**Modelling the Asymmetric Effects of Outward Foreign Direct Investment on Economic Growth in Romania**

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**Abstract**

Globally, the outward foreign direct investment (OFDI) has increased significantly during recent years. Given the role of OFDI in determining the GDP growth rate, it is vital to assess how economic growth rate responds to such outflows. Based on the nonlinear autoregressive distributive lag (NARDL) model, the present study investigates the long-run and short-run asymmetric impacts of OFDI on the economic growth in Romania covering the period 1990-2017. The overall results suggest that both an increase and a decrease in OFDI have a positive and significant impact on Romania’s economic growth, with a greater effect arising from the increase in OFDI. Our study contributes to the previous literature by providing new insights into the OFDI-led growth hypothesis. The results of the present study portray the growth-enhancing effects of OFDI, which are consistent with the notion that firms conduct OFDI in order to combine domestic output with overseas output to decrease expenditures and to enhance their competitiveness both at global and domestic levels. Thus, an increase in OFDI is both a cause and a consequence of the home country’s economic growth.

**Keywords**: outward foreign direct investment; economic growth; non-Linear ARDL; dynamic multiplier; Romania

**JEL Classification:** F23, O1

**1. Introduction**

In recent decades, the outward foreign direct investment (OFDI) has played an instrumental role in stimulating economic growth around the world [1,2]. Theoretically, two ways are described through which OFDI powers economic growth in the home country. Firstly, the overseas investment may encourage technology transfer to the home country, which, in turn, stimulates domestic production. Secondly, OFDI allows the domestic firms to enter new foreign markets and to import cheaper inputs from the host country so that they can produce final goods at lower prices and in higher volumes. From this perspective, cross-border investing firms combine domestic and overseas production in order to decrease expenditures and to enhance their competitiveness at home and abroad; consequently, the demand for domestic factors of production and the output is also stimulated. As a result, in the long run, the entire domestic economy gets to benefit from OFDI due to the rising competitiveness of the overseas investing firms and associated spillovers to domestic firms [3]. Based on the above factors, it is suggested that OFDI has a strong linkage with the economic growth of the home country. Surprisingly, the literature regarding the potential macroeconomic effects of OFDI on the home countries is scarce, as most of the existing studies mainly focused on the analysis using microeconomic data at the firm- and industry-levels [3,4,5]. However, research on the interactions of OFDI and economic growth, especially at the macroeconomic level, is limited[[1]](#footnote-1). The present study fills this gap by utilizing aggregate level data of OFDI and economic growth by providing essential policy implications at the macroeconomic level.

Another issue in the studies that assess the impact of OFDI on economic growth is the application of traditional econometric methods that assume a symmetric linkage between OFDI and economic growth, i.e., an increase in OFDI may stimulate economic growth and vice versa [2,7,3]. Nevertheless, in reality, the substitution between overseas and domestic investment indicates that both an upswing and downswing in OFDI can potentially stimulate economic growth, showing an asymmetric effect of OFDI. For instance, the decline in OFDI makes resources available for domestic investment, which ultimately boosts the economic growth of the home country. Considering that, the linkage between OFDI and economic growth may be asymmetric; there is a necessity for asymmetric test as well, which is missing in the previous studies.

In recent years, Romania -a transition economy- has started to pay more attention to the role of OFDI in order to further expand its markets abroad, improve efficiency, and acquire natural resources. During the 1990s and early 2000s, the outlook regarding Romanian OFDI was pessimistic [8]. It was after 2005 when the Government of Romania adopted *go global* policy in order to encourage its local firms to invest in overseas markets. The firms accepted the opportunity intending to expand their assets, and further protect themselves against internal instability. In the beginning, the banking sector took the lead in expanding its business abroad, followed by non-banking companies. Initially, the Romanian non-banking enterprises faced losses in their overseas investment, but very soon, they overcame this issue [9]. Between 2004 and 2017, OFDI flows from Romania grew over ten times, from a meager 213 million US$ to 2327 million US$ (Figure 1). However, despite its significance and relevance to the economy, less attention has been devoted to the importance of OFDI in promoting economic growth in Romania on an aggregate level.

**[Insert Figure 1 here]**

For Romania, several empirical studies have attempted to analyze how inward foreign direct investment (IFDI) contributes to economic growth and development for the country [10,11,12,13,14,15,16,17,18]. Although these studies used different methods (like ordinary least square and Johansen co-integration) and data sets, the results of these studies depict a positive relationship between FDI inflows and economic growth in Romania. According to our knowledge, no study has yet been conducted to examine the role of OFDI on economic growth in Romania. Our interest in this subject is therefore motivated by the neglected case of Romania, where a revival of OFDI has been put to the forefront by the government in the last decade or so.

Furthermore, the existing studies assume linear or symmetric effects of OFDI on economic growth [19,20,6,21,22], the contribution of this study is the use of non-linear model to capture the asymmetric effects of OFDI on growth. The non-linear ARDL (NARDL) technique, developed by [23], performs better because it captures both the long-run and the short-run asymmetries in contrast with traditional ARDL and other time-series methods that simply assume linear effects between dependent and independent variables. By using this improved method, we are hoping to present more insights into the impacts of OFDI on the macroeconomic performance of Romania.

We have organized the rest of the paper as follows. Section 2 describes theoretical and empirical background of the study. In section 3, the model specification, data source, and estimation method are presented, while section 4 contains the results and discussion based on the analysis of the study. The final section concludes the study with policy implications, limitations, and future research directions.

**2. Theoretical and empirical background**

This section discusses the theoretical and empirical background considering the growth effects of OFDI. We start with the potential effects of OFDI on the domestic production activities of multinational enterprises (MNEs). Then, we further deal with the possible impacts of OFDI on the entire domestic economy.

OFDI allows MNEs to improve their competitiveness by successfully entering new markets. This usually results in stimulating domestic production. OFDI may allow firms to import raw material from foreign partners at possible lowest prices. This implies that through OFDI, firms can enhance their competitive position and hence stimulate home production. Finally, OFDI allows the home country to acquire technological know-how and management techniques, which positively affect domestic production and growth as well [24,25].

The positive effects described above accrue not only to the overseas investing firms but also to the local manufacturing sector, thus benefiting the entire economy [26]. For instance, domestic firms may increase their output by acquiring technology used by cross-border investing firms. Also, local manufacturers take advantage of the diffusion of new technology through improved turnover of labor. Moreover, outward FDI increases the competition between foreign and local firms, which may catalyze a more efficient use of the existing technology and resources by the local firms. Moreover, overseas investing firms may produce intermediate goods that would become available domestically at lower prices. It is concluded that OFDI can have a significant impact on domestic production, and thus on the economic growth of the home country.

Empirically, an extensive body of existing studies have investigated the relationship between inward FDI and economic growth in the host countries [27,28,29,10,30,31,32,33,34,35,36,37]. However, the literature on the interaction of outward FDI and economic growth is rare and paid attention mostly on industrial economics, for instance, the United States, Japan, and EU countries (excluding Romania). For instance, [1] found a small but positive influence of OFDI on the source countries. For the 12 European Union countries, [22] concluded that OFDI expands the competitiveness and the output of domestic firms. By using regressions for 50 countries and time series estimation for the United States, [6,21] identified that OFDI plays a positive role in stimulating the economic growth of the home country.

A characteristic feature of previous studies regarding OFDI and economic growth is that they presumed the symmetric relationship between both variables. For instance, [38] analyzed OFDI and economic growth for the Malaysian economy by utilizing the vector error-correction model (VECM). [6] using a sample of 50 countries, investigated the association between outward FDI and economic growth by employing cross-country and time-series regressions. [39] investigated the relationship between OFDI and economic growth for Japan using bivariate and multivariate Granger causality tests. The impact of outward investment on economic growth might not be only symmetric; that is, it is not necessary if a rise in overseas investment increases economic growth, and a decline will also reduce economic growth. In reality, the substitution between local and overseas investment indicates that a decline in overseas investment might also fuel economic growth through rising domestic investment. Moreover, a decline in outward investment makes resources available for domestic investment, indicating higher economic activities in the home country. These insights require paying more attention to the asymmetric effects of overseas investment on economic growth. Only one study by [40] has used non-linear ARDL to capture the asymmetric effects of OFDI and economic growth for China.

Romania, the second-largest market (after Poland) and a vital transition economy in Central and Eastern Europe (CEE), is still neglected in previous OFDI studies. This study contributes to the literature by employing NARDL to capture both long-run and short-run asymmetric effects of OFDI on economic growth for the Romanian economy.

**3. Model specifications, estimation methods, and data sources**

**3.1. Model specification**

According to the previous discussion, we build the following model:

$LnY\_{t}=β\_{o}+β\_{1}OFDI+β\_{2}IFDI+β\_{3}CS+β\_{4}LnLE+μ\_{t}$ (1)

In Equation (1), Ln is a natural logarithm, Yt is real GDP per capita (a proxy of economic growth), OFDI and IFDI represent outward and inward foreign direct investment (measured as GDP ratio), CS is the capital stock (measured as a ratio of gross fixed capital formation to GDP), LE is life expectancy used to measure human capital[[2]](#footnote-2). β0 is a constant term, and μt is the error term.

The model is further extended by adding a set of control variables, as shown below:

$LnY\_{t}=βo+β\_{1}OFDI+β\_{2}IFDI+β\_{3}CS+β\_{4}LnLE+β\_{5}LnIQ+μ\_{t}$ (2)

$LnY\_{t}=βo+β\_{1}OFDI+β\_{2}IFDI+β\_{3}CS+β\_{4}LnLE+β\_{5}LnIQ+β\_{6}LnINFR++μ\_{t}$(3)

Equation (1) is the baseline Model (1), while Equation (2) represents Model (2) that incorporates institutional quality (IQ). In Equation 3 (Model 3), we have added both institutional quality and infrastructure (INFR), proxied by fixed telephone subscriptions (FTS). Institutional quality (IQ) is measured by using the Political Terror Scale (PTS) of [41, which is based on a scale 1 (higher political risk or lowest civil freedom) to 5 (lower political risk or higher civil freedom). Infrastructure is measured by using data from the telecommunications sector, which is the sum of the number of active analog fixed telephone-lines, wireless local loop subscriptions, voice-over-IP subscriptions, ISDN voice-channel equivalents, and fixed public payphones.

We have included all the variables in our models above, based on previous studies. OFDI is expected to have a positive sign, as OFDI contributes to economic growth by benefiting the domestic economy through positive spillover effects on domestic firms [6]. The coefficient sign of IFDI is also expected to have positive, for instance, IFDI stimulates economic growth by enhancing home country’s capital formation and technology diffusion [44]. Human capital is the total stock of educated and trained labor force that efficiently performs its role in the production process. Countries with high human capital would benefit more from FDI’s boost to their economic growth. The addition of human capital is vital for the countries, as empirical evidence shows that investing in education is positively correlated with economic growth [45]. Institutional quality is expected to have a positive relationship with economic growth, following [46], who argue that a higher level of institutional quality is associated with higher efficiency and acts as a driving force for investing in economic activities. The decision of including an infrastructure variable is based on the study by [47], who found that improved quality of telecommunication services and higher telephone diffusion explains the contribution of infrastructure to development.

The study uses annual data of Romania over 1990−2017. The starting and ending years of this dataset are chosen because of the availability dates of the data-set. The definitions and sources of all variables and are presented in Table A1 in Appendix A.

**3.2. Non-linear autoregressive distributive lag (NARDL)**

This study uses the asymmetric or (NARDL)[[3]](#footnote-3) approach developed by [23], which is a

relatively new technique for detecting both long-run and short-run asymmetries between variables. [48] suggested that the NARDL model outperforms traditional ARDL techniques in examining cointegration in small samples, which is also applicable to our case. Various studies have adopted this approach to examine whether an increase or a decrease in an independent variable has a different influence on the dependent variable [49,50]. Followed these studies, we estimate the NARDL model to capture asymmetric effects of OFDI on economic growth.

Following [23], we consider the asymmetric cointegration regression,

$Y\_{t}=β^{+}x\_{t}^{+}+β^{-}x\_{t}^{-}+μ\_{t}$ (4)

where *β+* and *β−* are long-run positive and negative parameters while *xt* is a *k×1* vector of regressors decomposed as;

$x\_{t}=x\_{o}+x\_{t}^{+}+x\_{t}^{-}$ (5)

$LnY\_{t}=βo+β\_{1}OFDI^{+}+β\_{2}OFDI^{-}+β\_{3}IFDI+β\_{4}CS+β\_{5}LnLE+β\_{6}LnINFR++μ\_{t}$ (6)

The baseline model (i.e., Equation 1) is converted into an asymmetric equation by substituting OFDI with the partial positive and negative sums decomposition following Equations (4) and (5).

In Equation (6), the movements in OFDI are decomposed into its increasing and decreasing partial sums, i.e., OFDI = OFDI+ + OFDI-, where positive and negative signs show increase and decrease in OFDI, respectively. The partial sums of positive and negative changes in OFDI are generated by the following formulas (Equations 7-8),

$OFDI\_{t}^{+}=\sum\_{i=1}^{t}∆OFDI\_{i}^{+}= \sum\_{i=1}^{t}max⁡(∆OFDI\_{i},0)$ (7)

$OFDI\_{t}^{-}=\sum\_{i=0}^{t}∆OFDI\_{i}^{-}= \sum\_{i=0}^{t}min⁡(∆OFDI\_{i},0)$ (8)

Following Shin et al. (2014), the asymmetry cointegration equation is obtained by substituting the positive and negative sums of$ OFDI\_{t}$.

$∆Y\_{t}=α\_{0}+∅y\_{t-1}+∅^{+}OFDI\_{t-1}^{+}+∅^{-}OFDI\_{t-1}^{-}+∅IFDI\_{t-1}+∅CS\_{t-1}+∅LE\_{t-1}+∅IQ\_{t-1}+∅INFR\_{t-1}+\sum\_{i=1}^{q}α\_{i}∆Y\_{t-1}+\sum\_{i=1}^{q}φ\_{i}∆IFDI\_{t-1}+\sum\_{i=1}^{q}φ\_{i}∆CS\_{t-1}+\sum\_{i=1}^{q}φ\_{i}∆LE\_{t-1}+\sum\_{i=1}^{q}φ\_{i}∆INFR\_{t-1}+\sum\_{i=1}^{q}φ\_{i}∆IQ\_{t-1}+\sum\_{i=1}^{p}ϑ\_{i}^{+}∆OFDI\_{t-1}^{+}+ϑ\_{i}^{-}∆OFDI\_{t-1}^{-})+μ\_{t} $(9)

From Equation (9), we can see that the asymmetric ARDL cointegration approach consists of various steps. First of all, we will estimate long-run non-linear effects by using the Wald test after evaluating the null hypothesis *Ho = θ + = θ −* against its alternative of *H1 = θ + ≠ θ −*. The rejection of the null hypothesis depicts the presence of asymmetric or non-linear effects of OFDI on economic growth. The long-run effects of an increase and a decrease are given by *θ +* and θ*-*, while $ϑ\_{i}^{+}=ϑ\_{i}^{-} or \sum\_{i=1}^{p}ϑ\_{i}^{+}=\sum\_{i=1}^{p}ϑ\_{i}^{-}$ suggests the short-run asymmetric effects of positive and negative changes in OFDI.

We can further estimate the asymmetric cumulative dynamic multiplier effect of a unit change in $OFDI\_{t-1}^{+}$ and $OFDI\_{t-1}^{-}$ defined as follows:

$m\_{p}^{+}=\sum\_{k=0}^{p}\frac{δY\_{t+k}}{δOFDI\_{t}^{+}}$ P=0,1,2,… (10)

$m\_{p}^{+}=\sum\_{k=0}^{p}\frac{δY\_{t+k}}{δOFDI\_{t}^{+}}$ P=0,1,2,… (11)

Note: m → ∞, mp+ → β+ and mp-→ β-, where β+ and β- represent the long-run asymmetric coefficients, respectively, as defined above.

For the stability test of the models, this study employs the cumulative sum of recursive residuals (CUSUM), and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests developed by [51].

**4. Results and Discussion**

First of all, for our empirical analysis, we used two different unit root tests, i.e., Augmented Dickey-Fuller (ADF) [52] and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) [53] tests, to check the integration order of all variables included in each model. The unit root test depicts the level of stationarity, which is considered an essential step before confirming the co-integration among variables. For example, the ARDL technique cannot be used if any variable is integrated of order 2 [52,53]. The results of ADF and KPSS tests confirm the stationarity level, as presented in Table 1. Our results show that the variables are not integrated at second order; we can infer that the ARDL technique is suitable for further analysis. The results in Table 1 show that all variables are integrated at first order, i.e., I(1), except OFDI and IQ, which are integrated at zero, i.e. I(0).

**[Insert Table 1 here]**

Next, we perform the bounds test analysis, where we check the value of F-statistics to check the existence or non-existence of the long-run relationship. The first order of integration proposes applying bounds test. The results of the bounds testing, as presented in Table 2, demonstrate that the values of F-statistics are 4.569, 5.985, and 5.613, respectively, that exceed the upper critical values at 1% significance level. The results confirm the presence of a stable long-run relationship among variables.

**[Insert Table 2 here]**

The long-run parameters of NARDL models are presented in Table 3. The asymmetrical effects can be observed from the positive and negative partial sum of OFDI, i.e., OFDI+ and OFDI- [49]. In our analysis, both OFDI+ and OFDI- seem to be highly significant with opposite signs, suggesting that both an increase and a decrease in OFDI has a different influence on economic growth. The coefficient of increase in OFDI (OFDI+) indicates that OFDI has a positive and significant relationship with economic growth in the long-run across all three models. These results are consistent with new growth theories, according to which overseas investment can benefit the home country through technology transfer in foreign markets, as well as through their positive spillovers to local firms, thereby stimulates economic growth [1,6]. It is evident from the results that a 1% increases in OFDI leads to an increase in economic growth within the range of 0.139% – 0.201%. The coefficient of decline in OFDI (OFDI-) implies that a reduction in OFDI also causes an increase in economic growth. These findings show that both an increase and decrease in OFDI stimulates economic growth in Romania, and further confirms the asymmetric effect of OFDI on economic growth in Romania.

In terms of control variables, IFDI shows positive and significant relationship with the economic growth in Models (1, 2) with a coefficient of 0.013 and 0.010 while exhibiting a negative and significant relationship in Model 3. The results on positive effects are consistent with those reported in studies such as [27,14,54,55,34,56], who concluded that IFDI has a positive impact on economic growth. The negative effects of IFDI in Model 3 are consistent with [57,58,59]. The coefficients of physical and human capital (CS and LE) are positive and significant across all three models, suggesting the importance of human and physical capital to Romania's economic growth prospects. The estimated coefficient of infrastructure (INFR) suggests that a 1% increase in the infrastructure stock and quality of infrastructure services is expected to cause an increase in economic growth in Romania by about 0.098% and 0.108%, respectively. As suggested by [60], the adequate provision of infrastructure can contribute towards trade liberalization strategies aimed at achieving optimal resource allocation and export growth. Our findings also suggest a positive and significant impact of infrastructure on economic growth for Romania, and the results are consistent with [47]. The coefficient of institutional quality (IQ) shows a positive and significant impact on economic growth in Romania. The results suggest that a 1% increase in institutional quality is expected to enhance economic growth by about 0.072%.

**[Insert Table 3 here]**

The short-run parameters are reported in Table 4. From the analysis, it is observed that the magnitude of the coefficient of *OFDIt*+ is higher than that of *OFDIt*−, suggesting that the stronger effects are caused by the positive movement in OFDI. It is interesting to observe that GDP growth increases despite an upswing or downswing in Romanian OFDI, indicating that FDI outflow is a crucial indicator of economic growth in Romania. The sign of the error correction term (ECTt-1), which is the speed of adjustment coefficient toward equilibrium, is negative and statistically significant. The coefficients of ECTt-1 are -0.725, -0.716, and -0.611 indicate that short-run disequilibrium is adjusted in the range of 61% to 72% towards the long-run.

**[Insert Table 4 here]**

We also employ diagnostic tests like RAMSEY, JB, ARCH, RESET, and LM to check autocorrelation and heteroscedasticity. The results in Table 5 confirm the absence of autocorrelation and heteroscedasticity in this study. Here, the findings indicate that the model is perfect and well fitted. Stability tests as presented in Appendix A, which demonstrate the stability of all the estimated models, as the plots of each blue line fall within the critical boundaries.

**[Insert Table 5 here]**

Finally, Figure 2 illustrates after observing a shock, how growth returns to its steady-state in the long-run through the dynamic asymmetric adjustment pattern. It is evident that economic growth responds positively and significantly to upswings in FDI outflows. Moreover, the adjustment of the dynamic multipliers of the negative changes in OFDI is more rapid and non-linear. After the shock hits the economy, for up to four years, it causes an adverse reaction. For the next few years, the neutral response has been observed, and it finally becomes stable after about four years. As a whole, we can see that the more significant effect is derived from the positive changes in OFDI in the long-run, while the economic growth effects of positive changes in OFDI significantly dominate the negative changes.

**[Insert Figure 2 here]**

**5. Conclusions, policy implications, limitations, and future research direction**

This study investigated the dynamics between OFDI and economic growth in Romania. We used a nonlinear ARDL approach to capture the non-linear effects of outward FDI on economic growth. Based on the theoretical and empirical background, it is argued that multinational firms pursue assets abroad through OFDI in order to generate funds. Moreover, these financial and tangible capabilities promote the country’s growth process, for example, by lending support to growth in industry and improvement in technology, increasing production capacity, and providing stability essential for the growth process.

The empirical findings of the present study indicate an asymmetric relationship between OFDI and economic growth, contrary to existing studies that mainly focused on their symmetric relationship. The overall findings of the study show that both an increase and a decrease in OFDI have a positive and significant influence on Romania’s economic growth. Nevertheless, the more significant effect is observed from the positive changes in the long-run, suggesting that the upward changes in OFDI dominates the downward changes. In general, overseas investment-related activities of Romanian firms improve the productivity of domestic activities, which in turn stimulate the economic growth of the country. The findings of the current supports to the new OFDI-led growth theories, which postulate that countries get involved in outward investment in order to acquire valued input factors at lower prices and to access the latest technology to promote economic growth in the country through transferring assets back to the home country.

In terms of policy implications, our analysis suggests an increase in GDP and related productivity improvements, in turn, encourage ﬁrms for higher cross-border investments. However, as a decline in OFDI also does not hurt the Romanian economy, we suggest that the government needs to find a balanced approach that promotes FDI outflows but still keeps it in a moderate range so that the benefits of both an increase and a decrease in OFDI can be realized in the long-run. The implications can also be applied to other transition economies who are looking at sustainable policies to promote OFDI.

In terms of the limitations of this study, as this is a single country analysis, we suggest that future studies can employ the NARDL approach to a larger sample of countries for broader conclusions.

**Acknowledgments**

We would like to acknowledge the support from the National Social Science Fund of China (No.18BGL200), the National Key Statistical Science Research Project (No.2016LZ11), the support from the Research on Major Theories and Practices in Shandong Province (NO.18BSJ03).

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| **Table 1**. Unit root test results |
|  |  ADF |  |  KPSS |
| Variables | At level | First difference |   | At level | First difference |
| Y | -2.559 | -3.483\*\*\* | 0.128 | 0.115\* |
| OFDI | -4.856\*\*\* | -4.489\*\*\* | 0.382 | 0.085\* |
| IFDI | -2.057 | -6.428\*\*\* | 0.135 | 0.055\* |
| CS | -2.249 | -4.437\*\*\* | 0.109\* | 0.155\* |
| LE | -2.51 | -3.384\*\*\* | 0.145 | 0.092\* |
| IQ | -3.586\*\*\* | -8.398\*\*\* | 0.156 | 0.236\* |
| INFR | 1.234 | -4.318\*\*\* | 0.181 | 0.101\* |
| Source: Author’s own calculationsNote: \*, \*\* and \*\*\* shows level of significance at 10%, 5% and 1%.Y denotes GDP per capita, OFDI, IFDI are an outward and inward foreign direct investment, CS is the capital stock, LE is life expectancy used to measure human capital, IQ and INFR are institutional and Infrastructure quality. |

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| **Table 2.** Bound cointegration test results |
|  | Model 1 | Model 2 | Model 3 |
| F-statistics | 4.569\*\*\* | 5.985\*\*\* | 5.613\*\*\* |
| Lower-upper bound (1%) | 3.41-4.68 | 3.15-4.43 | 3.15-4.43 |
| Lower-upper bound (5%) | 2.62-3.79 | 2.45-3.61 | 2.45-3.61 |
| Lower-upper bound (10%) | 2.26-3.35 | 2.12-3.23 | 2.12-3.23 |
| K | 4 | 5 | 6 |
| Source: Authors’ calculations.Note: \*\*\* denotes a statistical significance of 1%. The critical Values are from [61]. K signifies the number of regressors included in all three models. |

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| **Table 3.** Long-run results of asymmetric ARDL models |
| Variables | Model 1 |   | Model 2 |   | Model 3 |
| OFDI+ | 0.139\*\*\* |   | 0.171\*\*\* |   | 0.201\*\*\* |
|  | (0.034) |  | (0.016) |  | (0.040) |
| OFDI- | -0.089 |  | -0.075\*\*\* |  | 0.136 |
|  | (-0.008)\*\*\* |  | (0.0130)\*\* |  | (0.167) |
| IFDI | 0.013\*\*\* |  | 0.010\*\*\* |  | -0.004 |
|  | (0.005) |  | (0.002) |  | (0.030) |
| LE | 4.993\*\*\* |  | 4.165\*\*\* |  | 5.839\*\* |
|  | (1.604) |  | (0.396) |  | (2.077) |
| CS | 0.024\*\*\* |  | 0.023\*\*\* |  | 0.025\*\*\* |
|  | (0.003) |  | (0.004) |  | (0.003) |
| INFR |  |  | 0.098\*\*\* |  | 0.108\*\* |
|  |  |  | (0.003) |  | (0.079) |
| IQ |  |  |  |  | 0.072\*\*\* |
|  |  |  |  |  | (0.055) |
| constant | -13.236\* |  | -9.953\*\*\* |  | -17.148\*\* |
|  | (-6.772) |  | (-1.668) |  | (-8.741) |
| R2 | 0.99 |  | 0.76 |  | 0.98 |
| Adj R2 | 0.53 |  | 0.64 |  | 0.43 |
| F-statistic | 944.46 |   | 986.27 |   | 949.78 |
| Source: Authors’ calculationsNote: \*\*\*, \*\* and \* denote significance level at 1%, 5% and 10%. Std. errors are given in parenthesis.OFDI+, OFDI- are increasing and decreasing outward foreign direct investment, IFDI is inward foreign direct investment, CS is the capital stock, LE is life expectancy used to measure human capital, IQ and INFR are institutional and Infrastructure quality. |

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| **Table 4.** Short-run results of NARDL models |  |  |  |
| Variable |   | Model 1 |   | Model 2 |   | Model 3 |
| ΔOFDI+ |  | 0.282\*\*\* |  | 0.122\*\*\* |  | 0.123\*\*\* |
|  |  | (0.031) |  | (0.016) |  | (0.034) |
| ΔOFDI- |  | -0.101\*\* |  | -0.261\*\*\* |  | -0.358 |
|  |  | (-0.026) |  | (-0.001) |  | (-0.133) |
| ΔIFDI |  | 0.009\*\* |  | 0.007\*\*\* |  | 0.007\*\* |
|  |  | (0.004) |  | (0.001) |  | (0.003) |
| ΔLE |  | 0.307 |  | -0.387\*\*\* |  | 1.028 |
|  |  | (1.154) |  | (-0.127) |  | (1.376) |
| ΔCS |  | 0.009\*\*\* |  | 0.009\*\*\* |  | 0.008\*\*\* |
|  |  | (0.002) |  | (0.000) |  | (0.002) |
| ΔINFR |  |  |  | 0.070\*\*\* |  | 0.066 |
|  |  |  |  | (0.005) |  | (0.045) |
| ΔIQ |  |  |  |  |  | 0.044\* |
|  |  |  |  |  |  | (0.028) |
| ECTt-1 |  | -0.725\*\*\* |  | -0.716\*\*\* |  | -0.611\*\*\* |
|   |   | (-0.133) |   | (-0.029) |   | (-0.136) |
| Source: Authors calculationsNote: \*\*\*, \*\* and \* denote significance level at 1%, 5% and 10%. Std. errors are given in parenthesis. |

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| **Table 5.** Sensitivity tests results |   |   |
| Test |   | Model 1 |   | Model 2 |   | Model 3 |
| RAMSEY | 1.634 |  | 1.822 |  | 0.661 |
|  |  | (-0.441) |  | (-0.401) |  | (-0.718) |
| JB | 10.046 |  | 8.651 |  | 15.466 |
|  |  | (-0.346) |  | (-0.565) |  | (-0.216) |
| ARCH |  | 1.234 |  | 1.481 |  | 5.554 |
|  |  | (-0.266) |  | (-0.223) |  | (-0.91) |
| RESET |  | 5.772 |  | 5.449 |  | 3.095 |
|  |  | (-0.030) |  | (-0.036) |  | (-0.016) |
| LM |  | 1.392 |  | 0.782 |  | 1.143 |
|   |   | -0.247 |   | 0.376 |   | 0.338 |
| Source: Authors’ calculations.Note: numbers in parenthesis are p-values*.* |

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| **Figure 1.** Romania’s OFDI flows during 1990-2017 (Million US$)*Source:* [62] |
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**Figure 2.** Asymmetric Cumulative Dynamic Adjustment of GDP Per Capita to OFDI

**Appendix A**

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| **Table A1.** Description and sources of data  |
| **Variable Name** | **Label** | **Definition** |  **Source** |
| Economic Growth | Y | Real GDP per capita | World Bank, 2017 |
| Outward FDI | OFDI | Net outward FDI to GDP ratio | World Bank, 2017 |
| Inward FDI | IFDI | Net inward FDI to GDP ratio | World Bank, 2017 |
| Capital Stock | CS | Gross fixed capital formation (% of GDP) | World Bank, 2017 |
| Life Expectancy | LE | Life expectancy at birth, total (years) | World Bank, 2017 |
| Infrastructure | INFR | Fixed telephone subscriptions (per 100 people) | World Bank, 2017 |
| Institutional Quality | IQ | Political terror scale of Gibney et al., 2016 | Gibney et al., 2016 |

 

**Figure A1.** A plot of CUSUM & CUSUM of square of the recursive residuals from model 1.

 

**Figure A2.** A plot of CUSUM & CUSUM of square of the recursive residuals from model 2.

 **Figure A3.** A plot of CUSUM & CUSUM of square of the recursive residuals from model 3.

1. [6] found that domestic production responds positively and significantly to the positive changes in OFDI by employing Granger Causality test for the USA. [↑](#footnote-ref-1)
2. Education is usually considered as a proxy of human capital. In the present study, we use life expectancy as the alternate proxy, based on the argument that economic growth shows a positive response to the level of human capital in the form of education and health [42,43]. [↑](#footnote-ref-2)
3. Nonlinearity or asymmetry does not mean that the parameters are log linear or quadratic as normally described, it is actually a decomposed linear relationship to describe the influence of exogenous variable on endogenous variable in ARDL to examine if positive and negative changes in exogenous variable have different relations [23]. [↑](#footnote-ref-3)