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LIMITS OF BENEFIT-COST ANALYSIS

1. INTRODUCTION

Benefit-Cost (BC) analysis has become a familiar basis for assessing the prospective merits of regional development policies. The approach is straightforward. First, assess the economic benefits resulting directly from the planned initiative. Second, multiply the direct effect by a multiplier to get the direct and indirect primary benefits. Third, identify the induced, or secondary benefits and multiply them by the same multiplier to get direct and indirect secondary benefits. Fourth, add the total primary and secondary benefits to get total benefit. Compare these total benefits with total project cost, selecting only those initiatives where the B/C ratio is greater than one or B-C, the net benefits are greater than zero. Where there was no resource constraint, B/C and B-C would be equivalent.

Ordinarily benefits would be measured by the monetary returns from employment needed to produce the resulting services, but the use of employment as the yardstick is due to data limitations. The discussion to follow would be the same if benefits were measured by number of jobs, income generated or gross product originating.

2. SPECIFYING THE DIRECT EFFECT – THE MULTIPLICAND

The most serious source of bias in determining the direct effect is failure to allow for displacement of other demands when project related demands are calculated. In a traditional Keynesian system for a closed economy with fixed resources, any increase in aggregate demand necessarily must come from tax reduction or government subsidy. No worry about supply elasticity

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as there is a stock of unemployed factors sufficient to accommodate any increase in demand for their output up to full employment. Also, there is no need for concern about changes in relative product prices as demands shift. But where there is full or close to full employment the issue of how increased local demand for output is financed is a real one. This offset could be decreased local expenditure on other local goods, local imports, or reduced local savings by area residents, but this would require additional information and analysis.

In general, only part of the increased total local demand for a new project would be that by local and non-local residents combined. But for local demand the true multiplicand would be less than total use by area residents, due to the displacement of other local demand in the area. Most of such displacement would be present in almost all infrastructure built to serve local demand. For new infrastructure built to serve non-residents, ordinarily there would be no such offset. Very few impact analyses allow for interconnected declines in competing or complimentary segments of local demand. In one study that explicitly allowed for estimating displacement demands of a casino, $412 million of direct effect was displacedby a $314 million reduction in demand for other goods by regional residents. Thus, the new spending of $589 million by residents and non-residents would actually produce only about $300 million of direct effect. Thus, the spending of $589 million represents a substantial over-estimate of the total direct impact of total net wagering by people from in and out of the study area, the state of Missouri.

Offsets clearly would vary greatly from state to state. For, example, in Nevada displacement of other demands by net wagering at casinos would be much less since most of the clientele for Nevada's casinos would come from visitors from outside the State. The same effect also could be seen in New Jersey where casinos draw substantial custom from New York. For all other states, however, the adjustment for displaced demand in the state would produce a large reduction in the ratio of apparent to actual direct effect. Also, effects of development often are mis-estimated simply by exaggerated estimates by the partisans of direct effects themselves, even if displacement effect is allowed for. These exaggerations could be inflated estimates of actual spending or underestimates of costs of project construction.

A recent example of over-estimate can be seen in the current proposal to build a New York Sports and Convention Center on the west side of Manhattan. A recent independent study by the Independent Budget Office of the City of New York concludes there is a serious over-estimate of the use the facility. Most importantly, the developers fail to allow for net displacement of uses in existing facilities. In part this stems from no

accounting for use since the New York football team now plays in New Jersey, just across the Hudson River from New York. For a project of this scale these border problems could be significant.

Another recent example is my role in a study of proposed benefits of increasing lockage capacity on the Upper Mississippi. An outside review committee, of which I was a member, found substantial flaws in estimating increased traffic flow on the river with correspondingly very substantial over-estimates of benefits. As a result there was a postponement for one-year of the $4 billion request for Congressional Appropriation for widening of locks and some replacement of dams. During that year a new review committee was **appointed by the sponsors**, the U.S. Army Corps of Engineers, who recommended the same action as a year earlier but now at higher cost. Congress failed to approve that funding at that later date, but they are still at work trying to get approval with the cost estimate now up to $7 billion. If the Army Engineers ever get out of Iraq they may one day still get to build a project on the Mississippi with seriously over-estimated benefits.

3. PROBLEMS WITH THE "MULTIPLIER"

Depending on data availability multiplier analysis ordinarily is done in the U.S. for county or multi-county areas according to the RIMS system of regional input-output multiplier constructed by the U.S. Department of Commerce.

It should be noted that within the simple macro-economic conception of a region's economy used here, the government and investment sectors are suppressed (i.e. regarded as segments of C), the aggregate regional economy can be represented as $Y = C + X - M$, where $C = a + bY$ and, $M = c + d$, where Y = Total Output, C = Consumption, X = Exports and M = Imports measured by their jobs generated. Note, where T (equivalent to Y), N (equivalent to C) and B (equivalent to X) are total, nonbasic and basic jobs in economic base terminology. This is equivalent to the standard Keynesian conception, as indicated below.

KEYNESIAN	ECONOMIC BASE
(measured in gross output)	(measured in jobs)
$Y = C + X - \mathrm{M}$	$T = N + B$
where $C = a + bY$	where $N(t) = \{N/B(t)\}$
$M = c + dY$	

or,

$$\Delta Y = \{1/[1-(b-d)]\}\Delta(X-M)$$

but

$$\Delta Y = \{1/[1-(b-d)]\}\Delta X$$

or,

$$\Delta T = \{(1+(N/B)\}\Delta B$$

$$\Delta T = \{1/(T-N)/T\}\Delta B = \\ = 1/\{T-N/T)\}\Delta B = \\ = 1/\{1-N/T\}\Delta B$$

Note, the Keynesian multiplier is one divided by $1-(b-d)$ where $(b-d)$ is the marginal propensity to consume domestic goods. The Economic Base multiplier is one divided by $1-N/T$, where N/T is the average propensity of total employment to generate non-basic employment A simple conception of the differences is that the multiplier effect of an increase in net exports is reflected in Keynes by the marginal propensity to consume out of gross regional product whereas in the Economic Base conception the multiplier is measured by the average propensity to generate nonbasic out of total jobs. In the context of long-run growth, however, the region's marginal propensity to consume would be approximated by its average propensity.

Many advances have been achieved in differentiating the multiplier effects of increases in employment, mainly via incorporating inter-industry composition of "basic" sector changes. These calculated change would be in long-run equilibrium after all indirect effects had been realized. Other advances in differentiating changes in equilibrium employment by sector, such as the effects of different sectoral composition of change in basic activity, have been achieved by expanding the regional economic structural context within which economic base analysis has been done.

Much more serious for reliability are the procedural assumptions employed. Specifically, Keynesian type estimates of the equivalent multiplier, were originally derived for specification of **short-run national** effects (i.e. with population and work force constant) where unemployed supplies of all factors were assumed infinitely elastic and no allowance made for differential price change in among individual industrial sectors. Simply stated, up to the point where full-employment was achieved, all of the multiplier effect in an economy would be **short-run** change, and for equilibria at greater than full-employment, **all** of the multiplier effect would be reflected in change in price level. For short-run policies aimed at restoring full-employment in the short-run this is an appropriate as well as traditional application of Keynesian theory.

For a regional economy in the context of long-run growth this is clearly inappropriate. Applying economic base multiplier models to regional growth requires adjustment for less than perfectly elastic factor supply and effects

of differential changes in price equilibria as quantities demanded in individual sectors changes. In the real world, at less than full employment some wage increase would be necessary to move labor into expanding sectors.

Many technical issues arose in implementation of B-C analysis other than already noted, such as: the appropriate rate of discount for future benefits; quantification of benefits where services of proposed projects were not sold at market determined prices; of costs to particular purposes in multi-purpose projects. Mostly these problems are well defined by now, but work continues. Consider an ordinary project like a reservoir for recreation. There the primary direct benefit is the value of services to actual recreation users. The direct secondary benefits would include increased outputs at hotels and restaurants, and private purchases of fishing and boating supplies, etc. But increases in those sectors would result in indirect secondary effects analagous to the indirect effects of the direct secondary benefit. Also, it is not the total induced changes in all sectors anywhere, but rather those induced within the same region that are relevant for regional indirect effects. This means that multipliers evaluated within a traditional Keynesian context, **necessarily** would **over-state** the actual multiplier, correspondingly over-stating the impact of any development initiative so analyzed.

4. OPERATIONAL PROBLEMS IN ESTIMATING THE MULTIPLIER

Fundamental to establishing a numeric value for the multiplier is an estimate of the aggregate ratio of basic to total nonbasic jobs. This normally requires estimation then averaging over sectors of the distribution of employment between domestic (nonbasic) and export (basic) sales. These are not easily known quantities. An individual establishment knows its sales made outside and inside the region, but sales within the region of intermediate outputs, i.e. sales to other business establishments, they would not ordinarily be known.

Historically, a variety of techniques have been used to approximate the ratio of export to local sales. Simplest would be the assumption that all sales by manufacturing, mining and agricultural establishments would be assigned to "export"; all other sales would be assigned to "local" demand. But, depending on the geographic definition of the region, there could be under-estimates of exports by not allowing for such by trade and service establishments. This would lead to a downward bias in the estimate of total exports, hence an upward bias in the multiplier.

A more refined technique in use is "localization" coefficients. For any sector a "localization" coefficient would be the ratio of per capita employment in the region divided by the per capita employment in a larger

reference area, like the state or the nation. If this coefficient were greater than one it would reflect more than proportional sales to the outside world, the percent of exports would be equal to the localization coefficient minus one. If the coefficient were equal to or less than one, exports for that sector would be estimated at zero. The estimates of nonbasic consumption already would be implicitly net of imports. But, assuming product homogeneity among regions for individual sectors some under-estimate of net exports necessarily would result. Given the great differentiation between products in any category, surely **some** of the region's gross production would be exported. The result for all sectors combined would necessarily under estimate exports, and the more finely the individual sectors of production were defined, the more would their exports be **under-estimated**.

Another technique for estimating exports by sector would be the so-called "minimum requirements" technique. Here the lowest percentage of total production in a sample set of regions for any sector would be taken as indicating the minimum production needed to supply domestic consumption. Only production in excess of that percentage could be counted as export. Clearly this could only **underestimate exports** in any individual sector, compared with its production for local use. Overall exports for all sectors here too necessarily would be under-estimated.

Indirect exports by a firm selling to other firms could be determined by utilizing a table of interindustry coefficients, but this would depend on identifying the percentage of each sector's direct output that went to export. Here too the underestimation problems would be similar. **All** of the techniques for estimating sectoral assignment of output by sector, produce aggregate estimates of exports for any region, which **necessarily are downward biased**. This downward estimate of "exports" results in an upward bias in the estimated "multiplier". This makes projects appear to have more of an impact on total activity levels than is warranted. Note, the same sorts of bias would tend to over-estimate negative effects of negative developments, like the closing of military bases, for example.

Under-estimation of cost would be an addition al source of upward bias in net benefits. Review of cost estimation is beyond the scope of this paper, but in all my experience I have no recollection of any a priori cost estimate that was not lower than the final realized actual project cost.

5. SOME ALTERNATIVES

Within a Computable General Equilibrium (CGE) model there would be alternative ways of estimating exports. As a practical matter, however, the degree of regional and sectoral disaggregation surely would be limited by

data availabilities and cost of data assembly for CGE. For the U.S. an overall national model with disaggregation for perhaps only 30 or 40 regions with a dozen or two industrial sectors surely would cost several million dollars to construct and a few million dollars annually to maintain.

Also, a CGE model would have multiple dependent variables, so there would still be the problem of selecting what weighting of them would be relevant to policy choice. Neither would CGE avoid potential conflict between the research community and the policy decision community. The former would want a model capable of the maximum scope, but, policy makers would not want so much detail made explicit. Leaders of areas that might show up as benefiting from a particular project might not want a detailed identification of regions or industries that would suffer negative effects. Given the very high cost of developing an operational CGE model, its likely exposing of inter-regional political conflict, it would seem unwise to be very optimistic of chances for CGE, especially for regional applications.

Much less complicated, but perhaps even more difficult would be an initiative simply to eliminate the sources of bias in present B-C methods. Mainly this would involve incorporating information on supply of inputs and effect of changes in relative prices on composition of outputs. The supply elasticity data needed could be limited to elasticity of supply relative to changes in quantity of labor demanded. This would get us into the analysis of changes in labor force participation and changes in population. And population change necessarily would have to involve migration as well as natural increase modeling. This would represent a considerable research effort but one well within the limits of known modeling and data sources individual areas. The scale of research capability needed might not present much advantage over CGE, but the kind of "special interest" resistance here would be less of a problem than in a CGE approach.

Maybe it might be wisest simply to avoid B-C studies for almost all projects with more than from a few hundred to a few thousand jobs, depending on the regional scale involved. This means that B-C studies for mega-projects like building massive stadium and convention facilities, major additions to public transportation systems, or major modifications of river basin facilities should best be avoided. Current practices probably result in substantial over-estimation of net benefits and hence, substantial over-investment in anything except small projects like a neighbourhood park, a small shopping center or construction of a non-major highway. In large projects over-estimation of impact would result mainly from failure to net out jobs displaced and from upward biased estimates of regional multipliers and inflated estimates of direct effects. Thus, for large-scale projects we are probably better off simply letting proponents and opponents have their say politically, rather than in continuing analyses that we know are seriously biased, and which surely produce very unreliable public decisions.

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OGRANICZENIA W STOSOWANIU ANALIZY KORZYŚCI I KOSZTÓW

Autor rozważa słabości w podejściu do analizy korzyści kosztów jako narzędzia procesu decyzyjnego. Wskazując na ułomności związane z estymacją efektów mnożnikowych zarówno pozytywnych, jak i negatywnych, dochodzi do wniosku, iż analitycy mają skłonność do przeszacowywania antycypowanych korzyści i kosztów w zależności od społecznych i politycznych oczekiwań. W konkluzji stwierdza, iż nie chce podważać użyteczności tego narzędzia, ale z uwagi na specyficzne uwarunkowania polityczne i społeczne, w jakich działają analitycy, sugeruje, aby ostateczne decyzje uwzględniały fakt, iż prawie każda analiza jest obarczona błędem nadestymacji.