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EFFECTS OF BROADBAND AND TELEPHONE SUBSCRIPTION ON EXPORTS IN NEW GLOBAL ERA: EVIDENCE FROM SOUTHEAST EUROPEAN COUNTRIES

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Abstract

The overall objective of the present research is to examine the influence of information technology components on the export-to-GDP ratio, especially focused on the changes caused by the events of the 20th century for Southeast European countries (SEC). The motivation for selecting these countries is to evaluate whether they have achieved a sufficient level to adapt digital developments. To overcome these challenges, the study uses a hybrid technique, employing random-effects (RE) and fixed-effects (FE) regression and Arellano-Bond estimations on panel data gathered from 13 countries from 2006 to 2021. The results confirm that fixed broadband subscriptions (FBS), gross formation capital (GFC) and official exchange rate (ORE), have a strong positive effect on the export-to-GDP ratio. Additionally, fixed telephone subscriptions (FTS), foreign direct investments (FDI) and inflation (INF) have a significant negative impact on the export-to-GDP ratio. The Arellano-Bond technique reveals that FBS, INF and ORE have a positive effect on exports, whereas FTS, GFC and FDI have a negative effect. The novelty of this research is that it uses data comparisons that are not related to a single determinant in the economy but are conditioned to advancement, especially concerning global markets and the exploitation of gaps created by changes in supply chains.

Implications for Central European audience: Depending on the research results, it is anticipated that the policy-making structures and other regulatory authorities will create a clear overview of the importance of digitization and its dynamics in the realization of exports and the mitigation of the trade deficit. These discoveries will encourage the highly empowered actors to redesign the policies that will affect the expansion and increase of the quality of the infrastructure of broadband and telephone subscriptions. By expanding and increasing the quality of the economic structure of the respective countries, they will be able to maximize the progress of the export value, which is one of the main goals of almost every country included in the analysis.

Keywords: Export; digitization; panel data models
JEL Classification: F60, O30, C23

Introduction

This paper aims to estimate the influence of digitization on international trade in Southeast European countries[1] (SEC). To evaluate this impact as accurately as possible, we have analysed secondary data that express digitization and variables that may have an impact on these flows. Taking into account that global trade faces many barriers, particularly for less advanced economies, and that digitization overcomes these obstacles, the research aims to determine how digitization can facilitate international trade. This research became even more necessary after the consequences and obstacles brought by the COVID-19 pandemic when the need for online communication increased. Numerous studies over the last three decades have revealed digitization as a tool that can facilitate global trade and overcome many obstacles such as various protectionist measures and the impossibility created by physical distance. The UNCTAD study "Information Economy Report" (2017) concluded that discussions of digitization in lower-income countries still often remain around future hopes and ambitions. There has been limited systematic analysis of firm activities regarding digitization and platform use, as well as what can be learned from attempts to use new technologies to enhance international trade. On the other hand, the OECD report "Digital Trade and Market Openness" argues that digitization is having a profound influence on international trade (González & Ferencz, 2018).

The widespread adoption of digital technologies has reduced certain challenges associated with internationalization, additionally contributing to higher trade attractiveness. Similar studies have concluded that the impact of digitization on trade so far is undisputable to the point that it is nowadays quite inconceivable to believe that geographical distance could still represent an imperative obstacle to trade relationships. The present role of technology in information and communication (ICT) is so fundamental that the effect of previous decisive factors, such as geographical distance, is likely to be obscured and become increasingly irrelevant. In contradiction to the consensus, a few contend that the consequences of internet applications have a slight impact, which is compatible with the outcomes of Rodriguez-Crespo et al. (2019), who exposed a lesser effect of using the internet on both exports and imports for low and middle-income economies compared to advanced economies. Furthermore, they discovered a slight contribution to import and export patterns. In the aforementioned evaluation, the authors claimed that ICT broadcasting and education level are irrelevant in explaining imports and have only a slight effect on explaining exports. Consequently, emphasizing the importance of exports, we are going to reflect the export-to-GDP ratio[2] for SEC economies in 2020 and 2021 in the chart below. The selection of these two years is to be portrayed visually; there is no particular aim other than to study the

[1] Countries included in the research are: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, North Macedonia, Montenegro, Moldova, Romania, Slovenia and Serbia.
[2] The export-to-GDP ratio expresses the export of goods and all services to gross domestic product.

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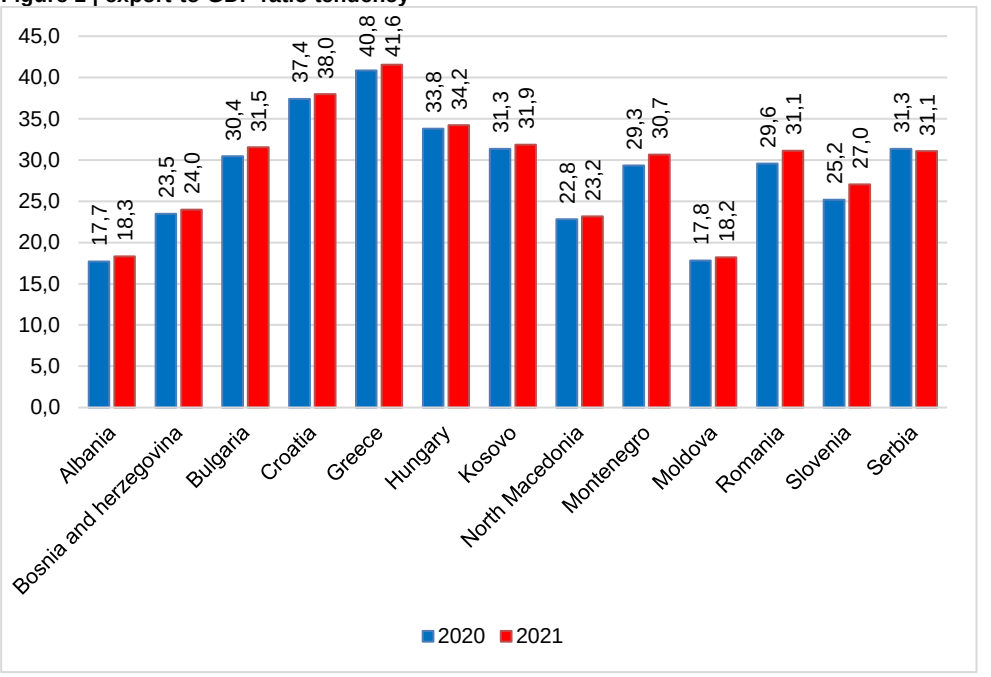
tendency of this ratio, especially after the termination of the measures imposed by the COVID-19 pandemic.

Examining the trajectory of the economies covered in this overview of indicators, we can observe that Greece and Croatia have the greatest participation rates with 41.6% and 38.0%, respectively, closely followed by Bulgaria at 31.5%, Hungary at 34.2%, Kosovo at 31.9%, Montenegro at 30.7%, Romania at 31.1%, Slovenia at 27.0% and Serbia at 31.1%. Albania, Bosnia and Herzegovina, as well as Moldova, possess the lowest participation rates.

Figure 1 | export-to-GDP ratio tendency



Source: Authors' compilation based on data

Adopting advances in information technology, or digitization, into company practices and marketplaces can serve as a means of modernizing the business models of firms and contributing to the expansion of domestic and international trade. As noted by Vendrell-Herrero et al. (2017, p. 71), the digital evolution of company models is reshaping customer behaviour and consumption as business entities set up technological solutions to enhance their overall competitiveness by transforming client interactions (Dellarocas, 2003), within-company procedures (BarNir et al., 2003), as well as value predictions (Lusch et al., 2010). This is particularly true for markets, such as the ones found in Southeast European countries, which are continuing to transition into 21st century practices and integrate with wider European and international markets (Dima et al., 2018). As firms seek to increase their export competitiveness and increase market presence and performance on international markets, embracing digital transformation or digitization, as core strategy plays a key role (Ritter & Pedersen, 2020). Even though there is no universal definition of

digitization, it has been characterized as "the adoption or rise in the utilization of technological devices or technological advances in computers by an institution, businesses, economies or other entity". Referring to the citation of Ritter and Pederson (2020) in the Oxford English Dictionary, many authors have tried to offer their definitions. As stated by Brennan and Kreiss (2016), digitization refers to "how different aspects of social life have transformed initially with electronic communication as well as broadcast infrastructure (p.6)". They distinguished these activities from digitation, which refers to the act of switching analogue sources of information via digital bits (p. 1).

Therefore, based on this perspective, the research aims to provide an added contribution to SEC, eliminating the dilemmas related to the effect of digitization on exports. Our research contribution and originality are oriented on the use of cross-sectoral data (panel data for the 13 SEC), using a combined static and dynamic approach to identify the degree of effect on the one hand, and the positive or negative significance of the export-to-GDP ratio on the other hand. Additionally, the outcomes of this breakdown will certainly have policy implications for the respective countries. The study is structured into four segments, opening with an introduction, supported by a literature review, an econometric analysis, a discussion of the discoveries and, finally, conclusions.

1 Literature Review

Starting in 2020, the world has gone through various experiences, making it clear to us that nothing is permanent. The COVID-19 pandemic has completely transformed the way of thinking about doing business, as well as the development and economic growth on a global scale. To develop more effective strategies for addressing the COVID-19 pandemic, innovation and forward thinking are required. Legislative concerns about entrepreneurship will help in comprehending the significance of upcoming studies on digital evolution, leadership, business influence and social inclusivity (Ratten, 2021). Major changes are mainly wanted to be made on the global scale, especially in the approach to exports, being limited by a physical vision and using more information technology in communication, management and administration.

The most prevalent characteristic of pandemics is their serious adverse influence on the worldwide economy. Furthermore, the distribution system needs to be sufficiently adaptable to respond to modifications within the food supply chain. Startups must become better organized, through the crisis as a catalyst of change. Businesses should prioritize the development of technology for communication and information networks for new markets (Serpil & Mehmet Aday, 2020). The best strategies to emerge and adopt changes in global trade and supply chain influenced the need to use more effective and advanced information technology. As a consequence of this, with the intent to boost supply chain agility, IT supports customers as technology users in providing information associated with businesses in offering services and logistics providers. IT connects supply chains in management resources among vendors, manufacturers and purchasers (Maemunah & Cuaca, 2021). With well-organized and effective access to IT, exports may perhaps be the best solution for businesses to tackle climate change through learning by exporting for sustainable growth. Exporting has benefited from upgraded high-tech innovation performance and faster technological and machinery upgrades (Debbarma et al., 2022).

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The relatively recent popularity of broadband has already sparked plenty of discussion over the possibility that it is a dominant general-purpose technology. Broadband has prompted widespread shifts in the IT sector, empowering services such as cloud computing and mobile apps. Practically all investigations, regardless of methodology or whether they were cross-country or single-country, have indicated that fixed broadband and phone services have a beneficial economic impact. Nevertheless, the outcomes were sometimes not statistically important (Minges, 2015). Partnership through export has been intensified in all Western Balkan economies, particularly focused on European countries, because trade arrangements with the EU and CEFTA significantly affected the liberalization of trade in Western Balkans (Matkovski et al., 2022). Since the pandemic has determined change in the supply chains for many European countries, determined by the different conditions of existing chains, the countries of the Western Balkans have been given an opportunity to export their products to the EU countries. Using this opportunity, information technology has played an important role in penetrating international markets with products. Additional controlling factors, such as inflation, trade openness, overall investments and the gap in production, have been identified as crucial determinants in determining the Western Balkan economies' growth performance (Dauti & Elezi, 2022).

The use of smartphones contributes to economic expansion in the G7 economies, with a 1% intensification in FTS per 100 inhabitants increasing GDP by about 0.1% in the long run. Additionally, variations in the use of mobile phones cause shifts in GDP. This explains exactly how a mobile phone is a significant contributor to GDP. Broadband adoption is also connected with improved economic growth, as indicated by the research (Birinci & Kirikkaleli, 2021). To acquire an improved comprehension of the differences in context within economies, groups divergent in IPTV diffusion, GDP per capita and the urban population ratio are compared. The outcomes emphasize the necessity for creating first-rate broadband connections and utilizing bundling strategies (Kim et al., 2020). Firstly, investigations demonstrated that the use of ICT has an ongoing advantageous influence on Tunisia's economic progress. Secondly, the researchers stated an adverse short-term consequence due to considerable investment bias. The aforementioned results have significant consequences for both stockholders and legislators. Moreover, the sectoral index promotes stockholders in identifying the division with the greatest possible growth following advances in ICT (Kalall et al., 2021). In terms of income disparity, it demonstrates that computer services help reduce income inequality in an economy through a network of high-technology exports.

2 Research Methodology

2.1 Data and sample

The study focuses on 13 Southeast European countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Kosovo, North Macedonia, Montenegro, Moldova, Romania, Slovenia and Serbia) by utilizing data and samples from a credible database (World Bank) covering the period 2006–2021. The countries in our sample are significant players in international trade, with different degrees of heterogeneity in terms of economic size on the one hand and economic development on the other. Data on the export-to-GDP ratio, as well

as other independent variables, were derived from the World Bank. The inclusion of these variables and the period was influenced by data availability and relevance. Generally, referring to terminology, data availability and usefulness are connected to the fact that the IMF and the WB have adopted a standard dataset and reporting methodology for the IMF member countries. An additional aspect is that we limit ourselves to the data until 2021, because even by the end of 2023, most of the variables selected do not have data for 2022. The data used are secondary and are processed by national authorities in the respective countries following the defined criteria before being published in the WB database. All the obtained data (export-to-GDP ratio, GFC, FDI, INF and ORE) are expressed as percentages; thus, the two variables (fixed broadband and telephone subscription) are converted to the natural logarithms.

The research tries to find out the association between GFC, FDI, INF, ORE, fixed broadband, telephone subscriptions and export-to-GDP ratio for the Southeast European countries. However, the research uses fixed broadband and telephone subscriptions (as a proxy of digitization) based on Meijers (2014) and Asiamah et al. (2019). Nevertheless, we have created a strongly balanced sample group, including seven variables on an annualized basis, as well as 208 observations for 13 SEC published by the World Bank during 2022 for the period of 2021.

2.2 Variables and development of hypotheses

Based on an overview of academic and scientific works, the study addresses six different variables to evaluate the export-to-GDP ratio for the 13 SEC. Considering the most recent international market developments, it is clear that the age of digitization has changed the dynamics and approach in all spheres of doing business, so this component must evaluate its influence on increasing exports to SEC. Table 1 explains the macroeconomic ratios employed for the modelling, as well as the type of influence on SEC export-to-GDP ratio.

Table 1 | Description of factors and predictable impact

Description	Denominations	Abbreviations	Sign
Dependent variable	Export-to-GDP ratio	EXP_{GDP}	
Independent variable	Fixed broadband subscription	*FBS*	+
	Fixed telephone subscription	*FTS*	+
Explanatory variables	Gross formation capital	*GFC*	+/-
	Foreign direct investment-to-GDP	*FDI*	+/-
	Inflation	*INF*	+/-
	Official rate exchange	*ORE*	+/-

Source: Authors' compilation

Numerous scientific studies have been conducted in this domain, with mixed findings. For example, Chenic et al. (2023) empirically examined the influence of digitization on macroeconomic variables and concluded that digitization has a beneficial effect on GDP and value added but there is a weak correlation between digitization and exports. Debbarma et al. (2022) advocated in the same vein that higher digitization of firms will have a significant positive influence on the promotion of exports. Similarly, scholars Kouam and Asongu (2022) used an econometric approach to observe the non-stationary impact of digitization on economic progress, specifically the increase in the level of exports as a catalyst of economic growth by investigating the FBS and FTS coverage thresholds. Those outcomes contend that

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if the coverage level drops below 60%, any reduction in this percentage harms exports and the promotion of economic growth.

Therefore, based on these premises mentioned above, we construct the following hypotheses.

H_1: Fixed broadband subscription has a positive effect on exports for SEC economies.

H_2: Fixed telephone subscription has a positive effect on exports for SEC economies.

The study claims that the econometric results will verify a significant positive relationship between digitization (FBS and FTS) and the export-to-GDP ratio for the economies of the countries contained in the analysis. In terms of selecting indicators and components of digitization, FBS and FTS have been employed as proxies of digitization in the context of cross-country observation (Meijers, 2014; Kumar et al., 2017; Asiamah et al., 2019). This technology facilitates and speeds up the process of effective communication while also reducing the overall costs of domestic and international transactions.

2.3 Model development

The following section discusses the characteristics and the development of econometric models employing panel data, otherwise known as a mixture of cross-sectional and time series (Baltagi, 2021, p. 15). Since the research focuses on country-specific analysis for the 13 SEC countries, intending to explore the factors that influence the export-to-GDP ratio, the research employs RE, FE and Arellano-Bond approaches (GMM). The use of panel regression, particularly when we have RE and FE, requires a decision on the appropriateness of these two models. As a result, in compliance with this principle of testing, our study employs the Hausman analysis, the outcomes of which are shown in Table 4. Our study adopts the methodology employed by Chenic et al. (2023), Wang and Choi (2019) and Bahrini and Qaffas (2019), but with an update to modify it for our selected variables.

The data used in this research are yearly and their up-to-dateness is dependent on previous actions. Hence, to achieve sustainable results after the static analysis, the application of a dynamic approach is required. The dynamic character of the design discourages the use of conventional estimators such as RE and FE, which at first can be univariate and unbalanced due to the association among unobserved effects at the panel data level and the lagged predicted variable (Hasanović & Latić, 2017). This model, expressed as an equation, is outlined below.

$$EXP_{GDP} = \beta_0 + \beta_1 LnFBS_{i,t} + \beta_2 LnFTS_{i,t} + \beta_3 GFC_{i,t} + \beta_4 FDI_{i,t} + \beta_5 INF_{i,t} + \beta_6 ORE_{i,t} + \mu_{i,t} \quad (1)$$

where:

EXP_{GDP} signifies the predicted variable (export-to-GDP ratio), while β_1 to β_6 are parameters of dependent and controlling variables (i signifies the individual effects of the economies in the panel, t signifies the period 2006-2021) and $\mu_{i,t}$ is the error term. As suggested by Baltagi (2021, p. 15), a framework with FE can be constructed via Equation (1):

$$EXP_{GDP} = \beta_0 + \beta_1 LnFBS_{i,t} + \beta_2 LnFTS_{i,t} + \beta_3 GFC_{i,t} + \beta_4 FDI_{i,t} + \beta_5 INF_{i,t} + \beta_6 ORE_{i,t} + \mu_{i,t} + \vartheta_i \quad (2)$$

Nevertheless, in certain instances, employing random and fixed-effects models fails to eliminate the issues associated with panel data, so dynamic models should additionally be employed. To address an endogeneity concern that makes the outcomes biased on the one hand and the degree of unobserved heterogeneity between countries on the other, Arellano and Bond (1991) created the GMM approach (difference GMM). They suggested interpreting additional instruments in the setting of the panel data model by employing a dynamic approach and the application of different transformations to this methodology. This approach was later completed by Arellano and Bover (1995) and also Blundell and Bond (1998) by improving it in terms of setting extra restrictions on the original situations, which enabled the outline of additional instruments to expand effectiveness. In this scenario, a set of modification was made to Equation (1) at level where the variables were instrumented by their first differences. As a consequence of these modifications, they constructed a system with two calculations: the original and the altered. The GMM is represented in a mathematical equation as follows:

$$EXP_{GDP} = \beta_0 + \mu EXP_{t-1} + \beta_1 LnFBS_{i,t} + \beta_2 LnFTS_{i,t} + \beta_3 GFC_{i,t} + \beta_4 FDI_{i,t} + \beta_5 INF_{i,t} + \beta_6 ORE_{i,t} + \mu_{i,t} + \vartheta_i \quad (3)$$

Additionally, converting this equation into the first difference generates Equation (4).

$$\Delta EXP_{GDP} = \beta_0 + \mu EXP_{t-1} + \beta_1 LnFBS_{i,t} + \beta_2 LnFTS_{i,t} + \beta_3 GFC_{i,t} + \beta_4 FDI_{i,t} + \beta_5 INF_{i,t} + \beta_6 ORE_{i,t} + \mu_{i,t} + \vartheta_i \quad (4)$$

In broader terms, according to Ullah et al. (2018), the GMM approach examines endogeneity, unobserved heterogeneity in the panel data basis, autocorrelation, potential omitted biases and sampling errors. In line with Bond's (2002) conclusions, the unit root patterns bias the difference estimator in GMM, where the GMM approach leads to substantially more precise findings. Therefore, as a conclusion of this section, the research will deal with both approaches and evaluate whether there are any significant differences between the models.

3 Results and Discussion

This part of the study deals with the empirical findings starting from descriptive statistics to the verification of the hypotheses through the applied models. As demonstrated by the initial findings displayed in Table 2, the mean export-to-GDP ratio for SEC is 43.89%. The minimum value of this ratio achieved by the countries included in the analysis was 13.2% in Kosovo in 2006, while the maximum value achieved during the observed period was 87.5% in Hungary in 2015.

To evaluate the impact of digitization, FBS and FTS were taken, which resulted in an average value of 19.8% of FBS, respectively 28.23% of FBS coverage per 100,000 inhabitants. The minimum value reached was in the economy of Albania in 2007, which was 0.33% of the coverage, while the maximum was reached by Greece in 2021 in the amount of 41.56% of FBS. Even though the FBS had an estimated value of 28.23% during the observed period,

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Kosovo had the lowest coverage at 6.11% in 2006, whereas Greece had the highest at 55.17% in 2006.

Table 2 | Descriptive statistics

	EXP	*FBS*	*FTS*	*GFC*	*FDI*	*INF*	*ORE*
Mean	43.890	19.182	28.234	24.968	6.984	2.881	46.891
Std. dev	18.300	9.5827	11.529	5.837	13.418	13.418	69.666
Min	13.117	0.33	6.11	77.892	-40.081	-40.081	0.68
Max	87.501	41.562	55.166	41.177	109.331	109.331	307.997
Skewness	0.896	-0.0420	0.2389	0.2209	4.3966	4.3966	1.8911
Kurtosis	2.865	2.865	2.555	2.823	31.107	31.107	6.347

Source: Authors' calculations

Gros formation capital turned out to have an average value of 24.97% with a standard deviation of 5.84%. Foreign direct investments, as a variable that is considered an indicator or infusion for the economy, turned out to have an average value of 6.98%, while inflation in 2021 reached an average value of 2.88%, while the highest value was reached in Moldova in 2008 at a rate of 12.78% and the lowest in Kosovo in 2009 had a rate of -2.41%.

The official real exchange rate, which plays a key role in international trade, had an average value of 46.89%, the maximum value reached was 307.99% in Hungary in 2020, while the lowest was 0.68% in 2008 in Kosovo. According to this table, the skewness was also analysed for the numerical description of the data, which in most cases are greater than zero, i.e., they are positively skewed, which indicates that the data are skewed, except FBS, which is lower than zero, with a value of -0.42, which indicates more high waves. With the kurtosis model, it turns out that all the variables are leptokurtic since they have a value higher than zero. This is taking into consideration that the data used in this study can describe or give indications that digitization affects international trade, respectively exports.

Table 3 | Correlation matrix

	EXP	*FBS*	*FTS*	*GFC*	*FDI*	*INF*	*ORE*
EXP	1.0000						
FBS	0.2412	1.0000					
FTS	0.1931	0.2244	1.0000				
GFC	-0.1813	-0.3924	-0.5005	1.0000			
FDI	0.1659	-0.0274	-0.0597	0.1975	1.0000		
INF	-0.1001	-0.3592	-0.3592	0.3227	0.1866	1.0000	
ORE	0.3778	0.1884	0.1295	-0.1465	0.3406	0.0155	1.0000

Source: Authors' calculations

To validate the characteristics of the selected data, it is essential to determine the correlation of the variables treated for this analysis. To test this parallel, a correlation analysis was performed. The outcomes presented in Table 3 display that FBS, FTS, FDI and ORE have a positive association with exports, while the GFC and inflation showed a negative association. Moreover, this analysis serves us to verify whether the panel data for the treated economies have any potential concern regarding multicollinearity. Such problems based on coefficients are eventually not a concern since $\beta \geq 0.5$, as argued by Pituch & Stevens (2016, p. 75). To

strengthen the confidence and previous findings, the VIF test contends, with an arithmetic mean of 1.43, that the evaluated data have no difficulties with multicollinearity.

To evaluate the adequacy and stability of the model, the Hausman test was applied, which is based on the premise that if the basic hypothesis turns out to be significant, then the adequate model is considered to be a random effect. Otherwise, if the result is not statistically significant, the alternative hypothesis would be used. In light of the test outcomes (ρ = 0.1811), the fixed-effects model appears to be appropriate for the selected data. Furthermore, the F-test has a value of 20.04 with a likelihood ρ = 0.0000, indicating that all of the variables incorporated into the analysis have values (F < 10), which is considered additional evidence of the model adequacy. The Breusch-Pagan/Cook-Weisberg test was executed to test whether the statistics have any particular problem with heteroscedasticity. Based on the findings of this examination, it is insignificant (ρ = 0.1886), which means that the statistics do not show heteroscedasticity. To verify the level of explainability (R^2 = 0.4224) between the export variable and other variables involved in the investigation, 42.24% of the variables contained within the analysis describe the predicted variable (export-to-GDP), while the remaining part is described by the factors which are not contained in this analysis.

Table 4 | Empirical results

	Random effects		Fixed effects		Arellano-Bond	
	β	**ρ ≥ [z]**	**β**	**ρ ≥ [z]**	**β**	**ρ ≥ [z]**
FBS	0.4673	0.000	0.4644	0.000	0.2445	0.014
FTS	0.3370	0.002	-0.3704	0.001	-0.4130	0.019
GFC	0.2437	0.016	0.3633	0.011	-0.2219	0.053
FDI	-0.0549	0.097	-0.3053	0.014	-0.0220	0.431
INF	-0.1690	0.343	-0.1932	0.285	0.4715	0.003
ORE	0.3039	0.281	0.0209	0.498	0.0985	0.047
_cons	37.7770	0.000	38.8135	0.000	39.7970	0.000
Screening tests						
Hausman	"-"	0.1811	"-"	"-"	"-"	"-"
F-test	"-"	"-"	23.09	0.0000	"-"	"-"
Wald chi2	138.17	0.0000	"-"	"-"	234.66	0.0000
R-sq	0.4218	"-"	0.4224	"-"	"-"	"-"
χ^2-test	0.1886	"-"	"-"	"-"	"-"	"-"
VIF Mean	1.4300	"-"	"-"	"-"	"-"	"-"
Sargan J- test		"-"	"-"	"-"	106.69	0.1160

Note: Significant, correspondingly, at 1%, 5% and 10%.

Source: Authors' calculations

The third model to observe the influence of the included variables on exports for SEC is the dynamic approach using Arellano-Bond estimation. The results of Wald chi (2) = 234.66, with ρ = 0.0000, which provides evidence that the use of this approach is fit and proper. Finally, to estimate the soundness of the instruments in this simulation, the Sargan J-test was applied, the result of which (ρ = 0.1160) provides evidence that if the value is insignificant, the instruments are adequately evaluated. Findings for the FBS variable provide evidence of a significant impact at the 99.9% confidence level in both models (fixed-effects and Arellano-Bond). We establish this argument based on the significance values (ρ = 0.0000 relating to fixed-effects and ρ = 0.014 relating to Arellano-Bond), which proves that each increase of this parameter positively influences the export-to-GDP ratio by 0.46‰, respectively 0.24‰.

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Additionally, we state that the additional parameter, expressed in the form of a hypothesis, has been verified, via the fact that it has resulted in a significant adverse effect with a confidence level of 99.9% in the two employed models. The ρ-value of the results (fixed-effects $\rho = 0.001$, Arrellano-Bond $\rho = 0.019$) validate the aforementioned. It therefore appears that a shortage of sufficient development of the FTS network will decrease export (β = -0.37040 and β = -0.41302), with a fixed effect of 0.37‰ and conferring to the Arellano-Bond effect of 0.41‰.

Numerous investigations into both of these variables have been performed on every continent of the world in light of our discoveries. Broekhuizen et al. (2021) noted that digitization has shifted competition in many industries. In a business-to-business context, industrial digital platforms (which intermediate the activities of various actors in a given market) necessitate the adoption of digital strategies by firms to remain connected to sellers, clients and collaborators (Veile et al., 2022). Palmié et al. (2022) framed this activity slightly differently, describing "digital service ecosystems" in the retail context, but noted that many companies make use of external relations and partner with external actors to modify business models and develop and employ digital firm strategies. Furthermore, analyses of Southeast European countries reinforce the importance of this link between IT and exports. In this context, Koutroumpis (2019) claimed that information networks have a substantial effect on the modern economy by studying the OECD economies from 2002 to 2016.

Moreover, this indicates their transformation as well as implementation in all countries linked together. In this sense, Wang and Choi (2019) came up with some interesting conclusions for the BRICS economies: Firstly, IT has an increasingly significant positive impact on exports than imports; secondly, more extensively developed or widespread IT levels in the value chain were less effective in boosting exports as well as imports simultaneously; thirdly, the influence of IT levels on exports increases continuously over time; and finally, a more sophisticated level IT has a more significant impact on labour-intensive trade economies compared with resource-intensive economies. To recover their export volume, BRICS economies would benefit from increasing their use of FBS and the internet. Zhou et al. (2022) emphasized the same conclusions, that the development and alteration of the economy in the process of digitization and the development of FBS, FTS and high-speed internet is a key factor in international trade. Empirical evidence shows that broadband infrastructure effectively endorses the growth of exports through the direct channel of improving information; on the other hand, it also affects reduction in logistics costs, as well as reducing trade barriers.

From another perspective, there are currently very few studies to observe the influence of GFC on exports in the context of European countries. The value of this ratio in the context of our analysis was discovered to be statistically significant in econometric models; nevertheless, with a different impact (according to fixed-effects, it has a positive effect of β =0.36334 with $\rho = 0.011$, while based on Arellano-Bond, it has a significant negative effect of β = -0.22195 with $\rho = 0.053$). Due to the fixed-effects discovery, each increase in GFC influences the growth of exports by 0.36‰, while for Arellano-Bond, each increase in GFC influences the reduction of exports by 0.22‰. The conclusions of our study based on the fixed effects are consistent with Fetah-Vehapi et al. (2015), who argued that the GFC has a

beneficial influence on exports, with a greater effect on economies with a high initial income per capita, as well as FDI. These outcomes were obtained by examining 10 SEC from 2002 to 2012 using the dynamic technique, i.e., the GMM system. Meanwhile, Durguti and Malaj (2022) analysed 14 of the 16 Southern European countries and 7 of the 8 Western European countries from 2010 to 2020. Results of their research indicate that there is a negative connection between the GFC and export-to-GDP ratio.

FDI, which can be considered an important indicator that accumulates fresh capital and is recognized as one of the accelerators of the expansion of an economy in our scenario, proved a significant adverse effect on exports in the regression with the fixed-effects model. The beta coefficient (β = -0.30531 with ρ = 0.014) signifies that increasing FDI by 1% reduces exports by 0.31‰. The conclusions drawn from this research are comparable to the findings of Mahmoodi and Mahmoodi (2016), who employed the VECM approach to explore 8 developing European economies and 8 developing Asian economies. The general findings of this study imply that there is a negative causal link between FDI and exports equally in the short and long term in both of the panels evaluated. On the other hand, there is evidence that contradicts the claims stated previously. Therefore, Pheang et al. (2017) examined the Asian region employing panel data covering the period 2000–2014, employing the dynamic OLS and MOLS approaches, and concluded that FDI has a positive impact on exports. Zhang et al. (2022) discovered a similar conclusion after analysing 173 economies employing stochastic frontier gravity to evaluate the link between both these metrics.

Furthermore, when we distinguish between the findings of the fixed-effects model and Arellano-Bond on inflation and its effect on the export-to-GDP ratio, we discover that the first model has an insignificant effect, while Arellano-Bond has a significant effect with a positive sign at the 99.9% confidence level. Taking into account the coefficient (β = 0.47153, ρ = 0.003), we may conclude that every single increase in inflation will ultimately be reflected in an increase in the size of exports for SEC. Hence, through this evidence, we can conclude that our findings are in agreement with the investigations performed by Sahoo and Sethi (2018) and Durguti et al. (2021), suggesting that inflation in the short and long term has positive effects on export-to-GDP ratio, employing the variance decomposition analysis (VDA) technique, respectively Arellano-Bover/Blundell-Bond for the Western Balkans economies. On the contrary, other scholars disclose evidence that contradicts our findings, particularly Al Marhubi (2021), who claimed that the complexity of the economy, respectively inflation, is the main cause that has a negative influence on exports using a sample of 94 economies for 1970–2014. Lastly, as reported by Arellano-Bond, the official real exchange rate has a positive impact on the expansion of exports at a 95% confidence level. Our empirical evidence in this setting lines up with the conclusions of Woo Kang and Dagli (2018), who analysed data from 72 economies during the financial crisis and presented evidence that a decrease in the ORE has a significant contribution to the export level during the financial crisis. In this regard, the researchers contend that there is a causal association between these two parameters, which may have a reduced impact on foreign trade, specifically on exports (Banik & Roy, 2020).

Conclusion

Information technology has accelerated the advancement of commercial transactions in rapid steps. The emergence of COVID-19 has raised the importance of digitization even higher; as far as we can say, it has become the only way to advance international trade. Today, all

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countries are fighting to increase exports and decrease imports, not only to improve their trade balance but to achieve faster development and make their economies as economically sovereign as possible. Information technology has made the methods of international economic cooperation more efficient; it has also simplified, rationalized, advanced and accelerated the communication routes between businesses on the global scale.

Although it appears from Table 4 that the independent variables are related to the predicted variable, the outcomes presented in the empirical valuation show that FBS, GFC and ORE have a positive impact on exports according to the fixed-effects model, while negative influence appeared in FTS, FDI and INF. Additionally, as stated by Arellano-Bond, the predictions of this research have been validated, with the metrics FBS, INF and ORE having a positive influence, whereas the metrics FTS, GFC and FDI have a negative influence on exports. Our study correlates with many studies worldwide. According to our study, even in the countries of Southeastern Europe, there is a high association between IT and international trade. Information technology will promote international trade as will the removal of other trade barriers. Indeed, certain trade barriers are immediately removed by information technology. Hence, the volume of international trade will grow through the effective support of information technology. Underdeveloped and developing countries will benefit from the opportunity of openness provided by information technology. Digitization can also have a significant stimulus on trade (Terzi, 2011).

Implications for policymakers

Digitization has created new possibilities, especially for countries that cannot penetrate developed markets due to their low economic capacity. After 2020, a new reality appeared on the global market: disruption of supply chains as a result of the COVID-19 pandemic. More popular economies that supplied the world, such as China, had serious problems and the advantages they had until now were not exploitable. The goods coming from China now had very high price tags. This new reality was an opportunity for faster development of the economies of Southeast Europe to take advantage of these gaps and create new and irresistible offers. These offers would be greatly facilitated by the opportunities provided by information technology. However, it is not that these countries have shown aggressiveness in using such an opportunity. Individual businesses do what is in their power and take advantage of new profit opportunities, although the biggest burden falls on the government, which would have to create incentives that allow businesses to penetrate more easily.

If lawmakers are interested in accelerating economic growth in their countries, they should pay close attention to ICT drivers such as mobile phone and broadband use in the long term. Therefore, national governments must first recognize the significant role of ICT drivers before facilitating ICT investments by either subsidizing them or speeding up telecommunications-related reforms in their respective countries (Birinci & Kirikkaleli, 2021). In this vein, authorities may foster broadband use by providing suitable incentives to private businesses or using budgetary funds to establish effective networks.

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