



The Participation of Mexico in Global Supply Chains

**The Challenge of Adding
Mexican Value**

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**Inter-American
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ABSTRACT*

There is a general perception that Mexico's insertion in global supply chains has been mostly in assembly operations and that efforts should be made to incorporate additional domestic value in the international production networks in which the country participates. To examine this issue properly one needs to have a measure of the share of domestic value added that is effectively embodied in Mexico's exports. We analyze firm-level data from the IMMEX census which covers all the firms that benefit from the Maquiladora and the PITEX programs. We find that the share of domestic value added as a proportion of the firm's exports has been declining in the last 6 years. We show that the decline is not the result of market share re-allocations; that it persists after controlling for price changes and that is observed across firms of all sizes. The results suggest that more segments of the supply chains are generally not moving into Mexico and that on the contrary there is a trend of falling domestic value added. This result contrasts with that of other countries engaged in similar export processing activities, like China.

JEL Codes: F14, F23, L23

Key Words: Global Supply Chains, International Fragmentation of Production, Suppliers, Mexico

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Introduction

During the last two decades the world economy has seen an increasing trend in international production fragmentation: the geographic separation of activities involved in producing a good or a service across two or more countries. The resulting international organization of production has substantially increased interdependencies among economies around the globe and has translated into a fast growing trade in intermediate inputs and services (Yeats, 2001; Hummels, Ishii and Yi, 2001).

The continuous international fragmentation of production is opening up clear opportunities for developing countries to participate in activities that were not available in the past. The process of fragmentation tends to eliminate the need to gain competency in all aspects of the production of a good and allows countries to enter into a network of cross-border production sharing by specializing in just one or a few stages involved in making a final good. Participation in international supply chains is also frequently associated with rapid learning, technology transfers and knowledge spillovers that emanates from global firms to local suppliers (Gereffi, 1999; Humphrey and Schmitz, 2002; Sturgeon and Linden, 2011).

Despite the clear benefits of joining international production networks, they have not been spread evenly across the world as they tend to concentrate around three regions, North America, Europe and East Asia, led by firms in the U.S., Germany and Japan, respectively. Mexico has been in a privileged position, relative to its peers in Latin America, to participate in multiple supply chains particularly with the U.S. Proximity, low trade barriers and low factor prices relative to the U.S. and Canada, are some of the factors that have made Mexico an attractive destination for firms in the North seeking to engage in cross-border production sharing. Accordingly, Mexico, and perhaps a few more countries in Central America, like Costa Rica, stands apart in Latin America in terms of having been able to join international production networks.

But there is a general perception that Mexico's insertion in supply chains has been mostly in assembly operations and that efforts should be made to incorporate additional domestic value in the international production networks in which the country participates. To examine this issue properly one needs to have a measure of the share of domestic value added that is effectively embodied in Mexico's exports and an assessment on how it compares to that in other countries

engaged in similar export processing activities. It is also important to know how is this share evolving over time; in other words, are more segments of the supply chain moving into Mexico or on the contrary there is a trend of falling domestic value added? The purpose of this short note is to provide answers to these questions.

Background

For several years, Mexico has sought to build international production linkages particularly with the U.S. through various programs. The Maquiladora program, for instance, started in the mid-1960s. Originally, the program was set to allow imports from the U.S. to enter duty-free as long as the output from the maquiladora firms was exported back to the U.S. Eventually, the benefits of the program were extended in various ways: eligible non-NAFTA inputs also benefited from zero (or very low) tariff rates in the U.S.; the output of the maquiladoras could be sold in Mexico; the value added tax on the exports was also exempted, and upon complying with certain rules, the income tax and the asset tax were also exempted.

The Program of Temporary Imports to Produce Export Goods (PITEX) was another major initiative to foster cross-border production sharing. PITEX allowed for duty free on the imports of intermediates and machinery as long as the final product was exported, but did not offer the other tax exemptions as in the Maquiladora program. On November of 2006, the Maquiladora and the PITEX program were combined in just one regime called the Manufacturing Industry, maquiladora and Export Services Program (IMMEX). The IMMEX program permits the temporary importation of inputs, raw materials, parts and components, and machinery and equipment free of duty for use in a production process as long as the final product is exported, and also allows for the exemption of the value added tax (De La Cruz et al., 2011). Today, Mexico's processing exports through the IMMEX program represent around 63% of the country's total exports.

While these programs have supported Mexico's insertion in international production networks, particularly with the U.S., the country's participation in cross-border production sharing has traditionally focused in assembly operations. This, in part, was the result of trade regimes created by the U.S., like the so call "807 production" (Bair and Dussel Peters, 2006).

This regime, for example, was a scheme in the apparel industry in which U.S. firms were able to export cut parts of garments to Mexico and also to countries in the Caribbean Basin Initiative (CBI) for assembly and re-import as long as the fabrics employed overseas were from the U.S. In the case of the Caribbean countries, the CBI was eventually expanded into the Caribbean Basin Trade and Promotion Act (CBTPA) but even at this point the US tariff rate was exempted on products in which the local value added consists only on cut, make, trim and finishing operations. It was not only until CAFTA went into effect in 2005, that every single aspect of the production process in this supply chain of textiles and apparel, including the use of local yarns, fibers and other raw materials, could be done in the Central American countries (Pipkin, 2011). In the case of Mexico, this became possible after NAFTA went into force.

While trade schemes like the “807 production” may have limited the share of domestic value that Mexico could add to its processing exports, the question today is whether the country has been able to start gaining segments of the international supply chains in which it participates, particularly after NAFTA. Answering this question requires some measure of domestic value added and an estimation of how it has evolved over time.

De La Cruz, et al., (2011) is perhaps the most comprehensive analysis today providing, among other things, a measure of the domestic value added incorporated in Mexico’s processing exports. Following a recent literature on measures of vertical specialization (Hummels, Ishii and Yi, 2001; Koopman, Powers, Wang and Wei, 2010), the authors combine an input-output table from the Instituto Nacional de Estadística, Geografía e Informática (INEGI) and trade data from the World Trade Atlas to generate measures of domestic (and foreign) value added incorporated in the country’s exports. The information that the authors employ allow them to construct separate measures of value added for processing exports (those under the Maquiladora and the PITEX programs) and for all other exports. The results show that the domestic value added embodied in processing exports of Mexico is in the range of 21%-28% depending on the level of aggregation. The values change only very slightly across the 3 years analyzed, 2000, 2003 and 2006. Following a somewhat similar technique and using the same input-output table from INEGI, Fujii and Cervantes (2011) calculate a domestic value added for processing exports of around 15% in 2003.

The use of input-output tables in combination with trade data have been very useful because it has allowed economists to trace the value added of a country's trade flows and thus develop measures of value chain participation. This represents an improvement over other methods that use descriptions of trade line classifications to pick up terms like "parts and components", which tend to rely on subjective criteria on what constitute an intermediate good. But the use of input-output tables also has some limitations. One of them is the proportionality assumption that all firms within the same industry use the same proportion of imported materials. In this note we employ an alternative strategy to measure domestic value added in Mexico's processing exports. We employ the information that comes directly from an establishment-level dataset, the IMMEX census generated by INEGI.

Empirical Analysis

The IMMEX census provides basic information for all the plants that participate in the IMMEX program. The census covers 6,400 establishments of which approximately 5,200 are engaged in manufacturing activities. We analyze the plants in the manufacturing sector. The census was initiated after the Maquiladora and the PITEEX programs were merged, specifically in July 2007 and it has a monthly periodicity. We examine the period from July 2007 to January 2013. This gives us 67 months of data which provide sufficient information to examine any potential trend in the evolution of the variables of interest.

The census covers basic information at the establishment level on employment, wages, revenues and costs. The main two variables that we employ in our analysis are the following:

K317c: Foreign inputs admitted under the temporary imports regime

M710c: Revenues from selling abroad the output of all the processing (maquiladora) activities including the value of the domestic inputs employed but excluding the value of the foreign inputs employed.

Note that the *M710c* variable is essentially the value of the processing exports of the establishment minus the foreign inputs employed in those exports; in other words, this is the domestic value added that is incorporated in the processing exports of the establishment. Accordingly, we define the variables that we use in this paper as follows:

Domestic value added of establishment i at time t incorporated in processing exports:

$$dva_{it} = M710c_{it} \quad (1)$$

Total processing exports of establishment i at time t :

$$exp_{it} = M710c_{it} + K317c_{it} \quad (2)$$

Share of domestic value added in total processing exports of establishment i at time t :

$$sdva_{it} = \frac{dva_{it}}{exp_{it}} = \frac{M710c_{it}}{M710c_{it} + K317c_{it}} \quad (3)$$

Total domestic value added incorporated in the processing exports of the country at time t :

$$dva_t = \sum_i^N dva_{it} \quad (4)$$

Total processing exports of the country at time t :

$$exp_t = \sum_i^N exp_{it} \quad (5)$$

Overall share of domestic value added in total processing exports of the country at time t :

$$sdva_t = \frac{dva_t}{exp_t} = \sum_i^N w_{it} \cdot sdva_{it} \quad (6)$$

Note from (6) that dividing dva_t by exp_t is the same as calculating a weighted average of the share of domestic value added across all the establishments where the weight (w_{it}) is the participation of the establishment's processing exports in the total processing exports of the country.

Figures 1 and 2 show the absolute values of the total processing exports of Mexico (exp_t) and the total domestic value added incorporated in those exports (dva_t) presented monthly between July 2007 and January 2013. The exports show an initial declining trend particularly during the year 2009 which is likely to be related to the global financial crisis originated in the U.S. From the beginning of 2010, however, the situation is reversed and a positive trend is

clearly evident. A somewhat similar evolution of an initial bust and a subsequent recovery in 2010 is observed in the total domestic value added, as shown in Figure 2.

Figure 1: Total Processing Exports

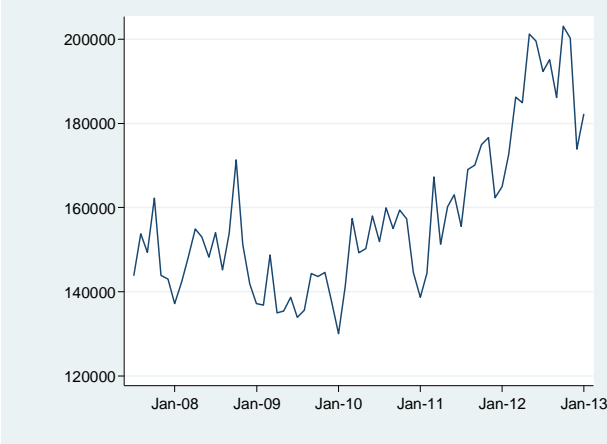


Figure 2: Total Domestic Value Added

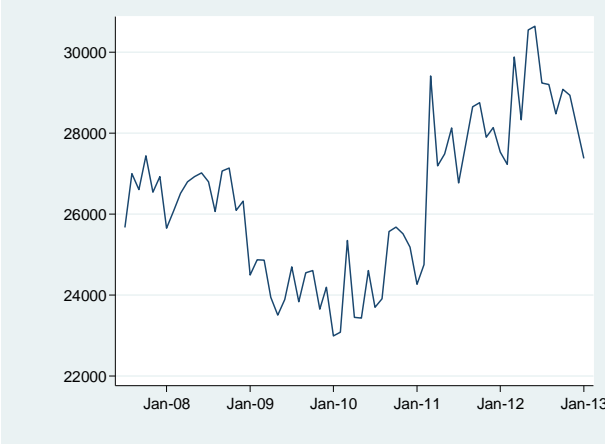
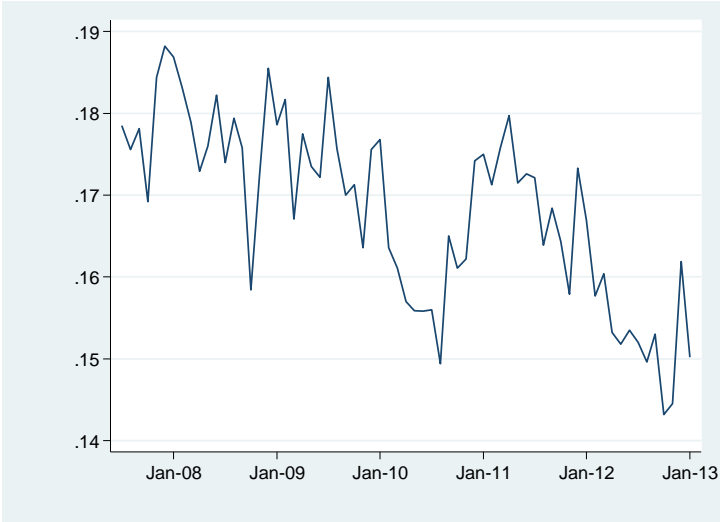


Figure 3 shows the overall share of domestic value added in total processing exports at the country level ($sdva_t$). While there are various episodes with noticeable changes, in general we observed a decreasing trend. For instance, in the middle of 2007 the share of domestic value added was around 18% but by the beginning of 2013 the share had fallen to 15%. While certainly this is not a large decline, it is clear that the share of domestic value added is not increasing.

Figure 3: Share of Domestic Value Added in Processing Exports



A decline in the overall share of domestic value added of the country does not necessarily mean that the establishments per se are reducing their value-added incorporated in their exports. A

decline could be the result of changes in the participation of each establishment in total exports. For instance, if establishments with large value added are losing participation in the total level of processing exports while the establishments with low value added are gaining participation, we will observe a decline in the overall share of domestic value added.

To assess whether the declining trend that we observe in figure 3 is the result of changes in the participation of the establishments, we decompose the overall share of domestic value added as follows:

$$sdva_t = \overline{sdva}_t + \sum_i^N (w_{it} - \bar{w}_t) \cdot (sdva_{it} - \overline{sdva}_t) \quad (7)$$

where a bar over a variable denotes the simple mean over all establishments at time t . The first term on the right-hand side of equation (7) is the un-weighted average of the share of domestic value added across all the establishments. The second term is the covariance. The covariance component represents the contribution to the overall weighted share of domestic value added resulting from changes in the participation of firms with different shares of domestic value added. If the covariance is positive, it indicates that more processing exports are generated by the establishments that have large shares of domestic value added. If the covariance falls over times, it means that there is a reallocation of market shares from plants with large shares of domestic value added to plants with small shares. The decomposition is presented in Figures 4 and 5.

Figure 4: Share of Domestic Value Added,

Simple Mean Across All Firms

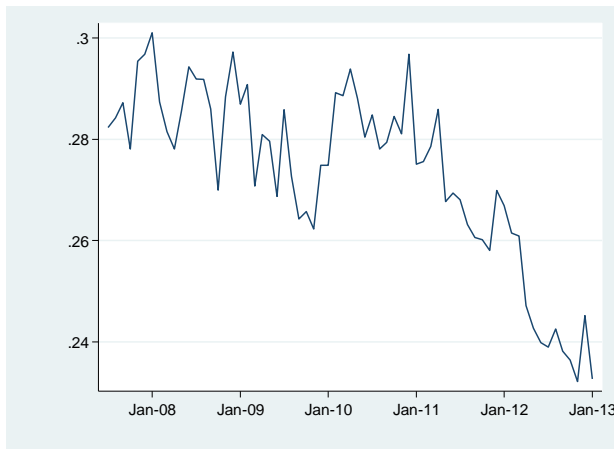


Figure 5: Covariance Term

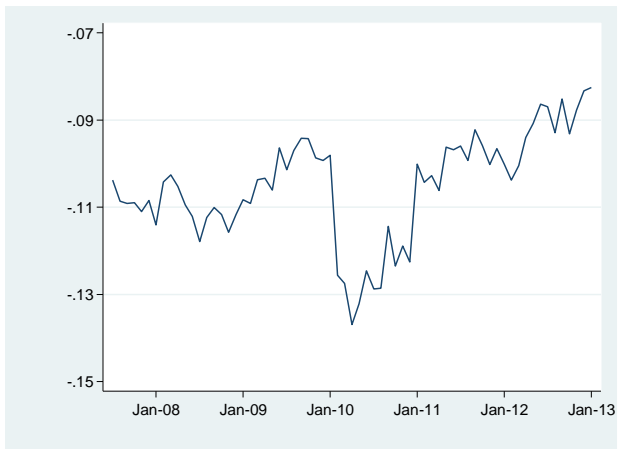


Figure 4 shows that the simple mean of the share of domestic value added across all the establishments have a general decreasing trend. Therefore, from the outset, this already indicates that the reduction in the overall weighted share of domestic value added that we observed in Figure 3 was not purely a result of changes in the establishment's participation. The establishments, on average, are indeed decreasing their share of domestic value added over time. The covariance component in Figure 5 shows two additional aspects. First, all the values are negative, meaning that in general more processing exports are generated by establishments with small shares of domestic value added. However, besides a large drop of the covariance in January of 2010, the trend is in general positive, indicating that over time, there has been a reallocation of market shares from plants with small shares of domestic value added to plants with large shares of domestic value added. This reallocation, however, has not been enough to compensate for the general decline in the share of domestic value added.

To analyze more formally whether the decline in the overall share of domestic value added is due to within-firm reduction in the share of domestic value added or to changes in the establishment's participation in total processing exports (including firm entry and exit), we follow Kee and Tang (2012) and estimate the following equation:¹

$$sdva_{it} = \beta_i + \beta_t + \varepsilon_{it} \quad (8)$$

where β_i and β_t are firm and year fixed effects, respectively. A within-firm decline in the share of domestic value added will be captured by decreasing year fixed effects:

$$\beta_t < \beta_{t-1}$$

We also augment equation (8) by including two additional variables that control for changes in production costs: wages and materials:

$$sdva_{it} = \beta_i + \beta_t + \beta_1 \cdot wage_{it} + \beta_2 \cdot material_{it} + \varepsilon_{it} \quad (9)$$

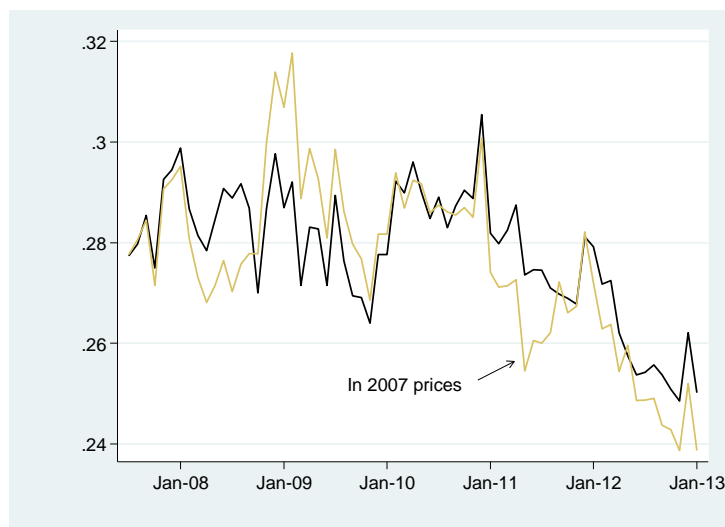
The idea behind including these additional variables is to strip the share of domestic value added from changes in production costs. In other words, we want to obtain a trend in the share of domestic value added that is not affected by price changes. Note that in principle, any nominal change in wages or in the costs of materials could affect the share of domestic value added.

¹ We are grateful to INEGI personnel for kindly running our Stata codes in their computers.

Specification (9) seeks to absorb these changes by including the wage and the material variables. The estimated β_t coefficients for regression (9) are represented by the black line in Figure 6. As clear from the picture, there is a within-firm decline in the share of domestic value added.

An alternative way to control for the effect of prices is to re-calculate the shares of domestic value added using real instead of nominal series; in other words, after deflating the domestic value added and the value of the foreign inputs, the two variables from the IMMEX census that we employ. We use INEGI's monthly production price index to deflate the domestic value added. In particular, we use, July 2007, as the baseline date. The result is a series of domestic value added in July 2007 prices. With respect to the foreign inputs we use the following procedure. In the IMMEX dataset, the imports are in pesos. We first convert all the imports from pesos into U.S. dollars using the monthly nominal exchange rate. Then, we convert them back into pesos using the nominal exchange rate of July 2007. This gives us a series for imports in July 2007 prices. With these variables we re-calculate the share of domestic value added as in equation (3). We then run the regressions again. The within-firm changes in the shares of domestic value added using July 2007 prices are represented by the brown line in Figure (6). A declining trend is again clear from the figure.

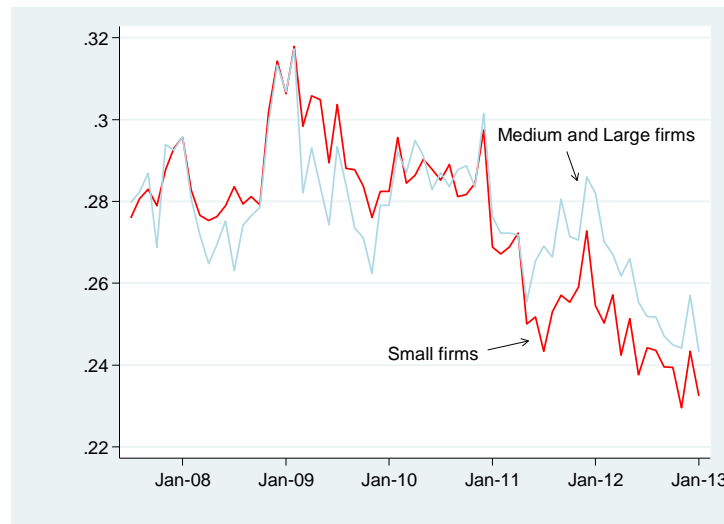
Figure 6: Within-firm Evolution of Share in Domestic Value Added



Finally, we repeat the last estimation but separating the small firms from the medium and large firms. The idea is to examine whether the declining trend in the share of domestic value

added is special to a group of firms or whether it is a singularity observed across the board. Figure 7 shows that the declining trend is prevalent across firms of all sizes.

Figure 7: Within-firm Evolution of Share in Domestic Value Added, Small Versus Medium and Large Firm



Discussion

Mexico stands apart in Latin America in terms of joining many international production networks, particularly with the U.S. For long, however, it has been argued that Mexico's challenge is to move beyond assembly operations and to foster the insertion of firms in other segments of the supply chain as well. In this note we analyze firm-level data from the IMMEX census which covers all the firms that benefit from the Maquiladora and the PITEX programs. We find that for the typical firm engaged in processing exports, the share of domestic value added as a proportion of its exports was equal to 24% in 2013, while in 2007 this share was around 28%. We show that the decline is not the result of market share re-allocations; we also show that it persists after controlling for price changes and that is observed across firms of all sizes.

While certainly this is not a large decline, it is clear that the share of domestic value added is not increasing, a finding that suggest that at least during the period considered, Mexico has not been able to incorporate additional local content to the international supply chains in which the country participates. It is worth mentioning that the findings for Mexico are the opposite to those for China. For instance, Kee and Tang (2012) measure the evolution of China's domestic value

added in processing exports between 2000 and 2006. One aspect that is noteworthy is that in 2000, the share of domestic value added in China at 35% was already higher than in Mexico. Secondly, the share in China has been increasing over time reaching 49% by 2006. Using a similar strategy than in this note, the authors show that this increasing trend in China is driven by within-firm substitution of imported materials with domestic materials and not by changes in the composition of firms or industries.

Analyzing why increasing the domestic value added of Mexico's processing exports remains an elusive goal should be the subject of future research.

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