Global Value Chain, Productivity and Job Market Effect

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Abstract

Applying a set of comprehensive Global Value Chain (GVC) indices, this study evaluates the GVC's employment impact with the most recent WIOD dataset between the years 2000 and 2014 from 56 industries in 43 economies, which include 28 EU countries and 15 other major countries and are classified into high-, middle-, and low-productivity groups. The results show that GVC participation only has some small positive impact for more advanced economies when the forward and backward GVCs are combined in estimation, all other impacts are very weak and insignificant.

Also, the backward GVCs tend to be more beneficial in generating domestic job opportunities than the forward GVCs, especially for the less developed economies.

Keywords: backward GVC linkage, employment, forward GVC linkage, Global Value Chains, GVCs

1. Introduction

International trade has been increasingly dominated by global value chains (GVCs), where the intermediate goods and services, instead of the final goods, are exchanged between countries. A joint report by OECD, WTO and UNCTAD finds that between 30% and 60% of G20 countries' exports are comprised of imported inputs or used as inputs by others (OECD, WTO & UNCTD, 2013). United Nations Conference on Trade and Development's 2013 World Investment Report also finds that about 60% of global trade ($20 tri) consists of trade in intermediate goods and services, which are then incorporated at different stages of production (UNCTD, 2013). According to an OECD report in 2015, around three quarters of international trade is businesses buying intermediate inputs (OECD, 2015).

The prevalence of GVCs has significantly transformed the world trade, and therefore the definition of exports and imports.

As the traditional measures of trade and competitiveness change, so should their interpretation and their impacts on economy. With value-added trade, the relationship between trade and employment becomes more complicated. The labour content associated with a country's international trade goes beyond domestic labour contained in exports and foreign labour contained in imports. With GVC trade, three more categories of employment come into play: foreign labour contained in exports, domestic labour contained in imports and third-country labour contained in a country's imports (Jiang & Milberg, 2013). Since GVC measures the degree a country's participation in global value chains, it focuses on the imports/exports of intermediate goods, while ignoring the imports/exports of final goods. Imports of final goods affect domestic job market negatively to the degree that the imported goods substitute for the domestic final goods. Imports of intermediate goods could still have similar substitution effect on domestic jobs. However, imported intermediate goods are directly used by the importing industry for further production, thus likely expanding its demand for labour. GVCs' perspective also highlights the positive impact on domestic jobs when the import contains significant domestic labour content, as illustrated in the case of iPhone and iPad. On the other hand, although exporting intermediate goods or services shares the same positive impact on domestic jobs as exporting final goods or service, it is also exporting downstream job opportunities to other countries, thus adding possible negative impacts on domestic jobs. As GVC trade becomes increasingly

dominant in the world economy, it is important to highlight all these important impacts hidden in the traditional measure of gross trade.

The current study will examine the GVC's employment impact using the World Input-Output Data from 56 industries in 43 economies. The 43 economies including 28 EU countries and 15 other major countries in the world are classified into three categories based on GDP per person engaged: high-productivity, middle-productivity and low-productivity economies. Based on the multi-country data, we try to examine if deeper involvement in the GVC is beneficial or detrimental to the domestic job opportunities. Are there any differences in the GVC's employment impact between an advanced economy and a less advanced economy? The hypothesis to be tested in the current study is that the employment impact of the GVC participation will exhibit a different pattern among the economies of different level of development. We cannot mechanically copy one country's experience to another.

2. Literature Review

Studies on GVC trade's impact on employment started to appear in the literature around 2000, initially focusing on the impact of outsourcing. As summarized in Görg (2011), the impact of outsourcings on employment could be complicated, including a technology (or relocation) effect and a scale effect [in the terminology of Hijzen & Swaim (2007)] the former displacing workers and the latter increasing business productivity, operation efficiency and sales, thus increasing employment.

Studies on employment impact should consider not only direct effects on the enterprise engaging in offshoring, but also possible indirect and second-order employment effects on other firms and broader ripple effects on the overall employment in the economy.

Empirical studies have generated mixed results. In a report that analyses the specific factors that affect the competitiveness of developing countries in GVCs, Bamber, Fernandez-Stark, Gere, and Guinn (2013) suggests that, for developing countries, GVC participation generally tends to lead to job creation and to higher employment growth. GVCs are also found to cause reallocation of jobs across and within countries (Grossman & Rossi-Hansberg, 2008). Reallocation of jobs between occupations takes time especially for low-skilled workers. In the presence of frictions in labour markets, the process of reallocation can lead to short-term unemployment in certain industries or occupations, even if aggregate employment may not be reduced. Taglioni and Winkler (2014) emphasizes how GVC trade can help upgrade the quality of the local labour force through three mechanisms: demand effect, training effect and labour turnover effect. Therefore, GVC participation may cause higher demand for high-skill workers.

Some earlier multi-country studies generate mixed results. Using twelve OECD countries' sector data that covers 26 industries from 1995 and 2000, OECD (2007) finds small job loss effect from offshoring. For a 1% increase in offshoring, the sectoral employment will contract by 0.15% in manufactories, but roughly 0.08% in services. The impact on employment varies from sector to sector and from country to country. Falk & Wolfmayr (2008) finds similar small negative impacts of outsourcing on employment in both the manufacturing and non-manufacturing sectors by using input-output tables for five European countries. Hijzen and Swaim (2007) uses sectoral data for 17 high-income OECD countries from 1995 and 2000 in a similar study. By separating the technology (or relocation) and the scale effects, they find offshoring has no effect or a slight positive effect on sectoral employment, which is consistent with findings by Amiti & Wei (2005a; 2005b). Their findings suggest productivity gains from offshoring may be sufficiently large that the jobs created by scale effect completely offset the jobs lost by relocation effect.

Current empirical studies on GVC's impact on employment tend to focus on one of its two important dimensions: outsourcing or offshoring, what is now termed "backward linkage" in the GVC literature. There are few studies on the "forward linkage" impact. Under the strong influence of traditional framing in theoretical and empirical studies on the employment impact of international trade, it is understandable to see how the backward linkage has gained such prominence in the literature. However, global value chains link an economy not only through importing intermediate

goods from its upstream foreign suppliers but also through exporting intermediates to its downstream foreign users, the "forward linkage". A study on GVC's employment impact should take both the "backward linkage" and "forward linkage" into consideration to provide a complete picture. One recent multi-country study (Farole, Hollweg & Winkler, 2018) specifically differentiates backward from forward integration when it examines the GVC impacts on labour demand. Their findings suggest that although a one percent increase in backward GVC integration (as measured by the level of foreign value added in exports) is associated with a 0.40 percent increase in labour demand (as measured by total labour value added), the intensity of both backward and forward GVC integration is negatively correlated with labour demand. However, in Farole, *et al*., (2018), the labour demand variables are measured by the labour compensation (total labour value added level and its share), instead of the actual number of workers/employees or working hours impacted. Since total labour compensation is affected by both the quantity and quality of labour, the result could potentially be biased by the skill composition of the labour force. Also, LACEX data used in Farole, *et al*., (2018) is limited to a number of years (Five years: 2001, 2004, 2007, 2011, and 2014).

This paper intends to complement the existing empirical studies on GVCs impact on employment by applying a comprehensive set of GVC indices recently developed by Wang, Wei, Yu & Zhu (2017), which measures both the backward and forward GVC linkages based on data from the World Input-Output Database that covers the years continuously from 2000 to 2014 across 56 primaries, manufacturing, and service industries in 43 economies. We hope our study will shed more light on the current issue surrounding GVCs' impact on employment in the multi-country context.

The rest of the paper is organized as follows: the next section discusses the GVC measurement and related data; Section 4 introduces the theoretical and empirical models for our estimation; Section 5 then discusses the estimation results; finally, in Section 6 we draw some conclusions.

3. GVC Measurement and Data

A GVC can be simply defined as the value added of all activities around the world that are directly and indirectly needed to produce a final product, like an iPhone. A little more elaborate definition, adapted from the Global Value Chain Initiative at Duke University, states that "[a] global value chain describes the full range of activities undertaken to bring a product or service from its conception to its end use and how these activities are distributed over geographic space and across international borders" (DFAIT, 2011; Amador & di Mauro, 2015). The key elements of a GVC are therefore "value-added" and "disintegration of the process across borders".

In order to trace out the source and use of the value-added across international borders, a world input output table is typically used to account for the GVCs at country-industry level. Each row of the input-output table shows how a country-industry's output is used as intermediate inputs across industries, and as final products, in various countries in the world. Each column shows how much each country-industry in the world contributes to the production of a particular country-industry's output. The value added from an industry is its output minus the value of the intermediates inputs.

Following Leontief's pioneer work in input-output model, matrix operations are then used to establish the relationship between the input requirements from all the related country-industries and the change in the final demand for a product. The cross-border input-output connection then provides the basis to measure the degree of global value chain participation.

There have been various measures for GVC participation used in literature. The most recent and comprehensive one is proposed by Wang *et al*., (2017), which clearly define GVCs only as those value added creation whose embodied factor content crosses national border for production purposes, and proposed a set of GVC participation indices, corresponding to a producer's perspective (based on forward industrial linkages) and a user's perspective (based on backward industrial linkages).

The backward linkage shows how much an industry depends on the imported intermediate inputs from other countries. China's tire industry importing natural rubber from Thailand, Indonesia, and

Malaysia is a good example of backward GVC linkage. The backward GVC participation index is thus defined as the share of all upstream sectors' value-added in an industry's total GDP:

$$GVCPt\_B = \frac{GVC\_B}{Y'} = \frac{GVC\_B\_S}{Y'} + \frac{GVC\_B\_C}{Y'} \qquad \textbf{(1)}$$

The forward GVC linkage shows how much a country-industry contributes to the global value chain activities by exporting intermediate inputs to other countries' industries. US auto industry exporting billions of dollars of auto parts to Mexico and Canada's auto industry is an example of the forward GVC linkage. The forward GVC participation index is thus defined as the share of all downstream sectors' use of a home industry's value-added:

$$GVCPt\_F = \frac{GVC\_F}{Va'} = \frac{GVC\_F\_S}{Va'} + \frac{GVC\_F\_C}{Va'} \qquad \textbf{(2)}$$

Since an industry could be engaged in both backward and forward GVC activities, a GVC ratio can be derived from the relative values of the two indices to indicate a country-industry's position in the global value chain activities. If we define GVC Ratio as the ratio of forward participation index to the backward participation index, a higher value indicates that the country-industry is dominated by upstream production activities in that global value chain. The world GVC ratios trend from 2000-2014 and for three productivity country groups are presented in Fig. 1. The figure shows an overall trend of moving from more downstream production to more upstream activities in GVC. There were big fluctuations for low-productivity countries (Group 3), but overall, they followed the same pattern as the world trend. The exception was high-productivity countries (Group 1). They had been moving away from upstream production to more downstream activities in GVC.

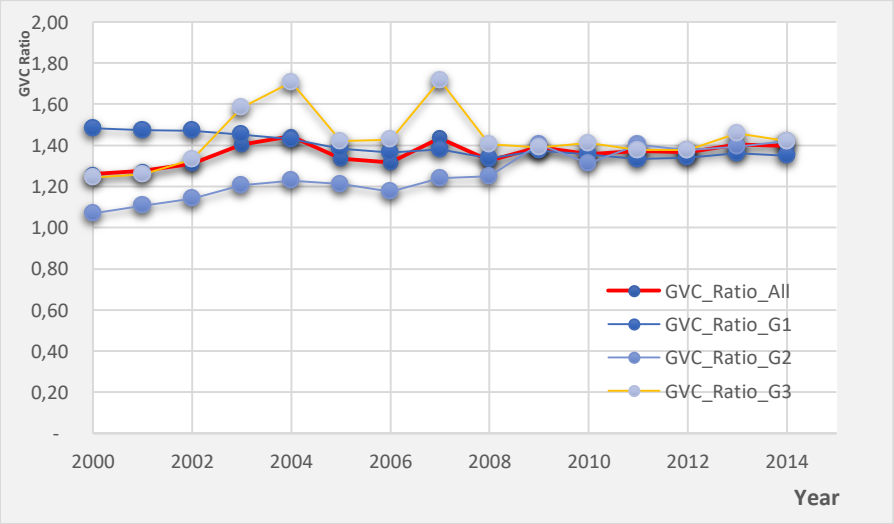

Fig. 1. World GVC Ratio (2000-2014)

We will use the World Input-Output Database (WIOD) constructed by the WIOD Project. As discussed in (Timmer, Dietzenbacher, Los, Stehrer, & Vries, 2015), the advantages of WIOD over other databases are public availability and free access to time series industry-level data, full transparency on the underlying data sources and methodologies, and extensive satellite accounts with environmental and socio-economic indicators that match the industry classification for the trade tables. The data derivation and processing has been greatly facilitated by the research team at University of International Business and Economics in China. Primarily based on the accounting methods in Koopman, Wang & Wei (2014) and Wang *et al.*, (2017), the team has constructed the UIBE GVC Index system from the major inter-country input-output databases (currently it includes

data from WIOD, OECD-TiVA, GTAP and ADB-MRIO). Our measures of the US GVC participation are extracted from UIBE GVC Index dataset that is based on WIOD.

WIOD Project currently has produced two dataset releases. Release 2013 consists of world input output tables for 35 industries from 40 countries (27 EU members and 13 other major countries) in the world for the period from 1995 to 2011. Release 2016 covers data from the period 2000-2014 with 56 industries from 43 countries (three more countries were added: Switzerland, Croatia and Norway). Unfortunately, the two datasets cannot be directly combined due to the fact that Release 2013's 35 sectors are classified according to the International Standard Industrial Classification revision 3 (ISIC Rev. 3), with its tables adhering to the 1993 version of the SNA, while Release 2016's 56 sectors are classified according to the ISIC Rev. 4, with its tables adhering to the 2008 version of the SNA. Our study will use the data based on Release 2016.

4. Regression Model and Methodology

Within the framework of Hamermesh (1996)'s approach, we can derive the labour demand in the spirit of Amiti and Wei (2005) from the industry production function given by:

$$Y = A(fw, bw)L^{\alpha}K^{\beta} \qquad \textbf{(3)}$$

Where output Y is a function of labour L, capital K. The productivity shifter A is a function of the industry's forward GVC linkage (fw) and backward GVC linkage (bw). An industry's productivity can benefit from backward GVC linkage as a result of increased specialization, access to more variety and higher quality of imported inputs, and stronger incentive for domestic suppliers within the same industry to lower costs under the pressure from foreign supplier competition (Criscuolo & Timmis, 2017). The returned domestic value-added components in GVCs serve as a channel to shift some efficiency dividends back to the home country after foreign firms have enjoyed the benefits of technology, know-hows and management transfers embodied in the GVC participation.

Based on the production function, a general form of the conditional labour demand can be derived from the first order conditions of the cost minimization problem. We can then specify a regression model that estimates the GVC's impact on the labour demand L as:

$$\ln L_{it} = \beta_0 + \beta_1 GVC_{it} + \beta_2 \ln Y_{it} + \beta_3 \ln w_{it} + \delta_i + u_{it} \qquad \textbf{(4)}$$

Where Y is the industry output; w is the labour to capital compensation ratio ($w_{it} = \frac{W_{it}}{r_{it}}$); δ_i is an industry fixed effect dummy, which controls for any heterogeneity across industries; GVC is an overall measure of GVC participation, which is the sum of the forward and backward linkage GVC indices, $GVC=bw+fw$. In the actual estimation, we also use the ratio of the forward to backward linkage GVC indices in place of GVC to measure how the GVC participation structure affects the employment.

It is highly likely that the firms engaged in downstream activities have different impacts on employment from those engaged in upstream activities in GVCs. In order to differentiate the impacts on labour demand between forward GVC linkage and backward GVC linkage, we break down GVCs and run the estimation against bw and fw as separate independent variables in a similar model setup:

$$\ln L_{it} = \beta_0 + \beta_1 bw_{it} + \beta_2 fw_{it} + \beta_3 \ln Y_{it} + \beta_4 \ln w_{it} + \delta_i + u_{it} \qquad \textbf{(5)}$$

In our estimations in () and **Errore. L'origine riferimento non è stata trovata.**), we also break down GVC into simple and complex types.

The 43 countries in the dataset are also classified into three groups according to the degree of economic development, which is based on the labour productivity (Fig. 2). Each country's productivity is calculated by dividing its GDP by all persons engaged in production. The top third in the ranking is designated as high-productivity, the bottom third as low-productivity and the middle

third as middle-productivity economies. We estimate the three groups separately and also as an aggregate whole in the study.

Ranking Group	Country			
High-Productivity	CAN	DNK	NLD	IRL
	FRA	AUS	USA	CHE
	AUT	BEL	FIN	NOR
	SWE	LUX		
Low-Productivity	IND	TUR	BRA	LTU
	IDN	MEX	ROU	HUN
	BGR	TWN	RUS	POL
	CHN	HRV		
Mid-Productivity	LVA	CYP	CZE	MLT
	EST	KOR	SVN	DEU
	PRT	JPN	SVK	ITA
	GRC	ESP		

Fig. 2. Country Grouping

The data used for our regression come from the World Input-Output database (WIOD) and its Socio-economic Accounts (SEAs) Release 2016. Release 2016 consists of world input output tables (WIOT) for 56 industries from 43 economies in the world for the period from 2000 to 2014. The backward and forward GVC linkage measures for the US against rest of the world are extracted from the UIBE GVC Index System that is based on WIOT.

Data on all other economic variables for all the countries are derived from the Socio-economic Accounts (SEA Release 2016). These accounts contain industry-level data on employment, capital stocks, factor compensation, gross output and value added with the same industry classification as for the World Input Output Tables.

5. Estimation Results

The estimated results are summarized in Tables 1 and 2. As expected from the model setup, the output shows significantly positive impacts on employment, while the relative wage rate shows significantly negative impacts consistently in all model specifications. However, GVC's impact varies in different circumstances. Table 1 reports the estimation impacts of the combined GVC which is the sum of the backward and forward GVC linkage indices. Aggregating all countries in the sample, GVCs do not show any significant impacts on the employment. For high-productivity countries, however, GVCs do have a significant (at 5% level), but small positive impact when they are examined at the overall level where no distinction is made between simple and complex GVCs. Each time the overall GVC participation index increases by one point, the employment in high-productivity countries increases by 0.12 percentage points on average. But no significant GVC impact is discovered for either middle-productivity or low-productivity countries, positive or negative.

Table 2 reports the estimated results as we examine the employment impacts by separating the forward from the backward GVC linkages. Aggregating all countries as a whole, the backward GVC participation shows a significant positive impact. Each time the overall backward GVC index increases by one point, the employment increases by 0.44 percentage points. This result holds across the three country groups of different productivity. However, the forward GVC participation doesn't register any significant impacts, either positive or negative, when all countries are examined as a whole. The same is true for both high- and mid-productivity countries. The only exception is the low-productivity countries. The overall (and complex) forward GVC participation shows a significant

negative impact on the employment in the low-productivity countries. Each point increase in the overall forward GVC participation lowers their employment by 0.28 percentage points on average.

The negative impact is even stronger when we look at the complex version of the forward GVC participation. This result testifies to the possibility that participating in GVCs by exporting intermediate goods or services could also export downstream job opportunities to other countries.

As discussed earlier, a GVC Ratio is defined as the ratio of forward participation index to the backward participation index. A higher value indicates that the country-industry is dominated by upstream production activities in that global value chain. The estimation using GVC ratio in place of the GVC variable didn't provide any significant results either from the combined GVC or its breakdown, the simple and complex versions. This result is consistent with the first part of our study, which suggests that forward GVC linkage in GVC has little impact on the domestic employment. The estimated results are not reported due to the limited space.

In addition to the fixed effect model, we also run a dynamic panel data model (DPD) as part of the robustness analysis. In the DPD model, the current labour demand is assumed to be affected by the level in the previous periods. We therefore introduce the lagged dependent variable into the RHS as in Eq (6), and apply a version of GMM estimator proposed in Arellano & Bond (1991).

$$\ln L_{it} = \beta_0 + \rho \ln L_{i,t-1} + \beta_1 GVC_{it} + \beta_2 \ln Y_{it} + \beta_3 \ln w_{it} + \delta_i + u_{it} \quad \textbf{(6)}$$

The estimated results are very similar to the fixed effect model, with significant combined GVC impacts, significant backward GVC linkage effect and insignificant forward GVC impact, confirming a preference for the downstream activities in generating domestic job opportunities in the global value chains. The results are not reported due to the limited space.

6. Conclusion

Based on a set of comprehensive Global Value Chain (GVC) indices developed by Wang & *et al*., (2017), this study examines the GVC's employment impact using the World Input-Output Data between 2000 and 2014 from 56 industries in 43 economies, including 28 EU members and 15 other countries.

The estimation results show that the employment impact of GVC participation is a complicated one. While GVC does register some small positive impact for more advanced economies when the forward and backward GVCs are combined in the estimation, all other impacts are very weak and insignificant.

The results also suggest that the backward GVCs tend to be more favourable to generating domestic job opportunities than the forward GVCs. In other words, participating in the downstream end of the global value chains are more beneficial to domestic job market than in the upstream end in general.

This is particularly the case for the less developed economies, where the lost downstream job opportunities could overweigh the added job opportunities by participating in the upstream end of global value chains.

Table 1. Estimation – Combined GVCs' Impacts on Employment

$ln\ L_{it}$	(1) All Countries	(2) High-Productivity Countries	(3) Mid-Productivity Countries	(4) Low-Productivity Countries
Overall GVCs				
Constant	*-3.630***	*.477*	*-3.090*	*2.069*
	(1.745)	*(1.568)*	*(2.313)*	*(2.858)*
GVC_{it}	*-.009*	*.122***	*-.033*	*-.052*
	(.034)	*(.056)*	*(.035)*	*(.068)*
$ln\ Y_{it}$	*.481****	*.573****	*.340****	*.682****
	(.076)	*(.031)*	*(.106)*	*(.029)*
$ln\ w_{it}$	*-.519****	*-.563****	*-.439****	*-.597****
	(.040)	*(.028)*	*(.066)*	*(.024)*
F	*106.48*	*103.32*	*20.24*	*212.83*
Prob > F	*0.000*	*0.000*	*0.000*	*0.000*
Simple GVCs				
Constant	*-3.469***	*-1.184*	*-2.337*	*2.786*
	(1.503)	*(1.389)*	*(2.263)*	*(2.579)*
GVC_{it}	*-.003*	*-.001*	*-.005*	*-.005*
	(.002)	*(.001)*	*(.004)*	*(.005)*
$ln\ Y_{it}$	*.481****	*.564****	*.346****	*.683****
	(.075)	*(.031)*	*(.105)*	*(.029)*
$ln\ w_{it}$	*-.518****	*-.555****	*-.444****	*-.598****
	(.039)	*(.029)*	*(.064)*	*(.024)*
F	*107.91*	*110.72*	*20.24*	*212.06*
Prob > F	*0.000*	*0.000*	*0.000*	*0.000*
Complex GVCs				
Constant	*-3.420***	*-1.147*	*-2.288*	*2.837*
	(1.506)	*(1.390)*	*(2.261)*	*(2.585)*
GVC_{it}	*.002*	*.002*	*-.0003*	*.003*
	(.002)	*(.002)*	*(.004)*	*(.005)*
$ln\ Y_{it}$	*.482****	*.564****	*.347****	*.683****
	(.075)	*(.031)*	*(.105)*	*(.029)*
$ln\ w_{it}$	*-.519****	*-.555****	*-.445****	*-.598****
	(.039)	*(.028)*	*(.065)*	*(.024)*
F	*106.35*	*105.26*	*19.97*	*212.17*
Prob > F	*0.000*	*0.000*	*0.000*	*0.000*
Observations	*33,341*	*11,277*	*12,223*	*9,841*
Groups	*2,225*	*752*	*816*	*657*

*Note: Fixed effect model with time trend. Combined GVCs = forward GVC linkage index + backward GVC linkage index. Standard errors in parenthesis. ***p<.01, **p<.05, *p<.1.*

Table 2. Estimation – Forward vs. Backward GVCs' Impacts on Employment

$ln\ L_{it}$	(1) All Countries	(2) High-Productivity Countries	(3) Mid-Productivity Countries	(4) Low-Productivity Countries
Overall GVCs				
Constant	*-.643* *(2.365)*	*1.842* *(1.618)*	*1.187* *(2.773)*	*3.189* *(2.884)*
GVC_b_{it}	*.436**** *(.154)*	*.464**** *(.106)*	*.541*** *(.248)*	*.562**** *(.169)*
GVC_f_{it}	*-.018* *(.036)*	*-.068* *(.073)*	*-.033* *(.036)*	*-.276**** *(.095)*
$ln\ Y_{it}$	*.491**** *(.081)*	*.585**** *(.032)*	*.351**** *(.112)*	*.694**** *(.028)*
$ln\ w_{it}$	*-.528**** *(.043)*	*-.573**** *(.029)*	*-.451**** *(.071)*	*-.609**** *(.023)*
F ***Prob > F***	*93.43* *0.000*	*85.60* *0.000*	*17.07* *0.000*	*191.93* *0.000*
Simple GVCs				
Constant	*-3.696*** *(1.573)*	*-1.168* *(1.408)*	*-2.927* *(2.256)*	*2.157* *(2.748)*
GVC_b_{it}	*-.002* *(.001)*	*-.001* *(.001)*	*-.001* *(.002)*	*-.004* *(.005)*
GVC_f_{it}	*-.044* *(.054)*	*.007* *(.103)*	*-.079* *(.056)*	*-.162* *(.139)*
$ln\ Y_{it}$	*.479**** *(.075)*	*.564**** *(.032)*	*.339**** *(.105)*	*.683**** *(.029)*
$ln\ w_{it}$	*-.517**** *(.039)*	*-.555**** *(.029)*	*-.439**** *(.065)*	*-.598**** *(.024)*
F ***Prob > F***	*87.02* *0.000*	*89.87* *0.000*	*16.63* *0.000*	*170.95* *0.000*
Complex GVCs				
Constant	*-3.640*** *(1.668)*	*-1.509* *(1.480)*	*-2.851* *(2.305)*	*-1.099* *(2.878)*
GVC_b_{it}	*.003*** *(.001)*	*.003* *(.002)*	*.002* *(.002)*	*.010** *(.006)*
GVC_f_{it}	*-.030* *(.084)*	*-.083* *(.155)*	*-.064* *(.083)*	*-.760**** *(.189)*
$ln\ Y_{it}$	*.480**** *(.076)*	*.564**** *(.031)*	*.341**** *(.106)*	*.683**** *(.029)*
$ln\ w_{it}$	*-.518**** *(.039)*	*-.554**** *(.029)*	*-.440**** *(.066)*	*-.600**** *(.024)*
F ***Prob > F***	*85.54* *0.000*	*83.68* *0.000*	*15.83* *0.000*	*179.59* *0.000*
Observations ***Groups***	*33,341* *2,225*	*11,277* *752*	*12,223* *816*	*9,841* *657*

*Note: Fixed Effect model with time trend. GVC_b and GVC_f is backward GVC linkage and forward GVC linkage measures, respectively. Standard errors in parenthesis. ***p<.01, **p<.05, *p<.1*

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