# IMPACT PROJECT

A Commonwealth Government inter-agency project in co-operation with the University of Melbourne, to facilitate the analysis of the impact of economic demographic and social changes on the structure of the Australian economy

# THE *IMPACT* MACRO PACKAGE AND EXPORT DEMAND ELASTICITIES

by

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*The views expressed in this paper do not necessarily reflect the opinions of the participating agencies, nor of the Commonwealth Government*

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# THE IMPACT MACRO PACKAGE AND EXPORT DEMAND ELASTICITIES

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## I Introduction

The attention of readers of the Australian Economic Papers has recently been drawn by Norman (4) to work on macroeconomic policy by Dixon, Powell and Parmenter (3). They used IMPACT's ORANI model of the Australian economy to compute combinations of changes in real aggregate domestic absorption and in domestic real wage costs which would

(a) result in no change in the balance of trade, and

(b) increase aggregate domestic employment by five per cent.

The macro policy package advanced in (3) as necessary for the satisfaction of both targets (a) and (b) is an increase in absorption of 3.21 per cent and a reduction in wage costs of 6.15 per cent. Norman pointed out that this analysis can be represented as "a simple adaptation of the revered Swan diagram", a representation which "may help to concentrate the debate about .... solution on the slopes and positions of the trade-off functions".

The slopes and positions of the trade-off functions implied by ORANI depend in principle on the whole of the model's data base. It is not difficult, however, to identify, a priori, parts of the data file to which the trade-off functions are likely to be most sensitive. Among these are the elasticties of demand

on world markets for Australia's major exports. In the standard ORANI data base, export demand is assumed to be, on average, quite elastic. Changes in domestic cost conditions (i.e., shifts in domestic supply curves) therefore cause large changes in export volumes and in export sector activity. This phenomenon is fundamental to the IMPACT macro-policy results. The usefulness of domestic demand expansion in generating employment is limited by the accompanying deterioration in the balance of trade, explained primarily by a cost-price squeeze on export volumes. On the other hand, cuts in domestic costs via real wage reductions are a strong stimulant to export sector activity.

Some controversy surrounds the assumptions made about export demand elasticities. A number of critics, especially Cronin [1], have suggested that the demand for exports is much less elastic than is usually assumed in ORANI. This paper presents an analysis of the sensitivity of the ORANI macro package results to variations in the export demand elasticities. Similar sensitivity analysis of ORANI tariff results has been reported recently by Dixon, Parmenter and Rimmer [2].

## References


1. M.R. Cronin, "The Treatment of Exports in ORANI Solutions", (Document circulated in the Industries Assistance Commission, Canberra, 1979).

2. Peter B. Dixon, B.R. Parmenter and Russell J. Rimmer, "The Sensitivity of ORANI Projections of the Short-Run Effects of Increases in Protection to Variations in the Values Adopted for Export Demand Elasticities", IMPACT Preliminary Working Paper No. OP-35, Melbourne, 1982.

3. Peter B. Dixon, Alan A. Powell and Brian R. Parmenter, Structural Adaptation in an Ailing Macroeconomy, (Melbourne : M.U.P., 1979).

4. N.R. Norman, "The IMPACT Macrofix : An Exposition", Australian Economic Papers, Vol. 20, No. 36, June 1981.




## II The macro package with standard export demand elasticities

Export demand elasticities from the standard ORANI data base for Australia's main export commodities are reproduced in Table 1. The diagrammatic representation of the IMPACT macro package generated using the standard elasticities is given in Figure 1(a). The package (a 3.7 per cent increase in absorption and a 4.9 per cent decrease in wage costs) is not precisely the same as that proposed in [3]. The package reported here is a revised estimate based on a more recent version of ORANI and using 1974/5, rather than 1968/9, input-output data. The policy implications of the two sets of results are, however, substantially the same.

The lines labelled "$\ell = 5$" and "$\Delta B = 0$" in Figure 1(a) are, respectively, plots of the equations

$$\eta_{L,A}\, a + \eta_{L,W}\, w = 5 \qquad (1)$$

and

$$\eta_{B,A}\, a + \eta_{B,W}\, w = 0 \ , \qquad (2)$$

where the $\eta_L$'s are the short-run elasticities (evaluated from ORANI using the standard data base) of aggregate employment with respect to real aggregate domestic absorption (A) and the real wage rate (W), the $\eta_B$'s are the changes induced (in ORANI) in the balance of trade by one per cent changes in real absorption and the real wage rate, and $a$ and $w$ are the percentage changes in real absorption and the real wage rate. Values for the $\eta$ coefficients based on the standard export demand elasticities are given in column one (i.e., headed $\alpha = 1.0$) of Table 2.

Table 1. Export demand elasticities from the standard ORANI data files

| Commodity[a] | | |
|---|---|---|
| ORANI number | Description | Elasticity |
| A1 | Wool | 1.3 |
| A3 | Wheat | 12.5 |
| A4 | Barley | 20.0 |
| A5 | Other cereal grains | 20.0 |
| 12 | Iron | 20.0 |
| 13 | Other metallic minerals | 20.0 |
| 14 | Coal | 20.0 |
| 18 | Meat products | 16.7 |
| 22 | Flour and cereal products | 20.0 |
| 25 | Food products n.e.c. | 20.0 |
| 30 | Prepared fibres | 2.6 |
| 63 | Basic iron and steel | 20.0 |
| 64 | Other basic metals | 20.0 |
| Average elasticity[b] | | 16.3 |

(a) Export demand elasticities for commodities identified in the model but not listed here play no role in the macro policy simulations because, for those commodities, export volumes are held exogenously constant.

(b) Weighted by commodity shares in base-period export revenue earned from the listed commodities.



lines) the more extreme are the required changes in the instruments.

Fortunately, it is very unlikely that policy makers need worry about the problems inherent in the case of extremely low export demand elasticity. Dixon, Parmenter and Rimmer [2] have argued that there is no policy-relevant sense in which export demand should be assumed to be very inelastic. Even when very low short-run export demand elasticity is apparent, exporters are usually assumed to be restrained by the long-run consequences of exploiting their temporary monopoly power. In any case, if exploitable monopoly power were available in export markets, it ought presumably to be exploited directly (e.g., via a system of export taxes) rather than as an incidental consequence of macroeconomic policy.

The most significant conclusion to be drawn from our sensitivity analysis is that, within the plausible range of variation of export demand elasticities, the IMPACT macro package is not very sensitive to changes in the elasticities. Cronin [1] has suggested, as an alternative to the standard ORANI values, a set of export demand elasticities for Australia's major exports which reduce the average elasticity to 8.83. Using Cronin's elasticities the macro package is a 3.66 per cent increase in real aggregate absorption combined with a 5.00 per cent reduction in real wage costs almost identical to the standard IMPACT package.

## IV Conclusion

The sensitivity analysis presented in Section III has shown that only when export demand is assumed on average to be inelastic does the IMPACT macro package become very sensitive to changes in export demand elasticities. When the average elasticity has fallen below 1, the favourable effects of a cut in real wage costs on the balance of trade are rapidly diminished by further reductions in export demand elasticities. This is because although a fall in wage costs will still reduce the import bill by improving the competitive position of domestic import competing industries vis à vis imports, the cost decrease, by causing an expansion in export volumes, will reduce export receipts. At very low levels of export demand elasticities, the effect on export receipts becomes so strong that a wage cut will cause a deterioration in the trade balance. The sign of the trade off between wage-cost and absorption changes which are trade balance neutral (i.e., the slope of the "$\Delta B = 0$" line in Figure 1) then changes from negative to positive. Within this very inelastic range, precise information about the response of the targets to the instruments is required even to establish the signs of the changes in wage costs and absorption required by the macro package. Depending on which instrument has a comparative advantage in achieving which target (i.e., depending on the relative slopes of the "$\Delta B = 0$" and "$\ell = 5$" lines in Figure 1), either reductions in both wage-costs and absorption or increases in both may be necessary. Moreover the smaller is the comparative advantage (i.e., the closer to parallel are the



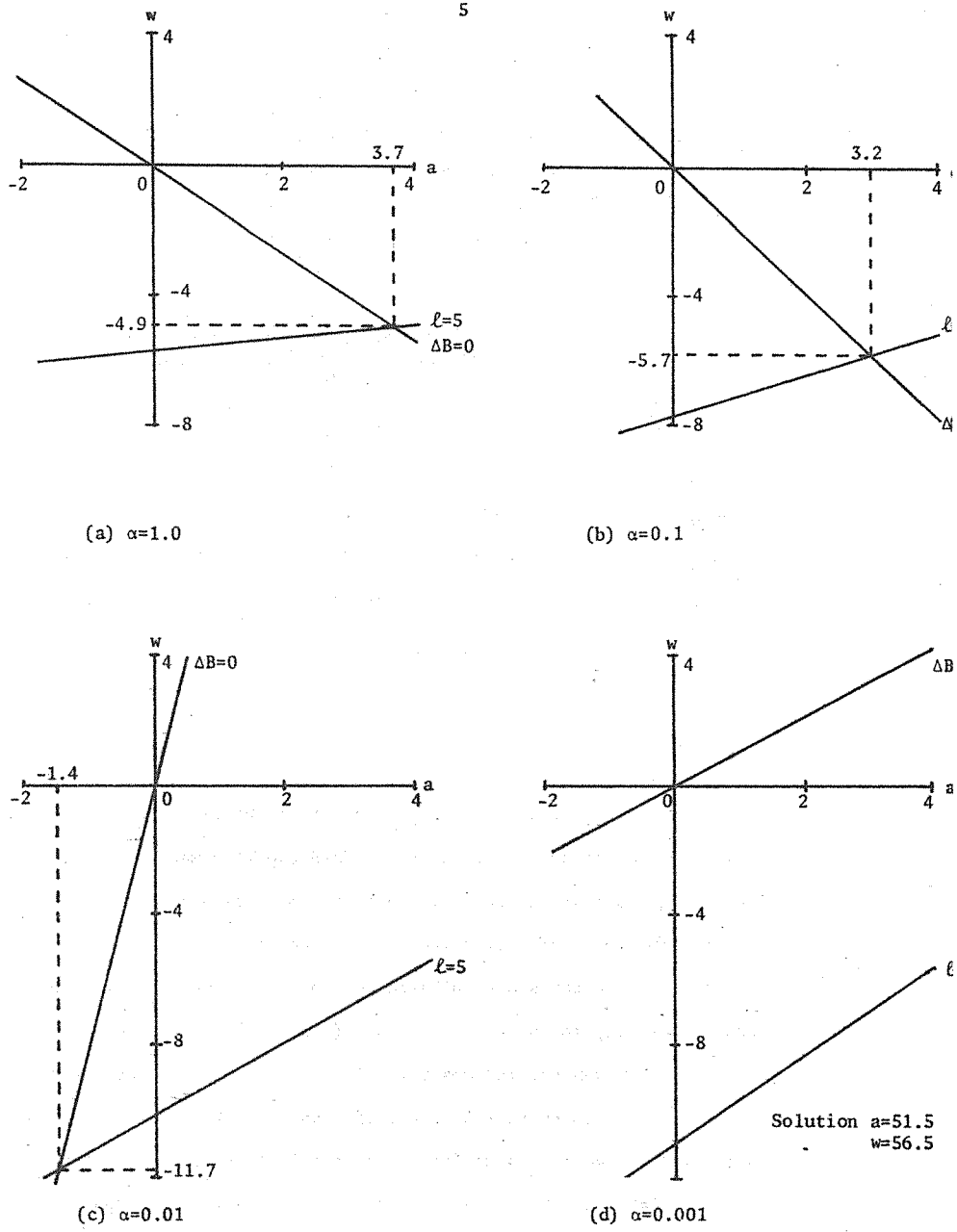


Figure 1. The IMPACT macro package under different assumptions about the elasticity of demand for exports

Table 2. Values of the coefficients ($\eta$) of the ORANI macro package equation system (equations (1) and (2)) with different assumptions about the elasticities of export demand

| Coefficient | Values generated using export demand elasticities equal to $\alpha$ times the standard values (Table 1) where $\alpha$=1.0 | 0.1 | 0.01 | 0.001 |
|---|---|---|---|---|
| $\eta_{L,A}$ | 0.15 | 0.30 | 0.56 | 0.60 |
| $\eta_{L,W}$ | -0.90 | -0.75 | -0.49 | -0.46 |
| $\eta_{B,A}$ | -0.42 | -0.31 | -0.08 | -0.05 |
| $\eta_{B,W}$ | -0.31 | -0.21 | 0.01 | 0.04 |

From the value of $\eta_{L,A}$ given in the first column of Table 2 it can be seen that, with standard export demand elasticities, ORANI suggests that increases in domestic absorption alone are not an efficient means of increasing domestic employment. The reason is that such increases are inflationary and that domestic inflation reduces activity in the export sector (via a cost-price squeeze) and erodes the competitive position vis à vis imports of the import competing sector. Further evidence of these effects of the inflation is the large negative value for the coefficient $\eta_{B,A}$ in the first column of Table 2. On the other hand, the sensitivity of exporting activity to domestic costs (combined with the role of relative prices



the consequent adverse movement in the trade balance. The optimal package is therefore a reduction in real wages combined with a reduction in aggregate absorption.

For Figure 1(d), increases in real absorption have the comparative advantage in increasing employment. (That is, in column 4 of Table 2

$$\left|\frac{-\eta_{L,W}}{-\eta_{B,W}}\right| = \frac{.46}{.04} < \left|\frac{\eta_{L,W}}{\eta_{B,A}}\right| = \frac{.60}{.05} \quad ,$$

or in Figure 1(d) the "$\ell$ = 5" line is steeper than the "$\Delta B$ = 0" line.)[1] The corresponding interpretation of the package is that absorption is assigned to the employment target and a wage increase used to eliminate the accompanying adverse movement in the trade balance. In fact very large increases in wages and absorption are required. Export demand is so inelastic that the economy is able to finance these large increases by exploiting monopoly power in its export markets to bring about a dramatic improvement in its terms of trade.

1. See footnote 1, p. 10.

employment and balance of trade targets. Both will increase domestic employment but cause a deterioration in the balance of trade. Both the "$\ell$ = 5" and the "$\Delta B$ = 0" lines therefore have positive slopes. The implication of this for the optimal policy package depends on the relative sensitivities of the two targets to the two instruments (i.e., on the relative slopes of the "$\ell$ = 5" and "$\Delta B$ = 0" lines). In Figure 1(c), reductions in real wages have a comparative advantage over increases in absorption in increasing employment. That is, the increase in employment which can be achieved per unit deterioration in the balance of trade is greater using the wage instrument than using the absorption instrument. (In terms of column 3 of Table 2

$$\left|\frac{-\eta_{L,W}}{\eta_{B,W}}\right| = \frac{.49}{.01} > \left|\frac{\eta_{L,A}}{\eta_{B,A}}\right| = \frac{.56}{.08} \quad ,$$

or in terms of Figure 1(c) the "$\Delta B$ = 0" line is steeper than the "$\ell$ = 5" line.)[1] In this situation the macro package can be thought of as requiring that the wage instrument be assigned to the employment target and the absorption instrument used to eliminate

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1. Note from equations (1) and (2) that the slope of the "$\ell$ = 5" line is $-(\eta_{L,A}/\eta_{L,W})$ and the slope of the "$\Delta B$ = 0" line is $-(\eta_{B,A}/\eta_{B,W})$. For cases in which the signs of the $\eta$ coefficients are restricted to be the same as in columns 3 and 4 of Table 2

$$\left|\frac{\eta_{L,W}}{\eta_{B,W}}\right| > \left|\frac{\eta_{L,W}}{\eta_{B,A}}\right| \Leftrightarrow -\frac{\eta_{B,A}}{\eta_{B,W}} > -\frac{\eta_{L,A}}{\eta_{L,W}} \quad .$$



in the import competing sector) implies that both domestic employment and the balance of trade can be improved significantly by reductions in real wage costs, hence the large negative values for the coefficients $\eta_{L,W}$ and $\eta_{B,W}$ in column 1 of the table. Equations (1) and (2), together with the signs on the coefficients in column 1 of Table 2, imply that, for the standard case shown in Figure 1(a), the line "$\ell$ = 5" has a negative intercept on the w axis and a positive slope, and that the "$\Delta B$ = 0" line is negatively sloped and passes through the origin.

The main differences between the results underlying Figure 1(a) and those from the earlier version of ORANI which were used in [3] are that, in the current version, increases in absorption and real wages are both more inflationary than was indicated by the earlier version. This primarily reflects a revised treatment of indirect taxes. The fixed specific-rate taxes which were assumed in the earlier version of the model have now been indexed to the model's index of consumer prices. In addition, the export sector in the latest version of the model is more sensitive to domestic cost changes than was the case in the version used in [3]. Owner-operator labour in the agricultural sector was treated as a fixed factor in generating the earlier results but as a variable factor for the results reported here.[1]

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1. The implications of all this are that the coefficients of equations (1) and (2) in our earlier macro-package study were $\eta_{L,A} = 0.58$, $\eta_{L,W} = -0.51$, $\eta_{B,A} = -0.14$ and $\eta_{B,W} = -0.08$.

## III The sensitivity of the macro package to variations in the export demand elasticities

Figures 1(b) - 1(d) are diagrammatic representations of ORANI macro packages generated using export demand elasticities equal to $\alpha$ times the elasticities given in Table 1, where $\alpha$ is equal, in turn, to 0.1, 0.01 and 0.001. The corresponding coefficient values for the equation system (1) and (2) are reported in columns 2 - 4 of Table 2.

Comparison of Figures 1(a) and 1(b) shows that, so long as the average export demand elasticity remains in the elastic range, the macro package is not very sensitive to reductions in the elasticities. In generating Figure 1(b) we used elasticities only one tenth as large as the standard values,i.e., we reduced the average elasticity from 16.3 to 1.63. Activity in the export sector is therefore much less sensitive to changes in domestic costs, with the result that increases in absorption are more effective in increasing domestic employment and less disruptive to the balance of trade (see Table 2, column 2). At the same time reductions in wages are less effective in increasing employment and improving the trade balance. In Figure 1 the effect of these changes is unambiguously to steepen the "$\ell$ = 5" line and to make its intercept on the w axis more negative. The absolute value of the slope of the "$\Delta B$ = 0" line increases because the proportional change in the coefficient $\eta_{B,A}$ turns out to be greater than the proportional change in the coefficient $\eta_{B,W}$ (see Table 2). The resulting macro package (a = 3.2, w = -5.7) is nevertheless very close to



that derived using the standard parameter file. Certainly, given the degree of precision which can be expected from the current generation of economy-wide models, it could not be claimed that the two packages are significantly different in their policy implications.

Reducing the average elasticity of export demand to the inelastic range has more serious consequences for the macro package. In generating Figures 1(c) and 1(d), and columns 3 and 4 of Table 2, the average elasticity has been reduced to 0.16 and 0.016 with the consequence that increasing the costs of the export sector and thus reducing export volumes will now increase export revenues and, ceteris paribus, improve the balance of trade. Note that in columns 3 and 4 of Table 2, $\eta_{B,W}$ has become positive and the absolute values of the negative coefficient $\eta_{B,A}$ have become very small. In Figures 1(c) and 1(d) the result is that the "$\Delta B$ = 0" lines now have positive slopes. Changes in the $\eta_L$ coefficients are less marked : further reductions in the sensitivity of export sector activity to domestic cost pressures have just further increased the (positive) sensitivity of domestic employment to changes in absorption and further reduced its (negative) sensitivity to changes in real wages. The implication for Figure 1 is that the "$\ell$ = 0" line rotates further in the counter-clockwise direction.

In the situation depicted in Figures 1(c) and 1(d) the two policy instruments, namely, increases in absorption and reductions in real wages, each have a similar combination of effects on the