and indirect and direct investments in the e-commerce ecosystem in Turkey. By 2020, the e-commerce ecosystem in Turkey experienced a rapid change, and in the same year, Turkey managed to rank 23rd among 94 countries in e-commerce expenditure per capita (T.C. Ticaret Bakanlığı, 2023).

The e-commerce volume in Turkey has been on a constantly increasing trend over the years, except for 2013. Findings summarized in Table 4 show that the e-commerce volume has increased continuously, especially from 2016 to 2021. The greatest increase occurred between 2020 and 2021 (Table 4).

**Table 4:** 2010-2021 E-commerce volume in Turkey and annual increase rates

| Years | E-Commerce Volume | Annual Increase Rates (%) |
|---|---|---|
| 2010 | 15.2 Billion TL | 39 |
| 2011 | 22.8 Billion TL | 36 |
| 2012 | 30.6 Billion TL | 35.3 |
| 2013 | 14 Billion TL | - |
| 2014 | 18.9 Billion TL | 35 |
| 2015 | 24.7 Billion TL | 31 |
| 2016 | 30.8 Billion TL | 24 |
| 2017 | 42.2 Billion TL | 37 |
| 2018 | 59.9 Billion TL | 42 |
| 2019 | 136 Billion TL | 39 |
| 2020 | 226 Billion TL | 66 |
| 2021 | 381.5 Billion TL | 69 |

**Source:** Demirdöğmez et al., 2018; Mukaddes, 2022

E-commerce expenditures have increased with the Covid-19 pandemic, which has affected Turkey since March 11, 2020. The increase in Covid-19 cases has led to the implementation of curfews. Due to the risk of transmission of the virus, people avoided physical contact, and their motivation to spend time indoors decreased. Those difficulties have caused consumers to change their habits of going to the grocery stores, and there was a significant increase in consumers' demand for e-commerce. At the end of 2021, the e-commerce volume in Turkey increased by 69% compared to the same period of the previous year. In the same period, e-commerce volume reached 381.5 billion TL. The order amount, which was 2 billion 297 million units in 2020, increased to 3 billion 347 million units in 2021, corresponding to an increase of 46% compared to the previous year. In 2021, the retail e-commerce volume reached 234 billion TL. The ratio of e-commerce to general commerce was 17.7% in 2021. The number of businesses operating under the name of e-commerce reached 484,347 in 2021. The number of mobile contactless payment transactions, which was 10 million 281 thousand in 2020, reached 18 million 700 thousand at the end of 2021 with the effect of the Covid-19 pandemic (T.C. Ticaret Bakanlığı, 2023).

## DOMESTIC AND FOREIGN LITERATURE ON E-COMMERCE

Related developments in e-commerce have mobilized many local, national, and international organizations. The development of e-commerce has necessitated many studies on this subject. Accordingly, the study will first touch on domestic literature. The first domestic study on this subject was carried out by Çeştepe in 2003. This study has brought a different perspective to e-commerce from an economic aspect. The study drew attention to the need to establish legal regulations against the possibility of e-commerce harming the Turkish economy in the future. The second study was carried out by Coşkun in 2004. Based on the findings of previous similar studies and the data of some countries in the world, Coşkun suggested that investments in information technologies would positively affect e-commerce. The third study was carried out by Kalaycı (2004). This study suggested that e-commerce would reduce research and development costs, accelerate corporate processes, and increase productivity in businesses. Another study found that the barriers to e-commerce for SMEs stem from investment uncertainty and technological adaptation levels of businesses. Another study on the tourism sector was carried out by Tutar, Kocabay, and Kılınç in 2007. The study determined that the e-commerce usage rates of the hotels are in parallel with their star ratings. In 2010, Türkmen and Songür studied the reasons for the low use of e-commerce in the axis of SMEs. Turkmen and Songür attributed the low internet usage to the lack of technical infrastructure, lack of education, and barriers to the use of e-commerce. The factors regulating e-commerce in Turkey were presented by Özdemir, Törenli, and Kıyan (2010). In their study, they revealed that the legislation related to e-commerce is insufficient. Despite the high rate of internet usage determined in the study, the interest in e-commerce was found to be quite low. They concluded that the legal regulations regulating e-commerce should be brought up to the standards of the European Union. In another study carried out by Yelkikalan, Kavaklıoğlu and Altın in 2011, the features that should be strong in the websites of businesses engaged in e-commerce activities were determined as payment, security, order, delivery, business concept and website interface. Again in 2011, Türen, Gökmen and Tokmak (2011) proposed a model on the factors affecting e-commerce volume. They determined that the increase in the number of internet users, the formulation of legal regulations and the increase in the purchasing power of the people positively affect e-commerce volume. In addition to their studies on SMEs in 2010, Coşgun and Döğerlioğlu (2012) conducted a similar study and discussed the success factors affecting the e-commerce activities of SMEs. In the study, they collected data using questionnaires and developed a model based on previous studies. They performed regression analysis on the data collected with questionnaires. Results revealed that financial resources, perceived benefits and content were among the factors affecting the e-commerce success of SMEs. Kayahan (2016) investigated the factors that increase the development of e-commerce. The first part of the study explained the current situation of e-commerce with the data obtained from Turkey and the world. The application part of the study

was analyzed with the help of an econometric model. The study revealed that GDP, consumer confidence index, fixed broadband penetration rate, number of credit and debit cards, and inflation rate were effective on e-commerce volume in Turkey. Turkey-based VAR analysis of the factors affecting the e-commerce volume was written by Kayahan and Hepektan (2016). In this work, how electronic trade came out, examining of the improving process and the factors that accelerate the improving of electronic trade are examined. In the study, it is understood that broad fixed band internet penetration rate, GDP, consumer confidence index, number of credit and debit cards and inflation rate are effective on electronic commerce volume in Turkey. In Turkish literature, Özekenci (2017) revealed the factors affecting e- commerce in Turkey and European countries using the "Panel" data model. Macro data from 2004 to 2015 were used to analyze the model. Inflation, education level in employment, number of internet users and PCGDP were found to have positive effects on e-commerce. Karabaş (2018) wrote in a domestic study to determine the attitudes and impression levels of university students towards e-commerce. For this purpose, the data obtained from 422 students from Çankırı Karatekin University were tested using an easy sampling method. According to the results of the correlation analysis, the presence of a relationship between the attitude and the level of interest, the level of faith in the benefit and the level of interest, and the presence of a relationship between the attitude and the level of faith in the benefit were determined. Another study on the factors affecting the development of e-commerce in Turkey was carried out by Özsağır (2019). The study stated that the widespread and comfortable use of the internet affects e-commerce positively and that e-commerce sites should meet human needs as soon as possible, have a strong infrastructure and be legally reliable. Another study on the factors affecting e-commerce was carried out by İlter (2020). That study discussed the factors affecting e-commerce on the axis of Turkey, and used the Turkey Regional Development Survey as a data set. The logit analysis of the factors affecting e-commerce in Turkey determined the variables of firm size, having a website, being an exporter, and being innovative as the factors affecting e-commerce the most. To the best of our knowledge, there is no study in the domestic literature that considers legal factors in determining the e-commerce volume. Another study to determine the factors affecting the use of e-commerce was carried out by Alkan and Ünver (2021) in the Eastern Region of Turkey. In the study, binary logistic regression analysis was used to determine the factors associated with individuals' e-commerce use. At the end of the study, the variables of demographic factors, income level, use of social media, searching for information about goods and services on the Internet, selling goods or services on the Internet, the number of information equipment in the household, the size of the household, internet banking and e-government use were determined by the use of e-commerce. found to be related. The last domestic study was carried out by Ünver and Alkan (2022). In the study, socio-demographic and economic factors that are effective in individuals having problems in their online purchases are discussed. As a result of the research, it has been discovered that education level, income level, age, gender, profession, family size, financial

transactions conducted over the Internet, and regional characteristics are all linked to experiencing problems with online shopping.

The first study in the foreign literature was carried out by Tan and Ouyang (2002), on the axis of China. That study examined the global and national factors affecting e-commerce, and discussed the effects of internet, national income, telecommunication infrastructure and communication infrastructure on e-commerce. The study concluded that e-commerce in China is still in its infancy and developing rapidly. The second study in the literature, by Wong in 2003, evaluated the factors affecting e-commerce on the axis of Singapore. The study mentioned that the manpower trained in the field of information technologies, the adequacy of the law and legislation, the existence of official institutions and the e-commerce incentives of the state affect e-commerce. In the third study, Quaddus and Achjari (2005) conducted a literature review to determine the factors affecting e-commerce. The findings obtained through surveys from large companies in Australia constituted the scientific dimension of the study. The study concluded that increasing internal and external benefits have an impact on the success of e-commerce, but reducing internal and external barriers have no significant effect on the success of e-commerce. Another study was conducted by Hsu, Kraemer and Dunkle (2006) in the USA. Using a model created with the data from 294 companies, they determined the factors that cause changes in the use of e-commerce among US companies. Their analysis of the e-business volume revealed government pressure as the strongest link and government incentives as the weakest. In 2006, Weixin discussed the factors affecting e-commerce, and emphasized the importance of investment in information technologies and the level of e-commerce readiness among consumers. Gibbs and Kreamer (2010) examined factors such as technology resources, firm size, business compatibility, perceived benefits, external pressure, and financial resources that affect e-commerce. The factors affecting e-commerce were tested with the least squares method and technology was determined as the most significant source. In addition to technology, perceived benefits, regulatory barriers, external pressure, financial resources and government promotions were also found significant. In the foreign literature, Ghobakhloo, Aranda and Amado (2011) discussed the factors affecting the decision to switch to e-commerce in the context of technology, organization, and environment. The data obtained through a questionnaire from 235 company owners in Iran were subjected to logistic regression analysis. Their findings revealed that variables such as perceived relative advantage, knowledge density, CEO innovativeness, perceived compliance, and buyer/supplier pressure affect the e-commerce adaptation of SMEs. Sila (2013) analyzed the factors that may affect e-commerce with multiple regression and ANOVA tests. They determined that, of the 9 factors found to affect e-commerce, almost all variables, except the firm's country of origin, affect e-commerce adoption. The last study in the foreign literature was carried out by Rahayu and Day (2015). It is similar to the study conducted by Ghobakhloo, Aranda and Amado (2011).

This study chose the technology-organization-environment triangle as the variable, and determined the factors affecting the adoption of e-commerce in developing countries. The study revealed that technology adaptation, innovative characteristics of company owners, perceived benefits, information technology experience and capabilities have significant effects on e-commerce adoption.

## FACTORS THAT MAY AFFECT E-COMMERCE VOLUME

The factors affecting e-commerce volume differ from country to country, and many different factors can affect e-commerce. E-commerce volume may be directly affected by the Per Capita Gross Domestic Product (PCGDP), the number of internet users, and the prevalence of social media. Moreover, inflation and the Covid-19 pandemic period could also affect e-commerce transaction volume.

### Per Capita Gross Domestic Product (PCGDP)

The sum of the monetary value of the completed goods and services produced by the resident production units in a country within a certain period of time is called Gross Domestic Product (Yaylalı, Oktay and Akan, 2010, p. 312). PCGDP is the primary indicator of economic performance and is generally used to determine the average living standards of societies and to measure the level of economic welfare (OECD, 2009, p. 20). In the framework of a production function, changes in both the input levels consisting of labor and capital, and the productivity of these inputs shape the development of an economy (Karahan, 2017, p. 66).

**Table 5:** Amount of per capita gross domestic product in Turkey by years (at current prices)

| Years | Per Capita Gross Domestic Product (TL) |
|---|---|
| 2010 | 15,138 |
| 2011 | 17,510 |
| 2012 | 18,927 |
| 2013 | 20,531 |
| 2014 | 22,753 |
| 2015 | 29,885 |
| 2016 | 32,676 |
| 2017 | 38,680 |
| 2018 | 45,750 |
| 2019 | 52,316 |
| 2020 | 60,525 |
| 2021 | 85,672 |

**Source:** TÜİK, 2022

Between the research dates of the study, 2010-2021, the amount of PCGDP increased continuously. The biggest increase in this period was in 2021 with 42.8% (Table 5).

As PCGDP increases, disposable income levels may also increase. According to the Absolute Income Hypothesis put forward by Keynes in 1936, the total amount of consumption depends on the total income. Income and consumption are positively correlated, i.e., consumption increases as income increases, and consumption decreases as income decreases. An increase in consumption means an increase in all kinds of trade (Romer, 1996, p. 312).

Caselli and Coleman (2001) revealed that PCGDP has a significant effect on e-commerce transaction volume. A study by Gibbs, Kraemer and Dedrick (2003) showed similar results.

Based on these findings, PCGDP was included in the model as an independent variable to explain the e-commerce transaction volume.

**Number of Internet Users**

Efforts on using internet in Turkey date back to the 1980s. Those efforts were supported by Ege University in 1987 and METU and TUBITAK in 1991. As a result of all the infrastructure work, the internet was used in Turkey for the first time on April 12, 1993 (Saka, 2019).

A consortium within Türk Telekom created an internet network under the name of TURNET in 1995, and this network started work in 1996. In addition to those efforts, a new center was established under the leadership of TÜBİTAK in June 1996, called the National Academic Network and Information Center (ULAKBİM). By 1999, important changes had taken place in the commercial network structure of the internet, and TURNET was replaced by a new formation called TTNet. The public took notice of the emerging developments and the opportunities offered by the internet, and private and legal entities took action to take their place in the new promising market environment. As a result of all these developments, people started to get internet connection installed in their homes (Türen et al., 2011, p. 56).

The number of internet users, which was around 2 million in 2000, reached 29.30 million in 2010 and 65.53 million in 2020. Between 2010-2021, the time interval of this study, the number of internet users in Turkey increased continuously, except for between 2012-2013. Likewise, the number of internet users has increased in parallel with the population of Turkey. The number of internet users, which was 29.30 million in 2010, increased to 65.8 million in 2021. While the ratio of the number of internet users to the population was 39.8% in 2010, this ratio increased to 77.7% in 2021 (Table 6).

**Table 6:** Number of internet users in Turkey by years

| Years | Population | Number of Internet Users | Ratio of Internet Users to Population |
|---|---|---|---|
| 2010 | 73.72 Million | 29.30 Million | 39.8% |
| 2011 | 73.44 Million | 30.00 Million | 43.1% |
| 2012 | 74.65 Million | 37,00 Million | 45.1% |
| 2013 | 75.93 Million | 32.50 Million | 46.2% |
| 2014 | 77.23 Million | 35.00 Million | 51.0% |
| 2015 | 78.53 Million | 37.70 Million | 53.7% |
| 2016 | 79.83 Million | 46.30 Million | 58.3% |
| 2017 | 81.12 Million | 53.13 Million | 64.7% |
| 2018 | 82.34 Million | 58.46 Million | 71.0% |
| 2019 | 83.43 Million | 61.73 Million | 74.0% |
| 2020 | 84.34 Million | 65.53 Million | 77.6% |
| 2021 | 84.68 Million | 65.80 Million | 77.7% |

**Source:** Sönmez, 2021

Today, there are many factors promoting growth in the number of internet users. The number of internet users increases each day, especially with the developments in technology, investments in internet infrastructure, and the decrease in internet access fees. The studies of Gibbs et al., (2003), who stated that the increase in the number of internet users positively affects the e-commerce transaction volume, support this fact. Sumita and Yoshii (2010) came to similar conclusions in their studies showing the positive impact of the increase in mobile internet usage on e-commerce transaction volume.

In light of all the findings, the number of internet users was included in the model as an independent variable in determining the e-commerce transaction volume in this study.

**Social Media Prevalence**

The continuous increase in the number of internet users emphasizes social media platforms as a powerful marketing channel, which in turn makes a great economic contribution to businesses that make direct sales transactions through these platforms.

The number of social media users in Turkey is constantly increasing, and the number of active social media users, which was 19 million in 2010, reached 60 million as of January 2021. Especially after 2020,

there has been a 13% increase in the number of social media users. This increase can be partially attributed to the widespread use of the internet and social media due to the impact of Covid-19 (Kemp, 2021).

**Table 7:** Social media prevalence in Turkey by years

| Years | Social Media Prevalence (Individual) |
|---|---|
| 2010 | 19 Million |
| 2011 | 25 Million |
| 2012 | 29 Million |
| 2013 | 36 Million |
| 2014 | 47 Million |
| 2015 | 48 Million |
| 2016 | 49 Million |
| 2017 | 50 Million |
| 2018 | 51 Million |
| 2019 | 52 Million |
| 2020 | 54 Million |
| 2021 | 60 Million |

**Source:** Türkiye'de Sosyal Medya Kullanımı Arttı, 2023

In Turkey, internet users between the ages of 16-64 spend an average of 2 hours and 57 minutes a day on social media, corresponding to 37% of the time users spend on the internet. 47% of internet users also utilize social media for business purposes, creating a significant potential for the e-commerce sector that directly targets the consumer. The prevalence of social media in Turkey enables brands to reach a large customer base in marketing and e-commerce activities via social media, which greatly increases their online sales figures (Kemp, 2021).

January 2020 data show that the social media platforms most commonly preferred by internet users between the ages of 16-64 in Turkey are YouTube (94.5%), Instagram (89.5%), and WhatsApp (87.5%). Businesses that carry out marketing operations on YouTube in Turkey reach approximately 50.6 million people (Kemp, 2021).

In addition to all these activities, the sale of products is carried out flawlessly through social commerce activity without being directed to a third site via social media. A study found that 2/3 of consumers think that a shopping experience offered through a single social platform will positively affect

their purchasing habits. Meanwhile, consumers support the purchasing process by reviewing brands and products on this platform (Owens, 2021). Social media platforms contribute to social commerce by providing consumers with more personalized recommendations and advertisements. Social trade, which reached 27 billion US dollars in 2020, is expected to reach approximately 80 billion US dollars in 2025 (Statista, 2021).

### The Covid-19 Pandemic Crisis

The Covid-19 pandemic, which started on November 17, 2019 in Wuhan, the capital of China's Hubei region, reached Turkey by March 11, 2020. As people went into lockdown in their homes during the Covid-19 pandemic, there appeared a global trend towards e-commerce. The comparison of data before and after Covid-19 both in the world and in Turkey reveals an increase in the e-commerce volume. The pandemic caused an increase in the demand for health, cleaning, and personal care products and a decrease in the demand for clothing, accessories, and luxury consumption products (Güven, 2020, p. 265).

Between 2020 and 2021, the Covid-19 pandemic affected the e-commerce volume. Therefore, the Covid-19 pandemic was included in the model as an independent variable in explaining the e-commerce volume in this period.

## STUDY METHODOLOGY

### Subject and Objective of the Study

This study examined the development process of e-commerce and analyzed the factors that affected the e-commerce volume in Turkey between the years 2010-2021. For data analysis, all the series to be included in the model must be stationary. Unit root test was used to test the stationarity of the series. The study model was created after the unit root tests. This study aimed to investigate the qualitative variables affecting ECTV in Turkey, to create models to predict the future values of ECTV, to fill the gap in the scientific literature, and to guide researchers who are considering working on similar issues in the future.

### Scope of the Study and Data Set

This study analyzed the change in e-commerce transaction volume from an economic point of view. E-commerce transaction volume is constantly increasing in line with the increase in the number of internet users. The model of the study to explain the change in e-commerce transaction volume was created using annual data between the years 2010-2021. Variables included in the model created using annual data:

- ECTV: Annual Rate of Change in Electronic Commerce Transaction Volume
- PCGDP : Annual Rate of Change in Per Capita Gross Domestic Product
- IUN : Annual Rate of Change in the Number of Internet Users
- INF: Annual Rate of Change in Inflation (CPI values)
- SMP: Annual Rate of Change in Social Media Prevalence

The annual data for determining the variables were obtained from the official websites of the institutions. The data for the ECTV variable was obtained from the E-Commerce Information Platform website (www.eticaret.gov.tr/), and the data for the PCGDP, IUN, and INF variables, from the official website of the Turkish Statistical Institute (www.tuik.gov.tr).

The following dummy variable, which affects e-commerce volume, was also included in the model.

- C19: The dummy variable of the Covid-19 pandemic period that started in 2020 in Turkey, was included in the model for the years 2020 and 2021 due to the annual data input in the model.

**Method of the Study**

The present study considered Turkey's e-commerce data between the years 2010-2021 as a dependent variable. In the modeling of this variable, PCGDP, the number of internet users and the prevalence of social media, the annual rate of change in inflation, and the Covid-19 pandemic were determined to be explanatory variables and included in the model.

All series to be included in the model should be stationary for data analysis as most of the economic variables that contain non-stationary stochastic trends such as production and consumption amount, Gross National Product, and returns on investment instruments have a strong trend. Since these variables are not stationary, estimations using the least squares method may result in misleading (false) regression.

Unit root tests are the most commonly used method to determine whether the existing series is stationary or not. The simplest explanation of this is supported by the following model (Gujarati, 1999, pp. 718-719; Göktaş, 2005; Tarı, 2015).

$$Yt = \alpha + \beta Yt\text{-}1 + ut \qquad (1)$$

If we subtract Yt-1 from both sides of the equation in (1), the model becomes

$Yt - Yt\text{-}1 = \alpha + \beta Yt\text{-}1 - Yt\text{-}1 + ut$ *(2)*

$(Yt - Yt\text{-}1) = \alpha + (\beta - 1)Yt\text{-}1 - Yt\text{-}1 + ut$ *(3)*

and the hypothesis for the test is determined as follows:

H0: There is a unit root ($\beta = 1$) the series is not stationary. *(4)*

H1: There is no unit root ($\beta < 1$) the series is stationary. *(5)*

If we substitute $\beta = 1$in the equation above, we get;

$\Delta Yt = \alpha + (1 - 1)Yt\text{-}1 + ut$ *(6)*

$\Delta Yt = \alpha + ut$ *(7)*

$Yt - Yt\text{-}1 = \alpha + ut$ *(8)*

$Yt = \alpha + \beta Yt\text{-}1 + ut$ *(9)*

In this case, *Yt* will become dependent on *Yt-1* . Our objective is to make *Yt* independent of *Yt-1*.

If ($\beta < 1$), it indicates that the effect ofshocks will gradually decrease, that is, *Yt* will affect *Y t-1* less. The fact that the series is not stationary here indicates that it is faced with permanent shocks.

The first-order integration of a time series depends on taking the first difference and leaving it stationary, and is represented with *I*(1). Its second-order integration depends on the second order difference and its stationary output, and it is shown as *I*(2). According to these findings, if a time series is integrated in the first or higher order, then the time series is not stationary. At this point, while applying the unit root test, the hypothesis test shown in (4) and (5) is created:

The H hypothesis is tested by comparing the threshold values obtained with the Monte Carlo method by Dickey and Fuller with the t statistic τ(tau ) value (Greene, 1997, p. 850).

Whether all the series in the model are stationary or not was tested with the unit root test. For this purpose, the k lag lengths of the series in the model should be determined. In this study, the use of annual data (since no daily, weekly, monthly, or quarterly periods were available) required the lag length to be 0, therefore, the Augmented Dickey-Fuller unit root test was applied. Below is the hypothesis of the test.

H0: There is a unit root ($\beta = 1$) the series is not stationary.

H1: There is no unit root ($\beta < 1$) the series is stationary.

Table 8 shows the results of the analysis obtained from the unit root test. Examination of the table shows that the only the level of the POPULATION variable was stationary in the model with and without a trend, the variables of ECTV and POPULATION were stationary in the model with a coefficient of intersection, and the variables of ECTV, IUN, POPULATION, and CPI were stationary in the model with an intersection coefficient and a trend. When the first-order differences of the series were taken, the H0 hypothesis was rejected at the α=0.05 significance level in all models with no intersection coefficient and no trend, with trend, with trend plus with intersection coefficient for the variables except SMP. Accordingly, since the variables other than SMP are stationary when first-order differences are taken, the trend-free model with the intersection coefficient will be considered.

**Table 8:** Unit root test

| **Variable** | **K** | ADF (None) ***1% = -2.792*** ***5% = -1.977*** ***10% = -1.602*** | | ADF (with Intersection Coefficient) ***1% = -4.200*** ***5% = -3.175*** ***10% = -2.728*** | | ADF (with Intersection Coefficient and Trend) ***1% = -5.124*** ***5% = -3.933*** ***10% = -3.420*** | |
|---|---|---|---|---|---|---|---|
| | | D | 1.F | D | 1.F | D | 1.F |
| **ECTV** | 0 | 0.264 | -6.624*** | -4.143*** | **-6.234*** ** | -4.381** | **-5.977*** ** |
| **PCGDP** | 0 | -0.898 | -4.508*** | -1.977 | **-4.308*** ** | -2.330 | **-5.059** ** |
| **IUN** | 0 | -0.923 | -4.534*** | -1.183 | **-4.895*** ** | -3.650* | **-4.599** ** |
| **POP** | 0 | -1.781* | -4.338*** | -4.771*** | **-3.954** ** | -4.426** | **-3.696* ** |
| **SMP** | 0 | -1.082 | -2.849*** | -1.523 | -2.707 | -0.919 | -3.045 |
| **CPI** | 0 | -1.469 | -5.265*** | -1.333 | **-5.463*** ** | -3.591* | **-5.682*** ** |
| **PCGDP** | 0 | -0.898 | -4.508*** | -1.977 | **-4.308*** ** | -2.330 | **-5.059** ** |

**Note:** The values written in bold in the table are the critical values at 0.01, 0.05, and 0.10 significance levels (α), respectively. (*) indicates critical values where τ values are exceeded.

**Findings and Comments**

Examination of the model tests shows that they comply with the multiple correlation and autocorrelation assumptions. Table 9 and Table 10 show the multiple linear regression analysis results of the presented models.

**Table 9:** Model summary

| Model | $R^2$ | $\Delta R^2$ | SH | F | SD1 | SD2 | p | Durbin - Watson | BG (PF/PX) |
|---|---|---|---|---|---|---|---|---|---|
| **1** | 0.866 | 0.760 | 0.305 | - | - | - | - | 1.426 | 0.640 / 1.000 |
| **2** | 0.856 | 0.741 | 0.317 | 7.439 | 4 | 7 | **0.024** | 2.175 | 0.714 / 0.541 |
| **3** | 0.882 | 0.734 | 0.321 | 5.976 | 5 | 6 | 0.053 | 2.585 | 0.440 / 0.149 |
| **4** | 0.861 | 0.686 | 0.349 | 4.940 | 4 | 7 | **0.043** | 2.148 | 0.755 / 0.540 |
| **5** | 0.889 | 0.751 | 0.311 | 6.431 | 4 | 7 | **0.047** | 1.586 | 0.859 / 0.726 |
| **6** | 0.856 | 0.676 | 0.355 | 4.768 | 4 | 7 | 0.077 | 2.154 | 0.765 / 0.558 |
| **7** | 0.923 | 0.771 | 0.298 | 6.056 | 6 | 5 | 0.083 | 1.417 | 0.695 / 0.335 |

BG: Breusch-Godfrey Serial Correlation LM Test, PF: Prob.F, PX2: Prob.ChiSquare
Model 1 independent variables: PCGDP, IUN, POP, SMP, CPI
Model 2 independent variables: PCGDP, IUN, POP, CPI, C
Model 3 independent variables: PCGDP , IUN, POP, CPI, C, @TREND
Model 4 independent variables: PCGDP , IUN, POP, CPI, C, K
Model 5 independent variables: PCGDP, IUN, POP, CPI, C, C2020
Model 6 independent variables: PCGDP, IUN, POP, CPI, C, C2021
Model 7 independent variables: PCGDP, IUN, POP, CPI, C, C2020, C2021

The findings summarized in Table 9 show that Model 2, Model 4, and Model 5, which do not include the dummy variable, are statistically significant at the α=0.05 level and have no autocorrelation (sequential dependency). Table 10 shows the values and significance levels of the coefficients in the model.

**Table 9:** Model coefficients

| **Model** | **Independent Variables** | **β** | **SH** | **t** | **p** | **VIF** |
|---|---|---|---|---|---|---|
| 1 | PCGDP | 30.060 | 12.958 | 2.320 | 0.068 | 8.978 |
| | IUN | -0.322 | 0.224 | -1.436 | 0.211 | 2.376 |
| | POP | 0.845 | 0.189 | 4.476 | 0.007 | 2.379 |
| | SMP | -0.128 | 0.130 | -0.986 | 0.369 | 1.679 |
| | CPI | -21.637 | 7.372 | -2.935 | 0.032 | 7.498 |
| **2** | PCGDP | 23.433 | 11.437 | 2.049 | 0.096 | 6.473 |
| | IUN | -0.237 | 0.235 | -1.008 | 0.360 | 2.149 |
| | POP | 0.782 | 0.190 | 4.104 | 0.009 | 2.240 |
| | CPI | -17.932 | 6.261 | -2.864 | 0.035 | 4.711 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | C | 0.081 | 0.111 | 0.730 | 0.498 | 6.473 |
| **3** | PCGDP | 22.025 | 11.682 | 1.885 | 0.133 | 6.582 |
| | IUN | -0.254 | 0.239 | -1.062 | 0.348 | 2.161 |
| | POP | 0.777 | 0.193 | 4.027 | 0.016 | 2.242 |
| | CPI | -17.120 | 6.401 | -2.675 | 0.056 | 4.800 |
| | C | -0.152 | 0.273 | -0.557 | 0.607 | NA |
| | @TREND | 0.034 | 0.037 | 0.935 | 0.403 | 1.073 |
| **4** | PCGDP | 24.483 | 12.922 | 1.895 | 0.131 | 6.823 |
| | IUN | -0.294 | 0.304 | -0.968 | 0.388 | 2.976 |
| | POP | 0.799 | 0.215 | 3.717 | 0.021 | 2.353 |
| | CPI | -18.097 | 6.905 | -2.621 | 0.059 | 4.732 |
| | C | 0.043 | 0.160 | 0.271 | 0.800 | NA |
| | DUMMY | 0.125 | 0.348 | 0.359 | 0.738 | 1.586 |
| **5** | PCGDP | 20.316 | 11.569 | 1.756 | 0.154 | 6.889 |
| | IUN | -0.360 | 0.256 | -1.405 | 0.233 | 2.663 |
| | POP | 0.579 | 0.263 | 2.200 | 0.093 | 4.444 |
| | CPI | -14.178 | 7.031 | -2.017 | 0.114 | 6.179 |
| | C | -0.053 | 0.163 | -0.325 | 0.762 | NA |
| | C2020 | 0.812 | 0.741 | 1.096 | 0.335 | 5.093 |
| **6** | PCGDP | 22.957 | 14.325 | 1.603 | 0.184 | 8.134 |
| | IUN | -0.225 | 0.309 | -0.728 | 0.507 | 2.979 |
| | POP | 0.767 | 0.294 | 2.604 | 0.060 | 4.290 |
| | CPI | -17,702 | 7.667 | -2.309 | 0.082 | 5.660 |
| | C | 0.086 | 0.142 | 0.603 | 0.579 | NA |
| | C2021 | -0.039 | 0.529 | -0.073 | 0.945 | 1.994 |
| **7** | PCGDP | 8.835 | 14.849 | 0.595 | 0.594 | 12.348 |
| | IUN | -0.259 | 0.261 | -0.993 | 0.394 | 2.999 |
| | POP | 0.120 | 0.468 | 0.257 | 0.814 | 15.308 |
| | CPI | -6.525 | 9.420 | -0.693 | 0.538 | 12.069 |
| | C | -0.083 | 0.159 | -0.525 | 0.636 | NA |
| | C2020 | 1.568 | 0.963 | 1.628 | 0.202 | 9.348 |
| | C2021 | -0.701 | 0.602 | 0.602 | 0.602 | 0.602 |

Tables 9 and 10 show that there is no non-stationary SMP variable, the first-order differences of the variables are taken, the model with intersection coefficient-without trend (Model-2) is significant (F=7.44;

p<0.05), and the independent variables explain 74% of the change in the ECTV variable. According to Model-2, ECTV has a positive and significant relationship at the level of α=0.10 with PCGDP, a positive and significant relationship at the level of α=0.01 with POP, and a negative but significant relationship with CPI at the level of α=0.05. The following regression model was created as a result of the analyses made according to Model-2.

$$ECTV = \beta 0 + \beta 1*X1 + \beta 2*X2 + \beta 3*X3 + \beta 4*X4 \quad (10)$$

$$ECTV = 0.081 + 23.433*PCGDP - 0.237*IUN + 0.782*POP - 17.932*CPI \quad (11)$$

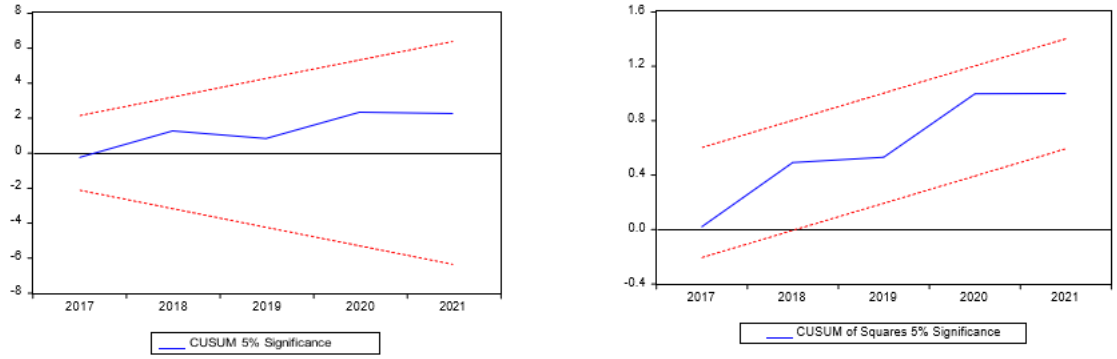
Equation (11) shows that among the variables included in the model (Model 2), the coefficients of PCGDP, POP and CPI are significant to explain the change in ECTV. The signs of the coefficients of the independent variables included in the model also coincide with the economic expectations. The change in the PCGDP affects the ECTV positively (+), in line with the economic expectations. While other variables in the model are constant, a one-unit change in PCGDP causes a positive 23.433-unit change in ECTV. On the other hand, while other variables are constant, one unit of change in the population (POP) causes a positive change of 0.782 units. Both variables coincide with expectations at this point.

It is an economic fact that inflation (CCPI) will negatively affect the ECTV. Because an increase in inflation will increase the general level of prices, which will have a negative impact on the amount of demand and reduce ECTV. Therefore, the CPI coefficient being negative (-) was an expected result. While other variables in the model are constant, one unit change in CPI causes a negative 17.932 unit change in ECTV.

With the C dummy variable, the lockdowns during pandemic in 2020 and 2021 was added to the model, and the coefficient of the C variable was in line with the expectations. It is seen that the dummy variable does not have a significant effect in Model 4, where the years 2020-2021 are included as the only variable, and in three other models (Model 5, Model 6 and Model 7), where it is included separately. In other words, the pandemic does not seem to have had a significant effect on the electronic commerce volume in 2020 and 2021. In these years, the impact of the pandemic also refers to a structural breakage. Therefore, CUSUM (Cumulative Sum of Recursive Residuals Test) and CUSUM-Q (Cumulative Sum of Recursive Squared Residuals Test) tests were performed. The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of recursive residuals. This option forms the cumulative sum with 5% critical lines. If the cumulative sum falls outside the area between the two critical lines, the test finds parameter instability. The estimation of the squares of consecutive errors in the CUSUM tests and the consecutive errors in the CUSUM-Q test remaining the same for a long time and having the same sign in the long run may indicate

uncertainty. In both tests, confidence limits are determined by plotting the errors of the model within a certain confidence interval. If the confidence limits are exceeded, it shows that there is a structural change and if not, there is no structural change (Çetin and Saygın, 2019). The graphs in Figure 1 show that there is no deviation from the 5% range, and the values with time-varying values show that there is no structural break (Figure 1).

**Figure 1:** Structural break test




## CONCLUSION AND EVALUATION

The widespread use of internet infrastructure and the introduction of digital technology into daily life have given businesses a competitive advantage and provided people with great benefits. In particular, the technological developments, investments in internet infrastructure, the increase in the number of personal computers, and the decrease in internet access fees accelerated the transition of shopping from a traditional environment to a digital one. That, in turn, facilitated the emergence of the concept of e-commerce and promoted interest in e-commerce over time.

This study examined the factors that affect the e-commerce transaction volume in Turkey between the years 2010-2021, created a multiple linear regression model, and subjected the data to econometric analysis. The analyzes showed that the change in the dependent variable (ECTV) caused by the independent variables (PCGDP, IUN, POP, CPI, C, C2020, C2021) included in the model was in line with the expectations. The coefficients of PCGDP, POP and CPI, defined as independent variables in the model, were significant. The expected signs of the coefficients of these variables were also consistent with the economic expectations.

While the other variables in the model are constant, a one-unit change in PCGDP causes a positive (23.433) change in the ECTV in the same direction. On the other hand, again while other variables are constant, one unit change in Population (POP) causes a milder positive (0.782) change in ECTV in the same

direction. The effects of both variables are in line with expectations. Inflation (CPI), included in the model, is another economic phenomenon that has a negative impact on ECTV. Because an increase in inflation will increase the general level of prices, which will have a negative impact on the amount of demand and reduce ECTV. Therefore, the CPI coefficient being negative (-) was an expected result. While other variables are constant, one unit change in CPI causes a negative 17.932 unit change in ECTV. With the C dummy variable, the lockdowns during pandemic in 2020 and 2021 was added to the model, and the coefficient of the C variable was in line with the expectations. Partial and full lockdowns that took place in 2020 and 2021 made some setback in e-commerce inevitable, as in all trade. Additionally, the dummy variable had no significant effect in Model 4, where the years 2020-2021 were included as the only variable, and in three other models (Model 5, Model 6 and Model 7), where it was included separately.

The analyzes determined that the independent variables included in the model explained 74% of the change in the dependent variable (ECTV). The remaining part may be attributed to other variables that we cannot predict within the scope of the model and are likely to be qualitative in nature, such as logistics, information, and communication infrastructures.

The model presented aims to determine the factors that affected the e-commerce transaction volume in Turkey between the years 2010-2021. The first of these factors, PCGDP, is one of the most significant indicators of the welfare level and size of the economies of all countries in the world. Since the living standards and purchasing power of people living in a country depend on PCGDP, it is natural for ECTV to increase in line with this variable, consistent with the findings of Caselli and Coleman (2001), Wong (2003), and Türen et al. (2011). However, the increase in PCGDP alone was not a sufficient factor for the increase in ECTV.

The benefits of e-commerce in recording money circulation, as put forward in this study, will better demonstrate the importance of economic support given to e-commerce by the state. The second factor, i.e., the number of internet users in the country, can be raised by increasing investments in internet infrastructure and making internet access cheaper. This finding is line with the findings of Wong (2003), Özekenci (2017), and Özsağır (2019).

In light of all these findings, this study aimed to fill the gap in the literature by investigating the qualitative variables affecting ECTV in Turkey and by constructing models to estimate the future values of ECTV.

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