Research in Applied Economics
ISSN 1948-5433
2024, Vol. 16, No. 1

FDI Inflows and Economic Growth: A Novel Application of Dose-Response Functions

Alessandro Cusimano[1,*], Chiara Paola Donegani[2], Federico Fantechi[1] & Eun Sun Godwin[3]

[1]Department of Economics, Business, and Statistics (SEAS), University of Palermo, Italy

[2]Department of Economics, Finance and Entrepreneurship, Aston University, UK

[3]Business School, University of Wolverhampton, UK

*Corresponding author: Department of Economics, Business, and Statistics (SEAS), University of Palermo, Italy. E-mail: alessandro.cusimano@unipa.it ORCID: 0000-0001-7935-4116

Received: January 10, 2024 Accepted: February 24, 2024 Published: March 11, 2024

doi: 10.5296/rae.v16i1.21607 URL: https://doi.org/10.5296/rae.v15i1.21607

Abstract

In this work we estimate different dose-response functions linking FDI inflows received by developing countries with their economic growth. Although the impact of FDI on the economic growth of host countries has been widely investigated in literature, findings have been ambiguous. Our study proposes a novel ‘dose-response’ approach which allows the response of recipients to different amounts of treatment in terms of FDI inflow to be observed. Our findings show that the estimated dose-response functions are statistically significant for treatment values greater than 20%, after the treatment has been rescaled to a percentage measure of the maximum dose observed, and increasing at a decreasing rate, therefore suggesting three relevant results: a) a country receiving a greater amount of FDI inflows will present a higher economic growth; b) there might be a minimum amount of FDI inflows required to reach some policy effectiveness; c) the initial amounts of FDI inflow are more effective than the subsequent ones. Results will help policymakers to better isolate the effect of FDI on economic growth and conduct informed FDI cost-benefit analysis.

Keywords: dose response functions; continuous treatment; FDI, economic growth

Research in Applied Economics
ISSN 1948-5433
2024, Vol. 16, No. 1

1. Introduction

Whilst globalisation and liberalisation have caused a surge in Foreign Direct Investment (FDI) during recent decades, there have also been consistent policy debates on whether FDI flows contribute to economic growth, particularly in developing countries. Positive FDI impact has been promoted by Western donors and international finance institutions for developing countries' policy debates to utilise FDI inflows as "engine of development" (UNCTAD, 1992). Indeed, FDI inflows to these countries have increased significantly, overtaking those to developed countries for the first time in 2012 (UNCTAD, 2012). In accordance with the trend, the topic has also drawn a great deal of academic attention and has been substantially studied (Ghazalian and Amponsem, 2019; Khalid and Marasco, 2019).

Nonetheless, empirical findings on this positive impact of FDI on economic growth have been ambiguous in both International Business and Economics studies (Narula and Driffield, 2012; Temiz and Gökmen, 2014; Soumare, 2015; Bairagi, 2017).

The aim of this study is to outline a more complicated picture of this relationship such as whether the FDI impact changes depending on its inflow level. Our investigation focuses on the impact of FDI inflows intensity on economic growth. Specifically, our contribution to the literature is twofold.

Firstly, we assess whether there is any minimum or maximum threshold; and, secondly, if a threshold does exist, whether and how it can be determined and what implications it would have. We provide an additional element of novelty as we try to answer these questions by estimating several dose-response functions, which link the FDI inflows received by a sample of developing countries with their economic growth.

Our interest is mainly on whether there might be "heterogeneities along different amounts" (*ibid*, p.486) of FDI in terms of its impact on economic growth (e.g. continuous relationship between amount of FDI and host country economic growth; any information on the optimal level of FDI for the latter etc.). Hence, our question on FDI impact also focuses on 'how much' FDI will be beneficial or 'to what extent' FDI can bring positive impact on the economy (Meyer, 2004).

To the best of our knowledge, our approach, which allows the estimation of a continuous function linking the FDI inflows received by a host country to economic performance, has never been implemented in this branch of literature. Thus, our findings addressing these questions contribute to the literature as it would allow policymakers to judge whether there exists a preferred level of FDI inflows and thus conduct a better analysis comparing the costs to attract FDI vs. the degree of benefits resulting from FDI.

The remainder of the paper is composed as follows: the second section introduces the theoretical background of this study's main subject, i.e. FDI and its impact on economic growth, and a review of previous literature on this topic; the third section discusses the methodology, i.e. 'dose-response approach', and its application to our study; this will be followed by a section on interpretation and discussion of the results; and the final section will discuss the implication of the study with concluding remarks.

2. Literature Review on FDI and Economic Growth

FDI is generally considered "an instrument of cash and non-cash long-term investment into the host countries by the overseas investors" (Bairagi, 2017, p.2832) which intends lasting interests, commitment and an effective voice/control of the investing enterprises in the host countries (OECD Benchmark Definition). Specifically, the purchase of physical assets or of a significant amount of the ownership of a company in another country is aimed at gaining a measure of management control in that country.

The world FDI flows started increasing significantly in the late 1990s, leading to a wealth of studies on FDI that have tried to assess its impact on economic growth of the host countries at macro level (e.g., Abdouli and Hammami 2017; Meyer, 2004; Temiz and Gökmen, 2014; Vu, 2008).

The well-established "FDI-led growth hypothesis" argues that FDI inflows can stimulate growth of the host country. Earliest studies saw the positive FDI impact on economic growth comes from capital formation and tax income creating a country's saving gap as a result of investment (e.g., MacDougall, 1960). Economic growth from FDI can also be achieved through extending production capacity (Cambazoglu and Karaalp, 2014) by increasing the rate of technical progress through the diffusion of more advanced technology and management practices (Findlay, 1978) and the knowledge applied to the production process (Wang, 1990; De Mello, 1997), by creating new job opportunities, and easing the transfer of technology (De Gregorio, 2003; De Mello, 1997). However, there are studies that found that FDI has a positive effect on growth only under certain circumstances, such as the level of income beyond a threshold (Blomstrom et al., 1992), human capital development (Borensztein et al., 1998; Khan et al., 2023), degree of openness of the economies (Balasubramanyam et al, 1999) and domestic financial markets development (Alfaro et al., 2004; Gaies and Nabi, 2021) in the host countries.

Another theory, the "market size hypothesis" assumes that GDP growth creating new investment opportunities (Mah, 2010, Rodrik, 1999), better electricity, roads and telecommunication infrastructure (Anyanwu, 2012; Jaiblai and Shenai (2019)) and greater human capital development (Borensztein et al., 1998) as well as better quality of economic, political and social environment (Li and Liu, 2005; Choe 2003) in the host country may trigger larger inflows of FDI.

However, there are also theories suggesting FDI has either none (the so-called "neutrality hypothesis") or negative effects on economic growth as FDI can potentially crowd out investment from domestic sources, increase external vulnerability, reduce the productivity of domestic companies, and thus, in turn, cause the host county economy's dependence on FDI (Aitken and Harrison; 1999, Lipsey, 2002, Carkovic and Levine, 2002). The theoretical explanation of negative effect of FDI on host country domestic wages and employment is that foreign wage premia cause 'market-stealing effects' or 'human-resource-specific advantages' (i.e. paying talented employees higher so that they don't move to domestic companies) (Girma et al., 2019, p.924). Similarly, MNEs, usually with better resources, efficiency and technology, particularly in the developing host country context, compete against domestic companies over market and scarce national resources (Jin et al., 2019). In this way, competition between MNEs and domestic firms can result in the extreme crowding out of domestic firms (Aitken and Harrison, 1999; Jin et al., 2019) which in turn also drives out domestic investment for the long term (De Backer and Sleuwagen, 2003; Miao, 2010; Herzer et al., 2014).

Empirical results of FDI impact on host country economic growth using macro level data still find inconclusive and/or often contrasting effects depending on different context such as host country or time-period (e.g., Burelea-Schiopoiu et al., 2021; Yimer, 2023). The mixed results on the relationship between FDI and economic growth seem to be particularly so in developing host country contexts when compared to developed countries. For example, Aitken et al. (1996) found that positive effects of FDI on domestic wages hardly exists in Mexico and Venezuela (i.e., developing host countries) compared to those in the US. Similarly, Beugelsdijk et al. (2008), which looked at the impact of horizontal and vertical FDI on host country economic growths in developed vs. developing host country groups, found positive and significant growth effect of FDI only in developed countries. Thus, it is relevant to explore further on the impact of FDI on economic growth, particularly in developing host countries' context as firstly, attracting FDI has been suggested as an important source of economic development (e.g., "engine of development", UNCTAD, 1992, see also Rao et al., 2023) as it can provide external saving and finance which developing countries often lack (Cambazoglu and Kaalap, 2014).

Secondly, although developed nations still dominate the existing stock of FDI worldwide, developing countries' shale of the world's total FDI flows have been increasing. For the first time ever, in 2014, developing countries attracted a greater amount of FDI than developed countries, accounting for about 55% of the world total. Whilst developed nations remain the sources of most FDI, indeed developing economies have been claiming the bulk of these inflows in the past decade. Outflows of FDI from the latter has also been increasing and are regarded as the main vehicle of foreign financing in the years to come. The most notable developing country contributing these trends is China. It has long been a major recipient of FDI among the developing countries since the early 1990s. Indeed, inflows of foreign direct investment (IFDI) to China already totalled $321 billion between 1990 and 2000 with attracting almost doubled amount of IFDI in the following decade. It reached then the astonishing amount of $2,538 billion between 2010 and 2020 (accounting for the 26% of the total OECD IFDI). Including China, several developing countries have also seen fast economic growth in recent years. Hence, it is relevant to understand whether these resource flows have contributed to the higher growth rates or equally, whether attracting/not being able to attract FDI has caused any differences in economic growth in developing countries.

Here, our study applies an approach that has not been used in the large literature on the growth effects of FDI, allowing us to observe the response of recipients (i.e. host country economy) to different amounts of treatment (i.e. FDI inflows considered as a continuous treatment). This can give us a more complete picture of FDI impact by considering aspects which have not been addressed in the previous literature in the field. We also assume a positive association between FDI and growth based on the theory, but using this novel approach, we firstly, would like to see whether this positive relationship can be confirmed when addressed from a different angle; and secondly, aim at addressing the impact of intensity of FDI flows, on economic growth. In doing so, we can extend existing literature on FDI-growth relationship. In the next section, we will review and discuss the methodology, followed by analysis and discussion of the results.

3. Methodology

3.1 The 'Dose-Response Approach'

Our main contribution consists of implementing a dose-response approach to determine whether we can detect a continuous relationship between FDI inflows and host country economic growth.

Methodologically, implementations of dose-response functions have originally been carried out in medical studies, where research aims at studying the correct 'dose' of a medical treatment such as a drug. Applying a similar concept, this methodology has subsequently been used widely in policy evaluation studies in social science avenues (for a review see D'Aurizio and De Blasio, 2008), considering certain policies as 'treatment' and investigating the impact of the policy on the response of beneficiaries. Our aim and contribution here is to apply one of these methods to the analysis of FDI. In other words, we may consider the FDI inflows as the policy under investigation in our framework and in doing so, our objective is to analyse its effectiveness on the economic growth of host countries. To the best of our knowledge, our work represents the first attempt to apply a dose-response model in the evaluation of the effects of FDI inflows.

Classical analysis of programme evaluation has usually considered the policy under investigation as a dummy variable assuming a value equal to 1 for the beneficiaries of the programme and 0 for the counterfactual (see among others Adorno et al., 2007; Bernini and Pellegrini, 2011; Cerqua and Pellegrini, 2017). However, in recent years this literature has experienced a significant diffusion of methodologies which has extended this basic approach in different ways (Cerulli, 2015). Particularly, we often observe cases where the beneficiaries of a specific policy receive different amounts of treatment according to their intrinsic characteristics or the specific objective of the policy. For this reason, many authors (e.g. see Cattaneo et al., 2013 among others) have gone beyond the classical binary division between treated and untreated units with the aim of taking into account the different amounts of treatment received by the beneficiaries of the policy.

Hirano and Imbens (2004) define a generalization of the propensity score methods (see also Imbens, 2000) in a framework where the treatment is continuous. The propensity score represents a methodological attempt to summarize in a single variable the pre-treatment characteristics of treated and untreated units when the approach is binary. The extension of this approach consists of creating an analogous proxy with respect to different levels of treatment. Ideally, if we were able to compare units being similar in terms of pre-treatment characteristics, the comparison of their economic performance after the treatment would be entirely as a result of the policy effect under investigation, expressed as a continuous function.

Research in Applied Economics
ISSN 1948-5433
2024, Vol. 16, No. 1

Unfortunately, as will be detailed later on, some degree of bias will still be present, but the purpose of the methodology is to minimize it.

This approach is appropriate for application in our case where we can consider the FDI inflows as a continuous treatment on beneficiary host countries. The objective here is to construct a dose-response function which focuses only on treated units and looks at the functional relation between the amount of dose and the outcome variable(s). This approach is implemented in Stata by Bia and Mattei (2008) and followed by several studies (Bia and Mattei, 2012, Kluve et al., 2012; Bocci and Mariani, 2015).

In detail, we consider N observations and, for each observation i we consider a vector X_i representing the pre-treatment characteristics of each observation; T_i, the amount of treatment received; and Y_i, the value assumed by the outcome measure for this specific amount of treatment.

Following Bia and Mattei (2008) and Hirano and Imbens (2004), we define a set of potential outcomes for each observation i $\{Y_i(t)\}$ (with $t \in \tau; i = 1, \dots, N$) where τ is a continuous set of potential treatment values, and $Y_i(t)$ is a random variable that maps a particular potential treatment t to a potential outcome measure. $\{Y_i(t)\}$ (with $t \in \tau$) constitutes the unit-level dose-response function. Since we want to find a general relation between the outcome measures and the treatment level, we focus on the average dose-response function $\mu(t) = E\{Y_i(t)\}$ rather than an individual dose-response function.

If we define $r(t, x)$ as the conditional density of the treatment given the covariates, $r(t, x) = f_{T|X}(t|x)$, then the generalised propensity score (GPS) is $R = r(T, X)$. Hirano and Imbens (2004) prove how the GPS can be used to reduce the bias arising from the difference in the covariates among observations. Therefore, we focus on the estimation of the dose-response function. The latter is carried out in three steps (Bia and Mattei, 2008):

- Estimate the generalised propensity score $r(t, x)$;
- Estimate the conditional expectation of the outcome measure as a function of the treatment level T and the GPS R: $\beta(t, r) = E(Y|T = t, R = r)$;
- Estimate the dose-response function $\mu(t) = E\{\beta[t, r(t, X)]\}, t \in \tau,$ by averaging the conditional expectation, $\beta^{\wedge}(t, r(t, X))$ estimated in the second step, over the GPS, at each level of the treatment of interest.

We move now to the data description.

3.2 Data Description

Data have been extracted mainly from UNCTADStat (i.e. FDI, GDP, export and import, exchange rate and external debt) and World Bank Group Indicators (industry, educational attainment) whilst Economic Freedom Index for measuring institutional constraints has come from Heritage Foundation. In line with Khalid and Marasco (2019), the developing countries list was filtered through the category of UNCTADStat FDI data(Note 1). However, we also included countries which were formerly categorised as transition economies as several relevant studies see their radical institutional change renders them not to be fully developed yet regardless their economic status (e.g., Luo and Tung, 2007; Khanna et al., 2010; Cuervo-Cazurra, 2012).

We started with a total of 178 potential observations in terms of countries that are recipients of FDI inflows. However, as we detail below, variables availability reduced the number of observations that could be included in our empirical analysis.

Our objective is to determine the effect of FDI inflows on the economic growth of host countries by constructing and estimating a continuous dose-response function linking the amount of FDI inflows with the economic performance observed. For this reason, our treatment consists of the annual inward FDI flows in US dollars at current prices per capita averaged over the period of 2012-2016. The choice of the time-period is led by the awareness that some time should be allowed before the effects of FDI inflows are observed in the outcome measure. Ideally, a longer time-period could be preferred, but due to the data availability, considering a longer time-period would reduce the number of covariates necessary for the implementation of the applied methodology. Nonetheless, as can be seen in our results later, although it is not ideal, the time-period considered here seems to be sufficient to detect some important effects.

In line with the literature (among others, Cambazoglu and Karaalp, 2014; Temiz and Gökmen, 2014), the economic performance of host countries in terms of growth is measured through the GDP per capita in US dollars (that we consider in millions at constant prices) to avoid inflation of the estimated growth due to population growth. Since our treatment is averaged between 2012 and 2016, we consider 2017 as reference year to observe some of the effects related to FDI inflows. In addition, we want to see whether the effect we may detect lasts only for a short term or whether this lasts for a substantial period (Note 2). For this reason, we set 2017 as our reference year, and we also investigate the effects in $t + 1$ and in $t - 1$. In addition, to test for robustness, we investigate the effect over a longer period, averaging over 2017 and 2018 first, and subsequently over 2016, 2017 and 2018. The different specifications of our outcome measure are therefore detailed as follows:

- GDP per capita in US dollars in 2018
- GDP per capita in US dollars in 2017
- GDP per capita in US dollars in 2016
- Average GDP per capita in US dollars between 2017 and 2018
- Average GDP per capita in US dollars between 2016, 2017 and 2018

In addition, we winsorize our outcome measures, i.e. we transformed the extreme values of our observations at 2.5th and 97.5th percentile of the distribution of each variable, in order to deal with the effects that outliers and extreme observations could have in the estimation of the policy effects (Yujun, 2014). Winsorization is considered a useful way of dealing with outliers without reducing the number of observations and therefore seems to be appropriate in our case where we have a relatively small sample.

Table 1 below shows some descriptive statistics related to our outcome measures. The table also shows the benefits obtained when such variables are winsorized:

Table 1. Descriptive Statistics for the Outcome Measures

Outcome measure	Number of Observations	Winsorized Sample	Mean	Median	St. dev.	Min	Max
GDP per capita in 2018	178	N	9609.29	4694.62	13041.18	107.20	81799.98
		Y	9050.65	4694.62	10577.05	439.37	45870.50
GDP per capita in 2017	178	N	9461.56	4734.94	12825.10	106.96	80192.77
		Y	8910.84	4734.94	10414.71	444.84	44932.10
GDP per capita in 2016	178	N	9313.99	4518.56	12554.67	107.53	78844.89
		Y	8780.45	4518.56	10266.89	445.05	43641.51
Average GDP per capita (2017-2018)	178		8980.75	4717.34	10494.15	442.11	45401.30
Average GDP per capita (2016-2017-2018)	178		8913.98	4651.08	10414.36	443.09	44814.70

Source: our elaborations

To proceed with the estimation of the dose-response function, we need to define a specification for the generalized propensity score, including the choice of the variables suitable for identifying the characteristics of host countries before treatment is assigned, with respect to a time period that must be set before the treatment. In this case, a trade-off exists between the dimension of the covariates vector that should, ideally, be as numerous as possible, and the data availability, which reduces the total number of observations as we increase the dimensionality of the vector.

To reach a reasonable compromise, we select the following variables, with respect to 2011:

- Flow of exports as a percentage of total world
- Flow of imports as a percentage of total world
- Real effective exchange rate index (CPI based)
- The industry sector as a percentage of GDP
- The Economic freedom index

The choice of the covariates above reduced the sample size to 135 observations. More covariates could be added but this would further reduce the number of observations and would create concerns regarding the representativeness of the sample size. For this reason, we believe that the above constitutes a good compromise in the pre-mentioned trade-off between the dimensionality of the covariates vector and sample size. Table 2 below shows some descriptive statistics for the covariates included.

Table 2. Descriptive Statistics for the Covariates Included

Variable	Number of Observations	Mean	Median	Min	Max
Flow of exports as a percentage of total world	135	0.2763	0.0435	0.0001	2.233
Flow of imports as a percentage of total world	135	0.2492	0.0551	0.0013	1.9836
Real effective exchange rate index (CPI based)	135	108.9665	106.881	71.7880	143.906
Industry sector as a percentage of GDP	135	28.8393	26.1931	9.6646	72.7251
Economic freedom index	135	58.8752	58.5	42.8	77.4

Source: our elaborations

These covariates were chosen in line with previous studies on FDI determinants as well as those on FDI impact, as the purpose of including these variables is controlling characteristics of host countries before the treatment is assigned.

We included exchange rate and trade-related variables as they are common control variables in FDI studies (e.g. Bevan and Estrin, 2004; Paul and Singh, 2017). Firstly, the exchange rate and the potential risk from its volatility is one of the significant exogenous changes that can possibly affect FDI flows and impact (Nguyen and Cieślik, 2020). We used 'Real effective exchange rate index' adjusted for domestic prices (CPI). Secondly, we included 'flows of export and import as a percentage of total world' as proxies of host countries' trade involvement. Trade openness can function as a signal of the host country's integration into the world economy. Thus, the level of trade openness of a host country can affect future market potential and studies have found it not only affects FDI inflows (e.g. Chakrabarti, 2001; El-Wassal, 2012) but also might influence both FDI impact and economic growth (e.g. Khalid and Marasco, 2019).

In addition, the industry composition of a country can affect not only economic growth itself but also FDI impact. Studies on FDI impact have found that industry differences affect FDI impact as they are closely linked to FDI motivation (i.e. FDI determinants) (e.g. Gönel and Aksoy, 2015; Narula, 2018). For example, efficiency-seeking FDI (i.e. close link to manufacturing industry) is not only likely to bring lower amounts of investment compared to market-seeking/serving FDI (Yamin and Sinkovics, 2009) but also the positive impact of the former on economic growth is also lower than that of the latter (Beugelsdijk et al., 2008). Akbar and McBride (2004) find resource-seeking FDI (i.e. close link to primary sector), has a shorter-term impact than market-seeking FDI.

Finally, institutional qualities/constraints, such as rule of law, effectiveness of government, regulatory efficiency and market infrastructure, in a host country also affect not only FDI inflow (Benacek et al., 2000; Bénassy-Quéré et al., 2007; Arslan et al., 2015) but also the extent of positive impact of FDI (e.g. Azman-Saini et al., 2010) (see Ghazalian and Amponsem (2019) for more comprehensive examples). To measure this aspect, we use 'Economic Freedom' concept as this is closely in line with what North et al. (2009, p.111) termed as 'open access order', which "…defines property rights, enforces contracts, and creates the rule of law necessary for markets" for a well-functioning economy. There are two indices for measuring the degree of Economic Freedom (i.e. index of Economic Freedom) developed by the Fraser Institute and The Heritage Foundation (Ghazalian and Amponsem, 2019). Both indices measure similar institutional aspects mentioned above and have also similar implications in terms of outcome (e.g. ranks of countries) (*ibid*). We chose the Economic Freedom Index from Heritage Foundation as the proxy for institutional constraint covariate following examples of Azman-Saini et al. (2010) and Ghazalian and Amponsem, (2019), which looked at the relationship between economic freedom and FDI.

3.3 Empirical Analysis and Results

In this section, we present our empirical analysis and the results of our exercise. In line with the literature (e.g. Kluve et al., 2012, Hirano & Imbens, 2004) we divide our 135 observations in 3 intervals by considering the 30th and 70th percentiles of the per-capita treatment variable. The three intervals are in detail [0, 44.73], (44.73, 307.24], (307.24, 6160.55].

To proceed in the estimation, we define a specification for the generalised propensity score. The first specification (that we name GPS specification A) considers the full set of covariates specified above. A second specification (named GPS specification B) excludes the covariate Economic freedom index, since, as explained later, this might be responsible for some degree of bias. Since the treatment distribution with the given covariates does not respect the normality assumption, we use its log-transformation. In this case the normality assumption is verified and its results are statistically satisfied at 5% level.

Within each treatment interval previously defined, we compute the GPS at the median. Therefore, as suggested by the literature cited above, for each interval we divide the observations into 5 groups according to the quantiles of the estimated value of the GPS. We then calculate the mean difference for each covariate between units that belong to each treatment interval and units that are in the same GPS interval but belong to another treatment interval (Bia & Mattei, 2008).

We aim at testing if, conditioning on GPS, the bias arising from the fact that we match countries that may present different characteristics is decreasing. It must be stressed that conditioning on GPS has the objective of reducing such bias. However, it is unlikely that the bias will be eliminated completely. Our objective is therefore to minimize the bias by exploiting the information that we have and adopting different specifications for the GPS for robustness.

To clarify this process, we follow Hirano & Imbens (2004) and in Table 3, report the t-statistics of the equality of means for the covariates previously defined, before and after adjusting for the generalised propensity score. Our objective is to check if, after adjusting for the GPS, we observe a reduction in the t-statistics. A similar approach is followed by Bia & Mattei (2012) and Kluve et al. (2012).

Table 3. Balance Given the Propensity Score: T-Statistics for Equality of Means

Covariate	Unadjusted			Adjusted (GPS A)			Adjusted (GPS B)		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
Flow of exports as a percentage of total world	1.81	0.97	0.22	1.10	-2.28	0.68	1.63	-1.28	-0.79
Flow of imports as a percentage of total world	1.63	0.96	0.24	1.08	-2.10	0.49	1.46	-1.19	-0.80
Real effective exchange rate index (CPI based)	-0.82	0.78	1.62	0.123	-0.39	0.91	0.09	-0.98	0.40
Industry sector as a percentage of GDP	-0.93	0.52	0.95	-0.28	-0.09	0.77	-0.62	0.41	0.78
Economic freedom index	5.35	0.35	-5.73	2.88	-0.51	-2.53			

Source: our elaborations. Number of observations = 135.

Conditioning for the GPS reduces the bias for most of the covariates. This is clear when we compare the t-statistics of the equality of means before and after conditioning. With GPS A, some degree of bias is still present, even if it is reduced with respect to the case of unadjusted covariates. GPS specification B seems to eliminate the remaining bias. In this second case, we have also used the log-transformation of the treatment variable given the covariates, in order to assess the validity of the normality assumption. We use therefore both specifications for the estimation of the dose-response functions to test for robustness; and to check if results are sensitive to the GPS specification used.

After the estimation of the generalized propensity score, we need to estimate the conditional expectation of the outcome measure Y_i, as a function of the treatment level T_i and the previously estimated GPS $\widehat{R_i}$. We use a quadratic approximation given by the equation below:

[1] $$E(Y_i \mid T_i, \widehat{R_i}) = \propto_0 + \propto_1 T_i + \propto_2 T_i^2 + \propto_3 \widehat{R_i} + \propto_4 \widehat{R_i^2} + \propto_5 T_i \widehat{R_i}$$

Finally, we estimate the dose-response function for every specific level of treatment, "by averaging the conditional expectation function over the GPS at that particular level of treatment" (Bia and Mattei, 2012, p. 496):

[2] $$\mu(t) = E\,\{\beta[t, r(t, X_i)]\}\_$$

The dose of the treatment has been rescaled to a percentage measure of the maximum dose observed. Therefore, this is now between 0 and 100.We report below our results when the GPS specification A is used. In the Appendix, we report the same exercise when GPS specification B is used for robustness. Figure 1 below shows the dose-response function estimated for the first outcome measure under investigation, i.e. the GDP per capita in US dollars in 2017, on the left and the estimated treatment-effect function, which can be interpreted as the first derivative of the dose-response function, on the right. We also report the confidence bands at the 95% of statistical significance.

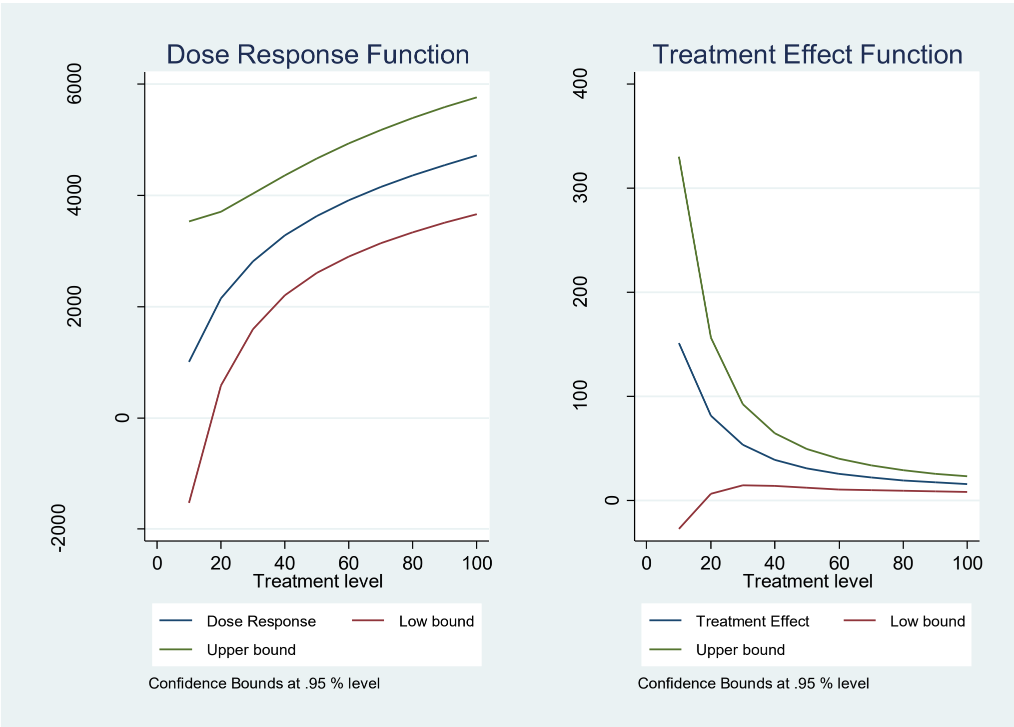

Figure 1. Dose-Response and Treatment Effect Functions for GDP per Capita in US Dollars in 2017

Source: our elaborations. Number of observations = 135.

The dose-response function that we obtain has a clearly increasing shape at a decreasing rate, as confirmed by the decreasing shape of the first derivative function. In addition, both upper and lower bounds lie above zero for all the treatment values above 20(Note 3). We proceed with the analysis related to the same outcome variable considered in $t+1$ and in $t-1$. Figure 2 reports the estimated dose-response function and treatment effect function for GDP per capita in US dollars in 2018 and Figure 3 refers to that in 2016.

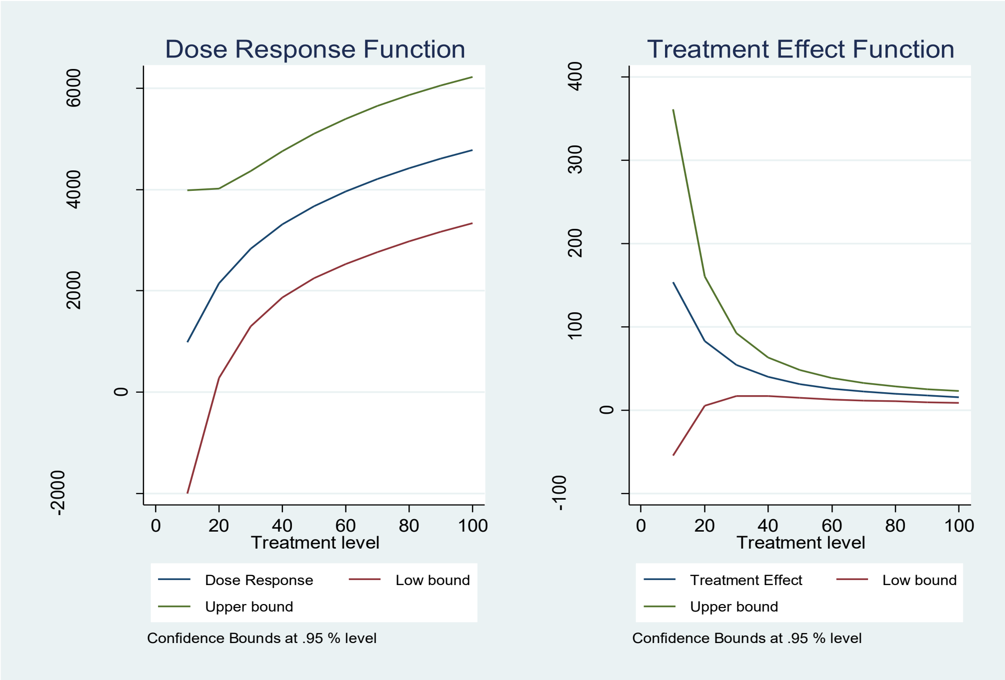

Figure 2. Dose-response and Treatment Effect Functions for GDP per Capita in US Dollars in 2018

Source: our elaborations. Number of observations = 135.

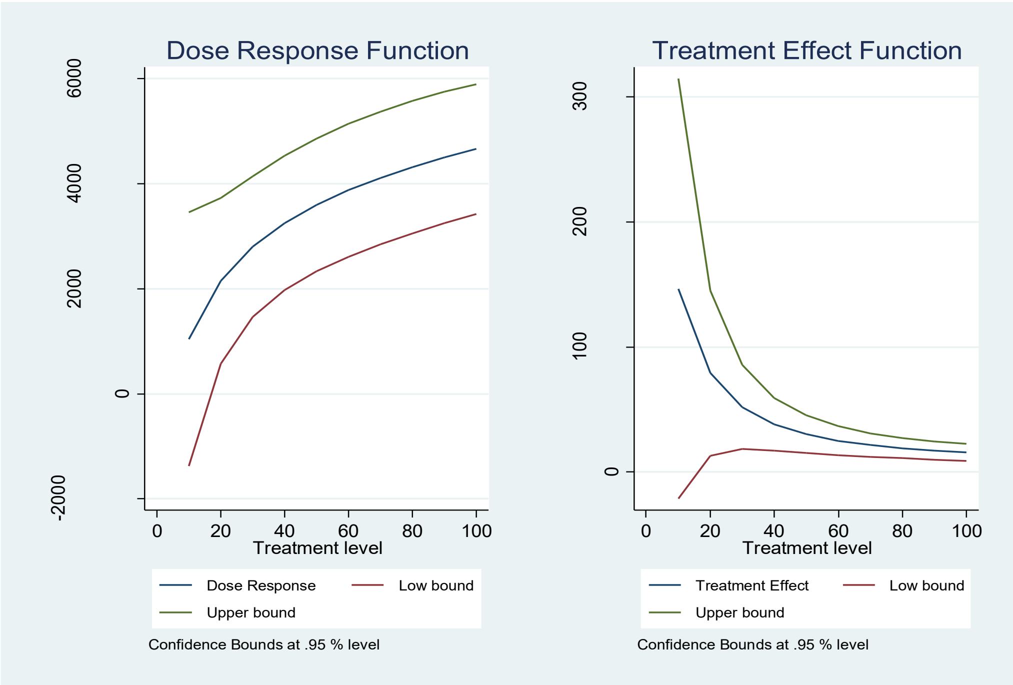

Figure 3. Dose-response and Treatment Effect Functions for GDP per Capita in US Dollars in 2016

Source: our elaborations. Number of observations = 135

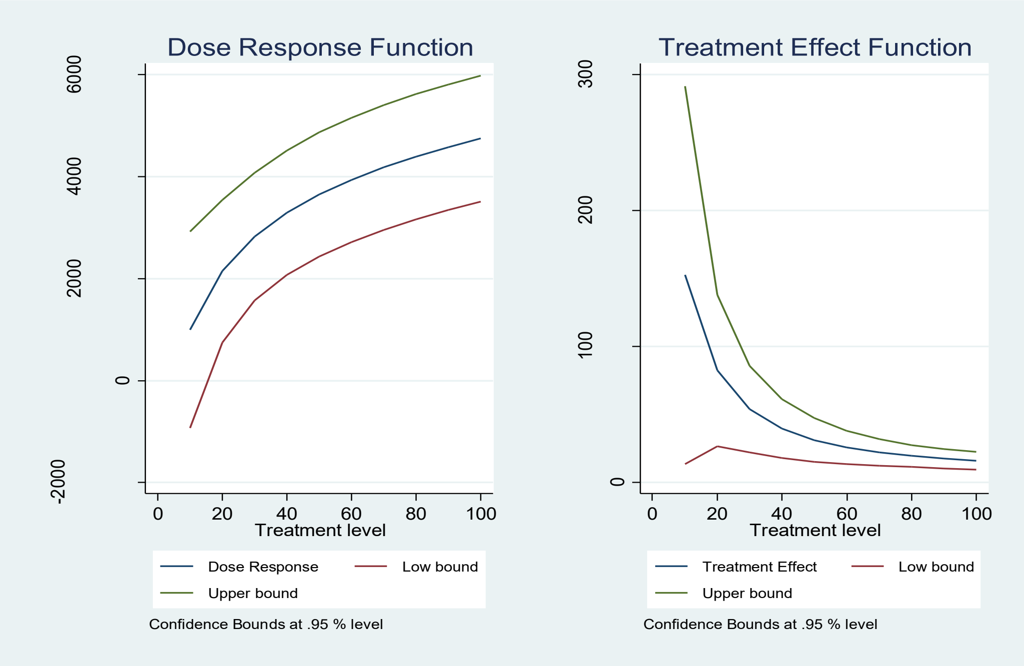

Figure 4. Dose-response and Treatment Effect Functions for the Average GDP in US Dollars between 2017 and 2018

Source: our elaborations. Number of observations = 135.

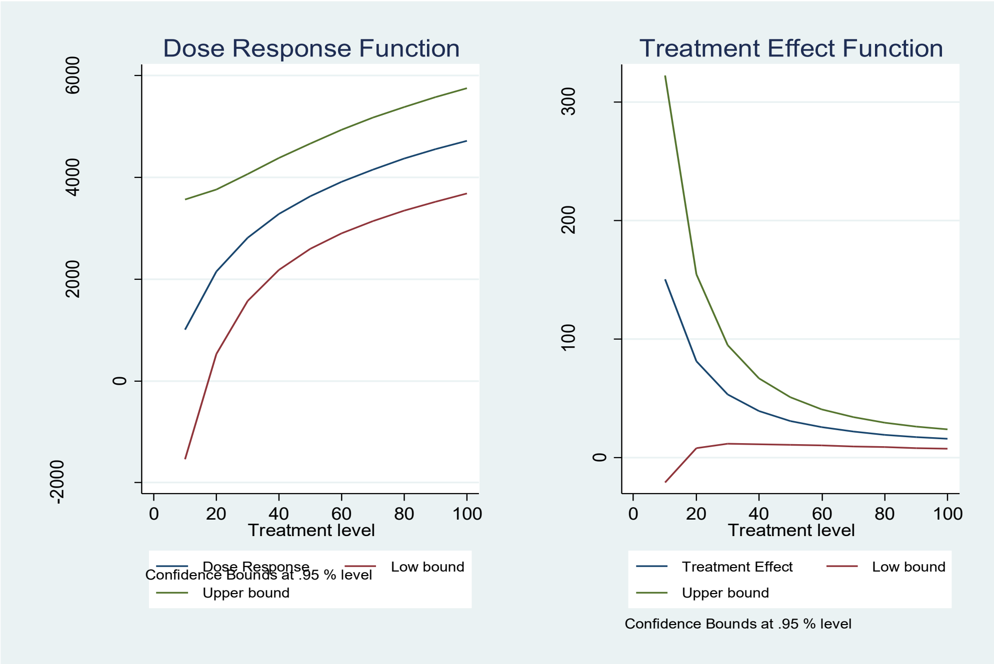

Figure 5. Dose-response and Treatment Effect Functions for the Average GDP in US Dollars between 2016, 2017 and 2018

Source: our elaborations. Number of observations = 135

Both figures 2 and 3 clearly confirm the robustness of the findings reported in Figure 1 both in terms of a) shape of the estimated dose-response function and treatment function; and b) statistical significance. To further test the robustness of our results, we consider our outcome measure over longer period of times, by focusing on the average GDP in US dollars between 2017 and 2018 (Figure 4) and the average GDP in US dollars between 2016, 2017 and 2018 (Figure 5).

Table 4. Dose-response Functions for Different Outcome Variables

Outcome variable	*GDP per capita in 2018*	*GDP per capita in 2017*	*GDP per capita in 2016*	*Average GDP per capita (2017-2018)*	*Average GDP per capita (2016-2017-2018)*
Treatment	9.5366***	9.2676***	9.1162***	9.4021***	9.3068***
	(5.44)	(5.34)	(5.27)	(5.39)	(5.36)
Treatment^2	-0.0012***	-0.0012***	-0.0012	-0.0012***	-0.0012***
	(-4.08)	(-4.06)	(-4.08) ***	(-4.07)	(-4.08)
GPS	36606.95	36679.40	35233.18	36643.17	36173.18
	(1.00)	(1.01)	(0.97)	(1.01)	(1.00)
GPS^2	-63667.07	-65436.70	-62323.01	-64551.89	-63808.93
	(-0.61)	(-0.64)	(-0.61)	(-0.62)	(-0.62)
Treatment*GPS	18.67***	18.80 ***	18.69***	18.74***	18.72***
	(4.31)	(4.28)	(4.37)	(4.35)	(4.36)
Constant	-1321.56	-1286.01	-1165.81	-1303.79	-1257.80
	(-0.43)	(-0.42)	(-0.38)	(-0.42)	(-0.41)
R^2	0.5835	0.5762	0.5633	0.5800	0.5748
Adjusted R^2	0.5673	0.5598	0.5464	0.5637	0.5583
F(5,129)	36.14	35.08	33.28	35.63	34.88
N. Obs.	135	135	135	135	135

*Source: our elaborations. T-statistics in parentheses. (*** indicates 99% statistical significance)*

Finally, in Table 4, we report the coefficients of the estimated dose-response functions, shown graphically above. Both Figures 4 and 5 present similarly shaped dose-response functions while using a different specification. All the considerations already discussed for the main results still hold over these tests. This reinforces the idea that our results are robust and reliable.

4. Discussion

Our estimated dose-response functions and the related treatment effect functions are confirmed by using different specifications of the outcome variables and this provides evidence of the robustness of our findings. With this confirmation, there are at least three main aspects that should be stressed. The first consideration is that all outcome measures are statistically significant for treatment (i.e. there is an effect of the treatment) values greater than 20%, implying that only above this threshold does the dose-response function become statistically significant. This means that if the amount of FDI inflow is too small, we cannot empirically detect a significant effect from it on the host country's economic growth. This finding addresses our research question of whether there exists a minimum amount of FDI inflows necessary to detect an effect on economic growth. Whilst our finding supports a positive effect of FDI on economic growth proposed by FDI theory (e.g., endogenous growth model) and confirmed by some causality studies (e.g. Cambazoglu and Karaalp, 2014; Temiz and Gökmen, 2014; Abdouli and Hammami 2017; Khan, et al., 2023), it brings meaningful progress to the previous contribution by identifying a minimum amount of FDI inflows required to have impact on economic growth. This will also bring an important FDI policy implication to host countries not only in designing such policies but also in assessing the effectiveness of their implementation (e.g. they should investigate the threshold from which benefit of having FDI flows on economic growth starts; see also Yimer, 2023).

The second consideration regards the shape of the estimated dose-response function that is increasing as the treatment, i.e. the amount of FDI inflows, increases. On the one side, this is what we were expecting *ex-ante*, that is a country receiving a greater amount of FDI inflows will experience higher economic growth. On the other side, we can confirm this empirically only with the estimation of a dose-response function whilst the similar pattern observed with different outcome measures provides statistical significance for our findings.

The last consideration, an interesting finding to be noted, refers to the shape of this growth pattern. All the estimated dose-response functions increase at a decreasing rate which is clearly confirmed by the decreasing and statistically significant shape of the treatment functions reported on the right-hand sides of Figures 1 to 5. This implies that the law of diminishing returns applies to the impact of FDI on economic growth when looking at the relationship as 'dose-response' one. In detail, the initial amounts of FDI inflows, after the minimum threshold, are more effective than the subsequent ones, analogously to what happens in production theory to the marginal productivity of a production factor when the others are kept constant. However, the results also show that we are not able to detect a maximum amount in our dose-response function. This implies in a way that we cannot observe any excessive amount of FDI inflows – i.e. there is no threshold where the relationship begins to turn negative. Together with the second consideration, this final aspect addresses our other research question – whether it is possible to estimate a continuous relationship between FDI inflows and economic growth and what the pattern of this relationship is like. Our findings support the assumption of continuous relationship between positive impact of FDI and economic growth but, at the same time, highlights that the effect wears out. Hence, although policy makers can assume the benefits of increasing FDI inflows on economic growth as the marginal impact is still positive, they, at the same time, should weigh carefully in terms of a cost-benefit analysis of FDI once the growth rate of positive FDI impacts slows down.

5. Implication of the Study and Conclusion

In this study, we investigated the relationship between host countries' economic growth and FDI inflows received in developing countries. Theoretically, FDI inflows can contribute to host country economic growth particularly in developing countries where overall domestic investment is still at a low level and hence, so is the saving gap at a national level. Thus, policy debate on FDI impact on economic growth, particularly in these countries, is relevant to and should interest not only policy makers but also MNEs as FDI policy directions will in turn affect MNEs' investment opportunities there. However, it is widely agreed that empirical results on the relationship between FDI impact and host countries economic growth have been ambiguous. This seems to be particularly so in developing countries, whilst these countries are the ones that would require better understanding/scientific evidence on the relationship for their economic development policy. Our study extended questions on FDI impact from a dichotomic question of whether it is positive vs. negative to host countries to more novel ones such as 'how much' FDI will be beneficial (i.e. whether there is any minimum vs. maximum amount of FDI inflows necessary to detect an effect on host country economic growth) or 'to what extent' FDI can bring positive impact (i.e. whether/how a continuous relationship between FDI inflows and economic growth can be estimated). To address these questions, we apply a 'dose-response' approach as a novel methodology that allows for the response of recipients to different amounts of treatment (i.e. FDI inflows in our case) on the beneficiaries to be observed. In doing so, our objective was to determine the effect of FDI inflows on the economic growth of host countries.

Our empirical findings revealed that FDI inflows indeed positively affect economic growth of the developing host countries. We have identified a minimum threshold below which the FDI inflows do not seem to be effective on the economic growth of host countries. Another noteworthy observation is that there is no maximum level of FDI in relation to economic growth – i.e. no maximum threshold on positive impact of FDI. However, the degree of positive impact of FDI decreases as the level of FDI inflow increases, which implies that although FDI might have continuous positive impact on economic growth after a certain threshold in developing countries, its impact tails off as the inflows increases. This brings a meaningful policy implication in that host country policy efforts to attract FDI for economic growth are relevant, but, at the same time, the efforts might need to be adjusted as the FDI inflow level changes (e.g. consideration of policy input vs. output from FDI). Here, discussions from previous studies on the importance of institutional environment (e.g. Jude and Levieuge, 2017) and capability development at both firm and national level (e.g. Narula and Driffield, 2012) are still relevant as host countries should gradually move away from reliance on FDI for their sustainable economic development considering the decreasing growth rate of positive relationship between the two aspects.

Moreover, this study's methodological choice will be a meaningful contribution not only to understanding of the given topic, i.e. FDI impact, but also to extending the scope of methodology development and of the research topics in the relevant field such as international business and economics. 'Dose-response' approach has been useful in several policy debates, especially in the field of local development programmes both at firm and territorial level where the objective was to quantify the effectiveness of different amounts of public aid on recipients. However, the extension of such methodologies to the analysis of FDI looks particularly useful, considering its dynamic nature.

However, our study has some limitations as well. The main limitation is related to the data availability that has forced us to limit our analysis to a specific time-period in terms of FDI inflows (2012-2016). As previously explained, there exists a trade-off between this time-period and the number of observations included into the empirical analysis. We believe that the time-period considered represents a good compromise taking account of the requirement of the availability of confounders before the treatment. Although this work addressed a more detailed relationship between FDI impact and host country economic growth which might not have been captured in previous studies, the implementation of this methodology in FDI literature is still at an early stage. Future studies might look into additional reasons, beyond the ones proposed, behind 'why' such relationship is observed. This can be addressed by looking at different relationships between FDI inflows and other elements which are attributed to economic growth such as job creation or by looking at the relationship at a different level such as firm level where data is available. We leave these objectives to future research.

References

Abdouli, M., & Hammami, S. (2017). Investigating the causality links between environmental quality, foreign direct investment and economic growth in MENA countries. *International Business Review*, *26*, 264-278. https://doi.org/10.1016/j.ibusrev.2016.07.004

Adorno, V., Bernini, C., & Pellegrini, G. (2007). The impact of capital subsidies: New estimations under continuous treatment. *Giornale degli economisti e annali di economia*, 67-92. http://www.jstor.org/stable/23248196.

Aitken, B., Harrison, A., & Lipsey, R. E. (1996). Wages and foreign ownership: A comparative study of Mexico, Venezuela, and the United States. *Journal of International Economics*, *40*(3), 345-371. https://doi.org/10.1016/0022-1996(95)01410-1.

Aitken, B., & A. Harrison (1999). Do Domestic Firms Benefit from Foreign Investment? Evidence from Venezuela. *American Economic Review*, *89*(3), 605-18. https://doi.org/10.1257/aer.89.3.605

Akbar, Y. H., & McBride, J. B. (2004). Multinational enterprise strategy, foreign direct investment and economic development: the case of the Hungarian banking industry. *Journal of World Business*, *39*, 89-105. https://doi.org/10.1016/j.jwb.2003.08.001

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: The role of local financial markets, *Journal of International Economics*, *64*, 89-112. https://doi.org/10.1016/S0022-1996(03)00081-3

Anyanwu, J. C. (2012). Why does foreign direct investment go where it goes? New evidence from African countries. *Annals of Economics and Fnance, 13*(2), 425-462.

Arslan, A., Tarba, S. Y., & Larimo, J. (2015). FDI entry strategies and the impacts of economic freedom distance: Evidence from Nordic FDIs in transitional periphery of CIS and SEE.

International Business Review, *11*, 465-484. https://doi.org/10.1016/j.ibusrev.2015.03.004

Azman-Saini, W. N. W., Baharumshah, A. Z., & Law, S. H. (2010). Foreign direct investment, economic freedom and economic growth: International evidence. *Economic Modelling*, *27*(2), 1079-1089. https://doi.org/10.1016/j.econmod.2010.04.001

Bairagi, R. (2017). Impact of foreign direct investment volatility on economic development in the Indian subcontinent. *the World Economy*, *40*, 2832-2853. https://doi.org/10.1111/twec.12496

Balasubramanyam, V. N., Salisu, M., & Dapsoford, D. (1999). Foreign Direct Investment as an Engine of Growth. *Journal of International Trade and Economic Development, 8*(1), 27-40. https://doi.org/10.1080/09638199900000003

Bénassy-Quéré, A., Coupet, M., & Mayer, T. (2007). Institutional Determinants of Foreign Direct Investment. *The World Economy*, *30*(5), 764-782. https://doi.org/10.1111/j.1467-9701.2007.01022.x

Benacek, V., Gronicki, M., Holland, D., & Sass, M. (2000). The Determinants and Impact of Foreign Direct Investment in Central and Eastern Europe: A comparison of survey and econometric evidence. *Transnational Corporations, Journal of United Nations, 9*(3), New York.

Bernini, C., & Pellegrini, G. (2011). How are growth and productivity in private firms affected by public subsidy? Evidence from a regional policy. *Regional Science and Urban Economics*, *41*(3), 253-265. https://doi.org/10.1016/j.regsciurbeco.2011. 01.005

Beugelsdijk, S., Smeets, R., & Zwinkels, R. (2008). The impact of horizontal and vertical FDI on host's country economic growth. *International Business Review*, *17*, 452-472. https://doi.org/10.1016/j.ibusrev.2008.02.004

Bevan, A., & Estrin, S. (2004). The determinants of foreign direct investment into European transition economies. *Journal of Comparative Economics*, *32*, 775-787. https://doi.org/10.1016/j.jce.2004.08.006

Bia M., & Mattei A. (2008). A Stata package for the estimation of the dose-response function through adjustment for the generalized propensity score. *The Stata Journal, 8*(3), 354-373. https://doi.org/10.1177/1536867X0800800303

Bia M., & Mattei A. (2012). Assessing the effect of the amount of financial aids to Piedmont firms using the generalized propensity score. *Stat Methods Appl*, *21*, 485-516.

Blomstrom, M., R. Lipsey, & M. Zejan. (1992). *What Explains Growth in Developing Countries*. Working Paper 4132. Cambridge, Mass.: National Bureau of Economic Research.

Bocci C., & Mariani M. (2015). L'approccio delle funzioni dose-risposta per la valutazione di trattamenti continui nei sussidi alla R&S. *Scienze Regionali, Italian Journal of Regional Science.* Franco Angeli, *14*, 81-102.

Borensztein, E., J. De Gregorio, & J-W. Lee. (1998). How Does Foreign Direct Investment Affect Economic Growth?, *Journal of International Economics, 45*, 115-35.

Burlea-Schiopoiu, A., Brostescu, S., & Popescu, L. (2021). The impact of foreign direct investment on the economic development of emerging countries of the European Union. *International Journal of Finance & Economics, 28*, 2148-2177, https://doi.org/10.1002/ijfe.2530

Cambazoglu, B., & Karaalp, H. S. (2014). Does foreign direct investment affect economic growth? The case of Turkey, *International Journal of Social Economics*, *41*(6), 434-449. DOI: 10.1108/IJSE-02-2012-0173

Carkovic, M., & Levine, R. (2002). "*Does Foreign Direct Investment Accelerate Economic Growth*", University of Minnesota, Working Paper.

Cattaneo M., Drukker D., Holland A. (2013). Estimation of multivalued treatment effects under conditional independence. *The Stata Journal, 13*(3), 407-450. https://doi.org/10.1177/1536867X1301300301

Cerqua, A., & Pellegrini, G. (2017). Industrial policy evaluation in the presence of spillovers. *Small Business Economics*, *49*(3), 671-686. https://doi.org/10.1007/s11187-017-9855-9

Cerulli G. (2015). *Econometric Evaluation of Socio-Economic Programs: Theory and Applications*. Springer.

Chakrabarti, A. (2001). The determinants of Foreign Direct Investment: Sensitivity Analyses of Cross-Country Regressions. *KYKLOS*, *54*(1), 89-114. https://doi.org/10.1111/1467-6435.00142

Choe, J. (2003). Do Foreign Direct Investment and Gross Domestic Investment Promote Economic Growth? *Review of Development Economics, 7*, 44-57. https://doi.org/10.1111/1467-9361.00174

Cuervo-Cazurra, A. (2012). Extending theory by analysing developing country multinational companies: solving the Goldilocks debate. *Global Strategy Journal, 2*(3), 153-167. https://doi.org/10.1111/j.2042-5805.2012.01039

D'Aurizio, L., & De Blasio, G. (2008). La valutazione degli incentive agli investimenti. In La valutazione degli aiuti alle imprese, 59-96.

De Backer, K., & Sleuwagen, L. (2003). Does foreign direct investment crowd out domestic entrepreneurship?, *Review of Industrial Organization, 22*, 84-97.

De Gregorio, J. (2003). The Role of Foreign Direct Investment and Natural Resources in Economic Development. Working Papers Central Bank of Chile 196, Central Bank of Chile.

De Mello, L.R. (1997). Foreign Direct Investment in Developing Countries and Growth: A Selective Survey, *Journal of Development Studies*, *34*, 1-34. https://doi.org/10.1080/00220389708422501

El-Wassal, K.A. (2012). Foreign Direct Investment and Economic Growth in Arab Countries (1970-2008): An Inquiry into Determinants of Growth Benefits. *Journal of Economic Development*, *37*, 79-100.

Findlay, R. (1978). Relative Backwardness, Direct Foreign Investment, and the Transfer of Technology: A Simple Dynamic Model. *The Quarterly Journal of Economics*, *92*(1), 1-16. https://doi.org/10.2307/1885996

Gaies, B., & Nabi, M. (2021). Banking crises and economic growth in developing countries: Why privileging foreign direct investment over external debt?, *Bulletin of Economic Research*, *73*, 736-761. https://doi.org/10.1111/boer.12271

Ghazalian, P., & Amponsem, F. (2019). The effects of economic freedom on FDI inflows: an empirical analysis, *Applied Economics*, *51*(11), 1111-1132. https://doi.org/10.1080/00036846.2018.1524979

Girma, S., Görg, H., & Kersting, E. (2019). Which boats are lifted by a foreign tide? Direct and indirect wage effects of foreign ownership. *Journal of International Business Studies*, *50*, 923-947. https://doi.org/10.1057/s41267-019-00248-2

Gönel, F., & Aksoy, T. (2015). Revisiting FDI-led growth hypothesis: the role of sector characteristics, *The journal of international trade and economic development*, *25*(8), 1144-1166. https://doi.org/10.1080/09638199.2016.1195431

Herzer, D., Huhne, P., & Nunnekamp, P. (2014). FDI and Income Inequality-Evidence from Latin American Economies. *Review of Development Economics*, *18*(4), 778-793. https://doi.org/10.1111/rode.12118

Hirano K., & Imbens G. (2004). The Propensity Score with Continuous Treatments. In A. Gelman & X. L. Meng (Eds.), *Applied Bayesian modelling and causal inference from incomplete-data perspectives*, 73-84, New York: Wiley.

Imbens G. (2000). The Role of the Propensity Score in Estimating Dose-Response Functions. *Biometrika*, *87*(3), 706-710. https://doi.org/10.1093/biomet/87.3.706

Jaiblai, P., & Shenai, V. (2019). The determinants of FDI in sub-Saharan economies: a study of data from 1990-2017. *International Journal of Financial Studies*, *7*(3), 1-31. https://doi.org/10.3390/ijfs7030043

Jin, B., Garcia, F., & Salomon, R. (2019). Inward foreign direct investment and local firm innovation: The moderating role of technological capabilities *Journal of International Business Studies, 50*, 847-855.

Jude, C., & Levieuge, G. (2017). Growth effect of Foreign Direct Investment in Developing Economies: the Role of Institutional Quality. *The World Economy, 40*(4), 715-742. https://doi.org/10.1111/twec.12402

Khalid, A., & Marasco, A. (2019). Do channels of financial integration matter for FDI's impact on growth? Empirical evidence using a panel. *Applied Economics*, *51*(37), 4025-4045. https://doi.org/10.1080/00036846.2019.1588945

Khan, S., Asteriou, D., & Jefferies, C. (2023). Can FDI explain the growth disparity of the BRIC and the non-BRIC countries? Theoretical and empirical evidence from panel growth regressions, *Economic Modelling,* 124. https://doi.org/10.1016/j.econmod.2023.106306

Khanna, T., Palepu, K. G., & Bullock, R. (2010). *Winning in Emerging Markets: A Road Map for Strategy and Execution*. Boston: Harvard Business Press.

Kluve J., Schneider H., Uhlendorff A., & Zhao Z. (2012). Evaluating continuous training programmes by using the generalized propensity score. *Journal of the Royal Statistical Society*: *Series A (Statistics in Society), 175*, 587-617. https://doi.org/10.1111/j.1467-985X.2011.01000.x

Li, X., & Liu, X. (2005). Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship. *World Development, 33*(3), 393-407. https://doi.org/10.1016/j.worlddev.2004.11.001

Lipsey, R. E. (2002). *Home and host country effects of FDI*. NBER Working Paper 9293.

Luo, Y., & Tung, R. (2007). International expansion of emerging market enterprises: A springboard perspective. *Journal of International Business Studies, 38*, 481-498.

MacDougall, G. D. A. (1960). The benefits and costs of private investment from abroad: A theoretical approach. *Economic Record*, *36*(73), 13-35.

Mah, J. S. (2010). Foreign Direct Investment Inflows and Economic Growth: The Case of Korea. *Review of Development Economics, 14*(4), 726-735.

Meyer, K. E. (2004). Perspectives on multinational enterprises in emerging economies, *Journal of International Business Studies, 35*, 259-276.

Miao, W. (2010). Foreign direct investment and domestic investment in the host country: evidence from panel study. *Applied Economics*, *42*(29), 3711-3721. https://doi.org/10.1080/00036840802314580

Narula, R. (2018). Multinational firms and the extractive sectors in the 21st century: Can they drive development?, *Journal of World Business*, *53*(1), 85-91. https://doi.org/10.1016/j.jwb.2017.09.004

Narula, R., & Driffield, N. (2012). Does FDI cause development? The ambiguity of the evidence and why it matters. *European Journal of Development Research*, *24*(1), 1-7.

Nguyen, A. T., & Cieślik (2020). Determinants of Foreign Direct Investment from Europe to Asia. *the World Economy*, *44*, 1842-1858. https://doi.org/10.1111/twec.13064

North, D. C., Wallis, J. J., & Weingast, B. R. (2009). Violence and the Rise of Open-Access Orders. *Journal of Democracy, 20*(1), 55-68.

Paul, J., & Singh, G. (2017). The 45 years of foreign direct investment research: Approaches, advances and analytical areas. *The World Economy*, *40*, 2512-2527. https://doi.org/10.1111/twec.12502

Rao, D. T., Sethi, N., Dash, D. P., & Bhujabal, P. (2023). Foreign Aid, FDI and Economic Growth in South-East Asia and South Asia. *Global Business Review, 24*, 31-47. https://doi.org/10.1177/0972150919890957

Rodrik, D. (1999). *The New Global Economy and Developing Countries: Making Opennes Work*. Washington: John Hopkins University Press for the Overseas Development Council.

Soumaré, I. (2015). Does FDI improve economic development in North African countries?, *Applied Economics, 47*(51), 5510-5533. https://doi.org/10.1080/00036846.2015.1051655

Temiz, D., & Gökmen, A. (2014). FDI inflow as an international business operation by MNCs and economic growth: an empirical study on Turkey. *International Business Review*, *23*, 145-154. https://doi.org/10.1016/j.ibusrev.2013.03.003

UNCTAD. (1992). *World investment report 1992 - transnational corporations as engines of growth.* New York: UN.

UNCTAD (2012), *World Investment Report 2012: Towards a new generation of investment policies*. Geneva: UN.

Vu, T. B. (2008). Foreign Direct Investment and endogenous growth in Vietnam. *Applied Economics, 40*, 1165-1173. https://doi.org/10.1080/00036840600749433

Wang, M. (2009). Manufacturing FDI and economic growth: evidence from Asian economies. *Applied Economics, 41*, 991-1002. https://doi.org/10.1080/00036840601019059

Yamin, M., & Sinkovics, R. (2009). Infrastructure or foreign direct investment?: An examination of the implications of MNE strategy for economic development. *Journal of World Business*, *44*, 144-157 https://doi.org/10.1016/j.jwb.2008.05.004

Yimer, A. (2023). The effects of FDI on economic growth in Africa. *The Journal of International Trade and Economic Development, 32*, 2-36, https://doi.org/10.1080/09638199.2022.2079709

Yujun, L. (2014). Winsor2: Stata module to winsorize data. Retrieved from https://ideas.repec.org/c/boc/bocode/s457765.html

Research in Applied Economics
ISSN 1948-5433
2024, Vol. 16, No. 1

Appendix - GPS specification B

Table A1. Dose-response functions for different outcome variables

Outcome variable	*GDP per capita in 2018*	*GDP per capita in 2017*	*GDP per capita in 2016*	*Average GDP per capita (2017-2018)*	*Average GDP per capita (2016-2017-2018)*
Treatment	-6.6546***	-6.7099***	-6.7136***	-6.6823***	-6.6927***
	(-2.21)	(-2.25)	(-2.26)	(-2.23)	(-2.24)
Treatment^2	0.0011***	0.0011***	0.0011***	0.0011***	0.0011***
	(2.71)	(2.72)	(2.67)	(2.71)	(2.70)
GPS	-29998.90	-31447.31	-45747.28	-30723.11	-31562.50
	(-0.65)	(-0.68)	(-0.73)	(-0.67)	(-0.69)
GPS^2	124276.20	131332.60	154022.90	127804.40	131688.70
	(0.80)	(0.85)	(0.91)	(0.82)	(0.85)
*Treatment*GPS*	163.21***	161.65***	23.5426***	162.43***	161.85***
	(6.83)	(6.83)	(6.82)	(6.84)	(6.84)
Constant	2577.11	2579.12	3156.66	2578.11	2582.75
	(0.80)	(0.81)	(0.82)	(0.81)	(0.81)
R^2	0.6255	0.6180	0.6082	0.6219	0.6177
Adjusted R^2	0.6110	0.6031	0.5930	0.6072	0.6029
F(5,129)	43.09	41.73	40.05	42.43	41.69
N. Obs.	135	135	135	135	135

*Source: our elaborations. (*** indicates 99% statistical significance).*

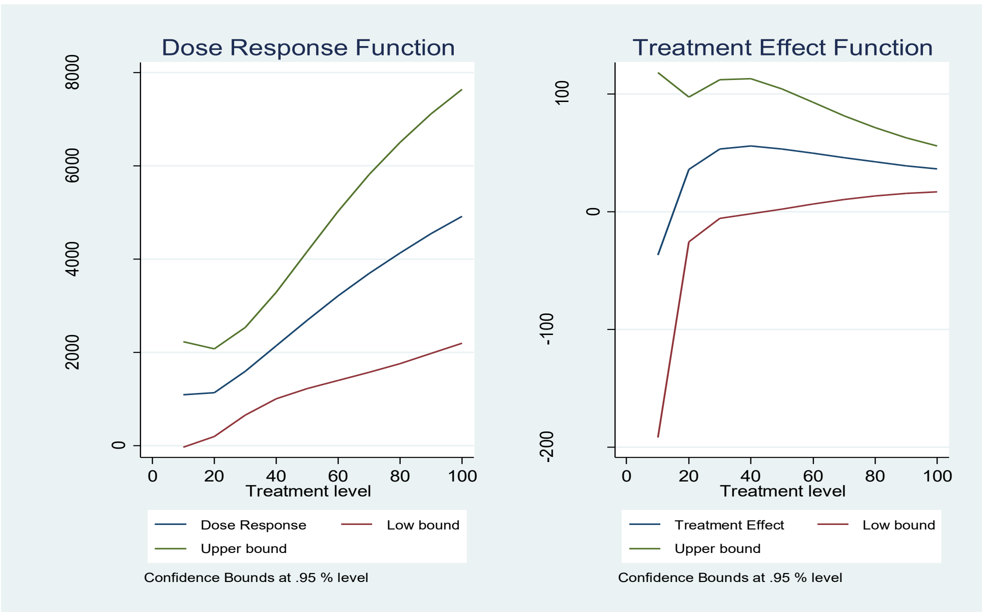

Figure A1. Dose-response and treatment effect functions for the GDP per capita in US dollars in 2018

Source: our elaborations. Number of observations = 135.

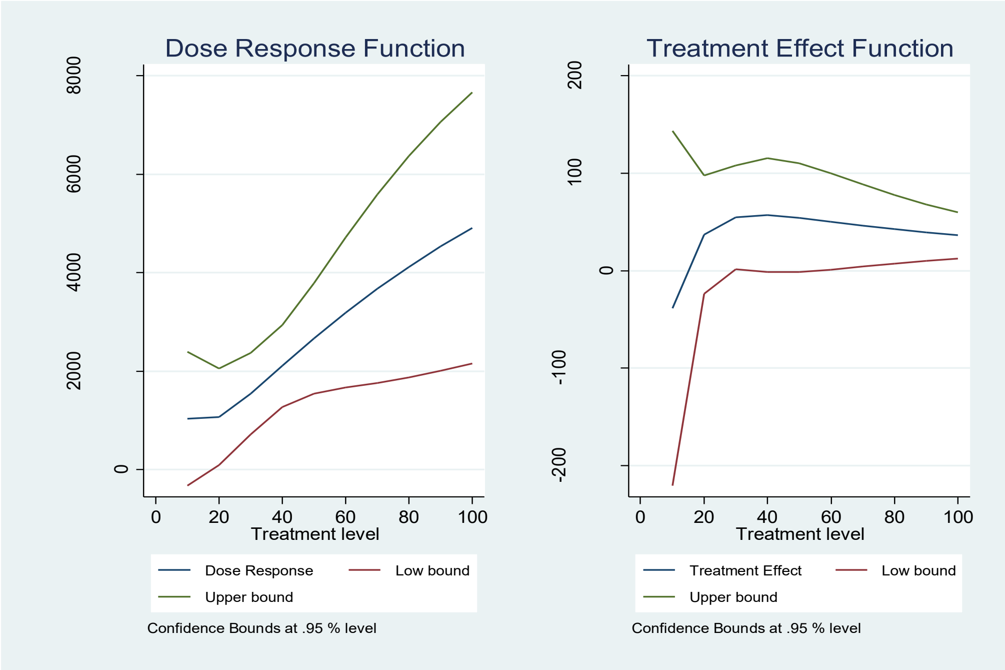

Figure A2. Dose-response and treatment effect functions for the GDP per capita in US dollars in 2017

Source: our elaborations. Number of observations = 135.

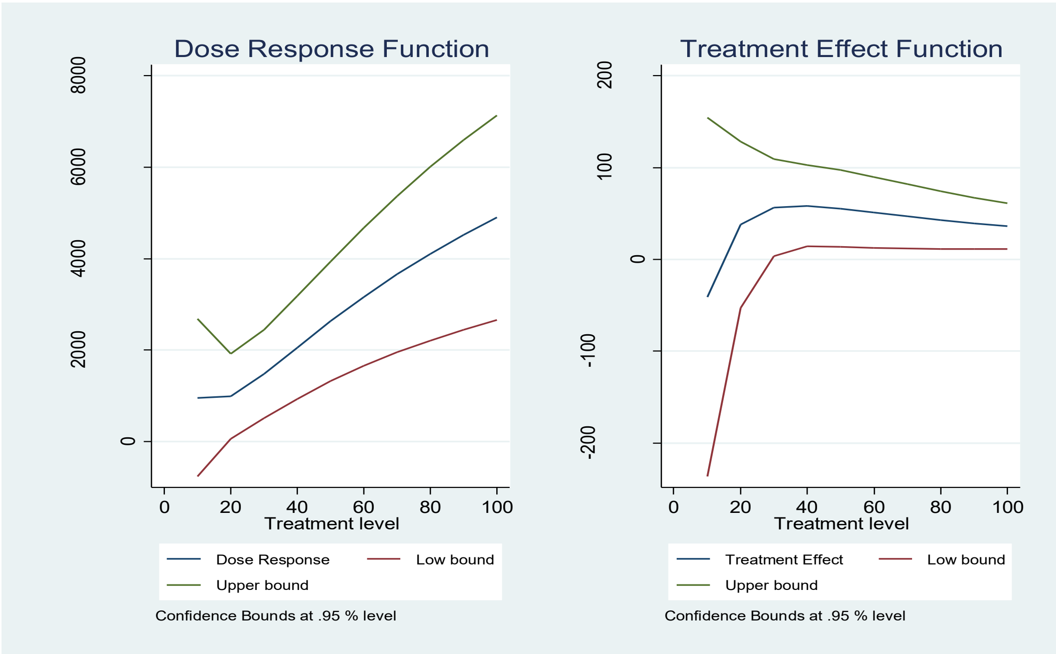

Figure A3. Dose-response and treatment effect functions for the GDP per capita in US dollars in 2016

Source: our elaborations. Number of observations = 135.

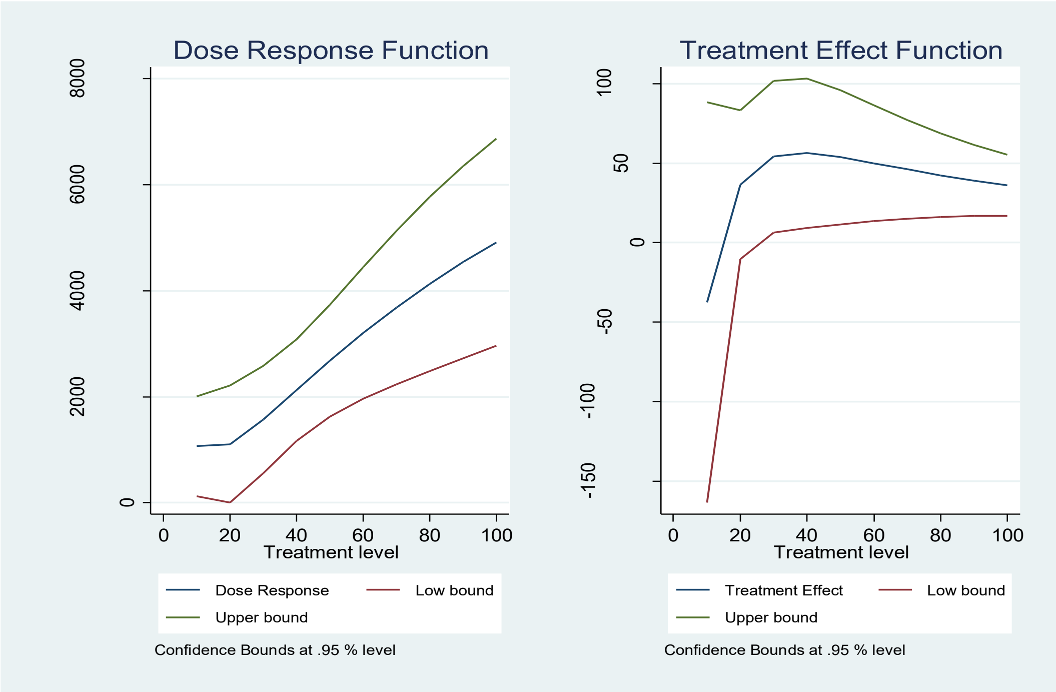

Figure A4. Dose-response and treatment effect functions for the average GDP in US dollars between 2017 and 2018

Source: our elaborations. Number of observations = 135.

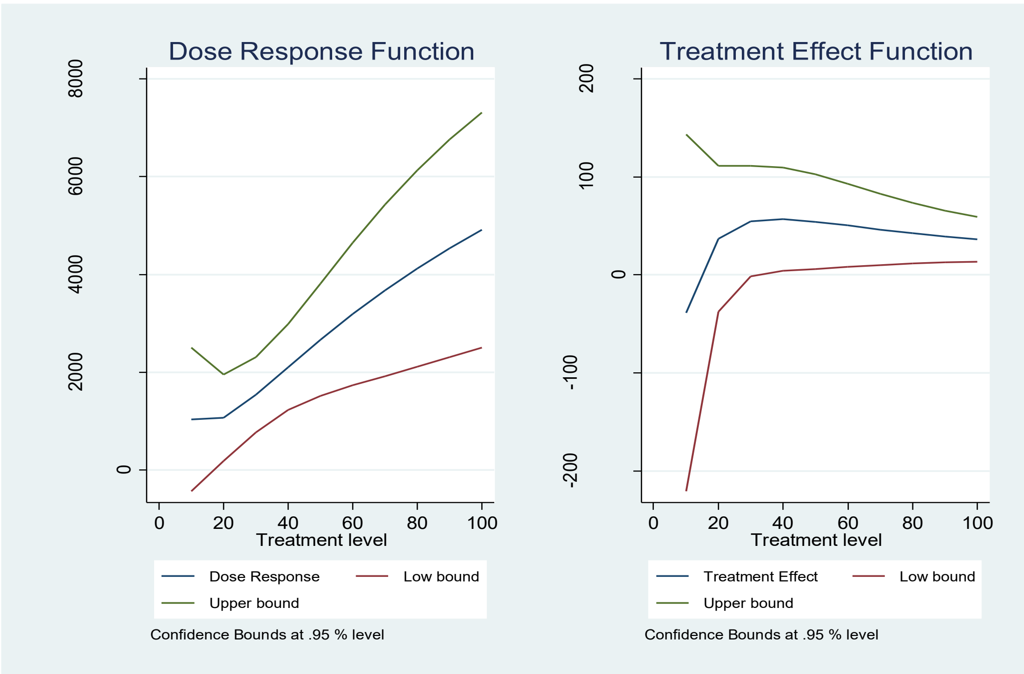

Figure A5. Dose-response and treatment effect functions for the average GDP in US dollars between 2016, 2017 and 2018

Source: our elaborations. Number of observations = 135.

Notes

Note 1. Data available on request from the authors.

Note 2. Ideally we would need to check if the effects are still in place after many years. Unfortunately data availability allows us to investigate the FDI inflows effect just for a short period of time.

Note 3. As previous explained, this means 20% of the dose of treatment, after the treatment has been rescaled to a percentage measure of the maximum dose observed.

Acknowledgments

Not applicable.

Authors contributions

The authors contributed equally to the study.

Funding

Not applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.