*I would like to acknowledge helpful comments by Fausto Hernández.

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MANUFACTURING GROWTH IN THE MEXICAN STATES 1988-1993: THE RELEVANCE OF PUBLIC POLICY AND MARKET-DETERMINED FACTORS

I. *Introduction.*

In Mexico, the empirical research on the determinants of interregional industrial growth and location decisions has received a remarkably little attention so far. A survey of this literature by Tamayo (1997) identifies four studies based on direct surveys to plant managers (Galbraith *et al.* 1990; Vleugels 1990; Quintanilla 1991; and Garza 1992), and only two studies using econometric techniques (Ramírez 1995; and Tamayo 1996).[1] This can be understood in light of the traditionally high regional concentration of economic activity, the weak federal policies for industrial deconcentration, and the severe fiscal and financial constraints faced by most state governments which have kept them from playing more than a minimal role in the area of industrial promotion and development. Nevertheless, the interest in this topic among scholars and practitioners in the field and its policy significance are likely to increase with the current, unprecedented strengthening of political forces advocating the financial autonomy of the states and as manufacturing production continues to spread over the Mexican territory.

A lively debate within the Congress regarding the fiscal relations between the federal and state governments has already started and it is likely to gain momentum shortly. The composition of the federal Congress elected just a few months ago, now as representative of the different political forces as ever, has allowed the positions advocating the financial autonomy of state and municipal governments to finally gain a foothold. It is very likely that in the short- to medium-term further progress will be made regarding this issue, and regardless of how it is planned and achieved, the state governments will be prone to use part of any additional financial resources at their disposal to promote industrial development within their jurisdictions. In fact, an unprecedented number of governments of states of intermediate and even lagging levels of industrialization have become quite active in promoting the development of their industrial sector during the 1990s. Thus, if the resources devoted to the promotion and development of industry are to be efficiently and effectively spent, it is important for state policy-makers and planners to know how and to what extent the different means of policy intervention can realistically stimulate industrial growth.

A pronounced decline of the traditional, overwhelming share of the capital region (i.e., the Federal District and the State of México) in manufacturing output from 50 to 36 percent occurred between 1980 and 1985. However, such a trend

[1] According to the same survey, previous studies in this field date of the 1960s and consist of descriptions of regional statistics, unstructured interviews with local public and private actors, and field observations. Their focus was on the locational advantages of Mexico City vis-à-vis other major regions of the country.

abated thereafter. The capital-region in 1993 still accounted for more than one third of national manufacturing value-added, and also achieved by far the largest absolute increase in the same measure between 1988 and 1993. During the late 1980s and early 1990s output continued shifting toward the central-west region —notably the State of Jalisco— and toward the northwest and north-central regions alternatively, just as in the early 1980s. But unlike the early 1980s, these more recent shifts were not as much at the expense of the capital-region as of other northern states as well as of states within the central and eastern regions.

In short, while the pronounced downward trend of the capital-region's share in manufacturing during the early 1980s has clearly stabilized, the magnitude of the activity of the important industrial centers in the central-west, northwest, and north-central regions has overcome a threshold that has allowed these centers to keep attracting industry. In contrast, manufacturing growth in the south remains rather sluggish, except for the areas where the oil industry concentrates. Overall, the magnitude of the manufacturing sector concentrated in the capital-region still implies advantages that are quite attractive for new industry and, thus, will continue imposing severe constraints on the range of potential location alternatives that new industries or expansions would consider.

Perhaps motivated by the gradual regional dispersion of Mexico's manufacturing sector since the early 1980s, the small number of inter-area studies that have appeared only recently, analyze the determinants of regional industrial growth and location decisions outside of the industrially preeminent capital-region. The main conclusions from a survey of that literature (Tamayo 1997) can be summarized as follows: *1)* the stock of local infrastructure or public capital and the accessibility to important national markets and, recently, to export markets are very important determinants of state/local industrial growth, *2)* the local supply of labor and a favorable "labor climate" are also important factors, *3)* federal-state fiscal incentives have been an important factor only within the central-region (the immediate area of influence of Mexico City), but even there these are subordinated to the existence of other local attributes, *4)* state/local markets, in general, are not important determinants of inter-area industry growth, *5)* neither the level of education of the labor force nor their qualifications seem to be important factors and, *7)* relatively high wage-rates have not discouraged industry growth. As noted by the author, the limited number of studies and their quite dissimilar methodologies and design by no means allows us to take these conclusions as definitive. Moreover, the relative importance of these factors should be expected to change over time.

Thus, the reasons why research in this field in Mexico has been neglected are no longer valid. The time has come to address the issue of how can public policy at the state/local level best promote industrial development. Hence, the objective of this paper is to make a modest contribution to the understanding of the relationship between some state tax and expenditure characteristics and state industrial growth.

Multiple regression analysis is applied to a disequilibrium-adjustment model which consists of relating changes in a measure of manufacturing growth over a period to levels of market-determined and public policy variables at the beginning of the period, wich are assumed to capture potential profitability. The central assumption is that the higher a state's potential profitability, the higher its growth of manufacturing production. The analysis is based on data for the 31 states and the Federal District, and it focuses on the period 1988-1993. The selection of explanatory variables was guided, to some extent, by the results of the survey mentioned above.

The results of this analysis lend considerable support to the finding of the few previous studies that local public infrastructure and access to national markets have the most important positive effect on state/local manufacturing growth. The growth of manufactures in a state is also importantly stimulated by the state's technical expertise. Contrary to previous studies, however, the negative impact on state industry growth of high wage rates and a high income tax effort turn out to be significant. It was also found that the aggregate manufacturing growth of the northern border states was not higher than that of the rest of the country. That is, the presumed advantages of border states conferred by their proximity to the U.S. market —which for certain export-oriented industries are out of question— do not provide a differential positive impact for their manufacturing sector as a whole.

The rest of the paper is organized into four sections. The second section is devoted to elaborating a theoretical model of regional industrial growth. In the third section, I specify the empirical measures of manufacturing growth and factors affecting profitability, as well as the expected relationships. The fourth section contains the report on the regression estimates of the model. The final section is a summary of the main conclusions and policy implications.

II. A framework for the analysis of regional industrial growth.

The econometric work analyzing aggregated industrial growth across regions or other sub-national areas commonly associates inter-area differences in measures of industrial growth (i.e., output, employment or income) with inter-area differentials in measures of markets and cost factors which are presumed to capture the relative profitability of these areas. The key assumption here is that industrial expansion in a given area is determined by the relative profitability of that area, which in turn is a function of its attributes regarding market access, supply (price and availability) of inputs, and tax-expenditure policies. Hence, insofar as market and factor costs differ across areas, so do potential profits and industrial growth. This relationship is based on the underlying concept of the location decision of the profit-maximizing firm, basically described as a function of potential profits at alternative areas—as firms are assumed to seek high-return areas, inter-area differentials in the rate of return induce inter-area shifts of production.[2]

Here, industrial growth across areas will be treated as a disequilibrium process. This approach assumes that differences in regional industry growth occur as production is attracted toward areas with above-equilibrium profit levels, i.e., as the effect of a state of disequilibrium at the beginning of the period analyzed. This reflects the idea that investment decisions materialize over a time span of several years. In order to apply this concept and following Bartik (1991) let us suppose that because of the durability of capital, the adjustment of industrial activity in region i at time t, Y_{it}, from its previous level, Y_{it-1}, to its long-run optimal level, Y^*_{it}, is only partial, or

(eq. 1)

$$\mathrm{Y}_{it} = \lambda \mathrm{Y}^*_{it} + (1-\lambda)\mathrm{Y}_{it-1} + \mu_{it}$$

where u_{it} is a random disturbance. Suppose also that the long-run optimal level of industrial activity is a function of the level of observed variables, X_{it}, at the beginning of the period, or

(eq. 2)

$$\mathrm{Y}^*_{it} = B'\mathrm{X}_{it-1} + E_{it}$$

where E_{it} is a disturbance. Substitution of (2) into (1) yields

(eq. 3)

$$\mathrm{Y}_{it} = \lambda B'\mathrm{X}_{it-1} + (1-\lambda)\mathrm{Y}_{it-1} + e_{it}$$

[2] The argument is that potential entrants in a particular industry are attracted to high-return regions and that existing firms would relocate also there to the extent that return differentials between high-return locations and their current location exceed relocation costs. The high-returns will shrink, however, as the number of competitors increase (i.e., market shares will tend to decrease and costs to increase) and a state of equilibrium will be reached when return differentials across locations are no longer sufficient to induce shifts of production (i.e., new entries, on-site expansions, or relocations) across locations. This locational equilibrium can be disturbed though by changes in demand and/or costs in the industry in question. For instance, an increase in demand will lead to increases in the level of output and, thus, in the minimum cost locations, given the inelasticity of supply of factors of production. This will cause production to shift again across locations. A good elaboration on this locational equilibrium path using spatial costs and revenue curves can be found in Chalmers and Beckhelm (1976).

where $e_{it} = \lambda E_{it} + u_{it}$. Subtraction of Y_{it-1} from both sides of (3) yields

(eq. 4)

$$Y_{it} - Y_{it-1} = \lambda B' X_{it-1} - \lambda Y_{it-1} + e_{it}$$

which represents a disequilibrium or levels model. Industrial growth in state i, from period *t-1* to *t*, $(Y_{it} - Y_{it-1})$, is thus expressed as a function of a vector of the levels of characteristics of state i, at period *t-1*, (X_{it-1}), and of its levels of industrial activity at period *t-1*, (Y_{it-1}). As was said, these characteristics are assumed to capture inter-area differentials in profitability. It is also assumed that these differentials are large enough to cause differences in industry growth across areas.

As the explanatory variables are measured at the start of the period of analysis, the possibility of simultaneous-equations bias is greatly reduced (Plaut and Pluta 1983; Newman and Sullivan 1988). Also, in the case of substantial measurement error in the state characteristics, the resulting downward bias of the coefficients will be lower in a disequilibrium model than in an alternative equilibrium model—i.e., the ratio of measurement-error variance to true variance is smaller in the disequilibrium model (Bartik 1991).[3] This disequilibrium framework has been applied in many empirical studies on interregional industrial growth and location decisions in the U.S. (Wasylenko 1981; Carlton 1979, 1983; Plaut and Pluta 1983; Bartik 1985; Wasylenko and McGuire 1985; Erickson 1989; and Eberts 1991).

III. Description of data and hypotheses.

The units of analysis are the Mexican states and the database is a cross-section for initial and terminal years of the period 1988-1993 in the case of the dependent variable, and for the initial year of that period in the case of the explanatory variables. The dependent variable measuring state manufacturing growth is the absolute change in real manufacturing value-added during the period. Since the initial and terminal years correspond to similar phases of the Mexican business cycle and the interval has a length of five years, it is reasonable to contend that the

[3] As shown by Bartik (1991), the alternative equilibrium or changes model is derived by substracting the previous period version of equation (3) from equation (3). The result is that industrial growth is defined as a function of lagged changes of both regional characteristics and industrial activity levels. This form assumes that regional industrial growth occurs when the equilibrium is disturbed by changes affecting demand or factor costs and, thus, relative regional profits, with a consequent adjustment of output across regions operating to restore equilibrium. The restoration of equilibrium is specified with a lag, given the short-run immobility of capital—i.e., the adjustment of capital to profit opportunities takes some time. Thus either approach can be derived from equation 3, the unifying framework.

changes in our measure of manufacturing growth actually represent long-term trends not sensitive to cyclical fluctuations within the interval.

The absolute changes in manufacturing value-added between 1988 and 1993 are presented in the third column of Table 1. Three 4-digit industries were excluded (primary petrochemicals 3511, oil refining 3530, and basic iron-steel 3710) as they would mislead the results of our analysis of how industry responds to inter-state differentials in profitability.[4] It is noticeable that 75 percent of that growth was concentrated in ten states. Moreover, 60 percent of it was accounted for by the four traditionally industrial states—the Federal District and México (capital-region), Nuevo León (northeast) and Jalisco (central-west). It is also noticeable that five of the six northern states bordering the U.S. ranked within that top-ten group. The other two states within that group were Guanajuato (central-west) and Puebla (central). The remaining 25 percent of that change in manufacturing value-added was distributed among the other 22 states.

Table 1 also presents the percent shares for initial and terminal years and the respective change (columns 4 to 6). The sixth column shows that three of the four traditionally industrial states experienced a slightly below-average growth rate (the exception is Jalisco which performed well above average) whereas three of the five highly-ranked northern border states grew at rates above the nation's average. Despite that most of the rest of the states grew at faster rates than the nation, their shares remained rather small as shown in the second and fifth columns. In short, a visible shift of production toward northern and central-west states is appreciated during the period, but it was not as much at the expense of the highly industrialized states as of other industrially lagging ones. The differentials in absolute growth and levels of activity between the capital-region states (Federal District and México) and the few dynamic states of the north and central-west, and between the latter and the rest of the states remain enormous.

The definition of the independent variables used in the base model are presented in Table 2. The selection of variables was guided by the objective of testing statistically some of the factors found to be decisive for state/local manufacturing growth in Mexico by the few recent survey-based studies, and by the purpose of contrasting some results with the only two econometric studies. Tamayo (1997) elaborates a review of the scant literature in the field for the case of Mexico. The analysis focuses on assessing how different means of policy intervention fare *vis-à-vis* factors over which the government has only a limited or no control.

[4] Industries 3511 and 3710 are strongly tied to the location of natural resources and thus characterized by a low degree of mobility. In addition, industries 3511 and 3530 are state-controlled and all three industries account for a fairly large share of manufacturing value-added in states otherwise characterized by a below-average industrial development (70 percent in the State of Oaxaca, 68 percent in Tabasco, 40 percent in Veracruz, 37 percent in Chiapas, and 30 percent in Michoacán).

Table 1
Inter-State Distribution and Shift of Manufacturing Value-Added 1988-1993[1,2]

State	*Real Manufacturing Value-added*[3]		*Absolute Change*[3]	*Percent Share*		*Change in Share*
	1988	*1993*	*1988-1993*	*1988*	*1993*	*1988-1993*
Chiapas	2.44	2.66	0.22	0.39	0.26	-0.12
Campeche	0.59	0.98	0.39	0.09	0.10	0.01
Baja California Sur	0.67	1.29	0.62	0.11	0.13	0.02
Colima	0.50	1.33	0.83	0.08	0.13	0.05
Quintana Roo	0.60	1.67	1.07	0.10	0.17	0.07
Nayarit	1.86	3.00	1.14	0.29	0.30	0.01
Zacatecas	0.67	2.23	1.56	0.11	0.22	0.11
Morelos	23.10	25.06	1.96	3.66	2.48	-1.18
Guerrero	1.46	3.47	2.01	0.23	0.34	0.11
Tabasco	1.62	3.81	2.19	0.26	0.38	0.12
Coahuila (B)	37.43	40.19	2.76	5.93	3.98	-1.95
Tlaxcala	5.18	8.07	2.89	0.82	0.80	-0.02
Oaxaca	3.40	6.79	3.39	0.54	0.67	0.13
Yucatán	5.17	8.86	3.69	0.82	0.88	0.06
Durango	4.67	8.63	3.96	0.74	0.86	0.12
Michoacán	6.06	10.78	4.72	0.96	1.07	0.11
Sinaloa	3.87	8.62	4.75	0.61	0.85	0.24
Hidalgo	8.30	15.29	6.99	1.31	1.52	0.21
Querétaro	15.77	23.07	7.30	2.50	2.29	-0.21
Aguascalientes	4.39	11.80	7.41	0.69	1.17	0.48
Veracruz	19.68	27.49	7.81	3.12	2.72	-0.40
San Luis Potosí	13.86	22.18	8.32	2.20	2.20	0.00
Chihuahua (B)	25.79	37.00	11.21	4.09	3.67	-0.42
Puebla	18.77	30.20	11.43	2.97	2.99	0.02
Mean of Abs. Change			11.81			
Guanajuato	18.30	31.27	12.97	2.90	3.10	0.20
Sonora (B)	13.17	26.30	13.13	2.09	2.61	0.52
Baja California (B)	12.44	26.56	14.12	1.97	2.63	0.66
Tamaulipas (B)	14.09	28.59	14.50	2.23	2.83	0.60
Nuevo León (B)	59.65	89.74	30.09	9.45	8.89	-0.56
Jalisco	42.53	89.48	46.95	6.74	8.87	2.13
México	128.58	197.17	68.59	20.37	19.54	-0.83
Distrito Federal	136.71	215.60	78.89	21.65	21.36	-0.29
MEXICO	631.35	1009.18	377.83	100.00	100.00	

1) Excludes primary petrochemicals (ind. 3511), oil refining (ind. 3530), and basic iron-steel industries (ind. 3710).
2) Ranked by absolute change.
3) Million new pesos 1980 = 100.
B = State bordering the U.S.
Source: Author, based on data from INEGI (1992, 1995).

Table 2
Description of Variables[a]

CMP_i:	Consumer market potential in state i.
	$$CMP_i = \sum_{i=1}^{32} \frac{Pop_j * Inc_j}{d_{ij}^2}$$
	where Pop_j is population in state j. Inc_j is household average per capita income in $state_j$ as a percentage of the same measure for the state with the lowest value. d^2_{ij} is the distance between the center of population in state i and the center of population in state j, squared. The distance from a state to itself (d^2_{ii}) is defined as one half the average distance between the center of the population in state i to the centers of population in adjacent states, squared. i=1...32 is the number of Mexican states, including the Federal District.
$PUBINV_i$:	Investment in public infrastructure in state i. Federal government investment in communications and transport networks plus state and municipal governments investment in urban infrastructure.
$TAXEFF_i$:	Tax effort in state i. Total federal income tax collections as a percentage of potential or hypothetical revenue capacity (PRC), where PRC = (representative tax rate (RTS) x gross state product) and RTS = (total federal income tax collections / gross domestic product).
$WAGE_i$:	Wage in state i. Manufacturing production worker's annual average wage.
ENG_i:	Technical expertise in state i. Ratio of number of mechanical-industrial engineers to working-age populaton (16-64 years old).
BORDER:	Advantageous characteristics of the states bordering the U.S. Dummy variable, 1 = border states with above average manufacturing value-added growth and above average population living in cities with at least 100,000 inhabitants, 0 = otherwise.

a) Variables are defined as levels at or around the beginning of the period (CMP, 1990; PUBINV, is an average for 1988-1990; TAXEF, 1988; WAGE 1988; and ENG, 1990).

The definition of consumer market potential, CMP, recognizes that industrial growth in a particular state can be stimulated importantly by the distribution of the national market among all other states. For that particular state, that distribution is weighted by the distance to each of the other states, reflecting transport costs, as in standard gravity models. The tax effort variable, TAXEFF, indicates how much the potential tax base of a particular state is exploited relative to other states. It is expected to reflect any federal and state tax concessions (granted against income taxes) which are not homogeneous across states, including those granted under the regionally differentiated federal system of tax credits for industrial promotion.[5] The qualitative variable BORDER is expected to reflect the advantages of northern border states in terms of their distance to the U.S. (e.g., proximity to that market, timely coordination of cross-border operations, and a better supply of foreign executive and highly technical personnel). Moreover, a border location is critical for distance-sensitive industries, which is the case for a large part of cross-border operations.[6] The rationale of the variables PUBINV, WAGE, and ENG should be readily apparent. The respective data sources are reported in the Appendix.

Regarding the hypothesized relationships of these variables with state manufacturing growth, CMP is expected to have a positive impact as it is directly related to potential revenues. PUBINV and ENG are also presumed to be positively related with growth as they confer cost-savings, whereas TAXEFF and WAGE are anticipated to show a negative relationship as they represent costs. Finally, BORDER is expected to be positively related to growth as it synthesizes both cost-saving and revenue-increasing factors. Careful analysis of the simple correlation coefficients among independent variables suggests that multicollinearity does not represent a serious problem for the efficiency of the estimates. The highest correlation is .82 between PUBINV and TAXEFF, and ten of the other thirteen correlations are below .41. Tests for heteroscedasticity (cook-weisberg) failed to reject the null hypothesis of constant variance. The relevant X^2 statistics for each variable in each model ranged from .00 to 2.45. Any test is available upon request.

IV. Empirical results.

The results from estimating OLS regressions are reported in Table 3. The base specification is identified as B. In specification A, the border dummy variable is excluded, and in specifications C and D, total public investment in infrastructure, PUBINV, is replaced by each of its two components: federal government investment

[5] This definition, however, assumes that the effectiveness of the tax collection system is the same for all states—i.e., any differences in the exploitation of their potential income tax base are not caused by differences in the effectivenes of their collection system.

[6] Leamer (1992) suggests that at 250 miles distance 50 percent of trade in manufactures between Mexico and California would be eliminated in 80 percent of the sectors.

Table 3
Regression Results of the Effects of State Attributes on State Manufacturing Growth in Mexico, 1988-1993

Dependent variable: absolute change in manufacturing value-added[1]

Independent Variables	*Mean*	*Specifications* (A)	(B)	(C)	(D)	*Beta Coefficient*
CMP	0.4513	6.4423	6.9208	8.0737	6.9034	0.5185
		(3.942)[a]	(4.263)[a]	(5.230)[a]	(4.018)[a]	
PUBINV	3.3974	2.4517	2.4971			0.6177
		(3.480)[a]	(3.633)[a]			
TAXEFF	0.5285	-12.4709	-13.6864	-14.7495	-9.2150	-0.3377
		(-1.867)[c]	(-2.086)[b]	(-2.012)[c]	(-1.508)	
WAGE	5.0196	-2.1928	-2.1578	-1.4011	-2.4273	-0.1711
		(-2.245)[b]	(-2.266)[b]	(-1.488)	(-2.375)[b]	
ENG	1.9901	4.4519	3.8305	3.9484	3.5211	0.2675
		(3.259)[a]	(2.752)[b]	(2.705)[b]	(2.473)[b]	
BORDER	0.1250		6.7480	7.3550	6.1609	0.1204
			(1.537)	(1.606)	(1.361)	
FEDINV				5.2144		
				(3.216)[a]		
LOCINV					3.6844	
					(3.296)[a]	
CONSTANT		9.3089	9.7987	7.2037	10.4052	
		(1.658)	(1.787)[c]	(1.296)	(1.812)[c]	
Adjusted-R^2		0.846	0.854	0.842	0.844	

Notes: t-values are in parentheses; significance levels are (a) .01, (b) .05, and (c) .10 using a two-tailed test; n=32.
See note 1 in Table 1.

in communications and transport infrastructure, FEDINV, and state-municipal investment in urban infrastructure, LOCINV, respectively.

All four model specifications performed rather well in terms of the overall variation explained. The coefficient of determination is above .84 in all cases. Without exception the effects of all estimates in all formulations of the model of state industrial growth are consistent with *a priori* expectations. Manufacturing growth is found to be positively and significantly related to consumer market potential. This indicates that output tended to expand most in states with relatively high consumer market potential—i.e., the capital- and central-region states. Such results lends support to the finding of a survey-based study that proximity to important national markets is the single most important locational factor among plants in the central-region (Vleugels 1990).

Manufacturing production is also positively and significantly associated with both total public investment in infrastructure, and its federal and local components. There was a tendency for manufacturing output to expand the most in states with relatively large investments in public infrastructure, as represented by the variable PUBINV (specification B). Additionally, separate regressions were run with each of the two components of total investment in public capital in order to compare their relative impact (specifications C and D). It turns out that *federal* investment in communications and transport, FEDINV, has a larger impact on state manufacturing growth than *state-municipal* investment in urban infrastructure, LOCINV. These two components of public investment were also introduced separately in a single regression, not reported. Neither appeared to be statistically significant since their intercorrelation is too high (.93). Nevertheless, a joint test of the hypothesis that both coefficients are zero was rejected at all levels of significance (F[2, 24]=6.36). It should be noted that these measures represent a short-run policy. It was not possible to include a variable to reflect the long-term public investment policy, such as the stock of public capital, as there is not yet sufficient relevant information for the construction of an appropriate measure. In general, these results confirm the finding of a survey-based study indicating that local infrastructure (e.g., power, fuel, water, transportation and other utilities) is the highest-rated location criteria among a sample of plants drawn from different regions covering a wide part of the country (Garza 1992). Galbraith *et al.* (1990) and Quintanilla (1990) also report that local infrastructure is an important factor –only second to personnel-related factors—for the maquiladora-plants in the border areas.[7]

Income tax effort shows, as anticipated, a negative and significant relationship with manufacturing growth. That is, manufacturing production tended to avoid or to expand the least in states characterized by a relatively high tax effort. Thus, manufacturing growth is in fact deterred by a high income tax effort. The tax effort coefficient becomes insignificant when total public investment in infrastructure is replaced by local investment in urban infrastructure, but the sign remains negative (specification D). This result lends some support to the finding of survey-based studies that federal and state-local incentives altogether are the second most important location factor in the central-region (Vleugels, Ibid.). A negative and

[7] Using a binary-choice model, Ramírez (1995) found that a composite variable called "traditional factors", which comprises, among other variables, the supply of public infrastructure and utilities, is not determining for the decision to locate an auto-plant in north Mexico. Nevertheless, the author defends the importance of such factor, by arguing that it is subordinated to or conditioned by the existence of other decisive regional attributes. Essentially, these decisive location attributes have to do with the supply of favorable conditions for the introduction of flexible technologies. Nevertheless, the importance of these conditions can not be generalized for the majority of manufacturing industries as they still operate with traditional technologies.

significant association is also found between manufacturing output growth and the wage rate. This suggests that output tended to increase the least in or to avoid high-wage states. The wage coefficient becomes insignificant when total public investment is replaced by federal investment in communications and transport, but the coefficient remains negative (specification C).

The level of technical expertise, as measured by the ratio of the number of mechanical-industrial engineers to the working-age population (16-64 years old), is positively and significantly related to the growth of manufactures. There is a tendency then for manufacturing production to expand mostly in or to be attracted to states characterized by having a high proportion of manufacturing-related engineers. In contrast, the proportion of the working-age population with at least secondary school completed, tried as a proxy of labor productivity, was insignificant in all specifications and finally excluded. Consistently, the survey-study by Garza (1992) reveals that the qualifications of the workers, as ranked by plant managers, is a factor of moderate-to-low importance in the location decision. These results have important implications for the education policy as integrated in industrial development strategies.

The dummy variable, intended to capture the effect of advantages of northern border states over the rest of the country given their proximity to the U.S. market, has the anticipated positive sign, but it is statistically insignificant. This indicates that manufacturing growth in the northern border states was not higher than in the rest of the states. While the growth of some industries with a large involvement of foreign subsidiaries and hence a high export-propensity in the northern border states is unambiguous and has been widely documented, the performance of the whole manufacturing sector in these states clearly masks or overwhelms such a tendency.

The last column of Table 3 presents the normalized coefficients corresponding to specification B. On one hand, these coefficients indicate that total public investments in infrastructure, and consumer market potential, in that order, have the largest positive effect on manufacturing growth. The positive impacts of the technical expertise and the border dummy are much smaller. On the other hand, the negative impact of the income tax effort is much larger than the wage effect. Finally, it should be noted that the magnitude of the negative impact of the income tax effort is larger than the positive impact of both the technical expertise and the border-dummy.

IV. Conclusions and policy implications.

This paper has started to explore an issue that will achieve considerable significance within the context of the expected strengthening of fiscal federalism in Mexico—the impact of taxation, public investment in infrastructure and other public policies on state-local industrial growth.[8] To the extent that industrial activity is associated with both employment and personal income growth, state and city governments are likely to use any transfer from the federal government of either jurisdiction over tax revenues, or control over expenditures to promote their industry. At least there is no reason to believe otherwise. Hence the importance for state-local governments to enhance their knowledge of the effectiveness of fiscal instruments for industrial development.

In agreement with conventional wisdom, the results of this analysis suggest that investment in the type of infrastructure that is functional to the operation of manufacturing businesses should be a key component of both state-level industrial development policy, and federal policies aimed at promoting growth in designated areas. To the extent that these policies aimed at upgrading economic infrastructure in a particular area improve the efficiency and productivity of private capital, they would contribute also to national growth.

The results also suggest that attention should be paid to the relative position of a state regarding the exploitation of its potential income tax base (tax effort), as a relatively low tax effort would increase the state's attractiveness for industrial production. It should be noted, however, that state-local rivalry can be worse than a zero-sum game in terms of national economic growth, if subsidies distort the efficient allocation of resources—i.e., if industry shifts as a result of these local subsidies toward areas in which the efficiency of capital is relatively low. The use of subsidies may also exact a heavy toll on the states' treasuries. Therefore, a mechanism to limit the use of tax concessions by state-local governments, supervised by the federal government, is always recommended. As for the design of federal industrial deconcentration strategies, an efficiency criteria must also prevail in the regional allocation of resources if these strategies are to contribute to national growth. That is, these strategies should promote areas in which private capital can operate at least with the same level of efficiency as the areas whose growth is to be discouraged simultaneously.

Another clear conclusion of this study is that an educational policy to improve the technical expertise of a state, rather than only widening its basic education coverage, is likely to generate a pay-off in terms of industrial growth. That is, state-local educational policy as integrated in industrial development strategies should particularly focus on increasing the supply of professionals related to the technical aspects of production.

The previous policy implications further suggest that the negative impact of a given state tax effort would be outweighed by the positive impact of appropriate

[8] Industrial development efforts within the states have been largely administered by the federal government, as it controls the income tax revenue sources and by far executes most of the investment in infrastructure. The efforts by most state governments have been largely limited to the provision of information, small scale loans, and other relatively inexpensive promotion programs.

expenditures in infrastructure and education. Hence, the degree to which the potential income tax base is exploited should be always viewed in relation to how public investment is structured. This relationship, however, has not been treated explicitly here.

The important attraction of manufacturing growth toward areas with a high consumer market potential —a variable beyond the control of government policy makers—together with the still high concentration of the potential market should be expected to offset to some extent the effect of fiscal incentives for industrial development in states-areas characterized by a low market potential (i.e., in areas beyond the central-region states or outside the immediate hinterland of the Metropolitan Area of Mexico City). Such implication also applies for the northern border states whose proximity to the U.S. market does not appear to have a positive impact on their manufacturing sectors as a whole. On the other hand, it is very likely that most new industrial activity in areas of high market potential would take place there even without fiscal incentives. That is, tax incentives in these areas are not likely to attract additional industrial activity.

The accumulated experience in this research field for the case of developed countries, mainly the U. S., suggests that in Mexico as in other large developing countries the research efforts should focus as soon as possible on disaggregation by industries and size as well as on explicit modeling of specific location decisions (e.g., branch plant and single plant births and deaths, on-site expansions and contractions, and relocations). The use of data at the firm level certainly will help to elucidate much of the differences in the reaction by these different components of industrial growth to a change in relative regional attributes across regions/locations, and thus will yield much more practical results for the crafting and evaluation of policy. Indeed, data at the metropolitan area or municipal levels will also improve the analysis. To the extent that further progress is made regarding the financial autonomy of the Mexican federated states such efforts are likely to produce a significant payoff.

Appendix

Data Sources

Variable name	*Data*	*Year*	*Source*
Real Manufacturing Value Added	Manufacturing Value Added.	1988	INEGI 1992.
		1993	INEGI 1995.
	Deflators.		INEGI 1991, 1994.
CMP	Population.	1990	INEGI 1992a.
	Household average per capita income.	1990	INEGI 1995a.
FEDINV	Federal Investment in Communications and Transport Infrastructure.	1988	Presidencia de la República 1989.
		1989	Presidencia de la República 1990.
		1990	Presidencia de la República 1991.
LOCINV	State-municipal Investment in Urban Infrastructure.	1988	INEGI 1992b.
		1989 y 1990	INEGI 1996.
TAXEFF	Total Federal Income Tax Collection.	1988	INEGI 1992c.
	Gross State Product.	1988	Presidencia de la República 1997.
WAGE	Manufacturing production worker's annual average wage.	1988	INEGI 1992.
ENG	Number of mechanical-industrial engineers.	1990	INEGI 1993.
	Population 16-64 years old.	1990	INEGI 1992a.

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