Statistical study on the stock of foreign direct investments in Bulgaria and Romania

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ABSTRACT

In this paper, a statistical research was done on the stock of foreign direct investments in the period 1995-2018 for Bulgaria and Romania. Several valid econometric models have been found that explain the determinants influencing the evolution of the stock of FDI inputs in the two countries. The stock of of foreign direct investments was used as a dependent variable, calculated as a percentage of gross domestic product, and as an independent variables, indicators of international trade, economic trends and components of the signaling indicator given by economic freedom indices. It was found that in the case of Bulgaria, the increase in exports, imports, trade balance and balance of payments lead to an increase in the stock of FDI. Also, a higher score of the components of economic freedom, which is characterized by a business environment as free as possible, by a level of taxation as low as possible, as well as by a diminished degree of corruption, lead to an increase in the stock of FDI inputs in the Bulgarian economy. In the case of Romania, it turned out that exports, trade balance, balance of payments have a positive influence on the stock of FDI, as well as a low level of taxation, both in the case of personal income and corporations, lead to growth stock of FDI. Contrary to Bulgaria, an increase in imports leads to a decrease in the stock of FDI in Romania. Finally, it is found that the indices of diversification of imports negatively influence the stock of FDI in both countries, which means that a greater divergence of imports from the world model leads to a decrease in the stock of FDI.

Keywords: *foreign direct investment stock, multiple linear regression, economic freedom index, international trade, quantitative methods.*

JEL classification: C12, C52, O24

1. Introduction

It is well known that direct investment means long-term investment relations between certain resident and non-resident entities that involve the exercise by investors of significant managerial influences in the companies in which they have invested. The main components of foreign direct investment (FDI) are given by the equity participations of non-resident investors holding at least 10% of the subscribed share capital of some resident enterprises, by the profit reinvested by them, as well as debt instruments (loans, trade credits, external receivables) between investors and the companies in which they have invested.

Given that more than 35% of EU assets are held by foreign companies, it is clear that it has one of the most open investment systems in the world. FDI stocks of non-EU investors reached the threshold of 6.295 billion euros at the end of 2017, which generated approximately 16 million new jobs in the European Union.

Statistical-econometric modeling of foreign direct investment has experienced a sharp diversification in recent decades, as the resulting models have included new factors that influence them and are important for their economic impact, in the literature there are a variety of econometric models related to FDI, each with a certain degree of originality and in order to anticipate economic developments.

Thus, in relation to a set of relevant statistical indicators, several types of statistical-econometric models can be identified in the literature. A first set of models quantifies the link between FDI and country risk assessment as the only exogenous variable or coupled with other social variables (Thomas (2006), Vijayakumar, Rasheed and Tondkar (2009), Lee and Rajan (2011), Săvoiu, Dinu and Ciucă (2013), Săvoiu and Țaicu (2014), Lacroix, Méon and Sekkat (2021)).

A second set of models describes the positive or negative correlation between corruption and FDI, increasing the impact or perception of corruption by increasing or decreasing the volume of investments (Barassi and Zhou (2012), Udenze (2014), Brada et all. (2019), Burlea-Schiopoiu, Brostescu and Popescu (2021)).

A third set of models is based on statistical indicators resulting from the notion of economic freedom generating an increase in FDI (Wells and Wint (2000), Bengoa and Sanchez–Robles (2003), the evolution of the value of the economic freedom index (Caetano and Caleiro (2009), Rožāns (2016)), export and import flows (Greenaway and Kneller (2007), Smits (1988)), local financial markets (Alfaro et all. (2004), Azman – Saini, Law and Ahmad, (2010)).

From the multitude of scientific papers studying FDI, we have selected mainly those that refer to the member countries of the European Union. Thus, Feldstein (1983) analyzed the relationship between domestic economies and international capital movement in 17 countries (1960 - 1979). Smits (1988) studied the correlation between FDI and export and import value in 30 countries. Culem (1988) analyzed the influence of FDI location in 6 European countries between 1969 and 1982. Fatehi and Safizadeh (1994) investigated the impact of social and political change on FDI in 15 of the least developed countries (1950-1982). Borensztein, De Gregorio and Lee (1998) researched the impact of FDI in 69 countries (1970-1989). Hejazi and Safarian (2001) established that trade and foreign direct investment (FDI) are complementary, using trade and FDI stock data on a bilateral basis between the U.S. and 51 other countries over the period 1982 to 1994. Noorbakhsk, Paloni and Youssef (2001) assessed the impact of FDI on human capital in 36 countries (1980-1994). Globerman and Shapiro (2002) assesses the impact of government policy, human capital and the environment on FDI in 144 countries (1995-1997). Bengoa and Sanzhez – Robles (2003) conducted an analysis of the interaction between FDI, economic growth and economic freedom in 18 Latin American countries (1970-1999). Bevan and Estrin (2004) studied the determinants of FDI in 11 European countries in transition (1994 - 2000). Bevan A., Estrin S., Meyer K. (2004) analyzed the impact of FDI on institutional development in 12 countries in transition (1994-1998). Alfaro, Chanda, Kalemli – Ozcan and Sayek (2004) investigated in their paper the impact of local financial markets on economic growth and FDI in 71 states (1975-1995). Durham (2004) measured the impact of FDI and foreign portfolio

71 states (1975-1995). Durham (2004) measured the impact of FDI and foreign portfolio investment on economic growth in 83 countries (1979-1998). Li and Liu (2005) assessed the impact of FDI on economic growth in 84 states (1970-1999). Agosin and Machado (2005) measured the impact of FDI on domestic investment in 12 countries (1971-2000). Schneider (2005) observed the interaction between international trade, economic growth and intellectual property rights in 47 countries (1970-1990). Vadlamannati and Tamazian (2009) measured the impact of FDI on economic growth in 80 countries (1980-2006). Kinda (2010) analyzed the correlation between FDI and the investment climate in 77 countries (2000-2006). Azman - Saini, Law and Ahmad (2010) analyzed the interaction between local financial markets and FDI in 91 countries (1975-2005). Doytch and Uctum (2011) investigated the impact of FDI on the growth of production and services in 60 countries (1990-2004). Fillat and Woerz (2011) assessed the impact of FDI on productivity growth in 35 countries (1987–2002). Barassi and Zhou (2012) analyzed the effect of corruption on the incentives of multinational enterprises to undertake FDI in a given country. Morrissey and Udomkerdmongkol (2012) assessed the interaction between private investment, FDI and government in 46 countries (1996-2009). Tintin (2013) analyzed the determinants of FDI in 6 European countries (1996-2009). Fereidouni (2013) studied the effect of the environment on FDI in 31 emerging economies (2000-2008). Thangavelu and Narjoko (2014) analyzed the relationship between free trade agreements and FDI in 39 countries (2000-2009). Imai, Gaiha, Ali and Kaicker (2014) measured the impact of FDI on economic growth in 24 countries (1980-2009). Goswami and Haider (2014) investigated the impact of political risk on FDI in 146 countries (1984–2009). Samargandi, Fidrmuc and Ghosh (2015) looked at the interaction between FDI and economic growth in 52 countries (1980 - 2008). Gui - Diby and Renard (2015) analyzed the relationship between industrialization and FDI in 49 countries (1980 - 2009). Broștescu (2018) studied a classic model of foreign direct investment for Romania and Bulgaria. Broștescu and Săvoiu (2019) investigated structural models based on the association of foreign direct investment flows and outflows (FDI) in some countries in ex-socialist, central and eastern Europe. Sujit, Kumar and Oberoi (2020) conducted an analysis on the impact of macroeconomic, governance and risk factors on FDI intensity. Sultana and Turkina (2020), studied the link between foreign direct investment, technological progress and absorption capacity. Burlea-Schiopoiu, Broștescu and Popescu (2021) analyzed the impact of foreign direct investment on the economic development of 10 emerging countries of the European Union in the period 2007-2017, including Romania and Bulgaria.

The stock of FDI is also studied. Thus, Kornecki and Raghavan (2011) estimate the impact of the FDI stock on economic growth in Central and Eastern Europe (CEE) during the post-communist era using a regression growth model based on the production function. Cardamone and Scoppola (2015) assessed the impact of tariffs on the European Union's external FDI stocks, using a sample of five EU countries and 24 partner countries in the period 1995-2008. Anghelache and Anghel (2015) performed an analysis of the dynamics of the FDI balance correlated with the evolution of GDP at European level. Dauti (2015) presented the main determinants of FDI stocks in 5 countries in south-eastern Europe and 10 new EU countries using an augmented gravity model in order to calculate potential levels of FDI stocks in Macedonia.

The main purpose of this paper is the statistical-econometric study of FDI input stocks in two member countries of the European Union, namely Bulgaria and Romania. Another goal of our research is to analyze a set of indicators from 1995 to 2018, which have the potential to predict the development of FDI stocks in terms of each of the economies of the countries analyzed. In the econometric modeling undertaken, export, import, import diversification index, trade balance, balance of payments, as well as some components of the economic freedom indicator for each country were considered as exogenous factors.

The novelty of the study consists in finding original and valid econometric models that explain the evolution of the stock of FDI inputs according to indicators of international trade, economic trends and components of the signaling indicator given by the index of economic freedom. Also, based on this research, we can identify measures that can be taken to increase the volume of FDI in Bulgaria and Romania.

The paper is structured as follows. The introductory part presents the notion of foreign direct investment and a classification of the factors that influence it. It also presents the current state of knowledge in the field through the review of the literature.
The second section of the paper presents the methods of research, the statistical indicators used in the study, as well as the statistical tests used in the validation of econometric models.

The third section contains the original results obtained by the authors, the interpretation of the results and possible measures that can be taken to increase the stock of foreign direct investment in the two countries analyzed. The paper ends with the section of conclusions, where a comparative analysis of the two countries is made in the light of the results obtained in the previous section, as well as possible further developments.

2. Research methodology

In this paper, multiple linear regression was used in order to find statistical-econometric relationships between the dependent variable and the independent variables, but also influenced between these variables (see Table 2.1). Our sample consists of two emerging markets in Bulgaria and Romania. The data analyzed cover the period 1995-2018 (see Annex 1).
In the econometric models from this paper, the stock of foreign direct investment is considered as a dependent variable, calculated as a percentage of gross domestic product, and as independent variables we have indicators of international trade, economic trends and components of the signaling indicator given by the economic freedom index (ILE). The indicators used in the study are presented in Table 2.1 and are calculated as a percentage when are used in the regression model for each country.

Table 2.1 Economic indicators used in the econometric modeling of stock FDI inflows.

Indicators	Unit	Abbreviations	Short description
Stock FDI inflows (% GDP)	%	$S_{FDI\_in(\%GDB)}$	The stock of FDI inflows represents the value of the share of capital and reserves (including retained profits) attributable to the parent company, plus the net debt of the affiliates to the parent companies. It is approximate the accumulated value of past FDI flows. This indicator is calculated as a percentage of GDP.
Exports (% global total)	%	$X_{\%G}$	Exports include all goods that leave the free movement of a country. This indicator is calculated as a percentage of the total globally.
Imports (% global total)	%	$M_{\%G}$	Imports include all goods entering the free zone of a country. This indicator is calculated as a percentage of the total globally.
Import diversification index	%	Id_M	This indicator is a modified Finger-Kreinin measure of similarity in trade, which takes values between 0 and 1. A value closer to 1 indicates a greater divergence from the global pattern of imports.
Trade balance (% imports)	%	$BC_{\%M}$	The trade balance is calculated as the difference between exports and imports, this indicator being expressed as a percentage of imports.
Balance of payments, current account balance, (% GDP)	%	$BP_{\%GDB}$	The balance of external payments is a system of accounts that includes the synthesis of economic and financial transactions of an economy with the rest of the world, over a period of time. The current account is part of the balance of payments and displays the flows of goods, services, primary and secondary income between residents and non-residents of an economy. The current account balance generally measures the difference between current receipts and expenses for internationally traded goods and services. At the same time, from a national perspective, the current account balance is the gap between domestic savings and investment
ILE - government integrity	%	ILE_{IG}	The ILE component that describes corruption that erodes economic freedom by introducing insecurity and coercion into economic relations. The score for each country is a number between 0 and 100, with the value 100 indicating the lowest level of corruption.

ILE - tax burden	%	ILE_{PF}	The ILE component that reflects marginal tax rates on both personal and corporate income and the general level of taxation (% of GDP), including direct and indirect taxes imposed by all levels of government. The score for each country is a number between 0 and 100, with the value 100 indicating the lowest level of taxation.
ILE – business freedom	%	ILE_{LA}	The ILE component that measures the degree to which regulatory environments and infrastructure constrain the efficient operation of business. The business freedom score for each country is a number between 0 and 100, with the value 100 indicating the freest business environment

Source*:* Authors' contribution based on the information available online at:
https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx
https://www.heritage.org/trade/report/2018-index-economic-freedom-freedom-trade-key-prosperity

It should be noted that other indicators were initially introduced in the study, such as the export diversification index, the import and export concentration index and other components of the economic freedom index, but no valid econometric models were found containing these indicators as exogenous variables..

The original econometric models presented in this paper rigorously went through the stages of specification, parameterization, testing and decision, with an emphasis on validation. Thus, the estimation of the parameters used the least squares method, aiming in the final models to obtain high values of the coefficient of determination (R-squared quantifying the percentage by which the influence of significant factors is explained, and adjusted R-squared representing a corrected value of R-squared, an increase possible and may sometimes be due to the number of variables in the model). The main tests used in the models were t-Student (with the null hypothesis H0: the coefficients are not significantly different from zero and the alternative hypothesis H1: the coefficients are significantly different from zero), the F test (checking if at least one coefficient is significantly different from zero, null hypothesis H0: all coefficients are not significantly different from zero, and H1: there is at least one non-zero coefficient), Durbin-Watson test to verify model error autocorrelation, Jarque-Bera test to prove whether model errors follow or not a normal distribution and the White test to verify the homoscedasticity or heteroskedasticity of econometric models.

By combining the indicators whose metadata were specified in Annex 1, a series of multifactor models were validated, with high values of the coefficient of determination, calculated F-statistic> tabulated F-statistic and Durbin-Watson test values in the range which errors are independent.

In order to validate the following proposed models, performed by means of the least squares method, the values of the tests on the significance of the independent variables, their influence on the evolution of the dependent variable, the verification of the asymmetry and kurtosis properties of the residual variable series, (their autocorrelation analysis or independent), as well as the verification of the homoskedasticity hypothesis, must satisfy the following conditions:

Test F:

- for models with two independent variables: F_calculated > 3.47 and associated probability less than 0.05;
- for models with three independent variables: F_calculated > 3.10 and associated probability less than 0.05;

Student *t* test:

- for models with two independent variables: |t_calculated|> 2.08 and associated probability less than 0.05;

- for models with three independent variables: |t_calculated|> 2,086 and an associated probability less than 0.05;

Durbin-Watson test:

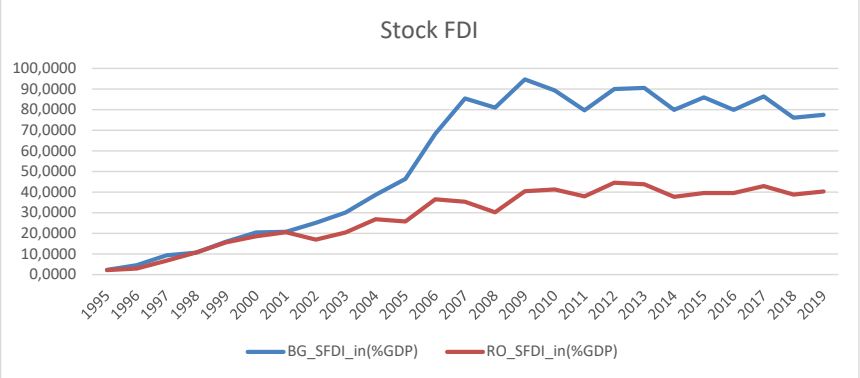
- for models with two independent variables, the value must be between 1.55 - 2.45, the range in which the errors are independent;
- for models with three independent variables, the value must be between 1.66 - 2.34, the range in which the errors are independent;

Probability associated with the Jarque-Bera test: greater than 0.05;
Probability associated with the White test: greater than 0.05.

3. Econometric models of the stock of FDI inflows in Bulgaria and Romania

Romania and Bulgaria had a similar history in terms of economic and political regime before 1989, and the transformations that took place after 1990 in the process of transition to a market economy and EU accession in 2007 support the comparative analysis between these countries. According to the study "Privatization and Restructuring in Central and Eastern Europe" conducted by the World Bank, in 1997, only 15% of companies in the Romanian manufacturing industry were privatized in 1995 and 8% of Bulgarian companies, compared to other Central European countries, such as Poland, Hungary and the Czech Republic where the percentage was over 60%, Privatization determines both costs and benefits. The costs consist of many restructurings and massive increases in unemployment, and the benefits are given by increasing employee productivity and attracting FDI. Consequently, emerging countries with massive and rapid privatizations have benefited from increased labor productivity and an increased volume of FDI. The slowdown in this process in Romania and Bulgaria is one of the causes of the reduced attraction of FDI.
Figure 1 shows the evolution of stocks of FDI inflows (% of GDP) in the economies of Bulgaria and Romania, in the period 1995 - 2019:

Figure 1. Evolution of stocks of FDI inflows (% of GDP) in the economies of Bulgaria and Romania in the period 1995 – 2019



Source: Authors' contribution based on the information available online at:
https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=96740

Based on the data in Figure 1, it can be seen that Bulgaria had a very good evolution of the FDI stock, reaching 94.67% of GDP in 2009, being the highest value recorded in the analyzed period. Romania left the lowest FDI stock as a percentage of GDP of only 2.18%, registering higher values since 2006, the maximum value of 44.59% of GDP being reached in 2012 (see Annex 1).
Next, it was decided to build multifactorial econometric models for the two countries with stocks of FDI inflows, calculated as a percentage of GDP in the position of dependent variables, in an attempt to determine the factors with major influence on them, based on indicators of international trade, economic trends and components of the signaling indicator given by the economic freedom index. The database used in the construction of the econometric models proposed in this paper can be found in Annex 1 containing data from 1995-2018.

3.1. Econometric models of the FDI stock in Bulgaria – BG

Bulgaria has maintained its macroeconomic and financial stability amid a restrictive fiscal and monetary policy, but with a negative impact on the living standards of the population and sometimes the business environment.
The increase of the attractiveness of the business and institutional environment was achieved by practicing a profit rate of 10%, dividend tax of 5% and income tax from independent activities of 15%. According to the Bulgarian Investment Agency (www.investbg.government.bg), this country has undergone an accelerated privatization process in recent years, so that currently about 88% of the country's economy belongs to the private sector. The structure of Bulgarian exports includes raw materials 42.6%, consumer goods 28.1%, investment goods 16.4%, mineral products and energy 12.8%. As external partners, for export, in order of its volume are: Germany, Italy, Romania, Turkey, Greece. At import, the share is held by: raw materials 33.7%, investment goods 25.1%, consumer goods 20.8%, petroleum products and electricity 20.1%. According to the volume of imports, the main partners are the Russian Federation, Germany, Italy, Romania, Greece, Turkey. Bulgaria has improved its investment legislation in order to promote and facilitate priority and green field investments.

Table 3.1 Model of $S_{FDI\_in(\%GDP)}$ by $X_{\%G}$, Id_M and ILE_{LA} for BG

Variables	Coefficient	Std. Error	t-Statistic	Prob
C	-3.200829	29.74237	-0.107618	0.9154
$X_{\%G}$	333.4586	73.31514	4.548291	0.0002
Id_M	-244.2447	46.97849	-5.199075	0.0000
ILE_{LA}	1.549448	0.311065	4.981109	0.0001
R-squared	0.961736	Mean dependent var		54.63978
Adjusted R-squared	0.955997	S.D. dependent var		33.85309
S.E. of regression	7.101328	Akaike info criterion		6.909453
Sum squared resid	1008.577	Schwarz criterion		7.105795
Log likelihood	-78.91343	F-statistic		167.5638
Durbin-Watson stat	2.246595	Prob(F-statistic)		0.000000
Jarque-Bera	0.514481	Prob(J-B)		0.773182
Skewness	-0.357081	Kurtosis		2.933275
White Heteroskedasticity Test:				
F-statistic	0.574957	Probability		0.796543
Obs*R-squared	6.476829	Probability		0.691408

Source: Authors' contribution with software EViews

$S_{FDI\_in(\%GDP)}$=-3.200829+333.4586*$X_{\%G}$-244.2447*Id_M+1.549448*ILE_{LA}+ε_i [1]

Table 3.1 shows that the factor with the greatest influence on the stock of FDI inputs is exports, whose percentage increase with 1% in this case generates a 333% increase in the stock of FDI while the others remain constant. Similarly, the increasing variation of Id_M by 1% leads to a decrease in the stock of FDI inflows by 244%. At the same time, it is found that a better score of the ILE_{LA} component has as an effect an increase of the stock of the studied dependent variable. The model specified, parameterized and tested in the previous table explains the phenomenon studied in the Bulgarian economy in proportion of 95,5%.

Table 3.2 1 Model of $S_{FDI\_in(\%GDP)}$ by $M_{\%G}$, Id_M and $BC_{\%M}$ for BG

Variables	Coefficient	Std. Error	t-Statistic	Prob
C	110.9777	41.14887	2.696980	0.0139
$M_{\%G}$	464.2059	91.68981	5.062787	0.0001
Id_M	-336.8783	82.54470	-4.081163	0.0006
$BC_{\%M}$	0.737036	0.190484	3.869271	0.0010
R-squared	0.927339	Mean dependent var		54.63978
Adjusted R-squared	0.916440	S.D. dependent var		33.85309
S.E. of regression	9.785820	Akaike info criterion		7.550758
Sum squared resid	1915.245	Schwarz criterion		7.747100
Log likelihood	-86.60909	F-statistic		85.08390
Durbin-Watson stat	2.052333	Prob(F-statistic)		0.000000
Jarque-Bera Test	1.280355	Prob(J-B)		0.527199
Skewness	0.388964	Kurtosis		2.178305
White Heteroskedasticity Test:				
F-statistic	0.888640	Probability		0.558022
Obs*R-squared	8.725717	Probability		0.462969

Source: Authors' contribution with software EViews

$S_{FDI\_in(\%GDP)}$=110.9777+464.2059*$M_{\%G}$-336.8783*Id_M+0.737036*$BC_{\%M}$+ε_i [2]

For the model proposed in the previous table, it is found that in Bulgaria, the explanatory variables with the greatest impact on the stock of FDI inflows (% of GDP) are imports and their diversification index. If in the case of the increase of imports by a percentage, in the conditions in which Id_M and $BC_{\%M}$ remain constant, the stock of FDI has an increase of 464%, a pronounced divergence of imports compared to the global pattern leads to the decrease of the variable explained by 337%. The trade balance (% of imports) positively influences Bulgaria's FDI stock, which means that a higher value of exports automatically leads to an increase in the trade balance and $S_{FDI_}$in (% of GDP) by 0.74%, even if this increase is not significant. The adjusted coefficient of determination demonstrates that the proposed model for BG explains 91.64% of the investigated economic phenomenon.

Table 3.3 Model of $S_{FDI\_in(\%GDP)}$ by $M_{\%G}$, $BP_{\%GDP}$ and ILE_{LA} pentru BG

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	-131.6941	12.82042	-10.27222	0.0000
$M_{\%G}$	489.8016	65.62289	7.463884	0.0000
$BP_{\%GDP}$	0.547394	0.224921	2.433724	0.0244
ILE_{LA}	1.782159	0.300480	5.931047	0.0000
R-squared	0.958796	Mean dependent var		54.63978
Adjusted R-squared	0.952615	S.D. dependent var		33.85309
S.E. of regression	7.369173	Akaike info criterion		6.983500
Sum squared resid	1086.094	Schwarz criterion		7.179842
Log likelihood	-79.80200	F-statistic		155.1286
Durbin-Watson stat	1.840211	Prob(F-statistic)		0.000000
Jarque-Bera Test	1.789993	Prob(J-B)		0.408609
Skewness / Asimetrie	-0.661815	Kurtosis / Aplatizare		2.805068
White Heteroskedasticity Test:				
F-statistic	0.301528	Probability		0.961930
Obs*R-squared	3.896791	Probability		0.918073

Source: Authors' contribution with software EViews

$S_{FDI\_in(\%GDP)}$=-131.6941+489.8016*$M_{\%G}$+0.547394*$BP_{\%GDP}$+1.782159*ILE_{LA}+ε_i [3]

The variables of the model specified for the Bulgarian economy in Table 3.3 explain in proportion of 95.26% the variation of the stock of FDI inputs (% of GDP) based on the adjusted coefficient of determination. At the same time, it is found that all three have a positive influence on the studied dependent variable, so that an increase of a percentage of $M_{\%G}$ leads to an increase of the FDI stock by 489.80%, as in the previous model, if $BP_{\%GDP}$ % and ILE_{LA} remain constant.

Table 3.4 Model of $S_{FDI\_in(\%GDP)}$ by $M_{\%G}$, ILE_{PF} and ILE_{LA} for BG

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	-145.5968	9.467480	-15.37862	0.0000
$M_{\%G}$	217.2547	56.79942	3.824945	0.0011
ILE_{PF}	0.802021	0.155660	5.152398	0.0000
ILE_{LA}	1.653140	0.222919	7.415862	0.0000
R-squared	0.977053	Mean dependent var		54.63978
Adjusted R-squared	0.973610	S.D. dependent var		33.85309
S.E. of regression	5.499392	Akaike info criterion		6.398164
Sum squared resid	604.8662	Schwarz criterion		6.594506
Log likelihood	-72.77797	F-statistic		283.8519
Durbin-Watson stat	2.174807	Prob(F-statistic)		0.000000
Jarque-Bera Test	0.392595	Prob(J-B)		0.821768
Skewness	-0.178951	Kurtosis		2.485704
White Heteroskedasticity Test:				
F-statistic	1.794266	Probability		0.160176
Obs*R-squared	9.305556	Probability		0.157109

Source: Authors' contribution with software EViews

$S_{FDI\_in(\%GDP)}$=- 145.5968+217.2547*$M_{\%G}$+0.802021*ILE_{PF}+1.653140*ILE_{LA}+ε_i [4]

The S_{FDI}_in model (% GDP) according to $M_{\%G}$, ILE_{PF} and ILE_{LA} for BG has a high coefficient of determination which explains about 97.36% of the variation of the investigated phenomenon. It is found, based on the data in Table 3.4, that an increased input of goods entering the territory of Bulgaria also leads to an increase in the stock of FDI ($M_{\%G}$ coefficient of 217.25%). Along with imports, it can be seen that an improvement in the score of the ILE component - business freedom by 1% leads to an increase in the dependent variable by 1.65%. However, the decrease of tax rates for both personal and corporate income does not significantly affect the stock of FDI inflows (% of GDP), a change of one percentage reflecting an increase of only 0.80% in the dependent variable.

Table 3.5 Model of $S_{FDI\_in(\%GDP)}$ by Id_M, ILE_{IG} and ILE_{LA} for BG

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	-104.1019	42.99991	-2.420981	0.0251
Id_M	-175.9396	58.55131	-3.004879	0.0070
ILE_{IG}	1.851335	0.481401	3.845720	0.0010
ILE_{LA}	2.363019	0.280941	8.411099	0.0000
R-squared	0.955250	Mean dependent var		54.63978
Adjusted R-squared	0.948538	S.D. dependent var		33.85309
S.E. of regression	7.679672	Akaike info criterion		7.066042
Sum squared resid	1179.547	Schwarz criterion		7.262385
Log likelihood	-80.79251	F-statistic		142.3099
Durbin-Watson stat	1.844073	Prob(F-statistic)		0.000000
Jarque-Bera Test	0.427592	Prob(J-B		0.807513
Skewness	0.003639	Kurtosis		2.346135
White Heteroskedasticity Test:				
F-statistic	0.459235	Probability		0.878663
Obs*R-squared	5.470365	Probability		0.791531

Source: Authors' contribution with software EViews

$S_{FDI\_in(\%GDP)}$=- 104.1019-175.9396*ID_M+1.851335*ILE_{IG}+2.363019*ILE_{LA}+ε_i [5]

The model proposed and validated by the Bulgarian economy in Table 3.5 explains the change in the stock of FDI inputs (% of GDP) in the proportion of 94.85%. Improving the quality of each of the two components of the ILE - government integrity and business freedom by a percentage has a positive effect on the dependent variable, a low degree of corruption and an effective business regulatory environment reflected in a stock of FDI inflows. (% GDP) by 1.85% higher, respectively 2.36%. In contrast to ILE components, an increased divergence of imports from the global pattern has a significant negative effect on the volume of the dependent variable studied, leading to a decrease of 175.94% as found in all previously validated models.

From the data presented in Annex 1 it is found that exports (calculated as a percentage of the global total) have subunit values, so it is more realistic an increase of 0.01% per year which leads to an increase of 3.33% of the FDI stock. Similarly, a 0.01% increase in imports (calculated as a percentage of the global total) leads to an increase in FDI stocks with values between 2.17% and 4.48%, as shown by previous econometric models. Regarding the index of diversification of imports, it has subunit values and a decrease of 0.01% can generate an increase in the stock of FDI with values between 1.75% and 3.36%.

3.2. Econometric models of the FDI stock in Romania-RO

According to a report on FDI in Romania in 2017 made to the Council of Foreign Investors (FIC) together with the Academy of Economic Studies (ASE) in Bucharest (https://fic.ro/Documents/view/Raport-Investitiile-straine-directe-evolutia-si-importanta-lor-in-Romania) Foreign investments in Romania have significantly contributed to the modernization of the national economy and their integration into the European economy and international production chains. FDI companies employ a third of Romania's private workforce, approximately 1.2 million people. FDI companies have a labor productivity twice as high as those with Romanian capital and invest twice as much in each employee. FDI companies make on average 70% of Romania's exports, but also 60% of its imports. Although the perception is that the volume of FDI is high, Romania has the lowest stock of FDI per capita in the region (3,130 EUR / inhabitant). The period of preparation and accession to the EU overlaps the most favorable periods for attracting FDI in Romania. FDI flows increased more than 5 times between 2003-2008. The Netherlands, Austria and Germany are the most important economies investing in Romania, holding a share of over 50% of the total FDI stock. Almost half of total FDI has been directed to industry, which should lead to significant volume and long-term investigations. The share of gross value added of multinational companies exceeds 60% in industries such as automotive and IT&C, according to Eurostat (FATS) data. Romania is on the last positions in the region among some indicators such as infrastructure, tertiary education and vocational training, labor market efficiency. The single share of profit and income tax is 16% and the dividend tax is 5%. From the above, it is important to find some determinants that influence the stock of FDI.

Table 3.6 Model of $S_{FDI\_in(\%GDP)}$ by $M_{\%G}$, Id_M and ILE_{PF} for RO

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	42.53046	26.94568	1.578378	0.1302
$M_{\%G}$	-57.29563	18.59278	-3.081606	0.0059
Id_M	-140.8939	54.82854	-2.569718	0.0183
ILE_{PF}	0.672961	0.136791	4.919636	0.0001
R-squared	0.954397	Mean dependent var		28.16701
Adjusted R-squared	0.947557	S.D. dependent var		13.68928
S.E. of regression	3.134904	Akaike info criterion		5.274086
Sum squared resid	196.5525	Schwarz criterion		5.470428
Log likelihood	-59.28903	F-statistic		139.5238
Durbin-Watson stat	1.958780	Prob(F-statistic)		0.000000
Jarque-Bera Test	0.112713	Prob(J-B)		0.945202
Skewness	-0.121135	Kurtosis		2.767583
White Heteroskedasticity Test:				
F-statistic	1.593099	Probability		0.209663
Obs*R-squared	12.14308	Probability		0.205363

Source: Authors' contribution with software EViews

$$S_{FDI\_in(\%GDP)} = 42.53046 - 57.29563 * M_{\%G} - -140.8939 * ID_M + 0.672961 * ILE_{PF} + \varepsilon_i \quad [6]$$

In the first model of the FDI stock (% of GDP) at the level of the Romanian economy, the following were used as explanatory variables: imports (global total%), the import diversification index and the ILE component (fiscal burden). The model specified in the table 3.6 explains in proportion of 94.76% the variation of the investigated economic phenomenon. The variable that produces the most significant changes in the $S_{FDI_}$in level (% of GDP) is the index of import diversification, thus, a higher value by a percentage of its value, which means a more pronounced divergence from the world import pattern, has the effect of a decrease with 140% of $S_{FDI_}$in (% GDP). The second variable with significant effect is represented by the level of goods entering the territory of Romania, i.e. imports, calculated as a percentage of the global total. The increase of this variable by one percentage, entails a decrease of the FDI stock (% of GDP) by 57.29563%. The third variable present in the model, the ILE component - the tax burden, does not have a significant impact on the target variable, an improved result with a percentage bringing an increase of $S_{FDI_}$in (% GDP) of only 0.672961%.

Table 3.7 Model of $S_{FDI\_in(\%GDP)}$ by $X_{\%G}$, Id_M for RO

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	67.32861	18.28979	3.681212	0.0014
$X_{\%G}$	50.58041	22.99035	2.200071	0.0391
Id_M	-173.6302	40.83534	-4.251960	0.0004
R-squared	0.910992	Mean dependent var		28.16702
Adjusted R-squared	0.902516	S.D. dependent var		13.68928
S.E. of regression	4.274136	Akaike info criterion		5.859509
Sum squared resid	383.6329	Schwarz criterion		6.006766
Log likelihood	-67.31411	F-statistic		107.4675
Durbin-Watson stat	1.800891	Prob(F-statistic)		0.000000
Jarque-Bera Test	0.960553	Prob(J-B)		0.618612
Skewness	-0.483017	Kurtosis		3.165323
White Heteroskedasticity Test:				
F-statistic	2.272573	Probability		0.091021
Obs*R-squared	9.287540	Probability		0.098130

Source: Authors' contribution with software EViews

$$S_{FDI\_in(\%GDP)} = 67.32861 + 50.58041 * X_{\%G} - 173.6302 * ID_M + \varepsilon_i \quad [7]$$

Table 3.7 shows that the factor with a positive influence on the stock of FDI inputs is exports, the variation of which increases by one percent in this case generates an increase of 50.5%. Similarly, the 1% increase in Id_M leads to a 173% decrease in the stock of FDI inflows. The model specified, parameterized and tested in the previous table explains the phenomenon studied at the level of the Romanian economy in proportion of 90,2%.

Table 3.8 Model of $S_{FDI\_in(\%GDP)}$ by Id_M, $BC_{\%M}$ for RO

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	112.3385	4.759749	23.60176	0.0000
Id_M	-249.2065	14.58327	-17.08852	0.0000
$BC_{\%M}$	0.349923	0.085254	4.104453	0.0005
R-squared	0.939229	Mean dependent var		28.16702
Adjusted R-squared	0.933441	S.D. dependent var		13.68928
S.E. of regression	3.531703	Akaike info criterion		5.477906
Sum squared resid	261.9314	Schwarz criterion		5.625163
Log likelihood	-62.73487	F-statistic		162.2790
Durbin-Watson stat	2.367805	Prob(F-statistic)		0.000000
Jarque-Bera Test	0.462224	Prob(J-B)		0.793650
Skewness	-0.159219	Kurtosis		2.399315
White Heteroskedasticity Test:				
F-statistic	2.493616	Probability		0.069634
Obs*R-squared	9.821226	Probability		0.080462

Source: Authors' contribution with software EViews

$$S_{FDI\_in(\%GDP)} = 112.3385 - 249.2065 * ID_M + 0.349923 * BC_{\%M} + \varepsilon_i \quad [8]$$

For the model proposed in the previous table, it is found that in Romania, the index of import diversification has a negative impact on the FDI stock, as seen in previous models. The trade balance (% of imports) influences Romania's FDI stock in a positive way, which means that a higher value of exports, automatically leads to the increase of the trade balance and S_{FDI}_in (% GDP) by 0.34%, even if this increase is not one significant. The adjusted coefficient of determination demonstrates that the proposed model for RO explains 93.3% of the investigated economic phenomenon.

Table 3.9 Model of $S_{FDI\_in(\%GDP)}$ by Id_M, $BP_{\%PGD}$ for RO

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	111.4965	4.925257	22.63770	0.0000
Id_M	-257.8297	15.17434	-16.99116	0.0000
$BP_{\%GDP}$	0.877708	0.236579	3.709996	0.0013
R-squared	0.933840	Mean dependent var		28.16702
Adjusted R-squared	0.927539	S.D. dependent var		13.68928
S.E. of regression	3.684952	Akaike info criterion		5.562861
Sum squared resid	285.1563	Schwarz criterion		5.710118
Log likelihood	-63.75433	F-statistic		148.2067
Durbin-Watson stat	2.374869	Prob(F-statistic)		0.000000
Jarque-Bera Test	0.735363	Prob(J-B)		0.692338
Skewness	-0.376583	Kurtosis		2.589997
White Heteroskedasticity Test:				
F-statistic	2.537132	Probability		0.073881
Obs*R-squared	8.355984	Probability		0.079375

Source: Authors' contribution with software EViews

$$S_{FDI\_in(\%GDP)} = 111.4965 - -257.8297 * ID_M + 0.877708 * BP_{\%GDP} + \varepsilon_i \quad [9]$$

In the previous model, the place of trade balance was taken by the balance of payments, which has a positive influence on the stock of FDI. Thus, a 1% increase of $BP_{\%GDP}$ generates a 0.87% increase in the FDI balance, in conditions where Id_M remains constant. The econometric model and tested and validated in the previous table explains the phenomenon studied at the level of the Romanian economy in proportion of 92,7%.

Analyzing the data from Annex 1, we find that exports (calculated as a percentage of the global total) have subunit values, which leads to the conclusion that a growth of 0.01% per year is more sustainable, which generates a growth of 0.5% of the stock of FDI. Similarly, an increase of 0.01% in imports (calculated as a percentage of the global total), generates a decrease in FDI stocks by 0.57% as shown by previous econometric models. Regarding the index of diversification of imports, it has subunit values and a decrease of 0.01% can generate an increase in the stock of FDI with values between 1.4% and 2.57%.

4. Conclusions and further developments

For a more visible influence of the indicators used in previous econometric models, we made a summary table.

Table 4.1 Influences of international trade indicators, economic trends and components of the ILE signaling indicator in Bulgaria and Romania

Cauntry	$X_{\%G}$	$M_{\%G}$	Id_M	$BC_{\%M}$	$BP_{\%GDP}$	ILE_{IG}	ILE_{PF}	ILE_{LA}
BG	+	+	-	+	+	+	+	+
RO	+	-	-	+	+		+	

Source: Authors' contribution

In the models previously presented for Bulgaria, all independent variables positively influence the change in the stock of FDI inputs (% of GDP), except for the import diversification index, in which case this country must align with the world import pattern to generate increases in the studied dependent variable. The change in the growth of imports, exports, trade balance and balance of payments leads to an increase in the dependent variable S_{FDI}_in (% of GDP) in Bulgaria. Also, a higher score of the components of economic freedom, which is characterized by a business environment as free as possible, by a level of taxation as low as possible, as well as by a diminished degree of corruption, lead to an increase in the stock of FDI inputs in the Bulgarian economy.

At the level of the Romanian economy, based on the models previously validated by this country, it is found that the increase in the stock of FDI inflows (% of GDP) can be achieved by increasing the volume of exports to the global total, trade balance and balance of payments and a level of taxation for both personal and corporate income and the general level of taxation (% of GDP), including direct and indirect taxes imposed by all levels of government as low as possible, based on an increased score of the ILE component - the tax burden.

Related to imports, it is found that an increase along with a pronounced divergence from them in the world pattern lead to a decrease in the stock of FDI inflows (% of GDP) in Romania. To counteract this effect, Romania must align its imports as close as possible to the global model and reduce as much as possible their volume, relative to the global total.

The analysis of the summary table shows that exports (% of total global) had a positive influence on the growth of the FDI stock (% of GDP) in both countries. Regarding the imports (% of the global total) they had different influences. Thus, if in Bulgaria a demand for imports generates an increase in the stock of FDI, in Romania the effect is completely opposite. This correlation between the decrease of imports and the increase of the stock of foreign direct investments is beneficial for Romania and in accordance with the economic policies in this country.

Another indicator that has the same effects in both countries is the index of diversification of imports, which negatively influences the increase of the FDI stock, a greater divergence of imports compared to the world model generating the decrease of the FDI stock.
The trade balance and the balance of payments positively influence the FDI stock in both countries, which means that a higher value of exports also generates the increase of the trade balance and implicitly of the FDI stock. Similarly, the increase in the current account balance, which generally measures the difference between current receipts and expenditures for internationally traded goods and services, generates an increase in the FDI balance in both countries.
A sixth indicator with influence in both countries is the index of economic freedom through its component given by the fiscal burden. Thus, a higher value of this index, which indicates the lowest level of taxation, has the positive effect of increasing the stock of FDI.
The other components of the economic freedom index, namely government integrity and business freedom, have positive effects on Bulgaria, in the sense that a diminished level of corruption and a freer business environment generate an increase in the stock of FDI.
As further developments, we believe that it is important to study other emerging economies in Central and South-Eastern Europe in terms of the stock of FDI inputs, as well as the source countries of these FDI. Also, other exogenous variables can be taken into account in finding econometric models, which explain the evolution of the FDI stock. A study of the influence of the COVID crisis on FDI may be a future direction of research.

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ANNEX 1.

BG	$S_{FDI\_in(\%GDB)}$	$X_{\%G}$	$M_{\%G}$	Id_M	$BC_{\%M}$	$BP_{\%GDB}$	ILE_{IG}	ILE_{PF}	ILE_{LA}
1995	2.3456	0.1035	0.1081	0.4342	-5.3887	-0.1788	30.00	46.00	55.00
1996	4.5098	0.0904	0.0923	0.4356	-3.6453	0.1553	30.00	50.60	55.00
1997	9.3607	0.0882	0.0867	0.4367	0.2028	3.8131	30.00	48.90	55.00
1998	10.6218	0.0780	0.0879	0.3772	-13.1206	-0.4231	30.00	53.50	55.00
1999	16.0138	0.0695	0.0935	0.3445	-27.3576	-4.8289	30.00	68.00	55.00
2000	20.4114	0.0752	0.0983	0.3819	-25.8554	-5.3500	29.00	67.90	55.00
2001	20.7661	0.0826	0.1135	0.3465	-29.6952	-5.7167	33.00	58.10	55.00
2002	25.1040	0.0882	0.1194	0.3583	-27.9194	-1.9601	35.00	68.30	55.00
2003	30.1314	0.0994	0.1397	0.3293	-30.6154	-4.8715	39.00	72.40	55.00
2004	38.6417	0.1077	0.1525	0.3321	-31.2804	-6.4378	40.00	81.10	55.00
2005	46.4338	0.1118	0.1685	0.3335	-35.3686	-11.2937	39.00	80.30	55.00
2006	68.3021	0.1242	0.1883	0.3461	-35.2623	-17.1787	41.00	83.20	70.50
2007	85.4337	0.1321	0.2105	0.2806	-38.1925	-25.7533	40.00	82.40	70.30
2008	80.9333	0.1385	0.2241	0.2742	-39.4114	-21.8246	40.00	82.70	68.40
2009	94.6652	0.1300	0.1855	0.2912	-30.6738	-8.2034	41.00	86.20	73.50
2010	89.2909	0.1348	0.1654	0.2950	-19.1409	-1.9060	36.00	86.30	77.80
2011	79.6291	0.1538	0.1767	0.2865	-13.4232	0.4746	38.00	86.90	75.80
2012	90.0083	0.1441	0.1753	0.2868	-18.4178	-0.9807	36.00	93.60	72.70

2013	90.4832	0.1561	0.1809	0.2986	-13.7827	1.2215	33.00	94.00	73.60
2014	79.9199	0.1539	0.1818	0.2920	-15.5992	1.3152	35.20	91.20	73.50
2015	85.9176	0.1532	0.1746	0.3208	-13.1292	-0.0380	41.00	91.00	68.50
2016	79.8797	0.1656	0.1786	0.3121	-8.1587	2.6535	43.00	91.10	66.90
2017	86.4442	0.1772	0.1902	0.3142	-8.0342	3.1728	41.80	91.00	66.70
2018	76.1073	0.1727	0.1911	0.2999	-11.1950	4.5635	38.20	90.90	64.30
2019	77.4909								
RO									
1995	2.1802	0.1528	0.1963	0.3953	-23.0388	-4.7110	10.00	39.40	55.00
1996	2.9520	0.1494	0.2080	0.3797	-29.3022	-6.9172	30.00	42.40	55.00
1997	6.7431	0.1506	0.1984	0.3946	-25.2542	-5.8707	30.00	44.30	55.00
1998	10.7848	0.1506	0.2099	0.3570	-29.7894	-6.9489	50.00	43.90	55.00
1999	15.6812	0.1488	0.1778	0.3661	-18.2269	-3.5845	34.00	45.00	55.00
2000	18.5715	0.1614	0.1976	0.3480	-20.8083	-3.6192	30.00	58.30	55.00
2001	20.4808	0.1839	0.2428	0.3517	-26.8147	-5.4744	33.00	57.60	55.00
2002	16.9931	0.2135	0.2679	0.3466	-22.2764	-3.3027	29.00	64.40	55.00
2003	20.3824	0.2327	0.3083	0.3442	-26.3551	-5.5305	28.00	69.10	55.00
2004	26.8783	0.2553	0.3449	0.3122	-27.9511	-8.3734	26.00	69.90	55.00
2005	25.7820	0.2636	0.3759	0.2884	-31.6669	-8.5663	28.00	70.10	55.00
2006	36.4818	0.2676	0.4141	0.2789	-36.5567	-10.4505	29.00	87.50	74.60
2007	35.2885	0.2888	0.4941	0.2600	-42.4177	-13.5982	30.00	85.90	73.20
2008	30.2164	0.3067	0.5104	0.2425	-41.0671	-11.6971	31.00	85.60	74.90
2009	40.4017	0.3231	0.4281	0.2611	-25.3239	-4.7704	37.00	87.00	74.90
2010	41.3291	0.3240	0.4027	0.2630	-20.1736	-5.0873	38.00	85.80	72.50
2011	37.8933	0.3437	0.4148	0.2603	-17.5797	-5.0316	38.00	86.80	72.00
2012	44.5855	0.3124	0.3763	0.2557	-17.6136	-4.7768	37.00	87.40	70.50
2013	43.7965	0.3475	0.3875	0.2762	-10.3995	-1.0840	36.00	87.90	70.40
2014	37.7066	0.3668	0.4080	0.2715	-10.3194	-0.6931	37.70	87.00	71.00
2015	39.5730	0.3660	0.4175	0.2661	-13.2173	-1.2117	43.00	86.90	69.80
2016	39.5602	0.3960	0.4603	0.2604	-14.7883	-2.1088	43.00	87.50	66.10
2017	42.9709	0.3989	0.4756	0.2620	-17.2243	-3.1892	45.90	87.40	65.90
2018	38.7755	0.4092	0.4934	0.2690	-18.5043	-4.4754	40.00	87.30	65.20
2019	40.3192								

https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx

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