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INKA HAVRILA
PEMASIRI GUNAWARDANA

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Inka Havrila
and
Pemasiri Gunawardana

School of Applied Economics and Centre for Strategic Economic Studies
Victoria University

ABSTRACT

Australia's share of intra-industry trade (IIT) in its total trade of textiles and clothing (TAC) is one of the lowest among the OECD countries. However, over the recent years there has been a rising trend in Australia's IIT in some categories of TAC products. The purpose of this paper is to analyse the extent and determinants of Australia's bilateral IIT in TAC. The Grubel-Lloyd index is used to measure the extent of IIT, and econometric models are developed and estimated using the Tobit model estimation procedure to analyse the determinants of Australia's bilateral IIT in TAC with eleven of Australia's major trade partner countries. The findings from the estimated model for textiles indicate that, as expected, the extent of Australia's bilateral IIT in textiles increases with expanding average market size, average per capita income, and openness, and greater participation in trading agreements between Australia and trading partners. However, as expected, the extent of Australia's bilateral IIT in textiles decreases with increasing differences in average market size, average per capita income and the distance between Australia and trading partners. Contrary to expectations, increases in average capital to labour ratio seems to reduce the extent of Australia's bilateral IIT in textiles. The results from the estimated model for clothing reveal that, as expected, the extent of Australia's bilateral IIT in clothing increases with increasing average per capita income and greater participation in trading agreements, while it decreases with increasing difference in average per capita income between Australia and trading partners. However, in contrast to expectations, Australia's bilateral IIT in clothing decreases with increasing average market size, while it increases with increasing difference in average market size, between Australia and trading partners.

KEYWORDS

Intra-industry trade, textiles, Grubel-Lloyd index, Tobit model, determinants of Australia's bilateral IIT, capital to labour ratio

Address for Correspondence:
Dr. Inka Havrila
Email: Inka.Havrila@vu.edu.au
Dr. Pemasiri Gunawardana
Email: P.J.Gunawardana@vu.edu.au
School of Applied Economics
Victoria University
PO Box 14428, Melbourne City
MC Vic 8001, Australia

INTRODUCTION

Intra-industry trade (IIT) occurs when a country both exports and imports different varieties of products that belong to a broad product category. Most of today's world trade, in particular trade between industrialised economies, involves IIT. The demand side factors that give rise to IIT are diversity of consumer incomes, tastes and preferences, and consumers' love of variety. Monopolistically competitive industries with firms producing differentiated products under internal economies of scale facilitate the countries participating in IIT. [1]

Since the 1970s, studies on IIT have focussed on theoretical foundations of IIT, the measurement of the extent of IIT and empirical analysis of patterns and the determinants of IIT. Grubel (1970) Grubel and Lloyd (1975)Lancaster (1980), Helpman (1981), Krugman (1981), Bergstrand (1983; 1990), Tharakan (1984), Greenaway and Milner , Balassa (1986a), Balassa (1986b), Balassa and Bauwens (1987), Vona , Menon and Dixon and Gullstrand (2002) are major pieces of work among the large body of literature on the subject of IIT.

A number of previous studies have analysed the various aspects of Australia's IIT (for example, Grubel and Lloyd (1975), Siriwardana (1990), Ratnayake and Jayasuriya (1991), Ratnayake and Athukorala (1992), Menon (1994) and Menon *et al*. (1999). However, this paper is the first to deal with the extent and determinants of Australia's bilateral IIT in textiles and clothing. [2] This paper makes an important contribution by analysing the extent and determinants of Australia's bilateral IIT in textiles and clothing (TAC) with eleven major trading partner countries, using data for the period 1970 to 1999 which covers both pre- and post-trade liberalisation periods.

The paper is structured as follows. In the following section, an analysis of the extent of Australia's IIT in TAC is presented. Econometric models of the determinants of bilateral IIT in TAC are specified, hypotheses to be tested introduced, and the data and data sources discussed in the section. The presentation and discussion of results from the empirical estimation of the models are then presented. Conclusions are presented in the final section.

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[1] Internal economies of scale occur when the cost per unit depends on the size of firm in an industry but not necessarily on the size of that industry (Krugman and Obstfeld, 1994, pp. 116-116).

[2] The most widely used and well known measure of the extent of IIT is the Grubel-Lloyd index of IIT. The index for a country *i*'s IIT in a product *k* with the rest of the world is: $1 - [(X_{ik} - M_{ik}) / (X_{ik} + M_{ik})]$, where X is exports, M is imports and the absolute value of $X_{ik} - M_{ik}$ is considered. The index for a country *i*'s IIT in a product *k* with country *j* is: $1 - [(X_{ijk} - M_{ijk}) / (X_{ijk} + M_{ijk})]$, where X is exports, M is imports and the absolute value of $X_{ijk} - M_{ijk}$ is considered.

AUSTRALIA'S IIT IN TAC PRODUCTS

The ensuing discussion of the extent and trends of Australia's IIT in TAC is based on the data drawn from the National Asia Pacific Economic and Scientific Database (NAPES), compiled by the Australian National University and Victoria University. At the time of the analysis, a complete data set for TAC was available for the period 1965 to 1999.

Based on the three-digit Standard International Trade Classification (SITC), Australia's IIT in TAC with the rest of the world (ROW) has been generally low over the period 1965 to 1999 (Appendix 1). Between 1965 and 1975 the extent of IIT in clothing was significantly higher than IIT in textiles where the values of the index were closer to zero. Between 1975 and the late 1980s both categories experienced a more or less similar, relatively stable and low level of IIT. However, since the late 1980s the values of the IIT index have shown a generally increasing trend for both textiles and clothing. A comparison of IIT indices for textiles and clothing reveals that whereas Australia's IIT in clothing in 1965 were almost four times higher than IIT in textiles, in the 1990s textiles not only drew levels with clothing but also demonstrated a higher overall level of IIT than clothing did. It is evident that Australia has demonstrated a remarkable growth in IIT in most categories of TAC between 5-10 percent in the 1960s to between 30-50 percent in the 1990s.

When the individual subcategories of textiles are considered, it is evident that Special textile products (SITC 655) have maintained the highest level of IIT over the period. However, the highest increase in IIT was marked by category 657 – Floor coverage, tapestry etc. (just over a sixteen-fold increase), followed by category 654 – Lace, ribbons, tulle, etc. (approximately thirteen-fold increase), 652–Cotton fabrics, woven and 656 – Textile products not elsewhere specified (both around nine-fold increase). The lowest, a two-fold growth in IIT is observed in category 651 – Textile yarn and thread. A composite category of all women, men, and children clothing made of the material other than fur have experienced a significantly lower level of IIT than in category 842-Fur-clothing.

Based on the examination of the extent of the total bilateral trade (exports + imports) between Australia and other countries for the period 1970 to 1999, the following countries have been identified as Australia's major trading partners for TAC: China, Hong Kong, India, Japan, Korea, New Zealand, Taiwan, United Kingdom, and the United States. In the 1970s, Australia

experienced a low level in both textiles and clothing (Appendix 2). Whereas in the 1990s, the bilateral IIT with some countries continued to be low in some categories, in other categories the bilateral IIT increased. Cases in point are China, India, Korea, and Taiwan. In the 1990s, for the most categories of textiles and both categories of clothing, the bilateral IIT between Australia and Hong Kong, the United Kingdom, and the United States rose significantly. An examination of the historical trend of Australia's bilateral IIT in TAC with its trading partners reveals that New Zealand is Australia's major trading partner in intra-industry trade of both textiles and clothing.

THE MODELS, HYPOTHESES AND DATA

As discussed the extent of Australia's IIT in TAC varies across the trading partners. In this section, the models are developed and the hypotheses concerning the effect of various country characteristics on the extent of bilateral IIT are specified The Grubell-Lloyd index is adopted here to measure the extent of IIT and is used as the dependent variable. The choice of independent variables (country- and industry-specific variables) stems mainly from the studies of Bergstrand (1990), Ratnayake and Athukorala (1992), Lee and Lee , Narayan and Dardis , Somma , Matthews , Stone and Lee , Thorpe , Torstensson , Nilsson , Blanes and Martin , Sharma , and Sharma .

THE MODELS

The models specifying the determinants of bilateral IIT in TAC between Australia and its eleven major trading partners (Equations 1 and 2) and the justification of the specified variables are presented below.

$$IITT_{it} = \delta_0 + \underset{(+)}{\delta_1 ANI_{it}} + \underset{(-)}{\delta_2 DANI_{it}} + \underset{(+)}{\delta_3 ACI_{it}} + \underset{(-)}{\delta_4 DACI_{it}} + \underset{(+)}{\delta_5 AKL_{it}} + \underset{(-)}{\delta_6 DKL_{it}} + \underset{(-)}{\delta_7 DIST_i} + \underset{(+)}{\delta_8 OPEN_{it}} + \underset{(+)}{\delta_9 TAGR_{it}} + \varepsilon_{it} \quad (1)$$

$$IITC_{it} = \phi_0 + \underset{(+)}{\phi_1 ANI_{it}} + \underset{(-)}{\phi_2 DANI_{it}} + \underset{(+)}{\phi_3 ACI_{it}} + \underset{(-)}{\phi_4 DACI_{it}} + \underset{(+)}{\phi_5 AKL_{it}} + \underset{(-)}{\phi_6 DKL_{it}} + \underset{(-)}{\phi_7 DIST_i} + \underset{(+)}{\phi_8 OPEN_{it}} + \underset{(+)}{\phi_9 TAGR_{it}} + \varepsilon_{it} \quad (2)$$

Expected sign of each coefficient is shown in parentheses underneath each variable.

$IITT_{it}$ = Grubel-Lloyd intra-industry trade index in textiles between Australia and Australia's trading partners (*i*) in period *t*

ANI_{it} = average national income of Australia and a trading partner in period *t*

$DANI_{it}$ = absolute difference in national income of Australia and a trading partner in period *t*

ACI_{it} = average per capita income of Australia and a trading partner in period *t*

$DACI_{it}$ = absolute difference in per capita income of Australia and a trading partner in period *t*

AKL_{it} = average capital to labour ratio of Australia and a trading partner in period *t*

DKL_{it} = absolute difference in capital to labour ratio of Australia and a trading partner in period *t*

$DIST_i$ = distance between Australia and a trading partner

$OPEN_{it}$ = openness of Australia and a trading partner in period *t*

$TAGR_{it}$ = membership in trading agreements (Australia and a partner) in period *t*

ε_{it} = error term.

VARIABLES AND HYPOTHESES

Average National Income (ANI)

It is argued that the larger the total market, as measured by average national income, the larger the scope for economies of scale for differentiated products and for the demand for those products. Thus, the greater the ANI of Australia and its trading partners, the greater is the extent of IIT between them. A *positive* parameter estimate with the variable *ANI* is therefore expected.

Difference in Average National Income (DANI)

A corollary of the above hypothesis is that if two countries have different average market sizes, the scope for IIT diminishes. Thus, the market size/demand would not sustain preconditions for the intensity of IIT. It is not the size of the population but the size of the national income that matters, so the level and the differences in income between Australia and trading partners are expected to absorb the effect of a country's market size and its difference on IIT. The absolute

differences in Australia's trading partners' incomes are expected to have a *negative* impact on the bilateral IIT between Australia and its trading partners.

Average per capita income (ACI)

It is assumed that with a rising level of income, the demand for variety (including imported goods) increases, leading to a higher IIT. So, the larger the level of Australia's and its trading partners' average per capita incomes, the greater would be the volume of bilateral trade between them. It is also hypothesised that this demand side effect of per capita income is closely related to the degree of economic development between two countries involved in bilateral IIT. The rationale behind this argument is that a higher stage of economic development is to be reflected in a higher level of per capita income. This in turn creates a higher capacity to innovate and supply differentiated products and communicate information about those products to potential customers. Thus, a *positive* parameter estimate for the variable ACI is expected.

Differences in Average per Capita Incomes (DACI)

It is hypothesised that the greater per capita income differences between countries are likely to create greater differences in demand patterns, a lower potential for the trade of differentiated products and ultimately lower IIT. The *negative* sign of the coefficient for the variable representing the difference in the levels of per capita income is therefore expected.

Average of and Difference in Capital to Labour Ratio (KL and DKL)

The countries with high capital-labour ratios are more likely to produce differentiated products and therefore, to be more involved in IIT. It is expected that the average capital to labour ratio (*AKL)* will have a *positive* effect, while the difference in the capital to labour ratio *(DKL)* a *negative* effect on the extent of IIT in TAC between Australia and a trading partner.

Distance (DIST)

The geographical position of a country affects IIT from two major aspects, the role of information in a market for differentiated products and the role of transportation costs. Low communication and low transportation costs are a prerequisite for an intense IIT between two countries. A higher degree of product differentiation is associated with a greater need for informing consumers about available variety and brands of those products. It is expected that with an increasing distance between Australia and its trading partners it would be more difficult

and more costly to spread the information and to deliver products to potential consumers. Therefore, a *negative* effect of distance on the extent of IIT is hypothesised.

It is probably reasonable to argue that with the evolution of communication technology and globalisation of educational services these 'barriers' to trade have been gradually diminishing in recent decades. Despite these advancements, given Australia's 'remote' geographic position it is considered to be relevant to include a variable accounting for these 'natural' trade barriers in the model.

Openness (OPEN)

It is hypothesised that the extents of trade barriers in Australia and in the trading partner countries restrict the volume and the range of products to be traded between them, and consequently the extent of IIT between Australia and its trading partners. Desirably, the variable accounting for the effect of tariff and non-tariff restrictions would be included in the model of bilateral IIT with Australia's major trading partners. This would require comparative data on barriers imposed by individual trading partners. However, due to numerous different forms of non-tariff barriers as well as due to the lack of data on tariff and non-tariff trade restrictions imposed by various countries it is unfeasible to construct a complete measure. Therefore, an indirect measure of their effect has to be applied. In view of the fact that alternative measures employed in empirical studies provide mixed results, it was decided to include 'openness' *(OPEN)*, measured as the proportion of total trade to the country's GDP. [3] While a *negative* relationship between the trade barriers and the extent of IIT is expected, given the indirect measure of this factor applied in this paper, the sign of the parameter estimate with the variable *OPEN* is expected to be *positive*.

Membership in Trading Agreements and other Integration Schemes (TAGR)

In view of the fact that a number of empirical studies confirmed a possible effect of integration on the extent of IIT, a dummy variable is specified to test whether taking part in various integration schemes by Australia and its trading partners increases the intensity of bilateral IIT. Australia has international trade obligations under a number of regional trade agreements including the Australia New Zealand closer Economic Trade Relations Agreement (ANZERTA) with the objective of liberalising bilateral trade between the two countries (since 1983),

[3] This measure is subject to a major shortcoming because even if a country has a high trade-GDP ratio, it may have distorting trade policies or the government intervention may take place.

Australia has also a preferential trade agreement, the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) that gives non-reciprocal benefits to the Forum Island countries. Under this agreement, TAC exports from these countries to Australia receive duty-free entry into Australia (IC 1997). Since 1989, Australia and a number of trade partner countries have become members of the Asia Pacific Economic Cooperation (APEC), which accounts for around seventy percent of Australia's trade (IC 1997). APEC is based on the voluntary commitments of its members to non-discriminatory 'open regionalism' to achieve free and open trade and investment no later than 2020, with industrialised APEC members to do so by 2010 (IC 1997, p. G6-G.7) . The membership in regional trading agreements, customs unions and the like, is expected to have a *positive* influence on bilateral IIT in textiles and clothing.

DATA AND DATA SOURCES

The data for the analysis were obtained from various sources.[4] The selection of Australia's trading partners was based on the historical data of the bilateral trade in TAC between Australia and the individual countries of the world during the period 1970 and 1999. The examination of the data showed that while some countries have been significant trading partners in TAC throughout the period, the position of some countries has changed. Some countries lost their significance, while others become important trading partners in TAC in recent years. Based on the historical data, the following countries have been included in the analysis: China, Hong Kong, India, Indonesia, Italy, Japan, Korea, New Zealand, Singapore, United Kingdom, and the United States.[5]

The *dependent* variable is the Grubel-Lloyd intra-industry trade index, *IIT*, expressed in percentages, thus it takes values between 0 and 100. The intra-industry trade index for Australia and Australia's trading partners were extracted from the NAPES database. The average values of the indices were calculated at the three-digit level of aggregation for Australia and each trading partner included in the analysis.

The majority of the data for explanatory variables was extracted from the National Asia Pacific Economic and Scientific Database (NAPES), compiled by the Australian National University

[4] A complete set of data used in the estimation of econometric models of bilateral IIT between Australia and its major trading partners is available on request from the authors.
[5] Initially, Taiwan was also included however the data limitation on some of the critical explanatory variables prevented its inclusion in further analysis.

and Victoria University, and various official databases integrated in the dXEconData. The analysis covers the period 1970 to 1999. As in most empirical studies, the proxy variables had to be applied for a number of independent variables.

The extent of trade barriers is represented by the ratio of total trade to GDP *(OPEN),* expressed in percentages. The information was obtained from the dXEconData, the Penn World Tables.

The variables *ANI*, the average level of the total national income, and *ACI*, the average per capita income and their differences, *DANI* and *DACI*, are expressed as the average and the absolute difference of Australia's and a trading partner's GDP and per capita GDP, respectively. The data were obtained from the World Bank World Tables, dXEconData database. They are expressed in the 1995 $US dollars.

The variables capital to labour ratio, *K/L* and its difference, *DKL*, representing the effect of technological advancement, is measured as the average of the ratios of gross capital formation per capita and their absolute differences for Australia and its trading partners. The variables were calculated from the information extracted from the World Bank World Tables, dXEconData. They are expressed in $US, at the 1995 constant values.

The distance between Australia and each trading partner is measured in nautical kilometres between Sydney, Australia and the capital city of the relevant countries.[6] The information was obtained from the website http://www.indo.com.

A dummy variable, *TAGR,* was included to account for the effect of Australia and trading partner country's membership in any form of trading agreement or a closer economic relation (such as with New Zealand). For New Zealand, the dummy variable equals zero (0) for the period 1970 to 1982 and one (1) for the period 1983 to 1999. For other APEC member countries the variable equals zero for 1970 to 1988, and one for 1989 to 1999.

[6] Often nautical miles are used. One nautical mile = 1.852 kilometres.

ESTIMATION PROCEDURES AND RESULTS

In analysing the determinants of IIT, there are no *a priori* criteria for selection of the functional form of the relationship between the dependent and independent variables. However, given the index form of the dependent variable, the IIT index, which takes values between zero and one hundred (when expressed in percentages), the estimation of linear or log-linear specifications may violate the theoretically feasible range $0 \leq \text{IIT} \leq 100$. To guarantee that such a situation does not occur, a logistic function using the Maximum Likelihood method is often applied that secures estimated values between zero and one.

However, Balassa and Bauwens and Lee and Lee pointed out, while the logit transformation guarantees that predicted values are within *0* and *1* (or 100), it does not include 0 and 100. Some studies (Loertscher and Wolter (1980), Tharakan (1984), Balassa (1986a), Balassa and Bauwens (1987), Lee and Lee (1993) applied the non-linear OLS method based on the logistic transformation of the logit that permits the inclusion of zero values.

Examination of the data reveals that there are some zero values for the dependent variable in the models of determinants of bilateral IIT between Australia and its trading partners. To ignore these zero observations and apply the OLS method would create bias and inconsistency in the parameter estimates. Therefore, a version of the probit model, the Tobit censored model, based on the maximum likelihood estimation is applied, using Eviews econometric package, to estimate the determinants of Australia's bilateral IIT in textiles and clothing.[7] The analysis is based on the pooled data across countries and time.

Statistically, the Tobit model can be expressed as:

$$y_i^* = x_i'\beta + \sigma\varepsilon_i \qquad (3)$$

Where y_i^* is the latent variable, σ is a scale parameter and is estimated along with β, by maximising the log likelihood function. In the censored Tobit regression model Eviews allows for both left and right censoring at arbitrary limit points so that the observed data, *y,* are given by:

[7] Even if the value of the dependent variable is zero, there exist corresponding values for the explanatory variables Kennedy, P. (2003).

$$y_i = \begin{cases} l_i & if \quad y_i^* \le l_i \\ y_i^* & if \quad l_i < y_i^* \le r_i \\ r_i & if \quad r_i < y_i^* \end{cases} \qquad (4)$$

Where l_i and r_i are fixed numbers representing the left and the right censoring points respectively. Applying this to the present situation, the left censoring point is zero (since the lower limit of the IIT index is zero) and the right censoring point is 100 (the upper limit of the IIT index is 100 percent). The models of the bilateral IIT were also re-estimated by the OLS method with small values (0.000001) substituted for zero values of the dependent variable, IIT. The results are by and large the same as if the models are estimated using the Tobit approach. The results from the estimation of the Tobit models are presented in Tables 1 and 2. As it can be observed from the tables, in addition to results for the regression coefficients, Eviews program reports an additional coefficient, SCALE, which is the estimated scale factor σ. This scale factor may be used to estimate the standard deviation of the residual. [8]

The results from the estimation of the determinants of the bilateral IIT in *textiles* are generally in accordance with expectations (Table 1). The coefficient for the variable representing the difference in capital to labour ratio, measured as the absolute difference in the gross capital formation per capita, is the only insignificant estimated coefficient and its sign is also contrary to our expectations. The signs of all the significant coefficients are as anticipated, except for the average and differences of capital to labour ratio.

In accordance with the theoretical proposition and the results of other studies, including Narayan and Dardis (1994) and Thorpe (1995), the coefficient for the variable *ANI*, the *average national income*, accounting for the effect of the 'economic size' of trading countries, is positive and statistically significant at the 1 percent level. Thus, it appears that a larger market provides a more diverse demand structure and better opportunities to exploit economies of scale in production.

Table 1: Intra-Industry Trade in Textiles, Australia and Eleven Trading Partners, 1970-1999

Dependent Variable: IITT			
Variable	Coefficient	z-ratio[a]	P-value

[8] It is equal to $\sigma * \pi / \sqrt{6}$ (Eviews Manual, 2003, p. 410).

C	25.677	9.813	0.000***
ANI	0.00003	4.064	0.000***
DANI	-0.00001	-4.222	0.000***
ACI	0.002	8.086	0.000***
DACI	-0.001	-8.702	0.000***
AKL	-0.005	-4.828	0.000***
DKL	0.001	0.864	0.388
DIST	-0.002	-8.728	0.000***
OPEN	0.083	4.538	0.000***
TAGR	10.087	5.998	0.000***
SCALE: C(11)	10.120	25.461	0.000***
R-squared	0.664	Mean dep. Var.	21.846
Adj. R-squared	0.654	S.D. dep. Var.	17.227
S.E.	10.137	A.I.C.	7.465
S.S. squared resid.	32679.19	S.C.	7.592
Log likelihood	-1216.974	H-Q.	7.515
Avg. log likelihood	-3.699		
Left censored obs.	4	Right censored obs.	0
Uncensored obs.	326	Total obs.	330

***Significant at the 1 percent level.; [a] z-ratio in the Tobit model has the same function as the t-ratio in the OLS estimation.

On the other hand, the greater *inequality in national income* indicates greater dissimilarity between the countries. Using the differences in gross national product as a proxy for economic inequality, it was found that IIT between countries decreases with greater differences in their average national incomes. The same results were found, for instance, by Balassa (1986b), Culem and Lundberg , Balassa and Bauwens , Narayan and Dardis , Stone and Lee , Nilsson , and Blanes and Martin .

A positive effect of the *level of economic development* on IIT is evident. The coefficient of the average level of per capita national income is positive and highly significant. On the other hand, IIT is likely to decrease as the demand patterns, generated by the differences in per capita incomes, diverge. It is indicative by a negative and statistically significant coefficient for the difference in per capita national income.

Contrary to our expectations, the empirical results show a negative and significant effect of the average *capital to labour ratio* and no significant effect of the difference in the capital to labour ratio on the bilateral IIT. While it is difficult to provide a reasonable explanation for these results, they are observed in both models (textiles and clothing). One reason may be that textiles are considered labour-intensive commodities and perhaps the gross capital formation

per capita is an inappropriate proxy to measure the effect. Or the effect of this variable may interact with the variable reflecting product differentiation.

Distance is found to have a negative effect on the level of IIT. The coefficient for the variable is significantly negative at the 1 percent level, suggesting that transportation and transaction costs are relevant determinants of IIT in textiles. Similar results are reported by Culem and Lundberg , Balassa and Bauwens , Narayan and Dardis , Stone and Lee , and Blanes and Martin .

The outcomes of the analysis of the determinants of IIT between Australia and the rest of the world presented in the previous section suggested that the extent of trade barriers inhibits IIT. Empirical findings from the estimation of the bilateral IIT support these indications. The estimated coefficient for the variable *OPEN*, the proportion of total trade to the country's GDP, an indirect measure of the trade barriers is, as expected, positive and statistically significant at the 1 percent level.

The coefficient for *TAGR*, representing the membership in various trade agreements, is highly significant with a positive sign, suggesting that trade agreements and closer economic relations encourage IIT. This finding is in line with some other studies, including Ratnayake and Athukorala , Narayan and Dardis , and Thorpe . Sharma , however, observed a statistically insignificant parameter estimate for the variable representing close economic integration with New Zealand. He associates this result with the fact that New Zealand's small share of Australia's overall trade which limits its effect on Australia's IIT in manufacturing. Thorpe encountered similar experience in the analysis of the determinants of Malaysian IIT in manufactured products. While the positive coefficient for the ASEAN dummy indicated relatively higher IIT with member countries, the coefficient for the dummy variable for Singapore, a trading partner with a relatively higher level of IIT, was negative and statistically insignificant effect.

Turning to the analysis of the determinants of bilateral IIT in *clothing*, presented in Table 2, the results show the disparity between the models for textiles and clothing in both the sign and the significance of the coefficients. Whereas the model specifications are the same, it appears that the effect of the variables on the intensity of IIT in textiles and clothing differs. In presenting the

results from the estimation of the model for clothing, the focus of discussion is, therefore, on the differences between the results from the two models.

With regard to specific hypotheses, it is observed that the intensity of Australia's IIT in clothing is influenced predominantly by the average per capita income, its differences between trading partners, and the participation in various forms of trade agreements, indicating closer relations between trading countries.
The effect of the country size, measured by the average national income of the trading partners varies both in sign and in significance between the models for the two industries. While average national income and differences in incomes are statistically significant, although of a negligible magnitude in textiles, in the model for clothing while also statistically significant, and in effect equal to zero, they have unexpected signs. Due to the conflicting results between the two models, it is difficult to make any general conclusions about the effect of the average country size and its differences on the intensity of IIT.

On the other hand, a consistent positive relationship between the average per capita income and IIT support the hypotheses that IIT is more intense, the higher the level of economic development. As expected, the differences in the level of economic development have a negative influence on IIT in clothing.

The coefficients of the average capital to labour ratio and its absolute difference as in the model for textiles, show unexpected signs, however, are statistically insignificant, indicating that the gross capital formation per capita has no significant effect on the bilateral IIT in clothing between Australia and its trading partners.

In contrast to what was observed in the analysis of the bilateral IIT in textiles, the distance and trade barriers do not appear to have any influence on the bilateral IIT in clothing. The coefficient estimates have unexpected signs and are statistically insignificant. It seems that people's 'affection for clothes' is insensitive to any kind of restrictions. With regard to distance, Stone and Lee (1995) obtained a positive coefficient for distance among the countries in an analysis of IIT in a non-manufacturing sector. They suggest that it may reflect the unique trading patterns between some of the countries.

Table 2: Intra-Industry Trade, Clothing, Australia and Eleven Trading Partners, 1970-1999

Dependent Variable: IITT			
Variable	Coefficient	z-ratio[a]	P-value
C	8.476	2.344	0.019
ANI	-0.00005	-3.574	0.000***
DANI	0.00002	3.602	0.000***
ACI	0.002	4.555	0.000***
DACI	-0.001	-5.865	0.000***
AKL	-0.0005	-0.331	0.741
DKL	0.0005	0.652	0.514
DIST	0.0004	1.273	0.203
OPEN	-0.034	-1.327	0.184
TAGR	11.731	5.074	0.000***
SCALE: C(11)	14.1998	24.684	0.000***
R-squared	0.450	Mean dep. Var.	18.984
Adj.R-squared	0.433	S.D. dep. Var.	18.484
S.E.	13.918	A.I.C	7.7436
S.S. squared resid.	61795.93	S.C.	7.870
Log likelihood	-1266.70	H-Q.	7.794
Avg. log likelihood	-3.838		
Left censored obs.	23	Right censored obs.	0
Uncensored obs.	307	Total obs.	330

***Significant at the 1 percent level; [a] z-ratio in the Tobit model has the same function as the t-ratio in the OLS estimation.

Similar to textiles, the membership in trade agreements seems to be the most influential factors of the intensity of bilateral IIT in clothing. In accordance with expectations, the variable *TAGR*, is positive and highly significant.

CONCLUSIONS

Australia appears a rather atypical industrial country in relation to the IIT share in TAC products, with one of the lowest IIT index for TAC among the OECD countries. However, a rising trend in intra-industry trade in some of these categories of TAC products in recent years indicates that Australia increasingly exports and imports differentiated TAC products. One of the contributing factors to an increase in Australia's IIT in recent years might be a significant reduction in the level of assistance to the TAC industries, especially since the mid 1980s.

The results of the analysis of determinants of Australia's bilateral IIT indicate that the intensity of the IIT in *textiles* between Australia and its eleven major trading partners is likely to increase with an increasing levels of economic development (per capita income) and average market size as indicated by the level of average national incomes, decreasing differences in the market

size and income levels, and the participation in trade agreements and other cooperation forms. In other words, IIT in textiles is more likely to occur between countries with similar characteristics.

With regard to Australia's bilateral IIT in *clothing* the major explanations of the extent of IIT focuses on the average per capita income, its differences and closer economic relations as suggested by positive and highly statistically significant coefficients with these variables. The results do not provide any support for the role of distance, openness, and the capital to labour ratio. It is likely that these unexpected results are due to inappropriate proxy variables and the limitations in data and the measurement methods. These may be further investigated in future studies employing appropriate variables and more accurate data.

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APPENDIX

Table A1: Intra-Industry Trade, Textiles and Clothing, Australia and the Rest of the World (ROW), (percent), 1965-1999[9]

Year	TEXTILES								CLOTHING		
	Textile Yarn, Fabrics, Made-up Art. (65)	Textile Yarn and Thread *(651)*	Cotton Fabrics, Woven (652)	Woven Textiles, Non-cotton (653)	Lace, Ribbons, Tulle (654)	Special Textile Products (655)	Textile Products n. e. s. (656)	Floor Coverage, Tapestry (657)	Clothing (84)	Not of Fur (841)[10]	Fur Clothing (842)
1965	7.58	15.90	3.55	10.90	3.31	13.80	3.84	3.38	29.10	29.00	37.80
1966	9.43	17.70	4.26	13.20	7.43	18.00	5.58	5.11	32.80	32.40	86.90
1967	12.80	11.40	6.56	15.10	8.74	20.60	26.60	6.17	98.10	98.10	95.10
1968	11.70	13.80	4.82	14.90	8.33	24.10	20.60	4.22	37.30	37.00	97.40
1969	12.30	16.10	7.05	16.60	14.50	21.10	13.20	4.98	38.60	38.20	74.90
1970	14.70	20.00	6.16	19.00	15.60	24.00	16.90	9.19	40.70	40.40	65.50
1971	13.80	20.30	4.78	17.60	18.40	23.90	12.60	9.20	38.40	38.20	69.40
1972	12.40	16.80	3.72	13.60	17.60	29.90	14.80	13.70	32.70	32.50	55.30
1973	11.60	14.40	4.05	12.50	15.20	30.40	14.50	12.40	24.90	24.80	36.40
1974	10.20	14.90	4.10	12.50	12.50	28.10	6.49	5.20	12.00	11.60	96.70
1975	10.80	13.00	4.07	11.90	14.00	35.30	9.28	5.06	12.80	12.30	70.90
1976	8.80	9.69	3.03	8.31	12.90	31.60	5.53	8.75	8.85	7.58	99.90
1977	8.62	7.89	2.69	7.01	8.40	27.50	12.20	9.57	6.58	5.83	80.60
1978	9.13	12.30	2.11	6.29	9.05	33.20	6.31	10.70	7.26	6.66	71.30
1979	11.80	18.30	2.34	7.56	14.40	36.50	5.49	15.70	11.10	10.30	75.90

[9] Compiled from the NAPES database. Numbers within parentheses are the SITC digits for the respective categories.

[10] This is a composite category of all women's, men', and children's clothing made of the material other than fur.

Year	TEXTILES								CLOTHING		
	Textile Yarn, Fabrics, Made-up Art. (65)	Textile Yarn and Thread *(651)*	Cotton Fabrics, Woven (652)	Woven Textiles, Non-cotton (653)	Lace, Ribbons, Tulle (654)	Special Textile Products (655)	Textile Products n. e. s. (656)	Floor Coverage, Tapestry (657)	Clothing (84)	Not of Fur (841)[10]	Fur Clothing (842)
1980	12.30	19.50	2.41	9.53	10.00	35.10	6.32	10.60	13.70	12.40	99.00
1981	12.80	22.60	2.98	7.74	7.01	34.20	5.95	11.40	8.85	7.46	76.90
1982	17.10	34.10	4.20	7.98	6.48	35.20	7.08	21.60	7.71	6.74	58.10
1983	16.30	26.10	5.55	7.48	6.59	32.70	9.10	25.80	9.88	8.83	42.90
1984	12.20	15.70	3.46	8.21	9.58	32.90	9.87	17.50	8.44	7.58	37.50
1985	15.60	24.60	4.60	9.20	11.00	31.40	10.40	20.30	8.91	8.26	39.40
1986	17.50	22.30	5.49	13.60	11.90	27.90	12.80	34.00	12.30	11.40	77.30
1987	14.20	6.43	7.46	12.90	11.30	30.80	21.00	39.20	16.80	15.70	86.40
1988	16.90	6.43	11.80	16.10	9.20	36.00	22.80	38.40	19.00	17.90	99.20
1989	18.40	7.25	12.40	18.60	13.00	38.70	24.60	34.80	21.20	20.50	95.70
1990	21.00	8.92	13.20	15.70	12.10	48.90	29.60	42.00	29.00	28.70	59.50
1991	22.40	10.10	17.90	16.10	19.20	50.80	35.80	39.30	31.40	31.20	51.80
1992	23.10	15.70	13.90	15.90	19.50	52.10	32.20	40.20	29.30	29.00	60.70
1993	26.70	20.60	17.70	18.40	15.40	52.90	33.00	48.40	27.70	27.50	65.80
1994	30.40	23.60	26.00	23.40	21.20	53.80	36.00	48.40	31.00	30.70	74.50
1995	35.40	33.30	35.40	25.80	22.50	53.80	37.70	50.50	30.00	29.80	63.70
1996	39.20	37.90	46.30	28.20	25.70	51.20	40.30	54.30	30.80	30.50	79.90
1997	40.70	45.70	47.10	29.50	28.50	51.00	33.70	56.20	33.10	32.80	91.10
1998	38.00	40.10	36.60	32.40	35.00	44.60	34.00	51.60	29.80	29.50	96.90
1999	37.90	34.90	32.00	36.10	42.70	44.20	34.00	54.90	34.40	34.20	73.10

Table A2: IIT, Australia and Trading Partners, 1970-1999, (percent)[11]

Year	China		Hong Kong		India		Indonesia		Italy		Japan	
	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C
1970	0.02	0.00	48.14	18.30	11.81	0.00	19.39	66.70	1.06	38.22	6.69	32.00
1971	11.02	0.00	45.36	8.57	12.54	1.08	8.30	44.40	2.65	6.20	6.79	18.95
1972	0.43	0.00	33.18	8.71	1.99	1.12	5.45	50.70	7.44	2.05	13.44	3.00
1973	0.00	0.03	29.22	5.32	1.06	0.02	17.16	44.10	1.94	3.68	18.63	11.00
1974	0.00	0.00	32.46	16.03	0.89	0.02	15.36	73.80	3.11	34.11	9.14	18.35
1975	0.30	0.18	31.87	26.08	3.38	0.07	24.91	43.60	5.37	0.04	5.84	7.97
1976	0.00	0.18	26.93	35.97	0.01	0.00	21.59	20.10	7.13	0.97	4.61	5.76
1977	0.00	0.00	30.26	39.70	16.33	0.01	16.03	12.30	2.76	0.25	5.85	4.80
1978	3.09	0.01	21.74	0.76	8.15	0.11	23.47	3.16	1.06	0.09	4.08	5.57
1979	5.80	0.01	29.12	7.09	24.13	0.00	19.16	4.68	2.15	23.22	11.07	13.63
1980	5.74	0.12	23.55	46.86	13.03	0.00	18.47	7.63	1.55	1.68	11.08	11.85
1981	2.81	0.24	17.79	9.01	22.67	0.00	15.51	6.05	0.65	13.00	5.91	6.00
1982	1.72	0.03	20.62	5.95	5.66	0.02	11.99	6.73	0.93	19.67	5.63	6.59
1983	9.79	0.43	21.15	3.24	10.31	0.00	5.17	3.20	0.84	26.26	1.79	4.18
1984	11.42	0.22	19.84	4.32	24.60	0.00	5.03	6.86	3.19	5.46	2.73	3.72
1985	7.46	0.08	26.09	2.80	13.61	0.00	10.80	3.05	2.46	13.30	5.84	8.23
1986	7.02	0.48	32.88	4.54	16.11	0.11	2.63	1.73	2.19	0.94	12.44	9.73
1987	25.95	0.00	34.95	3.28	11.28	0.00	12.85	2.88	18.86	38.56	28.56	15.86
1988	16.65	0.00	37.73	4.24	7.86	0.00	4.59	6.62	9.41	1.86	26.15	36.85
1989	20.03	0.00	40.34	15.02	7.13	0.00	5.82	5.74	5.97	14.69	27.51	31.41
1990	13.17	0.00	44.81	7.05	12.15	0.06	10.83	6.00	2.54	2.73	28.67	34.99
1991	17.36	0.00	48.11	22.75	8.68	0.00	20.65	4.13	8.72	1.72	32.13	36.90
1992	18.47	0.01	54.60	21.10	12.01	0.05	25.68	5.15	7.64	3.29	27.40	42.55
1993	39.13	2.58	49.76	18.52	16.79	0.11	30.35	2.43	10.35	3.58	30.13	44.85
1994	32.01	3.13	46.53	20.35	24.69	0.01	22.31	6.95	18.23	5.10	33.47	37.43
1995	36.74	5.91	52.55	33.90	32.20	0.00	22.95	9.08	15.59	7.70	30.86	34.91
1996	33.84	0.96	50.90	40.55	19.44	0.21	35.70	33.13	9.14	8.80	29.96	35.51
1997	26.23	8.32	58.57	41.10	18.00	0.02	35.50	3.74	9.02	1.04	32.96	53.23
1998	26.15	3.66	59.80	45.25	16.76	0.28	28.35	4.32	16.03	1.24	28.35	42.57
1999	20.44	2.57	61.10	52.40	10.92	0.39	24.64	12.35	.	6.13	31.73	51.50

[11] IIT_T - IIT index for textiles; IIT_C – IIT index for clothing.

Year	Korea		New Zealand		Singapore		United Kingdom		United States	
	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C	IIT_T	IIT_C
1970	24.34	0.74	32.50	17.10	11.99	28.95	3.92	35.30	8.55	39.31
1971	6.16	0.71	44.75	16.40	25.54	31.30	2.03	50.30	14.37	33.55
1972	1.83	0.52	43.00	31.50	44.84	43.45	2.57	33.90	12.36	9.40
1973	4.17	0.25	43.46	20.30	42.06	24.35	2.29	29.35	3.10	8.75
1974	1.59	0.08	39.99	21.52	37.91	44.95	3.19	39.90	1.43	20.57
1975	0.95	0.07	51.62	8.90	29.66	25.85	1.62	29.50	1.60	27.00
1976	1.55	0.15	43.44	3.15	28.70	37.60	1.43	12.30	1.59	18.05
1977	6.00	0.04	43.35	4.71	30.82	36.85	1.80	32.60	1.14	22.40
1978	11.57	0.01	40.57	7.79	30.94	26.85	1.78	37.56	1.14	42.18
1979	7.91	13.84	45.71	24.41	39.04	22.15	2.01	28.28	1.40	16.08
1980	10.19	0.01	42.57	21.87	36.30	20.80	2.15	46.50	2.17	45.20
1981	10.64	0.01	42.66	6.55	45.75	29.25	5.58	35.28	2.22	27.64
1982	13.37	0.04	43.57	12.35	43.67	39.70	10.29	5.05	5.13	24.75
1983	19.48	0.16	42.33	20.23	43.62	48.30	11.11	34.81	15.66	48.75
1984	15.72	0.19	39.51	20.48	53.77	44.50	6.91	11.61	15.31	49.45
1985	11.59	0.02	31.00	17.81	43.85	43.10	4.39	49.57	21.58	48.96
1986	10.64	0.06	40.37	34.65	43.38	42.30	6.67	3.31	29.36	35.79
1987	11.51	0.01	45.61	44.95	41.02	49.65	14.97	8.00	22.28	25.84
1988	12.21	6.59	51.36	43.59	39.15	40.20	21.34	36.10	24.24	32.09
1989	7.45	7.83	54.79	54.35	37.44	40.25	17.51	22.40	20.12	36.06
1990	13.20	12.58	54.90	46.94	51.39	42.90	17.44	52.30	22.63	28.86
1991	10.62	1.42	58.71	52.30	49.93	46.75	17.30	34.40	27.20	24.61
1992	13.87	15.00	57.10	43.32	41.83	38.45	25.44	36.55	24.71	28.72
1993	16.75	46.94	54.83	42.54	37.21	21.00	31.68	49.35	34.22	36.17
1994	18.99	44.70	58.96	50.18	42.68	11.00	30.77	35.85	38.65	37.17
1995	27.02	30.05	65.36	49.71	33.23	13.10	49.07	32.30	39.77	40.97
1996	24.95	36.05	70.43	49.18	29.76	10.95	57.40	44.00	44.12	44.83
1997	28.23	38.00	65.10	55.75	28.11	39.10	54.25	34.75	37.65	35.51
1998	17.57	16.95	70.89	62.20	27.46	29.45	57.78	65.10	42.29	31.89
1999	12.91	3.58	66.71	67.95	34.53	24.25	53.39	73.80	44.70	19.61