Economic Systems Research
Journal of the International Input-Output Association
Volume 29 Number 4 December 2017

Routledge
Taylor & Francis Group

Economic Systems Research

ISSN: 0953-5314 (Print) 1469-5758 (Online) Journal homepage: http://www.tandfonline.com/loi/cesr20

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To cite this article: Gerardo Fujii-Gambero & Rosario Cervantes-Martínez (2017) The weak linkages between processing exports and the internal economy. The Mexican case, Economic Systems Research, 29:4, 528-540, DOI: 10.1080/09535314.2017.1351332

To link to this article: https://doi.org/10.1080/09535314.2017.1351332

ECONOMIC SYSTEMS RESEARCH, 2017
VOL. 29, NO. 4, 528–540
https://doi.org/10.1080/09535314.2017.1351332

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The weak linkages between processing exports and the internal economy. The Mexican case

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ABSTRACT

The aim of this paper is to show the internal linkages of manufacturing exports and the rest of the economy. We take the Mexican economy as the case of study. Manufacturing exports constitute the most of exports and processing exports (maquiladora) represent an important part of them. We consider the indirect domestic value added contained in Mexican manufacturing exports, dividing them into exports from the internal economy and the maquiladora industry. We show that the internal backward linkages of exports are weak, that only a few sectors produce inputs for exports, and that the forward linkages are weak too because the Mexican maquiladora industry assembles imported parts and components into final goods for export. The actual picture is quite different from that presented by Hirschman [(1958) The Strategy of Economic Development. New Haven, Yale University Press], who argued that the manufacturing sector plays a key role to promote economic growth because of its dense forward and backward internal linkages.

ARTICLE HISTORY
Received 5 August 2013
In final form 3 July 2017

KEYWORDS
Domestic value added in exports; indirect value added; manufacturing exports; maquiladoras

1. Introduction

Inputs, parts, and domestic components contained in exports are indirectly exported by industries that produce them. We can view the value added (VA) embodied in such indirect exports from two perspectives: by the sector that produces these inputs and by the sector that uses them as inputs and subsequently exports them, embodied in a different final product. Herein we use the expression 'indirect domestic value added in exports' when discussing the VA of these goods or services, regardless of the perspective. Given this premise, we are interested in identifying, for each sector producing intermediate goods, manufacturing sectors through which indirect domestic value added (IDVA) produced by other sectors are exported. Analysis of data from this perspective allows us to identify the distribution of the indirect VA embodied in exported goods. Thus, this paper shows the distribution of IDVA contained in Mexican manufacturing exports.

The manufacturing industry dominates Mexican exports, more than half of which are integrated in global production chains. These exports are characterized by their elevated content of imported parts and components that are assembled to produce final goods for

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export. As a result, not only is IDVA in manufacturing exports a small portion, it also originates in few manufacturing sectors. That is, because Mexico's manufacturers produce a small number of components, they distribute their product to few directly exporting sectors. This deepens our understanding of complex relations among industries that are integral to global value chains (GVCs), the tenuous nature of some exporting industries with their host nations, and thus the potential ephemeral role in GVCs of countries with exporting profiles that are similar to Mexico's.

Koopman et al. (2008) and He and Zhang (2010) originally developed an approach to calculate the distribution of IDVA in manufacturing exports by sectors of origin and destination. We follow this approach using data from Mexico's input–output (IO) matrix for 2003 (INEGI, 2008a; 2008b) These data partition the economy into two parts: the maquiladoras and the rest of the economy. Given the characteristics of maquiladoras and their share of Mexico's exports, it is important to consider them separately. At the time of writing this paper, 2003 was the last year for which governmental statistical data enabled separate calculations of the distribution of IDVA in exports for these two aspects of the Mexican economy.[1]

2. Growth and changes in exports

Between 1992 and 2012 Mexico's total exports grew considerably, from nearly $50 billion (US) to some $375 billion. Its share of production in the form of exports grew concordantly, from 13% to more than 30% over the same period (Banco de México, 2013) Mexico's export growth occurred simultaneously with a change in the make-up of exported goods. The main features of the Mexico's export profile are:

- In 2013, manufacturing exports represent 84% of the country's total exports (INEGI, 2008a)
- In 2012, medium-to-high-technology manufacturing exports comprise 78% of industrial exports (UN COMTRADE).
- In 2003, exports of transportation equipment and electronics comprised the greatest shares of manufacturing exports: 29% and 28%, respectively (see Table 1).
- In 2003, maquiladoras produced the lion's share of exports (62%) They were responsible for an overwhelming share (88%) of electronic equipment exports (see Table 1).

Separating maquiladora from the rest of manufacturing is important if we are to evaluate export data by level of technology. This is because it is entirely possible that a country can specialize in the production of a technologically simple aspect of a product that is itself of technologically and scientifically complex (high tech) This is especially important for countries such as Mexico that both import and export intensively within the context of GVCs. Mexico's role within these chains is that of supplying relatively unskilled, low-cost labor that is hired in labor-intensive processes. Thus, although the products themselves may be considered 'high technology' the productive process performed within Mexico typically is, technologically speaking, relatively unsophisticated.

[1] Starting in 2007, separate statistical data for Mexico's maquiladora industry stopped being reported, so the official 2008 and 2012 IO tables no longer include this division.

Table 1. Export composition (percentages).

Type of product (2013)[a]		Industrial exports by technological content (2012)[b]			Manufacturing exports by products and sector (2003)[c]			
							Sector	
					Products		Domestic economy	Maquiladora exports
Manufactures	84	Natural-resource-based products		10	Electronic equipment	29	12	88
Crude oil	12	Technological level	Low	11	Transport equipment	28	58	42
Agriculture	3		Medium	49	Electric equipment	9	19	81
Minerals	1		High	29	Other	34	49	51
Total	100		Total	100	Total	100	38	62

[a]INEGI (2008a).
[b]COMTRADE.
[c]Fujii and Cervantes (2013).

Yet, notwithstanding the growth and transformations within the export sector, economic growth has been relatively modest at 2.6% (1994–2012). We can partially explain this significant contrast between exports and growth by highlighting that the domestic VA content in manufacturing exports is not particularly high.

3. Domestic VA in exports

Based on the 2003 matrix prepared by INEGI (2008a) and discussed in Fujii and Cervantes (2013), we present in what follows the calculations of domestic VA contained in manufacturing exports, both for all exports as well as for the domestic economy (DE), for the maquiladora export industry (MEI), and for sectors with the greatest weight in manufacturing exports. What follows is based largely on the main conclusions of the paper just cited (see Table 2):

- For all manufacturing exports, domestic VA represents 42% of exports; in DE exports, this coefficient is significantly higher than MEI (75% vs. 22%).
- This coefficient is significantly lower in electronic equipment exports (21%) as compared to transportation equipment (50%). Given the weight of the maquiladora sector in exports of the electronic industry, the former figure is very much influenced by the extremely low domestic VA contained in exports of electronic products originating in this export sector (14%). Looking at transportation-equipment exports, more than half comes from the DE in which domestic VA added is equal to 68% of export value.

Table 2. Domestic VA in manufacturing exports (2003; percentages of exports).

	Total manufacturing			Domestic economy			Maquiladora exports		
	VA	Direct VA	Indirect VA	VA	Direct VA	Indirect VA	VA	Direct VA	Indirect VA
Electronic equipment	21	13	8	71	44	27	14	8	6
Transport equipment	49	27	22	68	35	33	25	17	8
Electrical equipment	34	19	15	76	41	35	24	14	10
Other	56	28	28	82	38	44	33	19	14
Total	42	22	20	75	37	37	22	13	9

Source: Fujii and Cervantes (2013).

- For total manufacturing exports, direct VA is 23% of all exports, while indirect VA is 20%. Obviously these coefficients are significantly lower in electronic industry exports (13% and 8%, respectively), and even lower in the exports of the maquiladora industry's electronic products: direct VA is equal to 8% of exports, and IDVA is 6% of exports.
- In transportation equipment, which comprise half of all Mexico's nonmaquiladora exports, contribute 27% of the direct VA of all exports and its IDVA 22% of exports; these figures are significantly higher in exports for the DE than for the maquiladora industry (35% and 33% vs. 17% and 8%, respectively).

4. Research approach

Following Koopman et al. (2008) and He and Zhang (2010), elsewhere (Fujii and Cervantes, 2013) we have explained the approach used to calculate the total domestic VA contained in Mexico's manufacturing exports. With data from INEGI's 2003 IO tables (INEGI, 2008a), the matrices of VA multipliers for the DE and the MEI are expressed by Equations 1 and 2, respectively.

$$\mathbf{M}^{DE} = \hat{\mathbf{V}}^{DE}(\mathbf{I} - \mathbf{A}^{DE})^{-1}, \tag{1}$$

$$\mathbf{M}^{MEI} = \hat{\mathbf{V}}^{DE}(\mathbf{I} - \mathbf{A}^{DE})^{-1}\mathbf{A}^{MEI} + \hat{\mathbf{V}}^{MEI}, \tag{2}$$

where $\mathbf{M}^{DE}$ is an $n \times n$ matrix, whose elements m_{ij}^{DE} represent the share of domestic VA attributed to sector i by unit of export in sector j, produced by nonmaquiladora establishments; VA attributed to sector i by unit of export in sector j, produced by nonmaquiladora establishments; n is the number of subsectors of the economy; $(\mathbf{I} - \mathbf{A}^{DE})^{-1}$ is the known Leontief inverse matrix; and $\hat{\mathbf{V}}^{DE}$ is the diagonal matrix of VA coefficients, whose elements in the main diagonal are obtained by dividing the VA by sector i by the gross value of production in that same sector. Therefore, when $i = j$, the direct and indirect intra-industrial effects are obtained, all elements not found in the main diagonal represent solely indirect effects.

With regard to the effect that the MEI exports have on the generation of domestic VA, in Equation 2 the term $\hat{\mathbf{V}}^{DE}(\mathbf{I} - \mathbf{A}^{DE})^{-1}\mathbf{A}^{MEI}$ corresponds to the indirect effects that MEI have on the companies of the DE. Where $\mathbf{A}^{MEI}$ is an $n \times n$ matrix that has elements representing the share of inputs consumed by the export sector j that come from companies within the DE; $\mathbf{A}^{MEI}$ is a matrix of coefficients of domestic inputs consumed by the MEI and provided by the DE. Note that $\hat{\mathbf{V}}^{DE}(\mathbf{I} - \mathbf{A}^{DE})^{-1}$ is the value-added multiplier matrix from DE. Finally, $\hat{\mathbf{V}}^{MEI}$ is a diagonal matrix of VA coefficients from the MEI and represents the direct effects of maquiladora exports on domestic VA.

When estimating the effects that manufacturing exports have on domestic VA, in Equations 1 and 2, the assumption is that the model's equilibrium depends mainly on conditions of demand, in accordance with a production function of fixed proportions. This means that if, in the expression $\mathbf{L}^{DE} = (\mathbf{I} - \mathbf{A}^{DE})^{-1}$, the Leontief inverse, there are an infinite number of rounds of intermediate demand to satisfy a unit of final demand of each of the sectors, then in each round the shares of intermediate inputs and the value-added coefficients remain constant. Likewise, with this method, it is not possible to ascertain how and to what

extent domestic VA generated by exports, either direct or indirect, affects the other vectors that make up final demand (consumption or investment).[2]

Thus the model we use in this paper can be interpreted as an *ex post* equilibrium model in the sense that, for the period in question, that is, 2003, we take as given the following variables and coefficients: (1) final demand vector; (2) export vector; (3) technical coefficients matrix; and (4) VA-coefficients vector. Therefore this is a domestic VA (GDP) distribution model, based on the value of manufacturing exports among direct exporting sectors and indirect exporting sectors.[3] Consequently, the limitations in the approach adopted come mainly from the inability to explain how an export vector, based on VA generated directly and indirectly, affects the level of household consumption derived from wages paid to people employed, or even, based on that same VA, how investment can be induced based on the profit margin generated through exports.

To estimate just the indirect effects of manufacturing exports on the generation of domestic VA, in Equations 3 and 4, we find the 'IDVA multipliers' matrices.

$$ {}^{IN}\mathbf{M}^{DE} = \hat{\mathbf{V}}^{DE}[\mathbf{L}^{DE} - \mathbf{I}], \tag{3} $$

$$ {}^{IN}\mathbf{M}^{MEI} = \hat{\mathbf{V}}^{DE}\mathbf{L}^{DE}\mathbf{A}^{MEI}, \tag{4} $$

where ${}^{IN}\mathbf{M}^{DE}$ is an $n \times n$ matrix in which elements ${}^{IN}m_{ij}^{DE}$ represent IDVA generated by sector i by unit of export of sector j. Thus, for example, if the value of ${}^{IN}m_{ij}^{DE}$ is equal to zero, this means that sector i does not produce inputs for sector j; in other words, the position variables represent the origin and destination sectors of the inputs, respectively.

It can be shown, based on Equation 3, that subtracting the identity matrix ($\mathbf{I}$) from the inverse of Leontief does not eliminate the initial effect in the generation of domestic VA given by the direct effect per unit of exported product. As stated previously, since this is an *ex post* model, and given the distributive property of matrix multiplication we get from Equation 3:

$$ {}^{IN}\mathbf{M}^{DE} = \hat{\mathbf{V}}^{DE}\mathbf{L}^{DE} - \hat{\mathbf{V}}^{DE}\mathbf{I}, \tag{5} $$

and simplifying:

$$ {}^{IN}\mathbf{M}^{DE} = \hat{\mathbf{V}}^{DE}\mathbf{L}^{DE} - \hat{\mathbf{V}}^{DE}. \tag{6} $$

Multiplying Equation 6 by a diagonal matrix, $\hat{\mathbf{F}}$, that assumes a unit vector of exported product in each sector on the diagonal:

$$ {}^{IN}\mathbf{M}^{DE} = [\hat{\mathbf{V}}^{DE}\mathbf{L}^{DE} - \hat{\mathbf{V}}^{DE}]\hat{\mathbf{F}}. \tag{7} $$

Then, distributing,

$$ {}^{IN}\mathbf{M}^{DE} = \hat{\mathbf{V}}^{DE}\mathbf{L}^{DE}\hat{\mathbf{F}} - \hat{\mathbf{V}}^{DE}\hat{\mathbf{F}}. \tag{8} $$

We can now see that Equations 3 and 8 are equivalent and represent the indirect effects that final demand has in the generation of VA in supplier sectors of intermediate inputs: the

[2] With respect to the limitations of the input–output model based on the inverse of Leontief, and on the calculation of the VA generated, see the discussion in Guerra and Sancho (2010), and Manresa and Sancho (2012).

[3] See Los et al. (2012) and Timmer et al. (2013) regarding the illustrative and explanatory value of the input–output model using the inverse of Leontief in the generation of value through inter-industrial relationships.

subtraction of direct VA, expressed by $\hat{\mathbf{V}}^{DE}\hat{\mathbf{F}}$, is done after exports $\hat{\mathbf{F}}$ generated the indirect effect by means of the expression $\hat{\mathbf{V}}^{DE}\mathbf{L}^{DE}\hat{\mathbf{F}}$. Thus Equation 3 is considered to be a matrix of multipliers because, for each unit of exported product in sector *j*, in any element ${}^{IN}m_{ij}^{DE}$ we know how much VA in sector *i* was generated, in addition to the direct VA in export sector *j*. Further, the coefficient ${}^{IN}m_{ij}^{DE}$ is the ratio of change of VA in sector *i* as a result of increases in exports of sector *j*.

Reading by columns, in both Equations 3 and 4, yields the concept of backward linkages derived by a Leontief (fixed proportion) production function, which excludes the possibility of substituting intermediate inputs, so that the coefficients can be added to obtain the total indirect effects of export sector *j*. Yet if we read by rows, we get a dichotomous or binary interpretation, in the sense that if we begin with a Leontief production function, sector *i* does provide a certain amount of inputs to export sectors *j*, or it does not provide inputs because these are not required in the production processes. In other words, if we read by rows, in principle we are interested in determining how many elements have a value equal to zero and how many have a positive number.

If the industrial classification corresponds to products that, under the conditions of a Leontief production function, can be incorporated in other productive process in which value is added to them, a reading by rows of a matrix of indirect effects would indicate a potential level of diversification of production in sector *i* as an intermediate input. This means, indirectly, to the extent that within each industrial sector *i* there are more null entries, this sector will be more dependent on its own final demand and, at the same time, will benefit less from the positive changes in final demand in the remaining industrial sectors.

Thus for the purposes of this paper, the idea of 'forward linkages' is not associated with the supply conditions by industrial sector, in the sense that companies can allocate their production in fixed proportions among different destination sectors, as assumed in a Ghosh (1958) matrix. Notwithstanding that Guerra and Sancho (2010) have shown that the supply model represented by the inverse of Ghosh can be simplified to the demand model represented by the inverse of Leontief by means of a fixed-proportion production function, the purpose of introducing an estimation of indirect VA in matrix form is to demonstrate how industries participate as indirect exporters, in other words, as suppliers of intermediate inputs, for a given vector of manufacturing exports.

Calculating the indirect effects on domestic VA associated with maquiladora industry exports means estimating total inputs demanded by sectors *j* of the MEI, of sectors *i* of the DE, as if these inputs were exported by companies in the DE. Thus, in Equation 4, we see how, by means of the inverse of Leontief, if sector *j* of the MEI consumes one unit of input (product) that originates in sector *i* of the DE, the production of this input, in turn, demands a certain quantity of inputs from companies in the DE. So, each multiplier is the result of the product between each one of the value-added multipliers of the DE by the share of domestic inputs incorporated into the production of goods in each one of the MEI sectors. In Equations 9 and 10, an example shows how an indirect value-added multiplier is calculated:

$$ {}^{IN}m_{11}^{DE} = v_1^{DE} l_{11}^{DE} - v_1^{DE}, \tag{9} $$

$$ {}^{IN}m_{11}^{DE} = v_1^{DE} l_{11}^{DE} c_{11}^{MEI} + v_1^{DE} l_{12}^{DE} c_{21}^{MEI} + \cdots + v_1^{DE} l_{1n}^{DE} c_{n1}^{MEI}, \tag{10} $$

where terms l_{ij}^{DE} are elements from the Leontief inverse and represent the coefficients of input or total product requirements in sector i needed to satisfy a unit of final demand in sector j; v_i^{DE} is the VA coefficient for sector i of the DE; and c_{ij}^{MEI} is the coefficient of domestic inputs that maquiladora sector j demands from sector i of the DE. Thus, the value of multiplier ${}^{IN}m_{11}^{DE}$ in Equation 9 represents the quantity of VA generated by the purchase of inputs from sector 1 (origin) to produce one unit of exportable product in this same sector (destination); therefore, in the equation, only direct VA is subtracted.

On the other hand, in Equation 10, coefficient c_{11}^{MEI} shows us the share of domestic inputs that one unit of product in sector 1 (destination) of the MEI buys from sector 1 (origin) of the DE, while coefficient c_{21}^{MEI} indicates the share of domestic inputs that sector 1 of the MEI purchases from sector 2 of the DE in order to produce one unit of product, and so successively until coefficient c_{n1}^{MEI}, which indicates what the share is of domestic inputs of sector n of the DE that is demanded to produce a good in sector 1 of the MEI.

Hence, the expression $v_1^{DE} l_{11}^{DE} c_{11}^{MEI}$ measures the total VA generated in sector 1 of the DE (originating sector of total inputs) by unit of exports in sector 1 of the MEI. Expression $v_1^{DE} l_{12}^{DE} c_{21}^{MEI}$ measures VA in sector 1 of the DE that is generated because this sector is providing inputs to sector 2 of the DE, and the latter, in turn, sells inputs to sector 1 of the MEI, which, in the end, exports all its production. In other words, the sum of all terms in Equation 9 represents total VA generated in sector 1 of the DE because it provides, directly and indirectly, inputs to sector 1 of the MEI.

The following section discusses results of an estimation of indirect domestic VA by origin and destination sectors of domestic inputs generated by Mexican manufacturing exports that, based on Equations 3 and 4, are obtained by multiplying the diagonalized Mexican manufacturing export matrices by the IDVA matrices in 2003:

$$\mathbf{IDVA}^{DE} = \hat{\mathbf{V}}^{DE}(\mathbf{L}^{DE} - \mathbf{I})\hat{\mathbf{E}}^{DE}, \tag{11}$$

$$\mathbf{IDVA}^{MEI} = [\hat{\mathbf{V}}^{DE}(\mathbf{L}^{DE} - \mathbf{I})]\mathbf{A}^{MEI}\hat{\mathbf{E}}^{MEI}, \tag{12}$$

where $\hat{\mathbf{E}}^{DE}$ and $\hat{\mathbf{E}}^{MEI}$ are diagonal matrices of manufacturing exports of companies in the DE and the MEI, respectively, and where every matrix has only the value of the manufacturing sectors' exports in the main diagonal and zero in the rest.

5. IDVA in manufacturing exports by sectors of origin and destination

In Section 2, we indicated that IDVA is 20% of manufacturing exports; 37% in exports of the DE; and 9% of the MEI. This means that although maquiladora exports make up 62% of manufacturing exports, these have only 28% of the IDVA contained in them. In the following section, we will analyze data on sectors in which this indirect VA is created and also examine data from export sectors that receive this indirect VA and incorporate it in their exports.

5.1. Indirect VA in manufacturing exports by sector of origin

Figure 1 shows, by sectors of origin, the percentages of indirect VA contained in total manufacturing exports, and in exports of the three sectors that contribute most to exports,

Figure 1. Indirect VA in manufacturing exports by origin sector, percentages, 2003.

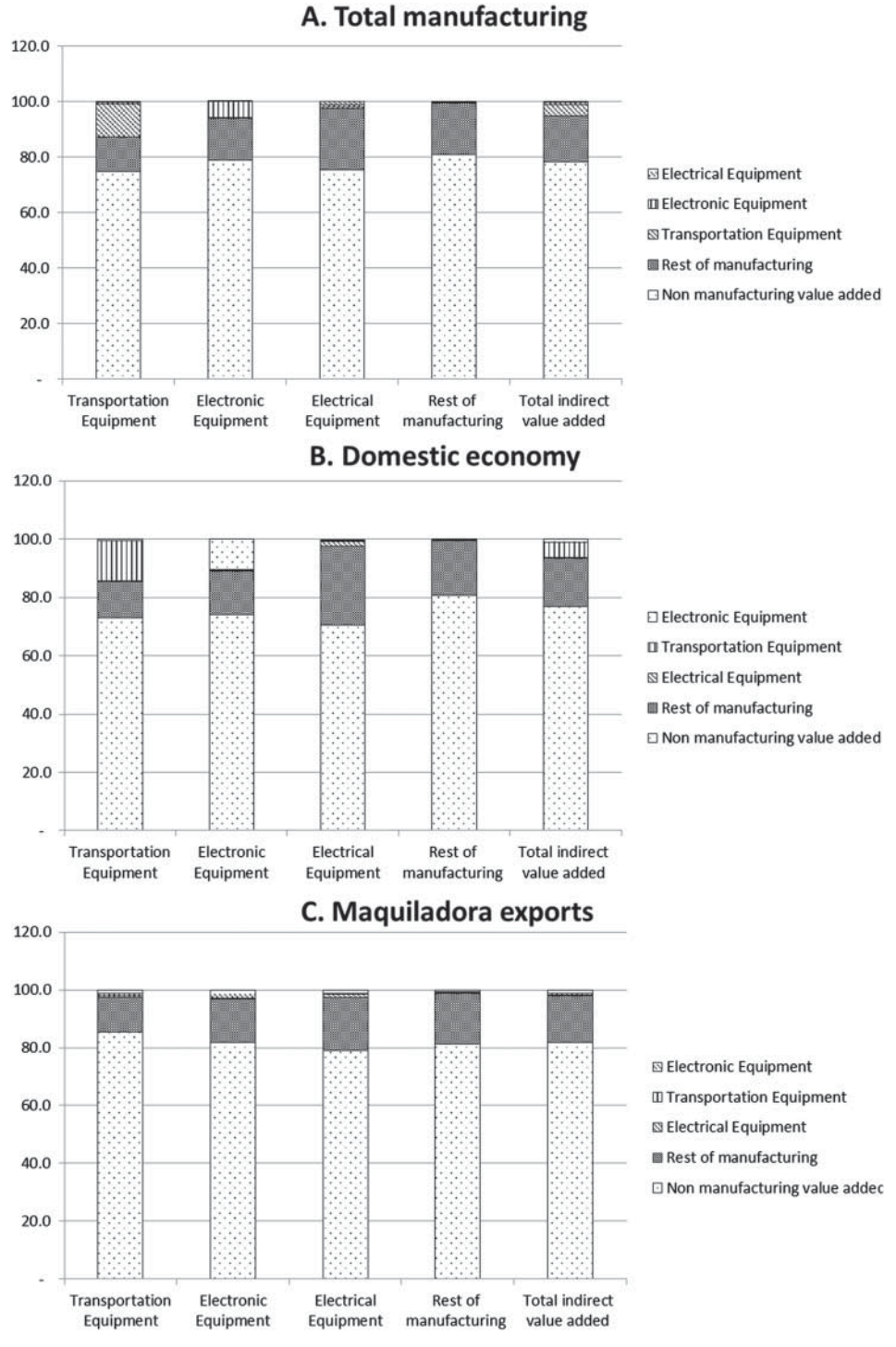


Figure 1(a); in exports of the DE, Figure 1(b), and in exports of the MEI, Figure 1(c). Almost 80% of indirect VA in manufacturing exports originates in nonmanufacturing sectors. This share is similar in the three sectors that contribute the largest part of manufacturing exports; slightly lower in exports of the DE, and slightly higher in exports of the MEI. For total manufacturing exports, only VA originating in the rest of manufacturing (i.e. neither the transportation equipment nor the electronic and electrical sector), is of particular prominence, but significantly less than indirect VA of nonmanufacturing origin. Intra-sectoral IDVA only bears some weight in transportation equipment and electronics exports provided by the DE. Still, this latter share should be evaluated in light of the fact that indirect VA contained in exports of this sector are only 5% of total indirect VA in manufacturing exports. Care must also be taken when evaluating the percentage by sectors of origin of indirect VA incorporated in MEI. Although this percentage is similar to that of total manufacturing exports and to that of DE exports, we should bear in mind that IDVA in MEI is only 28% of the total indirect VA in manufacturing exports.

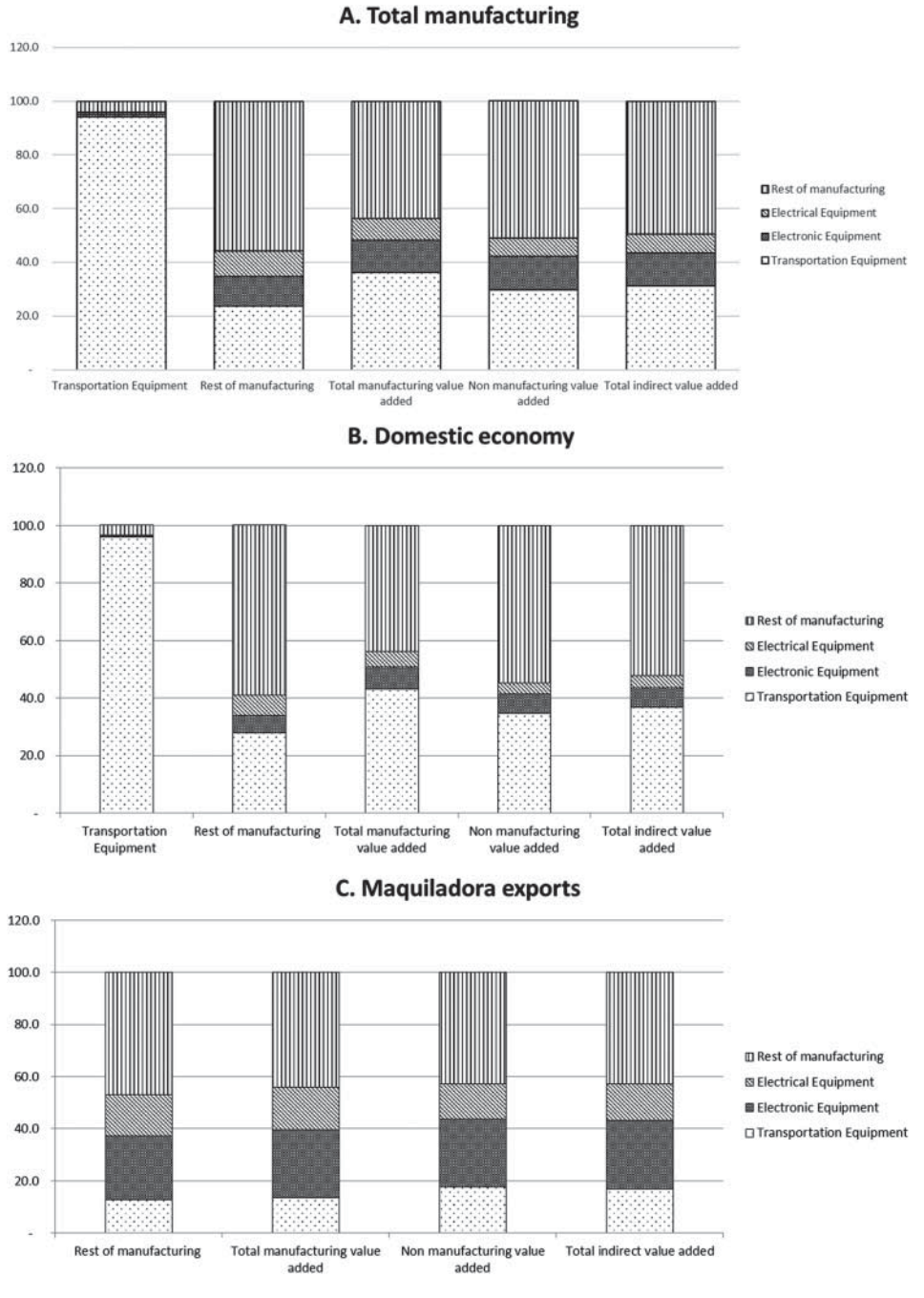
5.2. Indirect VA in manufacturing exports by sector of destination

Figure 2 reveals the distribution by final-export sectors of VA generated by indirect exports. Block A shows this distribution for total manufacturing exports; Block B for DE exports; and Block C for MEI. In these graphs we have excluded information related to electronic-and-electrical-equipment industry exports as well as MEI and transportation equipment-industry exports, since the absolute value of indirect VA incorporated in the exports of these sectors is of little significance. The graph shows that both for the total of manufacturing exports and for DE exports, the largest part of indirect VA contained in exports is incorporated in exports of transportation equipment and from other manufactures. This is usual for total exports as well as for manufacturing and nonmanufacturing VA incorporated in exports. Nonetheless, the transportation-equipment sector stands out from the rest due to the fact that almost all indirect VA incorporated in its exports is incorporated in the exports of that same sector. In this regard, MEI has a distinctive feature because it has four sectors that are a vehicle for exporting indirect VA. Yet the relevance of this information should be considered in light of the fact that, as previously mentioned, MEI contain only a bit more than a fourth of total indirect VA incorporated in Mexico's manufacturing exports.

5.3. Indirect VA and characteristics of the export sector

The characteristics described in the distribution of IDVA in manufacturing exports by sectors of origin of said VA, and according to the sectors to whose exports it is incorporated, demonstrate, on the one hand, certain traits that underpin relationships among the directly exporting activities and the rest of the economy, and, on the other hand, the characteristics of Mexico's manufacturing exports. With regards to the first point, the low IDVA incorporated in manufacturing exports, and particularly in those of the maquiladora industry, shows the weakness of the domestic linkages among export sectors and the rest of the economy. Second, it also shows that these linkages are particularly weak among the manufacturing sectors themselves.

Figure 2. Indirect VA in manufacturing exports by destination sector, percentages, 2003.



These traits have their origin in the fact that most of Mexico's manufacturing exports are located in GVCs in which Mexico has specialized in assembling products whose parts and components are imported. This means that the domestic indirect VA of manufacturing origin incorporated in manufacturing exports is small, also explaining that there are so few

directly exporting sectors that act as a vehicle through which other sectors can indirectly export VA. Exports of the electronics industry, which are a substantial part of exports and come almost exclusively from the maquiladora industry, are the most outstanding example of this situation. The VA generated in other sectors that is incorporated in the exports of the maquiladora electronics industry is almost 20 billion pesos, of which only 18% has its origin in manufacturing. This attests to the fact that the parts and components used by the electronics industry located in Mexico are essentially imported. On the other hand, the domestic VA contained in the exports of other sectors but which originate in the domestic electronics industry is only 1 billion pesos, indicating that this sector basically produces and exports finished goods.

Mexico's particular export specialization can be observed in the breakdown of export data into parts and components on the one hand, and finished goods on the other, as per the United Nation's COMTRADE Revision 2, Section 7 – Machinery and Transportation Equipment. Table 3 shows this sector's exports, which accounted for 74% of the country's manufacturing exports in 2010, as classified into these two types of goods. The same table details the information for products in Section 7 at the four-digit level of the North American Industry Classification System (NAICS) The most relevant conclusions from this information are the following: first, considering the entire section, 73% of exports are finished goods; and second, breaking exports down to two-digit NAICS and regrouping them in the six divisions that contribute 97% of the section's exports, we see that 74% of

Table 3. Exports composition: final goods and parts and components (percentages).

	% of Section 7 exports	Final goods	Parts and components
Section			
7. Machinery and transport equipment			
Total	100	73	27
Divisions			
71. Power generating machinery and equipment	7	57	43
74. General industrial machinery and equipment, nec, and parts of, nec	7	91	9
75. Office machines and automatic data processing equipment	10	96	4
76. Telecommunications, sound recording and reproducing equipment	22	64	36
77. Electric machinery, apparatus and appliances, nec, and parts, nec	18	76	24
78. Road vehicles	33	73	27
Sum	97	74	26
Groups			
752. Automatic data processing machines and units thereof	9	100	0
761. Television receivers	13	100	0
764. Telecommunication equipment, nes; parts and accessories, nes	8	0	100
772. Electrical apparatus for making and breaking electrical circuits	4	0	100
773. Equipment for distribution of electricity	4	100	0
778. Electrical machinery and apparatus, nes	4	96	4
781. Passenger motor vehicles (excluding buses)	15	100	0
782. Lorries and special purposes motor vehicles	7	100	0
784. Motor vehicle parts and accessories, nec	9	0	100
Sum	72	71	29
Subgroups			
7523. Complete digital central processing units; digital processors	5	100	0
7611. Television receivers, color	13	100	0
7643. Television, radio broadcasting; transmitters, etc.	6	0	100
7810. Passenger motor vehicles (excluding buses)	15	100	0
7821. Motor vehicles for transport of goods or materials	7	100	0
7849. Other parts and accessories, for vehicles of headings 722, 781–783	9	0	100
Sum	55	72	28

these are finished goods, rising to 96% in the case of Division 75 – Office Machines. For three-digit NAICS, 71% of the groups that contribute 72% of exports are finished goods, and at the four-digit level, six subgroups contribute 55% of Section 7 exports, 72% of which are finished goods.

6. Conclusions

Most of the indirect VA incorporated in Mexican manufacturing exports does not have it origin in manufacturing itself and most indirect VA contained in Mexican manufacturing exports is incorporated in exports of just one sector. These indicators, plus the low share of indirect VA incorporated in manufacturing exports points to the weakness of inter- and intra-sectoral linkages among manufacturing exports and the rest of manufacturing. This is particularly evident in the MEI, which comprise most manufacturing's exports.

The domestic VA incorporated in exports that are integrated in value chains depends directly on two factors: the imported component of exports and the role that countries have in the production chain. Up to now, discussion regarding ways of increasing domestic VA in exports has focused mostly on the former, leading to the proposal that, to increase same, the chains should be internally reintegrated, in other words, imported parts and components that are incorporated in exports should be produced within the country. In our opinion, the feasibility of such a policy is doubtful. Therefore, it may be necessary to refocus the substance of the discussion regarding this problem to the topic of the role that countries have within these chains. We ought to differentiate two rankings in the chain, high and low, according to the magnitude of the VA that is incorporated in them, the phase of product assembly representing the lower ranking in the chain, while the higher ranking includes the production of high-value components, the product's technological development, design, logistics, marketing, and post-sale servicing (Gereffi, 2014) From this discussion we see that one of the relevant research topics is finding the distribution of export value in countries that participate in integrated production in specific value chains, as well as identifying the factors that explain why companies decide to locate production in certain countries.

Further, IDVA in exports integrated into value chains and in exports that are not integrated into these chains are very different. Thus, at least in countries in which an important part of exports is concentrated in the integrated production within chains, it seems worthwhile to publish data of the VA content separately for these two types of exports. This requires us to separate the input–output (IO) tables into two segments, one for exports within the processing trade and the other for the remaining export sector.

The main limitations of this research arise in the availability of data, both in terms of aggregation of the data as well as in the share of imported inputs embodied in exported products versus those destined for the domestic market by DE companies. We show these can be quite different; that is, inputs can differ substantially with the type of product. Another limitation stems from the when we consider Leontief inverse as an *ex post* distribution model. In such a case, it is not possible to identify the role played by supply conditions in any particular economy – in our case Mexico's – in the generation of indirect VA (e.g. changes in labor productivity, in unit labor costs, or even in market conditions for determining prices) This means that results of our study should be interpreted solely as the VA that was indirectly generated based on the demand for intermediate inputs needed to produce a certain quantity and variety of export products, assuming that the VA coefficients

remain constant and that the production functions are Leontief (inputs have fixed shares). Based on the Leontief inverse domestic inputs incorporated directly in the production of exported goods require, in turn, more domestic inputs. This suggests that in each round of demand of intermediate inputs both the demand of domestic intermediate inputs and the VA coefficients remain constant. This means that the effects that generation of VA have, in turn, on final demand are not considered.

Acknowledgements

The authors are grateful to Bart Los and an anonymous referee for their valuable comments.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This study was sponsored by the National Council of Sciences and Technology of Mexico (CONACyT) [grant 10017, project 152740].

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