AN AREA ECONOMIC DEVELOPMENT IMPACT MODEL FOR EXTENSION APPLICATION

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Most area economic development impact models are based on the premise that the basis of an area economy is a group of local firms which produce goods and services for sale outside the area. Agriculture, mining, and manufacturing firms typically make up a large part of such a group of exporting or basic firms. However, in most communities and some larger areas, many service firms (wholesale, retail, transportation, finance, medical, utilities) sell some of their products outside the local economy. These exports are part of the area's economic base. That portion of the output of the firms in an area which goes to satisfy local demands is nonbasic output. Area employment used to produce basic and nonbasic goods and services can be classified similarly as basic and nonbasic employment, respectively.

These relationships can be modeled mathematically for an area economy (interindustry models) to yield estimates of the proportion of the area's nonbasic economic activity attributable to local basic industries [2, 3, 5, 10]. Such estimates usually are stated as multipliers. Multipliers can be used to indicate the relationship between an observed change in an economy and the amount of economic activity that this change creates throughout the economy.

Typically the multipliers calculated with such models relate to employment and income. An employment multiplier indicates how total employment in an economy will be affected if employment is increased or decreased in a particular industry. Similarly, an income multiplier measures the total change in income in an economy that is created by a change in a particular industry.

Such economic models have been developed for many areas in many states [10]. They can be based on primary data or can be synthesized from state or national models [1, 4].

The application of interindustry models often requires large amounts of data, computer hardware, and at least some familiarity with computer programming techniques. Computing equipment and programming expertise are usually available, for a price, to rural development decisionmakers, who therefore should not necessarily avoid complex models. If the capabilities of such models fit the needs of decisionmakers in particular situations, and if data collection and computer costs are not prohibitive, these types of models can be very useful.

However, such complexity is not inherent in all interindustry models. Economic base models (a type of interindustry model) can be structured to provide information on many area development questions by theoretically sound but relatively uncomplicated techniques. Readily available data on employment, population, income, and local tax structures in an area can be coupled with simple estimates of the nature of the area's economic base to answer many questions about the effects of development on the area and its residents. Such a model is presented and demonstrated. It is designed for use by community decisionmakers and rural development field practitioners. The model facilitates the estimation of employment, population, income, and tax impacts from new jobs in a rural community.

A SIMPLIFIED MODEL FOR FIELD USE

A simplified model in which economic base and location quotient theories are used to estimate such impacts involves estimating expected change in an area's total employment resulting from a change in the area's basic employment. This information then can be used to

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estimate expected changes in area population and income and expected impacts on the area's tax base. Employment changes can be estimated as follows.

$$ANB_i = \frac{NE_i}{NE} \times AE \text{ if } AE_i - \left(\frac{NE_i}{NE} \times AE\right) \geqslant 0$$

$$ANB_i = AE_i \text{ if } AE_i - \left(\frac{NE_i}{NE} \times AE\right) < 0$$

$$AB_i = AE_i - ANB_i$$

$$AB = \sum_{i=1}^{n} AB_i$$

$$ESNW = \left(\frac{NW}{APOP}\right) \times (AE - AB)$$

$$AMULT = \frac{(AE - ESNW)}{AB}$$

$$\Delta AE = \Delta AB \times AMULT$$

where

ANB_i = area nonbasic employment in industry type i
NE = total national employment
NE_i = national employment in industry type i
AE = total area employment
AE_i = area employment in industry type i
ΔAE = change in total area employment resulting from a change in area basic employment
AB = total area basic employment
AB_i = area basic employment in industry type i
ΔAB = change in area basic employment
NW = area population neither working in nor supported by workers in the local labor force
ESNW = local employment serving area persons neither working in nor supported by workers in the local labor force
APOP = area population
AMULT = change in total area employment per new area basic job and
n = number of industry types in the area.

It is assumed that, for a particular industry type in an area, the proportion of its employment attributable to local demand for its output (nonbasic employment) will not exceed the proportion of total national employment accounted for by that industry type [11]. For rural communities a more reasonable assumption may be that all agricultural, mining, and manufacturing employment is basic, and thus the division of employment between basic and nonbasic applies only to other types of firms.

Employment changes relate directly to population and income. If full employment in an area is assumed, population changes resulting from a change in the area's employment can be estimated as:

$$PMULT = (APOP - NW)/AE$$

$$\Delta APOP = \Delta AE \times PMULT$$

where

$\Delta APOP$ = change in area population and
PMULT = change in area population per new area job.

Change in area income (ΔAI) from new employment and population can be estimated by multiplying the change in area population ($\Delta APOP$) by per capita income (PCI). Or, if the expected wages of new basic employees are known, a more precise estimate can be made by considering these expected earnings in new basic employment separately:

$$\Delta PNB = (\Delta AE - \Delta AB) \times PMULT$$

$$\Delta AI = \Delta AIB + (\Delta PNB \times PCI)$$

where

ΔPNB = change in area population resulting from new nonbasic employment
ΔAI = change in area income resulting from a change in area basic employment and
ΔAIB = change in area basic income.

Expected new local tax revenue resulting from increased population can be estimated by multiplying the new population by per capita county and municipal taxes collected in the area. This information can be estimated more precisely for a particular area if local taxing mechanisms are well understood. For example, if a new plant bringing new basic employment is expected in an area where local tax bases are sales and property taxes, new sales tax collections can be estimated on a per capita basis and new property taxes can be estimated as:

$$\Delta IT = VP \times EITR$$

$$\Delta RT = \Delta APOP \times PCRT$$

$$\Delta CT = \Delta APOP \times PCCT$$

where

ΔIT = new tax on industrial property
ΔRT = new tax on residential property
ΔCT = new tax on commercial property
VP = value of new plant
EITR = effective tax rate on industrial property
PCRT = per capita local residential property tax and
PCCT = per capita local commercial property tax.

AN EXAMPLE APPLICATION OF THE MODEL

In Table 1 example estimates of basic employment by industry types are shown for a county in Oklahoma. From these estimates, a basic employment multiplier is calculated (Figure 1), and new county population, income, and local taxes which would result from 100 new basic jobs are estimated (Figure 2). Virtually all of the data for these calculations are available from readily accessible secondary sources. In the example, all agriculture, mining, and manufacturing employment in the county was assumed to be basic. Basic employment in other industries was estimated as discussed heretofore. A county employment multiplier of 2.1 was estimated (Figure 1). Thus, every new basic job created in the economy would be expected, over the long term, to result in 1.1 new nonbasic jobs.

Some of the impacts which could be expected from 100 new basic jobs in the example county are estimated in Figure 2. Locally supported population per job was calculated by subtracting county population not supported by local employment from total population and dividing the result by county employment. For the example county, locally supported population per job was estimated to be 2.0; therefore new population resulting from 100 new basic jobs and the resulting 110 new nonbasic jobs was estimated to be 420. Expected county income, county taxes, and city taxes resulting from such increases in employment and population were estimated from available data on per capita income and taxes.

TABLE 1. ESTIMATION OF BASIC EMPLOYMENT FOR PAYNE COUNTY, OKLAHOMA

	U.S. Employment - 1970		Payne County Employment - 1970		
	(1) Number of Employees[a] (thousands)	(2) Percentage of Total	(3) Number of Employees[b]	(4) Estimated Non-Basic Employment[c]	(5) Estimated Basic Employment[d]
Agriculture	3,566	4.5	1,087	0	1,087
Mining	515	0.7	485	0	485
Manufacturing	20,737	26.4	1,606	0	1,606
Construction	4,814	6.1	1,002	1,002	0
Transportation, Communication and Utilities	5,317	6.8	832	832	0
Wholesale and Retail Trade	14,996	19.1	3,624	3,624	0
Finance, Insurance, Real Estate and Business and Repair Services	6,325	8.0	1,005	1,005	0
Personal, Entertainment and Recreation Services	4,990	6.3	1,181	1,181	0
Professional and Related Services	12,894	16.4	8,254	3,248	5,006
Public Administration	4,473	5.7	729	729	0
Total	78,627	100.0	19,805	11,621	8,184

[a]From [12].
[b]From [13].
[c]Assumed to equal zero for Agriculture, Mining and Manufacturing. For other sectors this was calculated as the lesser of the value in column 3 or the value in column 2 times the total of column 3.
[d]Calculated as column 3 minus column 4.

FIGURE 1. ESTIMATION OF A BASIC EMPLOYMENT MULTIPLIER FOR PAYNE COUNTY, OKLAHOMA

$$\text{Local employment serving persons not supported in local labor force} = \frac{\text{Area population neither working nor supported by workers in the local labor force}}{\text{Area population}} \times \text{Area non-basic employment} =$$

$$\frac{10{,}879^a}{50{,}654^b} \times 11{,}621 = 2{,}496$$

$$\text{Basic Employment Multiplier} = \frac{\text{Total Employment} - \text{Local employment serving persons not supported in local labor force}}{\text{Basic employment}} = \frac{19{,}805 - 2{,}496}{8{,}184} = 2.1$$

[a]Inmates of institutions, persons in group quarters (primarily college dormitories and military barracks) and persons 65 and over who are not in the labor force (from [13]).

[b]From [13].

FIGURE 2. ESTIMATION OF NEW POPULATION, INCOME, AND LOCAL TAXES (1976 DOLLARS) FROM 100 NEW BASIC JOBS—PAYNE COUNTY, OKLAHOMA

Total new county employment = 100 x 2.1 = 210

Total new county population:

1970 county population	= 50,654
1970 county population not supported by local employment	= 10,879
1970 county population supported by local employment	= 39,775
1970 county employment	= 19,805
Locally supported population per job = 2.0	
Total new population 210 x 2.0 = 420	

Total new annual county income = annual county per capita income x new population =

$$\$4764^a \times 420 = \$2{,}000{,}880$$

Total new annual county taxes = annual county taxes per capita x new population =

$$\$123^b \times 420 = \$51{,}660$$

Total new annual city taxes = annual city taxes per capita x new population =

$$\$56^c \times 420 = \$23{,}520$$

[a]1970 data [13] adjusted to 1976 by the consumer price index.

[b]Calculated from data in [6, 7, 9].

[c]Calculated from data in [8, 9].

IMPLICATIONS

Estimates of income and employment impacts of development in an area or community can be very useful to local businessmen as they evaluate the effects of such development on their businesses and thus on their own economic wellbeing. Estimates of the impacts of development on local tax revenues are important to local government officials and others concerned with the provision of public services. Such persons must weigh the value of expected new tax revenues against the costs of expanding local public services to serve the increased population. They must consider carefully not only operating costs for such services but also any new capital costs which might be necessary to expand public service systems to accommodate local growth.

Aside from being useful for calculating impacts of development on local economies, estimates of local multipliers can be of value to persons involved with development planning as indicators of the degree of development of local economies. The employment multiplier for Payne County, Oklahoma, estimated to be 2.1 in the example, is rather large for small local Oklahoma economies (rural towns and counties). This estimate is indicative of a well developed area with a rather complete set of nonbasic firms for a small local economy. A much lower employment multiplier for a local economy of similar size (population) would suggest opportunities for the development of more nonbasic economic activity.

The model presented is one that can be used by field extension personnel or interested community leaders to evaluate the potential impacts of economic development on a particular area or community. Economic base and location quotient theories are used in the model to estimate basic employment and nonbasic employment for an area, and to estimate the expected change in total employment resulting from a change in basic employment. Once such economic base information has been estimated, it can be coupled in the model with available data on population, income, and local tax structures to answer many questions about the effects of development on the area and its residents.

This simplified model cannot be viewed as a comprehensive planning model for area development. Its input and output relate to only a few variable. However, these variables (employment, income, population, and tax bases) are key elements in area development.

The results obtained by using this model should be helpful to local decisionmakers including businessmen, economic development planners, industrial developers, and local government officials. The model can be applied legitmately to any geographic area for which data are available. Because of its simplicity, the model is particularly applicable at the municipality and county levels.

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