# “Assessing the impact of institutional environment quality on the development of e-commerce in developed and developing countries”


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# ASSESSING THE IMPACT OF INSTITUTIONAL ENVIRONMENT QUALITY ON THE DEVELOPMENT OF E-COMMERCE IN DEVELOPED AND DEVELOPING COUNTRIES

## Abstract

This study uses the new institutional economic theory and demonstrates how the quality of the institutional environment can be correlated with the development of e-commerce in different countries. The goal is to analyze the impact of international indices that assess the institutional environment on e-commerce penetration in countries with varying levels of economic development. The international indices used include the Networked Readiness Index, the E-Government Development Index, components of the Index of Economic Freedom, and indicators from The Worldwide Governance Indicators, such as control of corruption and rule of law. The level of e-commerce penetration was measured by its share in retail trade. The study analyzed developed countries with high e-commerce penetration, like the USA, the UK, Germany, South Korea, and Singapore, alongside developing countries, such as China, Turkey, Mexico, and Kazakhstan. The relationships between e-commerce penetration and international indices were identified using correlation analysis with the calculation of Spearman's coefficient, followed by an assessment of the statistical significance of the obtained coefficients. The analysis revealed varying degrees of association between institutional quality and e-commerce penetration. Notably, the E-Government Development Index and the Networked Readiness Index showed positive correlations with e-commerce levels in all studied countries. However, the rule of law, control of corruption, and Investment Freedom indices showed varying correlations, indicating that these relationships are influenced by factors beyond economic development, such as political systems and regulatory approaches.

**Keywords** e-commerce, institutional environment, correlation, developed countries, developing countries

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## INTRODUCTION

In recent years, the e-commerce market has reached unprecedented global proportions, radically transforming consumer shopping methods and business practices. According to Statista (2024) forecasts, by 2027, the share of e-commerce in the total volume of retail trade worldwide will exceed 22.6%, indicating the ongoing and accelerating growth of the e-commerce sector. At the same time, the gap in e-commerce penetration levels is widening every year. In 2021, the maximum contribution of e-commerce to the economy in leading countries was estimated at 7.6% of GDP (the United Kingdom), while in developing countries, it was 11.7% of GDP (China), with Internet penetration rates of 95.2% in the UK and 71% in China (ITU, n.d.). This statistic contradicts earlier studies that explained the development of e-commerce by the level of Internet penetration. Meanwhile, the continuing growth of e-commerce necessitates the creation and adaptation of legislative and regulatory frameworks that promote con-



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sumer rights protection, ensure transaction security, maintain fair competition, and develop appropriate e-commerce infrastructure. These measures will significantly improve the quality of e-commerce institutions on which the development of e-commerce will depend. In this regard, the issues of comparative assessment of the institutional environment of e-commerce are of particular scientific interest in explaining the reasons for the disparity in e-commerce penetration levels in different countries. Moreover, understanding the influence of the institutional environment on e-commerce allows for the development of more effective support and regulation measures, which, in turn, can stimulate more active e-commerce penetration.

## 1. LITERATURE REVIEW AND HYPOTHESES

The ongoing growth of e-commerce has made it increasingly important for both developed and developing countries to strengthen their economies and support national economic development. However, the development of the e-commerce market across different countries shows unevenness – it grows at varying rates and exhibits different market characteristics (OECD & WTO, 2017). Previous studies have attributed the varying levels of e-commerce adoption and development in different countries to Internet penetration (Molla & Licker, 2005; Kraemer et al., 2006; Freund & Weinhold, 2004; Ho et al., 2017; Yan et al., 2016), quality of logistics services and distribution infrastructure (Cho et al., 2008; Kshetri, 2007; Jiang et al., 2020; Wang et al., 2023), penetration of bank cards (Gomez-Herrera et al., 2014; Hawk, 2004), and level of digital skills of the population (Hiwarkar, 2013; OECD, 2019). Zhanbozova et al. (2021) have reflected further details on these factors.

Despite the fact that e-commerce penetration is most often associated with physical infrastructure, proponents of the new institutional theory also significantly associate e-commerce activities with the supporting institutional environment (Martinez & Williams, 2010; Zhu & Thatcher, 2010; OECD, 2019; UNCTAD, 2015).

According to the new institutional theory, organizations operate within a certain institutional environment that includes formal and informal rules. Informal rules encompass behavioral norms developed by people through prolonged social interactions, while formal rules are consciously created, forming a system of social rules that jointly constrain the behavior of individuals and organizations (North, 1990). Therefore, studying e-commerce from the perspective of the new institutional theory requires considering various factors and approaches that explain how institutional structures and norms influence the development and functioning of e-commerce.

The main characteristics of the e-commerce institutional environment include not only the presence of formal rules regulating the e-commerce sphere but also national respect for the "rule of law"; government policy that promotes fair transactions is crucial for the development of e-commerce (Oxley & Yeung, 2001; UNCTAD, 2015). Gibbs and Kraemer (2004) argued that legislative barriers, external pressure, and government support are the most significant predictors of e-commerce adoption, alongside technological and financial resources. Empirical studies of the driving forces behind e-commerce adoption in 135 countries have shown that access to ICT, the political and regulatory environment and the development of human resources collectively explain 70% of the differences in national e-commerce adoption (Adam et al., 2020).

Some studies have demonstrated the significant impact of the regulatory environment on e-commerce activities and revenues (Clegg, 2019; Zhao et al., 2007). Indeed, OECD and WTO (2017) reports and recommendations emphasize that a strong regulatory framework provides a transparent legal basis for electronic transactions, privacy and data protection, consumer rights protection, and cybercrime prevention, which collectively encourage participation in e-commerce. At the same time, the influence of the legal environment is less significant during the initial stages of e-commerce adoption compared to more intensive development stages (Zhu & Thatcher, 2010). E-commerce can only be adopted in a country if the govern-

ment recognizes its benefits and creates appropriate conditions for its proliferation (Hendricks & Mwapwele, 2024; Tamin & Abdul Adis, 2022; Scupola, 2003).

The quality of the e-commerce institutional environment is often associated with rules regarding data protection, online payments, intellectual property rights, and taxation specifics (Sheng et al., 2011; UNCITRAL, 2009). Furthermore, in countries with high technological levels and cultures conducive to innovation, e-commerce can develop more actively (Al-Omoush et al., 2022; Zimu, 2023; Aseri & Morris, 2013). Cultural characteristics can also affect the level of trust in the security of online transactions, as well as the level of education and digital skills in different countries, which in turn affects e-commerce penetration (Rabayah et al., 2022).

Overall, the main reasons for the gap in e-commerce penetration are the underdevelopment of formal and informal institutions (Jean et al., 2020; Doh et al., 2017). In any case, the formation and development of the e-commerce market, like any sectoral market, depend on the qualitative state of the corresponding institutional environment (OECD, 2019). Thus, reviewing previously published works has allowed the identification of particularly important components of the e-commerce institutional environment, which are presented in Table 1.

Thus, the conducted review allowed for systematizing knowledge about the components of the institutional environment of e-commerce. It is necessary to note the absence of scientific studies dedicated to a comprehensive assessment of the institutional environment of e-commerce. At the same time, international authoritative organizations offer various indices for measuring the quality of the institutional environment, enabling comparisons of countries based on specific components of the institutional environment. In this context, it becomes interesting to understand how the quality of a specific institution influences the development of e-commerce in different economies.

The research goal is to assess the impact of international indices evaluating the institutional environment on the penetration of e-commerce in countries with different levels of economic development. Based on theoretical and empirical relationships between variables, the following hypotheses were formulated:

*H1: There is a strong positive relationship between the Index of Economic Freedom and e-commerce penetration rates in all studied countries.*

*H2: There is a strong positive relationship between tax burden and e-commerce penetration rate in all studied countries.*

**Table 1.** Main components of the e-commerce institutional environment

| No. | Components of the e-commerce institutional environment | Description |
|---|---|---|
| 1 | Legislative framework (laws on consumer protection, data protection, and digital signature, which help ensure the security and legality of electronic transactions). | Transparent and modern laws governing e-commerce create trust among consumers and businesses (Clegg, 2019; Zhao et al., 2007; Oxley & Yeung, 2001; OECD & WTO, 2017). |
| 2 | Institutions regulate and develop infrastructure (access to the Internet, electronic payment systems, delivery of goods and services). | Effective infrastructure significantly influences the development of e-commerce (OECD & WTO, 2017; UNCITRAL, 2009). |
| 3 | Tax policy: taxation of electronic services, online trading, marketplaces, cross-border e-commerce, etc. | Tax structures must be adapted to the characteristics of e-commerce (UNCITRAL, 2009). |
| 4 | Protecting intellectual property rights (copyrights, patents, trademarks, etc.). | Intellectual property rights protection systems are important to enable innovation and protect property rights in the electronic environment (Al-Omoush et al., 2022; Zimu, 2023; Aseri & Morris, 2013; Tehan & Information Research Division, 2003). |
| 5 | Support for small and medium-sized businesses (grants, loans, advice and training). | Institutions that provide support to entrepreneurship can stimulate the development of e-commerce (Scupola, 2003). |
| 6 | Sociocultural factors (educational programs that promote high levels of digital literacy; cultural factors such as acceptance of online shopping, trust in online stores and online payment systems). | It may also influence the spread of e-commerce. For example, the higher the level of digital literacy in a society, the easier it will be to innovate in e-commerce (Rabayah et al., 2022). |


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*H3: There is a strong positive relationship between business freedom and e-commerce penetration rate in all studied countries.*

*H4: There is a strong positive relationship between monetary freedom and e-commerce penetration rate in all studied countries.*

*H5: There is a strong positive relationship between trade freedom and e-commerce penetration rate in all studied countries.*

*H6: There is a strong positive relationship between investment freedom and e-commerce penetration rate in all studied countries.*

*H7: There is a strong positive relationship between financial freedom and e-commerce penetration in all studied countries.*

*H8: There is a strong positive relationship between the E-Government Development Index and the e-commerce penetration rate in all studied countries.*

*H9: There is a strong positive relationship between the Network Readiness Index and e-commerce penetration rate in all studied countries.*

*H10: There is a strong positive relationship between the rule of law and e-commerce penetration in all studied countries.*

*H11: There is a strong positive relationship between control of corruption and e-commerce penetration in all studied countries.*

*H12: The impact of institutional quality on the level of e-commerce penetration depends on the level of economic development of the countries.*

## 2. METHODS

To analyze the degree of association between the variables, the Spearman correlation analysis method was used. Some of the data used in the calculations do not conform to a normal distribution. Since the Spearman coefficient assesses ranks rather than the values themselves, it is less sensitive to outliers and extreme values than other correlation methods. Moreover, the Spearman coefficient is effective in identifying monotonic (not necessarily linear) relationships between the variables. If there is a monotonic but nonlinear dependency between the variables, Spearman can more accurately identify it (Spearman, 1904).

The choice of countries for observation is justified by the fact that the selected countries represent various levels of economic development. The developed countries chosen are the USA, the UK, Germany (DEU), South Korea (KOR), and Singapore (SGP). The economically developing countries chosen are China (CHN), Turkey (TUR), Mexico (MEX), and Kazakhstan (KAZ).

As a relative indicator of e-commerce penetration, this study chose the share of e-commerce in retail trade indicator. Data on this indicator for all nine countries are presented in Appendix A. Table 2 presents the endogenous variables with their designations and sources.

**Table 2.** Endogenous variables

| Designation | Description | Sources |
|---|---|---|
| $X_1$ | Index of Economic Freedom | Wall Street Journal and Heritage Foundation Research Centre |
| $X_2$ | Tax Burden | Sub-indexes of the Economic Freedom index |
| $X_3$ | Business Freedom | |
| $X_4$ | Monetary Freedom | |
| $X_5$ | Trade Freedom | |
| $X_6$ | Investment Freedom | |
| $X_7$ | Financial Freedom | |
| $X_8$ | E-Government Development Index | United Nations Department of Economic and Social Affairs Division for Public Institutions and Digital Government |
| $X_9$ | Network Readiness Index | Portulans Institute |
| $X_{10}$ | Rule of Law | The Worldwide Governance Indicators |
| $X_{11}$ | Control of Corruption | |

To assess the ICT infrastructure of e-commerce for analysis, the Networked Readiness Index (NRI) was used. This index evaluates various factors, including infrastructure, availability, skills,

usage, and the overall business and innovation environment related to ICT. The choice of NRI as an endogenous variable among similar indices is justified by the availability of a sufficient number of observations for conducting correlation analysis. Another endogenous variable was the E-Government Development Index (EGDI) due to the following reasons. A high EGDI improves the telecommunications infrastructure, providing stable Internet necessary for online transactions. Second, transparent and secure electronic services increase trust in e-commerce. Third, simplified administrative processes, such as online business registration, reduce market entry barriers. Finally, a high level of human capital contributes to digital literacy, which is crucial for e-commerce development.

NRI and EGDI do not assess legal protection, regulation, access to finance, and other critical components. A more suitable index for measuring such indicators could be the World Bank's Doing Business Index, which evaluates the ease of doing business in various jurisdictions and provides a comparative assessment between countries across a range of indicators. Unfortunately, since 2020, the report on this index has not been published due to a rethinking of the measurement methodology. Therefore, the Index of Economic Freedom was chosen, which can, to some extent, assess the government's policy toward entrepreneurship in a country. Economic freedom here is understood as "the absence of government intervention or obstruction in the production, distribution, and consumption of goods and services, except for the necessary protection and support of freedom as such." The Index of Economic Freedom, published by the Heritage Foundation, is often based on several key criteria, such as government size, legal order, property rights efficiency, market openness, price stability, and others, and consists of 12 components. Of these, seven components relevant to the assessment of the institutional environment of e-commerce were used: tax burden, business freedom, monetary freedom, trade freedom, investment freedom, and financial freedom.

To assess the enforceability of legislative rules, the Rule of Law Index was included in the assessment. This index measures how well a country's legal system protects citizens' rights, limits government power, ensures access to justice, and enforces the rule of law. The inclusion of the control of corruption indicator is due to the impact of corruption on the business climate and economic development, including the e-commerce sector. Additionally, a low level of corruption increases consumer and business trust in the market, promotes technology development, and enhances purchasing power, among other benefits.

The study covers observations from 2007 to 2022. The correlation analysis was carried out for each country separately. The choice of the initial observation year is based on the availability of initial data. Data on the resulting indicator (Y) and the above endogenous variables (X1-X14) were collected for nine countries.

The calculated correlation coefficients were evaluated using the Chaddock scale for the degree of relationship tightness:

- $0.5 < rxy < 0.7$: noticeable;
- $0.7 < rxy < 0.9$: high;
- $0.9 < rxy < 1$: very high (Ratner, 2009).

The observed correlation coefficients were tested for statistical significance using statistical tests with a significance level of $\alpha = 0.05$ (Spearman, 1904).

## 3. RESULTS

Table 3 presents the results of the correlation analysis between the share of e-commerce in retail trade and international indices, as well as the results of statistical tests ($p$-values).

The results obtained were ambiguous for all the nine studied countries. The Economic Freedom Index positively correlates with e-commerce penetration in four countries, Germany, South Korea, and Mexico, and negatively in the USA. Therefore, hypothesis 1 is not accepted.

The tax burden indicator can influence the business environment in a country, including e-commerce, through the regulation of the cost of goods and services, as well as through tax incentives or


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**Table 3.** Correlation analysis using the Spearman method

| Country | USA | | UK | | DEU | | KOR | | SGP | | CHN | | TUR | | MEX | | KAZ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Designations** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** | **S** | **p-value S** |
| $X_1$ | –0.744 | **0.001** | –0.269 | 0.297 | 0.689 | **0.002** | 0.922 | **0.000** | 0.276 | 0.283 | 0.149 | 0.569 | 0.163 | 0.532 | –0.651 | 0.005 | 0.748 | **0.001** |
| $X_2$ | 0.405 | 0.107 | 0.728 | **0.001** | 0.187 | 0.472 | –0.343 | 0.178 | –0.122 | 0.640 | 0.361 | 0.155 | –0.366 | 0.149 | –0.812 | 0.000 | 0.673 | **0.003** |
| $X_3$ | –0.896 | **0.000** | –0.160 | 0.541 | –0.751 | **0.001** | –0.190 | 0.465 | –0.867 | 0.000 | 0.844 | 0.000 | –0.642 | 0.007 | –0.835 | **0.000** | 0.441 | 0.076 |
| $X_4$ | –0.216 | 0.405 | 0.360 | 0.156 | –0.422 | 0.091 | 0.761 | **0.000** | –0.223 | 0.388 | –0.625 | **0.007** | –0.438 | 0.079 | –0.444 | 0.074 | –0.300 | 0.242 |
| $X_5$ | –0.443 | 0.075 | –0.358 | 0.158 | –0.293 | 0.254 | 0.730 | **0.001** | 0.802 | 0.000 | 0.725 | 0.001 | –0.877 | **0.000** | 0.121 | 0.643 | –0.486 | 0.048 |
| $X_6$ | 0.614 | 0.009 | –0.736 | **0.001** | –0.472 | 0.056 | –0.699 | **0.002** | 0.767 | 0.000 | –0.659 | 0.004 | 0.597 | 0.011 | 0.955 | 0.000 | 0.938 | **0.000** |
| $X_7$ | 0.397 | 0.114 | –0.661 | 0.004 | 0.841 | **0.000** | 0.026 | 0.922 | 0.847 | 0.000 | –0.854 | 0.000 | 0.791 | **0.000** | no data | no data | –0.663 | **0.004** |
| $X_8$ | 0.768 | 0.000 | 0.939 | 0.000 | 0.910 | **0.000** | 0.792 | **0.000** | 0.922 | 0.000 | 0.988 | 0.000 | 0.990 | 0.000 | 0.936 | 0.000 | 0.801 | **0.000** |
| $X_9$ | 0.548 | 0.023 | 0.696 | 0.002 | 0.865 | **0.000** | 0.955 | 0.000 | 0.752 | **0.001** | 0.820 | 0.000 | 0.952 | 0.000 | 0.759 | 0.000 | 0.971 | **0.000** |
| $X_{10}$ | –0.844 | 0.000 | –0.784 | 0.000 | –0.788 | **0.000** | 0.653 | 0.004 | 0.984 | **0.000** | 0.875 | 0.000 | –0.939 | 0.000 | –0.692 | 0.002 | 0.906 | **0.000** |
| $X_{11}$ | –0.436 | 0.081 | 0.698 | 0.002 | 0.882 | **0.000** | 0.437 | 0.079 | 0.491 | 0.045 | 0.911 | 0.000 | –0.908 | 0.000 | –0.916 | 0.000 | 0.918 | **0.000** |

*Note:* Bold font highlights the variable values that have statistically significant correlations with the penetration of e-commerce.

burdens for companies engaged in online trading. As the analysis showed, this indicator has a significant positive relationship with the level of e-commerce penetration in the UK and Kazakhstan. This indicates that easing the tax burden on businesses contributes to the growth of e-commerce. At the same time, a negative relationship between the studied indicators was also identified in Mexico, which requires a more detailed investigation of the circumstances. Therefore, hypothesis 2 is rejected.

The business freedom indicator reflects the level of freedom and openness for entrepreneurial activity in a country. The results showed that this indicator negatively correlates with the level of e-commerce penetration in the USA, Germany, Singapore, Turkey, and Mexico. A positive relationship was found only in China. Therefore, hypothesis 3 is not confirmed.

Monetary freedom is used to describe the level of freedom that citizens and entrepreneurs have regarding the use and management of money. This includes both the rights and opportunities in terms of owning and using money, as well as the restrictions and obstacles they may face. A moderate positive correlation between monetary freedom and e-commerce penetration was recorded only in South Korea. A significant negative correlation is observed in China. In other countries, e-commerce is not related to monetary freedom. This does not confirm hypothesis 4.

Trade freedom evaluates the level of restrictions on international trade in a country, including tariffs, customs procedures, investment barriers, and other trade policies. In Singapore, the USA, and China, this indicator positively correlates with e-commerce penetration. All correlation coefficients are significant. Among all the studied countries, a significant reverse correlation was found in Turkey, indicating that restricting conditions for international trade in Turkey positively influences the growth of the e-commerce share in retail trade within the country. Therefore, hypothesis 5 is also not confirmed.

Investment freedom correlates with e-commerce penetration in only four countries: Kazakhstan, the USA, Singapore, and Mexico. It is worth noting that in the UK, China, and South Korea, the investment freedom indicator negatively correlates with e-commerce penetration. Since e-commerce is developing at a very high pace in these countries, the growth of e-commerce penetration is associated with other factors, such as high technologies and innovations. Since investment freedom does not positively correlate with the level of e-commerce penetration in all countries, hypothesis 6 is not confirmed.

The financial freedom indicator evaluates the availability of financial services, the efficiency of financial regulation, and the protection of property rights in a country. Improvements in this indicator in Germany, Singapore, and Turkey were positively associated with the e-commerce implementation indicator. In the UK, China, and Kazakhstan, financial freedom negatively correlates with e-commerce penetration. Therefore, hypothesis 7 is not confirmed.

The E-Government Development Index positively correlates with the level of e-commerce penetration in all nine studied countries, and the relationships are statistically significant. Interestingly, the degree of tightness of these indicators in Kazakhstan and the USA is high, and in other countries, it is very high. These results confirm hypothesis 8.

A statistically significant positive correlation between the Network Readiness Index and the level of e-commerce penetration was found in all studied countries. The tightness of the relationship was very high in Kazakhstan, South Korea, and Turkey. A noticeable degree of tightness of the relationship was observed in the USA and the UK, and in other countries, a high degree of tightness of the relationship was identified. Therefore, hypothesis 9 is confirmed.

The results show a noticeable, high, and very high degree of tightness of the relationship between the rule of law indicator and the share of e-commerce in retail trade. In countries such as the USA, the UK, Germany, and Mexico, this relationship was negative, while for other countries, it was positive. These results reject hypothesis 10.

The calculation results show a statistically significant positive relationship between the control of corruption indicator and the level of e-com-


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merce penetration in Kazakhstan and China (very strong), Germany (strong), and the UK (noticeable). Statistically significant very high negative relationships were found in Mexico and Turkey. No such relationships were found in the USA, Singapore, and South Korea. These results reject hypothesis 11.

Table 4 shows the obtained positive and negative correlation relationships, which are significant according to all tests (*p*-values for all coefficients do not exceed 0.005).

Based on Table 4, it can be concluded that the relationships between the examined indicators and the level of e-commerce penetration vary across the studied countries. Although the relationship between the indicators in developed and developing countries differs significantly, institutional environment factors do not act uniformly in developed economies. For instance, an improvement in the control of corruption indicator leads to an increase in the share of e-commerce in the UK and Germany, while in South Korea and Singapore, no such relationship exists, despite these countries being economically developed. In developing countries, this relationship is also ambiguous: it is positive in Kazakhstan and China, whereas in Mexico and Turkey, it is the opposite. The rule of law negatively correlates with the level of e-commerce penetration in the USA, Germany, and the UK, while it positively correlates in South Korea and Singapore. In the USA, an increase in the trade freedom and investment freedom indicators accompanies a rise in the share of e-commerce in retail trade, whereas in Germany, there is no significant relationship between these indicators, and in the UK, the investment freedom indicator negatively correlates with e-commerce penetration. Therefore, it is impossible to group the studied countries based on their economic development level by the nature of the relationships, and thus, hypothesis 12 is rejected.

Therefore, the hypotheses testing shows that H1 is rejected. The result indicates the absence of a significant positive correlation between the Index of Economic Freedom and the level of e-commerce penetration in all studied countries. H2 is rejected. The result indicates the absence of a close positive correlation between tax burden and the level of e-commerce penetration in all studied countries. H3 is rejected. The result indicates the absence of a close positive correlation between business freedom and the level of e-commerce penetration in all studied countries. H4 is rejected. The result indicates the absence of a close positive correlation between monetary freedom and the level of e-commerce penetration in all studied countries. H5 is rejected. The result indicates the absence of a close positive correlation between trade freedom and the level of e-commerce penetration in all studied countries. H6 is rejected. The result indicates the absence of a close positive correlation between investment freedom and the level of e-commerce penetration in all studied countries.

H7 is rejected. The result indicates the absence of a close positive correlation between financial freedom and the level of e-commerce penetration in

**Table 4.** Correlations of time series between the share of e-commerce and international indices and their components of measuring the institutional environment

| Index and sub-indexes | Designations | Direct correlation dependence | | Inverse correlation dependence | |
|---|---|---|---|---|---|
| Index of Economic Freedom | $X_1$ | 4 | DEU, KOR, MEX, KAZ | 1 | USA |
| Tax Burden | $X_2$ | 2 | UK, KAZ | 1 | MEX |
| Business Freedom | $X_3$ | 1 | CHN | 5 | USA, DEU, SGP, TUR, MEX |
| Monetary Freedom | $X_4$ | 1 | KOR | 1 | CHN |
| Trade Freedom | $X_5$ | 3 | KOR, SGP, CHN | 1 | TUR |
| Investment Freedom | $X_6$ | 5 | USA, SGP, TUR, MEX, KAZ | 3 | UK, KOR, CHN |
| Financial Freedom | $X_7$ | 3 | DEU, SGP, TUR, | 2 | UK, CHN, KAZ |
| E-Government Development Index | $X_8$ | 9 | USA, UK, DEU, KOR, SGP, CHN, TUR, MEX, KAZ | 0 | – |
| Network Readiness Index | $X_9$ | 9 | USA, UK, DEU, KOR, SGP, CHN, TUR, MEX, KAZ | 0 | – |
| The rule of law | $X_{10}$ | 4 | KOR, SGP, CHN, KAZ | 5 | USA, UK, DEU, MEX, TUR |
| Control of Corruption | $X_{11}$ | 4 | UK, DEU, CHN, KAZ | 2 | MEX, TUR |

all studied countries. H8 is accepted. The result indicates the presence of a close positive relationship between the E-Government Development Index and the level of e-commerce penetration in all studied countries. H9 is accepted. The result indicates the presence of a close positive relationship between the Network Readiness Index and the level of e-commerce penetration in all studied countries. H10 is rejected. The result indicates the absence of a close positive correlation between the rule of law indicator and the level of e-commerce penetration in all studied countries. H11 is rejected. The result indicates the absence of a close positive correlation between the control of corruption indicator and the level of e-commerce penetration in all studied countries. H12 is rejected. The result indicates that the nature of the impact of institutional quality on the level of e-commerce penetration does not depend on the level of economic development of the countries.

## 4. DISCUSSION

The results showed that among the studied endogenous variables, only the E-Government Index has a significantly strong positive relationship with e-commerce penetration in all countries. This is because it specifically assesses Internet infrastructure, online payment infrastructure, and the e-engagement of the population and businesses. This finding is consistent with the results of Sui et al. (2011), Scholl et al. (2009), Srivastava and Teo (2011), Blakeley and Matsuura (2004), and the UN (2022). Although the correlation between the studied indices was not measured in these works, comprehensive interconnections between e-government and e-commerce were substantiated.

In all the studied countries, the Network Readiness Index (NRI) is positively correlated with the e-commerce penetration rate. This result is consistent with the findings of the World Economic Forum (2016): countries with high NRI scores typically have more developed infrastructure, better legal and regulatory environments, and higher levels of ICT use by businesses and the population, collectively contributing to the growth of e-commerce. Bilbao-Osorio et al. (2013) confirm that readiness to use ICT promotes economic growth and e-commerce development in various countries. The stronger positive correlation in China, Germany, Kazakhstan, South Korea, and Turkey is due to the rapid expansion of Internet coverage in these countries over the past decade, along with the growing e-engagement of the population. The noticeable relationship between network readiness and e-commerce penetration in the UK may indicate that the country is at a more mature stage of e-commerce development, where other factors also influence e-commerce growth.

The relationships between the other variables and the share of e-commerce vary. However, the most important institutional environment indicators influencing e-commerce development have been identified. These are the investment freedom, control of corruption, and rule of law indicators.

Investment freedom correlates with e-commerce penetration only in three countries: Kazakhstan, Turkey, and Mexico. This result aligns with the recommendations of international organizations to create favorable investment conditions to promote e-commerce development (OECD, 2018; UNCTAD, 2019; Schwab, 2019). Overall, improving investment freedom can contribute to the development of digital infrastructure, such as communication networks and Internet infrastructure, which are necessary conditions for e-commerce (UNCTAD, 2020). Additionally, local entrepreneurs can gain access to the capital and technologies needed to launch and grow online businesses (OECD, 2018).

China and Kazakhstan exhibit a strong correlation between e-commerce penetration and the control of corruption indicator among developing countries. In Mexico and Turkey, despite the deterioration of the control of corruption indicator, the share of e-commerce is growing, although not as rapidly as in China and Kazakhstan. This indicates that control of corruption limits the faster penetration of e-commerce in Mexico and Turkey. The results confirm previous empirical studies showing that high corruption costs in developing countries negatively affect the deployment and development of e-commerce (Merhi & Ahluwalia, 2018). Furthermore, the results may partially align with earlier studies by Kaufmann and Kraay (2002), Kpodar and Andrianaivo (2011), Bilbao-Osorio et al. (2013), and Kaufmann and Wei (1999). These studies demonstrate the influence of corruption on the deployment of technologies and informa-


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tion systems necessary for the effective operation of e-commerce, including digitalization, Internet access, and the quality of information infrastructure, which can be crucial for the development of online trade. There are also findings that show improving the control of corruption indicator may result from reducing the informal (shadow) economy by promoting cashless payments in the economy (Dreher & Schneider, 2010; Saha et al., 2021). Thus, the detected correlation between the control of corruption indicator and e-commerce penetration may be mutually conditioned.

The results also found a positive correlation between the control of corruption indicator and e-commerce penetration in Germany and the UK, while no such relationship was found in the USA. Unfortunately, no studies have been found in this context specifically for developed countries. The detected differences are associated with the political systems of the studied countries. The USA predominantly employs a less regulated market approach to business management, while Germany and the UK have more balanced management involving the participation of workers and representatives in management bodies. Differences in political systems can affect decision-making processes and interactions between the government and business. The USA actively implements and widely disseminates innovations such as machine learning, artificial intelligence, and personalized offers due to high competition in the e-commerce market. Thus, in countries with similar institutional environments as the USA, predictors of further e-commerce growth may include other factors, such as innovations and technologies. Roszko-Wójtowicz et al. (2024) drew similar conclusions.

The rule of law indicator is closely correlated with e-commerce penetration in all nine studied countries. This aligns with the findings of Oxley and Yeung (2001). However, for some countries, this relationship was positive (China, Kazakhstan, Singapore, and South Korea), while for others, it was negative (the USA, the UK, Germany, Mexico, and Turkey), indicating that the nature of the relationship does not depend on the level of economic development. This may be due to the peculiarities of government management in these countries. For example, in Kazakhstan and China, centralized management ensures strict compliance with laws and regulations set by the government. Additionally, the detected high inverse correlation in the USA, Germany, and the UK may be due to more developed democratic institutions, one manifestation of which is the inadmissibility of unilateral government decisions. These results partially align with the conclusions of studies presented by Gibbs and Kraemer (2004) and Zhu and Kraemer (2005). These works demonstrated a stronger determining role of government regulation in the e-commerce sector in developing countries compared to developed countries.

This study provides insights into possible statistically significant correlations between international indices assessing the institutional environment and e-commerce penetration in a number of developed and developing countries. The findings support earlier research conclusions on the importance of physical infrastructure and digital literacy for e-commerce development. At the same time, this study empirically proves a strong positive relationship between e-commerce penetration and indices measuring e-government development and network readiness. Additionally, the results confirm recent research findings on the importance of improving the institutional environment for e-commerce development.

## CONCLUSION

This study examined the impact of international indices evaluating the institutional environment on the level of e-commerce penetration in countries with different levels of economic development. The results showed that among the considered international indices, only the E-Government Index and the Network Readiness Index have very high and high positive correlations with the level of e-commerce penetration in all studied countries. Among the remaining indices, three dimensions of institutional environment quality correlate with the level of e-commerce penetration in most of the studied countries. The rule of law indicator in the USA, Germany, and the UK has an inverse correlation with the

share of e-commerce, while in South Korea and Singapore, which are also developed economies, a positive correlation was found. This is likely due to the peculiarities of the political management model in these countries. In South Korea and Singapore, centralized management ensures strict compliance with laws and regulations set by the government. Similar government management characteristics are observed in China and Kazakhstan. According to the study results, these developing countries also show a positive relationship between the rule of law indicator and the share of e-commerce. This suggests that the nature of the correlation between the indices and the share of e-commerce does not depend on the level of development of national economies.

The results contribute to the scientific knowledge base on methods for assessing country differences in the institutional environment of e-commerce. The practical significance of the study lies in the possibility of replicating the research for other countries. The prospects for further research are determined by the possibility of using the obtained empirical results to develop models for e-commerce development for any of the studied countries to determine strategic and tactical tasks for improving the institutional conditions for e-commerce development.

## AUTHOR CONTRIBUTIONS

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# APPENDIX A

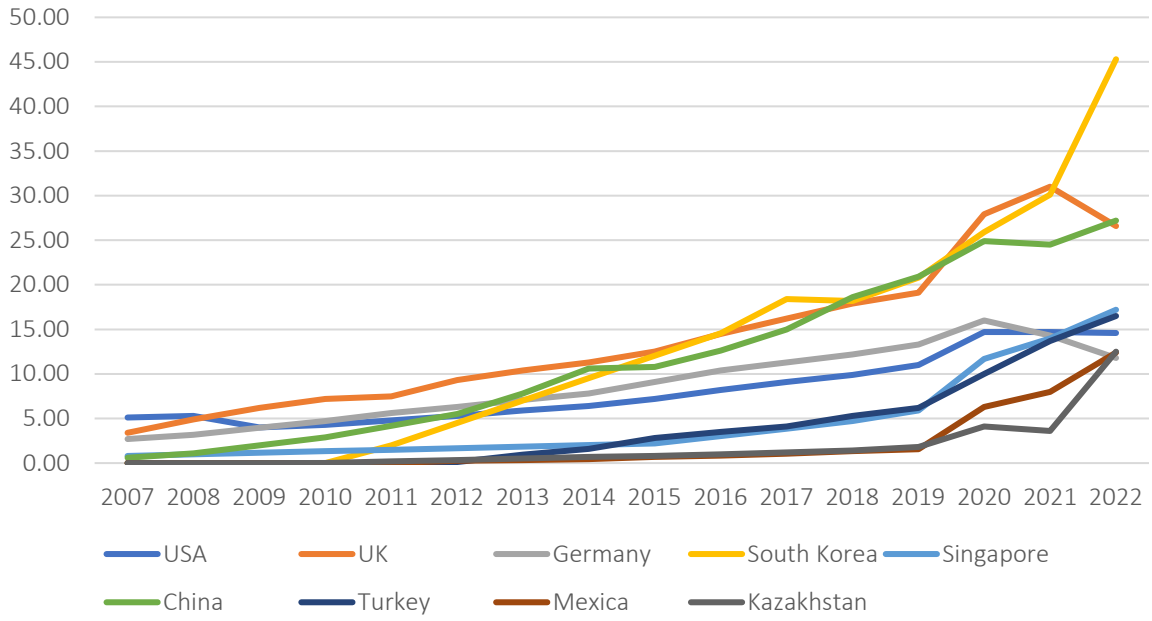


**Figure A1.** The share of e-commerce in retail trade in the studied countries from 2007 to 2022


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