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TECHNOLOGY-BASED FACTORS OF GLOBALIZATION IN MARKET AND TRANSITION ECONOMIES. IS THERE A DIFFERENCE?

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Abstract. *Purpose* – The global crises that emerged during the last two decades proved that economies that focus their development on demand are the most vulnerable during crises. However, development strategies depend on specific internal and external circumstances impacting development of particular country. In that sense, this research aims to identify how digitalization, science and technology, and ICT trade impact globalization in market and transition economies.

Research methodology – Authors employed the PLS-SEM methodology on available dataset for 32 European economies.

Findings – According to the findings, digitalization is the factor that has the highest positive impact on globalization in market economies, while ICT trade has the greatest positive impact on globalization in transition economies. Science and technological advancements have a diverse impact. The MGA results stressed out the difference between these groups even more clear.

Research limitations – The presented model does not consider country-level analysis of globalization.

Practical implications – The study is providing theoretical and empirical base for strategy and policy development in the globalization domain in line with economy character.

Originality – The value of the research is found in contributing to the globalization topic in market, and particularly in transition economie that lack empirical research in this field.

Keywords: globalization, PLS-SEM, ICT trade, digitalization, science and technology.

JEL Classification: F60, C51, F10, O30.

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1. Introduction

The world's greatest health crisis of the 21st century has occurred as a consequence of the spread of the COVID-19 virus, which is permanently transforming the patterns of business and daily life (Chen & Yeh, 2021). The last crisis that provoked a significant drop in economic activity and changes in the business environment occurred in 2008–2009 (Chau et al., 2020). Scientists argue that the fast technological development since the 1990s is responsible for the financial crash in 2007, while others state that the USA's economy's booming, especially in the information and communication technology (ICT) sector, is directly responsible (Mursa, 2012). In addition, many other world events have caused changes in the business environment, like the migrant crisis and the increasingly frequent sanctions of the great powers against other economies that violate the agreements on free trade (Garg, 2021). Such frequent changes in the global market have raised the question of whether the globalization concept is changing (Lee & Trimi, 2021).

But, not every country is capable of reacting to these challenges in the same way. So, in order to capture the real situation in the market, the development level and character of the economic system of the analyzed countries should be considered. According to that criterion, they can be classified as either market-oriented economies or transition economies. This is exactly the kind of division that is the focus of the European Bank for Reconstruction and Development [EBRD] (2021a).

The main motivation for performing this research study lies in the scarcity of literature on market and transition economies in terms of globalization trend. This kind of country division in researching such important issues like globalization helps to identify the ways in which countries at different stages of development and with different economic systems respond to changes in the market. Especially in the time when pandemic has brought the importance of digital technology and globalization as hot topic in society and economy. In that sense, the main aim of the study is to discover how digitalization, science and technology, and ICT trade are changing the existing globalization patterns in market-oriented and transition countries.

The primary scholarly contribution of this research is the identification of the impacts of various indicators on the development of globalization in both market and transition economies. This is particularly significant as the existing body of literature lacks studies that specifically classify countries in this manner. By using multi-group analysis, this study adds to the theoretical framework about the difference between market economies and transition economies, as well as their different globalization trends. Additionally, the research offers four distinct categories of indicators that can be used to represent the concepts of digitalization, science and technology, ICT trade, and globalization.

2. Literature review

There are a number of ways used in the literature to represent the level of globalization of an economy. According to a broad literature review, studies can be divided into two categories of research: those that explore the globalization concept through available individual indicators or those that already have an established or proposed globalization index. The first category of studies relies on independent indicators and most of the studies consider the historical data about international trade flow and merchandise trading used to discover the dynamics of globalization (Siddiqui, 2017; Erixon, 2018; Latif et al., 2018; van Neuss, 2018; Kalaitzi & Chamberlain, 2020; Estmann et al., 2020; Vu et al., 2021; Liboreiro et al., 2021; Istaiteyeh et al., 2023). The second category of studies is established on the use of the calculated globalization index (Gygli et al., 2019).

Much more emphasis in the literature was placed on identifying the difference between developed and developing countries (Kim et al. 2021). Because of this scarcity of research, the literature review is mostly based on the study of distinctions between developing and developed countries, as the most approximate classification of countries.

2.1. Digitalization effects on globalization

The increased interconnectedness of economies and societies enables the globalization process, which is enhanced by the continuing growth of a web and the Internet (Miśkiewicz & Ausloos, 2010). The process of digitalization is crucial to the transformation of traditional sectors that are involved in global value chains (GVC) (Guo et al., 2023). A recent study indicates that companies that prioritize investments in digital technology, particularly in Internet utilization, are more inclined to participate in GVCs (Gopalan et al., 2022). ICT growth is recognized as the initiating trigger of globalization (Miśkiewicz & Ausloos, 2010; Latif et al., 2018; Skare & Soriano, 2021). The authors Arvin et al. (2021) used the example of the G-20 advanced economic group to illustrate the interconnectedness and positive impact of various variables, including ICT development, on economic growth. According to the empirical evidence shown in their paper, economies are becoming more internationally interconnected as a result of the digital technology development. Because of open markets and the role that multinational corporations play in the transition economy in the form of enhanced cross-national collaboration, the ICT sector promotes faster globalization (Latif et al., 2018). The ICT sector has the potential to attract FDI that provides significant growth chances for economies of various sizes (Văduva & Neagoie, 2016). Developing countries are facing serious obstacles to adopting digital technology, such as weak institutions and obvious gaps in available infrastructure (Amankwah-Amoah et al., 2021). Some scholars evidenced that developed economies base ICT development on broadband connectivity, whereas developing countries, base ICT development on mobile connectivity, which requires basic infrastructure (Kim et al. 2021).

Overall, "ICT dispersion has a positive impact on globalization in developing countries, but the influence is more obvious in industrialized economies with high incomes. The digital divide between developing and developed economies has resulted in this mismatch in findings (Andrés et al., 2017; Lee et al., 2017). However, both developed and developing countries are leveraging digital transformation to promote greater economic growth (Stremousova & Buchinskaia, 2019a). This motivate authors to test the following hypotheses:

H1a: Digitalization has positive impact on globalization in market economies.

H1b: Digitalization has positive impact on globalization in transition economies.

2.2. Science and technology effects on globalization

Sharing knowledge among scientists from various countries and exchanging foreign technologies are incentives for globalization in science (Grossman & Helpman, 2015). The rapid improvement of technology facilitating the transmission of information and knowledge results in a more profound exchange of knowledge between economies and its inclusion into global knowledge channels (Liu et al., 2022). To increase degree of technological progress and knowledge, developing countries must invest in R&D activities, but, these countries are often hampered by a lack of financial resources. In such circumstances, R&D budgets are allocated from FDI sources available in multinational companies (MNCs) (Erdal & Göçer, 2015). As a result, the presence of MNCs in developing markets is crucial for supporting science and technology growth in those countries, particularly in the field of IT (Branstetter et al., 2019). Chatterjee et al. (2023) demonstrated that integrating knowledge into the activities of MNCs is crucial for enhancing their participation in GVCs through technology.

The significance of higher education has been amplified in the context of globalization (Turumbetova, 2014; Popescu, 2015; Hromcová & Agnese, 2019). Globalization increases the number of R&D researchers that are vital for creating knowledge and technology (Lee, 2006; Athukorala & Kohpaiboon, 2010). Although developed economies have enough financial and human resources to develop high-tech products, they do not share core technologies with developing economies (Hong et al., 2015). Developed economies can only outsource their manufacturing technology to developing countries to reduce production costs, but the technology stays foreign. Transition countries demonstrate remarkable potential for transitioning to a knowledge economy that allows for significant global ties with economies all over the world (Fan et al., 2019). Investing in technology in developing countries can contribute to long-term growth and create opportunities for people to learn and share technology (Kamel & Rizk, 2019; Tudor et al., 2021; Pérez-Castro et al., 2021). Following previous research studies that discovered a positive relationship between science and technology and globalization, the following hypothesis was tested:

H2a: Science and technology have positive impact on globalization in market economies.

H2b: Science and technology have positive impact on globalization in transition economies.

2.3. ICT trade effects on globalization

ICT products are proven to be extremely significant for economic development in both developed and developing economies, with developed economies having a higher rate of ICT adoption (Kariuki, 2021). Recent research discovers importance of developing digital technology that promotes economic integration in GVCs through exporting high-tech technology, especially if the trade partners are developed economies or economies with high financial growth rate (Liu et al., 2023). The data show that a high percentage of digitalized services promote their exports beyond national borders (Jiang & Jia, 2022). The share of high-income countries in the export of digital services is much higher than that of middle-income countries, while the share of participation in low-income countries has no effect (Jiang & Jia, 2022). Export activities in low-income economies are constrained by lack of financial resources, available FDI investments, and basic industrial activities (Jiang & Jia, 2022). Because the ICT sector in developing countries is relatively small, there is a strong tendency to promote digital activities that can contribute to the development of a strong ICT export-led economy (Kano & Toyama, 2020). Developing economies with a higher percentage of ICT use outperform in international trade while stifling economic growth (Adeleye et al., 2021). The total share of ICT goods and services exported by transition countries is increasing, with the potential to drive the volume of international trade performances and globalization in the future (Čorejová & Madudová, 2019). The structure of ICT trade encompasses the examination of metrics such as import and export of communications and computer services (Stremousova & Buchinskaia, 2019b; Sadigov, 2022) and ICT goods imports (Arvin et al., 2021; Dzator, 2023).

Developed countries are the primary exporters of ICT, while developing countries are the primary importers (Topuz & Doğan, 2016). Developed economies utilize available resources to build cutting-edge technology that can be exported to less developed economies who lack the resources to develop such technological solutions (Costantini & Liberati, 2014).

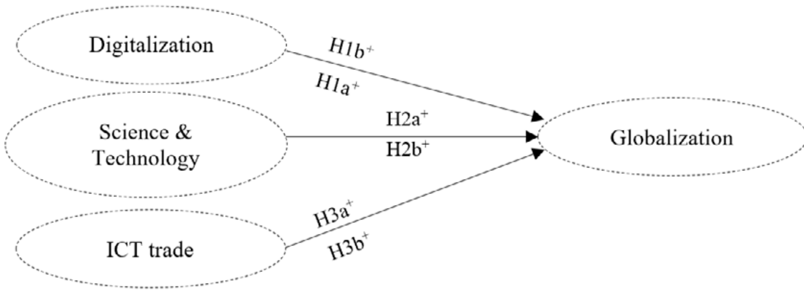

Figure 1. Theoretical research model

Developing economies that perform poorly in international R&D and rely on technology imports should aim to absorb current imported technology, develop it, and offer it as a new technological solution on the global market (Dnishev & Alzhanova, 2016). There is a vast number of available literature on the relationship between ICT trade and economic growth and development. However, there is a scarcity of literature specifically dealing with the effects of ICT trade on the globalization process, particularly in transition and market economies. As a result of a brief review of the previously presented literature on developed and developing economies, the following hypothesis can be defined:

H3a: ICT trade has positive impact on globalization in market economies.

H3b: ICT trade has positive impact on globalization in transition economies.

The proposed hypotheses outline the research theoretical framework, which is depicted in Figure 1.

In order to capture the difference between market-oriented and transition economies, the final H4 hypothesis is formulated as follows for the purpose of validating this assumption:

H4: There are statistically significant differences between market and transition economies in impact of digitalization, science and technology and ICT trade on globalization.

3. Data and methodology

The research method consists of several stages. The first stage represents the concept in which the research problem was recognized as a literature gap after reviewing the relevant literature. This stage included forming research hypotheses. The next stage focused on expanding the research question by selecting data that can be used as valuable indicators of the research problem and collecting data based on the available resources. In the next stage, based on the nature of the gathered data and the identified research question, a suitable methodology was selected to test the proposed hypothesis in the conceptual stage of the research. In this case, the study uses Partial Least Square Structural Equation Modeling (PLS-SEM) with the SmartPLS v.3 software (SmartPLS 3.0, 2022) to test the hypothesis. This software enables multi-group analysis (PLS-MGA) to be carried out in markets and transition economies to detect differences in factors affecting globalization. The final stage of the research was dedicated to the research results and final conclusions that could be derived from the empirical findings.

3.1. Data

To test the research hypotheses and model described above, a descriptive research approach with quantitative secondary data analysis is performed. Data for the empirical analysis incorporate a variety of sources. The initial data set covered all European economies, as well as indications on globalization and its affecting elements, to limit the risk of biased conclusions. The total number of countries was determined on the basis of available indicator data for European countries. The sample currently contains 32 European nations after eliminating indicators and countries with missing values (15 market and 17 transition economies). According to the Transition Report 2020–2021, the countries are classified into two groups (EBRD, 2021b). During the measurement model evaluation, the number of indicators is further reduced by removing indicators with loadings below a threshold of 0.7 (Henseler et al., 2016; Benitez et al., 2020), as specified in the measurement model section. Table 1 summarizes the final set of indicators.

Table 1. Indicators used in the model, their corresponding short names and data sources

Latent var.	Indicators	Short name	Ref.	Source
Digitalization	Fixed-telephone subscriptions in 100 inhabitants	Fixed_tel_subs	Lee et al. (2017) Erixon (2018) Arvin et al. (2021)	International Telecommunication Union (ITU) statistics (2021)
	Individuals using the Internet (% of population)	Internet_users	Andrés et al. (2017) Latif et al. (2018) Arvin et al. (2021)	
	Mobile-cellular subscriptions in 100 inhabitants	Mobile_cellular_subs	Lee et al. (2017) Latif et al. (2018) Arvin et al. (2021)	
Science and technology	Population with advanced education as a % of population	Pop_advan_educ	Turumbetova (2014) Popescu (2015) Hromcová and Agnese, (2019)	World bank's World Development Indicators database (2021)
	R&D expenditure (% of GDP)	R_D	Hong et al. (2015) Branstetter et al. (2019)	
	Researchers in R&D (% of population)	R_D_researchers	Lee (2006) Athukorala and Kohpaiboon (2010)	
ICT trade	Communications, computer, etc. (% of service exports, BoP)	Comm_computer__service_exp	Stremousova and Buchinskaia (2019b) Sadigov (2022)	World bank's World Development Indicators database (2021)
	Communications, computer, etc. (% of service imports, BoP)	Comm_computer__service_imp	Stremousova and Buchinskaia (2019b) Sadigov (2022)	
	High technology exports as a % of GDP	High_tech_exp	Topuz and Doğan (2016)	
	ICT goods imports (% total goods imports)	ICT_goods_imp	Arvin et al. (2021) Dzator et al. (2023)	

End of Table 1

Latent var.	Indicators	Short name	Ref.	Source
Globalization	The share of country's export in total world export	Export_share	Siddiqui (2017) Erixon (2018) Liboreiro et al. (2021)	World bank's World Development Indicators database (2021)
	The share of country's import in total world import	Import_share	Latif et al. (2018) Liboreiro et al. (2021) Arvin et al. (2021)	
	Merchandise exports to high-income economies (% of total merchandise exports)	Merch_exp_high-income_ec	Estmann et al. (2020) Kalaitzi and Chamberlain (2020) Istaiteyeh et al. (2023)	

Table 1 shows that globalization factors and globalization itself are made up of a number of latent variables that are expressed by a set of diverse indicators.

3.2. Methodology

The PLS-SEM approach is gaining popularity and application among economics academics due to its ability to model latent variables in conditions of nonmorality and small sample sizes (Barroso et al., 2010; Peña-Vinces et al., 2012; Anaza et al., 2015). In addition, the following facts (Hair et al., 2014; Henseler et al., 2016; Vinzi et al., 2010) influence the use of this model for evaluating macroeconomic problems:

1. PLS-SEM is a suggested approach for theory creation and causal applications when theoretical knowledge about a considered issue is lacking;
2. In terms of explaining variation in dependent factor indicators, PLS-SEM outperforms variance and covariance-based SEM (CB-SEM);
3. PLS-SEM is recommended when the phenomena under investigation arise from a macro-level theory with unknown variables;
4. If the purpose of the investigation is to identify the major drivers/barriers of a dependent variable and model these antecedent factors as reflective-formative hierarchical latent variables, PLS-SEM is preferable to CB-SEM;
5. PLS-SEM method is more concerned with the accuracy of predictions than with the accuracy of estimation.

The mentioned advantages of PLS-SEM over CB-SEM must be weighed against some limitations. First, because no distributional assumptions are made, researchers are unable to use the traditional parametric inferential framework. Second, since PLS-SEM lacks a global optimization criterion, there are no measurements for overall model fit (Chin, 1998; Tenenhaus & Vinzi, 2005). However, PLS-SEM is a logical and appropriate choice for this study, considering the prediction-oriented research goal and the fact that the path model contains more formatively measured constructs.

The PLS method suggests a two-stage procedure: measurement model validation and structural model hypothesis testing (Chen & Chang, 2013). Since this study aims to identify differences in links between globalization and digitalization, science and technology, and ICT trade in market and transition economies, the third step in analysis is Multi-Group Analysis (MGA).

4. Results and discussion

4.1. Results of measurement model and discussion

The first step of the PLS-SEM procedure implies the examination of constructs to determine their reliability and validity. Construct validity refers to the extent to which a scale consists of a suitable sample of items to represent the considered construct, or whether the items appropriately represent the construct's domain of content (Chin, 1988; Nannally, 1997). Individual item reliability was assessed by analyzing the standardized loadings (Hair et al., 2021). The item's measurement is considered as part of a construct if it exceeds a threshold of 0.7, indicating that the related latent variable can explain more than 50% of the variation in a single indicator (Henseler et al., 2016; Benitez et al., 2020). Table 2 presents the outer loadings for considered indicators (items).

The factor loadings in Table 2 vary from 0.784 to 0.965 and are all significant at the 1% level, implying that the measures are reliable.

Table 2. Outer loadings (source: author's calculations)

Indicators	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Fixed_tel_subs	0.834	0.835	0.019	44.878	0.000
Internet_users	0.927	0.928	0.009	103.538	0.000
Mobile_cellular_subs	0.886	0.887	0.017	51.538	0.000
Pop_advan_educ	0.870	0.870	0.014	60.844	0.000
R_D	0.925	0.925	0.007	142.011	0.000
R_D_researchers	0.965	0.966	0.004	270.940	0.000
Comm_computer__service_exp	0.876	0.876	0.014	64.018	0.000
Comm_computer__service_imp	0.876	0.875	0.018	49.950	0.000
High_tech_exp	0.772	0.772	0.019	40.801	0.000
ICT_goods_imp	0.836	0.837	0.019	44.257	0.000
Import_share	0.786	0.787	0.014	57.575	0.000
Export_share	0.784	0.786	0.014	57.473	0.000
Merch_exp_high-income_ec	0.825	0.825	0.008	100.250	0.000

The next stage in the measurement model evaluation process is to analyze construct reliability and internal consistency, which is often performed using composite reliability – CR and Rho (Hair et al., 2021) and Cronbach's Alpha (Castro & Roldán, 2013). The average variance extracted (AVE) shows how much of a construct's variance is attributable to its indicators vs how much is due to error (Hair et al., 2021). Convergent validity is the ability to verify that multiple items accurately measure the same construct (Hair et al., 2021). Table 3 lists all of these measurements.

Table 3 shows that all of the constructs in this study exceed the suggested value of 0.7 for both sets of values (Hair et al., 2021), indicating the existence of construct reliability. Table 3 further demonstrates that all AVE values are higher than the threshold of 0.5 (Fornell & Larcker, 1981). Specifically, the AVE values are greater than 0.638, indicating that the corresponding construct accounts for at least 63.8 percent of the variation in extended indicators (Hair et al., 2021).

Table 3. Construct reliability and validity (source: author's calculations)

Latent variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Digitalization	0.859	0.866	0.914	0.781
Science and technology	0.910	0.910	0.944	0.849
ICT trade	0.862	0.877	0.906	0.707
Globalization	0.772	0.880	0.841	0.638

The discriminant validity of a construct indicates how different it is from other constructs. The values should be greater than the model's shared variance between the construct and the other latent variables (Fornell & Larcker, 1981). In order to access discriminant validity in this case, the Fornell-Larcker criterion (Table 4) and cross-loadings (Table 5) are used.

Table 4. Discriminant validity according to Fornell-Larcker Criterion (source: author's calculations)

Latent variables	Digitalization	Science and technology	ICT trade	Globalization
Digitalization	0.883			
Science and technology	0.794	0.921		
ICT trade	0.611	0.565	0.841	
Globalization	0.832	0.734	0.667	0.799

Table 5 shows that the AVEs of each latent variable is greater than the correlation of the remaining latent variables, showing that, according to Fornell-Larcker Criterion, discriminant validity is achieved. To obtain additional evidence of discriminant validity, the cross-loadings are presented in Table 5.

Table 5. Discriminant validity according to cross-loadings (source: author's calculations)

Indicators	Digitalization	Science and technology	ICT trade	Globalization
Fixed_tel_subs	0.834	0.587	0.368	0.745
Internet_users	0.927	0.873	0.659	0.795
Mobile_cellular_subs	0.886	0.622	0.590	0.651
Pop_advan_educ	0.847	0.870	0.555	0.678
R_D	0.662	0.925	0.521	0.696
R_D_researchers	0.681	0.965	0.482	0.649
Comm_computer__service_exp	0.536	0.564	0.876	0.632
Comm_computer__service_imp	0.628	0.508	0.876	0.584
High_tech_exp	0.319	0.344	0.772	0.428
ICT_goods_imp	0.529	0.452	0.836	0.571
Export_share	0.421	0.393	0.290	0.784
Import_share	0.428	0.393	0.290	0.786
Merch_exp_high-income_ec	0.896	0.773	0.765	0.825

The cross loadings as a method of discriminant validity assessment requires that the loadings of each indicator on its construct are higher than the cross loadings on other constructs (Hair et al., 2014), which is fulfilled in this case according to data presented in Table 5.

4.2. Results of structural model and discussion

Once the build measurements have been verified as reliable and valid, the coefficient of determination (R2) should be checked before evaluation of the structural model findings. In this study, the inner path model for the globalization endogenous latent variable amounts to 0.74, which means that three independent latent variables explain 74 percent of the variance in the globalization variable, implying that three latent variables in the model account for approximately 74 percent of the change in the globalization level. Since an R2 value of 0.67 is considered substantial in exploratory research (Chin, 1998; Ringle & Sinkovics, 2009; Mubarak & Petraite, 2020), it can be concluded that the R2 value in this study is rather substantial.

The next stage is to evaluate the structural model findings. Many approaches are used to estimate the path coefficient of the measurement model to assure the robustness of the link between the latent variables. According to Kock (2015), this stable technique is based on the direct application of exponential smoothing formulae and produces estimates of the real standard errors that are consistent with those derived by bootstrapping. Results of the bootstrapping procedure for whole sample or so-called pooled data (Hair et al., 2021) are presented in Table 6.

Table 6. Bootstrapping results for pooled data (source: author's calculations)

Links	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Digitalization → Globalization	0.571	0.570	0.050	11.363	0.000
Science and technology → Globalization	0.148	0.149	0.046	3.225	0.001
ICT trade → Globalization	0.234	0.235	0.030	7.863	0.000

The empirical results presented in Table 6 indicate a statistically significant ($p < 0.05$) and positive relationship between all the independent latent variables and globalization if all the considered European countries are taken into account. It means that a higher level of digitalization, greater involvement in ICT trade, and developed science and technology result in a higher globalization level. However, the impact of digitalization is the highest (0.571), indicating that, in general, increased usage of ICT, the web, and the Internet enhances globalization in the form of international trade (Miśkiewicz & Ausloos, 2010; Stremousova & Buchinskaia, 2019b). On the other hand, the science and technology effect on globalization is the lowest, suggesting this factor has a diverging effect in considering countries.

Considering that the main focus of this research is identification of differences in impact of independent latent variables on globalization between market and transition economies, the bootstrapping procedure will be conducted for market and transition economies separately. The bootstrapping results for market economies are presented in Table 7.

Table 7. Bootstrapping results for market economies (source: author's calculations)

Links	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Digitalization → Globalization	0.909	0.910	0.045	20.149	**0.000**
Science and technology → Globalization	–0.127	–0.132	0.047	2.728	**0.006**
ICT trade → Globalization	0.157	0.161	0.037	4.287	**0.000**

Table 7 shows that digitalization and ICT trade have a statistically significant ($p < 0.05$) and positive impact on globalization. However, the impact of digitalization (0.909) is significantly greater than the impact of ICT trade (0.157). The results verify hypothesis H1a and H3a that respectively support the positive effects of digitalization and ICT trade on globalization level in market economies. It is consistent with Skare and Soriano (2021) findings that developed market economies with a high level of globalization have a high level of digital adoption, allowing for even faster globalization. As a result of this process, the impact of ICT trade on globalization is reduced. The path coefficient expressing the link between science and technology and globalization, on the other hand, amounts to –0.127, indicating that accelerated development of science and technology leads to less reliance on global trade and, as a result, a lower level of globalization (so-called de-globalization process). Thus the outcome fails to confirm hypothesis H2a that supports positive effects of science and technology on globalization development in market-oriented economies. The findings are backed up by studies by Akcali and Sismanoglu (2015) and Hong et al. (2015), which show significant benefits of R&D investments in science and technology in developed market economies, allowing for the development of domestic high-tech products and encouraging players to think locally (Kafouros et al., 2022). This relationship is also statistically significant at the $p < 0.05$ level.

The bootstrapping results for transition economies differ in great extent compared to market economies, as it is presented in Table 8.

Table 8. Bootstrapping results for transition economies (source: author's calculations)

Links	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Digitalization → Globalization	0.248	0.251	0.068	3.637	**0.000**
Science and technology → Globalization	0.128	0.121	0.077	1.674	**0.094**
ICT trade → Globalization	0.550	0.555	0.046	11.909	**0.000**

The path coefficients in Table 8 show that the linkages between the investigated independent latent variables and globalization are the same as for pooled data. However, their values differ in some extent compared to those obtained for whole sample. In this case, the highest positive impact on globalization have ICT trade (0.550). Such results can be explained by the fact that transition economies invest less in R&D and rely on technology imports and foster absorption of imported technology to change their export structure in the favor of ICT goods and services, especially in developed market economies (Costantini & Liberati, 2014; Dnishev & Alzhanova, 2016). The path coefficient for digitalization is relatively lower (0.248). It can be partly explained by the fact that countries with better ICT infrastructure and stable Internet connection can attract more FDI investment and, as a result, increase their share in global trade (Latif et al., 2018). The science and technology have the lowest impact on globalization (0.128), and the reason for that is that these economies still invest less in R&D (Akcali & Sismanoglu, 2015), which reduce impact of this factor on globalization. It should be emphasized that path coefficients for digitalization and ICT trade are statistically significant at the level $p < 0.05$ and for science and technology at the level $p < 0.1$. Therefore, the analysis verifies two established hypothesis H1b and H3b related to transition economies. Digitalization and ICT trade achieve positive effects on globalization in transition economies. However, hypothesis H2b that supports positive effects of science and technology on globalization fails to be confirmed at level 0.5.

4.3. Multi-group analysis (PLS-MGA) results and discussion

This study aims to evidence that analyzed independent latent constructs' impact on globalization differ across defined groups of countries. So, PLS-MGA is employed to test the possibility of any statistically significant difference in the effect of globalization factors on globalization, by country group. It should be noted that comparison with PLS-MGA does not require that sample groups' shares be the same (Matthews, 2017), and the minimum sample size that each group should meet is 30 cases (Hair et al., 2017), which is present in this case.

To ensure the validity of results and conclusions, Ringle and Sarstedt (2016) developed the measurement invariance of composite models (MICOM) procedure. MICOM procedure represent a series of tests for accessing the invariance of constructs across multiple groups of data. It involves three hierarchically interrelated steps: (1) configured invariance (i.e., equal parameterization and way of estimation), (2) compositional invariance (i.e., equal indicator weights), and (3) equality of composite mean values and variances (Hair et al., 2021). Full measurement invariance is obtained if, in addition to satisfying partial measurement invariance (Steps 1 and 2), composites have similar means and variances across groups (Step 3). However, even establishing partial measurement invariance enable researchers can compare the path coefficients to the MGA (Cheah et al., 2020).

For the assessment of MICOM, Table 9 shows that partial measurement invariance of both market and transition economies is established.

Table 9. MICOM results (Step 1 and Step 2) (source: author's calculations)

Constructs	Configural invariance	c = 1	5% quantile of Cu	Permutation p-values	Partial measurement invariance
Digitalization	Yes	1.000	1.000	0.266	Yes
Science and technology	Yes	1.000	1.000	0.227	Yes
ICT trade	Yes	1.000	0.998	0.624	Yes
Globalization	Yes	0.999	0.998	0.057	Yes

The results presented in Table 9 suggest that, partial measurement invariance of both country groups was established. Thus, the preconditions for the application of PLS-MGA are established. The PLS-MGA results are presented in Table 10.

Table 10. Multi-group analysis (MGA) results according to Parametric Test and Welch-Satterthwait Test (source: author's calculations)

Links	Path Coefficients diff. (Market - Transition)	Parametric Test t-Value (Market vs Transition)	Parametric test p-Value (Market vs Transition)	Welch-Satterthwait Test t-Value (Market vs Transition|)	Welch-Satterthwait Test p-Value (Market vs Transition)
Digitalization → Globalization	0.660	8.424	0.000	8.236	0.000
Science and technology → Globalization	–0.256	2.967	0.003	2.897	0.004
ICT trade → Globalization	–0.393	7.015	0.000	6.926	0.000

The Welch-Satterthwait and Parametric tests are used to analyze the statistical significance of identified differences in path coefficients between transition and market economies, following the approach of Mubarak and Petraite (2020). As shown in Table 10, the results of both tests indicate that all differences in path coefficients are statistically significant at the $p < 0.05$ level. It suggests that there are significant differences between observed groups of countries in terms of the impact of digitalization, ICT trade, and science and technology on the level of globalization thus confirms final hypothesis H4. The link between digitalization and globalization has the greatest difference in path coefficients. The comparative analysis of the path coefficients for transition and market economies is presented in the following Figure 2.

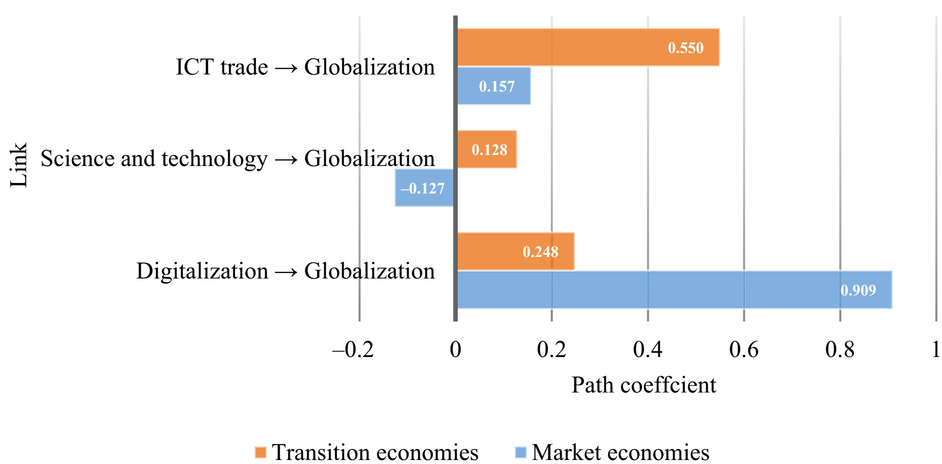

Figure 2. Comparative analysis of path coefficients in transition and market economies (source: author's calculation)

Overall, ICT dispersion have positive effects on transition countries, but the influence is more obvious in market economies with high incomes (Andrés et al., 2017; Lee et al., 2017). The difference in ICT trade and science and technology impacts can be explained by the fact that market economies invest more in R&D (Akcali & Sismanoglu, 2015), resulting in reduced reliance on global market involvement. These economies outsource their technological processes to developing countries in order to reduce production costs, whereas transition countries use advanced technology to transition to a knowledge economy, allowing them to establish stronger global connections with economies around the world (Fan et al., 2019).

5. Conclusions

Current study investigates the effects of digitalization, science and technology development, and ICT trade on globalization, using data on 32 European economies in the period 2010–2018. The authors used the EBRD's classification of countries into market and transition economies to identify differences between these two groups of countries to compare similar developed economies. Analysis was conducted by employing PLS-SEM methodology, as one of the most commonly used and appropriate approaches used in this type of analysis. The results pointed out that, in general (for the pooled data), digitalization has the greatest positive impact on the globalization level (the path coefficient amounts to 0.571). Intangibility, as a crucial characteristic of digitalization, enables the free conducting of economic activities without constraints like physical distance, transport organization, information and document sharing, and others. ICT trade and, especially science technology, have a much lower positive impact on globalization. However, all path coefficients are statistically significant at the level of $p < 0.05$. The study offers some theoretical and practical implications that are presented in the following part of the paper.

Theoretical implications come in a number of different forms. To begin with, the study contributes to broadening the empirical scope of the globalization topic in market-oriented and transition economies. To define the phenomenon of globalization, the current study offers a different structure of independent variables than those available in the literature. The following inference is connected to the widely used PLS-SEM analytical framework for explaining the impact of multiple independent factors on a phenomenon. Besides, the MGA allows authors to explore in more depth the differences among groups of countries. Also, the study is useful since it applies the EBRD's classification of nations based on their market structure to market and transition economies. Despite the fact that the classification is not new in and of itself, it is rarely considered in recent studies, especially using the new concept of transition introduced in 2016. Different economic systems in market and transition economies can lead to diverse outcomes in terms of the globalization process. Understanding how the economic system interacts with globalization factors can offer valuable insights into the dynamics of economic development in different contexts. A number of practitioners dismiss the economic system's characteristics in favor of concentrating on developed and developing economies. This methodological approach can inspire future studies to adopt similar comparative analysis techniques when examining other aspects of globalization across different groups of countries, sectors, or time periods.

Based on the results obtained for market economies, decision-makers and businesses in market economies should prioritize investments in digitalization to advance their global integration. This includes expanding access to digital infrastructure, improving digital literacy and skills development, and encouraging the expansion of digital sectors. The emphasis should be on taking advantage of ICT trade while ensuring that the growing prevalence of digitalization does not diminish the potential benefits arising from international trade cooperation. The conclusion of favorable trade agreements and the promotion of export-focused ICT industries can stimulate global connectivity and economic expansion. It is essential for decision-makers to carefully assess the consequences of significant investments in science and technology related to global integration. They must weigh the potential trade-offs between domestic technological progress and international trade partnerships, emphasizing a balanced approach that values local innovation and active global participation. Investing in the acquisition of digital skills by the population could promote the overall social development of a country that plans its progress on the use of digital technology and places human at the center. Establishing an environment that encourages research and innovation, facilitates technology transfer, and fosters the growth of local high-tech industries is imperative. This not only contributes to economic expansion but also strengthens the country's position in global markets and contributes to the development of advanced technology that reduces the negative impact on the environment.

On the other hand, research findings provided for transition economies lead to a little more different practical implications. Authorities in these economies should focus on leveraging the potential of ICT trade to enhance their global integration. This may involve creating favorable trade policies, attracting foreign investments in ICT-related industries, and fostering the absorption of imported technology to enhance export competitiveness in ICT goods and services. The government should prioritize digitalization initiatives to improve ICT infrastructure and stable internet connection to enhance the impact of digitalization on globalization. A robust ICT infrastructure can attract more foreign direct investments (FDI) and increase the country's share in global trade. This could enhance their competitive advantage on the global market and improve the life standard of the individuals. Public and private R&D investments in transition economies can increase the positive impact of science and technology on globalization. Encouraging domestic R&D activities can lead to the development of high-tech products and innovation, contributing to greater competitiveness in the global market. Also, creating a supportive environment for innovation and research can drive economic growth and enhance globalization outcomes. This could reduce the digital divide among population with diverse income status. Policymakers should tackle the problem of inadequate R&D financing by establishing tight collaborations between industry and key institutions such as research centers, universities, and governmental institutions. Governments should faciliate foreign collaborations between education and research institutions by signing collaboration agreements. Universities should engage in international student and researchers exchange programs. Future economic development can be facilitated by increasing investments in the ICT sector in the form of public-private partnerships. Furthermore, the government should provide financial incentives for domestic enterprises from the ICT sector to expand their activities across international borders and improve their worldwide competitiveness through a change in export structure in favor of ICT goods and services.

MGA results comparing the impact of digitalization, ICT trade, and science and technology on globalization between market and transition economies, also enabled deriving some practical implications. The significant differences in the path coefficients between market and transition economies indicate that one-size-fits-all policy approaches may not be suitable. Every economy should design and implement tailored interventions that address the unique characteristics and challenges of each group of countries. Customized policies can leverage strengths and opportunities while mitigating weaknesses and threats related to digitalization, ICT trade, and science and technology. Authorities in both market and transition economies should prioritize investments in digital infrastructure. Improving digital connectivity and internet penetration can attract foreign investments, facilitate business operations, and enhance global connectivity. At the end, the research suggests that ICT dispersion has positive effects on both transition and market economies, with a more obvious influence in market economies with high incomes. Policymakers in both types of economies should actively seek opportunities to engage in ICT trade and technology partnerships. Those partnerships could result in creating and trading cutting-edge technology that is energy efficient and sustainable thus promoting globalization in a sustainable manner. Encouraging foreign investments in ICT-related industries and facilitating the absorption of imported technology can enhance export capabilities and promote global integration.

The authors acknowledge several study limitations. The first constraint is a gap in the dataset that was acquired. The PLS-SEM analysis was performed on the historical period from 2010 to 2018. This research focuses on the distinctions between countries with different economic systems, defined by the EBRD. Future research should compare more homogenous group of countries with different levels of globalization, in order to gain a better insight into the impact of the considered factors of globalization. Future research should take into account the current model's lack of capability to perform analysis at the country level.

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