ITC WORKING PAPER SERIES

SMEs IN THE WORLD OF GLOBAL VALUE CHAINS

October 2017

Mauro Boffa
International Trade Centre, Geneva

Marion Jansen
International Trade Centre, Geneva

Olga Solleder
International Trade Centre, Geneva

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WP-01-2017.E

ITC Working Paper Series

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Mauro Boffa, Marion Jansen, Olga Solleder, International Trade Centre, Switzerland

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Mauro Boffa

International Trade Centre

Marion Jansen

International Trade Centre

Olga Solleder

International Trade Centre

Abstract

Large manufacturing multinationals have increased their productivity by creating, shaping and participating in Global Value Chains (GVCs). Contemporary international trade theory specifies how opening up to trade reorganizes exporting firms based on their productivity levels. The paper builds a case for the role that GVC participation may play on the competitiveness of Small and Medium Enterprises (SMEs). Using firm-level insights and information on trade in value-added; we find that some indicators of GVC participation are correlated with SMEs' competitiveness. We attempt to provide a causal framework with the help of an instrumental variables estimator.

JEL Classification: F14, L15

Keywords: Heterogeneous Firms, Competitiveness, Economic Integration.

Introduction

Trade theory is explicit on the anatomy of exporting firms. The typical exporter is large and dominates the productivity distribution of domestic firms (Eaton, Kortum, & Kramarz, 2011). Opening up to trade entails a reorganization of domestic firms where the most productive ones expand and less productive recess (Melitz, 2003). Thus, the impact of trade liberalization on firms is heterogeneous and part of the gains from trade revolve around pro-competitive effects. The result is the paradigm behind the contemporary theory of trade in goods.

In recent years, economic integration has been less about tariff cuts and more about facilitating international shared production. The split of production across borders allows firms to leverage their comparative advantage in a specific task. Instead of building final goods from scratch, they integrate in one step of the production process. The benefits from specialization are clear-cut. The production capabilities of factories are not confined to one geographical location and can therefore "unbundle". Trade flows are less and less about final goods and more about trade-in-tasks (Grossman & Rossi-Hansberg, 2008).

Exporting firms engaging in trade-in-tasks are commonly referred as part of Global Value Chains (GVCs). The benefits for these firms are not as clear-cut as the ones form trade in goods, although they both revolve around productivity gains. GVCs offer the possibility to share production processes with global lead firms, which in turn share knowledge, capital, managerial practices and technical assistance to local firms. However, the question on the benefits for SMEs participating in GVCs remains empirical, beyond anecdotal evidence.

The goal of the paper is to test the impact of participation in GVCs on the productivity of firms. The analysis distinguishes the impact according to firms' size in a panel of developing countries. Since we cannot directly measure productivity, we employ ITC's competitiveness score as a proxy. We measure two types of value chain integration from an importing and an exporting perspective. First, we look at backward linkages, which are related to the foreign content of exports. Second, we look at forward linkages, which denote integration from the exporting side.

Hypothetically, integrating value chains might help domestic firms to become more competitive in a dual fashion. On the one hand, they can make use of intermediate goods that might be unavailable in their domestic markets or that were too costly to produce in-house. On the other hand, they might contribute themselves as providers of highly specialized intermediate goods to firms in other countries. The empirical analysis finds that vertical integration as a buyer helps small firms become more productive and close the gap with the productivity levels of larger firms. According to our analysis, increasing the foreign content of exports by 100 basis points leads to a reduction of the gap of 21 basis points. In contrast, pure forward GVC integration, meant as intermediates re-exported, is not correlated with a reduction of the competitiveness gap. Vertical integration as a seller appears to be relevant only when the value chain responds to the demand in the domestic country. This is the case for exports are sent abroad for processing and returned to the domestic country for final consumption. After combining both seller and buyer GVC integration (as in Taglioni & Winkler, 2016), we evaluate the median impact for the competitiveness gap. We find that increasing GVC participation, at the median, by 2.5 % reduces the competitiveness gap, at the median, of 1.25%. Z

We use two databases for the analysis. First, the World Bank Enterprise survey to separate firms in three categories. Small firms (5 to 20 employees), medium firms (21 to 100 employees) and large firms (more than 100 employees). For each of the three firm categories we compute their competitiveness score over two survey rounds.[2] We extract the GVC participation variables from the EORA Multi-Regional Input-Output tables (Lenzen, Moran, Kanemoto, & Geschke, 2013) using (Quast & Kummritz, 2015) adaptation of Wang, Wei, and Zhu (2013) and (Koopman, Wang, & Wei, 2014) GVC indicators.

We faced some important challenges in estimating the effect of GVCs on firm competitiveness. First, we needed to gather time variation for firm level indicators in order to control for unobserved effects. Second, it

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[2] Enterprise Surveys (http://www.enterprisesurveys.org), The World Bank.

is likely that lead firms decide to establish supply chain linkages with firms that are already competitive. Hence is it not more GVCs that improve competitiveness but competitiveness that attracts GVCs.

We solved the first challenge by using several rounds of the World Bank Enterprise Survey. This way, we generated country-specific time variation that allows to control for country specific effects. For the second challenge we used an instrumental variables setting. The instrument that we propose is the depth of regional trade agreements. The argument for the choice of the instrument is that deep trade agreements help countries integrate in GVCs but trade agreements alone do not have a causal link with SME competitiveness.

The remainder of the paper is structure as follows. Section 1 presents the data. Section 2 discusses the econometric setup and the identification strategy. Section 3 displays the econometric results and Section 4 concludes.

1. Data Description

Our primary goal is to establish the link between firm competitiveness and GVCs for developing countries. Nowadays, firm level databases exists only for handful of countries. Therefore, we proxy firm productivity using ITCs competitiveness score (Falciola, Jansen, & Rollo, 2016) which is available for several developing countries. The index exploits the information on ten questions from the World Bank Enterprise Survey, which are averaged and standardized between 0 and 100 to allow for cross-country comparisons. Contrary to previous ITC studies we extend the calculation of the index over two time periods. We consider waves of the survey that have a properly randomized stratified sample, and we end up with 63 countries over two time periods for the three types of firms (small, medium and large).

The GVC participation variables steam from the EORA Multi-Regional Input-Output tables (Lenzen et al., 2013) using the algorithm of Quast & Kummritz (2015).[3] We measure GVC integration at the country level for the years in which the World Bank Enterprise Survey is available. To that effect, we employ some of the indicators proposed by Koopman et al. (2014). The framework separates gross exports at the country level in three variables (Figure 1): value-added exports, domestic value-added in intermediates that return home and foreign content of exports. Furthermore, each of these elements can be decomposed in three sub-categories, resulting in nine separate elements.

From the nine components in Figure 1, we extract two indicators of vertical specialization. One on the importing side and one in the exporting side. On the importing side, we consider the foreign content of exports as a share of gross exports, which is the sum of boxes (7) through (9) in Figure 1 as a share of gross exports. This refers to the imported content embedded in a country's exports. On the exporting side we consider the domestic value added that returns home as a share of gross exports, which is the sum of elements (4) to (6) in Figure 1. According to Koopman et al. (2014), these are a country's exported goods that are used as imported inputs by the rest of the world to produce goods that will be shipped back home.

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[3] The algorithm separates gross exports in 16 value-added components at the bilateral level by exporting country, exporting industry, importing country. The 16 components can be aggregated at the country level to retrieve the indicators of vertical specialization proposed by (Koopman, Wang, & Wei, 2014)

Figure 1. Decomposition of gross exports at the country level
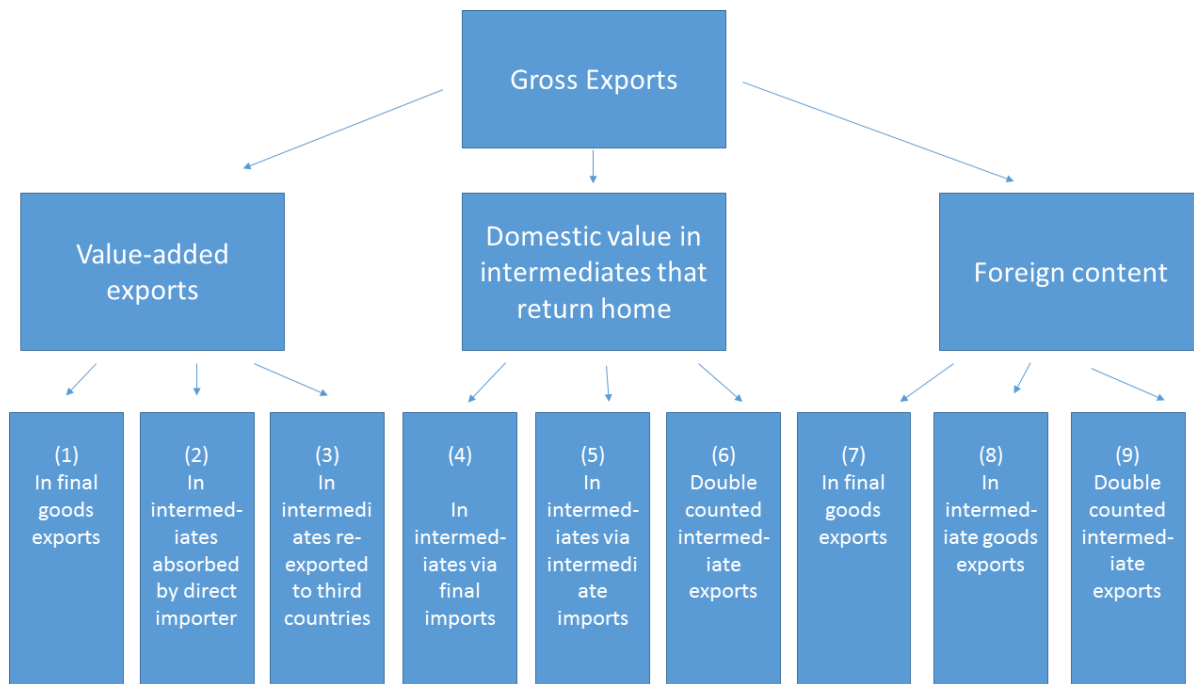
Source: Koopman, Wang and Wei (2014). A country's gross exports are separated in three major variables whose nine subcomponents can be used to measure.

While International Value Chains are considered global, we find that in the EORA data they appear to have a strong regional component (Figure 2). In fact, intra-regional trade appears to be more intensive in some GVC indicators that inter-regional trade. Trade within the region relies on a higher use of both imports to produce exports and the use of exports for re-exports. We notice that in the Americas, Asia and Europe, GVC trade is mostly regional while there is not such evidence in Africa and in Oceania.

Figure 2. GVCs Linkages, Inter-regional vs. Intra-Regional
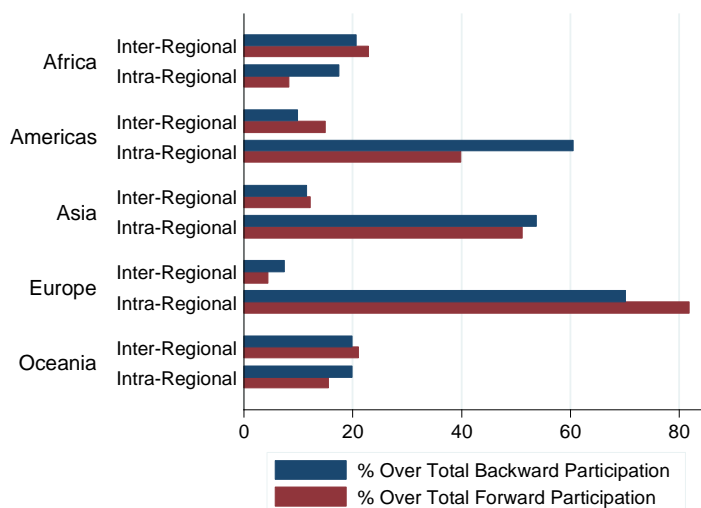
Source: authors' calculations using EORA multi-regional input-output tables. Backward participation is the foreign content of exports. Forward participation is domestic value added re-exported to third countries. The percentages for 2013.

In Figure 3 we plot two diagrams. In the left panel we plot the competitiveness score for small, medium and large enterprises against the import content of exports (VS). In the right panel we plot the difference between the competitiveness score of large firms and small firms. We observe that the competitiveness gap is negatively correlated with the import content of exports.
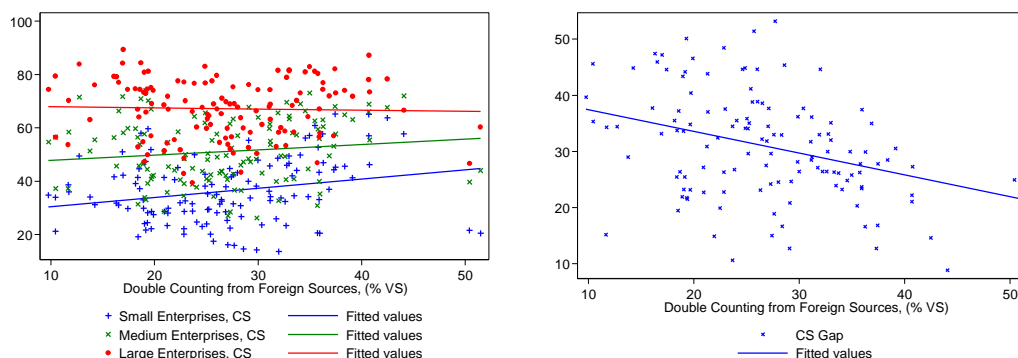
Figure 3. Import Content of Exports and Competitiveness Gap
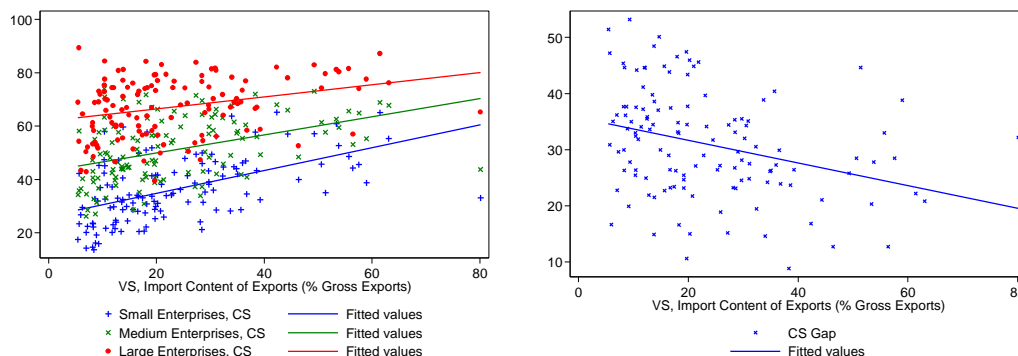
Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). Backward participation (VS) is the foreign content of exports, it is measured as the sum between foreign value added and the double counted import content of exports. The estimates on the gap are significant in a random effects component. The Hausman-test suggests that there is no correlation between VS and the individual specific effects.

We find that the component driving the correlation behind the import content of exports is the double-counting of intermediate foreign goods (Figure 4). The greater the share of double counting from foreign intermediate sources, the greater the reduction in the competitiveness gap. Double counting tends to be sizable when GVC trade is prevalent. Double counting occurs when intermediate goods cross several times borders, therefore it is a good indicator of GVC trade.

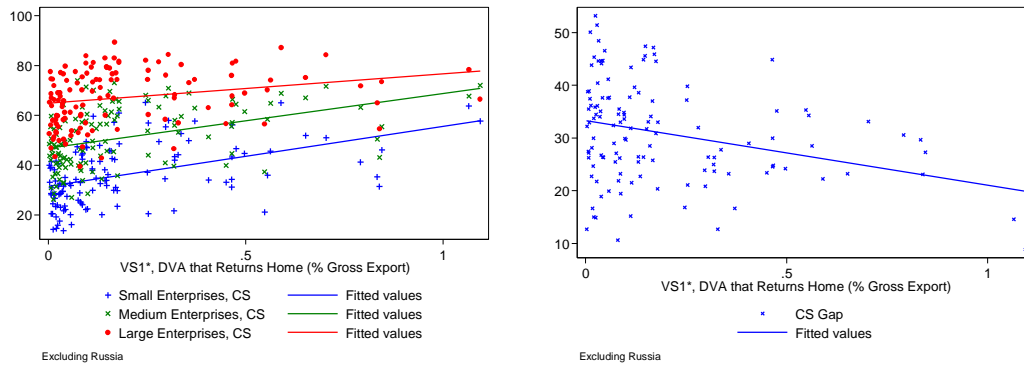**Figure 4. Double Counting Component and Competitiveness Gap**

Source: authors' calculations using EORA multi-regional input-output tables and World Bank Enterprise Survey. Double counting from foreign sources is the main source of reducing the competitiveness gap. A high share of double counting indicates that GVC trade is prevalent.

We look at two measures of GVC participation from the exporting side. Both measures are based on exports of intermediate goods that are in turn re-exported to partner countries. The literature provides two main indicators. First, there is the value of intermediate goods shipped back to the domestic economy (VS1*). Second, the value of intermediate goods that are re-exported to all other countries (VS1).

We observe that countries exporting a large share of intermediate goods that are shipped back home have a lower competitiveness gap (VS1*, Figure 5). In contrast, pure forward integration meant as intermediates re-exported, (VS1, Figure 6), is not correlated with a lower competitiveness gap. The result suggests that firms that integrate in value chains and that are linked back to the domestic markets may be better off than

their counterparts. By using the domestic market to leverage on GVCs firms might have the possibility to place themselves at the beginning, the middle or the bottom or the supply chain. The additional flexibility might allow them to choose the most adequate segment of the supply chain.

Figure 5. Domestic Value Added in Intermediate Goods that Eventually Return Home

Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). Forward participation (VS1*) is the value of intermediates that returns to be consumed in the domestic market. The estimates on the gap are significant in a random effects error component model. The Hausman-test suggests that there is no correlation between VS and the individual specific effects.

Figure 6. Forward Linkages are not related to a Lower Competitiveness Gap
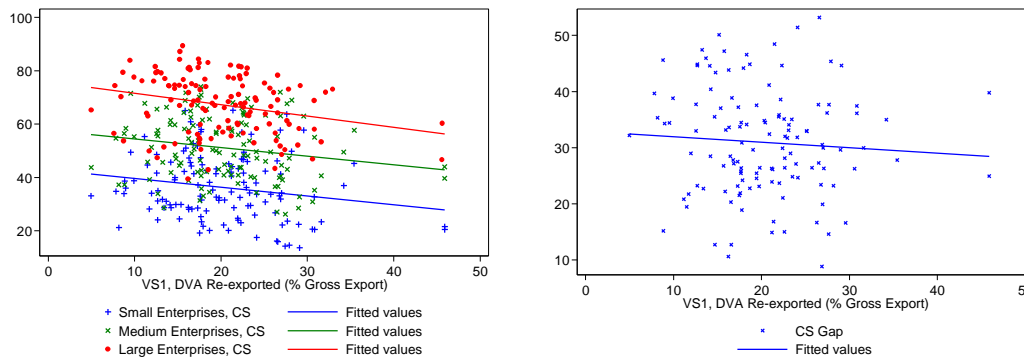
Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). Forward GVC participation (VS1) is the domestic value of intermediate imports that are re-exported by the partner country. The estimates on the gap are not significant in a random component / fixed effects econometric setting.

2. Econometric setup and identification strategy

To establish the role of GVC trade in SMEs' competitiveness we use an instrumental variables approach in a random-effects model for panel data. The error components model builds around the following five assumptions:

$$CompGap_{it} = \beta_1 GVCparticipation_{it} + T_t + \mu_i + \epsilon_{it} \qquad (1)$$

$$\mu_i \sim IID\left(0, \sigma_{\mu_i}^2\right); \ \epsilon_{it} \sim IID(0, \sigma^2) \qquad (2)$$

$$E[\mu_i * \epsilon_{it}] = 0 \ \forall \ i, t \qquad (3)$$

$$E[GVCparticipation_{it} * \epsilon_{it}] \neq 0 \; \forall \, i, t \qquad\qquad (4)$$

$$E[CompGap_{it} * \epsilon_{it}] = 0 \; \forall \, i, t \qquad\qquad (5)$$

$CompGap_{it}$ is defined as the difference between the competitiveness score of large firms and the competitiveness score of small firms in country i at time t. $GVCparticipation_{it}$ is a proxy of GVC participation for country i at time t measured in terms of forward or backward linkages. Backward linkages are the foreign content of exports. Forward linkages are the domestic value added first exported but that subsequently returns for consumption in the domestic market. T_t is a time-specific intercept.

Since the most competitive SMEs are more likely to participate in GVCs, the GVC variable might suffer from an identification problem. To deal with the issue, we propose an instrumental variables estimator that uses the depth of an agreement as the main instrument. Figure 7 depicts the underlying causal structure assumed in the model. We use the Generalized 2 Step Least Squares (G2SLS) estimator estimates the model (Baltagi, 2013). We exploit the fact that the signature of an agreement helps firms integrate in value chains. However, an agreement alone has no effect on the competitiveness of SMEs. Hence, the depth of an agreement is a reasonable instrument for GVC participation. The depth of trade agreements comes from the World Bank Database on the Content of Preferential Trade Agreements (Hofmann, Osnago, & Ruta, 2017).

To back up the assumption of random effects, we perform a Hausman-test where we compare between the fixed effects and random effects estimators. The test supports the random effects estimator, as it is the efficient one in the absence of correlation between the main covariate and the individual specific effect.

Figure 7. Causality Diagram behind Identification Strategy
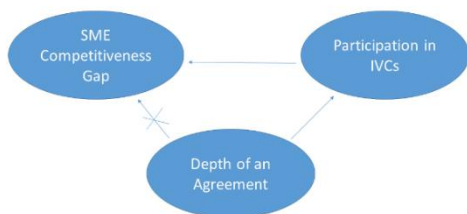
Source: ITC, arrows indicate the suspected direction of causality.

3. Results

We estimate model (1) with Generalized Least Squares and with generalized two Stage Least Squares using the depth of trade agreements as an instrument.[4] We take into account two types of dependent variables: Forward linkages variables - domestic value-added in exports re-exported, domestic value-added in exports shipped back home – and backward linkages –foreign content of exports, double counting in exports-. We report the results for the GLS estimation of forward linkages in Table 1.Table 2 reports the results for backward linkages and Table 3 presents the selected models with their G2SLS estimations.

In column (1) of Table 1 we report the result of the domestic value added that return home. The interpretation of the coefficient is the following. An increase in the domestic content of exports of 10 basis percentage points is accompanied by a decrease of the competitiveness gap of 120 basis points. In column (2) we observe that exports for re-exports to third countries are not related to the competitiveness gap. The large coefficient in column (1) is explained by the fact that the amount of domestic value added is usually very low, with the maximum being around 7%.

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[4] Alternatively we have used the average depth of WTO-plus and WTO-extra provisions. The additional instruments confirm the results.

Table 1. Forward linkages, random effects regression

	(1) CS Gap Random Effects	(2) CS Gap Random Effects
DVA that Finally Returns Home (% Gross Export)	-12.19*** (4.263)	
Indirect Value Added, (% Gross Exports)		-0.0700 (0.153)
Constant	33.27*** (1.274)	32.33*** (3.195)
Observations	124	124
Number of Countries	63	63

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). Indirect value-added is the domestic value of intermediate imports that are re-exported by the partner country. The domestic value added that returns home is the value added in intermediate goods shipped back home by the partner.

Table 2 shows the results of the GLS estimation for backward linkage variables. The main goal is to determine the impact of vertical specialization from the importing side on the competitiveness gap. Since the import-side vertical specialization index is composed of three parts (double counted terms, foreign value-added in intermediate goods and foreign value-added in final goods) we separate the impact for the three terms. We find in column (1) that indeed increasing the foreign content of exports by 10 basis decreases the competitiveness gap by 2 basis points. The component driving the result is the amount of double counting in gross exports. Double counted exports are an indicator that an intermediate good has cross several times the border, in contrast for foreign value-added in intermediate or final exports, it denotes a stronger GVC component. It is not only an import to be processed and re-exported, it is a product that has been imported and processed several times.

Table 2. Backward integration variables, random effects regression

	(1) CS Gap Random Effects	(2) CS Gap Random Effects	(3) CS Gap Random Effects	(4) CS Gap Random Effects
Vertical specialization (VS, % gross exports)	-0.207*** (0.0614)			
Double counting from foreign sources, (% VS)		-0.388*** (0.113)		
FVA in Intermediates, (% VS)			0.148 (0.0952)	
FVA in Final Goods, (% VS)				0.202** (0.0983)
Constant	35.82*** (1.722)	41.33*** (3.160)	24.69*** (4.146)	21.82*** (4.552)
Observations	126	126	126	126
Number of Countries	64	64	64	64

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized 2 Staged Least Squares. The instrument in the first stage is the average depth of a country's trade agreements. The F-statistic passes the weak instrument test.

In Table 3 we show the results for the instrumental variables estimator. The instrument if the average depth of a country's trade agreements. First stage fits are reported in the appendix. The IV corroborates our previous estimates. We observe a significant impact of the vertical specialization from the importing side. An increase of 10 basis points in the index results in a 4 basis point reduction of the competitiveness gap. In turn, the effect of domestic value added shipped back home is even stronger. We observe that a 10 basis point change deals a huge reduction of 120 basis points.

Table 3. Preferred models, 2SLS estimation results

	(1) CS Gap, IV	(2) CS Gap, IV
Import content of exports (VS, % gross exports)	-0.357***	
	(0.100)	
DVA that returns home (VS1*, % Gross Export)		-27.25***
		(7.819)
Constant	39.41***	36.16***
	(2.548)	(1.756)
Observations	124	124
Number of Countries	63	63

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized 2 Staged Least Squares. The instrument in the first stage is the average depth of a country's trade agreements. The F-statistic passes the weak instrument test.

Eventually, in Table 4, shows that increasing by 100 basis points GVC partition, defined as the sum of foreign content of exports and domestic value added re-exported as a share of gross exports, reduces by 37 basis points the competitiveness gap.

Table 4 Competitiveness gap and GVC participation, 2SLS estimation results

	(1) CS gap small firms vs large firms
GVC participation index	-0.368***
	(0.0943)
Constant	47.05***
	(4.203)
Observations	126
Number of countries	64

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized 2 Staged Least Squares. The instrument in the first stage is the average depth of a country's trade agreements. The F-statistic passes the weak instrument test.

4. Conclusion

The paper gathers firm-level indicators of competitiveness for developing countries, and tests the impact of GVC participation in lowering the gap competitiveness gap between large firms and small firms. Participation in GVCs has proved to be beneficial to multinationals because of cost efficiency gains. However, little is known about the role of smaller types of firms. In the paper, we argue that SMEs can benefit even more than multinationals from participating in value chains.

We present two main findings. First, imports to export are important for SME competitiveness. The use of foreign inputs allows for access to high quality intermediates that might be unavailable to small firms in their domestic economy. In addition, we provide evidence that double counted intermediates are the main factor driving the result, which is a clear indicator of cases where GVC trade is prevalent. Second, vertical specialization from the importing side appears to have an effect on SME competitiveness only in the case of domestic value-added returning home. This makes the case for "circular" value chains that leverage on the domestic economy for consumption and use foreign hubs for processing and assembly.

From an economic policy perspective, it is essential to understand the channels through which trade-in-tasks helps levelling the playing field for small, medium and large firms. While we cannot assess causality, we attempt to provide a causal framework to better isolate the effects.

References

Baltagi, B. H. (2013). *Econometric Analysis of Panel Data* (5th edition). John Wiley and Sons, Chichester.

Eaton, J., Kortum, S., & Kramarz, F. (2011). An Anatomy of International Trade: Evidence From French Firms. *Econometrica*, *79*(5), 1453–1498. https://doi.org/10.3982/ECTA8318

Falciola, J., Jansen, M., & Rollo, V. (2016). *Exploring firm competitiveness: a factor analysis approach* (ITC Working Paper). Geneva: International Trade Centre. Retrieved from www.intracen.org/SMEOutlook/ITC-WPS

Grossman, G., & Rossi-Hansberg, E. (2008). Trading Tasks: A Simple Theory of Offshoring. *American Economic Review*, *98*(5), 1978–1997.

Hofmann, C., Osnago, A., & Ruta, M. (2017). Horizontal depth: a new database on the content of preferential trade agreements. *World Bank Policy Research Working Paper 7981*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2923535

Koopman, R., Wang, Z., & Wei, S.-J. (2014). Tracing value-added and double counting in gross exports. *The American Economic Review*, *104*(2), 459–494.

Lenzen, M., Moran, D., Kanemoto, K., & Geschke, A. (2013). Building EORA: A Global Multi-Region Input–Output Database at High Country and Sector Resolution. *Economic Systems Research*, *25*(1), 20–49. https://doi.org/10.1080/09535314.2013.769938

Melitz, M. J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, *71*(6), 1695–1725.

Quast, B., & Kummritz, V. (2015). DECOMPR: A Global Value Chain Decomposition in R. Retrieved from http://www.academia.edu/download/39710218/CTEI-2015-01_Quast__Kummritz.pdf

Taglioni, D., & Winkler, D. (2016). *Making Global Value Chains Work for Development*. The World Bank. https://doi.org/10.1596/978-1-4648-0157-0

Appendix

Figure 8 First stage, import content of exports and average depth of trade agreements
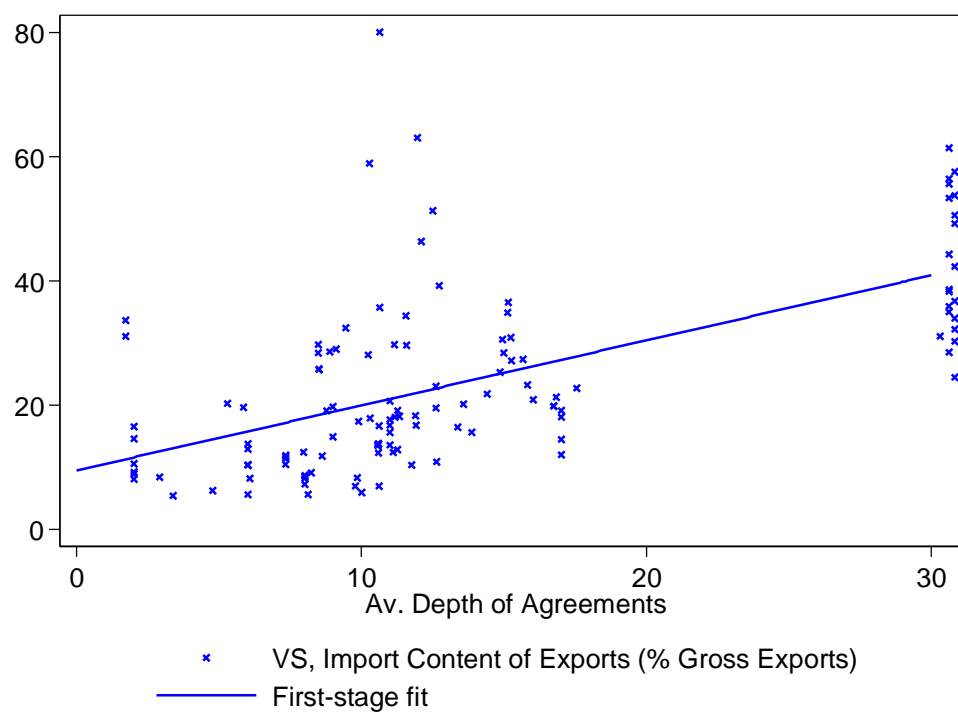
VS, Import Content of Exports (% Gross Exports)

First-stage fit

Note: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized two Staged Least Squares. First stage of 2sls random effects regression.

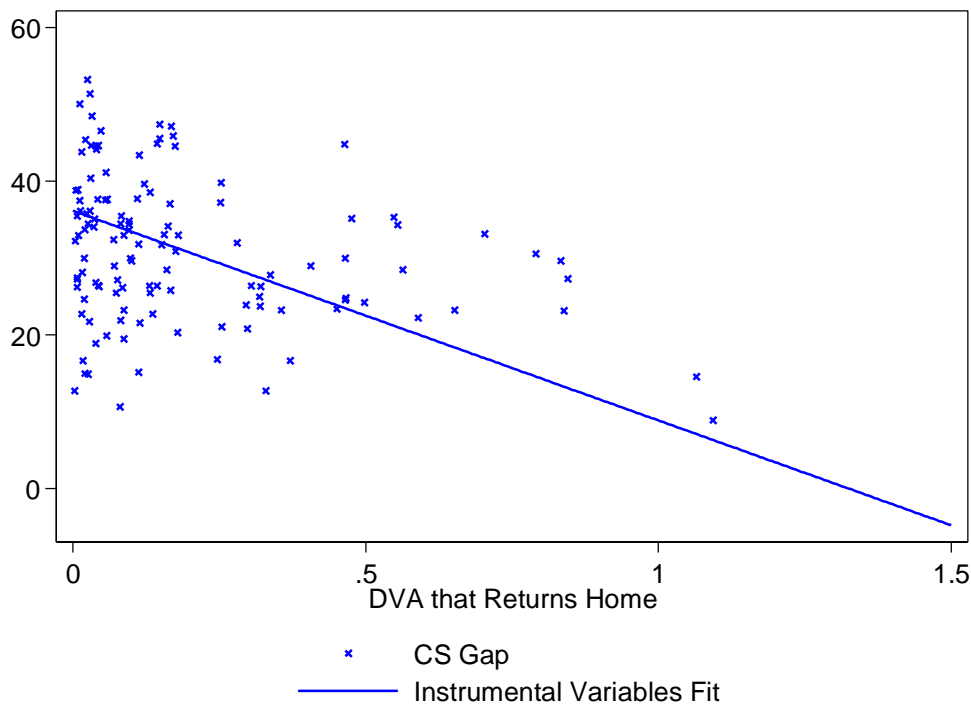**Figure 9 Second stage, competitiveness gap and import content of exports**
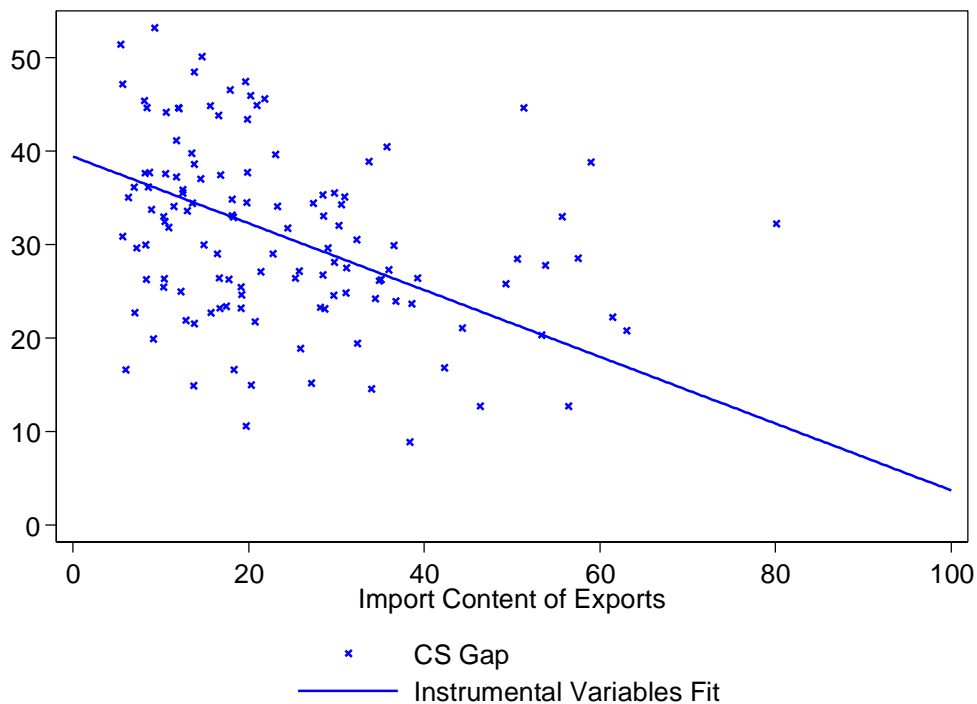
Note: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized two Staged Least Squares. Second stage of 2SLS random effects regression.

Figure 10 Domestic value added that returns home and av. depth of agreements

Note: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized two Staged Least Squares. First stage of 2SLS random effects regression.

Figure 11 Competitiveness gap and domestic value added that returns home

Note: authors' calculations using a panel data from EORA multi-regional input-output tables and World Bank Enterprise Survey (4th and 5th round). The model is estimated by Generalized two Staged Least Squares. Second stage of 2SLS random effects regression.

Table 5 Countries in the sample

Country	
Angola	Moldova
Albania	Madagascar
Argentina	Mexico
Armenia	Macedonia, Republic of
Azerbaijan	Mali
Burundi	Montenegro
Bangladesh	Malawi
Bulgaria	Namibia
Bosnia and Herzegovina	Nigeria
Belarus	Nicaragua
Bolivia	Nepal
Bhutan	Pakistan

Botswana	Panama
Chile	Peru
Congo, Democratic Republic of the	Poland
Colombia	Paraguay
Czech Republic	Romania
Ecuador	Rwanda
Estonia	Senegal
Georgia	Serbia
Ghana	Slovakia
Guatemala	Slovenia
Honduras	Tajikistan
Croatia	Turkey
Hungary	Tanzania
Kazakhstan	Uganda
Kenya	Ukraine
Kyrgyzstan	Uruguay
Lao PDR	Uzbekistan
Lithuania	Yemen
Latvia	Zambia

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