



UNITED NATIONS
UNIVERSITY

UNU-MERIT

Working Paper Series

#2020-026

How important is GVC participation to export upgrading
Gideon Ndubuisi and Solomon Owusu

Published 5 June 2020

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: <http://www.merit.unu.edu>

Boschstraat 24, 6211 AX Maastricht, The Netherlands
Tel: (31) (43) 388 44 00

UNU-MERIT Working Papers

ISSN 1871-9872

Maastricht Economic and social Research Institute on Innovation and Technology

UNU-MERIT

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at UNU-MERIT to stimulate discussion on the issues raised.

How important is GVC Participation to Export Upgrading*

Gideon Ndubuisi¹ and Solomon Owusu²

Abstract

Exporting higher-quality and complex products are deemed pathways to economic growth and development. However, producing such products are knowledge-intensive and require quality intermediate inputs and advanced technologies. Integration into global trade networks is increasingly argued to be amongst the pathways to obtain such inputs and technologies, although not all countries may benefit equally from such integration. This paper builds on these arguments and investigates how participation in the global value chain (GVC) affects export-quality. We use a sample of 120 developed and developing countries and find that participation in GVC impacts positively on export quality and, also, brings the export quality of countries closer to the quality frontier, but these effects only work through backward linkages. While this result persists in the sub-sample comprising developing economies, we, however, find that developed countries benefit from both forward and backward linkages in GVC. Overall, the results indicate that GVC participation matters to export upgrading but points to a potential heterogeneity on the channel of impact across countries at different levels of development.

Keywords: *Export Quality; Global Value Chains*

JEL Classification: F00, F01, F14

¹ UNU MERIT, Boschstraat 24, Maastricht, Netherlands Email: ndubuisi@merit.unu.edu

² UNU MERIT, Boschstraat 24, Maastricht, Netherlands Email: owusu@merit.unu.edu

*We are grateful to Neil Foster-McGregor, Elvis Avenyo, and Emmanuel .B. Mensah for their spot-on and insightful comments on the earlier versions of this paper. We are also grateful for comments and suggestions received at the Joint UNUMERIT/MGSoG seminar series. All other errors remain solely ours.

1. Introduction

In this paper, we focus on the potential effect of global value chain (GVC) integration on export upgrading³ and the mechanisms through which this works across countries at different levels of development. About 60 percent of global trade today is accounted for by trade in intermediate inputs (UNCTAD, 2013). Integration into GVCs has shifted the development paradigm of many countries, presenting countries with new development possibilities, all made possible by widespread removal of policy barriers to trade and foreign investment. Falling trade costs through declines in transportation and communication costs have allowed MNCs in pursuit of efficiency to globalize their production. Production is now sliced into a different sequence of stages of value-creating activities or tasks that are performed in different cost-saving locations across the world (Grossman & Rossi-Hansberg, 2008; Foster-McGregor *et al.*, 2015). There is now a large body of literature suggesting that through GVC participation, firms are provided with essential opportunities to access the international markets, specialize in core tasks, access higher quality and sophisticated intermediate inputs, and benefits from new ideas, technology transfer, and spillover to stimulate productivity growth and expand the scale of exports (Collier & Venables, 2007; Criscuolo & Timmis, 2017; Pahl & Timmer, 2019).

However, what is still understudied in the literature is whether, in addition to increasing productivity and expanding the scale of exports, integration into GVCs has any significant effect on export upgrading. In line with this but not directly examining export upgrading, Javorcik (2014) reported high positive productivity spillovers through Foreign Direct Investments (FDI) to firms and industries through backward linkages and less so for other channels (Iršová & Havránek, 2013). Analyzing the drivers of export upgrading, Zhu & Fu (2013) find results that suggest that export sophistication of countries is enhanced by FDI and imports (percent of GDP). A case study of the textile and garment industry in Bangladesh suggested that increasing the share or content of foreign intermediate inputs can be an essential source of increased productivity and upgrading (Mottaleb & Sonobe, 2011). Other studies have also argued that the relationship between GVC integration and capacity upgrading could be non-linear as countries build capabilities overtime in the value-chain (Baldwin, 2012; Baldwin & Gonzalez-Lopez, 2015).

³ In this paper, we use the phrase “export upgrading” to mean an improvement in the quality of exported goods.

The early stages of integration into the GVC network are characterized by imports of intermediates, assembling, and exports with little or no activities related to processing. In later stages of GVC integration, participating firms or countries are expected to move from occupying assembling position to a position where they become exporters of intermediates. China's model of industrialization, although exceptional, is a typical case in point. The country's industrialization strategy was simple and straight-forward—initially set out to specialize in lower value-added tasks in which the country had comparative advantage along the GVC. The country capitalized on its abundant low-skilled low-wage labor to create a global assembly hub for manufactures—imports parts and components from neighboring Asian countries—Japan, Korea, Taiwan, Singapore, and other East Asian economies, assembled them into finished products, and exported them to US and European markets. While pursuing this export-oriented strategy, the country was able to actively and effectively invest in activities that would later position it in higher value-added tasks along the GVC. The model has been a success in China, and today, the country is a global manufacturing powerhouse (Taglioni & Winkler, 2016).

However, this relationship needs rigorous and further empirical testing, given the idiosyncratic experiences of other countries, particularly other developing countries. It is specifically argued that there is a potential risk that developing countries could also be locked into low value-added stages of the value chain, providing primary products and simple manufactures that could limit the possibility of export upgrading (Foster-McGregor *et al.*, 2015). The full range of effects that GVCs can have on export upgrading of countries at different levels of development is yet to be understood. Countries stand to gain a lot from export upgrading. There seems to be a consensus, at least, in the economic literature, that the quality of a country's exports is essential for economic growth and competitiveness as countries become what they produce (Rodrik, 2006; Hausmann *et al.*, 2007). The signaling effect of the quality of exports tends to influence global patterns of trade. In this regard, countries with more diversified exports at the higher end of the quality spectrum tend to grow faster, by capitalizing on their comparative advantages to boost export revenues while creating jobs (Funkel & Ruhwedel, 2001; Hummels & Klenow, 2005; Broda & Weinstein, 2005; Hausmann *et al.*, 2007; Amiti & Freud, 2010). It is, therefore, crucial to understand the export upgrading effect of GVC integration and the mechanism underlying any such impact, especially given the rise in the share of globally traded intermediates.

To this end, we assemble country-level indicators of GVC participation and export quality across 120 developed and developing countries to study the impact of GVC integration on export upgrading, which to the best of our knowledge is the first of such analysis in the literature. We begin our empirical analysis by documenting significant heterogeneities in the levels of GVC integration and the average export quality across countries and regional blocs. Through simple means difference tests, we first document that compared to countries with lower GVC participation, countries with higher GVC participation have, on average higher levels of export quality. Secondly, we conduct econometric analyses utilizing panel Random-Effects Model and instrumental variable methods. We conduct the analysis on a full sample, and on two different subsamples of developed and developing countries, respectively. Analysis of the full sample and the sample comprising developing countries indicate that GVC participation is crucial for export upgrading, but this works only through backward GVC linkages. However, in the sample comprising developed economies, export upgrading that is associated with GVC participation works through both backward and forward GVC linkages. We also find strong evidence that GVC participation brings a country's export quality closer to the quality of the frontier. Hence, while our results generally suggest that GVC participation is crucial for export upgrading, they underline a potential heterogeneity in the effect and on the channel of impact across countries at different levels of economic development.

The remainder of this paper is organized as follows: Section 2 presents the theoretical background linking GVC participation and export upgrading. Section 3 specifies the model and describes the data sources used in the empirical analysis; Section 4 presents and discusses the results. Section 5 concludes.

2. Theoretical Framework

The growth and development experience of some developing countries in recent years has demonstrated the importance of export upgrading for long-term economic growth. For instance, Rodrik (2006) and Hausmann *et al.* (2007) present persuasive theoretical and empirical evidence to support that countries promoting exports of more sophisticated goods grow faster. Higher quality and sophisticated goods are less vulnerable to price competition from low-wage producers. This helps to boost export revenues and productivity, which ultimately contributes to the country's

economic growth and development (Khandelwal, 2010; Amiti & Khandelwal, 2013; Henn *et al.*, 2015). For this reason, it is widely argued that it is not how much of the goods exported that matter, but the quality of goods exported. However, producing quality goods for export requires a mix of intermediate inputs, some of which are often outside the bounds of a firm.

Several studies have examined the drivers of export upgrading. In these studies, it has been found that export upgrading of countries is enhanced by among other factors such as capital deepening, investment in R&D, FDI, imports, technology transfer, human capital development, institutional quality, factor endowments and access to credit (Faruq, 2011; Harding & Javorcik, 2012; Zhu & Fu, 2013; Amighini & Sanfilippo, 2014; Crino & Ogliari, 2017; Xu & Mao, 2018). While these studies provide useful insights, they paid rare attention to the importance of GVC integration for export upgrading. For instance, Zhu & Fu (2013), in a comprehensive study, acknowledged the importance of imports for export upgrading. However, the authors used imports to GDP ratio as their measure of the importance of sources of foreign knowledge embodied for a country's export upgrading. Farug (2010), on the other hand, used FDI inflow as a proxy for the importance of foreign knowledge content for export upgrading. Although these previous studies have recognized the importance of GVC integration for export upgrading, none of them employed standard measures of GVC participation. Hence, the mechanisms underlying such a potential relationship is totally ignored. This gap in the literature calls for improvement in the measurement of GVC integration and its subsequent inclusion as one of the main drivers of export upgrading.

The nexus between GVC participation and export upgrading can be rationalized on the premise that participation in GVC leads to technology transfer, knowledge spillover, and access to cheaper and higher-quality intermediate inputs needed for productivity improvement, which are important drivers of export upgrading (Collier & Venables, 2007; Criscuolo & Timmis, 2017; Pahl & Timmer, 2019). The conventional view is that GVC allows firms to use inputs of different quality. In this relation, the ability of a firm to operate at the higher end of the quality spectrum of the export value chain, command a higher price and generate higher sales for its exports in the global competitive market is dependent on the use of a variety of superior quality intermediate inputs in the production of its exports (Bas & Strauss-Khan, 2013; Halpern *et al.*, 2015; Manova & Yu, 2017).

Through the sourcing of intermediate inputs, GVC participation creates opportunities for fast technological learning and skill acquisition for local firms, given that they have built their absorptive capacity (Pietrobelli, 2008; Pietrobelli & Rabelloti, 2011). In this relationship, an upstream GVC partner through interactions is able to transfer technology (through embodied and disembodied capital and intermediate input use) to a firm downstream in the supply chain to aid the latter to produce more efficiently and quality-upgrade their exports (Bas & Strauss-Khan, 2014; Goldberg *et al.*, 2010, Harding & Javorcik, 2012; Halpern *et al.*, 2015; Xu & Mao, 2018). Related to this, Xu & Mao (2018) argue that the use of these imported new materials or services can improve the quality of exported goods either through the “variety effect” or “innovation effect”. The variety-effect channel works by providing GVC participating firms with a wider variety of inputs that they can choose from to produce final goods. The innovation-effect channel, on the other hand, works via the advanced technologies embedded in the variety of imported inputs from which producers choose the optimal technology to produce final goods. Thus, policies that inhibit access to foreign intermediates could have an adverse effect on the quality of final goods exports (Kasahara & Lapham, 2013).

Other studies also suggest that GVC participation leads to specialization in core tasks, which contributes positively to firm productivity (for an extensive literature review, see Amador & Cabral (2015)). The underlying argument here is that participation in GVC offers firms the opportunity to outsource activities they have a less comparative advantage and concentrate on core activities where they have a competitive advantage while using limited production resources more efficiently. This may provide an ideal opportunity for firms, particularly those in developing countries to specialize in niche product categories, instead of struggling to build capabilities to master entire production systems. By specializing in their most efficient core activities in the value chain, these firms are able to invest their resources to build technological and other specific capabilities for the specific GVC functions and activities they perform in the value chain in order to remain competitive in the value chain which ultimately affects the quality of their produce and export (Lall, 1992; Morrison *et al.*, 2008; Newman *et al.*, 2016; Baldwin, 2012; Amiti & Wei, 2009; Schwörer, 2013).

In the sections that follow, we bring the forgoing arguments to data within an empirical framework that envisions export upgrading as a function of GVC participation. While the discussions so far focused on firms,⁴ for lack of comparable firm-level data across different countries, we test our research idea using country-level indicators on the variables of interest.

3. Data Source and Model Specification

The two most important variables for our analysis are indicators of export quality and GVC participation. As an empirical measure of export quality, we utilize the newly computed indicator of export quality by the International Monetary Fund Database (IMF, 2014; Hen *et al.*, 2015). The indicator is calculated as the unit value adjusted for differences in production costs, selection bias stemming from relative distance and preferences for quality. We construct the indicators for GVC participation using the UNCTAD's EORA GVC database (Lenzen *et al.*, 2013). The dataset is a set of inter-country input-output tables covering 26 sectors in 187 countries of the years 1990-2015. We follow Hummels *et al.* (2001), Koopman *et al.* (2011), Koopman *et al.* (2014), and Aslam *et al.* (2017) to calculate trade in value-added using the EORA MRIO I-O table's dataset. The Eora dataset has three components; the intermediate goods demand (I matrix); the Final demand (Fd matrix) and the value added (VA matrix). Stacking all three components together and combining the sum of I and Fd with the sum of VA gives the gross output generated in each country and industry—($n \times i$) rows and columns with n and i as countries and industries respectively. Gross output is expressed as;

$$Q = I + Fd \quad (1)$$

$$Q = Ac + Fd \quad (2)$$

$$Q = LfFd, \text{ where } Lf = (Id - A)^{-1} \quad (3)$$

$$Q = (Id - A)^{-1} = LfQ \quad (4)$$

⁴ In fact, in reality, economic actors in the business of GVC participation are firms.

with Q being gross output, I intermediate demand, Fd final demand, Id identity matrix, and Lf Leontief inverse.

Three components are needed to calculate trade in valued-added (Tva)—the Leontief inverse matrix (Lf), value-added shares matrix (Vas), and total gross exports matrix (V). The Leontief matrix is recovered from the technical co-efficient matrix (A) by dividing elements of the matrix (I) with corresponding elements of (Q) vector. The value-added shares matrix (Vas) is obtained by summing across rows of the (A) matrix and subtracting all the elements on the diagonal of the square matrix from an identity matrix. Tva is arrived by multiplying the two components Lf and Vas , and the diagonalised row vector of the total gross exports matrix (X) (Aslam et al., 2017; Foster-McGregor et al 2015) and is given as:

$$Tva = \begin{bmatrix} Tva^{11} & \dots & Tva^{1n} \\ \vdots & \ddots & \vdots \\ Tva^{n1} & \dots & Tva^{nn} \end{bmatrix} = \begin{bmatrix} Vas^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & Vas^n \end{bmatrix} \begin{bmatrix} Lf^{11} & \dots & Lf^{1n} \\ \vdots & \ddots & \vdots \\ Lf^{n1} & \dots & Lf^{nn} \end{bmatrix} \begin{bmatrix} X^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & X^n \end{bmatrix} \quad (5)$$

with Vas^n and X^n as ($i \times 1$) diagonalised row vector of value-added shares and gross exports for each industry and country n . Lf^{nn} is the ($i \times 1$) Leontief inverse of country n . Given Tva we decompose and compute the indicators that are related to GVC participation. First is the indirect value-added (DVX) which is the row sum of the Tva matrix excluding diagonal terms and is defined as the share of value added used in the export of third countries. DVX is used to measure forward linkages. The second indicator is foreign value-added (FVA) which is the column sum of the Tva matrix excluding diagonal terms and is defined as the share of foreign value added used in a country's exports of the same GVC. FVA is used to measure backward linkages. The two indicators are shown in equations (6) and (7), respectively.

$$DVX \text{ share}_{it} = \frac{DVX_{it}}{Total \text{ Gross Export}_{it}} \quad (6)$$

$$FVA \text{ share}_{it} = \frac{FVA_{it}}{Total \text{ Gross Export}_{it}} \quad (7)$$

The sum of the two indicators or combining equation (6) and (7) yields equation (8) and measures the extent of GVC participation (UNCTAD, 2013; Foster-McGregor *et al.*, 2015).

$$GVC\ Participation_{it} = \frac{FVA_{it} + DVX_{it}}{Total\ Gross\ Export_{it}} \quad (8)$$

In our analysis, the aggregate GVC participation index is the main explanatory variable of interest. However, because we are interested in the mechanisms through which participation in GVC can impact on export upgrading, we also consider the independent effects of backward and forward linkages or participation. In what follows, to examine the importance of GVC participation on export upgrading, we consider the following empirical model:

$$\ln EU_{it} = \beta_1 \ln GVC_{i,t-1} + \delta X'_{it} + \chi_i + \chi_t + \varepsilon_{it} \quad (9)$$

Where χ_i and χ_t are the country and time fixed effects, ε_{it} is the error term. $\ln EU_{it}$ is the logarithm of our indicator of export quality of country i at time t . $\ln GVC$ is the logarithm of aggregate (or the backward and forward) GVC participation indicator(s) of country i . We lag the variable by a period to minimize contemporaneous endogeneity and to account for the time needed for knowledge and technology acquired through GVC to be used in industrial activities that would lead to quality upgrading. X'_{it} is a vector of control variables. It includes an index of human capital level, which we take from the Penn World Table version 9; inflation rate which we take from the World Bank Development Indicators; institutional quality – proxied by the rule of law – sourced from the World Governance Indicators; and an index of Financial Development level which we source from the IMF database (Svirydzenka, 2016). The inclusion of these variables is both informed and guided by existing studies on the determinants of export upgrading (e.g., see Harding & Jovorcik, 2013; Amighini & Sanfilippo, 2014; Hen *et al.*, 2015).

In particular, we use the inflation rate to proxy the distortionary effect of macroeconomic instability on productive economic activities such as export upgrading. We expect this variable to be negative. Human capital is aimed to capture the innovative ability of a country, and we expect the variable to have a positive effect on export upgrading. Rule of law is used to index the quality

of a country's contracting institution. Faruq (2011) argues that a better institutional environment increases the quality of exported goods by reducing market transaction costs, information asymmetries, and uncertainties, which enable producers to take-on longer and riskier, but productive investments. Hence, we expect this variable to have a positive effect on export upgrading. While Crino & Ogliari (2017) find that financially developed economies export higher quality goods because it enables them meet-up the enormous cost associated with quality upgrading, Choi & Lugvysky (2019) find that the export quality effect of financial development depends on a country's productivity level. Hence, we leave the data to determine the export quality effect of financial development since modeling the heterogeneous effect of financial development is outside the purview of this paper.

We use three different samples in the analysis: (a) a full sample comprising 120 developed and developing countries; (b) a sample comprising 39 developed economies; (c) a sample of 81 emerging and developing economies. Each sample spans over the periods 1996-2014. The choice of the countries in the sample and time period analyzed is solely determined by data availability. Table A1 in the appendix lists the countries in the sample, while Table A2 in the appendix presents the basic summary statistics of the main variables that are used in the analysis.

4. Empirical Results

4.1. A First Look

To examine the relationship between GVC participation and export upgrading empirically, we start with some descriptive analysis. First, we plot the evolution of GVC participation and export quality. We consider both the world sample and regional blocs to get a better impression of what is happening. Second, we plot average GVC participation against average export quality. Third, we perform simple means difference test between higher and lower GVC participating countries.

<<Insert figure 1 about here>>

4.1.1. Evolution of GVC Participation and Export Upgrading

Countries participate in the international trade by sourcing intermediate imports to be used in their exports (backward linkages or foreign value added) or by supplying intermediates inputs to be

used in the exports of third countries (forward linkages or indirect value-added). These two components put together give countries overall GVC participation. The picture emerging from Figure 1 is clear and it suggests that the world has become more integrated. Between 1996 and 2014, participation in GVC in the world increased by 5.8 percentage points, from 40.4 percent in 1996 to 46.3 percent in 2014, as shown in Figure 1. In terms of regions, overall participation in GVC has been highest in developed countries and lowest in developing countries. GVC participation in the developed countries increased from 47 percent to 55 percent between 1996 and 2014 while it increased from 37 percent to 42 percent in developing countries over the same time period. In West Europe, GVC participation increased from 46.6 percent in 1996 to 55 percent in 2014. In Latin America, GVC participation increased by 3.4 percent between 1996 and 2014, from 31.4 percent in 1996 to 34.9 percent in 2014. Sub-Saharan Africa's GVC participation is very encouraging. The region is heavily involved in GVCs, generally as high as those of their counterparts in South Asia, East Asia and Latin America. This finding is in line with previous findings (Foster-McGregor et al. 2015).

Figures 1A and 1B (see appendix) we plot the evolution of backward and forward integrations. In all the regions except for developed countries, European countries, and surprisingly in Latin America, forward integration remains the highest contributor to GVC participation (see Figure 1A). Whereas developing countries and regions such as those in Asia and SSA use minimal contents of foreign contents in their exports (on average 18 percent of foreign inputs; 14% in SSA; 20% in Asia), developed countries on average use higher contents of foreign contents in their exports (developed countries 29%; West Europe 27%) (See Figure 1A). Four factors could explain these variations, namely, size, geography, economic openness, and transport infrastructure. Typically, many countries in Europe are small, open economies, geographically close to each other and closer to larger European markets such as Germany and linked by very good transport infrastructures. These factors are undeniably pre-conditions for higher integration into GVCs and explain the region's strongest and highest participation in GVC compared to other regions of the world, allowing countries in the region to easily source inputs from each other to be used in their exports. At one extreme, Criscuolo & Timmis (2017, p.63) reported a GVC participation rate of 71 percent for Luxembourg and 31 for New Zealand which is relatively isolated and argued that

small open economies such as Luxembourg that is close to larger foreign markets in the EU are more likely to be more integrated into GVCs.

<<*Insert figure 2 about here*>>

Next, Figure 2 shows the evolution of export quality across selected countries and regional blocs. Looking at the graph, we observe that advanced economies or regional blocs like the US or Western European countries have higher export quality relative to the world average. They also have higher export qualities relative to developing countries or regional blocs like China or SSA. This observation is consistent with the conventional view that the richer the country, the more sophisticated its export structure (Hausmann *et al.*, 2007).

<<*Insert figure 3 about here*>>

<<*Insert Table 1 about here*>>

4.1.2. Higher vs. lower GVC participation and Export Upgrading

Figure 3 shows the kernel density plot of the export quality indicator across different levels of GVC participation. We pool the data on aggregate GVC participation across countries and years and then split it into two groups using the 75th percentile as the cutoff.⁵ Observations that are at the 75th percentile and above are defined as "high GVC participation", while observations that are below the 75th percentile are defined as "low GVC participation". From the figure, we observe that the distribution of "high GVC participation" is further to the right while that of the "low GVC participation" is to the left. In Table 1, we present t-tests for differences in (log) means between the two groups. The export quality mean of the "low GVC participation" is -0.264 while that of "high GVCs participation" is -0.098. This difference in means is highly statistically significant, as shown in t-tests in the table. This first piece of evidence suggests that countries that participate more intensively in GVC, on average, export higher quality goods.

⁵ The result is robust to using the median point as the cutoff.

<Insert figure 4a, 4b and 4c about here>

4.1.3. GVC Participation and Export Upgrading

In Figures (4a)-(4c), we illustrate the relationship between GVC participation and export quality in our data by plotting the aggregate GVC Participation index against export quality for the full (Figure 4a), advanced economy (Figure 4b), and developing economy (Figure 4c) samples, respectively. In the full sample, we observe a strong positive correlation between GVC participation and export quality. In the subsamples, however, we only observe a strong positive correlation between GVC participation and export quality in the sample comprising advanced economies. In the sample comprising developing countries, the relationship seems to be flat at best. Consequently, these first pieces of evidence using aggregate GVC participation indicator suggest possible cross-country heterogeneous effect of GVC participation that may arise, among others, due to differences in the levels of development.

4.2. Econometrics Analysis

Our economic results are reported under three subsections: (a) results for the whole dataset using the aggregate GVC participation index; (b) results for the whole dataset using two components of GVC participation index, i.e., backward and forward GVC participation indexes; and (c) results when the dataset are split into two subsamples: developed and developing countries. For the estimation strategy, we first implement panel Fixed-Effects (FEM) and Random-Effects (REM) models and conduct the Hausman test. The test statistic suggests that REM is preferred over the FEM. Therefore, we utilize the REM to estimate equation (9). One of the empirical challenges we face is that our measures of GVC participation may be endogenous. While the use of predetermined values of GVC indicators as specified in equation (9) reduces reverse causality, our GVC indicators may also be endogeneous due to other confounding factors such as omitted variable bias. To address this empirical challenge, we complement the REM with the instrumental variable (IV) method and report the second-stage results alongside those of REM.

We utilized two IV methods: the Random-Effect (IV-Random-Effect) and Lewbel (2012) (IV-Heteroskedasticity) IV methods, respectively. Unlike the IV-Random-Effect, which requires external instruments to identify the endogenous variable, the IV-Heteroskedasticity identifies the

endogenous variable in the absence of good external instruments by using heteroskedasticity present in the model to generate sets of instruments. In particular, identification is achieved by having regressors that are uncorrelated with the product of heteroskedasticity errors, which is a feature of many models where error correlations are due to an unobserved common factor (Baum *et al.*, 2013 p.13).⁶ Nevertheless, the method also allows the option of including external instruments, which Baum & Lewbel (2019) recommend to be adopted when there are external instruments in order to improve the efficiency of the IV estimator. In the analysis, we utilize IV-Heteroskedasticity results with and without external instruments. As instruments, we use country-specific indicators on landlocked, average remoteness index, and weighted average GVC participation for other countries.

Anecdotal and empirical evidence indicate that landlocked countries are less likely to participate in international trade and connect with other trading partners (Gallup *et al.*, 1999). In the same vein, we argue that landlocked countries are less likely to participate in GVC since being landlocked implies limited access to seaports. Anderson & van Wincoop (2003) have shown that trade between two countries is determined by their bilateral trade costs relative to the corresponding average with all their partners, rather than to absolute trade costs. Consistent with this view, we argue that such costs also affect a country's participation in GVC but not export quality, at least not directly. Hence, we compute the remoteness index for each country, which is argued in the literature to be a theoretically consistent approximation for this relative trade cost (Head, 2003; Santos-Silva & Tenreyro, 2006). We compute the index in two steps. First, we use a bilateral-data that shows the universe of distances between country-pairs and their respective GDP to compute the index as a country's average weighted distance from its partner countries, where weights are the partner countries' shares of world GDP. As a second step, for each country, we average this index over its partner countries and obtain an index that is country-time specific. To compute the "weighted average GVC participation for other countries", for each country that we observe the export quality, we first obtain its partners' GVC participation indexes by merging the data on GVC participation indexes to the bilateral-data showing the universe of distances between country-pairs. Secondly, we average across each country's partners while using the relative distance as a weight. For the relevance of this instrument, we build on the policy diffusion

⁶ For a detailed explanation of the method and how the instruments are constructed, see Baum *et al.* (2013).

argument, which is that countries learn from their neighbors. In which case, to the extent that high-GVC participation reflects the existence of GVC friendly policies, other things equal, closely related countries are more likely to adopt similar policies. The bilateral-data we utilize to construct the instruments, including the variable on whether a country is landlocked, are directly taken from the BACI-CEPII (Meyer & Zignago, 2011).

<<Insert table 2 about here>>

4.2.1. Aggregate GVC Participation - Full sample results

We begin by discussing the results for the global sample, which are reported in Table 2. Column (1) reports the result when we regress export quality indicators on aggregate GVC participation index without controlling for other regressors. The result suggests a positive association between GVC participation and export quality that is statistically significant at the 1 percent significance level. In column (2), we include other regressors as contained in equation (4). We find that our initial result remains unchanged in qualitative terms. However, the statistical significance level drops from 1 percent in column (1) to 10 percent in column (2). To address potential endogeneity issues, columns (3) to (5) show the second-stage results of the different IV methods when we treat the GVC participation index to be endogenous. In all the columns, we obtain results that are largely consistent with those reported in column (1) and (2). We test the appropriateness of the employed instruments using the Hansen-J over-identification restriction test (result reported in the last row of the table). The test satisfies the orthogonality condition. Therefore, the results presented in Table 2 indicate that GVC participation increases the quality of exported goods. These results are consistent with the correlation graph reported in Figure 4A. However, rather than association, this result is causal. The results are also consistent with the broader GVC-related literature arguing that through GVC participation, firms – or in more general terms, countries – are provided with important opportunities to access higher-quality and sophisticated intermediate inputs, and benefits from new ideas, technology transfer, and knowledge spillovers (Collier & Venables 2007; Criscuolo & Timmis, 2017) which have been underscored in another strand of literature to be important drivers of export upgrading (Faruq, 2010; 2011; Harding & Javorcik, 2013; Xu & Mao, 2018).

Regarding the control variables, the estimated coefficients of the inflation rate are negative and statistically significant at conventional levels in all the columns in the table, suggesting a distortionary impact macroeconomic instability may exert on productive economic activities. This result is somewhat consistent with the most reported coefficients of the inflation rate reported in Harding & Javorcik (2012) and Amighini & Sanfilippo (2014). The estimated coefficients of human capital and institutional quality are positive and statistically significant at 1 percent significance level in all the columns in the Table. These results are consistent with those in the existing literature on the determinants of export quality (see Faruq, 2011; Harding & Javorcik, 2012; Hen *et al.*, 2015). Finally, we obtain a statistically insignificant effect of financial development on export quality.

Next, in Table A3 in the appendix, we perform additional analysis to examine whether in addition to improving export quality, GVC participation also contributes to bringing the export quality of countries closer to the quality of the frontier. To do this, we compute a new dependent variable – *Fquality* – which defines the dependent variable as the logarithm of the distance of country *i*'s export quality in period *t* to the frontier export quality in the same period. Following Harding & Javorcik (2013), the frontier quality is defined as the 95th percentile of the distribution of export quality value at period *t* by all countries in our dataset. Therefore, the higher the value of *Fquality*, the farther the export quality of a country is to the frontier quality. In this way, we examine whether GVC participation brings a country's export quality closer to the frontier quality besides raising the level of export quality, as the results presented in Table 2 suggest. A negative estimated coefficient of the GVC participation index would then be a validation of this claim. Also, a negative estimated coefficient of the control variables is an indication that those variables contribute to the catch-up to the export quality of the frontier. As reported in Table A2 (see appendix), we find strong evidence that GVC participation brings a country's export quality closer to the frontier quality. This additional result leads to the further conclusion that besides raising the export quality level, participating in GVC brings the quality of exported goods closer to the frontier quality.

<<Insert table 3 about here>>

4.2.2. Backward and Forward GVC Participation – Full Sample

While the results reported in the previous section suggest an export quality gain due to a country's insertion into GVC, Morrison et al. (2008) argue that not all insertions into GVCs are beneficial. A similar argument has been raised by Banga (2013), who further suggests a disentangling of the GVC participation impact into forward and backward participation to provide more useful insights into the gains that go to a country from participating in GVC. To this end, we focus on the two components of GVC participation, i.e., backward and forward GVC participation, and examine their respective individual effects on the quality of exported goods. Table 3 reports the results of this exercise. The results of the control variables are consistent with those reported in Table 2; hence we immediately delve into the variables of interest.

In all the columns in the table, the coefficients of the backward GVC participation index are positive and statistically different from zero at conventional levels. However, the coefficients of the forward GVC participation index are statistically insignificant at all conventional levels. Furthermore, while the coefficients of the forward GVC participation index are consistently insignificant, also observe in each column, the absolute sizes of the coefficients of backward GVC participation are consistently higher than those of forward GVC participation. This suggests that backward GVC participation is a more robust channel (as measured by the statistical significance) through which GVC participation influences the quality of exported goods and also has a greater contribution, as measured by the size of the coefficient. Accordingly, the results displayed in Table 3 suggest that the export quality effects of aggregate GVC participation we observed in Table 2 are due to backward GVC participation.

<<Insert table 4 about here>>

4.2.3. GVC Participation and Export Quality: Development level

Table 4 reports the Random-Effect model estimates of equation (1) for two different subgroups at different levels of economic development. The results present interesting findings. In the sample comprising advanced economies, the coefficients of the aggregate GVC participation index, as reported in columns (1) and (2) are positive and statistically significant at the 1 percent significance level. In column (3), we consider the two components of GVC participation and find that their respective coefficients are positive and statistically different from zero at conventional levels. The

results are, therefore, different from those of the global sample where we find GVC participation to only influence the quality of exported goods through the backward GVC participation. A potential explanation for this finding could be that the higher technological capacity and knowledge of firms in developed countries suggest that they may self-select only into GVC which offers higher opportunities for learning or sophisticated inputs on the one hand, and because of the higher absorptive capacity such firms may possess, they are also able to appropriate as much relevant knowledge as they could.

Next, columns (4) to (6) present the result for the sample comprising developing countries. In contrast to previous results obtained for the full sample and the subsample of advanced economies, we find no evidence that GVC participation affects the quality of exported goods when we use the aggregate GVC participation index in column (4) and (5). However, when we examine the two components of GVC participation in column (6), the estimated coefficient of backward GVC participation index is positive and statistically significant at the 5 percent significance level, while the estimated coefficient of forward GVC participation is statistically insignificant at all conventional levels. This suggests that if developing countries are ever gaining from the insertion into GVC in terms of an improvement in the quality of goods exported, it is only through backward integration as they are allowed the opportunity to access quality inputs from advanced economies for their production (Manova & Yu, 2017; Kasahara, & Lapharm 2013; Halpern *et al.*, 2015). This result is also somewhat in line with a positive productivity effect of backward GVC participation documented in a recent study by Pahl & Timmer (2019). One of the plausible explanations for the insignificant effect of forward GVC participation could be that developing countries, as we have seen in Figure 1A and 1B, participate more through forward integration. However, despite their high participation through this channel, they end up supplying primary inputs which have less scope for quality adjustment. Hence, they may be locked-up into low value added activities in the chain, which limits the opportunity for upgrading and hence might not benefit from GVC integration through this channel to improve the quality of their export.

Regarding our control variables, while the coefficients of the inflation rate remain negative (albeit it is now statistically insignificant) in the developing economies subsample, they turn positive and are surprisingly statistically significant at all conventional levels in the sample containing

advanced economies. Nevertheless, this result is in line with Harding & Javorcik (2013), who found a positive effect of a high inflation rate on export upgrading in a sample comprising high-income countries. Interestingly, the coefficients of financial development turn positive and are significantly different from zero in the sample containing advanced economies. However, in the sample containing developing economies, they are negative, albeit statistically insignificant at all conventional levels. These results are somewhat in line with Choi & Lugovsky (2019) that found a positive differential export quality effect of financial development for countries with higher productivity levels. Finally, results for the rule of law and human capital are similar to those obtained using the full sample.

5. Conclusion

Economic growth and development require transformation of a country's economic structure. This relies on, among other things, the improvement in the quality of products produced and exported. Producing and exporting higher-quality products often requires access to advanced technologies and higher quality intermediate inputs. Participation in GVC could offer a pathway to access these technologies and intermediate inputs providing economies with opportunities for fast-track development through export upgrading. Consequently, the current study examined the impact of GVC participation on export quality across countries at varying levels of development. We specifically examine if the export upgrading effect of GVC is conditional on the type of GVC linkages and activities that countries perform in the value chain and the level of development.

Using indicators of export quality and GVC participation, results from the full sample analysis indicate that GVC participation is essential for export upgrading, but this works only through backward GVC participation. The results further show that the benefits associated with GVC through backward linkages do not only lead to increased export quality upgrading but also allow countries to catch-up with the frontier export quality. However, when we split our data into two subgroups comprising developed and developing economies, we obtained different but interesting results. In the sample comprising advanced economies, improvements in the quality of exported goods that are associated with GVC participation works through both backward and forward linkages. In the sample comprising developing economies, the channel of impact works only through backward linkages. Our findings, therefore, indicate that GVC participation matters to

export upgrading, but the channels underlying the impact differs across countries of different development levels.

Our findings have implications for policy, especially on the supply of intermediate inputs through GVC participation. Inadequate supply of quality foreign intermediate inputs could be a constraining factor to export upgrading. Policies that inhibit country's participation in GVC could be strategically reformed to allow firms, particularly those in developing economies to integrate into the global supply chain to access these crucial foreign intermediate inputs. Achieving this will require exerting effort towards gaining greater market access to the global trade network through favorable trade agreements, such as preferential tariffs on imported intermediates and implementing policies that would attract lead firms and global suppliers in the value chain. Such policies would include adopting better trade and investment promotion policies, competitive exchange rate regimes, favorable and attractive FDI policies, improved business environment together with analog complements.

We conclude with a few caveats that inform potential areas for further research. First, the concentration of GVC activities tends to differ across sectors and industries. Hence, while our study paints an overall positive effect of GVC participation on the quality of export, there may be within-country heterogeneity arising from sectoral heterogeneity. We have not explored this area, given the aggregate nature of our data. We believe that this is an important area for future research. Second, our study only considered heterogeneity in the impact that may arise due to differences in development level. Further studies could consider the role of other country characteristics such as human capital and the broader business climate and their interaction with GVC participation and the subsequent impact on export quality. Lastly, our export quality indicator only captures within product quality upgrading, i.e., the production of similar products with higher quality. GVC participation could also lead to other types of upgrading, such as movements to higher-quality products within industries or movement into other sectors using the knowledge acquired in another value chain. Theoretical discussions on these types of upgrading and how they are related to GVC participation are contained in Humphrey–Schmitz (2002). However, the empirical analysis that tests these relationships are lacking. Our study is just one in that direction, and more needs to be done in this area of research.

References

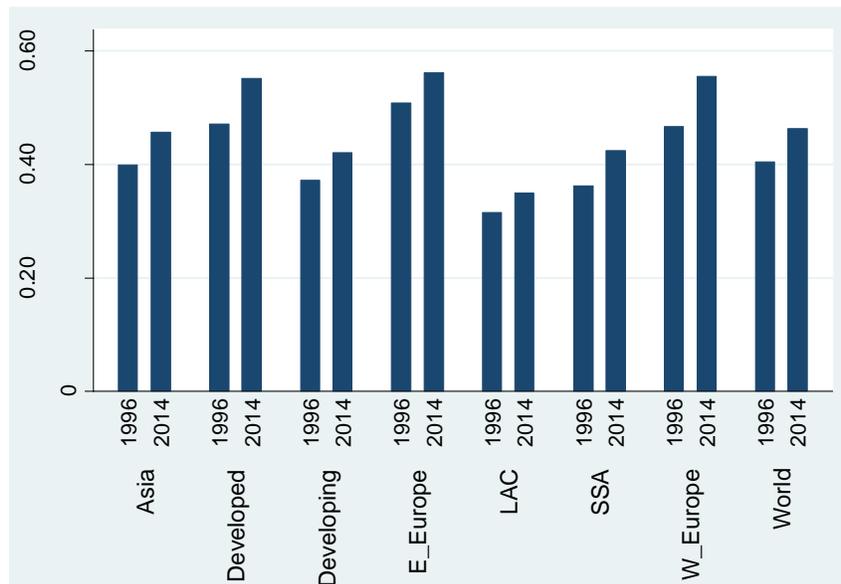
- Amador, J., & Cabral, S. (2015). *Global value chains, labor markets, and productivity*. In: Amador, J., & Filippo, D. (Eds.), *The age of global value chains*. London: CEPR Press.
- Amighini, A., & Sanfilippo, M. (2014). Impact of south-south FDI and trade on the export upgrading of African economies. *World Development*, 64, 1-17.
- Amiti, M., & Freund, C. (2010). An anatomy of China's export growth. In R. Feenstra, & S. Wei (Ed.), *China's growing role in World trade*. Chicago, USA: USA: University of Chicago Press.
- Amiti, M., & Khandelwal, A. (2013). Import competition and quality upgrading. *Review of Economics & Statistics*, 95(2), 476-490.
- Anderson, J., & van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review*, 93(1), 170-192.
- Aslam, A., Novta, N., & Rodrigues-Bastos, F. (2017). *Calculating trade in value-added*. IMF Working Papers #178.
- Baldwin, R. (2012). *Global supply chains: Why they emerged, why they matter, and where they are going*. CEPR Discussion Paper #9103.
- Baldwin, R., & Gonzalez-Lopez, J. (2015). Supply-chain trade: A portrait of global patterns and several testable hypotheses. *World Economy*, 38(11), 1682–1721.
- Banga, R. (2013). *Measuring value in global value chains*. UNCTAD Regional Value Chains Background Paper #RVC-8.
- Bas, M., & Strauss-Khan, V. (2013). *Input-trade liberalization, export prices, and quality upgrading*. Science Po Economics Discussion Papers #13.
- Bas, M., & Strauss-Khan, V. (2014). Does importing more inputs raise exports? Firm-level evidence from France. *Review of World Economics*, 150, 241-275.
- Baum, C., & Lewbel, A. (2019). *Advice on using heteroskedasticity based identification*. Mimeo. Boston College Department of Economics.
- Baum, C., Lewbel, A., Schaffer, M., & Talavera, O. (2013). *Instrumental variables estimation using heteroskedasticity-based instruments*. German Stata Users Group Meeting, Potsdam.
- Broda, C., & Weinstein, D. (2006). Globalization and the gains from variety. *Quarterly Journal of Economics*, 12(2), 541-585.
- Choi, B., & Lugovskyy, V. (2019). Asymmetric effects of financial development on export prices and quality across countries. *Review of International Economics*, 27(2), 594-642.
- Collier, P., & Venables, A. (2007). Rethinking trade preferences: How Africa can diversify its exports. *World Economy*, 30(8), 1326–45.
- Crino, R., & Ogliari, L. (2017). Financial imperfections, product quality, and international trade. *Journal of International Economics*, 104, 63-84.

- Criscuolo, C., & Timmis, J. (2017). The relationship between Global Value Chains and productivity. *International Productivity Monitor, Centre for the Study of Living Standards*, (32), 61–83.
- Faruq, H. (2010). Impact of technology on export quality. *Journal of Developing Area*, 44(1), 167–187.
- Faruq, H. (2011). How institutions affect export quality. *Economic Systems*, 35(4), 586–606.
- Foster-McGregor, N., Kaulich, F., & Stehrer, R. (2015). *Global Value Chains in Africa*. UNU-MERIT Working Papers #024.
- Funke, M., & Ruhwedel, R. (2001). Product variety and economic growth: Empirical evidence for the OECD countries. *IMF Staff Papers*, 48(2), 225–242.
- Gallup, J.L., Sachs, J.D., & Mellinger, A.D. Geography and economic development. *International Regional Science Review*, 22(2), 179–232.
- Goldberg, P., Khandelwal, A., Pavcnik, N., & Topalova, P. (2010). Imported intermediate inputs and domestic product growth: Evidence from India. *Quarterly Journal of Economics*, 125(4), 1727–1767.
- Grossman, G., & Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. *American Economic Review*, 98(5), 1978–97.
- Halpern, L., Koren, M., & Szeidel, A. (2015). Imported inputs and productivity. *American Economic Review*, 105(12), 3660–3703.
- Harding, T., & Javorcik, B. (2012). Foreign direct investment and export upgrading. *Review of Economics and Statistics*, 94(4), 964–980
- Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, 12, 1–25.
- Head, K. (2003). *Gravity for beginners*. Mimeo, University of British Columbia.
- Hen, C., Papageorgiou, C., & Spatafora, N. (2015). *Export quality in advanced and developing economies: Evidence from a new dataset*. WTO Working Paper ERSD-2015-02.
- Hummels, D., Ishii, J., & Kei-Mu, Y. (2001). The nature and growth of vertical specialization in world trade. *Journal of International Economics*, 54(1), 75–96.
- Hummels, D., & Klenow, P. (2005). The variety and quality of a nation's exports. *American Economic Review*, 95, 704–23.
- Humphrey, J., & Schmitz, H. (2002). How does insertion in global value chains affect upgrading in industrial clusters? *Regional Studies*, 36(9), 1017–1027.
- International Monetary Fund (IMF) (2014). *The diversification toolkit: Export diversification and quality databases*. <https://www.imf.org/external/np/res/dfidimf/diversification.htm>
- Iršová, Z., & Havránek, T. (2013). Determinants of horizontal spillovers from FDI: Evidence from a large meta-analysis. *World Development*, 42, 1–15.

- Javorcik, B. (2014). Does FDI bring good jobs to host countries? *World Bank Research Observer*, 30(1), 74–94.
- Kasahara, H., & Lapharm, B. (2013). Productivity and the decision to import and export: Theory and evidence. *Journal of International Economics*, 89, 297–316.
- Khandelwal, A. (2010). The long and short (of) quality ladder. *Review of Economic Studies*, 77, 1450–1476.
- Koopman, R., Wang, Z., & Wei, S-J. (2011). *Give credit where credit is due: Tracing value-added in global production chains*. NBER Working Paper #16426.
- Koopman, R., Wang, Z., & Wei, S-J. (2014). Tracing value-added and double counting. *American Economic Review* 104(2), 459–94.
- Lenzen, M., Moran, D., Keiichiro, K., & Geschke, A. (2013). Building EORA: A global multi-region input-output database in high country and sector resolution. *Economic Systems Research* 25(1), 20–49.
- Manova, K., & Yu, Z. (2017). Multi-product firms and product quality. *Journal of International Economics*, 109, 116-137.
- Mayer, T., & Zignago, S. (2011). Notes on CEPII’s distance measures: The GeoDist Database. CEPII Working Paper 2011-25.
- Morrison, A., Pietrobelli, C., & Rabellotti, R. (2008). Global value chains and technological capabilities: A framework to study learning and innovation in developing countries. *Oxford Development Studies* (1), 39–58.
- Mottaleb, K., & Sonobe, T. (2011). An inquiry into the rapid growth of the garment industry in Bangladesh. *Economic Development & Cultural Change*, 60(1), 67–89.
- Newman, Carol., Page, J., Rand, J., Shimeles, A., Söderbom, M., & Finn, T. (2016). *Made in Africa: Learning to Compete in Industry*. Brookings Institution Press.
- Lall, S. (1992). Technological capabilities and industrialization. *World Development* 20(2), 165–86.
- Lewbel, A. (2012). Using heteroskedasticity to identify and estimate miss-measured and endogenous regressor models. *Journal of Business & Economic Statistics*, 30(1), 67–80.
- Morrison, A., Pietrobelli, C., & Rabellotti, R. (2008). Global value chains and technological capabilities: A framework to study learning and innovation in developing countries. *Oxford Development Studies*, 36(1), 39-58.
- Pahl, S., & Timmer, M. (2019). Do global value chains enhance economic upgrading? A long view. *Journal of Development Studies*, DOI: 10.1080/00220388.2019.1702159.
- Pietrobelli, C. (2008). Global value chains in the least developed countries of the world: Threats and opportunities for local producers. *International Journal of Technological Learning, Innovation & Development*, 1(4), 459-481.

- Pietrobelli, C., & Rabelloti, R. (2011). Global value chains meet innovation systems: Are there learning opportunities for developing countries? *World Development*, 39(7), 1261-1269.
- Santos-Silva, J., & Tenreyro, S. (2006). The log of gravity. *Review of Economics & Statistics*, 88(4), 641–58.
- Schwörer, T. (2013). Offshoring, domestic outsourcing, and productivity: Evidence for a number of European countries. *Review of World Economics*, 149(1), 131–149.
- Svirydzhenka, K. (2016). *Introducing a new broad-based index of financial development*. IMF Working Paper #WP/16/5.
- Taglioni, D., & Winkler, D. (2016). *Making global value chains work for development*. World Bank Group. Retrieved from: <https://goo.gl/LVwyFl>.
- Rodrik, D. (2006). What is so special about China's exports? *China & the World Economy*, 14(5), 1-19.
- Xu, J., & Mao, Q. (2018). On the relationship between intermediate input imports and export quality in China. *Economics of Transition & Institutional Change*, 26(3), 429-467.
- UNCTAD. (2013). Global value chains and development: Investment and value-added trade in the global economy.
- Zhu, S., & Fu, X. (2013). Drivers of export upgrading. *World Development*, 51(), 221-233.

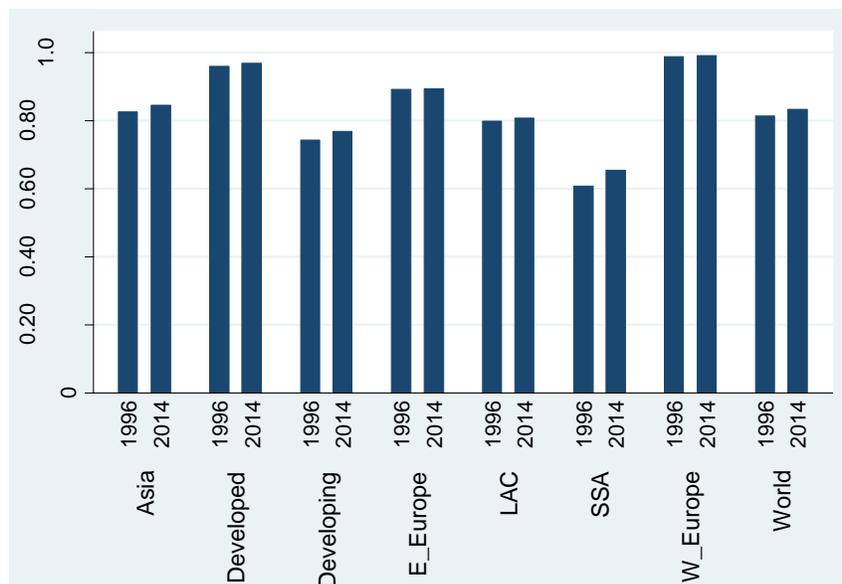
Figure 1: GVC Participation (1996-2014)



Source: Own calculation based on UNCTAD's EORA GVC database

Note: E_Europe is Eastern European countries; W_Europe is Western European countries

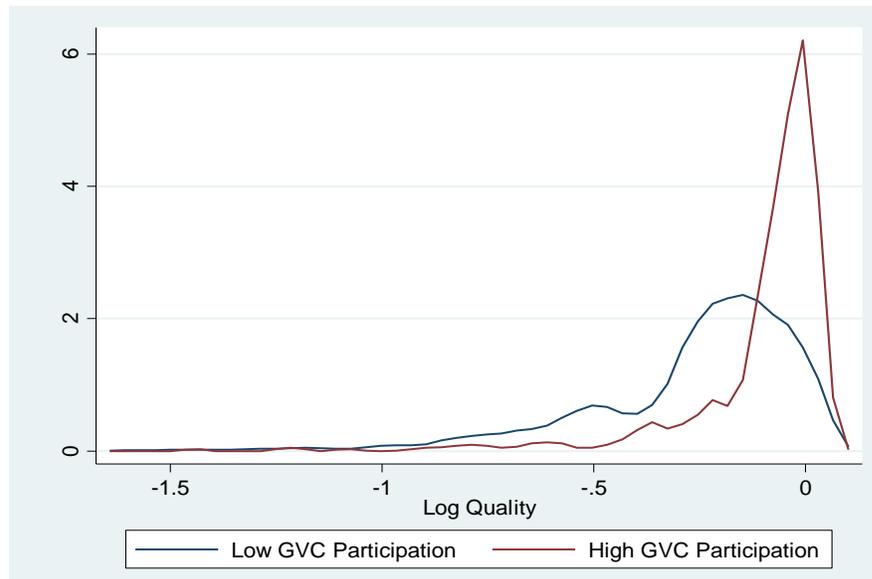
Figure 2: Export Quality, 1996-2014



Source: Own calculation based on data taken from IMF (2014) and Hen et al. (2015)

Note: E_Europe is Eastern European countries; W_Europe is Western European countries

Figure 3: Differences in GVC Participation and Export Quality: Kernel Plot



Source: Own calculation based on data taken from IMF (2014), Hen et al. (2015) and UNCTAD's EORA GVC database

Table 1: Differences in Export Quality: Means of Low and High GVCs

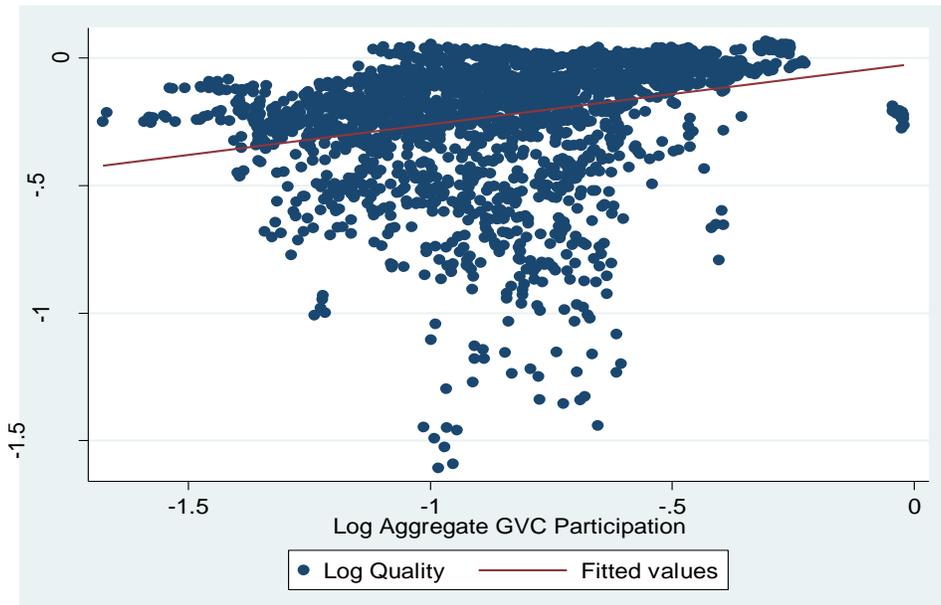
	Low GVC Participation	High GVC Participation	t – value
Mean (# Observation)	-0.264 (N=1,710)	-0.098 (N=570)	14.478***

*, ** and *** refers to 10 %, 5% and 1% significance levels, respectively

Source: Own calculation based on data taken from IMF (2014), Hen et al. (2015) and UNCTAD's EORA GVC database.

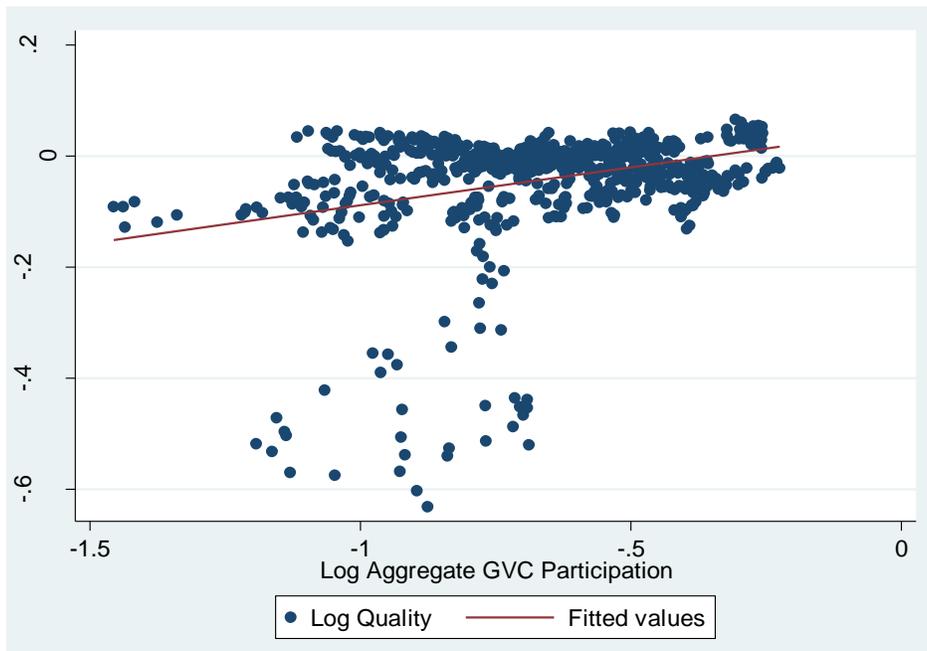
Note: “High GVCs participation” are all observations at the 75th percentile and above, while “low GVCs participation” are all observations below the 75th percentile.

Figure 4A. Full Sample: GVC and Export Upgrading



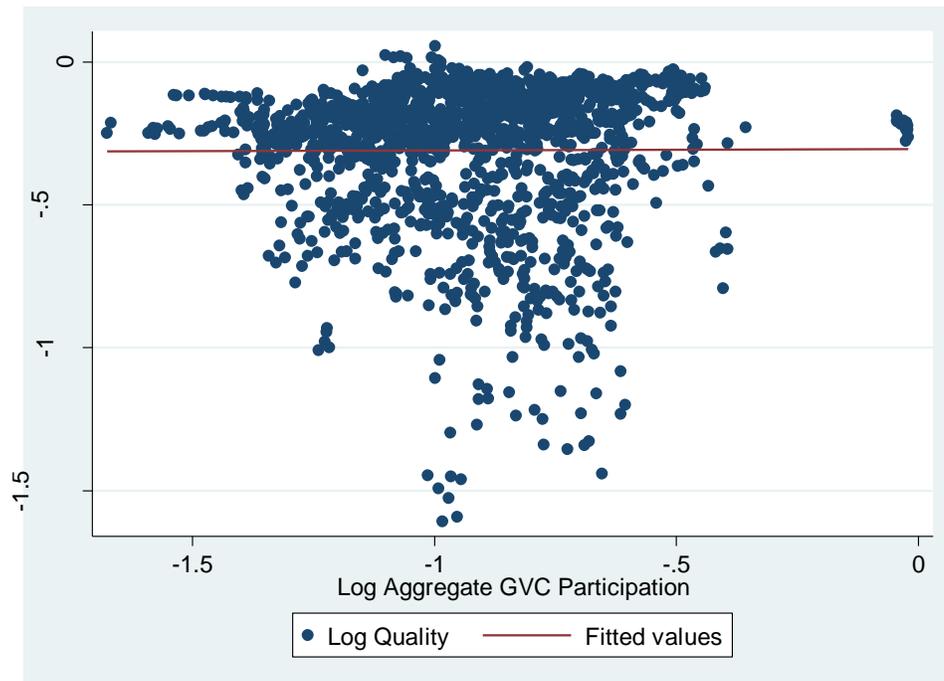
Source: Own calculation based on data taken from IMF (2014), Hen et al. (2015) and UNCTAD's EORA GVC database

Figure 4B. Advanced Economies: GVC and Export Upgrading



Source: Own calculation based on data taken from IMF (2014), Hen et al. (2015) and UNCTAD's EORA GVC database

Figure 4C. Developing Economies: GVC and Export Upgrading



Source: Own calculation based on data taken from IMF (2014), Hen et al. (2015) and UNCTAD's EORA GVC database

Table 2. Baseline Regression: GVC Participation and Export Quality

	Dependent Variable: Log Export Quality				
	Random Effect		IV-Random Effect	IV-Heteroscedasticity	
	(1)	(2)	(3)	(4)	(5)
GVC participation (ln)	0.0785*** (0.027)	0.0464* (0.026)	0.0764*** (0.027)	0.0600* (0.033)	0.1015*** (0.029)
Rule of Law		0.0719*** (0.009)	0.0668*** (0.009)	0.0637*** (0.013)	0.0622*** (0.011)
Human capital		0.1124*** (0.020)	0.1116*** (0.017)	0.0819*** (0.036)	0.1048*** (0.017)
Financial Development		-0.0094 (0.038)	0.0131 (0.039)	-0.0369 (0.032)	-0.0260 (0.027)
Inflation		-0.0001** (0.000)	-0.0001** (0.000)	-0.0001** (0.000)	-0.0001** (0.000)
# Observation	2,280	2,275	2,155	2,155	2,155
# Country	120	120	120	120	120
R-squared	0.06	0.40	0.39	0.07	0.06
Hansen <i>J</i> -test	–	–	0.39	0.92	0.26

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Column (3) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries. Column (4) and (5) use the heteroscedasticity based identification with column (4) utilizing the first period lagged value of GVC participation as an external instrument, while column (5) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries as an external instrument.

Table 3. Backward and Forward GVC Participation, and Export Quality

	Dependent Variable: Log Export Quality				
	Random-Effect		IV-Random Effect	IV-Heteroskedasticity	
	(1)	(2)	(3)	(4)	(5)
Backward GVC (ln)	0.0476*** (0.013)	0.0374*** (0.013)	0.0500*** (0.014)	0.0395* (0.023)	0.0510*** (0.021)
Forward GVC (ln)	0.0036 (0.016)	-0.0123 (0.016)	-0.0008 (0.016)	-0.0015 (0.022)	0.0181 (0.019)
Rule of Law		0.0689*** (0.009)	0.0618*** (0.009)	0.0621*** (0.013)	0.0599*** (0.013)
Human Capital		0.1138*** (0.019)	0.1163*** (0.017)	0.0939*** (0.036)	0.1150*** (0.019)
Financial Development		-0.0025 (0.038)	0.0279 (0.039)	-0.0300 (0.030)	-0.0158 (0.028)
Inflation		-0.0001* (0.000)	-0.0001** (0.000)	-0.0001** (0.000)	-0.0001** (0.000)
# Observation	2,280	2,275	2,155	2,155	2,155
# Country	120	120	120	120	120
R-squared	0.20	0.43	0.43	0.07	0.06
Hansen <i>J</i> -test	–	–	0.50	0.81	0.12

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Column (3) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries. Column (4) and (5) use the heteroscedasticity based identification with column (4) utilizing the first period lagged value of GVC participation as an external instrument, while column (5) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries as an external instrument.

Table 4. GVC Participation and Export Quality: Developing and Developed Countries

	Dependent Variable: Log Export Quality					
	Developed Countries			Developing Countries		
	Random Effect					
	(1)	(2)	(3)	(4)	(5)	(6)
GVC participation (ln)	0.1276*** (0.021)	0.0775*** (0.017)		0.0472 (0.035)	0.0390 (0.034)	
Backward GVC (ln)			0.0182** (0.009)			0.0377** (0.017)
Forward GVC (ln)			0.0456*** (0.015)			-0.0146 (0.020)
Rule of Law		0.0279*** (0.006)	0.0273*** (0.006)		0.0922*** (0.014)	0.0881*** (0.014)
Human Capital		0.0586*** (0.012)	0.0649*** (0.011)		0.1224*** (0.029)	0.1239*** (0.029)
Financial Development		0.0372** (0.015)	0.0402** (0.016)		-0.0468 (0.067)	-0.0272 (0.067)
Inflation		0.0007*** (0.000)	0.0007*** (0.000)		-0.0000 (0.000)	-0.0000 (0.000)
# Observation	741	736	736	1,539	1,539	1,539
# Country	39	39	39	81	81	81
R-squared	0.09	0.37	0.29	0.01	0.19	0.23

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.

Appendix

Table A1. List of Countries

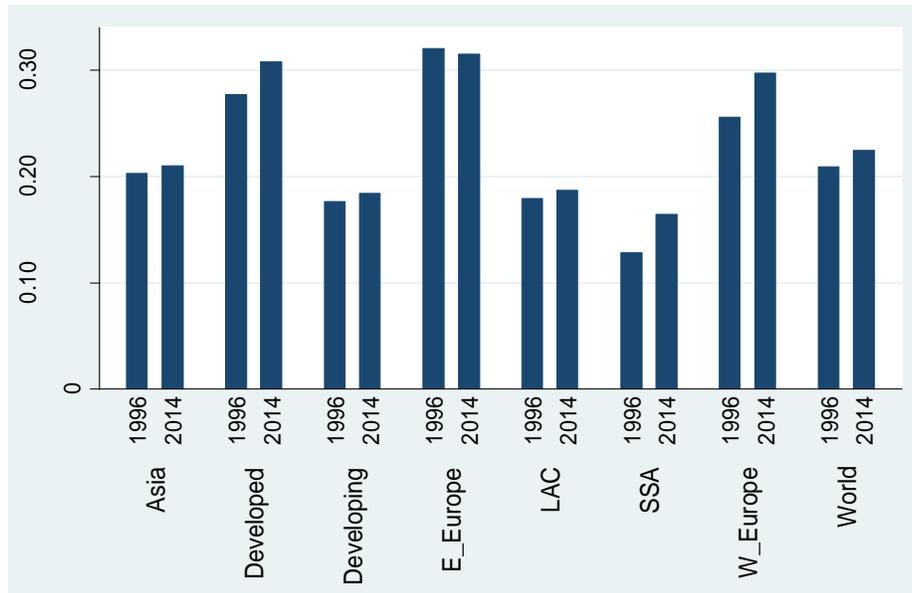
Albania	Denmark*	Korea*	Portugal*
Algeria	Dominican Rep.	Kuwait*	Qatar*
Argentina	Ecuador	Kyrgyz Rep.	Romania
Armenia	Egypt	Lao PDR	Russia
Australia*	El Salvador	Latvia*	Rwanda
Austria*	Estonia*	Lithuania	Saudi Arabia
Bahrain*	Finland*	Madagascar	Senegal
Bangladesh	France*	Malawi	Sierra Leone
Barbados	Gabon	Malaysia	Singapore*
Belize	Gambia	Mali	Slovak Republic*
Benin	Germany*	Malta*	Slovenia*
Bolivia	Ghana	Mauritania	South Africa
Brazil	Greece*	Mexico	Spain*
Bulgaria	Guatemala	Moldova	Sri Lanka
Burkina Faso	Haiti	Mongolia	Sweden*
Burundi	Honduras	Morocco	Switzerland*
Cambodia	Hong Kong*	Mozambique	Tajikistan
Cameroon	Hungary*	Nepal	Tanzania
Canada*	Iceland*	Netherlands*	Thailand
Central African Rep.	India	New Zealand*	Togo
Chile	Indonesia	Nicaragua	Tunisia
China	Iran	Niger	Turkey
Colombia	Ireland*	Nigeria	Uganda
Congo, Dem. Rep.	Israel*	Norway*	Ukraine
Congo, Rep.	Italy*	Pakistan	United Kingdom*
Costa Rica	Jamaica	Panama	United States*
Cote d'Ivoire	Japan*	Paraguay	Uruguay*
Croatia*	Jordan	Peru	Venezuela, RB
Cyprus*	Kazakhstan	Philippines	Vietnam
Czech Republic*	Kenya	Poland*	Zambia

**Developed countries*

Table A2. Basic Summary Statistics

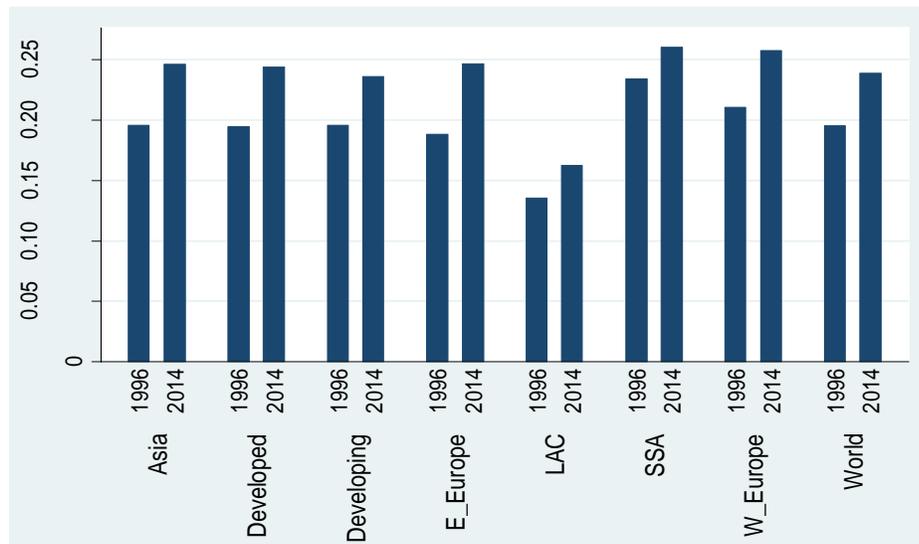
Variable	Mean	Stan. Dev.	Min.	Max.
Export Quality (ln)	-0.223	0.248	-1.607	0.066
Aggregate GVC (ln)	-0.842	0.270	-1.677	-0.020
Backward GVC (ln)	-1.696	0.601	-3.594	-0.030
Forward GVC (ln)	-1.557	0.446	-4.682	-0.547
Rule of Law	0.060	0.998	-2.130	2.100
Human Capital	2.462	0.700	1.053	3.734
Financial Development	0.346	0.242	0.000	1.000
Inflation	9.717	61.336	-26.300	2630.123

Figure 1A: Backward GVC participation, percent of gross export (1996-2014)



Source: Author's computation based on UNCTAD's EORA GVC database
Note: E_Europe is Eastern European countries; W_Europe is Western European countries

Figure 1B: Forward GVC participation, percent of gross export (1996-2014)



Source: Author's computation based on UNCTAD's EORA GVC database
Note: E_Europe is Eastern European countries; W_Europe is Western European countries

Table A3. GVC Participation and Quality Frontier

	Dependent Variable: Log Export Quality Frontier				
	Random Effect		IV-Random Effect	IV-Heteroscedasticity	
	(1)	(2)	(3)	(4)	(5)
GVC participation (ln)	-0.0785*** (0.027)	-0.0464* (0.026)	-0.0693*** (0.027)	-0.0600* (0.033)	-0.1001*** (0.030)
Rule of Law		-0.0719*** (0.009)	-0.0689*** (0.010)	-0.0637*** (0.013)	-0.0625*** (0.014)
Human Capital		-0.1124*** (0.020)	-0.0973*** (0.017)	-0.0819*** (0.036)	-0.0835*** (0.017)
Financial Development		0.0094 (0.038)	-0.0194 (0.039)	0.0369 (0.032)	0.0203 (0.027)
Inflation		0.0001** (0.000)	0.0001** (0.000)	0.0001** (0.000)	0.0001** (0.000)
# Observation	2,280	2,275	2,155	2,155	2,155
# Country	120	120	120	120	120
R-squared	0.06	0.40	0.39	0.06	0.05
Hansen <i>J</i> -test	–	–	0.41	0.92	0.17

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Column (3) column (4) and (5) use the heteroscedasticity based identification with column (4) utilizing the first period lagged value of GVC participation as an external instrument, while column (5) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries as external instrument.

Table A4. Backward and Forward GVC Participation, and Quality Frontier

	Dependent Variable: Log Export Quality Frontier				
	Random-Effect		IV-Random Effect	IV-Heteroskedasticity	
	(1)	(2)	(3)	(4)	(5)
Backward GVC (ln)	-0.0476*** (0.013)	-0.0374*** (0.013)	-0.0501*** (0.014)	-0.0447* (0.025)	-0.0425* (0.025)
Forward GVC (ln)	-0.0036 (0.016)	0.0123 (0.016)	-0.0002 (0.016)	-0.0094 (0.026)	-0.0038 (0.026)
Rule of Law		-0.0689*** (0.009)	-0.0645*** (0.009)	-0.0624*** (0.013)	-0.0603*** (0.013)
Human Capital		-0.1138*** (0.019)	-0.1000*** (0.017)	-0.0921** (0.036)	-0.0965*** (0.036)
Financial Development		0.0025 (0.038)	-0.0321 (0.039)	0.0307 (0.031)	0.0287 (0.031)
Inflation		0.0001* (0.000)	0.0001** (0.000)	0.0001** (0.000)	0.0001** (0.000)
# Observation	2,280	2,275	2,155	2,155	2,155
# Country	120	120	120	120	120
R-squared	0.198	0.431	0.431	0.061	0.061
Hansen <i>J</i> -test	–	–	0.12	0.83	0.61

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Column (3) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries. Column (4) and (5) use the heteroscedasticity based identification with column (4) utilizing the first period lagged value of GVC participation as an external instrument, while column (5) uses landlocked dummies, average remoteness index, and average weighted GVC participation of neighboring countries as external instrument.

The UNU-MERIT WORKING Paper Series

- 2020-01 *Debating the assumptions of the Thirlwall Model: A VECM analysis of the Balance of Payments for Argentina, Brazil, Colombia, and Mexico* by Danilo Spinola
- 2020-02 *The La Marca Model revisited: Structuralist Goodwin cycles with evolutionary supply side and balance of payments constraints* by Danilo Spinola
- 2020-03 *Uneven development and the balance of payments constrained model: Terms of trade, economic cycles, and productivity catching-up* by Danilo Spinola
- 2020-04 *Time-space dynamics of return and circular migration: Theories and evidence* by Amelie F. Constant
- 2020-05 *Mapping industrial patterns and structural change in exports* by Charlotte Guillard
- 2020-06 *For real? Income and non-income effects of cash transfers on the demand for food* by Stephan Dietrich and Georg Schmerzeck
- 2020-07 *Robots and the origin of their labour-saving impact* by Fabio Montobbio, Jacopo Staccioli, Maria Enrica Virgillito and Marco Vivarelli
- 2020-08 *STI-DUI innovation modes and firm performance in the Indian capital goods industry: Do small firms differ from large ones?* By Nanditha Mathew and George Paily
- 2020-09 *The impact of automation on inequality across Europe* by Mary Kaltenberg and Neil Foster-McGregor
- 2020-10 *What matters in funding: The value of research coherence and alignment in evaluators' decisions* by Charles Ayoubi, Sandra Barbosu, Michele Pezzoni and Fabiana Visentin
- 2020-11 *The productivity impact of business visits across industries* by Mariacristina Piva, Massimiliano Tani and Marco Vivarelli
- 2020-12 *Technological revolutions, structural change & catching-up* by Jan Fagerberg and Bart Verspagen
- 2020-13 *Semi-endogenous growth models with domestic and foreign private and public R&D linked to VECMs with evidence for five countries* by Thomas Ziesemer
- 2020-14 *The economic impact of public R&D: an international perspective* by Luc Soete, Bart Verspagen and Thomas H.W. Ziesemer
- 2020-15 *Taking the challenge: A joint European policy response to the corona crisis to strengthen the public sector and restart a more sustainable and social Europe* by Jo Ritzen, Javi Lopez, André Knottnerus, Salvador Perez Moreno, George Papandreou and Klaus F. Zimmermann
- 2020-16 *Migration of higher education students from the North Africa Region to the United Kingdom* by Samia Satti Osman Mohamed Nour
- 2020-17 *Overview of the Sudan Uprising* by Samia Satti Osman Mohamed Nour
- 2020-18 *Inter-country Distancing, Globalisation and the Coronavirus Pandemic* by Klaus F. Zimmermann, Gokhan Karabulut, Mehmet Huseyin Bilgin and Asli Cansin Doker
- 2020-19 *How does innovation take place in the mining industry? Understanding the logic behind innovation in a changing context* by Beatriz Calzada Olvera & Michiko Iizuka
- 2020-20 *Public universities, in search of enhanced funding* by Jo Ritzen
- 2020-21 *Ph.D. research output in STEM: the role of gender and race in supervision* by Giulia Rossello, Robin Cowan and Jacques Mairesse
- 2020-22 *Labour market effects of COVID-19 in sub-Saharan Africa: An informality lens from Burkina Faso, Mali and Senegal* by Racky Balde, Mohamed Boly, and Elvis Avenyo

- 2020-23 *Occupational sorting and wage gaps of refugees* by Christopher F Baum, Hans Lööf, Andreas Stephan and Klaus F. Zimmermann
- 2020-24 *Policy opportunities and challenges from the Covid-19 pandemic for economies with large informal sectors* by Rajneesh Narula
- 2020-25 *Economic gender gap in the Global South: how institutional quality matters* by Elena Bárcena-Martin, Samuel Medina-Claros and Salvador Pérez-Moreno
- 2020-26 *How important is GVC participation to export upgrading* by Gideon Ndubuisi and Solomon Owusu