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Foreign direct investment and participation of developing countries in global value chains: lessons from the last decade

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ABSTRACT

This study investigates how foreign direct investment (FDI) affects the participation of developing countries in global value chains (GVCs). This inquiry is crucial as FDI is seen, at least theoretically, as a means of expediting developing countries' participation in GVCs in some ways. It provides empirical evidence of this nexus between FDI and GVC using a dynamic panel data model including 43 developing countries (2010–2019). Our results show, among other things, that FDI has a significantly positive effect on the participation of developing countries in GVCs. This is found to be the case regardless of whether the FDI is in the primary, secondary or tertiary sector. However, to benefit fully requires policymakers to strengthen the absorptive capacity of the local labour force (productivity and education level).

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1. Introduction

Since the 1980s, global value chain trade¹ has attracted both theoretical and empirical attention from scholars. However, there is a lack of consensus on the contribution of national and foreign financial capital, which provides a germane basis for continuous research and increasing scholarly attention. Early theories of trade in intermediate products commenced in the eighties with authors such as Ethier (1982), Sanyal and Jones (1982), Frankel (1985), and Helpman (1985). They generally relied on a two-country model with two or more intermediate products used to produce one or more final goods. They assumed increasing returns to scale and the differentiation of middle products. These studies addressed various topics, such as the determinants of intermediate product production and trade, and the consequences of changes in global conditions and local policies on trade in intermediate products. According to these studies, global value chain trade is explained by production factors (labour and capital), the cost of the final goods using the intermediate product, existing alternative middle products, local production (in the output tier), and international demand for the product. No reference was made to financial capital: financial institutions' domestic supply of financial assets and foreign financial supply through foreign direct investment (FDI).

These studies, mainly theoretical, were followed in the early 2000s by other studies trying to understand what drives production fragmentation (Jones 2000; Deardorff 2001; Jones and Kierzkowski 2001). According to these studies, in addition to the determinants mentioned in earlier studies, growth in output, trade in services, the cost of local services, and trade barriers are key factors in understanding global value chain trade. These studies can be considered as the first to introduce financial matters in understanding trade in parts. Financial services are embodied in traded services, and the cost of financial services is contained in the costs of services. In the same vein, FDI is considered as trade in services in mode 3. Nonetheless, it should be noted that they did not explicitly evoke financial capital, particularly FDI.

Recently, with the measurement of trade in parts or trade in middle products, there is renewed interest in trying to understand countries' global value chain trade, as well as their position in different global value chains (GVCs). Studies have introduced financial capital as a determinant of GVC participation. As stated by Gereffi and Fernandez-Stark (2016), there are four critical factors for access to GVCs: market access, access to training, coordination/cooperation, and access to finance. Access to finance is assessed through financial services (Heuser and Mattoo 2017; Miroudot 2016), financial development (Okah Efogo 2020), financial institutions' credit to the economy (Gereffi and Fernandez-Stark 2016), and FDI (Martinez-Galan and Fontoura 2019; Bezuidenhout, Grater, and Kleynhans 2018; Allard et al., 2016; Amador and Cabral 2016; WTO 2014; Baldwin 2011).

Focusing particularly on the FDI–GVCs trade nexus, some authors argue, without any empirical evidence, that FDI can catalyse the establishment of GVCs (Asmussen, Pedersen, and Petersen 2007) and serve as a structuring instrument for GVCs (UNCTAD 2020; Amador and Cabral 2016). They also state that the effects of FDI on developing countries' participation in GVCs depend on the type of value chain (Bezuidenhout, Grater, and Kleynhans 2018). Similarly, some studies observe that countries with the highest ratio of FDI to GDP have a higher participation in GVCs (Del Prete, Giovannetti, and Marvasi 2018; UNCTAD 2013). In contrast, UNCTAD (2020) showed that GVC-intensive industries are characterised by low FDI intensity. Other studies proved that GVCs explain FDI (Giroud and Mirza 2015; Jabri, Guesmi, and Abid 2013). According to Comotti, Crescenzi, and Iammarino (2020), FDI and GVC trade are complementary phenomena.

Therefore, the FDI–GVCs participation nexus appears as a controversial two-way relationship. Moreover, studies have been unable to provide a clear-cut opinion on the effects of FDIs in terms of countries' GVC trade. To tackle this problem, some authors adopted an indirect approach based on the assumption that FDI acts on the determinants of participation in GVCs through externalities and diffusion effects. FDI can promote technology transfer (Lin and Kwan 2016; Merlevede, Schoors, and Spatareanu 2014; Damijan et al. 2013; Xu and Sheng 2012; Hale and Long 2011) and enhance learning and innovation (Gereffi, Humphrey, and Sturgeon 2005; Humphrey and Schmitz 2002). FDI can also act as an incentive to increase the quality of human capital through the creation of a specific demand for labour or learning. Overall, this literature leads to the conclusion that the effects of FDI on a country's GVC trade can be positive or negative. The outcome depends not only on the strategic role played by the multinational enterprise's (MNE) division (skill-creating activities or skill-consuming activities) but also on the level of the

actors' technological development (Ha and Giroud 2015) and the country's absorption capacity (Demena and Murshed 2018; Adams 2009).

The reality in developing countries has not helped to settle the debate. Indeed, FDI in developing countries has increased in recent years, rising from less than US\$650 million in 1990 to more than US\$12,000 million in 2018. Such an evolution of FDI could be perceived as good news for these countries because of the positive externalities that are supposed to be generated, including increasing participation in GVCs. Despite the increasing amount of FDI, the participation of developing countries in global GVCs remains low (15%) compared to emerging Asia (27%) and developed countries (31%).

Similarly, less than 15% of the foreign value-added is found in developing countries' exports. This global view is mixed with a country-by-country approach. Indeed, it seems, at first glance, that developing countries receiving the highest amount of FDI enjoy the highest participation in GVCs. This is the case for China, Singapore, and Brazil. In the same vein, countries with the lowest amount of FDI participate less in GVCs. This is the case for Kuwait, Paraguay, and Mauritius. However, a thorough analysis shows that there are countries with high FDI and low participation in GVCs (such as Columbia and Korea), as well as countries with low FDI and increased participation in GVCs (e.g. Algeria and Kuwait). Moreover, Mauritius, which is the lowest country in terms of FDI inflows, has higher participation in GVCs than Korea, which is ranked eighth in terms of FDI inflows. The same observation holds between Chile (ranked sixth) and some countries with lower FDI inflows that have higher participation in GVCs (South Africa, Philippines, Venezuela, Iran).

Based on these observations and the inconclusive literature, we argue that there is a need for empirical studies to draw a conclusion on the usefulness of FDI in improving the participation and upgrading of developing countries within GVCs. This is the objective of the present study. The paper is organised as follows: Section 2 presents the empirical model, the estimation strategy, and the data. Section 3 presents the results and a discussion. The conclusions are presented in Section 4.

2. Model and data

2.1. The model

Chang and Mayer (1973) proposed the following model to explain middle product exports:

$$X_t = \bar{x} (K_t^\alpha L_t^{1-\alpha})^{1-\sigma} X_{t-1}^\sigma \quad (1)$$

where X_t is trade in value-added, K_t is capital, and L_t is labour. We then introduce financial capital by decomposing K , which involves physical capital (INV) and financial capital (F). Then the model becomes

$$X_t = \bar{x} \left(\left(INV_t^\beta F_t^{1-\beta} \right)^\alpha L_t^{1-\alpha} \right)^{1-\sigma} X_{t-1}^\sigma \quad (2)$$

Given that financial capital is made of local financial capital (FINCREDIT) and foreign financial capital (FDI), we split F and obtain the following equation:

$$X_t = \bar{x} \left(\left(\text{INV}_t^\beta \left(\text{FINCREDIT}_t^\gamma \text{FDI}_t^{1-\gamma} \right)^{1-\beta} \right)^\alpha L_t^{1-\alpha} \right)^{1-\sigma} X_{t-1}^\sigma \quad (3)$$

The model is then linearised using logarithm, and we obtain the following equation:

$$\ln(X_t) = \text{cons} + A_1 \ln(\text{INV}_t) + A_2 \ln(\text{FINCREDIT}_t) + A_3 \ln(\text{FDI}_t) + A_4 \ln(L_t) + A_5 \ln(X_{t-1}) \quad (4)$$

where $A_1 = \beta\alpha(1 - \sigma)$, $A_2 = \gamma\alpha(1 - \sigma)(1 - \beta)$, $A_3 = \alpha(1 - \sigma)(1 - \beta)(1 - \gamma)$, $A_4 = (1 - \alpha)(1 - \sigma)$, and $A_5 = \sigma$ (for more details, see the Appendix).

From that generic model, we can draw three distinct econometric models of participation in GVCs. The reason is that the literature shows that FDI can have different effects given the position in a GVC. To analyse those differentiated effects, the first model based on Aslam, Novta, and Rodrigues-Bastos (2017) work focuses on overall participation in GVCs. It is structured as follows:

$$\ln \text{GVC}_{it} = \text{cons}_{it} + A_{1it} \ln(\text{INV}_{it}) + A_{2it} \ln(\text{FINCREDIT}_{it}) + A_{3it} \ln(\text{FDI}_{it}) + A_{4it} \ln(L_{it}) + A_{5it} \ln(\text{GVC}_{it-1}) + A_{6it} W_{it} + \gamma^i + \theta_t + \varepsilon_{it} \quad (5)$$

where $\text{GVC}_{it} = \frac{\text{foreignvalue-added}(FVA) + \text{indictvalue-added}(DVX)}{\text{grossexports}}$ is a measure of the total participation of country i in GVCs at date t . W_{it} is the vector of control variables. A country can insert into a GVC either backward or forward. The second and third equations address each case with the aim to see if FDI effects depend on the position of the country in the value chain. The second model focuses on the backward participation of countries in the GVC. It is based on Allard et al. (2016), using the following expression:

$$\ln FVA_{it} = \text{cons}_{it} + B_{1it} \ln(\text{INV}_{it}) + B_{2it} \ln(\text{FINCREDIT}_{it}) + B_{3it} \ln(\text{FDI}_{it}) + B_{4it} \ln(L_{it}) + B_{5it} \ln(FVA_{it-1}) + B_{6it} Z_{it} + \gamma^j + \theta_t + \varepsilon_{it} \quad (6)$$

where FVA_{it} is the share of foreign value-added contained in the exports of the developing country i at date t . For product j in country i , FVA_{ij} is computed as the amount of imported intermediate input multiplied by the ratio $\frac{\text{exports}_j}{\text{grossoutput}}$. The total for a country is computed as $FVA_{it} = \sum_j FVA_{ijt}$ (Aslam, Novta, and Rodrigues-Bastos 2017; Koopman, Wang, and Shang-Jin 2014). It comes from UNCTAD's EORA-TiVA database (UNCTAD, 2018). Z_{it} is the vector of control variables.

The third model deals with downstream participation in the GVC. It is an expression of a country's upgrading. Kowalski and Lopez-Gonzalez (2019) model guides its writing as follows:

$$\ln DVA_{it} = \text{cons}_{it} + C_{1it} \ln(\text{INV}_{it}) + C_{2it} \ln(\text{FINCREDIT}_{it}) + C_{3it} \ln(\text{FDI}_{it}) + C_{4it} \ln(L_{it}) + C_{5it} \ln(DVA_{it-1}) + C_{6it} Y_{it} + \gamma^i + \theta_t + \varepsilon_{it} \quad (7)$$

DVA_{it} stands for the domestic value-added exported by developing country i at date t . It is computed using the intermediate goods demand matrix and final demand matrix (Casella et al. 2019; Aslam, Novta, and Rodrigues-Bastos 2017; Koopman, Wang, and

Shang-Jin 2014). This variable comes from the UNCTAD EORA-TiVA database. Y_{it} is the vector of control variables.

2.2. Data

From the above-mentioned theoretical works, we identified the control variables for each equation. The first empirical models of value chains were gravity models (Olczyk and Kordalska 2017; Allard et al., 2016) that identified two main explanatory variables: market size measured by GDP per capita ($PCGDP_{it}$) and technology. Market size determines the demand for primary, intermediate, or final goods. Therefore, exports increase with the market size. Technology allows for a greater degree of openness and, thus, greater participation downstream and/or upstream in the value chain. These two variables are expected to have a positive effect on participation in GVCs, regardless of the country's position.

To account for the effect of the quality of labour, we introduced the index of population education level ($SECONDARY_EDUC_{it}$). Adequate human capital supports the transfer of technology and knowledge, as well as the capacity to process intermediate products. Moreover, a high index is an attractive factor for FDI, which incentivises multinationals to include local companies in their production chain, leading to greater participation in GVCs. Lastly, the new theory of international trade (Melitz and Ottaviano 2008; Mélitz 2003) considers labour productivity ($LABOURPROD_{it}$). The more productive the labour force, the more trade in value-added because of competitiveness. The rationale for the financial capital variables ($FINCREDIT_{it}$, FDI_{it}) is at the core of the current study and was documented in the introduction.

Market access is an essential factor in backward participation (importing value-added). Market access is captured by the decline in the average applied tariff ($WMTARIF_{it}$) and an increase in trade openness ($OPENNESS_{it}$), measured by the sum of exports and imports as a percentage of GDP. A country will certainly import more foreign value-added if it allows access to its market and encourages the establishment of multinational companies, which are the leading players in GVCs.

Sanyal and Jones (1982) suggested that changes in local conditions and policies can affect trade in value-added. To account for this, we introduced the following coordination variables: the socio-political environment, which is a synthetic index ($GOVSCORE_{it}$) calculated using a principal component analysis based on the six indicators of Kraay et al. (WDI 2018), and a logistics variable ($ELECT_{it}$). For this set of variables, we added the growth rate of the economy (GDP_GROWTH_{it}) as a measure of production evolution. Finally, following Deardorff (2001), and to find where FDI should foster GVC participation, we introduced sectoral value-added and cross interactions of FDI and sectoral value-added ($INDUSVA_{it}$ ## FDI_{it} ; $SERVVA_{it}$ ## FDI_{it} ; $AGRIVA_{it}$ ## FDI_{it}). Table 1 provides details on the variables with their measurements, sources, and expected signs. The list of countries in the panel is provided in the Appendix. The choice was based on the availability of the requisite data.

Table 1. Details on control variables.

Variables	Variable name	Y_{it} (global participation)	Z_{it} (backward integration)	W_{it} (forward integration)	Recent usage in extant Studies	Source (database)
Trade costs	Weighted mean tariff (<i>WMTARIF</i>)	-	0	-	Amador and Cabral (2016); Bamber et al. (2014); Tinta (2017); Miroudot and Cadestin (2017)	WDI
Openness	(EXPTS+IMPTS)/GDP (<i>OPENNESS</i>)	+	+	+	World Bank, IDE-JETRO, OECD, RCGVC-UIBE & WTO (2017)	WDI
Logistic Foreign direct investments	Access to electricity (<i>ELECTRICITY</i>)	+	+	+	Amador and Cabral (2016); Bamber et al. (2014)	WDI
Manufacture value-added	Inward FDI stock (<i>FDL_IN</i>)	±	±	0	Del Prete, Giovannetti, and Marvasi (2018); Tinta (2017); UNCTADSTAT	UNCTADSTAT
Demand	Manufacture value added (<i>INDUSVA</i>)	±	+	-	Kowalski et al. (2015)	WDI
Agriculture value-added	Real per capita GDP (<i>RPGDP</i>)	±	-	+	Tinta (2017); Allard et al. (2016)	WDI
Services value-added	Agriculture value added (<i>AGRIC_VA</i>)	±	+	±	-	WDI
Governance	Services value-added (<i>SERV_VA</i>)	±	+	±	-	WDI
Physical capital	Synthetic index (<i>GOVSCORE</i>)	+	+	+	Dollar and Kidder (2017); Dollar, Ge, and Yu (2016); Miranda and Wagner (2015)	Authors' construction using PCA on WDI (2018) data
Human Capital	Gross Fixed Capital Formation (<i>INVESTMENTS</i>)	+	+	+	Deardorff (2001)	WDI
Financial credit	Labour productivity (<i>LABOURPROD</i>)	0	+	+	World Bank, IDE-JETRO, OECD, RCGVC-UIBE & WTO (2017); Deardorff (2001)	ILOSTAT
Backward participation	Credit to economy by the financial sector (<i>FINCREDIT</i>)	+	+	+	Allard et al. (2016); Gereffi and Fernandez-Stark (2016)	WDI
	First lag Foreign value-added participation (<i>lnFVA_{t-1}</i>)	±	±	±	Allard et al. (2016); Gereffi and Fernandez-Stark (2016); Deardorff (2001)	WDI
				+	Kowalski and Lopez-Gonzalez (2019)	UNCTAD-EORA-TVA

The authors.

2.3. Estimation strategy

We engaged in a dynamic panel data model design. The dynamic panel model has two advantages. First, the static panel regression process may omit variables which are connected to income distribution, such as cultural, historical, and economic development stages. However, these factors do not change over time. Taking differences can remove these invariants with time variables and individual unobserved effects, solving the problem of missing variables. Second, taking these differences can eliminate reverse causality. As indicated by Reuveny and Li (2003), the inclusion of lagged values helps to control for some excluded but potentially important variables in the model. In the meantime, it suggests a problem of endogeneity. This renders the ordinary least squares estimator biased and inconsistent. This bias is of great concern because of the short temporal dimensions of the dataset used. For the fixed effects estimator, the within transformation wipes out the μ_i , but $\hat{y}_{i,t}$ will still be correlated with $\vartheta_{i,t}$ even if the $\vartheta_{i,t}$ are not serially correlated. The same problem occurs with random effects and the generalised least squares estimator (Anderson and Hsiao 1982; Sevestre and Trognon 1985).

In our model specifications, endogeneity bias could arise from various sources. (1) Participation in GVCs is a persistent phenomenon, as attested by the higher correlation between GVC indicators and their respective lags (see the Appendix). Therefore, the lagged dependent variable is introduced into the model inducing a potential endogeneity bias. (2) A two-way relationship between GVC participation and FDI is hypothesised in the literature (Giroud and Mirza 2015; Jabri, Guesmi, and Abid 2013). This hypothetical simultaneity bias causes endogeneity. Another simultaneity bias may arise with economic growth and labour, since GVC participation could affect economic growth (Ignatenko, Raei, and Mircheva 2019) as well as labour (Pan 2020; Dünhaupt and Herr 2021). (3) The model is built from extant literature that is not exhaustive in terms of the explanatory variables of GVCs. This fact introduces a bias linked to the omission of relevant variables, which is a cause of endogeneity. (4) Aslam, Novta, and Rodrigues-Bastos (2017) and Nielsen (2018) underlined the potential presence of measurement errors not only because the data available in developing countries are insufficient, but also because of the use of optimisation methods to measure their participation in GVCs. These measurement errors can induce endogeneity problems.

The choice of estimator should be consistent in addressing all of these shortcomings in the data. Thus, we relied on the generalised method of moments (GMM) (Arellano and Bond 1991; Blundell and Bond 1998; Arellano and Bover 1995). The GMM estimator was adequate for our data structure (43 countries over 10 years) as well as for solving most of the problems mentioned above, including the presence of heteroskedasticity and auto-correlation across and within countries (Roodman 2009).

To ensure a robust GMM specification, we should discuss the identification and exclusion restriction issues. For identification and based on the current literature, we hypothesised that all explanatory variables are predetermined or endogenous. The unique variable that exhibits strict exogeneity is the time indicator (Roodman 2009). Therefore, we employed the *gmmstyle* for predetermined variables and *ivstyle* for the time variable. From that identification strategy, it follows that the exclusion restriction assumption is assessed with the Hansen J test. The exclusion restriction assumption is adequate if we accept the null hypothesis ($p > 0.05$).

3. Results and discussion

The findings showed that increased FDI inflows induces higher participation by developing countries in GVCs (Table 2). Moreover, FDI has a positive effect on the overall participation of developing countries in GVCs and on the positioning of these countries as forward (DVA) or backward (FVA). Nonetheless, it should be acknowledged that the most important effect is on backward participation (FVA). The relationship between FDI and participation in GVCs is linear and positive. Concerning the issue of FDI orientation, the results (Table 2) showed that FDI should be attracted to all sectors with a higher effect of FDI in the agricultural sector. The following sub-sections provide more details on the statistical and econometric levels.

3.1. Statistical evidence on FDI and developing countries' participation in GVCs

Looking at the data, one may conclude that the participation of developing countries in GVCs has increased steadily since 1990 (Figure 1(a)). It is also noted that the forward position (DVA) improved faster and more significantly than backward positioning (FVA). This implies that developing countries are increasingly exporting international circuit products to which they have added some value. At the same time, FDI increased at almost the same speed in terms of value (Figure 1(b)). On the other hand, the ratio of FDI/GDP increased until the beginning of the financial crisis in 2007–2008. From the crisis onwards, there was a gradual decline in the ratio of FDI/GDP in developing countries. Over the entire period, FDI represented less than 5% of the GDP of developing countries. Additionally, the highest average FDI/GDP ratios were observed in countries receiving the highest amounts of FDI, such as Singapore (15.6%) and Chile (5.76%), as well as in countries with lower FDI inflows, such as Panama (6.48%), Vietnam (5.89%), and Bahrain (5.41%). Simultaneously, we observed the lowest FDI/GDP ratios in countries receiving high amounts of FDI, such as Korea (0.98%), as well as in countries receiving small amounts of FDI, such as Kuwait (0.45%), Bangladesh (0.87%), and Algeria (0.92%).

The observations in Figure 1(a,b) suggest that there is a positive correlation between the amount of FDI and the participation of developing countries in GVCs. Furthermore, the effect of FDI is more important in promoting forward positioning. However, the ratio of FDI/GDP would not be a relevant explanatory variable for the evolution of developing countries' participation in GVCs.

Figure 2(a-c) provide evidence for this, showing that there is a positive relationship between growth in FDI inflows and country participation in GVCs between 1990 and 2018. However, there are also specific situations that raise questions. For example, some countries with very low FDI inflows ($\ln(FDI) < 0$) enjoy participation in GVCs similar to or higher than in countries with high levels. As stated in the introduction, this is the case for Algeria, Kuwait, and Mauritius, for example. Another observation is that countries with a similar level of FDI do not have the same level of participation in GVCs. In the graphs, for example, between $\ln(FDI) = 5$ and $\ln(FDI) = 10$, different levels of GVC trade can be seen.

Table 2. Effects of FDI on developing countries' participation in global value chains.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	LGVC	LGVC	LGVC	LGVC	LFVA	LFVA	LFVA	LFVA	LFVA	LDVA	LDVA	LDVA
FDI	0.252*** (0.0149)	0.235*** (0.0178)	0.394*** (0.0218)	0.198*** (0.0302)	0.420*** (0.0180)	0.397*** (0.0214)	0.497*** (0.0250)	0.434*** (0.0338)	0.121*** (0.0151)	0.108*** (0.0171)	0.328*** (0.0214)	0.194*** (0.0295)
Ln(OPENNESS)	-1.180*** (0.0309)	-1.303*** (0.0376)	-1.276*** (0.0427)	-1.312*** (0.0440)	-0.821*** (0.0372)	-0.981*** (0.0452)	-0.964*** (0.0488)	-0.976*** (0.0492)	-1.347*** (0.0312)	-1.445*** (0.0361)	-1.407*** (0.0419)	-1.431*** (0.0429)
Ln(INVESTMENTS)	1.718*** (0.0463)	1.841*** (0.0557)	1.686*** (0.0637)	1.835*** (0.0672)	1.540*** (0.0558)	1.700*** (0.0669)	1.603*** (0.0728)	1.808*** (0.0751)	1.808*** (0.0468)	1.905*** (0.0533)	1.690*** (0.0625)	1.792*** (0.0656)
ELECTRICITY	0.0985*** (0.0163)	0.0616*** (0.0195)	0.0886*** (0.0222)	0.128*** (0.0231)	0.145*** (0.0196)	0.0966*** (0.0235)	0.114*** (0.0254)	0.126*** (0.0259)	0.0725*** (0.0165)	0.0434*** (0.0187)	0.0810*** (0.0218)	0.108*** (0.0226)
Ln(FINCREDIT)	0.344*** (0.0167)	0.350*** (0.0198)	0.459*** (0.0232)	0.469*** (0.0239)	0.421*** (0.0201)	0.430*** (0.0238)	0.498*** (0.0266)	0.501*** (0.0267)	0.361*** (0.0169)	0.366*** (0.0190)	0.518*** (0.0228)	0.524*** (0.0233)
Ln(SECONDARY_EDUC)	0.762*** (0.0379)	0.742*** (0.0451)	0.612*** (0.0516)	0.628*** (0.0529)	0.989*** (0.0456)	0.962*** (0.0541)	0.881*** (0.0589)	0.886*** (0.0592)	0.916*** (0.0383)	0.900*** (0.0432)	0.720*** (0.0506)	0.731*** (0.0517)
GDP GROWTH	0.0172*** (0.00416)	0.00844* (0.00499)	0.0166*** (0.00567)	0.0254*** (0.00589)	0.0284*** (0.00502)	0.0171*** (0.00599)	0.0222*** (0.00648)	0.0250*** (0.00659)	0.0162*** (0.00421)	0.00933* (0.00478)	0.0206*** (0.00556)	0.0266*** (0.00575)
Ln(PCGDP)	-0.733*** (0.0292)	-0.891*** (0.0362)	-0.509*** (0.0457)	-0.478*** (0.0470)	-0.652*** (0.0352)	-0.858*** (0.0435)	-0.618*** (0.0523)	-0.609*** (0.0526)	-0.706*** (0.0295)	-0.831*** (0.0347)	-0.300*** (0.0449)	-0.279*** (0.0459)
Ln(LABOUR PRODUCTIVITY)	1.696*** (0.0307)	1.831*** (0.0376)	1.537*** (0.0453)	1.461*** (0.0472)	1.303*** (0.0370)	1.478*** (0.0452)	1.294*** (0.0518)	1.270*** (0.0528)	1.698*** (0.0310)	1.804*** (0.0360)	1.396*** (0.0445)	1.344*** (0.0460)
WMTARIFF		-0.497*** (0.0324)	-0.667*** (0.0378)	-0.689*** (0.0389)		-0.645*** (0.0389)	-0.751*** (0.0432)	-0.758*** (0.0435)		-0.392*** (0.0310)	-0.628*** (0.0371)	-0.644*** (0.0380)
GOVERNANCE			-0.0753*** (0.00395)	-0.0854*** (0.00418)			-0.0471*** (0.00451)	-0.0504*** (0.00468)			-0.105*** (0.00387)	-0.112*** (0.00408)
FDI/GOVERNANCE			1.52e-06*** (1.58e-07)					4.89e-07*** (1.76e-07)				1.04e-06*** (1.54e-07)
Observations	429	429	429	429	429	429	429	429	429	429	429	429
Number of Id	43	43	43	43	43	43	43	43	43	43	43	43
Number of Instruments	19	20	22	22	19	21	22	22	19	20	22	22
Arellano-Bond test for AR(1) P - value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Arellano-Bond test for AR(2) P - value	0.64	0.88	0.52	0.25	0.21	0.69	0.52	0.41	0.68	0.69	0.67	0.47
Sargan test P-Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Hansen J test P-Value	0.24	0.18	0.35	0.12	0.20	0.19	0.32	0.31	0.28	0.29	0.27	0.27

The authors.

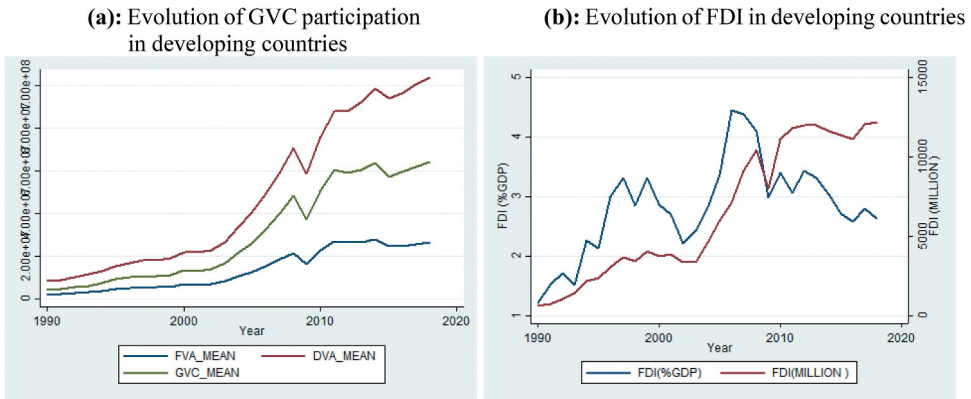


Figure 1. (a) Evolution of GVC participation. (b) Evolution of FDI in developing countries. Source: The authors' using UNCTAD-EORA data Source: The authors' using UNCTADStat data

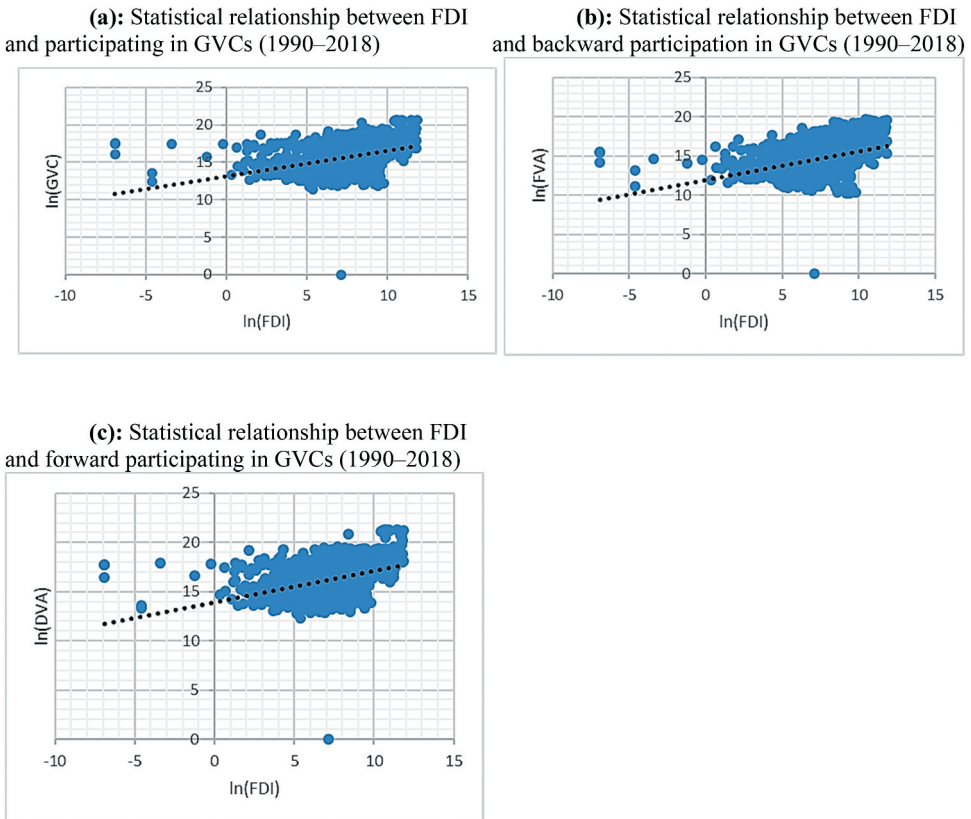
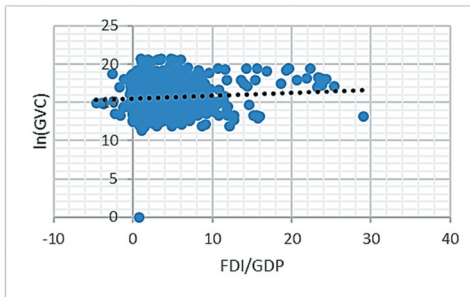
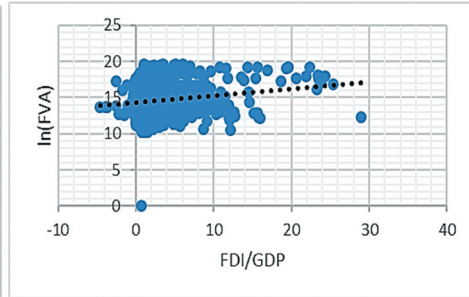


Figure 2. (a) Statistical relationship between FDI and participating in GVCs (1990–2018). (b) Statistical relationship between FDI and backward participation in GVCs (1990–2018). (c) Statistical relationship between FDI and forward participating in GVCs (1990–2018). Source: The authors' using UNCTADStat data.

(a): Statistical relationship between FDI share in GDP and forward participation in GVCs (1990–2018)



(b): Statistical relationship between FDI share in GDP and backward participation in GVCs (1990–2018)



(c): Statistical relationship between FDI share in GDP and participation in GVCs (1990–2018)

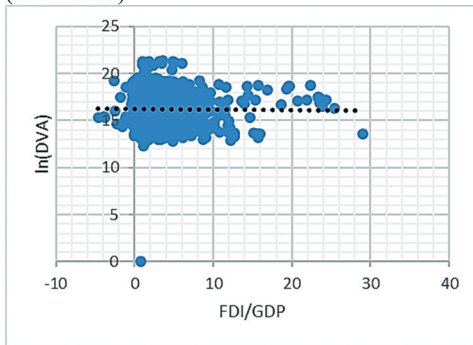


Figure 3. (a) Statistical relationship between FDI share in GDP and forward participation in GVCs (1990–2018). (b) Statistical relationship between FDI share in GDP and backward participation in GVCs (1990–2018). (c) Statistical relationship between FDI share in GDP and participation in GVCs (1990–2018). Source: The authors' using UNCTADStat data

Regarding the relationship between the ratio of FDI/GDP and participation in GVCs, it appears that the slopes are less significant (Figure 3). The link seems weak, except for backward positioning (FVA). Moreover, a high dependence on FDI improves backward participation in GVCs (FVA), while it impedes upgrading within GVCs, as ascertained by the negative effect of the ratio of FDI/GDP on forward positioning (DVA). UNCTAD (2020) provides a detailed explanation of this observation through an analysis of FDI intensity in GVCs.

The set of observations seems to corroborate the hypothesis of a positive correlation between the volume of FDI and a country's trade in GVCs, on the one hand, and between the ratio of FDI/GDP and participation in GVCs, on the other hand. Nonetheless, it is important to note that the more a country depends on FDI (a high ratio), the less it is upgrading in GVCs. It specialises in backward activities. Based on these observations and given the evidence of potential negative effects in the literature, it is important to test the existence of a non-linear relationship. The Simonsohn's test (Simonsohn 2018) results

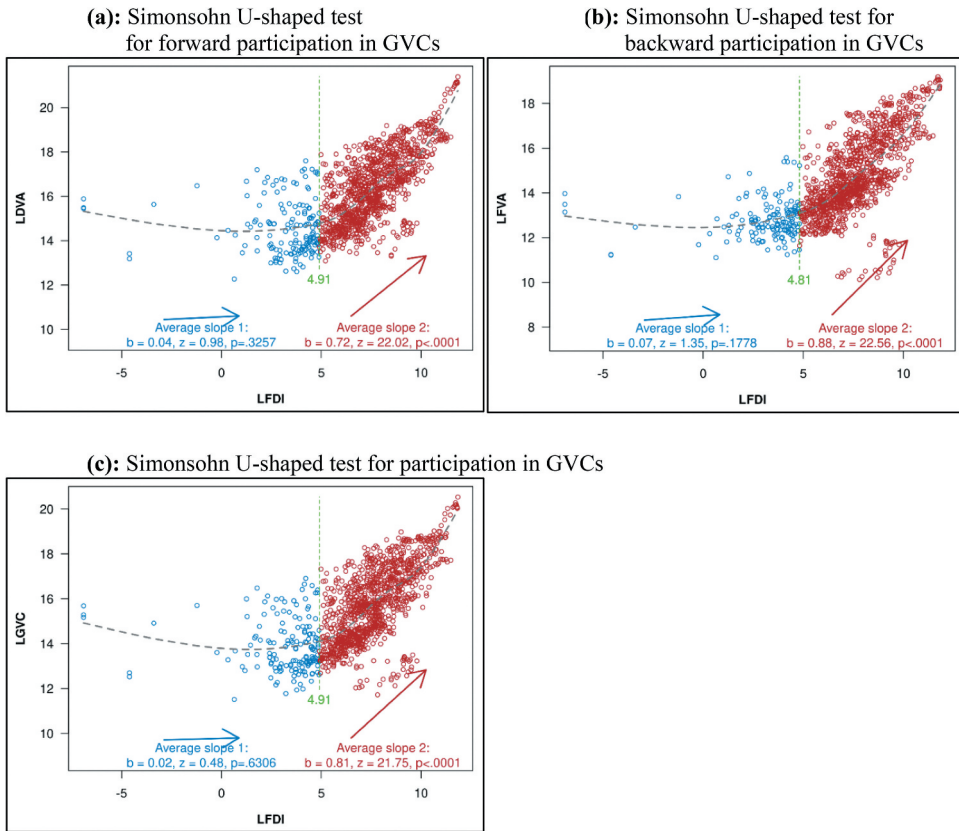


Figure 4. (a) Simonsohn U-shaped test for forward participation in GVCs. (b) Simonsohn U-shaped test for backward participation in GVCs. (c) Simonsohn U-shaped test for participation in GVCs. Source: <http://webstimate.org/twolines>.

presented in Figure 4(a-c) show that the hypothesis of a non-linear relationship is not relevant in developing countries. Increased FDI amounts lead to increased country GVC trade. Indeed, the two slopes do not have opposite signs, and the first one is not significant. However, the test seemed to suggest that FDI starts to have a significant effect when it reaches the critical value of US\$135.639 million for global GVC participation as well as forward participation, and the critical amount of US\$122.732 million for backward participation. The test was also performed for the ratio of FDI/GDP . The results also identified the critical value for a significant effect.

The country-by-country analysis revealed that actual FDI should have a significant positive effect in all developing countries, given that average FDI inflows were higher than the critical values. Overall, the statistical analyses allowed the identification of critical values for the effectiveness of FDI in developing countries. They also showed that the relationship is linear and positive. They partially validated the observation of UNCTAD (2013) that countries with high FDI/GDP ratios tend to have higher involvement in GVCs. Specifically, they provided evidence that a high dependence on FDI

impedes upgrading within GVCs. These observations were corroborated by the econometric analysis.

3.2. Lessons from the econometric analysis

The econometric analysis proved that FDI supports the greater participation of developing countries in GVCs. Indeed, an increase in FDI inflows leads to higher participation of developing countries in GVCs, regardless of their position. Table 2 shows that a 10% increase in FDI inflows leads to an increase of 2.5% in GVC, 4.5% in FVA, and 1.5% in DVA. The effect is higher when we consider governance matters. These results corroborate those obtained from the statistical analysis. Since, on average, developing countries received more than US\$122 million inflows of FDI, the effect is supposed to be positive. They also validated the hypothesis of Asmussen, Pedersen, and Petersen (2007) and Amador and Cabral (2016) for GVC, and those of Newman et al. (2015) and Farole and Winkler (2014) for backward involvement. In particular, Farole and Winkler stated that FDI should have a demand effect (demand for inputs and local intermediate products and services) and an assistance effect, including technological upgrading, quality, and standards (Ejemeyovwi, Osabuohien, and Bowale 2020; Karakara and Osabuohien 2020).

The model is well specified, as ascertained by the specification tests. First, we used the Arellano-Bond test for zero autocorrelation in first-differenced errors. This test checks whether the moment conditions are valid. The first-order serial correlation test rejected the null hypothesis, whereas the result of the second-order test did not reject the null hypothesis. Therefore, the moment condition is valid. Second, we conducted the Hansen J test, which tests the overidentification hypothesis. The Hansen J test relies on the assumption that the error term should not be correlated with all exogenous variables if the instruments are valid. As shown in Table 2, there is no misspecification because the p values are greater than 0.05.

The results displayed in Table 2 highlight the importance of most of the control variables. Indeed, physical capital (*INVESTMENTS*), logistics (*ELECTRICITY*), trade barrier reduction (*WMTARIFF*), labour (*SECONDARY_EDUC*), labour productivity (*LABOURPROD*), and increasing production (*GDP GROWTH*) are critical for countries' participation in GVCs at all positions. The highest contributions to GVC participation come from physical capital and labour productivity, of which a 10% increase leads, on average, to more than a 12% increase in GVC participation, either backward or forward. Developing countries should thus focus their efforts on adequate investments and labour productivity.

However, Table 2 presents some challenging and counterintuitive results. Greater trade openness (*OPENNESS*), increasing country revenue (*PCGDP*), and governance (*GOVERNANCE*) have a negative effect on developing countries' participation in GVCs. The negative effect of governance is in line with the extant literature (Dollar and Kidder 2017; Allard et al., 2016; Dollar, Ge, and Yu 2016; Miranda and Wagner 2015). The negative effect of an increasing country revenue (*PCGDP*) corroborates Allard et al.'s (2016) results on backward participation in countries where the GDP per capita is lower than \$22,000. Finally, the negative effect of openness on GVCs supports the findings of Koopman, Wang, and Shang-Jin (2014) and Johnson and Noguera (2017).

Table 3. Sectoral repartition of FDI in selected countries in 2018 (million US\$).

Country	GVC rank over 45 countries	FDI in primary sector	FDI in secondary sector	FDI in tertiary sector	FDI ranking over 45 countries
China	(1)	2050.00	41,190.00	93,640.00	(1)
Columbia	(22)	4142.62	1309.81	6082.68	(12)
Philippines	(10)	28.97	1166.02	2090.30	(21)
Chile	(18)	-2816.56	-317.15	18,807.49	(6)
Mauritius	(42)	0.47	27.38	484.02	(45)
Korea, Rep.	(44)	-26.92	5284.84	8040.9	(8)

Source: www.investmentmap.org

In sum, the econometric results allow the following conclusion: increasing FDI induces a deeper participation by developing countries in GVCs, either backward or forward. These countries should also work to improve labour productivity and physical capital. Thus, the question remains: Where should FDI go for better participation in GVCs?

To answer this question, we first observed data on sectoral FDI, as summarised in Table 3. The variables for selected countries between 2014 and 2018 (see Table 3) illustrated that the bulk of FDI was directed to the tertiary sector. This is consistent with the UNCTAD (2020) observation that services have gained importance in international production during the last decade. The sector with the lowest share was the primary sector, except in Colombia, which was in the second quarter in terms of participation in GVCs. This general finding held true both in countries with a high level of participation in GVCs (China and the Philippines) and in those with a low degree of participation (Mauritius and Korea). This finding suggests that the recipient sector is not important.

To prove this, we introduced the interaction variables ($INDUSVA_{it} \## FDI_{it}$; $SERVVA_{it} \## FDI_{it}$; $AGRIVA_{it} \## FDI_{it}$). This writing with the $\##$ sign allowed us to have the individual effects of the variables and the effect of the interaction. It also made it possible to calculate the marginal effects of FDI on participation in GVCs at different levels of wealth creation in various sectors. The results are listed in Table 4, which shows that, regardless of the sector receiving FDI, a 1% increase in FDI induces a 0.03% increase in participation in GVCs.

To assess the overall relevance of that conclusion, we computed the marginal effects and found that at any level of sectoral value-added, FDI had a positive effect on GVC participation. In addition, FDI in the agricultural and manufacturing sectors channels the outcomes of those sectors toward the integration of developing countries into GVCs. This is more evident because GVCs are not elastic to wealth creation in these sectors (Table 2, Column 1). The analysis of the interaction effects did not alter the results in Table 2, but gave a new finding that increasing FDI in different sectors of the economy has the same effect.

4. Conclusion

The recent World Investment Report (UNCTAD 2020) noted some specificities in the last decade. In particular, there was a slowdown in FDI and GVCs trade compared to the last 20 years of rapid growth. Moreover, services gained more importance in international relationships, and the financial component of FDI expanded. As FDI and GVCs trade represents excellent opportunities for industrialisation, economic upgrading, and perhaps sustainable development, it seems important to understand their empirical link.

Table 4. FDI sectoral impact on global value chains.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LGVC	LGVC	LGVC	LFVA	LFVA	LFVA	LDVA	LDVA	LDVA
Ln(AGRIC_VA)	-0.00196 (0.0137)			0.0273* (0.0148)			0.0928*** (0.0120)		
c.Ln(AGRIC_VA)#c.Ln(FDI)	0.0289*** (0.000580)			0.0296*** (0.000624)			0.0241*** (0.000508)		
Ln(OPENNESS)	0.612*** (0.0388)	0.451*** (0.0438)	0.500*** (0.0340)	1.069*** (0.0417)	0.815*** (0.0438)	0.936*** (0.0378)	0.388*** (0.0340)	0.126*** (0.0361)	0.260*** (0.0301)
ELECTRICITY	0.0858*** (0.0218)	0.0305 (0.0244)	0.203*** (0.0206)	0.136*** (0.0235)	0.0795*** (0.0246)	0.238*** (0.0229)	0.128*** (0.0192)	0.0790*** (0.0203)	0.251*** (0.0182)
Ln(FINCREDIT)	0.0601*** (0.0228)	0.152*** (0.0253)	-0.0178 (0.0213)	0.0389 (0.0245)	0.159*** (0.0258)	-0.0241 (0.0237)	0.110*** (0.0200)	0.217*** (0.0213)	0.0222 (0.0189)
Ln(SECONDARY EDUC)	0.322*** (0.0523)	0.494*** (0.0581)	0.292*** (0.0459)	0.462*** (0.0563)	0.657*** (0.0590)	0.490*** (0.0511)	0.323*** (0.0459)	0.480*** (0.0487)	0.315*** (0.0407)
Ln(PCGDP)	-0.449*** (0.0447)	-0.587*** (0.0521)	-0.577*** (0.0385)	-0.506*** (0.0482)	-0.578*** (0.0515)	-0.675*** (0.0429)	-0.155*** (0.0392)	-0.207*** (0.0424)	-0.323*** (0.0341)
Ln(LABOUR_PRODUCTIVITY)	1.007*** (0.0482)	1.000*** (0.0596)	0.751*** (0.0462)	0.640*** (0.0519)	0.606*** (0.0597)	0.433*** (0.0515)	0.759*** (0.0423)	0.657*** (0.0492)	0.487*** (0.0409)
WMTARIFF	-0.499*** (0.0349)	-0.559*** (0.0401)	-0.448*** (0.0315)	-0.576*** (0.0376)	-0.605*** (0.0408)	-0.529*** (0.0351)	-0.453*** (0.0306)	-0.474*** (0.0336)	-0.391*** (0.0279)
GOVERNANCE	-0.0649*** (0.00395)	-0.0855*** (0.00446)	-0.0601*** (0.00356)	-0.0242*** (0.00426)	-0.0508*** (0.00438)	-0.0241*** (0.00396)	-0.0838*** (0.00347)	-0.107*** (0.00361)	-0.0794*** (0.00315)
Ln(MANUF_VA)		0.0144 (0.0195)			0.0538*** (0.0194)			0.158*** (0.0160)	
c.Ln(MANUF_VA)#c.Ln(FDI)		0.0297*** (0.000710)			0.0286*** (0.000684)			0.0223*** (0.000564)	
Ln(SERV_VA)			0.222*** (0.0168)			0.229*** (0.0187)			0.334*** (0.0149)
c.Ln(SERV_VA)#c.Ln(FDI)			0.0215*** (0.000538)			0.0227*** (0.000599)			0.0167*** (0.000477)
Observations	429	420	429	429	429	429	429	429	429
Number of id	43	43	43	43	43	43	43	43	43
Number of Instruments	18	18	18	18	18	18	18	18	18
Arellano-Bond test for AR(1) P - value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arellano-Bond test for AR(2) P - value	0.16	0.22	0.11	0.24	0.43	0.17	0.19	0.22	0.12
Sargan test P - Value	0.003	0.004	0.003	0.001	0.001	0.004	0.004	0.003	0.005
Hansen J test	0.26	0.32	0.21	0.14	0.23	0.27	0.29	0.32	0.12

The authors.

To the best of our knowledge, our research is one of the first to propose an empirical assessment of the FDI–GVCs nexus.

We used a panel of 43 developing countries for the period 2010–2019. The empirical evidence, based on the generalised method of moments in the system, established the following findings. First, FDI should reach a critical value of US\$135.639 million to have a positive and significant effect on GVCs. At this level, FDI is a means of promoting deeper involvement and upgrading in value chains and international trade. Second, for backward participation, the critical value is US\$122.732 million. Third, independent of the recipient sector, increasing FDI leads to an increase in GVCs trade.

Beyond these results, we identified some transmission mechanisms. For backward participation, FDI is considered as trade in services in mode 3 (commercial presence). In this vein, policymakers should incentivise enterprises to formalise and support their upgrading to the ‘best practices’ standards. Regarding forward participation, the main effects are positive externalities. Indeed, forward participation is related to the export of intermediate or final goods and services that have undergone substantial transformation in developing countries. FDI can contribute to forward participation through technology and learning externalities. If externalities are appropriately absorbed and transformed into productive benefits, FDI would effectively contribute to the industrialisation of production and the upgrading of countries in GVCs.

Based on these mechanisms, we have some policy recommendations. First, policymakers should work to create or strengthen the absorptive capacity of the local labour force (productivity and education level); that is, people able to learn and replicate what has been learned in terms of know-how and technology. Second, following Sabir, Rafique, and Abbas (2019), they should work to attract FDI in technological projects to increase the use of technology in the production process, which can contribute to process upgrading. Third, they should incorporate FDI into educational projects to enhance the absorptive capacities of the local workforce as well as labour productivity. Fourth, they should tackle the problem of service quality to incentivise MNEs to insert their enterprises into their production network.

Note

1. Sometimes referred to in the literature as trade in parts, trade in value-added, or trade in intermediate products.

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Appendix

(I) COUNTRIES IN THE PANEL (44)

Algeria	Ecuador	Paraguay	Saudi Arabia
Argentina	Egypt, Arab Rep.	Peru	Singapore
Bahrain	El Salvador	Kuwait	South Africa
Bangladesh	Guatemala	Malaysia	Sri Lanka
Bolivia	Honduras	Mauritius	Tanzania
Brazil	India	Mexico	Thailand
Chile	Indonesia	Morocco	Tunisia
China	Iran, Islamic Rep.	Nigeria	Turkey
Colombia	Jordan	Pakistan	Uruguay
Costa Rica	Kenya	Panama	Venezuela, RB
Dominican Republic	Korea, Rep.	Philippines	Vietnam

(II) MODEL DEVELOPMENT

$$\ln(X_t) = \ln(\bar{x}) + \ln\left(\left(\left(\left(\text{INV}_t^\beta (\text{FINCREDIT}_t^\gamma \text{FDI}_t^{1-\gamma})^{1-\beta}\right)^\alpha L_t^{1-\alpha}\right)^{1-\sigma}\right) + \ln(X_{t-1}^\sigma)$$

$$\leftrightarrow \ln(X_t)$$

$$= \ln(\bar{x}) + (1 - \sigma)\ln\left(\left(\text{INV}_t^\beta (\text{FINCREDIT}_t^\gamma \text{FDI}_t^{1-\gamma})^{1-\beta}\right)^\alpha\right) + (1 - \sigma)\ln(L_t^{1-\alpha}) + \ln(X_{t-1}^\sigma)$$

$$\leftrightarrow \ln(X_t)$$

$$= \ln(\bar{x}) + \alpha(1 - \sigma)\ln(\text{INV}_t^\beta) + \alpha(1 - \sigma)\ln(\text{FINCREDIT}_t^\gamma \text{FDI}_t^{1-\gamma})^{1-\beta} + (1 - \sigma)\ln(L_t^{1-\alpha}) + \ln(X_{t-1}^\sigma)$$

$$\leftrightarrow \ln(X_t)$$

$$= \ln(\bar{x}) + \beta\alpha(1 - \sigma)\ln(\text{INV}_t) + \alpha(1 - \sigma)(1 - \beta)\ln(\text{FINCREDIT}_t^\gamma) + \alpha(1 - \sigma)(1 - \beta)\ln(\text{FDI}_t^{1-\gamma}) + (1 - \alpha)(1 - \sigma)\ln(L_t) + \sigma\ln(X_{t-1})$$

$$\begin{aligned} &\leftrightarrow \ln(X_t) \\ &= \ln(\bar{x}) + \beta\alpha(1 - \sigma)\ln(INV_t) + \gamma\alpha(1 - \sigma)(1 - \beta)\ln(FINCREDIT_t) \\ &\quad + \alpha(1 - \sigma)(1 - \beta)(1 - \gamma)\ln(FDI_t) + (1 - \alpha)(1 - \sigma)\ln(L_t) + \sigma\ln(X_{t-1}) \end{aligned}$$

$$\leftrightarrow \ln(X_t) = \text{cons} + A_1\ln(INV_t) + A_2\ln(FINCREDIT_t) + A_3\ln(FDI_t) + A_4\ln(L_t) + A_5\ln(X_{t-1})$$

These developments allow identification of elasticities so that: $\sigma = A_5$; $\alpha = 1 - \frac{A_4}{1-A_5}$; $\beta = \frac{A_1}{1-A_5-A_4}$; $\gamma = \frac{A_2}{1-A_5-A_4-A_1}$

For all those elasticities to exist A_5 should not be equal to 1, $A_5 + A_4$ should not be equal to 1 and $A_5 + A_4 + A_1$ should be equal to 1. These restrictions are then inserted in estimation.

(I) CORRELATION TESTS FOR GVCs VARIABLES AND THEIR LAGS

	GVC_{t-1}	FVA_{t-1}	DVA_{t-1}
GVC	0.9706*		
FVA		0.9696*	
DVA			0.9713*

(*) indicates a 5% level of significance

(I) SUMMARY STATISTICS

Variables	Obs	Mean	Std.Dev.	Min	Max
EDUC	440	.622	.111	.359	.862
CORRUPTION	440	-.256	.665	-1.468	2.217
GVTEFF	440	-.03	.639	-1.582	2.271
POLSTAB	440	-.483	.788	-2.81	1.615
REGQUAL	440	-.07	.723	-2.334	2.261
RULAW	440	-.228	.7	-2.339	1.845
VOICE_ACC	440	-.244	.729	-1.907	1.212
GOVERNANCE	440	-1.533	6.050	-18.251	19.310
FDI_GDP	440	2.996	3.398	-2.241	24.304
FDI (\$US)	440	11,002.48	22,263.27	-1180.525	139,043.5
FVA	440	2.49e+07	5.64e+07	161,000	3.40e+08
GVC	440	5.73e+07	1.34e+08	645,000	9.61e+08
DVA	440	8.94e+07	2.39e+08	668,000	1.88e+09
ELECTRICITY	440	89.346	16.939	11.2	100
FINCREDIT	440	67.526	38.938	10.152	218.308
GDPGROWTH	440	3.729	3.406	-19.621	14.526
NPCGDP	440	8974.922	10,446.08	695.217	64,581.95
L_PROD	440	38,065.92	31,212.55	4247.635	153,000
INVEST	440	23.822	6.603	11.999	45.69
WTARIF	440	5.939	3.184	.05	18.61
OPEN	440	76.877	54.56	20.723	379.099