

MEASURING ECONOMIC IMPACTS OF PROJECTS AND PROGRAMS

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There is often interest in assessing the local or regional economic impacts of a project, program or policy. However, economic impacts are easily misrepresented. This primer explains the fundamental options and tradeoffs involved in selecting the right kind of techniques for assessing economic impacts, and explains how to match the appropriate methods to different kinds of applications or situations.

1. WHAT ARE ECONOMIC IMPACTS?

Economic impacts are effects on the level of economic activity in a given area. They may be viewed in terms of: (1) business output (or sales volume), (2) value added (or gross regional product), (3) wealth (including property values), (4) personal income (including wages), or (5) jobs. Any of these measures can be an indicator of improvement in the economic well-being of area residents, which is usually the major goal of economic development efforts.

The *net* economic impact is usually viewed as the expansion or contraction of an area's economy, resulting from changes in (i.e., opening, closing, expansion or contraction of) a facility, project or program. Sometimes there is also interest in assessing the economic impact of an already existing facility or project. This is usually viewed in terms of the jobs, income and/or business sales that are directly or indirectly supported by the facility or project. Such measures actually represent the *gross* effect -- i.e., the facility's or project's role in (or contribution to) the area economy. That is not necessarily the same as the net impact, particularly if other activities would be expected to enter or expand in the absence of this facility or project.

Economic impacts are different from the valuation of individual *user benefits* of a particular facility or service, and they are also different from broader *social impacts*. The user benefits and social impacts may include the valuation of changes in amenity or quality of life factors (such as health, safety, recreation, air or noise quality). Yet while these various types of benefits and impacts may be valued in economic (money) terms, through studies of individuals' or society's "willingness to pay" for improving them, they are not economic impacts (as defined above) except insofar as they also affect an area's level of economic activity.

Economic impacts also lead to *fiscal impacts*, which are changes in government revenues and expenditures. Economic impacts on total business sales, wealth or personal income can affect government revenues by expanding or contracting the tax base. Impacts on employment and associated population levels can affect government expenditures by changing demand for public services. Yet while they are related, fiscal impacts are not the same as economic impacts.

2. HOW SHOULD ECONOMIC IMPACTS BE MEASURED?

Alternative Measures. The various measures of economic impacts have very different interpretations:

Total employment reflects the number of additional jobs created by economic growth. This is the most popular measure of economic impact because it is easier to comprehend than large, abstract dollar figures. However, job counts have two major limitations: (1) they don't necessarily reflect the quality of employment opportunities, and (2) they cannot be easily compared to the public costs of attracting those jobs (through subsidies, tax breaks or public investments).

Aggregate personal income rises as pay levels rise and/or additional workers are hired. Either or both of these conditions can occur as a result of business revenue growth. As long as nearly all of the affected workers live in the study area, this is a reasonable measure of the personal income benefit of a project or program. However, it is still an under-estimate of the true income impact, insofar as there is also some net business income (profit) generated that may be paid out as dividends to local business owners or else reinvested locally in buildings, equipment or labor training-- thus further improving the economic base of the area.

Value Added (which is normally equivalent to Gross Domestic Product or Gross Regional Product) is a broader measure of the full income effect. This measure essentially reflects the sum of wage income and corporate profit generated in the study area. However, in today's increasingly global economy, value added can be an over-estimate of the true income impact on a local area, insofar as it includes all business profit generated there -- including that paid out as dividends to owners of the business who do not reside in the study area, and that which is reinvested in corporate facilities outside of the study area. Thus, while value added is the most appropriate measure of impact on overall economic activity in a geographic area, the personal income (wage) measure is often preferred as a more conservative measure of income benefit to residents of the area.

Business Output (also referred to as revenue or sales volume) is the broadest measure of economic activity, as it generates the largest numbers. It includes the full (gross) level of business revenue, which pays for costs of materials and costs of labor, as well as generating net business income (profits). This can be a

misleading measure of economic development benefit, since it does not distinguish between a high value added activity (generating substantial local profit and income) and a low value added activity (generating relatively little local profit or income from the same level of sales).

Property Values are also a reflection of generated income and wealth. However, it would be double counting to add property value impacts to income or value added impacts. After all, when property values rise in a community as a result of increasing demand for property, that may be a direct consequence of increasing aggregate personal income or investment of business profits. It is also important to note that when property values go up in one neighborhood and down in another neighborhood, there may be a redistribution of wealth but no net change in the overall level of local wealth or income.

Overall, these various measures of economic impact are overlapping. A portion of business output (revenue) goes to pay worker incomes and generate profits, which are also the components of value added. Property values also reflect investment of personal income and corporate profits. For these reasons, the different measures of economic impact (income, value added and output) cannot be added together.

Selection of Appropriate Measures. The selection of the most appropriate measure of economic impact depends on the purpose of the analysis. For example:

A public information study is aimed at representing the impacts of an existing activity or planned project. It may be used to help guide economic development policy, or it may be used for public relations purposes. For this kind of study, the number of additional jobs created is the most popular benefit measure, as it is most widely understood and appreciated. Other common measures of benefit are aggregate dollar measures of business sales and wage income created as a result of the project. Other measures of benefit, such as value added or gross domestic product are also legitimate indicators of economic impact, but are less well understood by the public and political decision-makers. (Fiscal and/or environmental impacts can also be assessed for public relations purposes).

The economic portion of a formal "environmental impact assessment" is aimed at estimating the expected future impacts of a proposed project or policy. For that kind of study, potentially all of the different aspects of economic impact (reflected in various measures listed above) can be relevant. However, to avoid double-counting, the valuation of multiple measures of economic impacts should not be added together.

A benefit/cost (B/C) analysis is aimed at aiding decision-making by comparing the benefits to the costs of implementing an existing or planned project, program or policy. For this kind of study, there is typically a comparison of the net economic benefit to the area with the net cost. The economic benefit is usually expressed as either personal income or value added. Property value changes can

be another measure of economic benefit, but usually cannot be forecast well for assessing future benefits of proposed projects. (Note that while fiscal benefits and costs for government may also be compared, a project should be justified on the basis of net benefit for society --within the area of jurisdiction-- rather than on the basis of net revenue or profit for government.)

A "*retrospective*" *research study* requires that the benefit measure be based on available historical data. That is most frequently employment, business sales and/or property values.

3. HOW DO ECONOMIC IMPACTS OCCUR?

Direct Economic Effects are the changes in local business activity occurring as a direct consequence of public or private business decisions, or public policies and programs. These may occur as a result of various factors, each of which is analyzed differently:

- ***Investment and Spending Decisions*** - These directly affect the flow of spending, income and jobs associated with economic activities. It can be useful to distinguish between facility location/operation decisions and non-facility spending programs.
 - ⇒ Facility Investment and Operations -- A major business or government activity may move in or out, start up or close down, expand or contract within a given impact area. For example, this may be a military base, factory or office. The direct effect is the associated change in business activity (output, jobs and income) in the associated SIC (standard industrial classification) category there. Any such additional business activity gain to an area must be measured net of displacement of previously-existing activities, and any such business activity loss to an area must be measured net of any offsetting attraction of new activity to partially or totally fill that gap.
 - ⇒ Non-Facility Spending Program -- A public or private spending program may start up, expand, shrink or end. For example, this may be a major building, road or public facility construction project, or funding of a major employment program. The direct effect is the change in local business activity occurring as a result of the change in revenue flowing to local businesses from that spending activity. To calculate this, it is necessary to first establish a budget for how the spending is distributed among labor and purchases of products and services (i.e., SIC categories), and the portion of that spending (for each SIC category) that will flow to local workers and businesses.

- **Cost Shift** - A public or private policy change or project may change the cost of living and/or business operating cost within a given area. For example, this may include taxes, tolls, travel fares, or utility rates. The direct effect is the change in local business activity occurring as a result of the change in household and/or business operating cost. To calculate this, it is necessary to estimate the change in disposable household income and business operating cost, and how they would affect consumer spending and business sales volume. That typically requires economic modeling.
- **Locational Competitiveness** - A public or private program or policy may affect the attractiveness of an area for population growth and retention, and for business investment and retention. For example, this may include impacts of changes in business productivity (due to transportation or job training investments), or changes in public safety or local recreational amenities. The direct economic effect is the change in local economic activity occurring as a result of these changes. To calculate this, a model addressing population in/out migration and business competitiveness effects (including attraction and expansion) is necessary.

There are also broader indirect, induced and dynamic economic effects that follow from any and all of the above types of direct effects. (Some or all of these may be referred to as "multiplier effects"; however, see Section 5 for a discussion of multiplier impacts.) These additional effects include:

- **indirect business impacts** -- business growth/decline resulting from changes in sales for suppliers to the directly-affected businesses (including trade and services at the retail, wholesale and producer levels);
- **induced business impacts** -- further shifts in spending on food, clothing, shelter and other consumer goods and services, as a consequence of the change in workers and payroll of directly and indirectly affected businesses. This leads to further business growth/decline throughout the local economy.
- **dynamic economic effects** - consequences of broader shifts over time in population and business location patterns, land use and resulting land value patterns, which may also affect government costs and revenues. These changes will ultimately affect income and wealth - both overall and for particular groups of people in the affected area.

4: HOW SHOULD THE STUDY AREA BE DEFINED?

There is no subject that causes more error or confusion in economic impact analysis than the selection of the appropriate geographic area of study. The fundamental reason is that, depending on how the geographic area is defined, certain economic effects will

either be internal or external to the area, and the distribution of gainers and losers will differ. Consider the following example:

Example: Location Shift & Inter-Jurisdictional Spillover Effects

Consider a local project that successfully expands existing business and attracts other businesses to locate nearby --some moving from elsewhere in the city, some from elsewhere in the country and some from other countries. Assuming that job growth is desired at all levels, then each geographic unit would see a different measurement of job benefits:

- *From the viewpoint of a neighborhood jurisdiction, all of the new jobs attracted to the local area will normally be regarded as a benefit.*
- *From the viewpoint of a city jurisdiction, business expansion & business relocations from outside to inside the city will be seen as a benefit, but shifts within the city --gains in one part of the city being offset by losses in other parts of the city-- will not be seen as a net overall benefit.*
- *From the viewpoint of a state jurisdiction, business expansion & relocations from outside to inside the state will be seen as a benefit, but shifts within the state will not be seen as a benefit.*
- *From the viewpoint of a national jurisdiction, business expansion and relocations from outside to inside the country will be seen as a benefit, but shifts within the country will not be seen as a benefit.*

In general, the measured benefit from a project will change with the area of analysis. Analyses for smaller areas include resource shifting effects which are excluded from net benefits at the more global levels. However, they also miss broader external benefits for outside businesses which are included at the more global levels.

The primary study area for economic impact analysis must be explicitly defined, by considering four factors:

- (1) **The area of jurisdiction for the sponsoring agency**, which could be the agency responsible for project funding, project spending (implementation) and/or project evaluation. This area could be a neighborhood, city, county, state/province, nation or the world.
- (2) **The area of direct project influence**. Whether the project involves a route/line or a specific terminal facility, the "area of direct influence" includes the area in which people (users or non-users) are affected.

- (3) **Interest in distributional impacts on a sub-area.** Some projects are motivated by a desire to assist the economic development (attraction of investment and income) for a specific sub-area, and that may be deemed to be a "socially desirable" goal even if the net impact of the project is merely a redistribution of income and wealth. In other cases, fear of "dis-benefits" to a specific sub-area is also a social concern.
- (4) **Interest in external area consequences.** What might be economically efficient from the viewpoint of "self interest" for a small jurisdiction may have consequences (favorable or unfavorable) for a broader area. There may be public interest in the "equity" (fairness) of impacts on external areas. There may also be separate consideration of the broader "efficiency" associated with external impact responses (i.e., "Will outside parties respond with policies or investments in ways that that will ultimately enlarge or diminish the otherwise-expected local benefits?")

5. WHEN ARE MULTIPLIERS USED?

The "indirect" and "induced" business impacts of a program, project or facility are often referred to as "multiplier effects," since they can make the overall economic impacts substantially larger than the direct effects alone. In reality, while indirect and induced impacts do always occur, the net impact on the total level of economic activity in an area may or may not be increased by multiplier effects. That outcome depends on the definition of the study area and the ability of that area to provide additional workers and capital resources, or attract them from elsewhere.

If all that happens is that resources are shifted away from some other use to serve (indirect and induced) needs created by the new project or program or policy, then there are likely to be no net multiplier effects on total impact. The assumption that new workers and capital can indeed be attracted (providing for multiplier effects) is a reasonable assumption for many local and state impact studies, but it is often not applicable for larger regional and national impact studies.

Typical multipliers are defined as follows:

Output multiplier for a given industry in a given area

= Total overall increase in dollars of business output for all industries per dollar of additional final demand (purchases) of the given industry

Job multiplier for a given industry in a given area

= Total overall increase in jobs for all industries per new job created in the given industry

Input/output models and economic simulation models, both available for any given (county or larger) area, provide multipliers that are estimates of local spending impacts assuming continuation of current inter-industry trade patterns and local flows of money into and out of the area. Their magnitudes vary depending on the technology of the industry in which spending occurs and the size of the area economy --which affects the portion of these impacts that remain in the local economy and the portion that "leaks out" to outside areas. The multiplier values for most industries are generally around 2.5 - 3.5 for national impacts, 2.0 - 2.5 for state impacts and 1.5 - 2.0 for local area (large city) impacts.

6. WHAT ARE THE OPTIONS FOR ECONOMIC MODELING?

Economic models can be used to forecast personal income, employment, business sales and value added impacts. The available models represent a continuum of sophistication and cost, so it is prudent to match the economic model to the problem at hand.

Input/Output (I/O) Models. These are essentially accounting tables which trace the linkages of inter-industry purchases and sales within a given county, region, state or country. They utilize information on both technologies ("What inputs from other industries are used to produce a dollar of product for each specific industry?") and local trade ("How much of a given industry's purchases are supplied by other firms located within the study area?"). The I/O model yields "multipliers" that are used to calculate the total direct, indirect and induced effect on jobs, income and output generated per dollar of spending on various types of goods and services in the study area. Input/output models calibrated for specific counties or aggregations of counties are commercially available for any part of the US from MIG, Inc. (IMPLAN model) and US Bureau of Economic Analysis (RIMS-II: Regional Input/Output Multiplier System). Tables of typical multipliers for state and local levels are also available in printed form from the US Chamber of Commerce ("What 100 Jobs Means to a Community", 1993).

I/O Models can be used directly to estimate the full income and job effects of changes in business activity levels (e.g., plant closings and new plant openings), and with "demand translator" (budget breakdown) tools, to also estimate the effects of changes in spending (e.g., tourism or construction activities). However, I/O models have significant limitations because they do not cover dynamic impacts over time. Used alone, they assume that there are no impacts on wage levels, property values, prices or costs of other product inputs or outputs, no change in labor or capital productivity (the ratio of output per unit of input), and no change in population or business in/out migration patterns. They also do not provide a means for directly assessing impacts of projects or programs affecting relatives costs or locational competitiveness.

Economic Simulation Models. These are "econometric" and "general equilibrium" models -- sophisticated computer programs that trace the total effects over time of changing economic conditions in a study area. They include all of the functions of input/output models, plus additional functions to forecast effects of future changes in business costs, prices, wages, taxes, productivity and other aspects of business competitiveness, as well as shifts in population, employment and housing values. Simulation models calibrated for specific counties or aggregations of counties are commercially available for rental, purchase or custom studies from Regional Economic Models, Inc. (REMI Model).

Simulation Models, like I/O Models, can be directly applied to estimate the full income and job effects of business location, industry activity and spending shifts. Unlike I/O models, they may also be used to estimate the further effects over time of changes affecting relative costs, prices, productivity, business competitiveness, and population in/out migration. However, economic simulation models involve more analytic sophistication and cost more to acquire than the input/output accounting models.

7. HOW IS BENEFIT/COST ANALYSIS APPLIED?

Many economic impact studies are carried out for research or public information purposes, and are not meant to be Benefit/Cost (B/C) studies. B/C Analysis is primarily relevant as an aid for decision-making. There are several applicable "tests" for this decision-making:

Feasibility -- A project is "feasible" if there is the money and technical resources to do it. This test, by itself, is applicable if there is a desire to do the project regardless of resource costs -- a rare circumstance.

Cost Effectiveness -- This is the ratio of cost per unit of desired results (e.g., cost per ton of emissions reduction, or cost per person served). This test is applicable when the benefit measure cannot be reliably translated into money terms (e.g., pollution reduction). It is most usefully applied when there is a clear goal (measure) for the desired level of benefit results.

Net Present Value (NPV) -- This is calculated as follows:

NPV = Present Value of Project Benefit minus the Present Value of Project Cost, where "Present Value" is the discounted value of a stream of benefits or costs (explained below).

NPV reflects the value of the project at the time of decision-making. At its best, the NPV test can be the most comprehensive form of economic comparison, encompassing the money values of all favorable effects (benefits) and all unfavorable effects (costs). Included in costs should be the capital cost of borrowing

or obtaining equity capital --i.e., the interest required to obtain the funds. Any project with a positive NPV is "efficient." Among competing projects, the alternative that maximizes NPV is also the most desirable (i.e., "economically efficient") one.

Benefit/Cost Ratio (B/C) -- This is calculated as follows:

$$\text{B/C} = \text{Present Value of Project Benefit divided by Present Value of Project Cost}$$

By definition, any project with a positive NPV will also have a B/C ratio exceeding 1. However, a *large* project with lower B/C ratio (e.g., 1.4) may still have a higher NPV than a *small* project with a higher B/C (e.g., 1.6). For agencies with constrained funding resources, the B/C test is thus the preferred basis for decision-making among alternatives (such as the choice of project size, location or configuration). While in theory, any project with a B/C ratio exceeding 1 is worthwhile, most public agencies have recognized that there is some uncertainty associated with both the benefit and the cost estimates. Accordingly, it is not uncommon for agencies to desire a threshold of B/C exceeding 1.5 for large new projects, and 1.3 for incremental projects (in which uncertainty is less.)

Calculation of "Present Value". Both NPV and B/C tests require that costs and benefits be presented in terms of their value as of the time of the decision-making. This involves a two-step process. First, all costs and benefits must be expressed in constant dollars (which effectively controls for future inflation). Then, a discount factor is applied to reduce the values of future costs and benefits to represent their present values. The formula is as follows:

$$\text{Present value of a dollar of cost or benefit in a future year (n)} = 1 / (1 + d)^n$$

where d = discount rate (i.e., the time value of money over and above inflation)

Selection of the appropriate discount rate is an important and sometimes controversial policy issue. The lower the discount rate selected, the more likely will be that projects with high initial costs but benefits far off in the future will pass the NPV and benefit/cost tests. The principal criterion is the "opportunity cost of capital", which may be judged to be any one of the following:

- the *rate of return* that the money can could have otherwise earned in the private sector, or
- the *actual cost of borrowing money* by a public sector agency (which is typically a low interest rate due to its tax free status); or
- the *rate at which people effectively value receiving money now* rather than in the future (the "social rate of time preference").

Among these choices, an important consideration is the available alternatives available for use of the real resources (labor, machinery, etc.) which can be paid for by the available money. For public sector projects, the US Office of Management and Budget (OMB) now recommends a 7% real (inflation corrected) discount rate, as representing the private sector rate of return on capital investment.

8. CONCLUSIONS: THE SEVEN DEADLY SINS OF ECONOMIC IMPACT STUDIES

This discussion leads us to identify "seven deadly sins" to avoid in conducting economic impact studies. These are:

1. Confusing the *economic role* (gross effect) of a facility or project from its *net impact* on the economy of an area;
2. Adding together different measures of the same economic change (e.g., changes in business sales and personal income);
3. Confusing study areas (e.g., neighborhood, citywide, state and national effects);
4. Confusing time periods (e.g., immediate and eventual effects on economic growth);
5. Assuming that a facility's capacity and its actual level of activity are the same;
6. Applying multipliers in situations where they don't apply; and
7. Ignoring market effects on wages and land/building costs, which can also affect the economic competitiveness of an area.

NOTE

Portions of this primer are drawn from the guide: "Assessing the Economic Impacts of Transportation Projects" by Glen and Burton Weisbrod, published in 1997 by the National Academy of Sciences / Transportation Research Board as *Transportation Research Circular #477*.