THE IMPACT OF THE MACRO-ECONOMY ON THE AUSTRALIAN TRANSPORT SYSTEM: SOME REGIONAL RESULTS FROM ORANI [(1)]

by

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ABSTRACT

Within the context of a computable general equilibrium model of Australia, this paper examines the implications for Australia's regional transport industries of four economic phenomena, namely: a mining boom, a devaluation or depreciation of the Australian dollar, an agricultural sector stabilization scheme and an increase in the price of Australia's domestically produced oil. The paper computes the regionally disaggregated results from nationally aggregated results using the modified LMPST method, identifies the main regional losers and gainers, concludes that the losses and gains from any (of these) economic phenomena are not evenly distributed across all regions in Australia and suggests reasons as to why this is so.

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1. The work on this paper was started while the author was a Senior Research Economist on the Market Intelligence Research Project with the Australian Railway Research and Development Organisation (ARRDO) in Melbourne. Without commiting them to the contents of this paper, I would like to thank Professors Peter Dixon and Alan Powell of Melbourne University for their encouragement and assistance.

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SOME REGIONAL RESULTS FROM ORANI.

INTRODUCTION

A question which is repeatedly asked on the ARRDO Market Intelligence Research Project is: 'which macroeconomic variables or policies infringe in any way, on the Australian transport system?'. The idea being that an answer to such a question will produce a list of variables which are worth monitoring by the management of the transport enterprises. The contents of Chapter 2 of Lubulwa, Michael and Smith (1985) was a first step towards an answer to that question. This paper continues this search for variables which are of some significance to the Australian transport system, and uses a general equilibrium model of the Australian economy in order to explore the importance to the Australian transport system of the following phenomena :

(1) A resources boom

(2) A devaluation in the Australian dollar

(3) An agricultural sector stabilization scheme

(4) An increase in the price of domestically produced oil

Use is made of a modified LMPST[1] method developed by Dixon, Parmenter and Sutton (1978) to derive the effects of macro-economic phenomena on the transport sector at the regional or state level in Australia.

This paper starts off with a brief description of the ORANI model on which the results presented here are hinged, then the paper discusses the way the transport sector is modelled in the ORANI model, then it presents the results on how various macro-economic phenomena affect the transport sector nationally and at the state level, and finally ends with some concluding comments.

THE ORANI MODEL

ORANI, a general equilibrium model of the Australian economy, is one of the three modules namely : MACRO, a macroeconomic module of Australia; BACHUROO, a demographic module specifying the demographic composition of the population and the skill composition of the workforce in Australia; and ORANI, which together comprise what is known as the

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1. So called because it is a modification of a method developed by Leontief, W., A.Morgan, K.Polenske, D.Simpson and E.Tower (LMPST) (1965) "The Economic Impact - Industrial and Regional - of an arms cut" Review of Economics and Statistics, XLVII, August, pp.217-241.

IMPACT PROJECT[1]. The relationship between the three modules is summarized in figure 1 below:

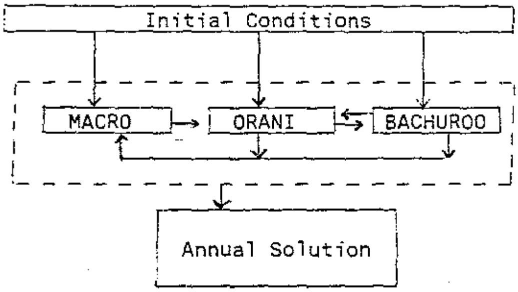

Figure 1 : Schematic view of the modular structure of IMPACT

Source : Powell, A.A. and T. Lawson (1975)

ORANI the largest of the three modules, is a large computable general equilibrium model of the Australian economy, distinguishing 113 domestic industries, 115 commodity categories and 9 labour occupations. The equations are derived from orthodox microeconomic assumptions about the behaviour of price-taking economic agents, e.g. producers minimise costs, and consumers maximise utility subject to budget constraints. ORANI is fully described in Dixon, Parmenter, Sutton and Vincent (1982).

The model has been widely used by several government agencies, including the Industries Assistance Commission which has been the major user, the Confederation of Australian Industry, the Bureau of Agricultural Economics, the Bureau of Industry Economics and on transport related issues the Bureau of Transport Economics and the National Road Freight Industry Inquiry have used ORANI to examine the implications of increased road and rail charges. Some of these applications and references to relevant papers are given in Dixon et al (1982, Section 50). From the view point of this paper, ORANI is interesting because it contains a detailed modelling of the transport sector. This paper exploits this facility to explore the effects of various macro economic policies on the transport sector at the state level. Before this is done, the next section discusses the way the transport section is modelled in ORANI.

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1. The impact project is an economic and demographic research project conducted by the Australian Commonwealth Government Agencies in association with the Faculty of Economics and Commerce at the University of Melbourne and the School of Economics at La Trobe University, and the Australian National University.

3. THE TRANSPORT SECTOR IN ORANI

In the ORANI model, the transport industries are modelled as a subset of margin industries. In order to model margins, ORANI defines the following :

- Basic Prices: these are the prices at which the 115 commodities recognised in ORANI are valued before commodity taxes or subsidies are charged.

- Producer Prices: are the prices at which commodities are valued after commodity taxes are levied, assuming that taxes accrue to producers.

- Purchasers Prices: are prices of commodities which are paid by the final user. This price includes not only commodity taxes and subsidies but also the cost of transport, insurance, storage, wholesaling and retailing of the commodity.

- A margin industry: is that industry which contributes to the difference between the purchaser's price and the producer's price. Out of the 115 commodities ORANI recognises 8 commodities used as margins namely :

1. Road transport
2. Railway transport
3. Water transport
4. Air transport
5. Wholesale trade
6. Retail trade
7. Restaurants and hotels
8. Other insurance

This paper concentrates on the first four margin industries which are of interest to transport economists.

ORANI distinguishes between three main users of transport services namely :

1. Transport used to deliver inputs domestically produced and imported to industrial users for current production and capital construction.

2. Transport used to deliver domestically produced and imported commodities to households and 'other' users.

3. Transport used to deliver commodities to Australian ports prior to export.

What should be noticed is that ORANI is not concerned with transport costs associated with transferring commodities between foreign ports and Australia. Thus in the first and second uses above, with respect to imported inputs and commodities, ORANI represents the demand for transport associated with deliveries from Australian ports to the users within Australia.

Table 1 below summarises the demand equations for rail transport services considered in ORANI. In this table r stands for rail. Instead of rail, one can substitute road or air or water ways to get the corresponding equations for those modes. That one is dealing with a very large model is obvious from the number of equations one is dealing with even with respect to the transport sector alone.

Table 1

The structure of the equations describing the demand for transport services in ORANI using rail transport as an example in percentage change form

	Variable	Equation Form	No. of Equations
(1a)	$r^{gD,iP}$	$= x^{P}_{gDi} + a^{gD,iP}_{rail}$	g = 1, 2,....115 i = 1, 2,....113 12995 = 115 X 113
(1b)	$r^{gM,iP}$	$= x^{P}_{gMi} + a^{gM,iP}_{rail}$	g = 1, ...115 i = 1, ...113 12995 = 115 X 113
(1c)	$r^{gD,iC}$	$= x^{C}_{gDi} + a^{gD,iC}_{rail}$	g = 1, 2,....115 i = 1, 2,...113 12995 = 115 X 113
(1d)	$r^{gM,iC}$	$= x^{C}_{gMi} + a^{gM,iC}_{rail}$	g = 1, 2,....115 i = 1, 2,...113 12995 = 115 X 113
(1e)	$r^{gD,HH}$	$= x^{HH}_{gM} + a^{gD,HH}_{rail}$	g = 1,....115 115
(1f)	$r^{gM,HH}$	$= x^{HH}_{gm} + a^{gM,HH}_{rail}$	g = 1,....115 115
(1g)	$r^{gD,Gov}$	$= x^{Gov}_{gD} + a^{gD,Gov}_{rail}$	g = 1,....115 115
(1h)	$r^{gM,Gov}$	$= x^{Gov}_{gM} + a^{gM,Gov}_{rail}$	g = 1,....115 115
(1i)	$r^{g,Export}$	$= x^{Export}_{g} + a^{g,Export}_{rail}$	g = 1,....115 115
Total No. of Equations per mode			52555
Total No. of Equations for 4 modes			210220

In equations (1a) and 1b)

$r^{gD,iP}$ Stands for the percentage change in the demand for rail transport services required to move good g, domestically produced (D) to industry i for use in current production (P). This percentage change comprises of:

$x^{P}_{gD,i}$ Standing for the percentage change in the flow of domestically produced good g to industry i for use in current production (P) and

$a^{gD,iP}_{rail}$ Standing for the percentage change in the transport and handling requirements associated with a unit flow to industry i of domestically produced good g used in current production. In other words this term captures the changes in the technology or the efficiency of the rail systems in the movement of domestically produced good g to industry i.

$r^{gM,iP}$ Stands for the percentage change in the demand for rail transport services required to move imported good g to industry i for use in current production (P). Again these percentages are composed of:

$x^{P}_{gM,i}$ Standing for the percentage change in the flow of good g, imported (M), to industry i for use in current production (P) and

$a^{gM,iP}_{rail}$ which represents the percentage change in the transport and handling requirements associated with a unit flow to industry i of import good g for use in current production.

A casual examination of equations (1c) and (1d) reveals that the equations are similar to those in (1a) and (1b), the only difference being that instead of P (standing for current production) one has C (standing for capital creation). Thus definitions for the variables in these equations are the same as for those in (1a) and (1b) except that whenever there is current production one should substitute capital creation.

In equations (1e) and (1f)

$r^{gD,HH}$ denotes the percentage change in the demand for rail transport services required to move domestically produced good g to households, HH and comprises of:

x^{HH}_{gD} denoting the percentage change in the households' demands for good g, domestically produced (D) and

$a^{gD,HH}_{rail}$ denoting the percentage change in the transport and handling requirements associated with a unit flow of domestically produced good g to households, HH.

It is clear that one can use the three immediately preceding definitions pertaining to equation (1e) to work out the definitions for the variables in (1f) by substituting the word imported for 'domestically produced'. Furthermore the only differences between (1e)-(1f) and (1g)-(1h) is that while in the former the users of transport services are households, in the latter the user of these services are governments. Finally the variables in equation (1i) are defined as follows :

$r^{g,Export}$ Stands for the percentage change in the demand for transport required to move good g from Australian producers to Australian ports prior to export, which percentage change is composed of

x_g^{Export} Standing for the percentage change in the flow of good g (from Australian producers) for export and

$a_{rail}^{g,Export}$ Standing for the percentage change in the transport and handling requirements associated with a unit flow of good g for export.

The ORANI model as Table 1 indicates contains an unusually detailed treatment of the transport sector. In order to arrive at the aggregate demand for rail transport, for example ORANI determines the demands for rail transport to be used in facilitating each of the many thousands of commodity flows recognised in the model and then it adds these up. While the disaggregated commodity level results are of interest in their own right, this paper concentrates on the results aggregated by mode of transport.

Since various aspects of the transport system are managed at the state level, (e.g., most government railway systems are organised and run at state level by state government authorities) it would be of interest to find out not only the results for the transport sector aggregated at the national level but also the state level or regional response of various modes of transport to the macro-economic policy initiatives. The mathematical properties of the modified LMPST method which is used here in estimating the regional effects of an economic disturbance are well documented in Dixon, Parmenter and Sutton (1978). The steps in this method which are most important for this paper are:

Step 1: Industries are divided into two distinct groups, national industries and local industries, on the basis of the degree of inter-regional trade in their products, that is the following measure of level of localization is computed for each industry in each region:

Measure of localization level (MLL)

$$= \left[\frac{\text{the total sales of the industry output in the region}}{\text{the total regional output of the industry}} \right]$$

If MLL is equal to one then the industry in question is a local industry; that is the industry in the region sells all its output in that region.

If MLL is different from one, then the industry is classified as national implying that there is interregional trade in the industry's output. Transport by all modes is classified as a national industry since the values of MLL are significantly different from one for all transport modes in all the regions under consideration (see Table 2 below)

Table 2.

$$\left[\frac{\text{Total Regional Transport Services sold in a region}}{\text{Total Regional Transport services produced}} \right]$$

Region	Road	Rail	Water	Air
1. N.S.W. & A.C.T.	.7964	.7925	.7000	.8285
2. Victoria	.9078	.8747	.7353	1.0434
3. Queensland	1.6147	1.7567	.9871	1.3930
4. S.A. & N.T.	.8582	.6355	.5822	1.0293
5. Western Australia	.7304	.5881	.4691	.9136
6. Tasmania	.7786	.9522	.4076	1.2590

Source: Lawson and Parmenter (1979, p.31).

For example New South Wales and ACT and Western Australia are net exporters of transport services of all transport modes since in these two regions services sold in the region are less than services generated from the region. Similarly Queensland is a net importer of all transport mode services except for water transport, since total sales of transport services of these modes exceed the services generated in that region.

Step 2: The national effects of an exogenous change are computed via the ORANI model, an input-output, computable general equilibrium model of Australia.

Step 3: The percentage change in outputs of the national industry (e.g transport) are allocated to the regions in the same proportions as were evident in the base period. Hence the different regional effects of the national policy change across regions or states depending purely upon the different industrial structures of the regions. In the case of the transport sector one can capture the regional differences in the importance of varius transport modes by computing the shares of each transport mode in the Gross State Product for each state. The results of this computation are in Table 3.

Table 3.

The Relative Shares of Transport by Mode in the Gross State Products

Region	Road	Rail	Water	Air	Total all modes
1. N.S.W. & A.C.T.	0.0314	0.0139	0.0109	0.0075	0.0637
2. Victoria	0.0278	0.0117	0.0090	0.0057	0.0542
3. Queensland	0.0167	0.0068	0.0071	0.0041	0.0347
4. S.A. & N.T.	0.0289	0.0162	0.0132	0.0056	0.0634
5. Western Australia	0.0314	0.0167	0.0151	0.0058	0.069
6. Tasmania	0.0329	0.0118	0.0173	0.0046	0.0666
7. Australia	0.0287	0.0129	0.0109	0.0061	0.0586

Source: Computed from Dixon, Parmenter and Sutton (1978), Table 1, pp.32-33.

In table 3, taking the row for Victoria, for example one finds that road transport is the most important mode accounting for 2.8% of Gross State Product, while rail transport accounts for 1.2%, water transport 0.9% and air transport 0.6% of Victoria's Gross State Product. From these transport modal importances at the regional level one can deduce the effects of various macro-economic phenomena on the transport sector in various regions. This is the next task of this paper.

REGIONAL TRANSPORT SECTOR RESPONSES TO NATIONAL MACRO ECONOMIC POLICY

In this section results from a number of ORANI policy analyses are examined in order to determine the impact of different macro-economic phenomena on the Australian transport sector at a regional or state level.

All the macro-economic policy analyses discussed here assume that the ORANI model is in the short run mode; where the short run is defined to be a

> "period long enough for local prices of imports to fully adjust to the ORANI shock, for major import users to decide whether or not to switch to domestic suppliers, for domestic suppliers to hire labour and to expand output with their existing plant, for new investment plans to be made but not completed and for price changes to be passed onto wages and for wage changes to be passed back to prices".

Dixon, Parmenter, Ryland and Sutton (1977, p.15).

The essential point though is that ORANI in short-run mode assumes that industry specific capital stocks are held fixed, while ORANI in longrun mode assumes that capital is freely mobile between industries. Typically, the ORANI short-run is assumed to take 1 to 2 years in calender time while the ORANI long-run is at least 5 calender years.

Policy Analysis No.1: The Effect of a Mining Boom

A mining boom is a macro-economic phenomena whereby one has a successful mining sector expansion coupled with expanding export markets for the minerals in question. The effects of such a boom have been grouped into two types of effects: the direct effects (on output and employment) and the indirect effects. It has been argued that the direct effects of such a mining boom on the mining industry itself and its suppliers are likely to be small compared with the indirect effects (i.e. via the balance of payments) of the additional foreign exchange earnings (Gregory 1976).

And it is the significance of these larger indirect mining boom effects for the Australian transport sector that is explored in this section. In order to carry out this exploration it is assumed that the economy as it exists at the beginning of each year of the experiment is allowed to run a balance of payments deficit of $0.35 billion dollars

(1974-75 prices). Then for each year in the mining boom period, the mining boom generates additional annual foreign exchange earnings equivalent to 0.35 billion Australian dollars (at 1974-75 prices). This additional foreign exchange earning capacity is assumed to build up at a linear rate through the period. The assumption of linearity is a simplification obviously since the dynamic path of the foreign exchange earning capacity is likely to be non-linear starting off with small additions in the early stages of the boom, accelerating for a while and then tapering off as the minerals boom 'matures'.

The National level effects of a mining boom on transport

Higgs, Parmenter, and Powell (1983) have shown that such a mining boom is likely at the whole of Australia level, to lead to reductions of 0.10%, 0.54% and 0.39% in the outputs of the road, rail and water transport sectors respectively while it is likely to increase the output of the air transport industry by 0.64%.

At a national level the mining boom has both an income effect and a price effect. The income effect is because the mining boom leads to an increase in real private consumption C, real private investment, I, and real government spending, G, which together lead to an increase in national income. The price effects derive from the inflationary consequences of the expansion in C+I+G in an environment of a hundred percent wage indexation. Generally then the mining boom shock will lead to an increase in the consumer price index which in turn represents a rise in the prices of domestically produced goods relative to world prices

In order to work out how these price and income effects impact on the transport sector it is crucial to note that the demand for road, rail and water transport services is a derived demand, derived mainly from the demand for exports and export related commodities to which industries the bulk of transport services are sold. Thus what happens to the transport sector hinges mainly on what happens to the exports and export related industries. Note firstly that the increase in C+I+G, the income effect that is, generally leads to a shift to the right of the domestic demand curve and thus to an increase in the demand for domestically produced goods, which in turn reduces the amount available for export. Furthermore the price effects by way of rising prices, increases the costs of inputs in the industries producing exports and export relates commodities, thereby leading to a shift to the left of the supply curve which in turn leads to a reduction in the quantity of goods produced. These two effects lead to a reduction in the quantities available for exports which in turn leads to a reduction in the demand for transport by road, rail and water ways as already noted.

Air transport in this simulation behaves differently from the other three modes of transport because it is technically an import-competing industry. Import competing industries in ORANI are those which sell in markets where the level of import penetration is significant and where imports and domestic outputs are close substitutes

In the case of air transport the income and price effects operate in opposite directions: whereby the income effect leads to an increase in the demand for air transport while the price effects leads to a switch away from domestic air transport services. In this case the income effect outweighs the price effect leading to an overall increase of 0.64% in the demand for air transport at the national level.

The regional effects of a mining boom on transport

In order to derive the mining boom regional effects on the transport sector, assume as did Dixon, Parmenter and Sutton (1978) that

(*) $$X_m^r = \dot{X}_m D_m^r \quad \text{for all } m \in M \text{ and } r \in R$$

where

X_m^r represents the output of transport mode or sector m in region r

X_m represent the aggregate or national level output of transport mode or sector m

D_m^r is the base proportion of the aggregate or national output of transport mode m which is produced in region r.

M is the set of transport modes in consideration i.e. M = (road, rail, water and air)

R is the set of regions whose elements are listed in column 1 of Table 4.

This is equivalent to assuming a fixed regional distribution of the outputs of the national transport sector and thus the equation labelled (*) above implies in percentage change format that

(**) $$x_m^r = x_m \text{ for all } m \in M \text{ and } r \in R$$

That is, if there is a one per cent increase in the national aggregate output of the road transport sector, for example (i.e x_m = 1%), then the road transport sector's output in all regions is assumed to increase by one percent (i.e. x_m^r = 1%). Hence the differences in regional effects of the mining boom depend purely on the different transport sector structures of the regions, which structures are summarised above in table 3

The regional disaggration of the mining boom national effects on the transport sector are presented in Table 4 below.

The entry in row r and column i referred to as the rith element represents the percentage change in value added in region r arising from the change in output in the ith transport mode in region r precipitated by the occurence of a mining boom.

Table 4.

REGIONAL DISAGGREGATION OF THE EFFECTS OF THE MINING BOOM ON THE TRANSPORT SECTOR

Region	Road	Rail	Water	Air	Total all modes
1. N.S.W. & A.C.T.	-0.0031	-0.0075	-0.0043	+ 0.0048	-0 0101
2. Victoria	-0.0028	-0.0063	-0.0035	+0.0036	-0 0090
3. Queensland	-0.0017	-0.0037	-0.0028	+0.0026	-0.0056
4. S.A. & N.T.	-0.0020	-0.0088	-0.0051	+0.0033	-0.0135
5. Western Australia	-0.0031	-0.0090	-0.0059	+0.0051	-0 0129
6. Tasmania	-0.0033	-0.0064	-0.0068	+0.0029	-0.0136
Australia	-0.0029	-0.0070	-0.0043	+0.0039	-0.0103

Source: Author's computations.

For example take the rail transport sector. It has already been noted that at a national level the mining boom leads to a 0.54% drop in the rail transport sectors output. Since rail transport is a national industry, this means that output of the rail transport sector is reduced by the same percentage of 0 54% in all states. Thus in New South Wales and Australian Capital Territory where rail transport account for 1.39% of total value added, this leads to .0075 percent reduction in total value added (i.e. .0139 X 0 54% = .0075 percent, correct to 4 decimal places) by comparison a 0 54% reduction in rail transport output nationally, produces a 0.0037 percent reduction in the Gross State Product of Queensland where rail transport account for only 0 68% of Gross State Product.

The row totals in table 4, Column 6, show that the ordering of regions is (from least negatively affected to most negatively affected)

1. Queensland
2. Victorian
3. New South Wales and A.C T.
4. Western Australia
5. South Australia and N.T.
6. Tasmania.

The position of Queensland as the first state least negatively affected by a mining boom despite its heavier reliance on export and export related industries can only be explained from the last column of Table 3 where it is shown that among all states, transport in Queensland has the smallest share in Gross State Product. That is the impact on Queensland's Gross State Product due to a decline in the output of the transport sector is small mainly because the state's transport sector's share in total value added is small in that state.

The main reason Victoria's transport sector is the second least affected by a mining boom is because Victoria is not heavily dependent on export related industries. Thus the reductions in the output of export industries are generally less severe in their effects on Victoria's transport sector than they are on the transport sectors of other states.

New South Wales and ACT is third in the ordering of states starting with the least affected. It is worth noting that the total impact of a mining boom on the transport sector of New South Wales and ACT (0.0101 percent) is very similar to the impact on the whole of Australia (0.0103 percent). This is a reflection of the fact that New South Wales and ACT represent a large share of the national economy so that the impact on the transport sector in this region approximates the impact on the transport sector at the aggregate or national level.

The last three states' transport sectors have mining boom induced reductions in outputs which are larger than the national average of (0.0103 percent). For Western Australia and South Australia this is only because the share of the transport sector in Gross State Product is relatively large compared to other states' transport sector shares; and partly because it has a heavy concentration of export and export related industries. As for Tasmania the large output decline accruing to the transport sector is mainly because it is a small state and because of the industrial structure of its transport sector. For example road transport accounts for 3.29% of Tasmania's Gross State Product which is the largest share across states, which in turn means that for any reduction in output in the national road transport sector, the largest reduction in Gross State Product accrues to Tasmania. Similarly water transport accounts for 1.23% of Tasmania's Gross State product which again is the largest water transport share across states with similar repercussions as for road transport. Finally the only mode, air transport, that has an increase in output due to the mining boom has an insigificant share of 0.46% in Tasmania's Gross state product which is the second smallest share for air transport in Gross State Products across states, implying that Tasmania is not well positioned to make significant gains from expansions in the air transport industry.

Transport and Three Other ORANI Policy Analyses

Before presenting the detailed regional results, this section describes briefly three other macro-economic policy analyses whose implications for the regional transport industries are important and yet the magnitudes and directions of the transport sectors responses to which are counter intuitive.

The first policy analysis involves the examination of the effects on Australia's Transport of a 1% devaluation in the Australian dollar. Dixon, Parmenter, Ryland and Sutton (1977) have shown that at a national level this would cause an increase of 0.1606%, 0.2209%. 0.1171%, and 0.1566% in the outputs of the national road, railway, water and air transport industries respectively. Using the modified LMPST method it is shown below that such gains are not evenly distributed across regions

The second policy analysis examines the impact on the transport sector of increasing the domestic price of an agricultural product in Australia over and above its world market price. This is a common method of supporting agricultural industries in Australia, insituted in order to insulate domestic prices from world-prices fluctuations. It isused in Australia as part of the stabilization schemes for certain dairy products, dried vine fruits, eggs, sugar and wheat. Consider an agricultural stabilization scheme which increases the price of wheat to non-agricultural users by 10%. It has been shown by Parmenter, Sams and Vincent (1981) that such a scheme would lead nationally to decreases of 0.03%, 0.066%, 0.012% and 0.014% in the outputs of road, rail, water and air transport industries respectively. What is not clear and is discussed below, is how these losses are shared out between the states.

The third policy analysis is an examination of the effects on the Australian transport system of a 40 percent increase in the price of Australia's domestically produced oil products. Again the aggregated national impact of such a policy shock are well known from Vincent, Dixon, Parmenter and Sams (1979) who have shown that it is likely to lead to reductions of 0.90%, 1.13%, 0.93% and 0.72%$ in the outputs of the road, railway, water and air transport industries respectively. The purpose of this section is to examine the regional impacts of these policy shocks.

At the national level the effect of a 1% devaluation of the Australian dollar was an improvement in Australia's competitiveness overseas and thus exports increased. Given the earlier comments about the relationship between exports and transport it is not surprising that the transport sector flourishes under devaluation. The main effect of the agricultural stabilization scheme is to increase the consumer price index. Aggregate exports fall in response to the cost-price squeeze imposed on domestic producers attempting to sell on world markets with high elasticities of demand for Australian exports. Thus the transport sector is generally negatively affected. Similar impacts as for rises in the price of wheat are observable in the policy analysis involving a rise in the price of domestically produced oil. The main question though addressed in this paper is what are the regional implications of these national or aggregated gains and losses? Table 5 below summarises the results of the regional disaggregation of these three policy shocks.

The figures in table 5 are interpreted as follows. Take Queensland and the row labelled (i) which corresponds to the one percent devaluation of the Australian dollar. The figure 0.0027 in the column labelled Road means that the value added (i.e. the Gross State Product) of Queensland increases by .27% as a result of the increase in road transport precipitated by a 1% devaluation. These figures are computed using table 3 and the national results for each of the policy simulation under consideration. The best way of identifying the losing and gaining states and modes is to scan the results and rank them starting with the least negatively impacted state. This is done in table 6.

Table 5:

Regional Disaggregation of the Effects of 3 Policy Analyses on the Transport Sector Outputs

Region and Policy	Road	Rail	Water	Air	State Total
1. N.S.W & A.C.T.					
(i) (a)	0.0050	0.0031	0.0013	0.0012	+0.0106
(ii) (b)	-0.0009	-0.0009	-0.0001	-0.0001	-0.0020
(iii) (c)	-0.0283	-0.0157	-0.0101	-0.0054	-0.0595
2. Victoria					
(i)	0.0045	0.0026	0.0011	0.0009	+0.0091
(ii)	-0.0008	-0.0008	-0.0001	-0.0001	-0.0018
(iii)	-0.0250	-0.0132	-0.0084	-0.0041	-0.0507
3. QLD.					
(i)	0.0027	0.0015	0.0008	0.0006	+0.0056
(ii)	-0.0005	-0.0004	-0.0001	-0.0001	-0.0011
(iii)	-0.0150	-0.0072	-0.0067	-0.0030	-0.0324
4. South Australia and N.T.					
(i)	0.0046	0.0036	0.0015	0.0008	+0.0105
(ii)	-0.0009	-0.0011	-0.0002	-0.0001	-0.0023
(iii)	-0.0260	-0.0183	-0.0123	-0.0037	-0.0603
5 Western Australia					
(i)	0.0050	0.0037	0.0018	0.0009	+0.0114
(ii)	-0.0009	-0.0011	-0.0002	-0.0001	-0.0023
(iii)	-0.0283	-0.0189	-0.0140	-0.0042	-0.0654
6. Tasmania					
(i)	0.0053	0.0026	0.0020	0.0007	+0.0106
(ii)	-0.0010	-0.0008	-0.0002	-0.0001	-0.0021
(iii)	-0.0296	-0.0133	-0.0161	-0.0033	-0.0623

(a) the rows labelled (i) correspond to the 1% devaluation of the Australian dollar.

(b) The rows labelled (ii) correspond to the 10% increase in the domestic price of wheat

(c) the rows labelled (iii) correspond to the 40% increase in the price of domestically produced oil.

Source: Author's computations.

Table 6.

The ordering of states across experiments starting with the least adversely affected state.

	Mining Boom	Devalue Australian $	Increase Wheat	Increase price of Domestic Oil
1. N.S.W. & ACT	3rd	2nd	3rd	3rd
2. Vic.	2nd	5th	2nd	2nd
3. Q'LD.	1st	6th	1st	1st
4. South Australia & N.T.	5th	4th	6th	4th
5. Western Australia	4th	1st	4th	6th
6. Tasmania	6th	2nd	6th	5th

Across the different policy analyses it is interesting that Queensland ranks 1st among all states from three out of the four experiments. What must be noted is that in those three experiments the transport sector of states was negatively affected in all states. For Queensland to rank first in these circumstances means that Queenslands gross state product was least adversely affected by the various policy initiatives. This as it was argued earlier on was because transport's share in Queensland's gross state product is small. This is consistent with the results in the devaluation experiment where Queensland ranks last in the environment where the transport sector is growing. Again the size of the transport sector in Queensland's economy contributes significantly to this rank.

In the mining boom, the wheat price increase and in the domestic oil price rise policy analyses, it is clear that the ordering of the top three regions are invariant across states: that is in these three experiments one has Queensland, Victoria, and New South Wales in that order. With respect to these three experiments the bottom three states are not consistently ordered across experiments though. Thus the ranking changes according to the experiment in question.

CONCLUSION

In this paper use has been made of the modified LMPST method to examine the implication of national macro-economic policies on the transport sector at a regional or state level. The national impacts were derived from simulations of ORANI, a general equilibrium model of the Australian economy. The main simplifying assumption made was that when a transport sector grows or contracts by a given percentage nationally, then the state transport sectors would grow or contract by the same percentage. Even under this simplifying assumption it was discovered that neither the gains from a growing national transport industry nor the losses from a contracting national industry are shared out evenly across states. This of course would be true for any policy initiative under consideration. The main parameters instrumental in this process of regionally unequitable distribution of gains and losses are the varying industrial structures of the various states, particularly the shares of the transport sectors in the various states gross state products.

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