economies

MDPI

Article

The Impact of Foreign Direct Investment on Exports: A Study of Selected Countries in the CESEE Region

Parveen Kumar [1], Ali Moridian [2], Magdalena Radulescu [3,4,5,6,*] and Ilinca Margarita [6]

[1] Department of Humanities and Social Science, National Institute of Technology Kurukshetra, Kurukshetra 136119, India; pkbhatt9@gmail.com
[2] Department of Economics and Management, Urimia University, Urmia 57179-44514, Iran; alimoridian@ymail.com
[3] Department of Finance, Accounting and Economics, National University of Science and Technology Politehnica Bucharest, 060042 Bucharest, Romania
[4] BEU-Scientific Research Center, Baku Engineering University, Hasan Aliyev Str., 120, Khirdalan City AZ0101, Azerbaijan
[5] UNEC Research Methods Application Center, Azerbaijan State University of Economics (UNEC), Istiqlaliyyat Str. 6, Baku 1001, Azerbaijan
[6] Institute of Doctoral and Postdoctoral Studies, University Lucian Blaga of Sibiu, 550024 Sibiu, Romania; ilinca.margarita@ulbsibiu.ro
* Correspondence: magdalena.radulescu@upb.ro

Abstract: The evolving macroeconomic landscape, shaped by the global financial crisis and the COVID-19 pandemic, poses significant challenges for economies worldwide. However, Central, Eastern, and Southeastern European (CESEE) countries have demonstrated resilience and rapid recovery during crises, driven by a surge in consumption fueled by domestic credit and robust export growth supported by flexible exchange rates and adaptive monetary policies. Prior to EU accession, substantial foreign direct investment (FDI) during privatization and restructuring facilitated knowledge and technology transfers in CESEE economies. This study examines the interplay of exports, real exchange rates, GDP growth, FDI, inflation, domestic credit, and the human development index (HDI) in the CESEE region from 1995 to 2022, covering the transition period, EU accession, and major crises. Employing a panel ARDL model, we account for asymmetric effects of these variables on exports. The results reveal that GDP, FDI, inflation, domestic credit, and HDI significantly and positively influence exports, with HDI and GDP exerting the strongest effects, underscoring the pivotal roles of human capital and economic growth in enhancing export competitiveness. Conversely, real exchange rate depreciation negatively impacts exports, though non-price factors, such as product quality, mitigate this effect. These findings provide a robust basis for targeted policy measures to strengthen economic resilience and export performance in the CESEE region.

Keywords: FDI; real exchange rate; GDP; inflation; domestic credit; export; CESEE countries

JEL Classification: C01; E31; F14; F21

Academic Editors: Ralf Fendel and Robert Czudaj

Received: 3 April 2025
Revised: 19 May 2025
Accepted: 23 May 2025
Published: 27 May 2025

Citation: Kumar, P., Moridian, A., Radulescu, M., & Margarita, I. (2025). The Impact of Foreign Direct Investment on Exports: A Study of Selected Countries in the CESEE Region. *Economies*, *13*(6), 150. https://doi.org/10.3390/economies13060150

1. Introduction

The European Union's economic competitiveness is facing mounting challenges, especially within its Central, Eastern, and South-Eastern (CESEE) member states (Ferrazzi et al., 2025). Prior to the 2008 global economic and financial crisis, the CESEE region experienced a period of robust economic growth. Rapid GDP expansion was driven by strong domestic consumption, fueled by accessible credit, significant foreign direct investment (FDI), and

growing exports. Optimism surrounding EU membership and potential euro adoption further amplified this momentum. When the global crisis hit in 2008, the CESEE region demonstrated notable resilience, achieving a swift recovery. However, vulnerabilities in the external and banking sectors exposed certain economic weaknesses (Gardo & Martin, 2010). From September 2008, the crisis intensified, disproportionately affecting the most vulnerable countries. Declining domestic demand in the CESEE region stemmed from deteriorating labor markets, reduced income prospects, slowing remittances, waning business and consumer confidence, and tighter credit conditions. Consequently, the composition of GDP growth shifted significantly, particularly in the crisis's early stages. Gross fixed capital formation, a cyclical component sensitive to funding availability, saw sharp declines, especially in the Baltics, Romania, and Bulgaria, where investment had previously surged. Private consumption also slowed, with the Baltic States and Romania most affected due to their reliance on credit-driven consumption growth. Domestic credit in the CESEE region expanded steadily until the 2008 crisis, after which growth stabilized through 2022 with minimal fluctuations. Czechia, Poland, and Bulgaria led in credit growth, though Bulgaria faced a significant contraction during the transition period, and Czechia experienced a decline in the 1990s (see Figure 1).

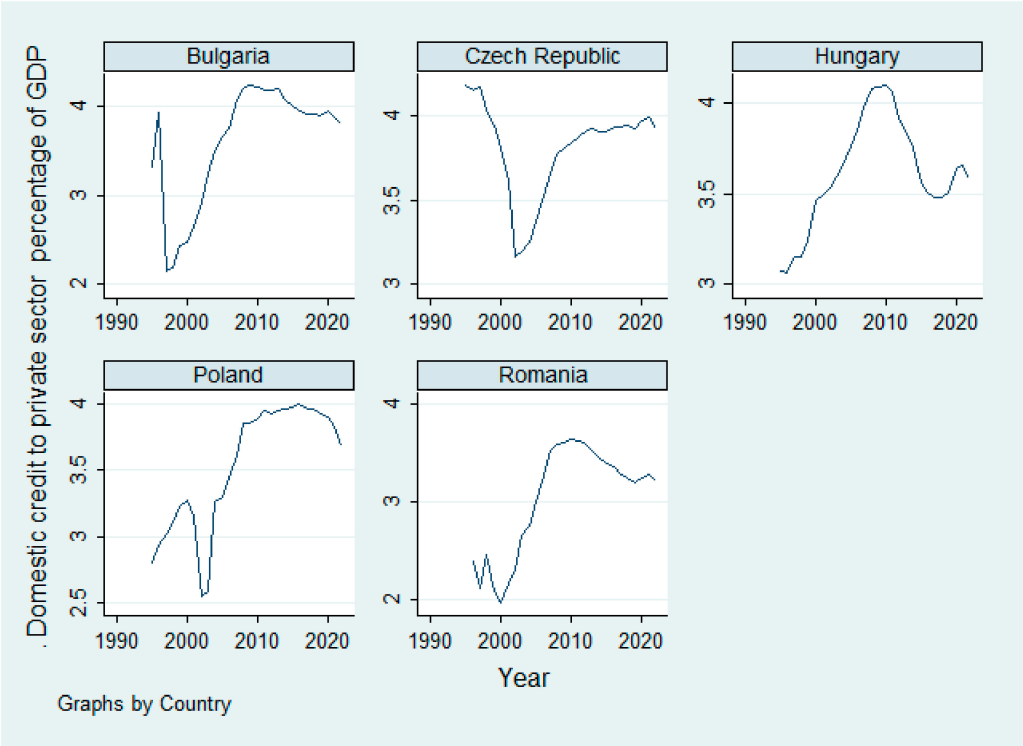

Figure 1. Trend of Domestic credit to private sector percentage of GDP in CESEE countries. Source: Elaborated by the authors based on World Bank data. Note: The variable is in logarithmic form.

The CESEE countries recover from the most severe recession since their transition to market-oriented economies (Schreiner, 2022). Since the second half of 2009, nearly all nations experience positive quarter-on-quarter GDP growth rates. However, the pace and robustness of economic recovery vary significantly across countries. Poland, the Czech Republic, and Estonia embark on their recovery earlier and demonstrate more resilient rebounds (EU Report, 2023). In contrast, Hungary, Latvia, Lithuania, Bulgaria, and Romania initiate their recovery later (European Central Bank, 2010). As illustrated in Figure 2, CESEE countries form a cohesive group in terms of economic growth rates (GDP per capita) from 1995 to 2022. The Czech Republic leads, followed closely by Poland and Hungary.

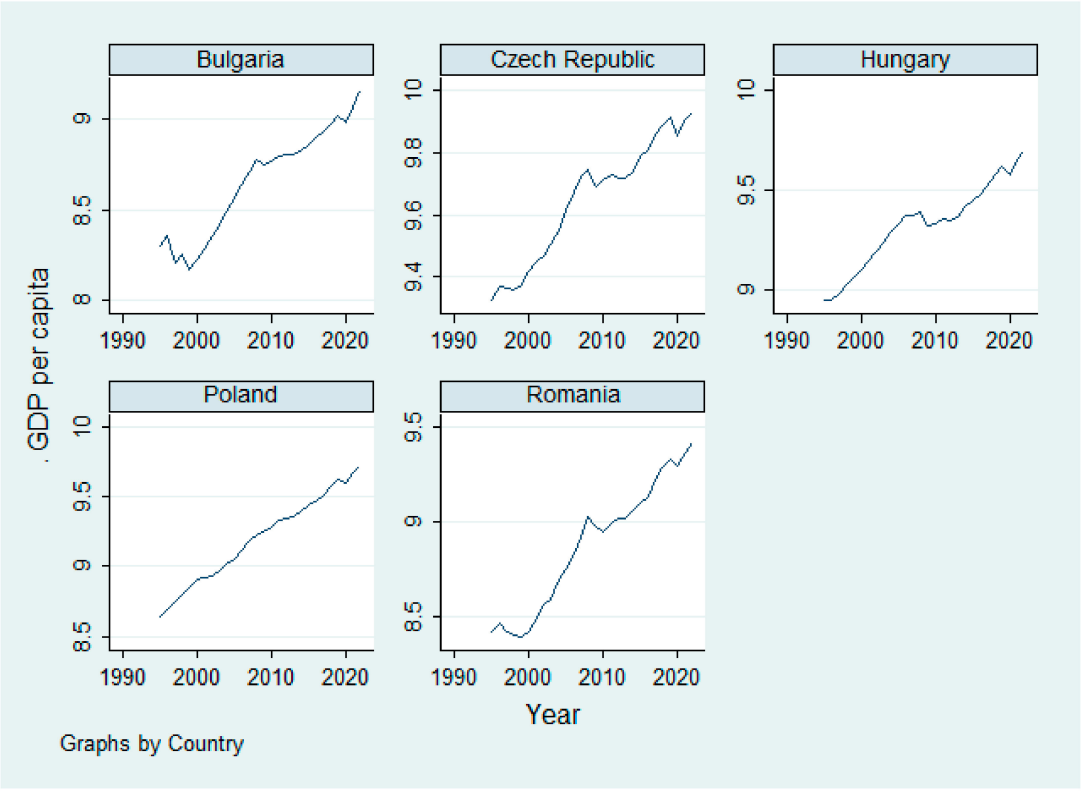

Figure 2. Trend of GDP per capita in CESEE countries. Source: Elaborated by the authors based on World Bank data. Note: The variable is in logarithmic form.

The CESEE region records remarkable economic progress, achieving a cumulative 117% growth in GDP per capita from 1995 to 2017, compared to just 27% for major EU economies (Germany, France, Italy, Spain, and the UK) (European Central Bank, 2020). This growth significantly narrows the economic gap with Western Europe, positioning CESEE economies as highly attractive markets for investors. Industries such as automotive and manufacturing, substantial FDI, dynamic export growth, competitive wages, and EU financial funds drive this economic surge (Ban & Adascalitei, 2022; Fidrmuc & Martin, 2011; Medve-Bálint & Éltető, 2024). However, these competitive advantages weaken over time. FDI declines following the completion of privatization processes, and rising wages erode cost advantages. Global fiscal competition intensifies, challenging efforts to attract foreign investors (Kumar et al., 2024a). Labor productivity lags behind Western Europe, and low unemployment rates in the CESEE region signal limited labor reserves compared to the broader EU. Additionally, these economies remain undercapitalized in terms of capital stock, and EU funding allocations trend downward post-2020 (Marciniak et al., 2018). Amid ongoing global economic, environmental, and political disruptions, the concept of development evolves to address emerging challenges, including poverty, social exclusion, aging populations, resource depletion, environmental crises, globalization, and political instability (Kumar et al., 2024b). These interconnected issues highlight the need for comprehensive, holistic solutions (Radulescu et al., 2018).

At the heart of a developed economy lies sustained economic progress, which enables resource allocation to enhance welfare and maintain high living standards through strategic public investments in critical sectors (Hunjra et al., 2023; Kumar et al., 2024a). As global challenges like globalization, resource constraints, and demographic shifts intensify, the CESEE region must proactively shape its future. Historical evidence from recent decades demonstrates that high growth rates and successful catch-up by less- or medium-developed

small economies closely tie to export-oriented development strategies. Since 1990, CESEE nations actively remove barriers to FDI by easing market access and offering fiscal incentives. These efforts attract FDI, which drives knowledge sharing and technological advancements. Concurrently, the region experiences increased trade openness, privatization of state-owned enterprises, a shift from socialist to market-driven economies, and the establishment of democratic governance frameworks (Rădulescu & Şerbănescu, 2012). Over the past two decades, CESEE countries significantly expand their presence in global markets. Between 1995 and 2014, Bulgaria's share of world exports rises from 0.1% to 0.2%, the Czech Republic's from 0.4% to 0.9%, Hungary's from 0.2% to 0.6%, Poland's from 0.4% to 1.1%, Romania's from 0.2% to 0.4%, and Slovakia's from 0.2% to 0.5% (Bierut & Kuziemska, 2016). CESEE countries emerge as a key driver of EU economic growth, outpacing Western Europe in export growth. From 2010 to 2020, CESEE goods exports surge by 53% and services exports by 49%, compared to Western Europe's modest increases of 15% and 9%, respectively. Poland leads the CESEE region with the highest levels of goods and services exports, followed by Czechia and Hungary for goods exports, and Romania for services exports. Slovakia also plays a significant role in goods exports, while Bulgaria remains a smaller contributor in both goods and services (CCS, 2022). Despite these achievements, challenges persist, particularly for the Czech Republic, which grapples with the Russia–Ukraine conflict, inflationary pressures, supply chain disruptions, and persistent budget deficits. Risks of heightened inflation and fiscal deficits exceeding projections loom large. Across the CESEE region, exports as a share of GDP reflect a cohesive group, with a steady upward trend from 1995 to 2022, led by Hungary and Czechia (Figure 3).

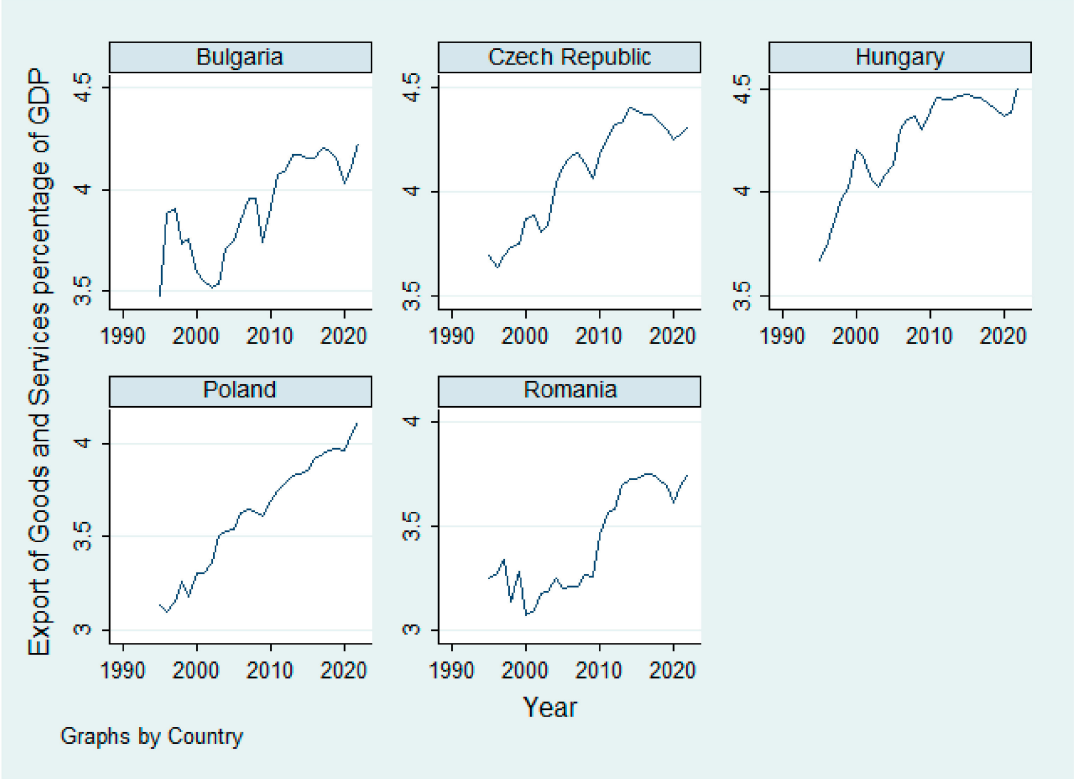

Figure 3. Trend in Exports of Goods and services in CESEE countries. Source: Elaborated by the authors based on World Bank data. Note: The variable is in logarithmic form.

Foreign direct investment (FDI) trends remain stable across the investigated period, with minimal fluctuations, except in Hungary, where net inflows as a percentage of GDP

show significant positive and negative swings (see Figure 4). Poland attracts substantial FDI until the 2008 crisis, while other CESEE countries form a relatively uniform group.

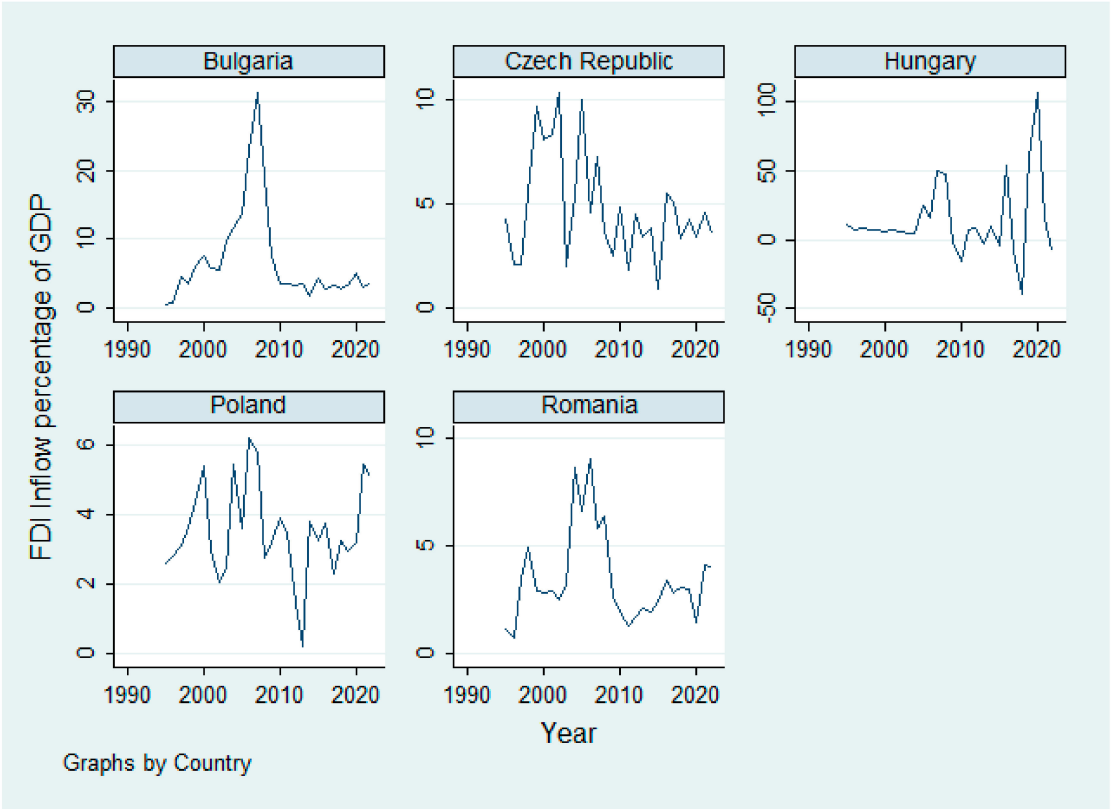

Figure 4. Trend of foreign direct investment CESEE countries. Source: Elaborated by the authors based on World Bank data.

This paper closely aligns with prior empirical research, including studies by Beck (2003), Caporale et al. (2022), Jakšić (2022), Leibovici (2021), and Manova (2013). These works explore the relationship between financial development and the scale of international trade across various sectors. They show that well-developed financial markets correlate with higher trade volumes, especially in finance-related industries. Despite substantial research on the economic resilience and export performance of CESEE countries, critical gaps persist in understanding the complex interplay among FDI, financial development, real exchange rates, and exports. Prior studies, such as Beck (2003), Caporale et al. (2022) and Manova (2013), establish that robust financial markets enhance trade volumes, yet they primarily focus on global trade patterns or specific sectors, often overlooking the CESEE region's distinct post-transition and crisis-recovery dynamics. Although existing literature recognizes FDI's contributions to technology transfer and economic growth during the CESEE's privatization and EU accession phases, it rarely examines FDI's heterogeneous effects on exports across varying levels of export performance. Furthermore, the combined influence of real exchange rates and financial development on export dynamics remains underexplored, particularly in the context of flexible monetary policies and external shocks induced by crises like the 2008 financial crisis and the COVID-19 pandemic. The absence of causality between FDI and exports, as identified in this study, highlights another overlooked area, as most research assumes a direct relationship without rigorously testing directional linkages. This study addresses these gaps by investigating the effects of FDI, financial development, domestic credit and real exchange rates on exports in five CESEE countries—Poland, Romania, Hungary, the Czech Republic, and Bulgaria—using data from 1995

to 2022, spanning their transition, EU accession, and crisis periods. These countries, all EU members but not part of the eurozone, demonstrate greater resilience and faster economic recovery compared to eurozone counterparts, raising questions about the role of their autonomous monetary and exchange rate policies and financial development in driving export-led growth. Unlike prior studies, this research accounts for cointegration, cross-sectional dependence, and the asymmetric impacts of these variables on exports, by employing Panel ARDL to capture their heterogeneous effects across different levels of export performance. By doing so, it provides a nuanced understanding of how FDI, financial development, and exchange rates shape export dynamics in the CESEE region, offering evidence-based policy recommendations to enhance economic resilience and export performance.

The paper is structured as follows: Section 2 provides a concise overview of relevant literature, while Section 3 outlines the methodology employed. Section 4 addresses the findings, followed by Section 5, which offers concluding remarks and further discussion.

2. Literature Review

2.1. Theoretical Frame Work

The export-led growth theory posits that sustained economic prosperity depends on a vibrant export sector, a principle particularly crucial for developing economies where FDI and financial development often anchors development. To elucidate the dynamic relationship between FDI and export growth in CESEE region, the gravity model provides a sophisticated framework, inspired by Newton's law of gravitation (Linders, 2006). This model connects trade and FDI flows to the economic "mass" of nations, measured by GDP, which reflects market potential and production capacity. Initially applied to trade by Tinbergen (1962) and Linnemann (1966), the model's early empirical success outstripped its theoretical rigor, prompting scholarly refinements. Anderson (1979) grounded it in microeconomic principles, Bergstrand (1985) incorporated supply-side dynamics, Helpman and Krugman (1985) linked it to economies of scale, and Deardorff and Stern (1998) aligned it with classical trade theories, leading Frankel et al. (1997) to celebrate its transformation into an "embarrassment of riches" (Frankel et al., 1997), FDI catalyzes exports by enhancing production capabilities and leveraging financial development, which facilitates capital access and drives innovation (Manova, 2013). Zwinkels and Beugelsdijk (2010) emphasize that trade liberalization has fueled CESEE's export surge, with FDI amplifying this effect. High institutional quality—marked by effective governance, regulatory stability, and secure property rights—further bolsters this dynamic by fostering stable environments that attract FDI and enhance trade (Zhao et al., 2017) and Kumar and Radulescu (2024). This framework illustrates how FDI, supported by robust financial and institutional ecosystems, powers CESEE's export boom, capitalizing on seamless integration with EU markets. The relationship between exports and various macroeconomic factors plays a critical role in shaping a country's economic performance. Key among these factors are exchange rates, foreign direct investment (FDI), gross domestic product (GDP), and inflation, each influencing export dynamics in distinct yet interconnected ways. Notably, the linkage between exports and FDI has garnered significant attention due to its potential to drive trade competitiveness and economic growth Podvorica et al. (2025). The following literature review explores these relationships, beginning with exports and exchange rates, followed by exports and FDI, exports and GDP, and exports and inflation.

2.2. Exports and Exchange Rate (EXCH)

In their 2017 study, Iwaisako and Nakata evaluated the impact of exchange rate (EXCH) shocks on Japanese exports using data from 1977 to 2014. Employing vector autoregression

(VAR) and impulse response function techniques, they found that EXCH shocks had a negligible effect on exports, while global demand shocks were a more significant driver of export fluctuations. They also identified oil price volatility as a key factor influencing Japanese export patterns. In 2014, Simaskova investigated the effects of exchange rate changes on Czech Republic trade flows. Using the Johansen co-integration test, the study analyzed the long-term relationship between EXCH volatility and bilateral trade. Empirical results showed that increased Czech koruna volatility reduced both imports and exports with Austria, Italy, the Netherlands, France, Germany, and Poland. Expected negative trade impacts were confirmed for the Slovak Republic and the United Kingdom. Audzei and Brázdik (2018) examined the effects of symmetric and asymmetric shocks on business cycles in Central and Eastern European (CEE) countries, focusing on real EXCH shocks' contribution to macroeconomic volatility. Using time series data from Q1 1998 to Q1 2017 and variance decomposition in two-country structural VAR models, they determined that real EXCH shocks had minimal impact on macroeconomic volatility in most CEE countries, except Bulgaria and Slovenia. Todorov et al. (2021) analyzed the influence of EXCH regimes and euro area membership on the GDP of ten CEE countries that joined the EU in 2004 and 2007. The study found that countries with floating exchange rates or euro area membership experienced more favorable GDP outcomes compared to those with fixed exchange rates or outside the euro area. However, the effects of EXCH regimes and euro area membership on real GDP growth were not statistically significant in either the short or long term. Shevchuk (2022) explored the long-term effects of anticipated currency depreciation in CEE countries from 2002 to 2019. The analysis revealed that expected EXCH depreciation only partially influenced consumer price changes.

Additionally, it found that the anticipated depreciation led to a decline in output. The study also revealed that liberalization efforts increased consumer prices and contractionary effects for trade. Moreover, it identified a trade-off between the effects on prices and output concerning changes in the money supply.

2.3. Exports and FDI

Anwar and Nguyen (2011) examined the impact of FDI on Vietnam's exports, imports, and net exports using a gravity model. Their study analyzed trade data from 1990 to 2007 across 19 major trading partners, covering the pre-Asian financial crisis, Asian financial crisis, and post-crisis periods. Employing ordinary least squares (OLS) and generalized least squares (GLS) techniques, they found that FDI significantly boosted net exports in the post-crisis period, driven by strengthened backward linkages between domestic and foreign firms in Vietnam. Sultan (2013) investigated the relationship between FDI inflows and exports from 1980 to 2010 using the Johansen co-integration method and Vector Error Correction Model (VECM). The results confirmed that FDI enhanced exports by improving efficiency and productivity. While no short-term causality existed between exports and FDI, a stable long-term equilibrium relationship was established. Pelinescu and Radulescu (2009) assessed FDI's effects on Romania's GDP and exports from 2000 to 2009. Their analysis demonstrated that FDI significantly promoted export growth by enhancing production capacity and competitiveness. Additional factors, such as local currency depreciation and interest rate fluctuations, also influenced export performance. Penkova-Pearson (2011) studied export and import demand functions in Bulgaria and Romania from 2000 to 2008. The findings highlighted EU economic growth and FDI inflows as key drivers of export dynamics. Notably, real exchange rate appreciation had negligible effects on exports. The study also observed that trade convergence between Bulgaria and Romania remained robust, reflecting structural similarities in trade patterns despite exchange rate fluctuations. Rădulescu and Şerbănescu (2012) analyzed the relationship between FDI and exports in

Central and Eastern European (CEE) countries from 1990 to 2010. Their theoretical framework posited a bidirectional link between FDI and exports. Empirical results confirmed that FDI significantly increased exports, particularly in new EU member states, by enhancing supply capacity. Acaravci and Ozturk (2012) explored the interplay among FDI, exports, and economic growth using the autoregressive distributed lag (ARDL) approach to co-integration. Their findings indicated that FDI positively influenced economic growth, with FDI-led growth evident in the Czech Republic and Slovak Republic. However, no consistent long-term equilibrium relationship among real GDP, exports, and FDI was found in Bulgaria, Estonia, Hungary, Lithuania, Romania, and Slovenia.

2.4. Exports and GDP

Acaravci and Ozturk (2012) investigated the relationships among foreign direct investment (FDI), exports, and GDP in Central and Eastern European (CEE) countries from 1994 to 2008. Their analysis confirmed a positive link between FDI inflows and economic growth, with FDI directly boosting GDP in the Czech Republic and Slovak Republic. No Granger causality was found between exports and GDP in the Czech Republic or Poland. In Latvia, FDI indirectly enhanced GDP through its effect on exports.

Silaghi and Ioana (2009) conducted a thorough examination of the relationship between exports and GDP across all CEE countries. Using Granger and Sims causality tests, they identified bidirectional causality between exports and GDP in certain CEE countries. Their findings supported the Growth-Led Export (GLE) hypothesis in Hungary, Romania, and Slovenia, demonstrating that GDP growth preceded export increases in these nations. Dritsakis (2004) analyzed the interplay among exports, investments, and economic development in the European Union, Bulgaria, and Romania, employing vector autoregression (VAR) and error correction model (ECM) techniques. The results indicated that exports drove economic development in both Bulgaria and Romania, while GDP growth spurred export expansion. In Bulgaria, GDP also exhibited a strong correlation with investment growth, highlighting a complex interdependence among these variables.

2.5. Exports and Inflation

Purusa and Istiqomah (2018) investigated the effects of foreign direct investment (FDI), inflation, and crude oil prices on exports in Indonesia, Malaysia, the Philippines, Thailand, and Vietnam from 2000 to 2015, using the Generalized Method of Moments (GMM). Their analysis revealed that FDI and crude oil prices significantly increased exports, while inflation exerted a significant negative impact. Jacob et al. (2021) examined the short- and long-term effects of macroeconomic factors on India's export performance from 1995 to 2020. Their findings indicated that inflation and exchange rate depreciation positively influenced exports. Additionally, exchange rate appreciation helped curb inflation, maintained a favorable trade balance, and promoted exports of domestic goods, contributing to sustained economic growth. De Grauwe and Schnabl (2008) analyzed the impact of exchange rate regimes on inflation and economic growth in South, Eastern, and Central Europe from 1994 to 2004. Their study provided strong evidence that stable exchange rates supported macroeconomic stabilization, creating a favorable environment for international trade and payment flows. Embergenov et al. (2022) explored the relationship between trade openness and inflation in Uzbekistan using time series data from 1997 to 2018. Their result showed that trade openness was associated with higher inflation. Specifically, export openness reduced inflation, while import openness increased it. Economic growth, measured by GDP, also drove inflation, with both GDP and trade openness identified as key determinants. The study further noted a negative correlation between export openness and inflation, contrasted by a positive link between import openness and inflation.

2.6. Exports and Financial Development (Private Domestic Credit)

A well-developed financial system provided exporters with access to credit, enabling investments in new technologies and innovations that supported export growth. Zhao et al. (2017) investigated the relationship between financial development (FD) and exports using a panel dataset of 108 countries from 1990 to 2011. Their findings confirmed that financial development initially had a significant positive effect on exports. However, beyond a certain threshold of financial system advancement, further development yielded diminishing returns, reflecting an inverted U-shaped relationship between financial development and export performance. Wajda-Lichy et al. (2020) analyzed the link between financial development and trade openness in 11 newly admitted EU member states from 2004 to 2018. In eight countries—Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and Slovenia—their study identified strong causal relationships between financial development and trade. Access to credit alleviated financial constraints for exporters, facilitating increased investment and higher export volumes.

The literature elucidates the relationships among FDI, exports, inflation, financial development, and economic growth in emerging economies, particularly Central and Eastern European countries, Vietnam, India, and Uzbekistan. However, significant gaps remain. Studies by Anwar and Nguyen (2011) and Rădulescu and Şerbănescu (2012) confirmed FDI's role in boosting exports but neglected its long-term sustainability after the 2008 global financial crisis. Contradictory findings on inflation's effect on exports (Purusa & Istiqomah, 2018; Jacob et al., 2021) and limited analysis of its interplay with exchange rates and FDI in CEE contexts underscore the need for integrated studies. Zhao et al. (2017) identified a non-linear relationship between financial development and exports, yet the impact of specific financial instruments in smaller CEE economies, such as Bulgaria and Slovenia, remains under examined. Inconsistent export–GDP causality findings (Acaravci & Ozturk, 2012) necessitate country-specific investigations, and the influence of external shocks, as noted by Penkova-Pearson (2011), is insufficiently explored. These gaps highlight the need for a comprehensive, up-to-date study that holistically examines these factors, focusing on recent data and the distinct economic paths of CESEE countries.

2.7. Exports and Human Development Index (HDI)

Scholars have increasingly focused on the link between export performance and human development, especially within the context of emerging and transitional economies. The HDI, which encompasses key indicators such as education, life expectancy, and per capita income, serves as a robust tool for assessing a country's potential to enhance its export competitiveness. While exports have been shown to be a significant driver of economic growth in Central and Eastern Europe (Lazarov & Petreski, 2023; Septiningrum et al., 2021), a higher HDI can also enhance export performance. This occurs through the development of high-quality human capital, improved infrastructure, and effective institutions, alongside increased innovation capacity and better governance—all of which are essential for producing globally competitive goods and services (Domazet et al., 2022; Tsapko-Piddubna, 2021; Simionescu et al., 2017). Table 1 provides a concise overview of key studies exploring the relationships among Foreign Direct Investment (FDI), exports, and macroeconomic factors such as exchange rates, inflation, and GDP in various countries. It highlights the diverse impacts of these factors on export performance and economic growth. This compilation underscores the need for a comprehensive study to address gaps in understanding the interplay of these variables in the CESEE region.

Table 1. Summary of Literature Review.

Author(s)	Time Period	Variable(s)	Technique(s)	Major Finding(s)
Iwaisako and Nakata (2017)	1977–2014	Exchange rate (EXCH), global demand, oil prices	Vector autoregression (VAR), impulse response function	EXCH shocks had negligible impact on Japanese exports; global demand and oil price volatility were significant drivers.
Šimáková (2014)	1997–2012	Exchange rate (EXCH) volatility	Johansen co-integration test	Czech koruna volatility reduced exports and imports with multiple EU countries; negative trade impacts confirmed for Slovak Republic and UK.
Audzei and Brázdik (2018)	Q1 1998–Q1 2017	Real EXCH shocks	Variance decomposition, two-country structural VAR	Real EXCH shocks had minimal impact on macroeconomic volatility in most CEE countries, except Bulgaria and Slovenia.
Todorov et al. (2021)	2004–2007 (EU accession)	EXCH regimes, euro area membership, GDP	Vector autoregressive	Floating EXCH rates or euro area membership led to better GDP outcomes, but effects on GDP growth were not statistically significant.
Shevchuk (2022)	2002–2019	Inflation Exchange rate Index of economic freedom	DOLS	Expected EXCH depreciation partially influenced consumer price changes in CEE countries.
Anwar and Nguyen (2011)	1990–2007	FDI, exports, imports, net exports	OLS, GLS, gravity model	FDI significantly boosted Vietnam's net exports post-Asian financial crisis via strengthened backward linkages.
Sultan (2013)	1980–2010	FDI, exports	Johansen co-integration, VECM	FDI enhanced exports through improved efficiency; stable long-term equilibrium, no short-term causality.
Pelinescu and Radulescu (2009)	2000–2009	FDI, GDP, exports, local currency depreciation, interest rates	Regression	FDI significantly promoted Romania's export growth by enhancing production capacity and competitiveness.
Penkova-Pearson (2011)	2000–2008	FDI, EXCH, EU economic growth	Engle Granger causality	EU growth and FDI drove Bulgaria and Romania's exports; EXCH appreciation had negligible effects.
Rădulescu and Şerbănescu (2012)	1990–2010	FDI, exports	Descriptive Statistics	FDI significantly increased exports in new EU member states by enhancing supply capacity.
Acaravci and Ozturk (2012)	1994–2008	FDI, exports, GDP	ARDL co-integration	FDI positively influenced GDP in Czech Republic and Slovak Republic; no consistent long-term equilibrium in other CEE countries.
Silaghi and Ioana (2009)	1990–2006	Exports, GDP	Granger and Sims causality tests	Bidirectional causality between exports and GDP in some CEE countries; supported Growth-Led Export hypothesis in Hungary, Romania, Slovenia.

Table 1. *Cont.*

Author(s)	Time Period	Variable(s)	Technique(s)	Major Finding(s)
Dritsakis (2004)	1994–2004	Exports, investments, GDP	VAR, ECM	Exports drove economic development in Bulgaria and Romania; GDP growth spurred exports, with strong GDP-investment correlation in Bulgaria.
Purusa and Istiqomah (2018)	2000–2015	FDI, inflation, crude oil prices	GMM	FDI and oil prices increased exports; inflation had a negative impact in Indonesia, Malaysia, Philippines, Thailand, Vietnam.
Jacob et al. (2021)	1995–2020	Inflation, EXCH, exports	VECM	Inflation and EXCH depreciation positively influenced India's exports; EXCH appreciation curbed inflation and promoted exports.
De Grauwe and Schnabl (2008)	1994–2004	Exchange rate regimes, inflation, GDP	GMM	Stable EXCH rates supported macroeconomic stabilization, fostering international trade in South, Eastern, and Central Europe.
Embergenov et al. (2022)	1997–2018	Trade openness, GDP, inflation	Co-integration	Export openness reduced inflation, import openness increased it; GDP drove inflation in Uzbekistan.
Zhao et al. (2017)	1990–2011	Financial development (FD), exports	Panel data analysis	FD had a positive but non-linear (inverted U-shaped) effect on exports across 108 countries.
Wajda-Lichy et al. (2020)	2004–2018	Financial development, trade openness	Granger Bootsrap model	Strong causal link between financial development and trade in 8 CEE countries, with credit access boosting exports.
Lazarov and Petreski (2023)	2009–2019	Exports, HDI	Not specified	Higher HDI enhanced export performance via improved human capital, infrastructure, innovation, and governance in CEE.

3. Methods and Data

3.1. Model and Data

This paper investigates the effects of FDI and exchange rates on exports, considering the contribution of GDP, inflation, and domestic credit. Data from Poland, Romania, Hungary, the Czech Republic, and Bulgaria between 1995 and 2022 have been utilized. Consequently, the subsequent model has been estimated to examine this relationship.

$$\text{Export}_{it} = \alpha_i + \zeta_t + \beta_1 \text{EXCH}_{it} + \beta_2 GDP + \beta_3 \text{FDI}_{it} + \beta_4\, Inflation_{it} + \beta_5\, Domestic + \beta_6 HDI + \vartheta_{it} \quad (1)$$

In Equation (1), export is a dependent variable, while FDI, EXCH (Exch), GDP, Inflation (Inflation), domestic credit (Domestic), and HDI are the independent variables. β_1 to β_5 are the coefficients. Finally, ϑ_{it} represented the error term. This model illustrates the complex association underlying econometric variables and export achievement, allowing sound decision making by government and policymakers to improve exports and stimulate economic growth.

Based on the streaming literature, we can hypothesize the signs of the respective coefficients of the parameters mentioned in Equation (1), in which the EXCH signs are

positive. $\beta_1 => 0$. The respective coefficients of GDP (GDP) and FDI parameters will be positive signs associated with Acaravci and Ozturk (2012). Meanwhile, we expected that domestic credit would boost the exports, which is the sign of $Domestic > 0$. For inflation, we can expect the following: ($\beta_5 < 0$) Jacob et al. (2021). All variables will be represented as normal data in the following section containing the examination results. The measurement units, data sources, and a description of the data are presented below (Table 2).

Table 2. Description of the Variables.

Variable	Description	Source
Export	Exports of goods and services (% of GDP)	The World Bank
Exchange rate	Real effective exchange rate index	The World Bank
FDI	Foreign direct investment, net inflows (% of GDP)	The World Bank
GDP	GDP per capita (constant 2015 US$)	The World Bank
Inflation	Inflation, consumer prices (annual %)	The World Bank
Domestic	Domestic credit to private sector (% of GDP)	The World Bank
HDI	Human Development Index	United Nations Development Programme

3.2. Methodology

The ARDL model, introduced by Pesaran and Shin (1997) and further developed by Pesaran et al. (2001), provides reliable estimates of long-run coefficients, regardless of whether the explanatory variables are integrated of order zero (I(0)), order one (I(1)), or a combination of both. A defining feature of cointegrated variables is their tendency to respond to deviations from long-run equilibrium. This behavior forms the basis of an error correction model (ECM), in which short-run dynamics are influenced by these deviations. Accordingly, the model can be represented by the following equation:

$$Y_{it} = \sum_{j=1}^{p} \alpha_i Y_{i,t-j} + \sum_{j=0}^{q} \beta_{ij} X_{i,t-j} + \theta_i + \varepsilon_{it} \quad (2)$$

In this model, Y_{it} represents the dependent variable, while $X_{i,t}$ is a $k \times 1$ vector of independent variables that may be integrated of order zero, I(0), or order one, I(1). The coefficient α_i corresponds to the lagged dependent variable, β_{ij} are the coefficients associated with the independent variables, θ_i denotes the unit-specific fixed effect, and ε_{it} is the error term. The estimated Auto-Regressive Distributed Lag (ARDL) Error Correction Model (ECM) is specified as follows:

$$\Delta Y_{it} = \sum_{j=1}^{p-1} r_i \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} z_{ij} \Delta X_{i,t-j} + \gamma_i ECT + \theta_i + \varepsilon_{it} \quad (3)$$

ECT is the error correction term, γ_i is the group specific speed of adjustment coefficient ($\vartheta i < 0$), r_i and z_{ij} are the short run dynamic coefficients, and γ_i is a vector of long run coefficients. The Y_{it} and X_{it} are presented in Equation (3).

The literature on dynamic heterogeneous panel estimation proposes several approaches for estimating Equation (2). One extreme approach is the Fixed Effects (FE) estimator, in which the time series data for each group are pooled, and only the intercepts are allowed to vary across groups. However, when slope coefficients are not identical across groups, the FE estimator yields inconsistent and potentially misleading results. Another extreme approach involves estimating the model separately for each group and then

computing a simple arithmetic average of the coefficients. This method is known as the Mean Group (MG) estimator, introduced by Pesaran and Smith (1995). In the MG estimator, intercepts, slope coefficients, and error variances are all allowed to differ across groups.

Subsequently, Pesaran et al. (1997, 1999) proposed the Pooled Mean Group (PMG) estimator, which combines the two previous approaches. The PMG estimator allows intercepts, short-run coefficients, and error variances to vary across groups (similar to the MG estimator), but constrains the long-run coefficients to be equal across groups (as in the FE estimator). Given that Equation (2) is non-linear in parameters, Pesaran et al. (1999) developed a Maximum Likelihood (ML) estimation method to estimate the parameters. The Hausman test is used to choose between the Pooled Mean Group (PMG) and Mean Group (MG) models in panel data analysis by testing the assumption of homogeneous long-run coefficients in the PMG model. The null hypothesis assumes that the PMG model is consistent and efficient (homogeneous coefficients), while the alternative favors the MG model (heterogeneous coefficients). A high p-value (>0.05) supports the PMG model, indicating no significant heterogeneity, while a low p-value ($\leq$0.05) favors the MG model, ensuring the correct model is selected for accurate estimation.

3.2.1. Co-Integration Test

It is important to ascertain if the variables of interest have a long-term co-accumulation connection after the stationary of the time series under study has been established. This research employed several CSD tests (Kao, 1999; Pedroni, 2004). Both null hypothesis tests presume the absence of a co-integration long-relationship among the variables of interest, as opposed to the H1 that posits a co-integration relationship.

3.2.2. CS Dependence Tests

The CD (Cross-Sectional Dependence) test is applied to check the cross-sectional dependence in panel data. The M. Hashem Pesaran CD test (Pesaran, 2006), (Breusch & Pagan, 1980), and (Pesaran, 2006) tests were applied here. The Pesaran CD test is applied for unbalanced panels. The Breusch and Pagan (1980) test is used to check CS dependence for panels. The (Pesaran, 2006) test is a more robust test that compensates for CS in an unbalanced panel.

CD is applied when variables exhibit different orders of integration or are stationary at first difference. The CD-test (Pesaran, 2006, 2007) is summarized in Equation (4):

$$\mathrm{CD} = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \rightarrow N(0,1) \tag{4}$$

where $\hat{\rho}_{ij}$ is the sample estimate of the pair-wise correlation of the OLS residuals, $\hat{u}_{it}$, associated with Equation (5)

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^{T}\hat{u}_{it}\hat{u}_{jt}}{\left(\sum_{t=1}^{T}u_{it}^2\right)^{1/2}\left(\sum_{t=1}^{T}u_{jt}^2\right)^{1/2}} \tag{5}$$

4. Results and Discussion

Figures 5–10 show the possible relationship between EXP and GDP, FDI, inflation, domestic credit, and exchange rate to better illustrate the key hypothesis. All figures indicate the positive slope and the positive relationship: an increase in exports leads to a rise in GDP, FDI, inflation, credit domestic, and exchange rate.

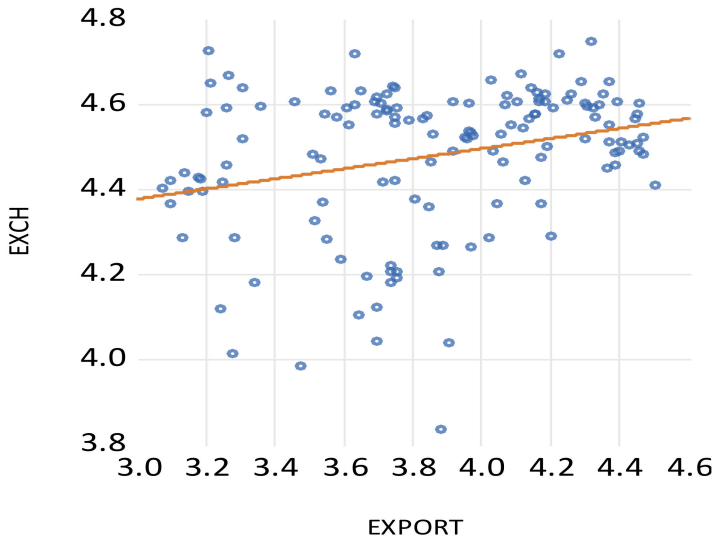

Figure 5. Relationship of Export and Exchange-rate (1995 to 2022).

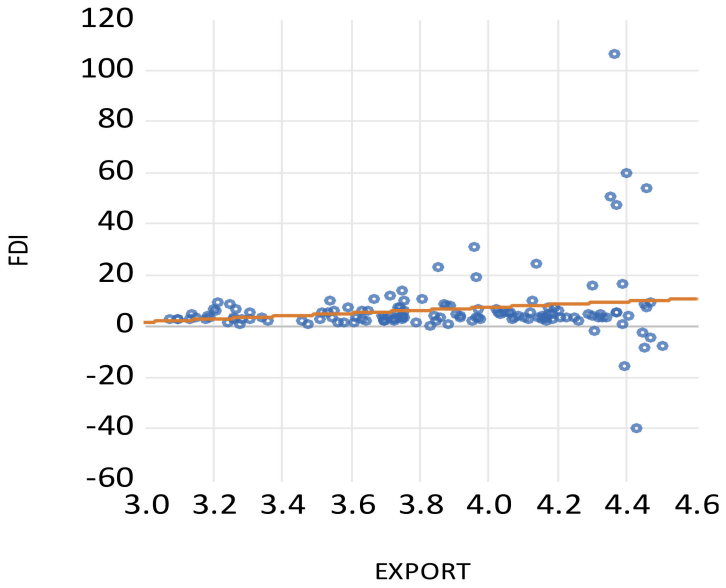

Figure 6. Relationship of Export and FDI (1995–2022).

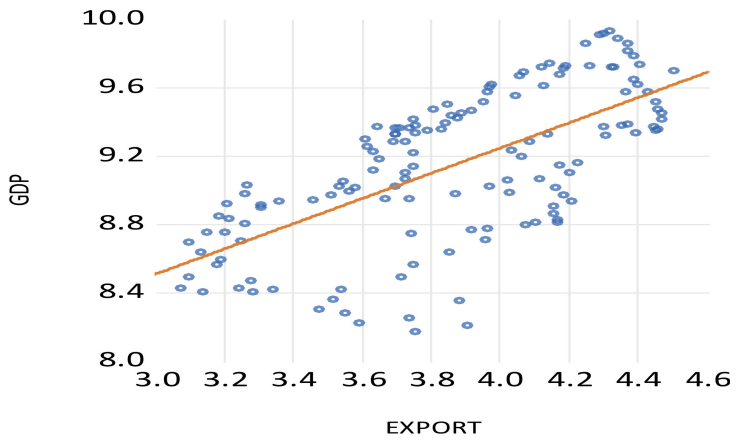

Figure 7. Relationship of Export and GDP (1995 to 2022).

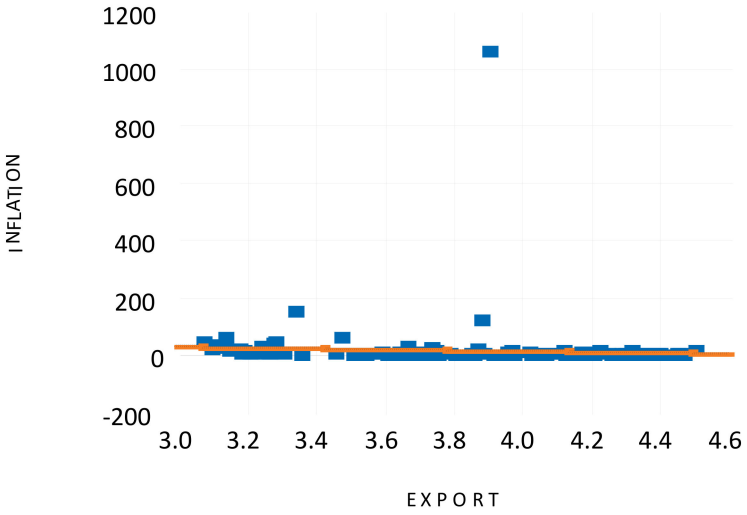

Figure 8. Relationship of Export and inflation rate in (1995 to 2022).

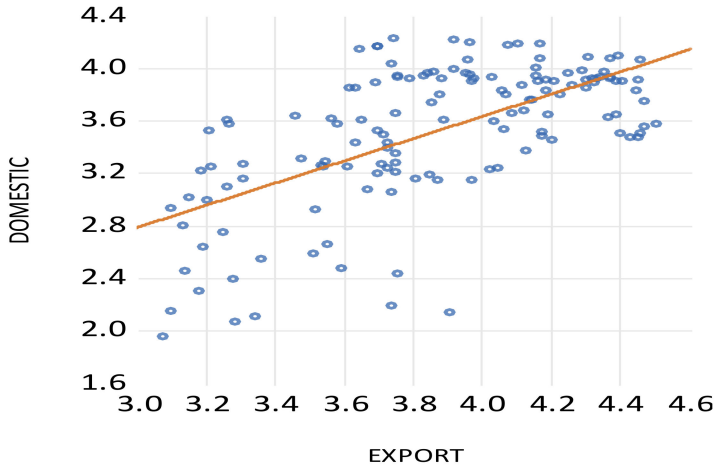

Figure 9. Relationship of Export and domestic credit (1995 to 2022).

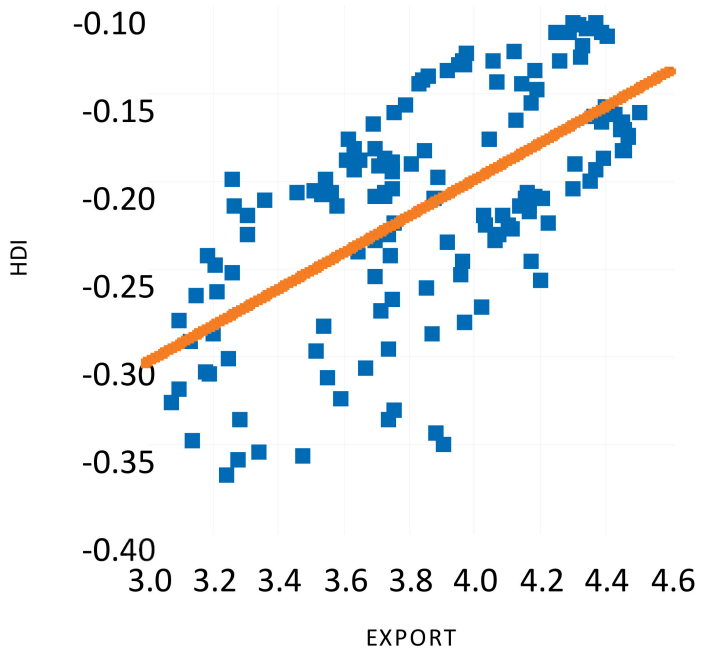

Figure 10. Relationship of Export and HDI (1995 to 2022).

4.1. Major Findings

4.1.1. Descriptive Statistics and Correlation

The descriptive statistics (Table 3) provides a summary of the key variables used in the analysis based on 140 observations for each. The export variable has a mean of 3.86 with a standard deviation of 0.395, indicating moderate variation across the sample, with values ranging from 3.07 to 4.50. This suggests relatively stable export levels among the observed countries or time periods. The exchange rate has a mean value of 4.47 and a low standard deviation of 0.172, showing minimal fluctuation, with a range between 3.83 and 4.74. This implies exchange rate stability across the panel. GDP, likely in logarithmic form, shows a mean of 9.14 with a standard deviation of 0.442, and values ranging from 8.17 to 9.93, reflecting differences in economic size across countries. FDI displays significant variation, with a mean of 6.51 and a very high standard deviation of 13.39, spanning from −40.08 to 106.59. This wide range suggests the presence of both strong inflows and negative values (possibly disinvestments or net outflows) in some countries or periods. Inflation shows the highest variability, with a mean of 16.97 and an extremely high standard deviation of 90.64, and values ranging from −1.545 to 1058.37. This indicates substantial disparities in inflation dynamics, likely reflecting economic instability or hyperinflation episodes in certain countries. The domestic credit to private sector variable has a mean of 3.52 and a standard deviation of 0.534, with values ranging from 1.96 to 4.234, suggesting moderate variation in financial development. Finally, the HDI is shown in a transformed (possibly normalized or differenced) form, with a mean of −0.214 and standard deviation of 0.065, ranging from −0.368 to −0.11, indicating some dispersion in human development levels across the countries observed.

Table 3. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Export	140	3.86	0.395	3.07	4.50
Exch	140	4.47	0.172	3.83	4.74
GDP	140	9.14	0.442	8.17	9.93
FDI	140	6.51	13.39	−40.08	106.59
Inflation	140	16.97	90.64	−1.545	1058.37
Domestic	140	3.52	0.534	1.96	4.234
HDI	140	−0.214	0.065	−0.368	−0.11

Source: Authors' calculations.

The correlation matrix (Table 4) reveals that exports are strongly and positively associated with GDP (0.65), Domestic (0.62), and HDI (0.62), indicating that higher income, financial development, and human development boost export performance. Exch (0.26) and FDI (0.17) show moderate to weak correlations with exports, while inflation (−0.06) has a negligible negative effect. GDP correlates strongly with HDI (0.92) and moderately with Domestic (0.59) and exchange rate (0.40), reflecting close ties between economic size and development. Inflation is negatively correlated with most variables, especially exchange rate, GDP, Domestic, and HDI, suggesting its destabilizing nature. FDI shows weak links overall, while HDI maintains strong positive associations with major growth and trade variables, underlining its central role in export performance.

In order to confirm multicollinearity and make sure the model is free of bias from missing variables, we also performed a multicollinearity assessment. The absence of significant value in Table 5's test results indicates that multicollinearity is not a problem.

Table 4. Correlation matrix.

Variables	EXPORT	EXCH	GDP	FDI	INFLATION	DOMESTIC	HDI
EXPORT	1						
EXCH	0.26	1.00					
GDP	0.65	0.40	1.00				
FDI	0.17	0.01	0.06	1.00			
INFLATION	−0.06	−0.32	−0.27	−0.03	1.00		
DOMESTIC	0.62	0.42	0.59	0.07	−0.30	1.00	
HDI	0.62	0.61	0.92	0.02	−0.30	0.66	1

Source: Authors' calculations. Note: Variable definitions are as follows: EXPORT = Exports of goods and services; EXCH = Real effective exchange rate index; GDP = GDP per capita; FDI = Foreign direct investment; INFLATION = Inflation rate; DOMESTIC = Domestic credit to the private sector; HDI = Human Development Index.

Table 5. VIF test.

Variable	VIF	1/VIF
Domestic	1.71	0.585358
GDP	1.64	0.611136
Exch	1.35	0.738993
Inflation	1.16	0.861528
FDI	1.01	0.993249
HDI	1.75	0.571886

Source: Authors' calculations.

4.1.2. Cross-Sectional Dependence Results

Table 6 displays the findings from the CD study. The Pesaran scaled exam is used to administer the CD test. The results support the alternative CSD hypothesis in the export residual with exchange rate, foreign direct investment, GDP, inflation, and domestic credit.

Table 6. CD-test Pesaran (2006).

Variable	CD-Test	*p*-Value
Export	14.005 *	0.000
Exch	13.644 *	0.000
FDI	5.115 *	0.000
GDP	16.335 *	0.000
Inflation	10.305 *	0.000
Domestic	7.677 *	0.000
HDI	16.435	0.000

Source: Authors' calculations. Note: * indicates 1% significance level.

4.2. Unit-Root Findings

In this section, we looked at the stationarity status to avoid spuriously regressed, biased, inconsistent, and false conclusions. The results of the unit root for the whole panel are shown in Table 7. We first implemented the second-generation CIPS unit root test. The findings support that exchange rate, FDI, and inflation are stationary at levels I(0). In contrast, the exports, GDP, and domestic credit are stationary at the first level I(1).

Table 7. Panel Unit-Root Test Pesaran (2007).

Varriables	I(0)	I(1)
	t-Statistic	t-Statistic
Exch	−2.457 **	
Export	−1.820	−5.454 **

Table 7. *Cont.*

Varriables	I(0)	I(1)
	t-Statistic	t-Statistic
FDI	−2.625 **	
GDP	−2.284	−4.709 **
Inflation	−3.644 **	
Domestic	−1.947	−3.901 **
HDI	−1.718	−3.716 **

Source: Authors' calculations, Note: ** indicate 5% significance level.

4.3. Co-Integration Findings

We applied the co-integration tests of Kao (1999), Pedroni (1999) and Westerlund (2007). Delta test statistics prove co-integration at 1% and 5% significance levels, respectively. This shows that variables are co-integrated; namely, there is a long-term relationship between them (Table 8).

Table 8. Co-integration tests.

Test	Statistic	*p*-Value
Kao	−3.3579 *	0.0004
Pedroni	2.4875 *	0.0064
Westerlund	−1.986 **	0.0235

Source: Authors' calculations. Note: * and ** indicate 1% and 5% significance level.

4.4. Panel ARDL Regression Results

Table 9 presents the PMG panel ARDL model results for CESEE countries, with exports as the dependent variable. The findings reveal significant long-run relationships between exports and key explanatory variables. The exchange rate exhibits a negative effect, with a coefficient of −0.295035 (p = 0.0011), indicating that a 1% currency depreciation reduces exports by approximately 0.3%. This finding aligns with prior studies (Kuziemska-Pawlak & Mućk, 2024; Audzei & Brázdik, 2018; Todorov et al., 2021), which suggest that while a weaker real exchange rate can enhance price competitiveness, non–price factors, such as product quality and market diversification, are critical drivers of export performance (Wanzala et al., 2024; Rădulescu & Şerbănescu, 2012). The decision by CESEE countries, including Poland, Romania, Hungary, the Czech Republic, and Bulgaria, to retain national currencies until 2024 has preserved monetary policy autonomy. This flexibility enables tailored interventions, such as interest rate adjustments, to bolster export competitiveness. Notably, a 1% increase in GDP boosts exports by approximately 0.37%, as indicated by a long-run coefficient of 0.374544 (p = 0.0000). This corroborates prior studies (Bugarčić et al., 2024; Simakova, 2024; Shevchuk, 2022; Acaravci & Ozturk, 2012), which suggest that economic growth drives the adoption of advanced technologies and efficient production methods, enhancing export quality and global competitiveness. Furthermore, higher GDP facilitates greater resource allocation to improved marketing strategies and distribution networks in international markets. Foreign direct investment (FDI) exerts a positive long-run effect on exports in CESEE countries, as evidenced by the PMG panel ARDL model. With a coefficient of 0.003771 (p = 0.0375), a 1% increase in FDI is associated with a modest 0.004% rise in exports. FDI enhances export capacity by injecting capital, introducing advanced technologies, and facilitating access to global markets, although its impact weakens at higher levels of investment intensity. These findings align with prior studies (Wenxuan, 2024; Rudy, 2024; Dai, 2024; Kumar et al., 2025; Pelinescu & Radulescu, 2009), which emphasize FDI's role in boosting productivity and competitiveness. Collectively,

these results highlight the interplay of price and non-price factors in driving CESEE export growth, with FDI complementing other dynamics, such as exchange rate effects, to shape export performance. The findings from model indicates that inflation has a statistically significant but minimal positive effect on exports in CESEE countries, with a coefficient of 0.002173 (p = 0.0000). This suggests that a 1% increase in inflation leads to a slight 0.002% rise in exports. The modest export boost can be attributed to inflation's interaction with flexible exchange rates, which often results in currency depreciation, making CESEE exports more price-competitive in international markets. Additionally, inflation may incentivize firms to enhance productivity and adopt cost-efficient production methods to offset rising costs, thereby maintaining or improving export quality. Strategic market diversification further mitigates inflationary pressures by reducing reliance on price-sensitive markets, allowing CESEE countries to sustain export growth. These findings align with prior studies (Daianu et al., 2024; Benk et al., 2024), which highlight how flexible exchange rates, productivity gains, and diversified market strategies enable CESEE countries to preserve export competitiveness despite inflationary challenges. Domestic credit to the private sector significantly enhances with a long-run coefficient of 0.099965 (p = 0.0000). This indicates that a 1% increase in domestic credit leads to a 0.1% rise in exports. The substantial impact reflects the pivotal role of credit availability in expanding production capacity, fostering innovation, and improving product quality, which collectively strengthen export competitiveness. These findings are consistent with prior studies (Hegerty, 2024; Bako, 2024), which highlight how access to domestic credit empowers firms to invest in technology, scale operations, and penetrate global markets, thereby driving export performance in CESEE economies. The coefficient of HDI indicates that a 1-unit increase in HDI boosts exports by over 6%. The substantial impact stems from HDI's components—education, health, and income—which enhance export performance through multiple channels. Improved education fosters a skilled workforce capable of innovation and high-value production, elevating the quality and competitiveness of exports. Better health outcomes ensure a productive labor force, reducing absenteeism and increasing output for export-oriented industries. Higher income levels enable investments in technology and infrastructure, further strengthening trade participation. These findings align with prior studies (Bozduman, 2025; Šlander-Wostner et al., 2025; Syam, 2025), which emphasize human capital's role in driving productivity and global market engagement. In contrast, the constant term (0.660396, p = 0.1313) is statistically insignificant, indicating no inherent baseline effect on exports. These results underscore the multifaceted drivers of CESEE export growth, with HDI and GDP exerting the most significant long-run impacts. The short-run coefficients from the PMG panel ARDL model indicate that approximately 39.67% of any disequilibrium in exports is corrected annually, reflecting a moderate adjustment speed toward the long-run equilibrium. The differenced inflation variable (D(INFLATION)), with a coefficient of 0.004363 (p = 0.0173), suggests that a 1% increase in inflation boosts exports by 0.004% in the short run, likely due to temporary price competitiveness gains from currency depreciation. Conversely, the lagged differenced inflation (D(INFLATION(-1), with a coefficient of −0.004300 (p = 0.0533), implies that a 1% increase in prior-period inflation reduces exports by 0.004%, possibly as firms adjust prices or lose competitiveness. These significant coefficients underscore the role of inflation dynamics and equilibrium adjustment in shaping short-run export performance in CESEE countries. The Mean Group (MG) estimation reveals several statistically significant relationships, generally consistent with the PMG results, although the latter demonstrate a better overall fit. The exchange rate (EXCH) has a negative and significant effect, while FDI exerts a weak positive influence. GDP, inflation, domestic investment, and HDI all exhibit positive and significant impacts, underscoring their importance in determining the dependent variable. The constant term

is statistically insignificant. Overall, while the MG results are coherent, the PMG estimates are more robust and reliable.

Table 9. Panel ARDL Regression.

Selected Model: PMG (2, 1, 2, 1, 2, 2, 2)				Mean Group		
Variable	**Coefficient**	**Std. Error**	**Prob.**	**Coefficient**	**Standard Error**	**Prob.**
Long-run (Pooled) Coefficients						
EXCH	−0.295035 *	0.088330	0.0011	−0.1556 **	0.1051	0.0041
FDI	0.003771 **	0.001793	0.0375	0.0020 **	0.0231	0.0451
GDP	0.374544 *	0.076959	0.0000	0.2922 ***	0.0101	0.0064
INFLATION	0.002173 *	0.000455	0.0000	0.0013 ***	0.0121	0.0034
DOMESTIC	0.099965 *	0.018671	0.0000	0.1155 ***	0.0542	0.0054
HDI	6.266831 *	0.793466	0.0000	5.2345 ***	0.1515	0.0051
C	0.660396	0.434662	0.1313	0.4515	0.4813	0.5132
Short-run (Mean-Group) Coefficients						
COINTEQ	−0.396714 **	0.171727	0.0226	−0.5031 ***	0.1943	0.000
D(EXPORT(-1))	0.146015	0.148117	0.3263	0.15122	0.4561	0.370
D(EXCH)	−0.105659	0.275743	0.7023	−0.0021	0.3515	0.234
D(FDI)	0.002642	0.003437	0.4436	0.00912	0.0055	0.093
D(FDI(-1))	0.001391	0.003023	0.6464	0.03554 **	0.0012	0.7541
D(GDP)	0.332254	0.284231	0.2448	0.27135	0.3255	0.3516
D(INFLATION)	0.004363 **	0.001808	0.0173	0.00356	0.0021	0.0462
D(INFLATION(-1))	−0.004300 *	0.002203	0.0533	−0.0054 *	0.0065	0.0652
D(DOMESTIC)	−0.007001	0.157603	0.9646	−0.0521	0.1813	0.9324
D(DOMESTIC(-1))	−0.054056	0.108829	0.6203	−003254	0.1510	0.2546
D(HDI)	1.490440	1.985268	0.4543	1.14552	2.1516	0.5401
D(HDI(-1))	−4.578443	2.865118	0.1127	−4.2136	3.161	0.1446
Hausman Test (*p*-Value)	0.5621					

Source: Authors' calculations. Note: *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are as follows: EXPORT = Exports of goods and services; EXCH = Real effective exchange rate index; GDP = GDP per capita; FDI = Foreign direct investment; INFLATION = Inflation rate; DOMESTIC = Domestic credit to the private sector; HDI = Human Development Index, D = denotes first-difference operator; (-1) indicates lagged first difference. Null Hypothesis (H_0):-PMG estimator is efficient and consistent, but MG is not efficient.

5. Conclusions and Policy Recommendations

This study investigates the determinants of export performance in Central, Eastern, and Southeastern European (CESEE) countries—Poland, Romania, Hungary, the Czech Republic, and Bulgaria—using data from 1995 to 2022. It examines the roles of foreign direct investment (FDI), exchange rates, GDP, inflation, domestic credit, and the human development index (HDI) through the PMG panel ARDL model. The PMG panel ARDL model results provide further insights into the long-run and short-run dynamics of export performance. In the long run, HDI has the most substantial impact, with a 1-unit increase boosting exports by over 6%, driven by enhanced education, health, and income levels that foster innovation and productivity. GDP significantly enhances exports, with a 1% increase raising exports by 0.37%, reflecting the role of economic growth in advancing technology and market access. Domestic credit to the private sector contributes notably, with a 1% increase leading to a 0.1% export rise, supporting production and innovation. Inflation has a slight positive effect, with a 1% rise increasing exports by 0.002%, facilitated by currency depreciation and diversified markets. FDI contributes modestly, with a 1% increase yielding a 0.004% export growth, though its effect weakens at higher intensities. Conversely, exchange rate depreciation negatively impacts exports, with a 1% depreciation reducing exports by 0.3%, though non-price factors mitigate this effect. The retention of national currencies until 2024 has preserved monetary policy autonomy, enabling tailored interventions to support competitiveness. In the short run, inflation dynamics and a mod-

erate adjustment speed (39.67% annually) toward equilibrium shape export performance. The Mean Group (MG) estimation reveals several statistically significant relationships, generally consistent with the PMG results, although the latter demonstrate a better overall fit. The exchange rate (EXCH) has a negative and significant effect, while FDI exerts a weak positive influence. GDP, inflation, domestic investment, and HDI all exhibit positive and significant impacts, underscoring their importance in determining the dependent variable. The constant term is statistically insignificant. Overall, while the MG results are coherent, the PMG estimates are more robust and reliable.

The findings from the PMG panel ARDL model underscore key strategies for enhancing export performance in Central, Eastern, and Southeastern European (CESEE) countries. Policymakers should prioritize sustainable GDP growth by supporting high-potential export industries through investments in innovation, technology, and productivity enhancements. Strengthening human capital via targeted investments in education and health is essential for fostering a skilled and productive workforce, which drives long-term export competitiveness. Improving access to domestic credit is critical, as it enables firms to expand operations, innovate, and compete globally, particularly in advanced financial systems. Promoting market diversification helps mitigate inflationary pressures and exchange rate volatility, ensuring CESEE countries maintain their global market competitiveness. Enhancing infrastructure is vital for reducing export-related costs and improving efficiency, thereby bolstering global competitiveness. Prudent fiscal and monetary policies can help manage inflation, preventing cost escalations that could undermine export performance. Exporters should leverage periods of GDP growth to expand production and explore new markets, while employing financial hedging strategies to minimize the impact of inflation and exchange rate fluctuations on costs and pricing. Awareness of and participation in government initiatives for export financing are crucial for exporters to secure necessary credit access.

This study acknowledges certain limitations. The dataset is constrained, lacking data for key variables such as labor productivity, real wages, stock market capitalization, and institutional factors like political stability, governance effectiveness, and corruption control. These factors, particularly relevant given the transitional and structural changes in CESEE economies, warrant further investigation. Additionally, the study does not distinguish between immediate and persistent effects of predictors on exports. Future research could address these gaps by employing alternative estimation methods, such as mean-based approaches, to comprehensively analyze these dynamics and incorporate institutional variables.

Author Contributions: Conceptualization, P.K. and M.R.; Data curation, P.K.; Formal analysis, P.K. and A.M.; Software, M.R.; Methodology, M.R., Validation, M.R.; Writing original draft, M.R.; Investigation, I.M.; Reviewing and editing, I.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data will be available on request from the corresponding author.

Conflicts of Interest: Authors declare no conflict of interests.

Abbreviations

CESEE	Central, Eastern, and South-Eastern Europe
EXCH	Exchange Rate
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HDI	Human Development Index

References

Acaravci, A., & Ozturk, I. (2012). Foreign direct investment, export and economic growth: Empirical evidence from new EU countries. *Romanian Journal of Economic Forecasting*, *2*(2), 52–67.

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. *The American Economic Review*, *69*(1), 106–116.

Anwar, S., & Nguyen, L. P. (2011). Foreign direct investment and trade: The case of Vietnam. *Research in International Business and Finance*, *25*(1), 39–52. [CrossRef]

Audzei, V., & Brázdik, F. (2018). Exchange rate dynamics and their effect on macroeconomic volatility in selected CEE countries. *Economic Systems*, *42*(4), 584–596. [CrossRef]

Bako, W. (2024). External financial flows and domestic credit volatility effect on industrialization in selected African countries. *Review of Business and Economics Studies*, *12*(2), 88–96. [CrossRef]

Ban, C., & Adascalitei, D. (2022). The FDI-led growth models of the East-Central and South-Eastern European periphery. In *Diminishing returns: The new politics of growth and stagnation* (pp. 189–211). Oxford University Press Inc.

Beck, T. (2003). Financial dependence and international trade. *Review of International Economics*, *11*(2), 296–316. [CrossRef]

Benk, S., Horváth, P., & Szepesi, N. (2024). Inflation shock and monetary policy. In *Central and eastern European economies and the war in Ukraine: Between a rock and a hard place* (pp. 101–126). Springer Nature.

Bergstrand, J. H. (1985). The gravity equation in international trade: Some microeconomic foundations and empirical evidence. *The Review of Economics and Statistics*, *67*, 474–481. [CrossRef]

Bierut, B. K., & Kuziemska, K. (2016). *Competitiveness and export performance of CEE countries* (NBP Working Paper No. 248). Available online: https://ssrn.com/abstract=2845772 (accessed on 2 April 2025).

Bozduman, E. T. (2025). How does export concentration affect economic complexity? Applying the seemingly unrelated regression approach for selected Central and Eastern European countries. *Journal of Competitiveness*, *17*(1), 185–200.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, *47*(1), 239–253. [CrossRef]

Bugarčić, F., Mićić, V., & Bošković, G. (2024). The nexus between trade infrastructure development and export: The case of central and eastern European countries. *TEME*, *XLVII*, 907–922. [CrossRef]

Caporale, G. M., Sova, A. D., & Sova, R. (2022). The direct and indirect effects of financial development on international trade: Evidence from the CEEC-6. *Journal of International Financial Markets, Institutions and Money*, *78*, 101550. [CrossRef]

Chamber of Commerce Switzerland-CCS. (2022). *Above average export growt of CEE countries*. Available online: https://cee.swiss/2022/03/22/above-average-export-growth-of-cee-countries/?lang=en (accessed on 28 February 2024).

Dai, R. (2024). *What is the effect of FDI on domestic investment in CEE countries and does it matter where the FDI comes from?* Univerzita Karlova.

Daianu, D., Grosu, T., Neacsu, A., Tanase, A., & Vranceanu, R. (2024). *Macroeconomic consequences of the war in Ukraine on Central and Eastern European economies: A SVAR analysis* (ESSEC Business School Research Paper, p. 2407). ESSEC Research Center.

Deardorff, A. V., & Stern, R. M. (1998). *Measurement of nontariff barriers* (Vol. 179). University of Michigan Press.

De Grauwe, P., & Schnabl, G. (2008). Exchange rate stability, inflation, and growth in (South) Eastern and Central Europe. *Review of Development Economics*, *12*(3), 530–549. [CrossRef]

Domazet, I., Marjanović, D., & Ahmetagić, D. (2022). The impact of high-tech products exports on economic growth–the case of Serbia, Bulgaria, Romania and Hungary. *Ekonomikapreduzeća*, *70*(3–4), 191–205. [CrossRef]

Dritsakis, N. (2004). Exports, investments and economic development of pre-accession countries of the European Union: An empirical investigation of Bulgaria and Romania. *Applied Economics*, *36*(16), 1831–1838. [CrossRef]

Embergenov, B., Allayarov, P., Azam, K., Juraeva, U., Sharipova, S., Kudiyarov, K., & Tleubergenov, R. (2022, December 15). *Analyzing the impact of trade openness on inflation: A time series study for Uzbekistan*. 6th International Conference on Future Networks & Distributed Systems (pp. 381–386), Tashkent, Uzbekistan.

EU Report. (2023). Available online: https://op.europa.eu/webpub/com/general-report-2023/pdf/the-eu-in-2023.pdf (accessed on 2 April 2025).

European Central Bank. (2010). *Monthly bulletin*. Available online: https://www.ecb.europa.eu/pub/pdf/mobu/mb201010en.pdf (accessed on 2 April 2025).

European Central Bank. (2020). *Annual report 2020*. Available online: https://www.ecb.europa.eu/press/annual-reports-financial-statements/annual/html/ar2020~4960fb81ae.en.html (accessed on 2 April 2025).

Ferrazzi, M., Schanz, J., & Wolski, M. (2025). *Growth and competitiveness in Central, Eastern and South-Eastern Europe: The role of innovation* (EIB Working Papers No. 2025-01). EIB.

Fidrmuc, J., & Martin, R. (2011). Capital inflows, exports and growth in the CESEE region. In *Post-Crisis growth and integration in Europe*. Edward Elgar Publishing.

Frankel, J. A., Stein, E., & Wei, S. J. (1997). *Regional trading blocs in the world economic system*. Peterson Institute.

Gardo, S., & Martin, R. (2010). *The impact of the global economic and financial crisis on central, eastern and southeastern Europe: A stock-taking exercise* (ECB Occasional Paper, p. 114). ECB.

Hegerty, S. W. (2024). Commodity prices and domestic credit in Central and Eastern Europe: Are there asymmetric effects? *Economic Systems*, *48*(1), 101170. [CrossRef]

Helpman, E., & Krugman, P. (1985). *Market structure and foreign trade*. MIT Press.

Hunjra, A. I., Azam, M., Bruna, M. G., & Bouri, E. (2023). A cross-regional investigation of institutional quality and sustainable development. *Journal of International Financial Markets, Institutions and Money*, *84*, 101758. [CrossRef]

Iwaisako, T., & Nakata, H. (2017). Impact of exchange rate shocks on Japanese exports: Quantitative assessment using a structural VAR model. *Journal of the Japanese and International Economies*, *46*, 1–16. [CrossRef]

Jacob, T., Raphael, R., & Ajina, V. S. (2021). Impact of exchange rate and inflation on the export performance of the Indian economy: An empirical analysis. *BIMTECH Business Perspective*, 1–13. [CrossRef]

Jakšić, S. (2022). Modelling CESEE countries export dynamics: Global vector autoregressive approach. *Zagreb International Review of Economics & Business*, *25*(2), 39–63.

Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics*, *90*(1), 1–44. [CrossRef]

Kumar, P., Kaur, R., Radulescu, M., Kalaš, B., & Hagiu, A. (2025). Drivers of environmental sustainability, economic growth, and inequality: A study of economic complexity, FDI, and human development role in BRICS+ Nations. *Sustainability*, *17*(9), 4180. [CrossRef]

Kumar, P., & Radulescu, M. (2024). CO_2 emission, life expectancy, and economic growth: A triad analysis of Sub-Saharan African countries. *Environment, Development and Sustainability*, *27*, 11955–11982. [CrossRef]

Kumar, P., Radulescu, M., & Rajwani, S. (2024a). G20 environmental transitions: A holistic exploration of the environmental Kuznets Curve (EKC). The role of FDI, urbanization and industrial trends. *Environmental Engineering & Management Journal (EEMJ)*, *23*(9), 1823–1835. [CrossRef]

Kumar, P., Radulescu, M., Sharma, H., Belascu, L., & Serbu, R. (2024b). Pollution haven hypothesis and EKC dynamics: Moderating effect of FDI. A study in Shanghai Cooperation Organization countries. *Environmental Research Communications*, *6*(11), 115032. [CrossRef]

Kuziemska-Pawlak, K., & Mućk, J. (2024). Global value chains and equilibrium exchange rate: Evidence from Central European Economies. *Review of International Economics*. [CrossRef]

Lazarov, D., & Petreski, G. (2023). Export complexity and economic growth: Empirical analysis for selected CEE countries. *Croatian Economic Survey*, *25*(2), 41–65. [CrossRef]

Leibovici, F. (2021). Financial development and international trade. *Journal of Political Economy*, *129*(12), 3405–3446. [CrossRef]

Linders, G.-J. M. (2006). *Intangible barriers to trade: The impact of institutions, culture and distance on patterns of trade* [Ph.D. thesis, Vrije Universiteit Amsterdam].

Linnemann, H. (1966). *An econometric study of international trade flows*. North-Holland.

Manova, K. (2013). Credit constraints, heterogeneous firms, and international trade. *Review of Economic Studies*, *80*(2), 711–744. [CrossRef]

Marciniak, T., Novak, J., & Purta, M. (2018). *CEE needs a new engine for growth, McKinsey report*. Available online: https://www.mckinsey.com/featured-insights/europe/central-and-eastern-europe-needs-a-new-engine-for-growth (accessed on 28 February 2024).

Medve-Bálint, G., & Éltető, A. (2024). Economic nationalists, regional investment aid, and the stability of FDI-led growth in East Central Europe. *Journal of European Public Policy*, *31*(3), 874–899. [CrossRef]

Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, *61*(S1), 653–670. [CrossRef]

Pedroni, P. (2004). Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory*, *20*(3), 597–625. [CrossRef]

Pelinescu, E., & Radulescu, M. (2009). The impact of foreign direct investment on the GDP and countries' export potential. *Romanian Journal of Economic Forecasting*, *4*(1), 153–169.

Penkova-Pearson, E. (2011). *Trade, convergence and exchange rate regime: Evidence from Bulgaria and Romania*. Bulgarian National Bank.

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, *74*(4), 967–1012. [CrossRef]

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, *22*(2), 265–312. [CrossRef]

Pesaran, M. H., & Shin, Y. (1997). An autoregressive distributed lag modelling approach to cointegration analysis. *Econometric Society Monographs*, *31*, 371–413.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. [CrossRef]

Pesaran, M. H., Shin, Y., & Smith, R. P. (1997). *Estimating long-run relationships in dynamic heterogeneous panels* (DAE Working Papers Amalgamated Series 9721). University of Cambridge.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, *94*(446), 621–634. [CrossRef]

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, *68*(1), 79–113. [CrossRef]

Podvorica, N., Hoti, A., & Gashi, P. (2025). *FDI drivers in central Europe, the Baltics, and the Western Balkans: The role of macroeconomic and institutional factors*. Ekonomskamisaoipraksa.

Purusa, N. A., & Istiqomah, N. (2018). Impact of FDI, COP, and inflation to export in five asean countries. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan*, *19*(1), 94–101. [CrossRef]

Radulescu, M., Fedajev, A., Sinisi, C. I., Popescu, C., & Iacob, S. E. (2018). Europe 2020 implementation as driver of economic performance and competitiveness. Panel analysis of CEE countries. *Sustainability*, *10*(2), 566. [CrossRef]

Rădulescu, M., & Şerbănescu, L. (2012). The impact of FDIs on exports, and export competitiveness in central and eastern European countries. *Journal of Knowledge Management, Economics and Information Technology*, *2*(1), 132–168.

Rudy, K. (2024). Political effects on FDI in the CEE region: Two cases of connectivity and decoupling from the west. *Global Journal of Emerging Market Economies*, *16*(2), 149–167. [CrossRef]

Schreiner, J. (2022). *Longer-term growth prospects for CESEE* (No. 2. Occasional Paper). Oesterreichische Nationalbank (OeNB).

Septiningrum, L., Dewanti, P., & Hikmawati, F. (2021, April 5–7). *The impact of domestic investment, foreign investments, HDI, export, and import on the economic growth in Indonesia*. International Conference on Data Science and Official Statistics (Vol. 2021, No. 1, pp. 529–536), Ma'an, Jordan.

Shevchuk, V. (2022). Price and output effects of long-term exchange rate changes: Central and Eastern European countries in 2002–2019. *Entrepreneurial Business & Economics Review*, *10*(3), 37–50.

Silaghi, P., & Ioana, M. (2009). Exports-economic growth causality: Evidence from CEE countries. *Romanian Journal of Economic Forecasting*, *2*, 105–117.

Simakova, J. (2024). Assessing the impact of exchange rates on international trade in the manufacturing sector of CEE countries: A specific focus on SMEs. *E&M Economics and Management*, *27*(3), 104–119.

Simionescu, M., Lazányi, K., Sopková, G., Dobeš, K., & Balcerzak, A. P. (2017). Determinants of economic growth in V4 countries and Romania. *Journal of Competitiveness*, *9*(1), 103–116. [CrossRef]

Sultan, Z. A. (2013). A causal relationship between FDI inflows and export: The case of India. *Journal of Economics and Sustainable Development*, *4*(2), 1–9.

Syam, I. H. (2025). Comparative study of infrastructure development and its impact on human development index: Economic and geographical insights. *Economic Military and Geographically Business Review*, *2*(2), 73–88. [CrossRef]

Šimáková, J. (2014). The impact of exchange rate development on Czech trade flows. *Procedia Economics and Finance*, *15*, 129–136. [CrossRef]

Šlander-Wostner, S., Križanič, F., & Vojinovic, B. (2025). Endogenous growth factors and economic development: An in-depth analysis of the impact of investments in R&D and human capital on total factor productivity and export dynamics. *Engineering Economics*, *36*(2), 255–267.

Tinbergen, J. (1962). *Shaping the world economy*. Twentieth Century Fund.

Todorov, I. K., Tanchev, S., Durova, K., & Yurukov, P. (2021). Impact of exchange rate regimes and euro area membership on the economic growth of the new member states from Central and Eastern Europe. *International Journal of Contemporary Economics and Administrative Sciences*, *11*(1), 216–246.

Tsapko-Piddubna, O. (2021). Inclusive growth policy and Institutional assessment: The case of Central and Eastern European countries. *Baltic Journal of Economic Studies*, *7*(2), 233–239. [CrossRef]

Wajda-Lichy, M., Kawa, P., Fijorek, K., & Denkowska, S. (2020). Trade openness and financial development in the new EU member States: Evidence from a granger panel bootstrap causality test. *Eastern European Economics*, *58*(3), 242–263. [CrossRef]

Wanzala, R. W., Marwa, N., & Nanziri Lwanga, E. (2024). Impact of exchange rate volatility on coffee export in Kenya. *Cogent Economics & Finance*, *12*(1), 2330447.

Wenxuan, S. (2024). *The impact of China's outward foreign direct investment on the bilateral trade with belt and road countries the case of Central Eastern European Countries (2007–2022)* [Ph.D. thesis, Corvinus University of Budapest].

Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, *69*(6), 709–748. [CrossRef]

Zhao, L., Liu, Z., Wei, W., & Andreosso-O'Callaghan, B. (2017). FDI outflows, exports and financial development. *Journal of Economic Studies*, *44*(6), 987–1002. [CrossRef]

Zwinkels, R. C., & Beugelsdijk, S. (2010). Gravity equations: Workhorse or Trojan horse in explaining trade and FDI patterns across time and space? *International Business Review*, *19*(1), 102–115. [CrossRef]