Economic Research
ARTICLES

ECONOMIC RESEARCH PAPER

MARCH 2002

Department of **Treasury and Finance**
Government of **Western Australia**

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ECONOMIC RESEARCH ARTICLES

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CONTENTS

Executive Summary

This is a compendium of papers written by the Department of Treasury and Finance. Some of these papers have been published in previous editions of the *Western Australian Economic Summary*, while other papers are unpublished to date.

Each of the papers focuses on an issue of relevance to the Western Australian economy.

The first paper examines how Commonwealth fiscal policies generate net flows of resources across States, providing the detailed methodology and calculations behind the Department of Treasury and Finance's estimation of each States' fiscal contribution to the Federation (as reported in the 2001-02 Budget). These "net fiscal subsidies" can be measured in different ways. The approach followed in this paper estimates Western Australia is providing the largest fiscal subsidy of any State – $2.7 billion or $1455 per person in 1999-2000. This is due in part to Western Australia's high share of company tax payments – reflecting its large resource sector, and the low share of personal benefit payments received by Western Australians – partly reflecting our relatively young and healthy population. This analysis is a useful supplement to important contemporary policy debates, such as the current review of the principles underpinning the distribution of Commonwealth GST revenues to the States and Territories.

Much discussion of the Western Australian economy does not distinguish between the different regions. Indeed, reliable regional economic indicators are very hard to come by. However, the second paper in this publication uses available data to provide some insight into the differences in regional economic performance.

Although the rate of industry protection in Australia continues to fall, there is still a relatively high cost to Western Australia of tariff protection. This issue is canvassed in the third article in this compendium, which builds upon studies by the Productivity Commission.

Greenhouse issues have continued to demand attention, with many countries suggesting they will soon ratify the Kyoto Protocol. A summary of several studies undertaken on the economic impacts on Western Australia of ratifying the Protocol is provided to highlight the importance of this issue for the State and to the mineral and energy sector in particular. However, the modelling needs to be interpreted with caution, given the broad range of assumptions employed and the creation of 'scenarios' that inevitably involve a large degree of guesswork. In addition, none of the studies account for possible benefits (social and environmental) from the reduction of greenhouse gases in the atmosphere – highlighting that all of the results should be analysed in the correct context.

The final article looks at the uses and abuses of output multipliers. Such multipliers are often used by proponents of particular projects to emphasise flow-on benefits and justify public assistance. However, these multipliers are often not well understood and should be used with extreme caution.

1. Fiscal Subsidies within the Federation[1]

Background

The extent of Commonwealth government induced fiscal transfers between the States and Territories (hereafter referred to as "States") has always been an issue of some interest in the Australian federation.

States often compare their allocation of Commonwealth grants with other benchmarks, such as population shares, to determine the extent to which they are subsidising, or being subsidised by, the other States in the federation.

However, such grant comparisons present only part of the picture. For example, the Commonwealth also provides benefits directly to State residents through its other outlays (eg. Medicare benefits, unemployment benefits and pensions). In addition, State residents and businesses contribute to the Commonwealth's coffers by paying Commonwealth taxes.

The net impact of the Federal Government's fiscal policy is to redistribute resources away from strong States towards economically weaker States.

Each year, the Western Australian Department of Treasury and Finance (DTF) assesses the net redistribution of resources between States arising from all Commonwealth general government fiscal transactions. This analysis results in the calculation of each States' net fiscal subsidy to the federation.

Under this approach, a State provides a fiscal subsidy to the federation if total Commonwealth revenues derived from that State exceed total Commonwealth outlays on that State.

Western Australia provides the largest fiscal subsidy of any State. This is due in part to Western Australia's high share of company tax payments – reflecting its large resource sector, and the low share of personal benefit payments received by Western Australians – partly reflecting our relatively young and healthy population.

The discussion in this paper includes more detail on how fiscal transfers among States arise, the methodology used by DTF to calculate each State's net fiscal subsidy, the results of the analysis and alternative approaches to our methodology.

1 Any queries about this article (which has not previously been published) can be addressed to Leonie Buktenica or Peter Cox of the Intergovernmental Relations Division.

How Fiscal Transfers Arise

Commonwealth tax and expenditure measures give rise to fiscal transfers between States through the following mechanisms:

- Firstly, Commonwealth taxes are raised on the basis of nationally uniform tax rates and tax base definitions, but are spent in ways that usually have no relation to where the taxes are collected or who paid them. For example, grants to State and local governments are not related to the level of Commonwealth taxes generated in those regions.
- Secondly, social and economic diversity among the States means that the net impact of Commonwealth tax and expenditure measures will vary from region to region. For example, regions with a high proportion of wealthy taxpayers will generally contribute more in taxes than they receive in benefits.

In addition to these mechanisms, the Commonwealth Government deliberately seeks (through the Grants Commission process) to allocate grants among the States in a way that gives all State governments the capacity to provide the same level of services (at an average level of efficiency), provided they each make the same effort to raise revenue from their own sources[2]. As a result, States will generally receive more or less than their equal per capita share of Commonwealth funding.

DTF's analysis takes into account the interstate distributions arising from the above mechanisms, but not the flow-on impacts on economic activity from Commonwealth policies. For example, including the impact of tariffs on economic activity would increase Western Australia's net fiscal subsidy, as they overwhelmingly support manufacturing industries in the Eastern States at the expense of Western Australian industries (notably the resource sector).

2 In distributing grants the Grants Commission process takes into account the fact that not all States have the same capacity to raise revenues from their own sources and may face higher costs of service provision which are beyond a State Government's control.

Methodology

Commonwealth transactions are allocated between States according to which State would have access to current Commonwealth revenues or responsibility for current Commonwealth services if the federation did not exist.

A State's net fiscal subsidy is calculated as:

- The value of Commonwealth taxes and other revenues attributable to production and consumption activities in the State; less
- The value of Commonwealth expenditures on the State, including grants to State and local governments, salaries of Federal Government employees and benefits paid to individuals; less
- The State's share of the Commonwealth deficit.

Revenues

The share of Commonwealth general government revenues contributed by individual States is estimated on the basis of the location of economic activities subject to Commonwealth taxes and other revenue measures.

For example, States' shares of:

- Personal income taxes are based on estimated receipts in each State on a residence basis (using data from the Australian Taxation Office's *Taxation Statistics*);
- Company taxes are allocated according to gross operating surplus of relevant industries in each State (using data from the Australian Bureau of Statistics' *State Accounts*, including unpublished dissections of that data); and
- Wholesale sales tax (and in future, GST) is allocated according to the value of components of household final consumption expenditure in each State (using data from *State Accounts*, including unpublished data).

Expenditures

Commonwealth expenditures are allocated between the States on the basis of the location of services and the destination of grants and cash benefits, using mainly *State Accounts* data (to estimate the interstate distribution).

For example, the Australian Bureau of Statistics, when compiling its *State Accounts*, produces estimates by States of:

- Commonwealth final consumption expenditure, which is general government current expenditure (such as salaries and rent) incurred in providing services to the community such as defence and administration of social security; and
- Personal benefit payments and grants to non-profit institutions.

Deficit or Surplus

The Commonwealth deficit (surplus) is allocated between States as it represents an impost on future taxpayers, either through increased (decreased) taxes or reduced (increased) services.

In the absence of any clear conceptually superior alternative, half the deficit (surplus) is distributed according to States' shares of total Commonwealth revenue and half according to States' shares of total Commonwealth expenditure.

Results

In 1999-2000, Western Australia provided the largest fiscal subsidy of any State, both in per capita terms and in absolute dollars (see following table). Other net contributors to the federation are New South Wales and Victoria.

In per capita terms, Western Australia's fiscal subsidy is more than three times larger than the subsidies of each of these States.

Each State's Net Fiscal Subsidy to the Federation, 1999-2000

	$m	$ per capita
New South Wales	2,579	401
Victoria	2,113	446
Queensland	-2,136	-604
Western Australia	**2,724**	**1,455**
South Australia	-2,300	-1,538
Tasmania	-1,394	-2,962
Northern Territory	-1,586	-8,171
All States[(a)]	**0**	**0**

(a) It is assumed that the ACT exists only to serve the federation and that if the federation were to be dissolved the ACT would cease to exist. Commonwealth expenditures and revenues attributed to the ACT have been allocated among the States according to population shares.

Western Australia's large net fiscal subsidy reflects both high Commonwealth revenue collections from Western Australia and low Commonwealth expenditures on Western Australia. The following table shows the main factors contributing to Western Australia's large fiscal subsidy to the federation.

Main Components Contributing to Western Australia's Net Fiscal Subsidy, 1999-2000

	$million
Company Tax	1,084
Revenues from petroleum production[(a)]	687
Final Consumption Expenditure[(b)]	555
Personal Benefit Payments and Grants to Non-Profit Institutions	399
Petroleum Excise Duties[(c)]	278
Income Tax	176
Grants to State and local governments[(d)]	-211
Subsidies[(e)]	-291
Other	47
Total	**2,724**

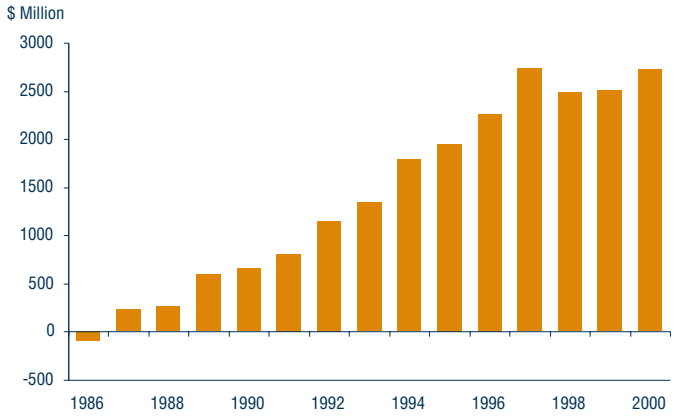
(a) Includes Petroleum Resource Rent Tax, petroleum royalties and excise on crude oil and LPG.
(b) General government current expenditure (such as salaries and rent) incurred in providing services to the community such as defence and administration of social security.
(c) Excise duties levied on petroleum sales less diesel rebates.
(d) Includes North West Shelf royalties collected by the Commonwealth and passed back to Western Australia.
(e) Excludes diesel rebates.

As a result of the State's large resource sector, Western Australia contributes high per capita shares of national company tax collections and revenues from petroleum production.

On the expenditure side, Western Australian residents draw a relatively low share of national social security benefits, partly reflecting our relatively young and healthy population and the generally low level of unemployment in Western Australia. Western Australia also receives a low share of health benefits, reflecting the lower use of private (as opposed to public) services in this State, as well as the younger population profile.

The subsidy provided by Western Australia has grown strongly over the period for which data is available, reflecting strong growth in Western Australia's economy, boosting tax collections from the State and further decreasing the need for personal benefit payments.

WA's Net Fiscal Subsidy to the Federation
Year ending 30 June



The net fiscal subsidy results shown here reflect a markedly different picture from the more commonly quoted benchmarks. Western Australia was providing a substantial net fiscal subsidy to the federation even when the State was receiving more than its population share of Commonwealth general purpose grants (ie. up until 1997-98).

Alternative Approaches

DTF's analysis was inspired by Professor Brosio of the University of Torino[3]. Professor Brosio noted two approaches for measuring fiscal transfers:

- The "welfare" approach, which looks at the net contribution of the Commonwealth budget to the welfare of residents in each State. This is made up of the difference between the value of cash benefits and other services residents receive, and the amount of taxes and other revenues they pay.
- The "income creation" approach, which looks at the net contribution of the Commonwealth budget to the income of the owners of factors of production in each State.

3 G. Brosio, "The Balance Sheet of the Australian Federation: Some Tentative Estimates", Federalism Research Centre Discussion Paper No. 24, August 1994, Research School of Social Sciences, Australian National University, Canberra, ACT.

Brosio's approaches are conceptually distinct from the approach adopted by DTF. DTF's analysis is based on the question "what if the federation did not exist?". Commonwealth fiscal transactions are allocated between States according to which State would have access to current Commonwealth revenues or responsibility for current Commonwealth services if the federation did not exist.

The DTF analysis does not attempt to assess possible diseconomies of small scale, or cost savings from streamlining and prioritising government operations, if States took over Commonwealth functions. Alternatively, one can imagine States financing a central body to provide some current Commonwealth-type functions.

The treatment of pensions provides an example of the difference between the alternative approaches to measuring fiscal transfers.

- Under the welfare approach, pensions are allocated according to the State of residence of the recipients as they receive the benefit from the payment.

- Under DTF's approach, pensions are also allocated to the State of residence of the recipient, but on the basis that if the federation did not exist the State of residence would be responsible for the payment.

- On the other hand, the income creation approach assumes that pensions spent in one jurisdiction may generate income for owners of production factors located in other States. For example, a pair of shoes purchased by a pensioner in Western Australia may have been manufactured in Victoria.

The overall outcomes from the three different methods are broadly similar, subject to some debate about the economic incidence of company tax. The results for the ACT are also different, as discussed below.

Treatment of the ACT

DTF's latest analysis allocates all Commonwealth outlays and revenues relating to the ACT among the other jurisdictions according to population shares. This approach reflects that, if the federation were to cease to exist, it is unlikely that the ACT would continue to exist as a separate entity.

The welfare approach adopts the view that central government expenditures on public servants in the ACT generate benefits across the nation, and should therefore be apportioned across all States in line with those benefits. The income creation approach attributes the incomes of public servants to the ACT.

Earlier DTF analysis treated the ACT as a separate jurisdiction, on a par with the States and the Northern Territory. Commonwealth expenditures in the ACT that provide services to ACT residents were allocated to the ACT. However, Commonwealth expenditures in the ACT that provide services to all Australian residents were allocated across all jurisdictions.

Under this approach, only Commonwealth expenditures on national administration (and some expenditures on the Australian National University) were allocated among other jurisdictions. On this basis, the ACT is estimated to provide a fiscal subsidy in 1999-2000 of $529 million (or $1,706 per capita). Other States' net fiscal subsidies are $28 per capita less than the amount shown in the first table in this paper.

Major reasons for this outcome are that ACT residents pay a higher level of income tax (due to the relatively high incomes of persons employed in Canberra), and receive a relatively low share of Commonwealth benefit payments (eg. unemployment benefits).

Treatment of Defence Expenditure

Defence salaries have been allocated in the DTF analysis according to the location of defence establishments, on the presumption that the defence benefit to each State is proportional to the size of the defence facilities stationed in each State (this is taken as a measure of the implicit commitment to defend each State). Non-salary defence expenditures have been allocated on a per capita basis, as there is insufficient data to do otherwise.

As DTF's analysis examines existing Commonwealth expenditures, it does not take into account the defence expenditure that would be required if the States were fully independent from the federation. For example, some States may need to spend more in per capita terms than other States if they were providing their own defence services.

It would be reasonable to assume that if the Commonwealth did not exist, the pattern of defence expenditure in the federation would be different, but that States would cooperate to provide a cost effective defence.

Policy Implications

There is significant unease in Western Australia about the large amount of resources being drained from the State, and a view that Western Australia deserves a better deal from the federation. A better deal for the State may also be in the national interest, given the State's strategic location and the fact that it is one of the most prospective development regions in the country.

Concerns in Western Australia have been heightened by apparent problems with the Grants Commission process for allocating GST revenues between the States. In particular, DTF believes that the Grants Commission may have understated Western Australia's grant entitlement, by:

- not adequately recognising the need for infrastructure in Western Australia to support its high population and economic growth; and
- not recognising the cost of establishing large resource projects, despite the fact that revenue benefits that accrue to Western Australia from resource projects are largely reallocated to other States under the Grants Commission's fiscal equalisation principle.

Reflecting this and other concerns, Western Australia, along with the governments of New South Wales and Victoria, have launched an independent review of the Commonwealth Grants Commission process.

References

Brosio, G. 1994, 'The Balance Sheet of the Australian Federation: Some Tentative Estimates', Federalism Research Centre Discussion Paper No. 24, Research School of Social Sciences, Australian National University, Canberra, August.

2. Regional Economic Conditions in Western Australia[4]

Introduction

Concern with differences in the economic prosperity between Australia's major cities and the outlying regions has been a major issue over recent years. Bank branch closures, declining general services and social infrastructure have increasingly been concerns of representatives of the regions. National competition policy, the privatisation of Telstra or economic rationalism generally have been commonly mentioned as contributing to this disparity.

There are many issues underlying these trends. While this paper does not attempt to address all concerns, it uses the available economic data to examine the situation in each region and suggests some underlying trends that might be determining the fortunes of regional Western Australia.

Unfortunately, quality data on regional Western Australia are not available, and those that are available are often not very timely. However, some inferences can be drawn from the available data, especially when examining longer-term trends. The comments drawn in this paper are not necessarily definitive but rather should be seen as providing some commentary on the data and encouraging further analysis in this area.

There are 114 local government areas (LGAs) in Western Australia outside of metropolitan Perth. It is useful for the purposes of analysis to group these LGAs into 9 regions, which correspond to the Department of Local Government and Regional Development (DLGRD) regions. These regions are the Gascoyne, Goldfields-Esperance, Great Southern, Kimberley, Mid-West, Peel, Pilbara, South West and the Wheatbelt.

Regional Indicators

Population

Western Australia's population increased from 1.46 million people in 1986 to 1.86 million people in 1999, an increase of 27.6%. Approximately 508,000 people lived in regional Western Australia in 1999, or 27.3% of Western Australia's population.

4 This article was written by Bruce Layman and was published in the March Quarter 2001 Western Australian Economic Summary. The data used were the latest available at the time.

There has been a very slight decline in the proportion of regional residents since 1986, with population in the Perth Metropolitan area increasing faster than the regions at 29.7% compared with 22.3%. Population change in the regions from 1986 to 1999 is shown in the following table. Only two regions, the Gascoyne and Pilbara, suffered population declines from 1986 to 1999. Both of these regions were faced with declining employment in their largest industries (agriculture for the Gascoyne and mining for the Pilbara).

Regional Population Change 1986-1999

Region	Population 1986	Population 1999	Change 1986 to 1999
Peel	36,546	70,338	92.5%
Kimberley	21,124	29,527	39.8%
South West	90,884	123,619	36.0%
Goldfields-Esperance	47,932	58,778	22.6%
Mid West	43,410	50,490	16.3%
Great Southern	45,797	51,840	13.2%
Wheatbelt	71,192	72,431	1.7%
Gascoyne	10,818	9,772	-9.7%
Pilbara	47,729	41,153	-13.8%
Total Regions	**415,432**	**507,948**	**22.3%**
Perth	1,043,588	1,353,068	29.7%
Western Australia	**1,459,020**	**1,861,016**	**27.6%**

Source: ABS, DLGRD

Some regions, namely the Kimberley, Peel and the South West, grew at much faster rates than Perth. Considerable manufacturing and service infrastructures have developed in Peel and the South West over this period. The Kimberley has benefited from the expansion of agricultural production in the Ord River irrigation scheme, and a substantial increase in employment in the community services industry.

The Wheatbelt region perhaps gives the best example of the stereotypical rural population decline depicted in the media. The population of the Wheatbelt grew by only 1.7% from 1986 to 1999. Increases in population were restricted to shires with coastal centres (Dandaragan and Gingin), major regional centres (Northam Shire and Narrogin), or municipalities close enough to Perth for city workers to commute or with some tourism potential (Chittering, Toodyay and York). Population was lost in almost every traditional small inland agricultural shire over the period, sometimes by very large amounts.

The Productivity Commission (1999) noted the presence of "sponge cities", where people from smaller regional towns shifted to larger regional centres as opportunities in the neighbouring small towns decreased. The Commission named Geraldton and Narrogin as such centres in Western Australia.

The Commission also noted the presence of "coastal drift", which reflects Australians' desire to live close to the ocean. In this regard, most coastal shires in the South West corner experienced growth, while almost all small inland agricultural shires stagnated or declined.

A typical example of this trend was in the Great Southern Region. The total population of the Great Southern Region rose from 45,797 in 1986 to 51,840 in 1999. However, the distribution of this gain was very uneven. Coastal centres grew strongly, with Albany increasing from 23,491 to 29,622 people and Denmark increasing from 2,771 to 4,421 people over the period. This was partially offset by declines in population in inland agricultural shires such as Broomehill (619 to 553 people), Cranbrook (1,299 to 1,109), Gnowangerup (2,226 to 1,699), Katanning (4,940 to 4,525), Kent (995 to 765) Tambellup (868 to 705) and Woodanilling (448 to 386).

Output

A reliable measure of the economic output of the regions is not currently available. DLGRD has published estimates of Gross Regional Product (GRP), but changes in the Australian Bureau of Statistics' (ABS) National Accounts after 1997-98 have reduced the reliability of these estimates. In 1997-98, GRP was around 34% of Gross State Product. This proportion has been fairly constant since the mid-1980s.

Employment

Approximately 251,000 people were employed in regional Western Australia in June 2000, or 27.2% of total employment in the State. The highest employment of the regions was in the South West Region, while the lowest employment was in the Gascoyne. The employment and the unemployment rate in each region as at March 2000 are shown in the following table.

Unemployment in the regions as a whole was slightly lower than for Perth, but there was great divergence about the regional mean. High unemployment rates were recorded in several regions, such as the Gascoyne, Kimberley and Peel.

Employment and Unemployment Rate in WA Regions, June 2000

Region	Employment	Unemployment Rate
South West	60,675	5.7%
Wheatbelt	36,816	3.9%
Goldfields-Esperance	31,277	5.6%
Peel	28,962	8.1%
Great Southern	26,420	5.8%
Mid-West	24,424	7.8%
Pilbara	23,533	4.9%
Kimberley	13,163	14.6%
Gascoyne	5,886	7.6%
Total Regions	**251,156**	**6.4%**
Perth	672,380	6.2%

Source: ABS, DLGRD

However, unemployment rates may not be a good indicator of economic health at a regional level. For example, the annual average unemployment rate in the Wheatbelt region was below the State average between 1985-86 and 1999-2000. However, the total population of this region grew by only 1.7% in total over this period, compared with growth of 27.6% for Western Australia. Employment in the Wheatbelt grew by only 4.8% from 1986 to 1996, compared with almost 15% for Western Australia as a whole. This could indicate that people faced with unemployment in the region have decided to seek employment elsewhere, or decided to be unemployed in a region where more services are available.

Cost of Living

It costs more to live in the regions of Western Australia than in Perth. DLGRD regularly commissions a survey of the cost of living in Western Australian regions compared to the cost of living in Perth. The survey consists of prices of commodities such as food, housing, transport, education and recreation. The overall index for each region in the latest survey (November 1999) is shown in the following table.

Regional Price Indices, November 1999

Region	Index
Kimberley	114.3
Pilbara	112.6
Gascoyne	109.6
Goldfields-Esperance	107.0
Wheatbelt	105.4
Mid-West	104.4
South West	102.6
Peel	102.1
Perth	**100.0**

Source: DLGRD

The most expensive region in Western Australia is the Kimberley, with a cost of living 14.3% above that of Perth. The Pilbara was the next most expensive region. The high cost of housing is the main influence for the high cost of living in these regions. The cost of living tends to be higher in regions that are further away from Perth.

Peel and the South West were the cheapest regions to live in 1999. They have benefited from large regional centres, giving adequate infrastructure for local production of some items, and close proximity to Perth, reducing transport costs.

Income

On average, the income of regional residents is lower than that of people in Perth. There are exceptions, such as the Pilbara, which has an average adult income 60% greater than that of Perth (see following table).

Kimberley, the most expensive region to live, has an average adult income less than that of Perth. However, unemployment in the Kimberley is high (see earlier table), which suggests that the average income figure is masking considerable divergence of wealth in the Kimberley.

Average Adult Income by Region, 1996

Region	Average Adult Income
Pilbara	$32,456
Goldfields-Esperance	$26,328
Mid West	$20,446
Wheatbelt	$19,503
Kimberley	$19,274
Gascoyne	$18,885
South West	$18,338
Peel	$17,418
Great Southern	$17,202
Total Regions	**$20,488**
Perth	$20,255
Western Australia	**$20,332**

Source: DLGRD

Average incomes in Peel and the Gascoyne would also be affected by relatively high unemployment rates. However, the Wheatbelt, Great Southern and South West have relatively low average adult incomes and low unemployment rates.

Comment

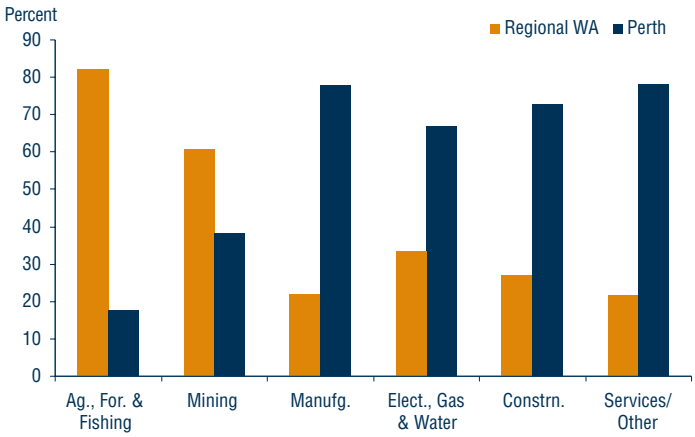
Employment in the Regions

Four regions – Peel, Kimberley, South West and Goldfields-Esperance – have experienced considerable growth in population and employment since 1986. Although these regions do not have every service and amenity available to Perth residents, a growing population and employment provides a favourable situation and outlook.

Two regions, the Pilbara and the Gascoyne, have suffered declining population and employment. There are also regions that have some growth areas and others in decline. These are the Mid-West, Great Southern and Wheatbelt. Usually, the areas that are doing well are located on the coast, and are often relatively large regional population centres (eg Albany and Geraldton). Inland agricultural areas with relatively small population centres are not performing so well, with the only exceptions being "sponge cities" such as Narrogin.

Reasons for this divergence are many, but the most likely explanation can be found from examining the industries providing employment in each region. The following chart shows the proportion of employment in Perth and regional Western Australia for some broad industry groupings at the time of the 1996 ABS census.

Share of Total State Employment
Perth and Regional Western Australia, 1996



Source: ABS

Not surprisingly, most employment in the agricultural and mining industries is in regional Western Australia, while Perth has the majority of State employment in the manufacturing, electricity, gas and water, and services industries. The Wheatbelt, Great Southern, Mid-West and Gascoyne are the dominant agricultural regions, while the Pilbara and Goldfields-Esperance derive much of their employment from mining.

Regional areas, especially those containing many traditional agricultural shires, have very low levels of service industry employment. Service industries employed about 51% of the Wheatbelt workforce in 1996, compared with 78% of the Perth workforce. The Kimberley is the exception, but a very high level of employment in the Health and Community Services industry distorts this figure.

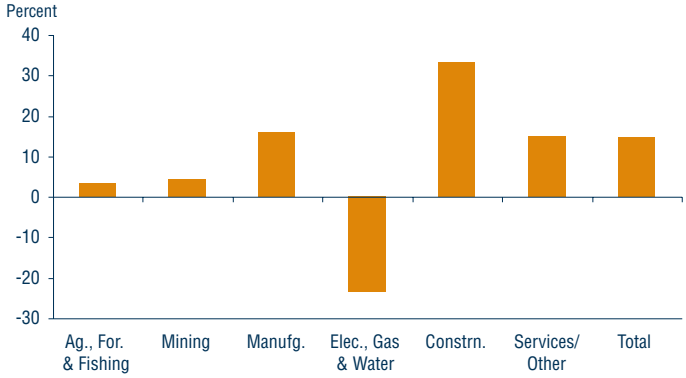
Regions that have considerable service infrastructure, especially parts of the South West, are likely to be quite reliant on tourism to sustain these industries. Tourism has the advantage of temporarily increasing the population of regions, and tourists consume many of the same services that local residents consume on a regular basis.

For example, even though the tourist attraction might be free (such as the surf at Margaret River), tourists use service stations, banks, supermarkets and restaurants/cafes while government services such as police need to be maintained for peak times. The existence of these businesses has substantial benefits for permanent residents.

Employment growth for the regions' major industries has been well below that of the industries located in Perth (tourism might be an exception but data are limited). The chart below shows that employment in agriculture declined at 0.5% per annum between 1985-86 and 1999-2000. Employment in mining increased at a reasonable rate (1.1% per annum), but ABS census data suggests that this was entirely due to growth in Perth-based mining employment.

The introduction of fly in-fly out employment practices has meant that some remote mines can operate with little economic impact in the region in which the mine is located. Income is likely to be largely spent in major centres such as Perth. Additionally, many mining services companies based in Perth, such as contract engineers, have developed in recent years.

Annual Growth in Employment in Western Australian Industries 1984-85 to 1999-2000



Services, construction and manufacturing employment increased at the fastest rates. Employment in electricity, gas and water industries declined across all regions.

Where Will Industries Locate?

A few things can be said about the structure of employment of the regions outlined above. Firstly, the regions tend to be relatively strong in industries that need a *location specific* resource or factor (which includes tourism). If you wish to farm, you need agricultural land, which can only be found in sufficient quantities in the regions. Likewise, mining must take place at the site of mineral deposits. Perth tends to dominate the *location free* industries, especially manufacturing and services.

Choice of industry location has long been considered in the study of economics, especially those that are location free. Marshall (1920) advanced the following reasons as to why people and industries locate together in large cities. The key seems to be access to a large, readily available workforce and cheap intermediate inputs:

- *production externalities, such as labour market pooling*. Firms benefit from being close to a large pool of labour with skills suited to their production processes. New labour can be added or recruited from other firms when expansion occurs, while excess labour can easily be shed during times of contraction;
- *proximity to close, cheap intermediate inputs and key infrastructure*. Firms can access competitively priced goods and services that can be obtained in a timely manner at low cost of transport;
- *technological spillovers*. Firms are able to take advantage of the externalities created by similar firms locating together in "clusters" via interactions between firms, recruiting staff from competitors, etc. Perhaps the best known example today is that of Silicon Valley in California; and

- *consumption externalities.* Consumers like the convenience of the amenities, diversity of retail outlets, atmosphere, etc. of large cities.

In short, there are powerful economic reasons as to why Perth tends to attract most of the manufacturing, utility, construction and services industries in Western Australia.

Krugman (1991) advanced a theory for the location decisions of a firm. Assume that there are two regions, city and country, of which the city is the largest market. Now consider a firm based in the city. It initially only sells goods to the city market but wishes to expand its sales into the country. It can either set up a plant in the country or expand production from its city plant. Also assume that there is no difference in the marginal cost of production of a plant at either location, but that the firm faces economies of scale so the average fixed costs faced by the firm decline as production increases.

The decision to build a second plant in the country then depends on whether the *average fixed cost* of setting up the plant in the country is less than the *unit transport* cost of servicing the remote market from the city. For many producers, it is better to maintain production in the main market (city) and bear the cost of transporting goods to the smaller market (country). Falling transport and communication costs, which are examined below, will exacerbate this effect.

Factors Affecting Regional Industries

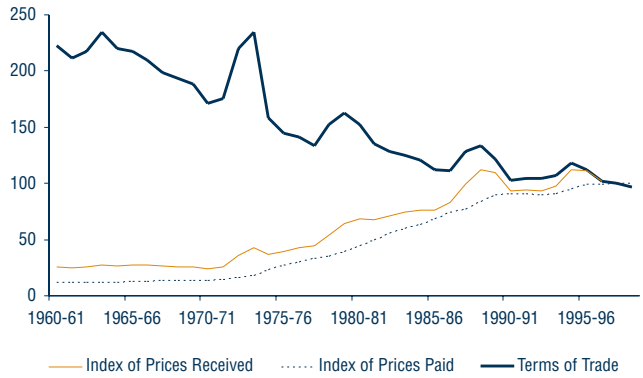
Declining Terms of Trade of Commodity Producers

In addition to the development of fly in-fly out mining operations and Perth-based mining services companies, two long-term trends have impacted upon the dominant regional industries, one of which has accelerated in recent years.

The declining terms-of-trade of agricultural industries is a well-known phenomenon, particularly for producers of commodities that are traded on world markets (such as wheat and wool). Prices farmers receive for their outputs tend to rise by less than the rise in prices of goods they need to produce their outputs. Indices of Australian farm costs, outputs and terms of trade are shown in the accompanying chart.

This is driven by the world supply of commodities rising faster than demand for those commodities. Improved productivity, new regions in the rest of the world starting production or the development of alternative products (eg. synthetic fibres in the case of wool) have been at the forefront of increasing world supply.

Australian Farm Sector Terms of Trade
1960-61 to 1998-99



Source: ABARE

This has led to increasing farm mechanisation and consolidation. Farmers can offset this to some degree by improving their own productivity, but this reduces employment as production is always constricted by the amount of land available. There were over 23,000 farms in Western Australia in 1968-69, but only 18,150 by 1980-81 and 14,000 by 1995-96.

The Productivity Commission (1999) noted that terms of trade for mining industries did not deteriorate to the same extent as for agriculture, although mineral prices did fall throughout the 1990s. Illustrative of this is that labour has been shed in recent years (especially in the Pilbara) as mining companies have tried to become more efficient.

Declining Transport and Communication Costs

The second long-term trend affecting the regions is declining transport and communication costs, which have accelerated in recent years with the advent of the internet. Falling transport and communications costs have always encouraged specialisation and trade, with the impact of the invention of the telegraph in 1845 and the rollout of the rail system between 1860 and 1890 on American industrial development a prime example (Meyers, 1983). Regions have become more reliant on their location specific industries, which have not generated significant employment growth.

The regions are easier to reach from Perth than they used to be, and just about anywhere in the South-West corner of the State is less than one day from Perth by car. It is now relatively easy to shop and conduct business in Perth compared to the past.

A trip to Perth is also a fixed cost, so it pays to do more than one task when you are there. If you are driving to Perth to see a farm consultant, then it is probably just as easy to see the tax accountant and do some shopping as well.

Falling transport and communication costs also help firms from Perth service country clients. Many agricultural consultants and marketing organisations (both statutory and private) are located in Perth. They prefer the ability to service a wide area of the state, being close to other service providers on which they rely and the better amenities of Perth for their employees over the additional transport cost of being away from their main clients.

Additionally, the advent of the internet has significantly altered the delivery system of many services such as banking, bill paying and shopping. Now infrastructure associated with these services need not be located at the site of delivery.

For regions close to Perth, especially Peel, falling transport costs have been a boon. Workers can now commute to Perth in much less time as the Southern Freeway expansion has been rolled out. Because the population is growing, service firms can develop that might expand their markets into Perth.

However, for smaller declining regions, firms are unlikely to be able to develop the economies of scale to challenge Perth or interstate companies. These regions are likely to become more reliant on their natural resource-based industry, and these are unlikely to be significant employment generators.

Conclusion

Data on regional Western Australia are difficult to obtain on a consistent and timely basis. The available data indicate that some regions have done better than others. Peel, the Kimberley, South West and Goldfields-Esperance have all experienced strong employment and population growth. Peel and the South West have developed substantial manufacturing and services infrastructure, while mining appears to be the main driver of growth in Goldfields-Esperance. Although gains in mining employment have been relatively small, construction and services in the Goldfields-Esperance region have benefited from the expansion of the last decade.

Some regions have fared relatively poorly, especially the Gascoyne and the Pilbara. These regions have suffered declines in employment in their dominant primary industry. The remaining regions have had mixed fortunes depending on which part of the region you look at. Populations of small inland agricultural shires have mostly declined, while populations of coastal or large regional centres have increased.

Regions that have fared much better economically have been able to expand employment in their construction and services industries. Peel and the South West have also developed substantial manufacturing capacity, particularly in mineral processing. These regions have been able to become less reliant on location specific industries. Tourism might be a key to regions developing services infrastructure as local residents can also use the same services tourists consume. Peel has also benefited from the expansion of the Southern Freeway system, allowing Mandurah residents to commute to Perth and vice versa.

Overall, the picture is one of diversity between regions and even within regions. Significantly, the economic and social forces affecting regional Western Australia are long term, powerful and difficult to counteract.

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3. The Impact of Tariffs on the Western Australian Economy[5]

Background

As is widely recognised, Western Australia is primarily an export driven economy with substantial investment in the mineral and energy industries, which source much of their capital inputs from overseas.

These industries, as well as the domestic consumers in the State, are adversely affected by measures (such as tariffs) designed to protect Australian industry from competition from overseas imports.

In particular, Australian prices of business inputs and consumer products are higher than the world price because imports are taxed (through tariffs). This dampens the incentive for domestic producers to improve efficiencies to match international prices.

In Australia, as in most developed economies, the degree of protection from imports is declining – underpinned by agreements with the World Trade Organisation. Nevertheless, tariffs still represent a significant impost on some sectors of the economy.

Economic theory suggests that government assistance – including tariffs – should only be provided where there is a demonstrated failure of the market to provide the "right" goods at the "right" level.

The market could "fail" in this regard because the price received by the producer does not fully reflect the benefits received by society in general. That is, there are positive externalities. Examples of such "externalities" include:

- spin-off benefits from research and development expenditure (such as improvements to health);
- community benefits from employment in regional areas; and
- cleaner air due to the use of a particular (substantial) technology.

5 This article was written by Hazel Kural and was published in the June Quarter 2001 *Western Australian Economic Summary*, although some data have since been udpated.

Rates of Assistance By Industry

According to the Productivity Commission's *Trade and Assistance Review 2000-01*, agriculture remains the most highly protected sector as a whole, with an effective rate of assistance (ERA)[6] of around 6.0%.

- Market milk is by far the most highly assisted commodity with an ERA above 200% (falling with the recent deregulation), although tobacco is also very highly protected.

- Wool and wheat (Western Australia's major agricultural outputs) have relatively low ERAs at 3% and 1% respectively.

Manufacturing also remains quite highly protected, with the textile, clothing and footwear (TCF) and passenger motor vehicle (PMV) industries pulling up the average rate. In this regard, the ERA for the manufacturing sector as a whole was 5% in 1999-2000, the rate of assistance for the TCF industry was 25% and for the PMV industry, 15%. Excluding these industries, the effective rate of assistance for manufacturing is around 3%.

Importantly, from Western Australia's perspective, the ERA for the mining industry is negative (at around -0.6%), with budgetary assistance being more than offset by import tariffs. This disparity is likely to be even more marked with the removal (from September 1999) of accelerated depreciation, which was a form of (indirect) budgetary assistance.

In addition, the mining industry is substantially impacted upon by a range of specific government policies, at both the State and Commonwealth levels, including native title legislation and environmental regulation.

Service sector industries receive limited budgetary assistance and are relatively unaffected by tariffs.

In conclusion, tariff protection provides significant support to the manufacturing industries in the eastern States, most notably the TCF and PMV industries, at the expense of Western Australia's mining industry.

6 The ERA takes into account the effects of tariff assistance on industries' inputs and outputs as well as direct budgetary assistance and statutory marketing and regulatory arrangements. The assistance can be measured as the proportional increase in landed duty-free prices permitted by the tariff.

Productivity Commission's Review of General Tariff Arrangements

The Productivity Commission's *Review of Australia's General Tariff Arrangements* (released in 2000) recommended that general tariffs of 5% or less, currently protecting domestic manufacturers, be abolished, along with the 3% concessional duty on business inputs where there is no Australian competitor[7].

The Productivity Commission claims that these tariffs distort producer and consumer choice and reduce the international competitiveness of a range of Australian producers. The interaction of the tariffs and concessional duty arrangements also causes significant monitoring and compliance costs for business.

Industry submissions in favour of and against the abolition of the general tariff were received. However, submissions from industry were overwhelmingly in favour of abolishing the 3% concessional duty, arguing that this was a Commonwealth Government revenue raising measure with no benefit for Australian producers, as it applies only where there is no domestic production to protect. Indeed, it can result in producers paying taxes on a major input while competing with finished goods that enter duty-free[8].

The Productivity Commission concluded that there would be merit in removing the 3% concessional duty, regardless of the decision on general tariffs.

However, the Commonwealth Government's response to the recommendations was that both these assistance measures would be retained at their current level for the time being.

7 The Tariff Concession System provides for a concessional (3%) rate of duty on all business inputs where there is no locally produced substitute.

8 Although Customs By-Laws allow duty-free imports of inputs for new projects with a value of more than $10 million.

Estimated Impact of Reducing Industry Assistance

The Productivity Commission has undertaken a modelling exercise to estimate the effects of reducing general tariffs to zero and removing the concessional duty arrangements. It concluded that such a reform measure would provide a permanent small increase in output, increasing from 0.04% to 0.08% of GDP over a nine year period after the tariffs have been removed.

Professor Warwick McKibbin has estimated[9] that, over the long term, gains from a move to zero tariffs would be around 1% of GDP. This estimate assumes that all tariffs are abolished – including those on the TCF and PMV industries, which were excluded from the Productivity Commission's modelling.

Industries that use business inputs currently subject to tariffs would benefit from lower costs if tariffs were removed. These include export industries, such as the mining industry. Minor decreases in output for the manufacturing and agricultural sectors could be expected.

Reflecting the importance of the mining industry to Western Australia's economy, the Productivity Commission modelling indicates that Western Australia would gain more than any other State from the removal of tariffs – with annual GSP increasing by 0.21% (or around $155 million, based on estimated GSP in 2000-01), and employment increasing by 0.1% (or around 1,000 persons, based on the level of employment as at June 2001).

Long Run Effects of Removing Tariffs Under Reference

% Deviation from Base Case

State	GSP	Employment
New South Wales	0.07	0.00
Victoria	0.02	-0.05
Queensland	0.11	0.02
South Australia	0.02	-0.07
Western Australia	0.21	0.10
Tasmania	0.07	-0.03

9 In research commissioned by the Department of Foreign Affairs and Trade.

Conclusion

The Commonwealth Government's industry assistance programs favour the economies of Victoria and New South Wales at a cost to Western Australia. Tariffs protecting manufacturing industries located in the eastern States (notably the TCF and PMV industries) result in higher costs to Western Australian businesses and consumers, with very few beneficiaries in the State and a net loss to the State economy as a whole.

While the mining industry does receive some Commonwealth budgetary assistance, this is more than offset by tariffs on inputs.

The 3% concessional duty on imports for which there is no domestic competitor serves no industry assistance purpose and simply increases costs for domestic producers.

Although imported inputs for projects valued at more than $10 million are exempt from the 3% duty, which does provide some relief for Western Australia's major resource projects, it is argued that this could be extended across the board to all projects with no negative implications for Australian industry.

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4. The Economic Impact of the Kyoto Protocol on Western Australia[10]

Background

In 1997, the international community signed an agreement in Kyoto, which has since become known as the Kyoto Protocol. Under the Kyoto Protocol, so called "Annex B" countries (developed countries plus the former Soviet Union and eastern Europe) agreed to reduce their emissions of greenhouse gases by at least 5% from 1990 levels over the period 2008-12.

Due in large part to strong arguments from Australia, individual countries were allocated differentiated targets under the Kyoto Protocol and, as a result, Australia is one of only three Annex B countries allowed to *increase* its emissions above 1990 levels during the commitment period. Australia's target is for an 8% increase on its 1990 levels.

Although an emissions target was agreed to for each country, a number of other items were left to be decided at future meetings[11]. Among future items to be discussed were the inclusion/definition of "sinks"[12] and the extent to which flexibility mechanisms (such as emissions trading) can be used for a country to meet its emissions target.

Since the Third Conference of the Parties' meeting in Kyoto there have been a number of studies undertaken to estimate the potential economic impact of the Kyoto Protocol, both with and without flexibility mechanisms. Some attempts have been made to quantify the potential economic impact on Western Australia. This analysis has generally been conducted using computable general equilibrium (CGE) models. This paper summarises and discusses the results of the modelling.

Overview of CGE Modelling and Results from Key Studies

CGE models are useful to analyse greenhouse gas policies because they are able to model the inter-industry effects of policy changes on the economy. Tracking the impact of a policy throughout the economy is important because it enables the economy-wide impact of a policy change to be thoroughly examined. For example, the direct and indirect impact of introducing a domestic emissions trading scheme can be followed throughout the economy by analysing how the consequent increase in the cost of inputs relying on fossil fuels (eg. electricity generation) affects different industries. The subsequent effect on employment and capital movements in the economy can then also be analysed.

10 This article was written by Marny Matthewson and is unpublished to date.
11 These meetings are generally known as Conferences of the Parties. Kyoto was the Third Conference of the Parties and is, therefore, known as COP-3.
12 Sinks refer to the reduction of emissions in the atmosphere due to natural processes (ie. trees soaking up carbon dioxide).

However, a key limitation among current CGE models is that they are generally either domestic models or global models – no CGE model currently being used is able to analyse both the domestic and global impacts.

In order to overcome this limitation, two of the studies analysed in this paper have been conducted using a domestic CGE model that has been linked to a global CGE model. However, because there are different assumptions employed behind each model, particularly in terms of how the energy sector is modelled, the comparability of the results is somewhat compromised.

Ideally, in analysing a global policy such as greenhouse gas abatement, higher quality results would be obtained if a combined global and domestic model were developed. To this end, ABARE is currently working on developing AUSTEM (a detailed CGE model of the domestic economy), which will work in conjunction with GTEM (ABARE's global CGE model). If this model were developed then it would be useful to compare any results obtained with the results of studies mentioned in this paper.

Each of the studies analysed in this paper employ slightly different background assumptions behind their CGE models. Despite this, the broad outcomes have generally been consistent:

- the brown and black coal electricity industries, the aluminium sector and the iron and steel sector are expected to be the hardest hit by implementation of the Kyoto Protocol;
- the forestry industry and electricity industries using gas are expected to gain the most; and
- export industries that are energy-intensive and compete with industries in non-Annex B countries (eg. the LNG industry in Western Australia) are likely to be severely disadvantaged.

Given these findings, it is not surprising that, at a State level, Western Australia is expected to be one of the most adversely impacted States under measures to abate greenhouse gas emissions, due to its heavy reliance on energy resources, particularly for export income.

In this regard, the LNG industry in particular stands to be adversely affected by implementation of emission abatement policies. LNG exports accounted for over 9% of Western Australia's export income in 2001. Moreover, the State's LNG industry accounts for just under 10% of the world LNG trade. While LNG is a relatively clean fuel compared with coal and oil, it still emits substantial amounts of greenhouse gases, particularly in its extraction process. Therefore, this industry could potentially face limitations in the future in terms of the approval of new projects, as well as increased costs, if greenhouse gas abatement policies are implemented. In addition, Western Australia's major competitors in the LNG industry are non-Annex B countries (which are not required to undertake emissions abatement), suggesting the State's LNG industry may become less competitive internationally.

While the Commonwealth Government has given an assurance that the LNG industry will not be adversely affected by the implementation of greenhouse gas abatement policies[13], there are no details yet as to how this will be put into practice and, therefore, some uncertainty as to the impact of the Kyoto Protocol on this industry – and the Western Australian economy in general – remains.

An analysis of four different studies that estimate the economic impact on Western Australia of the Kyoto Protocol is provided below.

ABARE study commissioned by the Department of Resources Development (DRD)[14] and the Western Australian Treasury Department[15]

An early attempt to quantify the impact of greenhouse gas emission abatement on the Western Australian economy was made in 1999 when WA Treasury and DRD commissioned ABARE to use its CGE model, GTEM, in combination with Treasury's CGE model, Federal-WA, to model possible scenarios.

Two different policy options for reducing greenhouse gas emissions were simulated: independent abatement, where Annex B countries (those bound by the Kyoto Protocol to reduce emissions) each meet their Kyoto commitments without international emissions trading; and a scheme of international tradable emission quotas, where Annex B countries can use international emissions trading to assist in meeting their Kyoto commitments.

Results

The key conclusions were:

- Western Australian GSP would be 0.49% lower in 2010 under independent abatement, or 0.25% lower under emissions trading, relative to the base case (ie. no policy change). This compared with declines of 0.58% and 0.32% respectively for the "Rest of Australia" region.
- Downstream processing industries such as the basic nonferrous metals industry (which includes such things as the refining of bauxite to produce alumina) and the iron and steel industry would experience the largest economic losses, particularly under independent abatement. This reflects the expansion of these industries in non-Annex B countries at the expense of production in Annex B countries, which face higher costs due to undertaking abatement.

13 Senator Minchin, the Federal Minister for Industry, Science and Resources, released a statement on 23 August 2000 stating that the Government would "avoid greenhouse policies and measures that distort investment decisions between particular LNG projects and locations".

14 Now known as the Department of Mineral and Petroleum Resources.

15 Now known as the Western Australian Department of Treasury and Finance.

- The production of iron ores, nonferrous metal ores, and coal, oil and gas (these latter three sectors are combined in the Federal-WA model) is projected to expand under both emission abatement scenarios, due to projected increases in export demand from non-Annex B countries.

These results are contrary to general expectations and the conclusions from the other studies, largely due to limitations in the modelling. This is discussed in further detail below.

Limitations

There were severe limitations involved with the modelling in this early study, suggesting that the results should not be afforded much credibility.

The limitations include:

- The base year from which the modelling began. The base year for the Federal-WA model was 1993-94, and changes to Western Australia's industry structure that have occurred since 1993-94 have not been taken into account for the base case. This means, for example, that the Windimurra vanadium mining and processing plant, Alcoa's Wagerup alumina refinery, expansions to the Worsley alumina refinery and the Yandicoogina iron ore plant, among others, have not been included.
  - An implication of this is that the base case output and export levels may be underestimated for industries such as iron and steel and alumina.
- More generally, the modelling does not take into account the extent to which abatement measures may curtail **future** investment in major new projects in Western Australia.
- The impact of abatement on electricity costs in Federal-WA is significantly lower than the modellers at ABARE expected from their experience in developing GTEM.
  - An implication of this is that the cost to industries that rely heavily on electricity (such as the basic nonferrous metals industry) may be substantially underestimated.
- The dynamic version of Federal-WA was found to be faulty, with the model only solving for a few time periods. As a result, the capital accumulation process could not be modelled correctly using Federal-WA. Reflecting this, results from the GTEM model for Australian investment were applied uniformly across all sectors in Federal-WA instead of increases in investment being concentrated in expanding industries.
  - That is, investment is implausibly assumed to increase at the same rate across all industries, including those industries that reduce their output (and have a lower rate of return) due to greenhouse gas abatement.

- Coal, oil and gas come under one industry in the Federal-WA model, which hinders any analysis of the effects of emissions reduction given the differing carbon intensities of these fuels. The high use of gas to produce electricity in Western Australia cannot be modelled very well because movements in this sector are affected by movements in coal and oil.

For these reasons, the results of this initial analysis were treated with caution, and further effort was directed at analysing other similar studies that modelled the impact for Western Australia of implementing greenhouse gas reduction measures.

Allen Consulting Group study commissioned by the Victorian Government

The Victorian Government commissioned the Allen Consulting Group to examine the economic impacts of various emissions abatement measures, particularly domestic emissions trading. The report, which details the Allen Consulting Group's findings, was released in early 2000 and contains detailed information not only for Victoria, but also other States.

Four different policy proposals were analysed in the study:

1. An economy-wide "cap and trade"[16] greenhouse gas emission permit system implemented independently by Australia, with permits sold by government auction.
2. An economy-wide domestic cap and trade system with grandfathered permits (these permits are allocated free to emitters according to their emissions in 2005).
3. A domestic cap and trade system that applies only to the stationary energy sector[17] with permits grandfathered as in scenario two.
4. A 'policy mix' scenario, with a combination of regulatory measures and economic instruments, designed to focus on measures generating positive externalities and minimise damage to the international competitiveness of Australian industry.

These four scenarios focus on the implementation of a domestic emissions trading scheme. In comparison, the modelling undertaken by ABARE for DRD and WA Treasury focused on *international* emissions trading as a key measure for Australia meeting its Kyoto target.

16 A cap and trade system involves the trading of emission permits, where the total supply of permits is strictly limited, or 'capped'.

17 The stationary energy sector includes the natural gas, electricity generation, liquid fuels and other industries (where "other" refers to the use of liquid fuels in fuel combustion and to emissions arising during industrial processing).

Another difference between this study and the one mentioned above is that the following projects were included in the base case:

- BHP's direct reduced iron project;
- Worsley and Alcoa's alumina refinery expansions;
- the mid-West pipeline to supply gas for electricity generation at mine sites in 2001; and
- additional direct reduced iron production in Western Australia in 2004, 2007, 2008 and 2009 to 2015.

Results

Western Australia is projected to be the most adversely affected State under the first two scenarios due to its heavy dependence on emissions-intensive mining and related industries, as well as agriculture. Under the first scenario, Western Australia's GSP is projected to be around 1.8% lower in 2011-12 relative to the base case (ie. if no emissions reduction action is taken), and 2.5% lower in 2011-12 under the second scenario. Victoria and Queensland are also projected to be adversely affected under both scenarios, while Tasmania and the ACT are projected to benefit in each case.

Under scenario three, which is highly unlikely due to the focus being on only one sector of the economy, the electricity and aluminium industries are the hardest hit, with the projected decline in aluminium being 40% – enough to suggest the aluminium industry may cease to exist in Australia. Victoria is expected to be the most adversely affected State (3.0% fall in real GSP by 2011-12) due to its large brown coal industry, followed by Western Australia with a 2.8% fall. It should be noted that within the MMRF-GREEN model – the CGE model used in this study – all activities relating to aluminium have been aggregated (ie. the model does not differentiate between alumina production (carried out in Western Australia) and aluminium smelting (carried out in Victoria for example)).

Under the fourth scenario, forestry and electricity industries using gas are key industries that experience a positive production result, while electricity industries using black and brown coal are the most adversely affected. As a result, Victoria and New South Wales are the most adversely affected States (with 0.5% and 0.3% falls in GSP respectively). Western Australia follows with a projected 0.25% fall in GSP by 2011-12.

The effects on Western Australia of the fourth scenario are less onerous than under the other scenarios because the burden of emissions abatement is spread across all sectors of the economy through measures such as taxation and regulation. In addition, and as stated previously, under this scenario electricity industries using gas would gain considerably, providing positive effects for Western Australia (which uses a relatively high share of gas to generate electricity) to help outweigh other negative impacts of the policy package.
Overall, the study highlights that Western Australia stands to be adversely affected by the implementation of emission reduction policies, even when flexibility mechanisms and other policies are used. This reinforces concerns about the future competitiveness of industries operating in Western Australia.

Limitations

One of the key limitations of the study by the Allen Consulting Group was that the effect of international trading was not modelled and, therefore, the economic costs to Australia and individual States are likely to have been overstated. Only the implementation of a domestic emissions trading scheme was analysed. In addition, the model was unable to take into account changes in demand for, and the world price of, exported commodities from Australia. As a result, the extent of the economic impact was cushioned to some extent by the ability to increase exports at prices unchanged by the effects of greenhouse gas reduction measures.

Allen Consulting Group commissioned by the Minerals Council of Australia (MCA)[18]

This study built upon the analysis/study presented to the Victorian Government and, importantly, the abovementioned limitations of the Victorian study were rectified for this study by incorporating ABARE global modelling results into Allen Consulting Group's Monash MMRF-GREEN CGE model. This study also included regional (ie. sub-State) results, unlike the other models. Results from the study were released in late 2000.

Two alternative scenarios were analysed. The first was the economic impact of the implementation of the Kyoto Protocol. Assumptions under this scenario included:

- international emissions trading occurring in 2007-08;
- permits grandfathered according to a 1997 base year;
- an international permit price of between $A30-A$35 per tonne of CO2 over the Kyoto commitment period; and
- 100% credit granted for the reduction of land clearing emissions.

18 Officially titled *Meeting the Kyoto Target: Impact on Regional Australia.*

The Allen Consulting Group commissioned ABARE to model an alternative global response to climate change (ie. an approach to reduce greenhouse emissions that does not involve implementation of the Kyoto Protocol). The assumptions for this scenario included:

- Kyoto targets for Annex B countries being applied over a new commitment period of 2015-20 rather than the current period of 2008-12;
- non-Annex B countries gradually being incorporated into the process and reducing their emissions but not taking part in an international emissions trading scheme (ie. meet their emission abatement targets through domestic policies only);
- a wealth/technology transfer of $A440 billion from Annex B to non-Annex B countries (this is equivalent to the estimated benefit derived by delaying Annex B countries' commitment period); and
- the existence of an international R&D program directed towards developing new fuel technologies, leading to a less greenhouse gas-intensive energy base.

Results – Scenario One

The key findings under this scenario were that if the Kyoto Protocol is implemented then:

- Australia's GDP would decline by around 1.9% in 2011-12.
  - Western Australia is expected to be the hardest hit State, with a projected 3.3% fall in GSP, followed by Queensland, with a 3.0% projected fall in GSP.
- Energy-intensive industries would suffer severe production declines, particularly the aluminium industry (-24%) and the black coal industry (-17%). In comparison, the gas electricity industry and the forestry industry are both expected to gain from the implementation of the Kyoto Protocol.
- The impact on employment would be severe in some States, particularly Western Australia with a projected 3.9% fall. This compares with a projected 2.5% decline in employment nationally.
  - The South West region of Western Australia is expected to experience the largest fall in employment in Australia, with an 11.8% decline (this result is analysed in more detail later).

The study highlights some major problems with the Kyoto Protocol. Examples are that developing countries do not face emission reduction targets; the Protocol does not allow sufficient time for technological change to occur; and the Protocol confuses two different policy objectives (greenhouse gas abatement and wealth distribution) and thereby fails to address either objective. As a result of these concerns, an alternative scenario was modelled.

Results – Scenario Two

This scenario focused on global impacts rather than State impacts. The key findings were that:

- Non-Annex B countries generally benefited due to the impact of subsidies from Annex B countries. However, countries in the Middle East suffered due to a reduction in oil consumption as countries meet their reduction commitments.
- The transition to reduce emission levels was much smoother in Annex B countries due to the role of technology.
- Better climate outcomes were achieved.

Based on the results, the key conclusion was that meeting Australia's obligations under the Kyoto Protocol would come at a high cost, particularly in regional Australia. The Allen Consulting Group concluded that it was unlikely the Kyoto Protocol would come into force and, therefore, Australia should focus on alternative scenarios such as scenario two described above.

From a Western Australian perspective, given that the characteristics of the Australian economy that make the nation vulnerable to the impact of emission reduction policies are particularly manifest in Western Australia, it is not surprising that Western Australia is projected to be the worst off in terms of both a fall in economic growth and employment under scenario one.

Limitations

Some of the results obtained in this study appear to be at odds with expectations.
For example, it is not clear why the South West region of Western Australia is projected to experience such large employment losses (11.8%), while the Pilbara region, in which the economy is widely based on mineral and petroleum processing projects, is projected to experience only a 2.5% fall in employment.

Given the tree planting opportunities available, and large forestry industry in the South West, it appears to be anomalous that the region is expected to experience such large employment losses given the study's projection that the forestry industry is expected to gain (along with the gas electricity industry). A key explanation for this appears to relate to the fact mentioned earlier that all activities relating to aluminium have been aggregated.

Aluminium smelting (carried out in States such as Victoria and Queensland) is one of the most energy-intensive processes and relies heavily on electricity – the price of which is likely to increase sharply under any emissions abatement scenario. In comparison, alumina production (carried out in Western Australia) is much less energy-intensive. Therefore, the impact on the alumina industry in the South West is likely to have been overstated, leading to larger than expected employment losses in the region.

Adding further to the inflated impacts on the South West region could be the assumptions behind scenario one. The assumption that permits were grandfathered from 1997 would provide a 'windfall' for companies whose emissions were high in this year, such as the large energy based projects in the Pilbara, and have since implemented technology to improve energy efficiency and thereby reduce emissions. In comparison, the alumina industry in Western Australia is already highly energy efficient. Therefore, this industry will continue to be faced with increased costs as the price of its energy inputs rises, little offset in the way of grandfathered emissions permits, and only limited opportunity to reduce emissions, thereby hurting the regional economy.

Furthermore, in relation to the assumptions employed for any study involving emissions trading, caution must be exercised in accepting any assumption concerning the international permit price of a tonne of carbon. With the rules for international emissions trading yet to be finalised there is a large degree of uncertainty surrounding any permit price estimates. Despite the above criticisms, the study's results are generally in line with other modelling and are intuitively sensible in terms of showing that the brown coal, aluminium, black coal and brown coal electricity industries are expected to be the hardest hit by implementation of the Kyoto Protocol, while the forestry and gas electricity industries are expected to gain the most.

University of Western Australia (UWA) study

The Department of Economics at UWA released a discussion paper in late 2001 that analysed the impacts of a number of possible allocation schemes for greenhouse gas emission permits on the Western Australian economy. This study used a CGE model known as WAE, which was developed at UWA.

Four simulations were run in the study:

- S1: Permits are sold with each industry paying \$35/tonne of CO_2^e. Trading of credits for carbon sequestered in Kyoto forests is allowed, but such credits will be granted for plantation forests only.
- S2: Same as simulation one (S1), but the Government maintains its previous budgetary position through lump sum transfers to households.
- S3: Same as S1, but without any carbon credits for Kyoto forests.
- S4: Permits are grandfathered. Each industry receives permits equivalent to 65% of its base level emissions and can then purchase additional permits at \$35/tonne of CO_2^e.

For the simulations, it is assumed that the Government sells permits equivalent to 108% of 1990 emission levels, in line with Australia's Kyoto target.

Results

Western Australia's total emissions are projected to fall by 3-11% relative to a "base case" or "business as usual" scenario, depending on which simulation is run, while GSP is projected to decline by 1-3%. While the simulations are not directly comparable, these results are similar to those obtained under the previously mentioned Allen Consulting Group study for the MCA. For example, the MCA study projected a 3% fall in Western Australia's GSP under a simulation that broadly accords to S3 in this study.

A table showing the impact on GSP for each simulation is provided below:

Key Results (% deviation from the base case)

	S1	S2	S3	S4
GSP	-1.87	-2.07	-3.10	-1.09

For interest, further simulations were run that were similar to S3, but only the transport and energy sectors reduced their emissions (ie. only these industries were required to pay for their greenhouse gas emissions). Two different responses were looked at:

1. "Response 1" – the energy and transport sectors reduce their output by 3.79% (an amount projected by WAE).
2. "Response 2" – the energy and transport sectors leave their output levels unchanged.

The results for these scenarios are presented below:

Key Results (% deviation from the base case)

	R1	R2
GSP	-1.33	-0.47
Employment	-2.64	-1.70
Emissions	-7.14	-3.37

As could be expected, the economy is projected to experience a greater economic loss under R1 when the energy and transport sectors reduce their level of output. It also leads to larger employment losses. However, from an environmental point of view it is the better strategy because emissions are reduced by 7.14% as opposed to only 3.37% under R2.

It should be noted though, that R2 is not a very 'realistic' scenario in that the energy and transport sectors are highly unlikely to leave their output levels unchanged in the face of higher costs as a result of emissions abatement. It is highly likely that demand will decline.

Key Conclusions from the Study

- If permits are sold by the Government at $35/tonne then Western Australia's GSP is projected to fall by around 1-3% relative to business as usual levels depending on other factors.
  - If the Government seeks to maintain its budgetary position then the costs to the economy overall are slightly greater (2.1% fall in GSP).
  - If carbon credits are not allowed then the cost is greater still (3.1% fall in GSP).
- If permits are grandfathered then the economic cost to the State is projected to be smaller, but emissions are reduced by a lower amount.
- If only the energy and transport sectors are required to pay for their greenhouse gas emissions then the impact on the overall economy is estimated to be lower (particularly if these industries' output levels remain unchanged) than if all industries undertake abatement.

Limitations

Similar to the CGE model used in the first study mentioned in this paper (conducted by ABARE, DRD and WA Treasury), WAE uses a fairly old database, with the base year being 1992-93 (even older than the 1993-94 base year used in the ABARE study).

Moreover, WAE is only a single-region model. This means that it does not take into account the potential reduction in international competitiveness, as well as the notion of carbon leakage (ie. the possibility that companies, in the energy sector in particular, will move production offshore due to increased costs) and, therefore, the economic impact is likely to be understated.

Conclusion

Economic modelling to date consistently indicates that Western Australia would be severely affected by implementation of the Kyoto Protocol (as it currently stands), with the energy and transport sectors, in particular, being adversely affected by having to reduce emissions.

However, the modelling needs to be interpreted with caution, given the broad range of assumptions employed and the creation of 'scenarios' that inevitably involve a large degree of guesswork. In addition, none of the CGE models are able to account for possible benefits that would occur due to the reduction of greenhouse gases in the atmosphere (it is likely that some of the costs will be partially offset by social and environmental benefits). This highlights that all modelling results should be analysed in the correct context.

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5. The Use and Abuse of Input-Output Multipliers[19]

Introduction

So called "multipliers" are often used to illustrate the significance of an industry or activity in the overall economy. They are used to quantify the impact increased activity in one area may have in terms of flow-on benefits for the rest of the economy.

In many cases these multipliers are presented as evidence to support claims for taxpayer funding to assist or promote particular activities over others.

However, such multipliers should be used with caution and a healthy respect for their shortcomings maintained if they are not to be abused.

It is necessary to understand how they are derived, exactly what they measure, the assumptions and the data on which they are based and how they should be used. Importantly, when it comes to assessing calls for public assistance, it must be recognised that that these multipliers do not even ask the "right" question policy makers should be asking themselves.

To assist users of these multipliers, the following explains the derivation of multipliers, their underlying assumptions and data, and some of their shortcomings.

Derivation of Multipliers

Multipliers are calculated from input-output (I-O) tables of the economy. I-O tables show the inter-linkages between industries in the economy in terms of the purchases that each industry has to make from others to produce its final products. Demands from the consumption, export and investment sectors are also shown.

Multipliers provide a measure of the impact on economy-wide income, employment or output from an increase in final demand for a particular industry. Multipliers can also be calculated for gross profits (approximated by gross operating surplus or GOS) but these are rarely quoted.

19 This article was written by Bruce Layman and was published in the December Quarter 2000 *Western Australian Economic Summary.*

The three major multiplier classifications are:

- **output multipliers** (which are most frequently quoted) that show the increase in the total production of all industries in the economy from an external (and usually unexplained) $1 increase in final demand for one industry. An output multiplier captures the increase in intermediate demands required to service the increase in final demand;
  - output multipliers effectively double-count the size of any expansion of the economy in national income accounting terms (see example). This is because the change in production of all industries in the economy is measured, rather than the increase in **value added** of all industries (which corresponds to the increase in gross domestic product);
- **income multipliers**, which show the increase in economy-wide income from an external increase in demand; and
- **employment multipliers**, which show the increase in economy-wide employment from an increase in demand.

There are two major types of I-O multipliers that can be calculated for changes in output, income or employment – the simple multiplier and the total multiplier. These can be constructed from 4 major effects:

- the **initial output effect** is simply the initial production, employment or income required to supply the extra final demand for the industry in question. This is always equal to 1.0 for output multipliers (although not necessarily for income and employment multipliers);
- the **first round effect**, which measures the demand for intermediate goods and services (or the associated income or employment) generated by the initial industry increasing production. An industry is said to have "backwards linkages" with industries supplying its inputs;
- the **industrial support effect**, where industries supplying the initial industry increase their own input demands in response to the increase in their production in the first round effect; and
- the **consumption induced effect**. When the economy expands in response to the initial increase in demand for the industry in question, wages, and salaries increase. This induces extra consumption from households that further expands production, which, in turn, further increases wages and so on. Hence final demand for all goods in the economy will increase in addition to the initial increase in demand for production by the specified industry.

The **simple multiplier** comprises the initial output effect plus the first round effect and the industrial support effect. The first round and industrial support effect are collectively referred to as the **production induced effect**.

The **total multiplier** is made up of the simple multiplier plus the consumption induced effect.

The accompanying box explains these terms using a simple example.

Calculating Multipliers – A Simple Example

Consider the output multiplier in a simple economy with no imports, exports, taxes, stocks or investment and consisting of only three industries. Industry 1 might sell $5 of output to Industry 2. Industry 2 then adds value to these goods through capital and labour and then sells $10 of output to Industry 3. Industry 3 then adds a $10 margin and sells $20 of output.

If demand for Industry 3's output increases by $1 (the initial effect), Industry 2 must increase production by $0.50 ($1 times $10/$20) to supply the increase in demand by Industry 3 (the first round effect). Industry 1 must increase production by $0.25 ($0.50 times $5/$10) to facilitate the increase in production by Industry 2 (the industrial support effect). In total, a further $0.75 ($0.50 + $0.25) must be produced in the economy to service the initial $1 increase in demand.

The initial output effect is 1.0 in this case, while the simple multiplier is 1.75. The total output in the economy initially increases by $1.75 ($1.0 + $0.50 + $0.25), although domestic product (GDP) or value added of the economy only expands by the initial $1.0 increase in final demand (this is the double counting referred to above).

The consumption induced or flow-on effect is slightly more complex. From the initial $1 increase in final demand, Industry 3 generates an additional $0.50 in income to be shared between capital and labour ($1 output minus $0.50 inputs), Industry 2 generates $0.25 ($0.50 minus $0.25) while Industry 1 generates $0.25. The $1 increase in final demand creates a total of $1 ($0.50 plus $0.25 plus $0.25) of additional income.

If the income generated in each firm is then assumed to be shared equally between capital and labour (ie the labour share of income is 50%) and workers spend all of their income, the total output multiplier for Industry 3 is 3.5.

In reality, leakages from the system such as imports and savings mean that the most calculated multipliers are much lower than this. The size of a total multiplier also increases with the labour share of factor income.

Data

Multipliers can be calculated at the State or national level. For Western Australia, there are two main sources of I-O multipliers:

- the ABS publishes I-O multipliers for Australia at the 35 and 107-industry level[20]. The latest multipliers are calculated from the I-O table for the 1994-95 financial year. The ABS does not produce State I-O tables; and
- a 111 industry I-O table for Western Australia has been compiled by the Economic Research Centre (ERC) at UWA. The table is calculated for the 1992-93 financial year[21].

Frequently, national I-O multipliers calculated by the ABS are used for Western Australian circumstances. This assumes that the structure of each industry in Western Australian is similar to that for Australia as a whole.

In many cases this is not a valid assumption. For example, if a Western Australian industry requires more cars because production has increased, it will have to import them from eastern Australia or overseas. The national industry multiplier assumes that some proportion will be produced domestically.

Additionally, I-O tables are not updated annually by the ABS. Their compilation is an onerous task and it takes two or three years after the reference period for the tables to be produced (ABS, 1996). While structural changes tend to be slow, even small changes in the economy after the year in which the tables are based could alter the order of the industry multipliers considerably (ranking industries by multipliers is often used to justify calls for public support – see below).

The Western Australian I-O table compiled by the ERC is derived from the national table. While the table is likely to be a good representation of the local economy, its compilation is more difficult and it suffers even more from lack of timeliness than the national tables.

20 The 35-industry table contains the same data as the 107-industry table, but the industries are in a more aggregated form. For example, the electricity, gas and water industries are included separately in the 107-industry table, but are grouped into the single electricity, gas and water industry in the 35-industry table.

21 The Economic Research Centre at UWA has since released an updated I-O table, for the 1994-95 financial year.

Shortcomings Of I-O Multipliers

I-O multipliers are relatively simple to calculate once an I-O table of the economy is compiled.

However, there are several problems with I-O multipliers that substantially reduce their usefulness, particularly as a tool for evaluating the benefit to the overall economy of a particular proposal. These shortcomings include:

- multipliers assume that extra output can be produced without constraints on the supply of labour, capital, land, good or service. The factors of production are assumed to be limitless in supply and therefore can be sourced without any price increase. That is, there is no "crowding out". If factors are in short supply, causing prices to rise, the flow-on benefits of increased activity will be reduced;
- multipliers assume that households consume goods and services in exact proportion to their initial budget shares. No allowance is made for purchasers' marginal preferences. For example, the household budget share of some goods might increase or fall as household income increases. This problem also applies to industrial consumption of intermediate inputs and primary factors;
- an increase in demand for a product implies an equal increase in production. In reality however, if domestic demand increases it might be more efficient for industries to divert some exports to local consumption or import to some extent rather than increasing local production by the full amount;
- multipliers are often misused when evaluating industry assistance proposals because they refer to changes in the economy caused by a change in final demand for a product, while requests for government assistance are usually framed in terms of increasing the production of an industry. However, the aggregate benefit to the economy is likely to be less than the multiplier infers if a price cut is required to sell the extra production; and
- if a government subsidy is required to propel an industry to a higher output, then multipliers do not include the cost of the subsidy on the rest of the economy. For example, the subsidy could be paid for by increasing taxes on other industries, or by increasing government borrowing. The adverse impact on the economy of either of these options is not included in the multiplier.

Justifying Public Support

As noted, multipliers are often used to support claims for taxpayer assistance in particular industries or activities. However, government assistance to industry should not be justified on the basis of the scale of an industry's multiplier, but on the basis of market failure.

For example, education has public good characteristics and, therefore, the market fails to provide the level of education we would like. Hence governments have historically funded the provision of education services to some degree (although the extent of this funding is often debated). However, the public benefits that motivate government to fund education are derived from increasing the education of the population (for example, increasing the skills base of the workforce), not the flow-on effects from this public spending of the input purchases by educational institutions.

The use of multipliers, or any other method for calculating the benefits from expanding an industry, must be placed into the context of the general process of analysing industry assistance measures. Any consideration for industry assistance should ask the following questions:

- is there a market failure at work that causes less than the optimal quantity of a good or service to be produced;
- if market failure is present, is the form of the requested assistance an effective method of correcting the problem; and
- are the likely benefits from correcting the market failure likely to be greater than the costs?

Calculations as to the net benefit of assisting an industry (including negative effects on the remainder of the economy) such as multipliers (or more sophisticated modelling discussed below) should enter only at this third stage.

Furthermore, to include multiplier benefits of an industry in any assistance proposal is implicitly saying that the multiplier from the industry in question is greater than that of other industries.

This is because of the negative effect on the economy of raising the revenue for the subsidy mentioned above. Those seeking a subsidy almost never mention this negative impact.

Data limitations mean that ranking the various industries in Western Australia on the basis of their output, employment or income multipliers is not particularly meaningful.

The values of multipliers for various industries do not vary by a great amount. Islam and Johnson (1997) of the ERC calculated that the output multipliers for 94 of the 111 industries in Western Australia lie between 2.0 and 2.94.

However, the accuracy of the I-O tables used is not sufficient for industries with very similar multipliers to be ranked on merit according to those multipliers.

Alternatives to Multipliers

The use of computable general equilibrium (CGE) models is a valid alternative to using I-O multipliers to evaluate the costs and benefits of industry assistance proposals. These models overcome many (although not all) of the problems outlined above. For example, in assessing industry assistance proposals in these models, taxes on other industries can be increased to fund a subsidy for a particular industry.

In recent years the use of these models to help assess policy impacts, particularly at the national level, has increased considerably. These models have been used to inform public debates on tax reform, greenhouse measures and assistance to the motor vehicle industry.

Some examples of local CGE models are the Western Australian Model (WAM), which is run by the ERC, and the MMRF-Green model (used by the DTF).

The largest disadvantage in using CGE models is that the level of expertise and resources needed to operate CGE models is far greater than for using I-O multipliers.

Conclusion

While multipliers can be a useful way of summarising and quantifying interlinkages within the economy, they are more often abused than used correctly.

Multipliers are used to suggest that an industry is more valuable to Western Australia than its current size would suggest. They are used to show substantial flow-on benefits to the broader economy and to justify claims for government support for that activity.

However, multipliers do not provide a measure of net economic benefit of expanding activity in a particular area. They are based on limiting assumptions and dated information.

It is in assessing claims for government assistance that the potential for misuse of multipliers is greatest.

Used alone, multipliers are merely a method of inflating the output of an industry to more impressive levels. They do not address the rationale for government intervention in the economy.

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