

Global integration, disarticulation and competitiveness in Mexico's electromechanical sector: A structural analysis

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ABSTRACT

This article analyses the dual functioning of the Mexican electromechanical sector between 1994 and 2008, as distinct from other globalized activities. An estimation of labour productivity in 52 industrial classes finds that structural heterogeneity increased particularly in the 1994-2001 subperiod, alongside technical and organizational improvements that were increasingly concentrated in a small number of subsidiary companies of transnational automotive-assembly enterprises. The application of a shift-share technique also revealed the absence of any significant structural change. Lastly, an extension of the methodology to evaluate competitiveness — developed by the Economic Commission for Latin America and the Caribbean (ECLAC)— and its application to a second database that reclassifies 1,345 foreign trade products, makes it possible to contrast these changes with the dynamism of the global production networks in which the leading firms of the sector in Mexico are engaged.

KEYWORDS

Engineering industries, industrial organization, production specialization, productivity, competitiveness, evaluation, Mexico

JEL CLASSIFICATION

F68, L16, L62

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I

Introduction

Since the 1980s, Mexico and several other Latin American countries have been implementing an economic-development strategy based on open trade and deregulation of the economy. The objectives of the measures thus adopted —inspired in an orthodox vision that believes the market has autonomous capacity to allocate resources efficiently— include promoting structural change in the productive system by integrating the model's leading activities into global value chains. Backdropped by a sophisticated international division of labour, the strategy based on productive specialization assumes that freely functioning markets, supported by the adopted measures, enable jobs to be created and factors to be reallocated towards the most productive uses.

Three decades on, the results obtained have called the validity of this argument into question. In Mexico, public policy has adhered to orthodox guidelines in exemplary fashion. Trade liberalization and economic deregulation have continued apace, while maquila activity has experienced an unprecedented boom. Capitalizing on the advantages afforded by geographical proximity to the United States market and the signing of the North American Free Trade Agreement (NAFTA), large transnational corporations have invested in the country; and the growth of exports of Mexican-assembled products has outpaced world trade as a whole. Nonetheless, the external competitiveness of the model's leading industries has been unable to counteract the deindustrialization process in non-globalized subsectors of the economy, which have to compete in the domestic market with imports that benefit from the adopted measures.

From the standpoint of the theoretical tradition of Latin American structuralist thinking, the spillover effects from the most efficient industries in terms of transferring technological capacities, modes of organization, and demand for inputs, are fundamental for achieving a major transformation of the productive sector. This would underpin not only on economic growth but also development in a broader sense (when considering the historical experience of the developed countries in 1970, Aníbal Pinto proposed as a key development objective for modern industries, which he defined as those of higher productivity, that they should transmit their progress

to the rest of the economy, and thus help to “lift up” backward populations, areas or sectors (Pinto, 1970, p. 97)). This same historical experience shows that structural change based on the development of complementarities between the different activities requires participation by a complex institutional fabric.¹

Pursuing these ideas, the present article seeks to analyse the structural evolution of the Mexican electromechanical sector, leader of the country's manufacturing export profile, highlighting the dualism that exists between globalized and non-globalized activities. For this purpose, two databases were constructed at the highest possible level of disaggregation for the period 1994-2008. The first refers to levels of labour productivity in 52 classes of activity in the sector; and the second relating to the exports and imports of the different sector activities (see annex) —resulting from the reclassification, nonexistent at the time, of 1,345 foreign trade products defined by the 1992 Harmonized System (HS92) in terms of the Mexican Activities and Products Classification (CMAP). The core of this study presents the results of different statistical exercises based on these information sources.

The first part of section II, which is theoretical, discusses the role played by public policy in integrating the leading Mexican manufacturing industries into global production networks; and the second part documents how the different activities' shares in the output and employment of the electromechanical sector have become more concentrated. Section III considers the heterogeneous pattern of change in disaggregated levels of labour productivity, while section IV uses a generic shift-share technique to distinguish the main determinants of the changes observed. Lastly, after section V has evaluated the sector's external competitive performance in dynamic terms, along with its constraints, section VI sets forth the main conclusions.

¹ José Antonio Ocampo, former Executive Secretary of ECLAC, defines the concept of complementarities extensively, referring not only to the role of the backward and forward linkages identified by Hirschman, but also to the role played by public, private, or mixed institutions created to reduce information costs (Ocampo, 2005).

II

Public policy in Mexico and global production networks

Arndt and Kierzkowski (2001) relate the international fragmentation of production to the emergence of assembly or maquila activities in less developed countries; and they characterize this phenomenon in terms of previously integrated productive processes being split into one or more components, the manufacturing of which migrates geographically, thereby giving rise to intra-industry and intra-product trade. Yamashita (2008) makes clear that this cross-border division of the productive process leads to activity segments that make intensive use of low-skill labour being relocated towards developing countries, while tasks with a high knowledge content or those involving sophisticated technologies are kept in advanced countries.

The above results in a highly hierarchical and rigid global form of organization, in which the benefits are unequally distributed, entailing a twofold specialization of the national economies. As capital-intensive productive segments would thus fall outside the “specialization cone” of labour-abundant developing countries, tasks that involve higher technology and knowledge content not only do not migrate towards these countries, but actually disappear from them if they previously existed (Dardoff, 1979). By testing the theory against empirical evidence for the Mexican manufacturing sector, Puyana and Romero argue that this phenomenon would explain the reduction in the national content of certain activities—in the automotive sector for example—which occurred after the Mexican economy was liberalized in the wake of the debt crisis (Puyana and Romero, 2006, p. 72).

By introducing elements of geographical political economy into the analysis of global production networks, MacKinnon (2012) finds that the role of institutions has been to ensure strategic coupling² between locally existing potentials and the needs posed by the firms that drive these international networks. Coe and others (2004) also mention the role of these institutions in moulding

those local capacities to complement the strategies defined by transnational actors located within these global production networks. In short, the transnationals condense a systemic power which they exercise under profit-maximization criteria, so as to transform the national and subnational regulatory frameworks and, definitively, the productive structures they subordinate (Dawley, 2011). Some discussions of this even define “corporate capture” as the potential for transnational enterprises to harness institutional capacities to the detriment of the interests of national firms and workers (Phelps, 2008).

1. Integration of the leading Mexican manufacturing industries into global production networks

The foregoing is relevant mainly in terms of the role of public institutions in developing countries, such as Mexico, which are specialized in tasks involving the assembly of manufactured goods. The promotion of duty-free importation of components, intermediate goods and inputs, along with the acceptance by the national authorities of a value-added tax imposed on the product to be re-exported to the country of origin, have aimed to underpin the organizational strategies of these global production networks to the detriment of local productive linkages and income levels (Yeats, 2001). In reality, the public-policy measures implemented by developing countries, to attract foreign investment and maquila activities, have mostly served as a disincentive to national content in the manufacturing process; and they are ultimately the result of needs created by the competitive pressures experienced by the parent companies of large transnational enterprises in advanced countries (Arndt, 2001).

In the case of Mexico, Puyana and Romero (2006) document a maquila “bonanza” stemming from the tax incentives provided by the governments of Mexico and the United States, which aimed at reducing costs of production, enhancing profitability, and simulating investments in maquila activity, with a consequent shift of productive factors towards that activity. Under this

² Yeung (2009, p. 213) defines strategic coupling as the dynamic process through which economic agents in either cities or regions, or both, coordinate, mediate, and arbitrate strategic interests between local stakeholders and their counterparts in the global economy.

arrangement, the small proportion of national value-added incorporated in the exported goods is explained by the combined effect of the incentives for duty-free importation of components, the charging of a tax on Mexican value-added in the United States, the global rationale underlying the fragmentation of productive processes that restricts the development of capital and knowledge-intensive activities, and exchange-rate revaluation which raises the relative cost of domestic inputs.

In this sense, public policy has been heavily biased in favour of the interests of transnational players, pursuant to a neoliberal economic strategy founded on financial deregulation and trade liberalization. In 1996, the Industrial Policy and Economic Deregulation Programme was absorbed by the Foreign Trade and Export Promotion Programme, in the belief that promotion measures in a context of globalization should not be separated from those related to international trade (Hernández, 2000). The resulting programme, which provided a frame of reference for national industrial policy, then favoured the export sector ahead of the manufacture of nontradable goods, with the specific central aim of enhancing the competitiveness of the productive structure and helping it to integrate into global production networks.

A trustworthy indication of the authorities' responsibility in the transformation of manufacturing industry was the implementation of specific promotion programmes centred on two main lines of action: export promotion (ECEX and ALTEX)³ and the development of maquila activity (PITEX, INMEX and DRAWBACK).⁴ Key provisions of these latter programmes include tax exemptions on the temporary importation of intermediate goods and inputs used in the manufacture, processing or repair of export merchandise (general import duty, value added tax and, where appropriate, countervailing duties). The industrial specialization pattern defined by the adopted measures thus favoured a subordinate role for the national productive apparatus in globalized sectors controlled by the "governance" of global production networks (Vázquez, 2012).

In the automotive sector, which is a pillar of the growth strategy, the State progressively dismantled legislation which had hitherto proven successful in terms of its capacity to encourage exports and develop

the domestic autoparts industry. The suppression of the Automotive Decree eliminated the following regulatory provisions: the upper limit on foreign capital in enterprises making vehicle parts (originally 49%); the domestic value-added requirement in the output of assembly plants (set at 60% prior to 1998); and the minimum export value required for every dollar of imports (prior to NAFTA, US\$ 1.75 of exports was required for every dollar of imports) (Hernández, 2000). Deregulation thus meant a significant reduction in the number of tasks undertaken, as determined by the productive needs of the integrated global system and consisting of greater specialization in the final assembly-related manufacturing segments.

2. Concentration and disarticulation in the Mexican electromechanical sector

In the case of the Mexican electromechanical sector, strategic coupling between the manufacturing structure and the needs of global production networks, as defined by the parent companies of transnational enterprises, has mainly manifested itself since trade liberalization in a growing divergence between the characteristics of industries serving the domestic market and those that are integrated into international chains generating exports. In order to obtain an initial differentiated approach to the sector's evolution, a database was constructed primarily to estimate labour-productivity levels, separating the surveyed classes into two groups (see annex). An initial group covers activities associated with the automotive industries and those relating to the electrical-electronic subsector and the manufacture of domestic and office equipment, hereinafter identified as the "globalized group"; whereas the second group encompasses other activities and is referred to as "non-globalized."

In general, the data for the period under analysis (1994-2008) show that the total sector shares of both groups stagnated, both in terms of output value and in terms of man-hours worked. This would suggest that open trading arrangements failed to generate any significant structural change that increased the weight of activities involved in international chains in the domestic manufacturing structure. Nonetheless, a more disaggregated analysis calls this statement into question, since a single activity "Manufacture and assembly of cars and trucks" (class 384110), which has the highest level of global integration, increased its share of output value from 40.8% in 1994 to 50.4% in 2008. In this

³ Foreign Trade Enterprises Programme (ECEX) and Highly Exporting Enterprises Programme (ALTEX).

⁴ Temporary Import Programme for Export (PITEX); Programme of the Manufacturing, Maquila and Export Service Industry (INMEX), and the Programme of Import Duty Refunds to Exporters (DRAWBACK).

latter year it accounted for half of the sector's total output, significantly more than offsetting the fall in the share of its main input supplier, "Manufacture of motors and their parts for automobiles and trucks" (class 384122), from 10.6% in 1994 to 6.6% in 2008 (see table 1).

TABLE 1

Share of the industry groups in the total gross production of the sector and Herfindahl-Hirschman indices (HHIn), 1994 and 2008
(Percentages)

Groups	1994	2008
Globalized group	80.1	81.8
Activity class 384110	40.8	50.4
Activity class 384122	10.6	6.6
Non-globalized group	19.9	18.3
Sector total	100	100
HHIn globalized group	41.3	52.9
HHIn non-globalized group	7.5	12.1
HHIn total sector	34.1	43.8

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAF), 205 clases de actividad económica", 2013.

The diametrically opposing trends experienced by the two main classes of the sector, integrated into the same subsector and value chain, reflect the fact that imports have displaced locally supplied vehicle parts, thereby breaking domestic productive linkages headed by the industry leaders engaged in global production networks. On this point, in the context of the globalization of the automotive sector, Álvarez states that "local firms have ceased to be suppliers of the assembly plants, deferring to the new foreign firms or else engaging in the importation and distribution of autoparts" (Álvarez, 2002, p. 46). This hypothesis is confirmed by comparing the results obtained from a calculation of the coefficients of articulation and integration of the globalized and non-globalized groups: whereas the first indicator is 16.9% lower for the globalized group, the second is 11% lower (see table 2).⁵

⁵ Following a review of the information available in the various statistical sources, the coefficient of articulation is defined in this study as the value of domestic raw materials and auxiliary inputs consumed, as a percentage of the total value of those inputs consumed. The coefficient of integration was calculated as the sum of value-added and the value of national raw materials and auxiliary inputs consumed in relation to

TABLE 2

Coefficients of articulation and integration of the industry groups in 2003^a
(Percentages)

Groups	Coefficient of articulation ^b	Coefficient of integration ^c
Globalized group	44.6	56.7
Non-globalized group	61.5	67.8
Total sector	46.6	58.5

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Anual. Clasificación Mexicana de Actividades y Productos (CMAF), 205 clases de actividad económica", 2013.

^a The data were calculated for 2003 because this was the last year for which the necessary information exists under the CMAF classification.

^b Coefficient of articulation: national raw materials and auxiliary inputs consumed/total raw materials and auxiliary inputs consumed.

^c Coefficient of integration: (value-added + national raw materials and auxiliary inputs consumed)/total gross production.

In this regard, the process of disarticulating local value chains in the sector goes hand-in-hand with a progressive concentration of production, mainly in a single activity controlled by the subsidiaries of large foreign transnational enterprises (the labour-intensive assembly of automobiles and trucks).⁶ This is corroborated by calculating the normalized Herfindahl-Hirschman index (HHIn),⁷ since the indicator rises in all cases, and by a considerable amount particularly in the globalized group, from 41.3% in 1994 to 52.9% in 2008 (see table 1). Thus

total gross production, with respect to each of the 53 activity classes in the sector, and for the groups considered. The information source used in this case was the Annual Industrial Survey, 205 activity classes (CMAF), conducted by INEGI (2013b).

⁶ The total output of Mexico's automotive sector in 2008 amounted to 2,180,294 units, of which 76.4% were destined for the international market. In the case of automobiles, production in that year totalled 1,387,913 units, of which 79.5% were exported; 32.4% were produced by the German Volkswagen assembly unit, 28.3% by the Japanese firm Nissan, and 19.7% and 14.8% by the United States Enterprises Ford and General Motors, respectively (INEGI, 2010).

⁷ The normalized Herfindahl-Hirschman index was separately calculated for production values and man-hours worked in the 23 activity classes of the globalized group and in the 30 classes in the non-globalized group, and also for all 53 classes of the sector. The formula used was:

$$HHIn = \frac{\left[\sqrt{\sum_{i=1}^n P_i^2} - \sqrt{\frac{1}{n}} \right]}{1 - \sqrt{\frac{1}{n}}} \times 100$$

where $P_i = X_i/X_j$ indicates the share of class i in the total production value or man-hours worked of the group in question (formula normalized on the basis of Durán and Álvarez, 2008).

there is evidence of a strong correlation between a trade liberalization process, driven by a public policy aimed at integrating the national productive system into global production networks, and a productive specialization trend that concentrates activity in a small number of industries and firms within those networks.

It should also be noted that, owing to the high technological level of manufacturing processes in the globalized activity classes (as exemplified by the automotive sector), both the increase in these classes' total sector shares, and their degree of concentration, are smaller in terms of man-hours worked. Comparing the situation in 2008 with that prevailing in 1994, the share of the globalized group in total time worked in the sector increases by just 2.2%, whereas the group's index of concentration shows a residual growth of 1.6% (see table 3). Consequently, an element that would explain the lack of spillover from exports to economic growth and employment is the inability of these globalized firms to generate jobs on a scale that reflects their standing in the productive structure. This contradicts the orthodox theoretical claim that liberalization and the market alone can reallocate labour towards the most profitable

uses. This feature would therefore imply that it would be impossible for such firms to drive any significant structural change—a hypothesis that will be evaluated in the following sections by analysing trends of labour productivity and its determinants.

TABLE 3

Share of the industry groups in man-hours worked in the sector and normalized Herfindahl-Hirschman indices (HHI), 1994 and 2008
(Percentages)

Groups	1994	2008
Globalized group	60.2	62.4
Activity class 384110	12.5	13.2
Activity class 384122	8.3	8.0
Non-globalized group	39.8	37.6
Sector total	100	100
HHI globalized group	12.2	13.8
HHI non-globalized group	5.6	6.7
HHI total sector	7.8	9.3

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

III

Trend of labour productivity and structural heterogeneity

In general, the estimations made from the constructed database show labour productivity in the period (1994–2008) growing at very similar rates in the two industry groups (globalized and non-globalized), and in line with the trend of that indicator both with respect to the sector total and for manufacturing as a whole (see table 4). In the case of the globalized group, seven of the 23 classes report a reduction in their labour-productivity level from 1994 to 2008, particularly in the classes "Manufacturing, assembly and repair of communication, transmission and signaling equipment" (383201) and "Manufacture and assembly of radios, television receivers and audio equipment" (383204), which have substantial export activity in a national electronics industry that relies heavily on the functioning of global production networks. Despite the competitive success of these activities, which generated external sales of US\$ 14,407 million and US\$ 24,999 million, respectively, in 2008

and jointly accounted for 23.2% of the sector's total exports,⁸ their labour productivity declined sharply at rates of 32.5% and 47.3% between 1994 and 2008 (see table 4). Consequently, the aggregate performance of the globalized group is not visibly superior to that of the non-globalized group, and there are signs of a "spurious" competitiveness that is not based on technological and organizational improvements in certain highly-exporting activities.

The sector's key activity, class 384110 (Manufacture and assembly of cars and trucks), records both the highest level of labour productivity of the sample in 2008, and a well-above-average rise in that indicator between

⁸ Exports in class 383201 correspond to a combination of the following HS92 categories: 8517+8521+8525+8526+8530+8531-851790-853090-853190. In the case of class 383204, the identity is 8518+8519+8520+8527+8528-851850 (see annex).

1994 and 2008. In contrast, the labour productivity of the sector's main input supplier, "Manufacture of car and truck motors and their parts" (class 384122), represents just 21.4% of the productivity level of the terminal industry having weakened further in the period studied (see table 4). On this point, the analysis of all the estimations performed points to widening efficiency gaps both between the leading and backward activities of the sector, and also within industries that are integrated into global production networks, and especially between those grouped in the input-supplier classes and assembly industries located in the final phases of the value chain.

TABLE 4

Trend of labour productivity by industry groups, 1994 and 2008

(Mexican pesos at December 2003 prices and percentages)

Groups	1994	2008	Growth rate
Globalized group	691.8	990.2	43.1
Activity class 384110	1 697.7	2 892.4	70.4
Activity class 384122	664.0	619.4	-6.7
Activity class 383201	744.7	502.5	-32.5
Activity class 383204	699.3	368.5	-47.3
Non-globalized group	259.1	366.1	41.3
Sector total	519.4	755.3	45.4
Manufacturing total	446.1	625.0	40.1

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

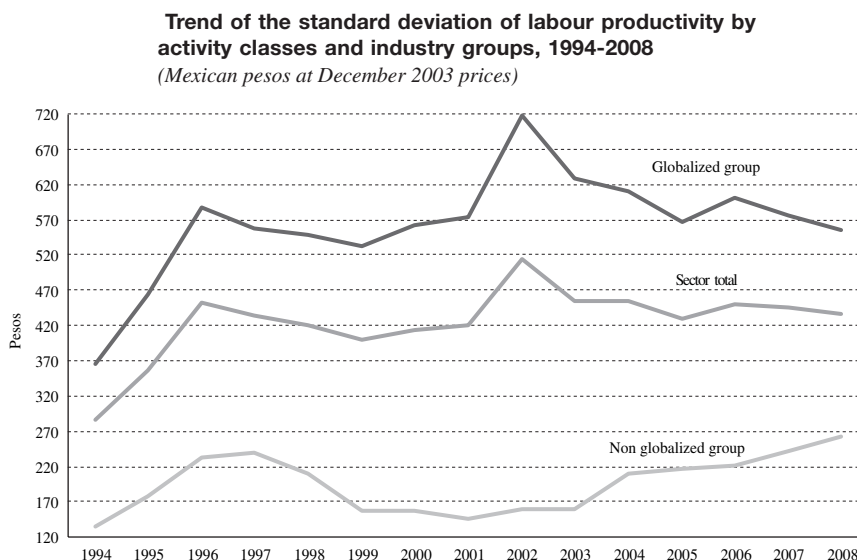
According to the theoretical approach adopted in this study, a structural homogenization process is a pre-requisite for advancing towards a more mature forms of industrialization (Furtado, 1967; Pinto, 1965 and 1970), so the widening of productive gaps within the leading industries of the export specialization profile entails an involution of the manufacturing structure. An initial approach to the topic of structural heterogeneity in the Mexican metalwork and machinery sector seems to confirm this hypothesis. The traditional dispersion statistics for the indicator, calculated both by activity class and with respect to the groups defined above (globalized and non-globalized), rise all cases. The largest increase occurs in the non-globalized group as result of a wide variety of patterns of investment and technological change, and where there is a predominant phenomenon of obsolescence and deindustrialization (in 16 of the 30 classes considered, output declines in

real terms; and, although time worked decreased in 10 of the group's activities, 10 classes recorded declining labour productivity during the period studied).

Meanwhile the standard deviation of the indicator for the globalized group and for the whole sector rises by 52.2% when comparing 2008 with 1994, whereas the coefficient of variation rises by 23.2% for the globalized group and by 20.6% for the sector. Nonetheless, there are two clearly differentiated subperiods. In the first one (1994-2002), following the entry into force of NAFTA and a rapid process of trade and financial liberalization in the Mexican economy, structural heterogeneity in the sector increases quickly, but to a greater extent within the globalized group, which includes the export industries that are privileged by the new public-policy measures (annual average growth rates of the standard deviation and coefficient of variation are 8.3% and 6.4%, respectively, for the sector as a whole; 9.7% and 6.7% for the globalized group, and 3.7% and 3.3% for the non-globalized group). In a second period of relative stabilization, and following the shakeout of much of the national productive apparatus, the trend, once again led by the globalized firms, reverses after peaking in 2002 to post negative annual average of rates growth of the standard deviation and coefficient of variation are negative between 2002 and 2008 (-4.1% and -4.4 respectively for the sector as a whole, and -2.6% and -4.5 for the globalized group (see figures 1 and 2)).

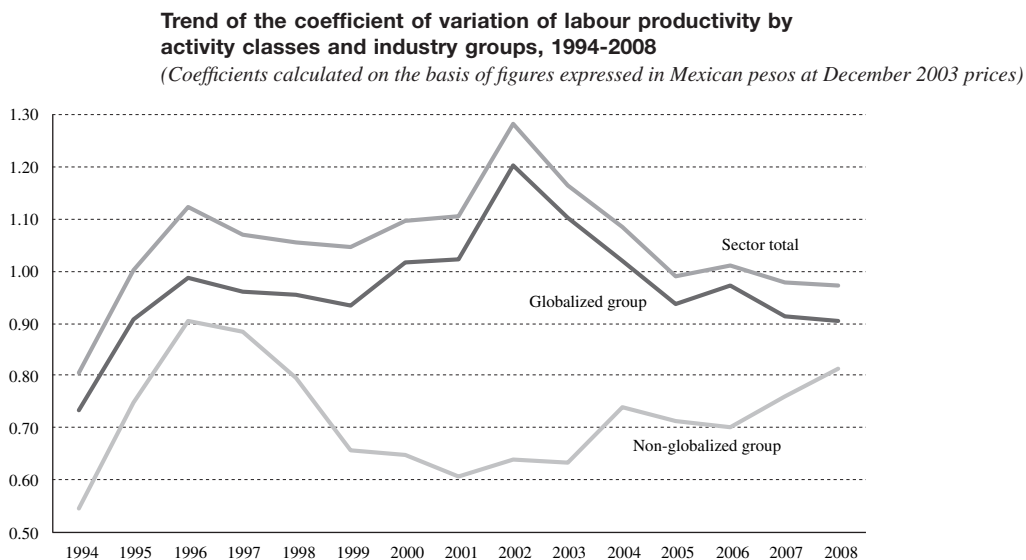
Various factors help explain the widening gaps in labour productivity between the activity classes of the electromechanical sector and their timings in Mexico. Firstly, following trade liberalization, the global integration process in the leading industries of the sector specialization pattern generated higher degrees of structural heterogeneity, particularly within the globalized group. The entry or takeoff of a few large and technically advanced exporting firms, mostly subsidiaries of foreign multinationals, coexisted with the incapacity of many other local industries to be competitive internationally, and with the aforementioned displacement of local supplies by imports. This was stimulated and protected by national export-promotion programmes that facilitated the purchase abroad of the parts and inputs to be incorporated into the exported goods. On this point, Unger stated that "Mexican industry consolidates increasingly concentrated oligopolistic structures, owing to the influence of the large transnational enterprises, and large export-oriented domestic conglomerates" (Unger, 2001, p. 100).

FIGURE 1



Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), “Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica”, 2013.

FIGURE 2



Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), “Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica”, 2013.

Similarly, some activity branches were restructured to meet the requirements defined by the “governance” of global production networks, and to be able to undertake tasks with different factor contents and essentially assembly work. As a result of competition from imports on the local market, most of the small and medium-

sized enterprises (SMEs) and entire industrial segments collapsed and disappeared, leading to a shakeout of the national productive apparatus. In a synthesis of this transformation, Capdevielle notes that “the composition of manufacturing output changed, partly because the economic sectors that produced for export were specialized

in certain segments of the value chain, and, at the same time, local production was displaced by imports, thanks to liberalization and the availability of foreign exchange obtained from the new form of participation in trade” (Capdevielle, 2005, p. 108).

It is in this new context of high market concentration, and in a second period (2003-2008), that degrees of heterogeneity within the globalized group decrease, with the presence of limited dissemination of technology and capacities within the leading activities. At the same time,

as there was no flow of knowledge outside the global network, nor any significant positive externalities, and no generalized organizational learning, the efficiency gaps continued to widen. This happened even more quickly in the residual industries of the non-globalized group, which were undergoing a genuine de-industrialization process. It should be noted that this periodization is consistent with the findings of previous studies for Mexican manufacturing as a whole, albeit with contrasting trends in the subperiods considered (Vázquez, 2013).

IV

Deindustrialization and structural change

In the context of the deindustrialization of activities serving the domestic market, two elements tend to corroborate the hypothesis put forward above in relation to the absence of a reinvigorating change in the overall structure of the Mexican metalwork and machinery sector: firstly, greater heterogeneity in terms of technologies and capacities; and, secondly, increased concentration of productive capacity, both in a small number of classes (especially those related to assembly activities) and, within those classes, in a few large firms that are integrated into global production networks and benefit from the public-policy measures implemented in the wake of trade liberalization. Consequently, this section seeks to evaluate the determinants of the labour-productivity trends observed in the different activities, to confirm the concentration of efficiency gains in a few globalized classes and the very weak role played in the improvements by the migration of labour towards more efficient uses.

A standard methodology of the shift-share type, a descriptive technique commonly found in this type of study, was used to identify the components of productivity changes (total effect) at two points in time. The first component was an effect related to the structural change, in other words the migration of productive factors towards more efficient uses (structural effect); and the second identified an effect linked to the changes that occurred within each activity, which can be associated with technical progress (intrinsic effect). Using the information base described in the first section of this article, the following paragraphs break down the increases in labour productivity that occurred in the sector

between 1994 and 2008. Needless to say, the effects may be negative when factors of production shift towards lower-productivity activities (structural effect), or when labour productivity declines owing to technological obsolescence or outdated modes of organization within the different activities (intrinsic effect).

The mathematical formulation of this decomposition, which is applied to compare the indicator values for the 53 classes at two points in time (1994 and 2008) is as follows:

$$\begin{aligned} & (P^{2008} - P^{1994}) \\ &= \sum_{i=1}^n \left[(P_i^{2008} - P_i^{1994}) \cdot (S_i^{1994} + S_i^{2008}) / 2 \right] \quad (1) \\ &+ \sum_{i=1}^n \left[(S_i^{2008} - S_i^{1994}) \cdot (P_i^{1994} + P_i^{2008}) / 2 \right] \end{aligned}$$

where P_i is productivity in activity i ($i = 1, 2, \dots, n$) and S_i is the share of the activity i ($i = 1, 2, \dots, n$) in the total active population employed in the sector. The first term on the right-hand side of equation (1) represents the variation in labour productivity caused by changes in the intrinsic productivity of the n activity classes (intrinsic effect). The second term identifies the contribution made by the recomposition of the labour force (structural effect) (ECLAC, 2007).

The results of the exercise are consistent with the analysis performed previously. In the subperiod 1994-2008, the growth of labour productivity in automotive assembly (class 384110) represents 83.7% of that recorded in the globalized group altogether, and 71.4% of the increase in the indicator for the entire sector. Of the contribution made by this activity, the intrinsic

effect, attributable to technological and organizational improvements within the class, explains 90.9% of that improvement, while the structural effect on the progress achieved is residual. Meanwhile, in activities related to the manufacture of inputs for automotive assembly, the modernization process is weak to say the least (the sum of the intrinsic effects amounts to 23 Mexican pesos at December 2003 prices in the period considered).⁹ Moreover, in class 384122 (supply of motors and parts), the two effects as calculated are actually negative, thereby denoting a lack of technology diffusion and capacities

⁹ Results from the sum of the intrinsic effects relating to classes 384121, 384122, 384123, 384124, 384125 and 384126.

within the activity segment, leading to a widening of efficiency gaps between the terminal industry and its potential local suppliers (see table 5).

The non-globalized group makes only a small contribution to labour-productivity growth in the sector during the period, accounting for just 14.6% of the total sector effect valued at 235.9 Mexican pesos at December 2003 prices. Within this group, however, efficiency improvements are highly concentrated. The sum of classes 381412: "Electroplating of metal parts", and 382206: "Manufacture of air-conditioning machines and refrigeration and heating equipment", accounts for 59.8% of the rise in the indicator in the non-globalized group. Within this group, the results of the activity "Manufacture of containers and products made of tin,

TABLE 5

Determinants of the trend of labour productivity by activity classes and industry groups 1994-2008
(Mexican pesos at December 2003 prices)

Non-globalized group				Globalized group			
Activity class	Intrinsic effect	Structural effect	Total effect	Activity class	Intrinsic effect	Structural effect	Total effect
381100	5.1	-0.1	5.0	384110	153.1	15.3	168.5
381201	3.9	-3.7	0.2	384121	12.2	-2.5	9.8
381202	-0.4	-0.8	-1.2	384122	-3.6	-1.8	-5.4
381203	1.5	-0.3	1.2	384123	7.2	4.3	11.5
381300	-0.1	-0.7	-0.8	384124	1.6	0.5	2.1
381401	-0.6	0.1	-0.5	384125	1.7	-0.1	1.5
381404	0.4	1.3	1.7	384126	3.8	5.8	9.6
381405	-0.3	-0.4	-0.7	382302	-3.3	-4.3	-7.6
381407	9.7	-6.3	3.4	383101	5.6	5.2	10.8
381408	0.3	-1.6	-1.2	383102	0.6	0.1	0.7
381409	0.6	-0.2	0.4	383103	0.5	5.7	6.2
381410	-0.1	0.3	0.2	383107	6.7	-5.8	0.9
381412	8.2	4.1	12.3	383108	-0.1	0.2	0.1
382101	2.2	1.1	3.3	383109	8.9	-8.8	0.1
382102	0.5	-0.7	-0.1	383110	-1.0	0.0	-1.0
382103	0.7	2.3	3.0	383201	-2.0	-3.1	-5.1
382104	0.1	-0.2	0.0	383204	-2.4	1.0	-1.4
382106	0.2	-1.3	-1.1	383205	0.9	-4.2	-3.3
382202	0.7	-1.3	-0.6	383206	0.1	-0.6	-0.5
382203	0.0	-0.3	-0.3	383301	0.2	2.1	2.3
382205	1.4	-0.3	1.1	383302	2.4	1.5	3.8
382206	2.9	5.4	8.3	383303	-0.2	-0.7	-0.9
382207	-0.2	0.1	0.0	383304	0.7	-1.9	-1.2
384201	0.4	-0.3	0.1	Total globalized	193.5	7.8	201.4
384202	0.6	0.7	1.3				
384203	-0.8	0.2	-0.5				
385001	-0.2	0.0	-0.2				
385002	0.0	0.0	0.0				
385004	-0.1	0.7	0.6				
385005	-0.2	-0.1	-0.3				
Total non-globalized	36.5	-2.0	34.5				
Total sector	230.0	5.9	235.9				

Source: prepared by the author, on the basis of data from the National Institute of Geography and Statistics (INEGI), "Encuesta Industrial Mensual (EIM). Clasificación Mexicana de Actividades y Productos (CMAP), 205 clases de actividad económica", 2013.

metal sheet and aluminium” (381407) are symptomatic, because, like other classes and despite recording an increase in its labour productivity during the period, it experiences efficiency losses owing to labour layoffs (man-hours worked in class 381407 declined from 19,458 in 1994 to 11,082 in 2008).

In this regard, there is overwhelming evidence that structural change (understood here as the shift of labour towards more efficient uses) contributes absolutely nothing to the trend of the indicator, both at the level of the 53 classes and in respect of the two groups defined. Of the total increase in labour productivity, the structural effect explains only 5.9 pesos of the 235.9 pesos in the sector as a whole; it is responsible for 7.8 pesos of the 201.4 pesos in the globalized group; and is actually negative in the non-globalized group (see table 5). In fact, the structural effect is negative in 29 of the 53 classes considered. In the case of automotive assembly, which accounts for most of the sector’s technological and organizational

improvements, labour attraction contributes less than 10% of the increase in labour productivity in the period studied (9.1%). This corroborates the inability of the leading industries to create new jobs to compensate for those destroyed in uncompetitive activities, as noted above.

In general, these findings contradict one of the main theoretical arguments for implementing a trade liberalization strategy, namely the existence of a creative-destruction process, in which jobs lost in non-export activities, damaged by the public-policy measures implemented, are offset by new job creation in the leading industries of the specialization pattern. A review of the data base used effectively shows that the electromechanical sector, which encompasses the pillar industries of Mexico’s manufacturing export model, shed 370,631 workers in net terms between 1994 and 2008, in other words a reduction of 58,251 man-hours worked.

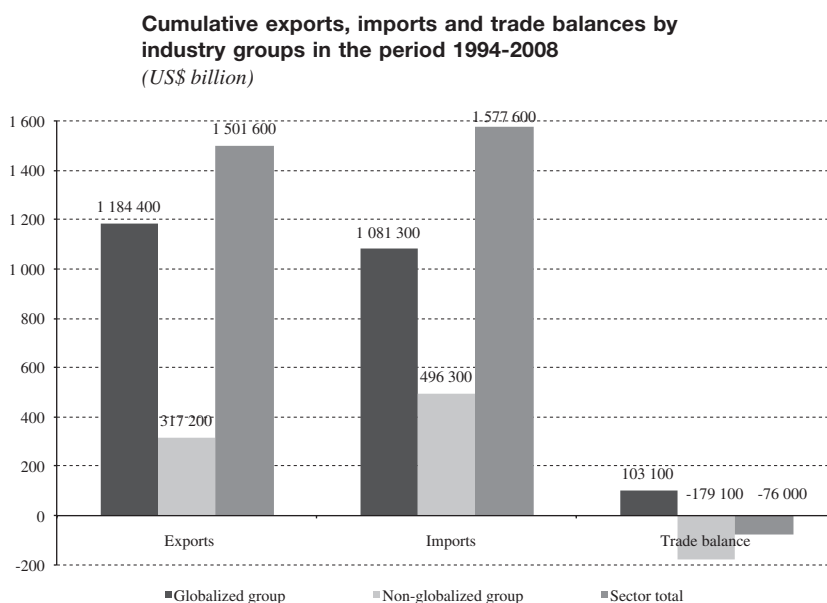
V Productive specialization and dynamic competitiveness

In terms of export development, the foreign sales of Mexico’s electromechanical sector grew vigorously by 380.2% between 1994 and 2008. As a counterpart, however, the sector’s imports grew by a very similar amount (358.7%). In fact, in the 15 years of the period indicated, the sector’s cumulative trade balance posted a deficit of US\$ 76 billion (see figure 3). In 2008, for example, the sector’s exports amounted to US\$ 169.6 billion: US\$ 131.9 billion in the globalized group and US\$ 37.7 billion in the non-globalized group. As a result of the liberalization dynamic, however, the sector as a whole reported an external deficit of US\$ 9.9 billion in that year, resulting from a trade surplus in the globalized group and a deficit in the non-globalized group. Deindustrialization in the latter group, and the consequent gain of domestic-market shares by imports, thus combined with an organizational rationale of the leading industries of the specialization pattern operating in global production networks, under which most of the inputs included in the exported products are imported.

To evaluate the trend of competitiveness in Mexico’s electromechanical sector from a dynamic perspective, a second database was created, in which 1,345 products identified as part of the sector in the HS classification were reclassified according to the Mexican Activities and Products Classification (CMAP) maintained by the National Institute of Statistics and Geography (INEGI) (see annex). Based on this input, an extension of the methodology prepared for the MAGIC programme by the ECLAC Subregional Office in Mexico, was applied to 1,199 of these products.¹⁰ This exercise made it possible to characterize the sector’s foreign sales by their performance (dynamic or stalled) and based on the change in each product’s relative share of global demand in total goods trade (growing or declining) (ECLAC, 2006). The MAGIC program thus establishes a typology that classifies exports in terms of rising

¹⁰ As the necessary statistical information was not available for 146 products, the exercise was performed for 1,199 of the 1,345 products present in the database prepared.

FIGURE 3



Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

stars (RS), waning stars (WS), lost opportunities (LO), and regressions (R).¹¹

The results of the exercise, which compared the years 1994 and 2008, are presented in table 6, where the total value of exports for each typology was calculated with respect to 2008. The sector total confirms the leadership of the electromechanical sector within the Mexican export specialization pattern and its integration into global production networks through the sale of dynamic goods, which, in the period studied, increased their share in world merchandise trade. Of the 1,199 goods considered, Mexico increased its international market share in 710, representing 82.8% of the sector's

total sales abroad in 2008.¹² Of these products, 215, representing 45.5% of total exports in that year, were classified as RS—in other words goods with growing trade in global markets in which Mexico increased its relative share—. The statistical evidence thus reveals a sustainable competitiveness of the global production networks into which these leading industries of the Mexican manufacturing sector are integrated, and an export dynamism that is heavily concentrated in a small number of goods.

In terms of the groups constructed, the exports of the non-globalized group display high levels of both diversification and dynamic competitiveness. In 2008, despite being responsible for just 22.3% of the sector's total exports, this group had foreign sales in 881 of the 1,199 products registered. Of these sales, 78.8% of the value corresponds to merchandise in which these industries increased their global market share, and 38.5% of their value was obtained from "Rising stars" (RS). As table 6 shows, some of these relative figures are similar in the case of the globalized group (318 products of the 1,199 registered, representing the

¹¹ "Rising star" means that imports of the product in question increased in the United States market and that the country in question gained a larger share of total imports of the product in the United States market. "Waning star" means that imports of the product in question decreased in the United States market, and that the country in question gained a larger share of the total imports of that product in the United States. "Lost opportunity" means that the imports of the product in question grew in the United States market but the country in question accounted for a smaller share of total imports of that product in the United States. "Withdrawn" means that the imports of the product in question decreased in the United States and that the country in question obtained a smaller share of total imports of that product in the United States market (Cordero, 2010, p. 26). The exercise was based on the world market instead of being restricted to the United States, and the comparison of export values was made for 1994 and 2008.

¹² Hereinafter the sector totals are obtained from the sum total of exports of the 1,199 products considered, so as to keep the exercise consistent.

TABLE 6

Typology of products exported by industry groups in 2008
(Number and US\$ million)

Groups		Rising star	Waning star	Lost opportunity	Regression	Total
Globalized group	Number of products	54	128	40	96	318
	Value	61 917 400	47 432 600	12 067 700	8 750 500	130 168 200
Non-globalized group	Number of products	161	367	100	253	881
	Value	14 377 500	15 046 800	4 725 200	3 200 800	37 350 300
Sector total	Number of products	215	495	140	349	1 199
	Value	76 294 900	62 479 400	16 792 900	11 951 300	167 518 500

Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

sum of RS (47.6%) and WS (36.4%) and 84% of the value of total exports of the group). This would suggest that certain industries which are not integrated into global production networks, but in some cases have a presence on the domestic market, still have the organizational and technological capacities to be able to compete in the global domain.

An analysis of the leading export products in 2008 confirms both the heavy concentration of the activity in a few tasks and also the restricted aspect of export dynamism achieved. The 50 leading export products represent 71.5% of the sector's total exports; the top 10, all relating to the manufacture of electrical-electronic and computer equipment, or else related to the automotive industry, account for 43.3%; and just three¹³ of the 1,199 products considered explain 28.4% of the sector's sales abroad. Moreover, when these 50 products are shown in a diagram on the basis of the established typologies, the results do not differ greatly from those seen for the information from the entire database. As would be expected given the leadership of those products in the Mexican manufacturing specialization pattern, the figures are slightly higher in the RS category, which means an increase in global market shares in dynamic goods during the period studied. In terms of the value of foreign sales of these 50 products, 50.4% are classified

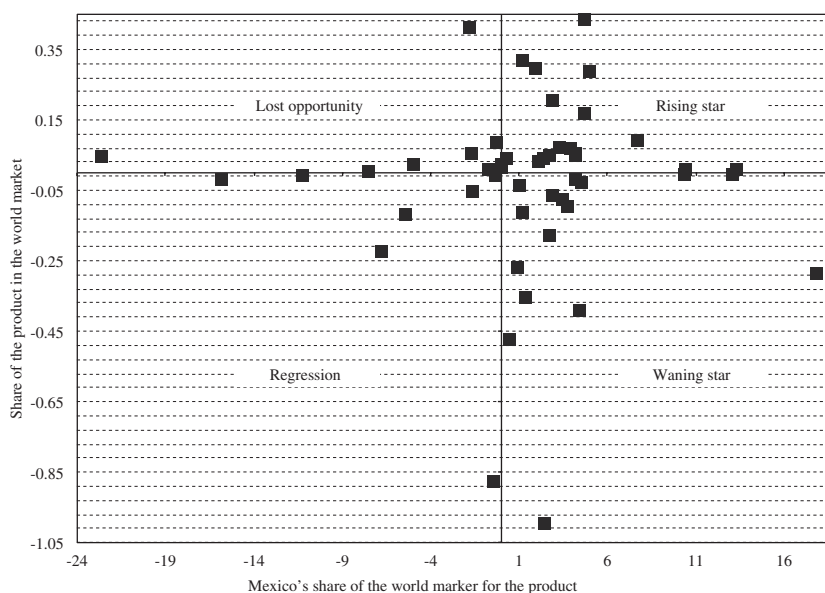
as RS (19 products), 34.3% as WS (16 products), 6.9% as LO (eight products) and 8.4% as R (seven products) (see figure 4).

A final note concerns the characteristics of the methodology used and features that are often present calculation of the indicators that exist to evaluate competitiveness. In the case of Mexico, the rapid trade-liberalization process implemented by public policy from the 1980s onwards fuelled a generalized increase in national exports that outpaced the average expansion of international trade generally. This partly explains the increase in the global-market shares of the "leading" products in the Mexican specialization profile. Another trend in the global context reveals the results obtained: dynamic goods, by definition, increase their share in international trade over time, so there is a bias in the methodology used that makes it more likely that the country being analysed will seem to evolve towards more competitive structures. In the case of the methodology developed by ECLAC, the established typologies are constructed by ECLAC trade in goods that are made from a whole series of components and inputs produced in different parts of the world. As it was impossible to consider the domestic value-added content of the goods, the methodology measures trade by the final price of the goods, imprecisely attributing capacities, capital investment, and hours worked to the trade shares. In the case of countries that have maquila-type productive structures, such as Mexico, the exercises tend to overstate the evolution of the export structure, as shown both by negative trade balances of the activity and the relative absence of spillover effects documented above.

¹³ In the HS International Classification these goods are: 852810, Television receivers, including video monitors and video projectors; 870323, Other vehicles, with spark-ignition internal combustion reciprocating piston engine, with cylinder capacity between 1,500 cc and 3,000 cc; and 852520, Transmission apparatus incorporating reception apparatus, etc.

FIGURE 4

Typology of the 50 main products exported by the Mexican electromechanical sector, 2008
(Percentage differences in 2008 with respect to 1994)^a



Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

^a In category 870422 the 1995 value was used because there were no data for 1994 in the information source.

VI Conclusions

The calculation of different indicators and statistical exercises, based on an extensive compilation of data from different information sources, confirms a number of trends observed in the structural evolution of the Mexican electromechanical sector, which is a pillar of the nation's export specialization profile. Firstly, efficiency improvements and supply have both become increasingly concentrated in a small number of firms that are subsidiaries of transnational automotive assembly enterprises; and this has led to the breakdown of local value chains. Secondly, the leading industries of the export model have been unable to create jobs on a sustained basis or generate substantial technological and organizational spillover and diffusion effects.

The structural analysis also confirms the hypothesis that intrasectoral heterogeneity initially increases within the globalized activities following trade liberalization, and then, once the productive apparatus has been

rationalized, in classes that are not engaged in global production networks. The latter, in some cases maintain the capacity to be competitive on the world stage, despite being immersed in a group that is undergoing obsolescence and deindustrialization. There is also overwhelming evidence of the absence of a significant structural effect that would allow labour to migrate towards more productive uses, thereby partially negating the orthodox theoretical argument used to defend the capacity of the market to assign resources efficiently in the economy.

In terms of global competitiveness, the impossibility of obtaining a long and consistent statistical series that quantifies international trade in terms of the value-added present in the goods, is one of the factors making it harder to comprehensively evaluate the sector's export performance. The results obtained with these constraints provide evidence of sustainably dynamic activity of the

global production networks in which firms resident in Mexico operate, as leaders of the model. Nonetheless, the exports of industries that are not involved in global production networks are also highly diversified and dynamic; and some eminently globalized classes of the electronics subsector display a phenomenon of “spurious” competitiveness, characterized by growing foreign sales accompanied by an adverse trend in labour productivity.

The role and results of the public policy implemented in Mexico as from the 1980s, under orthodox theoretical guidelines, thus seem to confirm the theses that several authors have presented in introductory fashion. As claimed by Coe and others (2004), the measures established have

moulded local capacities according to the competitive requirements of global production networks, resulting, among other things, in a twofold specialization of the leading industries in labour-intensive tasks (Deardoff, 1979). Nonetheless, the incapacity of the strategy to generate a significant structural change in terms of national productive development calls the chosen guidelines into question. An alternative proposal, aimed at developing the strategic structural complementarities needed to increase the density and degrees of diversification in the productive system, could therefore be centred on boosting the domestic market and, initially, on satisfying the population’s basic needs.

ANNEX

TABLE A.1

**Characteristics of the database on the productive structure
of the Mexican electromechanical sector**

Units	Variables	Time coverage	Sector coverage	Sources
Mexican pesos at December 2003 prices. The data were deflated using the National Producer Price Index (INPP) of the manufacturing sector, calculated by Banco de México (BANXICO) (2011).	Production, man-hours worked and its quotient, the labour-productivity indicator.	Monthly and annual. Period 1994-2008.	13 subsectors and 53 classes of activity ^a 28 620 data items in total.	The need to obtain lengthy and time-consistent series that could reflect possible transformations linked to structural change processes, meant that the only viable data source was the INEGI Monthly Industrial Survey (EIM) (INEGI, 2013a) under the Mexican Activities and Products Classification (CMAP).

Source: prepared by the author.

^a The globalized group contains 23 activity classes forming part of the following subsectors: 3841, “Automotive industry” (7 classes); 3823, “Manufacture and/or assembly of office, calculation, and information technology processing machines” (1 class); 3831, “Manufacture and/or assembly of electrical machinery, equipment and accessories, including for electric power generation” (7 classes); 3832, “Manufacture and/or assembly of electronic equipment for radio, television, communications and medical use” (4 classes); 3833, “Manufacture and/or assembly of appliances and accessories of domestic use. Excludes electronic appliances” (4 classes). The non-globalized group includes 30 activity classes forming part of the following subsectors: 3811, “Smelting and moulding of metallic pieces, ferrous and nonferrous” (1 class); 3812 “Manufacture of metallic structures, tanks and industrial boilers. Including blacksmith work” (3 classes); 3813, “Manufacture and repair of metallic furniture” (1 class); 3814, “Manufacture of other metallic products. Excludes machinery and equipment” (8 classes); 3821, “Manufacture, repair and/or assembly of machinery and equipment for specific purposes, with or without an integrated electric motor. Includes agricultural machinery” (5 classes); 3822, “Manufacture, repair and/or assembly of machinery and equipment for general uses, with or without an integrated electric motor. Includes mountings” (5 classes); 3842, “Manufacture, repair and/or assembly of transport equipment and parts. Excludes automobiles and trucks” (3 classes); 3850, “Manufacture, repair and/or assembly of precision instruments and equipment. Includes surgical instruments. Excludes electronic instruments” (4 classes). Activity classes 382301, 383202, 384204 and 385006 were not considered because there was no information on them in the survey as from 2003.

TABLE A.2

**Characteristics of the database on the external performance
of the Mexican electromechanical sector**

Units	Variables	Time coverage	Sector coverage	Sources
U.S. dollars at current prices and percentages.	<ul style="list-style-type: none"> - Exports from Mexico to the rest of the world by product and group. - Imports into Mexico from the rest of the world by product and group. - Share of Mexican exports of each product in the national total. - Mexico's share in the world market for the product. - Total world exports by product and group. - Share of each product in world exports. - Change in Mexico's market share by product. - Change in the share of world exports by product. - MAGIC typology by product. 	Annual. Period 1994-2008	1 345 products identified as part of the sector under the Harmonized System (HS 92). 161 400 data items in total. ^a	United Nations Commodity Trade Statistics Database (COMTRADE).

Source: prepared by the author.

^a To estimate the value of the exports of activity classes regrouped in the CMAP for the period 1994-2008, products manufactured by the electromechanical complex were differentiated under the HS 92 classification. As there are no official disaggregating equivalences between the Mexican Industrial Classification System and those commonly used for international trade, the 1,345 products at the six-digit level identified in HS 92 were reclassified according to the activity classes of the Mexican Activities and Products Classification (CMAP).

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