Business Climate, Taxes and Expenditures, and State Industrial Growth in the United States*

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I. Introduction

Many state and local public officials and businessmen have placed increasing emphasis on a state's so-called "business climate" as a central factor in determining its ability to attract industry and promote growth. Exactly what constitutes a good business climate is not entirely clear but it is usually associated with low state and local taxes, right to work laws, little union activity, and a cooperative governmental structure. In the newly emergent Sunbelt/Frostbelt controversy, the relatively good business climate of the southern states is frequently offered as a major explanation of Sunbelt growth.

The ambiguous nature of the term "business climate" has no doubt discouraged serious statistical inquiry into its possible effect on industrial location decisions and industrial growth. Like many poorly defined concepts, business climate has become both an all-encompassing term which includes a multitude of (frequently unquantifiable) factors alleged to be important in location decisions as well as a term which takes on different meanings depending upon whether the user is a corporate executive, location consultant, public official, or academic. Recent reports by industrial consulting firms [15; 6] have further fueled the controversy by ranking states according to variously defined business climate scores.[1]

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1. The Fantus Company [15], for example, ranked the states according to composite scores based on their rank in each of three major component areas: legislative climate, facilities for living, and population characteristics. Based on a total of fifteen variables, legislative climate takes into account tax, public expenditure, public debt, and labor law factors. Consisting of ten variables, the facilities for living component attempts to measure facilities for education, recreation, and health care but contains some very weak proxies, most notably park acreage and number of fishing and hunting license holders. Population characteristics are measured by eight variables which include skill level proxies (such as average school years completed and selective service registration rates), income characteristics (such as the percentage of families earning less than $3,000 and the percentage of owner occupied homes), and union membership figures.

The Alexander Grant and Company report [6] for the Conference of State Manufacturers' Associations (COSMA) appears to be based on a more relevant and more selective set of criteria (the entire report examines only eighteen variables). In addition to some measures contained in the Fantus report (such as union membership, state expenditures and debt per capita, and state and local taxes per capita), COSMA also includes such variables as the average weekly manufacturing wage, energy cost per million BTUs, and manufacturers' pollution abatement expendi-

Despite the vast literature on industrial location,[2] none of the available models use data for all U.S. states to test the relationship between a wide range of both non-economic and economic factors, including business climate, and multiple measures of industrial growth. Using principal components analysis and a multiple regression model on pooled data for the forty-eight contiguous states, this paper tests the effect of four groups of variables (accessibility to markets, cost and availability of factors of production, climate and environment, and business climate and state and local taxes and expenditures) on three separate measures of industrial growth (which measure overall, labor-intensive, and capital-intensive growth). Central to the issue is whether regional industrial expansion is more the result of traditional market factors (such as market size and wage rates), newly emergent market factors (such as energy costs), environmental factors, or tax/expenditure and other business climate factors.

Previous Results

Most of the literature on industrial location puts heavy emphasis on traditional market factors, specifically access to markets, cost and availability of labor, cost and availability of raw materials, and the availability of adequate transportation facilities, in explaining regional industrial growth. The importance of regional differences in energy costs, however, apparently has not yet been documented. Only in rare cases has climate been found to be a significant variable.

Although it has been argued that problems exist in measuring tax differentials among the states for different types of firms [46], previous studies have consistently found that state and local taxation is not a significant variable affecting industry location [2; 42; 50; 5; 17; 13; 45].[3] A similar conclusion has been reached regarding the effectiveness of other forms of publicly provided inducements to business firms [1; 34; 33].

While studies that have attempted to improve the theoretical basis of the public sector inducement/industrial growth relationship [32;28] have been criticized for lack of quantitative results, empirical support for existing theoretical models has been rather limited. In one case, a model employs a profit-maximizing theory of the firm with some other fairly restrictive assumptions, and is supported by data for only two states [30]. Another recent study, which does use data for forty-eight states, arrives at the rather startling conclusion (among other findings) that the level of business taxes is positively correlated with the growth of state personal incomes [40].[4]

A further deficiency in the literature is that theoretical models with no empirical support tend to be much too general for policy applications, whereas empirical support for theoretical models tends to be of value only in rather specific applications of those models. Examples of the former include rather broad examinations of the industrial location issue

tures per capita. In general, Fantus places a large emphasis on state and local taxes while COSMA places greate. emphasis on labor factors.

2. Rather than cite this voluminous literature, the interested reader is instead referred to two fairly exhaustive bibliographies [16;43].

3. One recent study, however, suggests that high personal taxes may inhibit the growth of high technology industries in certain areas because of difficulties in attracting highly-skilled professionals [14].

4. Without citing support, Romans and Subrahmanyam [40, 435] erroneously argue: "(s)urvey results of business firms indicate that 'high taxes' consistently rank close to or at the top of any list of determinants of industry location" despite the fact that at least ten studies of numerous firms which made location decisions provide evidence to the contrary. These ten studies are surveyed in Pluta [38].

in terms of information models [24], decision theory [12], organization theory and industrial geography [51], and cost minimizing location models of the firm [27]. Examples of the latter include studies of oliogopoly theory and the U. K. brewing industry [47], organization theory and limited results for six U. K. industries [29], and theories of metropolitan dominance and the location of home offices and branch plants [25]. One exception to the above division appears to be Oster [36], which contains empirical support for a search theory model and has fairly wide-ranging policy applications.

Motivations for this Study

Despite consistent findings in the literature regarding the relative unimportance of taxes and the reluctance of scholars to perform statistical tests on measures of business climate, explicit treatment of tax and non-tax variables (which may affect business climate) in a general model of industrial growth appears justified for at least four major reasons.

First, state and local government officials evidently feel that they can influence industrial location decisions given the large number of states which provide tax credits and exemptions, revenue bond financing and low-interest loans, and other special incentives to attract industry [48, 134].

Second, because a large number of previous studies relied on fairly broad measures of tax burdens (such as either corporate or personal income tax levels or total state and local taxes as a percentage of personal income), the correct specification of tax variables becomes an important issue. Perhaps previous studies did not adequately distinguish taxes borne, at least initially, by businesses and households.

Third, the fact that many of the studies cited here are relatively old suggests that tests using more recent data would be worthwhile, especially in light of rising energy costs and changing public opinion on the appropriate role of the public sector.

Finally, perhaps the notion of business climate continues to be an important, although as yet incorrectly specified, factor influencing industrial location. More accurate specification of the term which either downplays the role of taxes in the aggregate or increases the role of specific tax or non-tax components may enhance the importance of the business climate variable.

In the following section of the paper, simple correlations between the FANTUS and COSMA (Conference of State Manufacturers Associations) business climate rankings and measures of overall, capital-intensive, and labor-intensive industrial growth are calculated. In section III, a model of industrial growth is developed and our regression methodology is explained. In section IV, the regression results are presented and findings are compared with those of earlier studies. In section V, the major conclusions are highlighted.

II. Business Climate and State Industrial Growth: Simple Correlations

The strong relationship between state business climate and industrial growth is more often asserted to be the case than tested. Weinstein and Firestine [48, 137] and Alexander Grant and Company [6], for example, present tables comparing the Fantus and COSMA business climate rankings, respectively, to changes in manufacturing employment by state, but correlation coefficients are not calculated. Such correlations, however, are a simple and obvious method of summarizing the strength of the business climate—industrial growth relationship.

State business climate rankings for the 48 contiguous states are related to three measures of industrial growth:

1) The percentage change in real manufacturing value-added which measures increases in overall industrial production,

2) The percentage change in manufacturing employment which measures labor-intensive industrial growth, and

3) The percentage change in real manufacturing capital stock which measures capital-intensive industrial growth.

The above data were obtained from the *Census of Manufactures* and *Annual Survey of Manufactures*. The Appendix contains further details on data construction, and sources for all data used in this study. The industrial growth measures were calculated for two periods—1967 to 1972 and 1972 to 1977.

Table I shows that the expected negative relationship between the Fantus and COSMA business climate rankings and state industrial growth is significant, but not especially strong. All of the Spearman rank-order correlation coefficients are significant at the 5 percent level or better, and usually at the 1 percent level. In no case, however, does business climate explain any more than about 50 percent of the variance in the industrial growth measures.

III. A Model of State Industrial Growth

The relationship between state business climate and industrial growth obviously cannot be viewed in isolation. The relatively low, but significant, correlations between the state business climate rankings and the three measures of industrial growth suggests that other factors are also related to state industrial growth. A multiple regression model, which relates the three measures of industrial growth to variables measuring the relative profitability of states for industrial expansion, is useful for identifying the relationship between state business climate and industrial growth while controlling for the effects of other relevant variables.

The theoretical construct underlying the multiple regression model is the disequilibrium-adjustment model, which is commonly used in cross-sectional studies of regional growth.[5] In each regression, the *change* in the dependent variable over the period is related to *levels* of the independent variables at the beginning of the period. The independent variables in the regressions capture differentials in manufacturing profitability across states; differentials in manufacturing profitability then cause differentials in the rate of industrial expansion across states.

A key assumption behind the disequilibrium-adjustment model is that differences in manufacturing profitability across states at the beginning of the period are sufficiently large to cause differences in the rate of industrial growth. Perhaps a more sophisticated

5. See, for example, the MULTIREGION model [35] and the survey of the vast literature on cross-sectional population migration models [20].

Table I. Spearman Rank-Order Correlations between State Business Climate and Three Measures of Industrial Growth, 1967–1972, 1972–1977, and Pooled (1967–1972 and 1972–1977)

	Business Climate Rankings	
Period	FANTUS	COSMA
1967–1972		
% Change Real Value-Added	−0.65***	−0.67***
% Change Employment	−0.66***	−0.64***
% Change Real Capital Stock	−0.47***	−0.57***
1972–1977		
% Change Real Value-Added	−0.35***	−0.46***
% Change Employment	−0.30**	−0.41***
% Change Real Capital Stock	−0.65***	−0.70***
Pooled (1967–1972 and 1972–1977)		
% Change Real Value-Added	−0.50***	−0.56***
% Change Employment	−0.50***	−0.54***
% Change Real Capital Stock	−0.56***	−0.64***

Significance levels: *10%, **5%, ***1%

industrial growth model would not necessarily assume initial locational disequilibrium, but allow for locational equilibrium at the beginning of the period. In this case, differences in state industrial growth can still occur as an exogenous shock to state profitability during the period would cause the simultaneous adjustment of state profitability and industrial growth.

A fully-specified industrial growth model that allows for both locational disequilibrium and locational equilibrium would relate industrial growth during the period to: 1) the levels of the independent variables at the beginning of the period, 2) the changes in the independent variables during the period, and 3) the interaction of the levels of and the changes in the independent variables [10]. We do not attempt to estimate the fully-specified model here because it requires three times the number of independent variables than the 18 variables used in the disequilibrium-adjustment model. Estimation of such a model would certainly result in serious statistical problems such as multicollinearity, loss of degrees of freedom, and simultaneous-equations bias.

Independent Variables

A review of the industrial location literature suggests four classes of variables that are related to regional industrial growth [31, 81-135; 42, 23-94]: 1) accessibility to markets, 2) the cost and availability of factors of production (capital, labor, energy, land, and raw materials), 3) climatic and environmental factors, and 4) business climate, state and local taxes, and expenditures.

How each factor is measured in the model of industrial growth is discussed below. Whenever possible, groups of interrelated explanatory variables are reduced to one or two summary factor scores through the use of principal components analysis in order to save degrees of freedom in the estimation.

Market Accessibility. Access to final markets is measured by the ratio of personal income potential (*PIP*) to manufacturing value-added potential (*VAP*).

$$PIP_i = \sum_{j=1}^{48} PY_j / d_{ij}$$

$$VAP_i = \sum_{j=1}^{48} VA_j / d_{ij}$$

where PY_j and VA_j are, respectively, personal income and manufacturing value added in state j and d_{ij} is the distance from the center of population in state i to state j. The distance from a state to itself (d_{ii}) is approximated by one-half the average radius of the state [44]. State personal incomes are deflated by regional cost of living indices in order to account for differences in real buying incomes across states. Manufacturing value-added is not deflated because manufacturers sell to national markets so delivered prices should be equalized across regions.

Personal income potential measures regional final demand while value-added potential measures the concentration of manufacturing activity in the region (and implicitly, the supply of goods). Thus, the ratio of the two measures the size of the market relative to existing manufacturing activity. Because manufacturers are expected to locate relatively close to underserved markets to reduce transportation costs and to avoid competition, regional manufacturing growth should be positively correlated with the market accessibility ratio [49, 38; 10].[6]

Note that no measure of accessibility to intermediate industrial suppliers or demanders is included in the model. If this analysis were dealing with location patterns by industry, intermediate market variables would certainly need to be considered, but since we are dealing with total manufacturing growth, such variables are not relevant.

Cost and Availability of Capital. Money capital is assumed to flow freely between regions and, thus, is available at the same cost everywhere. This assumption is strongly supported by the common finding that interest rates tend to be almost equal across regions [9].

Labor: Cost, Availability, Activity and Productivity. Four variables, measuring the cost, availability, activity and productivity of labor are included in the model:

1) Labor cost is measured by the average hourly wage rate in manufacturing.
2) Labor availability is measured by the unemployment rate.[7]
3) The presence and activity of unions are measured by a principal components index

6. Some readers may wonder why no measure of market growth is used as an explanatory variable in the model. The use of a market growth variable, however, would not be consistent with the disequilibrium-adjustment framework being used in this analysis.

7. In early estimates of the industrial growth model, the labor force participation rate was included as an additional measure of labor availability. This variable was not significant in any of the regressions, however, so it was dropped.

that explains 67 percent of the variance of percentage of working time lost due to work stoppages (3-year average), percentage of work force unionized, and a right to work state dummy variable. Factor scores are, respectively, 0.371, 0.455, and −0.393. 4) Inherent labor productivity is measured by a principal components index that explains 86 percent of the variance of average years of schooling and the literacy rate. Factor scores are 0.538 and 0.538.[8]

Energy Cost and Availability. The cost and availability of energy are measured by a principal components index that explains 81 percent of the variance of the cost per BTU of fuels and power used in manufacturing and the ratio of energy production to consumption in the state. Factor scores are 0.544 and −0.544.

Land and Raw Materials: Cost and Availability. Various firms use a wide range of different raw materials in their production processes so while the cost and availability of a certain raw material might be relatively important to one firm in its location decision, it might be relatively unimportant to another. Raw land, however, is utilized in varying degrees by all manufacturing firms.

The cost and availability of land are measured by a principal components index that explains 95 percent of the variance of the value of agricultural land and buildings per acre and population density. Factor scores are 0.514 and 0.514.

Climate and the Environment. It could be argued that climate and environmental factors are more important to households in deciding where to live than to firms in their locational decisions. For two reasons, however, such considerations may also be important to firms. First, certain climatic and environmental conditions may lower (or increase) the cost of doing business. A warm and sunny climate, for example, may allow firms to carry out less costly open-air operations. Second, a desirable climate and environment may attract a productive labor force to the firm's area and the existing labor force may also be more productive because people are most satisfied with their lifestyle. Recent migration research, for example, has placed considerable emphasis on climatic and environmental factors in people's decision to move [11; 19; 39].

Climatic conditions are measured by two principal components indices that together explain 78 percent of the variance of average annual temperature, percentage of possible sunshine, percentage of months with the average maximum temperature exceeding 80 degrees F. or with the average minimum temperature less than 65 degrees F., and the average annual precipitation rate. The two principal components clearly delineate two climatic zones—the semi-arid, variable temperature climate of the West (factor scores are −0.033, 0.460, and 0.362, and −0.471) and the hot, humid climate of the Southeast (factor scores are 0.765, 0.328, 0.063, and 0.319).

Other environmental factors, such as pollution and congestion, are not explicitly included in the industrial growth model. These sorts of variables are not included in the analysis because of lack of data, measurement problems, and because of the questionability of the relevance of such considerations at the state level (rather than at the metropolitan area level where pollution and congestion considerations are more relevant).

8. The inherent labor productivity variable attempts to measure the productivity of the labor force independent of the amount of capital employed. After-the-fact measures of labor productivity, such as value-added per employee, largely reflect the capital-to-labor ratio in production.

Business Climate, State and Local Taxes and Government Expenditures. Overall business climate and state and local tax efforts are measured by the following two variables:

> 1) Business climate is measured by a principal components index that explains 90 percent of the variance of the Fantus business climate rankings and the COSMA business climate rankings. Factor scores are 0.527 and 0.527.
> 2) State and local tax effort, a concept developed by the Advisory Commission on Intergovernmental Relations [4], is measured by total state and local taxes as a percentage of revenue capacity (or potential yield). This variable is a superior measure of the level of state and local taxes than state and local taxes per capita or even state and local taxes relative to personal income because unique features of state and local revenue bases, such as the availability of taxable mineral production in resource-rich states, are taken into account.[9]

The relative burden of state and local taxes on business and households is measured by the following four variables:

> 1) Corporate taxes are measured by state corporate income taxes, corporate license tax collections, and occupational fees as a percentage of payroll generated by "corporate-like" business.[10] Corporate taxes are borne, at least initially, by business.
> 2) The level and progressivity of state personal income taxes are measured by a principal components index that explains 87 percent of the variance of state personal income taxes as a percentage of state personal income and the marginal state personal income tax rate.[11] Factor scores are 0.537 and 0.537. The personal income tax is obviously a tax on households.
> 3) Sales taxes are measured by state sales and gross receipts taxes as a percentage of retail sales. The sales tax probably falls most heavily on households, but in some states, business is also taxed because capital goods purchases are subject to the sales tax.
> 4) The property tax is measured by state and local property taxes divided by the estimated market value of real property (the effective property tax rate). The property tax, of course, is paid by both businesses and households.[12]

9. Based on empirical results by Genetski and Chen [18] and casual observations about the revival (?) of industrial growth in Massachusetts and New York, Bartlett has argued that the "newer view of the relationship between taxes and industrial growth . . . says that the changes in the tax burden are more important than the absolute burden of taxation" [8, 59]. Despite this argument, however, no change-in-tax burden variable is included in our industrial growth regessions. This is for two reasons.

First, using a change-in-tax burden variable would not be consistent with the disequilibrium-adjustment model being used in this analysis.

Second, even though a change-in-tax-burden variable would be consistent with an equilibrium-adjustment model of industrial growth, a careful analysis of Genetski and Chen's results reveals that they did not use such a model. Genetski and Chen find that a three-year lag between the change in the tax burden and the state growth rate in personal income works the best. This three-year lag, however, was used only after the contemporaneous change in the tax burden variable was not successful. Genetski and Chen argue that their results indicate that firms need time to respond to changing tax burdens, but no explicit theory supports these results. One could well argue, in fact, that Genetski and Chen's results are more a result of "data mining" than careful analysis.

As noted by the Advisory Commission on Intergovernmental Relations [2, 55], there is also an important technical problem with the Genetski and Chen analysis. The dependent variable in the Genetski and Chen regression is the growth rate in state personal income (relative to the U.S.) while the independent variable is the change in the tax burden (relative to the U.S.), lagged three years. Because the tax burden is measured as state and local taxes relative to personal income, there is a "built-in" correlation between the dependent and independent variables as fast-growing states (in terms of personal income) will have falling tax burdens if state and local taxes do not rise as quickly as personal income.

10. As suggested by the Advisory Commission on Intergovernmental Relations [4, 53-4], payroll generated by "corporate-like" business includes total private wages and salary disbursements less wages and salaries paid in the farm, personal services, and professional, social and related services industries.

11. The measure or progressivity used is the average marginal state personal tax rate with respect to family income. This is a measure of tax progression based on "calculations for each state of the levels of personal taxes which a hypothetical average family of four would pay at six different income levels in 1974" [40, 436-7].

12. Ideally, we would like to include in the model separate measures of the effective property tax rate on business

The level and distribution of government expenditures which potentially affect business location decisions are measured by the following two variables:

> 1) "Desirable" government expenditures are measured by a principal components index that explains 91 percent of the variance of total state and local expenditures as a percentage of state personal income and total state and local education expenditures as a percentage of state personal income. Factor scores are 0.52 and 0.52.[13]
> 2) "Undesirable" government expenditures are measured by total state and local welfare expenditures as a percentage of state personal income.

One might hypothesize that industry will avoid states with relatively high tax burdens on business, but this is not necessarily true. States that impose relatively low tax burdens on business must impose relatively high tax burdens on households (holding the total level of taxes constant). High household tax burdens might make it difficult to attract productive labor to the state, thus making the state look less attractive for industrial expansion. States with relatively low taxes, however, may also provide low levels of public services.[14] Because of the importance of public education, for example, in attracting quality employees, expenditures as well as tax influences on industrial location must be considered [7].

Regression Methodology

The three measures of industrial growth are related to the 18 independent variables using pooled state data for the periods 1967-72 and 1972-77. All coefficients except the intercept and the energy coefficient are forced to be equal in both periods. Changes in the intercept capture changes in overall industrial expansion from 1967-72 to 1972-77. The energy coefficient is allowed to shift because it is hypothesized that rising energy prices have made energy cost and availability much more important in determining regional industrial growth patterns since the 1973 Arab oil embargo.[15]

Pooling data for 1967-72 and 1972-77 doubles the sample size so the efficiency of the estimators is greatly increased. This increased efficiency, however, is acquired at the cost of possibly introducing *bias* in the estimated coefficients if the effects of the independent

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and on households. The Advisory Commission on Intergovernmental Relations [4, 128-9] did compute tax effort figures for local property taxes on nonfarm residential property, commercial and industrial property and farm property, by state for 1967, but those calculations have not been updated. The lack of sufficient detail in the 1972 *Census of Governments* prevented the calculation of such figures for that year [2, 69]. And although the percentage of property taxes paid by business was again calculated by the ACIR [3, 91] for 1977, property tax capacity for business and households, which is needed to calculate the tax effort measures, was not computed.

We did attempt to use the percentage of property tax paid by business (the 1972 figure was calculated as a simple average of the 1967 and 1977 figures) as an additional explanatory variable in the industrial growth regressions, but the variable was consistently insignificant and it was consequently dropped.

13. In early runs of the regressions, it was discovered that total state and local expenditures and education expenditures were highly correlated; the two measures were, therefore, combined into one principal components index. The extremely high correlation between total state and local expenditures as a percentage of personal income and educational expenditures as a percentage of personal income ($r = 0.81$) is surprising given Bahl's conclusion that differences in public welfare spending (and not education spending) is the principal characteristic distinguishing the state and local expenditure systems of northern and southern states [7, 78-9].

14. As mentioned earlier, several studies have indicated that public inducements have little effect on the location of industry. Nevertheless, as a rough measure of such inducements, the number of tax incentives and number of financial incentives available to incoming industry [21; 22; 23] were included as independent variables in early estimates of the industrial growth equations. These variables, however, turned out to be insignificant so they were excluded from further analysis.

15. It is recognized that the rapid increase in world oil prices did not begin until late 1973, but four out of the six years in the 1972-1977 period were dominated by high energy prices.

variables on industrial growth during the two periods are quite different. The appropriateness of the homogeneity assumption (equal slopes in both periods) is, therefore, tested by computing F-statistics [26, 322-6]. To insure comparability between the 1967 and 1972 variables, all independent variables are measured relative to their 48 state mean for the year.

All equations are estimated using ordinary least squares. There is no need for a simultaneous-equations estimation method because all independent variables are measured at the beginning of the period. One could argue, perhaps, that the estimation method should account for possible inefficiency in the pooled coefficient estimates because regression residuals in the 1967-72 data may be highly correlated with the residuals in the 1972-77 data. In practice, however, these correlations turned out to be small and insignificant.

In conducting the regression analysis, careful attention was paid to detecting the symptoms of multicollinearity among the independent variables. Multicollinearity could possibly affect the efficiency of the parameter estimates in regressions with so many independent variables. Based on an analysis of the simple correlations among the independent variables, however, multicollinearity does not appear to pose a serious problem in the estimation. The highest correlation among the independent variables is 0.77 between business climate and union activity and only six other intercorrelations are above 0.60.[16]

IV. Multiple Regression Results

The regression equations explain about one-half to three-quarters of the variance in the three industrial growth measures (Table II). These R^2's are quite high considering we are explaining changes, and not levels, of the dependent variable across states. The relatively low R^2 for the capital stock equation is probably due to: 1) the extreme volatility in new capital expenditures across states, 2) errors in measuring the capital stock series, and 3) difficulties in explaining large investment projects in relatively small states. One observation, New Mexico for the 1972-77 period, was deleted from the capital stock equation because of this third problem.[17]

F-statistics indicate that pooling the 1967-72 and 1972-77 data is probably acceptable in all three equations, but the F-statistic for the value-added equation is a little high.

The relative importance of the six groups of independent variables in explaining state industrial growth can be summarized by computing F-statistics where each variable group is sequentially dropped from the regressions. Table III shows the results of these calculations with each variable group ranked according to the size of its F-statistic.

Overall, the cost and availability of energy, labor-related factors, land cost and availability, and climate are strongly related to the growth of industrial output (value-added). Relatively labor-intensive industrial expansion is strongly related to climate; labor-related factors; and business climate, taxes and expenditures, while relatively capital-intensive industrial expansion is strongly related to the cost and availability of energy; the

16. A complete correlation matrix is available from the authors on request.

17. For example, from 1972 to 1976 a \$268 million copper smelter was built in Hidalgo County, New Mexico [41]. Total New Mexico new capital expenditures in manufacturing were only \$632 million during 1972-77, so the construction of the smelter had a significant impact. The difficulty in explaining this and other major expansions and pollution control expenditures in the smelting industry led us to delete the New Mexico observation for 1972-77.

Table II. Industrial Growth Model: Regression Results

Independent Variables	Dependent Variables					
	% Δ Real Value Added		% Δ Employment		% Δ Real Capital Stock	
	Coefficient (Std. error)	Beta Coefficient	Coefficient (Std. error)	Beta Coefficient	Coefficient (Std. error)	Beta Coefficient
Market Accessibility						
PIP/VAP	18.8609 (22.1542)	0.1044	23.5588* (13.1667)	0.1736	27.3837* (15.9294)	0.2348
Labor						
Wage Rate	20.7826 (17.7024)	0.1636	25.4163** (10.5208)	0.2663	23.0675* (13.4025)	0.2785
Unemployment Rate	15.4196** (6.4146)	0.2221	19.7497*** (3.8123)	0.3787	−1.5562 (1.7028)	−0.0348
Union Activity	−7.0763*** (2.3645)	−0.3902	−4.6669*** (1.4053)	−0.3425	−2.4380 (1.7028)	−0.2087
Inherent Productivity	−3.7592 (2.6289)	−0.2057	−2.1222 (1.5624)	−0.1545	−4.4434** (1.9045)	−0.3768
Energy						
High Price-Low Availability	1.4135 (2.4617)	0.0779	1.7494 (1.4630)	0.1284	6.1525*** (1.7663)	0.5181
HP-LA × 1972 Dummy	−9.9450*** (2.5975)	−0.3812	−1.7628 (1.5437)	−0.0899	−7.0798*** (1.8935)	−0.4068
Land						
High Price-Low Availability	−3.3113* (2.0207)	−0.1826	−1.3733 (1.2010)	−0.1008	−3.3190** (1.4478)	−0.2830

Table II. (cont.)

Independent Variables	Dependent Variables					
	% Δ Real Value Added		% Δ Employment		% Δ Real Capital Stock	
	Coefficient (Std. error)	Beta Coefficient	Coefficient (Std. error)	Beta Coefficient	Coefficient (Std. error)	Beta Coefficient
Climate						
Semi-Arid-Variable-Western	3.2082** (1.5114)	0.1760	5.0589*** (0.8983)	0.3693	1.3266 (1.1087)	0.1100
Hot-Humid Southeastern	−2.2405 (2.7193)	−0.1229	−2.2765 (1.6161)	−0.1662	−0.7192 (1.9696)	−0.0612
Business Climate, Taxes & Gov't Expenditures						
Business Climate	−3.0999 (2.9712)	−0.1700	−5.1265*** (1.7658)	−0.3742	−5.5199*** (2.1498)	−0.4688
Tax Effort	−25.8082 (17.3419)	−0.2173	−34.0925*** (10.3066)	−0.3821	−6.2370 (12.7685)	−0.0814
Corporate Taxes	1.2777 (2.6924)	0.0449	1.8529 (1.6001)	0.0867	0.3082 (1.9299)	0.0168
Personal Income Taxes	−0.9767 (2.3647)	−0.0538	0.1325 (1.4054)	0.0097	−1.1158 (1.7494)	−0.0956
Sales Tax	1.0814 (3.9462)	0.0292	1.0382 (2.3453)	0.0373	−1.4574 (2.9091)	−0.0606
Property Taxes	15.0141*** (5.5372)	0.3372	9.3262*** (3.2909)	0.2787	10.4268*** (4.0114)	0.3626

Total-Education Expenditures	3.9557*	0.2181	2.6340**	0.1933	0.8874	0.0750
	(2.1824)		(1.2970)		(1.5738)	
Welfare Expenditures	2.0722	0.0414	4.0401	0.1074	6.7222***	0.2085
	(4.3847)		(2.6059)		(3.1428)	
Constant Terms						
Constant	−21.5011		−44.3160**		−27.6741	
	(32.8978)		(19.5518)		(24.6111)	
1972 Dummy	−0.9868		3.5015***		1.0612	
	(2.3066)		(1.3708)		(1.6642)	
$\bar{R}^2$	0.612		0.757		0.525	
F for Pooling	2.02**		1.58*		1.65*	

Standard errors are in parentheses
Significance levels: *10%, **5%, ***1%

Table III. Rankings of Variable Groups in Explaining State Industrial Growth According to Sequential F-Tests

Dependent Variables					
% Δ Real Value Added		% Δ Employment		% Δ Real Capital Stock	
1. Energy	(10.51***)	1. Climate	(16.08***)	1. Energy	(8.05***)
2. Labor	(3.46**)	2. Labor	(9.08***)	2. Land	(5.26**)
3. Land	(2.69*)	3. Bus. Climate, Taxes, & Expend.	(3.30***)	3. Markets	(2.96*)
4. Climate	(2.41*)	4. Markets	(1.31)	4. Bus. Climate, Taxes, & Expend.	(2.48**)
5. Bus. Climate, Taxes, & Expend.	(1.41)	5. Land	(1.31)	5. Labor	(1.83)
6. Markets	(0.73)	6. Energy	(0.83)	6. Climate	(0.75)

F-statistics are in parentheses
Significance levels: *10%, **5%, ***1%

cost and availability of land; markets; and business climate, taxes, and expenditures. A review of the regressions by variable group reveals the following more detailed results.

Energy Cost and Availability

The cost and availability of energy are major determinants of output and capital stock growth, but relatively minor determinants of employment growth across states. This suggests that large capital investments in energy-related industries, chiefly oil-refining and petrochemicals in the Southwest, have been associated with large increases in industrial output, but relatively small increases in employment.

As hypothesized, energy cost and availability have become much more important in determining regional industrial growth patterns since the 1973 Arab oil embargo. In fact, before 1972, capital investment was actually attracted to states with relatively high energy prices and low availability.

Labor Cost, Availability, Activity, and Productivity

Labor-related factors are important determinants of state output and employment growth, but relatively minor determinants of capital stock growth. Apparently, relatively desirable labor market conditions (to the firm) have resulted in labor-intensive increases in industrial output.

Industry is strongly attracted to states with relatively high unemployment and relatively little union activity. Surprisingly, industry is also attracted to states with high wage rates. The positive wage coefficients, especially in the employment equation, however, may partially reflect a supply-side (labor migration) effect.

Industry also appears to be attracted to, not repelled from, states with a less productive labor force. This finding may indicate that years of schooling and the literacy rate are relatively poor measures of inherent labor productivity. A more likely explanation, however, is that advancing technology and the increasing routinization of most industrial tasks has reduced the necessity for firms to seek out highly trained and educated workers. In fact, firms may consciously locate and expand in areas with fewer educated and skilled workers because they will perform simple tasks with less resistance.

Land Cost and Availability

The cost and availability of land are major determinants of state capital stock growth and are a somewhat important determinant of state output growth. State employment growth, however, is only weakly related to land cost and availability. Apparently, new capital investment is strongly attracted to areas with relatively cheap and available land, but this has been associated with relatively small increases in employment.

Climate

Climate is, by far, the dominant factor in explaining employment growth and is a somewhat important determinant of output growth across states. Capital stock growth, however, is not strongly related to climatic factors. Thus, a relatively desirable climate leads to labor-intensive industrial expansion.

Industry is strongly attracted by the arid and variable climate of the West and slightly repelled by the hot and humid climate of the Southeast The relatively rapid growth of the Southeast, therefore, has occurred despite its somewhat undesirable climate.

Business Climate, Taxes, and Expenditures

As a group, the business climate, tax, and expenditure variables are not strongly related to state output growth, but are significant determinants of state employment and capital stock growth. The relationship between business climate, taxes, and expenditures and state employment growth is especially strong.

Among the business climate and tax variables, a poor business climate and high tax effort appear to strongly deter state employment growth while a poor business climate also negatively affects capital stock growth. Three of the variables measuring the relative business/household burden of state and local taxes—corporate taxes, personal income taxes, and sales taxes—have little effect on state industrial growth. The property tax rate, however, is positively and strongly related to all three measures of industrial growth. The strong relationship between high property taxes and state industrial growth is fairly surprising and deserves more explanation.

A further analysis of the four variables measuring the relative burden of state and local taxes on business and households reveals that high property taxes are indicative of a locally-dominated state and local tax system. A principal components analysis of the four variables revealed two distinctive state and local tax systems—a state-dominated tax system characterized by high corporate and personal income taxes and a locally-dominated tax system characterized by high property taxes.[18] We hypothesize that industry is strongly

18. The two principal components explain 75 percent of the variance of corporate taxes as a percentage of corporate-like payroll, the average-marginal personal income tax rate principal component, sales taxes as a percentage of retail sales, and the effective property tax rate. Factor scores are 0.342, 0.429, −0.383, and 0.242 for the first

attracted to those states with a locally-dominated tax system because firms are able to avoid high overall state taxes, pick a community with low local taxes, and/or choose a community with the tax/expenditure system that best meets their needs.

Among the state and local expenditure variables, industry is attracted to states with high total-education expenditures and with high welfare expenditures. The positive relationship between welfare expenditures and industrial growth is surprising and is counter to the conventional wisdom that industry avoids those states with large welfare payments. It should be noted, however, that the positive correlation between welfare expenditures and industrial growth becomes evident only after controlling for the negative relationship between industrial growth and tax effort, and states with high welfare payments also tend to have high tax efforts.

Markets

Accessibility to markets is a relatively unimportant determinant of state industrial growth. As hypothesized, industry is attracted to relatively large and underserved markets but the effect is only secondary compared to the major determinants of state industrial growth—energy cost and availability, labor-related factors, land cost and availability, and climate.

Our finding that markets are not an important determinant of regional industrial growth stands in marked contrast to previous industrial location studies which usually stress the market influence [37; 45; 49]. Among the major studies, only Fuchs [17] discounts the market influence and instead, like this study, ranks labor factors, climate, and accessibility to raw materials as major determinants of regional industrial growth.

The apparent conflict between our results and the almost universal stress on market factors in determining regional industrial growth can be, at least partially, resolved through the following observation. The *simple* correlations between our accessibility-to-markets variable and the three measures of industrial growth are indeed moderately high. The market variable explains about 21 to 28 percent of the variance in the three industrial growth measures. When the other independent variables are added to the regression equations, however, the significance of the market variables markedly declines.

Previous studies, therefore, have often confused the *observation* that industry is moving away from the "core" industrial states of the Northeast and Midwest to the "peripheral" states of the South and West with the *explanation* that this is occurring because industry is moving in search of new markets. In fact, the peripheral states are characterized by relatively cheap and available energy, relatively abundant and non-unionized labor, relatively cheap and abundant land, and a desirable climate and these factors, not market pull, largely explain the rapid industrial growth of the South and West.

V. Summary and Conclusions

Recent data confirm that differences in overall industrial expansion across states can still be explained largely by traditional market factors. Different types of variables, however,

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principal component (the state-dominated tax system) and −0.587, −0.049, −0.080, and 0.790 for the second principal component (the locally-dominated tax system).

some of which are not among the traditional market factors, lead to relatively labor-intensive or relatively capital-intensive growth. For example, the growth in manufacturing employment is strongly related to climate and labor factors while the growth in manufacturing capital stock is strongly related to energy cost and availability and land cost and availability. Accessibility to markets, which most previous studies have identified as the primary factor explaining differences in regional industrial growth, was found to be relatively unimportant in our model

After controlling for other factors, the business climate, tax, and expenditure variables as a group were found to be not significantly related to overall state industrial growth but significantly related to state employment and capital stock growth. Among individual component variables, a poor business climate and high tax effort both appear to have a negative effect especially on employment growth. State industrial growth appears to be affected least by state-imposed taxes such as corporate taxes, personal income taxes, and sales taxes. The highly significant correlation between *high* local property taxes and all three measures of state industrial growth suggests that business firms prefer locally-dominated tax systems over state-dominated tax systems. High local taxes may not be a deterent to industrial growth if the benefits from such taxes (such as quality education as measured by relatively high education expenditures) are perceived to accrue locally rather than statewide.

While empirical support is, therefore, provided for the almost universal finding in the literature that individual state and local taxes have little effect on state industrial growth, our results suggest that overall state and local tax effort is an important determinant of state employment growth. Even where business climate, tax, and expenditure variables were found to be significant determinants of regional growth, however, their role was still less important than that of traditional market factors (land and labor), newly emerging market factors (energy), and climate variables.

Appendix. Data Construction and Sources

Dependent Variables

%Δ Real Value Added: Calculated using manufacturing value added figures for 1967, 1972, and 1977 deflated by the U. S. implicit price deflator for manufacturing. Sources: value added, U. S. Department of Commerce, Bureau of the Census, *Census of Manufactures*, 1967, 1972, 1977; price deflators, U. S. Department of Commerce, Bureau of Economic Analysis, unpublished industry gross national product accounts.

%Δ Employment: Calculated using figures on all manufacturing employees for 1967, 1972, and 1977. Source: U. S. Department of Commerce, Bureau of the Census, *Census of Manufactures*, 1967, 1972, 1977.

%Δ Real Capital Stock: Calculated using estimates of the real capital stock in manufacturing for 1967, 1972, and 1977. Manufacturing capital stocks were calculated using the perpetual inventory method:

$$K_t = (1 - \delta)\, K_{t-1} + I_t$$

where K_t is the real capital stock in year t, K_{t-1} is the real capital stock in year $t-1$, δ is the depreciation rate, and I_t is real investment in year t.

Depreciation rates were calculated by Census geographic division using the "gross book value of depreciable assets" for 1967 and 1971 to approximate capital stocks and data on "new capital expenditures in manufacturing" for 1968, 1969, 1970, and 1971 to measure investment. Source: U. S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures*, 1968, 1969, 1970, 1971. Calculated depreciation rates by geographic division are: Northeast, 3.59%; Middle Atlantic States, 4.04%; East North Central, 2.80%; West North Central, 2.54%; South Atlantic, 2.02%; East South Central, 2.29%; West South Central, 1.91%; Mountain States, 2.86%; and Pacific 2.69%.

Real investment flows for 1968 through 1977 were measured by new capital expenditures in manufacturing deflated by the U. S. implicit price deflator for business fixed investment. Sources: new capital expenditures, U. S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures*, 1968, 1969, 1970, 1971, 1973, 1974, 1975, 1976, and *Census of Manufactures*, 1972, 1977; price deflators, U. S. Department of Commerce, Bureau of Economic Analysis, *The National Income and Product Accounts of the United States*, 1929-1974 (Washington: Government Printing Office, 1977) and *Survey of Current Business*, various July issues.

Market Variables

Personal Income Potential: Calculated using state personal incomes for 1967 and 1972 and regional cost of living deflators. Sources: personal income, U. S. Department of Commerce, Bureau of Economic Analysis, State personal income accounts; cost of living deflators, U. S. Department of Labor, Bureau of Labor Statistics, "Three Standards of Living for the Urban Family of Four Persons," Spring 1967 (Bulletin No. 1570-5, Washington: Government Printing Office, 1969) and "Autumn 1972 Urban Family Budgets and Comparative Indexes for Selected Urban Areas" (News Release, Washington, June 1973).

Cost of living indices were calculated by Census region by taking a weighted average of the "moderate budget cost of living" indices for metropolitan and nonmetropolitan areas with the weights reflecting the percentage of the population living in SMSAs. Metropolitan area indexes are a simple average of the indexes for each reported SMSA, except in the Northeast and West where New York and Los Angeles are weighted equal to the other SMSAs in the region because these cities so dominate their respective regions.

Value Added Potential: Calculated using figures on manufacturing value added for 1967 and 1972. Source: U. S. Department of Commerce, Bureau of the Census, *Census of Manufactures*, 1967, 1972.

Labor Variables

Wage Rate: Average hourly earnings in manufacturing, for 1967 and 1972. Source: U. S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings: States and Areas, 1939-1978* (Bulletin 1370-13, Washington: Government Printing Office, 1979).

Unemployment Rate: Percentage of the labor force unemployed for 1967 and 1972. Source: U. S. Department of Labor, *Manpower Report of the President* (Washington: Government Printing Office, 1971), U. S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 1974.

Work Stoppages: Percentage of working time lost due to work stoppages, three-year averages for 1966-68 and 1971-73. Source: U. S. Department of Labor, Bureau of Labor Statistics, *Handbook of Labor Statistics, 1978* (Bulletin 2000, Washington: Government Printing Office, 1979).

Labor Union Membership: Percentage of the work force unionized for 1966 and 1972. Source: U. S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 1969, 1974.

Right to Work State Dummy Variable: Delineates states with a right to work law. Source: U. S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 1974.

Average Years of Schooling: Median school years completed for 1970. Source: U. S. Department of Commerce: Bureau of the Census, *Census of Population*, 1970.

Literacy Rate: Percentage of the population 14 and over able to read and write in any language for 1970. Source: U. S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 1976.

Energy Variables

Energy Price: Total cost per KWH for purchased fuels and power used in manufacturing, for 1966 and 1971. Source: U. S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures,* 1966, and *Census of Manufactures*, 1972.

Note: 1966 data gives total cost of purchased fuels and power but not total quantity used. Thus, quantity used was estimated by "blowing-up" the quantity of electricity used in 1966 by (one over) the proportion of total power obtained from electricity in 1971 (times 0.9232, which is the percentage of power obtained from electricity in 1966 divided by the percentage obtained from electricity in 1971 in the U. S.).

Ratio of Energy Production to Consumption: For 1973. Source: Oak Ridge National Laboratories, *Energy Availability for State and Local Development: A Methodological and Data Outline* (ORNL/TM-5890, 1977).

Land Variables

Value of Agricultural Land and Buildings per Acre: For 1969 and 1974. Source: U. S. Department of Commerce, Bureau of the Census, *Census of Agriculture*, 1969, 1974.

Population Density: Population per square mile, for 1967 and 1972. Sources: population, U. S. Department of Commerce, Bureau of the Census, "Preliminary Intercensal Estimates of States and Components of Population Change, 1960 to 1970" Series P-25, *Current Population Reports* No. 460 (Washington, June, 1971), "Annual Estimates of the Population of States: July 1, 1970 to 1979," Series P-25, *Current Population Reports* No. 876 (Washington, February 1980); land area, U. S. Department of Commerce, Bureau of the Census, *County and City Data Book*, 1972.

Climate Variables

Average Annual Temperature, Percentage of Possible Sunshine, Average Annual Precipitation Rate, and Percentage of Months with Average Maximum Temperature Exceeding 80° F or Average Minimum Temperature Less than 65° F: Simple averages of data reported for cities in each state. Source: U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1979.

Business Climate, Tax and Expenditure Variables:

Fantus and COSMA Business Climate Rankings: Detailed explanations of the components of both rankings are given in footnote 1 to the text. Sources: Fantus Company, "A Study of the Business Climates of the States," prepared for the Illinois Manufacturers Association, Chicago, November 1975; Alexander Grant and Company, "A Study of Business Climates of the Forty-Eight Contiguous States of America," prepared for the Conference of State Manufacturers' Associations (COSMA), Chicago, March 1979.

State and Local Tax Effort: For 1967 and 1972. Sources: For 1967, Advisory Commission on Intergovernmental Relations, *Measuring the Fiscal Capacity and Effort of State and Local Areas* (Washington: ACIR, 1979). For 1972, total state and local taxes per capita relative to the U. S. average divided by Reishauer's tax capacity measure, U. S. Department of Commerce, Bureau of the Census, *Census of Governments*, 1972, and Robert D. Reischauer, "Rich Governments-Poor Governments: Determining the Fiscal Capacity and Revenue Requirements of State and Local Government," The Brookings Institution, December 1974, unpublished manuscript.

Corporate Taxes as a Percentage of Corporate-Like Payroll: Corporate income tax collections plus state license tax collections on corporations plus state license tax collections on occupations and businesses divided by private wage and salary disbursements less wages paid in the farm, personal services, and professional, social and related services industries, for 1967 and 1972. Source: U. S. Department of Commerce, Bureau of the Census, *State Tax Collections*, selected issues.

State Personal Income Tax Collections as a Percentage of State Personal Income: For 1967 and 1972. Source: U. S. Department of Commerce, Bureau of the Census, *State Tax Collections*, selected issues.

Marginal State Personal Tax Rate: For a hypothetical average family of four, for 1974. Source: Thomas Romans and Ganti Subrahmanyam, "State and Local Taxes, Transfers and Regional Economic Growth," *Southern Economic Journal* 46 (October 1979), pp. 453-444; Stephen E. Lile, *Family Tax Burdens Compared Among States and Among Cities Located Within Kentucky and Neighboring States* (Lexington: Kentucky Department of Revenue, 1975).

State Sales and Gross Receipts Tax Collections as a Percentage of Gross Retail Sales: For 1967 and 1972. Sources: taxes, U. S. Department of Commerce, Bureau of the Census, *State Tax Collections*, selected issues; retail sales, U. S. Department of Commerce, Bureau of the Census, *Census of Retail Trade*, 1967, 1972.

State and Local Property Taxes as a Percentage of Market Value of Real Property: For 1966 and 1971. Calculated as total state and local property tax revenues as a percentage of the net assessed value of real property (the nominal tax rate) times the aggregate assessment to sales ratio in the state. Source: U. S. Department of Commerce, Bureau of the Census, *Census of Governments*, 1967, 1972.

Total State and Local Expenditures as a Percentage of Personal Income: For 1967 and 1972. Source: U. S. Department of Commerce, Bureau of the Census, *Governmental Finances*, selected issues.

State and Local Education Expenditures as a Percentage of Personal Income: For 1967 and 1972. Source: U. S. Department of Commerce, Bureau of the Census, *Governmental Finances*, selected issues.

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