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# Computer Model Helps Communities Gauge Effects of New Industry

*The economic base of many rural communities centers around only a few firms, making the communities more vulnerable than urban areas to changing economic conditions. Planning additional development becomes more important in such situations. Rural planners in some Texas communities have been using a computerized model to figure out the potential benefits and costs from new firms. The Industrial Impact Model, programmed with data specific to the community and the firm, can estimate the effects of new development on the community's private and public sectors. Here's how it works.*

Rural officials must give constant attention to replacing jobs lost from declines in local industries and encouraging the local economy to diversify. Attracting a new industry or helping an existing firm to expand are two common approaches. Before making any decisions, however, a community needs to estimate the costs and benefits involved in industrial expansion or growth. Even a community that has not actively encouraged an industry to expand or move into the area needs to be aware of the implications of growth: its benefits as well as its hidden costs.

Some rural planners are now using computerized models to help them figure out the potential benefits and costs of industrial growth. Step by step, these models trace how the initial growth in employment can affect other parts of the local economy. In this way, the models make clear how the impacts on the community occur. Given an increase in employment

in one firm, they yield estimates of costs and revenues for different parts of the community. Since planners can change values given to the models, they can do "what if" analysis, which shows how differences in community or plant characteristics will affect the number of new jobs and income that the community will retain. The models' results can help planners prepare in advance for changes in demand for public services and shortfalls in revenues. In addition, impact models can help the communities find answers to questions like will the number of new jobs and income be as great as promised by promoters or will their towns grow too fast?

Recently, impact models have been redesigned for use on personal computers. The reduced costs of using the models are now within the financial reach of many rural communities. The Industrial Impact Model, developed at the Texas Agricultural Experiment Station, Texas A&M University, is one such model. The Texas model, given data specific to the community and the firm, can estimate the effects of new industrial development on the community's private and public sectors.

## The Industrial Impact Model Shows a Range of Outcomes

For the past 10 years, the Texas Agricultural Extension Service has used the Industrial Impact Model (IIM) to assess the impacts of new and expanding industries on rural Texas communities. The model is a general mathematical representation of the economic structure of the community. Since the model uses a partial budgeting technique, the community is divided into four accounts: the private sector, municipal government, county government, and school districts. After being given information about the community and the new or expanding industry, the

IIM estimates high, intermediate, and low impacts for each account. The model has been well received by both community planners and extension personnel. Recently the IIM was updated and adapted for use on IBM-compatible PC's. This makes the IIM more widely available and communities can use it without great expense and time delay.

The private account consists of wage and salary earners, private industry, and business organizations. Effects on this account elicit the most attention from community residents, telling how many new jobs and how much income will result from the location of a particular business in the town. The model not only accounts for the jobs at the new plant itself (the direct effect) but also estimates the additional jobs generated in the community (secondary effect). Secondary employment and income result from increased spending by community residents and the plant in local businesses.

Rural areas tend to retain less of the income and employment generated by a new or expanding firm than urban areas. Analysts call it a leakage when a firm is unable to buy inputs from local businesses and when community residents spend their income outside the local area. The greater the amount spent outside the community by the firm and by local residents, the larger the leakage. Additional leakages result from payment of non-local taxes, contributions to social security, and the elimination of jobs previously held by the new firm's employees.

The impact of a new or expanding firm goes beyond the generation of employment and income, however. Local governments and school districts are also affected. Local governments need to know if the taxes collected from the firm will be sufficient to upgrade or maintain water and sewer systems. Local facilities need to be able to accommodate not only the firm itself but new employees and their families who move in from outside the area. The school district may have to build additional facilities and hire new teachers to accommodate a larger student population.

## Data Collection at the Local Level

Information for the IIM is gathered at the community level by means of a question-

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Photos by J. Norman Reid

The Texas model has now been adapted to be used on IBM personal computers. Using information specific to the community and the new plant, the model estimates the effects of a new plant on the area.

naire. Most of the information, such as current revenues and expenditures, investment costs, local population, and personal income levels can be obtained from local sources: the county tax assessor, the superintendent of schools, and the town clerk. Additional community information concerning spending patterns of the plant and local residents, expected distribution of direct and secondary jobs between old and new residents, and residence patterns of local employees are used by the model to adjust for leakages of the industry's impact from the local area. These values can be estimated by local or extension personnel, or provided by local consumer expenditure surveys. Usually the new firm can estimate its local spending. Standard values (defaults) are incorporated into the model and are used if better estimates are not available.

### Making the Estimates

Once the questionnaire has been completed, extension staff enter the data into the IIM program, which checks the data and questions unreasonable and missing values. After the input data are complete, the model estimates the total number of direct and secondary jobs that result from the plant by multiplying the number of new plant employees by a community- and industry-specific multiplier. State input-output multipliers are adjusted using the information supplied by the community to account for local multiplier effects.

This multiplier represents the total number of new jobs that will be created in a community as a result of the employment of one person by the new industry. For instance, if the plant hires 100 new employees and the employment multiplier is 1.5, the total number of new jobs resulting from the plant is  $100 \times 1.5 = 150$ . One hundred of these jobs are from the new plant and 50 are created in other local businesses (secondary employment). The size of the local employment multiplier depends on the leakages from the community and the type of new industry.

Using the total number of new jobs, community residence patterns, and household sizes from the 1980 Census, the IIM estimates the total number of new residents who will settle in the county and municipality. The model also divides the new residents into age and sex categories and determines the number of new students who will be enrolled in the local school district. The model then calculates increases in municipal and county water use, sewer and solid waste production, ambulance and fire calls, and hospital bed days. Before making estimates for the four community accounts, the model estimates the total amount of new income that will be generated as a result of the new plant, by multiplying the new plant's payroll by a community- and industry-specific multiplier. The product is the total income generated in local businesses and

the payroll received directly from the new plant. As with the employment multiplier, the income multiplier represents the total income in the community that will result from each \$1 in payroll paid by the plant.

The *private account* estimates the net impact on the municipality's private sector. The income accruing to the private account are the primary and secondary wages and salaries generated by the plant. The recipients of this income are the new plant employees, and local businesses and their employees. Costs incurred on the private account include investments and expenditures made to attract or accommodate the plant and income lost from jobs left unfilled after workers go to work at the new plant. Secondary costs resulting from jobs left vacant are accounted for as well. Plant profits are considered a leakage since we do not know where they will be spent or invested or how profitable the new plant will be.

The *municipal government account* sees increased revenues and expenditures as a result of industrial growth. The IIM estimates increases in municipal revenues from utilities, property and sales taxes, and other sources of miscellaneous revenue. Direct and secondary expenditures are calculated for police and fire protection, other services, and utilities. Additional municipal costs include investment in services or utilities and forgone tax revenues. Investment costs are included in the IIM's analysis only when the number of new residents estimated by the model reaches a threshold set by the community. The threshold defines the point at which the demands of new residents for a certain service exceed the municipality's present capacity to supply that service. Both the amount of the investments and the threshold level are set by the community.

The *county government account* is affected much like the municipal account. Additional expenditures estimated include hospital, health, and welfare expenses and expected increases in highway and road construction costs.

The impact on the *school district account* includes additional property tax revenues and increases in per student State and Federal aid transfers. Costs for the school district consist of new student and teacher expenses, as well as possible investments for upgrading or expanding school facilities.

## Two Case Studies

To demonstrate the usefulness of the Industrial Impact Model, we have compiled selected data and results for two communities assessing the impact of the same plant. The examples are based on real information, but the names of the communities have been changed to Plateau and Midway. The discussion is limited to the intermediate estimates.

Both communities are being considered as sites for a plant that constructs prefabricated buildings. Each would like to know the potential costs and benefits.

Plateau is a community of 3,000 people located in Rustic, a county of 6,000 people. Half of the county's households earn less than \$10,000 per year and an additional quarter earn between \$10,000 and \$20,000 per year. A quarter of all county residents and a fifth of all families have incomes below the poverty level. Rustic County depends on agriculture for 35 percent of its income. Eighty-five percent of the county's farms are run by families and half of all farmers work more than 100 days off the farm. The average size of these family farms is 900 acres.

Midway is a community of 13,000 located in Outskirt, a county of 40,000. Outskirt County depends on manufacturing for a quarter of its income and employment, while agriculture contributes less than a tenth. Ninety percent of farms are family run, averaging 200 acres per farm. Two-thirds of farm operators work 100 days or more off the farm.

Income levels in Outskirt County are higher than those in Rustic County. Two-thirds of Outskirt's households earn \$20,000 or less per year and an additional fourth earn between \$20,000 and \$30,000 per year. Ten percent of all families and 15 percent of all residents live on incomes below the poverty level.

The branch plant intends to hire 180 employees and pay annual wages and salaries of approximately \$3,888,000. Each community's economic structure will determine how much of the payroll is spent locally and where the plant's employees will come from (table 1). These values will determine the size of each community's income and employment multipliers.

Note that 50 percent of Rustic County residents' income is spent in Plateau, while only 10 percent of Outskirt County residents' income is spent in Midway. So, if county residents take the new jobs in Midway, they will spend most of their money elsewhere and local merchants will not benefit much. This difference can be explained, in part, by Rustic County's isolation from urban areas and Outskirt's proximity to a metropolitan area. Midway, being more economically diversified, will be able to provide the plant with 40 percent of its inputs while Plateau can provide only 5 percent. Plateau will also have more jobs left unfilled, indicating a greater degree of underemployment, common in rural areas.

Because of leakages, Plateau and Midway both experience employment multipliers of less than one (table 2). This means that for each employee hired by the plant, there will be less than one job created in the municipality. Employment growth in both counties may be much less than local residents expected.

In Plateau, 25 of the 180 new plant employees gave up jobs that will not be refilled (table 1). This leaves a net gain of 155 jobs. After adjusting for jobs taken by people residing outside Plateau and for jobs not created locally due to consumption outside Plateau by both residents and the plant, only 129 net new jobs are created in Plateau. Multiplying Plateau's employment multiplier, 0.72, by the total number of new employees hired by the new plant, 180, results in 129 new jobs created in that municipality (table 3). An additional 60 jobs were created in Rustic County resulting in a total of 199 new jobs in the entire county. Of the 306 jobs created in the State as a result of the opening of the branch plant (180 x 1.7), 117 (38 percent) will be outside of Rustic County.

The number of new residents resulting from the new plant depends not only on income leakages, which reduce the number of new jobs created locally, but also on the local availability of labor suited to the plant's needs. If the plant cannot find the skilled labor it needs in the municipality or county it will employ out-of-county residents willing to relocate near the plant site. Families will accompany these new employees as well. Since Midway can provide a greater proportion of employees

**Table 1—Community-supplied adjustment values**

Value	Plateau	Midway
	<i>Percent</i>	
Employees living in:		
Municipality	65	75
County	30	20
Other	5	5
Income spent in municipality by residents of:		
Municipality	85	90
County	50	10
Other	1	2
Nonlocal taxes	28	33
Jobs going to new residents:		
Direct	45	30
Secondary	30	20
Inputs bought locally	5	40
	<i>Number</i>	
Jobs left unfilled	25	17

Note: Values to be used in adjusting State multipliers for each community.

**Table 2—Comparison of multipliers**

Item	Employment	Income
State	1.7	2.24
Rustic County	1.05	—
Plateau	.72	.90
Outskirt County	1.16	—
Midway	.91	1.01

Note: Income multipliers are not used at the county level by the IIM.

**Table 3—Estimates of new employment and residents**

Item	Plateau (Rustic County)	Midway (Outskirt County)
	<i>Number</i>	
Employment:		
Municipal County	129	164
Total	60	44
Total	189	208
Residents:		
Municipal County	153	127
Total	70	34
Total	223	161

**Table 4—Estimates of net impacts for community accounts**

Item	Plateau	Midway
<i>Dollars</i>		
Private:		
Income	3,513,000	3,933,000
Costs	-192,000	-127,000
Net	3,321,000	3,806,000
Municipal:		
Revenues	208,000	134,000
Expenditures	-152,000	-77,000
Net	56,000	57,000
School:		
Revenues	181,000	172,000
Expenditures	-216,000	-60,000
Net	-35,000	112,000
County:		
Revenues	63,000	42,000
Expenditures	-27,000	-13,000
Net	36,000	29,000

**Table 5—School district impact estimates, Plateau**

	<i>Dollars</i>
Revenues:	
Ad valorem taxes—	
Plant	7,000
New homes	61,000
State and Federal aid	113,000
Total	181,000
Expenditures:	
New student costs	34,000
New teacher costs	24,000
Forgone ad valorem tax	7,000
Investment in facilities (annualized)	152,000
Total	217,000
Net impact	-35,000

**Table 6—Investment cost summary, Plateau**

	<i>Dollars</i>
Municipal (incentive):	
First-year expenditure	42,000
Total 30-year expenditure	1,270,000
Municipal (fire):	
First-year expenditure	8,000
Total 6-year expenditure	47,000
County (highway):	
One-time expenditure	21,000
School district:	
First-year expenditure	152,000
Total 22.5-year expenditure	3,413,000

from its resident population than Plateau, Midway can expect a smaller number of new residents than Plateau.

Once the number of new residents is estimated by the model, the costs and revenues for each of the communities' accounts can be calculated (table 4). These net estimates are based on per capita increases in costs, one-time outlays, and annualized investment costs.

Plateau alone will be used to show model results for the remainder of the article. A typical breakdown of expenditures and revenues can be seen in Plateau's school district account (table 5). Using the school district's existing property tax rates and the total value of new homes and the plant, the model calculates the increase in ad valorem tax collection. Since the firm would be granted a concession by the municipality to build on municipal land, forgone tax revenues are included in school district costs. Other costs include the annualized cost of investment to

expand school facilities, and additional teacher salaries and per student expenditures. Given the negative balance, the Plateau school district might consider seeking Federal or State grants or increasing property tax rates to compensate for the additional investment costs. The breakdown of revenues and expenditures of Plateau's school district is very similar to that of the other community accounts.

As with any form of impact analysis, the model cannot tell a community that the efforts to industrialize will be successful. If we look at the investments planned by Plateau, we can see what could be risked if the plant did not locate there or failed after location (table 6). In addition to the tax concession, the municipality planned to make improvements on municipal land to accommodate the special needs of the plant. To provide adequate fire protection to the plant, an additional fire engine would have to be bought as well. The school district was to build a new building to house the larger student body and the county would build an access road to facilitate local rail deliveries to the plant. If these investments were made and the plant failed, local revenues could not cover these investments costs.

## Summary

Much is at risk in trying to encourage a company to relocate or a local one to expand. Many communities are competing for the same company and there is uncertainty in the ability of a local business to grow. The costs and benefits resulting from these development strategies need to be carefully considered and weighed against the risk involved. Contingency plans should be thought out in advance for the worst case scenarios: what if the industry does not relocate? what if the expansion efforts fail? The role of industrial impact models in this process is clear. They allow community planners to quantify some of the risk, as well as plan for increased demands, costs, and expenditures. The models show community officials how leakages affect growth in their area. Reducing leakages may be another strategy for officials to pursue to increase the benefits of future employment growth. Looking at a community as a complete economic system is the most important step in promoting healthy rural economic growth.

**RDP**

## A History of the Model

The Industrial Impact Model had its origin in a doctoral dissertation by Lynn Lee Reinschmidt at Texas A&M University. In 1976, Reinschmidt completed research on the net impact of industrialization on the private sector, municipal governments, and school districts in nine rural communities in Texas.

The analytical framework he used to evaluate these impacts was generalized by Jones and Cosby for use in any rural community in Texas. It was programmed in FORTRAN for use on the mainframe computer at Texas A&M. This program assessed the fiscal impacts on the private sector, the municipal and county governments, and the school district. In 1985, the model was updated and expanded by Long to include estimates of changes in population, population characteristics, and service needs. This model was programmed in BASIC for use on IBM or IBM-compatible personal computers.