CGE MODELLING AS A TOOL FOR EVALUATING PROPOSALS FOR PROJECT ASSISTANCE: A VIEW FROM THE TRENCHES

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ABSTRACT

Economic modelling results, particularly computable general equilibrium (CGE) model results, are currently extremely influential within government for evaluating economic policy alternatives, to the point where traditional cost-benefit analysis (CBA) technique has been largely supplanted. However, the results often presented from CGE analysis do not by themselves provide guidance on the merit of supporting the project. This paper asks whether results from CGE analysis can be condensed down to the strict discipline of a CBA. Building on work undertaken with regard to the tourism industry, it concludes that the two methods can in fact enhance each other, presenting a practical example of a simple fictional steel plant, 'ABC Metals' to demonstrate a possible method.

The opinions expressed in this paper are those of the author and not those of the Department of Treasury and Finance.

Much of the thinking behind this paper was formed during a recent Heads of Treasuries working group on the provision of assistance to major projects. I would like to thank the members of the working group for their expertise, which I am unashamedly drawing upon for this paper. However, conclusions in this paper should in no way be taken to reflect the opinions of Heads of Treasuries nor the working group.

INTRODUCTION

Economic impacts and benefits calculated from Computable General Equilibrium (CGE) models are increasingly being used to justify providing assistance for major projects to locate in a particular jurisdiction. CGE analyses have now largely supplanted more traditional forms of economic analysis, such as partial equilibrium Cost-benefit Analysis (CBA), and, thankfully, less reputable methods, such as input-output (I-O) multipliers.

The popularity of the application of CGE models to analysing the economic impact of projects has been partly due to many years of hard work from CGE modellers in developing quality models and undertaking analyses that have contributed to national and State-level policy debates in other areas, such as tariff assistance. However, probably the major reason has been to counter the rising popularity of I-O multipliers.

Supporters of projects, both outside of and within governments, often with memories of the Keynesian multiplier they studied in their one economics unit at university, felt that partial equilibrium analysis did not sufficiently capture the 'flow-on' or 'indirect' effect of projects. However, most economists agree that I-O multipliers suffer from several major flaws, including: double counting of benefits; the lack of consideration of the opportunity cost of project assistance funding; and the assumption that additional resources are infinitely available at current market rates.

CGE modelling, with its long history of economy-wide analysis for policy questions, was the obvious choice to satisfy the concerns of both parties. Their use could allay the concerns of project supporters that flow-on effects were not considered, but also to impose more realistic economic relationships, including restrictions on the availability of factors of production where appropriate.

However, while CGE analysis automatically removes many of the problems that are inherent in a multiplier analysis, the way CGE results are often presented can still be misleading. In particular, rather than using CGE results to enhance the strict cost-benefit discipline of CBA, results tend to be presented in statements like "Gross Domestic Product (GDP) will increase by $500 million per annum" due to the advent of the project. This is of little benefit to policy makers deciding whether to subsidise a project. As Dwyer, Forsth and Spurr (2003) noted with respect to attracting tourism events:

> *If subsidising events is to be regarded as an investment to produce benefits, it should be judged according to cost-benefit criteria.*

This paper finds that presenting gross economic benefits such as GDP or aggregate consumption neutralises the main strength of CGE models over I-O multipliers, which is that factor restrictions can be imposed and the cost of increased factor use can be accounted for. It also means that the results often presented from CGE modelling analysis are just an impressively big number, and do not provide decision makers with a neat 'decision rule', as does CBA.

A further development from the rise of economic modelling has been that some project proponents (and some decision makers) consider a modelling analysis showing an economic benefit from a project, together with some broad statement indicating that the project will not proceed without government assistance, as sufficient reason to assist a project. This is in contrast to traditional cost-benefit analysis where the presence of some sort of market failure had to be established be assistance was considered.

Additionally, even if a consultant contracted by a project proponent might undertake a basically sound analysis, but the project proponent could present the results to government in the best possible light. For example, the project proponent could present results for the year in which the maximum benefit is obtained as results for a typical year.

This paper examines a hypothetical example of a fictional iron and steel plant, ABC Metals, which has asked the State Government for assistance to locate in Western Australia, to illustrate the flaws in the process and the way CGE results are presented. It draws on work previously undertaken for the tourism industry to attempt to reconcile the results from a CGE model with a traditional CBA.

THE SITUATION TODAY

The ABC Metals Proposal

The fictitious company, ABC Metals, has submitted a request to the Western Australian Government to assist it in locating a new steel mill in the State. It has developed a new steel-making process and intends to replace one of its ageing mills in Japan with a new mill using this technology. The plant could either be located in Western Australia, close to the source of the iron ore that it already purchases from the Pilbara region, or in the Eastern African Peoples Democratic Republic of Somalambique, which has offered a very generous infrastructure package for ABC Metals to locate there.

The project would involve $A1 billion capital expenditure over two years and would produce $A445 million in exports once it is operating. Direct employment in the project would be 420 people. It would consume approximately $70 million per annum in chemicals, $38 million in iron ore and $15 million in natural gas, all from Western Australian suppliers. The full cash flow of the project is presented in Attachment A.

In its submission to the Western Australian Government, the company notes that Western Australia would be the preferred location but the Somalambiquian offer is "very compelling". However, the submission notes that if the Western Australian Government was able to provide a $200 million start-up grant, then it would at least give the company's local representatives "something to go back to the board with".

In support of its request, ABC metals hired the very reputable Eastern Melbourne University[1] (EMU), which has a long and distinguished history in CGE modelling, to undertake a study to show the net economic impact of the project on Western Australia. The EMU used the very credible EMMRF-Pink CGE model for this study.

The results of the EMU analysis presented in the company's submission were that Western Australian Gross State Product (GSP) would increase by $500 million per annum and employment by 6,000 people. Additionally, total own source State revenues would increase by around $60 million per annum.

Politicians in Western Australia immediately become very exited about the project, which would increase GSP in each year by over $600 million for the bargain-basement cost of a one-off payment of $200 million. Additionally, the extra revenue from the project means that the project will be 'revenue positive' for the State's budget in a relatively short time.

The Minister for Assisting Major Projects submits a proposal to the Government's Expenditure Review Committee for additional funding. A decision is required with a week so that ABC Metals representatives can present the Government's offer at the company's next board meeting in London.

The Treasurer, however, concerned with the State's razor thin budget surplus and perilous hold on its AAA credit rating, is concerned over the fiscal impact of the assistance. He has also been influenced by consistent Department of Treasury and Finance (DTF) advice that subsidies do not create new activity, but only transfer existing activity.

The Treasurer quickly passes the submission to the DTF and it finds its way down to the Economic Policy Branch (EPB), which has some members who have some limited experience in CGE modelling (having attended courses at the EMU), but is busy preparing macroeconomic forecasts for the upcoming Mid-year Review of the State's Budget.

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[1] Any similarity to persons or models, living or dead, is purely intentional. However, this paper does not imply that the real people would make any particular assumption discussed in this paper, nor present results in a misleading manner, but merely examines the impact of such assumptions and presentation methods on the perceived impact of the project.

Having, high regard for the EMU and the models that it produces, but also having the inherent Treasury suspicion over industry assistance, the Acting Assistant Director (AAD) of the EPB is a fraction confused. Additionally, it is difficult to gain any indication of the soundness of the analysis from the documentation provided.

As a starting point, he decides to contact the EMU to get some background on the analysis. However, the chief EMU consultant says that he is unable to release any of the data, because he has signed a confidentiality agreement with the company. He does, however, note that the EMU was only asked to undertake a CGE analysis of the data and project-specific assumptions as provided by the company, and that the mostly the standard assumptions regarding macroeconomic components of the model (such as labour and capital) were used.

The AAD then contacts the company to see if it will release the data and analysis, but the company insists that it will only release it if the AAD can sign a confidentiality agreement. However, previous advice from the State's Chief Solicitor's Department insists that Western Australian public servants need not sign confidentiality agreements, as provisions within the *Public Service Act 1829* are sufficient. This does not satisfy the company and so it refuses to supply the data.

Confused and unable to provide any useful advice, in a fit of frustration, the AAD starts trying to communicate with others in Tablo code language and is declared insane. He is straight jacketed and locked up in a room with four padded walls, and now spends his days in a much happier place where "the LHS matrix is singular" error messages are but a memory in seven of his eight personalities.

Areas for Improvement

The above example is a little fallacious in that it combines the worst components of various recent economic (including CGE) analyses presented to the Western Australian Government into a single analysis and exaggerates them. However, it does show how various analyses have been used to attempt to influence government policy and how difficult it can be for public servants to evaluate requests for assistance. While the analysis is basically sound, the process is flawed because of:

- lack of time to assess the proposal;
- the project is presented in isolation and does not consider other government priorities that require funding;

- the separation between the CGE modellers and the party presenting the information (in this case the company but it could be another consultant who has subcontracted the modelling work), which can lead to an unrealistic example being modelled and selective results presented. It also makes it difficult for public servants to gain information on the analysis within a reasonable time frame;

- lack of 'first principals' analysis, such as examining whether there is a failure in the market that is preventing a worthwhile project from occurring. The presence of a model result showing an economic benefit is deemed to be sufficient reason for assistance to be granted;

  - in this regard, the proposal implies that there is a 0% chance of the project occurring without the assistance, and a 100% chance with the project. However, no justification is provided for this assumption;

- the presentation of only selected results, which are often out of context;

- the lack of accepted suitable information for a single 'decision rule' is a gap in almost all CGE analyses, particularly as many policy makers think in 'cost-benefit' terms; and

- the fiscal impacts of the project are calculated in a very simplistic fashion and ignore Commonwealth Grants Commission (CGC) effects. The analysis presents only increased revenue, but not increased costs from interstate migration induced by the advent of the project.

This paper will not examine the first three issues in great detail. The time required to evaluate the proposal is perhaps the most unrealistic part of the example above, and in any event is a matter of governments being strong enough to put in place a process with a required time-line. It is also unreasonable for consultants to consider the full range of a government's priorities. That is a job for the government itself.

The way in which consultants' analyses are used by their clients is a very old issue, but it has become very pertinent to CGE modelling more recently as project proponents and other consultants increasingly use specialist CGE modelling consultants to undertake economic modelling. This has the advantage of making relatively rare skills available across a wider range of uses, but does seriously impinge on the information flow between the parties.

This paper argues that results are being presented in this manner because of the supplanting of CBA with CGE modelling, and the failure so far of a recognised set of assumptions and required results to emerge. Just as importantly, governments have not specified such assumptions and results. If the current situation is to change, governments must specify the methods, assumptions and results that they want from an analysis, forcing project proponents to specify contracts to modelling consultants in a satisfactory way and to present the required results.

This paper examines the economic impact of the ABC Metals project, and suggests a method for bringing the results down to a justifiable measure economic benefit, which is what should of interest to policy makers (Dwyer, Forsyth, Spurr and Ho, 2003). It suggests a method for presenting the economic benefit to policy makers in such a way that they can make a reasonable assessment of whether to grant assistance to the project. This method adheres to a strict cost-benefit line of thinking, and shows that CGE analysis can add valuable information to the process over traditional partial equilibrium methods.

MODELLING THE ECONOMIC IMPACT OF THE PROJECT

Background

The project is analysed in a two region (Western Australia and the Rest of Australia) version of the recursive-dynamic MMRF-Green model (Adams, Horridge and Wittwer, 2003) under the different assumptions to produce economic and fiscal results. The fiscal results are actually calculated outside of the model in an excel spreadsheet[2], and accounts fully for all revenues and expenditures (direct and indirect) flowing from the advent of the project, including CGC effects.

The impact of the project can be broadly classified into an investment phase, in which $A1 billion is invested over two years starting in 2004-05, and a production phase for the next 24 years, in which $445 million in output (in today's dollars) is produced, all of which is exported. The capital in the plant is able to continue to produce at this level until 2029-30, after which it is obsolete. A total of 420 people are directly employed in the project, earning $17 million in wages, while $122.5 million in intermediate inputs are consumed each year. The investment phase can be broadly thought of as the short run in comparative static terms, while the production phase can be analysed in terms of long-run assumptions.

[2] With the assumption of fixed rates of taxation and government budget balances endogenous.

Implementing the Shocks in the Model

The project is implemented in the model by a similar method to that established in Dixon, Horridge and Johnson (1992), and perhaps best explained in Madden (1999). A miniature version of the project, with its investments, capital stock, production[3], employment and intermediate demands is placed in a 'dummy'[4] industry in the model database. Investment, capital production, employment and return on capital for that industry are specified as exogenous.

Lack of information regarding the exact breakdown of the costs has meant that the modellers assume that margins on each cost are the same as for the most similar existing industry (iron and steel) in Western Australia. It is also assumed that the employment by occupation for ABC Metals is also in proportion to current employment in the Western Australian iron and steel industry. Similarly, the goods and services demanded during the investment phase, and their source, is in proportion to the existing iron and steel industry's current investment profile.

A series of shocks is then applied to these variables to mimic the investment and production phases of the project. Investment is raised to $500 million in the first year of the investment phase (2004-05), left there for the second year, before a shock is applied in the third year to take it back to a very low level. Concurrently in the third year, capital, exports and employment in the industry are shocked to take them up to the project's full capacity.

Additional Assumptions

A key theme that will run through this paper is that the cost of any additional resources used to increase production should be fully accounted for. To more accurately, but not entirely, reflect the cost of additional resources used or whether it is realistic to assume that more resources can be obtained, two additional assumptions are made in this analysis.

Firstly, the analysis does not follow the usual dynamic CGE assumption that, at the national level, a shock to the economy can increase employment in the short-run, but that wages will eventually respond to take employment back to its pre-shock level. In many cases, the usual assumption may be very valid, but an examination of current conditions in the Western Australian and national labour indicates that it is not in this case.

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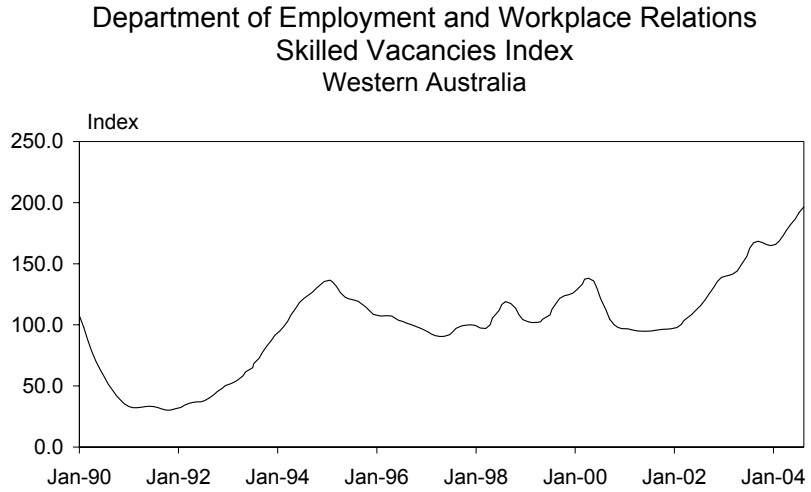
[3] This is actually implemented with exports, with a shift variable in the industry's export demand equation being made endogenous so that the expansion in exports does not affect its price. It is necessary to extract non-competing imports from the non-traditional export aggregate to undertake this closure.

[4] In this case, the Western Australian 'non-competing imports' industry was used.

The construction of a project such as ABC metals requires skilled tradesmen and women – engineers, boilermakers, welders etc. However, currently, the Western Australian and Australian unemployment rates are at 23-year lows, while skilled vacancies are at record levels. The following chart shows the Department of Employment and Workplace Relations skilled vacancies index for Western Australia is at record levels, while occupation data, which is only available at the national level, show that this shortage is mainly in non-professional trades. The presence of skills shortages is backed up by anecdotal evidence from Western Australian industry representatives.



This begs the question of where is the short-run flexibility in national labour supply going to come from? If unemployment is truly structural (as is assumed in the long-run), then reaching into the ranks of the unemployed will not provide the workers needed. Therefore, if the project is starting in the relatively near future, then short-run national labour-market flexibility may not be a reasonable assumption.

There are, of course, situations where a case can be made for the standard long-run assumption of fixed national labour supply. An example could be a mineral project in a remote location that has committed to providing employment to the local indigenous population, where no other local employment opportunities exist[5]. However, it is assumed that the ABC Metals project has no such characteristics.

The standard assumption regarding interstate migration is made in this analysis – that is that unemployment and participation rates in each State are exogenous, as is the real wage differential between States, and population will instantly migrate between regions to take up employment opportunities.

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[5] This is equivalent to the situation in a CBA where the shadow price of labour is less than the market wage rate.

Secondly, the standard MMRF-Green foreign capital repayments module is overwritten for the income earned by the project. This does not directly influence GDP, but does influence consumption, which, in the dynamic closure for MMRF-Green, is determined by Gross National Product (GNP).

In MMRF-Green, a proportion of any increased investment is assumed to be financed by foreigners through a deterioration in the economy's trade balance, with no sacrifice in consumption required. Foreign debt builds up equivalent to the trade deficit (or capital account surplus), and interest is paid on this debt (the current interest rate in MMRF-Green is 7%).

However, Attachment A shows that the income accruing to overseas shareholders is closer to 22% than 7%. Therefore, the foreign debt accruing due to the advent of the project is never added to foreign liabilities in the model, but the income payable is directly deducted from Western Australian GNP.

The company's proposal also indicates that the intermediate demand for iron ore is in fact replacing demand from a steel mill the company is closing in Japan. It turns out that the company is intending to buy exactly the same amount of iron ore from Western Australia as previously, so growth in the capital stock and production of the iron ore industry is maintained at without-project levels.

Economic Impacts

Table 1 below shows the commonly reported macroeconomic impacts from the advent of the project. It shows that Western Australian GSP will increase by a Net Present Value (NPV) of $6.4 billion dollars over the period until 2029-30. Consumption[6] would be $3.4 billion higher and employment almost 1,800 people[7] greater than without the project over the period to 2029-30. Detailed results of the advent of this project are contained in Attachment C.

The conventional method to analyse the logic behind CGE results is to use a Back of the Envelope (BOTE) model or sketch model (Dixon and Rimmer, 2003, p243). A copy of the BOTE model used in this paper is contained in Attachment B. The following analysis concentrates on State-level results, but does note some national outcomes to demonstrate the impact of stricter factor restrictions at national level.

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[6] Private and public.

[7] Peaking at 6,000 people in the first year of the investment phase of the project (2004-05).

Table 1: Economic Impact of the ABC Metals Project
Deviation from Base Case
$m NPV to 2029-30, 5% real discount rate, 2003-04 Prices

Western Australian Gross State Product	6,442
Rest of Australia Gross State Product	-3,175
Gross Domestic Product	3,267
Western Australian Consumption	3,394
Western Australian Employment[a]	1,800
Western Australian Own Source Revenue[b]	326

a. Persons, average over period.
b. Pre-Commonwealth Grants Commission redistribution.

Investment Phase

The inflow of capital associated with the investment phase of the project causes demand in the economy to increase. The economy attempts to produce more to service the demand, but is restricted by its production function:

$$Y = f(K,L,A) \qquad \text{Equation 1}$$

Where Y is real output, K is the economy's capital stock, L is the amount of labour utilised in the economy and A is a productivity factor.

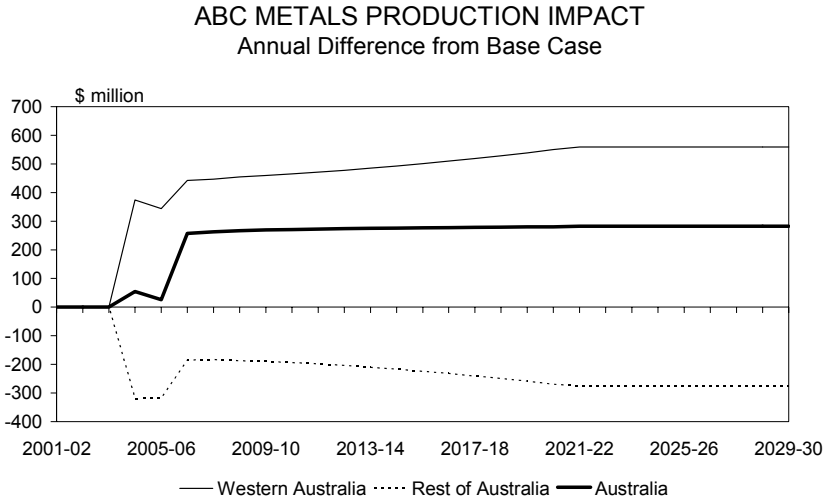
In the short run, the conventional CGE assumption is that the capital stock is fixed but labour/employment is flexible[8] (Dixon and Rimmer, 2003, p205). This means that employers are able to bring in labour at the market wage rate, but that fixed capital must be distributed across more demands, raising its price. This will lead to a decrease in the capital-labour ratio in the economy. Formally:

$$K/L = f(RP_L/RP_K) \qquad \text{Equation 2}$$

Where RP_L is the real price of labour and RP_K is the real price of capital.

However, if there are short-run labour restrictions, then the increase in output is limited. This is illustrated in the following chart, showing that the increase in national production is small during the two year investment phase of the project, with regional production shifting with labour flows across State borders.

[8] In a dynamic context,

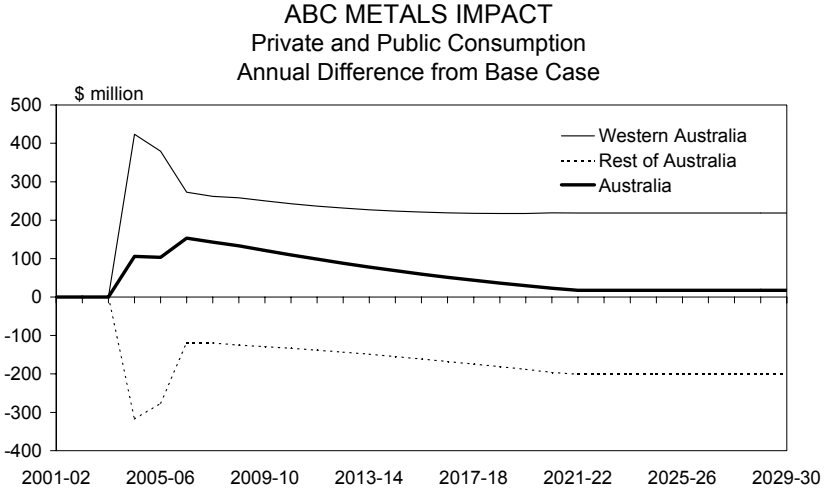


The economy's trade balance and current account will deteriorate by an amount equivalent to the inflow of capital on the capital account. The increase in the price of capital will cause the economy's real exchange rate to appreciate through a rise in the general level of prices, which will encourage imports and hurt exports.

In this case, the major benefit to the State could be a transfer of debt-financed consumption from the future to today. Real consumption, our rough measure of welfare in the BOTE, will increase proportionally to the increase in output and foreign capital inflow:

$C = f(Y, K_{IN}(NET))$ Equation 3

Where C is real aggregate consumption and K_{IN} is capital inflow associated with the project. The consumption impact of the project is shown in the following chart.



The bring forward of consumption can be of considerable benefit to economic welfare if foreigners have different preferences over the time value of money. If foreigners require less reward (i.e. interest) to invest and consume tomorrow rather than consume today than do domestic residents, then the bring-forward in domestic consumption will benefit both parties. A reduction in a project's cost of capital will also allow more marginal projects to proceed.

However, the return on capital for ABC metals is a very high 22%, so there would appear to be little time value of money benefit to Australia from the project. Therefore, there would not be a time value of money benefit if eventually domestic capital could undertake the project in the future. A time value of money benefit is available only if the project can only occur if the current proponent undertakes it now.

At the State level, the conventional assumption is that labour can move freely between States, so an increase in labour supply will always occur in response to the advent of a project (in both the short and long run). However, as is noted below, these additional resources must be accounted for in a cost-benefit analysis, and are at the expense of the other States, meaning that the net national impact of this transfer is zero.

Production Phase

In the long run, output in an economy can only increase if more factors are used for production or the economy becomes more productive.

In terms of the project itself, the addition of extra capital increases the economy's capital stock and its capital-output ratio, enabling production to increase. This production is required to pay international shareholders and creditors of ABC Metals for their investment.

The project itself is very productive, increasing output substantially relative to the amount of inputs used. However, in MMRF-Green, labour from each occupation is always paid its market rate, which does not allow the possibility of the project paying higher wages than the economy-wide average for each occupation. This is a common feature of many resource projects and could lead to an underestimate of the benefits in a CGE analysis[9].

This means that most of the direct benefits from the high productivity of the project accrue to capital in the model. While this will increase production, higher capital returns from the project accrue to foreign investors, so there is no welfare benefit to the Western Australian or Australian economy.

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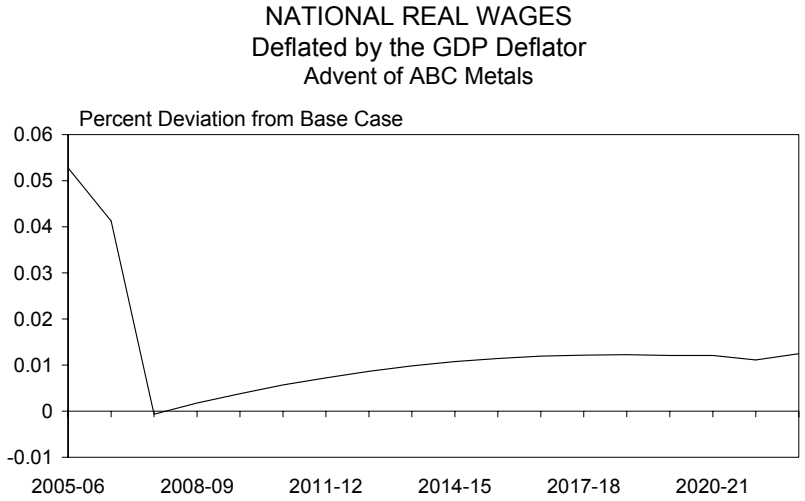
[9] In this analysis, labour valued at the market wage rate is inserted into the database, rather than at the higher rate particular to the project. This is because employment aggregates are calculated according to wage bill weights, so inserting the actual wage bill into the model will cause the call on labour resources by the project to be greater than it should be.

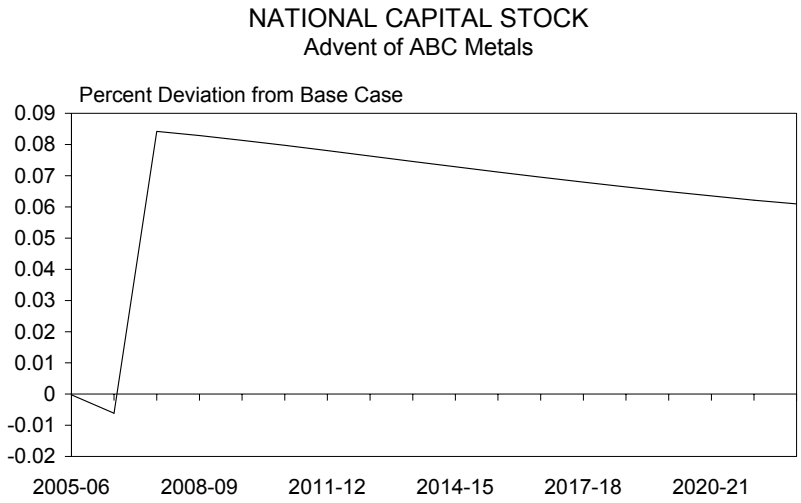
In economy-wide terms, the real price of labour will rise as the scarce resource must be distributed across the now higher capital stock. That is real wages will increase, as shown in the chart below. This will crowd out production in industries that cannot afford the higher wage.



The wage adjustment is not instantaneous, not reaching its long-run level until around 2015. This appears to be because labour migrates across State borders according to a fixed real wage differential, but one that is deflated by the national consumer price index, while production efficiency occurs according to real wages deflated by each regions price of GSP, so it takes some time for nominal wage differentials to cause population movements between States consistent with production efficiency to be achieved.

In a dynamic CGE model, the crowding out, through a reduction in capital in other industries, does not occur instantly, but occurs over time as the capital stock of other industries is allowed to depreciate without replacement investment. This means that the national capital stock is higher than desired, with returns lower than the long-run average, until the capital stock depreciates to its new desired level[10]. This will enable production to be held higher than the long-run equilibrium level for a considerable period of time. The chart below shows that the equilibrium was not in fact achieved during the 25-year period the model was run for.

[10] The standard rate of depreciation in MMRF-Green is 5% per annum.



Consumption will again be determined according to Equation 3, but this time, K_{IN}(NET) will detract from consumption, as after-tax profits from the project are paid to shareholders overseas. Nationally, in the very long run (by about 2020), consumption had dropped almost to the level it would have been without the advent of the project[11], as the economy's capital stock reduces to the point where all of the increase in production is required to compensate international shareholders and creditors of ABC Metals[12].

Fiscal Impacts

The calculation of fiscal impacts of the ABC Metals project is undertaken in a spreadsheet outside of the model. This is the common practice in the Western Australian Government and is in response to:

- relatively aggregated measures of revenue in the model. For example, mineral and petroleum royalties are included in 'other revenues' in MMRF-Green, which increase in line with general economic activity rather than with the fortunes of the industries from which they are derived. Royalty impacts from potential projects are often a key area of interest to policy makers in Western Australia; and

[11] There are still substantial Commonwealth tax collections from the project but, as is noted in the next section, this is used to accumulate higher surpluses or reduce deficits, rather than being returned to the Australian people through a tax cut or increased expenditure.

[12] That is, the national economy must run a balance of trade surplus equal to the repayments to shareholders of ABC Metals.

- the standard MMRF-Green assumption that Commonwealth General Purpose Payments (GPPs) to States increase in line with economic activity in each State. This assumption totally ignores CGC impacts, which actually reduces general purpose grants when economic activity, and hence potential State own-source revenues, increase.

Utilising a spreadsheet rather than the model to calculate fiscal impacts means that Government budget balances must be left endogenous, with tax rates exogenous. Expenditure depends on a State's population and general price level. This does not allow the neat closure of allowing allow of the benefits to the citizens of a jurisdiction through a tax cut. However, in the experience of the author, politicians mostly want to know the 'budget impact' of the project, or whether the assistance proposal is 'revenue positive', so the variable budget balance assumption has so far been appropriate for all situations encountered.

The CGC distributes funding to the States and Territories in the form of GPPs[13], which are funded from national Goods and Services Tax (GST) revenue, and Specific Purpose Payments[14] (SPPs). According to the Committee for the Review of Commonwealth-State Funding (2002), the CGC calculates each State's GPPs according to:

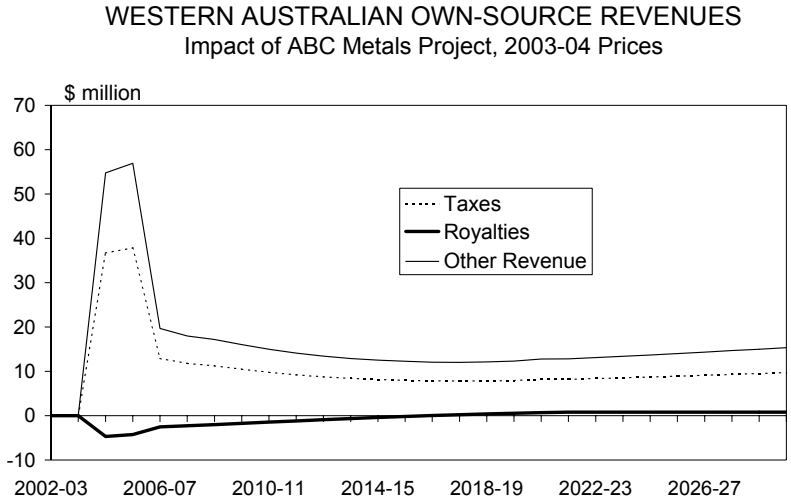
- a per capita share of total funds;
- plus expenditure needs to reflect differences in the demand for, or cost of, goods and services between States (e.g. due to socia-demographic and location characteristics);
- plus revenue needs to offset differences in assessed revenue raising capacity between States (e.g. differences in assessed capacity to collect mining royalties);
- plus needs for SPPs to offset differences in the per capita level of SPPs received by the States.

[13] Untied grants provided by the Commonwealth to the States that can be used by the States for any purpose.

[14] Commonwealth grants to the States which must be spent in specific areas, such as health and education. Specific purpose payments are subject to individual agreements which attach a variety of terms and conditions to the grants.

In the spreadsheet used for this analysis, changes in all own source revenues from all States and GST revenue is aggregated, and distributed according to population changes in each State. Commonwealth Specific Purpose Payments (SPPs) are assumed to unaffected by the advent of the project[15]. This is only an approximation of the impact of a very complex process[16], but it does at least account for the CGC's actions to some extent.

The investment phase of the project causes Western Australia's taxes and other revenues[17] (sales of goods and services, dividends from public corporations) to rise fairly dramatically. Royalties, however, decline slightly because the project has no expansionary impact on any industry paying royalties[18], while the increase in the real exchange rate tends to crowd out royalty-paying export-orientated mining industries. This is shown in the chart below.



In the production phase of the project, revenues are still greater than in the base case, but the annual deviation is less than the investment phase. This is because the deviation in SFD is less once the investment phase ends.

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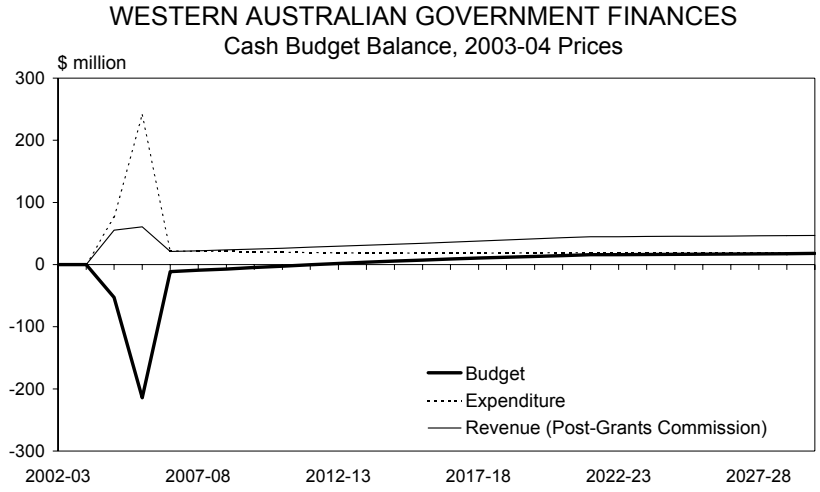
[15] This is acknowledged as an unrealistic assumption and is an area where future research is warranted.

[16] In particular, the GPP distribution ignores the five-year phase in period for population and own-source revenue changes.

[17] In the spreadsheet, nominal taxes increase by slightly less than nominal SFD due to the presence of several non-growth taxes, while nominal other revenue is assumed to grow at the same rate as nominal SFD.

[18] With iron-ore production fixed.



However, as shown in the chart above, once the impact the CGC, Commonwealth SPPs, additional expenditure pressures and the cost of the subsidy are taken into account, the State's finances are actually weakest during the investment phase of the project. The major reason for this is the $200million (2004-05 dollars) assistance grant, but population inflow from other States to service the construction phase of the project is also a factor. In this regard, the following chart shows that the Western Australian cash budget balance is $234 million in 2003-04 dollars further towards deficit in 2004-05 than would otherwise be the case with the cost of the subsidy included, of which the subsidy contributes a major part.

Table 2: Fiscal Impact of the ABC Metals Project
Western Australian Government Finances
Deviation from Base Case
$m NPV to 2029-30, 5% real discount rate, 2003-04 Prices

Revenues[a]	337
Expenditures[b]	355
Subsidy	172
Net Budget Impact	-185

a. Post-Commonwealth Grants Commission redistribution.
b. Not including the project-subsidy cost.

Overall, the provision of assistance has a negative impact on the Western Australian cash budget balance over the period until 2029-30, with the net negative impact slightly greater than the NPV of the assistance provided, as shown above in Table 2.

THE COST BENEFIT ANALYSIS FOR WESTERN AUSTRALIA OF ASSISTING THE ABC METALS PROJECT

Economic Impacts versus Net Economic Benefits

The above analysis has provided the economy-wide economic impacts of the project. However, we are no better of from having this information in terms of deciding whether it is worthwhile to assist this project or not, because we do not yet have estimates of the costs and benefits of providing the assistance. As noted in Dwyer, Forsyth, Spurr and Ho (2003):

> *Much decision making involves choosing whether to incur a cost (often in cash) to obtain a desirable outcome. When outcomes are evaluated in terms of additional economic activity it is not feasible to compare the positive and negative aspects of the change because the two are calculated in different ways. In fact, both are usually expressed in terms of the same measuring rod, dollars; something, which makes them look deceptively comparable.*

The key change required to move from an estimation of economic impact to economic benefit is to consider the cost of additional resources required to produce extra output or underpin extra consumption. As noted in Dwyer and Forsyth, (1993, quoted in Dwyer, Forsyth and Spurr, 2003):

> *This addition to output normally requires additional inputs, of land, labour and capital, to enable it to be produced. These inputs have a cost, and this cost must be deducted from the change in value of gross output if a measure of the net economic gain is to be made.*

Once the additional costs used to increase production and consumption are allowed for, CGE model results and CBA are speaking the same language. CGE modelling results can then be used to enhance the results of CBAs, rather than to be used as an alternative.

Stages of a CBA

Broadly speaking, the aim of a traditional cost-benefit analysis (CBA) was to determine why the market was failing to provide the project, and then to determine the cost to society of undertaking the project with the benefits to society from the same project. This process involved:

- first principles analysis, in which the rationale as to why the project should be assisted was determined;
- estimation of costs and benefits; and
- calculation of summary variables such as the NPV of assisting the project, benefit-cost ratio and, if there is negative cash-flow in the first year, the internal rate of return (IRR).

Between the first principals analysis and the summary variables, decision makers can be provided with a relatively simple set of reasons and numbers to determine whether it is worthwhile to assist the project or not. Importantly, the benefit-cost ratio has a simple benchmark that shows whether the individual project provides benefits greater than the cost of providing it, and allows a very quick and easy comparison with requests to assist other projects.

It should be noted that the CBA presented in this paper concentrates only on the economic aspects of the project. CBA can, and in fact should, account for non-economic factors (externalities) such as environmental, social and regional impacts of the project. In this regard, sustainability analysis is becoming more influential with governments across Australia.

The absence of non-economic considerations in this paper should not be taken to mean that these factors are not considered important. Rather, the paper should be considered an attempt to improve one part of the general CBA process.

First Principles

Traditionally, an analyst conducting a cost-benefit analysis would firstly look for some reason why the free market would not provide a project that is profitable. Most often, this can be tied down to some form of failure in the market, such as the presence of externalities or a lower shadow price of labour than the market wage rate.

Undertaking first-principals analysis serves two major purposes. Firstly, it gives the *raison d'être* behind any government assistance, providing justification for the assistance and differentiating the project from others that may wish to gain similar funding.

Secondly, it provides a 'cross-check' over whether the project proponent is being truthful over the need for a subsidy. For example, if a project is projected to be extremely profitable for the proponent but still requires a subsidy then questions would need to be asked over the need for a subsidy (although this can occur, see below).

Additionally, conducting first principals analysis also gives some perspective over whether the proposed project is an 'all or nothing now' proposal, or whether, if the market is competitive, another project proponent might undertake a similar project in the near future.

The financial analysis for ABC Metals contained in Attachment A shows that the project is extremely profitable in financial terms for the proponent. Therefore, there is no need to check for positive externalities to support the project (although negative externalities might need to be a cost that is accounted for) or to check whether the labour used in the project is valued at less than the market rate.

It would seem reasonable at first glance to ask why the project proponent would not undertake the project without government assistance and, if ABC Metals does decide to take the project to Somalambique, then why does another proponent step-in to advance a similar project? There are several possibilities. For example:

- the technology developed by ABC Metals could be new and unique and protected by a patent for a considerable period of time; and/or
- ABC Metals could occupy a very dominant position in the world steel market, and is able to maintain high prices for its outputs by restricting supply. Here, only a certain number of steel plants will be built and ABC Metals decides where they will be.

It can be argued that the either reason is in fact a form of market failure. This means that there could be a case, if the benefits of obtaining the project in Western Australia outweigh its costs, for assisting the project.

The Commonwealth Strategic Investment Coordination process recognises such market failures by requesting the company provide evidence that the company is viable as a stand alone enterprise in Australia, and there is an alternative location where the project is just as, if not more, viable (Invest Australia, 2004).

For the purposes of this paper, we will assume that ABC Metals passes this first test, because the technology allowing the project to be profitable is new and is locked away by a patent for 20 or so years. The task now is to work out whether the benefits of the project outweigh its costs.

Comparing the Costs and Benefits of the Request for Assistance

In assessing the costs and benefits of tourism, Dwyer et. al. (2003) focussed on increased output (GDP or GSP), and then deducted the increased resources required to produce the extra output. However, most measures of welfare tend to focus on consumption side. In fact, a major strength of CGE models is their ability to take foreign capital inflow (investment) and production/wages and calculate estimated consumption or consumption-related welfare measures[19].

Focussing on consumption also automatically removes many of the costs incurred due to the advent of the project. For example, in MMRF-Green, where consumption depends on GNP, payments for additional foreign-financed capital are automatically removed. Additionally, consumption is net of investment required to replace the constantly depreciating capital stock in the economy, while movements in the economy's terms of trade are accounted for.

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[19] In this regard, export projects produce no direct consumption benefit to Western Australia or Australia in the same way a sporting event does.

More complete measures of welfare gain are included in some CGE models (e.g. the approximations of compensating and equivalent variation in the MONASH model, see Dixon and Rimmer (2002), p211), but these can be a fraction esoteric to explain to policy makers. Consequently, real consumption is often considered the best practical measure of economic welfare.

Choosing real consumption as the measure of economic impact leaves only the labour imported from other States as the only additional economic resource yet to be accounted for. This can be easily deducted, and, in this case, is valued at market wage rates to reflect the cost that is required to induce that labour to shift locations.

Table 3: Cost-benefit Analysis of the ABC Metals Project
Western Australia
Deviation from Base Case
$m NPV to 2029-30, 8% nominal discount rate

Benefits	
Consumption	3,549
Government Revenue	314
Wage Bill[a]	1,056
Total Benefits[b]	2,803
Costs	
Government Expenditures	383
Subsidy	171
Total Costs	554
Net Present Value	2,249
Benefit-cost Ratio	5.06

a. Including additional labour used and increase in labour costs across the economy.
b. Equal to additional consumption, plus government revenue, minus additional wage costs.

Due to the closure chosen for the government finance component of the model, the NPV of State revenues and expenditures also need to be accounted for in the analysis. In this analysis, government expenses over and above the subsidy are considered as part of the costs of assisting the project, although they could be netted from revenue and used to reduce benefits.

While this will not affect the NPV of the project from the State's perspective, the chosen method does reduce the benefit-cost ratio compared with the alternative. This assumption is chosen to reflect the fact that the Western Australian Government is the entity undertaking the 'investment', and if it decides to assist the project it is also effectively deciding to incur a series of other expenditures due to the advent of the project. The additional government expenditure also has some interpretation in terms of the administrative cost required to provide the subsidy.

The results of the CGE-based CBA are presented above in Table 3. It shows that the project has a NPV of $2.25 billion in 2003-04 dollars over its life from 2004-05 to 2029-30 and a benefit cost ratio of 5.1. No IRR could be calculated because the project provided net benefits from the first year of the investment phase.

There are a few points worth noting about the results. Firstly, the net dollar benefit to Western Australia is relatively small relative to the $1 billion in investment, $11 billion in project exports over its 24-year productive life and an increase in the NPV of GSP of around $6.4 billion. This is because the CGE model imposes factor constraints at the national level, while the CBA accounts for the cost of any extra labour resources that are obtained from other States and for increases in factor prices.

Nevertheless, a benefit-cost ratio of greater than one indicates that this particular project is worth supporting. However, even this might be considered small relative to the scale of economic impacts relative to the direct cost of assisting the project.

This decision also assumes that the project is an 'all or nothing' bet. If first principles analysis indicated that there was a 50% chance that another company could undertake a similar investment, or that the company was not really considering locating in another jurisdiction, then assisting the project would become more marginal from the State's perspective.

Additionally, given the net fiscal impact of the project is negative for the State, any decision to assist the project should be considered in the context of other expenditure pressures and the relative strength of the State's fiscal position.

Alternatively, a more generous assumption regarding Commonwealth SPPs, a less severe short-run labour market closure or an incorporation of a wage premium for workers at ABC Metals would have increased the net economic benefits of the project.

Either way, decision makers are presented with an analysis that provides them with the information that they need to do their jobs. It also causes the assumptions behind the CGE analysis to be more of a focus in the results, rather than a set of numbers generated from a 'black box'.

CONCLUSIONS

The application of CGE models has been a major advance in evaluating the costs and benefits to a jurisdiction from assisting a major project. However, at this stage, CGE results have not commonly been presented in a manner useful for policy makers to weigh up a project's costs and benefits. Rather, project proponents have been happy to provide an impressively large number and expect governments to be sufficiently compelled to offer assistance.

This paper uses methods that have been used for analysing the tourism industry and special events to analyse the fictional example of a request for assistance by ABC metals to the Western Australian Government. It finds that the methods developed for the tourism industry to utilise CGE results in a CBA are totally applicable to major project analysis.

The key challenge ahead is for Governments to require that project proponents, and consultants that they employ, to provide the data required to fully analyse the costs and benefits of the request for assistant on the jurisdiction in question. This will be difficult, as the current method of splashing large numbers regarding production, consumption and employment into submissions and the media is to the benefit of project proponents seeking a subsidy. However, unlike at least some requests for project assistance, the benefits from undertaking this action should well and truly exceed its costs.

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Table A1: ABC Metals Financial Analysis

	2004-05	2005-06	2006-07	2007-08	2008-09		2029-30	2030-31
Investment	500	500						
Output			445	445	445		445	0
Intermediate Consumption								
Chemicals			69.8	69.8	69.8		69.8	0
Iron Ore			38	38	38		38	0
Natural Gas			14.7	14.7	14.7	.....		
Total Intermediate Inputs			122.5	122.5	122.5		122.5	0
Labour			17.0	17.0	17.0		17.0	0
Payroll Tax			1.02	1.02	1.02		1.02	0
Gross Operating Surplus (GOS)			304.48	304.48	304.48		304.48	0
Commonwealth Company Income Tax			81.34	81.34	81.34		81.34	0
After Tax GOS			223.14	223.14	223.14		223.14	0
Annual Return on Capital			22.3%	22.3%	22.3%		22.3%	0

ATTACHMENT B

BACK OF THE ENVELOPE MODEL

The Back of the Envelope (BOTE) model used to analyse the modelling results in this paper is similar the Sketch model provided in Dixon and Rimmer (2003, p243), but even more similar to the author's MONASH Model course notes (Adams, 2000). The equations in the model, in levels form, are as follows:

$$GDP = C + I + G + (X - M) \quad (B1)$$

$$GDP = f(K,L,A) \quad (B2)$$

$$C = APC*GDP + NETK_{IN} \quad (B3)$$

$$G = \hat{G} \quad (B4)$$

$$M = f(GDP, RER, T) \quad (B5)$$

$$X = f(GDP - (C + I + G), RER) \quad (B6)$$

$$I/K = f(ROR, NETK_{IN}) \quad (B7)$$

$$K/L = f(RPL*A/RPK) \quad (B8)$$

$$RPL = f(WAGE, -TOT) \quad (B9)$$

$$RPK = f(ROR, - TOT) \quad (B10)$$

$$TOT = f(-X) \quad (B11)$$

$$RER = f(P_{GDP}/P_W) \quad (B12)$$

$$PGDP = S_L*WAGE + S_K*ROR \quad (B13)$$

Where: GDP is Gross Domestic Product or Gross State Product

C is private consumption

G is government expenditure

X is exports

M is imports

K is the capital stock of the economy

L is labour employed in the economy

A is a productivity factor

APC is the average propensity to consume

$NETK_{IN}$ is net capital inflow from overseas

RER is the real exchange rate

T is a variable representing tastes for imports relative to domestic production

P_{GDP} is the GDP Price Deflator

P_W is the price level in the rest of the world

ROR is the nominal rate of return on capital

WAGE is the nominal wage level in the economy

RPK is the real price of capital in the economy

RPL is the real price of labour in the economy

TOT is the economy's terms of trade

S_K and S_L are the shares of labour and capital in GDP.

The BOTE model is applicable to either the national or to State-level economies. The primary difference between the two economies is the restriction on labour applying to each. For example, the conventional CGE assumption is that, at the national level, labour is flexible in the long-run, but will return to its level that it would have been without the chosen shock in the long run.

However, the usual assumption regarding interstate migration is that labour can flow freely between States according to a fixed real wage differential. This means that the restrictions on labour in the long run are much less severe than at the national level. A State can gain extra labour resources to increase production, but this will be exactly offset by losses from other States.

Table C1: Detailed Results of ABC Metals Simulation to 2020, Cumulative Percentage Deviation from Base Case

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
gspreal(WA)	0.4383	0.3909	0.4446	0.4296	0.4222	0.4101	0.3982	0.3871	0.3767	0.3670	0.3580	0.3495	0.3415	0.3340	0.3271	0.3204	0.3145	0.3074
gspreal(ROA)	-0.0492	-0.0478	-0.0248	-0.0238	-0.0237	-0.0234	-0.0230	-0.0228	-0.0227	-0.0227	-0.0227	-0.0227	-0.0228	-0.0229	-0.0231	-0.0232	-0.0234	-0.0232
gnp(WA)	0.8548	0.6736	0.2998	0.2645	0.2456	0.2181	0.1930	0.1720	0.1540	0.1389	0.1262	0.1155	0.1064	0.0987	0.0927	0.0873	0.0839	0.0768
gnp(ROA)	-0.0859	-0.0682	-0.0269	-0.0227	-0.0208	-0.0177	-0.0149	-0.0127	-0.0108	-0.0094	-0.0083	-0.0075	-0.0070	-0.0067	-0.0067	-0.0067	-0.0072	-0.0065
ir(WA)	2.5224	2.2862	0.3516	0.3135	0.2899	0.2594	0.2325	0.2102	0.1914	0.1762	0.1637	0.1536	0.1455	0.1392	0.1348	0.1312	0.1302	0.1246
ir(ROA)	-0.1599	-0.1196	-0.0201	-0.0171	-0.0179	-0.0177	-0.0179	-0.0182	-0.0182	-0.0187	-0.0193	-0.0200	-0.0206	-0.0211	-0.0214	-0.0219	-0.0216	-0.0225
x3tot(WA)	0.9807	0.8462	0.5343	0.4923	0.4703	0.4406	0.4122	0.3871	0.3648	0.3451	0.3277	0.3122	0.2985	0.2863	0.2759	0.2662	0.2587	0.2482
x3tot(ROA)	-0.0794	-0.0671	-0.0246	-0.0242	-0.0252	-0.0254	-0.0257	-0.0259	-0.0262	-0.0265	-0.0268	-0.0271	-0.0274	-0.0277	-0.0280	-0.0282	-0.0286	-0.0284
x4tot(WA)	-0.3270	-0.3270	0.7277	0.7118	0.7114	0.7083	0.7049	0.6998	0.6931	0.6849	0.6754	0.6649	0.6533	0.6411	0.6283	0.6152	0.6017	0.5890
x4tot(ROA)	-0.1014	-0.1337	-0.1069	-0.0956	-0.0886	-0.0815	-0.0750	-0.0696	-0.0653	-0.0615	-0.0581	-0.0552	-0.0528	-0.0509	-0.0497	-0.0485	-0.0484	-0.0464
impvol(WA)	1.4150	1.3110	0.2933	0.2702	0.2598	0.2453	0.2325	0.2220	0.2132	0.2059	0.2000	0.1951	0.1911	0.1878	0.1854	0.1832	0.1823	0.1786
impvol(ROA)	-0.0523	-0.0407	-0.0099	-0.0111	-0.0125	-0.0135	-0.0146	-0.0155	-0.0161	-0.0168	-0.0174	-0.0180	-0.0184	-0.0188	-0.0192	-0.0195	-0.0198	-0.0200
employ(WA)	0.5979	0.5048	0.1684	0.1562	0.1542	0.1465	0.1392	0.1334	0.1286	0.1247	0.1216	0.1190	0.1170	0.1154	0.1143	0.1132	0.1132	0.1102
employ(ROA)	-0.0786	-0.0670	-0.0226	-0.0211	-0.0210	-0.0201	-0.0193	-0.0187	-0.0181	-0.0177	-0.0175	-0.0172	-0.0171	-0.0170	-0.0170	-0.0170	-0.0171	-0.0168
p2tot(WA)	0.1771	0.1032	-0.0646	-0.0680	-0.0663	-0.0644	-0.0627	-0.0607	-0.0588	-0.0570	-0.0552	-0.0536	-0.0521	-0.0508	-0.0496	-0.0486	-0.0474	-0.0477
p2tot(ROA)	-0.0219	-0.0191	-0.0134	-0.0105	-0.0085	-0.0057	-0.0030	-0.0006	0.0014	0.0032	0.0047	0.0058	0.0066	0.0072	0.0075	0.0077	0.0073	0.0079
p3tot(WA)	0.5181	0.3687	0.1127	0.0799	0.0585	0.0334	0.0121	-0.0049	-0.0185	-0.0291	-0.0372	-0.0435	-0.0480	-0.0512	-0.0529	-0.0540	-0.0531	-0.0559
p3tot(ROA)	-0.0579	-0.0420	-0.0125	-0.0079	-0.0054	-0.0021	0.0006	0.0028	0.0045	0.0058	0.0068	0.0075	0.0080	0.0083	0.0084	0.0085	0.0082	0.0084
natxi3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
p4tot(WA)	0.0278	0.0209	0.0610	0.0540	0.0416	0.0291	0.0165	0.0035	-0.0097	-0.0228	-0.0357	-0.0485	-0.0610	-0.0732	-0.0849	-0.0964	-0.1066	-0.1186
p4tot(ROA)	-0.0324	-0.0298	-0.0217	-0.0155	-0.0105	-0.0058	-0.0017	0.0016	0.0041	0.0060	0.0075	0.0083	0.0088	0.0088	0.0088	0.0082	0.0084	0.0057
gspdef(WA)	0.3931	0.2818	0.0793	0.0588	0.0440	0.0253	0.0083	-0.0063	-0.0191	-0.0301	-0.0398	-0.0484	-0.0559	-0.0626	-0.0683	-0.0735	-0.0774	-0.0834
gspdef(ROA)	-0.0349	-0.0214	-0.0054	-0.0025	-0.0007	0.0019	0.0043	0.0062	0.0079	0.0092	0.0102	0.0109	0.0114	0.0117	0.0118	0.0118	0.0114	0.0118
gdpdef	0.0151	0.0146	0.0045	0.0034	0.0029	0.0023	0.0016	0.0011	0.0006	0.0001	-0.0004	-0.0009	-0.0015	-0.0021	-0.0027	-0.0033	-0.0040	-0.0043
pop(WA)	0.5979	0.5048	0.1684	0.1562	0.1542	0.1465	0.1392	0.1334	0.1286	0.1247	0.1216	0.1190	0.1170	0.1154	0.1143	0.1132	0.1132	0.1102
pop(ROA)	-0.0786	-0.0670	-0.0226	-0.0211	-0.0210	-0.0201	-0.0193	-0.0187	-0.0181	-0.0177	-0.0175	-0.0172	-0.0171	-0.0170	-0.0170	-0.0170	-0.0171	-0.0168
totfor(WA)	0.0864	0.0857	0.1108	0.0941	0.0746	0.0553	0.0366	0.0187	0.0017	-0.0145	-0.0299	-0.0444	-0.0581	-0.0710	-0.0831	-0.0944	-0.1049	-0.1149
totfor(ROA)	0.0260	0.0348	0.0276	0.0243	0.0223	0.0203	0.0185	0.0170	0.0159	0.0148	0.0139	0.0131	0.0124	0.0119	0.0116	0.0112	0.0112	0.0107
pwage(WA)	0.0546	0.0425	-0.0019	0.0007	0.0029	0.0048	0.0063	0.0077	0.0088	0.0097	0.0103	0.0107	0.0109	0.0110	0.0107	0.0107	0.0097	0.0112
pwage(ROA)	0.0546	0.0425	-0.0019	0.0007	0.0029	0.0048	0.0063	0.0077	0.0088	0.0097	0.0103	0.0107	0.0109	0.0110	0.0107	0.0107	0.0097	0.0112
natpwage	0.0546	0.0425	-0.0019	0.0007	0.0029	0.0048	0.0063	0.0077	0.0088	0.0097	0.0103	0.0107	0.0109	0.0110	0.0107	0.0107	0.0097	0.0112
realwage_w(WA)	-0.4693	-0.3320	-0.1210	-0.0858	-0.0621	-0.0351	-0.0122	0.0062	0.0210	0.0325	0.0413	0.0480	0.0527	0.0560	0.0574	0.0586	0.0566	0.0609
realwage_w(ROA)	0.1132	0.0849	0.0106	0.0085	0.0082	0.0069	0.0056	0.0048	0.0042	0.0038	0.0034	0.0031	0.0028	0.0026	0.0022	0.0022	0.0014	0.0028
natrwage_w	0.0550	0.0428	-0.0019	0.0007	0.0029	0.0049	0.0064	0.0078	0.0089	0.0098	0.0104	0.0108	0.0110	0.0110	0.0108	0.0108	0.0097	0.0113
realwage_p(WA)	-0.3457	-0.2459	-0.0870	-0.0642	-0.0472	-0.0265	-0.0081	0.0079	0.0218	0.0338	0.0442	0.0532	0.0609	0.0677	0.0732	0.0785	0.0813	0.0890
realwage_p(ROA)	0.0900	0.0642	0.0031	0.0028	0.0032	0.0026	0.0017	0.0011	0.0006	0.0001	-0.0002	-0.0006	-0.0009	-0.0011	-0.0014	-0.0015	-0.0021	-0.0010
natrwage_p	0.0485	0.0399	-0.0330	-0.0302	-0.0276	-0.0249	-0.0226	-0.0204	-0.0184	-0.0167	-0.0153	-0.0141	-0.0132	-0.0124	-0.0119	-0.0112	-0.0115	-0.0095