STATE ECONOMIC INCENTIVES: STIMULUS OR REALLOCATION?

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This article estimates the effects of state economic incentives during the 1980s and interprets results in the context of a general-equilibrium specific-factors model of production. The issue is whether investment incentives had a net positive impact on manufacturing value added because subsidized firms would pull resources from the rest of the state economy. The public finance literature provides the foundation of the econometric model. Empirical results are consistent with theoretical predictions of the specific-factors model that resources would come from other sectors. Incentives are associated with a reduction in manufacturing value added.

Keywords: *Economic incentives; net impact; reallocation*

There have been increasing economic incentives offered by state governments to attract manufacturing firms, as documented by Bartik (1994). According to the National Association of State Development Agencies (NASDA, 1986) state governments have made industry attraction part of their basic activities. Incentives include direct economic incentives as well as tax abatements. NASDA classifies incentives as state grants, loan guarantees, industrial development bonds and guarantees, umbrella bonds, general obligation bonds, customized industrial training, state-funded venture capital corporations, privately sponsored development credit corporations, and other financing programs. The issue of whether economic incentives stimulate output, however, remains a topic of debate (Buss 2001). The under-

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lying economic issue is whether incentives stimulate output or simply reallocate resources.

Several dramatic cases have attracted media attention. South Carolina “gave” BMW $100 million, Alabama gave Mercedes Benz $250 million and Hyundai half that amount, Indiana gave United Airlines $300 million, and Kentucky gave Toyota $125 million. Mississippi gave Nissan cash payments for 10 years, equal to 4% of gross payroll, along with a 50% corporate income tax credit for job training.

Mattey and Spiegel (1995) question the net benefits of such subsidies. Bartik (1994) points out that incentives might be efficient if a firm locates in an area with unemployment, and Finkle (1999) believes that state governments can play a positive role in generating growth. In contrast, Buss (1999, 2001) argues that the research of state development agencies has little economic value and believes that state governments should not meddle with private location decisions.

This article interprets econometric results across states during the 1980s in the context of a general-equilibrium model of production to evaluate the net effects of incentives on manufacturing value added. Assumptions of the model are that capital is sector specific and that labor is mobile within each state. Rassekh and Thompson (1997) suggest that the specific-factors model applies to a variety of policy issues, and Thompson (1994, 1996) provides applications of the model. General-equilibrium models allow reallocation of resources and provide a suitable theoretical framework to examine net effects of economic incentives. This model is then used to construct an econometric model to examine whether investment incentives had a net positive impact on manufacturing value added. The econometric results are consistent with theoretical predictions of the specific-factors model that resources would come from other sectors; that is, incentives are associated with a reduction in manufacturing value added.

The next section presents the general-equilibrium model.

A TARGETED FIRM IN A SPECIFIC-FACTORS MODEL

To isolate incentives, the targeted firm is separate from the rest of manufacturing in the state economy. The present model assumes full employment and competitive pricing of outputs. The assumption is that capital in each sector is a specific input, and capital for the targeted firm comes from outside the state. Firms with capital potential deciding where to locate receive financial incentives, characterized by the theoretical assumption of sector-specific capital mobile across states. Capital is also specific in the sense that it is available at a discount only for the targeted firm.

Labor is assumed to be fixed in supply in the state but freely mobile inside the state, resulting in a uniform state wage. The model is static and not concerned with labor force growth. Although there is, in fact, interstate migration, it is not large relative to the workforce. In addition, incentives are justified by the intention of creating jobs for the existing state labor force. In the present model with full employment, incentives raise wages.

Thompson (1985) develops properties of the specific-factors model with mobile capital as in the present article. Subsidized capital would increase the quantity of capital demanded and would also pull labor from the rest of the economy. The wage rises, but returns to capital in other sectors fall. Cheaper capital causes the ratio of capital to labor to fall throughout the economy. Output increases for the sector importing capital but decreases in the rest of the economy, holding prices of outputs constant.

Each state is a price taker in markets for outputs and targeted capital. Value added would depend on prices of the various outputs, which are constant in the state economy. The rationale is that the state is small relative to the relevant regional, national, and world markets. Let K_f and K_m represent the capital inputs for the targeted firm and manufacturing. Exogenous variables are K_m, the state labor supply is $L = \Sigma_i L_i$, the interstate return to capital is r_f for the targeted firm, and output prices are p_j $(j = f, m)$. Endogenous variables are output levels x_i, the state wage w, the returns to manufacturing capital r_m, and employment of capital by the targeted firm K_f.

Let ϕ represent the incentive that lowers the price of targeted capital. The targeted firm is assumed to face perfectly elastic capital supply and can purchase all it wants at r_f. Direct economic incentives lower the price of capital to $r_f - \phi$. In manufacturing, the supply of cap-

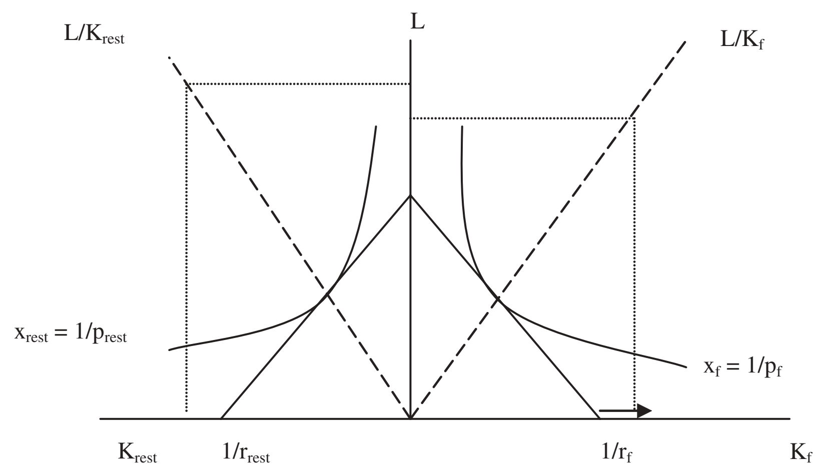

Figure 1: Adjustment to a Capital Subsidy

ital is perfectly inelastic, and changes in the demand result in adjustments in r_m.

Figure 1 presents a cost minimization diagram with a state economy split into the targeted firm and manufacturing. The common vertical axis measures shared labor input. Exogenous variables are output prices p_j, the total labor force L, capital in manufacturing K_m, and the return to capital r_f for the targeted firm. Unit value isoquants $1/p_j$ represent the amounts of inputs used to produce one dollar of output. With prices and technology constant, unit value isoquants are fixed. Cost minimization implies tangency between isoquants and isocost lines, leading to the ratios of labor to capital L/K_j.

A decrease in r_f due to the subsidy φ pushes the point $1/r_f$ to the right, forcing a lower L/K_f, a higher wage w, and a lower r_m. The ratio of labor to capital in manufacturing falls as labor moves to the targeted firm. The lower effective price of capital induces the targeted firm to increase its capital input, making its labor more productive and increasing labor demand. Figure 2 pictures the output adjustment. Output of the targeted firm increases with the incoming capital, and the attracted labor capital input K_f for the targeted firm increases along

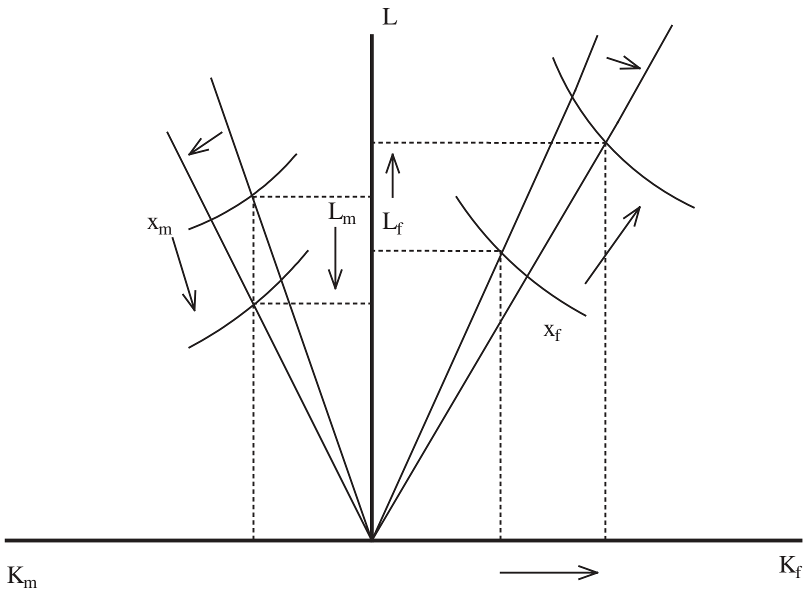

Figure 2: Output and Labor Adjustment to a Targeted Capital Subsidy

with its share of labor input $L_f = L - L_M$. Manufacturing, however, suffers with declines in output and capital return. Labor leaves manufacturing, and L_M declines.

With the increase in capital in the state, value added should rise as the production frontier expands. State income would increase by the payment to the incoming capital. The subsidy, however, has to be paid, and the net result could be a reduction of income and value added. There is also redistribution of income between labor and the different sorts of capital.

Summarizing, the incentive ϕ raises K_f, w, and x_f but lowers r_m and x_m. The incentive lowers the cost of capital and increases the capital input of the targeted firm. The targeted firm draws labor from the rest of the economy. Outputs and capital returns fall across the rest of the economy. Value added in the economy would increase short of having to finance the incentive. The next section presents the empirical framework for testing these predictions.

ISOLATING VARIABLES TO MEASURE STATE ECONOMIC DEVELOPMENT

The present estimation of the effects of incentives is consistent with the public finance and regional economics literatures using a cross section of data across the 48 contiguous states for 1981 and 1989.[1] Helms (1985) suggests using pooled data, although the literature predominantly uses cross-sectional data. Newman (1983), Wasylenko and McGuire (1985), Carroll and Wasylenko (1994), and De Bartolome and Spiegel (1995) represent state growth with employment. Following Plaut and Pluta (1983), the following analysis uses manufacturing value added adjusted by the labor force. Manufacturing value added is the value of output less intermediate products, reflecting real manufacturing growth, perhaps a better measure of the impact of incentives than employment.

Although many firms sell in regional and international markets, output is a reflection of costs at a particular location. Differences in price levels might account for differences in manufacturing value added, requiring appropriate adjustments across time and space using gross domestic product (GDP) deflators and price indices from the American Chamber of Commerce.

The literature on regional economic growth identifies several general factors that influence state economic development. The measure of *market accessibility* should capture how close the production would be to potential customers. Plaut and Pluta (1983) identify market accessibility as the ratio of personal income potential to manufacturing value-added potential. Distance d_{ji} is highway miles from the major metropolitan statistical area (MSA) in state j to the major MSA in state i. Personal income potential is $\Sigma_i \mathrm{PI}_{it}/d_{ji}$, where PI_{it} is real personal income in state i at time t. Manufacturing value-added potential is $\Sigma_i \mathrm{MVA}_{it}/d_{ji}$, where MVA_{it} is real manufacturing value added in state i at time t. Plaut and Pluta use distances between centers of population in states j and i. The present study uses interstate highway miles. Half the mileage of the average radius of the state approximates the distance from a state to itself, following Stewart and Warntz (1958). Market accessibility reflects the size of the market relative to existing manufacturing activity. Plaut and Pluta suggest that manufacturing firms might want to locate in underserved markets to avoid competition, implying a positive relationship between market accessibility and manufacturing value added. On the other hand, firms may want to locate close to each other if there are agglomeration economies and transport costs are low.

Eight demographic variables describe characteristics of the *labor supply*. These variables affect overall labor force characteristics in each state. The real average hourly wage rate of production workers in manufacturing is used. The ratio of manufacturing employees to the labor force provides the relative intensity of manufacturing employment in the state. To reflect age characteristics, proportions of the population younger than age 18 and older than age 65 are included. The proportion of high school graduates and college graduates provides a measure of human capital. The state unemployment rate provides information on labor availability. Finally, the percentage of unionized labor is included. Union membership could be a deterrent to firms, but Freeman and Medoff (1984) suggest that it may also signal a stable skilled workforce.

Resource variables affect characteristics of manufacturing production. Two measures of capital resources are included—first, the average price per kilowatt hour of electricity paid by manufacturing industries and, second, the land area of the state not owned by the federal government, which is a proxy for land rent, following Bartik (1985). Data for land rents are unavailable, but abundant land should imply low rent. The land variable, acreage owned by the state and private parties, is not normalized across states because it should reflect land availability. Normalizing by population would add a labor dimension to the variable, the inverse of the population density discussed below.

The model includes *taxation* variables: the state corporate tax rate, the property tax rate, and the corporate tax effort index. The state corporate tax rate is corporate tax revenue relative to corporate profits for all industries, similar to Wheaton's (1983) effective tax level. Data on corporate profit are available only at the national level. To approximate state corporate profits, the national ratio of profits to personal income is applied to each state. Following Plaut and Pluta (1983), the property tax rate is the ratio of total property tax revenue divided by estimated market value of real property. The property tax rate is state and local property tax revenues as a percentage of the net-assessed value of real property (the nominal tax rate) times the ratio of aggregate assessment to sales. The corporate tax effort index is taxes paid relative to state revenue capacity, calculated by the Advisory Commission on Intergovernmental Relations (1983, 1990**[PLS. PROVIDE REFS]**).

Firms may seek to locate in states that provide *amenities*: high levels of public spending on education and health care. Several variables reflect amenities and agglomeration effects on economic growth. Annual median temperature and per capita spending on education, public health care, highways, and public assistance are included as amenities. A highway variable may reflect the level of infrastructure in the state. Spending on public assistance may be a deterrent to firms. Helms (1985) uses population density as an agglomeration effect, which is also used in this study. In other words, when more individuals are provided with a public good, it allows for economies of scale in the production process. Bartik (1985) suggests that population density could reflect land prices, and this variable may have a double interpretation. Per capita transfers from the federal government are also included. Four regional dummy variables represent the Northeast, North Central, South, and West, adapted from the nine regions of the U.S. Bureau of the Census.

Data on *direct economic incentives* come from the NASDA (1983, 1986, 1991) *Directory*. In some instances, values reported for a particular program are cumulative, and so a yearly average is calculated. In other cases, there are only program appropriations. Following Niskanen (1968), each state development agency is assumed to spend its entire appropriation. To measure the impact of direct economic incentives (DEI), we construct an aggregate value similar to the weighting scheme of direct economic incentives relative to the labor force of De Bartolome and Spiegel (1995).

The *Directory* reports every category of DEI expenditure by state. There are adjustments to observations across time and space. The implicit price deflator with a base year of 1987 adjusts prices across time. Sums of observations arrive at a single observation for each state. Adjustments to these values account for differences in the cost of living across states. Cost-of-living adjustments normalize these development expenditures across states and allow for comparison between states. The American Chamber of Commerce Research Association's (ACCRA's) cost of living index serves for this calculation (ACCRA 1981, 1989). The measure is in real terms both across time and space, allowing time for adjustment to the DEI variable.

There is an adjustment to the measure of incentive spending to account for the relative sizes of states. The measure $\text{DEI}_{jt} = \text{REI}_{jt}/\text{LBR}_{jt}$, where REI_{jt} is the real economic incentive spending for state j at time t. The size of the labor force for state j at time t is LBR_{jt}, making DEI_{jt} real incentive spending relative to the labor force. Alternative methods of weighting direct economic incentives include state expenditures, manufacturing employment, population, and the number of incentives programs. Results with these alternatives are robust.

The estimated model is a two-stage least squares (2SLS) log-linear specification, treating corporate taxes and wages as endogenous (Papke 1987; Bartik 1991).[2] The log-linear form yields comparative static elasticities similar to Bartik (1985, 1991, 1992) and Papke (1987). Wages are endogenous in the specific-factors model and are endogenous in the first-stage estimation. The model is fully interactive to account for changes across periods. To correct for heteroskedasticity, the square root of the ratio of the mean square error of 1989 to 1981 weights the data.

The pooled data are tested for endogeneity using the omitted variable version of the Hausman test in Kennedy (1992), using a regression of the form $Y = X\beta + W\theta + \varepsilon$, where W is a set of instrument variables. If W and ε are not correlated, θ will equal zero. The hypothesis $\theta = 0$ yields an $F_{(4,62)} = 2.87$, with a critical value of 2.52 ($\alpha = .05$). The null hypothesis that $\theta = 0$ is rejected, implying endogenous corporate taxes and wages. The reduced form of the model is a linear function of manufacturing value added with first-stage linear estimates of the corporate tax rate and wage.

Variable descriptions are in Table 1, and equations are in Table 2. The term Dz creates dummy interaction terms, where z is the matrix of independent variables, and vectors of disturbance terms are included. D is 0 in 1981 and 1 otherwise. Reduced-form equations (2) and (3) provide estimates to substitute into (1), the 2SLS procedure.

TABLE 1: Variable Definitions

MVA	Manufacturing value added relative to the labor force
CTX	Effective corporate tax rate
WGE	Average hourly wage rate of production workers
DEI	Real direct economic incentives
ENR	Average price of electricity for manufacturing
LND	Land in the state, excluding federally owned land
MKT	Market accessibility
MFE	Manufacturing employment relative to the labor force
POP	Population density
PUB	Real per capital expenditure on public assistance
TMP	Median temperature of the state
TRN	Governmental transfers per capita from the federal to state government
TXE	Corporate tax effort by state governments
UNI	Percentage of state labor force unionized
NCN	North Central region
SOU	South region
WST	West region
Dz	Dummy interaction terms of independent variables
CED	Percentage of the labor force age 25 or older with college degree
EDU	Real per capita expenditure on public education
HSD	Percent of the labor force age 25 or older with high school degree
HWY	Real per capital expenditure on highways
MED	Real per capita expenditure on medical care
OLD	Percentage of the population older than age 65
PTX	Effective property tax rate
UNE	State unemployment rate
YTH	Percentage of the population between ages 5 and 17

EMPIRICAL RESULTS OF DIRECT ECONOMIC INCENTIVES

The 2SLS estimation results of equation (1) are in Table 3. The approximated R^2 is the correlation between the predicted and actual values of the dependent variables, appropriate for two-stage least squares. The estimated effect of market accessibility on manufacturing value added is negative, with firms evidently tending to agglomerate. Falling transport costs have made it easier for firms to locate firms from customers.

Wages are an endogenous variable in the first-stage estimation and have a positive association with manufacturing value added in the second stage. Across states, higher wages might imply a more skilled

TABLE 2: Estimated Linear Two-Stage Least Squares Model

	Equation (1) MVA	*Equation (2) CTX*	*Equation (3) WGE*
DEI	x		
WGE	x		
ENR	x	x	x
LND	x	x	x
MKT	x	x	x
MFE	x	x	x
POP	x	x	x
PUB	x	x	x
TMP	x	x	x
TRN	x	x	x
TXE	x	x	x
UNI	x	x	x
NCN	x	x	x
SOU	x	x	x
WST	x	x	x
Dz	x	x	x
CED		x	x
EDU		x	x
HSD		x	x
HWY		x	x
MED		x	x
OLD		x	x
PTX		x	x
UNE		x	x
YTH		x	x

NOTE: x = variable included in equation. For definitions of variables, see Table 1.

workforce. In the specific-factors model, a capital subsidy would raise wages at constant prices.

The positive coefficient for employment suggests relatively high average productivity of labor in manufacturing. Relative union membership, however, lowers manufacturing value added, as does population density. Government transfers have a positive association. Across regions, manufacturing value added is lower in the West.

The negative effect of incentives on manufacturing value added suggests a net burden of economic incentives. The lesson of the specific-factors model is that the capital subsidy reallocates resources within the economy, with production and employment falling in the rest of the economy. The model allows time for adjustment to direct

TABLE 3: Two-Stage Least Squares (2SLS) Estimates of Equation (1)

Variable	*Coefficient*	*Interaction*	*Coefficient*
Constant	7.531***	D	–8.810
	(4.809)		(–1.581)
MKT	–0.388**	DMKT	–0.546*
	(–2.342)		(–1.998)
WGE	0.9552***	DWGE	2.321**
	(3.118)		(2.105)
MFE	0.895***	DMFE	–0.018
	(15.945)		(–0.127)
UNI	–0.233***	DUNI	–0.057
	(–2.711)		(–0.328)
ENR	0.098	DENR	–0.156
	(1.311)		(–1.073)
LND	–0.011	DLND	–0.008
	(–0.374)		(–0.096)
CTX	0.001	DCTX	–0.108*
	(0.073)		(–1.741)
PTX	–0.024	DPTX	–0.004
	(–1.299)		(–0.167)
TMP	0.368	DTMP	0.485
	(1.482)		(0.695)
POP	–0.065*	DPOP	–0.119
	(–1.836)		(–1.296)
TRN	0.210**	DTRN	0.358
	(2.014)		(1.363)
DEI	–0.0192*	DDEI	–0.008
	(–1.901)		(–0.310)
NCN	–0.009	DNCN	–0.077
	(–0.116)		(–0.400)
SOU	–0.110	DSOU	0.158
	(–1.283)		(0.779)
WST	–0.323**	DWST	–0.330
	(–2.645)		(–1.211)

NOTE: $n = 96$; 2SLS $R^2 = .99$. For definitions of the variables, see Table 1. The *t*-ratios are as follows: *.10, **.05, and ***.01.

economic incentives, given the two sets of yearly observations almost a decade apart.

Interaction terms for corporate taxes, wages, and market accessibility are significant, implying a statistically significant change over time. Carroll and Wasylenko (1994) find evidence of a structural change during the 1980s in that fiscal variables that had no impact in the early 1980s became significant. The present result for corporate taxes is consistent with such a structural change. Direct economic incentives, however, switch from significance in 1981 to insignificance in 1989, suggesting declining influence as they became more common.

CONCLUSIONS

This study applies the specific-factors model in an empirical examination of the general-equilibrium effects of state economic incentives. There is evidence that manufacturing value added declines as resources are reallocated across the state economy due to incentives. The present results add to the reasons to question the desirability of state economic incentives.

NOTES

1. The source for state economic incentives is the *Directory of Incentives for Business Investment and Development in the United States* (National Association of State Development Agencies [NASDA] 1983, 1991). The data are broken down by state and type of incentive and contain information on all incentives available to firms. However, the data available on direct economic incentives (DEI) are inconsistently reported, with each edition of the *Directory* reporting expenditures for a range of years. For any one state, the *Directory* reports expenditures for the different DEI ranging over a 4-year period. The first and third editions of the *Directory* (1983, 1991) are the focus of the present study because this allows for a longer time span between periods to observe changes in DEI. The first edition of the *Directory* ranges over the years 1980 to 1983, whereas the third edition ranges over the period from 1987 to 1990. Even though the *Directory* reports the data over a 4-year range, the data from these two periods are primarily from the years 1981 and 1989, respectively.

2. Manufacturing employment may also be endogenous. However, it is not treated as such here due to the limits of identification. Many of the instrumental variables used to test for the endogeneity of wages would also be used in an equation to estimate manufacturing employment. Endogeneity issues are limited to wages and taxes, as in the literature.

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