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Factors Associated with the Growth of Local and Regional Economies

A Review of Selected Empirical Literature

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Abstract

Thirty-five empirical studies of factors influencing business location and/or regional economic growth are reviewed. Differences in methodology among the studies are described, and several methodological issues are discussed. Regional characteristics that have been hypothesized to affect regional growth and/or business location are identified, and the results of these studies with regard to the effects of these regional characteristics are discussed. Few results are found to be consistent across studies. Some suggestions are offered about methodological issues and regional characteristics to be considered in future studies of regional economic growth and/or business location.

Keywords: growth; economic development; business location; regional economics; literature review

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Summary

Thirty-five empirical studies of factors influencing business location and/or regional economic growth are reviewed. This review covers most of the more frequently cited studies published in this area between 1978 and 1991.

The studies differ along many dimensions. Some compare economic performance among communities in a single State or metropolitan area, while others compare U.S. States. Many measure economic growth in terms of employment, but others focus on such indicators as growth in output or capital stock, or the frequency of firm openings or relocations. Some studies look at growth across the entire economy, while others focus on manufacturing or on individual industries. Studies also differ in the structure of the underlying or implicit economic models; many studies attempt to explain growth in terms of initial regional characteristics, which may imply an underlying disequilibrium-adjustment model. Some studies are purely cross-sectional, while others utilize data on a cross section at several points in time. The studies also differ in the estimation methods used; ordinary least-squares regression is the most common method, but logit regression and other techniques are used in some models.

The regional characteristics that have been hypothesized to affect regional growth and/or business location are numerous. Many studies have tested for the effects of business or other taxes on regional growth or location, and some have tested for the effects of particular types of public expenditures. Most studies reviewed test in some fashion for the effects of local or regional wage levels; many also test for the effect of such labor market conditions as unemployment rates, levels of unionization, or the presence of State "right-to-work" laws. Also commonly included among factors that may influence growth is some measure of educational attainment; usually this is either average years of school completed or percentage of the adult population who have completed high school. Some studies also test for the influence of proximity to institutions of higher education. A variety of variables have been proposed to reflect regional differences in access to input and output markets. A number of studies include measures of access to highways, airports, or other transportation facilities; some include a measure of proximity to urban or metropolitan areas; and some propose regional per capita income, population, or income growth as indicators of market demand that may contribute to business growth or location decisions.

The industrial mix of a local economy is also suggested as a likely influence on growth and business location. Businesses may gain benefits from locating in areas where similar or related businesses already exist, and areas may tend to benefit from the presence of businesses that are experiencing more rapid demand

growth (while areas specialized in industries with slow-growing or declining demand may experience less growth than other areas).

Here are some other local or regional characteristics proposed as influences on economic growth or business location: demographic characteristics, including population size and density, urbanization, and racial mix; climate; energy and land prices; labor productivity; and fire protection ratings. Also considered in individual studies are these factors: small business activity levels, industrial revenue bond volume, population age distribution, occupational or industrial characteristics of the labor force, structure of the banking sector, change in level of unionization, and attractiveness to retirees. Regional "dummy variables" are also included in many models to capture unmeasured differences among regions such as New England, the Great Lakes States, and the Southeast.

While a few results appear to be consistent across studies (for example, growth will be faster in areas that are specialized in industries that are growing relatively rapidly), in most cases substantive conclusions appear instead to be sensitive to differences in study design or scope.

Some limitations of the literature should be noted. Most of the studies reviewed here focus on a limited set of predictive variables, raising the possibility of omitted variable bias. Few studies take into account the industrial composition of the regional economy as a factor influencing regional growth, and few attempt to assess the distinct contributions of high-school-educated and college-educated adults to growth or business attraction. Most focus either on State-level data, or on data for a limited geographic area or sample of communities; only a few use observations at the county or substate level for the entire United States.

Further, only a few studies have paid specific attention to nonmetro growth. Finally, the studies reviewed vary widely in the sophistication of the estimation methods used. These limitations of past work suggest possibilities for further research.

Factors Associated with the Growth of Local and Regional Economies: A Review of Selected Empirical Literature

Lorin D. Kusmin

Introduction

The literature of economics and social science includes many studies that attempt to explain regional differences in economic growth, or seek to identify the effects of particular regional characteristics on economic growth. These studies vary widely in the data and methods they use and in the hypotheses they test.

Much of this literature describes the outcome of interest as industrial location rather than economic growth or activity, and in some studies the focus is on growth in particular industries or on plant openings or relocation. However, others attempt to explain the movement in broad economic aggregates. Because these two groups of studies are similar in many respects, and because industrial location decisions are a major factor in determining growth in economic activity, this report reviews "industrial location" studies together with those that seek to identify determinants of regional economic growth more generally.

This report draws on a review of more than 40 such studies. I will discuss 35 studies, and present data on their methodologies, and the potential determinants of growth that they consider. I omit others of more limited interest from the tabulation and discussion. This review is not exhaustive. However, it does cover most of the more frequently cited studies published in this area between 1978 and 1991, as well as a number of others from this time period. In addition, parts of this report draw on the results of several earlier literature reviews.[1]

This report is part of a larger study of growth and stability in nonmetropolitan (nonmetro) counties in the United States. An earlier report (Sears and coauthors, 1992) described differences between nonmetro counties that experienced earnings declines

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[1]Among recent literature surveys of interest are: Newman and Sullivan (1988), focusing on tax impacts on industrial location; Wilson (1989), focusing on the effects of State business incentives; Dewar (1990), also reviewing literature relevant to the effect of various Government financial incentives to business; and Bartik (1991), which reviews empirical results on the growth effects of taxes, public services, unionization, wages, banking, and environmental regulation. In addition, Herzog and Schlottman (eds.) (1991) include several papers that review portions of the empirical literature on the determinants of industrial location.

during the 1980's and those that experienced growth or little change in earnings.[2] (That report also described differences between counties with more stable earnings paths and those where earnings varied more widely around trend growth.) A forthcoming report will present results of a regression analysis of factors associated with earnings growth during the same period.

Regression analysis

Regression analysis is a statistical technique that can be used to describe the relationship between a single "dependent" variable (for example, income growth) and multiple "independent" variables (for example, education levels, tax rates, or indices of public policy). It permits assessment of the strength of the relationship between the dependent variable and any one "independent" variable, after taking into account the effects of all the other independent variables. The simplest form of regression analysis is known as ordinary least-squares, or OLS. All of the studies covered in this literature review use some variant of regression analysis.

In preparation for our regression analysis, we conducted a literature review to identify local and State characteristics that were identified by past research as possible determinants of growth, and hence were candidates for inclusion in our model. The review also identified major modelling and estimation issues raised by the studies that we examined and that might be relevant

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[2]Nonmetro counties are those that are not part of any Metropolitan Statistical Area (MSA), Consolidated Metropolitan Statistical Area (CMSA), or New England County Metropolitan Area (NECMA), while metro counties are those that do belong to an MSA, CMSA, or NECMA. Metropolitan areas--MSAs, CMSAs, and NECMAs--are defined by the Office of Management and Budget (OMB) using Census data. These areas normally include a population nucleus (a city or urbanized area) of 50,000 or more, the county or counties containing that nucleus, and adjacent counties that meet specified requirements for commuting to the central counties and for "metropolitan character." (In New England, MSAs and CMSAs are composed of towns and cities rather than counties; thus county-level analysis of metro and nonmetro areas in New England must use the NECMAs instead.) (U.S. Statistical Abstract, 1991)

to the estimation of our own model and interpretation of the results. The present report reflects this literature review.[3]

Study Design

Table 1 provides summary data on the design of 33 studies of the determinants of economic growth or business location.[4] A discussion of specific study design issues follows.

Geographic Units and Geographic Coverage

Studies of regional economic performance have attempted to explain differences in the performance of States, counties, metropolitan areas or other multicounty areas, or of individual communities (table 1). While some studies have covered the entire United States, others have focused on a subset of States, on the counties in a single State, or on communities in a particular metropolitan area. Differences in the unit of analysis chosen or in geographic coverage may lead to different results. This is illustrated by Schmenner and coauthors (1987), who find evidence that plant location decisions were a two-stage process, and that different factors influenced the initial choice of region and the final site selection within a region, and by Quan and Beck (1987), who find significant differences between a model that explained economic activity in the Northeast and one for the Sunbelt States.

Measures of Economic Activity

The studies reviewed also differ widely in the measures of economic growth or business activity they seek to explain. Some attempt to explain variation in broad measures of economic activity, such as income, employment, earnings, output, or per

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[3]Because the primary purpose of the review was to identify potential growth determinants as well as methodological and estimation issues, no effort has been made to systematically compare the magnitude of estimated effects for particular variables across studies, as is done for selected policy variables in Bartik (1991). Nor do I seek to systematically assess the methodological strengths and weaknesses of particular studies.

[4]Two papers are mentioned in the text that are not included in tables 1 or 2. These are Debertin, Pagoulatos, and Smith (1980) and McHugh and Wilkinson (1988). Each reports on a reanalysis of data gathered by earlier studies (Smith, Deaton, and Kelch (1978) and Carlino and Mills (1987), respectively); hence each is identical to the corresponding earlier study on most dimensions covered by the tables.

Table 1--Selected features of studies covered by literature review

Study	Geographic unit of analysis	Geographic area covered	Dependent variable(s)
Bluestone and coauthors (1989)	County	48 States	Employment growth, earnings growth, earnings/worker, unemployment rate
Carlino and Mills (1987)	County	48 States	Population, employment, and manufacturing employment densities
Fox and Murray (1990)	County	Tennessee	Firm entry rate per active firm
McNamara and coauthors (1988)	County	Virginia	If new manufacturing plant
Porterfield (1990)	County	49 States	Employment growth
Sander and Schaeffer (1991)	County	113 highly urban counties	Employment growth
Killian and Parker (1991)	CZ	48 States	Employment growth
Charney (1983)	Locality	Detroit MSA	No. of firm relocations (per acre usable land)
Dorf and Emerson (1978)	Locality	West North Central United States	No. plants, employment, change in no. plants, employment change
Fox (1981)	Locality	Cuyahoga County, Ohio	Acres of land in industrial use
Kuehn and coauthors (1979)	Locality	Nonmetro Missouri	Whether community attracted new plant
Smith, Deaton, and Kelch (1978)	Locality	Nonmetro KY & TN	Whether community attracted new plant
Wasylenko (1980)	Locality	Milwaukee MSA	No. of relocating firms
Mead (1982)	SEA	69 nonmetro SEAs	In-migration, outmigration, employment change, per capita wage change
Carlton (1983)	SMSA	Selected SMSAs	No. new branch plants opened and employment at new plants
Bartik (1985)	State	48 or 50 States	No. new branch plants opened
Bartik (1989)	State	50 States	No. small business startups
Canto and Webb (1987)	State	48 States	Change in real per capita personal income
Deich (1989)	State	48 States	No. new branch plants or no. new single establishments
Helms (1985)	State	48 States	Personal income
Jaffee (1988)	State	48 States	Employment, value-added, or number of establishments
Kieschnick (1981)	State	48 States	State share of national gross new investment
Mehay and Solnick (1990)	State	48 States	Personal income; employment
Munnell and Cook (1990)	State	48 States	Employment growth
Newman (1983)	State	48 States	Change in employment
Papke (1987)	State	20 States	Capital investment per worker
Papke (1989)	State	22 States	Gross State product (GSP); industry share of manufacturing GSP
Plaut and Pluta (1983)	State	48 States	Growth in value added, employment, or real capital stock
Quan and Beck (1987)	State	32 States	Average hourly earnings, employment, or per capita income
Romans and Subrahmanyam (1979)	State	48 States	Growth of personal income, per capita income, or employment
Schmenner and coauthors (1987)	State	48 States	New plant location decisions
Wasylenko and McGuire (1985)	State	48 States	Employment growth
Wheat (1986)	State	48 States	Employment growth

Table 1--Selected features of studies covered by literature review

Study	Estimation approach			Economic scope of dependent variables	Period	Observations
	Levels predicted	Changes predicted*	Event** frequency or probability predicted			
Bluestone and coauthors (1989)	Y	L, C		Economy	1979-86	Counties
Carlino and Mills (1987)	Y			Economy; manufacturing	1970-80	Counties
Fox and Murray (1990)			FB	Economy	1980-86	County-year pairs
McNamara and coauthors (1988)			PO	Manufacturing	1979-81	Counties and ind. cities
Porterfield (1990)		L, c		Producer services; manufacturing	1981-86	Counties
Sander and Schaeffer (1991)		L		Economy	1980-84	Counties
Killian and Parker (1991)		L		Economy	1969-79 and 1979-86	Commuting zones
Charney (1983)			FR	Manufacturing	1970-75	Zip code areas
Dorf and Emerson (1978)	Y	L		Manufacturing	1960-70	Localities
Fox (1981)	Y			Economy	1969	Localities
Kuehn and coauthors (1979)			PO	Manufacturing	1972-74	Localities
Smith, Deaton, and Kelch (1978)			PO	Manufacturing	1970-73	Localities
Wasylenko (1980)			FR	Each of six broad industry groups	1964-74	Municipalities
Mead (1982)		L, C		Economy	1960-70	SEAs
Carlton (1983)			PO, SN	3 selected (four-digit SIC) manufacturing industries	1967-71	New branch plants
Bartik (1985)			PO	Manufacturing	1972-78	States
Bartik (1989)			FB	Manufacturing except SIC 21 (tobacco)	1976-78, 1978-80, 1980-82	State-industry pairs
Canto and Webb (1987)		C		Economy	1957-77	Years
Deich (1989)			FB,PO	All manufacturing; 3 selected (two-digit SIC) manuf. industries	1972-77	States
Helms (1985)	Y			Economy	1965-79	State-year pairs
Jaffee (1988)	Y	L		All manufacturing; 2 selected (two-digit SIC) manuf. industries	1972-82	States
Kieschnick (1981)	Y			Each of 13 (two-digit SIC) manufacturing industries	1977	States
Mehay and Solnick (1990)	Y			Economy; manufacturing	1976-85	State-year pairs
Munnell and Cook (1990)		L, C		Economy	1970-88, 1970-80, 1980-88	States
Newman (1983)		L, C		13 (two-digit SIC) manufacturing industries	1957-65 and 1965-73	State-period-industry triplets
Papke (1987)	Y			20 manufacturing industries	1978	State-industry pairs
Papke (1989)	Y			Each of four (two-digit SIC) manufacturing industries	1975-82	State-year pairs
Plaut and Pluta (1983)		L		Manufacturing	1967-72 and 1972-77	State-period pairs
Quan and Beck (1987)	Y			Manufacturing; economy	1974-83	State-year pairs
Romans and Subrahmanyam (1979)		L		Economy; nonagricultural economy	1964-74	States
Schmenner and coauthors (1987)			PO	Manufacturing	1970-80	Plant opening decisions
Wasylenko and McGuire (1985)		L, c		Economy; six broad industry groups	1973-80	States
Wheat (1986)		L		Manufacturing	1963-77	States

Table 1--Selected features of studies covered by literature review

Study	Simultaneous equations	Estimation method	Selected methodological features			
			Lagged dependent variable?	Correction for heteroskedasticity?	Principal components used?***	Temporal structure
Bluestone and coauthors (1989)		OLS				Cross-section
Carlino and Mills (1987)	2	2SLS	Y			Cross-section
Fox and Murray (1990)		OLS, Tobit				Pooled data
McNamara and coauthors (1988)		Logit				Cross-section
Porterfield (1990)	2	OLS, 2SLS		Y (in OLS models)		Cross-section
Sander and Schaeffer (1991)		OLS				Cross-section
Killian and Parker (1991)		OLS				Cross-section
Charney (1983)		OLS		NH		Cross-section
Dorf and Emerson (1978)		OLS			Y	Cross-section
Fox (1981)	4	2SLS				Cross-section
Kuehn and coauthors (1979)		OLS			Y	Cross-section
Smith, Deaton, and Kelch (1978)		OLS				Cross-section
Wasylenko (1980)		Logistic		Y		Cross-section
Mead (1982)	4	3SLS				Cross-section
Carlton (1983)		MLE				Cross-section
Bartik (1985)		GL				Cross-section
Bartik (1989)		GL, GL-FE		Y		Pooled data; panel data
Canto and Webb (1987)		OLS				Multiple time-series
Deich (1989)		GL				Cross-section
Helms (1985)		OLS, OLS-IV, OLS-FE, OLS-FE-IV, RE, RE-IV	Y			Time-series-cross-section
Jaffee (1988)		OLS	Y		Y	Cross-section
Kieschnick (1981)		OLS				Cross-section
Mehay and Solnick (1990)		OLS, OLS-FE, Parks model	Y	Y		Time-series-cross-section
Munnell and Cook (1990)		OLS				Cross-section
Newman (1983)		OLS		NH		Pooled data
Papke (1987)		OLS-IV				Cross-section
Papke (1989)		OLS-FE				Time-series-cross-section
Plaut and Pluta (1983)		OLS			Y (1 only)	Pooled data
Quan and Beck (1987)		PDL-FE, PDL-FE-IV	Y			Time-series-cross-section
Romans and Subrahmanyam (1979)		OLS				Cross-section
Schmenner and coauthors (1987)		Multinomial logit				Cross-section
Wasylenko and McGuire (1985)		OLS and WLS		Y (some); NH (some)		Cross-section
Wheat (1986)		OLS				Cross-section

Table 1--Selected features of studies covered by literature review

Study	Number of models presented	Comments
Bluestone and coauthors (1989)	72	Separate models computed for each combination of 4 dependent variables and three measures of small business activities for goods and service producers in metropolitan, adjacent nonmetro, and remote nonmetro counties
Carlino and Mills (1987)	2	Simultaneous equations - population, employment
Fox and Murray (1990)	6	Separate regressions reported for each of five firm size classes
McNamara and coauthors (1988)	1	
Porterfield (1990)	6	White's method used to correct for heteroskedasticity in OLS models; simultaneous equations - manufacturing, producer services
Sander and Schaeffer (1991)	8	Includes models with growth relative to that expected given industry mix
Killian and Parker (1991)	2	Separate regressions for metro and nonmetro
Charney (1983)	6	Separate regressions for durable and nondurable manuf.; separate regressions for small, medium, and large firms
Dorf and Emerson (1978)	8	Regression run on 16 principal components derived from 136 variables, or on 16 variables correlated with components
Fox (1981)	4	Simultaneous equation models - land demand, tax rate, business service level, capital-land ratio equations
Kuehn and coauthors (1979)	1	115 small Missouri towns
Smith, Deaton, and Kelch (1978)	1	565 nonmetro communities in two States
Wasylenko (1980)	12	Heteroskedasticity correction for each industry
Mead (1982)	1	Simultaneous equations - in-migration, outmigration, employment change, wage change; nonmetro areas
Carlton (1983)	6	Opening of new plants and size of new plants jointly predicted by model
Bartik (1985)	3	
Bartik (1989)	2	Pooled data analysis has one observation for each time period
Canto and Webb (1987)	48	Separate regressions for each State
Deich (1989)	8	
Helms (1985)	6	Panel data model with fixed effects; budget constraint
Jaffee (1988)	10	
Kieschnick (1981)	13	Models estimated for each industry
Mehay and Solnick (1990)	12	Parks model corrects for heteroskedasticity, serial correlation, and contemporaneous correlation
Munnell and Cook (1990)	4	Three levels-affect-change models; one lagged-change-affects-change model
Newman (1983)	20	Dependent variable and two of three regressors are measured in terms of change relative to national average
Papke (1987)	3	Three alternative tax measures compared
Papke (1989)	8	State and year fixed effects in model
Plaut and Pluta (1983)	3	1967-72 and 1972-77 treated as separate observations for each State
Quan and Beck (1987)	10	1) Fixed State effects (2) Regressors enter with polynomially distributed lags 3) Dependent variables measured relative to national averages (4) Separate regressions for 15 Northeastern and 17 Sunbelt States
Romans and Subrahmanyam (1979)	6	
Schmenner and coauthors (1987)	6	Interactions between area characteristics and firm characteristics also estimated; 2 decision stages modelled
Wasylenko and McGuire (1985)	7	
Wheat (1986)	2	Models presented reflect extensive specification searching

Table 1--Selected features of studies covered by literature review

Notes:

Y - Yes / method was used / variable was included

SEA - State Economic Area (multicounty substate area)
SMSA - Standard Metropolitan Statistical Area
CZ - commuting zone (multicounty area connected by commuting ties)

* - Changes predicted:

L - change predicted by initial levels of independent variables
C - change predicted by changes in levels of independent variables
L, C - change predicted by both levels and changes of regressors
L, c - change predicted primarily by levels of independent variables

** - Event frequencies or probabilities:

FB - Firm births
FR - Firm relocations
PO - Plant openings
PR - Plant relocations
SN - Size of new plant

*** - to construct dependent variables

Estimation methods:

OLS - ordinary least-squares
WLS - weighted least-squares
IV - Instrumental variables
FE - model with controls for fixed area effects
RE - model that assumes randomly distributed area effects
GL - grouped logit estimation
MLE - maximum likelihood estimation (of non-standard function)
2SLS - 2-stage least squares
3SLS - 3-stage least-squares (method for estimating simultaneous equation models)

Table 1--Selected features of studies covered by literature review

Notes (continued):

Temporal structure:

Cross-section - one observation per area
Pooled data - multiple observations per area
Time-series-cross-section - multiple observation per area - controls for unchanging area effects

Units of observation:

In studies of the determinants of plant or firm openings or relocations, the geographic area has been identified as the unit of observation if only counts of openings/relocations are used in the analysis. If additional data on individual firms or plants is incorporated in the analysis (for example, plant size (Carlton) or multiple plant characteristics (Schmenner and coauthors)) then the opening/relocation is identified as the unit of observation.

Simultaneous equations:

For studies that report results for systems of simultaneous equations, the number of equations in the system is shown.

NH - tested for heteroskedasticity, none found

capita income. A few attempt to explain differences in business investment or capital stock growth.

Other studies focus on explaining the frequency of a particular type of business decision: branch plant openings, firm or plant relocations, or firm startups. As noted by Bartik (1991, pp. 30-31), the latter studies may permit more rigorous modelling, because they need model only one type of decision. However, the results may also be of more limited utility to policymakers, as they do not capture the impact of policy instruments on overall economic aggregates, such as total employment growth or total income growth.

Sectoral Coverage

While a few of these studies focus on growth in specific industries,[5] others attempt to explain growth or business activity in one or more broad industry groups--most often manufacturing. Some seek to explain growth in overall regional economic aggregates. Focusing on a narrow economic sector, much like focusing on a particular kind of business decision, may permit more rigorous modelling. But here again, this rigor may be at the cost of some policy relevance. Finding that particular conditions are conducive to growth in one industry may be of interest to those in that industry, but it may be less useful to policymakers who wish to encourage overall economic growth in a region.

Economic Activity and Population Growth

A few of the studies reviewed treat changes in employment and population as simultaneously generated by distinct individual and business decision-making processes (see Mead, 1982, or Carlino and Mills, 1987). These studies provide evidence that population changes or migration flows not only reflect changes in business activity but also contribute to such changes. However, most studies of regional economic growth disregard the role of individual migration decisions; they instead model changes in regional employment and output as driven by business location decisions to which individuals may respond.

Structure of Models of Economic Activity

Among those studies that attempt to explain differences among regions in some measure of economic activity, a majority seek to explain <u>changes</u> in economic activity levels over time (for example, employment growth). Most of these studies assume that the change in the level of economic activity is a function of

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[5]For example, one study by Carlton (1983) focuses on the fabricated plastics, electronic components, and communication transmitting equipment industries.

each area's initial characteristics (for example, education levels, tax levels, and industry mix).

Some studies justify this assumption by reference to a disequilibrium adjustment model, where the initial characteristics of an area are viewed as indicators of the direction of the disequilibrium.[6]

Equilibrium and disequilibrium models

The simplest economic model is one which is an equilibrium model. An economic model is an equilibrium model if it assumes that all economic actors promptly make full adjustments to any changes in prices, demand, or other conditions. If all economic actors have fully adjusted to the initial characteristics of an area, then only some change in those characteristics, or in some other factor not included in the model, can lead to change in the level of economic activity.

In contrast, a disequilibrium adjustment model assumes that some economic actors do not adjust immediately to changes in prices or other constraints, but instead adjust gradually and/or with some delay. In this case, the level of economic activity in an area may change as economic actors carry out their adjustments to past change, even if there is no contemporaneous change in area characteristics or other factors that would influence the economic activity level.

Studies that make this assumption explicit include Plaut and Pluta (1983) and Wasylenko and McGuire (1985); a similar line of reasoning is also suggested in other studies. However, as noted by Newman and Sullivan (1988, p. 220), this approach requires that appropriate measures of both demand and supply be included in the model. For example, growth in consumer service industries is expected not simply where demand is high (for example, due to high incomes), but where demand is high relative to the initial supply of services. This requirement is not consistently addressed by those studies that use levels of local characteristics to explain changes in economic activity.

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[6]That is, some characteristics are indicators that an area's current economic activity level is likely to be above its equilibrium level, while others are associated with an equilibrium level above the current level.

Changes in national or global supply conditions may also justify such an empirical model, if those changes influence local equilibrium levels of economic activity during the observation period in ways that are systematically related to initial local characteristics. For instance, if national (or global) demand for educated labor rises over some period of time, we might expect areas with a more educated labor force to experience more rapid earnings growth over that period--even if the local labor market was initially in equilibrium. Some authors note this as a rationale for the inclusion of industrial mix variables in their models (Killian and Parker, 1991; Sander and Schaeffer, 1991).

One study covered in this review (Canto and Webb, 1987) explains changes in economic activity in terms of changes in the determinants of that activity. The authors model economic growth as a movement from one equilibrium to another, with changes in local characteristics (rather than changes in national or global market conditions) accounting for the changes in local equilibrium.

A few of the studies examined include both levels of and changes in local characteristics or other variables as predictors of economic growth. These studies do not usually specify the assumptions underlying this mixed structure. However, the implicit assumption must be that changes in the level of local economic activity reflect more than one of the processes described above. (That is, these studies implicitly assume that contemporaneous changes in local characteristics are causing some change in the local equilibrium level of economic activity, while initial disequilibrium and/or external changes that affect the local equilibrium drive additional change in the actual level of activity that is associated with the levels of local characteristics.)

Still other studies try to account for interregional differences in the level of economic activity. These include several studies in which "fixed-effects" are used to account for any unexplained differences in activity levels across areas at the beginning of the period, while regressors explain the level of activity in each year conditional on the initial fixed effect (see discussion of fixed effects below.) In other instances, the list of regressors includes one or more variables that reflect the scale of the local economy and hence may "explain" any very large differences in the level of economic activity. For example, in Dorf and Emerson (1978), population[7] is one of the predictors of

[7]Or rather, the authors used a principal component index highly correlated with population and other measures of community size.

employment.[8] Several studies that seek to account for differences in the level of economic activity also use past economic activity levels as one of the predictive variables.

Cross-Sectional and Time-Series-Cross-Sectional Analyses

Most of the studies reviewed use purely cross-sectional methods. That is, for each geographical unit there is one observation of regional characteristics and one observation of the outcome measure.[9] However, some have employed a time-series cross-sectional approach that controls for any unobserved but unchanging differences across jurisdictions ("fixed effects") (for example, Helms, 1985; Quan and Beck, 1987; Papke, 1989; Bartik, 1989). The latter approach requires the use of panel data, that is, data on a number of cross-sectional cases with multiple observations (normally observations at a number of points in time) for each case.

Fixed-effects models

The fixed-effects approach requires data on both the outcome measure and the predictive variables of interest at two or (preferably) more points in time. In general, a fixed-effect model posits that any outcome differences between individual cross-sectional elements (persons, counties, States, and so forth) that persist over time are accounted for by unobserved differences among those cross-sectional elements. A fixed-effects model of regional economic performance posits that each jurisdiction has a distinct unobserved characteristic or set of characteristics that accounts for any persistent difference in the economic performance of that jurisdiction relative to other jurisdictions.

This method does reduce the risk that unobserved differences among jurisdictions will bias estimated regression coefficients

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[8]There seems little reason for confidence about the assumed direction of causality in such a model. Does the size of a community determine the level of employment, or does the availability of employment determine community size?

[9]Schmenner and coauthors (1987) treat branch plant openings as the outcome of interest. They use information on the characteristics of each firm that opened a plant; each firm decision is thus a separate observation in this analysis. However, since there are no repeated observations over time, this is still a purely cross-sectional model.

on variables of interest. However, it also precludes efforts to estimate the effects of any variable that is fixed over time (for example, regional effects), and makes it more difficult to estimate parameters of predictive variables that change little over time relative to their cross-sectional variance (for example, the presence of "right-to-work" laws[10]).

In addition, several studies take a "pooled cross-section" approach, simply combining repeated observations on each geographical unit, without any control for fixed regional effects.[11]

Empirical Estimation Methods

Many of the studies reviewed employ simple ordinary-least squares (OLS), the simplest form of regression analysis, to estimate their proposed regression models. OLS assumes a linear relationship between the independent variables presumed to determine business activity and the outcome measure, and makes other simplifying assumptions.

Among those studies that focus on factors that influence the probability of some outcome (for example, the probability of a town obtaining a new plant, or the probability of a relocating firm choosing a particular community), some (although not all) use logit estimation techniques. These techniques, unlike OLS, constrain the <u>predicted value</u> of the outcome measure to fall between 0 and 1 for all values of the prediction variables, as it should if the outcome being predicted is the probability of an event.

A number of models use an instrumental variables (IV) or two-stage least-squares (2SLS) approach. These techniques are appropriate if two conditions both exist: (1) a particular predictive variable X is <u>itself influenced by</u> the outcome variable Y[12] (in which case the estimated coefficient of X will be biased if it is estimated by OLS, reflecting the effect of Y on X as well as the effect of X on Y) <u>and</u> (2) it is possible to

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[10]"Right-to-work" laws prohibit labor agreements that require union membership as a condition of continued employment of a person who was not a member when hired.

[11]One study reviewed falls into none of the categories described above. Canto and Webb (1987) estimate separate time-series regressions for each State, and then compare coefficients for the variables of interest across States.

[12]More precisely, the condition is that the predictive variable be correlated with the <u>true</u> error term--the "disturbance"--in the process that generates the outcome variable.

replace that predictive variable with a fitted value, computed from other variables ("instruments") that are not influenced by the outcome variable. One weakness of the method is that it is often difficult to find good predictors of the variable X that are not correlated with the disturbance term.

Several of the studies make some type of correction for heteroskedasticity. In several other studies, the authors report that testing for heteroskedasticity indicated no need for a correction.

Heteroskedasticity

OLS assumes that the model will fit all kinds of observations equally well. Formally, this amounts to assuming that the variance of the disturbance term is the same for all cases. However, it may be the case that the model will fit better for some kinds of observations than for others. If the variance of the disturbance term--or equivalently, the variance of actual outcomes around the outcomes that would be predicted by the true model--is not the same for all observations, we have heteroskedasticity. For example, the growth rate of economic activity might be more variable and less predictable in communities where a few employers account for a large share of total economic activity, so that growth is sensitive to the decisions of individual employers. Where heteroskedasticity is present, OLS coefficient estimates are unbiased, but they are inefficient; methods that give less weight to high-variance observations can yield more efficient estimates.

A few studies employed principal component methods.

Principal components

The method of principal components creates a new set of variables that are linear combinations of the original variables, but are uncorrelated with each other. The complete set of principal components includes one component for each of the original variables, but analysts may discard those components that have little variance. Any one of the original variables could then be approximated by some linear combination of the remaining components; thus, the subset of components that have substantial variances may be seen as containing nearly all of the information in the original set of variables.

Dorf and Emerson (1978) reduce more than 100 different variables to 16 factors that together serve as fairly good predictors of each of the original variables. They then use these factors to predict plant location. This method can eliminate the problem of multicollinearity, because, by construction, no factor is correlated with any other.

Collinearity and multicollinearity

Collinearity in a regression analysis arises when two explanatory variables are highly correlated with each other, so that it is difficult to distinguish the effects of one from the effects of the other. Multicollinearity arises when one explanatory variable is highly correlated with some linear combination of other variables, again making it difficult to distinguish among the effects of the variables involved. When collinearity or multicollinearity is present, estimates of the affected coefficients will be subject to greater uncertainty.

However, this approach makes it more difficult to interpret the results in terms of possible cause and effect relationships, as one factor may be correlated with a number of county characteristics, each of which might be expected to have quite distinct effects on local growth. For example, a single factor in Dorf and Emerson's study is highly correlated with per capita education spending and per capita highway spending and per capita welfare spending and per capita property tax. If such a factor is found to have a significant effect on growth, the practical implications of the result are unclear; which of the underlying variables accounts for the result? A few other studies have used principal component methods to reduce several related variables into a single factor correlated with each of them before including the latter in a larger regression model.

Possible Determinants of Growth or Business Activity

The studies reviewed also vary in the possible determinants of growth they consider and in the research questions the authors view as most important. Determinants of growth considered by each study are identified in table 2. While much of this literature examines the possible effects of State and/or local taxation on business growth, other public policy variables also

Table 2—Variables identified as potential determinants of growth, by study

Table 2--Variables identified as potential determinants of growth, by study

Study	Unit of analysis	Tax variables			Expenditure variables			Labor market variables			
		Corporate	Property	Other*	Education*	Welfare	Other	Wage measure(s)*	Unionization or union activity	Right-to-work laws*	Unemployment rate or measure
Bluestone and coauthors (1989)	County										
Carlino and Mills (1987)	County			X					X		
Fox and Murray (1990)	County		X	3	X		X	X	X		X
McNamara and coauthors (1988)	County		X					X			
Porterfield (1990)	County			X	X			X	X		X
Sander and Schaeffer (1991)	County			X	X						
Killian and Parker (1991)	CZ							X			
Charney (1983)	Locality		X	X							
Dorf and Emerson (1978)	Locality		X				2				
Fox (1981)	Locality		X				X				
Kuehn and coauthors (1979)	Locality		X					X			
Smith, Deaton, and Kelch (1978)	Locality				X						
Wasylenko (1980)	Locality		X				2				
Mead (1982)	SEA		X					2			X
Carlton (1983)	SMSA		X	X				X			X
Bartik (1985)	State	X	X	2				X	2		
Bartik (1989)	State	X	X	4	2	X	3	X	X		
Canto and Webb (1987)	State			X		X	X				
Deich (1989)	State	X	X				X	X	X		
Helms (1985)	State		X	X	2	(X)	3	X	2		
Jaffee (1988)	State			2		X			X		
Kieschnick (1981)	State	X		X		X		X	X		
Mehay and Solnick (1990)	State			X	X	(X)	X	X			
Munnell and Cook (1990)	State			X				X			X
Newman (1983)	State	X							X	X	
Papke (1987)	State	X					3	X			
Papke (1989)	State	X						X			
Plaut and Pluta (1983)	State	X	X	3		X	X	X	X		X
Quan and Beck (1987)	State			X	2	(X)	X				
Romans and Subrahmanyam (1979)	State	X		2		X		X			
Schmenner and coauthors (1987)	State	X	X	2			X	X	2	X	
Wasylenko and McGuire (1985)	State	X		3	X	X		X	X		
Wheat (1986)	State	X						X	X	X	

Tabulation includes variables entered in alternative or preliminary forms of model, but alternative specifications of same variable are only entered once.
Variables marked with asterisks have analogues in the specification used in Kusmin and coauthors (forthcoming).
Numerical entries indicate the number of variables of the specified type in the model if more than one.
(X) - included in specification implicitly but not explicitly.

Table 2--Variables identified as potential determinants of growth, by study

Study	Unit of analysis	Education		Market access variables				Demographic characteristics			
		Educational attainment*	Access to or presence of higher ed*	Transportation*	Proximity to city or metro area*	Per capita or family income	Other market demand	Population density	Locality or area population*	Urbanization measures	Percent black or minority*
Bluestone and coauthors (1989)	County										
Carlino and Mills (1987)	County	X		X	X	X					X
Fox and Murray (1990)	County	X		11		X				X	
McNamara and coauthors (1988)	County	X	X		X				X		X
Porterfield (1990)	County	2	X	2							X
Sander and Schaeffer (1991)	County	X				X		X	X		
Killian and Parker (1991)	CZ	3							X		X
Charney (1983)	Locality			3	X			X			
Dorf and Emerson (1978)	Locality		X	3	X						
Fox (1981)	Locality			2				X			
Kuehn and coauthors (1979)	Locality			4				X	X		
Smith, Deaton, and Kelch (1978)	Locality		X	X	X				X		
Wasylenko (1980)	Locality			X	X	X		X			
Mead (1982)	SEA	X			2		X			X	X
Carlton (1983)	SMSA										
Bartik (1985)	State	X		X				X			
Bartik (1989)	State	2		X		X		X			
Canto and Webb (1987)	State						X				
Deich (1989)	State	X					X				
Helms (1985)	State							X			
Jaffee (1988)	State								X		
Kieschnick (1981)	State					X	2	X			
Mehay and Solnick (1990)	State							X			
Munnell and Cook (1990)	State	X						X		X	
Newman (1983)	State										
Papke (1987)	State										
Papke (1989)	State										
Plaut and Pluta (1983)	State						X				
Quan and Beck (1987)	State										
Romans and Subrahmanyam (1979)	State						X				
Schmenner and coauthors (1987)	State	X						X			
Wasylenko and McGuire (1985)	State	X				X		X			
Wheat (1986)	State						2			X	

Table 2--Variables identified as potential determinants of growth, by study

Study	Unit of analysis	Other regional characteristics			Industrial composition of economy		Additional variables		
		Regional dummies*	Climate*	Energy prices	Industry density or agglomeration*	Industry mix/ expected growth*	Land price or availability	Labor productivity measure(s)	Fire protection rating
Bluestone and coauthors (1989)	County	3							
Carlino and Mills (1987)	County	8							
Fox and Murray (1990)	County			X		X	X		
McNamara and coauthors (1988)	County				X				X
Porterfield (1990)	County	3			X				
Sander and Schaeffer (1991)	County	8				X			
Killian and Parker (1991)	CZ	3				X			
Charney (1983)	Locality								
Dorf and Emerson (1978)	Locality			X					
Fox (1981)	Locality						X		
Kuehn and coauthors (1979)	Locality				X				X
Smith, Deaton, and Kelch (1978)	Locality				X		X		X
Wasylenko (1980)	Locality				X		3		
Mead (1982)	SEA	X							
Carlton (1983)	SMSA			2	X				
Bartik (1985)	State			X	X		X		
Bartik (1989)	State	8		X	X		X		
Canto and Webb (1987)	State								
Deich (1989)	State	3		X	X		2		
Helms (1985)	State								
Jaffee (1988)	State								
Kieschnick (1981)	State		X	X	X			X	
Mehay and Solnick (1990)	State								
Munnell and Cook (1990)	State		X	X					
Newman (1983)	State	X							
Papke (1987)	State			X				X	
Papke (1989)	State								
Plaut and Pluta (1983)	State		2	X			X	X	
Quan and Beck (1987)	State	X							
Romans and Subrahmanyam (1979)	State								
Schmenner and coauthors (1987)	State		X	X					
Wasylenko and McGuire (1985)	State		2	X	X				
Wheat (1986)	State		2	X					

Table 2--Variables identified as potential determinants of growth, by study

Study	Unit of analysis	Other (no.)	Other (description)
Bluestone and coauthors (1989)	County	3	One of three measures of small business activity: small business reach, small business turbulence, or small independent business reach*
Carlino and Mills (1987)	County	4	Total industrial revenue bond value, crime rate, remote rural*, central city
Fox and Murray (1990)	County	9	Water rates, natural gas lines, phone lines, per capita transfers from State, per capita hospital beds, school quality proxy, 3 others tried
McNamara and coauthors (1988)	County	2	School quality proxy, locally funded development group dummy
Porterfield (1990)	County	1	Metro/nonmetro dummy
Sander and Schaeffer (1991)	County	0	
Killian and Parker (1991)	CZ	4	Percent workforce female, average population age*, percent workforce Hispanic*, high-amenity area dummy*
Charney (1983)	Locality	5	Access to low income households, density of high income households, percent land with sewer access, employment density, zoning variable
Dorf and Emerson (1978)	Locality	7	Per capita county debt, water rate, male LFP*, community size (no. service establishments), county size (no. hospital beds), 2 others
Fox (1981)	Locality	1	Local capital-land ratio
Kuehn and coauthors (1979)	Locality	9	If zoning, water capacity, sewer capacity, distance to voc-tech, number police, 4 others
Smith, Deaton, and Kelch (1978)	Locality	3	Available labor measure, if bond financing available, best-site quality index
Wasylenko (1980)	Locality	1	Sectoral labor availability measure*
Mead (1982)	SEA	4	Agricultural employment decline, nonagricultural employment growth, MSA wage growth, magnitude of past migration flows
Carlton (1983)	SMSA	1	Number of engineers*
Bartik (1985)	State	1	Construction costs
Bartik (1989)	State	10	Strictness of environmental regulation, venture capital availability, four banking variables*, four demographic variables
Canto and Webb (1987)	State	0	
Deich (1989)	State	0	
Helms (1985)	State	3	User fees, State deficit, federal source revenue
Jaffee (1988)	State	0	
Kieschnick (1981)	State	1	Union growth
Mehay and Solnick (1990)	State	3	Department of Defense spending variables, intergovernmental aid, State/local deficits
Munnell and Cook (1990)	State	1	Public capital stock (infrastructure)
Newman (1983)	State	0	
Papke (1987)	State	10	Dummy variables for each two-digit industry
Papke (1989)	State	0	
Plaut and Pluta (1983)	State	3	Business climate, 1972 dummy, energy-1972 interaction
Quan and Beck (1987)	State	0	
Romans and Subrahmanyam (1979)	State	1	Ratio of nonagricultural to agricultural income
Schmenner and coauthors (1987)	State	2	Building cost index, voc-ed enrollments
Wasylenko and McGuire (1985)	State	1	Population share 18-44*
Wheat (1986)	State	6	Petroleum availability, timber availability, farm production, business climate index, retiree state dummy*, Montana-Wyoming dummy

LFP - labor force participation

receive attention. These include:

- public spending in various categories
- "right-to-work" laws
- public capital stocks
- branch banking laws
- availability of industrial revenue bond financing

Many studies also consider area characteristics that public policy influences less directly if at all. These include:

- wage levels
- unionization levels
- unemployment levels
- labor force quality (as measured by education level)
- proximity to an institution of higher education
- availability of transportation infrastructure[13]
- proximity to a metropolitan area
- per capita or family income
- population size and density
- urbanization
- minority population concentration
- temperature and precipitation
- energy prices
- measures of the mix of industries or the concentration of particular industries
- measures of land prices or availability
- labor productivity
- local fire protection ratings
- small business activity measures
- population age distribution measures[14]

Taxation and Expenditures

While the effects of taxation policies on economic growth or business location are often treated as distinct from the corresponding effect of expenditure policies, in fact they should be considered together. As noted by Helms (1985), total State and local revenues and expenditures are related by a budget constraint. That is, sources of funds--including borrowing and transfers from other levels of government as well as taxes--must equal uses of funds--including expenditures and debt repayment. Even when the revenue or taxation and expenditure variables in a particular study do not have an exact mathematical relationship

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[13]Availability of roads, highways, or airports reflects past policy decisions, but access to railroads reflects in part private decisions, while access to water transportation largely reflects natural geography.

[14]This list is not exhaustive; a variety of other variables were also included in one or more of the studies reviewed.

to each other, they are usually related to some extent, so that higher expenditure levels will usually be associated with higher tax rates. Hence, when a study estimates the effects of tax policy without including separate variables for expenditure policy, the estimated tax effects may reflect the combined effects of higher taxes and of the services paid for by those taxes. These studies may indicate the overall difference in performance between areas with high taxation and expenditure policies and areas that have lower taxes and fewer public expenditures, but cannot indicate the likely effect on growth if a specific tax is increased to pay for a particular government program.[15]

Where studies do control for both taxation and expenditure, the policy-relevant question is not the sign or magnitude of the individual coefficients, but it is rather the implied impact of a feasible combination of changes in taxes and expenditures. For instance, an increase in educational expenditures will require an increase in taxes (or other revenue sources) or a decrease in other expenditures; a tax cut will require compensating expenditure cuts or increases in other taxes. Hence, finding a positive relationship between educational spending and growth, or a negative relationship between a tax rate and growth, is not enough to tell us how growth will be affected by policy changes that require compensating changes in taxes and expenditures.

The effect of increased taxation on economic activity may depend on which taxes are raised. The presumption in most of the literature is that business decisions drive differences in economic growth across regions, and, therefore, increases in corporate income taxes or other taxes levied directly on business are most likely to have adverse effects.[16] Responding to this

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[15]In addition, if areas with higher tax rates also differ systematically from other areas in the strength of their tax bases or in the cost of providing services--and if those differences are not captured by other variables--then any empirical results will reflect these differences as well as any actual effects of a differing policy mix. Hence the estimated effect of a tax rate variable may not accurately reflect the impact of changes in the level of taxation and expenditure, given a fixed tax base and fixed costs.

[16]However, as noted earlier, individual migration decisions may also drive changes in the level of economic activity in an area. This is suggested by results of some of the studies reviewed, and also by the economic growth of retirement attraction areas and others that offer recreational and lifestyle amenities. Thus, it is likely that differences in personal taxes, by influencing those individual decisions, will also indirectly affect business location decisions and changes in employment and output.

possibility, governments often try to raise taxes on industries that are locationally inflexible (such as natural resource-based industries) while lowering tax rates on industries that are more footloose (such as manufacturing plants.) Models that estimate the effect of tax rates on business activity, while ignoring the potential for the level and mix of business activity to influence tax rates, may yield erroneous estimates of the effects of business taxes.

The effect of public expenditure on business activity depends on the function of that expenditure. The literature suggests that business will assign some positive value to expenditures on highways, sewers, police and fire services, and perhaps public education. On the other hand, a number of authors suggest that the business community generally believes that outlays for public welfare yield little benefit to business. Some analysts suggest that more generous expenditures on income-support programs may even impact adversely on business by reducing the supply of potential labor willing to work at low wages.

The studies discussed below differ in the extent to which they control for expenditure differences, or for differences in the composition of revenues and of expenditures.

Bartik (1991) also draws a further distinction between studies that examine the effects of interstate tax differentials and those that examine the effect of differentials within a State or substate area. When businesses choose alternative locations, choices within the same State or metropolitan area will be relatively close substitutes, while locations in other States will be poorer substitutes. Therefore, he expects intrastate differences in economic growth to be quite sensitive to intrastate tax differentials, while interstate growth differences will be less sensitive to differences in tax levels among States (Bartik, 1991, p. 39). The following discussion maintains that distinction.

Interstate Studies

Romans and Subrahmanyam (1979) consider how State growth in each of three economic activity measures--personal income, per capita personal income, and employment--was affected by four fiscal measures during the 1964-74 period. Their model's fiscal measures included: (1) a measure of State business tax effort based on estimates by the Advisory Commission on Intergovernmental Relations (ACIR), (2) a measure of State personal tax effort, also based on estimates by ACIR, (3) an index of the progressivity of personal taxes,[17] and (4) a

[17]Progressivity is the extent to which the share of income claimed by personal income taxes rises with the income of the taxpayer.

measure of the proportion of revenue devoted to transfer payments. They find that both the progressivity of personal taxes and the level of transfer payments had negative effects on growth which were statistically significant for some growth indicators.

Statistical significance

When an estimated effect is described as statistically significant, it means that an estimate this large in magnitude would be a relatively unlikely result if the true effect were 0. When not further qualified, "statistically significant" is equivalent to "statistically significant at the 5 percent level", meaning that if the true effect were 0, the probability of obtaining an estimate as large as the one observed is less than 1 in 20. Some analysts also note findings that are statistically significant at the 10 percent level.

However, when they control for these two measures of redistributive fiscal policy, the average level of personal taxes had no effect on growth, and the average level of business taxation had a significant positive effect on growth of total personal income. These results suggest that increases in State taxation and expenditure levels affect growth adversely only when they are explicitly redistributive in nature. However, the small number of data points, the use of a simple cross-section, and the limited number of variables included in their specification weaken this study.

Kieschnick (1981) examined the effect of a number of factors on new investment by State in each of 13 two-digit SIC manufacturing industries during 1977.[18] Fiscal variables included in his model were (1) an industry-specific estimate of the business tax burden for each State and industry, (2) a measure of personal taxes as a share of personal income, and (3) a measure of general

[18]SIC stands for Standard Industrial Classification. The SIC is an industrial classification system used by the U.S. Census Bureau to categorize businesses by industry. Examples of two-digit SIC industries include textile mill products (SIC 22) and food stores (SIC 54).

welfare expenditures as a share of personal income.[19] Kieschnick's estimates of the effect of business taxes on investment were negative for most industries and were significantly negative for several. He found no significant effect of personal taxation on new investment, and little evidence of a negative effect from welfare expenditures.

Newman (1983) estimated the effects of changes in the nominal corporate tax rate on State employment growth for each of 13 industries in two periods (1957-65 and 1965-73). He found the effect of corporate tax rates to be negative in 11 of 13 cases, and significantly negative in 5 cases. However, Newman included only two other independent variables in his specification--the change in unionization and a "right-to-work" dummy variable--so that omitted variable bias may well affect his results.

Omitted variable bias

When one or more variables that have an effect on the outcome of interest are omitted from the model, the coefficients for the remaining variables will be biased if there is a correlation between the variables left out and those included in the model. The resulting omitted variable bias may cause the effects of variables included in the model to be either overstated or understated. Variables that actually have no effect may appear to be powerful influences on the outcome, if these variables are strongly correlated with others that were omitted and that are important determinants of the outcome. Conversely, variables that have an important effect on the outcome may appear to be unimportant.

Carlton (1983) studied branch plant location decisions and employment level decisions between 1967 and 1971 in three specific four-digit SIC manufacturing industries with national markets, using metropolitan area-level data to jointly explain the distribution of new plant locations and employment levels across 40 metropolitan areas. Carlton uses two tax variables--one a weighted average of corporate and personal income tax rates at specified income levels, and the other an effective property

[19] Kieschnick's study reports results for the "best" regression for each sector, reflecting some sort of specification search conducted separately for each one. Thus, coefficients for all three variables are not reported for all sectors. One infers that those variables not appearing in his preferred specification for a particular sector were not significant when added to that specification, although this is not explicitly stated.

tax rate--and no Government expenditure variables. He finds no significant taxation effects in the three industries he studied. However, his focus on only three detailed industries makes it difficult to generalize from his results.

Plaut and Pluta (1983) investigate the determinants of interstate variation in each of three measures of manufacturing growth--employment growth, output growth, and capital stock growth--during the 1967-72 and 1972-77 periods. Their specification includes five tax variables and two expenditure variables. The tax variables included are: (1) corporate taxation as a percentage of payroll; (2) an index of personal income taxation level and progressivity; (3) sales taxes as a percentage of retail sales; (4) the effective property tax rate; and (5) ACIR's measure of State and local tax effort. Expenditure variables included in their model are: (1) a principal components index, reflecting both education expenditure and total expenditure, and (2) welfare expenditures as a percentage of State personal income.

Plaut and Pluta find a significant positive correlation between property taxes and all measures of growth, a significant negative relationship between overall tax effort and employment growth, and positive relationships (which are significant in some cases) between both expenditure variables and each growth measure. However, by including an aggregate tax effort measure, measures of each major specific tax, and a variable closely related to total expenditures in a single specification, Plaut and Pluta invite multicollinearity problems and make their individual coefficient estimates difficult to interpret. Overall, they find that tax and expenditure variables explain little of interstate variance in growth rates.

Bartik (1985) examines factors associated with the location of new manufacturing branch plants between 1972 and 1978. Bartik finds strong evidence that corporate income taxes have a negative effect on plant location, and weaker evidence of a similar effect from property taxes paid by business. The estimated effects of unemployment compensation taxes and workers' compensation insurance rates in models tested by Bartik were either insignificant or significantly positive. Bartik does not include separate controls for expenditure effects.

Helms (1985) employs a fixed-effects model to estimate the effect on State personal income of changes over time in five sources of State and local revenue--property taxes, "other" State taxes, user fees, deficit financing, and Federal financing--and five classes of State expenditures--higher education, local schools, highways, public health, and "other" expenditures (largely transfer payments). He finds that revenue increases from any source that are spent on transfers and other unclassified expenditures exercise a substantial negative effect on growth. However, increases in revenue that finance public health,

highways, and education have either no substantial effect or else a positive effect on income growth.

While Helms employs a sophisticated methodology, some of his results may arouse skepticism. He finds that increases in the revenue received from the Federal Government have an adverse effect on growth which exceeds the adverse effect of increases in taxes or user fees; further, the magnitude of longrun fiscal effects on personal income implied by Helms' results seem very large--for example, the results from his preferred specification imply that an increase in general taxes of 1 percent of State personal income, used to finance increased spending on public health, would ultimately raise the level of State personal income by 22 percent!

Wasylenko and McGuire (1985) attempt to explain both total employment growth and employment growth in each of six broad industry categories between 1973 and 1980. They estimate the effects of four tax variables and two expenditure variables. The tax variables in their model are measures of (1) State corporate income taxes, (2) sales taxation, and (3) personal income taxes on higher-income individuals, as well as (4) the 1967-77 change in State relative tax effort. The expenditure variables they include in their model are the percentages of State income spent on education and on welfare. Their results vary by industry, but they find no evidence in any industry of significant effects from either corporate income tax rates or welfare spending levels. They do find significant positive effects of education spending on employment growth in several industry groups. They find weaker evidence for negative effects from higher personal income tax levels or increases in overall tax effort.

Wheat (1986) attempts to identify factors that explain variation in 1963-77 manufacturing employment growth by State. His model includes a single fiscal variable--State corporate income taxes as a percentage of manufacturing value added.[20] He finds no significant tax effect on growth.

Papke (1987) seeks to explain differences across States and industries in new capital expenditure per production worker. Papke's main innovation is to use a more carefully specified business tax measure together with other explanatory variables in her regression analysis. To measure business tax levels, Papke employs a simulation model (AFTAX) to estimate, for each two-digit SIC manufacturing industry, the effect of tax code differences among 20 States on the profits of a representative firm in that industry.

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[20]If corporate profit margins in manufacturing operations vary widely from State to State, this statistic will poorly reflect the actual burden of State corporate taxes.

Papke finds this tax variable to have a highly significant effect on investment, higher taxes being associated with lower levels of investment per worker. She also reports that substitution of two less carefully specified tax measures fails to reveal this relationship. Papke finds no significant relationship between several measures of public services to business--police and fire expenditures, utility expenditures, or support for arterial roads and highways--and new investment per worker.

Quan and Beck (1987) employ a fixed-effects model that allows for lagged effects to assess the impact of taxation, education expenditure and "other" expenditure (that is, expenditure excluding education and public welfare expenditure) on economic activity from 1974 to 1983 in 15 "Northeastern" States and in 17 Sunbelt States.[21] They find that higher tax levels have the expected negative effects on manufacturing wages, manufacturing employment, and per capita income within their Northeastern sample, but not within their Sunbelt sample. Higher local education expenditures have significant positive effects on economic activity levels in the Northeast, but have significant negative effects within the Sunbelt. They find less evidence for any effects from higher education expenditures. "Other" expenditures have significant positive effects on manufacturing employment, but not on wages or income.

Schmenner, Huber, and Cook (1987) examine factors associated with 114 manufacturing plant location decisions by major firms during the 1970's. They fail to find significant effects from corporate tax rates or property tax levels for these decisions as a group.[22]

Bartik (1989) uses panel data to estimate the impact of factors that may influence small business startups. He attempts to explain business startup rates by State and two-digit SIC manufacturing industry between 1976 and 1982, where the startup rate for a given State and industry is defined as the ratio of

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[21]The States they define as Northeastern include Maryland, Delaware, and the Great Lakes States, as well as New England, New York, Pennsylvania and New Jersey. The Sunbelt States include those States (other than Maryland and Delaware) that are part of the Census-defined Southern region, with the addition of New Mexico, Arizona, and California.

[22]They do find that the level of property taxes is negatively associated with location decisions under some conditions, but this is offset by a positive relationship under other conditions.

startups to employment in that industry in that State.[23] He includes extensive controls for fiscal variables, including measures of six tax variables: (1) the corporate income tax rate, (2) the personal income tax rate, (3) the sales tax rate, (4) business property taxes, (5) the extent of corporate income tax relief for small firms, and (6) the extent of any sales tax relief for machinery and equipment purchases. The expenditure variables in Bartik's model are public school spending per pupil and per capita expenditure in each of five other categories (police, fire protection, higher education, welfare, and "all other").

Bartik finds that increases in business property taxes, general corporate tax rates, and sales taxes on machinery and equipment all reduced small business startup rates significantly. Increases in personal income taxes and general sales taxes had negative but nonsignificant effects on startup rates. Among expenditure categories, only fire protection had a significant positive effect on startup rates, while public school expenditures had a nonsignificant positive effect; welfare spending and "other" spending had significant negative effects on startups.

Deich (1989) explores determinants of firm births--branch plant openings and single-establishment openings--between 1972 and 1977 for manufacturing as a whole and for three two-digit SIC manufacturing industries. The fiscal variables Deich includes in his models are (1) an effective State corporate income tax rate, (2) an effective industrial property tax rate, and (3) per capita spending on police and fire services. Deich finds no significant tax effects on single-establishment openings. In the four estimated models of branch plant openings, six of the eight coefficients on tax variables are significant--but three of these have the "wrong" sign, indicating a positive relationship between taxation and plant openings. Expenditures on public services have significant positive effects on plant openings in four of Deich's eight equations.

In another application of the AFTAX simulation model, one which controls for fixed State and time effects, Papke (1989) estimates the effect of industry taxes and industry wage rates on gross State product in each of four two-digit SIC manufacturing industries in 1975-82. She finds that tax levels generally have a negative effect on industry output, and the implied responses of output to variations in the effective tax rate are substantial. However, the estimated tax effects are not statistically significant for particular industries, perhaps

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[23]Bartik argues that employees within an industry are the most likely to become entrepreneurs in that industry, and cites evidence that most entrepreneurs start businesses where they already live.

because the limited amount of data and the large number of fixed effects to be estimated leave Papke with relatively few degrees of freedom.[24]

Munnell and Cook (1990) consider a model that includes a single measure of tax levels--State and local taxes as a percentage of State personal income--together with a measure of the public capital stock which they developed. They assess the effect of these and other variables on private employment growth over several periods--the earliest is 1970-80 and the most recent is 1980-88. They find that higher tax levels had a negative effect on growth, which was significant for some time periods, while public capital stocks had a positive effect, which was also significant over some time periods.

Overall, the implications of these studies are unclear. While studies by several authors, including Newman, Bartik, Helms, and Papke, offer clear evidence of a negative relationship between business taxation and economic growth or business location decisions, other studies find business taxes insignificant or yield ambiguous results. Four studies test for a possible relationship between personal taxes and economic growth; only Bartik's model of small-business startups yields evidence for such a relationship. Several studies do yield evidence for a positive relationship between education expenditures and growth, but the study by Quan and Beck (1987) suggests that this relationship may vary by region. Welfare or transfer expenditures are negatively associated with growth indicators in three studies, but have no significant effect in two others, and are positively associated with growth in one study. Finally, the studies provide limited and contradictory evidence on whether other types of government expenditures (on police and fire services, roads and highways, and so forth) have an impact on growth.

Bartik, in Who Benefits from State and Local Economic Development Policies? (1991), summarizes results from a large number of

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[24]The degrees of freedom for a linear regression are equal to the number of pieces of information (observations) minus the number of parameters estimated (coefficients of explanatory variables, where explanatory variables may include an "intercept" term and/or dummy variables that capture fixed regional effects) (Myers, 1990, p. 19). If the number of variables exceeds the number of observations, the effects of each variable cannot be estimated; in order to estimate these effects with any precision, the number of observations must be considerably larger than the number of variables.

econometric studies of economic growth and business location.[25] He concludes that this literature does show a negative effect of higher State tax levels on business activity--particularly if public service expenditure levels are controlled for, and especially if greater weight is given to studies that use fixed-effect methods to control for unobserved permanent differences among jurisdictions. He finds that the literature suggests an elasticity of business activity with respect to tax levels of -0.1 to -0.6.[26]

Bartik's reading of studies that control for public expenditures at the State and/or local level suggests that there are positive effects from public service expenditures, and from spending on education and infrastructure in particular; his review also suggests that higher levels of spending on welfare may have a negative effect on business activity. According to Bartik, most of these studies also controlled for one or more tax variables. However, only a few of the studies have been designed to permit direct comparison of the estimated effects of expenditure increases and of compensating tax increases (Bartik, 1991, pp. 36-48).

In a smaller survey of the literature on the impact of fiscal incentives on business location decisions at the interstate or intermetropolitan level, Wasylenko (1991) concludes that the results are sensitive to the type of study considered. "Micro-level" studies of firm decisions do not show tax effects in most instances. However, "macro" studies of the determination of employment growth often suggest that education spending and personal taxes do have significant effects on growth, and sometimes indicate such effects for business taxes as well. Finally, "macro" studies of total income or investment show tax effects on growth more consistently. Wasylenko suggests that lower business taxes, by reducing the cost of capital relative to labor, may lead to substitution of capital for labor in regional economies; lower taxes may thus stimulate investment and income growth but have a lesser impact on employment.

In their review of post-1978 studies, Newman and Sullivan (1988) concentrate on methodological issues. Their review covers some studies of specific locational choice, as well as others that attempt to explain movements in broader measures of economic activity. Among the issues they address are: how to measure effective tax rates; the possibility of tax shifting; the choice between purely cross-sectional methods and those that employ

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[25]Bartik's review covers 21 of the 35 studies covered in this report, together with more than 50 other empirical studies that include estimates of tax effects.

[26]That is, a 10-percent increase in tax levels is associated with a 1- to 6-percent reduction in business activity.

cross-sectional data at two or more points in time; whether observed levels of business activity are treated as equilibrium or disequilibrium levels; correct specification of the supply of possible business sites; and the possibility of factor substitution within industries (meaning that movements in employment may not parallel movements in capital). Their review concludes that "the most recent studies, employing more detailed data sets and more refined econometric techniques, have generated results which cast some doubt on the received conclusion that tax effects are generally negligible" and that "the evaluation of tax impacts on industrial location should be treated as an open rather than a settled question" (Newman and Sullivan, 1988, p. 232).

Wilson (1989) discusses results from several econometric studies of the impact of taxes on economic growth, together with other data he finds relevant to assessing the impact of "State business incentives" on economic growth. Wilson concludes that, while some evidence suggests that business tax incentives do influence State economic growth, these incentives are not major determinants. Wilson also suggests that taxes (and other business incentives) may influence growth specifically because they are used in the computation of State business climate indices (Wilson, 1989, p. 22).[27]

Comparisons of Counties or Communities

While the ready availability of State-level data has produced more analyses of interstate differences in economic growth or business attraction, a number of studies have employed data below the State or metropolitan area level. Some of these studies focus on variations in business activity among communities within metropolitan areas, while others employ data on counties in one or more States, or focus on nonmetropolitan areas.

Dorf and Emerson (1978) try to identify factors that help to account for either levels of or changes in manufacturing activity in small nonmetropolitan communities in the West North Central States. They test for the possible influence of four county fiscal variables, all measured in per capita terms: property taxes, debt, housing expenditures, and natural-resource-related expenditures.[28] Their results provide weak evidence that high

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[27]However, Wilson offers no specific evidence that business climate indices per se (as opposed to the underlying policies or conditions that they reflect) actually have any direct effect on business location decisions.

[28]As noted earlier, they first extract 16 principal components from a list of more than 100 community characteristics that might influence manufacturing activity, and then regress

(continued...)

property taxes have a negative effect on manufacturing activity; they find no evidence for effects from debt, housing expenditures, or natural resource expenditures.

Smith, Deaton, and Kelch (1978) investigate the distribution of new manufacturing plants in nonmetropolitan municipalities in Kentucky and Tennessee between 1970 and 1973. They find that per-pupil educational expenditures have a significant positive effect on the probability of attracting a new manufacturing plant. No tax variables appear in their model. Debertin, Pagoulatos, and Smith (1980) report a reanalysis of the same data with different techniques. Their logit analysis also shows a significant positive relationship between education expenditures and manufacturing plant attraction.

Kuehn and coauthors (1979) attempt to identify factors associated with attraction of new manufacturing plants for a sample of 115 small Missouri communities in the 1972-74 period. The single fiscal variable in their model--the property tax rate--has a negligible effect on the probability of attracting a plant.[29]

Wasylenko (1980) examines decisions by firms that relocated from the city of Milwaukee to the Milwaukee suburbs between 1964 and 1974; he distinguishes among six major industry groups in his analysis. After controlling for those suburbs which had apparently "zoned out" certain industries,[30] Wasylenko finds evidence that higher property tax rates significantly affected relocation decisions in two of the six industries, but little

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[28](...continued)
activity measures against these components. However, they also provide results for models in which each of the 16 principal components is replaced by one of the original variables highly correlated with that component; it is these results that are cited here.

[29]The authors convert the 19 variables in their original model to uncorrelated principal components, and estimate the model with these components as regressors. Components that are not significant at the 10 percent level are dropped from the model, and coefficients on the original variables are recomputed from the results of the simplified model. Because fewer than 19 distinct components are used to estimate the 19 coefficients, the reported coefficients on the original variables are related to each other by some set of linear restrictions. This raises the possibility that results from least-squares regression on the original variables would be different.

[30]That is, these communities had zoning restrictions that effectively ruled them out as possible sites for firms in these industries.

evidence that local expenditures on police, fire, streets, or sanitation had a significant effect on these decisions.

Fox (1981) seeks to identify factors that influenced the demand for industrial land in the Cleveland suburbs. Like Wasylenko, although using a somewhat different methodology, Fox finds a significant negative relationship between property taxes and site demand in those communities that have not "zoned out" industry. However, in contrast to Wasylenko, he also finds that police and fire service expenditures have a significant positive influence on site demand.

Mead (1982) takes a simultaneous equations approach to modelling in-migration, outmigration, employment growth, and per capita wage growth in 69 nonmetropolitan substate areas during the 1960's, allowing for the influence of each outcome variable on the others. Mead includes the effective area property tax rate for each State Economic Area[31] as a percent of the statewide average as a predictor of employment growth, and finds that higher relative tax rates significantly reduced growth.

Carlino and Mills (1987) model 1980 population and employment densities for U.S. counties as simultaneously determined functions of 1970 population and employment densities and of other county and State characteristics. They include one measure of local taxes per capita in their population equation; the resulting coefficient is small and not significantly different from zero. They exclude this tax measure from their employment equation, however, on the grounds that a measure of business tax rates would be the proper variable to include in this equation.

McHugh and Wilkinson (1988) reanalyze the same data using a model that includes random State effects. They do find a significant negative relationship between local taxes and 1980 population, estimating that a 10 percent difference in the level of local taxes in 1972 accounted for a 0.52 percent reduction in 1980 population.

McNamara and coauthors (1988), using a logit model, seek to explain openings of new manufacturing plants in Virginia counties (and independent cities) during the 1979-81 period. While the effective real estate tax rate is among their regressors, the estimated coefficient on this variable is positive, contrary to expectations, and not statistically significant. They include no measure of public expenditures in their model.

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[31]State Economic Areas are substate multicounty areas defined by the U.S. Census Bureau.

The random effects model

The random effects model used here assumes that while one random process generates county deviations from expected outcomes that are independent from one county to the next, a second, distinct process generates random deviations that are independent from one State to the next, but are common to all counties in a single State. More generally, a random effects model may be relevant to any situation where observations can be grouped, with one random process generating independent disturbance terms for individual observations and a second process generating disturbance terms for groups of observations.

Porterfield (1990) investigates growth in manufacturing and producer service employment between 1981 and 1986.[32] For each of these sectors, separate models are estimated for metropolitan counties, nonmetropolitan counties adjacent to metro areas, and remote nonmetropolitan counties. Porterfield includes a measure of local revenue effort as a predictor of producer service employment growth, and a measure of local per-student expenditures as a predictor of manufacturing employment growth. (She does not include both fiscal variables in the same model because the two are highly correlated.) Porterfield finds the effect of higher levels of taxation/expenditure consistently negative, and, in most of the models estimated, statistically significant.

In summary, property tax rates had a significant negative effect on some growth indicator for four of six substate-level studies that tested for such effects, and nonsignificant effects in the other two. Tests for expenditure effects in substate-level studies were ambiguous, with two studies finding evidence of positive effects for some type of expenditure, two finding only nonsignificant effects, and one reporting significant negative effects for education expenditures.

Bartik (1991b) reviews research that tests the impact of local property taxes and other local policies on the distribution of business activity within a metropolitan area. He finds most

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[32]Producer service industries are service industries that provide services to other businesses. Among the industries included in the producer services sector in Porterfield's study are banking, security and commodity brokers, insurance carriers, insurance agents, real estate, advertising, mailing and reproduction services, personnel supply services, computer and data processing services, and legal services. For a complete list see Porterfield (1990), table 1.

recent studies indicate local business activity is strongly responsive to property tax levels. He reports that a typical elasticity of business activity with respect to tax rates is about -2.0.[33] Bartik also suggests that further research is needed to better estimate the impact of public services on business location.

Labor Market Conditions

Wages

If business location decisions drive economic growth, and a desire to hold down production costs drives business location decisions, then higher wages will tend to result in relative decreases in business activity. Authors of many of the studies reviewed expected this outcome. However, it is not the only one possible. To the extent that changes in business activity respond to individuals' migration decisions, and those decisions respond to higher wages, then higher wages could generate an increase in business activity.

Further, even if a search for the lowest production costs does drive changes in business activity, empirical studies may fail to find the expected negative relationship between wages and business activity change if they fail to adjust for labor quality. When there are no effective controls for labor quality differences, differences in the wage measure may primarily reflect differences in labor quality rather than in the cost of labor of a given quality.

A majority of the studies reviewed include some measure of wage levels as a predictor of business activity.[34] While some of these studies do find a significant negative relationship between wages and business activity, several others find a significant positive relationship, at least for some sectors of the economy or some measures of activity. Others find no clear or consistent relationship. Results for selected studies are discussed below.

Plaut and Pluta (1983) find consistently positive relationships between the average hourly manufacturing wage rate and several measures of growth in manufacturing activity between 1967 and 1977; these include statistically significant relationships

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[33]That is, other things being equal, a community where property tax levels are 10 percent higher will have 20 percent less business activity.

[34]Such measures are not included in the three studies reviewed that try to explain business location decisions within a single labor market, but are included in 13 of 17 analyses of industrial location or growth at the State level, and in 8 of 13 other studies.

between the wage level and growth in both employment and capital stock. Their specification does include a control for labor quality,[35] although wage differences may still reflect unmeasured quality differences. The authors suggest that the results may reflect labor migration toward high-wage areas.

On the other hand, Bartik (1985) finds that higher manufacturing wage rates had a negative and significant effect on the location of new manufacturing plants between 1972 and 1978--although only when a full set of regional dummies is included in the model. Wasylenko and McGuire (1985) find a negative relationship between the manufacturing wage and 1973-80 State employment growth in each of six broad industry groups,[36] and find that the relationship between the manufacturing wage and overall employment growth is negative and highly significant. And Kuehn and coauthors (1979) find a negative association between local wage rates and the probability of attracting new manufacturing plants to small communities in Missouri.

Several other studies yield ambiguous results. Romans and Subrahmanyam (1979) tested the effect of differences in nonagricultural earnings per employee ("wages") on several measures of growth in State business activity between 1964 and 1974. They find a positive relationship between initial wage levels and employment growth (significant in some specifications), a negative relationship between wage levels and per capita income growth (consistently significant at at least the 10 percent level), and no clear relationship between wage levels and State income growth. They control for regional effects by including growth in the dependent variable in surrounding States among their regressors. They offer no interpretation of their wage results.

In Mead's 1982 study of migration and economic change in nonmetropolitan areas, the direct effects of initial wage levels on subsequent employment growth and per capita wage growth are negative. However, higher initial wage levels also stimulate in-migration and reduce outmigration; Mead finds that these migration effects lead to higher employment and per capita wage levels. Mead does not report the net effect of initial wages on

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[35]This is a variable that they label "inherent productivity;" it is an index that reflects educational attainment (average years of school completed) and the State literacy rate.

[36]However, this relationship is statistically significant at the 5 percent level for only two of the six industry models.

employment or wage growth after these indirect effects have been taken into account.[37]

Porterfield (1990) includes estimates of average annual payroll per employee in manufacturing and in producer services among variables that might explain 1981-86 employment growth in those sectors. Manufacturing wages have a negative effect on manufacturing employment growth; this effect is statistically significant when a single model is estimated for metro and nonmetro counties. However, producer service wages have a strong positive association with producer service employment growth that is statistically significant in all models of the producer service sector reported in the study. Porterfield suggests that producer service firms may be willing to pay a premium for well-qualified workers.[38]

Still other studies suggest that the effect of wages on business activity might be relatively weak. Schmenner and coauthors (1987) examine 114 plant location decisions, modelling the decision as one with two stages: (1) the selection of a set of States to "consider seriously," and (2) the selection of an actual site.[39] For the average plant, the average hourly wage had little effect at either stage of the decision. The estimated effect on first-stage decisions is nonsignificantly positive, while the estimated effect on second-stage decisions is nonsignificantly negative.

McNamara and coauthors (1988) find that average county manufacturing wages had almost no influence on the opening of new manufacturing establishments in Virginia counties between 1979 and 1981.

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[37]Mead also includes, as a separate predictor, the wage level relative to that in the nearest metro area. According to Mead's estimates, higher relative wages have a negative effect on employment, and a significant negative effect on wage growth, but do not stimulate net in-migration. Hence, both the direct and the net effect of higher relative wages on business activity appear to be negative. Note that, since Mead's model also controls for the absolute wage level, the estimated effects of higher relative nonmetropolitan wages are equivalent to the estimated effects of lower wages in the nearest metropolitan area.

[38]Porterfield's payroll data are end-of-period (1986) values, so these results may also reflect upward pressure from sectoral employment growth on sectoral wages.

[39]The authors gathered information from the 114 firms as to which States they considered seriously in each case.

In a study of the influence of defense spending on State economic growth between 1976 and 1985, Mehay and Solnick (1990) find that the manufacturing wage had a small and nonsignificant effect on State personal income and manufacturing employment when their preferred estimation techniques are applied. Alternative estimation techniques yielded either nonsignificant or significantly positive effects.

Bartik (1991) summarizes the results of 42 studies that produced estimates of wage effects on business location (including some of those discussed above). Bartik reports that 26 of these studies yielded "at least one negative and statistically significant wage effect," and finds that the longrun elasticity of business activity with respect to wages implied by most of these studies falls between -0.2 and -1.0.

Bartik also points out that employee compensation is a far larger share of business cost than is business taxation--he estimates the ratio at about 14:1. He notes that one would expect the elasticity of business activity with respect to any cost factor to be proportional to the share of that factor in total costs. Thus, Bartik suggests, either the estimated tax elasticities yielded by the literature are too high, or the estimated wage elasticities are too low. He suggests the latter is more likely, arguing that: (1) errors in the measurement of wages, including failure to control for differences in industrial mix or labor force quality, may bias estimated wage coefficients toward zero, and (2) endogenous determination of wages ("local wages increase when business activity increases") will tend to obscure the negative effect of wages on business activity.[40]

Unionization, Work Stoppages, and "Right-to-Work" Laws

It is widely suggested that businesses that can choose their location will seek to avoid areas where unions are powerful, because: (1) unions command higher wages, and (2) businesses will seek to avoid both the limitations on management discretion imposed by union agreements and the pro-labor State laws and regulatory policies that may be associated with union political strength. Further, if union agreements and pro-labor public policies do in fact make businesses less competitive, then businesses in nationally or globally competitive markets will grow more slowly in areas of greater union power, even when such power does not lead individual businesses to move.

A number of studies have tested the potential influence of union power on business location decisions or business activity. These

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[40]Bartik does not discuss the possibility that net individual migration in response to higher wages may offset the adverse effects of higher wages on business decisions.

studies have assessed the possible impact of unionization levels, of work stoppage rates, and of "right-to-work" laws.[41]

Unionization levels. Those studies that have taken unionization levels into account have often, but not always, found a significant negative relationship between unionization and business activity.

Newman (1983) finds a strong negative association between changes in State unionization and changes in manufacturing employment. However, as noted earlier, the restrictive nature of Newman's model--in particular, here, the failure to include any wage measure as a predictor of growth--suggests the strong possibility of omitted variable bias.

Bartik (1985) finds a significant negative relationship between State unionization levels and the location of new manufacturing plants. As Bartik--like most of those cited below--does include a distinct wage variable in his model specification, this unionization effect is not a pure wage effect, but more likely reflects other effects of unionization.

Helms (1985) also finds that unionization rates have a significant negative impact on business activity. His model implies a 2.23-percent reduction in the longrun level of State personal income for each percentage point increase in unionization.

On the other hand, Schmenner and coauthors (1987) find that the percent of the workforce unionized statewide had a nonsignificant but positive association with the choice of plant location in their assessment of factors influencing 114 location decisions. Their analysis is the only one discussed here which also controls for both "right-to-work" status and work stoppage rate. Their results might suggest that unionization has no independent effect after the effects of these two factors are taken into account. However, the estimated effect of the work stoppage rate is not significant in this or other studies reviewed (see below).

Carlino and Mills (1987) find that 1970 State unionization levels were not a significant determinant of county employment density in 1980. However, McHugh and Wilkinson (1988), who reanalyze the Carlino and Mills data, using a model that allows for random State effects, do find a significant negative relationship between unionization and employment density. They estimate that the elasticity of total 1980 employment with respect to the 1970 unionization level was about -0.10.

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[41]These laws forbid "closed shops" in which union membership is a condition of employment. By ensuring that the hiring of non-union employees is permitted, these laws reduce union power.

In his 1989 study of the determinants of firm and branch plant openings, Deich finds that unionization had a significant negative effect on the establishment of branch plants.[42] However, according to his results, State unionization levels did not deter the opening of single-establishment manufacturing firms, except in the apparel industry.

Bartik (1989) finds that unionization levels had a small and statistically insignificant effect on small business startups between 1976 and 1982. This result, together with those from the Deich study, suggest that unionization levels may be more relevant to large firms, which are the more likely targets of union organizing. Bartik (1991) makes a similar suggestion (p. 54). On the other hand, Bartik also notes a 1987 study by Heywood and Deich that found industry-specific unionization levels to have less effect on growth than overall area unionization. Bartik views this result as suggesting unionization may be operating as a proxy for "social climate," independent of a particular firm's probability of being unionized.

Work stoppages. Studies of business location or economic growth that test the influence of some measure of strike activity include Bartik (1985), Helms (1985), Wasylenko and McGuire (1985), Schmenner and coauthors (1987), and Fox and Murray (1990). None of these studies finds a statistically significant relationship between strike activity and subsequent business activity.

"Right-to-work" laws. Only three of the studies reviewed here include a "right-to-work" law dummy variable among possible growth predictors.[43] Newman's 1983 study finds that "right-to-work" laws have a highly significant positive effect on State employment growth; however, the sparsity of this study's list of regressors has already been noted. Schmenner and coauthors (1987) report that these laws have a positive effect on the first round of the plant location decision (that is, selection of a group of States for possible sites) that is statistically significant at the 10 percent level. However, Wheat (1986) finds no significant relationship between "right-to-work" laws and manufacturing employment growth. Wheat's model includes controls for access to growing and underserved markets that are not

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[42]The estimated effect of unionization is significant at the 5 percent level (or better) for food products, apparel, and all manufacturing, and significant at the 10 percent level for printing.

[43]Note that, because few States have changed their "right-to-work" status in the past few decades, there is little time-series variation in this variable. Hence, it cannot be used in studies employing a panel data approach.

present in the other two studies. The author suggests that "right-to-work" law dummies in earlier studies functioned as proxies for these variables. However, the unusual econometric approach of Wheat's study, in which a wide variety of transformations of the underlying variables are tested in order to find those that best fit the data, may cast some doubt on the results.

Bartik (1991) reports that 15 of 27 studies with unionization-related variables found "at least one unionization related coefficient that is statistically significant and of expected sign." On average, those studies that were comparable suggested that a 1-percentage point increase in unionization will yield a longrun decrease in business activity of close to 1 percent. However, Bartik notes that this conclusion is driven by strong results from just a few studies, while the others suggest a considerably smaller effect. Bartik does not report separately on the results of his literature review with regard to work stoppages or "right-to-work" laws.

Combined indicators of labor power. Two studies include as regressors measures that reflect unionization levels together with other measures of labor power. Plaut and Pluta (1983) include a principal components index that reflects unionization levels, time lost to work stoppages, and the presence of "right-to-work" laws in their growth in manufacturing. Jaffee (1988), in a study of 1972-82 change in manufacturing activity, also employs a principal components index, one that reflects levels of unionization and time lost to work stoppages, as well as the average hourly wage for manufacturing workers. In both cases, the authors find significant negative relationships between measures of union or labor power and growth in manufacturing activity.

Unemployment

Some studies of industrial location have included the unemployment rate among potential determinants of economic growth or business location. However, the expected effect of unemployment on business location and economic growth is uncertain. Some authors suggest that a high rate of unemployment may be attractive to businesses making location decisions. High unemployment may permit businesses to recruit new employees without bidding up local wage rates; workers in areas of high unemployment may also be more docile and less likely to unionize. In addition, areas which are initially near a cyclical high in unemployment are likely to experience more rapid subsequent growth as economic activity returns to normal local levels (see below).

On the other hand, persistent high unemployment may be a proxy for unmeasured local conditions that are unfavorable to economic activity. Further, some economists believe that extended

unemployment reduces worker quality due to loss of skills and work habits; thus, areas of persistent unemployment may have a lower quality workforce.

Mead (1982) finds that the unemployment rate has a small positive direct effect on employment growth (significant at the 10 percent level), but a strong negative direct effect on per capita wage growth. Carlton (1983), in a study that seeks to explain both the establishment of new plants and the size of those new plants in three manufacturing industries, finds that the effects of unemployment vary by industry. Carlton finds that the unemployment rate was positively and significantly associated with plant openings and size in the Fabricated Plastics industry (SIC 3079), negatively associated with plant openings and size in the Communication Transmitting Equipment industry (SIC 3662), and negatively and significantly associated with plant openings and size in the Electronic Components industry (SIC 3679).

Plaut and Pluta (1983) also include the unemployment rate as a regressor, and find it positively and significantly related to growth in manufacturing employment and growth in value added during the manufacturing process. On the other hand, Fox and Murray (1990) report that county unemployment rates were not significant when included in their model of firm entry rates in 95 Tennessee counties between 1980 and 1986. Porterfield (1990), however, finds a significant positive relationship between 1981 unemployment rates and subsequent growth in employment in both manufacturing and producer services.[44]

While these results may suggest a positive statistical relationship between initial unemployment rates and subsequent employment growth, there is reason to question the implication that areas with higher unemployment rates are more attractive to business. The area unemployment rate at the beginning of any observation period will reflect both long-term economic conditions and temporary reverses affecting industries in that area at that time. To the extent that areas with higher unemployment rates are those that have suffered temporary reverses, it is predictable that they will experience faster-than-average employment growth over the subsequent period. Similarly, areas with especially low initial unemployment rates will probably include some where short-term conditions (for example, a construction boom) have temporarily boosted labor demand and business activity; these areas are likely to grow

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[44]Porterfield finds a significant relationship for producer services for these entities: all counties, metropolitan counties, adjacent nonmetropolitan counties, and remote nonmetropolitan counties. She finds a similar relationship for manufacturing for all counties and for adjacent nonmetropolitan counties.

slowly or decline as these conditions return to normal.[45] It is suggestive that Carlton finds no consistently positive relationship between unemployment and new plant openings in several export-oriented industries; such openings are less likely to be affected by reversion to the expected level of overall local economic activity than employment growth would be.

Education

Educational Attainment

There is widespread agreement that the level of skill and education demanded in the labor marketplace is increasing, although there is uncertainty about the magnitude and rate of this increase and about whether the process is accelerating (Teixeira and Swaim, 1991). With rising demand for skills, it is plausible that areas with a greater supply of more educated labor might experience more economic growth. At the same time, the demand for educated labor varies across industries, and for some establishments, an area where educational attainment is lower might be attractive.[46]

Many studies have attempted to assess the impact of educational attainment levels on business location decisions or business activity. Among those assessed here, most include only a single measure of educational attainment--either median years of schooling completed, or the percent of adults who have completed high school. A few recent studies include variables intended to assess the impact of college-educated populations (Bartik, 1989; Porterfield, 1990; Killian and Parker, 1991). However, only one of those reviewed here (Bartik, 1989) directly compares the effect of high school attainment on growth or business location with the effect of college attainment.[47]

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[45]To put this in statistical terms, if the level of business activity at any point in time is determined, in part, by a transitory random component or error, then the unemployment rate at that time is likely to be negatively correlated with that error, and areas with positive errors (and lower unemployment rates) at the initial observation will tend to experience below-average growth over the subsequent period.

[46]For example, firms in an industry with limited demand for well-educated labor might prefer an area where educational attainment levels are lower because they perceive residents in such areas as being less likely to offer community resistance to industrial activity that generates pollution or other disamenities.

[47]In addition, Plaut and Pluta (1983) assess the effect of an index of "inherent productivity" reflecting average years of schooling and the adult literacy rate. See p. 66 below.

Bartik (1985) finds that median educational attainment has no significant effect on 1972-78 manufacturing branch plant location decisions once regional control variables are included in the model. (Without such controls, the estimated effect is significant and negative, suggesting that manufacturers did prefer to locate in regions of the country that had a less educated workforce.) However, Wasylenko and McGuire (1985) found that median school attainment had a significant and positive association with employment growth between 1973 and 1980 in manufacturing as well as transportation and wholesale trade, although not in overall employment growth. Their estimates do not reflect any regional control variables.

In Schmenner and coauthors (1987), the percentage of the State workforce that completed high school has a nonsignificant--but negative--effect on the probability of attracting serious consideration for a manufacturing branch plant, and a near-zero effect on the second-stage decision on a plant location. McNamara and coauthors (1988) also find that the percentage of the workforce that has completed high school has a negative impact on the probability of attracting a new manufacturing plant. In this case, the relationship is statistically significant.

On the other hand, Bartik (1989) finds that the high school attainment level has a significant positive relationship with the State's small-business startup rate. Bartik also tests for the effect of college attainment on small-business starts, but finds no significant relationship.[48]

Deich (1989) finds a positive relationship between the high school attainment rate and 1972-77 single-plant firm births in manufacturing as a whole, and also in three two-digit SIC manufacturing industries. The effects are comparable in magnitude across all four cases, and statistically significant for food products and for all manufacturing. High school attainment rates also exercised a significant positive effect on branch plant openings for manufacturing as a whole, but the estimated effects are nonsignificant and inconsistent in sign for the three two-digit sectors Deich considers.

Porterfield (1990) finds that the concentration of college-educated adults had a strong positive effect on growth in producer services employment (but no significant effect on manufacturing employment). Porterfield measures sectoral growth by computing the growth in sectoral employment as a percentage of

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[48]These results are drawn from Bartik's pooled cross-section estimates. Because Bartik has data on educational attainment for only one point in time relevant to his study period, he cannot include educational attainment as a regressor in his preferred fixed-effect model estimates.

the initial level of total employment; thus, if the growth rate of the producer service sector was the same in two counties, Porterfield's measure would show more growth in the county that initially had a larger producer service sector (as a share of total employment). Hence, Porterfield's results may in large measure reflect an initial correlation of college-educated populations and producer services employment, and need not imply a faster growth rate for producer services employment in areas where more adults have completed college.

Porterfield finds no significant relationship between a measure of the "dropout" population and the growth of manufacturing employment. However, the author's definition of "dropouts" includes only those adults with less than a 9th-grade education. Thus, this study contains no explicit test of the effects of high school attainment (or nonattainment) levels on regional economic growth.

Killian and Parker (1991) seek to explain 1979-88 employment growth in metropolitan areas and in nonmetro areas.[49] They find that average years of schooling have a nonsignificant negative effect on employment growth in nonmetro areas, but have a positive and statistically significant effect in metro areas. They then test separately for the effects of the college attainment rate and a "dropout" rate. They find that neither has a significant effect on nonmetro employment growth, but in metro areas they find that both the college attainment rate and the dropout rate have a significant association with faster employment growth.[50] The authors propose that while some employers are seeking educated, skilled workers, their results suggest that others are still seeking "local economies where the labor pool is relatively uneducated and nonunionized;" they also suggest that growing economies in general may require substantial numbers of relatively unskilled workers to provide support services for other workers and local businesses.

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[49]The definition of metro and nonmetro areas used by Killian and Parker (1991) differs from the conventional definition. Their unit of analysis is the commuting zone, a group of counties linked by significant commuting ties (Killian and Tolbert, 1992). They classify any commuting zone that includes an MSA or CMSA as "metropolitan;" the remaining commuting zones are "nonmetropolitan." Most commuting zones that include an MSA or CMSA also include some counties that are not part of the MSA or CMSA. As a result, many counties that are not classified by the Census as belonging to an MSA or CMSA are treated by Killian and Parker as parts of "metropolitan" areas. Only those counties without significant commuting ties to any MSA or CMSA are included in their "nonmetro" sample.

[50]The college attainment rate is significant only at the 10 percent level.

However, while the college attainment rate is defined for adults 25 and older, the measure of the dropout rate used by Killian and Parker is the percentage of those 16-21 who are neither high school graduates nor still in school. Hence, this study does not allow us to compare the growth effects of high school completion rates and college completion rates for the adult population.

In sum, the studies reviewed provide limited, and sometimes contradictory, evidence for the effects of educational attainment on economic growth. Several recent studies include separate variables to capture college attainment and lesser levels of educational attainment, and the results of these studies suggest that the effect of increases in educational level may not be linear. However, there is little direct evidence to permit comparison of the relative growth effects of high school completion and college completion rates.

Access to Higher Education

Several authors have suggested that proximity to institutions of higher education might have some effect on growth. For instance, Smith, Deaton, and Kelch (1978, p. 25) speculate that access to such institutions may be "important as a means of reducing personnel cost through manpower development and in-service training, and...[may] make the community a more acceptable residential area for company personnel." These authors test several possible measures of access to such institutions, but find no consistent evidence for the proposed relationship.

Smith, Deaton, and Kelch (1978) find that presence of a college in a rural Kentucky or Tennessee community did have a significant (at the 10 percent level) positive effect on the probability of attracting a new manufacturing plant between 1970 and 1973. On the other hand, Dorf and Emerson's 1978 study of small nonmetro communities in the West North Central States found a statistically significant negative relationship between junior college enrollments and manufacturing employment growth. More recently, McNamara and coauthors (1988) found a nonsignificant negative relationship between distance to the nearest 4-year college and the probability of attracting new manufacturing plants. (Note that a greater distance represents less access, so this represents a positive, albeit not significant, association between access to higher education and business attraction.) Finally, Porterfield (1990) has mixed results when testing for a relationship between the number of 4-year colleges in a county and producer service employment growth. She finds no significant relationship when considering either all counties together, or nonmetro counties adjacent to a metro area alone--but finds a significant and negative relationship for producer service employment growth in remote nonmetro counties (those not adjacent to a metro area) and (at the 10 percent level) in metropolitan counties.

Access to Input and Output Markets

Many analysts consider ready access to final markets and to needed production inputs to be a key determinant of the level of economic activity, and likely to influence changes in that level. Transportation systems provide access to both input and output markets, while nearby urban or metropolitan areas are potential sources for both product demand and production inputs. Regional incomes also play an important role in determining the size of the local market for locally produced final goods and services. A variety of other measures of access to markets have also been considered. However, while growth or decline in market access (for example, the opening of a new road, or growth in demand in an adjacent area) might be a critical determinant of changes in local economic activity, only a handful of the studies reviewed include measures of such changes. More commonly, the level of access is used to explain either the level of economic activity or changes in that level.

Transportation

A number of the studies reviewed, mostly those at the substate level, consider measures of access to transportation among the possible influences on business activity. Nearly all of these have included some measure of access to interstate or other major highways; several have included measures of access to air service and/or to railroad lines. One study included a river-access dummy variable, and another included a count of the number of motor freight terminals in the county.

Highways. In a study of Kentucky and Tennessee counties, Smith, Deaton, and Kelch (1978) find a significant relationship between access to an interstate or other major highway within a county and the likelihood of attracting new manufacturing plants. Carlino and Mills (1987) find that interstate highway density (highway mileage per square mile) was a highly significant predictor of both greater population growth and greater employment growth at the county level; this result is confirmed by McHugh and Wilkinson's (1988) reanalysis.

Fox and Murray (1990) estimate a model of firm startups by county in Tennessee in which North-South interstate highways and East-West interstate highways are entered separately. The presence of either type of highway had a positive effect on firm startup rates; the effect of each highway type is similar in magnitude for four of five firm size categories. An interaction term to capture the effects of an intersection between North-South and East-West highways is not significant, nor is a measure of State highway mileage.

On the other hand, Porterfield's study of sectoral growth (1990) finds access to interstate highways nonsignificant for 6 of 10 models estimated. Her estimates yield some evidence for a

significant positive effect on growth in producer services employment, but two models suggest a significant negative effect on growth in manufacturing employment.

Air service. Several studies have included measures of access to airline service or airports as potential influences on regional business activity, but with largely negative results. Dorf and Emerson (1978) find no significant relationship between a community's distance from scheduled airline service and several measures of manufacturing business attraction (employment, change in employment, number of plants, or change in number of plants). Similarly, Fox and Murray (1990) find no strong relationship between firm entry rates by county and the county's distance from a major airport. However, Porterfield (1990) finds mixed results: a measure of commercial takeoffs and landings in county airports positively influenced employment growth in metropolitan counties, and producer service employment growth in remote nonmetropolitan counties, but did not influence employment growth in nonmetro counties adjacent to a metro area.[51]

Other transportation. Several studies test for a possible relationship between rail service and business activity, but these studies yield little evidence of the expected positive relationship. Dorf and Emerson (1978) find that the number of rail lines serving a community has a negative association with manufacturing activity. Furthermore, this relationship is significant in some of their specifications. Fox's 1981 study of industrial site demand in suburban Cleveland communities finds no significant relationship between the presence of a railroad and site demand, although the small sample size may limit this result's importance. Fox and Murray (1990) find no effect from the presence of a main line railroad on firm location rates overall. However, such presence did enhance the likelihood of firm startups in some size categories. They also report that the presence of short-line railroads had no significant effect on firm entry rates.

Charney (1983), in a study of firm relocations in the Detroit area, finds a positive relationship between river access and relocation decisions, but this relationship is significant only for small firms. Fox and Murray (1990) find no relationship between access to motor freight terminals and firm entry rates.

Proximity to Urban Areas

Proximity to urban or metropolitan areas may permit easier access to input suppliers and to customers. Several of the studies reviewed test for such an effect. Smith, Deaton, and Kelch (1978) find no significant relationship between community

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[51]Total commercial takeoffs and landings may also play the role of a proxy for the size of the local economy in this model.

distance from a metro area and plant location decisions in Kentucky and Tennessee during the early 1970's. However, Dorf and Emerson (1978) do find manufacturing activity and growth significantly lessened the greater the distance from a metro area. Mead (1982) finds that closer association with one or more metropolitan areas enhances both in-migration and outmigration, while stimulating employment and per capita wage growth; however, most of these estimated relationships are not statistically significant. In a more recent study, McNamara and coauthors (1988) find no significant relationship between distance from a metro area and manufacturing plant openings in Virginia during 1979-81. Overall, the results of the reviewed studies are consistent with the expectation that proximity to a metro area encourages business activity, but are not strongly supportive of that expectation.

Per Capita or Family Income

Some authors suggest that areas where per capita or family incomes are higher might be more attractive to business because of greater market demand for a given population. Higher per capita income levels may be associated with greater growth of businesses that market their products locally if areas with high per capita incomes also tend to have local consumer demand for these goods and services in excess of the local supply of goods and services, so that there exists unmet demand for local business expansion.[52] This is most likely if these high-income areas are also areas where incomes have been rising more rapidly--for example, in a period of growing regional income disparities such as the 1980's (Rowley and coauthors, 1991). However, in a period of diminishing inequality, we might expect to find greater growth in business activity in lower-income areas. Further, because local incomes in large measure reflect local business activity, there is a danger of obtaining estimates of the effect of incomes on growth that reflect simultaneous equations bias. That is, unless the analysis is carefully designed, we may measure the effect of economic growth on local incomes when we think we are measuring the effect of local incomes on economic growth.

Kieschnick (1981) tests for the effect of State per capita incomes on capital investment in 13 two-digit SIC manufacturing industries in 1977. While Kieschnick anticipates finding a positive relationship, he finds a significant positive relationship for only one of the industries studied. Wasylenko and McGuire (1985), however, do find that 1977 State per capita

[52]Initial per capita income should also be positively associated with the subsequent growth of local-market sectors in a model that includes separate controls for both population size and the initial local supply of goods and services from those sectors.

income levels were significantly associated with greater 1973-80 employment growth overall and in several major industry groups. Those groups included retail trade; finance, insurance, and real estate; and services. Further, Carlino and Mills (1987) find that higher 1970 family income levels were strongly associated with higher 1980 population, employment, and manufacturing employment densities (conditional on the 1970 densities); and the reanalysis by McHugh and Wilkinson (1988) yields similar results.

The 1989 study of small-business startup rates by Bartik illustrates the importance of the choice of estimation method. A model estimated by pooling data for several years for each jurisdiction indicates a substantial and significant negative relationship between State per capita income and small-business startup rates. But when an approach that controls for fixed jurisdictional effects is applied to the same data, the estimated effect of per capita income is significant and positive, suggesting that in any given State, a rise in per capita income was likely to be followed by an increase in small business startups.

Fox and Murray (1990) find mixed results in their study of firm entry rates in Tennessee counties. They find that county per capita incomes have a positive effect on entry rates for the smallest firms and for firms overall. But higher per capita incomes have a significant negative effect on entry rates for firms with 20 to 49 employees, and little effect in other specific size categories. Fox and Murray describe the per capita income variable as an indicator of "consumer tastes." Sander and Schaeffer (1991), in their study of 1980-84 income growth in urban counties, find that higher 1980 household incomes have a positive relationship with such growth.

Other Market Demand Measures

Individual studies include a variety of other variables in an effort to capture various aspects of market demand or change in market demand. As noted earlier, Romans and Subrahmanyam (1979) try to explain 1964-74 State growth in personal income, per capita income, and nonagricultural employment. Included among their predictors is the contemporaneous rate of growth in other nearby States for the appropriate variable. Not surprisingly, they find regional growth has a consistently positive and usually significant effect on State growth. However, this could reflect either a causal relationship, in which market demand in nearby States spurs the local economy, or the impact of unmeasured factors affecting growth throughout the region.

Kieschnick (1981) includes 1970-77 State population change and/or 1970-77 State personal income change among the potential predictors of 1977 capital investment levels in 13 manufacturing industries. In most industries, neither variable contributes

significantly to explaining variation in capital investment, and the signs of the estimated effects are not consistent.

Mead (1982) finds that wage growth in the nearest large metropolitan area has a positive effect on nonmetro wage growth, and also that nonmetro employment is positively affected by employment growth in the nearest large metro area. However, only the first effect is significant at the 5 percent level.

Plaut and Pluta (1983) develop a variable that is intended to capture, for each State, the ratio of potential demand for manufactured goods in that State and other nearby States (as measured by State personal income) to the supply of manufactured goods produced in the same region. In constructing this variable, the weights given to other States decrease as distance increases. The authors expect that States located in areas where incomes were high relative to manufactured goods production would experience more growth in manufacturing production capacity, employment, and output. They do find that their measure of excess demand is positively associated with growth in manufacturing value added, employment, and capital stock. However, the estimated coefficient is not significantly different from zero in the case of value added, and is significant only at the 10 percent level for employment and capital stock.

Wheat (1986), attempting to explain 1963-77 growth in manufacturing employment, constructs a "markets" variable that reflects both the State ratio of personal income to manufacturing employment and the State's distance from a region that he terms the "Manufacturing Belt."[53] Wheat argues that the incentives to expand manufacturing capacity were greatest in States where (a) local demand for manufactured goods exceeded local supply, while (b) the cost of importing goods from older centers of manufacturing was relatively high because of distance. The study does find greater manufacturing growth in those areas that fit this description.

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[53]Wheat defines the Manufacturing Belt to include the New England, Middle Atlantic, and East North Central States, as well as Delaware, Maryland, and West Virginia. However, rather than computing the actual distance of States from either the perimeter or the center of this area, Wheat follows a more obscure procedure. He assigns all States to one of ten "zones": he indicates that the assignments are based roughly on distance from the center of the "Belt," but also reflect whether the State is in the "Belt," and the author's desire to "minimize the correlation between zone and climate." All States in a zone are then treated as if they were the same distance from the "Belt." Thus, the "distance" assigned to some States by this method may differ substantially from their actual distance from the areas of greatest manufacturing activity in 1963.

Canto and Webb (1987) estimate a separate time-series equation for each State that attempts to explain 1957-77 growth in State personal income. They include contemporaneous growth in U.S. personal income--which may be viewed in part as a market demand variable--among the explanatory variables in each State model. In all but a handful of States, the value of this coefficient is not significantly different from 1.

Finally, Deich (1989), in seeking to explain firm births and new plant locations by State, includes a "market access" variable that reflects State distance from population and income centers throughout the Nation. Unlike the measures proposed by Wheat or Plaut and Pluta, this measure does not reflect the local ratio of supply to demand. The effects of this variable are consistently positive, and are statistically significant in three of the eight models estimated by Deich.

Demographic Characteristics

Population Density

Perhaps in part because of its ready availability, numerous studies include population density as a potential predictor of business activity. However, authors diverge in their interpretation of the coefficient on this variable and in their expectations about the direction of its effect (depending in part on other characteristics of their models). Some, such as Kieschnick (1981), suggest that population density may serve as a proxy for land costs, and therefore expect that higher population densities will discourage business investment or location decisions. Others, including Wasylenko (1980), Fox (1981), Wasylenko and McGuire (1985), and Mehay and Solnick (1990), suggest that higher population densities imply greater market demand for output, and therefore will be positively associated with business activity--particularly for trade and service industries that must be located near final customers. Bartik (1985) views population density as a measure of labor force availability, while Charney (1983) suggests that, in an urban area, it serves as a proxy for site assembly costs. Helms (1985) suggests that it may serve as a measure of agglomeration economies in the context of a study of overall economic growth, while Wasylenko and McGuire (1985) suggest that higher population densities may discourage employment growth by putting a strain on local infrastructure.[54]

Several authors have suggested that population density may serve as a proxy or control for more than one factor.

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[54]Agglomeration economies are present if the productivity of some firms is enhanced by their physical proximity to other firms in the same or related industries.

Of the dozen studies covered in this review that included population density as a potential explanatory variable, half found no significant effect of population density on business activity.

Among those that did find a significant effect, three find a positive association between population density and business activity. One of these is Bartik (1989), which finds a significant positive relationship between population density and small business startups for both pooled cross-section and fixed effect models. A positive relationship is also reported by Wasylenko (1980), who finds that population density is significant at the 10 percent level in models of firm relocation in the Milwaukee area for two of six sectors. Kuehn and coauthors (1979) find that county population density is significantly related to community success in attracting manufacturing plants in nonmetropolitan Missouri.

However, three other studies find a significant negative association between density and business activity. One of these is Charney's 1983 study of manufacturing firm relocations in the Detroit area; Charney finds that population density is significant at the 10 percent level for large firms, for durable goods producers, and for all manufacturing considered together. Helms (1985) finds that population density exerts a significant negative effect on State personal income growth in a time-series model that includes fixed State and time effects. Finally, Kieschnick (1981) finds that population density has a significant negative effect on new investment for 2 of the 13 manufacturing industries considered.

Thus, neither theory nor past empirical work provides a basis for expecting a particular relationship between population density and changes in economic activity. Population density may serve as a proxy for other factors that have both positive and negative effects on business growth. The estimated effect of population density, if any, will depend in large measure on what other factors are included in the analysis, as well as the dependent variable of interest, the study's geographic coverage, the geographic units of analysis used, and the period over which growth is observed.

Population

In addition to, or in place of, controls for population density, some studies include the actual population of the study's unit of analysis as a possible predictor of growth. Where the unit of analysis is a natural economic unit (such as a town), this may be justified as a measure of potential agglomeration economies (for example, Kuehn and coauthors, 1979). In other cases, if the dependent variable is likely to be sensitive to the size of the

unit of analysis,[55] a significant population size variable may help to account for any size differences among the observations that are not captured by other variables in the model (for example, Jaffee, 1988). While some of these studies offer a specific justification for including population size as an explanatory variable, others merely include it, without particular explanation, as one of a class of demographic variables used as controls (for example, Sander and Schaeffer, 1991).

Among those studies including population size as an explanatory variable, two--Jaffee (1988) and McNamara and coauthors (1988)--yielded a positive and significant coefficient. Several others found no significant relationship between population size and industrial location or employment growth; one study by Kuehn and coauthors (1979) found a significant negative relationship between town population and the probability of attracting a new manufacturing plant.[56]

Urbanization Measures

Mead (1982) includes the percentage of the area population living in urban areas as a potential influence on labor demand (employment) in nonmetropolitan areas.[57] The author suggests several differences between urban and rural areas that might influence labor demand. Some--for example, lower levels of unionization in rural areas--would lead to a negative

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[55]For instance, by combining several counties with a low probability of attracting a new manufacturing plant, we could create a new area with more people and a higher probability of attracting a plant. Thus "probability of attracting a manufacturing plant" is sensitive to differences across observations in the size of the unit of analysis. On the other hand, if each county experienced the same percentage growth in employment, the combined area would have the same percentage employment growth as any single county; percentage employment growth is not linked to the size of the analysis unit in the same way.

[56]The latter study also included a measure of county population density among the explanatory variables. This variable may have captured any positive effects that a concentration of population might have on the choice of site for a manufacturing plant.

[57]While "urban" and "metropolitan" are sometimes treated as synonyms, urban areas as defined by the U.S. Census Bureau include incorporated places and other built-up areas with populations of 2,500 or more. Thus many nonmetropolitan areas include "urban" populations; also, metropolitan areas can include nonurban ("rural") populations.

relationship between urbanization and growth; others--for example, a well-developed transportation system--would make urban areas more attractive to firms.[58] Mead's empirical results indicate that urbanization had a significant negative impact on 1970-80 employment growth.

Wheat (1986) suggests that rural-urban (or urban-rural) migration may cause manufacturing industries with local markets to shift to more urban (more rural) States. Wheat's preferred model specification includes a variable reflecting both State rural population and State farm population. He finds that 1963-77 manufacturing employment growth was more rapid, all else equal, in more rural States.

Fox and Murray (1990) also include an urbanization variable in their model, justifying it by reference to "consumer tastes" and as "a measure of market conditions related to population dispersion." They find that the percentage of county population in urbanized areas is negatively (and significantly) related to total firm entry rates and to small firm entry rates; but entry rates for firms with 20-49 employees are significantly higher in more urbanized counties.

Percent Black or Minority

Some authors have suggested that the percentage of area residents who belong to racial minorities might have an influence on changes in business activity. Porterfield (1990) suggests that concentrations of minority residents might be associated with slower employment growth because, on average, such populations have less schooling and less occupational training.[59] On the other hand, Killian and Parker (1991) suggest that areas with concentrations of black or Hispanic workers may be attractive

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[58]It seems unlikely that these factors would differ that much between urban and rural localities within a single State Economic Area (SEA). However, nonmetro SEAs that have more heavily urban populations may differ along these and other dimensions from other nonmetro SEAs that are predominantly rural.

[59]Porterfield includes some controls for the quantity of schooling in her models. If these controls are sufficient (see pp. 45-46 above) then the coefficients on the minority population share should not reflect any differences in educational attainment among racial groups. However, if minorities also receive a lower quality education (a possibility not explicitly addressed by Porterfield) then the estimated coefficient on the minority population variable might reflect that quality difference, insofar as it affects workforce quality.

because of low wages.[60] Other authors include the percentage of the population that is black as an explanatory variable in their models without offering a specific justification for doing so (Carlino and Mills, 1987).

Mead (1982) includes the share of the population that is black as an explanatory variable only in the study's outmigration equation; Mead hypothesizes and confirms that nonmetro areas with larger black populations experienced significantly more outmigration in the 1970's, even after other characteristics of these areas were taken into account. Carlino and Mills (1987) find that the percentage of the population that is black had little effect on 1970-80 growth in county population or total employment, but did have a significantly positive effect on growth in county manufacturing employment. However, McNamara and coauthors (1988) do not find any significant relationship between black population share and county success in attracting new manufacturing plants in Virginia.

Porterfield (1990) finds that the percentage of the population belonging to ethnic minorities had no significant effect on growth in producer services employment, but did have a significant negative effect on employment growth in manufacturing--particularly in more urban areas. In contrast, Killian and Parker (1991) find that concentrations of blacks or Hispanics reduced total employment growth significantly in nonmetro commuting zones, but not in metropolitan areas. Overall, these studies suggest that minority population concentrations may affect subsequent economic growth, but offer no clear indication of the direction or character of the expected effects.

Other Regional Characteristics

Climate

Some studies have identified differences in climate as possible contributors to differential rates of change in regional economic activity. Generally, the authors of these studies suggest that drier, warmer, and/or milder climates will attract new or relocating businesses or encourage business expansion by reducing business costs (due to production interruptions, transportation costs, and heating and possibly air conditioning needs). Climate might also induce economic growth by attracting individual migrants in search of more agreeable weather.

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[60]As Killian and Parker include a wage measure (earnings per job) as a separate explanatory variable, the implication must be that areas with concentrations of minority workers offer a cheaper quality-adjusted wage. That is, their suggestion implies that given any level of earnings per job, the quality of the workforce is higher in areas with more minority residents.

One potential problem with estimating the effects of climate variables is that regional climatic variations may correlate highly with variation in other regional characteristics. This raises the problem of collinearity to the extent that those other characteristics are measured, and introduces the likelihood of omitted variable bias for those variables (such as political culture) which are not or cannot be measured.

Kieschnick (1981) tests the influence of average temperature on 1977 investment in various manufacturing industries. He generally finds higher temperatures associated with higher rates of investment, but the relationship is statistically significant for only one industry. Plaut and Pluta (1983) combine data on four climatic variables into two principal component indexes. They describe one of these as associated with semiarid variable-temperature Western climates, and the other as reflecting hot, humid Southeastern climates. They find the Western climate index associated with significantly faster growth in manufacturing employment and output, while the Southeastern index had a nonsignificant (but negative) effect on growth in manufacturing activity.

Wasylenko and McGuire (1985) include the average July maximum temperature and the average January minimum temperature among the factors explaining differences in State employment growth. They find some evidence that higher maximum temperatures correlated with faster employment growth, particularly in manufacturing and transportation, but find little evidence of an effect from higher minimum temperatures. Wheat (1986) finds that 1963-77 manufacturing employment growth was faster in States where there was <u>greater</u> demand for air conditioning, and slower in States with low January temperatures (provided these States were outside of Wheat's "Manufacturing Belt").

Finally, Schmenner and coauthors (1987) find mean January temperature a powerful and significant predictor of whether a State will be considered as a possible location for a new manufacturing branch plant.

In sum, each of these studies suggests that climate influences growth in business activity; four of the five (all but Plaut and Pluta) suggest that warmer temperatures are generally more attractive to business. The relative importance of warmer winters and warmer weather at other times of year is unclear, but there is little evidence here that hotter summer weather discourages business expansion. There is less evidence in the studies reviewed regarding the effect of humidity or precipitation on business growth, although the Plaut and Pluta study suggests that drier climates may be preferred. Finally, the parameters estimated in these studies may in part reflect the influence of nonclimatic regional differences that might be better captured by regional control variables, which are

discussed below. None of these studies include such regional controls.

Energy Prices

Because energy prices affect business costs, some businesses will be attracted to areas where energy is relatively cheap, particularly when the regional variance in energy prices is large and/or growing. Accordingly, numerous investigators have included measures of energy prices in their regional growth or business location models.

Among those studies that attempt to explain variations in business activity among a set of communities within a single region, only two included any measure of energy prices among possible explanatory variables. Dorf and Emerson (1978) test the influence of variations in electric rates on manufacturing plant size, numbers, and growth in small West North Central communities. Fox and Murray (1990) test the impact of variation in natural gas prices on firm entry rates in Tennessee counties. Neither finds a significant effect from energy prices.[61]

Among studies that are national in scope, and thereby offer more variation in energy prices, results are more varied. Bartik's 1985 study of branch plant openings and his 1989 study of small-business startups also fail to demonstrate any effect of energy prices.[62] Wheat (1986) and Papke (1987) likewise fail to demonstrate significant energy cost effects on employment or capital investment in manufacturing.

However, Kieschnick (1981) does find a significant relationship between energy cost per 1,000 Btu and 1977 capital investment in the textile, chemical, and rubber industries. Curiously, in textiles and rubber the relationship is positive. Possibly, in the wake of the 1973-74 rise in energy prices, plants operating in areas of higher energy cost were under pressure in 1977 to replace existing equipment with more energy-efficient equipment, and therefore invested more in new equipment.

Carlton (1983), finds no significant negative relationship between natural gas prices and new plant sizes or entry rates in any of three industries covered by his study. However, a significant negative relationship between electricity costs and

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[61]It is not clear from these studies whether the range of variation in energy prices within the regions covered in each study was sufficient to permit detection of an energy price effect of moderate magnitude if such an effect existed.

[62]Bartik measures energy prices by the average cost of 1,000 Btu-equivalents to manufacturers.

new plant sizes and entry rates appeared for all three industries.

Plaut and Pluta (1983) include among their explanatory variables an index that reflects both energy costs and the State ratio of energy consumption to energy production. They view the latter as an indicator of vulnerability to problems with energy availability. For the 1967-72 period, energy cost and availability did not significantly relate to growth in manufacturing employment or output. In this period, States with less favorable access to energy had significantly greater rates of manufacturing capital stock growth. However, in the 1972-77 period, when energy costs and availability had much greater salience, higher costs and/or lesser availability of energy presaged significantly slower growth in manufacturing output and capital stock.

Wasylenko and McGuire (1985) treat the costs of the average electric bill for firms in a certain use class as a proxy for energy costs. They find that higher electric rates had a significant negative effect on employment growth rates in the economy as a whole and in most major sectors--but not in manufacturing or in wholesale trade.

Deich (1989) finds no significant relationship between Btu-equivalent costs by State and branch plant startup rates, but does find significantly lower startup rates for single-establishment manufacturing firms where energy costs were higher (albeit not for every industry). On the other hand, Bartik (1989) fails to find any significant relationship between energy costs and startup rates for small manufacturing firms.

In sum, the results of these studies are generally consistent with the expectation that higher regional energy prices depress economic growth. However, the results are not uniform, and the studies discussed here do not indicate clearly which sectors are most subject to energy price influences.

Finally, energy prices, like climate variables, may function in part as a proxy for other regional effects. Only two of the studies cited here, Bartik (1989) and Deich (1989), also include regional control variables as regressors, and only one of these provided any evidence for energy price effects.

Regional Dummies

A number of the studies reviewed here include "dummy variables" for one or more regional effects among the explanatory variables in the models used. These "dummy variables" do not really explain differences in economic growth rates between Northern and Southern States, or between the Northeast and the West, in any substantive fashion. Rather, they serve as "control" variables for effects that might otherwise bias results of substantive

interest. If unmeasured or unmeasurable differences across units of observation affect their relative economic performance--for example, differences in access to growing markets overseas, or work ethic, or political culture--and if these differences tend to follow regional lines, then inclusion of regional dummies in a model will tend to capture the effects of these unmeasured variables. This reduces the magnitude of omitted variable bias, therefore, in estimating the effects of other measured variables.

One of the studies reviewed, Mead (1982), includes a simple North-South dummy, and only in one of the four simultaneous equations estimated. Mead finds the 1980 per capita wage significantly higher in the North.

Several other studies include dummy variables to control for the four major U.S. Census Bureau divisions.[63] After other county characteristics are taken into account, Porterfield (1990) finds that both manufacturing and producer services employment grew fastest in the South between 1981 and 1986. Manufacturing employment grew most slowly in the Northeast, while producer services employment grew most slowly in the West. Killian and Parker (1991) find that 1979-88 nonmetro employment growth was significantly faster in the Northeast, and significantly slower in the Midwest, after other variables in their model are taken into account. Deich (1989) finds that manufacturing branch plant and single-establishment startups between 1972 and 1977 were generally more frequent in the West.

Still other studies include separate dummy variables to control for the nine U.S. Census Bureau regions.[64] One of these is Carlino and Mills (1987); another is Bartik (1989). While some apparent typographical errors make it difficult to interpret the Carlino and Mills results, some of the differences among regions appear to be statistically significant. Bartik does not report the estimated effects of the regional dummy variables in his paper.

In addition, two studies--Newman (1983) and Quan and Beck (1987)--estimate regression models separately for North and South. Newman finds that his Southern and non-Southern models are similar, but Quan and Beck find substantial differences.[65]

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[63]Northeast, Midwest, South, and West.

[64]New England, Middle Atlantic, South Atlantic, East South Central, West South Central, East North Central, West North Central, Mountain, and Pacific.

[65]For the areas included in Quan and Beck's definitions of North ("Northeast") and South ("Sunbelt") see footnote 21, p. 28.

Industrial Composition of Economy

The mix of industries in an economy affects the nature and rate of subsequent economic growth. The overall success of a region over any period of time will likely reflect, in large measure, the success of the industries that have concentrated there. A surge in demand for airplanes is likely to mean faster growth in Washington State, home of Boeing, while growth in the domestic automotive industry is still good news for Michigan.

Firms in particular industries may also be more likely to locate in areas where firms in related industries are already present, thus ensuring easier access to appropriately trained labor and other specialized inputs. Thus, growth in a particular industry will reflect, at least in part, the current distribution of that industry, and of other complementary industries. On the other hand, firms in some industries, such as those that produce goods or services that are largely consumed locally, may be drawn to areas where they will have little local competition from existing firms in those industries.

Industrial Density or Agglomeration

As noted above, the current distribution of business activity may influence growth, as firms seek out locations where specialized labor and service providers are available. The current concentration of business activity in a particular industry may also serve as a proxy for unmeasured regional characteristics that make an area attractive to firms in that industry. Cost savings associated with proximity to firms in the same or related industries are known as "agglomeration economies." On the other hand, labor and other resources may be cheaper in other areas, and in those industries where transportation costs are important, areas that are currently underserved may offer better growth opportunities. Thus, the estimated effect of initial industrial activity levels on subsequent growth or location decisions is not certain. The results of any particular study may well depend on the extent to which other variables included in the model serve as proxies for unmeasured regional characteristics.

A number of authors do find evidence of a positive relationship between industry density and location decisions or industrial growth. In a study of 115 small towns in Missouri, Kuehn and coauthors (1979) report that the number of manufacturing plants already in a town was a strong predictor of the probability of attracting a new manufacturing plant. Wasylenko (1980) finds that those Milwaukee area jurisdictions with more employment in a particular industry (manufacturing, construction, wholesale trade, and so forth) were more likely to attract relocating firms in that industry. Kieschnick (1981) finds that the State share of all U.S. production hours in an industry was a consistently powerful predictor of that State's share of new investment in that industry. Carlton (1983) finds that, for each of three

four-digit SIC manufacturing industries, the initial level of production activity in a particular metropolitan area is a significant predictor of the number of new branch plants opened in that industry and the size of such plants. Bartik (1985) finds that initial State "manufacturing density" (manufacturing man-hours/square mile) helps to predict the probability of new manufacturing plants opening in that State. And Deich (1989) finds that the initial level of State employment in manufacturing--and in each of three two-digit SIC manufacturing industries--is a significant predictor of branch plant openings and/or single-establishment firm births in that State.

These findings, however, may reflect inadequate control for scale effects. Areas that initially have more economic activity will experience more plant openings, more plant relocations, and more investment even if their rate of economic growth is no faster than that of other areas with smaller economies. Furthermore, several of the studies cited above--Kieschnick (1981), Carlton (1983), and Deich (1989)--fail to include any other, broader measure of the initial level of economic activity or potential--such as total population or employment--among the potential explanatory variables in their models.[66]

In contrast, several other studies that explicitly control for population size and/or employ measures of growth that are independent of initial population size fail to find a significant positive effect from industry density measures. Smith, Deaton, and Kelch (1978) find that county manufacturing employment had almost no effect on the probability of attracting a new plant once community population and other variables are taken into account; McNamara and coauthors (1988) report a similar result for a different area and time period. Wasylenko and McGuire (1985) fail to find any significant relationship between industry density measures and industry percentage employment growth. And Bartik (1989) finds that, after controlling for population density, small business startup rates are significantly higher where current industry densities are lower.[67]

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[66]Only Kuehn and coauthors (1979) explicitly control for community population size, while Bartik (1985), by including both measures of land area and population density among the explanatory variables in his model, effectively controls for variations in population. Wasylenko (1980) includes a measure of available potential employees which may function (in part) as a measure of local and nearby population for each jurisdiction.

[67]It should be noted that current State employment in industry X appears in the denominator of Bartik's definition of the small-business startup rate for industry X. Bartik argues that current State employment in an industry is the best measure of potential employment in that industry. Thus, Bartik's results

(continued...)

Industry Mix/Expected Growth

Especially in the short run, growth in demand for those goods and services already produced in an area is likely to be one of the most important factors influencing the rate of local economic growth. Hence, it is perhaps surprising that so few of the studies reviewed here have attempted to take this into account in explaining differences in regional economic growth. Two of the most recent, however, have done so.[68]

Killian and Parker (1991) estimate, for each commuting zone, the "expected" zonal employment growth rate, given the initial industry mix of employment, if zonal employment in each two-digit SIC industry had grown at the national rate. This "initial industry mix" variable is then used as one of the predictors of the observed growth rate in their regression models. This "measure of expected growth" helps significantly to explain actual growth rates. The magnitude of the estimated coefficient suggests that a 1-percentage point difference in the "expected" growth rate does correspond to a difference of approximately 1 percentage point in the average observed rate, after other variables are taken into account.[69]

Sander and Schaeffer (1991) compute a similar industry mix variable, and then compute two sets of regressions. In one set, the authors subtract the "expected" employment growth rate from the observed employment growth rate, and use the difference as

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[67](...continued)
do not necessarily imply that higher industry densities yield absolutely lower numbers of startups, only that in an area where an industry is already concentrated, startups are smaller in number relative to existing employment in that industry.

[68]Fox and Murray (1990) also refer (in a footnote) to testing a measure of "the composition of the prevailing employment structure" as an explanatory variable in their model of firm entry rates, and indicate that it was not significant, but provide no further detail on the definition or construction of this measure.

[69]The reported regression coefficient for this variable is 0.09 to 0.14. However, while the dependent variable is an annualized growth rate, the initial industry mix variable represents cumulative "expected" growth over the 1979-88 period (personal communication, Timothy Parker, July 9, 1992). Thus, a regression coefficient of approximately 0.11 would imply that a difference of 1 percentage point in the "expected" annual growth rate (or about 9 percentage points in cumulative growth over the period) led to a difference of 1 percentage point in the observed annualized growth rate.

the dependent variable explained by regression.[70] In the other set, the "expected" growth rate appears as a regression variable in a model attempting to explain the observed growth rate. In this case, Sander and Schaeffer find their industry mix index to be a highly significant predictor of employment growth in urban counties.

Sander and Schaeffer also find that the estimated effect of the industry mix variable is greater than 1. This implies that in those counties that contained concentrations of fast-growing industries, local industry growth rates typically exceeded the national growth rate for the same industry. While the authors do not attempt to explain this result, it is not in fact surprising. Areas with a concentration of fast-growing export-oriented industries are also likely to experience faster than average growth in those local service, trade, and support industries that sell to businesses in those export industries, or to their employees.

Other

Land Price or Availability

Eight of the studies reviewed consider the possible influence of land prices or availability on the distribution of new economic activity.[71] All but one of these is an effort to explain actual industrial location decisions (firm births, firm relocations, or plant startups).

Smith, Deaton, and Kelch (1978), in their attempt to explain manufacturing plant startups in Kentucky and Tennessee, include among the explanatory variables a dummy variable that indicates whether a community had available a potential plant site owned by a public body or nonprofit organization. They find that availability of such a site significantly increased the probability of a manufacturing plant startup. However, in a study of suburban Milwaukee jurisdictions, Wasylenko (1980) fails to find any consistent relationship between the availability of vacant land and the probability of attracting a relocating firm. Wasylenko does find that those jurisdictions where more land is already in commercial or industrial use are less likely to attract relocating firms, but the relationship is statistically significant only for firms in manufacturing and in finance. Fox (1981) fails to detect a significant relationship between land

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[70]In effect, this procedure constrains the coefficient of the "expected" growth rate to equal 1 in the equation fitting the actual growth rate.

[71]In addition, as noted earlier, some studies have suggested that population density might be viewed as a proxy for the cost of land.

prices and the demand for industrial land in 43 Cleveland-area jurisdictions.

Plaut and Pluta (1983), seeking to explain the movement of broad economic aggregates within the manufacturing sector, find that an index reflecting both population density and land prices--in particular, the value of agricultural land and buildings per acre--is significant in explaining growth in manufacturing value-added or real capital stock, with higher population densities or land prices associated with slower manufacturing growth.

Bartik (1985) finds that State land area, which he views as a measure of available sites, is significantly and positively associated with branch-plant openings. However, in Bartik (1989), the author finds that greater land area has a significant negative relationship with small-business startup rates (recall, however, that in Bartik's 1989 study, the startup rate is defined in per capita terms.) Deich (1989) also finds a significant positive relationship between land area and the number of branch plant startups, for manufacturing as a whole and for several two-digit SIC industries. Deich also finds that higher land prices had a negative and sometimes significant effect on branch-plant openings, but did not have a significant effect on the frequency of single-establishment startups. Finally, Fox and Murray (1991) fail to find any significant relationship between land prices and firm entry rates.

On the whole, these studies tend to confirm our expectation that land costs and availability should affect industrial location decisions, but the study results are not altogether consistent. Further, the studies reviewed do not offer clear guidance on the preferred measure of or proxy for land costs.

Labor Productivity Measures

Two of the studies reviewed include measures of labor productivity among the possible predictors of business activity. Both of these studies seek to explain interstate variation in capital investment. Kieschnick (1981) considers a variable that measures manufacturing value added per dollar of labor costs, a measure that reflects both labor productivity and wage levels. He finds that this variable is generally not significant. Papke (1987) includes a more conventional measure of labor productivity in a model of the determination of capital investment per worker. She finds a significant positive relationship between the two. In addition, Plaut and Pluta (1983) include a variable that they label "inherent productivity" as a potential determinant of manufacturing growth. This variable is, in fact, a measure of educational attainment and achievement, reflecting average years of schooling completed and the adult literacy rate for each State.

Inclusion of labor productivity as conventionally measured in a model of change in business activity--and particularly in a model of new capital investment--appears likely to lead to a confounding of cause and effect. Areas that are attracting new capital investment are likely to experience higher labor productivity because of the availability of new, higher quality machinery and other capital, independent of any inherent characteristics of the local labor pool. A meaningful estimate of the effects of initial labor productivity on subsequent growth would require an estimate of the marginal productivity of labor after controlling for the quantity and quality of capital. This procedure was not followed in any of the studies reviewed. The data requirements for such an approach would be formidable.

Fire Protection Rating

Several studies of community success in attracting manufacturing plants include the community's fire protection rating to reflect the quality of those local public services valued by business. Of these, only Smith, Deaton, and Kelch (1978) find the fire protection rating to have a significant effect on new plant openings. Kuehn and coauthors (1979) and McNamara and coauthors (1988) find no such effect.

Selected Other Variables

As indicated by the last page of table 2, individual researchers have proposed many other factors that might influence the growth or level of regional business activity. It may be useful to comment on some of them here:

- Bluestone and coauthors (1989) propose a relationship between the extent of small business activity in a county and county economic activity. They assess the influence of each of three measures--two measures of the extent of small business activity in the county economy, and one measure of small business turnover--on each of four measures of county economic activity. Their results suggest that the extent of small business activity may influence local economic growth rates. However, their analysis fails to control for other factors that may influence county business activity.[72] They also find evidence that the proposed association is stronger in urban than rural areas.

- Carlino and Mills (1987) test for a relationship between employment density and the value of outstanding industrial revenue bonds by State. They find no effect approaching significance for either total or manufacturing employment.

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[72]The only other variables included in their regression models are regional dummies.

- Two studies include measures that reflect the age distribution of the population. Killian and Parker (1991) include the average population age, suggesting that younger labor will be cheaper. They find that younger populations are associated with faster growth in nonmetro (but not metro) areas. Wasylenko and McGuire (1985) treat the percentage of the population aged 18-44 as a potential determinant of employment growth, describing this as the "prime-aged" working population. However, they fail to find a significant relationship between the share of the population that is prime-aged and employment growth in any sector.

- Two authors consider the effect of labor availability in specific sectors on the expansion of business activity in associated industries. Wasylenko (1980) tests whether the number of residents living within ready commuting range who are currently employed in a given industry (manufacturing, construction, wholesale trade, and so forth) influences the probability that a firm in that industry will relocate to a particular jurisdiction. The author finds that such sectoral labor availability has a significantly positive effect on relocations in all six industries covered by the study. Carlton (1983) finds that the number of engineers in a metropolitan area did have a significant effect on branch plant openings in the Communication Transmitting Equipment industry (SIC 3662), but not in two technologically less intensive industries.

- Bartik (1989) hypothesizes that a more competitive banking sector might be conducive to small business startups, while also noting some evidence that small banks not subject to competitive pressure might provide more loans to small business based on a belief in their service role. Bartik's model of the determination of small-business startups includes several measures of banking competitiveness. These include dummy variables for statewide or limited branch banking, a measure of the system's openness to multibank holding companies in those areas where branching was limited, and a measure of statewide banking concentration. Bartik's preferred (fixed effects) results suggest that both statewide branching and the presence of multibank holding companies were conducive to small-business startups.

- Kieschnick (1981) is the one study that assesses the effect of recent <u>change</u> in the level of unionization on current economic activity. Kieschnick includes this variable in models of several industries. It is generally not statistically significant.

- Wheat (1986) is the only study among those reviewed to include a measure of retiree attraction among the possible determinants of growth in economic activity. Wheat

identifies States as retiree States if they had one or more counties where (a) at least 15 percent of the 1970 population was 65+ and (b) there was a "1960-1970 net migration rate of +7 percent or more." Despite the imprecision implicit in assigning the retiree label to entire States based on the characteristics of (in some instances) just a few counties in those States, Wheat does find that the retiree variable had a highly significant positive effect on manufacturing employment growth. The author suggests that this may reflect both retiree demand for locally produced manufactured goods, and the presence of amenities in retiree attraction areas that are also attractive to manufacturers.

Conclusions

While not exhaustive, the preceding review does highlight the variety of methods and data that have been applied in efforts to identify key determinants of differential regional economic growth. The review may also illustrate the sensitivity of most substantive conclusions to differences in outcome variables, models, estimation methods, periods, and geographic areas. While the studies identify many local and regional characteristics that may have an influence on regional economic growth, there appear to be few results that are robust across differences in study design features. Thus, a particular regional characteristic that appears to have a strong effect on growth or business location in some studies will typically appear to have little effect--or the opposite effect--in other studies. Hence, it may be difficult to draw many substantive conclusions about the growth effects of these variables from this literature.

This review may also illustrate some other limitations of the existing literature. Most of the studies reviewed focus on a limited set of predictive variables, raising the possibility of omitted variable bias. In particular, few take into account the industrial composition of the regional economy as a factor influencing regional growth, and few attempt to assess the distinct contributions of high-school-educated and college-educated adults to growth or business attraction.

In addition, most focus either on State-level data, or on data for a limited geographic area or sample of communities. Only a few make use of the additional degrees of freedom allowed by a national set of data at the substate level. Many further limit the scope of their results by focusing on manufacturing or other individual sectors of the economy, potentially obscuring the significance of their results for regional economies as a whole.

Further, only a few studies have paid specific attention to nonmetro growth, with three (Dorf and Emerson, 1978; Smith, Deaton, and Kelch, 1978; Kuehn and coauthors, 1979) examining

nonmetro communities in particular States or regions, while four others have modelled a national sample or population of nonmetro areas (Mead, 1982; Bluestone and coauthors, 1989; Porterfield, 1990; and Killian and Parker, 1991).

Finally, the studies reviewed vary widely in the sophistication of the estimation methods used. While a number of researchers do apply advanced techniques, use of simple multivariate regression is common.

Thus, for researchers interested in the determinants of regional growth, particularly in nonmetropolitan areas, this review suggests that many substantive questions remain open. The review further suggests the potential utility of a study that focuses on nonmetro areas throughout the United States, that uses substate data, that makes a broad economic aggregate the outcome of interest, that uses an inclusive list of independent variables, including controls for the industrial composition of the area economy and the mix of educational attainment levels in the area population, and that applies regression techniques that correct for some of the limitations of simple OLS regression. The forthcoming Economic Research Service paper on rural economic growth in the 1980's[73] is one attempt to perform such a study.

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[73]Kusmin, Lorin, John Redman, and David Sears, Rural Economic Growth in the 1980's: A Look at Factors Associated with Earnings Growth, Economic Research Service, U.S. Dept. Agr., (forthcoming).

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