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Does participation in global value chain foster export concentration?

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Abstract

This study examines the extent to which participation in global value chains (GVCs) enabled countries to specialize their exports by using a panel of 91 economies categorized into high, middle, and low-income groups from 1995 to 2017. Both the forward and backward linkages in GVCs are considered. By employing the cross-sectional augmented Im–Pesaran–Shin panel unit root test, we found that the variables are nonstationary across the income groups. The findings from the Westerlund cointegration test supports the long-run association between GVCs and export concentration for all the income groups. The long-run elasticities obtained using the dynamic ordinary least squares method provided mixed results for the various income groups. Moreover, the results derived using the Dumitrescu–Hurlin panel causality test provides evidence of mixed outcomes.

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1. Introduction

The term global value chains (GVCs) refers to a "series of stages involved in producing a good or service with at least two stages of production accomplished in two different countries" (Global value chain development report, 2017). The activities in the production process range from designing, production, marketing, distribution, and support to the final consumer. The emergence of GVCs has altered the export patterns. Escalating exports in the traditional modes of trade require that the complete product should be manufactured in the country. However, through participation in GVCs, a country can either involve in the production of an intermediate input or a final product. GVCs also offers new prospects for economies to increase their association in global trade by either specializing or diversifying their exports[1] (Global value chain development report, 2017). Studies have examined the various channels through which GVCs affect exports. Hummels *et al*. (2001) and Koopman *et al*. (2011) explored the effects of GVC on firms' production and exporting activities. GVCs provide local firms with an opportunity to collaborate with foreign firms to specialize in new, complex, and competitive products (Lall, 2000). Countries tend to specialize in their exports due to their factor intensities and comparative advantages (Jaud *et al.*, 2012). Moreover, GVCs are related to technology spillovers, knowledge transfers, and collaboration for learning, thus helping firms to participate in new sectors and products (Humphrey and Schmitz, 2002; Pietrobelli and Rabelloti, 2011; Taglioni and Winkler, 2016; Cainelli *et al*., 2018). Most of the exports are due to foreign value-added content, which is widely ignored in export concentration studies (Hummels *et al*., 2001; Amador and Cabral, 2009). Mariscal and Taglioni (2017) examined the spillover effects of GVCs and concluded the heterogeneous outcomes of GVCs on the basis of the income level and type of production activities. The GVC development report also includes the different activities considered across income groups. For instance, the high-income countries mostly involve in complex operations such as branding, organizational capital, and coordination. Middle-income countries engage in the activities of cutting-edge manufacturing and services. Moreover, low-income countries concentrate on activities such as assembly, which are generally low value-added activities.

A higher income level generates greater demand for diversity of goods and services, thus leading to diversification of the economy. The availability of complementarities through GVCs may compel countries to diversify or concentrate their exports. Moreover, the demand for higher quality and sourcing requirements may influence countries to concentrate their exports. In addition to the above arguments, the varying degrees of activities considered by various income groups based on the availability of resources, factor intensities, and advantage in the production of specific tasks motivated this study to examine whether participation in GVCs encourages countries to specialize or diversify their production and exporting patterns across the income groups. A few studies have examined the relation between GVCs and production specialization through comparative advantage factors (Levchenko, 2007; Nunn, 2007; Costinot *et al*., 2013; Criscuolo and Timmis, 2017; Lanz and Piermartini, 2018). However, there is no evidence on the extent to which GVC participation enables countries to diversify or concentrate their exports. Moreover, the measurement of GVCs is narrow in the above studies and does not reflect the true degree of GVC participation. Our study bridges this research gap and contributes to the literature on several counts. First, we examined whether participation in GVCs enables countries to

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[1]Export specialization or export concentration indicate whether a country's exports are focused on a small number of products or a few number of trading partners. Conversely, exports of a country which comprise of large number of products or large number of trading partners reflects export diversification (Dennis and Shepherd, 2007; Akram, 2019).

specialize or diversify their exports. Since the GVC participation varies among countries with different income levels, countries were categorized into the high-income group (HIG), middle-income group (MIG), and low-income group (LIG) to determine whether exporting patterns remain similar across different income groups. Examining this issue is policy relevant because GVC is one of the key determinants of production patterns, which ultimately alter the exporting patterns. Second, we examined the aforementioned relation by considering the broader measures of GVC participation advanced by Koopman *et al*. (2014). Third, we considered both forward linkage (FL) and backward linkage (BL) of GVCs to better understand the dynamics of export concentration or diversification because most of the studies conducted to date only consider one aspect of GVC either by taking FL or BL. Finally, we contributed to previous related studies in terms of the methodology by considering the recent techniques that are robust to cross-sectional dependence and heterogeneity.

This paper is organized as follows: Section 2 presents the data and methodology. Section 3 discusses the empirical results, and section 4 concludes the study.

2. Data and Methodology

Based on the data availability, this study considered 91 countries. These countries were broadly categorized into HIG, MIG, and LIG[2]. The analysis period was from 1995–2017. We selected the Hirschmann Index (Product HHI) published by the United Nations Conference on Trade and Development as a measure of export concentration. The export concentration was measured by using an index. The index value closer to 1 (or 0) indicates that a country's export is highly concentrated (or diversified). We considered both FL and BL of GVCs that were extracted from the EORA global supply chain database. FL in GVCs are calculated in terms of the domestic value-added embodied in foreign exports. Similarly, BL in GVCs are calculated in terms of the foreign value-added embodied in domestic exports.

To examine the long-run relationship between the GVCs and export concentration (XC), we considered two specifications. In the specification I, the link between the FL of GVCs and XC were investigated. Specification II refers to the relationship between the BL of GVCs and XC. The empirical model is given as follows:

$$\textbf{I: } XC_{it} = \alpha_{0i} + \alpha_{1it} FL_{it} + \mu_{it} \quad (1)$$

$$\textbf{II: } XC_{it} = \beta_{0i} + \beta_{1it} BL_{it} + \mu_{it} \quad (2)$$

where αs and βs are the unknown parameters that have to be estimated, i indicates the cross-section over time t, and μ_{it} is the error term.

To examine the above relation, we first employed the cross-sectional dependence (CD) (Pesaran, 2004) and cross-sectional augmented Im–Pesaran–Shin (CIPS) panel unit root tests by Pesaran (2007). These tests were selected because we dealt with a large number of cross-sections that may cause CD to lead to a biased outcome. Therefore, to tackle this issue, we considered CD and CIPS tests because they are superior to the conventional unit root tests. Second, to avoid the possible sources of endogeneity in our empirical specification, we implemented the following procedure (Akram and Rath, 2019):

$$\textbf{I: } XC_{it} = \alpha_i + \beta FL_{it-1} + \varepsilon_{it} \quad (3)$$

$$FL_{it} = \mu_i(1-\rho) + \rho FL_{it-1} + \epsilon_{it} \quad (4)$$

$$\varepsilon_{it} = \gamma_i \epsilon_{it} + \eta_{it} \quad (5)$$

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[2] The categorization is based on the World Bank classification of countries. The list of countries in each income group are presented in the Appendix.

$$\textbf{II: } XC_{it} = \varphi_i + \delta BL_{it-1} + \theta_{it} \tag{6}$$
$$BL_{it} = \vartheta_i(1 - \emptyset) + \emptyset BL_{it-1} + \mu_{it} \tag{7}$$
$$\theta_{it} = \sigma_i \mu_{it} + \omega_{it} \tag{8}$$

where ε_{it}, ϵ_{it}, η_{it}, θ_{it}, μ_{it}, and ω_{it} are the errors of the respective models and α_i, β, μ_i, ρ, γ_i, φ_i, δ, ϑ_i, $\emptyset$, and σ_i are the parameters to be estimated. We reject the null of "no endogeneity" if $H_0: \gamma_i = 0$ for specification I and $H_0: \sigma_i = 0$ for specification II.

Third, to attain the aim of this study, we applied the Westerlund (2007) panel cointegration test because this test produces consistent results in the presence of CD. The null hypothesis of "no cointegration" in the presence of CD was tested by validating whether the conditional error-correction term is equivalent to zero. Fourth, to estimate the long-run results, we used the dynamic ordinary least squares (DOLS) technique developed by Stock and Watson (1993), which is superior to the fully modified ordinary least squares. Finally, we checked the direction of causality between GVCs and export concentration by using the Dumitrescu–Hurlin (DH, 2012) panel causality test. This test is useful when there are CDs and heterogeneities in the panel. Hence, this test yields robust results over the Granger (2004) causality test. The DH panel causality model is given as follows:

$$\textbf{I: } XC_{it} = \sum_{k=1}^{K} \gamma_i^{(k)} XC_{i,t-k} + \sum_{k=1}^{K} \alpha_i^{(k)} FL_{i,t-k} + \varepsilon_{it} \tag{9}$$
$$\textbf{II: } XC_{it} = \sum_{k=1}^{K} \delta_i^{(k)} XC_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} BL_{i,t-k} + \varepsilon_{it} \tag{10}$$

where K denotes the lag length, which is identical for all the countries in the panel. $\gamma_i^{(k)}$ and $\delta_i^{(k)}$ are the autoregressive parameters, and $\alpha_i^{(k)}$ and $\beta_i^{(k)}$ are the regression coefficients. We also considered the country-specific fixed effects for equations 1 and 2 to account for the unobserved characteristics.

3. Empirical results

We begin this section by examining the presence of CDs by using the Pesaran (2004) test. The null hypothesis (H_0) of the test is "cross-sectional independence." The results presented in Table I reveal the rejection of the null hypothesis, thus signifying the presence of CD for the specification I and II across all the income groups (high, middle, and low). We examined the stationary properties of a unit root in the presence of CD by using the panel unit root test of Pesaran (CIPS, 2007). The null hypothesis of the test is that the series is homogenous with a unit root. The results are reported in terms of the level and trend in Table II. The null hypothesis is accepted, thus indicating that the series XC, FL, and BL are nonstationarity across all the income groups.

Table I: Evidence of cross-sectional dependence

Variables	HIG		MIG		LIG	
	Pesaran (2004)	Absolute correlation	Pesaran (2004)	Absolute correlation	Pesaran (2004)	Absolute correlation
XC	7.12*** (0.00)	0.38	2.36*** (0.00)	0.44	2.85*** (0.00)	0.39
FL	82.55*** (0.00)	0.65	55.81*** (0.00)	0.68	40.87***(0.00)	0.59
BL	36.97*** (0.00)	0.46	4.86*** (0.00)	0.34	14.27*** (0.00)	0.46

Notes: XC, FL, and BL represent export concentration, forward, and backward linkages in GVCs. The p-values are given in parenthesis. *** denote statistical significance at 1% level. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

Table II: Results of the panel unit root test

CIPS statistic	HIG			MIG			LIG		
	XC	FL	BL	XC	FL	BL	XC	FL	BL
C	-0.74	-0.57	-0.84	0.18	2.34	0.19	0.66	0.28	-0.36
	(0.23)	(0.28)	(0.20)	(0.57)	(0.99)	(0.57)	(0.74)	(0.61)	(0.35)
K	0	3	4	2	3	1	2	3	0
C&T	-0.33	-0.07	-0.56	-0.56	2.10	-0.08	-0.85	-0.71	-0.98
	(0.37)	(0.47)	(0.28)	(0.28)	(0.98)	(0.46)	(0.19)	(0.24)	(0.16)
K	1	2	1	0	3	1	0	1	0

Notes: XC, FL, and BL represent export concentration, forward and backward linkages in GVCs. C and C&T refer to intercept and intercept with the trend. K is the number of lags chosen. The p-values are given in parenthesis. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

Table III: Results of the endogeneity test for panel data.

Sample	Specification	Coefficient	p-value
HIG	I: XC=f(FL)	-0.003	(0.96)
	II: XC=f(BL)	-0.12	(0.21)
MIG	I: XC=f(FL)	0.43	(0.37)
	II: XC=f(BL)	-0.31	(0.09)
LIG	I: XC=f(FL)	0.09	(0.61)
	II: XC=f(BL)	-0.18	(0.51)

Notes: XC, FL, and BL represent export concentration, forward and backward linkages in GVCs. The p-values are given in parenthesis. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

In the next stage, we checked for the presence of endogeneity by using equations (3)– (8). The results presented in Table III reveal that the null of "no endogeneity" is accepted for all the income groups at a significance level of 5%, thus suggesting the absence of endogeneity. The non-stationarity of variables motivated us to examine whether a long-run relationship exists between GVCs and export concentration. Table IV presents the panel cointegration results estimated through the Westerlund cointegration test (2007). The test assumes the null hypothesis of "no cointegration." The results point out the rejection of the null hypothesis. This provides the evidence of long-run cointegration in the case of all the income groups for specifications I and II.

Table IV: Evidence of panel cointegration

Sample	Specification	Westerlund (2007) statistic			
		Gt	Ga	Pt	Pa
HIG	I: XC=f(FL)	-2.51*** (0.00)	-9.43*** (0.00)	-16.29*** (0.00)	-8.55*** (0.00)
	II:XC=f(BL)	-2.30*** (0.00)	-8.77** (0.03)	-13.62*** (0.00)	-6.94*** (0.00)
MIG	I: XC=f(FL)	-2.45*** (0.00)	-9.06** (0.04)	-13.55*** (0.00)	-10.83*** (0.00)
	II:XC=f(BL)	-2.05* (0.07)	-7.34 (0.44)	-11.55*** (0.00)	-8.47*** (0.00)
LIG	I: XC=f(FL)	-2.74*** (0.00)	-10.38*** (0.00)	-12.74*** (0.00)	-8.04*** (0.00)
	II:XC=f(BL)	-2.49*** (0.00)	-8.35 (1.54)	-10.83*** (0.00)	-7.41*** (0.00)

Notes: XC, FL, and BL represent export concentration, forward and backward linkages in GVCs. The p-values are given in parenthesis. ***, ** and * denote statistical significance at 1%, 5% and 10% level respectively. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

The long-run results are estimated using the DOLS method. The indicators of GVCs are expressed as a percentage of the gross exports, whereas the export concentration is measured as an index. An improvement in the index suggests that the exports of a country are concentrated in a few products or few trading partners. Conversely, a decline in the index refers to export diversification. The results presented in Table V suggest that the coefficient of FL is 0.12 for a

HIG, thus suggesting that a one-unit increase in FL in terms of the percentage of gross exports leads to increase in the export concentration index by 0.12 units. Similarly, in the case of the MIG, our results reveal that a one-unit increase in FL in terms of the percentage of gross exports leads to an increase in the export concentration index by 0.67 units. However, for the LIG, the FL expressed as a percentage of the gross exports negatively affects the export concentration index. This outcome reveals that a one-unit increase in FL as a percentage of the gross exports leads to a decrease in the export concentration index by 0.35 units. In summary, FLs have a positive association with the export concentration for HIGs and MIGs and negative association for the LIG.

Table V: Long-run results

Sample	I: XC=f(FL)	II: XC=f(BL)
HIG	0.12*(0.08)	0.15** (0.04)
MIG	0.67*** (0.00)	-0.97*** (0.00)
LIG	-0.35*** (0.00)	-0.14* (0.09)

Notes: XC, FL, and BL represent export concentration, forward and backward linkages in GVCs. The p-values are given in parenthesis. ***, ** and * denote statistical significance at 1%, 5% and 10% level respectively. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

Conversely, a one-unit improvement in the BL expressed as a percentage of the gross exports in the HIG leads to a 0.15 unit increase in the export concentration index. However, a one-unit improvement in the BL expressed as a percentage of gross exports in the MIG and LIG decreases the export concentration index by 0.97 and 0.14 units, respectively. In other words, the availability of cheaper and efficient inputs is fostering the MIG and LIG to diversify their exports. The reasoning behind the aforementioned results is that the high-income countries are mostly involved in the upstream part of the value chain, that is, providing intermediates to produce final goods, innovation, and design. These countries specialize and export goods that have a comparative advantage due to the scale effects and abundant availability of capital. Conversely, low-income countries are mostly involved in the manufacturing or assembling stages due to the availability of a vast workforce, and thus they tend to diversify their exports (Farole *et al*., 2018). The middle-income countries comprise emerging economies that have moved upstream of the value chain (De Backer and Miroudot, 2013). In other words, these countries have begun specializing in the production of complex intermediates due to the substitutability between labor and capital. The additional differences in the specialization and diversification patterns of exports can be due to the transport costs, logistic capabilities, trade openness, human capital, remoteness, terms of trade, domestic credit, and natural resources (Agosin *et al*., 2011; Osakwe and Kilolo, 2018).

Moreover, we examined the direction of causality by applying the DH (2012) panel causality test. This test is preferred over the Granger (2004) causality test because the DH test is robust in the presence of CDs and heterogeneities in the panel. Table VI reveals a unidirectional causality from 'FL' to 'export concentration' for specification I in both HIGs and MIGs. This infers that FL in GVCs enables countries to specialize their exports for all the income groups. Furthermore, bi-directional causality was observed for the LIG. This implies that the export concentration enables the LIG to participate in the FLs of GVCs. In specification II, we found a unidirectional causality from 'BL' to 'export concentration' across all the income groups. The findings suggest that BL in GVCs facilitates countries to specialize in their exports for all the income groups.

Table VI: Results of panel causality test.

Sample	Specification	Direction	W-stat.	Zbar Stat.	Prob.
HIG	I	FL → XC	5.21***	2.80***	(0.01)
		XC → FL	3.72	-0.64	0.52
	II	BL → XC	6.02***	4.70***	(0.00)
		XC → BL	4.32	0.76	(0.44)
MIG	I	FL → XC	13.13***	12.86***	(0.00)
		XC → FL	1.30	1.06	(0.28)
	II	BL → XC	1.69***	2.46***	(0.01)
		XC → BL	1.14	0.51	(0.61)
LIG	I	FL → XC	1.55*	1.88*	(0.06)
		XC → FL	1.59**	2.02**	(0.04)
	II	BL → XC	1.78***	2.66***	(0.00)
		XC → BL	0.79	-0.68	(0.49)

Notes: XC, FL, and BL represent export concentration, forward and backward linkages in GVCs. The p-values are given in parenthesis. ***, ** and * denote statistical significance at 1%, 5% and 10% level respectively. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

Table VII: Results of fixed/random effects

Sample	Specification	Coefficient	Hausman test
HIG	I: XC=f(FL)	0.08* (0.08)	3.26* (0.07)
	II: XC=f(BL)	0.18*** (0.00)	18.25*** (0.00)
MIG	I: XC=f(FL)	0.73*** (0.00)	0.07 (0.79)
	II: XC=f(BL)	-0.87*** (0.00)	0.95 (0.33)
LIG	I: XC=f(FL)	-0.33*** (0.00)	0.47 (0.48)
	II: XC=f(BL)	0.04 (0.73)	1.45 (0.23)

Notes: XC, FL, and BL represent export concentration, forward and backward linkages in GVCs. The p-values are given in parenthesis. ***, and * denote statistical significance at 1%, and 10% level respectively. HIG: High-income group; MIG: Middle-income group; LIG: Low-income group.

Finally, to account for country-specific fixed effects, we estimated the equations (1) and (2) by using fixed and random effect specifications. The results are presented in Table VII. Based on the Hausman test, the fixed effect is used for the HIG, and random effects are used for the MIGs and LIGs. After accounting for the country-specific fixed effects, our results are found to be consistent with the DOLS estimates except for the BL in LIG.

In summary, a country's participation in GVCs has facilitated some economies to associate with new markets, integrate well with the world economy, advance in technology, and diversify exports. GVCs have assisted few other countries to specialize in specific tasks in which they have a comparative advantage rather than developing the complete industry.

4. Concluding remarks

This study examined whether participation in GVCs through FLs and BLs enables in the specialization or diversification of exports for high, middle, and low-income countries. We found the existence of a long-run association between GVCs (both FL and BL) and export concentration. However, the long-run findings pointed out the mixed results for the across income groups. Moreover, this study examined the direction of causality. The results obtained from the DH (2012) panel causality test reveal mixed results across the different income groups.

From the policy perspective, participation in GVCs helps countries to specialize or diversify in the products that have a comparative advantage. In other words, GVCs enable countries to focus on the available abundant resources more efficiently than investing in developing a complete industry. Strategies to improve research and development, logistic capabilities, and legal institutions are vital in addition to the trade policies to reap the benefits associated with GVCs.

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Appendix

HIG	MIG	LIG
Argentina, Australia, Austria, Barbados, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Qatar, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad & Tobago, United Kingdom, United States, Uruguay.	Albania, Algeria, Armenia, Azerbaijan, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Iran, Jamaica, Jordan, Kazakhstan, Malaysia, Mexico, Peru, Romania, Russian Federation, South Africa, Thailand, Turkey, Venezuela.	Bangladesh, Bolivia, Cameroon, Egypt, Ghana, India, Indonesia, Kenya, Madagascar, Malawi, Mali, Morocco, Niger, Nigeria, Pakistan, Philippines, Senegal, Sri Lanka, Syria, Tunisia, Uganda, Ukraine, Uzbekistan

Notes: HIG-High-income group; MIG-Middle-income group; and LIG-Low-income group.