Economic impact multipliers

Technote

Introduction

Economic impact analysis is an important tool for predicting the effects of a variety of economic decisions on a community, town, city, or country. This type of analysis is used for forecasting changes in a myriad of economic variables including unemployment, income, investment and tax revenue in response to an economic shock. Economic impact analysis can address questions such as: “How much tax revenue will be generated by a 1% increase in income tax?” “How many jobs will be lost if the food processing plant relocates?” and “How much economic activity will an increase in consumer spending generate?”

Inputs and outputs

The fundamental philosophy behind impact analysis is that changes (increases or decreases) in expenditures are *multiplied* through the economy; an increase in spending on some goods and services generates a need for additional goods and services. Similarly, expenditure declines lead to larger economic contractions. Using *input-output* analysis, we are able to track this cascading effect through the economy. Mathematical manipulation of input-output tables generates economic *impact multipliers*, which estimate the total effect of an initial change in spending in a particular area of the economy.

The creation of accurate input-output tables is a detailed and lengthy procedure usually performed only by central statistical agencies such as Statistics Canada. They are generally only constructed for large urban centres or entire provinces and countries. This clearly limits the use of input-output analysis for smaller urban communities and rural areas. Further, even larger cities, states, or provinces may not have a recent set of input-output tables available for use in an economic impact study. In such cases, an alternative methodology must be employed that performs the same function of the input-output matrices. For an example of how to model economic impacts when no input-output matrices are available, consider the fictional town of Deptford, located in southern Ontario, whose town council is considering whether to build a new recreation centre.

Terms and definitions

The concepts of *direct* and *induced* effects are integral to the calculation of economic impacts.

- **Direct effects** are total payments made to suppliers of labour, equipment, operation and maintenance supplies and services required for the construction of the centre.
- **Induced effects** include all other changes occurring in the economy as a result of the construction of the recreation centre.

The firms contracted to construct and maintain the recreation centre pay wages, which in turn will be spent and will generate more demand for a variety of goods and services, which will become income and be spent again. This is the induced effect of wage payments.

Consider the example of the increased demand for labour associated with the recreation centre. This will have both direct and induced effects on the labour market and other related industries. Operations and maintenance expenditures as well as payments for capital equipment will also have a direct effect, and ensuing rounds of induced effects. Essentially, this means that the final impact on the economy will be greater than the initial cost of the centre.

Identifying local impacts

Expenditures on wages and salaries tend to have a high local impact. Expenditures on equipment tend to be more diffused, especially if the machines and materials are purchased from outside the region or are manufactured elsewhere. Typically, the economic leakage associated with capital expenditures is quite high, which means that local impacts are low.

Undoubtedly, the town and surrounding region will be able to supply some of the demand for goods and services created by the project, but it is also likely that a portion of the centre's requirements will be satisfied by importing goods from a larger urban centre, in this case Toronto, and from other locations outside of Deptford.

A method is needed to approximate the direct and induced effects that are frequently supplied from an input-output table, and which allows for the calculation of local effects (on Deptford and surrounding communities) and the more general impacts on the province as a whole.

This problem is solved by developing a series of coefficients. The coefficients developed for wage payments will estimate how much of every dollar received as initial wages will be spent in the immediate community, and in what category of goods or services the local expenditures will fall (giving the direct effect). To model the impact, these recurring expenditures are treated as re-spending in the form of wages, and will then be multiplied by the appropriate coefficients to determine what effects they will have locally (generating a portion of the induced effect). Eventually, the wages created by the last round of expenditure will approximate zero as the coefficients are necessarily less than 1.0, since not all income is spent.

The same methodology can be used for investigating the economic impact of operations, maintenance, and capital expenditures. Naturally, the coefficients used for the purchase of physical goods are different (generally lower) than those employed for the evaluation of the effects of wage payments. This is because local production of specialized equipment is low. The "leakages" from the local economy for capital goods are therefore much higher than for wages.

Frequently, the direct effects of operations, maintenance, and capital expenditures will be calculated with one set of coefficients specifically developed for the goods in question. The induced effects can be approximated using the coefficients developed for wages. This methodology assumes that the supplier of capital products incurs costs only in the form of wage payments to employees or subcontractors; this is clearly a weak assumption, but it greatly simplifies the necessary computations.

Wages

Looking at the economic impact of wages paid to residents of Deptford is easier than considering the impact of capital expenditures or trying to estimate the separate economic effects of wages paid to both residents and non-residents. Since the same methodology can be applied to both the simple (local wages only) and complex (non-resident wages and capital expenditures), we consider only the wages paid to town residents.

Assume that construction of the recreation facility will cost the town $500,000 in wages paid to workers hired from the Deptford community. Clearly, this will initially increase the employment income in the town by an identical figure. Once these earnings have been received by the workers, they are spent on either taxes, savings, or consumption expenditures. The consumption expenditures will flow both to residents and non-residents, with expenditures to residents creating a second round of wages that will be spent, thus creating a third round, etc.

We can mathematically model this process by constructing a multiplier. Based on expenditure patterns by province (these can be obtained from the Statistics Canada publication #62-555), expenditure patterns can be identified. Next, we must identify the proportion of each category of expenditure that goes to local residents, with the remainder going to "imported" goods from other areas in Ontario, Canada, or the rest of the world.

The categories of consumption from Statistics Canada's "Family Expenditure in Canada" publication and the consumption patterns for Ontario are listed in Table 1 (the ones listed here are from 1986). These figures indicate what proportion of consumption spending occurs in the following categories of goods and services.

FOOD: Agricultural products, fruit, vegetables, meat, fish, and dairy;

SHELTER: Residential construction, repair construction, furniture and fixtures;

CLOTHING: Textile products, knotted products and clothing;

TRANSPORTATION: Transportation, storage, autos, trucks, and other transportation equipment;

SERVICES: Personal and other miscellaneous services, and miscellaneous manufactured products;

READING MATERIAL: Paper products, printing, and publishing;

TOBACCO AND ALCOHOL: Beverages, tobacco, and tobacco products;

PERSONAL TAXES: Income tax.

The second figure in Table 1 is a hypothetical domestic content variable that indicates how much of each consumption category is supplied from producers in Deptford. In a true study, the local supply coefficients would have to be identified by considering what local businesses can produce or by administering a survey.

TABLE 1

Personal expenditure categories	Average expenditure coefficients for Ontario residents	Local production coefficients (hypothetical)
Food	0.149	0.451
Shelter	0.257	0.822
Clothing	0.059	0.033
Transport	0.142	0.301
Services	0.144	0.683
Tobacco/Alcohol	0.039	0.007
Reading Material	0.204	0.246
Income Tax	0.006	0

Based on these figures, we can construct the following flow chart (next page) for the town of Deptford, illustrating how wage expenditures impact the local economy.

A Deptford worker who receives $1 in wages will therefore spend $0.067 on food produced in Deptford (0.149*0.451), and $0.082 (0.149*0.549) on food imported from other locations. Using this chart, we can calculate what proportion of every dollar spent stays in the town, and how much leaks out of the system in the form of imports and taxes—assuming that income tax, GST, and PST are all leakages on the local economy (this may not be the case, and the model may be modified as required). If we add up the proportions of each dollar that is spent locally for each consumption category, and then adjust for 7% GST and 8% PST levied on every transaction, we find that 36.3 cents out of every dollar spent in Deptford is retained by the town's economy.

One dollar in additional wages will cause a secondary economic impact of $1*(0.363) = $0.363 in the town. This secondary economic impact can then be multiplied by the same local multiplier to arrive at the third round of economic activity $0.363*(0.363) = $.132. Naturally, we can calculate these spending rounds indefinitely, or simply use the formula 1/(1-r), where r is the local economic multiplier, to calculate the total local economic impact of additional wage payments. Given our assumption that the entire bill for construction of the recreation centre in the form of local wage payments is $500,000, we can now conclude that the entire local economic impact of this project associated with wage payments will be $500,000/(1-0.363) or $784,929.

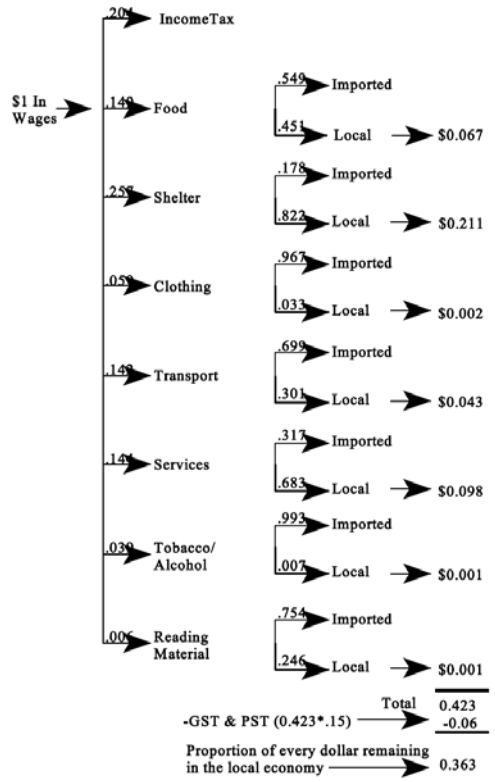

FIGURE 1

Other applications

This example of economic impact analysis using multipliers is simplified, but it shows the fundamental theory and strategy used in more complex models. Clearly, considerations such as where the money for the project is coming from (taxes versus money market products), the change in tax revenues (from increased or decreased income and expenditure taxes), and how the nonwage expenditures alter the economic impact all have to be evaluated. However, these and other considerations can be incorporated into the model, which provides the analyst with a flexible and adaptable economic modelling tool.

Additional readings

Davis, Craig H. *Regional Economic Impact Analysis and Project Evaluation.* Vancouver: University of British Columbia Press, 1990.

Harmston, F. and R. Lund. *Application of an Input-Output Framework to a Community Economic System.* Columbia: University of Missouri Press, 1967.

Jensen, R. et al. *Regional Economic Planning: Generation of Regional Input-Output Analysis.* London: Billing & Sons Ltd., 1979.

Richardson, H. *Input-Output and Regional Economics.* London: Weidenfeld and Nicolson, 1972..

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