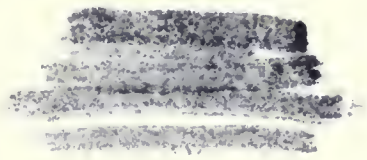

Economic and Fiscal Impact Analysis: A Primer

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Introduction

This bulletin gives local public officials and analysts a methodology for conducting economic and fiscal impact studies. Whether an "impact" is planned, accidental, or hypothetical, decision makers require a framework and an established routine that can be implemented quickly at low cost. The methodology presented herein fulfills these requirements and is an approximation of the economic and fiscal impacts associated with economic change. We have implemented this model for all counties in Illinois using a computer-driven program and database. This bulletin explains how the approach can be implemented for any other local area.

The paper is organized as follows: Economic base theory is discussed in Section 2. This framework provides the basis from which economic impacts are estimated. Section 3 develops the impact model, which includes the fundamental equations characterizing economic and social relationships. Data requirements and sources are considered in Section 4. Section 5 provides a step-by-step illustration of the model, and Section 6 concludes the paper.

Economic Base Theory

Economic base analysis is a widely applied theory of regional economic change and is used to analyze the economic base of an area. The economic base of a community consists of activities providing "basic" employment and income on which the rest of the local economy depends (Tiebout 1962). Economic base studies are used for a variety of purposes, including the following: (a) to provide an understanding of local sources of employment and income, (b) to identify strengths and weaknesses in a local economy, and (c) to provide analysts with information for evaluating policy options.

The central hypothesis is that community employment, income, and growth are determined by the export of goods and services. Exports are the primary means by which new employment and income are created. The injection of new spending into the local economy through increased exports stimulates additional industries that serve local markets and causes an area to grow further. These further rounds of spending constitute the "multiplier effect" of some initial impact, such as the opening or closing of a manufacturing plant. Economic base theory is, therefore, an export-led theory of economic growth that emphasizes the demand side of the local economy.

A community's economic base is defined as those industries or parts of industries whose products are exported outside the community. By identifying an area's export composition, the diversity and stability of the local economy can be evaluated. Communities with much of their exports concentrated in a few sectors are vulnerable to cyclical changes in the broader regional, state, and national economies. Through periodic evaluation of the economic base, analysts can monitor whether an economy is increasing and diversifying employment and income opportunities.

Simple economic base analysis is based on several assumptions: (a) local technology is similar to national technology, (b) local labor productivity is similar to labor productivity elsewhere, (c) tastes and preferences in the local area are similar to national averages, (d) the capacity exists to meet new levels of product and service demand, and (e) regions do not import and export the same commodities.

The following section illustrates how multipliers are estimated and used in calculating the total impact of economic changes in a local area.

An Economic Base and Fiscal Impact Model

The central theme of economic base theory is that growth of export-oriented industry stimu-

lates other industries serving local markets. The model has the virtues of emphasizing a community's interdependence with other places and the notion that what occurs in a community depends, in part, on what takes place beyond its borders (Richardson 1979). The basic framework is described first in words and then with arithmetic.

Overview. The impact model relates a change in a community's export employment to the changes in total employment, income, and local government revenues and expenditures. The change in total employment caused by the initial impact is used to calculate all other changes.

The location quotient method is used to calculate the employment multiplier. The change in total employment is found by multiplying the number of new jobs directly associated with an impact by the employment multiplier. The change in total personal income is calculated as the average income per job times total new jobs. Similarly, the change in population is calculated as the number of residents per job times the total number of new jobs.

Estimating fiscal impacts follows a similar procedure. Changes in total personal income determine revenue impacts, and changes in population determine expenditure impacts. For example, the impact on property taxes is calculated as the property tax revenue per dollar of income times the change in total personal income. For expenditure impacts, local government spending per capita is multiplied by the change in population.

Although these relationships are relatively simple, they provide an approximation of the economic and fiscal impacts of a change in the community's economic base. Let us now turn to the arithmetic of the model.

The Economic Base Model. To determine a community's economic base, it is necessary to identify its export sector.[1] The method used here adopts the location quotient method. Other methods are available, the most reliable of which involves a survey of local business. However, surveys are expensive and time-consuming. Location quotients offer an expedient and inexpensive way to estimate exports from readily available data.

Location Quotients and Export Employment. Location quotients provide an indirect means of estimating exports. This index compares the relative importance of an industry in a community to its relative importance in the broader national economy. This measure is often constructed using industry-specific employment data because these data are easily obtained. However, income or sales data can also be used. Formally, the location quotient for industry i in community C is as follows:

Equation 1. $$LQ_i = \frac{(E_{iC}/E_{TC})}{(E_{iN}/E_{TN})}$$

In this equation, E_{iC} is employment in industry i in community C; E_{TC} is total employment in community C; E_{iN} is employment in industry i in the nation; and E_{TN} is total national employment.

If the location quotient exceeds one ($LQ > 1$), then exports are indicated. Industries with location quotients less than or equal to one ($LQ \leq 1$) are assumed to be sectors serving local markets only. For example, a location quotient of 1.20 indicates that 20 percent of the employment in the industry produces exports. Similarly, location quotients of 1.16 and 1.43 indicate that 16 percent and 43 percent of employment in these industries serve export markets. Multiplying these percentages by employment in each exporting industry, and then summing over all industries, provides an estimate of

[1] Throughout the discussion, we use the term *community* rather loosely. *Community* can mean a city, town, county, or multicounty region. Ideally, the study area should correspond to a *functional economic area*, such as a labor catchment area based on commuting patterns. In all cases, we use the term *local* to mean the geographic area of the study. For rural areas, counties are often the unit of analysis.

total export employment. In particular, export employment in industry i (X_i) is calculated thusly:

Equation 2. $X_i = (LQ_i\text{-}1)\ (E_{ic})$

This holds true for $1 < LQ_i \leq 2$ and for Equation 3, where X is total export employment:

Equation 3. $X = \sum X_{ic}$

The number of export jobs in a sector cannot exceed the total number of jobs in that sector. Therefore, if $LQ_i>2$, all jobs in that sector are assigned to exports. It should be noted that in some cases the location quotient need not be calculated. Frequently, agriculture, mining, and certain manufacturing sectors produce for export only. This is particularly true in small or rural communities. In these cases, one should simply assign employment in these sectors to exports.

The Employment Multiplier and Employment Impact. Given Equation 3, the employment multiplier is estimated as the ratio of total employment in the area, E_{TC}, to total export employment, X, where M is the employment multiplier:

Equation 4. $M = \frac{E_{TC}}{X}$

Equation 4 calculates the multiplier as the total number of local jobs supported by each job in the export sector. Typically, the employment multiplier ranges between 1.25 and 2.50. The change in total employment due to new or lost jobs in the export sector is simply:

Equation 5. $\Delta E_{TR} = (M)\ (\Delta X)$

This equation illustrates that the change in total employment equals the multiplier times the change in export employment.

Other Impacts. Changes in an area's economic base lead to changes in income and may induce migration to the area. As a first approximation, changes in total personal income can be expressed as a function of the change in employment:

Equation 6. $\Delta Y = (\frac{Y}{E_{TC}})\ (\Delta E_{TC})$

Here, Y/E_{TC} is the ratio of total personal income in the area to total area employment. Equation 6 states that the change in total personal income equals total personal income per job multiplied by the number of new jobs. Similarly, if we assume that the ratio of population to employment is constant, then the change in total population is given thusly, where P is the area's population:

Equation 7a. $\Delta P = (\frac{P}{E_{TC}})\ (\Delta E_{TC})$

It is important to recognize that population change is an estimate of net new migrants to the area and that Equation 7a implies that all net job vacancies are filled by in-migrants. This is true only if there are few unemployed persons in the area seeking work and there is no net commuting into the impact area. If unemployment is high or the community is integrated within a larger labor market, then Equation 7a will overestimate the population change associated with new job opportunities in the area. Greenwood et al. (1986) estimate for regions in the United States that every new job created in a region attracts about 0.522 net employed in-migrants. In other words, 47.8 percent of new jobs are filled by local job seekers. For these communities, population change is calculated thusly:

Equation 7b. $$\Delta P = \left(\frac{P}{E_{TC}}\right)(0.522)(\Delta E_{TC})$$

Assumptions about the number of net in-migrants associated with local employment change can have a major influence on fiscal impacts. This influence is explained below.

To summarize the discussion to this point, the employment impact is given in Equation 5, the income impact is in Equation 6, and the population impact in either 7a or 7b.

The Fiscal Impact Model. These changes in population and total personal income are used to estimate fiscal impacts. Fiscal impacts can be estimated for several revenue and expenditure categories. Local government revenue is closely related to personal income. Similarly, programmatic public expenditures are highly correlated with the number of people who receive service.

Local Revenue Impacts. If there is a stable relationship between *own-source* revenue and total personal income, then the change in own-source revenue is:

Equation 8. $$\Delta OSR = (OSR/Y)\ (\Delta Y)$$

In this equation, *OSR* is the level of local own-source revenue.[2] Estimates for subcategories of own-source revenues, such as property taxes and other taxes and charges, can also be determined. For these revenue subcategories, changes in property taxes (*PT*) and other taxes and charges (*OT*) can be calculated:

Equation 8a. $$\Delta PT = \left(\frac{PT}{Y}\right)\ (\Delta Y)$$

Equation 8b. $$\Delta OT = (OT/Y)\ (\Delta Y)$$

One subcategory of "other" taxes is the sales tax. To estimate changes in sales tax revenue, one must know how much local income is spent in the local economy. This is a straightforward calculation because the employment multiplier is related to the marginal propensity to consume locally (*MPC*):[3]

Equation 9. $$M = \frac{1}{(1\text{-}MPC)}$$

[2]Own-source revenues are revenues that are generated locally and are not *transfers* from other units of government. They consist mainly of taxes and fees collected by local government units.

[3]This relationship is identical to the "Keynesian multiplier" developed in undergraduate macroeconomics.

Rearranging terms in Equation 9 gives the following:

Equation 9a. $$MPC = 1 - (\frac{1}{M})$$

The change in local retail sales ($\Delta LOCRETAIL$) is calculated as follows:

Equation 10.
$$\Delta LOCRETAIL = (MPC)(\Delta Y)$$

Sales tax revenue is estimated by applying the local sales tax rate (T_{sales}). The change in local sales tax revenue ($\Delta LOCSALESTAX$) is:

Equation 11.
$$\Delta LOCSALESTAX = (\Delta LOCRETAIL)(T_{sales})$$

If intergovernmental revenues are allocated to local jurisdictions on the basis of population, then the intergovernmental revenue impact, ΔIG, is:

Equation 12. $$\Delta IG = (\frac{IG}{P})(\Delta P)$$

That is, the change in intergovernmental revenue equals intergovernmental revenue per capita times the change in population. From Equations 8 and 12, the total general revenue impact, *GREV*, is:

Equation 13. $$\Delta GREV = \Delta OSR + \Delta IG$$

Public Expenditure Impact. Estimates of local government expenditure change are tied to changes in population. Accordingly, assumptions concerning migration and local population response to new employment opportunities are essential in determining future public expenditure levels. Because all fiscal expenditure impacts use local population as the service base, the fiscal impact for each service expenditure, *i*, is determined in the following equation, where EXP_i is the level of public expenditure for service category *i*:

Equation 14. $$\Delta EXP_i = (\frac{EXP_i}{P})(\Delta P)$$

The total expenditure impact, ΔEXP, is the sum of all individual expenditure impacts:

Equation 15. $$\Delta EXP = \sum \Delta EXP_i$$

In summary, the impacts of a change in local export employment on total local employment, income, and population are given in Equations 5 through 7b. These estimates are used to derive the fiscal impacts as described by revenue Equations 8, 8a, 8b, 11, 12, and 13, and expenditure Equations 14 and 15.

Data Requirements

The geographic area to which data correspond should be consistent with the objectives of the study. Whenever possible, a county-based study should use county-level data, a multicounty regional study should combine data from several counties, and a community study should include data for the city or town in question.

The location quotient technique used in this model is best applied to employment data at the two-digit SIC level of aggregation. (SIC stands for "standard industrial classification" and is one way the Census Bureau classifies industries.) The utility of location quotients increases with finer levels of detail (Isserman 1980). Because two-digit SIC employment data are usually available and because disclosure problems become more serious as the level of detail increases, it is recommended that two-digit SIC data be used. The analyst may choose to use a mixture of one-, two-, and three-digit SIC data, but this may increase the burden of data collection.

An excellent source of two-digit employment data at the county level is *County Business Patterns (CBP)*. This source is published annually, usually with a three-year lag. Thus, in 1992 the most current CBP comprises 1989 data. For multicounty regional studies, data for several counties can be combined. County-based employment and income data can also be found in data books published by state departments of commerce or community development, or colleges and universities. If there are only a few employers within an SIC code, data will be presented as a range of values. Disclosure problems of this kind occur frequently. A procedure for estimating data withheld due to disclosures is found in Gardocki and Baj (1985).

At the community level, data are often difficult to obtain. Local public agencies sometimes maintain employment data for the local area and may help in providing information. If the city or regional planning authority cannot provide data, the analyst can combine *CBP* data with specific knowledge of the community. For example, if it is known that roughly 85 percent of county employment in the lumber and wood products industry (*SIC 24*) is located in a community, then the employment number for *SIC 24* from *CBP* is multiplied by 0.85 to provide an estimate of community employment in the industry. If an industry does not exist in the study area (which happens frequently in rural areas), simply enter zero for the category.

Population data for off-census years can be found in *Local Population Estimates*, another Census Bureau document. Local public planning offices often maintain these data.

Fiscal data can be obtained from a variety of sources. An impact study for a town or small city can draw data from local budget documents. These documents typically provide detail on sources of revenue such as property taxes, sales taxes, and revenue from other governments. Most states also require taxing jurisdictions to provide an annual audit to the state comptroller or department of revenue. These are also valuable sources of expenditure data.

Larger cities and counties can use all of the data sources discussed above. In addition, another source of fiscal data for these places is the *County and City Data Book* published by the Census Bureau. This book contains data for all counties and cities with populations of 25,000 or more. Data from this source cover the revenue and expenditures of *all* taxing districts in a county. Thus, revenue and expenditure data reflect the fiscal activity of all governmental units in the county, not just the county government. In most cases, the analyst can obtain the data necessary to implement this model.

An Illustration

The economic and fiscal impact model is illustrated with a case study: the impact of a new meat-packing plant in Cass County, Illinois, a rural county in the west-central part of the state. Figure 1 shows the basic procedure for an impact study. One must first identify the impact. An impact's "direct" effect must be clearly defined. This is the initial external stimulus to the local economy. Secondary, or spill-over, effects are not included here because the multiplier incorporates these later on. In the example, the direct effect is easily identified: jobs created at the new meat-packing plant.

After collecting employment data from *County Business Patterns* and other sources, and fiscal data from local records or state data books, the next step uses location quotients as described in Equation 1 to determine the export sectors of the region. Then, from Equations 2 and 3, one estimates export employment. This is done for two years to be sure there is nothing peculiar about the data. Results from this procedure are presented in Table 1.

It is evident from Table 1 that manufacturing is an export sector in Cass County. Because meat packing belongs to "Food and Kindred Products" (SIC 20) in the manufacturing sector, one knows that the direct effect of 100 new jobs in meat packing represents a change in export employment. If the initial impact did not occur in an export sector, then the initial effect would equal the total effect, and there would be no multiplier process.

Equation 4 calculates the employment multiplier. Data from 1980 give an employment multiplier of 1.83, whereas the 1986 multiplier is 1.96. These values are close, and the average (1.89) is taken as the employment multiplier for Cass County (see Table 2). From Equation 5, the total job impact in Cass County equals the employment multiplier times the change in export employment, or 189 new jobs (that is, 1.89 times 100).

Total personal income per job in constant 1990 dollars (that is, inflation-adjusted dollars) in Cass County is $33,823. Using Equation 6 and multiplying this number by total employment change yields $6.4 million as the estimate of total personal income change. Two population change estimates are also given in Table 2. The first is from Equation 7a, which assumes that the population-to-employment ratio (2.14) is constant. Given this assumption, the change in total population is 404 people. From Equation 7b, which allows for migration and intercounty commuting, the population change is 211.

Table 3 presents data for calculating the population and total personal income impacts. The table also lists revenue and expenditure data required for the fiscal impacts of the meat-packing plant. Equations 8 through 13 yield total general revenue impacts ranging from $392,166 to $482,956 in 1990 dollars (Table 4). Because expenditure impacts are based on anticipated population change, both high and low estimates are presented in Table 5. High estimates are derived by assuming that the population-to-employment ratio is constant. Low estimates allow for both migration and intercounty commuting. Consequently, the impact on total general expenditures ranges from $250,777 to $480,416. Expenditure changes for individual categories are also shown.

Table 6 illustrates the meat-packing plant's net budgetary impact on local governments in Cass County. If the ratio of population to employment is constant, then the plant increases local public revenue by $2,500. On the other hand, if the assumptions in Equation 7b are appropriate, then the plant increases local public revenue by more than $141,000.

Conclusion

The economic and fiscal impact model provides a low-cost methodology for estimating effects from a change in the local employment base. Because analysis of this kind is important to communities everywhere, it should interest local government officials, planners, and others charged with evaluating economic development efforts. The methodology is relatively simple and employs readily available data. This methodology can be used as the first stage of a larger study using more sophisticated forms of analysis, such as econometric or input-output methods, which require more technical expertise, higher expense, and extended lengths of time to complete.

The meat-packing example illustrates the importance of the analyst's judgement and assumptions when conducting a study. If the plant requires an incentive package worth

$100,000 as a condition to locate in Cass County, it would not be in the local government's budgetary interests if the "high" scenario is thought to be appropriate. If the area is characterized by high levels of unemployment and a labor surplus, however, then the "low" scenario indicates that there would be budgetary gains to local governments in Cass County. In this case, the "low" scenario is probably appropriate because the county had a 1990 unemployment rate of 14.8 percent.

The economic and fiscal impact model has several important limitations. In any evaluation, its assumptions must be stated clearly to ensure proper assessment of the economic development effort. Furthermore, economic and budgetary criteria alone are not the only criteria to consider in an evaluation. Other social and political considerations are often relevant, and these must be recognized in the overall evaluation.

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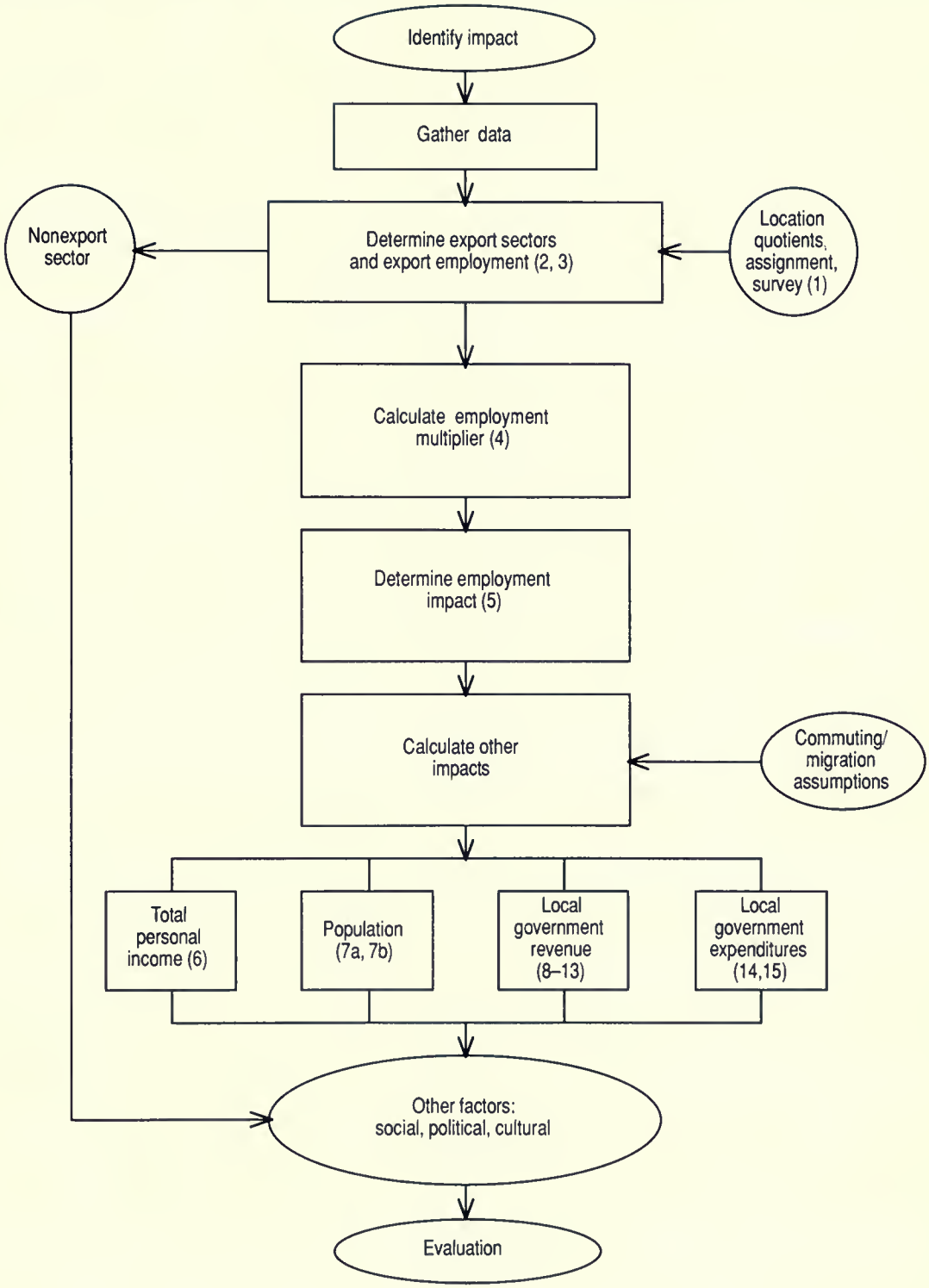
Figure 1. Steps of the impact study



Note: Equation numbers are indicated in parentheses.

Table 1. Export employment in Cass County: 1980 and 1986

Major industry group	Export employment 1980	1986
Farm	857	793
Agricultural services, fishing, and forestry	53	74
Mining	0	0
Construction	212	188
Manufacturing	1,508	1,298
Transportation and public utilities	662	529
Wholesale trade	0	0
Retail trade	0	0
Finance, insurance, and real estate	263	332
Services	0	0
Government	0	0
Total export employment	3,555	3,214

Note: Export employment is presented at the one-digit SIC level.

Table 2. Estimates of economic impacts

Employment multiplier:	1.89
Direct employment impact:	100
Total employment impact:	189
Estimated population change	
High:	404
Low:	211
Total personal income impact:	$6,392,568

Note: The employment multiplier represents an average for two years, 1980 and 1986. For the "high" estimate of population change, the population-to-employment ratio is held constant; for the "low" estimate, the ratio is multiplied by 0.522. For total personal income, the ratio of local total personal income to employment is assumed constant. Total personal income impact is in 1990 dollars.

Table 3. Data for population, income, and fiscal impact calculations

Population, 1986	13,465	
Total personal income ($1,000s), 1986	174,093	
Total employment, 1986	6,292	
Local sales tax rate (percent)	1.25	
Fiscal data: FY 1986–87	$1,000s	Per dollar of income
Own-source revenue	5,544	0.0318
Property taxes	4,792	0.0275
Other taxes and charges	752	0.0043
Intergovernmental revenue	$1,000s	Dollars per capita
State	5,075	376.90
Federal	273	20.27
Total general expenditures	13,527	1,004.60
Education	6,491	482.06
Health and hospitals	220	16.34
Police	712	52.88
Public welfare	32	2.38
Highways	1,908	141.70

Note: All dollar values are in current dollars.

Table 4. Revenue impacts to local governments in Cass County from meat packing

Revenue category	Dollars
Own-source	293,020
Property taxes	175,959
Other taxes and charges	117,061
Sales taxes	37,712
Intergovernmental revenue	
State	
High	180,240
Low	94,085
Federal	
High	9,696
Low	5,061
Total general revenue	
High	482,956
Low	392,166

Note: All values are in 1990 dollars. High and low estimates reflect migration and commuting assumptions. Own-source revenue impacts are calculated assuming a constant relationship between the revenue source and income. Intergovernmental revenue is calculated on a per-capita basis given estimated changes in population.

Table 5. Expenditure impacts to local governments in Cass County from meat packing

Expenditure category	High	Low
Total general	$480,416	$250,777
Education	230,530	120,337
Health and hospitals	7,813	4,078
Police	25,287	13,120
Public welfare	1,136	593
Highways	67,763	35,372

Note: Table entries are in 1990 dollars. High and low estimates reflect migration and commuting assumptions. All expenditure impacts assume constant per-capita spending.

Table 6. Net impact on local government fiscal position

Category	High	Low
General revenue	$482,956	$392,165
General expenditure	480,416	250,777
Net positive budgetary impact	2,540	141,388

Note: Table entries are in 1990 dollars.

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