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Specialization and Technology in Mexico: A Virtual Pattern of Development and Competiveness?

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Preface

This new research project at IIASA is concerned with modeling technological and organisational change; the broader economic developments that are associated with technological change, both as cause and effect; the processes by which economic agents—first of all, business firms—acquire and develop the capabilities to generate, imitate and adopt technological and organisational innovations; and the aggregate dynamics—at the levels of single industries and whole economies—engendered by the interactions among agents which are heterogeneous in their innovative abilities, behavioural rules and expectations. The central purpose is to develop stronger theory and better modeling techniques. However, the basic philosophy is that such theoretical and modeling work is most fruitful when attention is paid to the known empirical details of the phenomena the work aims to address: therefore, a considerable effort is put into a better understanding of the 'stylized facts' concerning corporate organisation routines and strategy; industrial evolution and the 'demography' of firms; patterns of macroeconomic growth and trade.

From a modeling perspective, over the last decade considerable progress has been made on various techniques of dynamic modeling. Some of this work has employed ordinary differential and difference equations, and some of it stochastic equations. A number of efforts have taken advantage of the growing power of simulation techniques. Others have employed more traditional mathematics. As a result of this theoretical work, the toolkit for modeling technological and economic dynamics is significantly richer than it was a decade ago.

During the same period, there have been major advances in the empirical understanding. There are now many more detailed technological histories available. Much more is known about the similarities and differencers of technical advance in different fields and industries and there is some understanding of the key variables that lie behind those differences. A number of studies have provided rich information about how industry structure co-evolves with technology. In addition to empirical work at the technology or sector level, the last decade has also seen a great deal of empirical research on productivity growth and measured technical advance at the level of whole economies. A considerable body of empirical research now exists on the facts that seem associated with different rates of productivity growth across the range of nations, with the dynamics of convergence and divergence in the levels and rates of growth of income in different countries, with the diverse national institutional arrangements in which technological change is embedded.

As a result of this recent empirical work, the questions that successful theory and useful modeling techniques ought to address now are much more clearly defined. The theoretical work described above often has been undertaken in appreciation of certain stylized facts that needed to be explained. The list of these 'facts' is indeed very long,

ranging from the microeconomic evidence concerning for example dynamic increasing returns in learning activities or the persistence of particular sets of problem-solving routines within business firms; the industry-level evidence on entry, exit and size-distributions—approximately log-normal; all the way to the evidence regarding the time-series properties of major economic aggregates. However, the connection between the theoretical work and the empirical phenomena has so far not been very close. The philosophy of this project is that the chances of developing powerful new theory and useful new analytical techniques can be greatly enhanced by performing the work in an environment where scholars who understand the empirical phenomena provide questions and challenges for the theorists and their work.

In particular, the project is meant to pursue an 'evolutionary' interpretation of technological and economic dynamics modeling, first, the processes by which individual agents and organisations learn, search, adapt; second, the economic analogues of 'natural selection' by which interactive environments—often markets—winnow out a population whose members have different attributes and behavioural traits; and, third, the collective emergence of statistical patterns, regularities and higher-level structures as the aggregate outcomes of the two former processes.

Together with a group of researchers located permanently at IIASA, the project coordinates multiple research efforts undertaken in several institutions around the world, organises workshops and provides a venue of scientific discussion among scholars working on evolutionary modeling, computer simulation and non-linear dynamical systems. The research will focus upon the following three major areas:

1. Learning Processes and Organisational Competence.
2. Technological and Industrial Dynamics
3. Innovation, Competition and Macrodynamics

Abstract

By the end of the 80s and the beginning of the 90s, Mexico has shown important trasformations in its pattern of industrialisation and competitiveness. It is hard to determine whether this pattern might become a successful one in the near future. However, some points about the features which are presently prevailing can be emphasized:

1) The structural change in the composition of Mexican exports and the improved performance in competitiveness when the dynamics in market shares are considered. This pattern is mainly related to a gain in competitiveness which is supported by what has been defined in terms of static allocative efficiency. Still, when actual competitiveness is analysed, domestic industry appears to maintain the traditional structure which emerged during the ISI period. In a sense, sectors and firms that developed technological capabilities and economies of scale in this period possess higher opportunities to achieve actual competitiveness.

2) The specificity of this pattern seems to support the hypothesis that the new Mexican specialisation has not been followed by a change in both the development of production capacity and technological capabilities. Moreover, when the analysis is extented to the most recent years, it seems to confirm how the maquila industry is one of the leading actors in industrial modernisation. The diffusion of this type of industry introduces only very weak linkages with domestic productive sectors, strengthening the specificities of the competitiveness pattern in terms of production capacity and technological capabilities.

Acknowledgments

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I. Introduction

Between the end of World War Two and the late 1970s, the largest Latin American economies developed an industrial structure which was largely the result of the import substitution strategy of industrialisation (ISI strategy). The ISI period was mainly characterised by a high orientation in favour of the domestic market and by active state intervention based on indirect and direct subsidies.

During this period, these countries showed increased technological dynamics associated with a subsequent development of their industrial structures. Thus, some significant technological progress did indeed occur, associated mainly to domestic capabilities in the adoption of imported technologies, adaptation to the local environment and mastery of technology through specific modes of organizing production.

However, during the 1980s, this pattern seemed to show structural difficulties in developing further, and its main limits clearly emerged with problems in improving the technological learning capabilities. The principal specificities of this pattern are related to the prevailing of discontinuous modes of organizing production, the small production scale, the firms' consolidation of managerial technological skills, the weakness of the subcontractors network and the low degree of international competitiveness. In general, these elements explain the difficulties of developing dynamic economies of scale ((Katz (1986), (1987), (1993) and Cimoli (1988)).

Throughout the 80s, the debt crisis, institutional structural reforms -mainly implemented with privatization- and adjustment policies played an important role in transforming the industrial structure in the major economies of Latin America. Moreover, under the popular dictates of the *East Asian liberalization fashion* and the *usual* policy recommendation of international institutions, industrial and trade strategy was radically changed[1].

By the end of the 80s and the beginning of the 90s, most Latin American countries had shown important trasformation in their pattern of development and industrial structure. In particular, various studies from different perspectives seem to recognise that the

Mexican economy has invoked a new path in this process, showing significant changes in the pattern of development associated to structural competitiveness and specialisation (Casar (1993), (1995), Calder▪n, Mortimore and Péres (1995), Dutrénit and Capdevielle (1993), Mortimore (1995), Unger (1993)).

Yet, despite scholars' disagreement about the actual modernization, some specific features are recognised to prevail in the Mexican industrial structure. The evidence of changes in the industrial structure and specialisation seems to suggest that the process is mainly led by specific sectors like the automobile industry, electric machinery and electronic equipment. The altered pattern of competitiveness seems to be explained by the increasing international linkages in the production process within sectors and firms. In the capital and labour intensive sectors this integration process is mainly explained by the strategy of the foreign firms, which can be considered as the new leading actors in the pattern of competitiveness.

From this scenario, do the Mexican patterns of competitiveness and specialisation go together with increasing technological capabilities? How do the changes in domestic industrial structure, in terms of production capacity and technological capabilities, support this new pattern? These are the subjects of this paper which introduces some theoretical and empirical answers to these questions.

Whenever a view of development exclusively shaped by endowments, degrees of perfection in market signals, and the like, is abandoned in favour of focussing on the conditions for fostering technological/organizational learning, then it also becomes easier to appreciate the diversity of the sources of learning opportunities and their different economic potentials. In fact, good circumstantial evidence exists from contemporary as well as previous late-industrializing countries (such as, in their days, the USA, Germany, the Scandinavian countries, Japan, etc.).

In this context, it is useful to maintain the distinction emphasized by Bell and Pavitt (1993) and Cimoli and Dosi (1995) (which indeed bears some Listian flavour!) between the development of a "production capacity" and of "technological capabilities". Production capacity concerns the stocks of resources, the nature of capital-embodied technologies, labour skills, product and input specification and the organizational routines in use. Technological capabilities rest on the knowledge and resources requested for the generation and management of technical change.

There seem to be some patterns, albeit rather loose ones, in the development of domestic production capacity. For example, practically every country starts with manufacturing of clothing and textiles, possibly natural resource processing, and moves on -if it does- to more complex and knowledge-intensive activities. However, the tricky question is whether there are some activities which hold a special status in the construction of a national system of production and innovation, due to the fact that a production capacity in such activities, other things being equal, makes easier the development of technological capabilities. The conjecture is quite old (it goes back at least to List, Ferrier and Hamilton) and is present in contemporary notions such those of Filière or Dahmen's "development blocks".

There are technologies whose domains of application are so wide and whose role has been so crucial that the pattern of technical change of each country depends to a large

extent on the national capabilities in mastering production/ imitation/innovation in a set of crucial knowledge areas (eg, in the past, mechanical engineering, electricity and electrical devices, and nowadays, also information technologies). Moreover, the linkages among production activities embody structured hierarchies whereby the most dynamic technological elements play a fundamental role as sources of technological skills, problem-solving opportunities and productivity improvements. Much empirical evidence strongly conveys the idea that a proper technological dynamism in semi-industrialised countries is impossible without major structural changes and a sequential construction of a widening manufacturing sector involving also indigenous skills in a set of "core" technologies.

From this scenario, a re-examination of production capacity and technological capability will be developed in the following sections. In the first section we shall analyse the changes in competitiveness and specialisation of Mexican exports. Section two will be dedicated to the pattern of production capacity and competitiveness. In section three, the pattern of sectoral technological capabilities is analysed. The evolution in the trade pattern at the beginning of the 90s and the role played by the "maquila industry" is analysed in section four. Section five is dedicated to the conclusions.

II.Competitiveness and specialisation of Mexican exports

During the 1980s Mexican exports of manufactured commodities exhibited an impressive growth, the share of these commodities in Mexican exports rising from 22% to 63% in the period between 1980-1992. Thus, between 1980 and 1991, the annual average rate of growth of the industrial value added (and per worker) and the share of industrial exports were higher than the other economies in Latin America (CEPAL (1994)).

This process has been related to a situation where the dropping of the oil price, the change in the sectoral composition of exports and the appearance of a new "maquiladora" industry, which became widespread in this period, played a crucial role[2]. Moreover, in other recent empirical studies it is explicitly accepted that a new pattern of industrial development is taking shape and the Mexican economy is increasing its integration in the international order (Casar (1995), Calderon, Mortimer and Peres (1995), Mortimor (1995)).

In this section, we shall analyse a first view of the changes in Mexican competitiveness, presenting the results that emerge from the *competitive matrix* introduced in Mandeng (1991) and Fajnzylberg (1991). Competitiveness is analysed evaluating the relative dynamics of the market share for one product (or sector group) of the one country in the total OECD imports. The results are described in the following matrix where the horizontal axis shows the evolution of a sector in the OECD market and the vertical axis indicates the changes of the sectoral contribution in the country exports[3].

+		
	waning stars	*rising stars*

market share

retreats	*missed opportunities*

\- sector share +

Competitive matrix.

The four quadrants are: i) retreats represent the group of sectors which decrease their participations in the OECD market and in which Mexico loses market shares; ii) waning stars (declining stars) indicate the declining sectors in the OECD market where Mexican exports increase their market shares; iii) missed opportunities represent dynamic sectors in the OECD market which lose importance in Mexican exports; iiii) rising stars represent the group of sectors gaining share in both the OECD market and Mexican exports. In general, the competitive matrix indicates the interplay between the dynamics of the different sectors it comprises and the structural change in the market pattern for a specific country (and/or group of countries). The share of the sectors allocated in each quadrant illustrates the country's competitive position relative to both other competitors and the structure of the market pattern.

Figure 1 indicates the contribution of the sectoral groups in Mexican exports according to the competitive matrix for two specific periods 1963-1971 and 1980-1991 (the percentages are calculated on the total Mexican exports excluding oil). In the most recent period, this figure shows that the rising stars sectors increased their share from 26% to 75% indicating an increase in relative competitiveness and a change of specialisation in favour of the sectors where the imports share in the OECD market have increased.

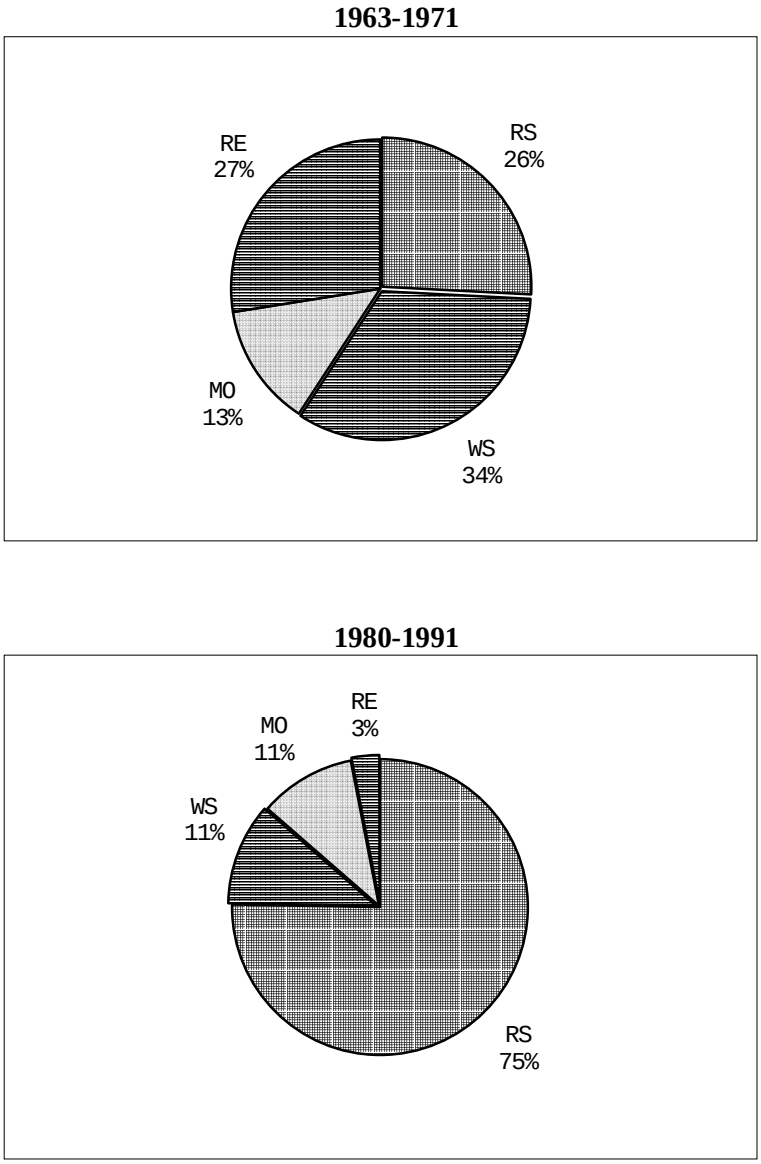

Fig 1: Increasing competitiveness in Mexico

Source: C.A.N. (Competitive Analysis of Nations), version CAN2.0, CEPAL (1995).
RS = rising stars, WS = waning stars, MO = missed opportunities, RE = retreats.
C.A.N. uses a three-year average, for instance the datum of 1991 is the average of 1990-1991-1992.
The percentages are calculated on total Mexican exports excluding crude petroleum oils.

During the 80s, it is largely recognised that the Mexican economy seems to be characterised by a pattern of most intensive specialisation oriented to manufactured commodities compared with other Latin American countries such as Argentina, Brasil and Chile. Transport equipment, electrical equipment and components are the main sectors which determine the new specialisation of the Mexican trade pattern and its

difference from the other major economies in Latin America. Moreover, from a general exercise with the matrix, it can be shown that the Mexican economy seems to find a group of well-trained competitors in the international arena such as China, Japan, Republic of Korea and Taiwan.

Waning Stars		(11)	Rising stars		(75)
SITC	Sector	Con. 71 Con. 91	SITC	Sector	Con. 71 Con. 91
057	Fruit and nuts	1.8 1.6	054	Vegetables, fresh, chilled, frozen or preserved	8.5 3.1
071	Coffee and coffee substitutes	5.3 1.2	112	Alcoholic beverages	0.4 1
334	Petroleum products, refined	0.4 1	513	Carboxylic acids	0.1 0.6
674	Universals, plates and sheets	1.5 0.5	658	Made-up articles, wholly or chiefly of textile	0 0.6
682	Copper	0.8 0.7	699	Manufactures of base metal	0.2 1
			713	Internal combustion piston engines	0.8 3.8
			716	Rotating electric plant and parts thereof	0.8 1.2
			741	Heating and cooling equipment and parts	0 0.8
			744	Mechanical handing equipment, and parts	0 0.6
			749	Non-electric parts and acc. of machinery	0.2 0.8
			752	Automatic data processing machines	0 1.9
			761	Television receivers	1.2 3.4
			762	Radio-broadcast receivers	0 2.1
			763	Gramophones, dictating machines	0.1 0.8
			771	Electric power machinery	0 1.6
			772	Elec. apparatus for making electrical	0.6 3.3
			773	Equipment for distributing electriciry	0.3 5.8
			775	Household type, electrical and non-electrical	0 1.3
			778	Electrical machinery and apparatus	0.9 2.7
			781	Passenger motor cars	0 8.8
			782	Motor vehicles for the transport of goods	0 1
			784	Parts and accessories of the motor vehicles	1.1 6.1
			821	Furniture and parts thereof	0.5 2.2
			842	Outer gar., men's and boys' of textile fabrics	0.2 0.8
			843	Outer garments, women's, girls' and infants'	0.7 1.2
			851	Footwear	0.5 0.5
			872	Medical instruments and appliances	0 0.8
			874	Measuring, checking and analysing	0.2 1.2
			893	Plastic articles	0.1 0.6
			894	Baby carriages, toys and sporting goods	1.6 1
			898	Musical instruments and parts and accessories	0.6 0.7
Retreats		(3)	Missed Opportunities		(11)
SITC	Sector	Con. 71 Con. 91	SITC	Sector	Con. 71 Con. 91
522	Inorganic chemicals elements	1.3 0.6	036	Crustaceans and molluscs	5.7 0.7
681	Silver, platinum and other metals	1.7 0.8	759	Parts of office and aut. data proc. machines	1.2 1.2
			764	Telecommunication equipment	2.9 3.8
			776	Thermionic, cold cathode valves	2.7 1.5

Table 1 Mexican competitive matrix (1980-1991)

Source: C.A.N. (Competitive Analysis of Nations) United Nations Comtrade Database on OECD merchandise imports classified by the Standard International Trade Classification (SITC) Revision 2 on a 3-digit basis (239 merchandise): CEPAL (1995).
CAN is a database application software for IBM-compatible personal computers. A first version CAN1.1 and a revised one (CAN2.0) are available.
Con71 is the contribution of 1971 and Con 91 the contribution of 1991. The contribution is calculated on total Mexican exports excluding crude petroleum oils. Only the sectors with at least a contribution of 0.5% in 1991 were inserted.

At a more disaggregated level, table 1 presents the competitive matrix obtained for the period between 1980 and 1991 in the Mexican exports to the OECD area. Each quadrant distributes the Mexican sectors in terms of their adaptability to the changes in the

OECD market and the contribution conferred in this period. The sectoral contribution in 1971 is also indicated in the table.

In particular, the composition of Mexican exports to the OECD has shown an important change in correspondence with the fact that manufactured commodities have increased their shares relative to petroleum oils and some traditional sectors. At a first glance, the different pattern of contribution between 1971 and 1991 seems to indicate a substantial change in the sectoral contribution to Mexican exports. In 1971, the traditional sectors such as 071 (coffee), 054 (vegetables) and (036) crustaceans and molluscs mainly contributed to exports. During the 80s, other sectors which require a further step in the development of industrial production capacity increased their contribution; in particular, at the beginning of the 90s the following sectors showed a good performance: passenger motor cars (781), parts and accessories of motor vehicles (784), internal combustion piston engines for cars (713), electrical equipment (772, 773) and television receivers (761).

Thus, during this period, it would seem that Mexican competitiveness was quite high and that new sectors appeared in the pattern of specialisation. The data on the dynamics of market shares give the impression that a process of increasing competitiveness is actually taking place with a new pattern of sectoral production capacity in sectors such as: passenger motor cars, internal combustion piston engines, automatic data processing machines, television receivers, electric power machinary, electrical controlling equipment, equipment for distributing electricity, etc. In a sense, this preliminary analysis supports the results obtained in Casar (1989), Unger (1993), Guerrieri (1994), H. Shaiken (1995), M. Mortimore (1995), A. Calderòn, M. Mortimore and W. Peres (1995).

Although we can note that new sectors which require a different pattern of industrialisation and technological accumulation appear in the rising stars quadrant, another element which should be taken into account is that radical macro stabilisation policies, which have reduced the absortion capability of the domestic market, have been implemented. In a sense, the identification of the sources of competitiveness requires a sectoral analysis of the variables that determine the structural changes in production capacity.

III. The pattern of production capacity and actual competitiveness

In this section, we shall analyse the changes in production capacity of manufactured industry for a group of SITC sectors characterised by an increasing participation in the export shares[4]. In table 2, forty industrial activities which are mainly export oriented, aggregated from 69 sectors on the basis of the SITC classification, are obtained from the competitive matrix for the period between 1980 and 1991 with the sectors that have shown a share in Mexican exports higher than 0.5%. These activities are analysed in terms of: share in gross industrial product, export shares, trade balance, growth rate of industrial product, productivity rate of growth and employment growth rate. Their contribution to the total export of manufactured commodities is about 68.6% and 32.7% in terms of manufactured domestic product[5].

SITC	Industrial activities	%GDP89	%X89	TB80	TB91	gdp	pro	emp
054,056,058	Fruit and vegetables, preserved	0.64	1.35	94	178	5.14	3.87	0.80
057	Fruit, dehydrated	0.04	0.44	17	45	4.65	4.35	0.05
036, 037	Fish, crustaceans and molluscs	0.58	3.18	395	279	3.64	0.37	3.26
	Coffe, prepared	0.71	3.73	415	368	3.08	1.23	1.88
071p	Roasted coffee	0.25	0.53	32	46	0.05	-1.43	1.51
	Beverage of "agave"	0.22	0.55	37	103	2.68	3.18	-0.34
112p	Beer and malt	1.73	1.14	24	124	2.00	0.84	1.37
851	Footwear	1.07	0.49	27	-39	-2.96	-0.10	-2.82
247, 248	Wood, simply worked	0.86	0.09	-53	-109	-1.01	1.49	-2.39
512, 513, 514, 515								
516, 522, 523, 524	Secondary and basic chemical	2.28	3.45	-425	-652	4.92	2.46	2.48
334, 335, 341	Petroleum products, refined	2.23	3.02	199	-549	1.40	-2.34	3.92
658	Sheets and clothes	0.16	0.16	-8	-2	1.09	0.90	0.03
	Glass vases	0.49	0.39	0	112	0.66	0.98	-0.39
665p	Other glass and crystal manufactured	0.25	1.18	30	105	1.95	3.70	-2.49
674, 675	Plates and sheets of iron and steel	1.89	2.30	-211	221	0.48	1.92	-1.67
681, 683								
685, 686, 687	Manufactured of lead, zinc and tin	0.04	4.81	69	390	2.72	0.76	1.94
682	Copper, manufactured	1.21	2.48	-113	132	3.34	3.59	0.29
743	Pumps and compressors	0.11	0.04	-47	-95	1.61	2.14	0.59
821	Furniture of base metal and parts	0.37	0.17	-19	-64	-2.50	0.30	-2.79
699p	Other manufactured of base metal	0.14	0.50	-41	-9	-0.60	0.07	-0.75
697	Cooking equipment of base metal	0.05	0.02	5	6	-8.07	0.18	-8.14
744	Tows, cranes and similar equipment	0.16	0.07	-425	-366	-7.37	-4.87	-2.79
741	Other machinery and equipment	0.41	2.10	-1305	-1137	-4.91	-1.43	-3.49
751, 752, 759	Office and calculating machines	0.58	2.91	-278	-862	10.89	6.89	3.85
716, 771	Electric motors	0.90	0.25	-203	-169	-0.02	0.12	0.18
741, 772	Electrical equipment and machinery	0.42	0.13	-49	-220	-1.01	-1.70	0.66
778	Accumulators and batteries	0.28	0.15	5	6	2.80	3.33	-0.27
773	Electrical parts and accessories	0.34	1.71	-180	-585	0.30	-2.80	3.36
764, 776p	Parts for communication equipment	0.60	1.21	-12	-163	5.56	4.81	0.51
761, 762, 763	Radio and TV	0.23	0.07	-176	-1050	-6.06	9.11	-13.81
774	Electric apparatus for medical use	0.11	0.15	-78	-208	6.36	-3.91	10.37
775	Household electric equipment	0.47	0.17	-11	-60	-5.58	-0.57	-5.02
781, 782, 783	Motor vehicles	5.71	13.11	-260	3459	2.68	3.53	-0.43
714	Tows and carriages	0.20	0.14	-23	30	-8.86	-3.21	-6.16
713p*	Engines for cars	1.49	11.30	-93	1068	8.70	2.13	6.72
784	Parts and accessories for cars	1.67	3.52	-1095	-5425	-3.34	0.24	0.33
581, 582, 583, 893	Plastic products	1.91	0.74	-53	-257	1.69	1.06	1.65
874	Measuring and checking instruments	0.16	0.03	-229	-651	2.84	-2.43	4.63
841,842, 843, 844p	Garments	1.20	0.17	-51	-292	-2.79	-1.21	-1.35
898	Records and magnetic tapes	0.24	0.61	-6	52	0.64	2.19	-1.31
	Total manufacturing	100	100	-11849	385	1.15	1.36	0.62

Table 2: International competitiveness in the main Mexican industrial activities

Source: Data are obtained from System National Accounts, database of ILET and SECOFI (see appendix A, B and C).

%GDP 89= % on the aggregate value in 1989

%X 89= % on exports in 1989

TB80= trade balance in 1980 in millions of dollars

TB 91= trade balance in 1991 in millions of dollars

gdp = yearly average growth rate of GDP from 1980 to 1989

pro = yearly growth rate of production for employed from 1980 to 1989

emp = yearly growth rate of employment from 1980 to 1989

* Most engines for cars are combustion piston engines.

At first sight, it emerges that only twenty industrial activities show a yearly growth rate higher than the average growth rate of domestic product. On the one side, in table 1, we can observe an impressive growth in export shares; on the other side, however, we can observe that in table 2 a large part of these activities show a relatively weak performance in terms of domestic production capacity. This scenario seems to indicate

that the structural adjustment policies implemented in the 80s and the consequent narrowing of the domestic market are important reasons for this change in specialisation.

From table 2, we can also observe only nineteen industrial activities which show improvement or stability in the trade balance in the late 80s. Other sectors such as secondary and basic chemicals, electronic and electrical industries and parts and accessories for cars are characterised by a negative trade balance during the same period. In a sense, this result seems to support the increases in intra-industry and intra-firm trade flows[6].

Moreover, when the productivity growth rate is taken into account, we can note that only sixteen activities are characterised by a growth rate higher than the average of industrial activities; another twelve industrial activities exhibit a negative growth rate. This simple and descriptive analysis introduces only some doubts about the view which argues that there is a positive effect from productivity growth to export. In a sense, it may be considered that the resulting scenario does not support a generalised positive causality between productivity and exports growth[7].

At a more detailed level of analysis, we can observe that only a quarter of the industrial activities show both a growth rate in productivity and production higher than the average of the industrial activities. Moreover, in some activities, the increase in productivity is related only to a diminution of the employment rate, meanwhile the growth rate of production decreases. Thus, the higher productivity obtained is mainly related to the introduction of innovative changes in the modes of organisation of production processes and/or reductions in employment in these activities.

In figure 2 the activities with a higher productivity growth rate are localised as a function of their performance, where the axes indicate the GDP rate of growth and trade balance. In the first quadrant are the industries characterised by actual competitiveness; that is, these sectors show an increased productivity, a high production rate of growth and an improvement in trade balance (Fajnzylberg (1991)). Thus, the industrial activities which show a favourable *actual* competitiveness are:

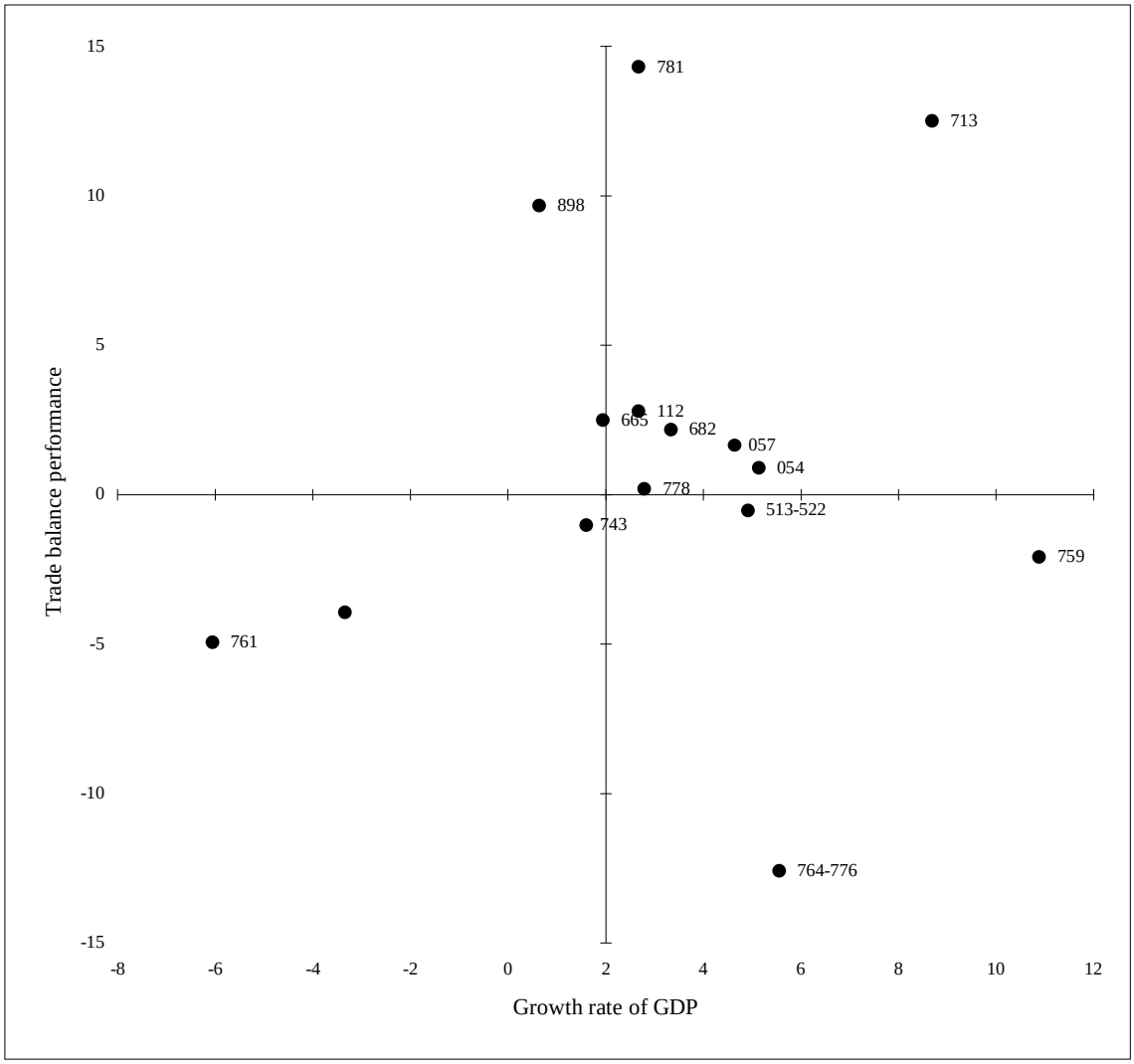

Fig.2 Analysis of the competitiveness in sectors with the best performance in productivity growth

Source: see table 2.
RS=rising star, WS=waning stars, MO=missed opportunities
GDP= yearly average growth of GDP from 1980-1989

Trade balance performance is given by: $\frac{|TB91 - TB80|}{TB80}$

054, 056, 058, fruit and vegetables, preserved; WS
057, fruit, dehydrated; WS
112p, beverage of agave; RS
512, 513, 514, 515, 516, 522, 523, 524
secondary and basic chemics; WS
665p, glass vases, other glass and crystal manufactured; RS
682, copper, manufactured; WS
713p, engines for cars; RS
743, pumps and compressors; RS
751, 752, 759, office and calculating machines; RS
761, 762, 763, television receivers; RS
764, 776p, parts for communication equipment; MO
778, accumulators and batteries; RS
781, 782, 783, passenger motor cars; RS
898, records and magnetic tapes; RS

SITC	Industrial activities
054, 056, 058	Fruit and vegetables preserved
057	Fruit, dehydrated
112p	Beverage of agave and beer
512, 513, 514, 515 516, 522, 523, 524	Secondary and basic chemicals
665p	Glass vases, other glass and crystal manufactured
682	Copper, manufactured
778	Accumulators and batteries
781, 782, 783	Motor vehicles
713p,	Engines for cars

This group of industries produced 34% of manufactured goods exported and 12.1% of production in the manufactured activities.

From figure 2, it can be also noted that only some sectors with actual competitiveness are included in the group of rising stars -three sectors- and others are included in the declining stars -three sector. The car industry is shown to be well allocated in terms of actual competitiveness, contributing with 28% to Mexican exports. This point indicates that the strategy of multinational firms and the related policy of import restriction, implemented until 1991, are really important in the understanding of the main elements which explain competitiveness. In particular, the successful pattern of competitiveness in some of the sectors based on capital-intensive modes of production -such as chemicals activities and passenger cars and parts- is related to the export orientation of the main foreign firms[8].

It can also be noted that some sectors, such as other glass and crystal manufactured (665, SITC classification), fruit/vegetables, preserved (54) and copper manufactured

(682) largely integrated in the domestic industry, are determinant in the Mexican pattern of specialisation. Thus, the traditional pattern of specialisation resulting from the ISI period "revives" when actual competitiveness is considered.

In summary, the pattern of actual competitiveness seems to result from the interaction of "static allocative efficiency" and "dynamic efficiency" (definitions for these useful concepts and the differences between them can be found in Dosi, Pavitt and Soete (1990), Dosi, Tyson and Zysman (1989) and, within other perspectives for Latin American countries, see Fajnzylber (1991)). However, static efficiency seems largely to prevail in the explanation of the gain in sectoral competitiveness.

In the first scenario, the gain of world market shares of the Mexican industry is not necessarily related to the improvement in productivity and the structural change in patterns of industrialisation. In other words, a gain in market share or trade surplus is not a necessary condition for dynamic efficiency in the world market arena. What generally happens in these cases is that the domestic "macro" adjustments play a central role in order to increase the trade surplus compatible with the stabilization programs. Thus, we can easily see that a country gains from its exports' market share since it discharges more commodities into the world market than it would otherwise be able to produce for the domestic market.

The second scenario, exploited by a small group of sectors which achieve a relative actual competitiveness, is mainly related to the general property that emerges from the economies which show success in domestic technical change. In the Mexican industrial sectors with actual competitiveness, this mechanism seems to be mainly related to both the introduction of new modes of production organisation and the international trade integration of sectors and firms supported by the multinational enterprises.

IV. The pattern of sectoral technological capabilities

Following Dutrénit and Capdevielle (1993) and Guerrieri (1994) we may refer to the taxonomy of the sectoral patterns of acquisition of innovative knowledge suggested by Pavitt (1984), in order to explain the interplay between technological capabilities and international trade pattern. We by no means suggest that there is any invariant sequence of industrial sectors which account for the upgrading of national technological capabilities. However, some rough sequences in the predominant modes of technological learning might still be identified. In this respect, this taxonomy is a good -albeit somewhat theoretically fuzzy- point of departure (see also, Cimoli (1988), Vernon (1989), Bell and Pavitt (1993)).

As it is well known, Pavitt identifies four groups of industrial sectors, namely (i) supplier dominated, where innovations mainly enter as exogenously generated changes in capital and intermediate goods, and where learning is primarily associated with adoption and production skills; (ii) specialized suppliers, providing equipment and instruments to the industrial system, and relying in their innovative activities on both formal (more or less scientific) knowledge and more tacit information based also on the user-producer relationships; (iii) scale-intensive sectors, whose innovative abilities jointly draw on the development/adoption of innovative equipment, on the design of

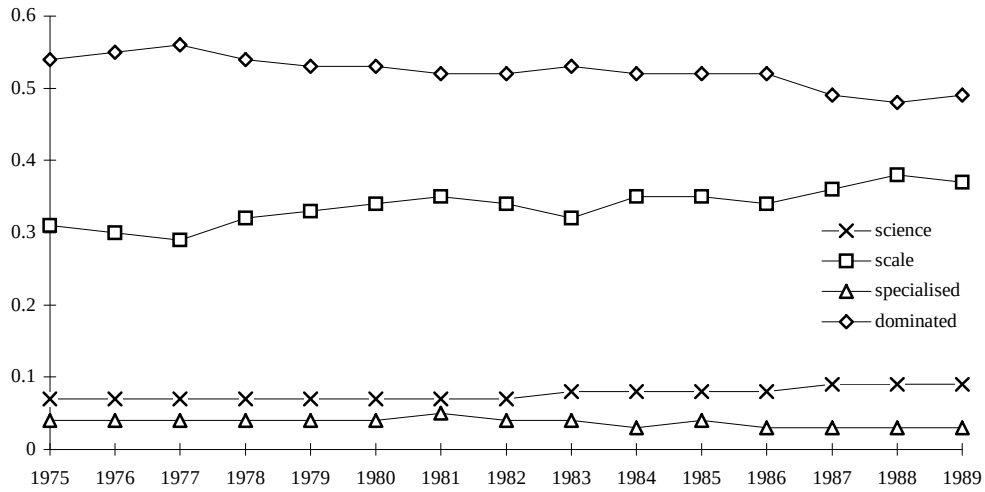

Fig. 3 Composition of industrial production in terms of Pavitt's taxonomy

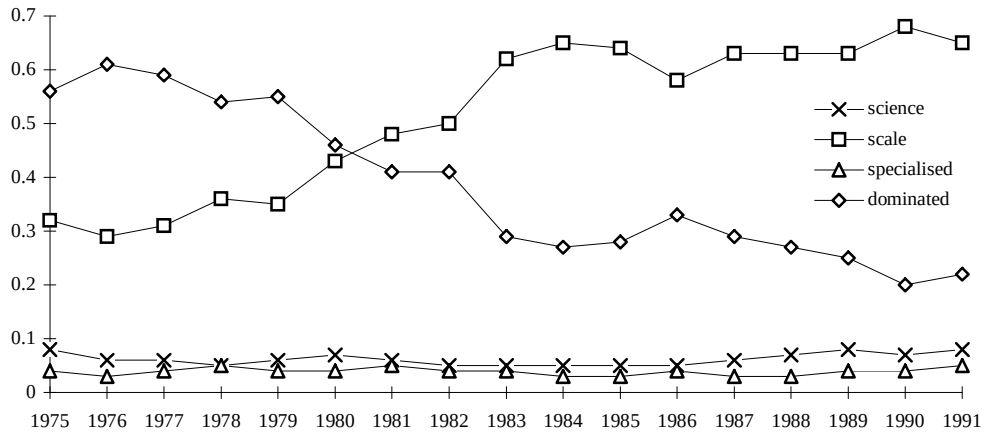

Fig. 4 Composition of industrial exports in terms of Pavitt's taxonomy

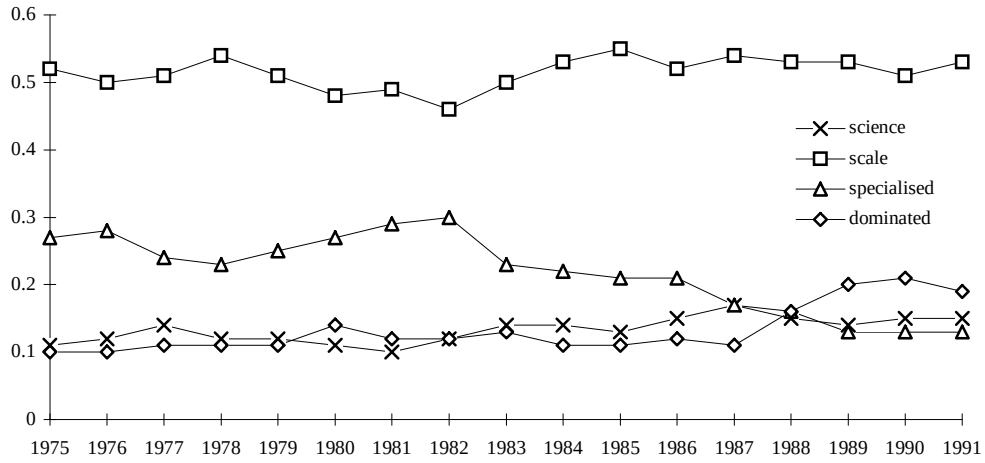

Fig. 5 Composition of industrial imports in terms of Pavitt's taxonomy

Source: Trends are obtained from S.N.A., database of ILET and SECOFI data; Dutrénit and Capdevielle (1993), see appendix D.

mastering complex organizations; (iv) science-based sectors, whose innovative opportunities are more directly linked with advances in basic research.

Figures 3, 4 and 5 indicate domestic production, exports and imports for the technological sectors defined on the basis of Pavitt's taxonomy[9].

As shown in Dutrénit and Capdevielle (1993) and in figure 3 on production, between 1975 and 1989, the composition of the industrial product exhibits a stable pattern with a small increase in scale intensive and science based sectors in the late 80s.

During the 80s industrial production was mainly oriented to the world market, increasing the export share of all sectors. Figure 4 on exports confirms that the scale intensive is the sector which has mainly contributed to explaining the success in Mexican exports. The supplier dominated sector which naturally was a key sector in the Mexican economy during the 60s and 70s, has decreased its participation in industrial production and export. It is important to point out how this sector was really affected by structural adjustment policies and its difficulties in gaining new shares in the world market.

However, when figures 3 and 4 (on production and export) are compared, what clearly emerges is that the production pattern has not been influenced by changes in the export composition. The production and export sectoral patterns have exhibited different trends.

The analysis developed here seems to indicate that the new specialisation is not really followed by a domestic change in the structure of production, which would be necessary in order to develop higher interlinkages among sectors. Moreover, during the 80s, from the import and production figures (3 and 5), we can note that the reduction in the specialised suppliers indicates the lower investment in imported and domestically produced capital goods.

What seems to emerge is that the process of gains in sectoral shares in the world market weakly integrates domestic sectoral technological flows with production capabilities. However, the structural interaction and linkages of individual economic activities and technologies via the intersectoral flows is a crucial element for dynamic efficiency. A complex array of externalities, interdependence and incentives among sectors is an implicit component that determines the extent and potentiality of each economy; an example of theses is the untraded interdependence, based on technological spill-overs, complementaries and communality of knowledge bases. Both inter-sectoral linkages and untraded technological flows contribute to shape the organizational and technological context within which each economic activity takes place. In a sense, they organize the externalities available to each individual process of production and innovation, including the availability of complementary skills, opportunities/ bottlenecks, information on intermediate inputs and capital goods, and stimuli to improve particular products. In the next section, we shall verify whether and how this dynamic pattern has prevailed in technological capability and specialisation.

The emerging manufacturing sector requires an initial stage where supplier-dominated sectors play a primary role, accompanied by the emergence of specialized suppliers. The process of technical change in these sectors is characterized by a sequential development of various forms of tacit and incremental learning related to the transfer

and acquisition of foreign technology. These learning activities are mainly related to the use of equipment, development of engineering skills in machine-transformation, adaptation of existing machines and final products to specific environmental conditions.

The emergence and interlinkage of "scale-intensive" industries, by analogy with the supplier-dominated sector, introduces further forms of learning related to the development and use of capital equipment which are likely to be very important. However, unlike the latter sector, new technological efforts are focused on (i) the development of technological synergism between production and use of groups of innovations, often internalized via horizontal and vertical integration; (ii) the development and adoption of new technologies associated with the exploitation of static and dynamic economies of scale; (iii) the development of formal search/learning through R&D, complementary to informal learning and diffusion of technological knowledge.

Thus, it may be thought that the changes in the industrial structure require the development of an inter-sectoral linkage which has not emerged from the Mexican experience. Moreover, from the import and production figures, it can be noted that the science-based sector exhibits considerable difficulties in increasing its share. This sector would be important for the evolution of intersectoral linkages. Thus, we can expect expensive research processes (R&D) to be the typical learning mechanism. The premium for innovative success is generally high: successful "Schumpeterian" firms often become large and international rather quickly, and the cumulation of technical progress frequently allows them to remain big and successful thereafter.

Sectoral learning patterns are clearly nested into broader ("macro") conditions such as those defining the educational system. For example, in "supplier-dominated" and "specialized supplier" sectors, a significant role is played by the levels of literacy and skills of the workforce, and the skills and technical competence of engineers and designers in the mechanical and (increasingly) electronics fields. In scale-intensive sectors, the existence of managers capable of efficiently running complex organizations is also likely to be important. In science-based sectors, the quality of higher education and research capabilities is obviously relevant. Moreover, sectoral learning patterns and overall national capabilities are dynamically coupled via input-output flows, knowledge-spillovers, complementarities and context-specific externalities. Together, they contribute to shape the organizational and technological context within which each economic activity takes place. In a sense, they set the opportunities and constraints facing each individual process of production and, including the availability of complementary skills, information on intermediate inputs and capital goods, and demand stimuli to improve particular products. This links straightforwardly with the analyses focusing on structural change and development (here, from a vast literature, the contributions that come inmediately to mind range from Hirschman to Rosenstein Rodan, Gerschenkron, Prebisch, Lowe, Kuznets, Chenery, Sirquin, among others).

	number of plants	employment (thousands of workers)	Value added (millions of dollars)
1980	620	124	772
1983	600	151	818
1985	789	212	1267
1987	1125	305	1598
1989	1655	430	3047
1990	1938	460	3607
1991	1925	467	4119
1992	2075	505	4809
1993*	2142	549	5410

Table 3: Increasing trends in maquila industry

Source: INEGI "Estadistica de la industria maquiladora de exportacion 1989-1993.

* 1993 is a provisional estimate.

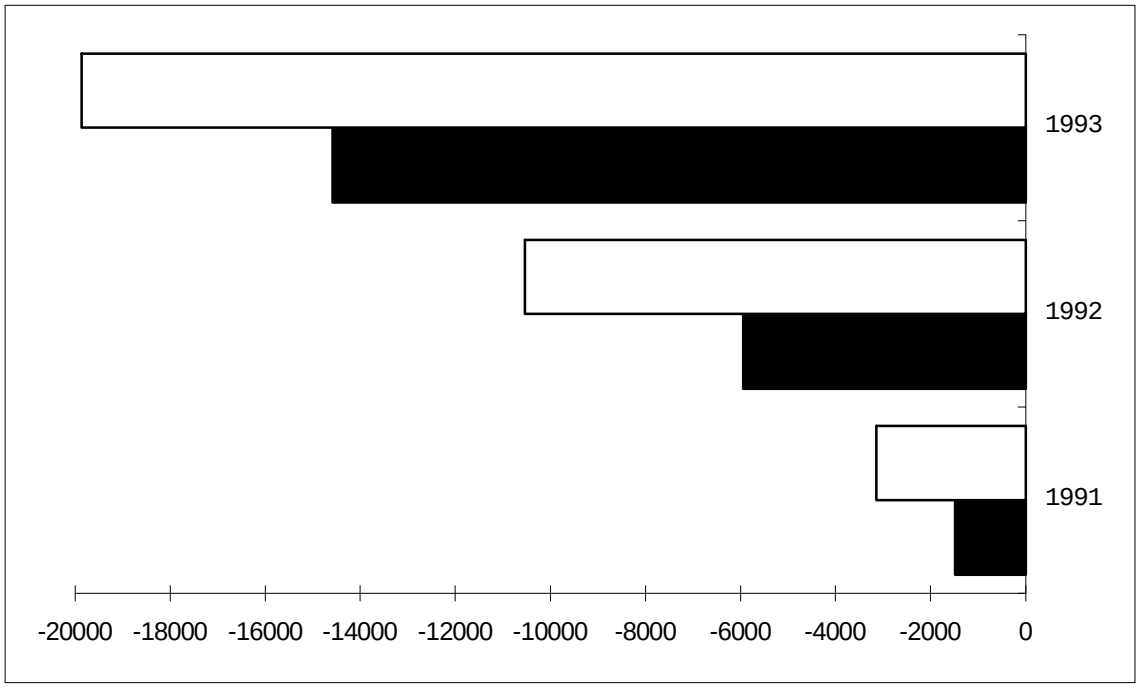

Fig. 6 Total trade balance with and without maquila industry (millions of dollars)

Source: SECOFI, database on Mexican exports classified by the SITC, Rev. 2, 3-digit.

V.The pattern of competitiveness and the “maquila” industry

The growing extention of maquiladora industry, another feature of the recent Mexican industrialisation, is related to the export orientation strategy of the foreign firms. However, this type of industry is based on labour-intensive processes of production and weaker linkages with the domestic industry compared with the sectors characterised by actual competitiveness.

From table 3, we can observe that in the period between 1987 and 1993, this industry showed an impressive growth in the number of plants, mainly localised along the Mexican border, the number of workers employed and value added. At the beginning of 1992, the percentage of imported inputs requested in the maquila industry was about 98%. The total value added in real terms grew by about 6.5% in early 1993 (INEGI (1993)). In general, this industry is an important source of foreign exchange and its contribution in reducing the trade balance deficit was fundamental during the 90s (figure 6).

Figure 7 represents the trends of the total Mexican share in OECD imports for the period 1977-1992, the petrolium oils share and the contribution of the maquila industry. This figure indicates that during the 80s the total trend seems to be dominated by the petroleum oils sector, while at the beginning of the 90s the maquila industry seems to support the increasing share of Mexican exports. Thus, at an aggregate level, it seems to confirm how the maquila industry is one of the leading actors of the new emerging pattern of specialisation.

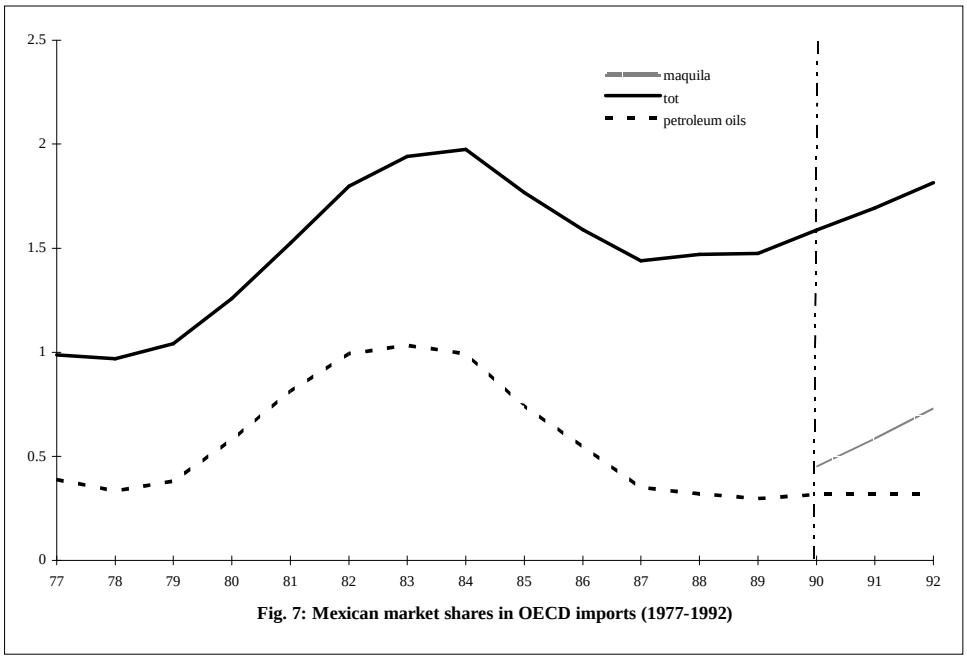

Fig. 7: Mexican market shares in OECD imports (1977-1992)

Source: C.A.N. United Nations Comtrade database on OECD imports classified by the SITC, Rev. 2 on a 3 digit. Maquila percentage derives from SECOFI data, the share of "maquila industry" is weighed by the total market share obtained from C.A.N. Maquila data are available only from 1990 to 1993. C.A.N. uses an average year (for example 1979-1980-1981 as 1980) and the percentages presented are a three-year average.

Moreover, the matrix in table 4 also indicates the contribution of the maquila industry for each sectoral share of the OECD market in 1992. This table reveals that a large number of sectors included in the matrix had an important contribution by maquila industry. In particular, in the rising stars group we can observe that most of the sectors are characterised by a contribution of the maquila industry that is larger than 70%.

Waning Stars	(18.2)		Rising stars	(69.1)	
SITC Sector	Con. 92	%Maquila	SITC Sector	Con. 92	%Maquila
054 Vegetables, fresh, chilled, frozen or preserved	2.8	5.1	519 Carboxylic acids and their anhydrides, halides	0.7	0.1
057 Fruit and nuts	1.7	0.9	658 Made-up articles, wholly or chiefly of textile	0.6	83
071 Coffee and coffee substitutes	1	0	699 Manufactures of base metal	1	74
112 Alcoholic beverages	0.9	0	713 Internal combustion piston engines	3.6	11
334 Petroleum products, refined	0.9	0.2	716 Rotating electric plant and parts thereof	1.3	91
651 Textile yarn	0.3	1.8	741 Heating and cooling equipment and parts	0.9	74
682 Copper	0.8	5.9	744 Mechanical handing equipment, and parts	0.6	29
697 Household equipment of base metal	0.5	7.6	749 Non-electric parts and acc. of machinery	0.8	54
762 Radio-broadcast receivers	2	98	752 Automatic data processing machines	1.8	30
			761 Television receivers	3.5	100
			763 Gramophones, dictating machines	0.9	96
			771 Electric power machinery	1.6	94
			772 Elec. apparatus for making electrical	3.2	98
			773 Equipment for distributing electriciry	5.9	94
			775 Household type, electrical and non-electrical	1.4	67
			778 Electrical machinery and apparatus	2.8	88
			781 Passenger motor cars	9.3	0.1
			782 Motor vehicles for the transport of goods	1.1	0.8
			784 Parts and accessories of the motor vehicles	6.5	71
			812 Sanitary, plumbing and lighting fixtures	0.5	56
			821 Furniture and parts thereof	2.3	85
			842 Outer gar., men's and boys' of textile fabrics	0.9	90
			843 Outer garments, women's, girls' and infants'	1.3	92
			851 Footwear	0.5	21
			872 Medical instruments and appliances	0.8	96
			874 Measuring, checking and analysing	1.3	84
			893 Plastic articles	0.7	84
			894 Baby carriages, toys and sporting goods	1	86
			898 Musical instruments and parts and accessories	0.7	77
Retreats	**(3.2)**		**Missed Opportunities**	**(9.5)**	
SITC Sector	Con. 92	%Maquila	SITC Sector	Con. 92	%Maquila
522 Inorganic chemicals elements	0.5	2.4	036 Crustaceans and molluscs	0.6	14
681 Silver, platinum and other metals	0.7	0.4	759 Parts of office and aut. data proc. machines	1.3	49
			764 Telecommunication equipment	3.8	94
			776 Thermionic, cold cathode valves	1.4	91

Table 4 Competitive matrix and "maquila" share* (1980-1992)

Source: C.A.N. revised version (CEPAL (1995)) and Secofi database on Mexican exports, classified by the SITC, rev. 2, 3-digit.
Con 92 is the contribution of 1992 and it is calculated on total Mexican exports excluding crude petroleum oils. Only the sectors with at least a contribution of 0.5% were inserted. The share of "maquila industry" for each sector is obtained by SECOFI database on Mexican exports, excluding oil and it is a three-year average from 1991 to 1993, as data from CAN.
*The difference between the sectors in this matrix and those in table 1 depends on the period. Here the last year is 1992, in table 1 it was 1991.

The specialization pattern can also be analysed aggregating the Mexican exports in terms of the market share in the OECD market for the sectoral taxonomy introduced in the above section. Figure 8 shows that the changes in Mexican specialisation are determined by an increasing participation of the scale intensive and specialised sectors during the 80s and the beginning of the 90s. From this figure we can observe a trend which indicates that the Mexican economy is not only more integrated in the OECD market but also shows an increasing capability to capture market shares in the technologically advanced sectors. This, however, is a *virtual* trend because when we

remove the maquila industry the scenario that emerges seems to be quite different. In fact, the “technological” groups of sectors maintain (scale and dominated) or decrease (science and specialised) their market shares.

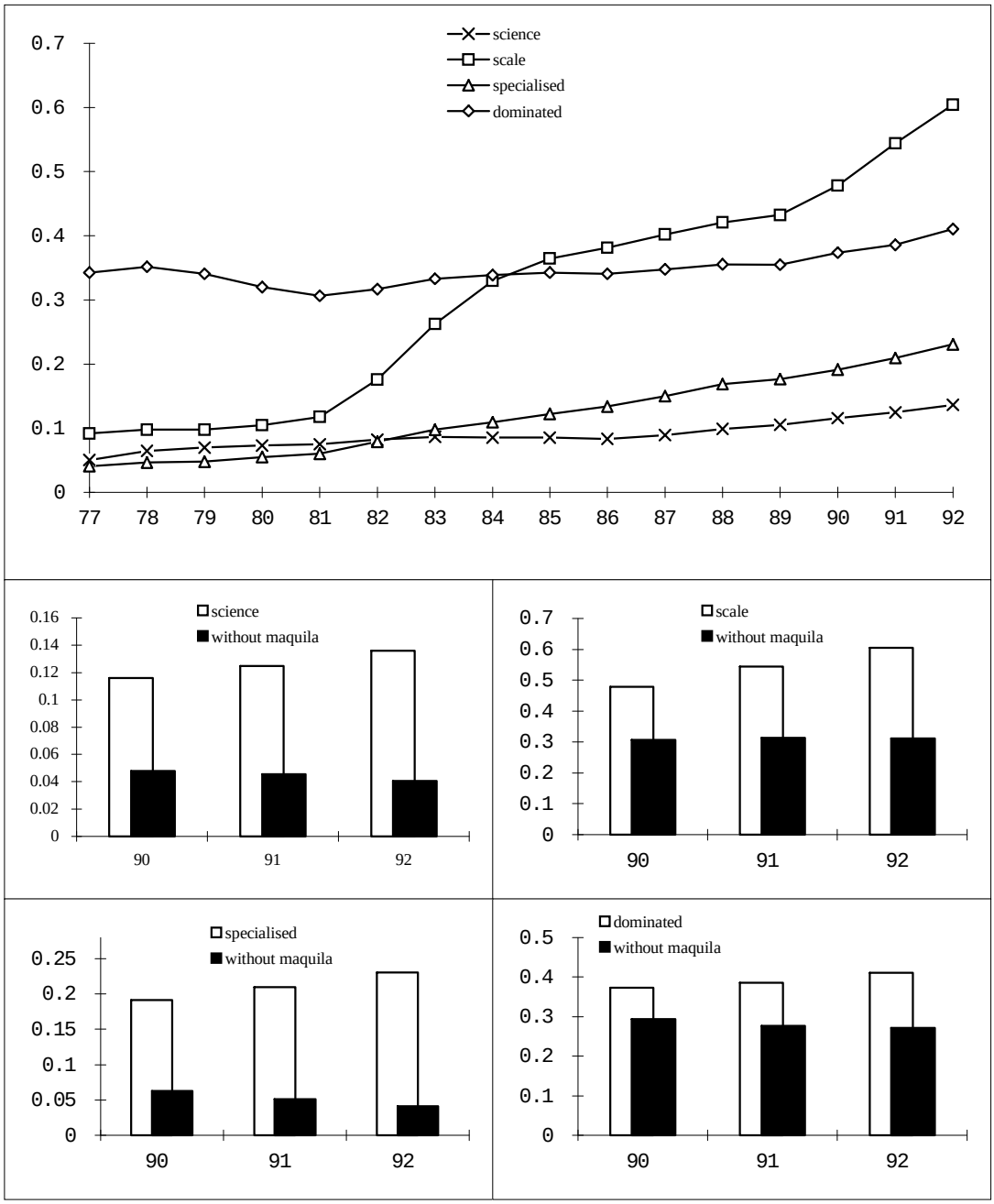

Fig. 8: Pavitt's market shares in OECD imports

Source: C.A.N. (CEPAL (1995)). Maquila percentages are calculated with the SECOFI data; the shares of "maquila industry" in each sector are weighed by the market share obtained from C.A.N and by aggregating them in Pavitt's groups (for Pavitt's taxonomy see appendix B).
Maquila data are available only from 1990 to 1993. C.A.N. uses an average year (for example 1979-1980-1981 as 1980) and the percentages presented are a three-year average.

At the beginning of the 90s part of the jump in market share of the scale-intensive sector should be attributed to the increasing participation of the maquila industry. The specialised sector has decreased its participation in terms of market share. Table 3,

figures 7 and 8 seem to confirm that the maquila industry plays an important function in the explanation of the recent changes in the specialisation of Mexican exports.

Thus, the only market shares analysis seems to blow up the resulting competitiveness of the Mexican industry. Moreover, the analysis of the maquila industry share introduces some important specificities in the patterns of competitiveness and specialisation that emerged in Mexico from the late 80s to the early 90s. Table 5 represents the contribution of the maquila industry for the ten fastest growing sectors between 1980 and 1992 that contribute to Mexican exports for more than 35% in 1992. This sectoral specification indicates that the sectors which showed an increasing participation during the 80s are characterised by overturning of their participation share, in particular for passenger automobiles and internal combustion piston engines for cars. Thus, the sectors that seem to be most integrated with domestic industry have lost market shares. Other sectors, such as electric power machinery, electrical controlling equipment, and equipment for distributing electricity, television receivers and radio-broadcast receivers, are clearly dominated by the maquila industry. Moreover, the specificities of the maquila industry are clearly represented in figure 9 where the ICTB index is obtained for the 10 fastest increasing sectors. The contribution to trade balance shows that the maquila was clearly important to reduce the deficit or produce a surplus of the sectoral trade balance.

In sum, the maquiladora industry assumes an important role in the process of industrial modernisation. However, the maquila contribution is characterised by contrasting effects and linkages on the industrial structure, we shall only indicate the most relevant features: 1) a notable increase related to the number of plants, the workers employed and the net value added; 2)the fact that a large part of the recent competitiveness in the dynamics of the market shares is related to sectors where the maquila explain a high part of production capacity; 3) an important contribution related to the reduction of the aggregated trade deficit and, at the sectoral level, where this industry share mainly contributes to production capacity; 4) an increasing contribution to market shares in terms of sectoral technological capabilities which, however, when the weak linkages with the domestic industrial structure and therefore the effective process of diffusing technology across sectors are considered, seems to be very reduced; 5) a higher integration of maquiladora plants in the organisation of production capacity and development of technological capabilities within the process of organising production in foreign firms.

Those characteristics introduce elements in favour of both maquila supporters and critics. On the one hand, this industry gains market shares increasing employment and reducing the negative trade deficit effects. On the other hand, a moderate impulse for the development of technological capabilities in the domestic industrial structure and across sectors seems to emerge. In a sense, the static efficiencies are clearly exploited on the basis of labour cost differences while a contribution to domestic technological capabilities, through the sectoral learning patterns coupled with the inter-sectoral flows, is not taking place.

	1988	1989	1990	1991	1992	1993
713=internal combustion piston engines						
Contribution without maquila	11.13	10.40	8.67	7.28	7.27	1.12
Contribution with maquila	na	na	na	4.86	4.07	0.86
Maquila %	na	na	na	0.06	0.09	1.45
752= automatic data processing machines						
Contribution without maquila	2.47	2.35	1.33	1.90	1.78	2.30
Contribution with maquila	na	na	na	1.43	1.19	1.42
Maquila %	na	na	na	16.16	23.00	49.20
761=television receivers						
Contribution without maquila	0.01	0.00	0.00	0.01	0.01	0.05
Contribution with maquila	na	na	na	2.71	4.75	7.49
Maquila %	na	na	na	99.87	99.87	99.79
762=radio-broadcast receivers						
Contribution without maquila	0.02	0.05	0.02	0.08	0.02	0.00
Contribution with maquila	na	na	na	0.60	1.34	1.14
Maquila %	na	na	na	91.46	99.10	99.92
771=electric power machinery						
Contribution without maquila	0.15	0.12	0.14	0.21	0.34	0.08
Contribution with maquila	na	na	na	1.41	1.80	2.38
Maquila %	na	na	na	90.79	90.25	98.93
772=electrical controlling equipment						
Contribution without maquila	0.13	0.09	0.10	0.14	0.15	0.16
Contribution with maquila	na	na	na	2.26	2.99	3.72
Maquila %	na	na	na	96.12	97.36	98.64
773=equipment for distributing electricity						
Contribution without maquila	0.91	1.24	0.89	0.80	0.79	0.44
Contribution with maquila	na	na	na	5.09	5.55	7.23
Maquila %	na	na	na	90.11	92.67	98.09
781=passenger motor cars						
Contribution without maquila	7.68	9.92	17.33	20.57	17.67	10.10
Contribution with maquila	na	na	na	13.01	9.11	3.18
Maquila %	na	na	na	0.17	0.00	0.08
784=parts and acc. of motor vehicles						
Contribution without maquila	2.92	2.71	1.48	2.46	2.85	1.77
Contribution with maquila	na	na	na	3.18	4.32	5.10
Maquila %	na	na	na	51.08	65.95	89.12
821=furniture and parts thereof						
Contribution without maquila	0.29	0.32	0.27	0.42	0.47	0.81
Contribution with maquila	na	na	na	1.68	1.30	2.03
Maquila %	na	na	na	84.01	81.51	87.48

Table 5: The ten highest dynamic sectors with a relevant contribution to Mexican exports*. Difference of contribution with and without maquila between 1991and 1993

Source: SECOFI, Original database on Mexican exports classified by the SITC Rev. 2, 3-digit.

In the first index the contribution of each sector to Mexican exports is calculated excluding maquila data from total and sectoral export. Otherwise in the second index maquila data are included. The last index gives the percentage of maquila data included. The last index gives the percentage of maquila in the export of each sector.

Note: From 1988 to 1990 maquila is not available and not included in the contribution. Contribution is calculated on total Mexican exports, excluding crude petroleum oils.

* The ten sectors derive from CAN in terms of contribution growth from 1980 to 1992 with at least a contribution of 1.5% in 1992.

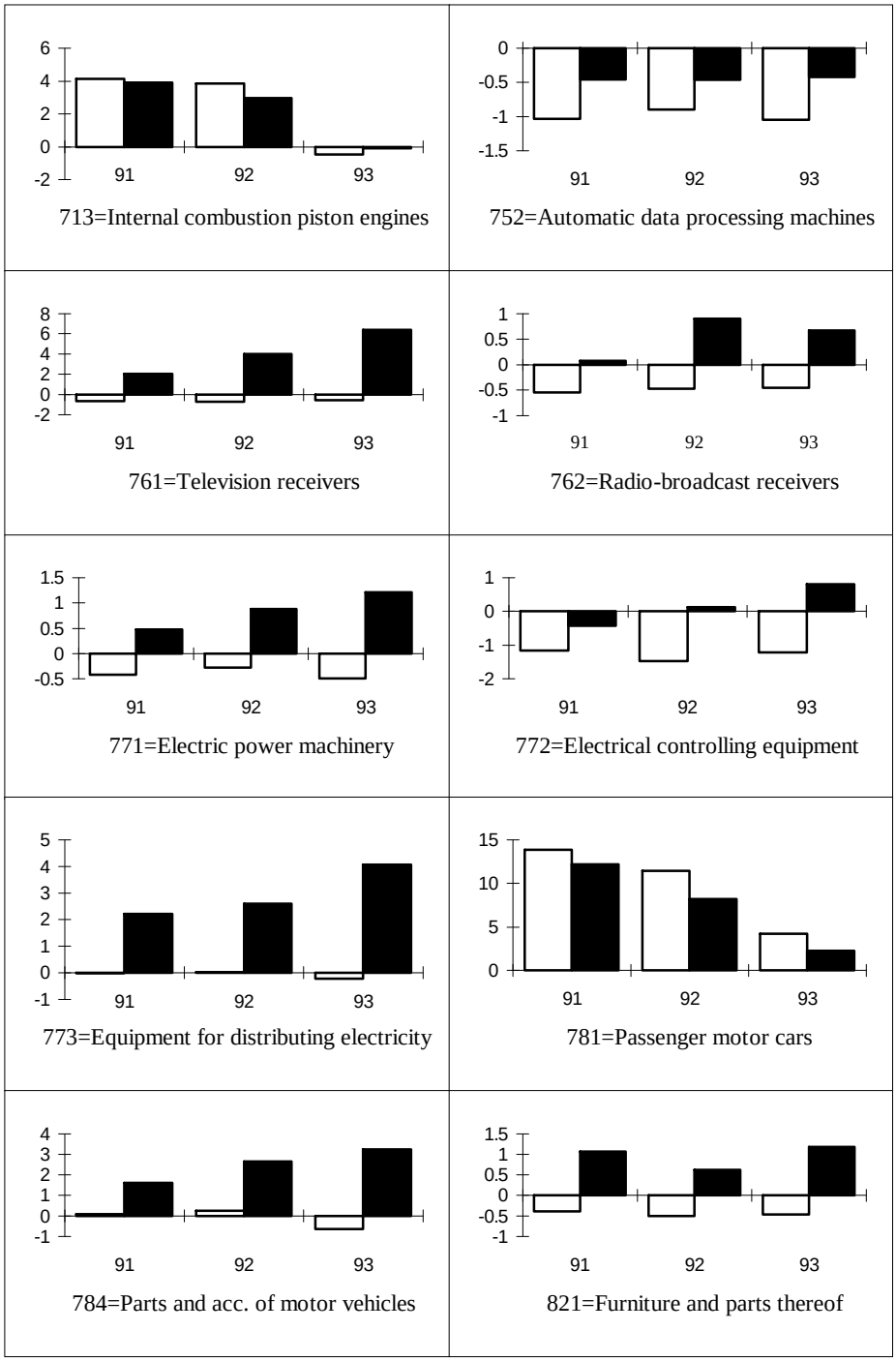

Fig. 9: ICTB index, 10 fastest increasing and most important sectors* Difference of contribution with and without maquila.

Source: SECOFI, database on Mexican exports classified by the SITC, Rev 2, 3-digit.

From 1988 to 1990 maquila data is not available and not included in the index. The contribution with maquila is in black.

* The ten sectors derive from CAN in terms of contribution growth from 1980 to 1992, with at least a contribution of 1.5% in 1992.

The indicator of the contribution to trade balance (ICTB) with respect to a given group of products (i) is:

$$ICTB = \frac{x_i - m_i}{(X+M)/2} * 100 - \frac{X - M}{(X+M)/2} * \frac{x_i + m_i}{(X+M)} * 100$$

X,M=total Mexican exports and imports; xi,mi=exports and imports in product group i;

The sum of the indicators with respect to the product groups, in which the total trade of a country is disaggregated, equals 0.

A positive (negative) ICTB value indicates a presence of a comparative advantage (disvantage) in the same sector.

VI.Concluding remarks

At first sight, by the early 90s, the Mexican pattern of industrialisation seems to invoke a new pattern of competitiveness and specialisation. A general point is related to the overturning of the features that emerged from the ISI strategy, where a higher embeddedness of firms and sectors into the domestic industrial structure characterised the competitiveness of the period. Conversely, during the 80s and 90s, the resulting competitiveness in some of the more dynamic sectors, such as related automobile and electronic products, is mainly supported by linkages with international industry in the United States and Canada or in other countries which use the Mexican economy as a springboard for the NAFTA market. Thus, the industrial structure is characterised by the increased integration of firms and production plants in a larger international production network which mainly follows the strategy of transnational corporation.

The Mexican economy seems to invoke a new pattern of industrialisation and competitiveness. It is hard to determine whether this pattern might became a successful one in the near future. However, some points about the features which are presently prevailing can be emphasized:

1) The structural change in the composition of Mexican exports and the improved performance of competitiveness when the dynamics market shares are considered. This pattern is mainly related to a gain in competitiveness which is supported by what has been defined in terms of static allocative efficiency.

   In fact, a part of the leading sectors of the new competitiveness and specialisation seems to be unable to exploit dynamic efficiency and diffuse technological capabilities across the industrial structure. By contrast, only a small group of sectors has been characterised by a pattern of actual competitiveness (e.g. preserved fruit and vegetables, dehydrated fruit , other glass and crystal manufactured, secondary-basic chemical, copper manufactured, accumulators and batteries, motor vehicles and engines for cars).

   In particular, some industries defined as a scale intensive -such as the car industry- have shown actual competitiveness and explain an important part of export pattern during the 80s. However, by the early 90s a part of these industries seems to show a decreasing role in Mexican exports.

   Still, when actual competitiveness is analysed, domestic industry appears to maintain the traditional structure which emerged during the ISI period. In a sense, sectors and firms that developed technological capabilities and economies of scale in this period show higher opportunities to achieve actual competitiveness.

2) The specificity of this pattern seems to support the hypothesis that the new Mexican specialisation has not been followed by a change in both the development of production capacity and technological capabilities. Thus, although we have observed that the scale intensive, specialised suppliers and science-based sectors have increased their export shares, production capacities have not invoked the same road and the weakness of their inter-sectoral linkages may have increased.

Moreover, when the analysis is developed for the most recent years, it seems to confirm how the maquila industry is one of the leading actors of industrial modernisation. The diffusion of this type of industry introduces only very weak linkages with the domestic productive sectors, strengthening the specificities of the competitiveness pattern in terms of production capacity and technological capabilities.

In general, the emergence of this new pattern does not link straightforwardly with the traditional literature on structural change and development. Certainly, the dynamics of development also rest upon major structural transformations which entail a changing importance of different branches of economic activity as generators of both technological/organizational innovations and demand impulses. So, for example, in this interpretative framework, it does not sound so outragious to conjecture that the "quality" (in terms of the interplay between production capacity and technological capabilities) of the Mexican structure of production and export is bound to influence the relative ability of the country to absorbe its labour supply, meet its foreign balance constraints, increase its per capita income...However, at this level, under the analysis sketched above, there might be reasons for worry. Indeed, one may empirically find that Mexico is increasingly biased in favour of a *virtual* pattern of competitiveness in terms of both domestic production capacity and technological capabilities.

Notes:

1) The effects of the liberalization policies in the semi-industrialised economies and the recommendations of internationational institutions, see Kirpatrick (1995).

2) In 1988 the share of the maquila industry in the Mexican exports to the EEUU was about 46%, see Fajnzylberg (1991).

3) For a more detailed explanation see Mandeng (1991), CEPAL (1993).

4) See Appendixes A, and B where the sources and the compatibility between SITC classification and industrial activities are explained.

5) Note, however, that the information included in this table is obtained from production and export data where none of these incorporate the share atributed to the maquila industry.

6) On the intra-industry and intra-firm trade flows between Mexico and the United States, see Mattar and Schatan (1993), Casar (1989).

7) See, on this point, Casar (1993) and Unger (1993) who produce an empirical analysis on the causality nexus between export and productivity in Mexican industry. Casar (1993) introduces an index of revealed comparative advantage and verifies the interplay between productivity growth-exports to establish the type of prevailing competitiveness. The resulting pattern of specialisation seems to be supported by an effective and technological-based competitiveness. Unger (1993) has stressed the importance of the multinational, the intra-industry/intra-firm trade and the exchange rate policy for the explanation of the export growth. With regard to the interplay

between productivity and technological contents of exports, very weak support is found.

8) On the increasing role played by the foreign firms in the industrial structure in Mexico , see Mortimore (1995) and Calderon, Mortimore and Peres (1995).

9) See Appendix D where the activities classification in terms of the Pavitt technological taxonomy are indicated.

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Appendix A: Information sources

1) Production and employment

Complete series of industrial classification (4-digit) from 1970 to 1989 were obtained from the System National Accounts of Mexico and the database of ILET. This information was used to calculate the performances of export industries.

2) Exports and imports

Information about Mexico’s external trade was obtained from SECOFI (Secreteria de Comercio y Fomento Industrial). SECOFI uses original information which comes directly from the custom-houses.

We used the following series:

a) annual series from 1975 to 1991 of exports and imports for industrial classes (4-digit), which was used to calculate export and import composition in terms of technological taxonomy.

b) two annual series 1988-1993 of exports and imports classified in the classes of “Sistema Armonizado de Agregacion y Codificacion de Mercancies”.

- total exports and imports without maquila industry;

- exports and imports of maquila industry.

We used these series to calculate maquila percentage in the competitive matrix obtained from CAN20. CAN20 uses SITC rev. 2 and to make the data comparable it was necessary to convert information obtained from the "Classificacion del Sistema Armonizado". For this transformation we used a special table presented in "Classificaciones Estadisticas Internacionales incorporadas en el Banco de Datos del Comercio Exterior de America Latina y el Caribe de la CEPAL", Cuadernos Estadisticos de la CEPAL # 18.

APPENDIX B: Compatibility between industrial classification and SITC for export industries

SITC	Industrial activities
036, 037	Fish and crustaceans, prepared or preserved
054,056,058	Fruit and vegetables, preserved
057	Fruit, dehydrated
071p	Coffee, prepared Roasted coffee Soluble coffee
112p	Beverage of "agave" Rum, vodka and juniper Wine and brandy Fermented beverages Beer and malt
247, 248	Wood, simply worked
334, 335, 341	Petroleum products, refined Industrial gas
512, 513, 514, 515 516, 522, 523, 524	Secondary and basic chemical
581, 582, 583, 893	Plastic products
658	Sheets and clothes
664	Smooth and processed glass Mirrors Glass fibers
665p	Glass vases Other glass and crystal manufactured
674, 675	Smelting and rolling of iron and steel
681, 683 685, 686, 687	Manufacture of lead, zinc and tin
682	Copper, manufactured and its metal alloys
697	Cooking equipment of metal base
699p	Keys and padlocks Other manufactured of base metal
713p, 744	Engines for cars Parts and accessories for cars
716, 771	Electric motors
741, 772	Machinery and industrial electric equipment
744	Tows, cranes and similar equipment
751, 752, 759	Office and calculating machines
761, 762, 763	Radio and TV
764, 776p	Parts for communication equipment
773	Electrical parts and accessories
774	Electric apparatus for medical use
775	Household electric equipment
778	Accumulators and batteries
821	Furniture of base metal and parts
851	Footwear
874	Measuring and checking instruments

Appendix C: Source table used to estimate competitiveness in export industries classified by SITC

SITC	Industrial activities	%GDP89	%X89	TB80	TB91	gdp	pro	emp
054,056,058	Fruit and vegetables, preserved	0.64	1.35	94	178	5.14	3.87	0.80
057	Fruit, dehydrated	0.04	0.44	17	45	4.65	4.35	0.05
036, 037	Fish, crustaceans and molluscs	0.58	3.18	395	279	3.64	0.37	3.26
	Coffee, prepared	0.71	3.73	415	368	3.08	1.23	1.88
071p	*Soluble coffee*	*0.21*	*0.01*	*6*	*2*	*2.95*	*2.18*	*1.73*
	Roasted coffee	0.25	0.53	32	46	0.05	-1.43	1.51
	Beverage of "agave"	0.22	0.55	37	103	2.68	3.18	-0.34
	Rum, Vodka and Juniper	*0.33*	*0.07*	*-43*	*-48*	*15.10*	*9.04*	*1.23*
112p	*Wine and brandy*	*0.36*	*0.03*	*-9*	*-33*	*-2.11*	*3.51*	*-5.4*
	Fermented beverages	*0.02*	*0.23*	*0*	*57*	*-1.31*	*0.16*	*-2.34*
	Beer and malt	1.73	1.14	24	124	2.00	0.84	1.37
851	Footwear	1.07	0.49	27	-39	-2.96	-0.10	-2.82
247, 248	Wood, simply worked	0.86	0.09	-53	-109	-1.01	1.49	-2.39
512, 513, 514, 515								
516, 522, 523, 524	Secondary and basic chemical	2.28	3.45	-425	-652	4.92	2.46	2.48
334, 335, 341	Petroleum products, refined	2.23	3.02	199	-549	1.40	-2.34	3.92
658	Sheets and clothes	0.16	0.16	-8	-2	1.09	0.90	0.03
	Smooth and processed glass	*0.12*	*0.01*	*-33*	*-63*	*0.59*	*0.31*	*0.80*
664	*Mirrors*	*0.02*	*0.08*	*0*	*-6*	*0.81*	*1.59*	*-0.86*
	Glass fibers	*0.09*	*0.05*	*3*	*-19*	*-1.76*	*-0.1*	*-1.31*
	Glass vases	0.49	0.39	0	112	0.66	0.98	-0.39
665p	Other glass and crystal manufactured	0.25	1.18	30	105	1.95	3.70	-2.49
674, 675	Plates and sheets of iron and steel	1.89	2.30	-211	221	0.48	1.92	-1.67
681, 683								
685, 686, 687	Manufacture of lead, zinc and tin	0.04	4.81	69	390	2.72	0.76	1.94
682	Copper, manufactured	1.21	2.48	-113	132	3.34	3.59	0.29
743	Pumps and compressors	0.11	0.04	-47	-95	1.61	2.14	0.59
821	Furniture of base metal and parts	0.37	0.17	-19	-64	-2.50	0.30	-2.79
	Keys and padlocks	*0.12*	*0.01*	*-19*	*-116*	*3.12*	*0.84*	*2.31*
699p	Other manufactured of base metal	0.14	0.50	-41	-9	-0.60	0.07	-0.75
697	Cooking equipment of base metal	0.05	0.02	5	6	-8.07	0.18	-8.14
744	Tows, cranes and similar equipment	0.16	0.07	-425	-366	-7.37	-4.87	-2.79
741	Other machinery and equipment	0.41	2.10	-1305	-1137	-4.91	-1.43	-3.49
751, 752, 759	Office and calculating machines	0.58	2.91	-278	-862	10.89	6.89	3.85
716, 771	Electric motors	0.90	0.25	-203	-169	-0.02	0.12	0.18
741, 772	Electrical equipment and machinery	0.42	0.13	-49	-220	-1.01	-1.70	0.66
778	Accumulators and batteries	0.28	0.15	5	6	2.80	3.33	-0.27
773	Electrical parts and accessories	0.34	1.71	-180	-585	0.30	-2.80	3.36
	Communication equipment	*0.14*	*0.10*	*-111*	*-671*	*-3.47*	*-0.31*	*-2.72*
764, 776p	Parts for communication equipment	0.60	1.21	-12	-163	5.56	4.81	0.51
761, 762, 763	Radio and TV	0.23	0.07	-176	-1050	-6.06	9.11	-13.81
774	Electric apparatus for medical use	0.11	0.15	-78	-208	6.36	-3.91	10.37
775	Household electric equipment	0.47	0.17	-11	-60	-5.58	-0.57	-5.02
781, 782, 783	Motor vehicles	5.71	13.11	-260	3459	2.68	3.53	-0.43
714	Tows and carriages	0.20	0.14	-23	30	-8.86	-3.21	-6.16
713p	Engines for cars	1.49	11.30	-93	1068	8.70	2.13	6.72
784	Parts and accessories for cars	1.67	3.52	-1095	-5425	-3.34	0.24	0.33
581, 582, 583, 893	Plastic products	1.91	0.74	-53	-257	1.69	1.06	1.65
874	Measuring and checking instruments	0.16	0.03	-229	-651	2.84	-2.43	4.63
	Shirts	*0.26*	*0.02*	*-21*	*-84*	*-1.62*	*-0.55*	*-1.1*
841,842, 843, 844p	Garments	1.20	0.17	-51	-292	-2.79	-1.21	-1.35
898	Records and magnetic tapes	0.24	0.61	-6	52	0.64	2.19	-1.31
	Total manufacturing	100	100	-11849	385	1.15	1.36	0.62

Source: Data are obtained from System National Accounts, database of ILET and SECOFI.

Activities in italics are in the SITC classification, but they present a low production and export.

%GDP 89= % on the aggregate value in 1989

%X 89= % on exports in 1989

TB80= trade balance in 1980 in millions of dollars

TB 91= trade balance in 1991 in millions of dollars

gdp = yearly average growth rate of GDP from 1980 to 1989

pro = yearly growth rate of production for employed from 1980 to 1989

emp = yearly growth rate of employment from 1980 to 1989

Appendix D: Activity classification in terms of technological taxonomy

1) For highly-worked industrial products we used the classification of activities of SITC rev. 1 (3-digit) presented in “El Comercio de Manufacturas de America Latina. Evolucion y Estructura 1962-1989”, Estudios e Informes de la CEPAL # 88. We made the necessary corrections to convert information in SITC rev. 2.

We used the CEPAL classification table to convert industrial activities in SITC.

2) Industrial products classified in semimanufacture are about half of the Mexican industrial product, so they were also included.

We used the classification presented in “El perfil tecnologico de la industria mexicana y su dinamica innovadora en la década de los ochenta”, G. Dutrenit and M. Capdevielle, El Trimestre Economico, vol. LX (3), # 239,1993.