Factors determining participation of developing countries in global value chains

Liudmila Chikhun [1], Igor Romanov [1]

1 *Faculty of Economics, Lomonosov Moscow State University, Moscow (Russia)*

Corresponding author: Liudmila Chikhun (chihun@mail.ru)

Abstract

The paper examines the key economic and institutional factors that determine the participation of developing countries in global value chains (GVCs). To assess the impact of a number of factors on the foreign value added in export of developing countries, an econometric model for 84 countries for the period 1999-2018 is used. Obtained results indicate that developing countries with higher per capita income, more developed manufacturing industry, more open economy, less administrative burden on business and those actively engaged in foreign direct investment (FDI) activities demonstrate higher upward participation in the GVCs. It is also shown that trade liberalization and investments in foreign production strengthen the positions of developing countries in the GVCs in the long term. Based on these findings, recommendations are formulated for the state policy of these countries in order to accelerate their integration into more complex stages of the GVCs.

Keywords

developing countries, foreign direct investment, global value chains, globalization, transnational corporations, upward participation in GVCs

JEL: C23, F21,F23, O12.

Introduction

International trade had been the main form of international economic relations since time immemorial but only in XV-XVI centuries it came into focus of researchers' attention. The Age of Discovery and the rise of manufacturing brought about the first theoretical concepts explaining the causes and effects of trade relations between countries. Yet, for several centuries after that, most theories, including mercantilist, classical and neoclassical, had treated international trade exclusively as the exchange of finished products, which was a natural view as all business operations involved in the production of final goods were carried out within national borders. Later, in the 1960-1970s international outsourcing of parts and components allowed transnational corporations (TNCs) from developed countries, mainly in the automobile industry, to organize their production processes across borders: this is considered the reference point for the emergence of GVCs. Yet, it was only in the 1980s, when the growing globalization of the world economy together with liberalization of capital flows and ICT revolution created favourable conditions for GVCs' expansion on a truly global scale and the share of intermediate products in international trade began to grow dramatically.

Global value chain is a form of internationalization of business activities characterized by splitting production process into separate stages carried out in different countries. It is based on cross-border production agreements between enterprises that are either part of the TNC's network or independent producers. The motives for creating GVC are diverse: access to natural resources, increased production efficiency, market expansion, and others. Krugman and Helpman (1985) point out that concentration of entire production process in one place reduces costs of coordination and management whereas fragmentation of production facilitates the leveraging of resource price advantage that results in lowering total production costs. Jones and Findlay (2000) emphasize the importance of access to raw materials and intermediate products produced in other countries for organization of domestic industrial production and trade.

There are two types of participation in GVC: participation on the production side (the descending component) and participation on the consumption side (the ascending component). The former is typical of countries integrated into raw material stages of the production process. Such countries are mainly suppliers of intermediate goods and services to the world market. The degree of top-down participation in GVC is measured as the share of domestic value added in the value of exports of other countries' products that were made using these goods and services. The second type participation means that the country purchases intermediate products from abroad for the production of finished products. In this case manufacturers of final goods within GVC framework demonstrate upward participation. An indicator of such participation is the share of foreign value added in the value of domestic exports generated by these products.

The shift to geographically fragmented production processes opened up great opportunities for companies from various countries to participate in GVCs. It is important

to note that this reorganization of international production has created prospects for participation not only of advanced countries but developing countries as well. This work focuses on the analysis of developing countries' involvement in GVCs.

Although developing countries generally demonstrate low participation rate in GVCs, most of them have been actively joining in the GVCs' activities over the past few decades. This is a good chance for them to enter international markets via joint production and thus secure sustained growth and development of the national economy. At present, the character of integration into GVCs varies across developing economies: countries of Sub-Saharan Africa and South America are mostly integrated into production chains at the primary stages with low levels of product diversification and internal value added. The developing countries of Southeast Asia are actively involved in the processing of raw materials and assembly of industrial goods. Malaysia, the Philippines and Thailand assemble computer and electronic equipment. China, Singapore and the Republic of Korea produce components for mechanical engineering products assembled in advanced countries. Indonesia is the major supplier of raw materials to the Asia-Pacific value chains (WTO, 2011). Over time, developing countries are striving to improve their positions in GVCs in order to gain more economic benefits from international fragmentation of production.

The most significant conjunctural factor determining the character of countries' participation in GVCs over the past few years is the COVID-19 pandemic. It is possible to identify at least three channels of its impact on the global supply chains (Fu, 2020). Firstly, it is the disruption of transport and logistics systems. For the globally dispersed production, stable and timely logistics is a must since a failure at any of its stages jeopardizes all subsequent activities along the chain. Secondly, the pandemic crisis led to reduction in supply of many products because of job closures, social distancing and restricted movement of people and goods. Thirdly, the pandemic had a negative impact on the activities within GVCs due to a sharp decline in demand. Thus, Asian chains producing clothing and electronic equipment suffered badly as the garment factories in Bangladesh and Sri Lanka and electronics factories in Southeast Asia faced massive cancellation of orders both from advanced and developing countries. It is important to note that developing countries, especially low-income ones, were hit hardest by the consequences of the COVID-19 pandemic, which is not surprising: production in these countries is dominated by industries that require significant physical contact of workers, such as agriculture and mining. Besides, digital infrastructure and digital competencies are not sufficiently developed in these countries and shifting activities online was often impossible.

The purpose of the study is to assess the impact of selected economic and institutional factors on the ascending-type participation of developing countries in GVCs.

The paper consists of four main sections. Section 1 is a review of literature on developing countries participation in GVCs including the impact of the COVID-19 pandemic on GVCs in developing countries. Section 2 presents the data and specification of the econometric model used by the authors. In Section 3 we describe the tests carried out to check the reliability of the data. The results of the model evaluation and their

interpretation are offered in the final section, followed by the main findings and practical recommendations.

Literature review

Today there is no universal approach to the task of explaining what determines the degree of a country's participation in global supply chains. The way countries integrate into GVCs is influenced by country-specific factors, such as geographical location, natural resource endowments, national income, economic structure, the nature of trade and economic integration agreements, openness of the economy and availability of physical and human capital. Among these factors it is possible to identify those common to countries with similar levels of development, e.g., the developing countries.

Lopez-Gonzalez (2016) found that the greater the volume of domestic demand in developing countries, the higher is the probability of their integration into GVCs. This factor is the most significant for large economies such as India and China, which, being the most densely populated countries in the world, are important sales markets for firms in many industries. Stringer and Ge (2010) have shown that, in response to the growing demand for agricultural products in South America, the agro-industrial TNCs from New Zealand are actively investing in the region, locating service segments of food value chains there and creating the base for food exports to other regions.

The degree of developing countries' participation in GVCs is also impacted by the nature of the trade policies in the FDI recipient countries. It is well known that TNCs prefer more open economies with minimal trade barriers to expand the geography of activities beyond the domestic market. Given the growing international fragmentation of production, the competitiveness of final product producer substantially depends on the import of intermediate goods and services. Protectionist barriers, therefore, undermine the development of GVCs. Slany (2019) investigated the impact of export and import tariffs on value-added trade within the region using a sample of 37 African countries over the period of 2006-2012. The author found that high import tariffs on intermediate products and capital goods along with export tariffs on raw materials hindered the development of regional value chains in Africa. Other obstacles including costs of intra-continental trade associated with lengthy customs checks, long distances between the main logistics centers, and weak transport infrastructure make it difficult to fragment production process in the region. The author concludes that in African countries integration into regional and international supply chains requires efforts to liberalize trade on the whole continent.

Many studies confirm the essential role of institutional quality in ensuring participation of developing countries in GVCs. The efficiency of public administration, rule of law and anti-corruption policies facilitate international investment in the developing countries striving to join GVCs. Poor institutional quality reduces the potential for the country's participation in global production networks. Natsuda et al. (2010) note the crucial role of the garment industry in Cambodia's economic

development in the 1990s. The industry was created mainly by TNCs with the newly industrialized countries of Asia and China as parts of their GVCs in production of clothes. However, in recent years this industry has been losing investment attractiveness because of the weak state institutions, high level of corruption and increasing activity of trade unions.

Today, the expansion of GVCs' activity in developing countries increases the demand for skilled labor in most of them. TNCs reinforce this trend by implementing professional development programs in the host economies. Farole et al. (2018) have used empirical data to show that there is a growing demand for skilled labor in the primary sector in such countries. Shepherd and Stone (2013) found a positive and statistically significant relationship between the number of skilled workers and the presence of firms involved in international activities in developing countries.

We should mention the role of public policy in developing countries aimed at promoting participation in GVCs. Gereffi et al. (2019) maintain that transition from import-substitution to export-oriented industrialization in Costa Rica in the 1980s and 1990s was one of the factors that helped the country attract high-tech FDI in assembly production on its territory. In 1998 Intel opened a factory for the assembly and testing of integrated circuits for electronic products to be exported to the United States. Arnold et al. (2016) show that India's reforms in the 1990s aimed at liberalization of banking, transport, telecommunications and insurance sectors had very important outcomes. One of these was that Indian industrial firms gained access to a wide range of foreign service providers, which allowed them to benefit from economies of scale due to international fragmentation of production. Overall, it stimulated the rise of manufacturing industry in India. In China, according to Zeng (2019), since the 1980s, its special economic zones (SEZs) have contributed to strengthening the country's position in the GVCs and thus promoted its industrialization. The strong national government together with advanced knowledge and technologies brought to the country by foreign TNCs have led to the significant expansion of China's participation in the GVCs. Other developing countries may find it worthwhile to study and use this experience.

The COVID-19 pandemic had a particularly evident impact on GVCs' activity. The rapid spread of the new coronavirus in the world economy sharply exposed the interdependencies and vulnerabilities of national economies and companies formed over the past thirty years. It caused serious violations and in some cases complete disruptions of global supply chains. There is ample research analyzing the critical changes in GVCs' functioning triggered by the new coronavirus pandemic and its implications for fragmented mode of production.

Bisson and Hambleton (2020) look into the impact of the COVID-19 pandemic on regional and global value chains in West Africa. Agri-food chains proved to be the most vulnerable to the pandemic as the market closures and curfews had made it difficult or impossible to transport food from rural areas to cities, which led to rising food prices and the loss of livelihoods of those employed in the agricultural sector. In countries like Gambia, Liberia, Mauritania, Senegal, Sierra Leone prices of agricultural

products jumped by 10-20% (Bisson and Hambleton, 2020). Since agriculture accounts for almost half of all jobs in West Africa, the COVID-19 pandemic caused a significant rise in unemployment. Disruptions in West African food supply chains still threaten food security both in the region and in many developed countries linked to West Africa via agrifood chains.

Teijlingen and Hogenboom (2020) analyze the effects of the COVID-19 pandemic on commodity supply chains in Latin America. They point out that even before the coronavirus crisis, Latin America had been experiencing economic and political instability caused by the heavy dependence of the region's economy on exports of minerals, oil and agricultural products: the average annual economic growth rate in Latin America between 2014 and 2019 was about 0.4% (Teijlingen and Hogenboom, 2020). Then the COVID-19 pandemic severely hit the supply chains of mineral and agricultural raw materials in the region. As global commodity prices plummeted after the pandemic outbreak, many Colombian and Peruvian mining companies went bankrupt, and farms sold their livestock and reduced crop production. Moreover, Latin America's main partners in primary sector trade – China and the US – decreased their demand for raw materials, which further deepened the economic crisis in the region.

One of the Southeast Asian countries worst affected by the COVID-19 pandemic is Indonesia. According to Dekker (2020), the lack of timely and adequate response to the current situation from the central government and uncoordinated actions of local authorities aggravated the economic crisis in the country. The author notes that this had the greatest impact on Indonesia's participation in Asian agricultural supply chains: domestic export-oriented palm oil production stagnated because of decreased consumption of this product in key Asian markets and quarantine-induced disruptions in the work of maritime and ground transport led to a sharp reduction in cross-border supplies of palm oil. At the same time, the mining industry demonstrated high resistance to the pandemic; as a result, in recent years Indonesia has been vigorously expanding its operation on the markets for ferrous and non-ferrous metals. Diversification of consumer markets has provided some stability to export activities.

The analysis of the main factors that contribute to developing countries' participation in GVCs reveal their different nature. While some of them are determined by the specifics of the overall macroeconomic, political and institutional environment of the host countries, others are shaped by the purposeful state policy. One possible conclusion is that it may be necessary for the government to create the conditions that would stimulate the arrival of GVCs to the national economy.

Reorganization of GVCs by international companies in response to the consequences of the COVID-19 crisis is becoming particularly relevant today. Miroudot (2020) points out that the slowdown in the activity of production fragmentation in East Asia has been going on since 2011 firstly because of the change in the structure of demand for finished products in China: its manufacturing industry increasingly relies on local suppliers of components. The second reason is the digital transformation of business leading

to the emergence of new business models that require that production be located closer to the consumer. The author notes that the pandemic reinforced this trend since the governments of many developing countries introduced incentives to localize production of components in their countries and raised tariffs on the import of raw materials. Along with rising freight rates and disruptions in transport logistics it will intensify re-shoring in East Asia. Kimura et al. (2020), based on the example of the Asia-Pacific region, show that, in order to maintain macroeconomic and financial stability in developing countries during the COVID-19 pandemic, it was necessary to provide regional coordination of trade and investment policies aimed at ensuring flexibility of global supply chains of essential medical goods and services.

Model specification and dataset compilation

This study uses data from 84 developing countries[1] for the period 1999-2018 sourced from the World Bank World Development Indicators database and UNCTAD-Eora Global Value Chain Database. All data are presented on the annual basis. The missing data points were imputed using linear interpolation, i.e. taking arithmetic average for the two neighbouring years with available data for the respective country. The period of 1999-2018 was chosen for the following reasons: first, at the end of the 1990s and in the earlier 2000s, production within GVCs was growing rapidly, thanks to high world prices of natural resources that reached their historical peaks and to the growth rates of international trade that exceeded those of the world GDP (international trade continued to grow at this pace till the early 2010's).

The second reason is purely statistical: the data on many indicators prior to 1999 are unavailable as are the data on foreign value added after 2018, which makes it impossible for this study to assess the impact of the COVID-19 pandemic. The remaining approximately 50 developing countries were not included in the sample also because of the lack of necessary data or the presence of «outliers» (which, as a rule, significantly distort the model estimates unless they are deleted from a sample beforehand). The complete dataset used is presented in Annex I.

The choice of the independent variables was based on the preliminary analysis of the existing research on the topic. All variables characterize the quality of business

---

[1]   Algeria, Angola, Argentina, the Bahamas, Bahrain, Bangladesh, Belize, Bhutan, Bolivia, Botswana, Brazil, Brunei, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Costa Rica, Democratic Republic of Congo, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gabon, Gambia, Ghana, Guatemala, Honduras, Hong Kong, India, Indonesia, Iran, Ivory Coast, Jamaica, Jordan, Kenya, Kuwait, Laos, Lebanon, Lesotho, Madagascar, Malaysia, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Qatar, Republic of Korea, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, South Africa, Sri Lanka, Tanzania, Thailand, the Seychelles, Togo, Tunisia, Turkey, UAE, Uganda, Uruguay, Vietnam, Zambia.

environment and have either macroeconomic or institutional nature. Moreover, as will be shown below, understanding the influence of these variables on developing countries' integration into GVCs will allow us to draw important conclusions about the role of public policies in promoting effective participation in the international fragmentation of production. Since there are significant differences in the character of the economies included in the sample, the study makes use of a panel analysis.

To determine the nature and extent of the impact of the chosen economic factors on the participation of developing countries in global supply chains, the following econometric model is applied:

$$\ln\left(FVA\right)_{it} = \alpha_0 + \alpha_1 \ln\left(GDP\_PERCAP\right)_{it} + \alpha_2 \ln\left(MAN\right)_{it} + \alpha_3 FDI\_OUT_{it} + \\ + \alpha_4 \ln\left(TRADE\_OPEN\right)_{it} + \alpha_5 TIME\_BUS_{it} + \mu_i + \varepsilon_{it} \tag{1}$$

Where α_0 is a constant; $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ – estimated coefficients for explanatory variables; μ corresponds for unobservable heterogeneity between developing countries; ε is an error term. Indices i and t denote the number of the country and year, respectively ($i = 1, …, 84$; $t = 1, …, 20$).

The dependent variable is the rate of upward participation in GVCs, i.e. foreign value added embodied in the country's exports (FVA). The variable GDP_PERCAP is country's per capita income that also indicates the volume and, implicitly, the structure of internal demand. The higher the GDP_PERCAP, the greater the demand for technologically sophisticated goods and services of high quality, and the lower the demand for processed raw materials; this stimulates exports of processed products used to produce final goods outside the country. The variable MAN denotes added value created in manufacturing industry – this indicator can be used as a proxy for the structure of national economy and its potential to host sophisticated production. The larger it is, the higher the degree of a country's participation in complex products manufacturing. The volume of outward FDI relative to GDP is represented by the variable FDI_OUT. It could be assumed that with the growth of outward FDI, vertical integration intensifies, and the country's participation in GVCs as a buyer of intermediate products expands, which means that the more open developing countries (TRADE_OPEN) are more attractive for the placement of production facilities by TNCs. As time required to organize business in the country (TIME_BUS) increases, the costs of foreign investment rise, impeding the country's integration into GVCs. Moreover, the last variable can be seen as a proxy for the general quality of national institutions. The variables FVA, GDP_PERCAP, MAN and TRADE_OPEN are used with natural logarithm for a more correct specification of the model. The description of all the variables can be seen in Table 1.

Scatter plots of the dependent variable and chosen regressors are presented in Appendix A1. The straight lines indicate the regression lines of the different pairwise regressions. We can conclude from their analysis that the discovered patterns are consistent with the theoretical provisions. The spread of observed values is generally uneven, which makes it necessary to use robust standard errors when estimating the model.

Table 1. Variables used in the model

Variable name	Variable description	Data source
FVA	Foreign value added embodied in country's exports (USD)	UNCTAD-Eora Global Value Chain Database
GDP_PERCAP	GDP per capita, constant prices, 2015 (USD)	World Development Indicators (2023)
MAN	Added value created in manufacturing industry, constant prices, 2015 (USD)	World Development Indicators (2023)
FDI_OUT	Net FDI outflow (in percent of GDP)	World Development Indicators (2023)
TRADE_OPEN	Sum of exports and imports of goods and services (in percent of GDP)	World Development Indicators (2023)
TIME_BUS	Time required to start business (days)	World Development Indicators (2023)

Source: compiled from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

Annexes A2 and A3 contain the main descriptive statistics and the correlation matrix of model variables, respectively. For example, the net outflow of FDI from developing countries in 1999-2018 averaged 1.07% of GDP, and it took about 38 days to go through all the stages necessary to open a business. This is dramatically different from the OECD member countries, for which the average values of the corresponding indicators for the same period were 3.23% and 22 days, respectively, highlighting the importance of these factors for accelerating the integration of developing countries into GVCs (WDI, 2023). At the same time, the correlation of explanatory variables with each other is low, except for the correlation of ln(MAN) and ln(TRADE_OPEN) with ln(GDP_PERCAP) and the correlation of ln(TRADE_OPEN) with FDI_OUT. However, this is not expected to strongly skew the coefficient estimates, since the variables ln(GDP_PERCAP), ln(MAN) and FDI_OUT are highly correlated with the dependent variable (correlation coefficients of 0.59, 0.87 and 0.33, respectively). Therefore, no significant risk of multicollinearity is expected in the model under consideration.

Further on econometric tests for stationarity and cointegration of the model variables were carried out since the use of non-stationary time series, as well as the lack of cointegration of selected variables, can lead to false results. After that, a direct evaluation of model (1) was made based on the available sample. In addition, the paper evaluated dynamic model (2) with three-period lags of explanatory variables.

Preliminary data analysis

The results of unit root tests for the variables included in the model can be seen in Table 2. For appropriate testing, the two most common stationarity panel tests

were used in the paper – LLC test and IPS test. The null hypothesis of both tests is that the series is non-stationary. The alternative hypothesis assumes that the series is stationary. The lag order of each of the variables was determined automatically by the Schwartz information criterion. The obtained results allow to reject the null hypothesis for all variables except ln(GDP_PERCAP) and ln(MAN) at the 1% significance level. So, we should conclude that ln(FVA), FDI_OUT, ln(TRADE_OPEN) and TIME_BUS series are zero-order integrated (I(0)), while ln(GDP_PERCAP) and ln(MAN) series are first-order integrated (I(1)).

Table 2. Unit root test results

Variable	*LLC*-test		*IPS*-test	
	Levels	First differences	Levels	First differences
ln(*FVA*)	-12.38***	-34.73***	-2.34***	-26.82***
ln(*GDP_PERCAP*)	-2.27**	-18.95***	5.35	-17.46***
ln(*MAN*)	0.20	-25.61***	4.90	-22.96***
FDI_OUT	-84.91***	-40.18***	-29.16***	-40.44***
ln(*TRADE_OPEN*)	-5.55***	-29.47***	-4.27***	-25.65***
TIME_BUS	-196.63***	-6.81***	-31.82***	-17.28***

Note: ***, ** indicates that the variable is stationary at 1% and 5% significance levels respectively

Source: calculated based on data from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

As the next step, we checked for the presence of cointegration of variables using the Johansen test. There are two main varieties of it: the trace test and the maximum eigenvalue test (max-eigen test). The null hypothesis in both tests is that the number of cointegrating equations is less than "r". The alternative hypothesis is that it is not less than "r" (trace test) or equals "r+1" (max-eigen test). The test was conducted without a constant and a trend.

According to the test results, the null hypothesis is rejected for all values of "r" from zero to five (see Table 3). We conclude that at least five cointegration equations are significant at the 1% level. Therefore, estimates of model (1) for the levels of the variables will be super consistent.

Table 3. Johansen test results

Number of cointegration equations	trace test		max-eigen-test	
	F-statistics	*p*-value	*F*-statistics	*p*-value
None	5204.3***	0.0000	3076.0***	0.0000
At most 1	2610.2***	0.0000	1594.1***	0.0000
At most 2	1352.0***	0.0000	865.5***	0.0000
At most 3	701.9***	0.0000	468.6***	0.0000
At most 4	423.9***	0.0000	354.3***	0.0000
At most 5	258.9***	0.0000	258.9***	0.0000

Note: *** means rejection of the null hypothesis at 1% significance level

Source: calculated based on data from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

Model evaluation results and their interpretation

Basic model

In this Section the results of model evaluation are presented and analyzed. First, we evaluate the basic model using various methods: pooled least squares, weighted least squares, fixed effects and random effects. In case of weighted least squares, the weights are based on the estimates of the error term variance for each country in the sample over the respective period. The results are presented in Table 4.

It can be seen that the estimates of the coefficients for the explanatory variables are highly significant, and their signs correspond to the expectations stated in the previous Section. At the same time, the p-values of the Breusch-Pagan test and the Hausman test are equal to zero, which makes it possible to reject the hypothesis of validity of the generalized least squares estimates at any level of significance, as well as the hypothesis of the constancy of the error term variance for all observations of the sample. Hence, it is necessary to pick the fixed-effects model because it has the highest predictive quality. This choice is also consistent with logical considerations: the existing differences between developing countries are substantial and they should be determined by fundamental socio-economic factors rather than regarded as manifestation of pure chance.

Table 4. Model (1) regression results

Regressors	Dependent variable: ln(*FVA*) Number of observations: 1680			
	Pooled least squares	Weighted least squares	Fixed effects	Random effects
const	-6.121***	-6.453***	-8.162***	-7.736***
ln(*GDP_PERCAP*)	0.156*	0.165***	1.211***	0.730***
ln(*MAN*)	0.951***	0.958***	0.700***	0.863***
FDI_OUT	0.069***	0.052***	0.017***	0.019***
ln(*TRADE_OPEN*)	1.039***	1.066***	0.831***	0.801***
TIME_BUS	-0.0069***	-0.0068***	-0.0061***	-0.0071***
R^2	0.898	0.947	0.982	0.726
F-statistics	168.03	5965.96	1002.11	887.03

Note: ***, * indicate 1% and 10% significances levels respectively

Source: calculated based on data from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

The obtained results show that the factors included in the model can explain 98% of the dispersion of foreign value added in developing countries' exports for the period of 1999-2018.

The estimation of the fixed effects model provides further insights into the impact of the selected economic factors on the nature and extent of developing countries' participation in GVCs. Firstly, as their industrial potential is growing they become more and more integrated into complex and capital-intensive stages of GVCs: 1% increase in manufacturing value added in developing countries causes the corresponding growth of foreign value added in their exports by about 0.7%. Secondly, the obtained estimates reveal that the more outward foreign direct investment they make, the deeper they are integrated into GVCs, since FDI is partly channeled to the construction or acquisition of production facilities abroad. Besides, reduction of tariff and non-tariff barriers to trade stimulates the expansion of developing countries' participation in GVCs: 1% growth in the openness of their economies increases foreign value added in their exports on average by 0.83%. Finally, the saturation of the domestic market with necessary goods makes it expedient to obtain economic benefits through the development of assembly production and processing of intermediate products for export (the estimated elasticity of foreign value added in the developing countries' exports by their real per capita income is about 1.21). The latter is vital for the economies heavily dependent on the world prices for raw materials. It is also important to note that simplification of procedure for starting a business and reduction of its administrative burdens could allow developing countries to attract significant

foreign direct investment, which in turn would stimulate further integration into global production networks.

The empirical distribution of the fixed effects is presented in Appendix A4. As shown in the diagram, estimates of the fixed effects calculated based on the compiled data set vary from -4.5 to 3.2. However, for more than 50 countries out of total 84, their absolute values are within 1. Such a significant unevenness in the empirical distribution of fixed effects once again highlights the depth of differences in the degree of involvement of various developing countries in the processes of global accumulation of value.

Extended model

To identify possible dynamic effects of developing countries' participation in GVCs we will evaluate an extended panel model with fixed effects:

$$\ln\left(FVA\right)_{it} = \beta_0 + \beta_1 \ln\left(GDP\_PERCAP\right)_{it-k} + \beta_2 \ln\left(MAN\right)_{it-k} +$$
$$+ \beta_3 FDI\_OUT_{it-k} + \beta_4 \ln\left(TRADE\_OPEN\right)_{it-k} + \beta_5 TIME\_BUS_{it-k} + \mu_i + u_{it} \quad (2)$$

The sample and the time pβeriod here are the same as for the basic model. In order for the number of observations to remain sufficient to obtain consistent estimates, we take the lag order equal to three (k= 1, 2, 3). The extended model evaluation results can be seen in Table 5.

Table 5. Model (2) regression results

	Dependent variable: ln(*FVA*) Number of observations: 1428		
Regressors	**First lag (k = 1)**	**Second lag (k = 2)**	**Third lag (k = 3)**
const		-4.698**	
ln(*GDP_PERCAP*)	1.100***	-0.523	0.473*
ln(*MAN*)	0.322**	0.045	0.244
FDI_OUT	0.0116***	0.0059*	0.0073**
ln(*TRADE_OPEN*)	0.481***	-0.022	0.345***
TIME_BUS	-0.00432***	0.00036	-0.00023
R²		0.986	
F-statistics		939.52	

Note: ***, **, * indicate 1%, 5% and 10% significances levels respectively.

Source: calculated based on data from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

The obtained estimates confirm that all factors considered have significant impact on the amount of foreign value added in developing countries' exports in the short run. However, some of them also determine the scope of participation of these countries in GVCs in the longer term. In particular, with a 1% increase in real GDP per capita, foreign value added in developing countries' exports grows by an average of 1.1% in the short run and by 0.5% in the medium run. Furthermore, a rise in the share of net FDI outflow in the GDP of developing countries by 1 p.p. leads to a short run increase in foreign value added in their exports by an average of 1.2% and a medium run growth of 0.6-0.7%. This empirical pattern seems logical, since foreign direct investment typically results in the building of long-term production and trade relations between enterprises involved. Besides, trade liberalization stimulates the expansion of developing countries' participation in GVCs in a dynamic way. The short run effect of the rise in the openness of the economy by 1% for upward participation in GVCs is almost 0.48%, and the medium run effect is 0.35%. In other words, the fewer restrictions on foreign trade are imposed, the more secure is the country's position in the global supply chain's segments with high domestic value added.

Conclusion

The study has shown that developing countries have significant potential to increase their participation in GVCs and move up to more capital-intensive and high-tech stages of the production chain. Despite the varying nature of the current integration of developing countries into GVCs, empirical testing has revealed some common patterns. Richer economies with more developed manufacturing industries are more involved in the processing of raw materials and assembly of finished products. China, India and the newly industrialized countries of the "first wave", which are heavily engaged in the production of machinery and equipment within the GVCs, provide conclusive evidence. South Africa, however, despite some success in assembling cars for the world's leading automakers, has a low level of complexity and diversification of the manufacturing sector, which is the main reason for the country's lower integration in the ascending segments of GVCs. It has become clear that the developing countries that consistently adhere to free trade policy are much more attractive for offshoring as part of the international fragmentation of production. Another important finding of the study is the conclusion about the role of the administrative burden on business as a factor which hinders effective integration of developing countries into GVCs. While the influence of market factors and trade policy has been investigated in the previous studies, the evaluation of the impact of administrative burden on the degree of these countries' participation in global production networks is a major contribution of this paper to the understanding of the actual and potential place of developing economies in the global value chains.

The analysis revealed the favorable dynamic effect of the volume of outward FDI and the degree of openness of the economy on the participation of developing

countries in GVCs. Brazil, being one of the world's largest producers of biofuels, is a good example, since Brazilian oil and gas TNCs (such as Petrobras) own numerous oil production and refining plants in Africa and Latin America. Petroleum products are then imported in Brazil at low tariffs on the production and sale of biofuels both on the domestic market and abroad. The host governments are to ensure the coherence of foreign trade and investment policies in the long run so that the development of trade relations with other countries and the resulting economies of scale could help modernize and diversify production in the FDI recipient developing countries. State support for domestic small and medium-sized firms involved in the production of manufactured goods in the form of subsidies, tax breaks, loan guarantees, and assistance in finding overseas business partners can also allow developing countries to join GVCs more actively and with greater economic benefits. Measures are needed to simplify the procedure of registering businesses by foreign TNCs, improve transport and logistics infrastructure, enhance the transparency of the investment environment, strengthen political legitimacy and fight corruption. This paper does not examine the effects of a wide range of institutional factors on countries' participation in GVCs; this is a subject for further research.

In modern conditions, global supply chains are undergoing significant changes due to both corporate decisions of the TNCs and transformation processes currently underway in the world economy. Post-2008 crisis trade tensions that have intensified practically to the degree of trade wars, a build-up of the global financial imbalances together with growing contradictions between advanced and developing countries have led to a slowdown in globalization processes in the world economy, forcing GVCs to shrink and become more regional. The COVID-19 pandemic further affected GVCs, especially in developing countries, causing cascading disruptions along production chains. The decline in the volume of foreign investment because of restrictive measures imposed on the cross-border capital movement resulted in substantial reduction of activity within GVCs. Obviously, developing countries suffered the greatest economic damage during the COVID-19 crisis, as for many of them FDI and participation in GVCs are the major driving forces for economic growth and development.

Acknowledgments

References

Arnold, J., Javorcik, B., Lipscomb, M. & Mattoo, A. (2016). Services reform and manufacturing performance: Evidence from India. *The Economic Journal*, *590* (126), 1–39. https://doi.org/10.1111/ecoj.12206

Bisson, L. & Hambleton, T. (2020). *COVID-19 impact on West-African value chains*. Clingendael Institute. https://www.clingendael.org/sites/default/files/2020-06/Policy_Brief_COVID-19_Impact_on_West_African_Value_Chains_June_2020.pdf

Dekker, B. (2020). *The impact of COVID-19 measures on Indonesian value chains.* Clingendael Institute. https://www.clingendael.org/sites/default/files/2020-06/Policy_Brief_COVID-19_Impact_on_the_Value_Chain_Asia_June_2020.pdf

Farole, T., Hollweg C.H. & Winkler, D. (2018). *Trade in global value chains: An assessment of labor market implications.* World Bank, Jobs Working Paper. https://documents1.worldbank.org/curated/en/109621533186813850/pdf/129143-Trade-in-Global-Value-Chains.pdf

Fu, X. (2020). Digital transformation of global value chains and sustainable post-pandemic recovery. *Transnational Corporations*, 2 (27), 157–166. https://unctad.org/system/files/official-document/diaeia2020d2a9_en.pdf

Ge, Y., Dollar, D. & Yu, X. (2020). Institutions and participation in global value chains: Evidence from belt and road initiative. *China Economic Review*, 61, 1–14. https://doi.org/10.1016/j.chieco.2020.101447

Gereffi, G., Frederick, S. & Bamber, P. (2019). Diverse paths of upgrading in high-tech manufacturing: Costa Rica in the electronics and medical devices global value chains. *Transnational Corporations*, 1 (26), 1–29. https://unctad.org/system/files/official-document/diaeia2019d1a1_en.pdf

Jones, R. & Findlay, R. (2000). Factor bias and technical progress. *Economics Letters*, 68, 303–308. https://doi.org/10.1016/S0165-1765(99)00194-9

Kimura, F., Thangavelu, S.M., Narjoko, D. & Findlay, C. (2020). Pandemic (COVID-19) policy, regional cooperation and the emerging global production network. *Asian Economic Journal*, 1 (34), 3–27. https://doi.org/10.1111/asej.12198

Krugman, P. & Helpman, E. (1985). *Market structure and foreign trade.* Cambridge: MIT Press.

Lopez-Gonzalez, J. (2016). *Using foreign factors to enhance domestic export performance: A focus on Southeast Asia.* OECD Trade Policy Paper. https://read.oecd-ilibrary.org/trade/using-foreign-factors-to-enhance-domestic-export-performance_5jlpq82v1jxw-en#page1

Miroudot, S. (2020). The reorganization of global value chains in East Asia before and after COVID-19. *East Asian Economic Review*, 4 (24), 389–416. https://dx.doi.org/10.11644/KIEP.EAER.2020.24.4.385

Natsuda, K., Goto, K. & Thoburn J. (2010). Challenges to the Cambodian garment industry in the global garment value chain. *European Journal of Development Research*, 4 (22), 469–493. https://doi.org/10.1057/ejdr.2010.21

Shepherd, B. & Stone, S. (2013). *Global production networks and employment: A developing country perspective.* OECD Trade Policy Paper. https://read.oecd-ilibrary.org/trade/global-production-networks-and-employment_5k46j0rjq9s8-en#page1

Slany, A. (2019). The role of trade policies in building regional value chains – some preliminary evidence from Africa. *South African Journal of Economics*, 3 (87), 326–353. https://doi.org/10.1111/saje.12214

Stringer, C. & Ge, G. (2010). New Zealand agri-business investment in South America: A global value chain perspective. *The Journal of Globalization, Competitiveness and Governability*, 3 (4), 84–101. https://www.redalyc.org/pdf/5118/511851325005.pdf

Teijlingen, K. & Hogenboom, B. (2020). *COVID-19 impact on the value chain in Latin America.* Clingendael Institute. https://www.clingendael.org/sites/default/files/2020-07/Policy_ Brief_COVID-19_impact_value_chain_Latin_America_July_2020.pdf

UNCTAD-Eora Global Value Chain Database. https://worldmrio.com/unctadgvc/ (Accessed on January 12, 2023)

World Development Indicators | DataBank. https://databank.worldbank.org/source/world-development-indicators (Accessed on January 12, 2023)

WTO. (2011). *Trade patterns and global value chains in East Asia: From trade in goods to trade in tasks.* https://www.wto.org/english/res_e/booksp_e/stat_tradepat_globvalchains_e.pdf

WTO. (2019). *Global value chain development report 2019. Technological innovation, supply chain trade, and workers in a globalized world.* https://www.wto.org/english/res_e/booksp_e/gvc_dev_ report_2019_e.pdf

Zeng, D.Z. (2019). Building a competitive city through integrating into global value chains: The case of the Sino-Singapore Suzhou industrial park. *China: An International Journal*, *2* (17), 164–180. https://doi.org/10.1353/chn.2019.0021

Appendix

A1. Scatter plots of ln(FVA) and different explanatory variables
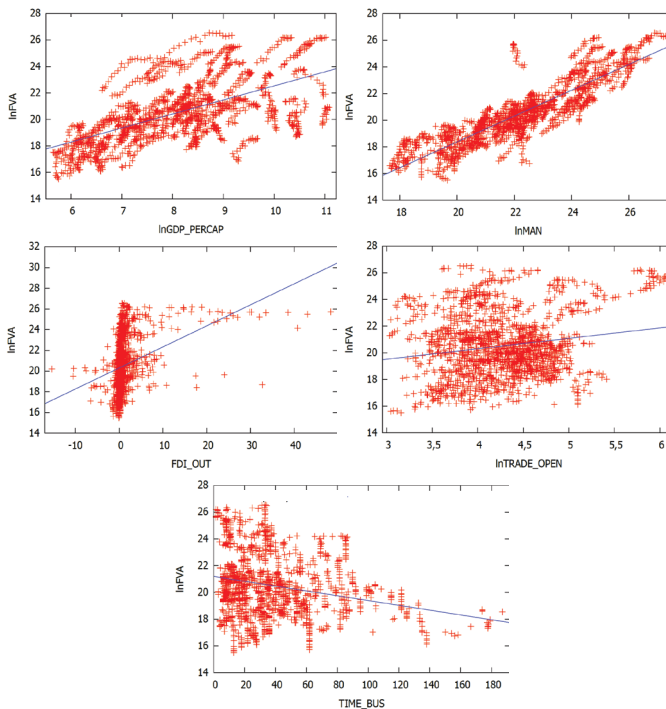
Source: compiled from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

A2. Descriptive statistics of the compiled dataset

Variable	Mean	Median	Standard deviation	Minimum	Maximum
ln(*FVA*)	20.52	20.2	2.352	15.5	26.55
ln(*GDP_PERCAP*)	8.094	8.16	1.309	5.642	11.08
ln(*MAN*)	22.21	22.16	2.118	17.65	27.34
FDI_OUT	1.073	0.2264	3.847	-15.38	48.34
ln(*TRADE_OPEN*)	4.268	4.245	0.5283	3.031	6.093
TIME_BUS	37.81	31	30.77	1.5	187

Source: calculated based on data from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

A3. Correlation matrix of the model variables

ln(*FVA*)	ln(*GDP_PERCAP*)	ln(*MAN*)	*FDI_OUT*	ln(*TRADE_OPEN*)	*TIME_BUS*	
1.0000	0.5903	0.8727	0.3320	0.1758	-0.2353	ln(*FVA*)
	1.0000	0.4099	0.3424	0.4293	-0.1512	ln(*GDP_PERCAP*)
		1.0000	0.0873	-0.1717	-0.1207	ln(*MAN*)
			1.0000	0.4291	-0.1618	*FDI_OUT*
				1.0000	-0.0431	ln(*TRADE_OPEN*)
					1.0000	*TIME_BUS*

Source: calculated based on data from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)

A4. Empirical distribution of the fixed effects
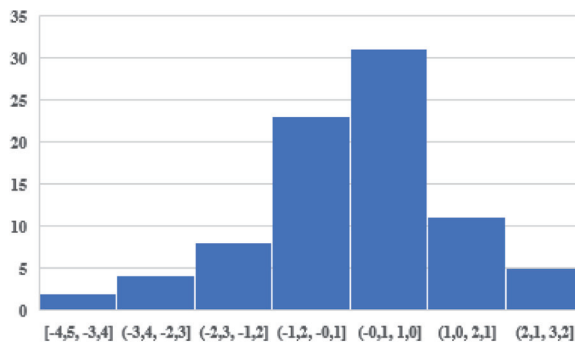
Note: the horizontal axis shows the ranges of the estimates of fixed effects, the vertical axis – number of countries from the sample for each range of the estimates

Source: compiled from UNCTAD-Eora Global Value Chain Database. URL: https://worldmrio.com/unctadgvc/ (data retrieved: 12.01.2023); World Development Indicators | DataBank. URL: https://databank.worldbank.org/source/world-development-indicators (data retrieved: 12.01.2023)