The Impact of Foreign Direct Investment Management on Economic Growth Using Multiple Linear Regression (MLR)

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Abstract **– Global economies are facing geopolitical and ongoing economic impacts from the COVID-19 pandemic, which brings back the topic of growth determinants. This study focuses on the United States, the world's largest economy and a significant recipient of foreign direct investment (FDI). For this reason, we analysed whether there is a positive correlation between the volume of FDI inflows and the growth of gross domestic product (GDP). A multiple linear regression (MLR) model was used to examine the effects of various exogenous control variables on the quarterly GDP growth in the USA from 1999 to 2022. During these 96 quarters, FDI was found to have a positive effect on GDP growth at statistical significance of 5% ($p < 0.05$). Specifically, a one-million increase in FDI ceteris paribus caused an estimated GDP growth of approximately 743.43 dollars. The results ultimately propose positive implications for less developed countries that could utilize emphasising their FDI management policies to achieve higher economic growth.**

Keywords **– Foreign direct investment, economic growth, GDP determinants, international trade strategy, investment management.**

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1. Introduction

The performance of global economies and long-term sustainable growth are an important subject of interest in economic, as well as political science due to the close connection between the performance of the economy and the general life quality of its population. Economic growth is most often measured through the overall increase in the GDP indicator, but what determines the increase in each of its components, can be diametrically different [1], [2].

In today's era of globalization trends and the expansion of international trade, we have decided to consider the size of direct foreign investments (FDI) as the examined determinant of economic growth. On this fundamental basis, the United States of America was chosen as the country of our analysis, because with over 5 trillion US dollars per year it stands as the largest recipient of FDI in 2020 [3], [4], [5].

As for the economy of the United States itself, the long-term growth analysis of its real GDP per capita has revealed a remarkable stability of this economy within the past 125 years of its existence. It has progressed over the long term with only a slight and temporary deviation from the annual average trend of 1.8% [3], [6]. Based on these statistics, it can be assumed that the American economy can rather effectively manage their FDI inflows and maximize the added value from FDI, which makes the results of this article that much more beneficial for all follow-up research of this area in the future.

From the point of view of the literature addressing this issue, the inflows of FDI can be determined by several subsequent factors of economic growth. In this context, we further reviewed more relevant literature on the empirical analysis of the by prior research confirmed links between FDI and national economic growth rates [1], [7], [8], [9].

To perform economic growth modeling in an open economy, it has been emphasized that FDI should appear as explanatory variables in the gross domestic product equation [10], [11], as its omission leads to model misspecification with ambiguous causality relationships.

The results of these multi-stage modeling between the time series of FDI and GDP proposed a so-called feedback hypothesis [1], [10]. The hypothesis introduces a suggestion that FDI and economic growth appear as positively interdependent. This can happen when high growth countries provide better opportunities to generate profit, which attracts more FDI [12]. Conversely, exceptional management of FDI inflows can simultaneously promote growth in relation to host countries through combination of both direct and indirect positive effects [7].

In line with the region of the United States of America being the analyzed subject within our research, a study from 2013 also stands out, which examined the connection between the growth of FDI for individual countries of the Western Hemisphere over the past three decades [13]. Using the Toda-Yamamoto (TYDL) methodology to test for causality, evidence of unidirectional causality was found for all selected countries except Bolivia, Colombia, and Ecuador from Latin America, as well as Costa Rica, Dominican Republic, El Salvador, Guatemala, and Jamaica from the Caribbean area.

Subsequently, from the point of view of the neoclassical theory of economic growth [14], an increase in FDI would be able to generate only a temporary increase in the levels of GDP per capita, but without affecting long-term expansion [15]. According to this theory, the impact of FDI management on the longer-term growth rates can occur only through technological development or labor productivity improvements [16].

From the view of endogenous growth [17], [18], it is concluded that FDI plays an important part in the technology transfer through its effect of transposition to other areas, so-called the spill-over effect [19].

However, foreign direct investments can increase growth only if the inflows are managed well [20]. The relationship between FDI and macroeconomic growth, as well as this growth's stability, are central factors when host countries evaluate the respective trade-offs associated with foreign country entry [21].

It is further reported that FDI can support economic growth because it provides countries with additional financial resources, which will increase competitiveness in the global market [22]. In general, FDI supports a country's preparedness and provides access to the global market, which in exchange presents innumerable opportunities for global investments and technological advancements to the economy. With increased trade can then be experienced maximal economic growth [9], [23].

Research examining the impact of FDI on economic growth in both primary production sectors and services indicates that the extent to which FDI influences economic growth can vary in its intensity across different sectors. [15], [24].

Considering the fact that the majority of the analyzed literary sources point to the positive impact of FDI on economic growth in connection with the continued growth of foreign direct investments in the USA, the article will be testing the hypothesis of a positive effect of FDI volume growth on the growth of the US economy.

2. Methodology and Data

The used quantitative econometric analysis was based on the multiple linear regression (MLR) model, in which the quarterly growth of the US GDP appears as an endogenous variable, while in accordance with the expenditure approach of calculating GDP, which divides GDP into household consumption (C), investment (I) and government purchases (G) [2], the respective exogenous control variables were further supplemented by the additional factor of the quarterly volume of FDI.

Adapting the model to the research context of the article, the model was then formulated in the following form:

$$GDPgrowth = \beta_0 + \beta_1 FDI + \beta_2 C + \beta_3 I + \beta_4 G + \varepsilon_i$$

wherein

GDPgrowth = economic growth
FDI = foreign direct investment
C = household consumption
I = private domestic investment
G = government spending
ε = unobserved random variables (error)

Based on the defined model, a series of test statistics was implemented to test the suitability of the model in principle. First of all, the time series analysis was accompanied by input tests such as the identification of trendiness and seasonality, the test of normality and data distribution using the Shapiro-Wilk and Jarque-Bera tests, as well as the stationarity test using the ADF-GLS function and the KPPS test. Subsequently, as part of the output statistics, the statistical significance and quality of the model will be interpreted through the following criteria: level of statistical error, p-value, t-test, F-statistics, coefficients of determination R^2 and R^2 adjusted, heteroscedasticity test using White and Breusch-Pagan tests, test collinearity using Variance Inflation Factors (VIF) and autocorrelation test using Breusch-Godfrey test. All the mentioned analyzes were performed using the Gretl econometric software.

The data sample used in following econometric analysis consisted of 96 observations that were published on a quarterly basis in the time period from January 1, 1999 to October 1, 2022.
As input data for the regression, historical time series values for all dependent and independent variables were drawn from the Federal Reserve Bank of St. Louis Economic Database in the following format:

- **GDPgrowth**: Real GDP, Percent Change, Quarterly in Billions of Dollars [25].
- **FDI**: Foreign Direct Investment in U.S., Asset, Current Cost, Transactions, Quarterly in Billions of Dollars [26].
- **C**: Personal Consumption Expenditures, Seasonally Adjusted Quarterly Rate in Billions of Dollars [27].
- **I**: Gross Private Domestic Investment, Seasonally Adjusted Quarterly Rate in Billions of Dollars [28].
- **G**: Federal Government Current Expenditures, Seasonally Adjusted Quarterly Rate in Billions of Dollars [29].

3. Results and Discussion

During the interpretation of the input statistics an occurrence of non-stationarity and right-sided skew was detected due to a structural break within the time series showing a sharp drop in GDP at the beginnings of the COVID-19 pandemic in 2020 (Figure 1).

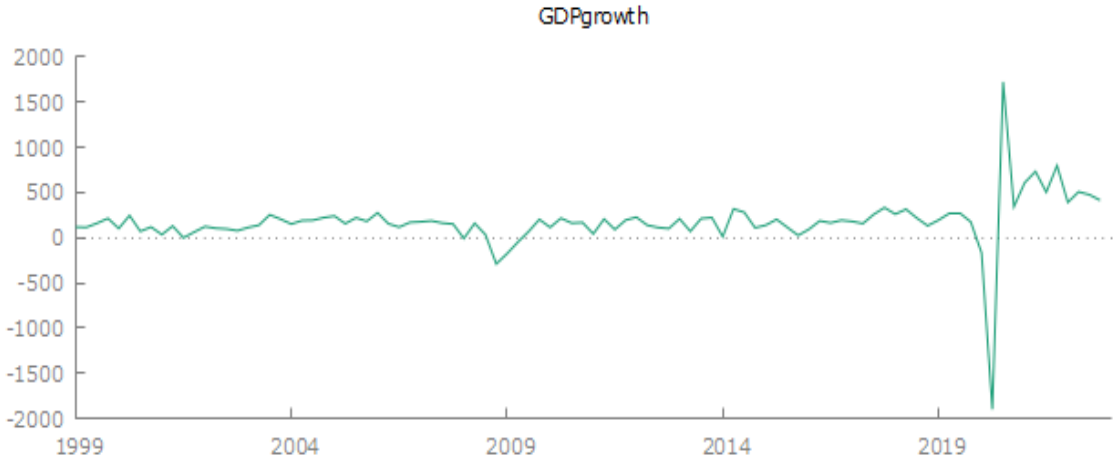

Figure 1. Graphic development of GDP growth in the USA in the years 1999-2022

The onset of the COVID-19 pandemic undoubtedly caused a sharp stop to the US economic activity in March 2020, which led to a drop in real GDP by approximately 7.7 percent in the second quarter of the same year. The reopening of businesses and government stimulus measures supported the ongoing recovery in the first and second quarters of 2021, when real GDP grew by a record 17.4 percent.

Such a sharp down and up movement on the graph of the time series significantly disturbed the previous white noise-like stationary course, which made it necessary to manually rescale the data using logarithmization and differentiation functions.

The econometric model was thus reformulated in the following composition, where l represents the logarithm and d the first difference of the time series:

$$l\_GDPgrowth = \beta_0 + \beta_1 FDI + \beta_2 l\_C + \beta_3 d\_I + \beta_4 d\_G + \varepsilon_i$$

wherein

l_GDPgrowth = log economic growth
FDI = foreign direct investment
l_C = log household consumption
d_I = 1st diff of private domestic investment
d_G = 1st diff of government spending
ε = unobserved random variables (error)

Looking at the correlation matrix (Figure 2) of the examined exogenous variables and the endogenous variable of economic growth, it can be reported that FDI are positively correlated with economic growth at the level of a correlation coefficient value of 0.2. At the same time, a weaker to mild dependence is observed in the interval from < 0.0 to 0.2 > in the dependence of FDI with other exogenous variables, which indicates that multicollinearity should not occur in the data.

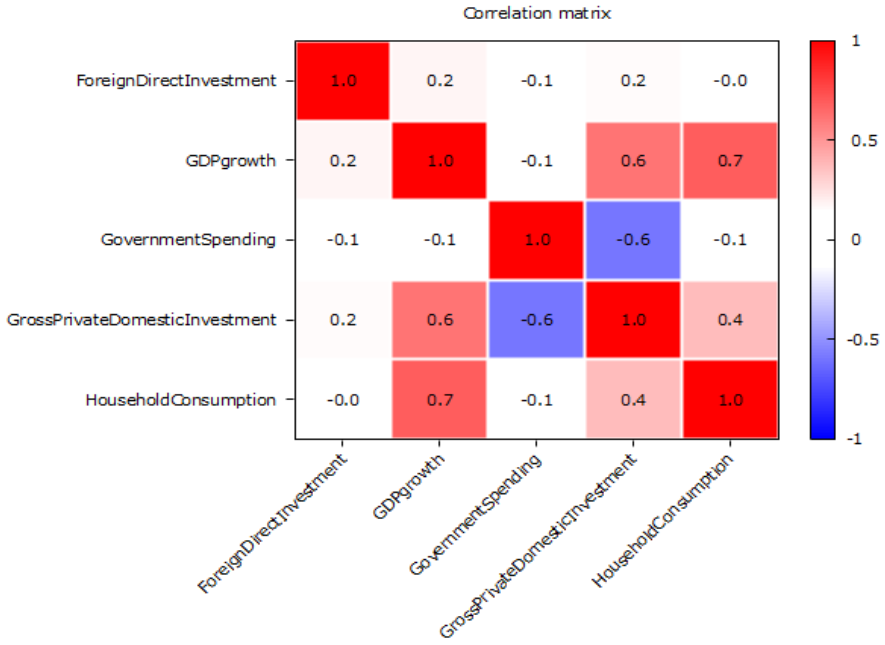

Figure 2. Correlation matrix for selected variables

Looking at the Pearson correlation coefficients for other control variables, it can be concluded that government investments currently have mildly negative effect on economic growth (r = - 0.1), which is aligned with the preferred low state intervention of the US economy.

On the other hand, the domestic sector appears to be the prime accelerator of the nation's economic growth, in the form of private consumption (r = 0,7) and domestic investment (r = 0,6).

An interesting aspect of the correlation matrix is also the strong negative dependence between government spending and gross private domestic investment (r = - 0.6), which accordingly confirms the so-called crowding out effect of excessive fiscal policy [30], [31].

The multiple linear regression results for our specified model (Table 1) subsequently show that there is a positive relationship between the foreign direct investment (FDI) and economic growth (GDP) in the US.

We also observe a positive influence of the remaining exogenous variables household consumption, government spending, and private domestic investment on economic growth in the USA, while this influence is understandably higher, considering that these factors stand as explicit determinants within the calculation of GDP by the expenditure method.

In terms of the statistical significance of identified estimated coefficients, all estimates were statistically significant at the 5% significance level ($p < 0.05$). The t-ratio also confirms the quality of the regression coefficient estimates and the standard errors are throughout sufficiently small.

The model as a whole was overall able to explain approximately 67% of the variability of US economic growth through the variability of exogenous variables including the influence of the examined quarterly size of the FDI. Based on the high F-statistic ($F > 3.95$), it is possible to further assess that the model altogether is of adequate quality.

Table 1. Regression analysis of the impact of the volume of direct foreign investment on US economic growth

Model 1: OLS, using observations 1999:1-2022:4 (T = 88)					
Missing or incomplete observations dropped: 8					
Dependent variable: l_GDPgrowth					
	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	1.73461	0.379134	4.575	<0.0001	***
FDI	$7.43423e^{-07}$	$2.89808e^{-07}$	2.565	0.0121	**
l_C	0.630517	0.0779856	8.085	<0.0001	***
d_I	0.00377523	0.000590510	6.393	<0.0001	***
d_G	0.000288820	0.000132848	2.174	0.0325	**
Mean dependent var	5.128367	S.D. dependent var	0.730328		
Sum squared resid	15.33366	S.E. of regression	0.429817		
R-squared	0.669561	Adjusted R-squared	0.653636		
F(4, 83)	42.04525	P-value(F)	3.17e-19		
Log-likelihood	−47.98600	Akaike criterion	105.9720		
Schwarz criterion	118.3587	Hannan-Quinn	110.9623		

As for the further analysis of the statistical characteristics of the model (Table 2), we can reject the original hypothesis H0 at a critical value of 0.05 (5% significance level) and accept the alternatives that the model is stationary, homoscedastic, without multicollinearity and adequately specified according to the Ramsey RESET test methodology.

Table 2. Test statistics of the model at 5% critical value

Panel A: Statistical tests	Critical value	Model
Normality (Shapiro - Wilk test)	<0,05	0,0001
Distribution (Jarque-Bera test)	<0,05	0,0001
Stationarity (ADF-GLS test)	>0,05	0,071
Stationarity (KPPS test)	<0,05	0,002
Heteroscedasticity (White test)	<0,05	0,000005
Heteroscedasticity (Breusch-Pagan test)	<0,05	0,000000
Multicollinearity (Variance Inflation Factors)	<0,05	0,0074348
Autocorrelation (Breusch-Godfrey test)	<0,05	0,0011
Model specification (Ramsey RESET test)	<0,05	0,00114
Omitted variable (OVB test)	>0,05	$5{,}04e^{-076}$

The only test prerequisite that the model does not meet is the occurrence of serial autocorrelation of residuals over time, which can potentially be explained by the occurrence of reverse dependence, when not only FDI affects GDP, but also countries with higher GDP appear more attractive and stable to foreign investors.

On the contrary, the hypothesis to reject the problem of omitted variable bias (OVB) was accepted, considering that all of the β_1 to β_4 coefficients reached values different from zero, and their omission could thus cause the problem of the exogeneity of the independent variable FDI.

The hypothesis of the normality of the residual's distribution was also accepted, which is further confirmed by the graphical representation of the distribution (Figure 3), which resembles a desired bell-shape and has a mean value centered around zero. There is also a slight rightward skew, which was however already explained by the structural break in GDP time series during the beginnings of the COVID-19 pandemic (Figure 1).

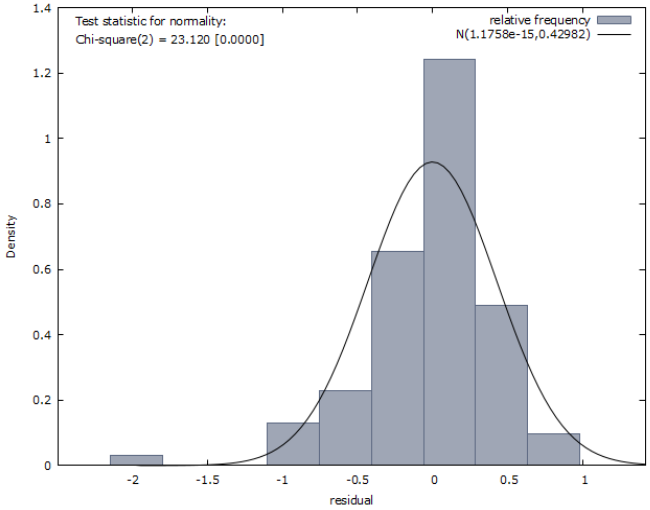

Figure 3. Normality of residuals distribution test

4. Conclusion

Based on our analysis of 96 observations of quarterly data in the years 1999 - 2022, we used a multiple linear regression model (MLR) to investigate the impact of FDI on economic growth in the conditions of the US economy. As part of the results, we confirmed this hypothesis at the 5% level of significance ($p < 0.05$).

The model also confirmed the positive dependence of other control variables such as household consumption, government spending, and private domestic investment on GDP growth in the USA. The effect of FDI impact, as well as the remaining control variables was statistically significant, and the model as a whole can be considered of high quality with an F-statistic of 42.04.

Since, despite the recalibrations of the model, absolute variability of US economic growth was not explained, it is necessary to take into account the underlying limitations of the model, namely the occurrence of a structural break during the COVID-19 pandemic, the possible occurrence of autocorrelation and reverse dependence.

In order to confront these shortcomings, we can propose a series of improvements to the model, such as extending the model by additional control variables (like stock markets returns, population size, labor productivity rate, proxy variables for technical progress and other), extending the investigated time horizon, as well as taking into account the difference in the convergence pace of economic growth for developed and developing economies.

Nevertheless, the positive effect of FDI on the economic growth rate in the US confirmed by this article indicates that the USA has historically been able to utilize its competitive advantage of exceptional FDI management to the maximum extend, the implications of which can further serve as an inspiration for the long-term strategies of less developed economies, in sense of extending their focus on the support of export-oriented industries or establishing more liberal trade and tax policies.

References:

[1]. Zhang, K. H. (2001). Does foreign direct investment promote economic growth? Evidence from East Asia and Latin America. *Contemporary economic policy*, *19*(2), 175-185.

[2]. Lábaj, M. (2007). Analýza zdrojov ekonomického rastu metódou celkovej produktivity faktorov v Slovenskej republike v rokoch 1995–2006. [Analysis of the sources of economic growth using the total factor productivity method in the Slovak Republic in 1995-2006]. *Journal of Economics*, *55*(10), 976-991.

[3]. Sánchez-Muñoz, C., Matei, S., Howell, K. (2020). The World's Top Recipients of Foreign Direct Investment. IMF. Retrieved from: https://www.imf.org/en/Blogs/Articles/2021/12/16/the-worlds-top-recipients-of-foreign-direct-investment [accessed: 12 June 2023].

[4]. Lichtenbaum, G., Ribner, D.J. (2020). Foreign Investment Screening in the USA. In Hindelang, S., Moberg, A. (eds) *YSEC Yearbook of Socio-Economic Constitutions 2020*. Springer, Cham.

[5]. Globerman, S., & Shapiro, D. (2003). Governance infrastructure and US foreign direct investment. *Journal of international business studies*, *34*, 19-39.

[6]. Walmsley, T., Rose, A., & Wei, D. (2021) The Impacts of the Coronavirus on the Economy of the United States. *Economics of Disasters and Climate Change*, *5*(1), 1–53.

[7]. Herzer, D., Stephan K., & Felicitas N. L. (2008). In Search of FDI-Led Growth in Developing Countries: The Way Forward. *Economic Modelling*, *25*(5), 793–810.

[8]. Sarker, B., & Farid K. (2020). Nexus Between Foreign Direct Investment and Economic Growth in Bangladesh: An Augmented Autoregressive Distributed Lag Bounds Testing Approach. *Financial Innovation*, *6*(10), 110-119.

[9]. Tanaya, O., & Suyanto S. (2022). The Causal Nexus Between Foreign Direct Investment and Economic Growth in Indonesia. *Periodica Polytechnica Social and Management Sciences*, *30*(1), 57–61.

[10]. Hsiao, F., & Mei-Chu H. (2006). FDI, Exports, and GDP In East and Southeast Asia—Panel Data Versus Time-Series Causality Analyses. *Journal of Asian Economics*, *17*(6), 1082–1106.

[11]. Ucal, M., Ozgan, K.M., & Mungo, J. (2010). Relationship between financial crisis and foreign direct investment in developing countries using semiparametric regression approach. *Journal of Business, Economics and Management*, *11*(1), 20–33.

[12]. Aitken, B., & Harrison, A. E. (1999). Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. *American Economic Review*, *89*(3), 605–618.

[13]. Oladipo, O.S. (2015). Does foreign direct investment cause long run economic growth? Evidence from the Latin American and the Caribbean countries. *International Economics and Economic Policy*, *10*(3), 569–582.

[14]. Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, *70*(1), 65-94.

[15]. Simionescu, M. (2016). The relation between economic growth and foreign direct investment during the economic crisis in the European Union. *Journal of Economic Business*, *34*(1), 187–213.

[16]. Belloumi, M. (2014). The Relationship Between Trade, FDI and Economic Growth in Tunisia: An Application of The Autoregressive Distributed Lag Model. *Economic Systems*, *38*(2), 269–287.

[17]. Lucas, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, *22*(1), 3–42.

[18]. Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, *98*(5), 103–125.

[19]. Aitken, B., Hanson, G. H., & Harrison, A. E. (1997). Spillovers, Foreign Investment and Export Behaviour. *Journal of International Economics*, *43*, 103–131.

[20]. Bezuidenhout, H. (2009). A regional perspective on aid and FDI in Southern Africa. *International Advances in Economic Research*, *15*(3), 310-321.

[21]. Cheng, L.K., & Y.K. Kwan. (2000). What are the Determinants of the Location of Foreign Direct Investment? The Chinese Experience. *Journal of International Economics*, *51*(2), 379–399.

[22]. Yao, S. (2006). On Economic Growth, FDI and Exports in China. *Applied Economics*, *38*(3), 339–351.

[23]. Bauerle, S. (2020). Foreign direct investment policy, domestic firms, and financial constraints. *Business and Politics*, *22*(1), 279–306.

[24]. Alfaro, L. (2003). Foreign direct investment and growth: Does the sector matter. *Harvard Business Review*, 1-33.

[25]. Federal Reserve Bank of St. Louis & U.S. Bureau of Economic Analysis. (2023). *Gross Domestic Product*. FRED. Retrieved from: https://fred.stlouisfed.org/series/GDP [accessed: 15 June 2023].

[26]. Federal Reserve Bank of St. Louis. (2023). *Rest of the world: foreign direct investment in U.S, Current Cost Transactions*. FRED. Retrieved from: https://fred.stlouisfed.org/series/ROWFDIQ027S [accessed: 17 June 2023].

[27]. Federal Reserve Bank of St. Louis. (2023). *Personal Consumption Expenditures*. FRED. Retrieved from: https://fred.stlouisfed.org/series/PCE [accessed: 23 June 2023].

[28]. Federal Reserve Bank of St. Louis & U.S. Bureau of Economic Analysis. (2023). *Capital Account: Gross Private Domestic Investment*. FRED. Retrieved from: https://fred.stlouisfed.org/series/GPDI [accessed: 03 July 2023].

[29]. Federal Reserve Bank of St. Louis & U.S. Bureau of Economic Analysis. (2023). *Federal Government: Current Expenditures*. FRED. Retrieved from: https://fred.stlouisfed.org/series/FGEXPND [accessed: 03 July 2023].

[30]. Carlos, C., & Koch, J.V. (1981). The 'crowding out' effect of federal government outlay decisions: An empirical note. *Public Choice*, *36*(2), 329–336.

[31]. Abrams, B.A., & Schmitz, M.D. (1978). The 'crowding out' effect of government transfers on private charitable contributions. *Public Choice*, *33*(1), 29–39.