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Industrial Deconcentration Policy: Venezuela

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In 1974 the Venezuelan government, conscious of problems caused by the concentration of activities in the north central area around the cities of Caracas, Maracay, and Valencia and the limited economic activity in lagging areas, decided to intervene in the spatial distribution of the country's manufacturing industry. A series of presidential decrees provided a legal framework for an industrial deconcentration policy. Evaluations of the results show little agreement: a report by the Ministry of the Environment (Ministerio del Ambiente 1979a, p. 81) claims that the behavior of the entrepreneur is changing, but a document prepared by the National Planning Office (Cordiplan 1979, pp. 7–9) indicates that the policy merely accentuated existing tendencies toward concentration of manufacturing activity in metropolitan Caracas and its surroundings. This study attempts to throw light on the debate.

Venezuela's industrial deconcentration policy had three aims: to prohibit the location of new manufacturing in the metropolitan region (Caracas and its surroundings); to induce industries that are considered hazardous to move to safer places and to encourage nonhazardous firms already located in the congested metropolitan region to move to designated development areas; and to attract new manufacturing plants to the designated development areas. The main policy instruments for carrying out industrial deconcentration have been direct incentives (including financial and fiscal incentives such as grants, loans, and tax concessions), indirect forms of assistance, such as the provision of industrial parks and the improvement of transport and communication facilities, and negative incentives, such as control over location. Incentives vary among zones in accordance with the national goal of reducing interregional disparities in wealth and well-being. Venezuela's five areas of industrial deconcentration are shown in map 9-1.

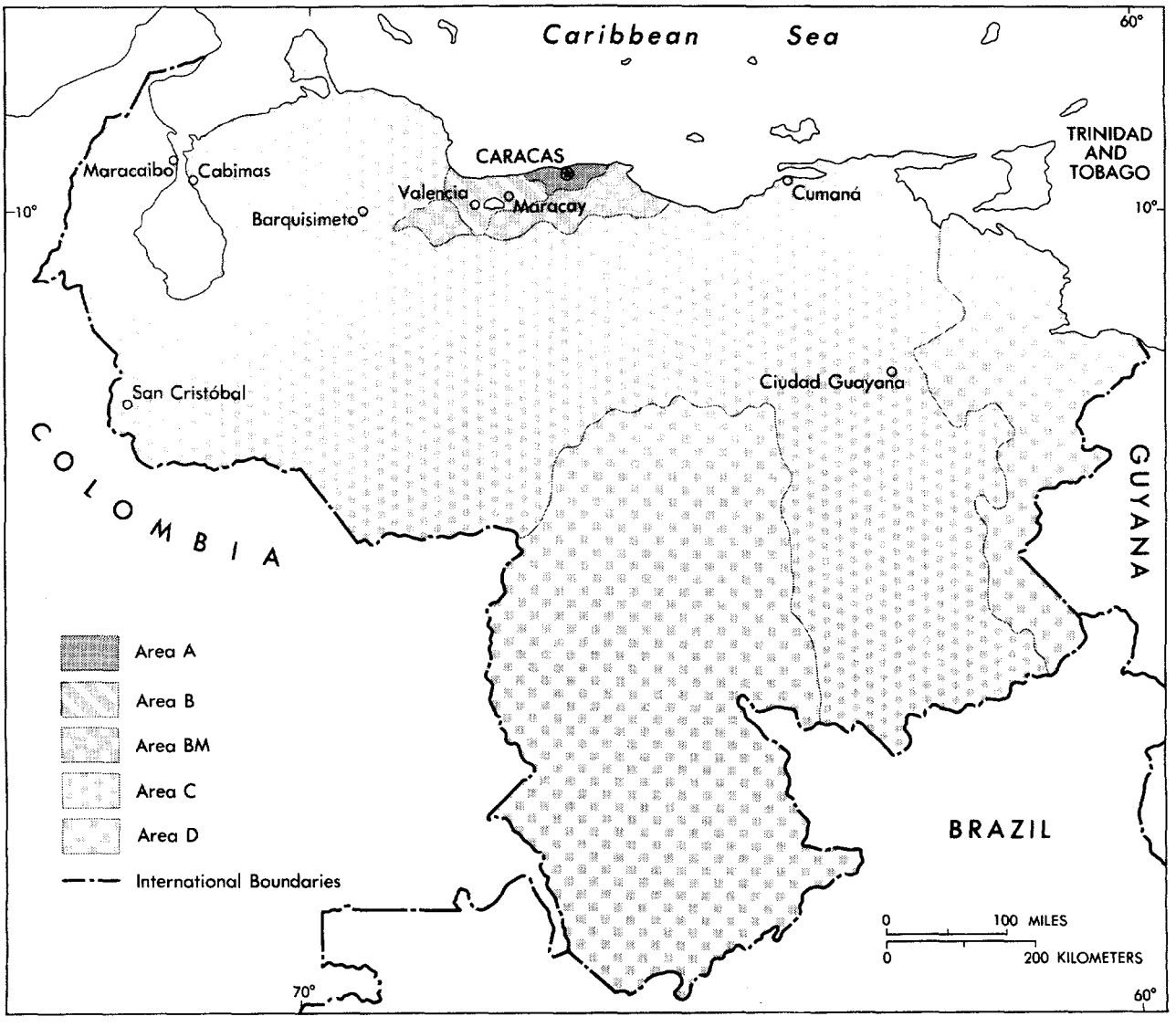
The main question is whether government instruments, including incentives and restrictions, have contributed to the deconcentration of industry. This question brings up more specific questions. Has deconcentration of industry taken place? Is deconcentration a result of the policy instruments? What other factors have influenced industrial location, and what has been their relative importance? The following sections attempt to answer these questions.

Has Deconcentration of Industry Taken Place?

The effects of industrial deconcentration policy are expected to be felt at the regional level. The firm is the basic statistical unit, and in this study it is defined to be identical to an establishment. Much of the data, such as the number of employees and the production value, is tabulated by firm. On the basis of aggregate data for administrative regions, used to identify changes in the distribution of establishments (table 9-1), it can hardly be concluded that the spatial pattern of industry by administrative region has changed substantially. At most, it can be said that between 1974 and 1976 the concentration of manufacturing in the Capital region increased by 5 percent at the expense of the other regions.

It may be argued that the results, when presented as a whole, may fail to illuminate the fact that individual industrial subgroups may behave differently. Several

Map 9-1. *Industrial Deconcentration Areas in Venezuela*



manufacturing sectors have therefore been selected for analysis. (A study of all the sectors is beyond the scope of this research.)

Of the twenty-seven three-digit ISIC (International Standard Industrial Classification) manufacturing codes, sectors having between 140 and 300 establishments—the middle range—were chosen for study. Eleven sectors were initially selected, after excluding (1) industrial sectors with many establishments that serve local markets and are little affected by regional policy (for example, bakeries) and (2) sectors that have such a small number of plants (probably serving national or international markets, as is the case with oil refineries) that studying them would yield only limited insights into locational behavior. Selected industries also had to experience a high rate of growth. The industries chosen had to have strong linkages with other manufacturing industries and with local input and product markets, as indicated by the input-output table of the Venezuelan economy, to include the possible effect of spatial policies on the location of transport-oriented industries. The levels of effective protection for the industries had to be diverse, as did their intensities of capital and labor. (The mean electricity consumption value, in kilowatt-hours per thousand hours, was used as a proxy to reflect any tendency toward deconcentration of labor-intensive industries.) Six three-digit ISIC codes were chosen for further study: textiles (321), leather products (323), plastic products (356), nonelectrical machinery and equipment (382), electrical machinery and equipment (383), and transport equipment (384).

Venezuelan manufacturing is concentrated in an axis that extends over parts of the Capital and Central regions. One way to ascertain whether deconcentration of

Table 9-1. ***Shares of Manufacturing Establishments, by Administrative Region***
(percent)

Region	*1971*	*1974*	*1976*	*1978*
Capital	51	50	55	54
Central	16	17	16	15
Centro-Occidental	8	7	7	7
Zuliana	8	9	7	7
Andes	7	8	7	8
Sur	1	0	0	0
Nor-Oriental	7	6	5	6
Guayana	2	3	3	3
Memorandum:				
Number of establishments	6,401	7,554	9,538	10,478

Sources: Cordiplan (1973); Oficina Central de Estadística e Informática (1974, 1976, 1978).

Table 9-2. ***Shares of Manufacturing Establishments in the Capital and Central Regions Combined***
(percent)

Industry	*1971*	*1974*	*1976*	*1978*
Textiles	84	88	88	88
Leather	76	71	77	75
Plastics	97	90	90	89
Nonelectrical machinery	69	71	77	75
Electrical machinery	91	88	90	87
Transport equipment	71	72	75	72

Sources: Same as for table 9-1.

manufacturing has taken place is to combine the shares of the Capital and Central regions, as in table 9-2. No major changes took place during the period of the study except in the plastics and nonelectrical machinery industries, which show a relatively higher share for 1971 and 1976, respectively; that is, no significant evidence of concentration or deconcentration can be found.

Because the results are not given for the officially defined areas of industrial deconcentration, a proper evaluation of the effects of the policy instruments is difficult. Furthermore, aggregate figures like those used here do not permit assessment of the spatial changes in the manufacturing industry. The data are for the net number of establishments that existed in a particular year and do not show the actual numbers of new firms established in an area, of firms that went out of business, or of plants that changed locations. Attempts were made to find data that overcome these limitations.

By comparing the 1974 and 1976 industrial directories, changes that occurred in 1975 and 1976 were identified. Similarly, by comparing the 1976 and 1978 directories, changes during 1977 and 1978 were identified. Once the directories were matched, factors could be examined for each period—for example, which firms were *new* (founded during the period); which *closed down* (went out of business); which were *stationary* (remained in the same location); and which *moved* to another location or from another region. The results of the matching (table 9-3) show the share of new establishments in the Venezuelan industrial axis (areas A, B, and BM on map 9-1).

Each of the six industries shows a similar trend toward deconcentration. Some of this may be a consequence of the big increases in income and demand in 1974–76 as a result of oil price increases. The effects of these increases were perceived mainly in Caracas and led to an unusually high concentration of new firms. Nevertheless, as table 9-3 shows, for leather, nonelectrical machinery, and electrical machinery the share of the industrial axis in the national total decreased by more than 33 percent by the second period. It thus appears that between periods these three industrial subgroups experienced deconcentration. Declines in the shares of the other manufacturing groups—textiles, plastics, and transport equipment—are mainly a result of the initial distortions created by the big increase in demand and therefore are not necessarily evidence of decentralization.

The absence of disaggregated data before 1974 places limits on the conclusions. When an industrial subsector shows a tendency to deconcentrate, the tendency may have started in 1974 or may have its origins in an earlier period. This uncertainty makes it difficult to relate the

Table 9-3. ***Share of New Manufacturing Establishments in the Industrial Axis***
(percent)

Industry	*1974–76*	*1976–78*	*Change*
Textiles	89 (82)	81 (26)	− 8
Leather	81 (52)	47 (17)	−34
Plastics	92 (98)	74 (27)	−18
Nonelectrical machinery	87 (87)	51 (33)	−36
Electrical machinery	88 (61)	33 (12)	−55
Transport equipment	76 (74)	59 (34)	−17

Note: Number of new firms is in parentheses.
Source: Author's estimates on the basis of the matched directories and Oficina Central de Estadística e Informática (1978).

pattern of industrial deconcentration to government policies. But the important issue is whether deconcentration of manufacturing took place over the two periods for which there is evidence for three of the six subsectors analyzed.

Is Deconcentration a Result of Policy?

Owing to difficulties in measuring the effects of regional policies (variables may be affected by migration and long-term structural changes as well as by regional policy), it is not possible to employ conventional statistical methods for rejecting or accepting hypotheses. Instead, we will assess alternative hypotheses on the basis of indirect evidence. Additional evidence from econometric models is discussed in subsequent sections.

Financial Incentives

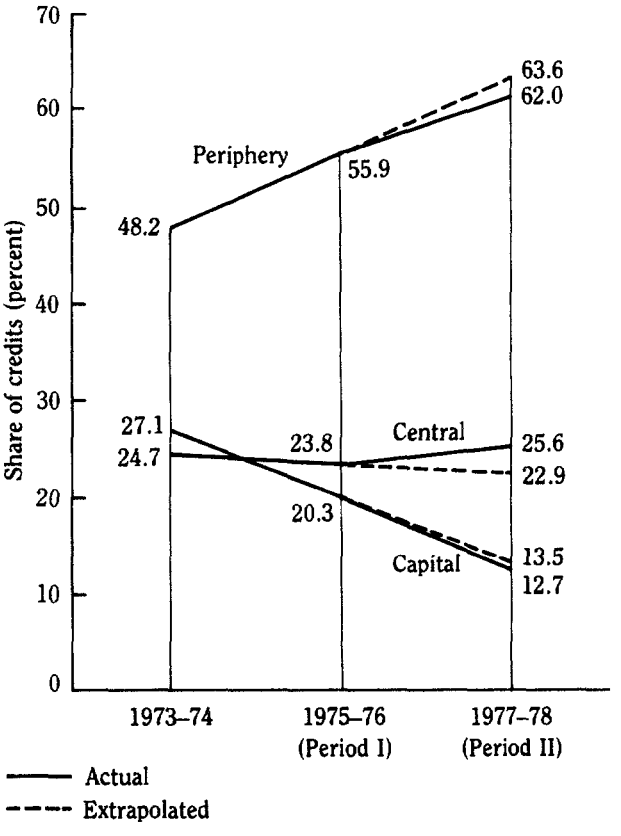
If industrialists took advantage of government-sponsored financial incentives in developing areas, this should be reflected in the number of credit applications in these areas. Available data are for number of credits awarded, not for number of applications; it is assumed that the proportion of applications approved does not vary by region. The number of credits granted to a region was thus used as a proxy for the number of applications. Similarly, the data did not differentiate between credits for new firms and for expansions; it was assumed that the proportion of expansions to new firms did not vary by region.

Figure 9-1 shows the actual and extrapolated shares of credits for the Capital, Central, and peripheral regions. The results suggest that the regional trends existed before the introduction of financial incentives in March 1976 and continued over the next two years, and that the introduction of the incentives may have had little additional effect on the spatial distribution of manufacturing.

Fiscal Incentives

A study by the Ministry of the Environment (Ministerio del Ambiente 1979b, p. 33) estimates that the savings from tax holidays represent only 1.5 to 2 percent of sales value. World Bank data indicate that—subject to caveats regarding statistical reliability—industrial profit rates are very high in Venezuela. When petroleum refining and the state-enterprise-dominated basic metal industries are removed from the total the average industrial profit rate, net of depreciation and taxes, in the 1970s rises from 19 to 28 percent, a figure that more accurately reflects what the private sector, of both national and foreign ownership, is able to earn through industrial investment. In relation to the average profit margins of Venezuelan manufacturing industry, the saving owing to fiscal incentives may be insignificant in many cases.

Figure 9-1. *Actual and Extrapolated Share of Credits, Three Regions*



Negative Incentives

As early as January 1975 a decree was issued that prohibited new establishments from locating in the metropolitan area (Caracas and its surroundings) unless they qualified under special conditions. Furthermore, the government drew up three lists of industries, identified here as groups 1, 2, and 3. A firm's right to continue to operate or to locate in area A depended on the list to which it was assigned. It is assumed that the lists, although approved in 1976, had actually been in effect since January 1975, when the prohibition on locating in area A first took effect. The lag constituted an informal grace period to reduce hardships on firms whose location was already planned.

New Firms. New firms in group 1 are the only ones allowed to locate in the metropolitan area. All others are

considered "transgressors." The table shows that there was a lower percentage of transgressors in 1975–76 than in 1977–78, although the absolute number of transgressors was higher.[1]

Period	*Number of new firms in area A*	*Number of transgressors*	*Percentage of transgressors*
I (1975–76)	290	127	43.8
II (1977–78)	64	33	51.6

An explanation for the lower percentage in 1975–76 may be that government officials were stricter during that period. There are no disaggregated data before 1975, and it is not possible to know what was happening before the location controls were imposed. It may be that the percentage of firms identified with groups 1 and 2 that located in the metropolitan area was higher before the controls were imposed. Or, the controls may not have been implemented effectively in 1977–78.

Moves of Existing Establishments. Figure 9-2 shows an origin-destination matrix of interarea moves for each period. The framed cells represent the expected impact of deconcentration policy. In spite of the reduced number of cases, the general trend seems to be one of concentration. The evidence indicates that negative incentives were not applied effectively during the study period.

Preliminary Conclusions. There seems to be little evidence that changes in the spatial pattern of industry are related to the application of government instruments. The nearly stable trend in regional shares of credits does not support the hypothesis that financial incentives influenced the location of new firms. Information on the actual application of fiscal incentives is generally not available, but the impact of such incentives is likely to be insignificant compared with the profits of the manufacturing industry, and it is probable that they have had little effect on location. Negative incentives do not seem to have been applied effectively during the study period.

Figure 9-2. *Origin-Destination Matrix of Interarea Movers, 1975–76 and 1977–78*

1975–76

	To area					Moved	Moved	Net
From area	A	B	BM	C	D	out	in	change
A		7	4			11	12	+1
B			1			1	7	+6
BM	12					12	5	−7
C						0	0	0

1977–78

	To area					Moved	Moved	Net
From area	A	B	BM	C	D	out	in	change
A		2	2			4	5	+1
B	2					2	2	0
BM	3					3	2	−1
D						0	0	0

Note: The framed cells represent the expected impact of the policy.
Source: Author's estimates on the basis of the matched directories and on Oficina Central de Estadística e Informática (1968).

Other Factors

The evidence suggests that some manufacturing industries had a tendency to deconcentrate and that government policies had little effect on industrial deconcentration. This leaves deconcentration unexplained and leads toward investigation of other factors that influence industrial location.

Changes in the Venezuelan economy during 1974, when the national budget increased threefold, probably had two significant effects on manufacturing. First, many new manufacturing firms appeared that were primarily concerned with satisfying the sudden increase in demand and that benefited from the high profits. During this period most entrepreneurs had a short-term commercial bent rather than a long-term interest in manufacturing. As a consequence, most of the firms established during 1975–76 chose sites without much concern for cost or other locational factors. Second, the steep increase in the number of manufacturing establishments aggravated the diseconomies of the physical and social infrastructure. This started in Caracas and slowly spread to many of the surrounding cities. New industries that located in places where the level of services was inadequate suffered along with plants already there.

By the second period (1977–78) the economy had reached equilibrium in the supply of and demand for national manufactured products. By then most entrepreneurs were not only aware of the problems of locating in the congested industrial axis but were also aware that the bonanza, or high-profit, period was over. These entrepreneurs were therefore more concerned with lo-

cational factors than were entrepreneurs during period I, and they probably planned more carefully the selection of their plant sites, looking for places with lower wages, a satisfactory water supply, a good social infrastructure, and low transport costs. The search for those characteristics may have led some industrialists to consider settlements outside the industrial axis, and consequently deconcentration occurred. Deconcentration probably began before the economic boom of 1974, but the sudden change in the economy at that time may have temporarily slowed the process.

These arguments may explain why some manufacturing sectors deconcentrated, but what about those which did not? A clue may be found in World Bank research which indicates that the salient feature of the Venezuelan industrial environment in the 1970s was the high degree of protection from import competition accorded by government policies. This suggests that highly protected industries were attracted to Caracas. For example, small, highly protected industries would probably consider closeness to the government's decisionmaking center to be crucial; exonerations, licenses, and other benefits received on a case-by-case basis might outweigh the disadvantages of locating in the industrial axis. Murray (1982) states that "access to government is one input in many production processes." Renaud (chapter 5, above), in a discussion of the unintended biases of national economic policies, stresses that the management practices of the central government and its regulation of economic activities require location of these activities close to the capital and contribute to the urban vortex. A complementary explanation would be that the savings that could have been obtained through deconcentration were low compared with the large profits made possible by the high level of protection.

If this argument holds, we would expect to find supporting evidence, for example:

- Concentration of highly protected manufacturing in the industrial axis and deconcentration of less protected manufacturing firms
- Greater concern with location on the part of less protected industries; a higher sensitivity of second-period industrialists to locational factors, owing both to their awareness of the physical limitations in cities of the industrial axis and to a return to more realistic profit levels
- Relatively little weight attached to government incentives as a factor in location.

The rest of this section will address these issues.

Concentration and Protection

If the benefits of being close to government agencies that grant exonerations and other benefits outweigh the diseconomies of being in the industrial axis, we might expect highly protected industries to concentrate and less protected industries to deconcentrate. The six manufacturing groups considered here behaved as expected: textiles, plastics, and transport equipment are highly protected and are concentrated; leather, nonelectrical machinery, and electrical machinery face a low level of protection and are deconcentrated.[2]

One could argue that industries which concentrated did so not because of government protection but for other reasons and that the pattern of association described above is spurious. This is possible, and we do not want to present the results shown here as conclusive. Attempts to find other causes were made. For example, we tested capital or labor intensity, the product cycle theory, and other factors, but none were associated with concentration.

The next tasks were to determine whether less protected industries were more concerned with factors of location, to identify these factors, and to evaluate the extent to which government financial incentives have been considered as a locational factor by industrialists. For this purpose a discrete choice logit model was used that represents an entrepreneur who considers the attributes of both the firm and the city in deciding where to locate a manufacturing plant. The model relates the variables of the cities to the locational choice of the entrepreneur. The choice is made from a known set of alternative cities. Modelers are faced with the task of explicitly defining this location choice set. In one respect this is virtually a hopeless task: Venezuela consists of many settlements of varying size and quality, and the subset actively considered by any given entrepreneur is probably known to the industrialist alone. Central place theory, however, argues that a natural hierarchy, or system of settlements, exists within a country. If such a hierarchy exists, it is possible to identify the most important settlements for manufacturing activity. (These settlements presumably constitute a large sample of possible locations for those manufacturing entrepreneurs who desire a regional or national market for their products.) For such a hierarchy the modeling technique employed here is useful. The logit model assumes one underlying utility function and looks at relative choice frequencies as sample draws.

Because of computational limitations—it is unlikely that existing computer programs could adequately handle more than twenty potential choices of location—a limited number of alternative locations was selected. For this purpose, several criteria were applied.

- The choice set should be large enough to adequately represent the variables to be analyzed, that is, to have a wide range of values for the independent variables.

- The choice set should include a mix of core and peripheral cities as well as settlements with and without manufacturing. The manufacturing need not be new.
- The choice set should represent all areas of deconcentration as well as the special growth centers identified by the policy of industrial deconcentration.
- The choice set should have geographic balance; it should include cities located in the east, west, and south of the country as well as in the traditional north-central area.

With the use of this selection procedure, twenty cities were chosen.

Specification of the Logit Model

Many independent variables may affect locational choice. To reduce them to a manageable set, we examined the statistical correlation among a large number of variables for which we had data. High correlations between groups of variables were found—for example, between accessibility to local inputs and accessibility to final consumers. After examination of the variables in terms of statistical correlation, existing empirical work (see, for example, Carlton 1979), reliability of the source, and, especially, the economic theory of location, the independent variables were selected. They are as follows:

UI	1 in the Caracas alternative, 0 otherwise
FI	Percentage savings in present value terms owing to financial incentives (log)
TWAGE	Wage times number of employees in the firm (log)
LIP	Agglomeration potential associated with local inputs (log)
TEC	Proportion of the city's professionals, technicians, and related occupations to its population (log)
STR	Average number of working hours lost per thousand workers per year because of unexpected stoppages (log)
PHN	Number of telephone lines (installed capacity) per thousand inhabitants (log)
DOC	Number of inhabitants per doctor (log)
FIP	Agglomeration potential associated with foreign inputs (log)
WPR	Percentage of the city's population serviced with water (log)

The variable *UI* is a constant term in the utility function that measures the so-called pure alternative effect, that is, the net effect of all attributes of an alternative which is not measured by the other variables. A dummy variable was assigned to Caracas because it is the location chosen by about 66 percent of new manufacturing industries.

The variable *FI* represents the financial incentives of the industrial deconcentration policy. It incorporates a number of elements, including interest rates, grace and loan periods, and uses of money, whether for land and construction, machinery and equipment, or working capital.

Total wage (*TWAGE*) represents the interaction between the prevailing wages of the city and the number of employees in the firm—that is, the total payroll that each firm would have in each of the twenty cities. The interaction reflects the hypothesis that firms with large payrolls are proportionately much more sensitive to labor costs than are smaller ones. Furthermore, it may be hypothesized that firms tend to locate where wages are lower and hence a negative coefficient is expected.

The agglomeration potential associated with local inputs, *LIP*, was designed to reflect a firm's accessibility to both local inputs and product markets in each city. It is a composite variable that reflects not only industrial linkages but also transport costs. It is assumed that as the distance to a particular source of inputs increases, the attractiveness of that source decreases.

The variable *TEC* reflects the hypothesis that entrepreneurs look for places where technicians and related professionals are available. This should be especially true for firms with a high level and proportion of skilled workers. A positive coefficient is expected.

The variable *STR* reflects the hypothesis that entrepreneurs tend to locate their plants away from areas of high labor unrest. It is measured in terms of average working hours lost per thousand workers per year because of unexpected stoppages. A negative coefficient is expected.

The variable *PHN* reflects the effect of telephone service on an industry's desire to locate in cities with telecommunication facilities. A positive coefficient is expected.

The variable *DOC* measures the number of inhabitants per doctor. It may be hypothesized that entrepreneurs are more attracted to cities with better health facilities, and it is assumed that a lower number of inhabitants per doctor implies better health services. A negative coefficient is expected.

The agglomeration potential associated with foreign inputs, *FIP*, was designed to reflect the accessibility to foreign inputs in each city. It is a composite variable that reflects dependence on foreign raw materials and components and the transport costs to international ports. The hypothesis is that the higher the proportion of

Table 9-4. *Parameter Estimates for Five Model Specifications for 1975–76*

Variable	Model specification 1	2	3	4	5
UI	0.35	−0.95	−2.85	−3.04	−1.06
	(0.87)	(1.50)	(2.71)	(2.88)	(1.75)
FI	—	—	—	—	—
TWAGE	−1.32	−0.91	−1.42	−1.45	−1.47
	(2.90)	(1.93)	(3.16)	(3.21)	(3.18)
LIP	1.12	1.16	1.36	1.29	1.09
	(8.18)	(8.06)	(7.48)	(6.91)	(7.19)
TEC	1.90	3.20	3.26	3.41	2.71
	(3.01)	(4.20)	(4.25)	(4.48)	(3.90)
STR	−0.19	−0.16	−0.49	−0.51	−0.31
	(1.99)	(1.52)	(3.69)	(3.68)	(2.77)
PHN	—	1.24	—	0.76	1.15
		(3.21)		(1.94)	(3.16)
DOC	—	—	−2.37	−0.82	—
			(3.52)	(2.46)	
FIP	—	−0.50	—	—	—
		(3.74)			
WPR	1.39	—	4.12	3.78	1.59
	(1.83)		(3.28)	(2.83)	(1.73)
Sum of squared residuals	12,350	19,890	43,820	40,660	15,300
Degrees of freedom	7,157	7,156	7,156	7,155	7,156
Percentage correctly predicted	70.29	70.29	70.29	70.29	70.29
Likelihood ratio index	0.5637	0.5742	0.5696	0.5714	0.5686
Likelihood ratio statistic	1,273	1,297	1,287	1,291	1,284

— Not applicable.
Note: Number of firms in the sample, 377. Numbers in parentheses are *t*-statistics.

imported components for local assembly, the closer the assembly plant will be to international ports. A positive coefficient is expected.

The variable *WPR* reflects the hypothesis that industries tend to locate where water is available. This variable may be considered a proxy for the availability of infrastructure services.

Selection of the Model Specification

For any applied model of locational choice, the selection of an appropriate specification must include experimentation with the data. It is, of course, important to avoid mining the data. To guard against this danger, all experimentation was done with the subsample of data for the period before the introduction of the financial incentives package. As will be seen, this model fits the second subsample equally well.

Several distinct logit model specifications were estimated with data for the first period. These models correspond to different combinations of the variables selected earlier. The details of five of the model specifications estimated are given in table 9-4. Of the five models, we reject model 2 because of the unexpected sign on the variable *FIP*. Models 3 and 4 are dropped because of high variation in the parameter values of the variable *DOC*. We disregard model 5 because it has one more variable than model 1 and adds no additional explanatory power. (Both models have a likelihood ratio index of 0.56.) Furthermore, the unexplained residuals are higher in model 5. (The sum of squared residuals is 15,300 in model 5 and 12,350 in model 1.) Hence, of the five specifications we select the first; indeed, specification 1 was selected out of all those analyzed as the model to be used in this research. The likelihood ratio index of 0.56 for this model indicates that its overall goodness of fit is satisfactory.

To analyze the data for the second period (1977–78), variable *FI* (financial incentives) was added to specification 1, and the parameters were estimated. The results appear in table 9-5, which allows us to compare the results from the model with data from the two periods 1975–76 and 1977–78. The model seems to be structurally stable over time. The signs of the coefficients (except *UI*) are the same for both periods. Furthermore, the values of the coefficients are similar except for *WPR* (availability of water or infrastructure services), which shows a significant increase in the second period.

Table 9-5. *Parameter Estimates for the Sample of Six Industry Subgroups, 1975–76 and 1977–78*

Variable	*1975–76*	*1977–78*
UI	0.35	−0.06
	(0.87)	(0.08)
FI	—	0.01
		(0.31)
TWAGE	−1.32	−1.69
	(2.90)	(3.86)
LIP	1.12	0.96
	(8.18)	(5.26)
TEC	1.90	1.41
	(3.01)	(1.50)
STR	−0.19	−0.21
	(1.99)	(1.91)
WPR	1.39	4.79
	(1.83)	(3.45)
Sum of squared residuals	12,350	1,914
Degrees of freedom	7,157	2,235
Percentage correctly predicted	70.29	52.54
Likelihood ratio index	0.5637	0.3683
Likelihood ratio statistic	1,273	260.4
Memorandum: Number of firms in the sample	377	118

— Not applicable.
Note: Numbers in parentheses are *t*-statistics.

Analysis of the Coefficients

The dummy coefficient for Caracas, *UI*, is subject to a wide confidence interval in both periods, as is shown in table 9-5. The net effect of all attributes of Caracas which are not measured by the other variables may be the most important factor in attracting new industry, but the data simply do not allow us to determine this effect with much precision. Indeed, the opposite could be the case; Caracas may exert a negative effect. (Some evidence of this is seen in table 9-4.) In those cases in which we have controlled for more variables, a negative coefficient for Caracas is obtained.

The coefficient of the financial incentives variable (*FI*) is very small and statistically insignificant. The failure of financial incentives to show up as an important influence on location is consistent with our previous finding. Wage levels, especially when they interact with the number of employees, *TWAGE*, exert a large influence on the location of industry. The coefficients are statistically significant in both periods. The accessibility to sources of local inputs and to product markets, *LIP*, enters significantly in both periods; the coefficients are statistically significant. Having a pool of technical expertise in the city, *TEC*, as measured by the proportion of the city's professionals, technicians, and related occupations to its population, seems to be an important factor in location. The coefficient of the variable measuring work stoppages, *STR*, is not large but is statistically significant in both periods, which implies that entrepreneurs are concerned with locating their plants away from cities with high labor unrest. The coefficient for the variable measuring water availability, *WPR*, increases more than three times in the second period and becomes even more statistically significant. A close look at variable *WPR* in table 9-5 indicates two issues. First, manufacturing firms seem to be attracted to places where water (or infrastructure services) is available. Second, it is likely that second-period entrepreneurs were more sensitive to availability of water (or infrastructure services).

On the basis of these results it seems reasonable to conclude the following.

- Wages are an important factor in explaining the location of industry.
- The evidence provides little support for the proposition that financial incentives have exerted an effect on the location of manufacturing.
- Accessibility to both local inputs and product markets exerts a large influence on the locational decision of a manufacturing firm.
- The presence of technical expertise is probably an important locational factor.
- The more labor unrest a city has, the less likely it is to attract new manufacturing.
- The availability of water (or infrastructure services) exerts a major influence on the location of new manufacturing. It is likely that this variable was more important during the second period than during the first period.

Results, by Industry Subgroups

So far the results have dealt with all six industrial subgroups together. The next question is whether the results apply to each subgroup. One might expect the importance of the attributes to vary among manufacturing groups.

The number of establishments (by industry subgroup and by year of foundation) to be used in our econometric analysis is less than the total number of new establishments because firms that locate outside the choice set (the twenty cities selected) are not considered. Because electrical machinery had only nine establishments in the second period, and it is unlikely that we can infer any meaningful conclusions from the analysis of such a small number of observations, results for electrical machinery for the second period are omitted.

The results, stratified by manufacturing groups, are presented in tables 9-6 to 9-8. For plastics, the maximum likelihood routine had difficulty converging when

Table 9-6. *Parameter Estimates for the Textile and Transport Equipment Industries, 1975–76 and 1977–78*

Variable	Textiles		Transport equipment	
	1975–76	*1977–78*	*1975–76*	*1977–78*
UI	0.05	−0.09	−2.38	−0.33
	(0.02)	(0.02)	(1.78)	(0.16)
FI	—	0.04	—	0.04
		(0.38)		(0.25)
TWAGE	−2.66	−2.54	−3.31	0.14
	(0.88)	(0.79)	(1.78)	(0.13)
LIP	1.42	1.36	2.00	1.23
	(1.79)	(1.54)	(3.31)	(2.36)
TEC	4.69	2.21	3.54	−0.16
	(1.78)	(0.51)	(1.85)	(0.07)
STR	−0.22	−0.09	−0.55	−0.47
	(0.80)	(0.31)	(2.12)	(1.68)
WPR	9.73	20.93	1.22	6.88
	(1.37)	(1.66)	(0.72)	(1.52)
Sum of squared residuals	795.7	267.7	929.4	465.1
Degrees of freedom	1,286	430	1,153	468
Percentage correctly predicted	86.76	78.26	44.26	52.0
Likelihood ratio index	0.7685	0.67	0.3478	0.3793
Likelihood ratio statistic	313.1	92.32	127.1	56.81
Memorandum: Number of firms in the sample	68	23	61	25

— Not applicable.
Note: Numbers in parentheses are *t*-statistics.

the *WPR* variable was included in the model for 1977–78. Hence, in table 9-8 we present the results for plastics for period I only. To investigate the possible effects of the independent variables on locational decisions in the plastics industry, several other specifications without *WPR* were analyzed, and the results are presented in table 9-9.

Wages (TWAGE). We indicated earlier that, for the unstratified sample of industries, wages seem to exert a large influence on location. Under stratification the wage coefficient for all six industries is always subject to a wide confidence interval (see tables 9-6 to 9-8). Except for the plastics industry, the expected negative sign predominates. Wages seem to be very important for the leather, nonelectrical machinery, and textiles industries. Furthermore, for leather and nonelectrical machinery the coefficients in period II are larger, which may imply an increased sensitivity to this variable.

The hypothesis proposed here is that less protected industries are more concerned with locational factors and that the economic bonanza of the first period may have masked the effects of locational factors. We expect coefficient values for the less protected industries to be larger during period II; that is, it is hypothesized that during period II entrepreneurs of less protected industries searched more carefully for places that offered reduced costs and increased revenues.

The pattern of association between the protection level and the expected behavior of wages shows that leather and nonelectrical machinery, with low levels of protection, have larger wage coefficients (*TWAGE*) during period II, and textiles and transport equipment, which are highly protected, do not, so they behave as expected. (Plastics and electrical machinery are not considered because of the limitations indicated earlier.) Thus, less protected industries are more sensitive to wages during period II, in accordance with our hypothesis. Even if the plastics and electrical machinery industries are considered, these conclusions hold. This finding lends additional support to the hypothesis that protection for manufacturing may suppress the entrepreneur's interest in locating in low-wage areas.

Access to Local Inputs and Product Markets (LIP). The coefficients for the variable which measures access to sources of local inputs and product markets (*LIP*) are usually important for all six manufacturing

Table 9-7. *Parameter Estimates for the Leather and Nonelectrical Machinery Industries, 1975–76 and 1977–78*

Variable	Leather		Nonelectrical machinery	
	1975–76	*1977–78*	*1975–76*	*1977–78*
UI	5.26	−2.26	1.26	−0.20
	(2.02)	(0.67)	(1.36)	(0.13)
FI	—	−0.16	—	0.15
		(0.99)		(0.97)
TWAGE	−2.66	−12.23	−0.86	−2.26
	(0.73)	(1.40)	(0.49)	(0.94)
LIP	0.66	1.15	1.03	0.96
	(0.95)	(1.10)	(2.89)	(2.36)
TEC	1.01	7.77	0.90	2.82
	(0.30)	(1.32)	(0.43)	(0.76)
STR	−0.46	−0.48	−0.26	0.10
	(1.57)	(0.54)	(0.80)	(0.26)
WPR	10.36	9.71	1.15	4.09
	(2.32)	(1.76)	(0.61)	(1.22)
Sum of squared residuals	803.1	190.6	1,364	345.2
Degrees of freedom	887	259	1,343	449
Percentage correctly predicted	87.23	57.14	73.24	29.17
Likelihood ratio index	0.7891	0.47	0.5831	0.2118
Likelihood ratio statistic	222.2	39.50	248.0	30.46
Memorandum: Number of firms in the sample	47	14	71	24

— Not applicable.
Note: Numbers in parentheses are *t*-statistics.

Table 9-8. *Parameter Estimates for the Plastics and Electrical Machinery Industries, 1975–76*

Variable	*Plastics*	*Electrical machinery*
UI	1.87	−0.59
	(2.22)	(0.63)
FI	—	—
TWAGE	1.09	−0.42
	(0.74)	(0.17)
LIP	0.45	1.40
	(1.69)	(3.61)
TEC	1.51	1.20
	(1.15)	(0.54)
STR	−0.11	−0.27
	(0.51)	(0.72)
WPR	−0.93	0.42
	(0.60)	(0.21)
Sum of squared residuals	1,727	764.8
Degrees of freedom	1,495	963
Percentage correctly predicted	74.68	52.94
Likelihood ratio index	0.5889	0.4428
Likelihood ratio statistic	278.7	135.3
Memorandum: Number of firms in the sample	79	51

— Not applicable.
Note: Numbers in parentheses are *t*-statistics.

groups (see tables 9-6 to 9-8). Coefficients for transport equipment, nonelectrical machinery, and electrical machinery are statistically significant, as is also true for plastics, especially in the four model specifications that appear in table 9-9.

Technical Expertise (TEC). When results are stratified by industry subgroup, technical expertise exerts influence on each of the six manufacturing sectors. The coefficients have wide confidence intervals (primarily during period I) except for textiles and transport equipment. Table 9-6 shows that textiles and transport equipment behave unexpectedly by lowering their coefficients during period II. Table 9-7 indicates that leather and nonelectrical machinery have larger coefficients in period II, in accordance with the expected behavior.

The pattern of association between the level of protection and the expected behavior for technical expertise provides additional evidence in support of the hypothesis that during period II less protected industries were more concerned with locational factors—that is, the values for the coefficients of the less protected industries during the second period are larger than the values for period I. Leather and nonelectrical machinery, which have low levels of protection, have larger *TEC* coefficients; textiles

Table 9-9. *Parameter Estimates for Four Model Specifications for the Plastics Industry, 1977–78*

Variable	*Model specification*			
	A	*B*	*C*	*D*
UI	67.32	69.26	70.71	67.08
	(2.74)	(2.65)	(2.65)	(2.66)
FI	7.30	8.21	7.11	7.52
	(2.78)	(2.76)	(2.80)	(2.78)
TWAGE	1.57	3.07	−1.32	0.03
	(0.93)	(1.45)	(0.29)	(0.00)
LIP	2.70	2.57	3.18	3.40
	(2.52)	(2.27)	(2.31)	(1.78)
TEC	3.70	9.94	2.63	7.81
	(1.07)	(2.04)	(0.68)	(1.55)
STR	−1.33	−1.57	−1.32	−1.73
	(1.81)	(1.90)	(1.64)	(1.51)
PHN	—	4.75	—	6.38
		(1.39)		(1.15)
DOC	—	—	5.70	7.70
			(0.77)	(1.06)
Sum of squared residuals	168.1	95.92	159.8	87.13
Degrees of freedom	431	430	430	429
Percentage correctly predicted	60.87	52.17	60.87	52.17
Likelihood ratio index	0.5736	0.6055	0.5793	0.6150
Likelihood ratio statistic	79.04	83.44	79.83	84.75
Memorandum: Number of firms in the sample	23	23	23	23

— Not applicable.
Note: Numbers in parentheses are *t*-statistics.

and transport equipment, which are highly protected, do not, so they behave as expected. An explanation as to why some subgroups show a lower coefficient for technical expertise in period II may be that it is cheaper for the firm to pay whatever amount is required to relocate its technicians with it than to locate in places where technical expertise is available but where other locational factors are lacking. The additional cost is more easily absorbed by high-profit firms, which usually are highly protected.

Labor Unrest (STR). The coefficient for labor unrest is usually small and is subject to a wide confidence interval, except in transport equipment, where it is statistically significant. An explanation for the high significance (although low value) in this sector may be that it includes motor vehicle assembly and the specialized manufacture of motor vehicle parts. Because workers in these activities are usually well organized, the transport equipment sector is prone to conflicts. Locating plants away from areas of high labor unrest may be a measure to reduce the probability of unexpected stoppages.

Water Availability (WPR). Plastics and electrical machinery seem to be little affected by water availability, but the coefficient for this variable is quite large for the other four manufacturing industries. Furthermore, with the exception of the leather industry, for which the coefficient in period II remains stable, the parameters for the other three subgroups increase dramatically during 1977–78. Again we may argue that this increase may be a result of heightened awareness among second-period entrepreneurs. The reason that the coefficient remains unchanged during period II for leather manufacturing can be found in the ISIC 323 code, leather and leather products, which includes tanning and leather finishing as well as fur dressing and dyeing. According to Fair and Geyer (1954, p. 856), high-quality water is crucial to production for this subgroup, and it is unlikely that first-period entrepreneurs would have overlooked its importance. Hence, water availability was seen as equally important during both periods by leather industrialists.

Caracas Dummy (UI). The net effect of all attributes of Caracas not measured by the other variables is reflected in the dummy variable, *UI*. Among the attributes not captured are diseconomies related to congestion, land cost, and location control. Other factors, however, such as access to the bureaucracy, work in favor of Caracas.

The contribution of Caracas to the utility functions of

less protected firms is expected to decline with time because of increasing diseconomies. For highly protected industries the disadvantages of Caracas also increase with time, but this effect may be offset by the rising fear that protection will be removed (a likelihood for textiles today), or by the search for additional benefits, such as those related to local content regulation. Both factors make Caracas attractive. Hence, large negative effects in period II cannot be expected for highly protected industries, since nearness to government is an advantage that counteracts the disadvantages of locating in Caracas. The pattern of association between the level of governmental protection and the expected behavior for the Caracas variable shows that leather and nonelectrical machinery, with low levels of protection, have a lower negative coefficient (*UI*); textiles and transport equipment, which are highly protected, do not, so they behave as expected.

It may be argued that Caracas was not always perceived by entrepreneurs as experiencing diseconomies. The larger negative effects observed in period II probably represent a return to conditions similar to those that existed before the distortions of the sudden economic changes of 1974. Unfortunately, the effects of location control cannot be separated from those of other diseconomies such as congestion and land cost.

Financial Incentives (FI). In tables 9-6 and 9-7 the coefficients on the variable for financial incentives are sometimes negative, always small, and usually statistically insignificant. Until adequate data are available conclusions cannot be drawn for the electrical machinery and plastics industries. Only nine new electrical firms located within the twenty cities, too small a number for statistical tests. For plastics we recall that the maximum likelihood routine had difficulty converging with the *WPR* variable in the model for 1977–78. Several other specifications without *WPR* were analyzed for the plastics industry, however, and the results for four of them are presented in table 9-9. An analysis of the coefficients for the variable *FI* shows that for plastics the financial incentive variable enters in all four specifications with a large and significant coefficient. Thus, for this sector financial incentives exerted a substantial effect on location. One might argue that these results are a product of sampling error. On the assumption that they are not, we offer the following explanation, based on interviews with entrepreneurs. ISIC code 356 includes the molding, extruding, and fabricating of plastic articles. A typical factory has few employees, requires relatively little floor space, and has one or two machines that process raw material. The basic component of the machines is the mold, which determines the end product (such as a fork, plate, or syringe) and accounts for a high proportion of machine cost. Usually, a different mold is needed for each product.

The relative ease of setting up a plastics factory contributed to the growth of this sector. During period I, seventy-nine new establishments were started, fifty-nine of them in Caracas. By period II private financial institutions had apparently become more aware of the risks involved in extending loans to this sector because of the proliferation of plastics factories. The low flexibility of plastics machinery may have contributed to this perception: in case of bankruptcy, a bank would have to take over the plant and sell it, and a prospective buyer would have to be interested in producing products similar to the existing line or would have to make additional costly investments in molds. That the earlier owner went bankrupt because of high competition lent the operation an added sense of risk. Consequently, during period II private financial organizations were probably reluctant to give loans for manufacture of plastic products. Under these conditions an industrialist in plastics might well find it advantageous to move to the designated areas to become eligible for government loans. Some industrialists therefore reacted favorably to the financial incentives. It is likely that some of these entrepreneurs selected locations in the area of deconcentration closest to Caracas (BM). By doing so, they remained close to the industrial axis and did not contribute to deconcentration.

Conclusions

The hypothesis that less protected industries are more concerned with locational factors is supported by the evidence. More generally, this model attempts to identify the factors that affect the locational decisions of firms. Alternative explanatory factors were sought when evidence was found that government incentives do not affect a firm's location. In particular, it was found that entrepreneurs attach an insignificant weight to government financial incentives.

The model does not claim to represent completely the complex set of locational factors that enter into the decision process; it only attempts to point out some factors that decisionmakers seem to consider when choosing a location. Some of these may be subject to control by policymakers.

The findings should be interpreted in the context of two limitations. First, only a short period has elapsed since 1974, when the first presidential decree concerning industrial deconcentration was issued. Second, the data base of this study cannot be accepted without the standard caveats, and the results must be considered tentative. This study reaches cautious conclusions on

the basis of available statistics and indicates a methodological approach for future work.

Notes

1. Data are author's estimates based on the matched directories and Oficina Central de Estadística e Informática (1978).

2. World Bank data; Oficina Central de Estadística e Informática (1978); matched directories for 1974 and 1976. Throughout this chapter, an industry group is classified as having a low level of protection if its effective protection is below 80 percent and as having a high level if effective protection is above 130 percent.

Bibliography

Carlton, Dennis. 1979. "Why Do New Firms Locate Where They Do: An Economic Model." In William Wheaton, ed., *Interregional Movements and Regional Growth*, pp. 13–50. Washington, D.C.: Urban Institute.

Cordiplan. 1973. *Encuesta Industrial 1971.* Caracas.

———. 1979. *Evaluación de la Política de Desconcentración Industrial.* Caracas.

Fair, Gordon, and John Geyer. 1954. *Water and Wastewater Disposal.* New York: John Wiley & Sons.

Ministerio del Ambiente. 1979a. *Esquema de Ordenamiento de la Región Centro Norte Costera.* Vol. diagnóstico, tomo de síntesis. Caracas.

———. 1979b. *Esquema de Ordenamiento de la Región Centro Norte Costera.* vol. 7: *Industria*. Caracas.

Murray, Michael P. 1982. "Here, There, Where? A Strategy for Evaluating Industrial Relocation Policies in Korea." Urban Development Discussion Paper 6. World Bank, Washington, D.C.

Oficina Central de Estadística e Informática. 1974. *Encuesta Industrial.* Caracas.

———. 1976. *Encuesta Industrial.* Caracas.

———. 1978. *Directorio Industrial.* Caracas.