A MODEL OF THE GAINS FROM INTRA-INDUSTRY TRADE: THE BENEFITS OF THE AUSTRALIA-NEW ZEALAND FREE TRADE AGREEMENT

Clive Hamilton

DISCUSSION PAPER NO. 220

December 1989

G.P.O. Box 4, Canberra 2601, Australia
A MODEL OF THE GAINS FROM INTRA-INDUSTRY TRADE: THE BENEFITS OF THE AUSTRALIA-NEW ZEALAND FREE TRADE AGREEMENT*

Clive Hamilton
Bureau of Industry Economics
51 Alara Street
Canberra City ACT 2601

DISCUSSION PAPER NO. 220
December 1989

ISBN: 0 7315 0205 1
ISSN: 0725 430X

* While absolving them of responsibility for the final product, I would like to thank participants in seminars at the Bureau of Industry Economics and the Department of Economics, Research School of Social Sciences, Australian National University and especially Rod Falvey of the ANU for his comments.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>1</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>2</td>
</tr>
<tr>
<td>2. The Standard Approach: Specialisation Between Industries</td>
<td>3</td>
</tr>
<tr>
<td>4. The Economic Benefits of CER</td>
<td>15</td>
</tr>
<tr>
<td>The Data</td>
<td>16</td>
</tr>
<tr>
<td>Results</td>
<td>18</td>
</tr>
<tr>
<td>5. Conclusions</td>
<td>23</td>
</tr>
<tr>
<td>Appendix: Data Sources and Methods</td>
<td>25</td>
</tr>
<tr>
<td>References</td>
<td>29</td>
</tr>
</tbody>
</table>
Abstract

This paper develops a simple model of the economic benefits of a customs union in the presence of economies of scale and intra-industry trade. The model is an intra-industry version of those of Corden (1972) and Pearson and Ingram (1980).

The adjustment to trade liberalisation, and the measurement of gains, occurs in two phases - a process of intra-industry specialisation and trade where unit cost differences are unimportant, and a process of inter-industry specialisation and trade where cost differences are substantial.

The model is applied to the potential benefits of the free trade agreement between Australia and New Zealand.
1. Introduction

Traditionally, analysis of the gains from trade liberalisation has assumed that trade is based on inter-industry specialisation. This has been true of both theoretical and applied trade models. In more recent years, however, it has become clear that a large proportion of trade - especially trade in manufactured goods between industrially developed countries - is of the intra-industry type.¹

Models which emphasise inter-industry trade fail to capture the benefits that accrue from specialisation and trade within industries. In this context, specialisation means concentration of production in the manufacture of particular varieties or variants of the output of each industry. In his study of the EEC, Owen (1983, p9) sums up the benefits of these diseconomies of scope as follows:

Once it is acknowledged that all product varieties cannot be produced within one country at minimum efficient scales, it is intuitively clear that producers must find compromises between efficiency and the number of varieties they offer. Widening the market by trade allows greater specialisation in respect to product varieties.

Intra-industry specialisation and trade - in which both countries maintain their industries in one form or another - can provide benefits to both countries by encouraging efficient resource use. Nevertheless, the opening of trade can also induce inter-industry specialisation and trade based on unit cost differences in the traditional way even between countries with very similar factor endowments and factor rewards.
This paper develops a simple model of the economic benefits of a customs union in the presence of economies of scale and intra-industry trade. The model is adapted from those of Corden (1972) and Pearson and Ingram (1980). The process of adjustment to trade liberalisation occurs in two phases - an intra-industry phase and an inter-industry phase. The model is applied to the potential benefits of the free trade agreement between Australia and New Zealand which came into effect in 1983. Under the Australia-New Zealand Closer Economic Relations Trade Agreement (CER) all goods have been made subject to phased reductions in tariff and non-tariff barriers so that by 1990 there will be completely free trade in goods.

The next section presents the standard case of the gains from inter-industry trade in a customs union in the presence of economies of scale. The inadequacy of this approach in a free trade area is pointed out. Section 3 presents an adaptation of the standard model to account for product differentiation and intra-industry specialisation. Section 4 provides the details of the empirical implementation of the method and discusses the results. The final section draws some conclusions.

2. The Standard Approach: Specialisation Between Industries

For two countries, Country A and Country B, the standard model of the gains from trade in a given industry characterised by declining costs is depicted in Figure 1 (see especially Corden, 1972). Before the free trade agreement (FTA) both countries produce the good, or rather the set of differentiated products, in question. After the FTA, Country A, with higher unit costs, loses the industry while Country B expands its industry and exports to Country A. The world price is $P_w$ and the tariffs, assumed to be ad valorem, made-to-measure tariffs, are $t_A$ and $t_B$. It is assumed that Country B applies a
made-to-measure tariff on imports from the rest of the world (RoW) after the FTA at the level $t_b'$ which is lower than $t_b$ because of scale economies. Industries are allocated to countries on the basis of differences in unit costs.

$AC_a$ and $AC_b$ are the average cost curves for the two countries; $D_a$, $D_b$ and $D_a+D_b$ are the demand curves for the two countries before the FTA and the combined demand of the two countries after the FTA. In the literature, it is standard practice to assume that average-cost pricing prevails in the presence of economies of scale. The same practice is adopted throughout this paper. Pearson and Ingram (1980) point out that, while average-cost pricing is inconsistent with normal profit-maximising theory, in the presence of increasing returns marginal-cost pricing would result in losses. Here we postulate a situation of differentiated oligopoly in which a fixed markup is built into average costs. The imposition of made-to-measure tariffs provides enough threat of competition to restrict prices to average costs.

Country A benefits to the extent of area $X$ - increased consumer surplus due to trade creation. Country B benefits by area $Y$, a cost reduction effect which provides increased consumer surplus. Clearly, Country A could enjoy greater trade creation benefits by abolishing its tariff on RoW imports as well as its tariff on imports from Country B. If Country A reduced its tariff so that RoW imports were cheaper than $PW + t_b'$, Country B could not compete and would lose the entire market of Country A.

This raises the basic problem of free trade areas: if there is specialisation between industries, why would the country that loses an industry continue to protect it from RoW imports? The key element of a customs union is that tariff decisions are made collectively and this imposes an obligation on each member to preserve its markets for union
Figures 1

**Before FTA**

- Country A:
  - Initial price: $P_w$
  - Demand: $D_a$
  - New price: $P_{w+ta}$

- Country B:
  - Initial price: $P_w$
  - Demand: $Q_b$
  - New price: $P_{w+tb}$

**After FTA**

- Country A:
  - Initial price: $P_w$
  - Demand: $D_a$
  - New price: $P_{w+ta}$
  - New area: $X$

- Country B:
  - Initial price: $P_w$
  - Demand: $Q_b$
  - New price: $P_{w+tb}$
  - New area: $Y$

Figure 1
members. There is no such obligation under an FTA, so that a system of 'rules of origin' governing the duty-free status of imports is necessary.

However, rules of origin are irrelevant for many manufactured goods since both countries preserve the industry and both maintain barriers against imports from the rest of the world. Thus part of the answer to the problem of free trade areas lies in the benefits of rationalisation within industries rather than between them. As long as each country preserves its industries, albeit in different forms, then these industries remain subject to competition from Row imports and need to be protected. The question revolves around the degree of substitutability of Row imports for domestically produced goods and of domestic goods for the partner’s goods. If the two countries produce different but substitutable variants of a good then Row imports into Country A of the Country B variant will also compete with the Country A variant and will thus attract a tariff.

3. A New Approach: The Gains from Intra-Industry Specialisation

In this section it is assumed that initially, prior to the FTA, each country produces two variants or groups of variants within the given industry. After free trade between the two countries is introduced, each country specialises in a distinct variant or group of variants.

Where diseconomies of scope occur, specialisation within an industry will be reflected in a downward shift in the average cost curve, in addition to the shift along the average cost curve due to economies of scale. Here we concentrate on economies of scale through intra-industry specialisation.
Figure 2 depicts an industry which has two variants, 1 and 2, each produced in Country A and B before the FTA. Note that tariffs are set on a made-to-measure basis so that they are high enough to exclude imports of the goods in question. As a result there is no tariff revenue on these goods.6

After the FTA, Country A specialises in variant 1 and sets a common market price \( P_{A1} \), while Country B specialises in variant 2 and sets a common market price \( P_{B2} \). Notice that the allocation of variants between countries is not carried out on the basis of cost differences, which are assumed to be small. This is in the nature of intra-industry trade, trade which is most prevalent among countries with similar cost structures. The determination of the pattern of specialisation under intra-industry trade is a complex phenomenon, one which has evaded the theorists to date. It depends on hard-to-quantify factors such as historical precedence, the perceived need to be close to the market, the utility of variety and the idiosyncracies of local demand patterns, in addition to traditional cost considerations.

The present study makes no attempt to model the allocation process under intra-industry trade. However, it is clear that unit cost differences in some sectors may be so great that strong pressures will appear to locate all of the production of these sectors in the lower cost country. This is the standard case of inter-industry specialisation of the previous section. In this case we do have an allocation rule, one which coincides with the information required for assessing the gains from (inter-industry) trade.

The benefits of intra-industry specialisation and trade due to the FTA are represented by the shaded regions in Figures 2e-2h. With average-cost pricing, these benefits take the form of consumer surplus. Country A benefits from a cost-reduction effect, area \( W \), in the production of variant 1.
BEFORE FTA

Country A

Country B

Figure 2a

Figure 2b

Figure 2c

Figure 2d

Figure 2a-2d
AFTER FTA

Country A
Specialises in 1

Country B
Specialises in 2

Figure 2e

Figure 2f

Figure 2g

Figure 2h
Country A no longer produces variant 2 but can buy it more cheaply from Country B than it could previously produce it, and enjoys a trade creation gain equal to area $Y$ in Figure 2g. Analogously, Country B benefits by a trade creation gain, area $X$, and a cost-reduction gain, area $Z$. We have not explicitly included the effects of the fall in one variant's price on demand for the other. The implicit assumption is that these cross-price elasticities cancel each other out.

Since for all affected industries, both countries are producers applying made-to-measure tariffs before integration, there can be no trade diversion effects.\footnote{The absence of imports is justified by the use of made-to-measure tariffs. This is necessary to maintain consistency with the assumption of average-cost pricing in the presence of scale economies. If imports were present, there would have been scope for domestic producers to reduce costs by expanding output and displacing those imports. If in practice imports of liberalised goods are present, either the imports are of differentiated products which are not highly substitutable for the domestic items, or the average-cost pricing rule breaks down. In the latter case, monopolists may maximise profits by pricing above average costs and allowing imports to absorb some of the market.}

The problem in applying the analysis of Figure 2 to a real-world trade relationship is that the required information is not available at anything less than the industry level of aggregation. This is so for three reasons.

Firstly, in an ex ante analysis such as this one, we cannot predict which variants each country will specialise in because the factors determining the pattern of specialisation are too complex. The pattern is not simply a function of relative unit costs.
Secondly, the variants within an industry that are the focus of the analysis are often joint products of a production process, so that it is not conceptually sensible to collect information on a variant-by-variant basis.

Thirdly, internationally comparable information on outputs, prices, demand elasticities and scale economies is usually collected only at the industry level. The information constraint is a binding one.

We are constrained, therefore, to carry out the analysis at the industry level in order to estimate the gains from within-industry specialisation. The procedure employed approximates the sum of the shaded areas W and Y in Figure 2 for Country A and areas X and Z for Country B. In order to do this, it is necessary to make some assumptions about the allocation of variants between countries before and after trade liberalisation.

In the case of pure intra-industry trade, using a prime to indicate post-FTA quantities and prices, subscripts a and b to indicate countries, and subscripts 1 and 2 to indicate variants, we have for each industry

\[ Q_{a1}' = C_{a1} \left(1 + \epsilon_{a1} \frac{\Delta P_{a1}}{P_{a1}}\right) + C_{b1} \left(1 + \epsilon_{b1} \frac{\Delta P_{b1}}{P_{b1}}\right) \]  

\[ Q_{b2}' = C_{b2} \left(1 + \epsilon_{b2} \frac{\Delta P_{b2}}{P_{b2}}\right) + C_{a2} \left(1 + \epsilon_{a2} \frac{\Delta P_{a2}}{P_{a2}}\right) \]

where \( C_{a1} \) is consumption of variant 1 in Country A, \( \epsilon_{a1} \) is the Country A price elasticity of demand for variant 1 and \( \Delta P_{a1} \) is the change in the price in Country A of variant 1. Thus,

\[ \Delta P_{a1} = P_{a1}' - P_{a1} \]
\[ \Delta P_{b1} = P_{b1}' - P_{b1} \]
\[ \Delta P_{b2} = P_{b2}' - P_{b2} \]
\[ \Delta P_{a2} = P_{a2}' - P_{a2} \]

Other symbols have obvious meanings.
We make the important assumption that each variant’s share of the industry market is the same in each country, i.e. 

\[
\frac{Q_{a1}}{Q_{a2}} = \frac{Q_{b1}}{Q_{b2}}
\]

where \(Q_{a1}\) is the output of variant 1 in Country A prior to the FTA. Define Country A’s share of the total market as 

\[
\alpha = \frac{Q_{a1}}{Q_{a1} + Q_{a2}} = \frac{Q_{b1}}{Q_{b1} + Q_{b2}} = \frac{Q_A}{Q_A + Q_B}
\]

(3)

Normalising prices we write

\[
P_{a1} = P_{a2} = P_a = 1
\]

(4)

\[
P_{b1} = P_{b2} = P_b = \frac{1}{\beta}
\]

(5)

where \(\beta = Pa/Pb\) is the consumer price of industry output in Country A relative to the consumer price of industry output in Country B at the prevailing exchange rate.

From (3) we have

\[
Q_{b1} = \frac{1-\alpha}{\alpha} \cdot Q_{a1}
\]

(6)

and we can derive an expression we will need

\[
\frac{\Delta Q_{b1}}{Q_{a1}} = \frac{Q_{a1} - Q_{a1}}{Q_{a1}} = \varepsilon_{a1} \cdot \frac{\Delta P_{a1}}{P_{a1}} + \frac{1-\alpha}{\alpha} \cdot \varepsilon_{b1} \cdot \frac{\Delta P_{b1}}{P_{b1}}
\]

(7)

Now writing the price equations

\[
P_{a1} = P_{a1} (1 + \varepsilon_a \frac{\Delta Q_{a1}}{Q_{a1}})
\]

(8)

\[
P_{b1} = P_{b1} (1 + \varepsilon_b \frac{\Delta Q_{b2}}{Q_{b2}})
\]

(9)

where \(\Delta Qb2 = Qb2' - Qb2\) and the elasticity of scale economies in Country A is \(\varepsilon_a = (\delta Pa/\delta Qa)/(Qa/Pa)\).

When there are economies of scale \(\varepsilon_a < 0\). In (8) and (9), the \(Qs\) represent output for the domestic market before the...
FTA and the Q's represent output for the combined (intra-area) market after the FTA. It is assumed that there is no extra-area trade in those goods affected by the FTA. Thus before the FTA consumption equals output in each country and after the FTA consumption equals output within the free trade area.

Substituting (4) and (5) into (7) and using the resulting expression for \( \Delta Q_a / Q_a \) in (8) we obtain a solution for the new price of variant 1, produced in Country A

\[
p_{a1} = \frac{1 + e_a \frac{1 - \alpha}{\alpha} - \epsilon_a (\epsilon_a + e_b \frac{1 - \alpha}{\alpha})}{1 - \epsilon_b (\epsilon_a + e_b \frac{1 - \alpha}{\alpha})}
\] (10)

Note that for \( \alpha = 1 \) there is no increase in Country A's market for variant 1 and \( P'a1 = 1 = Pa1 \).

By a similar process we obtain the following expression for the new price of variant 2, produced in Country B.

\[
p_{b2} = \frac{1 + e_b \frac{\alpha}{\alpha - \epsilon_b (\epsilon_a + e_a \frac{1}{1 - \alpha})}}{\phi \frac{1 - \epsilon_b (\epsilon_a + e_a \frac{1}{1 - \alpha})}{\phi}}
\] (11)

Total output in Country A after the FTA depends on the demand elasticities, price changes and market shares. By way of an allocation rule, it is assumed that pre-FTA shares of the total free trade area market in each industry are preserved after specialisation and trade. In other words, it is assumed in the first instance that the new trade is pure intra-industry trade. Equation (1) can be rewritten using (4) and (5) as

\[
Q_a = Q_a[1 + \epsilon_a (P_a' - 1)] + Q_b[1 + \epsilon_b (P_b' - 1)]
\]

Using (8) and \( Qa1 = \alpha Qa \), \( Qb1 = \alpha Qb \) we obtain

\[
Q_a = Q_a[1 - \alpha \epsilon_a - (1 - \alpha) \epsilon_b + P_a' (\alpha \epsilon_a + (1 - \alpha) \epsilon_b)]
\] (12)
Similarly for Country B

\[ Q_b' = Q_b \left[ 1 - \alpha \varepsilon_a - (1-\alpha) \varepsilon_b + p_b' \left( \alpha \varepsilon_a + (1-\alpha) \varepsilon_b \right) \right] \quad (13) \]

We are now in a position to solve for the gains from pure intra-industry trade. The gains from trade for Country A, Ga, and Country B, Gb, can be divided into cost-reduction and trade-creation components. The logic essentially derives from Figure 2. The relevant expressions are

\[ G_a = \alpha (1-p_a')(Q_a + Q_a')/2 + (1-\alpha)(1-p_b')(Q_a + Q_a')/2 \quad (14) \]

\[ G_b = (1-\alpha)(1-p_b')(Q_b + Q_b')/2 + \alpha (1-p_b')(Q_b + Q_b')/2 \quad (15) \]

It may transpire that the total gains from intra-industry trade for one of our countries, let us say Country A, are negative. This may be so if the term \((1 - P_b')\) in equation (14) is negative, giving rise to 'negative trade creation'. In this case, Country B is so inefficient relative to A that the scale economies are inadequate to drive \(P_b'\) below the old price of Country A, \(P_a = 1\).

In these circumstances, it is reasonable to postulate that Country A would take over all of the industry in question and inter-industry specialization and trade occur. This would depend, however, on the availability of idle resources for the purpose.

In this case, the only post-FTA industry price is \(P_a'\). The expression for \(P_a'\) will be the same as in the intra-industry trade case, i.e. equation (10), but the quantities to which it is applied will differ. We have

\[ C_a' = Q_a (1 + \varepsilon_a (P_a' - 1)) \quad (16) \]

\[ C_b' = Q_b (1 + \varepsilon_b (P_a' - 1)) \quad (17) \]
and the gains from inter-industry trade are

\[ G_a = (1 - P_a')(Q_a + C_a')/2 \]  \hspace{1cm} (18)  
\[ G_b = (1/P_a - P_a')(Q_b + C_b')/2 \]  \hspace{1cm} (19)  

An analogous procedure applies if Country B wins the industry in question.

Finally, note that one of the most important approximating assumptions is inherent in the partial equilibrium approach adopted here. That is, we examine the effects of trade liberalisation only on the sectors directly affected by the PTA and ignore inter-industry effects such as the impact on 'unaffected sectors' of cheaper intermediate inputs supplied by 'affected sectors'. We also ignore income effects and macroeconomic effects such as changes in the exchange rate as a result of changes in trade and investment flows. The key assumption is that each of these general equilibrium effects is small when compared to the direct impact of trade liberalisation.

4. The Economic Benefits of CER

The method of calculating the potential gains from trade liberalisation of the previous section is now applied to the impact of the Closer Economic Relations Agreement between Australia and New Zealand. It is applied to data on manufacturing industry only, for the year 1982-83. As is true of most applied trade models it is ex ante in character, attempting to predict the gains that ensue from trade liberalisation. The potential benefits rather than the actual benefits of CER are estimated. This is so principally because of the 'attribution problem' whereby it is very difficult ex post to separate the impact of trade liberalisation from other influences.
The Data

The data used are reported in Table 1. The sources and construction of the data are described in detail in the Appendix. Here it is important to note that the sectors selected for analysis are singled out as 'CER-affected' when the level of protection from partner-country imports either has been significantly reduced or, in the case of 'modified arrangements', will be reduced. Historically, both tariffs and import licences have been used as trade prophylactics.

There is some dispute over the importance of economies of scale in manufacturing industry. On the one hand, an Australian study (BIE, 1986, p61) suggests that economies of scale, while prevalent in the 1970s, are no longer available in the 1980s. On the other hand, Bollard and Daly (1984) demonstrate that plant sizes in Australia and New Zealand are substantially smaller than in the USA, Germany and Britain. They argue that since largely the same technology is used in Australasia as overseas, this fact suggests unexploited scale economies in the former.

A range of overseas studies has shown that scale economies are significant in manufacturing. In his study of the EEC, Owen (1983), having reviewed the evidence, accepts that unit costs in manufacturing typically fall by 10 per cent with each doubling of volume. Smith and Venables (1988) demonstrate that substantial gains from European integration are dependent on the presence of scale economies, in addition to the pro-competitive effects of unified markets. Harris and Cox (1984) build a general equilibrium real trade model based on imperfect competition and product differentiation. The existence of scale economies is an essential component of the analysis of the gains from trade. Industry-level Australian studies have shown that scale economies are prevalent in manufacturing sectors such as automobile assembly, automotive components, pulp and paper, and paper products (see BIE, 1988a, 1988b).
<table>
<thead>
<tr>
<th>Section</th>
<th>Page 1: Data for Selected Manufacturing Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Table 1: Data for Selected Manufacturing Industries</td>
</tr>
</tbody>
</table>
In small economies like those of New Zealand and Australia we might expect manufacturers to be able to maintain profitability with substantial increases in unit costs as they attempt to meet demands for a wide variety of product types. The present study does not attempt explicitly to incorporate diseconomies of scope into the analysis even though increased productivity within industries as a result of specialisation is at the centre of the study. Information on the extent of diseconomies of scope is scarce. Jubb and Markowski (1988) report that in the automotive and pulp and paper industries 'substantial' reductions in product range would reduce unit costs by about 5 per cent. However, more flexible production systems in some industries enable much greater product variety at only marginal additional cost. In this study, diseconomies of scope can be thought of as being captured in the measure of economies of scale, so that our scale economy numbers tend to underestimate the impact of market expansion and intra-industry specialisation.

It should be noted here that while ignoring diseconomies of scope will leave the gains from CER underestimated, ignoring the transport costs of additional trade, as we do, will mean that the gains are overstated. Trans-Tasman shipping costs are high and will dissipate some of the unit cost savings due to intra-industry specialisation. Transport costs are not incorporated numerically because of the absence of appropriate industry-level data.9

Results

The calculated results for the potential gains from the CER agreement appear in Table 2. The results are calculated in two stages. In the first stage, it is assumed that only pure intra-industry trade prevails. In the second stage, industries in which, in either country, net gains from intra-industry trade are negative are allocated wholly to
one country so that inter-industry trade prevails. The gains represent annual increments in the value of consumption that will arise once structural adjustment within and between industries has had time to occur fully. They are calculated in Australian dollars using the exchange rate prevailing in the years from which the New Zealand output figures were taken (see the Appendix).

In Table 2 the sectors are divided into those in which phased reductions in tariffs or licensing restrictions came into effect from the beginning of 1983 and those for which modified arrangements were negotiated. The benefits of structural adjustment in the first group - CER-affected sectors - will be fully realised only when the adjustment process is completed in each sector, processes that may take several years. The full benefits of trade liberalisation in sectors covered by modified arrangements will be delayed until several years after the barriers are finally removed. It is worth noting that the costs of adjustment in the latter sectors are likely to be higher than in the former and that is the reason why modified arrangements were requested.

The first point to note from the numerical analysis is that there are potential welfare gains (increases in annual consumption) of A$684.9 million for Australia and A$1117.3 million for New Zealand. For Australia this represents 7.9 percent of the value of the additional manufactured trade between the two countries as a result of the policy change.

New Zealand’s gains, on the other hand, represent 13.7 percent of the additional trans-Tasman manufactured trade due to CER. The fact that New Zealand enjoys welfare gains that exceed Australia’s in absolute terms is remarkable given their relative sizes. Per capita, New Zealand benefits by around 8 times more than Australia from CER. This disparity principally reflects the large trade creation gains accruing to New Zealand as a result of its initially higher prices.
In terms of the overall value of the CER agreement, the potential total welfare gains are estimated to be 21.6 percent of the value of the additional trade created by the trade liberalisation. Smith and Venables (1988) estimate the welfare gains from tariff reductions aimed at completing the market in the EEC to be in the range 8 percent to 25 percent of the value of additional trade. Harris and Cox (1984, Table 9) estimate the welfare gain from Canadian multilateral free trade to be 17.5 percent of the value of additional trade (with 8.4 percent in the case of unilateral free trade). The results for CER are thus comparable, on the high side, with those of studies elsewhere.

While New Zealand's benefits derive predominantly from trade creation (93 percent of the total), Australia benefits predominantly from cost-reduction effects (68 percent of the total). With initially higher prices on a range of industrial products, New Zealand can gain very substantially from specialisation and importation of cheaper Australian products. Australia abandons fewer segments of its industries under intra-industry specialisation and fewer of its whole industries under inter-industry specialisation. Where sectors within an industry are abandoned, the reductions in prices of imports from New Zealand are lower and in some cases prices paid actually increase over the pre-FTA Australian domestic price since New Zealand has higher costs initially. This generates 'negative trade creation' in some sectors. Although costs are reduced in New Zealand, scale economies are not sufficiently large to bring the final price below the pre-CER Australian price. These losses are therefore all due to negative trade creation effects. If these losses outweigh the cost reduction benefits, inter-industry specialisation occurs.

Finally, notice that while both countries gain substantially in pulp and paper and in the structural and fabricated metal products industries, Australia gains most in beverages and malt, clothing, and footwear. These are
sectors which are large and in which New Zealand does not have a large price disadvantage. New Zealand also gains from wooden furniture and mattresses, motor vehicles, and refrigerators and household appliances. These are sectors which are comparatively large and which are initially very inefficient leading to large trade creation gains.

The sensitivity of the results to possible inaccuracies in the estimates of the key parameters of the model is revealed in Table 3. The key sets of parameters are the Australia-New Zealand relative prices ($\beta$), the elasticities of scale economies ($e$) and, less so, the price elasticities of demand ($\epsilon$). It is clear a priori that the total gains from the trade liberalisation depend principally on the extent of the scale economies available while the distribution of these gains between the two countries depends principally on relative price differences. However,

<table>
<thead>
<tr>
<th>Parameter Changes</th>
<th>Australia Gains</th>
<th>Australia Share of TC</th>
<th>New Zealand Gains</th>
<th>New Zealand Share of TC</th>
<th>Total Gains</th>
<th>Total Share of TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>648.9</td>
<td>0.32</td>
<td>1117.3</td>
<td>0.93</td>
<td>1766.1</td>
<td>0.70</td>
</tr>
<tr>
<td>$\beta = 1$</td>
<td>1033.6</td>
<td>0.61</td>
<td>190.1</td>
<td>0.38</td>
<td>1223.6</td>
<td>0.58</td>
</tr>
<tr>
<td>$\beta = 0.1$</td>
<td>1943.9</td>
<td>0.84</td>
<td>1350.6</td>
<td>0.26</td>
<td>3334.5</td>
<td>0.60</td>
</tr>
<tr>
<td>$\beta = -0.1$</td>
<td>603.2</td>
<td>0.20</td>
<td>2050.9</td>
<td>0.97</td>
<td>2654.1</td>
<td>0.80</td>
</tr>
<tr>
<td>$e \times 0$</td>
<td>18.5</td>
<td>1.00</td>
<td>992.4</td>
<td>1.00</td>
<td>1010.9</td>
<td>1.00</td>
</tr>
<tr>
<td>$e \times 1.5$</td>
<td>1101.3</td>
<td>0.42</td>
<td>1201.7</td>
<td>0.81</td>
<td>2302.9</td>
<td>0.62</td>
</tr>
<tr>
<td>$e \times 0.5$</td>
<td>310.4</td>
<td>0.28</td>
<td>1050.6</td>
<td>0.98</td>
<td>1361.0</td>
<td>0.62</td>
</tr>
<tr>
<td>$\epsilon \times 2.0$</td>
<td>695.0</td>
<td>0.33</td>
<td>1148.1</td>
<td>0.91</td>
<td>1843.0</td>
<td>0.69</td>
</tr>
<tr>
<td>$\epsilon \times 0.5$</td>
<td>593.5</td>
<td>0.29</td>
<td>1010.4</td>
<td>0.93</td>
<td>1678.7</td>
<td>0.70</td>
</tr>
</tbody>
</table>
the size of the gains also depends heavily on relative price differences because the latter influence the allocation of industries between countries. Under pure intra-industry trade the total gains are little influenced by relative price differences.

5. Conclusions

As is true of most applied trade models, the present method of evaluating the Australia-New Zealand free trade agreement takes no account of the costs of the policy. Economists typically evaluate trade policy in a long-run framework in which full employment of resources is assumed to prevail.11 In these circumstances, labour and other resources simply move out of declining industries and into those which are expanding consistent with comparative advantage. Since these transfers can only mean a more efficient allocation of resources, overall social welfare must rise.

In practice, workers displaced by imports, and the resources they work with, may become unemployed and remain unemployed for a long time. In the 1980s with unemployment in both Australia and New Zealand in the 4-8 per cent range, this outcome is probable, particularly as those most likely to be made redundant due to trade liberalisation are unskilled and semi-skilled workers. Most of the unemployment of the 1980s cannot be characterised as frictional and must therefore be counted in terms of its social cost. Redundant resources may have large and continuing opportunity costs in terms of lost output, even if that output is produced relatively inefficiently.12

The novelty of the present model is its stress on specialisation and trade within industries. Gains from trade arise from the availability of economies of scale and diseconomies of scope. There are no firm guidelines for the
allocation between trading partners of production of the various outputs of an industry, as this allocation process seems to be influenced by considerations other than relative unit costs. In this respect the present model is less satisfactory than the usual inter-industry models which have a well-defined allocation rule, but it is consistent with the reality of observed patterns of specialisation.

While cost differences are not necessary for trade to be beneficial, where cost differences are sufficiently large there are trade creation benefits to be had. The present model attempts to capture both types of benefits by allowing for inter-industry specialisation and trade when pure intra-industry trade in a given industry would not provide net benefits to both trading partners.

Differences in factor productivity and factor rewards enter the model through both the allocation of industries between countries and through the calculation of trade creation benefits. However, a more general model would allow for the possibility that, in the longer run, allocation will be influenced by the fact that increased demand for factors of production in the low-cost country may drive wages up. Wages may be driven up directly in the labour market or indirectly through a trade surplus and real appreciation.
APPENDIX

DATA SOURCES AND METHODS

Table 1 records the data used in the calculations of the benefits of CER. All data refer to the year 1982-83 unless otherwise specified. It was necessary to aggregate some combinations of 4-digit ASIC categories into 3-digit categories in order to make the data concord.

Australian output data are approximated by statistics on turnover from the Australian Bureau of Statistics (ABS), Manufacturing Establishments: Details of Operations by Industry Class, Australia, 1982-83 (Catalogue No. 8203.0). Total exports are subtracted from total output in each industry for reasons explained below. Export data are from the ABS trade data base (microfiche number MX13A). Therefore, 'output' should be taken to mean output net of exports.

Some CER-affected sectors exported part of their output to the partner country and the rest of the world prior to CER. Since affected sectors are defined as those that have been protected from international competition, these exports (which are sold at world prices) pose a dilemma. The solution lies in recognition of the inaccuracy of aggregation. It is very likely that these exports are of variants other than those responsible for a sector being classified as CER-affected. They are therefore excluded from the analysis and treated as non-CER affected. In effect this means that we have assumed that there is no extra-area trade in CER-affected goods before or after CER. Thus, before CER consumption equals output in each country and after CER consumption equals output within the free trade area. Pearson and Ingram (1980) make the same assumption. One difficulty raised by this approach is that in excluding exports from affected sectors we are left with potential gains on home consumption of exported goods. The gains from trade will to this extent be overstated.
The New Zealand output figures are averages for the years 1981-82 and 1983-84 of 'total sales and other income' from the Census of Manufacturing Bulletin 1983-84 (Department of Statistics, New Zealand). Export data are from the same source. There was no census for the year 1982-83. New Zealand data were converted into Australian dollars using the average mid-rates of exchange for the New Zealand census years and are taken from A Comparison of New Zealand and Australian Manufacturing Industries 1983-84 (Department of Statistics, New Zealand). The last-mentioned publication is also the source for the concordance between Australia's ASIC industry classification system and New Zealand's NZSIC system.

The Australia-New Zealand relative price variable (C) is measured by (100 + \eta_a)/(100 + \eta_a) where \eta_a and \eta_a are the average nominal rates of assistance in Australia and New Zealand respectively. Estimates of \eta_a for 1982-83 at the 4-digit level are taken from the Industries Assistance Commission (1987), Table A8.5. They include 'assistance provided by tariff and certain non-tariff measures'.

The New Zealand measure of nominal rates of assistance (\eta_a) for 1982-83 is more complicated due to the extensive system of import licencing. The source of the figures used here is Pickford (1985), Table 2 and Table A.1. The measure is the sum of the nominal ad valorem tariff (as a percentage) and the premium paid for an import licence expressed as a percentage of the value of the licence unit. The premium is the mean of the successful bids in the rounds of tenders in the period March 1981 to March 1984.

There were difficulties in obtaining the exact concordances, and for 15 of the 39 sectors it has not been possible to obtain an estimate of nominal assistance in New Zealand. In those cases the relative price was taken to be \beta = .9. Due to the uncertainties surrounding all of these estimates, the results must be treated cautiously. Sensitivity analysis is carried out and reported in the text.
Price elasticities of demand for domestically produced goods in Australia are given by the product of the elasticity of substitution between domestically produced and imported products (the Armington elasticities) and the share of imports in total domestic sales. The rationale for this procedure is explained in BIE (1980c), Appendix 5.2. The elasticities of substitution are taken from the 1977-78 ORANI data base reported in Dixon et al. (1982), Table 29.2. The import shares are derived from the output figures referred to above and import figures from the ABS trade data base (microfiche number MM13A).

Due to the absence of information on elasticities of demand for New Zealand, we have assumed that they are the same as in Australia.

The data for elasticities of scale economies are from Harris and Cox (1984), Table 16, p.105. The use of Canadian data may result in understatement of the potential benefits of increased scale in Australia and especially New Zealand since the Canadian economy is significantly larger than both.

In practice the use of equation (11) for the New Zealand price would grossly exaggerate the price reduction of the variants in which New Zealand specialise. This is because the Australian market is so much larger than New Zealand's that the scale economies factor would be multiplied many times over. It seems much more reasonable to set an upper limit on the cost reductions available from economies of scale. We therefore have imposed on New Zealand the condition $\alpha < .6$ (this reduces $\alpha$ for all but one sector). This means that scale economies as measured are available as the market increases to 250 percent of its former size ($\alpha/(1-\alpha) = 1.5$) after which the AC curve is flat.
Sectors are classified as 'CER-affected' if, firstly, average rates of duty on imports from the partner country exceeded 5 per cent in 1982-83. Data on average rates of duty are from the ABS trade data referred to above. Secondly, sectors are classified as CER-affected if special import licences for partner-country imports were made available under CER and these licences had a take-up rate of more than 75 percent in 1983-84. This information, which clearly applies to imports into New Zealand from Australia, was provided by the Australian Department of Foreign Affairs and Trade which used the New Zealand Import Licencing Schedules.
References


Bureau of Industry Economics (1986), Manufacturing Industry Productivity Growth: Causes, Effects and Implications, Research Report 21, (AGPS, Canberra)


(1988b), The Impact of Microelectronics on Scale and Competitiveness in Australian Manufacturing: Case Studies of Automotive Products Industries, Research Report No. 27, (AGPS, Canberra)


Corden, W.M. (1972), ‘Economies of Scale and Customs Union Theory’, Journal of Political Economy, Volume 80, Number 3 (May/June)


Harris, Richard and David Cox (1984), *Trade, Industrial Policy, and Canadian Manufacturing* (Ontario Economic Council, Toronto)


Owen, Nicholas (1983), *Economies of Scale, Competitiveness, and Trade Patterns within the European Community* (Oxford University Press, Oxford)


1 Some recent studies include Balassa and Bauwens (1987) and Marvel and Ray (1987).

2 For a review see Bollard (1986).

3 Made-to-measure tariffs are tariffs set at a level just high enough to cover average costs plus normal profits so that there are no tariff revenues and no excess profits (Corden, 1972, p409).

4 See for instance, Corden (1972), Pearson and Ingram (1980) and Wonnacott and Wonnacott (1967, pp285-286). Empirical evidence that is consistent with average-cost pricing is provided by Hall (1980).

5 Diseconomies of scope arise when additional costs are imposed by the manufacture of more product types or variants. For instance, specialisation allows cost savings by permitting production facilities to be dedicated to the speciality thus avoiding costs of production flexibility such as the downtime required to switch to production of different variants.

6 It is apparent that exploitation of economies of scale (and perhaps diseconomies of scope) may leave ‘water in the tariffs’ which allows reductions in tariff rates on ROW imports.

7 This is also the case in the model of Pearson and Ingram (1980, p1005). The emphasis of the present model on intra-industry trade makes the assumption more plausible than in the inter-industry case.

8 For $\beta = 1$, $\omega = \frac{1}{\epsilon}$, $e_a = e_b = e$ and $\xi_a = \xi_b = \xi$ we have

$$p_{\alpha} = p_{\beta} = \left| 1 + \frac{\epsilon}{1 - 2\omega} \right|$$

In the presence of scale economies ($e < 0$), prices fall when $1 - 2\omega > 0$.

9 There are also methodological reasons for believing that the impact shipping costs will not be as high as expected. A full discussion of the impact of shipping costs and some estimates of their impact on the results of the model may be found in BIE (1989).

10 The negative trade creation in some sectors is not the same as trade diversion since the new trade is diverted not from third country imports but from domestic production.

11 For a discussion see Blinder (1980).

12 Brecher (1974) has shown that free trade can reduce employment and social welfare in the presence of unemployment due to real wage rigidity.