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THE NET EFFECTS OF LARGE PLANT LOCATIONS AND EXPANSIONS ON COUNTY EMPLOYMENT

Kelly D. Edmiston

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Andrew Young School of Policy Studies

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Kelly D. Edmiston*
Department of Economics
Andrew Young School of Policy Studies
Georgia State University

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Abstract. This paper argues that the net economic impact of new firm locations or expansions is determined by a multitude of opposing forces. Using a unique database, I set out to evaluate the net effects of these opposing forces by looking at the net change in local employment and population arising from large (greater than 300 new jobs) firm locations or expansions in the State of Georgia. The analysis suggests that the employment multipliers associated with new firm locations are much less than one; that is, that the net employment effect of a large firm opening is smaller than the gross employment impact. This result is consistent with other empirical economic impact studies, which find multipliers much smaller than those of typical input-output models, often less than unity, and a previous study showing little net effect of large plant openings. Expansions of existing establishments are shown to have substantial multiplicative effects, however, with an average employment multiplier of 2.0. I discuss possible reasons for differential impacts across new and expanding firms, focusing on the nature of the firms. Differences in net impact across industries and high-tech *vs*. low-tech firms also is evaluated. I find that the impact of large firm locations or expansions on population in the resident county generally is negative, but positive for the broader region encompassing the county of location and its contiguous neighbors.

* University Plaza, Atlanta, GA 30303-3083. Tel: (404) 651-3519. Fax: (404) 651-2737. Email: edmiston@gsu.edu. Financial support for this research was provided by the Georgia Governor's Office of Planning and Budget. The author would like to thank Marlon Boarnet, David Sjoquist, Ben Scafidi, Steed Robinson, Terry Gandy, and three anonymous referees for very useful comments and suggestions. All remaining errors and omissions are, of course, my own.

1. INTRODUCTION

In an effort to create jobs, spur income growth, and enhance the economic opportunities of its citizens more generally, state and local governments often offer newly locating or expanding business enterprises substantial financial incentives. Recognizing the necessity of budget frugality, state and local governments often commission economic impact studies to evaluate the likely effects of these plant locations or expansions. While these studies do a reasonably good job of predicting the gross economic impact of a single firm location or expansion decision, they tend to neglect the simultaneity that exists between a single firm's location decision and the broader set of all firm start-up, relocation, expansion, and contraction decisions. This means that they may do a relatively poor job of estimating the net impact of firm location decisions, although it is this net impact that is of most concern. Recent work by Fox and Murray (2000, 1998) suggests, in fact, that large firm openings often generate very little in the way of spillover employment, or multiplier effects, and in some cases may even have a negative effect on net.

This paper is an effort to empirically gauge the net economic impact of new firm locations and expansions on both employment and population in a simultaneous model. The research improves on existing research in several ways. First, I measure the effects of both large firm locations and expansions on both population and employment within a simultaneous model. Not only are the investigation of differential impacts of large firm locations *versus* expansions and the analysis of population effects innovations, but the simultaneous equations setup also allows me to pick up feedback effects between population and employment. Second, I allow the results to vary depending on the initial level of employment, which allows me to construct multiplier values. Third, given my rich database on relevant firms, I am able to explore differentials in economic impacts across industry types, including divisions into high-tech and low-tech.

This research also extends the work of Carlino and Mills (1987), Boarnet (1994), and Clark and Murphy (1996) on the determinants of county employment and population,[1] and serves to inform the debate over whether "people follow jobs or "jobs follow people." It does so by utilizing panel data with fixed effects, where previous studies have employed cross-sectional analysis. The fixed effects allow me to control for county specific unobservables and time-specific unobservables that may affect county population and employment growth.

The remainder of the paper is structured as follows. Section 2 provides a brief overview of tradional input-ouput analysis and discusses several agglomerating and dispersive forces that are not picked up by traditional analysis, but are likely to affect the net economic impact of large firm locations and expansions in important ways. Section 3 describes the simultaneous model of employment and population generation that serves as the basis of the empirical analysis, discusses the data employed, and notes various econometric issues that arise. The results of the empirical analysis are presented in section 4, followed by a brief conclusion in section 5.

2. FORCES FOR AGGLOMERATION AND DISPERSION

On the surface, one might think that the location or significant expansion of a large firm would spur local economic growth, all else equal. That is, we might expect the county of location to register significantly greater gains in terms of employment and personal income than would have been the case if the firm had chosen not to open or expand there. The direct effect would certainly suggest this to be the case. In reality, however, it is often the indirect effects of large firm openings or expansions, which can be positive or negative, that tend to carry the greatest weight in the total, or net, economic impact. Traditional regional economic impact analyses, based on input-output models, account for some of the positive effects, specifically supply linkages and induced spending, but are unable to account for other positive forces, like the attraction of additional activities seeking to take advantage of external scale economies. Further,

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[1] Other extensions of the Carlino-Mills model include Deller *et al*. (2001), Liechenko (2001), Henry *et al*. (1999), Barkely *et al*. (1998), Henry *et al*. (1997), and Vias and Mulligan (1999).

traditional regional economic impact analyses cannot account for the ways in which large plant locations and expansions might repel existing establishments or other potentials entrants, largely by raising factor costs and congesting factor supplies and infrastructure.

Agglomeration Forces: Traditional Input-Output Analysis

Perhaps the greatest potential for spillover benefits with a large plant location or expansion is the inducement of upstream firms, or suppliers, to migrate to the same location. If the newly locating or expanding enterprise does not require enough of an intermediate input to cost-effectively produce it in-house, transportation costs are sufficiently high (because of size or fragility, for example), and/or the product must be delivered quickly at irregular intervals, then downstream firms are likely to cluster around a common input supplier, or alternatively, input suppliers are likely to cluster around a common downstream firm. This additional employment and income generated indirectly from suppliers, which is the heart and soul of traditional input-output analysis, potentially can meet or exceed the levels generated directly by a newly locating enterprise.[2]

Of course, any personal income arising from one firm's activity also generates multiplier effects through subsequent rounds of consumer spending, which generates additional employment and income; and larger markets are a significant draw for industrial location (Krugman, 1991; Calzonetti and Walker, 1991). These induced effects are also picked up in most traditional input-output analysis (those utilizying type II or SAM multipliers).[3]

Agglomeration Forces: External Economies

Other forces for agglomeration are external in nature and are not picked up in traditional regional economic impacts analyses based on input-output models. Generally these external economies of scale are quite localized, especially in high-technology industries (Fesar and Sweeney, 2000; Fesar, 2001). From an economic development perspective, the crucial

[2] For example, suppliers for the BMW assembly plant in the Greenville-Spartanburg, SC area have created approximately 4,700 jobs, while the facility itself has created only 3,000 ("BMW Expands Spartanburg," BMW Press Release, June 28, 2000).

[3] Isard *et al*. (1998) explains regional input-output analysis in detail and discusses the construction and use of alternative multipliers.

importance of localized external scale economies is that the situs of a single firm may yield substantial spillover benefits by increasing the attractiveness of that location to other firms within the industry.

One of the great advantages of industry agglomeration is the potential for sharing workers, or labor pooling (Krugman, 1991). Given the uncertainty of labor demand, workers will have an interest in locating where there are many firms that require their skills so that if they get laid off, another firm may be available to hire them locally. Likewise, given the uncertainty of labor demand, firms will want a large pool of specialized workers from which to hire so that they may take advantage of cyclically high demand for their products. Pooled labor also allows for a better matching of skills between worker and employer.

The benefits of labor pooling have been verified in several empirical studies. Neuman and Topel (1991) show that diversity in sectoral demand shocks reduces equilibrium unemployment. The work of Dumais, Ellison, and Glaeser (1997) finds that industrial location is driven "far more" by labor pooling than by any other of their explanatory variables, and Audretsch and Feldman (1996) find that industries where skilled labor are more important tend to exhibit a greater degree of concentration than do industries that rely less on highly skilled labor. Finally, regressing measures of spatial concentration on proxies for labor pooling, Rosenthal and Strange (2001) find a "robust effect," with labor pooling proxies positively related to agglomeration at the zip code, county, and state levels (191).

Another argument made for the intra- and inter-industry agglomeration is that locational proximity speeds the transfer of knowledge (Romer, 1986; Grossman and Helpman, 1991; Krugman, 1991). Intellectual spillovers are often cited, for example, in explaining the development of high-technology clusters such as the Silicon Valley and Route 128. Of the three external factors purported by Alfred Marshall, and later by Krugman (1991), to influence location of industry (market size effects, labor pooling, and technological spillovers), the potential for technological spillovers has received perhaps the greatest amount of empirical attention. Rauch (1993) and Glaeser and Maré (2001) support a notion that agglomeration increases the return to human capital *via* spillovers from highly educated people, an idea popularized long before by Chinitz (1961) . A substantial amount of recent work has provided further evidence to support the existence of technological spillovers. Some of the earliest, Jaffe (1986, 1989) and Jaffe *et al*. (1993), uses data on patents and patent citations to demonstrate the existence of localized knowledge and technological spillovers. Other research has provided support for the existence of localized information and technological spillovers by comparing the concentration of industry relative to a random pattern (Ellison and Glaeser, 1997), and by examining clusters of innovative R&D activity (Audretsch and Feldman, 1996; Wallsten, 2001).

Even entirely different industries benefit from the physical and economic infrastructure that is made available by the presence of numerous substantial business firms. This infrastructure is not limited to roads, highways, and schools, but also includes the presence of well-developed financial institutions and supporting service firms (de Vaal and van den Berg, 1999) – many of which are profitable only in locations where they can tap into a large number of firms. Thus the location of a business services firm, for example, might have a linkage effect similar to that associated with the location of an input supplier.

Finally, the role of perceptions cannot be underestimated in business location decisions. Although many start-up computer firms might be able to produce at much lower cost outside of the Silicon Valley, that location is understood to be the Eden of the industry, and perhaps more importantly, to be friendly to computer firms and to computer people.

Dispersive Forces

Large firm locations and expansions may also generate substantial negative spillovers. Subsequent increases in input costs like wages and rents, reductions in input supplies, or even the perception that this might be occurring may deter other potential entrants from locating or expanding in the same jurisdiction. Moreover, in addition to increased labor market competition, there is evidence that firms producing in larger markets may be deterred by stronger competition in product markets (Ottaviano and Puga, 1997). Finally, new or expanded firms generally will congest public services and infrastructure.

When a large firm locates in a community, the local labor market would be expected to tighten, reducing the supply of labor available for other potential entrants and raising wages. Further, to the degree that the location of a large firm causes a population influx, rents also would be expected to rise and the supply of available land would be reduced. To the extent that the availability and cost of inputs such as labor and land are a factor in location decisions, the entrance of a large firm or significant expansion of an existing firm is likely to deter other potential entrants or expansions or drive away existing firms. Evidence from business surveys and empirical studies suggest that the availability and cost of inputs are critical factors in the location process.

In a study of Fortune 500 companies, Schemmer (1982) found that a favorable labor climate is the most important factor in business location decisions. This finding was echoed in Calzonetti and Walker (1991), who in a survey of 174 newly located plants (which had conducted a search across *regions*), showed labor, along with access to markets, to be the most significant decision factor. Other traditional cost factors topped the ranking as well, including the availability and cost of land (3) and taxes (4). In evaluating plants that conducted a *local* search, Calzonetti and Walker found non-union labor to be the second most crucial factor (following markets), while wages were listed fourth. The availability and cost of land also were shown to be critical factors in a local search.

Empirical evidence supports these survey findings. In an examination of the electronics industry in Thailand, Kittiprapas and McCann (1999) observed that low wages and land rents drew large firms to peripheral areas. Land rents were found to be a significant deterrent for firms in Schmitt (1999) and Dekle and Eaton (1999), as were wages in Dekle and Eaton. Organized labor has been found to significantly deter industrial location and employment in a number of studies (*e.g.*, Bartik, 1985 and Vedder and Gallaway, 2002), further indicating the important role of wage levels in location.

Another way in which large firm locations and expansions may deter other potential entrants or repel existing firms is by congesting public services and infrastructure. Some congestion arises directly from the firm's activities, while other congestion results from related population increases. This congestion is aggravated if the newly locating firm has been provided incentives, such as property tax abatements (Fox and Murray, 2000). The congestion of public services and infrastructure will generate additional costs to the government sector, with little in the way of additional financial resources. The local government then may be forced to raise tax rates, diminishing the attractiveness of the community to other potential investment. There is a substantial literature that investigates the role of taxes in location, and the consensus seems to be that higher taxes deter location, but not to a great degree (see Wasylenko, 1997).

Brakman (1996) finds that negative feedbacks such as congestion caused by environmental pollution, space and resource limitations, and the clustering of roads, storage facilities, and communications channels are of "crucial importance" to industrial location, and that these forces tend to make industrial production "more evenly spread" across regions (646-647).

3. MODLE, DATA, AND ESTIMATION

The Empirical Model

I utilize the simultaneous model of employment and population introduced by Steinnes and Fisher (1974) and extended by Carlino and Mills (1987), Boarnet (1994), and Clark and Murphy (1996). The basic model is given by

(1) $$E^e = \alpha_E P_t + \boldsymbol{\beta}'_E \boldsymbol{X} + \boldsymbol{\gamma}'_E \boldsymbol{Y}_E$$

(2) $$P^e = \alpha_P E_t + \boldsymbol{\beta}'_P \boldsymbol{X} + \boldsymbol{\gamma}'_P \boldsymbol{Y}_P$$

where E^e and P^e are equilibrium levels of county employment and population, E_t and P_t are current levels of county employment and population, $\boldsymbol{X}$ is a vector of predetermined variables affecting equilibrium levels of both employment and population, $\boldsymbol{Y}_E$ is a vector of predetermined variables affecting equilibrium employment, but not population, and $\boldsymbol{Y}_P$ is a vector of variables affecting equilibrium population, but not employment. Population and employment are expected to adjust to their equilibrium levels with significant lags (Mills and Price, 1984), and thus

(3) $$E_t = E_{t-1} + \lambda_E\left(E^e - E_{t-1}\right) + u_{E,t}$$

(4) $$P_t = P_{t-1} + \lambda_P\left(P^e - P_{t-1}\right) + u_{P,t}$$

where λ_E, λ_P are speed-of-adjustment parameters and $u_{E,t}$ and $u_{P,t}$ are zero-mean random shocks. Substituting (1) and (2) into (3) and (4) yields

(5) $$E_t = \lambda_E \alpha_E P_t + \lambda_E \boldsymbol{\beta}'_E \boldsymbol{X} + \lambda_E \boldsymbol{\gamma}'_E \boldsymbol{Y}_E + (1-\lambda_E)E_{t-1} + u_{E,t}$$

(6) $$P_t = \lambda_P \alpha_P E_t + \lambda_P \boldsymbol{\beta}'_P \boldsymbol{X} + \lambda_P \boldsymbol{\gamma}'_P \boldsymbol{Y}_P + (1-\lambda_P)P_{t-1} + u_{P,t}$$

The use of a multi-equation adjustment model reflects the simultaneity and dual causality (or lack of consensus on direction of causality) of population and employment in the regional literature (See, *e.g.*, early papers by Muth (1971), Steinnes (1978), and Greenwood (1985)). Other variables in the analysis are tested for possible endogenity as well.

Data

The dataset employed in this analysis consists of observations on 154 Georgia counties over 16 years: 1984-1998. After lagging some variables one-period, I was left with 2,310 usable observations. A description of the data, sources, and descriptive statistics are reported in Table 1.

New Firm Openings and Expansions. The primary objective of this study is to examine the impact of large firm locations and expansions on county employment and population. I utilize a substantial database which contains information on all announced firm locations or expansions in the State of Georgia over the period 1984 - 1998. The database is maintained by the Georgia Department of Industry, Trade, and Tourism, and includes, for each record, the date of projected entry or expansion, product description, industry description, projected new investment, and projected new jobs, among other fields. The database is complete in that it records every such new location or expansion in the state. Excluding the Atlanta metropolitan area's 5 core counties, a total of 166 firms announced new locations or expansions in Georgia during the period that generated 300 or more new jobs.[4] While the threshold level of 300 employees is somewhat arbitrary, it reflects a judgement of balance between including a sufficiently large database of new plants and expansions while at the same time focusing the analysis on the impact of large locations and expansions. In total, there were 4,755 announcements of new jobs reported in the database. Of these, 3,935 reported 100 or fewer new jobs, 574 reported between 101 and 299 new jobs, and the remaining 246 reported more than 300 new jobs (80 in core Atlanta counties).

Based on the announcements, outside sources were used to determine whether or not each firm making an announcement actually located a new enterprise in the state or significantly expanded, the date at which the enterprise became operational (utilized new employees), and the actual employment generated.

Most firms were matched with ES-202 firm-level employment data collected by the Georgia Department of Labor and maintained by the Georgia Fiscal Research Program.[5] The data is compiled from quarterly tax and wage information submitted to the Department of Labor by every employer covered by Georgia unemployment insurance. From the raw data I was able to calculate and record the employment of individual firms on quarterly basis, which was then annualized for the purpose of this analysis. For firms in which I was able to make a match, I used the ES-202 records to confirm the location/expansion and to calculate actual employment records. For expanding firms, the change in employment was calculated by subtracting employment in the year previous to the expansion.

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[4] I excluded Atlanta's five core counties (Clayton, Cobb, Dekalb, Fulton, and Gwinnett) because there were numerous new firm locations and expansions in most years (68 announcements in total), and Atlanta seems to drive the results. That is, when the core 5 counties of Atlanta are included in the analysis, the coefficients on the firm location and expansion variables are statistically insignificant. This result reflects the relatively enormous population size of these counties (average 525,563 in 1998 for core Atlanta *vs*. 32,524 for the remaining counties) and the relatively rapid growth in these counties over the period of the analysis (2.5 percent average compound annual growth for core Atlanta counties *vs*. 1.7 percent average compound annual growth for remaining counties). Gwinnett Country grew at a compound annual growth rate of 6.1 percent over the period. My interest is in smaller counties outside of Atlanta, and the inclusion of core Atlanta counties obscures these results.

[5] http://frp.aysps.gsu.edu/frp/

For firms in which I was unable to match ES-202 records, I used Internet sources, the *ReferenceUSA* business directory,[6] local chambers of commerce, and direct correspondence with firms to confirm the new location/expansion and to calculate actual employment levels. In addition to calculating employment levels for 11 of the firms in my database, with these sources I was able to eliminate a number of firms that did not actually locate or expand significantly in Georgia.

In total, of the 166 announcements, I compiled a database of 91 new and expanding firms with new employment of 300 or more within 5 years of becoming operational. Of the remainder, 24 represented firms that established new locations but the net new employment was below 300. Another 42 announcements did not bear out in the sense that there was no associated firm location or significant expansion. Finally, there were 9 announcements for which I was unable to find any information whatsoever. I presume that these represent firms that did not locate in Georgia, but I was unable to get confirmation from a chamber of commerce, news article, company headquarters or other source to ensure that they did not locate in a different place under a different name. Although I am virtually certain that these firms did not locate in Georgia, to be safe I include dummy variables to represent these potential locations.

As shown in Table 2, 68 of the 91 firms in the dataset were new locations. The total number of new jobs generated by these firms was 27,565 (86.2 percent of announced employment), with the average firm employing 418. The 23 expansions of existing enterprises generated 10,697 new jobs in Georgia (roughly 92.5 percent of announced employment), and each firm created 465 new jobs, on average. In total, 39,162 new jobs were generated by these 91 firms, representing 88.1 percent of announced employment. The 91 firms in the dataset are largely manufacturing firms (Table 3), although manufacturing firms of a variety of types are

[6] The *ReferenceUSA* business directory is a near exhaustive source for business information in that it covers so many primary sources. U.S. – wide, the database covers more than 5,600 yellow and white page telephone directories; annual reports, 10-Ks and other SEC information; federal, state, and municipal government data; chambers of commerce information; leading business magazines; trade publications; newsletters; major newspapers; industry and specialty directories; and postal service information, including change of address updates. The information on each business in the database is telephone-verified each year, and firms with greater than 100 employees are telephone-verified at least two times per year. See http://www.referenceusa.com/au/au.asp.

represented in the data. The modal industry group (16 firms) was food and kindred products (SIC 20), which in this case consisted mostly of poultry processing establishments. There were also a relatively large number of general merchandise stores (SIC 53) and textile mills (SIC 22), at 12 and 11 establishments, respectively.

Finally I differentiate the firms according to their placement in high technology categories. To accomplish this task I had to first define high technology in terms of the Standard Industrial Classification (SIC). While several groups have defined what it means to be a high-technology firm, I chose to narrow my classification to two, which I term the *American Electronics Association (AEA) definition* (American Electronics Association, 2000), my narrowest grouping; and the *Fiscal Research Program (FRP) definition* (Walcott, 2000), which includes all firms covered in the AEA definition as well as other industries for which the technology is somewhat less intensive than in the AEA definition. Table 4 provides the SIC 4-digit codes that fall under each classification. Of the 91 firms in our dataset, 6 were in high technology industries according to the AEA definition, while 16 were in high technology industries under the FRP definition.

The geographic location of the new firm locations and expansions was relatively sporadic and occurred in all areas of the state and 45 of 159 counties (Figure 1). Most counties contained either one or two locations/expansions, if any. Muscogee county (Columbus MSA) contained the most new locations/expansions with seven. Slightly less than one-half (43) of the new firm locations and expansions occurred in Census-defined metropolitan areas (29 counties). In the empirical analysis, the variable *Expanding (Year 0)* is equal to the number of new jobs generated by large expansions (300+ new jobs) in county *i* at time *t*, and is equal to zero if there were no large expansions in county *i* at time *t*. *New (Year 0)* represents the same number for new firms. These variables were then lagged for several periods in an effort to capture dynamic effects on population and employment, and are indicated below by the vectors:

$$Exp = \left[Expanding\ (Year\,0) \quad Expanding\ (Year\,1) \quad \cdots \quad Expanding\ (Year\,4) \right]$$

$$New = \left[New\,(Year\,0) \quad New\,(Year\,1) \quad \cdots \quad New\,(Year\,4) \right]$$

Dependent Variables. The dependent (endogenous) variables in the analysis are wage and salary employment (E_{it}) and population (P_{it}), which were provided by the Bureau of Economic Analysis' Regional Economic Information System (REIS).

Control Variables. In addition to the new and expanding firm indicator, several other variables were included in the vector $\boldsymbol{X}$ (affects both employment and population). The violent crime rate and property crime rate are expected to have a negative effect on both population and employment. The sales tax rate, which ranges from 4-7 percent in Georgia, is expected to have a negative effect on both employment and population, as is the effective property tax rate, which averages 1.0. Demographic variables included in the analysis are per capita income, percentage of the adult (25+) population with at least a bachelor degree, percentage of the adult population with less than a high school education (25+), and the percentage of the population that is black. Per capita income and the share of adults with a bachelor degree are expected to have a positive relationship with population, while percent black and share of adults without a high school diploma are expected to be negatively related to population. While I expect employment to be positively related to the share of adults with a bachelor degree and negatively related to the share of adults without a high school diploma, which are measures of worker productivity, I have no *a priori* expectations with respect to the relationship between employment and percent black and per capita income. The unemployment rate is expected to have a negative relationship with both population and employment. Finally, the vector $\boldsymbol{X}$ contains a set of county specific and time specific fixed effects, which are intended to capture the effects of unobservables that may vary across county or over time.

The vectors $\boldsymbol{Y}_E$ and $\boldsymbol{Y}_P$ include the lagged values of employment and population, respectively, and additional variables. The employment equation includes a measure of the average wage (w_{it}) and the percentage of total employment that is manufacturing ($\%M_{it}$). As a measure of the average wage, I utilized real net earnings per worker. As I include controls for worker productivity, all else equal, I would expect the average wage to reduce county employment because of the additional production cost. Percent manufacturing is included in the employment equation to pick up long-term structural changes in employment, but is not expected to alter preferences for county of residence. Because manufacturing employment has been declining over the last few decades due to gains in productivity and other influences, the coefficient on percent manufacturing is expected to be negative. The population equation contains the median year in which houses were built in the county ($MedYr_{it}$), which is expected to have a positive coefficient and to be unrelated to employment, and the percentage of the population below the poverty line ($\%Pov_{it}$), which is expected to be negative and unrelated to employment.

Estimation Issues

The estimating equations are given by (county subscripts dropped)

$$(7) \qquad E_t = \alpha_0^E + \alpha_1^E P_t + \alpha_2^E E_{t-1} + X_t \beta^E + Y_t^E \gamma^E + Exp\delta^E + New\phi^E + u_t^E$$

$$(8) \qquad P_t = \alpha_0^P + \alpha_1^P E_t + \alpha_2^P P_{t-1} + X_t \beta^P + Y_t^P \gamma^P + Exp\delta^P + New\phi^P + u_t^P$$

The simultaneous equations given in (7) and (8) are estimated using three-stage least squares (Zellner and Theil, 1962). I tested several of explanatory variables for endogeneity using the procedure outlined in Spencer and Berk (1981), finding the two-equation model to be the appropriate choice. Specifically, I tested the exogeneity of the sales and property tax rates, the wage, violent and property crime rates, the lagged dependent variables, and the unemployment rate. Tests for overidentifying restrictions based on Basmann (1960) also suggest a proper specification of the model. The statistics from these tests are reported with our results.

Another econometric issue arises with the use of panel data. I specify the disturbance terms from equations (7) – (8) with a two-way error components structure given by

$$(9) \qquad u_{it} = \mu_i + \theta_t + \nu_{it}$$

where the μ_i capture unobserved individual effects, the θ_t capture unobserved time effects, and the remaining stochastic error is assumed to follow a distribution $\nu_{it} \sim N(0, \sigma_\nu^2)$. While the μ_i

and θ_t may be modeled as random or fixed in repeated samples, Hausman (1978) tests reject the independence of the county and time effects and the remaining stochastic disturbance $v_{i,t}$, and thus only the fixed effects specification is appropriate in my analysis.

4. EMPIRICAL RESULTS AND DISCUSSION

Net Impact of New Firm Locations and Expansions

Tables 5 and 6 present results for the basic model, which includes a set of variables for expanding firms and newly locating firms.

For expanding firms, there appears to be no statistically significant effect on county employment in the initial year of the expansion and the year following, but impacts are positive and statistically significant for years 2 – 4, with the coefficients ranging in value from 0.456 (year 3) to 1.227 (year 4). A Wald statistic for the joint significance of the *Expi* was 8.27, which is significant at the 99 percent confidence level.

The cumulative employment impact over five years works through E_{it-1} and is given by

$$(10) \qquad \frac{\partial E_{it}}{\partial Exp_{it-5}} = \delta^E_{(0)} + \left(\alpha^E_2\right)\delta^E_{(1)} + \left(\alpha^E_2\right)^2 \delta^E_{(2)} + \left(\alpha^E_2\right)^3 \delta^E_{(3)} + \left(\alpha^E_2\right)^4 \delta^E_{(4)}$$

where $\delta^E_{(i)}$ is the *i*th element of δ^E, the coefficient on *Expanding (Year i)*. For the employment equation, this cumulative impact was found to be 2.006. Because the value is greater than 1.0, the results suggest that agglomeration forces may be more important than forces for dispersion, at least for the first few years following an expansion. An expansion yields approximately two workers on net for every new employee.

For newly locating firms, there appears to be no statistically significant effect on county employment in the first four years of operation, and only a relatively minor impact of 0.456 in the fifth year of operation. The net economic impact is statistically greater than zero, however, as the Wald statistic was 2.43, which is significant at the 95 percent confidence level.

Similar to the calculation for expanding firms, the cumulative employment impact over five years works through E_{it-1} and in this case is given by

(11) $$\frac{\partial E_{it}}{\partial New_{it-5}} = \phi_{(0)}^{E} + \left(\alpha_2^E\right)\phi_{(1)}^{E} + \left(\alpha_2^E\right)^2 \phi_{(2)}^{E} + \left(\alpha_2^E\right)^3 \phi_{(3)}^{E} + \left(\alpha_2^E\right)^4 \phi_{(4)}^{E}$$

where $\phi_{(i)}^{E}$ is the *i*th element of ϕ^{E}, the coefficient on *New (Year i)*. For the employment equation, this cumulative impact was found to be only 0.285. This result is broadly consistent with Fox and Murray's (2000) work, which finds no impact of new firm locations on local employment (they did not estimate multipliers). Because the value is less than one, the results suggest that dispersive forces may be more important than forces for agglomeration in the case of newly locating firms. After five years, each 100 new employees hired by a new or expanding firm results in a net gain of only 29 workers to the resident county. This result suggests that calculations of the cost of development incentives for new firms may be underestimated by 71.5 percent (1 – 0.285). Cost per job generated with incentives generally is measured as the gross cost of the incentive divided by the gross number of new jobs. My findings suggest that the cost of incentives per new worker *on net*, which is the critical figure, is 251 percent greater than is typically estimated (1/0.285 – 1).

Other recent empirical estimates of multipliers have also found that standard economic impact analysis exaggerates local economic impacts, including studies of government consumption (Aschauer, 1990), military base closures (Hooker and Knetter, 2001), and sports expenditures (Siegfried and Zimbalist, 2002). The studies of Aschauer and Hooker and Knetter both found multipliers of less than unity. Recent appeals for the use of "net multipliers" also echos the feeling that economic impacts with standard input-output multipliers are exaggerated (Oosterhaven and Stelder, 2002; de Mesnard, 2002).

In an attempt to measure broader impacts, I also estimated the model in an aggregated form. Specifically, for each county I aggregated that county and all counties adjacent to it. In this specification none of the *Expanding (Year i)* or *New (Year i)* came out to be statistically different from zero, and thus the broader impact of new firm locations and expansions is statistically zero.[7]

[7] Results available upon request from the author.

There are several possibilities for explaining differential impacts across new and expanding enterprises. I note first that the average number of new jobs created is not significantly different between new and expanding firms (418 and 465, respectively), and thus the explanation is not likely there. Further, population and other demographic characteristics of the counties are held constant in determining the net economic impacts. More likely the explanation lies in the *nature* of new *versus* expanding firms. New firms occupy a new location in the county of residence, whereas an expanding firm is likely to enlarge an existing facility. This difference can have several effects. First, we might expact expanding firms to do relatively more of their hiring local, whereas new firms are expected to relocate at least some of their employees from other locations. To the extent that families are left behind temporarily in the prior location and money is sent home, induced spending is likely to be lower for new firm locations than for expansions. The individual coefficients on *New* and *Expanding* in Table 5 support this notion, as the *Expanding* (*Year i*) coefficients become statistically positive much earlier (year 2) than do the *New* (*Year i*) coefficients (year 4). Secondly, while new firms often modify a previously abandoned facility, expansions are likely to require significant new construction, as the occupation of an abandoned facility across town, say, would create logistical problems. Finally, some explanation may lie in the potential repellant forces of new relative to expanding firms. As noted above, a perception that wages and rents will rise, taxes will rise, factor supplies will diminish, or infrastructure will be congested is all that is required for large firm locations or expansions to repel existing smaller firms or potential new entrants.

A firm expansion is shown to have a minor positive impact on population in its residence county, but new firm locations have a significant negative impact on population.

For expanding firms, the cumulative population impact over five years, calculated as in (10) and (11), is 0.582. Thus, for every 100 workers hired by an expanding firm, the resident county may expect to gain 58 residents over the course of five years. Because new workers may live in counties outside of their place of work, and some employment is met by existing slack in the labor force, I expected population growth of about this magnitude following a firm expansion. The cumulative population impact over five years for a newly locating firm is –0.722, however, meaning that for every 100 workers hired, the county of the location *loses* 72 residents. To the extent that industrial enterprises make their surrounding environment less attractive as a residential location due to pollution, congestion, *etc*., I would not be surprised to see a small decrease in population in the resident county, but the magnitude of the population impact is somewhat surprising, especially in light of other research showing that most local job growth goes to in-migrants (Bartik, 1993; Blanchard and Katz, 1992). The results suggest that while expansion of an existing site may result in a minor boost to population from incoming workers, the negative externalities associated with occupying new facilities is a repelling force in county population dynamics. Some of the reasons given for larger employment impacts for expanding than for new firms, such as the temporary retention of families in prior locations, are also likely reflected in the differential population impacts estimated here.

To investigate the population impact further, again I aggregated the county of location/expansion and all counties adjacent to it. The population estimates were much different in this case, with cumulative five-year impacts of 1.998 for expansions and 0.606 for new firm locations. This suggests that the broader area (the resident county and its contiguous neighbors) gains approximately 200 residents for every 100 new jobs generated by large expansions and approximately 61 residents for every 100 jobs generated by large firm locations. The results suggest that in-migration stimulated by large new plant locations affects mainly neighboring counties, with negative externalities like congestion keeping the new residents from the border. For expansions, even resident population is moderately stimulated.

The feedback effects between population and employment are significant in each case, but the magnitudes are quite small. The results suggest that employment growth of 100 workers generates a decrease in population of 2.1 people, on average. An increase of 100 in population generates an employment increase of 3.6 workers, on average. The negative coefficient on employment in the population equation is surprising, as the two primary variables would be expected to move together. Together, results from the two equations could support the contention that jobs follow people rather than people follow jobs, but more likely reflects an increasing disconnect between migration and jobs (Vias and Mulligan, 1999), especially given the small coefficients and the level of geographic disaggregation.[8]

Other variables in the county employment and population equations generated what were, for the most part, expected results. Lagged values of employment and population are highly significant determinants of current levels. The coefficient on sales tax rates is negative, but statistically insignificant, in both the employment and population equations. Although the property tax rate was found to have a negative (and marginally significant) effect on population, the effect on employment is statistically zero. Crime rates were not found to be statistically significant in either of the two equations. Per capita income has a significant positive impact on employment, but surprisingly seems to have little impact on population. Population density is positive and significant in both equations.

Demographic variables generally are significant determinants of both population and employment. The percentage of the county that is black is negative and significant in the population equation, which is consistent with research suggesting that whites prefer to live in segregated areas while blacks prefer to live in integrated areas (Clark, 1991), propelling both towards white areas. The percentage of the adult population with at least a bachelor degree is positive and significant in both equations, as expected. The percentage of the adult population with less than a high school diploma is negative and significant in the population equations, as anticipated, but was found to be positive and significant in the employment equation. I suspect that employers favor locations for which there are pools of both low-wage workers for menial jobs and workers with college degrees for technical, management, and other high-skill positions. The poverty rate, which is excluded from the employment equation, has no statistically significant impact on population.

[8] Carlino and Mills (1987) and Vias and Mulligan (1999) suggest that a negative coefficient on employment in the population equation could reflect an unstable population-employment system; however, a coefficienct of less than unity on lagged population substantially diminishes the likelihood of that explanation in this case.

Other excluded variables include percent manufacturing and the wage in the employment equation and median year built of houses in the population equation. Given structural trends in employment, specifically the decline in manufacturing employment in the last few decades, I expected that the percentage of total employment in manufacturing would have a negative impact on total employment. While the point estimate is indeed negative, it is not statistically different from zero. The wage is negative and significant, as anticipated. Median year built of houses is positive and significant, suggesting that people are attracted to counties with a relatively new housing stock.

Variations Across Industry Types

In an effort to further examine the effects of large plant locations and expansions on population and employment, I broadened the empirical analysis to account for differences across SIC 1-digit industry classes.[9] The results for employment are presented in Table 7 and the results for population are presented in Table 8. New and expanding firms were aggregated for this section of the analysis for the sake of brevity.

Manufacturing, TCPU (transportation, communications and public utilities), and services had a positive impact on employment, with the associated Wald statistics all significant at the 99 percent confidence level.

The employment multiplier for manufacturing was less than unity at 0.685. By contrast, the U.S. Commerce Department's RIMS II multipliers for manufacturing, which do not account for many of the agglomeration forces and account for none of the dispersive forces discussed above, range from 1.99 (apparel and other textile products) to 5.2 (chemicals and allied products).[10] For manufacturing enterprises, specifically relatively low-tech cut-and-sew operations, low production cost tends to be the major factor in business location decisions, as evidenced by business surveys, the deconcentration in durable goods manufacturing, and the

[9] There were no large firm locations or expansions in the agriculture, mining, construction, or wholesale trade sectors in Georgia during the period of our analysis.

[10] See http://www.bea.doc.gov/bea/regional/rims.

shift of production from the northeast and Midwest to the relatively low-wage, right-to-work South, or overseas to southeast Asia and Latin America. This suggests that dispersion forces may be relatively more important in these types of industries. In a study of Japanese manufacturing plants, Mano and Otsuka (2000) found the "push" of firms away from cities by congestion (among other factors) is "pervasive," while the "pull" of agglomeration economies is "weak." Dekle and Eaton (1999) found that agglomeration forces were stronger for financial firms than manufacturing firms, and thus manufacturing firms were shifted elsewhere. Moreover, there are likely to be few synergies across manufacturing firms because of less reliance on skilled labor pools and information spillovers. Thus it is not surprising that manufacturing would come out at near bottom when I analyze the results by industry.

TCPU and services both show employment multipliers significantly greater than unity, at 2.136 and 6.156, respectively. On average, every 100 individuals employed by new or expanding enterprises generated 214 net workers in the TCPU industry and a substantial 616 workers in the services industry. The RIMS II multipliers for TCPU, which range from 2.29 (transportation) to 7.38 (electric, gas and sanitary services), are again higher than the employment multipliers estimated here, suggesting that dispersive forces may cause typically used input-output multipliers to overestimate employment impacts in this industry.

RIMS II multipliers for services range from 1.49 (eating and drinking places) to 2.00 (health services), which are considerably lower than those calculated here. I believe that part of the explanation may lie in the fact that these multipliers include only input-output linkages and induced spending, and no account is taken of other agglomeration forces such as labor pooling, knowledge spillovers, and especially urbanization economies, which I expect may be quite strong in the services industry. Seven of the nine firm locations and expansions in my dataset are in SIC 73: Business Services, for which the RIMS II employment multiplier is 1.98. Further, proximity to customers tends to be crucial in the services, trade, and construction industries. In this sense we might expect the expansion of local consumer markets that arises with large firm locations to drive service- and retail-based industries to high density areas. Nevertheless, the estimated size of the employment multiplier is clearly much larger than expected, and agglomeration forces in this industry probably are not significant enough to explain all of the difference between the multipliers estimated here for the services industry and the RIMS II multipliers.

New and expanding firms in neither the FIRE (finance, insurance, and real estate) nor the retail industries show a statistically significant impact (in total) on employment in the resident county. The cumulative impacts over five years, which again are not statistically significant, are –0.043 for the retail industry and –0.532 for FIRE.[11] The results for other variables in the system are consistent with those reported above.

As expected given earlier results, new firm locations and expansions generally had a negative impact on population in the resident county, with the exception of retail enterprises. The average cumulative five-year impact for new and expanding firms in the retail sector was 2.658, suggesting that new and expanding retail enterprises attract residents in relatively large numbers. For other industries the cumulative five year impact ranged between – 0.182 (manufacturing) to a substantial – 6.406 (services). Again, the negative externalities associated with occupying new facilities appears to be a strong repelling force in county population dynamics, with in-migrants locating residence in neighboring counties.

High-Tech vs. Low-Tech Firms

As a final effort to differentiate net employment and population impacts of significant new firm locations and expansions, I separated the industries into “high-tech” and “low-tech” groupings based on 4-digit SIC code, as described above. For high-technology firms, innovation, speed, and flexibility tend to be the major location factor, and input cost seems to be less important, which means that agglomeration forces are likely to relatively strong within high-technology industries, as reflected by the presence of high-technology concentrated areas like Route 128, Silicon Valley, and Research Triangle Park. Despite the unusually high average

[11] Only one firm located in Georgia in the FIRE industry during the period of our analysis.

wages in these communities, high-technology firms continue to flock there, as the agglomeration benefits presumably far out-weight the repellant forces of high labor costs and congestion costs. Recent empirical evidence supports the notion that high technology industries are more likely to benefit from agglomeration (Fujita and Tabuchi, 1997). Moreover, most high technology firms are small and competitive, the types of firms for which Rosenthal and Strange (2001) found the pull of knowledge spillovers to be strongest.

As expected, the results suggest that the location or expansion of large high-tech firms has a larger positive net local employment impact than does the location or expansion of non-high-tech enterprises (Table 9). The cumulative five-year impact for high-tech enterprises, as measured by the FRP definition, was 1.280, suggesting that approximately one spillover job is generated for every four jobs created by new and expanding high-tech enterprises. The cumulative five-year impact for low-tech enterprises was only 0.701. These results are consistent with my predictions above that high-tech enterprises are likely to be more motivated by agglomeration forces such as labor pooling and knowledge spillovers, while low-tech enterprises such as cut-and-sew manufacturing firms are more likely to be motivated by traditional cost factors. Differences in cumulative five-year impact between high-tech and low-tech firms according to the AEA definition of high technology industries is even more pronounced, at 1.651 and 0.692, respectively. The results suggest that efforts to attract high-tech firms are likely to be much more productive in terms of net employment impacts than are efforts to attract more traditional, low-tech enterprises.

There is a marked difference in population impact across the high-tech and low-tech classification of new and expanding enterprises. The location or expansion of high-tech enterprises is shown to have a significant negative five-year impact on population (-4.736), while the location or expansion of low-tech enterprises has a net positive effect on population (0.841). This result likely reflects the inclusion of retail enterprises among the low-tech category, which were shown to stimulate population, while the negative externalities associated with new and expanding firms generally seem to deter population growth.

5. CONCLUSION

This paper argues that the net economic impact of new firm locations or expansions is determined by a multitude of opposing forces. Forces for agglomeration include market size effects, supply linkages, information spillovers, labor pooling, and urbanization economies among other factors. Forces for dispersion are centered mostly around input costs: wage and rent pressures, congestion, and tax burdens.

Using a unique database, I then set out to evaluate the net effects of these opposing forces by looking at the net change in local employment and population arising from large (greater than 300 new jobs) firm locations or expansions in the State of Georgia. The analysis suggests that the employment multipliers associated with these events are less than one for new firm locations, on average; that is, that the net employment effect of a large firm opening or expansion is smaller than the gross employment impact. Because the cost per job of incentives packages generally are calculated on the basis of gross job impacts, we argue that these cost estimates generally are too low by 71.5 percent, on average. The relevant multiplier for expanding firms is considerably larger at 2.0, suggesting that one spillover job is generated for every new employee hired by expanding firms. I find that the impact of large firm locations or expansions on population in the resident county generally is negative for newly locating enterprises and statistically zero for expansions. I find that the population impact is positive for both new and expanding firms in the broader area consisting of the resident county and its contiguous neighbors.

I also find that large firm locations and expansions in the services and transportation, communications, and public utilities sectors tend to result in the most significant positive net employment impacts, with multipliers that are 2.1 and 6.2, respectively, by five years out. I find that manufacturing firms have a significant positive impact on employment in the resident county, but that the multiplier is less than unity, suggesting that dispersive forces outweigh agglomeration forces with new employment in these industries. Large firm locations and expansions in the retail and finance, insurance, and real estate sectors are shown to generate no statistically significant effects on total county employment either initially or longer term. For all sectors other than retail there were zero or negative population effects for large firm openings and expansions. Retail was shown to generate significant positive population effects relative to the employment generated.

Finally, I show that the location or expansion of large high technology firms are likely to generate more in the way of employment benefits and population losses than are the locations or expansions of non-high-tech firms.

In total my results suggest that the net economic impact of large new firm locations generally are over-estimated, as traditional input-output models generate gross impacts that are always larger than 1.0, sometimes considerably greater, and these gross impacts generally are used for calculating the costs per job of economic development incentive packages. The results suggest that local governments are not likely to receive significant long-term employment or population benefits from large new firm locations, where estimated multipliers are on the order of 0.3, and therefore local governments should be skeptical of typical economic impact studies which encourage the recruitment of these firms with incentives. Large expansions of existing enterprises do have a substantial multiplicative impact on employment in the resident county, however.

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TABLES

Table 1: Data Sources and Descriptive Statistics

Variable	Description	Source	Mean (Std. Dev.)
Employment	Wage and salary employment	BEA	12,105 (19,252)
Population	Population	BEA	29,235 (34,805)
Population Density	Population per square mile	BEA	94.2 (131.2)
Violent Crime Rate	Violent crimes per 1,000 population	Georgia Bureau of Investigation	3.4 (3.1)
Property Crime Rate	Property crimes per 1,000 population	Georgia Bureau of Investigation	26.2 (21.5)
% of Employment in Manuf	Percentage of employment in manufacturing	BEA (REIS)	23.0 (12.0)
Wage	Per-worker net earnings (wage proxy) (real)	BEA (REIS)	\$27,906 (\$3,638)
Per Capita Income	Per capita income (real)	BEA (REIS)	\$17,016 (\$2,635)
Sales Tax Rate	Statutory sales tax rate	Fiscal Research Program	5.6 (0.5)
Property Tax Rate	Effective property tax rate	Author's calculations from data provided by the Georgia Dept of Revenue	1.0 (0.2)
Median Year House Built	Median Year House Built	U.S. Census Bureau	1973 (5.2)
% with BA Degree	Percent of population >25 with a BA degree or higher	U.S. Census Bureau	11.3 (5.4)
% Not High School Grad	Percent of population with less than a high school education	U.S. Census Bureau	37.0 (9.2)
% in Poverty	Percent of the population living below the poverty line	U.S. Census Bureau	18.6 (6.9)
% Black	Percent of the population that is black	U.S. Census Bureau	27.4 (17.3)
Unemployment Rate	Unemployment rate	Georgia Department of Labor	6.4 (2.2)
	Employment of new and expanding firms	Georgia Department of Community Affairs / Georgia Department of Labor / Other Sources	

Table 2: Descriptive Statistics for New and Expanding Firms in Georgia, 1984 – 1998

Item	All Firms	New Firms	Expanding Firms
Number of Establishments	91	68	23
Announced Employment [a]	44,458	31,990	11,568
Actual Employment [b]	39,162	27,565	10,697
Actual as a Percent of Announced	88.1	86.2	92.5
Average New Jobs per Firm	430	418	465

[a] As reported to the Georgia Department of Community Affairs
[b] Average over first five years

Figure 1: New and Expanding Firm Locations (300+ New Jobs), 1984 – 1998

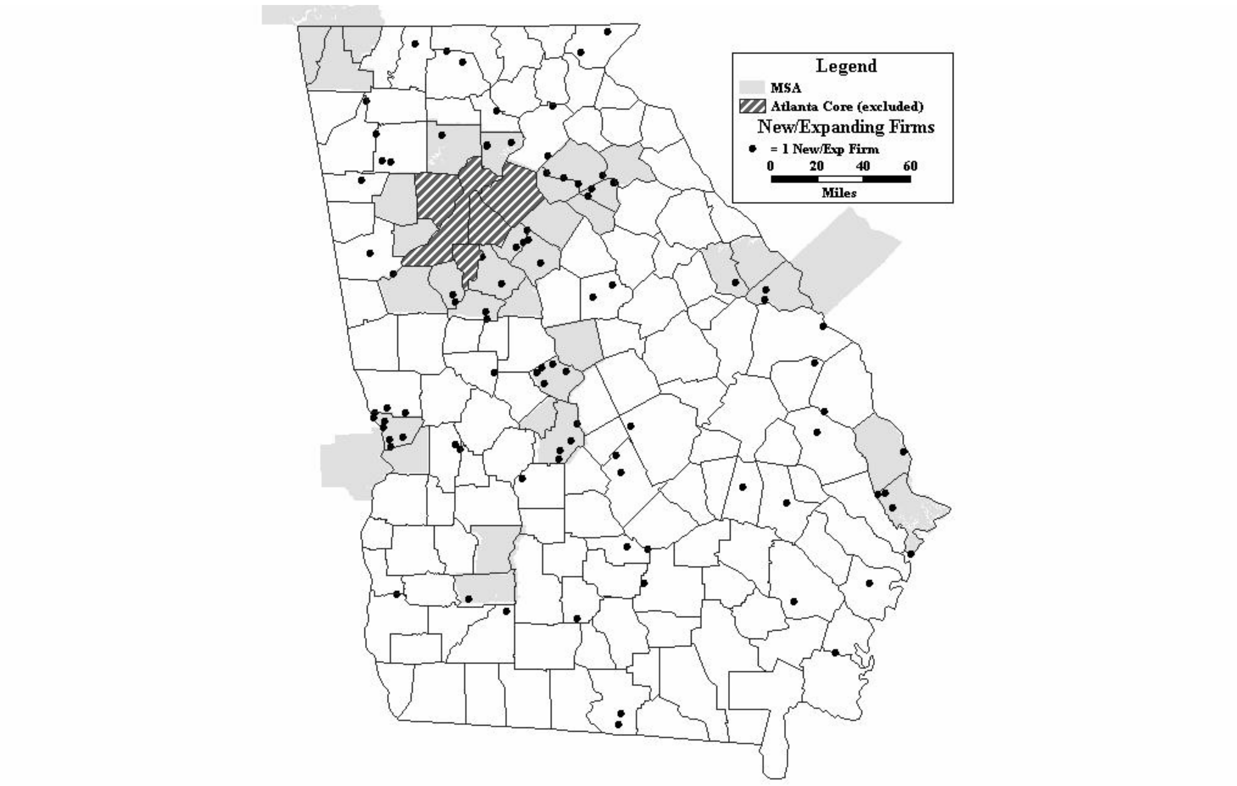

Table 3: New and Expanding Firms in Georgia, 1984 – 1998, by Industry Type

1-Digit SIC Breakdown

SIC	Industry Description	#
D	Manufacturing	62
E	Transportation, Communications, and Public Utilities	4
G	Retail Trade	15
H	Finance, Insurance, and Real Estate	1
I	Services	9
	TOTAL	**91**

2-Digit SIC Breakdown

SIC	Description	#	SIC	Description	#
20	Food and Kindred Products	16	37	Transportation Equipment	6
22	Textile Mill Products	11	42	Motor Freight Transportation and Warehousing	2
23	Apparel and Other Finished Products Made From Fabrics	4	47	Transportation Services	1
24	Lumber and Wood Products, Except Furniture	1	48	Communications	1
26	Paper and Allied Products	2	52	Buildg Materials, Hardware, Garden Supply, and Mobile Home Dealers	2
27	Printing, Publishing, and Allied Industries	3	53	General Merchandise Stores	12
28	Chemicals and Allied Products	1	56	Apparel and Accessory Stores	1
30	Rubber and Miscellaneous Plastics Products	5	65	Real Estate	1
32	Stone, Clay, Glass, and Concrete Products	1	73	Business Services	7
34	Fabricated Metal Products, Exc Machinery and Transp Equip	2	80	Health Services	1
35	Industrial and Commercial Machinery and Computer Equipment	3	87	Engineering, Accounting, Research, Management, and Related Services	1
36	Electr and Other Elec Equip and Components, Excl Computer Equip	7		**TOTAL**	**91**

Table 4: High Technology Industry Definitions

American Electronics Association (AEA)

3571 3572 3575 3577 3578 3579 3651 3652 3661 3663 3669 3671 3672 3675 3676 3677 3678 3679 3821 3822 3823 3824 3825 3826 3829 3827 3861 3821 3844 3845 4812 4813 4822 4841 4899 7371 7372 7373 7374 7375 7376 7377 7378 7379

Fiscal Research Program (FRP)

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Table 5: Results, Employment Equation

Variable	Parameter Estimate (Std. Error)	Variable	Parameter Estimate (Std. Error)
Intercept	- 2,375.6*** (528.1)	*% Not High School Grad*	14.7** (7.0)
Population	0.036*** (0.008)	*% in Poverty*	
Employmen		*% Black*	40.0*** (7.9)
Lagged Employment	0.890*** (0.008)	*Unemployment Rate*	- 46.5*** (7.7)
Lagged Population		*Expanding (Year 0)*	0.147 (0.199)
Population Density	3.859* (2.038)	*Expanding (Year 1)*	0.292 (0.200)
Violent Crime Rate	- 9.670 (6.658)	*Expanding (Year 2)*	0.641*** (0.201)
Property Crime Rate	0.647 (0.998)	*Expanding (Year 3)*	0.456** (0.204)
% of Employmwnt in Manuf	- 3.389 (2.777)	*Expanding (Year 4)*	1.227*** (0.215)
Wage	- 0.021*** (0.008)	*New (Year 0)*	0.141 (0.128)
Per Capita Income	0.158*** (0.019)	*New (Year 1)*	0.053 (0.131)
Sales Tax Rate	- 45.1 (29.2)	*New (Year 2)*	- 0.063 (0.137)
Property Tax Rate	78.4 (97.9)	*New (Year 3)*	- 0.197 (0.144)
MedianYear House Built		*New (Year 4)*	0.456*** (0.167)
% with BA degree	31.2*** (10.1)		
F-statistic Overidentifying Restrictions	0.80		
F-statistic Joint (*Expanding* = 0)	8.27***		
F-statistic Joint (*New* = 0)	2.43**		

*** Indicates significance at the 99% confidence level
** Indicates significance at the 95% confidence level
* Indicates significance at the 90% confidence level

Table 6: Results, Population Equation

Variable	Parameter Estimate (Std. Error)	Variable	Parameter Estimate (Std. Error)
Intercept	- 108,759*** (21,961)	*% Not High School Grad*	- 37.4*** (8.4)
Population		*% in Poverty*	11.6 (8.5)
Employmen	- 0.021** (0.009)	*% Black*	- 38.1*** (8.2)
Lagged Employment		*Unemployment Rate*	- 15.7** (7.5)
Lagged Population	0.961*** (0.008)	*Expanding (Year 0)*	0.432** (0.200)
Population Density	23.1*** (1.9)	*Expanding (Year 1)*	- 0.121 (0.201)
Violent Crime Rate	- 3.237 (6.707)	*Expanding (Year 2)*	0.207 (0.203)
Property Crime Rate	1.0 (1.0)	*Expanding (Year 3)*	0.059 (0.206)
% of Employmwnt in Manuf		*Expanding (Year 4)*	0.027 (0.218)
Wage		*New (Year 0)*	- 0.342*** (0.129)
Per Capita Income	0.016 (0.018)	*New (Year 1)*	- 0.280** (0.131)
Sales Tax Rate	- 30.1 (29.4)	*New (Year 2)*	- 0.278** (0.138)
Property Tax Rate	- 183.9* (98.8)	*New (Year 3)*	0.138 (0.145)
MedianYear House Built	56.3*** (11.1)	*New (Year 4)*	0.027 (0.169)
% with BA degree	21.9** (10.4)		
F-statistic Overidentifying Restrictions	0.11		
F-statistic Joint (*Expanding* = 0)	1.15		
F-statistic Joint (*New* = 0)	2.97**		

*** Indicates significance at the 99% confidence level
** Indicates significance at the 95% confidence level
* Indicates significance at the 90% confidence level

Table 7: Results, Employment Equation (by Industry)

Variable	Parameter Estimate (Std. Error)	Variable	Parameter Estimate (Std. Error)
Intercept	- 2,414.2*** (521.4)	*Manufacturing (Year 3)*	- 0.295** (0.149)
Population	0.039*** (0.008)	*Manufacturing (Year 4)*	0.663*** (0.153)
Employmen		*TCPU (Year 0)*	0.829** (0.355)
Lagged Employment	0.882*** (0.009)	*TCPU (Year 1)*	0.737** (0.355)
Lagged Population		*TCPU (Year 2)*	0.999*** (0.359)
Population Density	3.865* (2.039)	*TCPU (Year 3)*	- 0.255 (0.362)
Violent Crime Rate	- 13.0** (6.5)	*TCPU (Year 4)*	0.091 (0.380)
Property Crime Rate	1.078 (0.978)	*Retail (Year 0)*	- 0.265 (0.007)
% of Employmwnt in Manuf	- 2.090 (2.726)	*Retail (Year 1)*	0.142 (0.230)
Wage	- 0.022*** (0.008)	*Retail (Year 2)*	- 0.251 (0.240)
Per Capita Income	0.170*** (0.019)	*Retail (Year 3)*	- 0.022 (0.244)
Sales Tax Rate	- 61.7** (28.8)	*Retail (Year 4)*	0.508 (0.380)
Property Tax Rate	18.8 (96.2)	*FIRE (Year 0)*	0.687 (0.789)
MedianYear House Built		*FIRE (Year 1)*	- 0.435 (0.790)
% with BA degree	29.4*** (10.0)	*FIRE (Year 2)*	- 1.213 (0.789)
% Not High School Grad	16.1** (6.9)	*FIRE (Year 3)*	0.158 (0.790)
% in Poverty		*FIRE (Year 4)*	
% Black	36.5*** (7.8)	*Services (Year 0)*	- 0.301 (0.381)
Unemployment Rate	- 46.4*** (7.5)	*Services (Year 1)*	- 0.077 (0.385)
Manufacturing (Year 0)	0.383*** (0.137)	*Services (Year 2)*	2.646*** (0.516)
Manufacturing (Year 1)	0.119 (0.138)	*Services (Year 3)*	3.565*** (0.529)
Manufacturing (Year 2)	- 0.054 (0.140)	*Services (Year 4)*	3.338*** (0.545)
F-statistic (Over ID)	0.90	F-statistic (*Retail*)	0.92
F-statistic (*Manufacturing*)	6.68***	F-statistic (*FIRE*)	0.94
F-statistic (*TCPU*)	3.26***	F-statistic (*Services*)	19.82***

*** Indicates significance at the 99% confidence level
** Indicates significance at the 95% confidence level
* Indicates significance at the 90% confidence level

Table 8: Results, Population Equation (by Industry)

Variable	Parameter Estimate (Std. Error)	Variable	Parameter Estimate (Std. Error)
Intercept	- 98,880*** (21,303)	*Manufacturing (Year 3)*	0.073 (0.147)
Population		*Manufacturing (Year 4)*	0.318** (0.152)
Employmen	- 0.007 (0.010)	*TCPU (Year 0)*	- 0.856** (0.354)
Lagged Employment		*TCPU (Year 1)*	- 1.370*** (0.353)
Lagged Population	0.951*** (0.008)	*TCPU (Year 2)*	- 1.395*** (0.357)
Population Density	24.2*** (1.9)	*TCPU (Year 3)*	- 0.796** (0.359)
Violent Crime Rate	0.906 (6.515)	*TCPU (Year 4)*	- 1.578*** (0.377)
Property Crime Rate	0.579 (0.973)	*Retail (Year 0)*	0.598*** (0.225)
% of Employmwnt in Manuf		*Retail (Year 1)*	0.476** (0.229)
Wage		*Retail (Year 2)*	0.741*** (0.239)
Per Capita Income	0.002 (0.018)	*Retail (Year 3)*	0.987*** (0.242)
Sales Tax Rate	- 7.325 (28.7)	*Retail (Year 4)*	0.108 (0.378)
Property Tax Rate	- 91.4 (95.9)	*FIRE (Year 0)*	- 0.324 (0.785)
MedianYear House Built	51.1*** (10.8)	*FIRE (Year 1)*	- 0.267 (0.786)
% with BA degree	23.9** (10.2)	*FIRE (Year 2)*	- 0.036 (0.785)
% Not High School Grad	- 28.0*** (8.2)	*FIRE (Year 3)*	0.100 (0.786)
% in Poverty	5.704 (8.240)	*FIRE (Year 4)*	
% Black	- 30.7*** (8.1)	*Services (Year 0)*	- 0.326 (0.378)
Unemployment Rate	- 13.4* (7.3)	*Services (Year 1)*	- 1.032*** (0.382)
Manufacturing (Year 0)	- 0.357*** (0.136)	*Services (Year 2)*	- 4.431*** (0.515)
Manufacturing (Year 1)	- 0.195 (0.137)	*Services (Year 3)*	- 1.061** (0.532)
Manufacturing (Year 2)	0.042 (0.138)	*Services (Year 4)*	- 1.644*** (0.549)
F-statistic (Over ID)	0.05	F-statistic (*Retail*)	5.96***
F-statistic (*Manufacturing*)	2.88**	F-statistic (*FIRE*)	0.07
F-statistic (*TCPU*)	8.21***	F-statistic (*Services*)	16.02***

*** Indicates significance at the 99% confidence level
** Indicates significance at the 95% confidence level
* Indicates significance at the 90% confidence level

Table 9: Results, Employment Equation (by technology definition)

Variable	Parameter Estimate (Std. Error)	Variable	Parameter Estimate (Std. Error)
Intercept	- 2,354*** (529)	*% Not High School Grad*	14.8** (7.0)
Population	0.038*** (0.008)	*% in Poverty*	
Employmen		*% Black*	36.2*** (8.0)
Lagged Employment	0.894*** (0.008)	*Unemployment Rate*	- 44.3*** (7.7)
Lagged Population		*FRP (Year 0)*	0.220 (0.228)
Population Density	2.585 (2.093)	*FRP (Year 1)*	- 0.123 (0.230)
Violent Crime Rate	- 11.6* (6.7)	*FRP (Year 2)*	0.241 (0.240)
Property Crime Rate	0.886 (1.000)	*FRP (Year 3)*	0.525** (0.252)
% of Employmwnt in Manuf	- 2.270 (2.783)	*FRP (Year 4)*	0.942*** (0.275)
Wage	- 0.021*** (0.008)	*Not FRP (Year 0)*	0.085 (0.120)
Per Capita Income	0.159*** (0.019)	*Not FRP (Year 1)*	0.142 (0.121)
Sales Tax Rate	- 48.8* (29.3)	*Not FRP (Year 2)*	0.111 (0.126)
Property Tax Rate	57.6 (98.1)	*Not FRP (Year 3)*	- 0.093 (0.131)
MedianYear House Built		*Not FRP (Year 4)*	0.730*** (0.146)
% with BA degree	32.0*** (10.2)		
F-statistic Overidentifying Restrictions	0.91		
F-statistic Joint (*FRP* = 0)	3.25***		
F-statistic Joint (*Not FRP*) = 0	5.48***		

*** Indicates significance at the 99% confidence level
** Indicates significance at the 95% confidence level
* Indicates significance at the 90% confidence level

Table 10: Results, Population Equation (by technology definition)

Variable	Parameter Estimate (Std. Error)	Variable	Parameter Estimate (Std. Error)
Intercept	- 95,448*** (21,580)	*% Not High School Grad*	- 31.3*** (8.3)
Population		*% in Poverty*	8.135 (8.365)
Employmen	- 0.017* (0.009)	*% Black*	- 36.9*** (8.1)
Lagged Employment		*Unemployment Rate*	- 16.9** (7.4)
Lagged Population	0.953*** (0.008)	*FRP (Year 0)*	- 0.690*** (0.225)
Population Density	25.8*** (1.9)	*FRP (Year 1)*	- 0.956*** (0.225)
Violent Crime Rate	- 2.338 (6.587)	*FRP (Year 2)*	- 1.691*** (0.236)
Property Crime Rate		*FRP (Year 3)*	- 0.713*** (0.248)
% of Employmwnt in Manuf		*FRP (Year 4)*	- 1.191*** (0.271)
Wage		*Not FRP (Year 0)*	0.091 (0.119)
Per Capita Income	0.006 (0.018)	*Not FRP (Year 1)*	- 0.001 (0.120)
Sales Tax Rate	- 19.6 (28.9)	*Not FRP (Year 2)*	0.323*** (0.124)
Property Tax Rate	- 166.6* (96.9)	*Not FRP (Year 3)*	0.281** (0.129)
MedianYear House Built	49.5*** (10.9)	*Not FRP (Year 4)*	0.260* (0.144)
% with BA degree	14.3 (10.3)		
F-statistic Overidentifying Restrictions	0.15		
F-statistic Joint (*FRP* = 0)	15.35***		
F-statistic Joint (*Not FRP*) = 0	2.55**		

*** Indicates significance at the 99% confidence level
** Indicates significance at the 95% confidence level
* Indicates significance at the 90% confidence level