

# CHAPTER 4

## BACKWARD LINKAGES IN THE AUTO INDUSTRY

### 4.1 Introduction

In the development literature, forward and backward linkages across industries have been widely emphasized. Import substitution policies were advocated partly on the grounds that these linkages could be insured by the protection of domestic industries. Formation of linkage would then provide the basis for what is referred to as “balanced” growth. Proponents of export oriented development, on the other hand, suggest that competition in international markets entails these linkages through some form of externalities. The widely held belief is that competition in the world market forces the export oriented sectors to be more efficient, which in turn spills over to other sectors of the economy. These spillover effects are assumed to be a source of productivity gains in sectors which are either direct suppliers of intermediate goods to the export oriented sectors, or share common technological and managerial features.<sup>1</sup>

Cross-country evidence for the to last three decades suggests that export oriented countries fared better in terms of growth of output. This has been interpreted as supporting of the externalities argument (e.g. Balassa 1978, and Feder 1983). Some authors (e.g. Corbo et. al. 1985), on the other hand, suggest that growing manufacturing exports is one of the main determinants of high, *sustain-*

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<sup>1</sup>The theoretical possibility, of course, does not preclude similar efficiency gains in import competing industries. Here, the focus is strictly export competing industries.

*able* growth rates of nations like Republic of Korea, Taiwan, and city states like Hong-Kong and Singapore. The main argument is that international competition enhances productivity, and induces a more efficient allocation of domestic resources not only in the manufacturing sector, but also in non-tradables as well. The claim that there are of efficiency gains in all tradables due to externalities and/or more efficient resource allocation resulting from the export competing sectors is thus the main theme of the export oriented growth approaches.

Another way to test the linkages hypothesis is through sectoral studies in individual countries. To achieve this aim, this chapter studies the backward linkages in the Mexican automobile assembly, and automobile parts (henceforth autoparts) and automobile bodies industries. The choice of these sector is due to their export capabilities in the Mexican context. While automobile vehicles has been the fastest growing export industry of Mexico, autoparts has traditionally been an important export oriented sector. During the early eighties automobile engines were the leading export growing sector of the Mexican economy. Furthermore, these sectors had one of the highest total factor productivity growth rates in the Mexican manufacturing industry during the eighties (Brown and Domínguez 1993). These facts seem to suggest that Mexican automobile industry provides strong evidence for the case of export oriented approaches. Yet a closer look at the data indicates that the limits to export based growth are quite visible.

This study also investigates whether the trade policy had an impact on the evolution of these linkages. The study covers the period from 1970 to 1991. The two phases of Mexican industrialization drive over this period provide rich evidence to test for the alternative linkages hypotheses. Mexican industrial sector can be characterized as protectionist during the 1970s and up until the major economic

crisis of 1982. Also overvalued exchange rate policies did not favor the export competing sectors. During the protectionist period, the automobile industry as a whole had been one of the most highly protected industries. As a part of the economic adjustment program which began in the 1980s, the Mexican government liberalized trade substantially, and provided incentives for exports. Consequently, the former period is suitable for the analysis of linkages in the context of import substitution policies. For the test of the hypothesis of linkages through export led policies the latter period will be used.

The formal proposition of the externality argument states that, as they enter into more competitive markets, high export growth sectors' productivity will increase. Furthermore, this increase in productivity in high export growth sectors will spill-over to sectors with which they "interact". The extent of productivity spillovers are determined by the degree of interaction between sectors. In this study, the criterion of interaction is chosen as the significance of physical product flows between two sectors. In the case of the automobile and autoparts industries in Mexico, the data from 1980 (the latest available) shows that there is substantial inter-industry trade between these sectors. The linkage effects would then suggest that as the output and exports grow in the automobile vehicles industry, there would be proportional increases in the output of the autopart industry. The directional choice for linkages is because of the explosive growth of automobile vehicle exports from Mexico in the second half of the 1980s.

## 4.2 Facts and Data

### 4.2.1 Brief Historical Background

The automobile industry in Mexico has a very long (and important for its own sake) history that will not be reviewed here. Rather, the main factors that had substantial impact on the development of this industry in the second half of this century will be summarized. The sources of industrial protection can be traced to the promulgation of a law (*Ley de Industrias Nuevas y Necesarias*) in 1955 which created incentives and provided protection for the “new and necessary” industries.<sup>2</sup> In early 1960’s the government initiated an industrial strategy with heavy emphasis on backward linkages in industrial development. Subsequently, vertical integration of industries were promoted according to a production program negotiated between the firms and the former Department of Industry and Commerce. Thereafter, protected by tariffs and exempted from import duties on capital goods, domestic manufacturers found it easier to invest to expand output and to diversify industrial production.

Beginning from early sixties automobile industry as a whole became one of the strategic industries that the Mexican government had strongly supported.<sup>3</sup> The form of governmental support had taken various forms including preferential access to credit, foreign exchange and protection of the domestic market. Import tariffs, for instance, on automobiles were the highest (100 percent of the imported

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<sup>2</sup>See Solís (1981, p.6). In 1964 this law was broadened and modified to allow for the import of complete industries and plants.

<sup>3</sup>On the earlier decrees concerning the automobile industry, see Camarena (1981), esp. pp. 24-25. See also Bennett and Sharpe (1985) for an extensive discussion of these decrees, and their political implications.

value) among the commodities during the seventies. There were also various regulations ranging from price controls in the late sixties and early seventies to ownership structure of the firms. While policies such as local content requirements clearly facilitated the growth of integrated industries, such as the autoparts, an ownership restrictions were introduced to promote Mexicanization of the industry. Although hundred percent foreign ownership was allowed in the terminal firms, the autoparts firms had to satisfy at least 60 percent national equity ownership.<sup>4</sup>

No doubt the Mexican government had a long term vision of the automobile industry. In the second phase of the development of this industry the government provided incentives for exporters of automobiles, engines and autoparts beginning from 1969 and much more forcefully emphasized these measures after 1977. It should be noted that these export promotion policies were directed solely for the automobile industry, and they preceded economywide trade liberalization following 1982. For instance, the terminal firms which exported autoparts would be subject to 50 percent local content requirements in their assembling of automobiles, as opposed to otherwise 60 percent of the cost of production.<sup>5</sup> The export promotion system essentially functioned on the basis of tax rebates and larger domestic production quotas for those terminal firms who fulfilled their export requirements. These export requirements were aimed at promoting mostly national autoparts industry in the export markets by forcing sourcing to the international

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<sup>4</sup>Exceptions to this rule, however, can be found in the seventies when the insufficient local production of certain products and the local content requirements became severely incompatible.

<sup>5</sup>Also the definition of these requirements were also changed from domestic production to domestic purchases, which in many cases allowed for imported parts purchased from a domestic subsidiary to be accounted for the requirements. See Unger (1990 p.150).

production units of transnational corporations.

As a result of these policies, the evolution of the production and the interaction between the sectors in the industry have taken different forms. In the 1970s the growing automobile vehicles market increased the demand for autoparts. Beginning from the 1980s the growth of the automobile industry has been shaped by the export orientation of individual sectors in the industry. For instance, in the early 1980s despite the declining domestic automobile vehicles market the automobile engines dominated by international capital became the booming sector. Lately, however, the assembly of automobiles has been the most dynamic sector.

The consequences of the industrial policies of the Mexican government in this sector has been a topic of continuous controversy. Today, it is a shared view among the experts that satisfactory degree of sourcing and backward linkages did not develop in the Mexican automobile industry.<sup>6</sup> For the most part, the inbound autoparts industries are technologically obsolete investments that were established to supply parts to the U.S. and Canadian assembly plants (Womack 1991, p.57). The rest of the autoparts industry is seen as an (inefficient) outcome of the protectionist era. On the other hand, the main feature of the automobile assembly in Mexico today is that most of the production takes place in the state-of-the-art-plants which achieve remarkable productivity levels (Shaiken 1990).

#### **4.2.2 Data and Definitions**

The aggregate data come from the national income accounts of Mexico collected by INEGI. The level of disaggregation used in this study is roughly at the three

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<sup>6</sup>See, for instance, Sklair (1989), Shaiken (1990), and Womack (1991).

digit international industrial classification level. There are three sectors of interest; automobile vehicles (56), autoparts and automobile bodies (57), and other transportation equipment (58). The last sector is included in some parts of the analysis for completeness. It should be emphasized that even though the data set includes the inbound industries which operate under special legislation and export most of their low value added output, the level of aggregation does not allow to distinguish between inbound and other industrial production.

Annual machinery and equipment stock, and investment figures are from Banco de México. 1990 is the latest available year in these series. Employment in what follows refers to production and non-production workers who received wage and salary payments.

Automobile vehicles sector (57) consists of manufacturing and assembly of passenger cars and vans, busses, trucks and tractors. However, the bulk of the production takes place in the 4 cylinder automobile production (X Censo Industrial, 1976). Almost all exports are under the category of 4 cylinder passenger cars, vans and small trucks. Most of the firms in the production of busses and trucks are owned by national capital with public participation.<sup>7</sup>

Assembly and manufacturing of autoparts and automobile bodies mainly comprises automobile bodies, assembly and manufacturing of the components of automobile engines, transmissions, suspensions, and breaks. There is substantial private national capital participation in the production of autoparts industry.

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<sup>7</sup>Unger (1990). This is mostly due to the fact that foreign firms were not allowed to produce certain kinds of diesel engines. For the state-owned firms in 1980 see Bennett and Sharpe (1985), Table 6.4.

### 4.2.3 Exports

Automobile industry has become the fastest growing export industry in Mexico, especially after mid-eighties. It is one of the most dynamic sectors of the economy (Dussel 1993). In 1993 affiliates of three U.S. automakers, General Motors, Chrysler, and Ford were the fourth, fifth and sixth largest exporting enterprises of Latin America, respectively.<sup>8</sup> Today, there are five major terminal auto producers in Mexico (Nissan and Volkswagen are the other two); all are owned by transnational enterprises.<sup>9</sup> In the U.S. import market, the market share of automobiles produced in Mexico was roughly 5 percent in 1991, and it has been growing steadily.<sup>10</sup>

Automobile parts and auto engines have been an important export industry in Mexico. In the 1970s and early 1980s, this sector was highly praised in terms of its competitiveness. In fact, within the U.S. import market, the autoparts industry had 15 percent share in 1991; higher than automobiles. In the early eighties the exports of auto engines from Mexico to the United States showed a marked increase. This was primarily due to the exports of the affiliates of the three U.S. automakers which were located in Mexico to reduce production costs of their assembled cars in the U.S. In that sense, these figures mostly reflect intra-firm trade pattern. For instance, in 1985 66 percent of the auto engine exports of Mexico originated from three plants only; Ramox Arizpe (General

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<sup>8</sup> *La Hornada*, August 16, 1993, p. 45, quoted in Arteaga (1993).

<sup>9</sup> Mexican affiliate of Renault stopped production in Mexico in 1986, yet continues to produce and export engines to France at a declining scale. Volkswagen, which was the biggest automobile exporter to the U.S. market from Mexico during the 1970s lost its market share considerably, and as of 1994 had still not reached to the 100,000 units per year that once it has achieved.

<sup>10</sup> Market share figures are from Arteaga (1993).



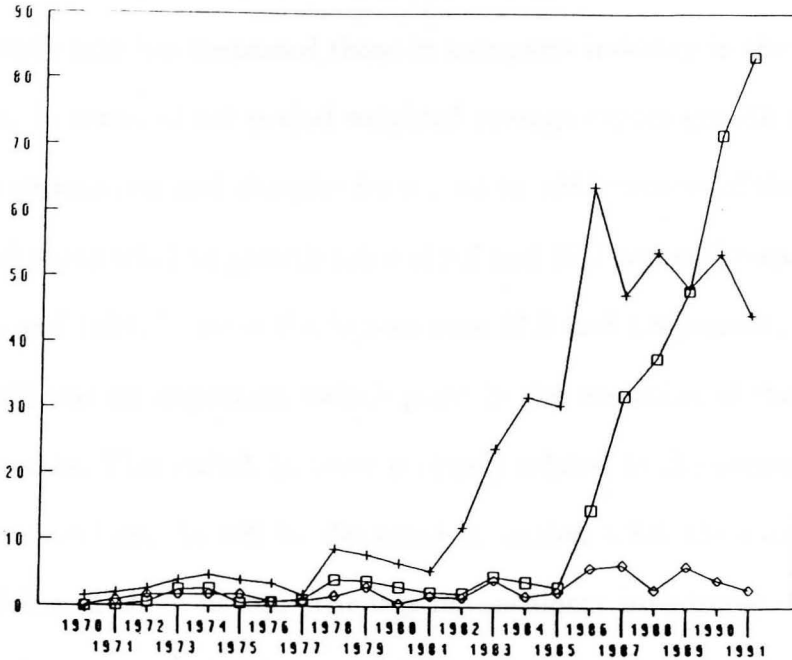


Figure 4.1: Exports of the Automobile Industry, 1970-1991  
 □: Automobile vehicles, +: Autoparts, ◇: Other transportation equipment. In billions of 1980 pesos.

Motors), Saltillo (Chrysler), and Chihuahua (Ford).<sup>11</sup> Note, however, that the concentration of exports is not markedly different than the figures pertaining to 1975, when three firms with foreign equity participation accounted for 70 percent of the automotive-parts exports.<sup>12</sup> Yet the changing composition of the foreign participants is indicative towards the increasing importance of intra-firm trade.

The evolution of exports in the automobile vehicles, autoparts and other transportation equipment industries are presented in Figure 4.1. The data delineates the two important turning points of the export sector, 1981 and 1985: a boom period for the autoparts from 1981 to 1985 and a subsequent boom for the vehi-

<sup>11</sup>Urgen (1990). General Motors also has a automobile assembly plant in Ramox Arizpe, whose exports only reached to 17 percent of the exports of the unit that produces motors. This shows the orientation of the enterprise in different products.

<sup>12</sup>These were Transmisiones y Equipos Mecánicos (Clark Equipment), Equipo Automotriz Americana (foreign participant known but unidentified), and Rassini Rheem (Rheem International). See Bennett and Sharpe, Table 8.1.

cles from 1985 onwards. It is also clear from the figure that after 1986 automobile exports growth rate has surpassed those in autoparts industry in the later part of the eighties. In terms of per period weighted average export growth rates the following two sectors contrast sharply; from 1981 to 1985 exports of the automobile vehicles and autoparts had growth rates of 8.2 and 27.7 percent, respectively. Between 1986 and 1991, however the figures were 37.9 and 1.8 percent, respectively. Clearly, 1986 was an important switch point in the evolution of the automobile industry exports. This switch however is closely related to the patterns of investment in these sectors. As will be discussed in section 4.2.6, the exports of these industries follow a three to four year lags in machinery investment. Both export boom periods were preceded by heavy investment activity in respective sectors, especially by transnational corporations. In the cutoff year of 1985 almost 73 percent of the exports of the automobile industry were by the auto engines sector only, whose exports, as mentioned earlier, were predominantly claimed by transnationals. Autoparts' and automobile vehicles' shares were modest 20 and 7 percent, respectively.<sup>13</sup> Undoubtedly, increase in automobile exports after 1985 owe much to new establishments such as Ford at Hermosillo which was planned for export oriented production only. Thus the relative and somewhat absolute decline in the autoparts exports can be partially explained by the changing market conditions in the U.S. market. Finally, exports in sector (58) has been low throughout the period.

The fact that, there has been a shift in the composition of exports from autoparts to finished automobile, in view of the linkages hypothesis suggest that the

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<sup>13</sup>Data are from INEGI, *Anuario Estadístico del Comercio Exterior de los Estados Unidos Mexicanos*, 1985, 1987.

output composition of the autoparts sector should change but should be positively affected. More specifically, if there are externalities due to export growth, then it is reasonable to expect these efficiency gains to be realized in the autoparts industry due to growing vehicle industry exports.

#### **4.2.4 Value Composition of Automobile Industry**

The selection of automobile industry as a whole to study backward linkages is justified by the fact that there is substantial interaction within the industry's subsectors. This interaction is mostly between autoparts and automobile bodies, and assembling of automobile vehicles; the former is the producer of intermediate goods and the latter is the producer of final goods. In order to document this interaction, Mexican input-output table is used. 1980 is the latest year for which this data is publicly available. Data extracted from the national input-output table is presented in Table 4.1. The data shows that sector (58) has a relatively insignificant share of value of output in the automobile and transportation equipment industry.

Table 4.1 shows that automobile vehicles (56) has a large import component; roughly 50 percent, and this contrasts with the relatively high domestic input share of the autoparts industry (57) and other transportation equipment sector (58). It is important to note that 35 percent of the total inputs of the automobile industry come from the autoparts industry. In return, 45 percent of the total value of production in the autoparts industry is purchased by the automobile industry. As indicated by the data, the purchases of the autoparts industry from the automobile industry consists a small portion of the former sector's inputs, as well as a small share of the total value of production of the automobile industry.

Table 4.1: Mexican Automobile Industry  
Extract from 1980 Input-Output Matrix

<i>Inputs</i>	<i>Sales</i>		
	(56)	(57)	(58)
Automobile vehicles & tractors (56)	185	102	2
Autoparts and bodies (57)	27,183	4,101	72
Other transportation equipment (58)	0	0	774
Total domestic inputs	53,797	29,253	7,009
Total imports of intermediates	24,681	4,581	1,307
Total inputs	78,478	33,834	8,316
Gross value added	36,849	26,510	9,823
Salaries and wages	12,378	11,573	6,320
Profits and interest payments	17,655	14,134	3,602
Indirect taxes net of subsidies	6,816	803	(99)
Total value of production	115,327	60,344	18,139

*Notes:* Data from Banco de México. All figures are in billions of current Mexican pesos. Only the sectors of interest are included in the table.

Hence, as expected the interaction between these two industries is a one way seller (autoparts) and buyer (automobile) interaction, as implied by backward linkages.

It should also be noted that a significant percentage of the value added in the autoparts and automobile bodies industry (57) comes from the autoparts industry. Data from the national income accounts of INEGI at roughly 3-digit industrial classification level indicates that in 1980 more than 90 percent of the value added in this sector was produced in the autoparts industry (see Figure 4.2).<sup>14</sup> Industrial censuses which are conducted almost in every five years also exhibit the same tendencies; between 1975 and 1988 the value added share of the automobile bodies industry within the autoparts and automobile bodies industry has been less than 10 percent, and, in 1988 it has declined to 4 percent. Hence it is legitimate to refer to the autoparts and automobile bodies industries jointly as autoparts.

#### **4.2.5 Changing Structure of the Automobile Industry**

##### **Output and Employment**

Two figures are provided to emphasize the industry differences between automobile and autoparts sectors. Figure 4.3 shows the data on output and employment in the three sectors of interest. Both the employment and output figures of the transport equipment sector (58) indicate that the importance of this sector in the automobile and transportation equipment industry is very low, and overall in the Mexican economy its relative significance has been declining. Hence in what follows this sector will be omitted from the analysis.

The data indicates that after 1986 the increase in the value of output in the

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<sup>14</sup>Continuous national income series at 3-digit level became available after 1980.

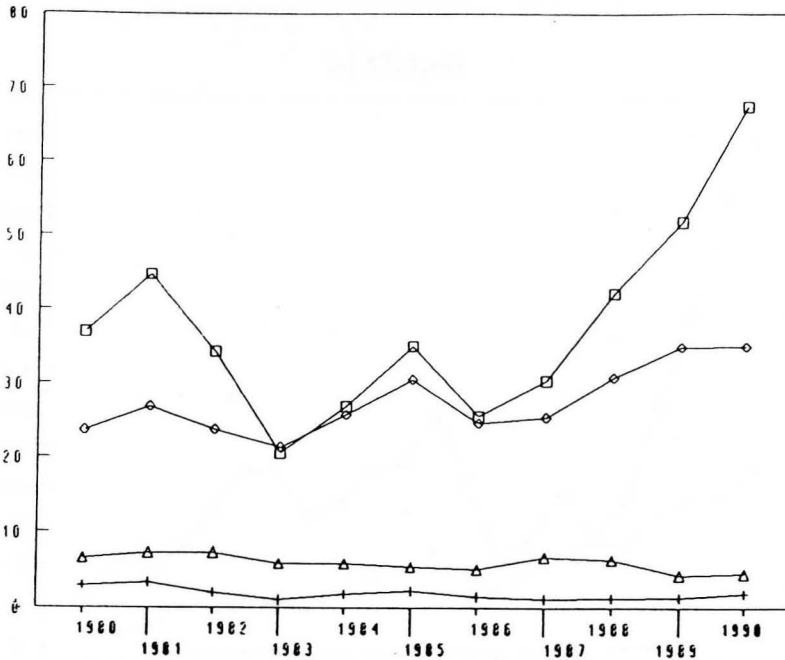


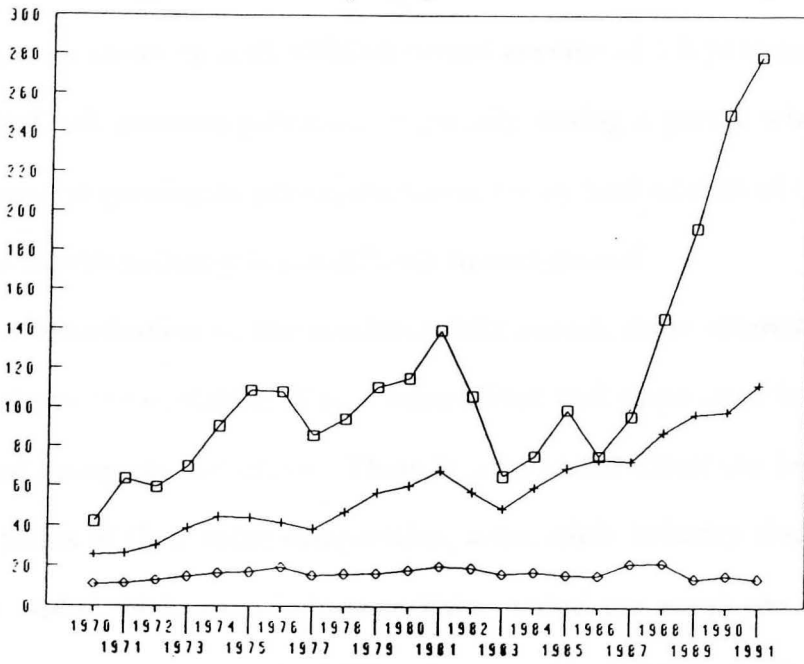
Figure 4.2: Value Added in the Mexican Automobile Industry, 1980-1991

□:Automobile vehicles, ◇:Autoparts, +:Automobile bodies,  
 △:Construction and repair of railroad equipment. In billions of 1980 pesos.

automobile vehicles industry has surpassed that in the autoparts sector. It is important to note that the gap between the growth rates took place despite the fact that local input requirements were raised to 55 percent in 1981. As in the case of exports 1986 is an important turning point in the evolution of the industry. Between 1981 and 1985 the period weighted average output growth rates were 15.8 and 11.4 percent in the automobile vehicles and autoparts industries, respectively. Between 1986 and 1991 the figures are 24.9 and 10 percent, respectively. The gap between the growth rates of these industries widens during a period when the terminal firms in the industry are entering international markets.

Another important feature of the data is the large employment absorption capabilities of autoparts and other transportation equipment industries *disproportional* to their output generation when compared to the automobile vehicles industry. Employment, over the period, has grown steadily in the autoparts sec-

a) Output



b) Employment

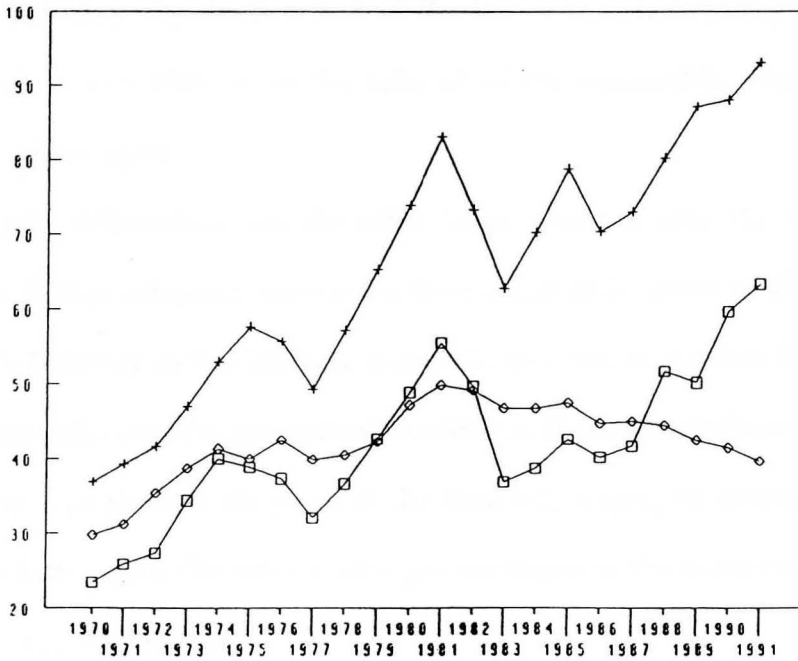


Figure 4.3: Output and Employment, 1970-1991  
 □: Automobile vehicles, +: Autoparts, ◇: Other transportation  
 equipment. Output is in billions of 1980 pesos.

tor (2.9 and 3.4 percent between 1981-85 and 1986-91, respectively). In the vehicles sector after a slight decline in the period 1981-85 (-.4 percent), employment showed a strong recovery with 1986-91 period average of 7.9 percent. Given its apparent high job creation potentials, especially during a period when Mexican economy was not growing in per capita terms, the special interest of the Mexican government in this industry is not difficult to understand.

A closer examination of the available data reveals more interesting results. Table 4.2 shows the evolution of real value added and wage rates in automobile vehicles and autoparts industries. There is substantial difference between these sectors in terms of their value composition; automobile industry singles out as a high value added, high wage industry. Value added per employee in the automobile industry was, during the 1970s, almost twice as much as the one in the autoparts industry. By the first half of the 1980's this discrepancy had declined but beginning from 1986, after the take off of the automobile exports, the gap started to widen again.

Wage rate differentials, on the other hand, declined over the entire period; real wages in the autoparts have risen from a low of 50 percent of the wages in automobile industry in the 1970s to almost 70 percent, in the late 1980s. In fact, while the growth rate of wages and value added in the vehicle industry was roughly seven percent in the last six years of the data set, wages, on average, have been increasing faster than the value added per employee in the autoparts industry (8 and 1 percent, respectively).

The sectoral data presented in this section can be compared with a recent study conducted for the Ministry of Labor based on the manufacturing surveys of the years 1984, and 1986-1989 (Secretaría 1993). This study, which was based



Table 4.2: Value Added and Real Wages, 1970-1991  
(Averages and standard deviations)

<i>Period</i>	<u>Automobile Vehicles</u>		<u>Autoparts Industry</u>	
	<i>va/l</i>	<i>w</i>	<i>va/l</i>	<i>w</i>
1970-1991:	747 (202)	262 (83)	360 (42)	147 (21)
1970-1981:	653 (89)	307 (74)	332 (26)	152 (15)
1982-1985:	688 (94)	189 (40)	377 (26)	126 (19)
1986-1991:	976 (236)	219 (64)	403 (31)	149 (22)

*Notes:* *va/l* is value added per employee, *w* is the real wage rate. All value figures are in thousands of 1980 Mexican pesos.

on the establishment level data, has the advantage of using labor hours worked rather than the employment figures. The index of value added per labor hour from this study, and the figures pertaining to our data set are presented in Table 4.3. Notably, if the survey based data is taken as benchmark, the figures underestimate the growing discrepancy in value added per labor input between the vehicles and autoparts industries. In fact, by the end of 1989, this gap might have doubled compared to 1984, and, perhaps more strikingly, after the growth of automobile vehicles exports, the evolution of the value added per labor-hour worked has been in *opposite* directions in those two sectors.

### Size Structure of the Automobile Industry

There is a noteworthy methodological issue regarding the survey data used by the Secretaría study. The manufacturing industry surveys in Mexico mostly in-

Table 4.3: Value Added per Labor-Hour Worked, 1984-1989

<i>Sector</i>	1984	1986	1987	1988	1989
Automobile Vehicles (56)	100 (100)	105 (91)	137 (109)	182 (137)	206 (149)
Autoparts (57)	100 (100)	120 (94)	120 (93)	105 (102)	101 (106)

*Notes:* Data from Secretaría (1993), Tables C.4 and C.5. Numbers in parentheses are my calculations based on data from INEGI, national accounts, using total employment.

clude large size establishments. Hence these results are not sample results in the statistical sense. To the extent that large establishments in both industries are representative of the entire industry, accurate generalizations can be drawn. Yet the representativeness of the large size establishments in Mexico during the economic restructuring of the 1980s is questionable. Based on the same micro level data Brown and Domínguez conclude that during the eighties small and medium size manufacturing units were the most adversely affected in terms of output and value added, while large units fared better. For instance, from 1984 to 1989 in the small size (25 to 50 employees) establishments classified within the production of metals, machinery and equipment industry, value added and employment, on average, decreased 11.2 and 9.9 percent, respectively. In sharp contrast, the very large size enterprises that employ more than 500 employees increased their value added and employment at 11 and 1.6 percent, respectively.

More disaggregated data from the industrial censuses provide some interesting insights regarding the evolution of the industry. Table 4.4 confirms that throughout the 1970s and until 1985, the expansion in the automobile industry was accompanied by increasing number of establishments which simultaneously reduced

the average establishment size. This trend seems to be more pronounced in automobile engines sector. Automobile vehicles industry, on the other hand, increased the average establishment size throughout the 1970s and 1980s. Another interesting aspect of the table is that the number of establishments covered by the census in the automobile vehicles was relatively stable, and actually decreased after 1988.<sup>15</sup> The sharp decline in the number of establishments in both vehicles and automobile engines industries after the 1985 census is another striking feature of the data.

The developments in the Mexican automobile industry during the eighties have forced many firms to exit the industry. The majority of those firms that faced difficulties were predominantly small size firms. To provide insight regarding this process, the distribution of establishments in the automobile industry (sectors (56) and (57)) with respect to their employment is presented in Table 4.5. It should be noted that in 1988 the number of small establishments with employment less than 50 declined below to its 1975 level. The most significant expansion, on the other hand, took place in the large (between 251 and 500 employees) and very large (more than 500 employees) establishments. In line with the employment figures the distribution of output by establishment was also shifting from small to large and very large establishments. For instance, while in 1980 small size establishments produced 3 percent of the output in the automobile industry, this figure declined to one third of a 1 percent in 1988.<sup>16</sup> Very large firms, on the other hand, increased their output share from 85 percent in 1980 to 88 percent in 1988. In the same period, while large establishments increased their share slightly,

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<sup>15</sup>Primarily due to plant closings by Renault and state-owned enterprises during the economic crisis.

<sup>16</sup>Figures are from X, and XII Censo Industrial.

Table 4.4: Size of Establishments in the Automobile Industry

<i>Sector</i>	a) Number of Establishments				
	1970	1975	1980	1985	1988
Automobile Industry (56+57)	626	714	937	1216	852
Manuf. of Automobiles (56)	22	21	21	31	17
Manuf. of Auto Bodies	189	229	256	254	290
Manuf. of Auto Engines	5	43	266	468	102
Manuf. of Transmissions	n.a.	28	43	32	33
Manuf. of Suspension	n.a.	57	48	26	64
Manuf. of Auto Breaks	n.a.	45	46	57	57
Manuf. of Other Autoparts	410	291	257	328	289

<i>Sector</i>	b) Average Employment per Establishment				
	1970	1975	1980	1985	1988
Automobile Industry (56+57)	92.6	131.8	116.3	120.0	160.7
Manuf. of Automobiles (56)	969.9	1734.8	1472.7	1921.5	2389.4
Manuf. of Auto Bodies	29.0	40.3	47.0	51.8	38.7
Manuf. of Auto Engines	609.2	244.9	95.9	55.4	298.3
Manuf. of Transmissions	n.a.	294.8	264.7	250.0	260.3
Manuf. of Suspension	n.a.	77.3	91.0	164.7	80.8
Manuf. of Auto Breaks	n.a.	85.2	140.7	143.1	104.1
Manuf. of Other Autoparts	68.6	73.6	71.2	81.9	120.9

*Notes:* Data extracted from INEGI, *Censo Industrial*, 1971, 1976, 1981, 1986 and 1989. n.a., not available.

Table 4.5: Distribution of Establishments by Employment

Number of Employees	Number of Establishments			
	1970	1975	1980	1988
less than 50	469	746	652	578
from 51 to 250	114	123	133	155
from 251 to 500	16	30	32	55
more than 501	27	38	40	64

*Notes:* Data extracted from Censo Industrial, 1971, 1976, 1981, and 1989.

medium size ones retained their relative position.

#### 4.2.6 Evolution of Equipment and Machinery

During the 1980s, automobile vehicles and autoparts industries also had substantially larger total factor productivity (TFP) growth rates compared to the entire manufacturing industry; between 1984 and 1990 automobile vehicles industry (56), and autoparts industry (57) had average TFP growth rates of 23 and 10 percent, respectively (Brown and Domínguez). It has been suggested that the main factors behind this growth was the more efficient use of factors of production in response to rising interest rates. Interestingly enough, fixed capital stock net of depreciation increased continuously in the vehicles industry until 1986, and stabilized in the following years. In the autoparts industry, on the other hand, net capital stock declined since 1982. Therefore, the gains in total factor productivity in these two industries are occurring due to different reasons; while the vehicles industry expanded its capital stock and used it more efficiently, autoparts industry disposed of the obsolete capital stock, which rendered the existing stock, on average, more

efficient.

Machinery and equipment comprises roughly 55 percent of the entire capital stock in the vehicles industry and 70 percent in the autoparts industry. Even though this figure has been fairly stable for the former industry, it declined for the latter from an average 76 percent between 1970-1981 to 65 percent from 1986 to 1990. Table 4.6 presents the evolution of the machinery and equipment in the automobile vehicles and autoparts industries. The vehicle industry, as the table shows, is more capital intensive by two measures; machinery-output and machinery-labor ratios. As indicated above for the net capital formation, per period gross machinery and equipment growth rates differ across two sectors: automobile vehicles industry expanded its machinery stock during the nationwide economic crisis years and then slowed its growth process after 1986.<sup>17</sup> Autoparts industry, on the other hand, has been facing an acute and exacerbating slowdown in machinery and equipment formation.<sup>18</sup>

### 4.3 Concluding Remarks

It is worthwhile to summarize the data presented above. Data from 1970 to 1991 suggest several important issues: first, both automobile vehicles and autoparts industries were affected by the economic crisis during the first half of the 1980s. The automobile vehicles industry overcame the crisis after an expansion in foreign

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<sup>17</sup>The growth of the capital stock in the automobile industry during a period of general decline in capital formation in Mexico is an indication that credit constraints were not a significant determinant of the decline in investment in manufacturing industry after 1982. See also Chapter 2.

<sup>18</sup>Net machinery and equipment capital stock growth figures exhibit a very similar pattern.

Table 4.6: Evolution of Machinery and Equipment Stock, 1970-1990

<i>Period</i>	Automobile Vehicles			Autoparts		
	<i>mach/q</i>	<i>mach/l</i>	<i>Machinery growth</i>	<i>mach/q</i>	<i>mach/l</i>	<i>Machinery growth</i>
1970-1990:	0.305	0.124	12.7	0.298	0.048	9.1
1970-1981:	0.175	0.073	13.9	0.261	0.043	12.9
1982-1985:	0.513	0.174	16.2	0.422	0.060	5.2
1986-1990:	0.449	0.206	6.9	0.288	0.049	3.0

*Notes:* *mach/q* is the machinery and equipment-output ratio, *mach/l* is the machinery-labor ratio. Gross machinery and equipment stock figures are used. Data are from INEGI, and Banco de México.

markets and growing domestic demand. The autoparts industry, on the other hand— partially due to the elimination of its traditional export markets— went through a prolonged industrial restructuring. Rising real wages in the autoparts sector, as well as the restructuring taking place in the capital stock of this sector, suggests that small scale, owner managed firms have been exiting the industry. Also, there is strong evidence that average firm size measured by employment and output increased in the second half of the 1980s. Production became more and more concentrated in large scale enterprises.

The relatively different performances of these two sectors in the second half of the 1980s is primarily due to the changing needs of the automobile vehicles industry worldwide, and the difficulties of adopting to that new environment. Especially, a large percentage of the small scale production units, specialized in the production of single products seem to be in a disadvantaged position in the competitive environment of “global sourcing” and product standardization. To the extent that scale is a proxy for product quality and product standardization,

the data suggests that small firms, which cannot meet the quality and quantity expectations of the firms competing in international markets, are the ones losing the most. Yet the inability of larger autoparts producers to meet the demands of the assembly firms is indicative of a more structural problem in the industry. In fact, even the large local firms failed to achieve the productivity levels that would match the scale and quality demanded by final automobile manufacturers. The main bottleneck for the sustained growth of the industry thus seems to be the technological capabilities of the local producers, rather than simply operation at less than the optimum scale.

All these facts indicate that the hopes of the Mexican government, which perceived the automobile industry as a “strategic” industry, have not been realized. Contrary to the expectations of the export oriented growth advocates, there is also no indication that export growth provided a sustainable productivity *and* output growth in integrated industries. Although both of these sectors realized high TFP growth rates in the 1980s, they had substantially different output growth trajectories. This phenomenon suggests to inadequacies involved in the export oriented growth framework. In fact, low (and negative) growth rates of the Mexican economy in the 1990s indicate that the productivity and output growth have been confined to several manufacturing industries only. Thus it seems that backward linkages in the automobile industry have been very “weak”, if existing at all.

The protection and legal framework provided for the automobile industry during the 1960s and 1970s helped to generate a large autoparts sector in Mexico. But the growth and export potentials of this sector was based on two factors: demand from domestic producers who were required to attain local domestic input requirements, and demand from mainly U.S. automobile producers. An analysis of



the latter issue from an industrial organization standpoint is beyond the scope of this study. However transnational corporations' global investment decisions were critical in the expansion of the automobile industry in Mexico and the growth of its exports. For instance, in the 1970s, as manual transmissions were becoming less and less popular in the U.S., their production, as well as the manufacturing of environmentally hazardous products (such as springs), were primarily carried out in Mexico (Bennett and Sharpe, p. 185). As the U.S. automobile industry underwent a restructuring between the first and second oil shocks, the demand for autoparts for older generation cars was curtailed. Furthermore, Mexican autoparts producers seem to have lost their "traditional" domestic customers, namely terminal firms in Mexico. This last generation automobile assembly plants in Mexico are characterized as being "world class". Big three U.S. automobile producers located numerous plants in Mexico in response to fierce competition with Japanese auto producers. These plants had already targeted the U.S. market for their final sales at the beginning of the 1980s. As the production becomes more global, the competition that the Mexican autoparts producers face, will intensify.

Another important development in the industry has been a shift towards more complete autoparts compared to the past. For instance, terminal firms are sourcing more and more from the manufacturers of complete transmission boxes as opposed to assembling transmission parts. The Mexican autoparts industry have already lagged behind this higher technology— a market mostly dominated by firms from Taiwan and Republic of Korea. Whether the Mexican autoparts industry will manage to survive the repercussions of global sourcing will depend on its achievement of higher product quality, and capacity to reduce their delivery

lags.<sup>19</sup> The most recent experience in the Mexican automobile industry suggests that backward linkages are not an automatic mechanism that would provide this “push” for the autoparts industry.

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<sup>19</sup>These were the two main points brought to our attention by the managers during a factory visit in Mexico. This firm, which was well-known for the high local content in its previous models is becoming more and more dependent on foreign sourcing as it expands to newer models and tries to increase its share in the U.S. market.