

The Mexican Automobile Industry and International Trade, 1970-1983*

Lila J. Truett**
and
Dale B. Truett

This study examines the growth of the Mexican automobile industry since the 1960s and its relation to Mexico's trade and foreign exchange problems. Statistical data presented on production, value added, employment, productivity, and international trade show that growth of the industry has been dramatic, that productivity has increased, and that the trade deficit of the industry has fallen as a proportion of the total deficit of the manufacturing sector. The government has adjusted its policies toward the industry many times, gradually moving from import substitution, to foreign exchange budgeting, to export promotion. A regression analysis of the relation of net automotive exports to domestic GDP, relative prices, and government policies enacted in 1977 provides results consistent with a "vent for surplus" explanation of exports, the law of demand, and the expected policy impact. It is likely that future growth will be increasingly oriented toward the U.S. market, thereby changing the historical relation between exports and Mexican GDP.

I. Introduction

Mexico's well-known and persistent difficulties in international

* Special thanks are due Lic. César Flores E. and Lic. Félix Rojas Cruz, of the Asociación Mexicana de la Industria Automotriz, for their cooperation in the data-gathering phase of this study.

** The authors are professors in the Division of Economics and Finance at The University of Texas at San Antonio.

trade and payments have spurred its government to take many steps to ensure that domestic industries grow in ways that do not exacerbate its balance of payments dilemma. Historically, Mexican planners have taken the position that the motor vehicle industry generates adverse balance-of-payments pressure and has great potential for becoming a massive net importer of intermediate goods. However, with the enormous United States market for automobiles at its doorstep, Mexico has also entertained hopes that substantial exports of vehicles and parts might be possible.

The purpose of this paper is to examine the progress of the Mexican motor vehicle industry over the past 15 years, especially in order to (1) assess its historical impact on international trade and (2) evaluate its potential for becoming a net earner of foreign exchange. We should note at the outset that government intervention in the industry has been quite intensive ever since 1962, when policymakers decided to force private firms (primarily multinational corporations) assembling vehicles in Mexico to either invest in full-scale manufacturing facilities or leave the country (in Mexico, such policies are effected through executive orders known as "decrees," or, in Spanish, "decretos"). The policy odyssey since 1962 will be traced in the third section of the paper, and this will be followed by a regression analysis of the trade balance impact of the industry. However, immediately below we begin our discussion with a statistical description of the expansion of the industry.

II. A Statistical Overview of the Industry

In the overview that follows, we survey the growth of production, employment, and international trade in the automotive and automotive parts industries over the decade from 1970 to 1980.¹

¹ There are two principal domestic sources of current and historical data on the Mexican automobile industry. These are (1) official government publications, such as annual data and occasional industry surveys published by the SPP, and (2) trade association data published by organizations such as the AMIA (Mexican Automobile Manufacturers Association). To some extent, the government relies on AMIA for certain of the data published in the official series. Nonetheless, there are numerous inconsistencies in the data (frequently due to differences in level of aggregation or definitions); and it is necessary to combine statistics from various sources in order to get a good picture of the industry's recent development.

Where data permit, we extend our presentation back into the 1960s or forward to 1983. The outstanding feature of the Mexican motor vehicle industry has been its rapid growth in production. However, it has been plagued by trade deficits and the shocks of temporary economic dislocations following substantial devaluations of the peso.

In 1962, when the first governmental decree to promote the move from assembly to manufacturing of vehicles was issued, there were nineteen motor vehicle *assembly* plants in Mexico. Most components were imported; and, by value, the domestic content level was reported to be only 15 percent for cars and 10 percent for trucks.² During the ensuing years, as assembly was eliminated, the number of automobile and light truck manufacturers generally has been eight (in 1984, Chrysler, Ford, General Motors, Nissan, Renault, Vehiculos Automotores Mexicanos, Volkswagen, and Diesel Nacional). An assortment of about a half dozen other firms have produced heavy tractor trucks (such as Kenworths, Whites, and Macks) or integral buses (long-distance or city buses not based on an ordinary truck chassis). In general, the tractor-truck and bus segments of the industry are considered to be quite different from the auto and light truck segment since the larger vehicles require a more labor-intensive production process and are characterized by fewer economies of scale in manufacture.

As a benchmark, it is worth noting that in 1962 assembly of vehicles in Mexico totaled 66,637 units.³ Table 1 shows that the firms that remained in operation under the new program produced in excess of 100,000 vehicles in 1965 and that, thereafter, the industry grew dramatically. In 1981, a production record of 597,118 vehicles was set. Output then declined by 28 percent in 1982 and 71 percent in 1983 as the peso tumbled disastrously. Preliminary AMIA data for 1984 indicate that production levels for the first two quarters were about the same as in 1983.⁴

² Gabriel Fernández Sáyo, "Industria automotriz," *Tres industrias mexicanas ante la A.I.A.I.C.*, 3, Mexico, D.F., Colección SELA, 1962, p. 87.

³ AMIA, *La industria automotriz de Mexico en cifras: 1976*, Mexico, D.F., 1977, p. 187.

⁴ Interview with Lic. Carlos Uriegas Ramírez, Gerente de Estudios Economicos, AMIA, May 1978, and interview with Lic. Félix Rojas Cruz, jefe del Depto. de Estudios Economicos, AMIA, March 1984.

Table 1

PRODUCTION OF MOTOR VEHICLES IN MEXICO: 1965-1983

Year	Automobiles	Trucks	Tractor Trucks	Integral Buses	Total
1965	70,242	32,266	505	571	103,584
1970	133,412	54,735	1,086	947	189,986
1975	237,118	115,075	2,724	1,707	356,624
1980	303,056	178,456	6,819	1,675	490,006
1981	355,497	231,963	8,217	1,441	597,118
1982	286,761	174,861	3,611	1,430	466,663
1983	192,052	80,037	451	275	272,815

Sources: AMIA, A.C. *La industria automotriz de México en cifras*, México, D.F., 1977, pp. 62-3 (with two corrections); 1982, p. 46; and *AMIA Boletín*, 217, enero 1984, p. 2.

Given the growth record of motor vehicle production in Mexico, it is not surprising to find that the industry's share of total manufacturing output and value added has tended to increase. In 1950, the motor vehicle industry accounted for only 3.5 percent of the value of manufacturing output and just 3.7 percent of value added in manufacturing. Once the government's integration program was in place, these proportions escalated to the 5.5 to 6.5 percent range; and they continued to grow until they reached about 8 percent in 1980 (see Table 2).

As the motor vehicle industry's share of total output grew, it also became an important generator of manufacturing employment. Employment more than doubled between 1970 and 1980 (Table 3), and it increased from 3.6 percent of the total manufacturing workforce to 5.5 percent. As Table 3 shows, productivity per worker also rose significantly, as did real wages. However, downturns in real wages did occur in the inflationary periods preceding the two major devaluations of the peso. It is likely that real wages are currently below their 1977-79 peak since the government has not allowed post-devaluation wages to rise as quickly as have prices.

While the motor vehicle industry has established an impressive record of growth in Mexico, through 1982 it tended always to have a substantial international trade deficit that at times rapidly

Table 2
MEXICO: PRODUCTION AND VALUE ADDED IN
MANUFACTURING SECTOR AND MOTOR VEHICLE INDUSTRY

Year	Value of Production				Value Added			
	Total		Motor Vehicle		Total		Motor Vehicle	
	Manufacturing	Motor Vehicle Industry	Industry as Percent of Total	Motor Vehicle Industry as Percent of Total	Manufacturing	Motor Vehicle Industry	Motor Vehicle Industry as Percent of Total	Motor Vehicle Industry as Percent of Total
1950	46,714.4	1,634.7	3.5		20,549.9	671.0	3.7	
1960	96,288.9	4,979.4	5.2		37,574.6	2,136.8	5.7	
1970	260,357.9	14,395.4	5.5		100,637.1	4,941.1	4.9	
1971	270,469.1	16,058.4	5.9		104,392.1	5,486.0	5.3	
1972	295,944.0	18,022.5	6.1		114,593.4	6,134.4	5.4	
1973	324,758.4	22,402.4	6.9		126,630.2	7,585.6	6.0	
1974	346,156.0	26,912.9	7.8		134,458.8	9,060.8	6.7	
1975	361,112.6	27,578.5	7.6		141,248.5	9,235.5	6.5	
1976	376,314.9	25,033.1	6.7		148,116.9	8,437.1	5.7	
1977	389,445.6	23,442.1	6.0		153,275.5	8,018.3	5.2	
1978	426,163.6	30,326.9	7.1		168,382.0	10,233.1	6.1	
1979	468,222.3	35,518.1	7.6		186,018.4	11,987.9	6.4	
1980	499,800.4	40,113.5	8.0		198,969.2	13,477.9	6.8	
1981					213,228.0	16,671.0	7.8	

* Value data in million pesos at 1970 prices.

Source: SPP, *La industria automotriz en México*, México City, D.F., diciembre de 1983.

Table 3
MEXICO: EMPLOYMENT SHARE, PRODUCTIVITY, AND WAGES IN MOTOR VEHICLE INDUSTRY

Year	Employees		Motor Vehicle			Productivity		Wages	
	Total Manufacturing	Motor Vehicle Industry	Industry as Percent of Total	Value Added Per worker (1970 Pesos)	Index of Value Added Per Worker	Average Annual Wages (1970 Pesos)	Index of Average Annual Wages		
1970	1,674,778	60,292	3.6	81,953	100.0	33,545	100.0		
1971	1,757,973	65,045	3.7	84,342	102.9	35,930	107.1		
1972	1,812,632	68,880	3.8	89,059	108.7	36,517	108.9		
1973	1,891,279	81,325	4.3	93,275	113.8	32,426	96.7		
1974	1,975,596	92,853	4.7	97,582	119.1	34,570	103.1		
1975	1,966,837	96,375	4.9	95,829	116.9	37,479	111.7		
1976	2,020,609	92,948	4.6	90,772	110.8	38,002	113.3		
1977	2,030,925	81,237	4.0	98,703	120.4	42,417	126.5		
1978	2,083,000	93,735	4.5	109,171	133.2	41,952	125.1		
1979	2,247,375	107,874	4.8	111,129	135.8	41,312	123.2		
1980	2,375,118	121,131	5.1	111,267	135.8	36,964	110.2		

Source: SPP, *La industria automotriz en México*, México City, D.F., diciembre de 1983.

increased. In Table 4, the motor vehicle industry is again compared to all manufacturing in order to assess its relative impact on Mexico's balance of trade. Over the period from 1970 to 1982, both the manufacturing sector and the motor vehicle industry posted significant trade deficits. However, preliminary data for 1983 indicate a small surplus for the motor vehicle industry (the source of this information is unofficial). Such a surplus, if verified, is probably attributable to (1) a very sharp reduction in overall vehicle production and (2) an increase in exports by Volkswagen de Mexico.⁵

As Table 4 shows, motor vehicle industry exports in recent years have become an increasing proportion of total exports of manufactured goods. After decreasing from an early peak of 8.3 percent in 1973, there was a dramatic upswing in the industry's exports in 1978 followed by significant gains in 1982 and 1983. Meanwhile, motor vehicle industry *imports* as a percentage of total imports of the manufacturing sector have been much lower since 1978 than previously. The overall result, as seen in the rightmost column of Table 4, has been a reduction in the proportion of the total manufacturing trade deficit attributable to the industry.

In the next section of this paper, we summarize the history of Mexican government policies regarding the automobile industry. We especially consider the 1977 decree, which was far more comprehensive than earlier decrees. We also more carefully consider the 1983 decree, which was a follow-up to the 1977 decree.

III. Mexican Government Policies Regarding the Automobile Industry

In the first half of this century, Mexican government policies regarding the motor vehicle industry were directed toward substituting domestic for foreign labor. An extremely high tariff on imported vehicles formed the primary policy incentive, although there were some limited efforts to promote the manufac-

⁵ See Table 1 above for drop in production. Volkswagen information is from interview with Félix rojas Cruz, *op. cit.*

Table 4
MEXICO: INTERNATIONAL TRADE OF MANUFACTURING SECTOR AND MOTOR VEHICLE INDUSTRY

Year	Exports			Imports			Trade Balance		
	Motor Vehicle Industry			Motor Vehicle Industry			Motor Vehicle Industry		
	All Manu- facturing (million dollars)	Value (million dollars)	Percent of All Manu- facturing	All Manu- facturing (million dollars)	Value (million dollars)	Percent of All Manu- facturing	All Manu- facturing (million dollars)	Value (million dollars)	Percent of All Manu- facturing
1970	794.0	27.8	3.5	2,143.8	287.0	13.4	-1,349.3	-259.2	19.2
1971	900.5	42.5	4.7	2,084.3	306.7	14.7	-1,183.8	-264.2	22.3
1972	1,126.3	60.1	5.3	2,397.9	295.8	12.3	-1,271.5	-236.1	18.5
1973	1,481.9	122.4	8.3	3,128.6	368.3	11.8	-2,367.4	-245.8	14.9
1974	2,039.5	158.2	7.8	4,486.0	678.7	15.1	-2,446.4	-520.5	21.3
1975	1,777.2	115.2	6.5	5,188.2	877.5	16.9	-3,411.0	-762.2	22.3
1976	2,088.6	96.7	4.6	4,893.1	860.4	17.6	-2,804.5	-763.7	27.2
1977	2,552.8	94.8	2.5	4,776.2	850.2	17.8	-2,223.4	-785.5	35.3
1978	3,365.5	369.7	11.0	6,781.3	1,114.0	16.4	-3,415.9	-744.3	21.8
1979	2,948.5	384.2	13.0	10,608.3	800.5	7.6	-7,659.9	-416.4	5.4
1980	3,352.7	403.9	12.0	15,964.5	908.4	5.7	-12,611.8	-504.5	4.0
1981	3,320.5	383.1	11.5	20,239.4	1,283.0	6.3	-16,918.9	-899.9	5.3
1982	2,981.5	489.1	16.4	14,455.1	1,228.2	8.5	-11,473.6	-739.1	6.4
1983	3,286.9	649.1	19.7	5,645.1	336.5	6.0	-2,358.2	312.5	

Sources: SPP, *La industria automotriz en México*, México, D.F., diciembre de 1983; AMIA, A.C., *La industria automotriz en cifras: 1982*, México, D.F., diciembre de 1982; SPP, *Boletín mensual de información económica*, various issues, México, D.F.; and *Excelsior*, Mar. 13, 1984.

ture of certain components and extend public sector investment into various segments of the industry.

The role of the Mexican government became far more interventionist in nature with respect to the motor vehicle industry in 1962 when an extensive development program was launched through the issuance of a presidential decree regulating the industry.⁶ Since that time, the government's policy goals have been to increase the production and domestic content of Mexican-made vehicles, to generate additional employment in motor vehicle manufacturing and related activities, and to reduce the adverse effect of the industry on Mexico's balance of payments.

The second and third decrees issued by the Mexican government regarding the motor vehicle industry, in 1972 and 1977, respectively, had primarily the same goals as the 1962 decree.⁷ However, the 1977 decree was much more far-reaching in its provisions for meeting these goals than were the two previous ones. For example, it was designed to force the motor vehicle industry to completely eliminate the trade deficit by 1982, and it provided that automobile prices were no longer to be government regulated.

Although the 1977 decree did appear to have a positive effect on output, employment, and the trade deficit of the motor vehicle industry, the trade deficit was not eliminated by 1982. Moreover, the government still hoped for greater progress in the areas of output and employment as well. Consequently, the government issued a fourth decree regarding the automotive industry on September 15, 1983.

The goals of the 1983 decree were quite similar to those of the earlier decrees. In fact, since some of the specific requirements regarding the percentage of national content in automotive

⁶ "Decreto que prohíbe la importación de motores para automóviles y camiones, así como de conjuntos mecánicos armados para su uso o ensamble, a partir del 10 de Septiembre de 1964," *Diario oficial*, Aug. 25, 1962.

⁷ See "Decreto sobre la industria automotriz," *Comercio exterior*, 22, noviembre de 1972, p. 1022, and "Decreto para el fomento de la industria automotriz," México: Presidencia de la República, June 20, 1977, and "Acuerdo que establece las reglas de aplicación del decreto para el fomento de la industria automotriz," Secretaría de Patrimonio y Fomento Industrial, México, Oct. 19, 1977. Mimeographed copies furnished by AMIA, A.C.

vehicles and parts and the foreign exchange budget for the motor vehicle industry had not been met by September 1983, one purpose of the 1983 decree seems to be an adjustment of these provisions to reflect economic reality and the alternative future requirements that the Mexican motor vehicle industry will be expected to meet.

For example, with respect to the minimum level of domestic content, the motor vehicle industry was to have achieved the following percentages by 1981:

	<u>Level of Domestic Content</u>
Automobiles	55%
Trucks	70%
Tractor-Trailers and Buses	75%

The Mexican Automobil Manufacturers Association (Asociación Mexicana de la Industria Automotriz) reported that the levels of national integration (content) given below were actually achieved in 1981.⁸

<u>Automobile Models</u>	<u>Level of Domestic Content</u>
Popular	58 to 80%
Compact	54 to 59%
Luxury	52 to 58%

<u>Trucks</u>	<u>Level of Domestic Content</u>
Light	67 to 69%
Heavy	78 to 82%
Tractor-Trailers	80 to 93%

If these figures are correct, the final motor vehicle industry came close to and, in some cases, exceeded the requirements of the 1977 decree. However, given the terms in the 1983 decree, the firms in the terminal industry may not have totally fulfilled the domestic content provisions.

⁸ AMIA, A.C., *La industria automotriz de México en cifras*, 1982.

As shown in the table below, the 1983 decree specified a lower level of national integration for 1984 than had apparently already been achieved, at least in some cases. However, these percentages increase somewhat for later years, and the respective levels of national integration are to be achieved for *each model*.⁹

Vehicle	Level of Domestic Content			
	1984	1985	1986	1987
Automobiles	50%	50%	55%	60%
Commercial and Light Trucks	65%	70%	70%	70%
Medium an Heavy Trucks	65%	70%	75%	80%
Semi-Trailers	70%	90%	90%	90%
Buses	70%	90%	90%	90%

As in the 1977 decree, the 1983 decree is designed to promote the production of the auto parts industry. Both decrees provide that the firms in the final product industry are not to produce any component parts produced by the parts industry unless they already produce them or are authorized to produce them. However, the firms in the terminal industry may receive authorization to produce additional parts if the parts industry cannot supply a sufficient number as long as an internationally competitive scale of production is maintained, the majority of the output is destined for export, and other requirements are met.

As indicated above, the 1977 decree specified that the foreign trade deficit with respect to the automotive industry be eliminated by 1982. This result was not achieved.¹⁰ The 1983 decree states that all firms in the final product industry should generate all of the foreign exchange necessary for their imports and that the foreign exchange budget for each firm will be determined by the Secretariat of Commerce and Industrial Development.

With respect to the computation of the foreign exchange generated by firms in the final product industry, both the 1977 and 1983 decrees state that the Secretariat will recognize 100 per-

⁹ See "Decreto para la racionalización de la industria automotriz." *Diario oficial*, 15 de septiembre de 1983, p. 5.

¹⁰ Preliminary data, however, indicate that the deficit may have been eliminated in 1983. See "Total de la balanza comercial por actividad económica de origen," *Excelsior*, 13 de marzo de 1984.

cent of the net foreign exchange generated through the export of vehicles, tools, and parts. Moreover, the 1983 decree provides that additional foreign capital invested in a firm and foreign financing of capital equipment will also be recognized. However, a maximum of 20 percent of the foreign exchange budget for a given firm may be met with external financing of assembly materials and repair parts.

As set forth in the 1977 decree, the 1983 decree specifies that firms in the terminal industry should generate at least 50 percent of the foreign exchange necessary to fulfill their budget with the export of automobile parts manufactured by properly registered firms in the autoparts industry. The value of the domestic materials, parts, and other components incorporated into exports of vehicles, motors, and other automotive products may be included in this percentage. In addition, a maximum of 20 percent of the annual foreign exchange budget may be generated from automotive parts produced by maquiladoras either owned by or affiliated with the respective firm in the final product industry.

In an attempt to force the automobile manufacturers to further take advantage of economies of scale in production, the 1983 decree establishes limits on the number of lines and models of automobiles that the terminal industry may produce. In 1984, they were allowed to produce no more than three lines of automobiles with no more than seven total models. For 1985 and 1986, the firms could produce only two lines of automobiles with no more than five models. In the 1987 model year, the terminal firms may produce one line with no more than five models.

In addition, the 1977 decree specified that if firms in the final industry were to produce more than one type of motor, they had to export at least 60 percent of the volume of production of the additional motor(s). The 1983 decree did not repeat this requirement. However, it did state that the terminal industry could not put 8 cylinder gasoline motors in automobiles and trucks for the domestic market after November 1, 1984, and November 1, 1985, respectively. The decree also stated that after November 1, 1985, no gasoline motors were to be used in heavy trucks for the national market. These conditions also appear to reflect some concern by the Mexican government for fuel economy, a goal that is expressed in several other locations in the 1983 decree.

The 1977 decree specified that at least 20 percent of the cars produced must be sold without optional equipment. This requirement was increased to 25 percent in the 1983 decree. In addition, the latter decree specifies that these units should correspond to the total production of one or more models.

Finally, the 1983 decree stated that the firms in the autoparts industry must be at least 60 percent Mexican-owned, and they must be registered with the Secretariat of Commerce and Industrial Development. Furthermore, they must maintain a level of national content in each product line equal to a minimum of 50 percent in 1984 and increasing to 60 percent in 1987. However, each firm must maintain a level of domestic content equal to 80 percent of the value of its output, *taken as a whole*.

Although the industry has made some progress in its international trade position in the recent past, the Mexican government has continued to demonstrate a great deal of concern over its propensity to run trade deficits. Certainly, this concern was expressed in the decree of 1977 as well as in that of 1983. As Table 4 showed, in the years immediately preceding the 1977 decree, the motor vehicle industry trade balance *was* deteriorating. The 1977 decree appears to have had a salutary effect, but some further data (Table 5) may help to show why the government has singled out the automotive industry for so much attention on the issue of trade.

In Table 5, the trade deficit of the motor vehicle industry and that of the manufacturing sector are compared with value added in each of the two. Except for 1979 and 1980, the deficit of the vehicle industry is much larger *relative to value added* than is that of manufacturing in general. Further, prior to 1978, the position of the former is again shown to be worsening. The marked improvements in 1979 and 1980 are important but probably are overstated in Table 5 since the trade data for the motor vehicle industry are from a noncomparable source (AMIA instead of the government). Given an earlier systematic differential between these data and those for previous years, it is likely that the vehicle industry deficit was in the neighborhood of 44 percent of value added in 1979 and 37 percent in 1980.

Despite the improvements that followed the decree of 1977 and the 1976 devaluation, the industry again posted large deficits

Table 5
MEXICO: RELATION OF TRADE DEFICIT TO
VALUE ADDED, ALL MANUFACTURING AND MOTOR VEHICLE INDUSTRY

Year	Value Added			Trade Deficit		
	Motor Vehicle Industry		As Percent of Value Added	Motor Vehicle Industry		As Percent of Value Added
	Manufacturing (million pesos)	Industry (million pesos)		Manufacturing (million pesos)	Industry (million pesos)	
1970	100,637.1	4,941.1	16,852.9	16.7	3,237.4	65.5
1971	112,743.5	5,486.0	14,785.1	13.1	3,299.9	60.2
1972	128,803.0	6,152.8	15,881.5	12.3	2,949.4	47.9
1973	156,641.6	7,813.2	29,568.5	17.0	3,070.6	39.3
1974	205,722.0	9,604.4	30,556.1	14.8	6,500.5	67.7
1975	244,924.9	11,295.0	42,602.8	17.4	9,520.2	84.3
1976	301,121.7	13,656.1	43,785.5	14.5	11,923.9	87.3
1977	419,515.0	18,217.6	50,491.8	12.0	17,837.1	97.9
1978	524,509.9	28,110.3	77,573.1	14.8	16,902.8	60.1
1979	679,711.2	39,092.5	173,948.5	25.6	9,455.3	24.2
1980	934,757.3	55,758.1	291,707.0	31.8	11,668.8	20.9

Sources: SPP, *La industria automotriz en México*, México, D.F., diciembre de 1983; AMIA, *La industria automotriz de México en cifras*, México, D.F., diciembre de 1982; Nacional Financiera, S.A., *La economía mexicana en cifras*, México, D.F., 1981; and SPP, *Boletín mensual de información económica*, various issues, México, D.F.

in 1981 and 1982. Thus, in the aftermath of the dramatic 1982 devaluation, the government remained concerned that the motor vehicle industry would again become a source of trade problems as general economic recovery and a sharp rise in production and imports became a real possibility. The decree of 1983 was no doubt drafted with this prospect in mind. In the following section, regression analysis is employed to further examine the apparent positive impact of the 1977 decree on the trade balance of the industry.

IV. Impact of the 1977 Decree on the Trade Balance

We have already emphasized that a primary objective of the 1977 decree was the elimination of the foreign trade deficit with respect to the motor vehicle industry by 1982. In this section of the paper, we use linear regression analysis to examine the effect, if any, of the 1977 decree on the trade balance for the automotive industry. Although the goal of complete elimination of the deficit was apparently not quite achieved by 1982, our results are consistent with the hypothesis that this decree did have a positive effect on the trade balance.

We hypothesized that the dollar value of net exports from the Mexican motor vehicle industry is a function of Mexico's real gross domestic product, Mexican prices for motor vehicle equipment relative to those in the United States, and the 1977 decree:

$$EX_M = f \left(GDP_M, \frac{P_M}{P_{US}}, D_{1977} \right),$$

where

EX_M = the dollar value of the net exports of the Mexican motor vehicle industry (in thousands of dollars),

GDP_M = Mexican real gross domestic product (in millions of 1970 pesos),

$\frac{P_M}{P_{US}}$ = The ratio of the wholesale price index for Mexican motor vehicle equipment to the corresponding index for the United States, and

D_{1977} is a dummy variable reflecting the presence of the 1977 decree.

We chose to use total rather than per capita GDP as our income variable because increases in real product are likely to have a disproportionate effect on domestic motor vehicle demand that per capita figures would not pick up. That is, as real output expands, demand for motor vehicles increases rapidly because (1) the largest share of incremental income is received by the middle and upper classes, who buy automobiles, and (2) business demand to replace older vehicles and expand fleets of trucks and utility vehicles also increases dramatically. Given Mexico's rapid rate of population increase, both of these phenomena could occur during a period in which per capita GDP did not change markedly.

Mexican real gross domestic product is expected to affect the value of net exports of the Mexican motor vehicle industry because of capacity constraints. In particular, Mexico historically has had problems with exporting manufactures to the United States when its own domestic economy is in an expansionary phase. Mexican manufacturers normally gear their productive capacity to domestic, rather than export, markets because domestic demand often expands very rapidly. Moreover, they are able to obtain higher prices in the domestic market than internationally since government policy has been highly protectionist. The typical pattern, then, is that exports of manufactures fall off when the economy expands since domestic plants approach capacity and direct their activities toward satisfying internal demand. In regard to automobile production, the U.S.-Mexico Chamber of Commerce has noted, "The manufacturers reportedly have been able to make substantial profits on production runs of as little as 3,000 units, mainly because demand for outstrips production and rising costs can be met through price increases. Thus, there is little incentive for greater productivity and more efficient operations."¹¹ Such a statement is consistent with the hypothesis that Mexican exports of automobiles are inversely related to the country's own GDP.

On the other hand, we would expect, *ceteris paribus*, that the

¹¹ "\$500 Million Ford Plant to Have Major Impact on Mexican Economy," *Washington Letter*, 10, 1, U.S.-Mexico Chamber of Commerce, Feb. 1984, pp. 1-4.

higher Mexican prices for motor vehicles and parts relative to those of the rest of the world, the smaller the value of Mexican exports. The producer price index for motor vehicle equipment in the United States is used as a proxy for the motor vehicle equipment price indices of nations that are potential importers of Mexican motor vehicle equipment. Finally, we used a dummy variable, D_{1977} , to reflect the presence of the 1977 decree (the value of D_{1977} was zero before 1978 and one thereafter).¹²

More precisely, we estimated the coefficients of the variables in the linear relationship below:

$$EX_{M_t} = \beta_0 + \beta_1 GDP_{M_t} + \beta_2 \frac{P_M}{P_{US}} + \beta_3 D_{1977_t} + e_t$$

As should be clear from the discussion above, we expect that β_1 would be negative because of capacity constraints and that β_2 would also be negative as a result of the law of demand. If the decree of 1977 had a positive impact on the trade balance of the Mexican motor vehicle industry, the value of β_3 will be positive. We used data from 1970-1981 in the analysis.

The regression results are presented in Table 6. The signs of the coefficients are as hypothesized and the $R^2 = .87$. The value of the Durbin-Watson statistic is such that the hypothesis of no serial correlation is not rejected (5 percent level of significance). The coefficients of the GDP_M and D_{1977} variables are significant at the 0.5 and 2.5 percent levels of significance, respectively. The coefficient of the relative price variable is significant at the 10 percent level of significance.

The results obtained for the coefficient of the GDP variable and that of the dummy variable for the 1977 decree are especially interesting with regard to the question of policy formulation. As

¹² Data for the regression analysis were obtained from the following sources: AMIA, A.C., *La industria automotriz de México en cifras*, 1982; Secretaria de Programación y Presupuesto, *La industria automotriz en México*, México, D.F., diciembre de 1983; Secretaria de Programación y Presupuesto, *Boletín mensual de información económica*, various issues; México, D.F., International Monetary Fund, *International Financial Statistics*, various issues, Washington, D.C.; and Office of the President, *Economic Report of the President*, various issues, United States Government Printing Office, Washington, D.C.

Table 6
REGRESSION RESULTS

$$EX_{M_t} = 1,101,973 - 1.637 GDP_{M_t} - 1,573,043 \left(\frac{P_M}{P_{US}} \right)_t$$

(-5.002)**** (-1.639)*

$+ 250,528.6 D_{1977_t}$ (2.343)***	$\frac{R^2}{.87}$	$\frac{DW}{2.216}$
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- * Significant at the 10 percent level of significance.
- ** Significant at the 5 percent level of significance.
- *** Significant at the 2.5 percent level of significance.
- **** Significant at the 0.5 percent level of significance.

was expected, domestic absorption (GDP) is negatively related to exports of the motor vehicle industry, suggesting that, at least to some extent, exports respond to the "vent for surplus" motive for international trade. Thus, when the Mexican domestic economy is expanding in real terms, the motor vehicle industry is hard pressed to supply domestic purchasers of automobiles and trucks. Importation of parts expands, and there is insufficient capacity for exports of either vehicles or components. In the absence of a restrictive measure such as the foreign exchange budget required by the decree, it is unlikely that firms would take steps to offset the balance-of-payments consequences of surges in parts imports and limited capacity to export.

The regression results are consistent with the hypothesis that the measures enacted in 1977 did improve the net international trade position of the industry. Although more evidence is needed about the policy impact, it seems reasonable that the government would choose to continue to insist that firms in the industry take steps to improve their effect on the trade balance. Moreover, policymakers would be prudent to expect that the industry's capacity limitations will lead to balance-of-payments pressure whenever the domestic economy is expanding. On the positive side, the industry might be expected to become a significant net exporter during periods of slack domestic demand.

V. Conclusions

The Mexican motor vehicle industry has made great strides over the last two decades in the areas of production and employment, and the industry is gradually becoming a more important part of the manufacturing sector in Mexico. In general, the motor vehicle industry has aggravated Mexico's trade deficits rather than helped to reduce them. Recently, government policy has focused on the industry's trade problem and on its relation to the domestic autoparts industry, although there has been continued formulation of rules intended to "rationalize" production by reducing model proliferation and increasing the size of model runs. There is some evidence that the 1977 regulations regarding foreign exchange budgets did lead to increased automotive industry exports. Both raw data on exports and the regression analysis above would tend to support this view.

Although the lag in processing and publication of Mexican economic statistics keeps us from extending the formal part of this study beyond what was presented above, data from the Mexican Automobile Manufacturers Association confirm several facts about the progress of the industry during the period from 1983 until mid-1986. Mexico's recession has had a devastating effect on production levels in the motor vehicle industry. Even though total output recovered significantly after 1983, by year-end 1985 it was still 40-percent below its 1981 peak. In mid-1986, the industry was in crisis, with total output below the 1983 level. However, the slump in domestic demand was indeed accompanied by an increase in exports of finished vehicles. The latter increased from 16,000 units in calendar year 1984 to over 60,000 units in 1985. This increase is in keeping with the findings of the regression model presented above.

In all likelihood, the Mexican motor vehicle industry will weather the current crisis in domestic demand and continue to grow once again. Clearly, this development is something that awaits government efforts to get other parts of its economic household in order (resolution of the debt crisis and breaking though myriad international bottlenecks). Historical data seem to suggest that the industry's fortunes will depend primarily on the *resurgence of domestic demand* since exports have not been positively related to GDP. However, the Mexican subsidiaries of

U.S. automobile companies have been developing new facilities geared increasingly toward a long-run strategy of exporting finished vehicles to the United States.¹³ To some extent, this is occurring because of recent Mexican government policies aimed at improving the cost picture and promoting exports. Thus, the relation between Mexico's GDP and its automobile exports may change profoundly within the next decade or so.

Currently, there are definite signs that exports of vehicles will continue to increase. Barring new U.S. trade restrictions against automobile imports, the multinationals operating in Mexico can be expected to take advantage of the fall in the peso to expand their production for export. An exchange rate-based cost differential has opened up new opportunities for exports, and if it remains once Mexico's domestic economy gets back on track, a new wave of investment in the motor vehicle industry probably will occur.

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¹³ See "\$500 Million Ford Plant..." *op. cit.*, and "Chrysler Tests Consumer Reaction to Mexican-Made Cars Sold in U.S.," *The Wall Street Journal*, July 23, 1984, p. 15.

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