

INPUT-OUTPUT ANALYSIS AND COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

Input-Output Analysis

- IO analysis is a cost effective and simple method for estimating the gross market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.
- IO analysis is the most widely used model for regional impact assessment (West and Jackson 2005).
- IO analysis can be undertaken at the LGA or aggregation of LGAs level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a projects operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added¹ and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a BCA.
- IO analysis does not attempt to examine non-market environmental, social or cultural impacts.
- IO analysis does not depend on the assumption “*that there is a ghost pool of highly skilled yet unemployed people*” in a region as suggested by a Land and Environment Court Judgement.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions (“crowding out”) of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

Computable General Equilibrium Modelling

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.

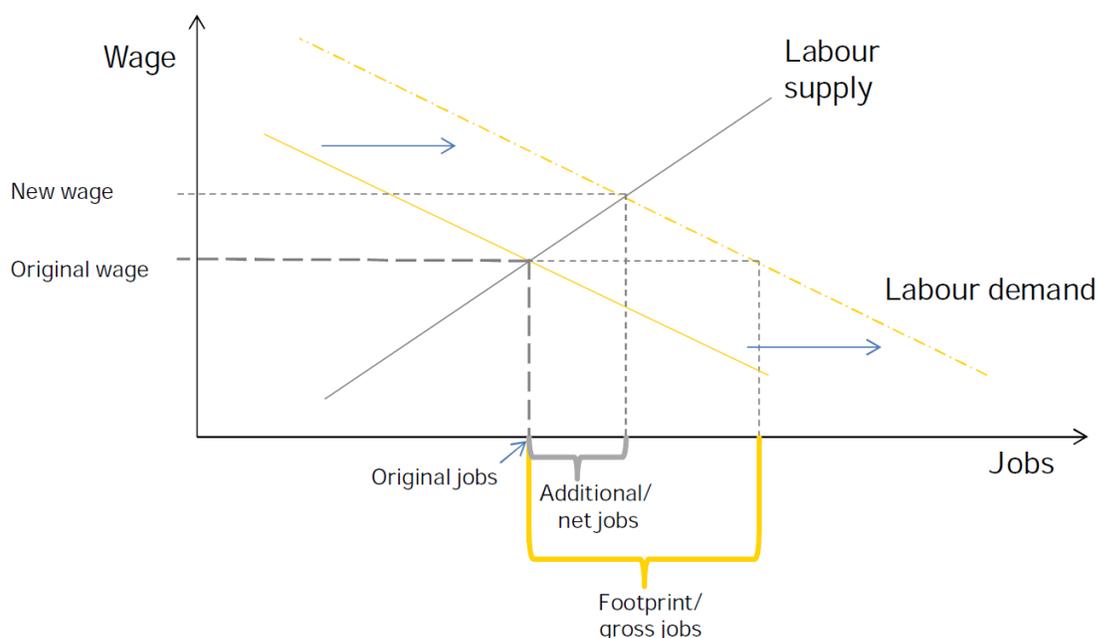
¹ Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

- CGE modelling can be dynamic or comparative static² and has historically been applied at the State and National level for determining the potential economic activity associated with the introduction of major government policy changes and investment in large infrastructure projects.
- CGE modelling can also be undertaken at a regional level but normally at no finer scale than the Statistical Subdivision level.
- CGE modelling estimates the additional net (positive and negative) economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a BCA, although CGE modelling can also be used to estimate market costs or market benefits, as part of a BCA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO analysis.
- CGE modelling does not attempt to examine non-market environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some ‘crowding out’ of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- ‘Crowding out’ of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

² Comparative static models compare one equilibrium point with another but do not trace the impact path along the way. Dynamic models give year by year impacts of a shock.

Comparison of IO Analysis and CGE Modelling

Figure 1 – Comparison of Employment Estimates in IO Analysis and CGE Modelling



Source: Ernst Young (2014) Capital Metro Job Creation Analysis, p. 30.

- Figure 1 illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity³. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.
- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and “crowding out” across all other sectors in the economy.
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

Guidelines

- Both IO analysis and CGE modelling are identified in the DP&I’s *draft Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.

³ This is akin to the marginal assumption in BCA.

- Other guidelines to recognise the role of IO analysis include:
 - US Environment Protection Agency (2010) *Guidelines for Preparing Economic Analyses*;
 - Australian Bureau of Rural Science (2005) *Socio-economic Impact Assessment Toolkit: A guide to assessing the socio-economic impacts of Marine Protected Areas in Australia*.
- NSW Treasury (2007) identify that IO analysis is commonly used to assess the regional impacts of a project. However, IO analysis is concerned with measuring economic activity, and is not a tool for the evaluation of projects (in the way that BCA is).

Government Applications of IO Analysis

- Applications of IO analysis commissioned by Government agencies include:
 - Department of Sustainability, Environment, Water, Population and Communities (2011) *Assessing the Socio-Economic Impacts of Sustainable Diversion Limits and Water for the Future Investments: An Assessment of the Short-Term Impacts at a Local Scale*
 - NSW Natural Resources Commission (2009) *River Red Gum Assessment: Socio-economic impact assessment*,
 - Victorian Environmental Assessment Council (2007) *River Red Gum Forests Investigation – Socio-Economic Assessment*.
 - Resource and Conservation Division of the NSW Department of Urban Affairs and Planning (1999) *Regional Impact Assessments as part of the NSW Comprehensive Regional Assessments under the National Forestry Policy*.
 - Reserve Bank of Australia (2012) *Industry Dimensions of the Resource Boom: An Input-Output Analysis*.
 - DECCW (2009) *Economic benefits of national parks and other reserves in New South Wales - Summary report*, reports the results of numerous studies it and its' predecessors have commissioned on the regional economic impacts of national parks and protected areas.
 - DECCW (2006) *Socio Economic Assessment of the Batemans Bay Marine National Park*
 - DECCW (2006) *Socio Economic Assessment of the Port Stephens – Great Lakes Marine Park*
 - National Parks Service, US Department of the Interior (2014) *2012 National Parks Visitor Spending Effects: Economic Contribution to Local Communities, States and the Nation*.

Criticisms Misrepresented

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute in numerous submissions to mining projects in NSW) have with IO is its use as a substitute for BCA, not its use for estimating direct and indirect regional economic activity impacts.
 - NSW Treasury (2009) "*Model based economic impact assessment [such as IO analysis] is not a substitute for a thorough economic analysis of a policy. The appropriate method for analysing policy alternatives is benefit cost analysis (BCA)*".
 - The main "abuse" reported by the Productivity Commission is using IO analysis to "*make the case for government intervention*" when BCA is the appropriate method for doing this.

- ABS's concerns with IO being "*biased*" refer to it being a "*biased estimator of the benefits or costs of a project*". IO does not estimate benefits and costs but economic activity.
- Concerns of the Warkworth Judgement with IO analysis being "deficient" related to the data (industry data from surveys undertaken in 2001 and assumptions used (see next dot point)), but more fundamentally for not "*assisting in weighing the economic factors relative to the various environmental and social factors, or in balancing economic, social and environmental factors*". This is an inappropriate criticism of the IO method, since it does not pretend to do this.
- IO analysis does not depend on the assumption "*that there is a ghost pool of highly skilled yet unemployed people*" in a region as suggested in the Warkworth Judgement. It allows for labour to come from within or outside the region.

Latest Use of IO Analysis

- BAEconomics (2014) in its Economic Impact Assessment for Warkworth Continuation 2014 and Mt Thorley Operations 2014 justifies the use of IO analysis to estimate economic activity associated with the Project.
- Dr Brian Fisher, the Managing Director of BAEconomics is a highly respected resource economist who previously held the positions of Executive Director of the Australian Bureau of Agricultural and Resource Economics (ABARE) and Associate Commissioner of the Productivity Commission. He received an Order of Australia in the Queen's Birthday Honours List in 2007.