

LAND USE POLICY PRESCRIPTIONS FOR LOCAL GOVERNMENT USING SPATIALLY ORIENTED DATA^[a]

By

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ABSTRACT

This paper presents a model of land prices for the Valdosta-Lowndes County Industrial Authority, with the goal to recommend the parcels it should purchase to meet 2030 industrial employment projections. This model is coupled with a separate multi-criteria analysis by the South Georgia Regional Development Center that uses geographic information system data, which allows us to determine parcel development suitability for industrial purposes. Using these two different data sources with no overlapping variables, the hedonic regression model and parcel suitability study are used jointly to predict the similar parcels should be purchased and developed by the Industrial Authority.

INTRODUCTION

Comprehensive land-use and transportation planning is essential to the successful growth of an area. This kind of planning seeks to determine the appropriate mix of land uses and transportation alternatives that will attract new businesses, new households, and retain existing businesses and households. It is easy to see the recursive relationship that exists between land-use planning and transportation planning: transportation planning impacts the existing land-use designations *and* the existing land-use designations impact future transportation planning. This is the justification for the simultaneous consideration of alternative land uses and the kinds of transportation alternatives an area will consider.

Valdosta, Georgia gained Metropolitan Statistical Area (MSA) status after the 2000 Census. The federal government requires of all urbanized areas “transportation planning activities that will improve the transportation system and help coordinate the area’s future growth within the area bounded, at minimum, by the existing Urbanized Area plus the contiguous area expected to become urbanized within the next 20 years” (Final Metro 2030 Long Range Transportation Plan) as required by Title 23 (U.S.C. 134 Section 450.322). As part of these planning activities, the South Georgia Regional Development Center (SGRDC), which is the local Metropolitan Planning Organization (MPO) for the urbanized area, created a parcel suitability algorithm to determine the most likely land uses for each parcel in Lowndes County. This algorithm and its data requirements, which are included in the Lowndes Comprehensive Plan, will be discussed in the Methods and Data section of the paper.

The use of this parcel suitability algorithm, we argue, should not be used alone to prescribe policy for the local government. While land characteristics (i.e. supply side characteristics) are captured by this algorithm, the *willingness to pay* by land consumers for certain land characteristics are not considered by this algorithm. Therefore, since actual land purchases (i.e. arms-length transactions) communicate willingness to pay information, it is important to consider jointly the demand for certain characteristics of

land, including their location in the county, and the supply side characteristics of land. The willingness to pay for certain land characteristics will be modeled using a hedonic property value model, the details of which also will be included in the Methods and Data section of the paper. We argue here that policy prescriptions for local government are possible using not only historical data on land sales and distance variables, but also geographic descriptors of water and sewer infrastructure availability, concentrations of natural resources (water, forestlands, etc.), flood plains, and other descriptors.

Considering both the characteristics of land that make it suitable for particular uses and the willingness to pay for specific land parcels, this paper uses the two separate processes to determine the locations in Lowndes County that are most suitable for future expansion of industrial parks. Interestingly, the data requirements for each algorithm are completely different with no overlapping variables. So, these two processes can be viewed as the separate contributions of government agencies and academic researchers, which when brought together can be used to produce policy prescriptions for local government that are statistically validated.

THEORETICAL MODEL

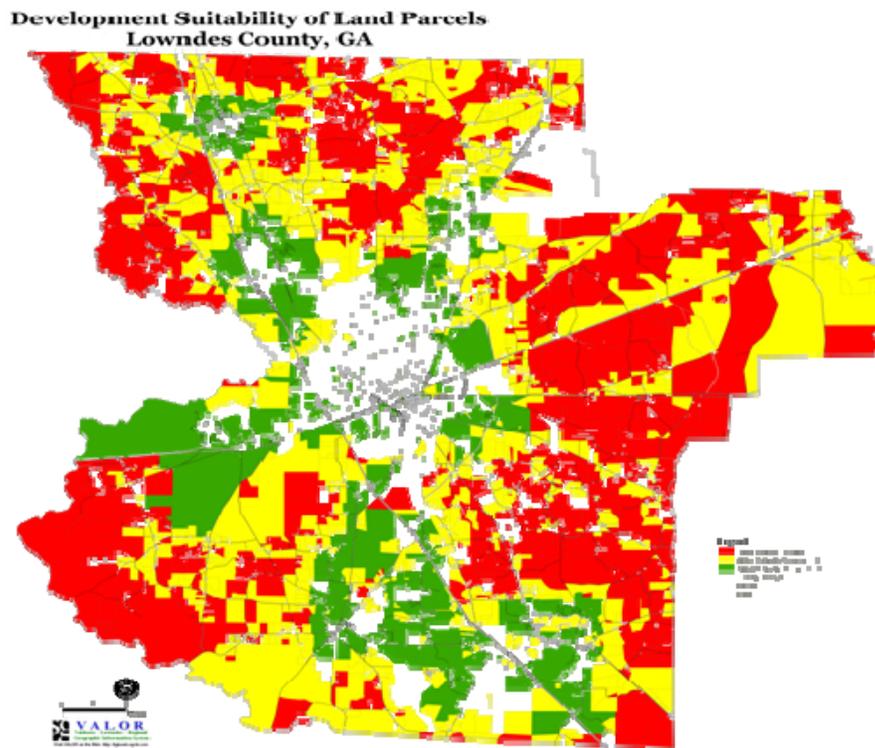
Consider a metropolitan area with a variety of manufacturing and service activities distributed heterogeneously across space. Within this space, clusters of manufacturing and service activity exist in industrial parks created by the Valdosta-Lowndes County Industrial Authority (VLCIA).^[b] Land parcels are assumed to be of identical quality at all locations, a reasonable assumption given the topography of the area. Establishments choose to locate to the parcel that best suits their needs, whether or not these parcels are located within industrial parks; industrial activities “require large spaces per employee and tremendous external inputs such as utilities, transportation, and labor” (Hughes 1994, p. 306).^[c] Establishments actually bid upon a bundle of characteristics associated with each parcel, including the distances of these parcels from interstate interchanges, from deep-water ports, from major urban centers, and even from the central business district (CBD). [The latter is used to test the monocentric model assumption.] Other characteristics in these bundles include the structural characteristics of the buildings that occupy these parcels^[d] and the package of local public goods.

According to McCann (2001), the “firm land consumption decision is modeled using a profit function” (p. 127). So, in this model, each establishment in an industrial park seeks to maximize its bid for a particular site subject to an acceptable amount of profit. Following Blackley (1984), the representative establishment is assumed to have a general production function $Q = Q[X, L(Z)]$ where Q is the level of output, X is a vector of nonsite factors of production that measure firm characteristics, and L is the site factor of production that depends on a vector of site attributes, Z . Then, the establishment’s profit equation can be expressed as $\pi = P*Q[X, L(Z)] - nX - R*L(Z)$, where π is profit, P is the market price of the product sold, n is a vector of average nonsite factor prices, and R is the unit price of the establishment’s location. “Then, if we use average market prices for n , all differentials in factor availability over the metropolitan area are capitalized into the site price. Thus, the expenditure on the site input, $R*L(Z)$, is a function of site attributes, a formulation consistent with the hedonic theory of housing price determination” (Blackley 1984, p. 543). So, the next step is to describe the data and methods used to create the parcel suitability model and to estimate the hedonic property value model.^[e]

METHODS AND DATA

Parcel suitability model

To create the parcel suitability model, the SGRDC first identifies the land parcels in Lowndes County that are not developed. Then, the coincidence of each undeveloped parcel with natural resources, transportation access, and water/sewer infrastructures is analyzed and recorded as attributes of the parcels themselves. This process forms multiple data layers that may be overlaid on each other to determine parcel suitability. The specific variables include flood hazard areas, wetlands, ground recharge areas, transportation network access, and water and sewer infrastructure accessibility.



Mickey-Minnie 1

Layer	Best-4	3	2	1	Worst-0
Flood Hazard Areas	0-10% of land area	10-30% of land area	30-50% of land area	50-70% of land area	70-100% of land area
NWI Designated Wetlands	0-10% of land area	10-30% of land area	30-50% of land area	50-70% of land area	70-100% of land area
Groundwater Recharge Areas				NOT in a recharge area	IN a groundwater recharge area
Access to the Transportation Network	Access via an Arterial Road/Street	Access via Paved Major or Minor Collector	Access via Dirt Major Collector or Local Paved Road	Access via a Dirt Minor Collector	Access via a Dirt Local road/street.
Future Water Utility				IN a planned service area	NOT in a planned service area
Future Sewer Utility				IN a planned service area	NOT in a planned service area
Existing Water Utility	Intersects the 1/2 mile buffer	Intersects the 1/2 mile buffer	Intersects the 1/4 mile buffer	Intersects the 1 mile buffer	DOES NOT intersect buffers of existing services
Existing Sewer Utility	Intersects the 1/2 mile buffer	Intersects the 1/2 mile buffer	Intersects the 1/4 mile buffer	Intersects the 1 mile buffer	DOES NOT intersect buffers of existing services

Figure 1. Parcel Suitability Map and Multi-Criteria Ranking System

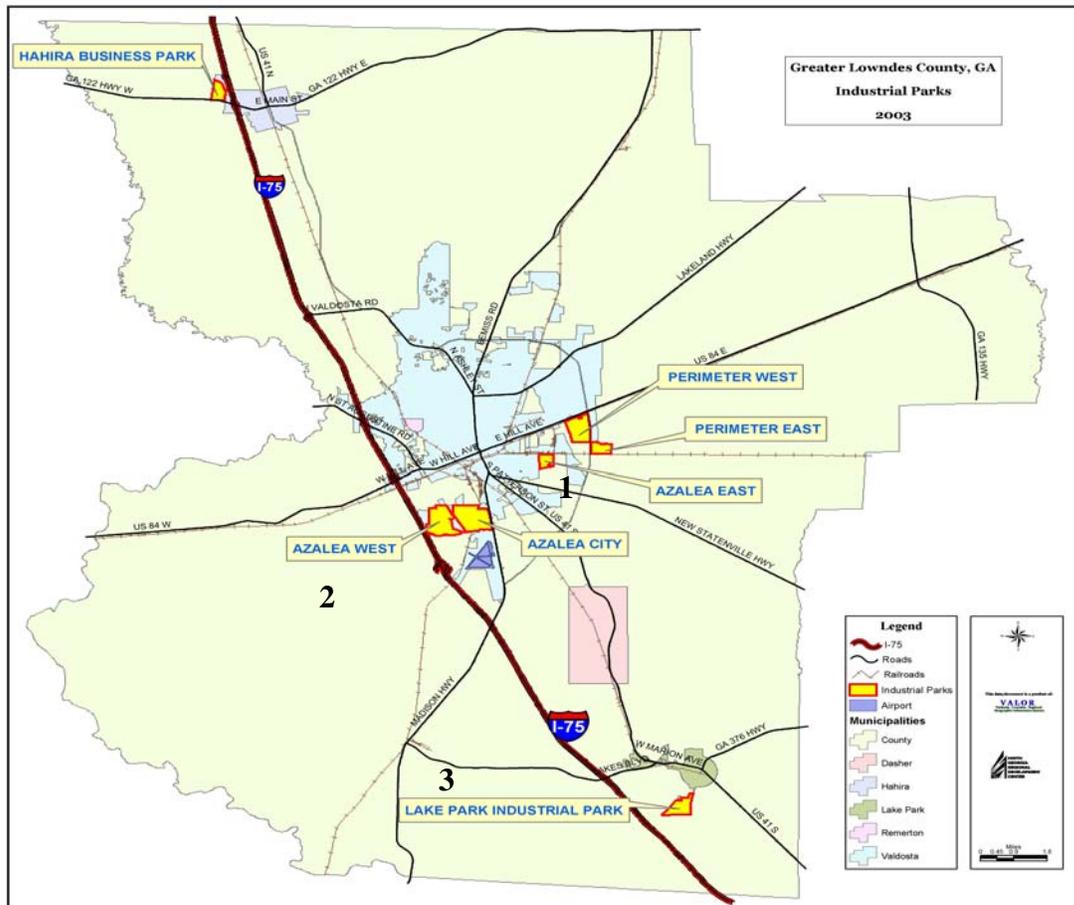


Figure 2. Lowndes County Industrial Parks

Figure 1 shows the parcel suitability map for Lowndes County as well as the scoring process used to classify parcels according to a five-category multi-criteria ranking. Also, Figure 2 shows a map of the Lowndes County industrial parks.

Hedonic property value model

To create the hedonic property value model, data were collected from the VLCIA. These data include establishment names and addresses, the type of establishment (manufacturing or service), the year it opened for business, the number of employees, total payroll, whether or not the establishment has a freeport exemption on goods sold across state lines, the number of acres owned, and parcel site attributes such as fire insurance rating and the presence of water, sewer, and natural gas lines on the parcel. Once these data were obtained, then each address was geocoded by the SGRDC, which allowed the distance of each parcel to important locations to be calculated. These locations include the CBD, Moody Air Force Base, the nearest Interstate 75 interchange, the deep-water port in Brunswick, barge service in Bainbridge, the City of Atlanta, the City of Jacksonville, and the City of Tallahassee.^[f,g]

Since we do not have data on the characteristics of the structures that occupy the land, traditional hedonic estimates for structural characteristics are not attainable. *Note that the sales price variable in this research (natural log of sales price) is the amount paid for the bare land, and not any structure that occupies the parcel.* This suggests that we can decompose the sales price of the land into particular site attributes Z to determine the attributes of industrial park parcels that generate a positive and negative price premium. So, in this study, we specify the following hedonic equation:

$$\ln P_i = \beta_0 + \beta_1 \ln(ACRES) + \beta_2 YEAR + \beta_3 SPACE + \beta_4 WATER + \beta_5 \ln(D_CBD) + \beta_6 \ln(D_MOODY) + u_i . \quad (1)$$

In this log-log model, $\ln P_i$ is the natural log of sales price, the estimated coefficients β_1 , β_5 , and β_6 are elasticities that can be manipulated to report marginal effects in dollars, and u_i is a random error term that is normally distributed with mean zero and constant standard deviation σ . Since sales of industrial park parcels occurred throughout the 1972 to 2005 period, we account for inflation by converting the nominal sales prices into 2005 dollars using Consumer Price Index data from the Bureau of Labor Statistics, U.S. Department of Commerce. These regression estimates contain powerful information that can be used to inform the policy decisions of local governments as they choose future sites for industrial development. The next section presents these results.

RESULTS

Descriptive statistics

Some descriptive statistics are reported in Table 1.

Table 1. Descriptive Statistics for Industrial Park Establishments

Variable	Description	Mean	Standard Deviation
PRICE	Parcel Sales Price (in 2005 dollars)	241011	710818
SPACE	= 1 if Business has Room for Expansion, 0 otherwise	.09	.29
FREEPORT	= 1 if Business has Freeport Exemption on Cross-State Sales, 0 otherwise	.78	.41
YEAR	Year of Parcel's Purchase	1996	7.69
ACRES	Number of Acres in the Parcel	8.17	18.48
WATER	=1 if Presence of Water and Sewer Infrastructure, 0 otherwise	.65	.47
D_CBD	Distance to Valdosta CBD	4.29	4.31
D_MOODY	Distance to Moody Air Force Base	14.91	4.20
D_RAILX	Distance to Railroad Transfer Station	4.13	3.94
D_I-75	Distance to Nearest I-75 Interchange	2.75	1.50

The average establishment located in an industrial park has 58 employees, operates on 8.17 acres, and has a payroll of \$1,984,672. 65 percent of the parcels have existing water and sewer infrastructure at the time of purchase. Also, we see that 9 percent of establishments have acres on which they can expand their operations and that 78 percent of establishments have freeport exemption, meaning that they can sell their goods across state lines without incurring an additional export-type tax.

Analysis also was conducted that relates current employment density (number of jobs per acre of land used) to projected employment based on analysis by the SGRDC. Currently, VLCIA-assisted establishments have an average employment density of six jobs per acre. But, by category, we see that manufacturing establishments in industrial parks have an employment density of nine jobs per acre compared to seven for service establishments.

Table 2. Top 15 Employment Density Establishments

Name	Jobs per Acre
Bath Craft Inc.	46.0
US Press Inc.	33.3
U.P.S. Center	33.3
Regal Marine	25.2
Shaw Industries	23.2
Five Star Foods Inc.	22.5
T.M. Poly Film Inc.	19.7
Firstline Corp	16.7
Grey Flex/Snap Rite	16.6
Beardin Trucking	15.8
MAAX U.S.A.	14.9
Market Bag Co.	14.5
Ryder Transportation Services	12.7
Dillard's Distribution Center	12.5
Roadway	11.8

Table 2 shows the 15 establishments with the highest employment densities in the industrial parks. These results will be discussed further in the Discussion section.

Regression estimates

Land price variation for industrial property depends on relevant public goods and services such as streets and highways, sanitation, and police and fire protection (McDonald and Yurova, 2006). In preliminary runs of the hedonic model, a lack of variation in variables such as fire insurance ratings lead to a low degree of explanatory power of the natural log of sales price. Also, since we only consider the establishments that locate in industrial parks in Lowndes County, we avoid consideration of variables that relate to the tax structure. In addition, the VLCIA does not collect data on the characteristics of the establishment itself except for payroll and the number of employees. So, the log-log hedonic property value estimates in Table 3 depict the most parsimonious model that explains the variation in the natural log of parcel sales price.

Table 3. OLS Regression Results, Robust Standard Errors
(Dependent Variable: Natural Log of Parcel Sales Price in 2005 dollars)

Variable	All Industries	Service Industries Only	Manufacturing Industries Only
	<i>Coefficient</i> <i>(Std. Error)</i>	<i>Coefficient</i> <i>(Std. Error)</i>	<i>Coefficient</i> <i>(Std. Error)</i>
Constant	70.97*** (7.64)	54.11*** (9.44)	78.63*** (11.26)
LN(ACRES)	1.06*** (.03)	1.08*** (.04)	1.03*** (.06)
YEAR	-.03*** (.003)	-.02*** (.004)	-.03*** (.005)
SPACE	.14* (.07)	.14 (.15)	.16** (.07)
WATER	-.10 (.12)	.05 (.23)	-.33** (.13)
LN(D_CBD)	-.12* (.07)	-.13 (.11)	-.19* (.10)
LN(D_MOODY)	.10 (.16)	.84*** (.22)	-.21 (.16)
F-Statistic	231.54	273.34	180.12
R-Square	.97	.97	.97
Root Mean Squared Error	.20	.20	.20
Number of Observations	69	41	28

The regression results suggest seven different outcomes that relate to the spatial variation of parcel sales price in Lowndes County industrial parks:

1. A positive and significant relationship exists between the number of acres at a site and the sales price. This suggests that a one percent change in the number of acres corresponds to a 1.06 percent change in the sales price, *ceteris paribus*.
2. A negative and significant relationship exists between the purchase date of a site and the sales price. This suggests that, even with the sales price variable reported in 2005 dollars, the sales prices of more recent site sales have decreased and have not kept pace with inflation.
3. A positive and significant relationship exists between the presence of land available for business expansion and the sales price. This suggests that a positive premium exists for the opportunity to expand facilities for current establishments, *ceteris paribus*. This premium might be a proxy for “option value”, meaning the value to the company of leaving open the option of expanding the establishment in the future. In fact, the data suggest that this result is even stronger for the manufacturing industries in Lowndes County.
4. A negative but insignificant relationship exists between the presence of water and sewer infrastructure and the sales price. This suggests that the presence of this infrastructure has no aggregate effect on sales price, *ceteris paribus*. However, the data suggest that there is a negative and significant impact of water

and sewer infrastructure on sales price *for manufacturing industries* in Lowndes County. Of course, with so few manufacturing industries in the industrial parks (27), we really cannot determine whether this is a significant effect or not.

5. A negative and significant relationship exists between the distance to the CBD and the sales price. This suggests that as a land parcel is further away from the CBD station, the lower the sales price. Put another way, industrial park land in Lowndes County has an approximately .12 percent lower sales price for every one percent change in distance further from the CBD, *ceteris paribus*. In dollars, the marginal

impact is \$6741, calculated as $\frac{\partial P_i}{\partial D_CBD} = -.12 \cdot \left(\frac{\bar{P}_i}{D_CBD} \right) = -.12 \cdot \left(\frac{241011}{4.29} \right)$. Interestingly, this

effect seems a little stronger for manufacturing establishments ($\hat{\beta}_{CBD}^{MANUF} = -.19$).

6. A positive but insignificant relationship exists between the distance to Moody Air Force Base and the sales price. This suggests that as a land site is further away from Moody AFB, the higher the sales price. However, the impact on sales price of this distance variable is much stronger and significant for service industries ($\hat{\beta}_{MOODY}^{SERV} = .84$).

7. A visual inspection of the residuals from the primary regression model shows no clear relationship to the dependent variable, suggesting that omitted variable bias is not a problem in this analysis. Also, our judicious choice of distance variables paid off in terms of decreasing the risk of multicollinearity, as evidenced by the variance inflation factors (VIF) for each independent variable; the two highest VIFs in the overall model are for the LN(D_CBD) and WATER variables (3.93 and 3.07, respectively).

DISCUSSION

Regression estimates

The regression estimates suggest some price trajectories throughout Lowndes County that may affect the parcels to be purchased by the VLCIA. First, the hedonic property value model suggests that land is less expensive the further away from the CBD an establishment locates, thereby supporting empirically the monocentric model assumption. Coupling this information with the SGRDC's parcel development suitability categories shown in Figure 1, several parcels emerge as likely candidates for purchase by the Valdosta-Lowndes County Industrial Authority. These are the northwest tract at E. Hill Ave and Inner Perimeter, north of Perimeter West Industrial Park (Parcel 1 in Figure 2); the tracts north and south of Highway 84 West near Kinderlou Forest (Parcel 2 in Figure 2); and the tracts between Madison Highway, the railroad, and Interstate 75 south of the airport (Parcel 3 in Figure 2). Interestingly, the use of two different sets of data enhances the external validity of the regression estimates, which increases the confidence of local government officials in our policy prescriptions.

Second, in addition to the available land parcels further away from the CBD (to take advantage of lower land prices) that are not currently near an existing industrial park, the Industrial Authority may wish to purchase land that is adjacent to current industrial parks in Perimeter East, Perimeter West, Azalea East, and Lake Park (if it can obtain a relatively low price per acre) to keep transactions costs low as well as to take advantage of some potential agglomeration efficiencies.^[h] [Transactions costs include the costs associated with showing available properties to potential clients, driving times, etc.] If lands adjacent to these industrial parks are not available for purchase, then these results support the purchase of large tracts

of land on the west and northeast portions of Lowndes County where land prices are lower due to their distance from the CBD. This reinforces the recommendation to purchase Parcels 1, 2, and 3 in Figure 2.

Third, it seems that industrial park sites near railroad transfer stations and near Interstate 75 do not command positive price premiums in Lowndes County. In fact, the inclusion of these two variables (D_RAILX and D_I-75) jointly as well as individually in the hedonic property value model did not significantly increase the overall F statistic. Of course, there are two caveats to this point. First, there may not be enough variation in the distance to Interstate 75 variable (mean = 2.75, standard deviation = 1.50) to correlate with sales price, *ceteris paribus*. Or, the other two distance variables included in the hedonic property value model leave no unique explanatory power for the distance to Interstate 75 variable. Second, future industries that locate to Lowndes County may do so *because of* close access to Interstate 75 and/or railroad transfer points. Conversations with VLCIA officials suggest that proximity to Interstate 75 is one of the most important location attributes for the area. So, historical industrial park land sales seem not to lend statistical support to the location attributes prized by current industrial prospects.

Fourth, the results suggest that a one percent increase in the number of acres at a site corresponds to a 1.06 percent increase in price. This suggests that the VLCIA could experience a positive return on future land sales if it keeps its operating costs low. However, related to an earlier point, the policy prescription is for the Industrial Authority to explore business attraction incentives other than “cheap land” to keep industrial land sales prices per acre in proportion with commercial land prices in the local market.

Finally, the hedonic property value model suggests nothing directly about employment density in these new land parcel purchases to meet employment projections. However, given the current average jobs per acre of approximately seven as well as the increasing future demand for residential parcels, special consideration given to new businesses locating to Lowndes County that will increase the average employment density is suggested.

Other estimates

The discussion of regression estimates suggests the general areas of Lowndes County in which the Industrial Authority should focus its land purchases. Now, data on employment densities will be used to prescribe the *number* of acres the Industrial Authority should purchase to meet the 2030 SGRDC employment and population projections.

The SGRDC projects that between 119,256 and 137,595 people will reside in Lowndes County by the year 2030. It also projects total employment in the year 2030 to be 82,868, which is disaggregated into Wholesale (1,676), Manufacturing (6,706), Retail (18,917), and Service (55,629) jobs.

The Long Range Transportation Plan suggests that total manufacturing growth in Lowndes County between 2003 and 2030 will be 1,787 jobs (page 7 of the Technical Process and Criteria for determining allocation and probable location of future developments in Lowndes County, Georgia). Assuming an extreme outcome (that all of these manufacturing jobs are absorbed into Industrial Authority assisted businesses), this suggests that the IA needs to purchase 198.5 acres (1787 jobs / 9 jobs per acre) to meet all of the projected manufacturing employment. Assuming a middle-of-the-road outcome (that half of these manufacturing jobs are absorbed into Industrial Authority assisted establishments), this suggests that the Industrial Authority needs to purchase 99.3 acres (893.5 jobs / 9 jobs per acre) to meet half of the projected manufacturing employment.^[1]

For service businesses, the current employment density in industrial parks is seven jobs per acre. The projected growth in service industries by SGRDC is disaggregated into sectors. The sectors we consider here are 1) Transportation, Communication, and Public Utilities [TCU] and 2) Services (general). Further, we speculate that, in an extreme situation, all 675 jobs in TCU will be absorbed into the industrial parks and one-eighth of the services jobs (10458 service jobs / 8 = 1,307 jobs). This seems to be a conservative assumption given the current number of employees in local industrial parks that work in service-oriented industries (2,631) versus manufacturing-oriented industries (2,300). Using these estimates, we compute the number of acres that will be required to meet service businesses as 283 acres (1,982 jobs / 7 jobs per acre).

Of course, if other data suggest a different proportion of service jobs that would be absorbed into industrial parks, then those calculations can be computed easily. Fortunately, the Georgia Department of Labor’s Local Area Profiles contain the data we need for these calculations. In Table 4 below, we show the relative percentages of manufacturing and service jobs in Lowndes County. Also, as expected, location quotient analysis shows the existence of a much higher concentration of manufacturing jobs in industrial parks compared to Lowndes County as a whole.^[j]

Table 4. Manufacturing and Service Establishment Comparisons

Percentage of all Lowndes Co. Employees in Manufacturing	11.70
Percentage of all Lowndes Co. Employees in Service Industries	60.02
Percentage of all Industrial Park Employees in Manufacturing	46.64
Percentage of all Industrial Park Employees in Service Industries	53.35
Location Quotient - Manufacturing	3.984
Location Quotient - Service Industries	0.888

Sources: Georgia Department of Labor - Local Area Profiles; Industrial Authority; Author’s calculations

Therefore, naively assuming that historical trends in the demand for industrial park land remain the same, we would recommend the purchase of 600 acres to meet 2030 employment projections. However, changes in key personnel at the VLCIA have resulted in fresh perspectives on business attraction, particularly the time spent recruiting new establishments instead of having them contact the VLCIA first. As Figure 3 below suggests, establishments locating to industrial parks in recent years have low jobs-to-acres ratios that may account for the low number of acres predicted to handle 2030 employment projections. So, given the high level of current interest in industrial land in Lowndes County (150 acres of the current 250 acres in inventory are likely to be leased to new clients in the next two years), which is a direct result of new recruiting efforts, it is recommended that the VLCIA purchase between 750 and 1000 acres immediately to build up inventory and to have on-hand several large parcels (at least 200 contiguous acres) for those clients with that kind of acreage needs. Then, if current demand for acreage remains strong, the VLCIA can re-evaluate its needs for more acreage in the next five years.

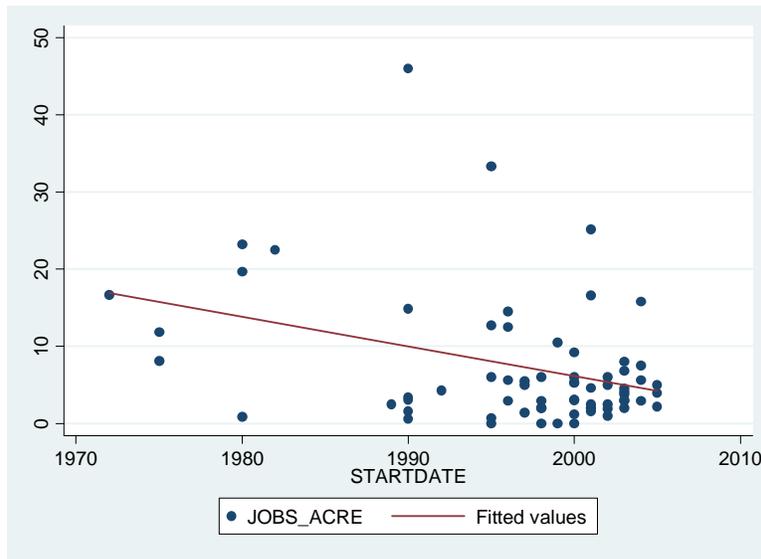


Figure 3. Jobs per Acre over Time

CONCLUSION

The findings from this research are instructive to local governments and to policy researchers. First, this research is instructive to other local governments in that it shows how cooperation between policy researchers and local government officials can result in meaningful policy recommendations that will benefit the community and region. Data sharing between two different sections of local government (the VLCIA and SGRDC), coupled with statistical analysis provided by a policy researcher, produces a unified approach that provides insight and policy recommendations for local government far beyond what each communicates individually. In other words, the community gains from gestalt compared to the individually coordinated efforts of these agencies.

Second, this research is instructive to policy researchers in that the view from the “ivory tower” is certainly enhanced when data and insight are provided by local government officials. The complementarities offered by the local government policy “lens” help to guide the overall research approach. The end result is the recommendation of specific policy changes based on multiple data sources and multiple empirical approaches, which enhances the external validity of such a study and provides a template that can be followed by other communities.

ENDNOTES

^a A very comprehensive article on the history of the literature on industrial parks was written by Peddle (1993).

² Recent anecdotal evidence provided by the Industrial Authority suggests that approximately ten potential employers over the last ten years were dissuaded from locating to Lowndes County because of a lack of large tracts of land (at least 200 contiguous acres). This information will be extremely useful as the VLCIA seeks new sources of funding (part of the millage rate) from the city and county governments in 2007.

³ The Industrial Authority database does not include the characteristics of the structures that occupy each parcel. Therefore, no structural characteristics are included in the regression models to be estimated.

⁴ Solving the profit equation for R while introducing a satisfactory level of profits gives us the bid-rent function $R = (P*Q[X, L(Z)] - nX - \pi)/L(Z)$. In this case, the slope of the bid-rent function is negative and convex to the origin if land and non-land production factors are mutually substitutable inputs, irrespective of the type of good produced.

⁵ The distances to cities such as Atlanta, Jacksonville, and Tallahassee are important to control for the impacts of major population centers that may demand the products produced by businesses located in industrial parks. These distances, along with topographical features of each parcel, may be viewed as control variables used to estimate the spatial variation in parcel prices. However, the use of all of these variables in the present study to explain sales prices is not consistent with econometric theory. In particular, the distances to points outside of Lowndes County are highly collinear with each other; this is why the model is specified using distances to points inside Lowndes County – to decrease the chances of having a multicollinearity problem. Also, the topography of industrial park parcels does not vary as manufacturing facilities require very flat parcels to keep construction costs low.

⁶ To address the concern of potential spurious correlation between the distance variables and the dependent variable, we re-scaled all distance variables so that the distance of an individual establishment to, say, any point outside the county stops at the Lowndes County line. This technique, used by Lipscomb and Farmer (2005) previously in residential hedonic models, essentially forces the effects of distance on sales price to equal zero at all points outside the county. The use of these re-scaled distance variables in preliminary runs of the hedonic regression model did not significantly change the coefficient estimates, which suggests that spurious correlation is not problematic. Separately, we used the variable interaction technique of Fik, Ling, and Mulligan (2003) to control for the influence of space on dwelling prices, which produced no significantly different results from the method used here.

⁷ Agglomeration economies may result from the co-location of new establishments with existing establishments. The efficiencies offered by agglomeration (more specifically urbanization economies across multiple industries) include the sharing of intermediate inputs, the sharing of a common labor pool, labor matching, and knowledge spillovers (O’Sullivan, 2007), all of which seem relevant to the industrial parks in Lowndes County given the local business culture.

⁸ For benchmark purposes, four development authorities were contacted regarding their employment densities. They are the City of Pearson, Bainbridge-Decatur County, Thomaston-Upson County, and the Development Authority of Cherokee County, all in Georgia. These four authorities were selected at random from an Internet search. The maximum employment density (Cherokee County) was 10.3 whereas the minimum (City of Pearson) was less than one. Given the VLCIA’s average employment density of eight, one can argue that relatively speaking, the VLCIA has done well at attracting industries that bring lots of jobs per acre of land consumed by the business.

⁹ Here, following Isard *et al.* (1998), location quotients are calculated as $LQ_{ij} = \frac{share_{ij}}{share_{in}}$, where $share_{ij}$ is

the percent share of employment in industry classification i in the industrial parks (j); and $share_{in}$ is the percent share of industry i in the county (n). If the $LQ > 1$, then employment is more highly concentrated in the industrial parks than in the county.

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