# Frameworks for economic impact analysis and benefit-cost analysis

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Marsden Jacob Associates

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# Frameworks for benefit-cost analysis and economic impact analysis

1. The purpose of this note is to:

   a) distinguish between the differing natures and purposes of benefit-cost evaluations on the one hand and the description and analysis of economic impacts on the other;

   b) provide guidance on where consideration of flow on effects can add additional and relevant information to private and government decision-makers; and

   c) provide guidance on matters that need to be considered in describing economic impacts.

2. This note draws upon major authorities on benefit-cost analysis and project appraisal including the Australian Government Department of Finance's *Handbook of Cost Benefit Analysis* (1991), the UK Treasury's *The Green Book – Appraisal and Evaluation in Central Government* (2002) and the Australian text by Campbell and Brown *Benefit-Cost Analysis: Financial and Economic Appraisal Using Spreadsheets* (2003).

## Purpose and nature

3. A primary purpose of a **benefit-cost analysis** is to evaluate the net benefits of proceeding with an investment compared with a specified alternative (or base) case. The alternative may be do nothing, the status quo or an alternative competing project. On the cost side, the relevant tangible costs are the directly attributable cash costs incurred as a result of the project proceeding. Intangible costs such as adverse environmental impacts and increases in risk should be identified and at a minimum described.

4. In terms of benefits, by definition only tangible benefits can be evaluated. However, non-tangible benefits such as environmental improvements and increased diversification of risk should be described where relevant. The relevant tangible benefits are the increase in (surplus) value as a result of the project. This comprises:

   - **avoided costs**[1] to both consumers and producers as a result of the proposal at existing levels of demand; and
   - the **induced avoided costs** arising as a result of the interaction of the unit reduction in costs and the (potentially) increased level of demand as a result of the reduction in the cost of supply.

[1] The source of benefit is the costs avoided by producers and consumers as a result of a project proceeding. Avoided costs are defined to exclude past investment expenditures and all other (sunk) costs. As we are interested in the difference between the investment and the base case, avoided costs also exclude all common or overhead costs as these would still be incurred regardless of whether the project proceeds.

This induced benefit is zero unless the reduction in the unit costs of supply results in an increase in demand. Since the magnitude of demand induced as a result of the reduction in the costs of supply is typically unknown, rather than conjecture, a frequent simplifying assumption is that there is no induced increase in demand. These points are illustrated diagrammatically in the Attachment.

5. In addition to reducing the costs of supply, a new investment proposal can be expected to have other impacts…

> *A large project, such as construction of a major highway or development of a large mine, will have a significant impact on the economy. The spending in the construction and operating phases will generate income and employment….*[2]

Thus, the purpose of **economic impact analysis** is to quantify and describe the pertinent impacts (such as the number of jobs created during the construction period of a major piece of infrastructure or the amount of income generated). However, these aggregates describe economic impacts and do not in themselves indicate the magnitude of the benefits and costs and whether the project is desirable from a public or social viewpoint. As a result,

> *… an economic impact analysis is a different procedure from a cost-benefit analysis in that it attempts to predict, but not evaluate, the effects of a project.*

6. The initial impacts of a major project will trigger second and later round flow-on effects. These can be both positive and negative. What is clear is that the ultimate impact of an investment project may differ significantly from the initial, first round impacts.[3]

7. A comprehensive description of economic impacts requires separate identification of first round and final round effects on income, employment, tax receipts and similar aggregates at the local, state and national levels. This raises the question of whether the effort to develop a comprehensive description and quantification of the flow-on effects is necessary and worthwhile.

## Relevance of economic impact analysis

8. When comparing two projects, flow-on impacts (second round effects) are of most pertinence and interest where they differ significantly between the projects. All projects have "multiplier" effects and where these are the same or very similar, then there is likely to be little value in expending effort to quantify and describe these flow-on effects. Indeed, if the flow-on impacts of competing investments are the same then the relative rankings provided by the benefit cost analysis will be unchanged.

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2 Campbell & Brown (2003), p.288.

3 Economic impacts typically describe changes in activity and for this reason capital expenditure and other costs are often described as if they were benefits – which they are not.

9. What is of interest when evaluating competing proposals is the differences between them. Thus[4],

> *"The decision whether or not to take the multiplier or flow-on effects into account in the evaluation should be based on an assessment of the extent to which similar such effects would or would not occur in the absence of the project in question. When choosing between alternative projects this would depend on the extent to which the multiplier effects can be expected to vary significantly between the alternatives…"*

10. Moreover, major differences in flow-on effects between projects competing for private funding and for government infrastructure are observable in Western Australia. For instance, a major project in the East Kimberley may through its second round effects draw into employment a substantial number of indigenous people who would otherwise remain unemployed. Alternatively, some mining and pipeline projects may rely almost wholly on Fly-in Fly-out labour and there may be little or no unemployed labour in the area.

11. Is it possible to have positive **net** flow-ons if the Benefit Cost ratio is less than one? The general answer to this is no, so long as:

    a) the Benefit Cost Analysis captures all benefits and costs including externalities, relating to the proposal when compared with the alternative;

    b) there are no major externalities captured in the flow-on effects, but not captured in the project itself; and

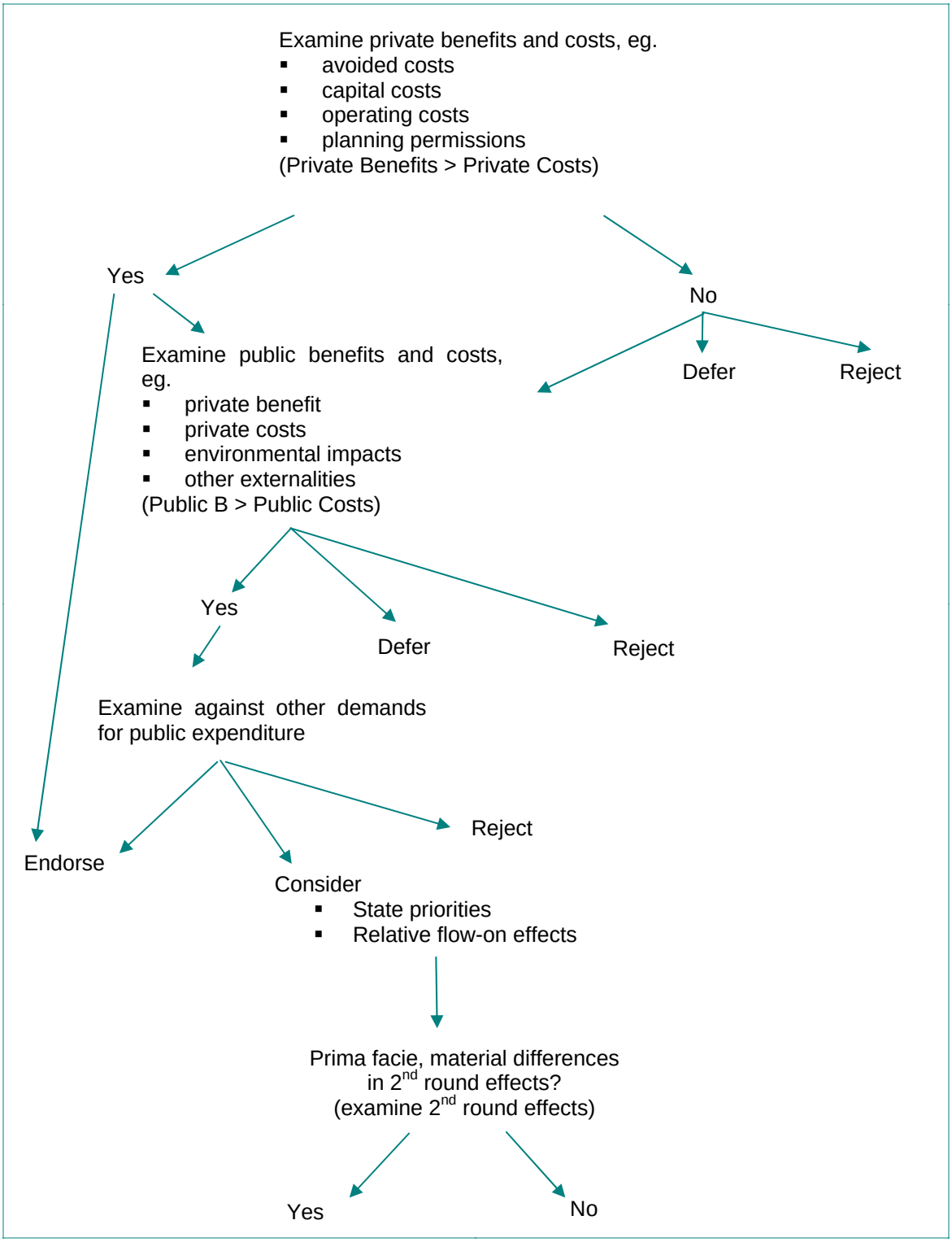
    c) the proposal and the competing alternatives do not represent polar extremes in terms of flow-on effects, such as one characterised in "congealed labour, highly reliant on local materials" and the other characterised as a "highly capitalised, Fly-in Fly-out island".

12. Where these conditions hold, there is likely to be little or no value in terms of the decision making process in undertaking analysis of economic impacts over and above the information already provided by the benefit cost analysis. Indeed, to do so may simply cloud and confuse the issues. This is especially the case with 'gross' impact analyses which ignore the fact that the same money could be invested elsewhere in the economy and would also produce flow-on impacts. A second dominating concern with impact analyses is that the measures examined ignore the costs and tend to double-count or overstate the benefits.

13. In terms of analysis and decision gateways, there is therefore a decision tree. Figure A illustrates one interpretation of this decision tree.

[4] Campbell & Brown (2003), p.288.

**Figure A : Decision tree for analysis and decisions in major investments**



# Estimating second round flow-on effects

14. As noted, for any direct economic impact there is an economic flow-on effect – or indirect impact. This is the combination of upstream industry (i.e., the suppliers of goods and services) effects, downstream producer (e.g., processors of natural resources) effects, and consumption effects (this applies to the economic stimulus associated with the extra spending from those employed in the core activity as well in upstream and downstream industries).

15. The second round effects of any project will depend on the duration of the stimulus. Such flow-on effects are therefore likely to be focussed on the construction phase when expenditure and project employment are at their highest.

16. **Import leakages**: Neither a state economy nor its component regions are self-contained. All regions require imports, either from overseas or from elsewhere in the state economy. The greater the extent of these imports, e.g., prefabricated pipe, pumps, filters, membranes and so on, the larger the leakage of the initial stimulus outside the local economy and hence the smaller the impact on a regional economy. The smaller the region, the larger the leakage. However, much of this leakage will typically be captured at the state borders, and similarly, much of the remaining leakage will be captured at the national borders. As a result, multiplier and flow-on effects tend to rise as the focus of the analysis moves from the region to the state economy to the national economy. (However, offsetting this, factor movements (mainly labour) mean that regional multipliers may be larger.)

17. The extent of such imports therefore needs to be carefully specified both for the base case and the competitive proposal being evaluated.

18. **Income leakages**: Income increases in a local area as a result of a new project will rarely be fully retained in that area. Payments to head office, franchise fees, in addition to more direct costs, may substantially reduce the proportion of any increase in income which is retained in the local area/state. It follows therefore that any analysis of second round flow-on effects needs to examine carefully the extent to which income is retained within the boundaries of the relevant region/state.

19. Where the competing projects differ substantially in their ownership and tax status then the flow and distribution of income increases will need to be further examined. For instance, from the perspective of a state, company tax paid by its publicly-owned utilities (under the National Tax Equivalent Regime) is not a leakage of income to the Commonwealth Government since those tax payments are ultimately paid to the state treasury. In contrast, company tax paid by a private corporation does constitute a leakage to central government. Dividend payments will similarly be directed differentially according to the ownership of the companies putting forward competing proposals. These issues may need to be carefully examined in assessing the comparative impacts of the proposals.

20. **Opportunity cost**: To describe and quantify the second round impacts to a state economy from an investment proposal, it is necessary to trace through the links in the economy to ascertain the indirect benefits flowing from the identified core activities (e.g., building, extending or operating pipelines) to input suppliers to the project and other suppliers located in areas where workers spend their income. On the other side of the ledger, however, if resources were not used by sectors receiving the economic flow-on benefits they would not lay idle but would be used elsewhere in the economy to create economic value. The forgone economic value represents the opportunity cost to be deducted from the gross economic flow-ons.

21. **Spare capacity and opportunity costs**: The extent of spare capacity, particularly for the relevant types of labour, is a critical determinant of the overall economic impact of a project. Where unemployment of particular types of labour in the local region is low, additional employment in the local area is likely to require inward migration of those skills on at least a short-term basis. To attract these skills, wages and conditions may need to be bid up to attract labour away from existing activities – possibly in the region but more certainly for the state as a whole. Thus, this bidding process serves to rearrange where employment is located and therefore to reduce activity in existing firms and industries. Where a project is sufficiently large to influence the price of labour and/or other factors of production it is essential that this is identified and its implications examined. A computable general equilibrium model provides a disciplined method of doing so.

22. It follows therefore that the extent of spare capacity of labour of different types and skills and other resources needs to be examined for each of the competing proposals being examined.[5] This further requires attention to the timing and location of the new demands of labour and other resources. For instance, two similar investment projects will have different effects on labour and resource markets if one project has most of its investment bunched into a very short timeframe and the other has the same amount of investment spread over a longer period of years.

23. **Need for caution in use of multipliers**: Multipliers are unlikely to have a valid role in terms of estimating economic impacts at the state level. One reason is that estimation of multipliers is based on the assumption of excess productive capacity (i.e., capital, labour and other inputs) being available in the economy. Sinclair and Stabler (1997, p. 140) highlight the problem in applying multipliers:

> *"The assumption that spare capacity is available and utilised to produce more output in response to an increase in demand… provides the basis for the use of the multiplier methodology to estimate the value of income and employment*

[5] These same issues arise where state treasuries are asked to consider requests for subsidies or public investment in order to allow different projects to proceed. When a wider range of potential projects and subventions is considered, the differences between projects across the state in terms of economic leakages, spare capacity and so on are typically much greater than they are for projects located in the same or similar regions. For instance, spare labour capacity for a project in, say, the East Kimberley may differ quite substantially from a project in, say, the Eastern Goldfields.

> *which is generated by* [the project in question]. *If surplus capacity is not available, the use of the methodology is likely to produce spurious results."*

24. A second reason why input-output multipliers are inappropriate is that:

> *Given limited government funds, the expenditure on the project could be spent on a range of other uses, all of which will also have a multiplier. Counting multipliers for the expenditure, without taking into account the multiplier effect of the alterative use of the funds, biases the results for the project upwards …*[6]

25. In other words, if there is an alternative use of resources that are drawn into sectors receiving economic flow-on benefits, then multiplier analysis is likely to be misleading.

26. Despite reliance on the assumption of excess capacity, use of multipliers to estimate indirect impacts at the regional level – as distinct from the state level − may be reasonable in circumstances where capital and labour are more likely to be drawn into the region in response to an increase in economic activity. However, at the state level, the need to draw those resources away from existing activities and other locations will mean that net impacts for the state may be less than the gross impacts at the local level.

27. **General equilibrium models**: Computable general equilibrium (CGE) models are available to examine the response of the state and national economics to a major stimulus such as a large scale infrastructure expenditure and a lowering of costs of input supplies to industry.

28. One such model is the MONASH model and its regional variant, the Monash - MMRF model. The Western Australian Treasury has a general equilibrium model of this type in order to examine impacts on the Western Australian economy of major investment proposals. All such models allow the net impact on employment and value-added (either Gross State Product or Gross Domestic Product) to be examined and most models also examine impacts on state and commonwealth taxes and possibly expenditures. Thus where regional models are available, the impacts of an investment proposal can be assessed comprehensively.

29. Such models do not take account of all leakages, and side calculations may need to take place outside the models themselves in order to examine items such as dividend flows or the inputs of, say, mine expansions after changes in Grants Commission payments have been taken into account. The Project Evaluation Guidelines prepared by the WA Department of Treasury and Finance give strong endorsement to the use of general equilibrium models as a method of excluding flow-on effects.

## Summary and directions

30. The magnitude of second round, flow-on effects depends critically upon the extent to which the initial stimulus to income remains in the region or state, how much of that

[6] Department of Treasury and Finance (2005), *Project Evaluation Guidelines, Exposure Draft*, 21 March.

income is spent on goods and services produced in the region or state and whether the regional or state economy has sufficient unemployed resources to allow the potential expansion of activity without consequent price rises.

31. The net benefits arising from both the first and second round effects of an investment proposal – i.e., including both indirect benefit less the indirect costs – can be estimated using general equilibrium models, and hence, at the state level it is the preferred tool for estimating net indirect impacts.

32. As noted above, multiplier analysis – which has been a widely used technique for estimating second round economic impacts − focuses only on the indirect benefits and not the indirect costs, and therefore is not a measure of *net* indirect benefits. Because of this shortcoming, analysis based on simple multipliers is likely to be unreliable except in restricted, specific circumstances.

33. Queensland Treasury (1999), in the "*Queensland Guidelines for Financial and Economic Evaluation of New Water Infrastructure in Queensland*", correctly specified that regional impacts, such as flow-on employment and investment effects (economic multiplier effects) should not be included as part of financial or benefit-cost assessments – and that they should be seen as only relevant in assessing social impacts and the distribution of costs and benefits across the economy. The West Australian Guidelines take a harder line stating "*under no circumstances should input - output multipliers be used*".

34. This conclusion reflects the difficulty in achieving rigour and discipline in ad hoc assessments of multiplier and flow-on effects and of integrating a partial and incomplete analysis of multiplier and flow-on effects with the partial equilibrium analysis of the economic benefits and costs of each proposal.

35. Nonetheless, it would be admissible to include net indirect benefits using a General Equilibrium model of the state economy as general equilibrium models take systematic – albeit stylised – account of resource constraints and other important economic linkages. Indeed, the benefit cost framework in seeking to compare public benefits with public costs provides a disciplined framework in which to select and order the outputs of the general equilibrium modelling.

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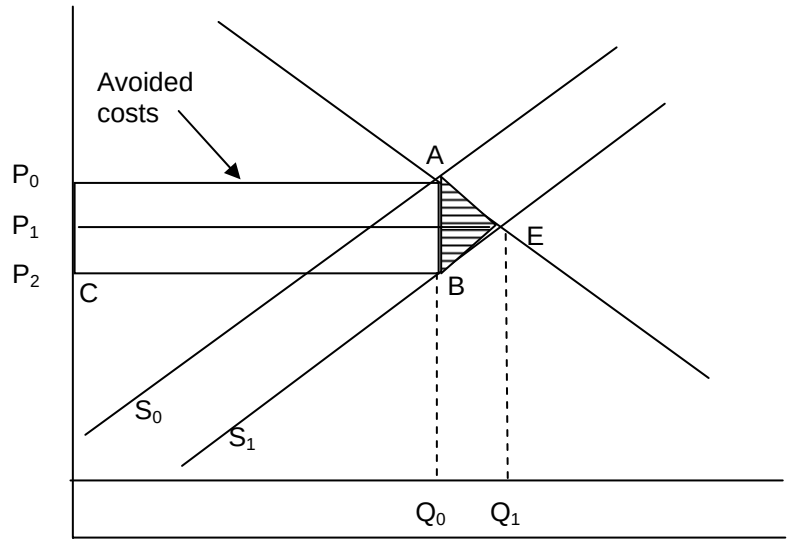
# ATTACHMENT

Figures 1(a) and 1(b) illustrate these two sources of benefit as the result of an investment proposal which reduces the costs of supply (in this case by a uniform amount equal to AB).

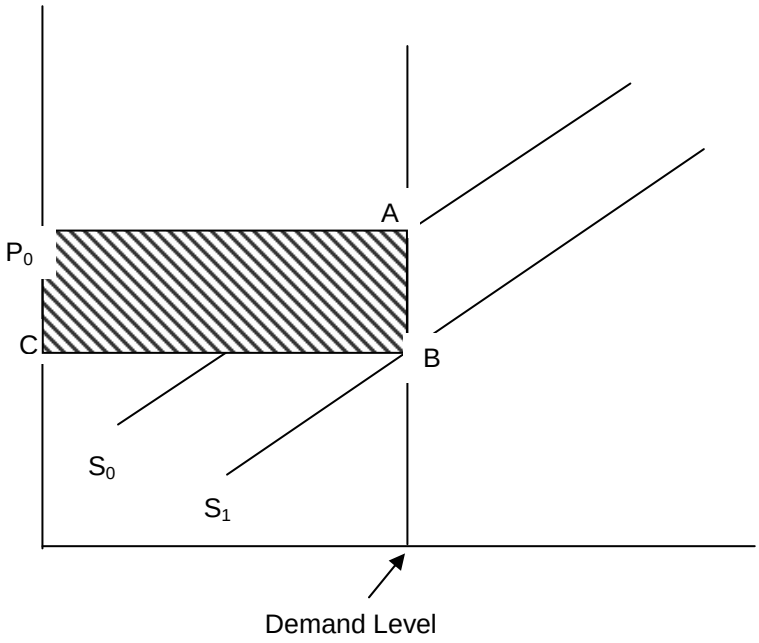
**Figure 1(a) : Avoided costs and Induced Benefits**




| | | | | |
|---|---|---|---|---|
| Avoided costs at existing demand level | + | Avoided costs on induced demand | = | Increase in surplus |
| RECTANGLE $P_oABC$ | + | TRIANGLE ABE | = | Increase in surplus |

Since the magnitude of demand induced as a result of the reduction in the costs of supply is typically unknown, rather than conjecture, a frequent simplifying assumption is that there is no induced increase in demand. This is shown in Figure 1(b).

**Figure 1(b) : Avoided costs in absence of induced increase in demand**




Avoided costs = Increase in surplus

Avoided costs = Rectangle $P_oABC$

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