



Foreign Inputs and Changes in Domestic Value Added Exports: Empirical Evidence from Latin American Countries

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Received: 19 March 2019

Accepted: 19 May 2019

DOI: <https://doi.org/10.32479/ijefi.8059>

ABSTRACT

This paper aims to analyze the factors affecting domestic value added in exports for seven Latin American countries (LAC) with a focus on the role played by foreign inputs. By using panel data (1995-2016) with fixed effects model, the paper finds that foreign value added (FVA) in exports is a strong determinant of positive changes in domestic value added exports in Latin America. The paper also finds that institutions, tariffs and labor productivity are important determinants of changes in DVA in exports. Additionally, a sectoral analysis reveals the positive effect of FVA in exports on changes in DVA in exports in three sectors: Agriculture, manufacture and services. However, FVA in exports has no significant effect on DVA in exports in the mining sector. Overall, our results suggest countries to lower tariffs, to adopt policies that enhance the import of sophisticated intermediates inputs and to promote favorable business environment.

Keywords: Value Added Exports, Global Value Chains, Latin America

JEL Classifications: F13, F14, N16, P33

1. INTRODUCTION

With the emergence of global value chains (GVCs), traditional trade statistics measuring gross exports became unable to objectively capture a country's real export performance (Jara and Escaith, 2012; Banga, 2014; Suder et al., 2014). Domestic value added (DVA) in exports provides a better measure of a country's export performance and global competitiveness since only the domestic part of the country's total exports contributes to its G.D.P. (UNCTAD, 2013). Therefore, it is become important for policymakers to understand the main drivers that contribute to greater domestic content of exports.

Recent studies have investigated the determinants of changes in domestic value added in exports (Kowalski et al., 2015, Vrh, 2018; Gonzales, 2016; Yu and Luo, 2018). Like Kowalski et al.

(2015), most of the studies subdivided the factors that affecting domestic value added in exports into two broad categories: The structural factors that refer to factor endowments and the policy factors that include trade policies, investment openness, the quality of infrastructure as well as the quality of institutions.

Few studies have explored the dimension relating to domestic and international linkages. Gonzales (2016) has contributed to the literature by investigating the role of foreign factors on enhancing domestic export performance. He found that foreign sourcing (foreign value added [FVA]) is a complement to the creation of domestic value added in exports for Southeast Asian countries.

Following Lopez, this paper aims to investigate the role of foreign factors on changes in domestic value added exports for seven

selected Latin American countries (LAC): Argentina, Brazil, Chile, Columbia, Costa Rica, Mexico and Peru. Latin America's participation in global value chains is low compared to other developing regions like South East Asian Economies (Blyde, 2014; De Backer and Miroudot, 2013; UNECLAC, 2014 and OECD/CAF/ECLAC, 2015). Thus, most studies were focused on factors that limiting that participation and suggested policies to enhance Latin America's participation in GVCs (Cadestin et al., 2016; Cruz et al., 2013).

However, increasing a country's participation in GVCs does not necessarily lead to an increase of the domestic content of its exports. Therefore, unlike most previous studies on Latin America, this study aims to analyze specifically the main drivers that contribute to greater domestic content of Latin America exports with a focus on the role played by foreign inputs (FVA). Figure 1 shows the share of DVA and FVA in gross exports for the selected countries.

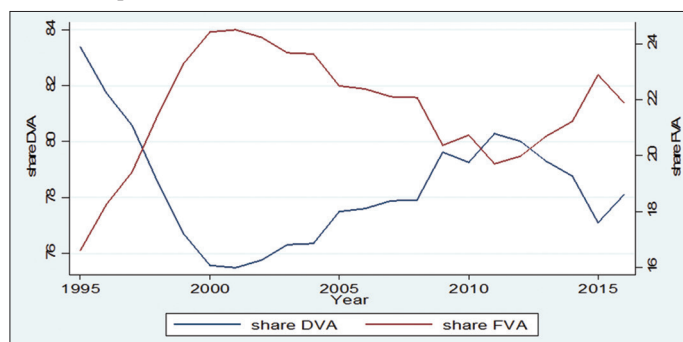
It can be noticed that the share of domestic value added in exports¹ was relatively important (about 75% of the total exports) over the whole period 1995-2016. On the DVA share in exports dynamics, three periods can be identified. First, in the period 1995-2000, DVA share in exports considerably decreased from around 83% in 1995 to about 75% in 2000. Then, a general upward trend in the share of DVA in exports may be observed from 2001 (around 75%) to 2011 (over 80%). Finally, there was another decrease of DVA share over the period 2012-2015 followed by a slight rise just after 2015.

Additionally, Figure 1 shows that an increase of DVA share was associated to a decrease of FVA share and inversely. Over the whole period, an important increase of FVA share in exports is observed. This situation may lead to concerns about possible reduction in future domestic share of value added in exports. Are the concerns justified? In what extent FVA in exports contribute to the domestic export performance of the selected countries? What are the relevant factors that affect domestic value added in exports in those countries? These are precisely the questions this paper seeks to answer.

In addition, this paper also provides a sectoral analysis by investigating the role of foreign factors on domestic export performance in the following sectors: Agriculture, mining, manufacture and services. Overall, the results confirm the positive and strong association between FVA in exports and domestic value added in exports. Tariffs, institutions as well as labor productivity are also found to be strong determinants of changes in domestic value added exports in Latin America. Moreover, the results show differences across the determinants of changes in DVA across the sectors.

¹ The share of DVA in exports (GDP in exports) in this paper is calculated relying on the decomposition method of gross exports into value-added exports provided by Koopman et al (2010). According to Koopman et al (2010), $GDP \text{ in exports} = \text{Domestic value in direct final goods exports} + \text{Domestic value in intermediates exports absorbed by direct importers} + \text{Domestic value in intermediates exports reexported to third countries} + \text{Domestic value in intermediates exports that return home}$. $\text{Share of DVA in exports} = (GDP \text{ in exports} / \text{Total gross exports})$.

Figure 1: Share (%) of domestic value added and foreign value added in exports for seven Latin American Countries, 1995-2016



Source: OECD-TIVA 2016 and 2018, own calculations

The rest of the paper is structured as follows. Section 2 presents the existing empirical research evidence on the determinants of DVA. Section 3 gives a description of the empirical strategy. Then, the results are presented in section 4, and finally section 5 provides the conclusions.

2. LITERATURE REVIEW

Several studies have investigated the determinants of changes in domestic value added in exports. Relying on the existing literature, the factors affecting domestic value added in exports can be classified into two broad categories: The structural factors and the policy factors. The structural factors refer to factors endowments while the policy factors include trade policies, investment openness, research and development (R&D), quality of infrastructure as well as quality of institutions (Kowalski et al., 2015; Johnson and Noguera, 2012).

Focusing on structural factors, Johnson and Noguera (2012) found that more manufactured products in a country's export goods will reduce the value-added in its exports. In other words, the higher the share of the manufacturing sector in a country's gross domestic product (GDP), the lower the share of domestic value added in its exports. Another important structural factor is the market size. Countries with larger markets are expected to have higher share of DVA in exports since they can rely on a wider array of domestic intermediates both in terms of purchases and sales (OECD, 2015).

Regarding the policy factors, inward foreign direct investment (IFDI) and trade policy are found to be important determinants of changes in DVA in exports. For example, Vrh (2018) found that IFDI leads to reduced demand for domestic inputs and has a negative effect on DVA in exports for old and new E.U. member states. Likewise, Kowalski et al. (2015) explained that IFDI is likely to be associated more with importing of foreign inputs for exports processing rather than with exporting the domestic value added for export processing abroad.

Tariffs also play an important role. Gonzales (2016) showed that tariffs have a negative effect on domestic value as tariffs may reduce access to more sophisticated intermediate products which might otherwise help firms become more competitive (Bas and Strauss-Kahn, 2014; Bas and Strauss-Kahn, 2015). By contrast,

Caraballo and Jiang (2016) found a positive correlation between the tariffs applied to manufactured products and the DVA share suggesting that countries with greater protectionism are likely to increase their DVA. share in exports.

Still focusing on policy factors, recent studies emphasized the importance of R&D, labor productivity and institutions on positive changes in DVA in exports (Beverelli et al., 2017). For example, Yu and Luo (2018) found that R&D and capital physical positively influences China's DVA in exports. An explanation is that R&D is expected to boost the technological catch-up and innovation while the capital formation will contribute to modern productive system. As for labor productivity, Sahu (2016) explained that higher skilled labor tend to positively affect the efficiency of manufacturing and thereby exports and DVA in exports. He found a strong and positive relationship between human capital and Malaysia's domestic value added in exports.

Besides the structural and policy factors, Gonzales (2016) shed light on the role of FVA in production of exports on positive changes in the domestic value added embodied in exports. He found that FVA is a strong complement to the creation of domestic value added in exports for Southeast Asian countries. This confirms the important link between importing and export competitiveness. By using industry data, Kummritz (2014) reached the same conclusion that countries which rely on FVA can increase their domestic value added in GDP.

Focusing on Latin America, the existing literature discussed more the determinants of LAC's participation in global value chains rather than specifically discussed the factors that contribute to greater domestic content of their exports. For example, (Blyde, 2014; Hernández et al., 2014 and OECD/CAF/ECLAC, 2015) found that Latin America's participation in global value chains which is low compared to other developing regions like Asia and essentially consists of supplying relatively unprocessed natural resource-based inputs and suggested more diversification of economic activity.

Likewise, Ahmad and Primi (2018) also found the extent of GVC's participation for LAC relatively low. Thus, they suggested that improving regional integration, reducing barriers to trade as well as building strong domestic supply chains may help to enhance the two regions participation in GVCs. Similarly, Cadestin et al. (2016) have analyzed, along with other factors, the impact of rules of origin (RoO) and non-tariff measures (NTMs) on GVC integration in Latin America. They found that convergence on RoO and regulatory standards as well as a reduction of NTMs may help to increase the integration of the region into global value chains (Grubler et al., 2015).

The key ideas from the existing research findings suggest that in addition to the structural and policy factors (the traditional factors), FVA in exports is also an important determinant of the changes in DVA in exports. The existing literature also shows that most studies on Latin America were focused on suggesting policies to increase LAC's participation in global value chains rather than specifically discussed the factors that may contribute to higher share of DVA in their exports. Since increasing a country's participation in GVCs does not necessarily lead to higher share of DVA in its exports,

this study aims to specifically analyze the factors affecting the changes of DVA in exports for Latin American with a focus on the role played by FVA in the production of exports.

3. EMPIRICAL STRATEGY

3.1. Regression Specification

This study investigates the determinants of changes in domestic value added in exports with a focus on the role played by FVA in exports. As mentioned by Kowalski et al. (2015), there is no empirical "gold standard" for analyzing the determinants of GVC trade, so this paper mainly relies on theoretical predictions and existing empirical findings. Thus, the regression model for testing the factors affecting domestic value added in exports of the selected LAC is as follows:

$$DVA_{it} = \alpha + (X_{it-1})\beta + \mu + \varepsilon_{it} \quad (1)$$

Where DVA is an estimated measure of domestic value added content of gross exports in millions US dollar relating to country i and time t . ε_{it} is the random error term, while μ represents the country-fixed effects and X_{it-1} the vector of explanatory variables.

X includes the following independent variables: GDP in current US dollar as an indicator of market size, FDI net inflows in current US dollar that indicates the openness to FDI, the simple average of tariff rates applied to all products (Tariff), a measure of rule of law (Law), labor productivity as an indicator of the output per worker (Labor prod) and FVA in exports in millions US dollar.

All regression specifications are estimated with a fixed effect model. The fixed effect model assumes that each country specific characteristics are correlated with the independent variables. The Hausman test statistic confirms the fixed effects as more appropriate than the random-effects model. In all regressions, White's heteroscedasticity robust standard errors are used for calculating standards errors.

To avoid simultaneity bias and to allow for a deferred reaction of DVA., all explanatory variables are lagged by 1 year. Moreover, all variables, with the exception of rule of law, are in logs to eliminate potential outliers. As a robustness check, a new variable, manufacture value added (Manuf) is added to the initial model for regression.

Additionally, estimations have been reiterated for four broad sectors (agriculture, manufacturing, mining and services) to capture differences across the determinants changes in DVA in exports across sectors.

3.2. Data and Descriptive statistics

This study combines several datasets available for the selected countries over the period 1995-2016. The dataset for DVA and FVA content of gross exports are the OECD value added-trade data (TIVA database) of December 2016 and December 2018². As

2 OECD-TIVA database (December 2018) covers 64 countries (including all OECD, EU and G20 countries and most East and Southeast Asian Countries and seven Latin American Countries) and 36 industries. Data are provided for the years 2005-2015. For certain indicators, preliminary estimates for 2016 are given.

for labor productivity, data have been collected from International Labor Organization (ILOSTAT) while data on rule of laws were provided by Worldwide Governance Indicators. Finally, World Development Indicators serves as data source for GDP, FDI and tariffs.

According to Figure 1, and as already mentioned above, there was a general downward in the share of DVA in exports (associated with a general upward in the FVA share in exports) for the whole sample over the defined period. The two figures below provides detailed information by showing the share of DVA and FVA in exports by country as well as the share of DVA and FVA in exports by sector (agriculture, manufacture, mining and services).

3.2.1. Share of DVA and FVA in exports, by country

Figure 2 shows the share of DVA and FVA in total exports for each selected country over the period 1995-2016.

Overall, it can be noticed that the share of DVA in exports is much higher than FVA’s share in exports for each country. In average, Columbia and Argentina have the highest share of DVA in exports with respectively 90.37% and 90.25%, followed by Brazil (88.95%), Peru (88.74%), and Chile (82.23%) while Mexico has the lowest share of DVA in exports with (66.84%).

Regarding the share of FVA in exports, in average, Mexico has the highest share of FVA in exports with 33.16% just followed by Costa Rica with about 25% and at a lower proportion by Chile (17.77%). FVA in exports represents less than 12% of the total exports for each of the remaining four countries with Columbia and Argentina having the lowest shares of FVA in their exports. Figure 2 also shows that higher share of DVA is associated with lower share of FVA and vice versa.

3.2.2. Share of DVA and FVA in exports, by sector

Figure 3 provides the share of DVA and FVA in exports by sector for all selected countries over the period 1995-2015.

A sectoral analysis also shows that FVA has a lower share than DVA in exports for each sector. The manufacturing sector has the highest share of FVA in exports with about 31% in average. Far behind, the agriculture sector receives the second largest share of FVA in exports with 8.92% while the services sector has the lowest share of FVA in exports (6.30%). The share of FVA in exports for the mining sector accounts for about 7.26%.

Focusing on DVA in exports, it can be observed that the services and mining sector have the highest share of DVA in exports with respectively 93.70% and 92.74%, just followed by the agriculture sector (91.08%) while the manufacturing sector has the lowest share of DVA in exports about 68%.

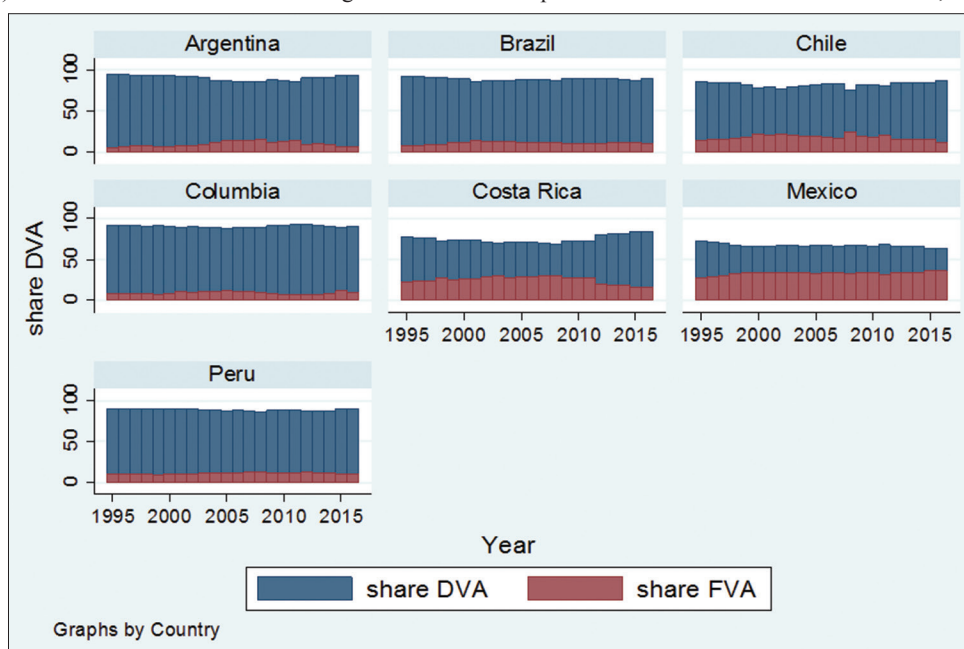
Similarly, as shown before, slight decreases in the share of DVA in exports were associated with slight increases in the share of FVA in exports. All sectors have experienced a slight decrease in the share of DVA in exports with the manufacturing sector experiencing the most noticeable decrease from around 75.5% in 1995 to about 66% in 2015.

4. RESULTS AND DISCUSSIONS

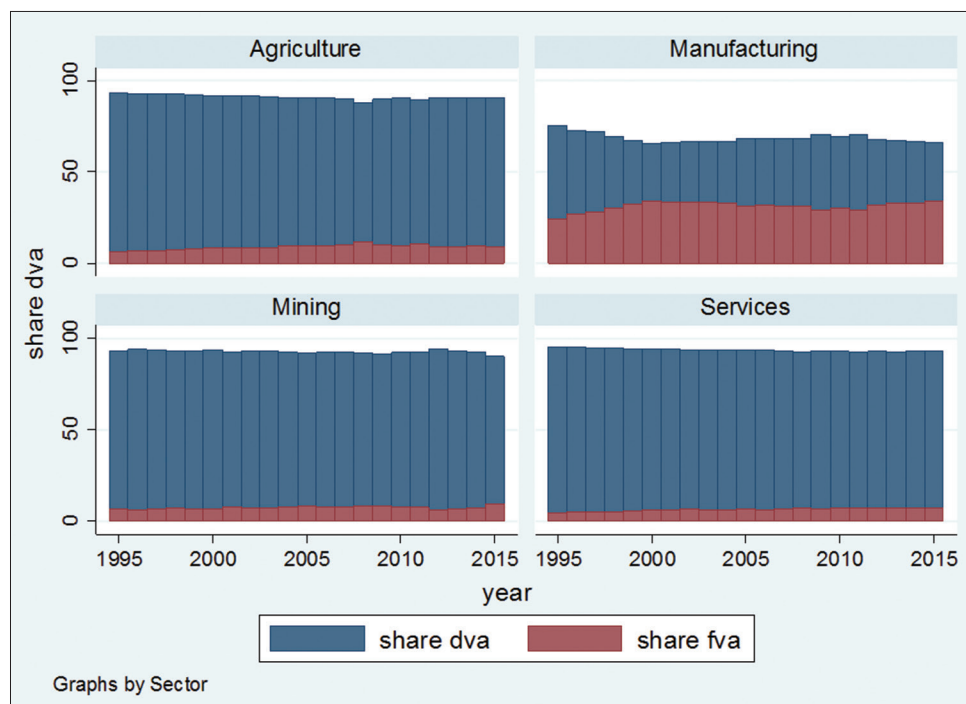
4.1. Main Results

Table 1 provides the regressions results of the determinants of changes in domestic value added in exports. The column (1) presents the regressions results for all sectors while the following columns (2)-(5) indicate the results for agriculture, manufacturing, mining and services sectors respectively. All regressions include country fixed effects.

Figure 2: Share (%) of domestic value added and foreign value added in exports for seven Latin American Countries, 1995-2016, by country



Source: OECD-TIVA 2016 and 2018, own calculations

Figure 3: Share (%) of domestic value added and foreign value added in exports for the selected seven Latin American Countries, 1995-2015, by sector

Source: OECD-TIVA 2016 and 2018, own calculations

Table 1: Determinants of the changes in domestic value added in exports

Independent Variables	Dependent variable: ln DVA in exports				
	(1) All	(2) Agriculture	(3) Manufacturing	(4) Mining	(5) Services
GDP (lag 1)	0.0780037 (0.217832)	0.054805 (0.1156474)	0.0113818 (0.2015726)	-0.0173691 (0.5143146)	-0.0636684 (0.2415249)
FDI (lag 1)	0.0833266 (0.1219542)	0.0830824 (0.0698436)	0.0331792 (0.1082664)	0.3846291 (0.2632001)	0.03115 (0.0838503)
Tariffs (lag 1)	-0.5887414*** (0.1577099)	-0.3318174 (0.2521703)	-0.5800067*** (0.135883)	-0.8528735** (0.2327643)	-0.2711783 (0.1467295)
Law (lag 1)	0.6113053* (0.3362863)	0.5718278 (0.4124418)	0.5029466* (0.2863512)	0.8014704 (0.4441006)	0.5498652** (0.2548033)
Labor prod (lag 1)	-2.514297** (1.163242)	-2.02963* (1.06998)	-2.403765*** (1.018439)	-2.556158 (1.464801)	-2.687322*** (0.7224764)
Foreign value added in exports (lag 1)	0.5052265*** (0.0876905)	0.6071612** (0.1734159)	0.491878*** (0.0820556)	0.2689233 (0.1767534)	0.8973187*** (0.1047421)
Constant	28.17891** (8.717721)	21.82213** (9.329606)	29.45275*** (7.376985)	25.12121*** (6.767117)	31.17262*** (6.418689)
Observations	121	121	121	121	121
R ² (within)	0.6386	0.6296	0.6060	0.5558	0.6641
Country-specific effects	Yes	Yes	Yes	Yes	Yes
Hausman test	243.05	173.64	1687.77	1164.57	357.10
Chi-square (6)					
Prob>Chi-square	0.000	0.000	0.000	0.000	0.000

Robust standards errors in parentheses. All variables are in natural logarithm with the exception of the variable law. Explanatory variables are lagged by 1 year. ***P<0.01, **P<0.05, *P<0.1

While considering all sectors, the estimates indicate that rule of laws, tariffs, labor productivity and FVA in exports are significant determinants of changes in DVA in exports for LAC. The results confirm the positive and strong association between FVA in exports and domestic value added in exports. FVA in exports are found to be strong complement to domestic value added in exports as found by Lopez (2016) when focusing on Southeast Asia.

Likewise, rule of laws plays a positive role on changes in DVA in exports. Since rule of laws may give an indication of the quality of institutions, the result suggests that countries with good quality of institutions are expected to have higher share of DVA in their exports. As explained by Nunn and Daniel (2014), poor institutions can hinder the domestic production of intermediate goods leading domestic firms to rely more on foreign intermediates. Thus, good institutions can enhance the domestic

production of intermediate goods and therefore increase the share of DVA in exports.

Contrary to Caraballo and Jiang (2016) who found a positive correlation between the tariffs and the DVA share, tariffs have a negative effect on changes in DVA in exports in selected countries meaning that countries which practice higher tariffs are likely to decrease their share of DVA in exports. An explanation is that tariffs tend to reduce the access of more sophisticated intermediates (Ahn et al., 2014; Cadot and Gourdon, 2016, Halpern et al., 2015; Bas and Strauss-Khan, 2015).

Surprisingly, the coefficient of labor productivity is negative which suggests that the higher is the output per worker in a country the lower is its share of DVA in exports. This unexpected result may be explained by the fact that the variable labor productivity fails to distinguish between skilled and unskilled labor. Thus, labor productivity may not be an appropriate measure for the quality of human capital.

Regarding the agriculture sector, labor productivity and FVA in exports are statistically significant. The coefficient of labor productivity is negative meaning that labor productivity negatively influences the changes in DVA in exports while FVA in exports positively affects the changes in DVA in agriculture exports.

Focusing on the manufacturing sector, rule of laws, tariffs, labor productivity and FVA in exports are found to be significant determinants of changes in DVA in exports in the manufacturing sector. Tariffs and labor productivity have a negative effect on changes in DVA in exports while FVA in exports and rule of laws have positive impact on changes in DVA in exports.

As for the mining sector, only the coefficient of tariffs is statistically significant. The negative coefficient of tariffs indicates

that tariffs have a negative impact on changes in DVA in exports in the mining sector.

Finally, for the services sector, rule of law and FVA have positive impact on changes in DVA in exports while labor productivity has a negative effect on changes in DVA in exports.

In sum, the results confirm the significant role of FVA in exports on positive changes in DVA which reinforces the idea that domestic export performance is extremely linked to importing. Across the four selected sectors, it can be noticed the effect of FVA on positive changes in DVA in exports in all sectors with the exception of the mining sector. The services sector is the one with the highest effect of FVA on positive changes in DVA in exports.

4.2. Robustness Check

To check for the robustness of the results, another variable, namely manufacture, value added (in current US dollars) is added to the initial model. This variable indicates the contribution of the manufacturing sector to GDP and controls for the industrial structure of each country. The higher the share of the manufacturing sector in a country's GDP, the lower the share of domestic value added in its exports (Kowalski et al., 2015).

Table 2 provides the regressions results with the new added variable. Still, the column (1) presents the regressions results for all sectors while columns (2)-(5) indicate the results for agriculture, manufacturing, mining and services sectors respectively. All regressions include country fixed effects.

The results in Table 2 indicate that the estimations results still hold when a new variable is added to the initial model. When considering all sectors, the coefficients of FVA in exports and rule of laws are statistically significant and positive while those

Table 2: Determinants of changes in domestic value added in exports, robustness check results

Independent variables	Dependent variable: ln DVA in exports				
	(1) All	(2) Agriculture	(3) Manufacturing	(4) Mining	(5) Services
Manufacture, value added (lag 1)	-0.8208745 (0.5451541)	0.0726811 (0.5695514)	-0.6471861 (0.5635193)	0.5590266 (0.9215635)	-0.0672973 (0.5716532)
GDP (lag 1)	0.7991685 (0.4342855)	-0.0128048 (0.5061275)	0.5750025 (0.4651363)	-0.5053449 (0.8072007)	-0.0018613 (0.4757154)
FDI (lag 1)	0.0423037 (0.1262582)	0.0837519 (0.0722417)	0.0061156 (0.1160691)	0.4019914 (0.2702971)	0.0299701 (0.04722)
Tariffs (lag 1)	-0.485667** (0.1793543)	-0.3391846*** (0.2435197)	-0.4950732** (0.1586926)	-0.9261246** (0.2822679)	-0.2630832 (0.1537043)
Law (lag 1)	0.6294352** (0.284479)	0.5784017 (0.4440775)	0.5335054* (0.2364085)	0.8432607 (0.4747855)	0.5456696* (0.2635823)
Labor Prod (lag 1)	-2.752106** (0.9611751)	-2.038481* (1.085724)	-2.596609** (0.8670772)	-2.629288 (1.490555)	-2.687188*** (0.7132279)
Foreign value added in exports (lag 1)	0.6280066*** (0.0590537)	0.609187** (0.1651756)	0.5887756*** (0.075761)	0.2433967 (0.2042099)	0.898988*** (0.1152552)
Constant	31.18229*** (6.898899)	21.90433** (9.37441)	31.90721*** (6.68274)	24.95259** (7.169069)	31.1848*** (6.340516)
Observations	121	121	121	121	121
R ² (within)	0.6553	0.6298	0.6181	0.5595	0.6643
Country-specific effects	Yes	Yes	Yes	Yes	Yes
Hausman test	261.98	101.34	1244.57	910.99	304.37
Chi-square (7)					
Prob>Chi-square	0.000	0.000	0.000	0.000	0.000

Robust standards errors in parentheses. All variables are in natural logarithm with the exception of the variable law. Explanatory variables are lagged by 1 year. ***P<0.01, **P<0.05, *P<0.1

of tariffs and labor productivity are statistically significant and negative. Table 2 also shows that the estimations results still hold for each sector.

5. CONCLUSIONS

This paper relies on the decomposition method of gross exports into value-added exports provided by Koopman et al. (2010) and recent empirical findings referring to the determinants of changes in DVA in exports with a focus on the potential role of foreign inputs (Gonzales, 2016; Kowalski et al., 2015).

Fixed effects models are used to investigate the impact of FVA in exports and others factors on changes in DVA in exports in seven LAC. OECD-TIVA database (2016 and 2018) served as the main sources of value-added exports data. Further, a robustness check is undertaken by adding another variable (the share of manufacturing sector in GDP) to the initial model.

The results confirm the strong impact of FVA in exports on positive changes in domestic value added in exports reinforcing the idea that domestic export performance is closely linked to importing. Likewise, the quality of institutions also plays a positive role on changes in DVA in exports. However, tariffs and surprisingly labor productivity have negative effect on changes in DVA. The results still hold under the robustness check.

Additionally, a sectoral analysis is done to capture differences across the determinants of changes in DVA in exports across four broad sectors: Agriculture, manufacturing, mining and services. FVA in exports is found to be a common important factor on positive changes in DVA in exports in all sectors with the exception of the mining sector. FVA has no significant effect on changes in DVA in exports in the mining sector.

Focusing on differences across sectors, tariffs are strong determinants of changes in DVA in exports in the manufacture and mining sectors. The coefficient of labor productivity is statistically significant and negative in all sectors except the mining sector. Rule of laws positively influences the changes in DVA in exports only in the manufacture and services sectors.

Overall, the results suggest the countries to lower tariffs in order to enhance the import of sophisticated intermediate inputs. Moreover, countries are likely to increase their share of domestic value added in exports by promoting favorable business environment.

The paper shows that the seven selected LAC have benefited from using FVA to boost their domestic export performance. One of the limitations of this paper is the limited coverage of value-added exports data for LAC. One could improve the analysis by using different source of input-output table and include more countries.

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