PATTERNS AND DETERMINANTS OF AUSTRALIA'S INTERNATIONAL TRADE IN TEXTILES AND CLOTHING

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ABSTRACT

Structural change of textile and clothing industries in Australia has intensified in recent years due to a range of factors including reductions in protection, import competition, shifts in consumer spending, and technological change. This thesis provides a comprehensive analysis of patterns and determinants of international trade in textiles and clothing (TAC) during the period 1965 to 1999. It starts with an overview of the industries in terms of the structure, employment and overall contribution to Australia's economy. Given Australia's long history of the high level protection of TAC industries, the study presents a summary of government policies oriented towards assisting domestic producers from low cost foreign competitors.

The thesis makes a substantial contribution to the general literature on patterns and determinants of trade flows. In addition, the thesis informs the debate on trade and industry policy reforms in Australia in relation to the textiles and clothing industries.

Following a review of measurements of comparative advantage and trade performance, these measures are applied to analyse Australia's comparative advantage and international competitiveness in TAC. The results from the analysis indicate that in spite of high level of government assistance, Australia's TAC did not become internationally competitive. Australia remains a net importer in all TAC products and shows a high degree of comparative disadvantage. There are, however, some indications that trade performance in some of the subcategories, such as 'special textiles' has slightly improved.

After a review of theoretical and empirical studies concerned with export supply and import demand, econometric models of export supply and import demand for TAC are developed and empirically estimated. The results of the estimation indicate that, in the short-run as well as in the long-run, there is a significant positive relationship between the relative price of exports (Australia's export price relative to domestic price of textiles) and export supply of textiles. On the other hand, the effective rate of assistance appears to have a negative effect on export supply of textiles, proportionally more in the long-run than in the short-run. While the relative price does not seem to play a significant role in export supply of *clothing* in the short-run, it emerges as a strong positive determinant of the long-run export supply of clothing.

The outcomes of the analysis show that in the short-run, the import demand for *textiles* does not respond significantly to either the relative price (the ratio of Australia's import price to the domestic price) or income. In the long-run, however, the import demand for textiles is inversely influenced by changes in the relative price and positively influenced by income. In the short-run, except for the negative effect of the relative price none of the other determinants seem to play a significant role in import demand for *clothing*. On the other hand, in the long-run the relative price, income and the effective rate of assistance are important determinants of import demand for clothing. The relative price and the effective rate of assistance have a significant negative effect, while income has a positive and significant effect on import demand for clothing.

The findings of this study on the *extent and trend* of Australia's intra-industry (IIT) trade in textiles and clothing identify that, compared to other developed countries, Australia demonstrates a significantly lower level of IIT in general as well as with respect to TAC.

The analysis of the *determinants* of Australia's IIT in TAC with the rest of the world reveals that the effective rate of assistance is the strongest single factor that has a negative effect on the level of IIT in TAC. Contrary to expectations, there is no empirical evidence for the effect of product differentiation and research and development on IIT in textiles and clothing. With reference to Australia's bilateral IIT with its trading partners, the intensity of IIT in *textiles* appears to significantly increase with an increasing average income, a decreasing distance, decreasing differences in the average income, and with the participation in various regional and bilateral trading and economic cooperation arrangements between Australia and trading partner countries. The most important determinants of Australia's bilateral IIT in *clothing* are the average per capita income, the differences in per capita income, and the participation in various forms of trade agreements. The bilateral IIT in clothing appears to increase most significantly with the participation in trade agreements, followed by increasing average per capita income. The IIT tends to decrease with increasing differences in average per capita income.

The study examined important factors in relation to Australia's trade in textiles and clothing. These are the sectors in which value may be added to primary products, in particular wool and cotton fibres that Australia is well endowed with. A better understanding of the determinants of export supply, import demand, and intra-industry trade is an important prerequisite for making appropriate policy decisions. The findings from the analysis of the key factors that are deemed to influence the export supply of and import demand for Australia's textiles and clothing are expected to be beneficial to exporters as well as importers of textiles and clothing in their operational and planning decisions.

DECLARATION

I, Inka Irena Havrila, declare that the PhD thesis entitled 'Patterns and Determinants of Australia's International Trade in Textiles and Clothing' is no more than 100,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Inka Irena Havrila

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LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
ADF	Augmented Dickey-Fuller (test)
AES	Australian Economic Statistics
AGPS	Australian Government Publishing Service
AIC	Akaike Information Criterion
AMC	Australian Manufacturing Council
ANU	Australian National University
ANZSIC	Australian and New Zealand Standard Industrial Classification
ANZCERTA	Australia and New Zealand Closer Economic Relations Trading Agreement
APEC	Asia-Pacific Economic Co-operation
AR	Autoregressive Process
ARCH	Autoregressive Conditional Heteroscedastic Model
ARDL	Autoregressive Distributed Lag (model)
ARMA	Autoregressive Moving Average
ARIMA	Autoregressive Integrated Moving Average
ASEAN	Association of South East Asian Nations
ASIC	Australian Standard Industrial Classification
ASTEC	Australian Science and Technology Council
ATC	Agreement on Textiles and Clothing
BG	Breusch-Godfrey (test)
CGA	Commonwealth Government of Australia
CIS	Commonwealth of Independent States
CMEA	Council for Mutual Economic Assistance
CPI	Consumer Price Index
CRDW	Co-integrating Regression Durbin-Watson
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DF	Dickey-Fuller (test)
DW	Durbin-Watson (test)
ECM	Error Correction Model
EEC	European Economic Community

EG	Engle-Granger (test)
EPI	Export Propensity Index
ERA	Effective Rate of Assistance
EU	European Union
FDI	Foreign Direct Investment
GCF	Gross Capital Formation
GDP	Gross Domestic Product
G-L	Grubel-Lloyd (index)
GNE	Gross National Expenditure
GATT	General Agreement on Tariffs and Trade
GNP	Gross National Product
GTAP	Global Trade Analysis Project
H-O	Heckscher-Ohlin (model)
HSC	Heteroscedasticity (test)
IEDB	International Economic Data Bank
IAC	Industries Assistance Commission
IC	Industry Commission
ICS	Import Credit Scheme
IDS	Industries Development Strategy
IIT	Intra-Industry Trade
ISIC	International Standard Industrial Classification
JBN	Jarque-Bera Normality (test)
LDCs	Less-Developed Countries
LL	Log-Likelihood
LMS	Lagrange Multiplier (test for serial correlation)
LTA	Long Term Arrangement
MFA	Multi-Fibre Agreement
MIIT	Marginal Intra-Industry Trade
ML	Maximum Likelihood
MPI	Import Penetration Index
MWD	MacKinnon, White and Davidson (test)
NAPES	National Asia Pacific Economic and Scientific Database
NICs	Newly-Industrialised Countries
NIEs	Newly-Industrialised Economies

NECs	Newly-Exporting Countries
NRA	Nominal Rate of Assistance
NX	Net Export (index)
NZ	New Zealand
OECD	Organisation for Economic and Co-operation Development
OLS	Ordinary Least Squares
OAP	Overseas Assembly Provisions
PC	Productivity Commission
PMV	Passenger Motor Vehicles
PP	Phillips-Perron (test)
RBA	Reserve Bank of Australia
R&D	Research and Development
RC	Revealed Competitiveness (index)
RCA	Revealed Comparative Advantage
RESET	Ramsey's (test for functional form misspecification)
RIA	Regional Integration Agreement
RMA	Relative Import Advantage
ROW	Rest of the World
RTA	Relative Trade Advantage
RXA	Relative Export Advantage
SBC	Schwartz-Bayesian Criterion
SIP	Strategic Investment Program
SITC	Standard International Trade Classification
SPARTECA	South Pacific Regional Trade and Economic Cooperation Agreement
STA	Short Term Arrangement
START	Strategic Assistance for Research and Development
TAC	Textiles and Clothing
TCF	Textiles, Clothing and Footwear
TCFDA	Textiles, Clothing and Footwear Development Authority
TMB	Textiles Monitoring Body
TSI	Trade Specialisation Index
TSP	Time Series Processor
UECM	Unrestricted Error Correction Model
UK	United Kingdom

UN	United Nations
VAD	Value Added
VAR	Vector Autoregression
VERs	Voluntary Export Restraints
WS	Weighted Symmetric (test)
XPI	Export Price Index
WTO	World Trade Organisation

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Chapter 1

INTRODUCTION AND PROBLEM DEFINITION

1. 1 The Textile and Clothing Sector Among Australian Manufacturing Industries

In recent years, Australia has been increasingly participating in the global market and has also experienced significant changes in trade performance. Whereas the volume of trade has increased, in relative terms, Australia has not been performing as well as some other OECD countries. This phenomenon can be explained partly by consequences of Australia's earlier *inward-oriented* policies. Despite the fact that Australia had been one of the original signatories to the GATT (General Agreement on Tariffs and Trade)[1], it did not take part in any of the GATT multilateral tariff reductions in the 1950s and 1960s. As a result, by 1970, Australia had the highest tariff rates among developed countries (Anderson and Garnaut 1987, p. 6-7)[2].

When it became apparent that, while manufactured products were increasing their proportion in global trade, the manufacturing sector in Australia was in decline, the government recognised the urgency for long-term structural adjustment. Three Reports on industry policy[3] produced between 1975 and 1979 strongly indicated the need for tariff cuts and greater government assistance during the 'transition' period, to eliminate adverse effects of tariff reductions. However, it was not until the early 1980s that the focus of Australia's industry policy shifted toward the development of

[1] GATT was established in 1947 to pursue global trade liberalisation. It provided a framework for multilateral negotiations designed to reduce tariff and non-tariff restrictions to trade (Cappling and Galligan, 1992, p. 10).

[2] For instance in the late 1960s the effective rate of assistance to manufacturing reached an exceptionally high level of 36 (Athukorala, 1995, p.2). Australia resisted tariff reductions because of its high proportion of agriculture in exports, which was excluded from the GATT negotiations.

[3] Commonwealth of Australia (1975; 1977; 1979).

export-oriented industries, to promoting industry expansion into areas where Australia has a comparative advantage and to reducing assistance to inefficient industries. On recommendations of the Australian Manufacturing Council (AMC), each industry council reviewed the strengths, weaknesses and potential of the relevant industries. The aim was to develop efficient industries and to maintain the overall objective of reducing protection, however, at the same time to control its adverse effects.

The outcome of these policy reforms has been reflected in Australia's trade performance. Improvements have taken place mainly due to the shift in Australia's export composition[4]. Trade has also been shifted from the traditional markets of Japan, the European Union and the United States, towards North- and South-East Asian countries[5]. For instance, annual growth of exports of goods and services to East Asia between 1991 and 1996 was 16 percent, around three times greater than growth of exports to the rest of the world (Bowdich, 1996).

Australia's textile and clothing (TAC) industries have not been immune from these developments. They experienced major structural changes driven by more intense competition, changes in production, consumption and gradual liberalisation of a long distorted international trade in recent years.

Anderson (1992) discussed some effects of global developments in the textile and clothing industries and their implications on Australia and major players in the market. The study concentrates on a descriptive analysis of production and trade in

[4] Factors contributing to the recent growth in manufactured exports are discussed in Sheehan *et al.* (1994); Athukorala (1995), and Dixon *et al.* (1996).
[5] Appendix 2.1 provides a ranking of Australia's top ten trading partners between 1965 and 1999, in a 5-year interval.

textiles and clothing rather than on econometric approach. The time-series on which the analysis is based covers the period between the 1960s and mid 1980s (in some cases late 1980s). Thus, it does not include the period of significant changes that have taken place recently. These changes include notable reduction in the rate of effective assistance to the TAC industries and some value-added and export enhancement programs.

A number of researchers have emphasised, on the one hand, the importance of taking into consideration the effect of various exogenous factors on trade and on the other hand, a lack of studies focusing on these issues. For instance, Vollrath (1991) pointed out that the trade effects of real economic determinants, government intervention, and imperfect information represent challenging areas needing additional research. Caves (1981) emphasised that the effects of policy changes on trade should be considered systematically. Torstensson (1991) indicated the need for more empirical tests at a disaggregated, or industry level. Greenaway and Torstensson (1997) made a point that whereas in recent decades a numerous studies accumulated on the incidence of intra-industry trade (IIT) and on the determinants of country and industry patterns of IIT, it appears that the analysis of industry-specific factors lacks behind. In particular, they called for more of time-series analysis of various aspects of IIT. Stone and Lee (1995) stressed the importance of discerning the changes in trade patterns over time, which, they argue, can be rather significant. Matthews (1995) argued that Australia could expect a significant improvement in intra-industry trade (IIT) with Asia-Pacific countries as the income of those countries increase. She also pointed out that reduction in trade barriers is likely to encourage intra-industry trade for all trading countries. Ratnayake and Athukorala (1992) examined the determinants of IIT in

Australia's trade in manufactures. However, they did not include TAC in their analysis. All these studies have one common feature in that they draw attention to the importance and the need to intensify research into the sources and the effects on trade flows, in particular with reference to specific industry sectors.

A comprehensive study, in particular one including econometric analysis, of Australia's international trade in TAC is yet to be undertaken. This thesis expects to fill some of this gap. Its major objective is an econometric analysis of the patterns and determinants of Australia's international trade in TAC. The study also addresses the role of the TAC in the Australian economy especially in the course of recent trade policy reforms.

1. 2 Objectives of the Study

In light of the issues discussed in Section 1.1, the main objective of this study is to provide a comprehensive economic analysis of the patterns and determinants of Australia's TAC trade. In order to accomplish this goal, the thesis sets the specific objectives in the following dimensions:

- To provide an overview of protection policies and policy reforms towards Australia's textile and clothing industries.

- To apply international trade theory and measurements to examine Australia's comparative advantage in textiles and clothing.

- To develop and estimate econometric models of Australia's export supply of textiles and clothing to the rest of the world and Australia's import demand for textiles and clothing from the rest of the world.

- To analyse the extent and the trends in Australia's intra-industry trade in textiles and clothing.

- To develop and test the hypotheses concerning the determinants of intra-industry trade in textiles and clothing between Australia and the rest of the world and of the bilateral intra-industry trade between Australia and its major trading partners.

To achieve further improvement in Australia's trade performance, it is important to examine particular industries from the perspective of their potential to complement existing exports. However, as Sheehan *et al.* (1994) pointed out, the extent to which the process of penetration to the world market will be successful will depend on the trends of domestic and world demand as well as on the capacity of Australia to respond to emerging changes in market forces. In this study the focus will be on the textile and clothing industries, the sectors in which value may be added to primary products of wool and cotton fibres.

The study expects to make a significant contribution by:

- Providing insights into various economic aspects of Australia's textile and clothing industries.

- Providing a systematic analysis of Australia's inter- and intra-industry trade flows in textiles and clothing.

- Analysing the determinants of intra-industry trade in TAC, some of which may be controlled by industry management to improve trade performance.

- Examining the effects of trade liberalisation within the context of export supply, import demand and the extent of intra-industry trade in textiles and clothing.

The results of this research study may be utilised by the concerned industries, trade analysts, and policy makers in the development of policies and strategies targeted at improving trade performance of the TAC industries. A better understanding of the determinants of export supply, import demand, and intra-industry trade is an important prerequisite for making appropriate policy, strategy, and production decisions.

1. 3 Outline of the Thesis

The structure of the thesis consists of nine chapters. Chapter 2 provides an overview of Australia's textiles and clothing industries, including the history of the Government assistance and trends in TAC trade. In Chapter 3, Australia's comparative advantage in textiles and clothing is analysed using the relevant theoretical concepts and methods of revealed comparative, competitive advantage, measurement of trade specialisation, export propensity, import penetration, and export to import ratio. Chapter 4 focuses on the review and empirical studies pertaining to export supply and import demand. Subsequently, the factors expected to influence the export supply of and the import demand for Australia's textiles and clothing are incorporated into separate model specifications.

Discussion of data and data sources in Chapter 5 is followed by a review of theoretical highlights and potential methodological problems that may arise when dealing with time series data. Next, the chapter includes a preliminary testing of time series properties of the data employed in the empirical analysis of export supply and import demand. Taking into account the diagnostic testing results the models of export supply and import demand are estimated in Chapter 6, using an appropriate estimation technique. Based on the estimated coefficients, the long-run elasticities with respect to individual variables are derived.

Chapter 7 starts with a review of the theory and measurements of intra-industry trade. Then, the focus of the chapter shifts to the analysis of the extent and trend of Australia's intra-industry trade in TAC. Chapter 8 first provides a review of the theory and empirical studies pertaining to determinants of intra-industry trade. Subsequently, the determinants of Australia's intra-industry trade in TAC are incorporated in separate econometric models for textiles and clothing. The analysis is performed separately for the intra-industry trade between Australia and the rest of the world and for the bilateral intra-industry trade between Australia and its significant trading partners. Finally, the major findings of the thesis and suggestions for further research in relation to Australia's international trade in TAC are presented in Chapter 9.

Chapter 2

TEXTILES AND CLOTHING INDUSTRIES AND TRADE - AN OVERVIEW

2. 1 Introduction

The purpose of this chapter is to set the scene for the empirical analysis and modelling to be pursued in Chapters 3 through to Chapter 8, by providing an overview of global and Australian domestic textiles and clothing (TAC) industries and trade. Section 2.2 concentrates on global trends in TAC industries. In Section 2.3 an overview of the TAC industries in Australia is presented. This will include a general description of the industries with respect to their classifications, contribution to the economy, industry concentration, and employment. In this section Australia's TAC trade performance and its position within the world TAC trade environment is also reviewed. Given the traditionally high level of protection afforded TAC industries, in Section 2.4 the history of assistance to TAC industries is summarised. A history and Australia's standpoint to the Multi-fibre Arrangement is highlighted in Section 2.5. A summary of recent trends, opportunities and likely future developments in Australia's TAC industries is provided in Section 2.6.

2. 2 Global Trends in Textiles and Clothing Industries and Trade

Textiles and clothing industries have undergone notable global changes in production, consumption and trade in recent years. Some parts of these industries have played an important role in the economic progress of many developing countries with implications for developed countries, including Australia. Prior to the 1980s, developed countries dominated the global market in textiles. The emergence of East-

Asian newly industrialising economies (NIEs) and the resulting change in comparative advantage have shifted the relative importance of different countries in the world trade in textiles, clothing, and natural fibres. The labour-intensive sectors of these industries, in particular clothing, continue to relocate to relatively low-labour-cost countries, such as China. As a result, the local TAC industries of Australia have lost market share to imports, mainly from those low-labour-cost countries[6]. Other significant factors influencing the industries are the weak demand for and structural change in household budget with a declining share committed to textiles and clothing products[7].

A major contributor to world trade in TAC has been a strong growth in the member countries of Asia-Pacific Economic Co-operation (APEC). This rapid growth was mainly the result of international trade liberalisation under the flag of GATT (General Agreement on Tariffs and Trade) and the World Trade Organization (WTO)[8] as well as of some regional trading agreements. There have been two significant developments within the WTO process. First, the WTO Agreement on Textiles and Clothing (ATC), which appeals to all members to remove all quantitative restrictions on TAC trade by 1 January 2005. Second, the commitment by all participants of the APEC Forum, including Australia, to free trade and investment by 2010 for developed and by 2020 for all APEC countries[9].

[6] For instance, in 1993, the cost of one hour of work in the clothing industry in Australia was the equivalent of 35 hours of work in China (IC, 1997, p. 19).

[7] For instance, share of clothing and footwear consumption in total household consumption between 1990 and 2000 decreased in Australia by 22 percent, the United States by 22.1 percent, France by 21.9 percent, Japan by 19.9 percent, Italy by 9.8 percent and the United Kingdom by 7.3 percent (PC, 2003, p. 159).

[8] The WTO was established in 1995 as an outcome of the Uruguay Round of the GATT.

[9] More details on this issue in relation to Australia will be provided later in this chapter.

To form a better picture of the global TAC trade, Tables 2.1 to 2.7 below show the trend in the world trade in TAC, their share in both total merchandise trade and in manufacture trade. World major exporters and importers and a regional trade distribution in TAC are also presented.

As shown in Table 2.1 the share of *textiles* in the world merchandise trade in 1990 was 3.1 percent and it was at the same rate in 1995. In 2000, the share had declined to 2.5 percent of total merchandise trade, and in 2002 it has declined further to a current level of 2.4 percent of total merchandise trade. The contribution of textiles to the world exports in manufactures has been marked by a steady decline from 4.2 in 1995 to 3.4 in 2000 and 3.2 in 2002.

Table 2. 1: **Share of Textiles and Clothing in World Exports, Selected Years**

	Textiles				**Clothing**			
	1990	**1995**	**2000**	**2002**	**1990**	**1995**	**2000**	**2002**
Share in world merchandise trade	3.1	3.1	2.5	2.4	3.2	3.2	3.2	3.2
Share in manufactures	-	4.2	3.4	3.2	-	4.3	4.3	4.3

- not reported

Source: WTO (2001; 2003), various tables.

Prior to 1980s, exports of textiles were dominated by Europe, in particular by Germany, Italy, Belgium, France, and United Kingdom. Other leading exporters were China, Korea, and Chinese Taipei. While in 1980, European Union's share in the world exports of textiles was 49.4 percent, in 1990 it was 48.7 percent. By 2002 it declined to 34.2 percent. On the other hand, countries such as Turkey, India, Indonesia, Mexico, and Thailand have been increasing their share in the world clothing exports. However, while exports from China and Korea almost doubled, exports from Germany declined from 11.4 percent in 1980 to 9.3 percent in 1995 and

7 percent in 2000. Another significant decline in the world export share was that of Japan, from 9.3 percent in 1980 to 4.7 percent in 1995 and 4.0 percent in 2002.

The share of the United States in the world exports of textiles declined from 6.8 percent in 1980 to 4.8 percent between 1980 and 1995. However, in recent years it has been rising steadily and currently it is at 7 percent of the world exports in textiles. World imports of textiles have been also dominated by Germany (although with a continual decline), China and the United States (at a rising rate), United Kingdom, France, Italy and Netherlands (at a declining rate) during 1980 and 2002. A declining position of Europe in the world imports of textiles is evident. The share of the European Union in the world exports of textiles declined from 46.5 percent in 1980 to 28.8 percent in 2002. Further details regarding world leading exporters and importers of TAC are presented in Tables 2.4 through to Table 2.7. Regional shares in world trade in TAC are presented in Tables 2.2 and 2.3.

Total share of *clothing* in the world merchandise exports between 1990 and 2002 has stagnated at 3.2 percent. The contribution of clothing to world exports in manufactures has also remained at a stable rate of 4.3 percent.

In recent years, clothing exports were dominated by China's rising share in world exports (from 4 percent in 1980, to 9 percent in 1990, to 15.2 percent in 1995, and to almost 21 percent in 2002). Other significant exporters, although with a declining trade share, have been Italy, Germany, France. Korea, United Kingdom, and Thailand. Again, a shift of exports away from Europe is evident.

With a near one quarter of the world imports of clothing in 1990 and almost a one third in 2002, the United States remain the leading importer of clothing. Their share in the world imports of clothing in fact doubled between 1980 and 2002 (from 16.4 percent to 31.7 percent). With Germany's fall (by almost 50 percent), and Japan's rise in the world share in clothing imports between 1980 and 2002, Germany's position as the second largest importer of clothing was taken by Japan.

Table 2. 2: **Regional Shares in World Exports of Textiles and Clothing, 1990, (%)**

Region	**Textiles**	**Clothing**
Western Europe	53.2	43.6
Asia	35.3	43.6
North America	5.5	2.7
Central/Eastern Europe /Baltic States, CIS	-	2.6
Latin America	-	3.3

\- not reported

Source: WTO (2001, Table IV. 70 and 78).

Table 2. 3: **Regional Shares in World Trade, Textiles and Clothing, 2002, (%)**

Region	**Share (%)**			
	Textiles		**Clothing**	
	Exports	**Imports**	**Exports**	**Imports**
Western Europe	38.4	33.4	30.1	41.4
Asia	44.5	28.5	44.8	13.2
North America	8.5	12.9	4.0	32.2
Central/Eastern Europe /Baltic States, CIS	3.7	7.8	5.7	4.4
Latin America	2.7	7.2	10.4	4.1
Africa	0.9	4.8	3.7	1.2
Middle East	1.3	4.4	1.4	2.1

Source: WTO (2003, Data, Chart IV. 11 and 12).

Table 2. 4: **Leading Exporters of Textiles, 1980-2002**

Country	Share in world exports (%)				
	1980	**1990**	**1995**	**2000**	**2002**
Germany	11.4	13.4	9.3	7.0	[a]
China[b]	4.6	6.9	9.1	10.2	13.5
Italy	7.6	9.0	8.3	7.6	-
Republic of Korea	4.0	5.8	8.1	8.1	7.0
Chinese Taipei	3.2	5.8	7.8	7.4	6.3
Belgium-Luxembourg	6.5	6.1	5.1	4.1	-
France	6.2	5.8	4.9	4.3	-
United States	6.8	4.8	4.8	7.0	7.0
Japan	9.3	5.6	4.7	4.5	4.0
United Kingdom	5.7	4.2	3.4	2.7	-
Pakistan	1.6	2.5	2.8	2.9	3.1
India	2.1	2.1	2.9	3.4	3.7
Netherlands	4.1	2.8	2.3	-	-
Spain	1.3	1.4	1.7	-	-
Turkey	0.6	1.4	-	2.3	2.8
Indonesia	0.1	1.2	-	2.2	1.9

Source: WTO (1996, Tab. IV.51); WTO (2001, Tab. IV.72); WTO (2003, Tab. IV. 61).
[a] European Union 34.2 percent. [b] Includes shipments through processing zones. - not reported.

2. 5: **Leading Importers of Textiles, 1980-2002**

Country	Share in world imports (%)				
	1980	**1990**	**1995**	**2000**	**2002**
Germany	12.2	11.1	7.6	5.6	-[a]
China[b]	2.0	4.9	6.8	7.7	8.1
United States	4.5	6.3	6.5	9.4	10.6
United Kingdom	6.3	6.6	4.8	4.1	-
France	7.3	7.1	4.7	4.0	-
Italy	4.7	5.7	3.9	3.7	-
Japan	3.0	3.8	3.7	2.9	2.8
Belgium-Luxembourg	4.2	3.3	2.5	2.2	-
Republic of Korea	0.7	1.8	2.5	1.9	2.0
Netherlands	4.0	3.4	2.2	1.6	-
Canada	2.3	2.2	2.0	2.5	2.4
Spain	0.6	1.9	1.7	2.0	-
Singapore	1.5	1.7	1.3	-	-
Mexico	0.2	0.9	-	3.6	4.0

Source: WTO (1996, Tab IV.51); WTO (2001, Tab. IV): WTO (2003, Tab. IV 61).
[a] European Union 28.8 percent. [b] Includes shipments through processing zones. - not reported.

Table 2. 6: **Leading Exporters of Clothing, 1980-2002**

Country	Share in world exports (%)				
	1980	1990	1995	2000	2002
China [b]	4.0	8.9	15.2	18.1	20.6
Italy	11.3	10.9	8.9	6.6	-
Germany	7.1	7.3	4.7	3.4	-
United States	3.1	2.4	4.2	4.3	3.0
Turkey	0.3	3.1	3.9	3.3	4.0
France	5.7	4.3	3.6	2.7	-
Republic of Korea	7.3	7.3	3.1	2.5	1.8
United Kingdom	4.6	2.8	2.9	2.1	-
Thailand	0.7	2.6	2.9	2.0	1.7
India	1.5	2.3	2.6	2.8	2.8
Portugal	1.6	3.2	2.3	.	-
Indonesia	0.2	1.5	2.1	2.4	2.0
Chinese Taipei	6.0	3.7	2.1	1.5	-
Netherlands	2.2	2.0	1.8	-	-
Mexico	0.0	0.5	-	4.4	3.9

Source: WTO (1996, Tab.IV.58); WTO (2001, Tab. IV. 80); WTO (2003, Tab. IV 61), [a] European Union 25.1 percent. [b] Includes shipments through processing zones. - not reported.

Table 2. 7: **Leading Importers of Clothing, 1980-2002**

Country	Share in world imports (%)				
	1980	1990	1995	2000	2002
United States	16.7	24.3	24.8	31.6	31.7
Germany	20.0	18.4	14.5	9.2	-[a]
Japan	3.7	7.9	11.2	9.4	8.4
France	6.3	7.5	6.2	5.5	-
United Kingdom	6.9	6.3	5.0	6.2	-
Netherlands	6.9	4.3	3.0	2.3	-
Italy	1.9	2.3	2.8	2.9	-
Belgium-Luxembourg	4.4	3.2	2.6	2.3	-
Switzerland	3.5	3.1	2.3	1.5	1.6
Canada	1.7	2.1	1.6	1.8	1.9
Austria	2.3	2.1	1.6	1.2	-
Spain	0.4	1.5	1.6	1.8	-
Sweden	3.2	2.3	1.3	-	-
Mexico[a]	0.3	0.5	1.2	1.6	1.9

Source: WTO (1996, Tab. IV.58); WTO (2001, Tab. IV.80); WTO (2003, Tab. IV 61), [a] European Union 40.3 percent. [b] Includes shipments through processing zones. - not reported.

2. 3 The Textiles and Clothing Industries in Australia

The textiles and clothing industries include all stages of production of textiles and clothing products, from processing of raw materials to producing of final products such as clothes, carpets, linen and industrial textiles. Because of this character, the industries are linked both vertically and horizontally to other parts of the economy, as well as to other activities within the industry itself. A high proportion of the output is used as inputs within the industry, however, textiles are used in other industries, such as car and furniture industries.

In terms of overall economic activity, the TAC industries do not play a significant role in the Australian economy as a whole. Nevertheless, they are an important part of the manufacturing sector in terms of their contribution to manufacturing GDP and employment. The industries account for 4 percent of manufacturing value added (VAD) and 6 percent (excluding outworkers) of manufacturing employment and 0.4 percent of VAD and 0.6 percent of employment in the economy as a whole (PC, 2003). In 2000-01, Australia's textiles, clothing and footwear (TCF) industries generated a turnover of $9 billion, and provided 'factory-based' employment for at least 58,000 people (PC, 2003). The Productivity Commission estimates suggest that in clothing industry there might be an equivalent of 25,000 full time employees engaged in outwork.

2. 3. 1 Industry Structure and Performance[10]

The character of the TAC industries is reflected in the diversity of concentration of various stages of production. The industries are less dominated by large-scale

[10] A significant part of the information for this section has been drawn from the Industry Commission report (1997),

operators than other areas of manufacturing. The small domestic market limits the utilisation of benefits form economies of scale for Australian manufacturers. A high proportion of establishments (around 60 percent) is of small size, with less than 10 employees, in particular in the clothing industry. In contrast, only about 5 percent of establishments employ more than 100 people, however, the latter provides a high proportion of the industries' turnover. Some researchers argue that this may be associated with the varying capital intensity involved in various activities embodied in the TAC manufacturing (Baston, 1996, cit. IC 1997, p. B.11-12). However, many small firms do not have the resources to make capital investments thus, many areas of the industry still operate inefficiently (PC, 2003, p. 32).

Table 2. 8 shows the classification of the industry, at the four-digit level, according to the Australian and New Zealand Standard Industrial Classification (ANZSIC)[11]. With respect to geographical distribution, the bulk of the industry is located in the metropolitan areas of Victoria, followed by New South Wales (PC, 2003).

In recent years, various global and domestic factors such as reductions in industry protection from imports, changes in consumer spending patterns, shifts of TAC manufacturing from developed to developing countries, and development of new technology have influenced the size and structure of the industry. Many firms closed their operations and consequently, reduced the output and employment in the industry. Since the early 1990s output decreased by 25 percent and employment by 35 percent. More focus has been given to high VAD and more capital-intensive, and less to labour-intensive standardised products (PC, 2003).

[11] The Standard International Trade Classification (SITC) of TAC is presented in Appendix 2. 1.

Table 2. 8: **The ANZSIC Classification of Textiles and Clothing**

Group		Class	
221	Textile fibre, yarn and woven fabric manufacturing	2211	Wool scouring
		2212	Synthetic fibre textile manufacturing
		2213	Cotton textile manufacturing
		2214	Wool textile manufacturing
		2215	Textile finishing
222	Textile product manufacturing	2221	Made-up textile product manufacturing
		2222	Textile floor covering manufacturing
		2223	Rope, cordage and twine manufacturing
		2229	Textile product manufacturing *nec*
223	Knitting mills	2231	Hosiery manufacturing
		2232	Cardigan and pullover manufacturing
		2239	Knitting mill product manufacturing *nec*
224	Clothing manufacturing	2241	Men's and boys' wear manufacturing
		2242	Women's and girls' wear manufacturing
		2243	Sleepwear, underwear and infant clothing
		2249	Clothing manufacturing *nec*

nec = not elsewhere classified.

Source: ABS (1993).

These developments led to an increase in the proportion of imports in the domestic markets, the reduction of consumer expenditures, in particular on clothing (share of clothing and footwear consumption in total household consumption between 1990 and 2000 decreased in Australia by 22 percent) and consequently in the reduction of contribution of TAC to GDP and employment. For instance, while the gross product of all manufacturing increased between 1984-85 and 1994-95 by just over 20 percent, the gross product declined by almost 9 percent for textile products, by just over 12 percent for clothing manufacturing and by over 34 percent for knitting mills. The only sector that experienced a positive growth rate of gross product was 'Textile fibre, yarn and woven fabric manufacturing' (4 percent), (IC, 1997, p. 7).

The performance of the TAC industries in the decade to 1995-96, has maintained the trend of the manufacturing sector in general[12]. While the TAC industries are much more efficient than in the past, there is still a significant diversity in individual performance. In terms of labour productivity, over the same period, the TAC industries under-performed the total manufacturing, with the exception of 'fibre, yarn and fabric manufacturing and clothing manufacturing' sectors (IC, 1997).

Various segments of the industry have experienced different trends. Some textiles, for instance, increased domestic market share at the expense of imports. However, many sectors, in particular labour-intensive clothing sectors, have declined. This uneven growth distribution resulted in disproportionate impact on the industries' regional employment. Whereas over the period between May 1985 and May 1997, the TAC employment in New South Wales, and more significantly in Queensland increased, in Victoria, employment declined. The ABS statistics show that TCF (including footwear) manufacturing employment was about 9 percent of total manufacturing employment and about one percent of the country's total employment in 1997. These numbers underestimate the TCF total employment because official statistics do not include 'homeworking', which, in particular in the clothing sector is estimated to be equivalent about 23,000 full-time jobs (IC, 1997, p. 85).

[12] This closely related performance leads some economists to the conclusion that the country's economic conditions may be more important determinants of the TAC performance than the industry-specific factors, such as the reduction in protection (IC, 1997).

Diversity between the overall manufacturing trend and the TAC, in terms of employment, is evident from Table 2.9. Whereas, during the period between 1985 and 1997, manufacturing employment remained stable, the various categories of the TAC recorded a significant, though diverse decline. The largest decline was in knitting mills, textile fibre, yarn and woven fabric, and clothing manufacturing. In contrast, textile product manufacturing recorded strong employment growth of more than 70 percent, with the male employment growth of more than 112 percent (IC, 1997, p. C.5).

Table 2. 9: **The TAC Manufacturing Employment, by Industry, May 1985 to November 2002**

Industry	Employment by ANZSIC Industry (000)					
	1985	1991	1997	1985 - 97 (%)	2002	1997-02 (%)
Textile fibres, yarn and woven fabrics	20.3	15.3	11.6	-42.9	7.0	-39.7
Textile product manufacturing	12.6	15.2	21.7	72.2	21.9	0.5
Knitting mills	8.2	9.9	3.7	-54.9	3.1	-16.2
Clothing	62.2	51.2	49.3	-20.7	39.3	-20.8
All manufacturing	1128	1099	1128	0.0	1147	1.7

Source: IC (1997), Table C. 2, p. C. 4 and PC (2003), Table B. 5, p.162.

In order to protect jobs, the industries have been arguing for maintaining tariffs. However, the analysis of the trend in the rate of protection and employment does not support a claimed positive correlation between the level of employment and protection (IC, 1997)[13]. Instead, the factors being responsible for declined employment may be technological change, especially in the textiles sector,

[13] A decline in employment, despite various forms of protection, has been also experienced in other OECD countries (IC, 1997).

consumers' preferences for imported products, and undeniably, labour cost differences between Australia and developing countries.

An extensive variation in capital intensity at intermediate stages of production of TAC, and at any stage tradeable commodities being involved, enable the production to take place in any country. Australia has been traditionally involved in the early stages of the production process. However, in recent years, the government has taken policy action to increasing value-added exports by further processing of raw material, such as wool and cotton, reducing the intra-industry diversity in the rate of assistance, and promoting specialisation and export orientation[14].

There is evidence that investment in TAC has been volatile and diverse across individual TAC industries. Investment between mid 1980s and late 1990s was higher in more capital-intensive textiles than in the clothing industry and it maintains an increasing trend. Investment intensity (expressed as investment per unit of output and investment per employee) has been affected by global changes, in particular, shifting labour-intensive activities of clothing manufacturing from high-labour cost developed countries such as Australia to low-labour cost developing countries such as China. In order to improve international competitiveness of the industries, the Australian government provides specific budgetary assistance through the Industries Development Strategy (IDS) to promote capital investment, rationalisation and modernisation of the TAC industries.

[14] For instance, the majority of Australia's wool is exported in its 'greasy' or unprocessed state. However, in recent years there has been significant growth in early stage processing of wool in Australia. For example, in 1996, 37 percent of the Australian wool clip was processed to an early stage in Australia (up from 23 percent ten years earlier), but only 13 percent of the clip was processed to the tops stage (IC, 1997, p. 15).

2. 3. 2 Australia's Trade in TAC Products

Australia's natural endowments of land and climate are suitable for wool and cotton production, the essential inputs into the production of TAC products. However, some claim that Australia fails to take advantage of this potential because of poor cooperation between producers and processors (IC, 1997, p. 15). Thus, Australia, like most advanced industrial countries, is a net importer of those products.

This fact is reflected in the relative share of exports and imports of TAC in total merchandise trade. In 1990, textiles contributed to Australia's total merchandise exports by 0.4 percent and in 2001 their share increased to 0.5 percent. In terms of imports, however, the share was 3.6 percent in 1990 whereas it declined to 2.1 percent in 2001. The contribution of clothing to Australia's total merchandise imports has been marked by a steady rise. In 1990 it was 1.8 percent, in 1995, 2.3 percent, in 2000, 2.6 percent, and in 2001 it rose to 2.7 percent.

Australia's share in the world exports of textiles is rather insignificant. In 1990 it was 0.15 percent, in 1995, 0.25 percent, in 2000, 0.22 percent, and in 2001 it was 0.20 percent (WTO, 2002, Table IV. 62). Another significant fact is that Australia's share in the world imports of textiles has been declining steadily. In 1980 it was 2 percent, in 1990, 1.3 percent and in 2002 it decreased to 0.9 percent. Australia's share in the world imports of clothing is slightly lower and is not as steady as the share of textiles in the world imports of textiles. In 1980 it was 0.8 percent and it declined to 0.6 percent in 1990. However, in 2002 it increased to 0.9 percent of the world imports in clothing (WTO, 2002, Table IV. 61 and 69).

Global changes in the trading environment as well as in domestic levels of TAC protection have resulted in shifting the origins and destinations of Australia's TAC trade. China is the major source of clothing imports for Australia. Other significant suppliers of TAC imports to Australia are New Zealand and the U.S. Whereas South Korea and Taiwan remain substantial suppliers (mainly of synthetic fibres and fabrics) their shares in Australian imports have been declining. On the other hand, Australia's imports from Fiji, Indonesia and India have been increasing.

On the export side, over the past decade, there has been a significant reduction in Australia's export of TAC to Japan. However, this decline has been compensated by growth in exports to other countries, in particular Italy, New Zealand[15], China, South Korea, Fiji[16], and Malaysia (See Appendix 2.1).

Factors such as economic development of newly-industrialised countries, trade liberalisation, technologies, input combinations to produce goods, and consumers' tastes, have significant implications for various Australia's industries and trade. Australian TAC firms are becoming increasingly exposed to international competition and the industries have recorded a growth in both exports and imports (see Appendix 2.2 to 2.5).

However, the crisis in East Asia in mid 1997, in particular exchange rate restructuring and the poor market perceptions of their economies and their inability to obtain credit, to varying degrees, influenced many sectors of their economies, including the TAC.

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[15] This significant increase in export to New Zealand reflects the implementation of the ANZCERTA, Australia-New Zealand Closer Economic Relations Trade Agreement.

[16] A large proportion of exports is re-exported back to Australia under the SPARTECA, South Pacific Regional Trade and Economic Cooperation Agreement (IC, 1997, p.13).

This is due to the fact that these sectors import up-to 70-80 percent of their inputs, such as silk, dye and cotton, (Ray, 1998, p. 52). Because Australia has been achieving a greater integration with East Asia, the effects on Australia's trade and investment were expected to be substantial (Sheehan, 1998).

Lang (1998) compared actual trade performance from the beginning of the Asian crisis and performance in the absence of the crisis. The results of this comparison indicate that the crisis affected both exports to and imports from troubled countries (Indonesia, Malaysia, Philippines, Thailand, and South Korea) to Australia. Australian export levels to the Asian countries that have experienced economic crisis have been significantly below trend. However, an adverse effect on exports to these countries has been, to some extent, offset by increasing exports to the rest of Asia and the world (non-Asia).

On the other hand, there has been a significant increase in imports to Australia, not only from the troubled economies but also from other Asian economies. This rise in imports has been offset by a decline in imports from the rest of the world, in particular, imports of clothing from Indonesia and Philippines. Imports from Malaysia have not deviated much from the trend.

Whereas the trend from the rest of Asia (China, Hong Kong, Taiwan, Japan, Singapore and Vietnam) was essentially flat, there are some differences among countries. Particularly, declining imports from Japan are compensated by rising imports from China and other economies. Textiles and clothing industries, especially in Victoria, have been significantly affected by the increasing TAC imports fuelled by the Asian crisis.

1. 4 A History of Assistance to the TAC Sector[17]

Australia, like most developed countries, has a long history of protecting textile and clothing industries. The application of quantitative restrictions on textile imports by Australia dates back to the 1930s. They were directed not only against the competitive pressure from developing countries but also to curtail the consequences of weak domestic demand on output and employment (Keesing and Wolf, 1980).

Between 1901 and eruption of the the Second World War, the TAC industries were protected mainly by tariffs. After the War these were replaced by import licensing arrangements that were abolished in 1960 when tariffs were restored. Until the 1970s government reports[18] recommended increasing levels of assistance (Cappling and Galligan, 1992).

However, the imposition of tariffs (in 1972) did not stop the surge in imports and the decline of the local industries. Therefore, in 1977 the government introduced global quotas[19]. In response, then the Industries Assistance Commission communicated that, as a result of past assistance policies, the TCF industries had become inward-oriented, tariff-dependent and fragmented, and unfit to adapt to the major domestic and international changes taking place. Accordingly, in August 1977, and again in 1980, the Commission recommended removing all quotas and the reduction of assistance to

[17] A chronological summary of assistance is provided in Table 2.11.
[18] In the past 75 years, over 500 government reports have been issued dealing with assistance to Australia's TCF industries (IAC, 1987, p. 113).
[19] Global import quotas limit the quantity of goods that can be imported in a given period.

the average rate for all manufactures. Influenced by strong lobbying, in November 1977, the government, however, announced a three-year assistance program. However, the need for structural adjustment in the sector was acknowledged, and a seven-year plan was set to stimulate the industries.

In November 1986, the government, however, announced a TCF Plan. The declared objectives of the Plan were to promote the restructuring and revitalisation of the industries, to improve their efficiency and international competitiveness, and to reduce their dependence on assistance. The Textiles, Clothing and Footwear Development Authority (TCFDA) was established to implement the Industries Development Strategy[20].

The implementation of the Industry Plan began in March 1989 by eliminating quotas (except on some fabrics) and implementing tariff reductions to 45 percent for textiles and 60 percent for clothing, and reducing yarn bounty payments[21] to 30 percent by March 1994 which was later brought forward to July 1992 and removed on 1 July 1995. Tariff levels were also reduced by another 5 percent by that date. In the early stages of the Plan the effective rate of assistance continued to be high (see Table 2.10). In 1989-90 it was 78 percent for textiles and 183 percent for clothing (IAC, 1990). It was also recognised that the industries still maintained an inward-oriented view. Consequently, in the March 1991 Industry Statement, the government announced significant alterations to the TCF Plan. To promote exports, in 1991, the

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[20] It has four major components: the Raw Materials Processing Program, the Industries Efficiency Program, the Industries Infrastructure Program, and the Export Development Program.

[21] A bounty is a subsidy to the cost of domestic production. It has a similar effect for producers as a tariff, however, it does not raise the price to consumers. Bounties can be paid as a fixed amount per unit of output, or, as a proportion of value-added in production (value-added bounty), Quotas and bounties were the main forms of assistance in the 1980s (IC, 1997, p. 14).

government introduced the Import Credit Scheme[22], which allowed producers in the TCF industries to acquire credits that can be converted to facilitate an import levy[23]. The aim was to achieve a closer integration with the global industry by making the industries more trade-oriented and capable of taking advantage of overseas opportunities (PC, 2003, p. 293).

Table 2. 10: **Nominal and Effective Rates of Assistance, 1968-69 to 2000-01**

Year	Textiles (ASIC 23)		Clothing (ASIC 245)		All Manufacturing	
	NRA	ERA	NRA	ERA	NRA	EFA
1968-69	25	43	58	108	24	36
1970-71	24	42	54	101	23	36
1975-76	23	50	47	96	16	28
1980-81	28	55	66	135	15	23
1981-82	26	54	90	216	16	25
1982-83	23	68	72	189	13	21
1983-84	23	69	81	222	13	22
1984-85	25	75	90	243	13	22
1985-86	23	72	56	136	12	20
1990-91	18	51	66	106	8	14
1991-92	16	46	54	84	8	13
1992-93	14	41	44	66	7	12
1993-94	12	37	39	59	6	10
1994-95	11	33	36	54	5	9
1995-96	10	27	33	50	5	8
1996-97	9	25	30	47	4	6
2000-01	6	17	19	34	3	5

NRA – Nominal rate of assistance;
ERA – Effective rate of assistance

Source: IC (1997, Vol.2, p. 1.12) and PC (1998, p. 15).

[22] This allowed firms which added value to exports to reduce tariff duty payments on TCF imports (Cappling and Galligan, 1992, p. 249).

[23] Credits are calculated as a percentage (30 percent) of the domestic value added content of their exports. The rate will be reduced by 5 percent in every consecutive year to 15 percent by the year 2000 (Sheehan, *et al.* 1994, p. 102).

After the termination of tariff quotas by March 1993, protection has been in the form of tariffs only. Duty concessions for goods made and cut from Australian fabric, but with finishing completed overseas, are obtainable through Overseas Assembly Provisions (OAP) and a number of Policy By-law arrangements[24]. In addition, the government set a $22 million development package to assist the industries in the adjustment to lower levels of protection. Despite the considerable reduction in the level of protection, TAC industries still remains the most highly protected manufacturing sector.

Between 1997 and 2000, the government was to provide TCF producers with over $520 million through the new Strategic Assistance for Research and Development (START) Program. Incentive payments were to be provided as part of a national training system under the umbrella of the Modern Australian Apprenticeship and Traineeship system, targeting small and medium sized firms. Smaller firms have been given better access to export support, as the threshold for Export Market Development Grant assistance has been reduced from $30,000 to $20,000.

Currently, there is a great diversity in tariffs on TAC imports, ranging from zero to 37[25] with most final clothing at the highest level. Early stages of production, such as wool scouring and top making, spinning and leather tanning get a low assistance. Clothing and some finished textiles such as bed sheets receive a very high assistance.

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[24] Policy By-laws permit concessional entry (usually duty free) for particular imports which are used as inputs for further production. Tariff concessions usually apply where the goods having the same function are not produced domestically. However, almost all textile yarns are permitted concessional access by policy By-laws despite the presence of domestic production (IC, 1995, p. 74).

[25] Compared to tariffs on other manufactures that had a tariff of 5 percent in July 1996. However, tariffs on passenger motor vehicles are still relatively high at 25 percent, (PC, 2003, p. 149),

In 1996-97, the average rate of effective assistance for clothing was eight times and for textiles four times, greater than for manufacturing as a whole.

By July 2000 successive reductions were to bring the tariff rate for most fibres and textiles to a maximum of 15 percent, and tariffs on apparel and most other finished textile imports will be 25 percent, compared with the maximum 5 percent for other manufacturing, except Passenger Motor Vehicles, PMV (IC, 1996). In 2000, average effective rates (without the Import Credit Scheme) were to be 33 percent for clothing and 17 percent for textiles compared to 4 percent for the remaining manufacturing industries[26].

However, in July 2000, after nine years of gradual reduction of tariffs, cutbacks were put on hold until January 2005. One outcome of this pause was to maintain a disparity in tariff rates for the sector and the rest of manufacturing. From 1 January 2005 tariffs for apparel and certain finished textiles will be reduced from 25 percent to 17.5 percent until 2010 when they drop to 10 percent and then to 5 percent in 2015. Tariffs on cotton sheeting and woven fabrics, carpets will drop from 15 percent to 10 percent, and tariffs on sleeping bags and table linen stay at 7.5 percent between 2005 and 2010. Tariffs on items currently at 5 percent, for instance, textile yarns will not change.

In addition, during the transition period to lower tariff protection, the sector has received budgetary assistance, through the Strategic Investment Program (SIP) that makes available an average of $140 million a year to TCF industries over the five-

[26] The average effective rate of assistance for footwear will be 24 per cent (IC, 1997, p. XXXVII).

year period between June 2000 and 2005. The funding to individual firms in a year is limited to 5 percent of their annual sales. The main objective of the SIP is to improve the competitiveness of TAC firms by encouraging investment and innovation (PC, 2003, p.174). It replaced the ICS whose orientation was directly on promoting exports.

2. 5 The Multi-Fibre Agreement and Australia's TAC Trade

Multilateral coordination of protection began in the early sixties, with cotton textiles by a Short-Term Arrangement (STA) in cotton textile trade, initiated by the US who, at that time, faced declining international competitiveness of TAC, and under the auspices of the GATT, in 1961. It evolved into a Long-Term Arrangement (LTA) in 1962 that introduced a system of quantitative protection against textile exports from low-cost developing countries. With successive renegotiations the LTA lasted until 1973. The core of the MFA is the quantitative restrictions on textile exports from developing countries, mainly through bilateral agreements on export quotas and voluntary export restraints (VERs).

Export quotas are allowed to be transferred from one category to another and from both previous and the following years to the current year. The MFA has been renegotiated every few years under the auspices of the GATT Committee on Textiles[27]. At its advent, the MFA dealt almost entirely with exports from developing countries. Over time, however, restrictions were also imposed on exports from developed countries, including Japan, Portugal, and Spain. Over the period, the MFA

[27] MFA I operated between January 1974 to December 1977; MFA II between January 1978 and December 1981, MFA III between 1982 and July 1986. The current MFA IV was adopted in August 1986 and, initially, planned to operate until July 1991 but has been extended to December 1994 (Trela and Whalley, 1990; 1995, p. 305).

Table 2.11: **History of TCF Assistance, 1969-2000***

Year	Action
1969	Temporary quantitative restriction on all knitted shirts and outer garments. They were removed after one month, but re-applied two years later for 18 months.
1971	Negotiations with foreign low-cost suppliers of clothing for 'voluntary' export restrictions.
1972	Tariff quotas introduced on a selection of intermediate and final goods.
1974	Import licensing re-introduced on imports from Taiwan. Voluntary Export Restraint Arrangements negotiated with Hong Kong, South Korea, India and China. Australia became a member of first Multi-Fibre Agreement.
1975	Country-specific quotas imposed.
1976	Non-discriminatory global quotas imposed.
1977	IAC TCF Inquiry. Three year industry program announced.
1978	Tariff quotas introduced on a range of hosiery, knitted underwear and sleepwear.
1979	Tariff quotas introduced on certain fabrics. One-year extension to the three-year assistance program for TCF industries announced.
1980	IAC TCF Inquiry. Seven-year program of assistance for TCF industries announced. Sale of quota entitlements above base quota announced.
1981	The TCF Advisory Committee (replacing TCF Review Committee) established.
1982	Bounty assistance to local production of most yarns commenced. Start of seven year plan.
1986	IAC TCF Inquiry.
1987	TCF Industry Plan – the Button Plan – announced in response to IAC Report.
1988	Textile Clothing and Footwear Development Authority established. Changes to 1987 Plan announced as part of May Economic Statement. Changes included: the sunset for quotas brought forward by six months to 1995; and a five percentage point reduction in 1996 tariff levels.
1991	Changes to the 1987 TCF Plan announced as part of May Industry Statement. Import Credit Scheme introduced.
1992	Further changes in tariff cuts, quota elimination brought forward to 1993.
1993	Further changes to the 1987 TCF Plan announced in the July Industry Statement.
1995	TCF quotas abolished. Overseas Assembly Provisions Program introduced.
2000	Remaining bounties phased out.
	Tariff reductions put on hold until January 2005. The Strategic Investment Program (SIP) introduced.

Based on IC (1997, Vol. 2) and PC (2003).

has extended to include a growing number of products and countries. A number of countries participated in the MFA at earlier stages and then adopted other restrictive trade policies.

Australia participated in the MFA in the earlier Long-Term Arrangement and in the first phase of the MFA, until December 1974 when the Government imposed global tariff quotas outside the MFA. However, Australia did not participate in the other three extensions of the Agreement. This decision was based on two factors; the failure of the MFA to reduce imports and on the adverse effect on Australia's relations with Asian countries (IAC, 1986, pp. 134-35). Consequently, in early 1975, the voluntary restraint agreements were substituted by unilateral quotas[28] that operated until 1993. In the fourth phase of the MFA, there have been eight developed (importing) countries participating in the MFA, the US, Canada, the EU, Japan, Austria, Finland, Norway, and Switzerland[29] and 36 developing and the newly industrialised (exporting) countries (Trela and Whalley, 1995, p. 285).

In 1974, major trading nations expanded coverage of the MFA to include man-made fibre products under the Multi-Fibre Arrangement (MFA). Under the MFA, import quotas were allowed to grow at the maximum rate of 6 percent per year. However, as Trela and Whalley (1990) point out, imports from some countries, such as Korea, Taiwan and Hong Kong have been at the higher rate.

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[28] Bora and Pomfret (1995, p. 106) pointed out that about 30 percent of textiles and 90 percent of clothing were protected by import quotas.

[29] Japan and Switzerland, however, have not imposed quotas.

By the early 1980s the MFA was a comprehensive device for the control of international trade in TAC[30]. However, a number of factors, including the bilateral character of the MFA import quotas, a less than full incorporating of products, changes in economic conditions in concerned countries, that have increasingly complicated the implementation and quantitative evaluation of the MFA (Gehlhar, 1997, p. 94). Therefore, in the recent Uruguay Round, it was agreed to transfer the products from the export quota restrictions under the MFA to the GATT, in four stages over the period of ten years, 1 January 1995, 1998, 2002, and 2005. At the same time it was agreed to reduce import tariffs on both textiles and clothing. The process will be facilitated by the Agreement on Textiles and Clothing (ATC), established for that purpose. In order to monitor the implementation of the ATC, the WTO has established the Textiles Monitoring Body (TMB) to report on the progress. From 1 January 2005, tariffs will be the major instrument of border protection (Smeets, 1995).

Australia has not been a participant of the MFA. The Australian TAC trade is limited indirectly, through restrictions on exports from countries that use Australian inputs, such as wool. An adverse effect on Australia is magnified by rising cost of final products, and by increasing the supply of some imports (IC, 1997, p. 232). The elimination of the bilateral quotas in TAC trade is expected to stimulate the world demand for Australian wool and to improve market access for Australia's TAC exports (IC, 1997, p. 253). Unfortunately, the opportunity for Australian companies to enter export markets before 2005, when the MFA is phased-out, is reduced by the fact

[30] It covered about one-fourth of world trade in TAC. Apparel was covered by about 40 percent and textiles by about 14 percent (Cline, 1990, p. 40).

that Australia does not have a comparative advantage in products that will be freed from the quota restrictions.

Australia has also been affected by the MFA in another way. Since Australia is the only western country that has abolished quotas, the experience shows that exporting countries, in particular those who have exhausted their quota entitlements into the MFA countries, often seek to supply their exportable surplus to quota free Australia, often at prices below cost.

2.6 Conclusion

As the extent of protection has been reduced there has been a large increase in the exposure of Australia's TAC industries to international competition, both in terms of the share of the local market accounted for by imports and in terms of export growth. While the industries have increased exports as proportion of their turnover, this proportion remains low. Given the disadvantages in labour costs, it is clear that Australia is unable to compete internationally in activities in which labour costs are a crucial aspect of competitiveness. Therefore, in these activities Australia must address other competitive criteria, such as quality, service, and distinctive characteristics of products or brand names.

Important factors in further enhancing the overall performance and international competitiveness of TAC manufacturing in Australia will be investment in technology, research and development and innovative strategies. It is, however, crucial that Australia takes advantage of its abundant natural resources and complements it with capital and technological improvements. However, the implementation of these strategies might be hindered by the smaller size of Australian TAC firms compared to the average size of overall manufacturing. Australia should also rationalise production, in order to benefit from economies of scale and consequently be more involved in product differentiation of TAC products.

In the next chapter an analysis of Australia's comparative advantage in textiles and clothing is presented. In order to determine Australia's relative advantage position, a number of indicators will be calculated, using trade flow data. Prior to empirical analysis, a review of theoretical and empirical studies on comparative advantage will be presented.

Chapter 3

AUSTRALIA'S COMPARATIVE ADVANTAGE AND TRADE PERFORMANCE IN TEXTILES AND CLOTHING INDUSTRIES

3. 1 Introduction

The aim of this chapter is to analyse Australia's comparative advantage and trade performance in TAC products. Prior to empirical examination of Australia's comparative advantage in TAC, a brief summary of the theoretical framework and a review of empirical studies will be presented in Section 3.2. Following Balassa's method of measuring a country's revealed comparative advantage in a given product, the revealed comparative advantage index for Australia's TAC will be presented in Section 3.3. For the purpose of comparison, revealed comparative advantage of Australia's trading partners in TAC will be discussed in Section 3.4. In order to examine Australia's relative competitive position within the global market in TAC, Vollrath's revealed competitiveness index will be calculated and commented on in Section 3.5. A number of trade performance measures, including trade specialisation index, export propensity ratio, import penetration ratio, and the export/import ratio will be presented in Section 3.6. A summary of the analysis will be provided in Section 3.7.

3. 2 Theoretical Background of Comparative Advantage

3. 2. 1 Absolute Advantage

Adam Smith (1776) explained that trade between two countries is based on *absolute advantage*. The concept suggests that when one nation is more efficient in terms of lower labour cost of producing a commodity than (or has an absolute advantage over) another nation but is less efficient than (or has an absolute disadvantage with respect to) the other nation in producing a second commodity, then, by each nation specialising in the production and trading of the product in which it has the absolute advantage, both nations can benefit. As a result, world resources would be used more efficiently and all nations would gain from free trade.

3. 2. 2 Comparative Advantage

David Ricardo (1817) introduced the *principle of comparative advantage*. Ricardo based his theory of comparative advantage on the labour theory of value that states that goods are mutually exchanged according to the relative amounts of labour embodied in them[31]. According to this principle, even if one nation has an absolute cost advantage in the production of both commodities, the trade may still be mutually beneficial. Ricardo argues that the first nation should specialise in the production of, and export, the commodity in which it has a comparative advantage (that is in which its absolute disadvantage, compared to other nation is smaller) and import the commodity in which it has a comparative disadvantage[32]. Thus, as long as each country possesses a comparative advantage in at least one activity, it is worth to specialise in that activity and engage in trade.

Ricardo's concept of comparative advantage implies that labour is the only input in production, used in the fixed proportion in production of all products, and it is homogenous. However, Haberler (1936) argues that neither of these assumptions is

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[31] A more rigorous discussion of the Ricardian model and its empirical testing can be found in Jones and Kenen (1984. p. 467-517).

[32] The first empirical test of the theory was performed by MacDougall (1951) on the bilateral trade in manufactured products between the U.S. and U.K. and the rest of the world on the basis of the relationship between their wage rate differences and export structure. The study supports the Ricardian theory that it is comparative and not absoulute advantage that rules trade.

valid or necessary. Haberler relaxes some of Ricardo's assumptions and demonstrates the principle of comparative advantage by the concept of comparative (opportunity) cost. This can be expressed as the amount of a commodity that must be given up in order to produce more of another commodity. According to the principle, countries will benefit from specialisation, and trade, whenever differences in opportunity costs exist. The nation with the lower opportunity cost in the production of a commodity has a comparative advantage in that commodity.

3. 2. 3 Heckscher-Ohlin Theory of Trade

As noted above, classical economists explain comparative advantage by the difference in the productivity of labour among nations. However, they do not provide reasons for such differences. Heckscher (1919) and Ohlin (1933) expand the theory by exploring the basis for comparative advantage as well as the effect of trade on factor prices in trading nations.

The Heckscher-Ohlin (H-O) model of international trade, based on a number of assumptions[33], states that a country tends to export commodities which require relatively intensive use of the country's relatively abundant factors of production, and to import commodities that use intensively the country's relatively scarce factors of production.

Following the propositions of Heckscher and Ohlin, neo-classical economists explain differences in comparative costs in terms of factor proportions required to produce various products. They argue that, on the one hand, there are relative differences in

[33] Such as: two products, two factors, two countries, homogenous products, perfectly competitive input and product markets, identical production functions, equal access to technology, perfect internal (however, no external, between countries) factor mobility, no transport costs or barriers to trade, and identical consumer preferences (Grimwade, 2000).

factor endowments between countries, and on the other hand, there are differences in input requirements in the production of various products (factor intensities) which together give rise to different factor prices and therefore, differences in comparative advantage in production.

Jones (1956) suggests that if products were ranked in terms of their capital-labour ratios, the products with the higher capital intensity would be exported by capital-abundant country while other products would be imported. Deardorff (1982) argues that comparative advantage and its determinants explain only the direction but not the volume of trade. So the principle of comparative advantage raises the question of which factors generate differences in comparative costs between countries.

3. 2. 4 Empirical Testing of the Heckscher-Ohlin Theory

The preceding section suggests that factor abundance is the source of comparative advantage and an indicator of trade patterns. This prediction of trade patterns has inspired an extensive empirical testing of the H-O model, for instance, Leontief (1954, 1956), Brown (1957), Vanek (1959), Kravis (1971), Melvin, (1968), Deardorff (1982).

Leontief (1954) tested the propositions that the United States had a comparative advantage in producing capital-intensive products, and therefore, are expected to export goods in that category. He used the input-output tables to measure the factor intensity of exports and imports replacements. The results appear to contradict the H-O theory since US imports were more capital-intensive than US exports. This is the well-known *Leontief paradox*. Leontief's results and similar investigations for Japan, West Germany, India and Canada generated a great deal of interest among economists to explain the Leontief paradox and to find some alternative justification for countries' patterns of trade. A number of explanations of these paradoxical results were put forward by economists that led to the extension of the H-O theory to allow for factors other than labour and capital.

High level of protection and tariffs, biased against labour-intensive products, are also claimed to be responsible for Leontief's findings (Kravis, 1956; Kunimoto, 1977). Under free trade the share of labour-intensive goods in imports would be higher than is actually the case. In order to test the impact of tariffs and non-tariff protection on the capital-labour ratio adopted in import-competing production, Baldwin (1971) applied import demand elasticities facing trading industries. By assuming zero import duties, Baldwin derived competitive imports and found that results are consistent with Kravis's findings supporting the Leontief's paradox. Leamer (1984), however, argues that Baldwin's conclusion in support of the Leontief paradox is based on a false proposition that the signs of the estimated coefficients *are the same as the signs of the excess factor supplies* (p. 56).

Studies by Vanek (1959), and Weiser (1968) attempted to explain Leontief's results by taking into account natural resources that were omitted in Leontief's analysis. The results from their analyses manifest the complementarity between capital and natural resources and offer a partial explanation of the Leontief paradox. Vanek concludes that natural resources should be excluded from any test of the theory.

Kenen (1965) attempted to include human capital to physical capital to the analysis of U.S. exports and imports, using the same data as Leontief (1954). The results appear to support the H-O theory. Stern and Maskus (1981) analysed the direct factor content of U.S. trade in manufactures in the context of Leontief's findings, over the period of almost twenty years. They tested the relationship between net exports and physical capital and unskilled labour. The results testify a negative influence of unskilled labour on net exports that appears to increase over time. Stern and Maskus justify this phenomenon by technological developments in human capital-intensive industries and greater imports in unskilled labour-intensive products. Human capital, however, appears to have a positive effect on net exports. Their results give support to the theory of product cycle and evidently demonstrate the importance of technological influence. Stern and Maskus infer that the inclusion of human capital removes the Leontief paradox.

Other studies that test the role of research and development (R&D) activities in explaining trade pattern, and conclude their strong positive role include Keesing (1967), Gruber and Vernon (1967), Lowinger (1975), and Stern and Maskus (1981). A number of studies, for instance, Keesing (1965; 1966), Kenen (1965), Bharadwaj and Bhagwati (1967), Yahr (1968), Baldwin (1971), Branson (1971), Branson and Monoyios (1977), and Tan (1992) emphasise the importance of the skill intensities in explaining the net export patterns. They relax the assumption of labour being a single homogeneous factor and despite some differences in details they conclude that differences in skill intensity, including technological innovation, explain the Leontief paradox.

Leamer (1980) offers some explanation for the paradox by re-examining Leontief's data. He found that in the data, the U. S. was a net exporter of both capital and labour services. He shows that if trade is unbalanced, the claimed relationship between the input intensity in traded commodities and the country's factor endowments may be violated. Leamer challenges the validity of the H-O model in unbalanced trade situations when he proposes the ratio of factor manifested in production against consumption as a more appropriate determinant of trade. He indeed found that capital-labour ratio incorporated in production was greater than that in consumption, which he views as resolution of Leontief's paradoxical results.

Havrylyshyn (1984) tested the Heckscher-Ohlin theory on trade between developed and developing countries and observed that exports from developing to developed countries were less capital-intensive than their imports that include both physical and human capital. Based on this observation, Havrylyshyn draws the conclusion that the theory predicts trade patterns between developed and developing countries.

Deardorff (1994) explored some issues that indicate the continued significance of comparative advantage. He showed that, given the assumption of homotheticity, which restricts demand to take the same dimensions that would be reached with balanced trade, even if trade is unbalanced in a single time period, comparative advantage can still be used to explain the patterns of trade.

Results of the empirical testing of the H-O theorem of trade in the single country setting by Tan (1992) give the overall support to the theory. The results also indicate that human capital is the crucial determinant of dynamic comparative advantage.

However, according to the results, the skill ratio, representing accumulation of scientific and technical skills is statistically insignificant. Physical and human capital appears to be complementary. Tan suggests that this phenomenon reflects the fact that investment inflows often occur with physical capital imports and human capital movements.

In the next section, Australia's comparative advantage in general and in textiles and clothing products are examined.

3. 3 Australia's Comparative Advantage in TAC Products

3. 3. 1 Australia's Comparative Advantage in General

Economic theory states that a country's comparative advantage can be generated by differences in factor endowment ratios, technologies and consumer tastes with respect to the rest of the world. However. he claims that for Australia the fundamental determinant is its relative factor endowment. This is because the country is well endowed with agricultural land and mineral and energy resources per capita. Furthermore, it has relatively highly skilled workforce.

Krause (1984) examined the resource content of Australia's bilateral trade with Japan and the United States, and concludes that while Australia's comparative advantage is still largely in natural resource goods, during the 1970s, there may have been some shift towards greater comparative advantage in technology-intensive goods. Krause detects a decline in exports and imports as a proportion of GDP in the 1950s and the failure to recover afterwards. The most influential explanation of this phenomenon is considered to be Australia's persistent inward-oriented industrial policies, especially a strategy to promote manufacturing through import-substitution policies, and Australia's slow response to a widespread deregulation movement in the early seventies. From his empirical analysis, Krause noted that the export performance is inversely related to government assistance. He argues that without government assistance, producers have to be able to meet foreign competition at home and, thus exist in an environment that promotes competitiveness and exports (p. 292).

Dyster and Meredith (1991) maintain that the decline in the growth of demand for primary products, and resulted deterioration in terms of trade, in the late 1970s and 1980s challenged many countries, including Australia, to make manufacturing industries more competitive, to deregulate and revitalise markets and to find new sources of employment growth. At the end of the 1980s, the trend was towards more openness to the rest of the world and towards a higher level of international economic integration. Given Australia's geographical position in the Asia-Pacific region further effort was required to secure the degree of regional economic integration that would allow Australia to take advantage of economic growth in neighbouring as well as other countries with growth potential.

Kalirajan and Shand (1998) reviewed Australia's trade patterns and composition with India and South Africa. They found that labour-intensive commodities (in particular, textiles and clothing and related products) dominate Australia's imports from India, while capital-intensive products dominate Australia's imports from South Africa. On the other hand, Australia's exports to India are dominated by mineral-intensive, and exports to South Africa are dominated by capital-intensive commodities. The findings support the complementarity in trade among these countries, given their respective comparative advantage.

Son and Wilson (1995) examined the trade between Australia and Korea. The findings reveal that much of the trade between the two countries is inter-industry trade based on their factor endowments. They found that Australia has a strong comparative advantage in primary product industries, minerals and non-ferrous metal industries. Korea has comparative advantage in a number of manufacturing industries.

Sheehan *et al.* (1995) pointed out that due to Australia's relative abundance of natural resources, its prosperity and trade was traditionally based on its agricultural and mineral industries. The surplus in non-manufacturing commodity trade and the deficit in both services and elaborately transformed manufactures trade have been the dominant feature of Australia's trade position. For instance, exports from agriculture and mining accounted for over 80 percent of the Australian commodity exports in 1985-86. Whereas this share fell to about 70 percent by 1994-95, it remained high compared to the OECD average of about 25 percent of total commodity exports in 1985-86 (Sheehan *et al.*, 1995, p.16).

In recent years, Australian economy has been affected by a number of factors, including changes in resource endowments, policy changes in Australia and abroad, and the world economy moving towards more knowledge-intensive and less resource-intensive patterns of output. These factors resulted in alterations in the composition and direction of Australia's trade (Dyster and Meredith, 1991; Swan and Zeitsch, 1992; McKinsey *et al.*, 1993; Anderson, 1995; Sheehan *et al.*, 1995; 1998[34]).

Huey (1998) pointed out that a new aspect of international trade, an increasing share of knowledge-intensive products brings more dynamics into comparative advantage and reinforces the notion that the basis for trade may not be static as proposed by the traditional trade theory of comparative advantage. Given Australia's strong involvement in trade with East and South-East Asian economies that experience changes in human, physical and technological endowments, Huey stresses potential implications of these shifts in comparative advantage between industries and across countries on demand and supply in factors and products.

In this context, Huey (1998) examined the changing patterns of comparative advantage in Australia, based on 71 manufacturing industries and nine major regional trading partners over the period of 10 years, between 1979 and 1989. The results reveal that Australia experienced some shifts in comparative advantage. More specifically, it gained comparative advantage in a number of skilled labour-intensive and technology-intensive products. These are mainly the commodities in which some Asian countries lost their competitiveness. The findings also support the indications by other studies that Australia's comparative advantage is not completely dominated by natural resource-intensive manufactures. In fact, the analysis shows that Australia's greatest comparative advantage is in the production of a range of human capital (12) and technology-intensive (6) commodities. On the other hand, the findings reveal that despite high levels of protection, Australia has not been able to

[34] A more detailed discussion of this aspect may be found in Pomfret (1995, Ch. 1 and 3).

develop competitiveness in the labour-intensive footwear and clothing, and human capital-intensive motor vehicle industries.

Sheehan *et al.* (1995) examined Australia's relative position from a different angle, with respect to the adoption of innovation and its effect on trade. They determined the R&D intensity[35] for various industry groups in Australia and compared it to the OECD average. Results of the analysis indicate a significant increase in R&D activities across, and substantial differences between industries. The composition of Australian R&D, relative to the OECD average reflects Australia's natural resource endowments and a substantial increase in innovative activities in many traditional industries, including those tied to the resources base.

Australia's TAC industries stand out as having a relatively low share of businesses undertaking technological innovation (29.9 percent). In particular, process innovation share is very low (20.6 percent). The product innovation is at 27.6 percent (p. 35). Whereas the R&D intensity, measured as the ratio of R&D to the value of production, in the OECD in TAC over the period of 1979-1989 has increased substantially, it still remains very low, compared to other industries (p. 59).

Sheehan *et al.* (1995) finds a significant positive correlation between technological innovation and the level of exports. The derived long-run elasticities of Australia's share of OECD exports with respect to the share of OECD R&D indicate that the increase in R&D expenditure has contributed to the growth in exports. These

[35] They used two indicators:- the ratio of business R&D expenditure to the value of production and a 'more refined measure', the ratio of R&D to value added in the industry (Sheehan *et al.*, 1995, p. 58 and 87).

inferences apply also to the TAC industry categories, included in a 'low'[36] technology group, one of the industry categories being examined[37]. The link between technological innovation and export growth in TAC industries has been rather pronounced. Proportion of businesses with growth of exports of more than 50 percent over the considered period (1979-1989) was 45 percent, compared to businesses with no such innovative activities (31 percent). Evidence of a correlation between technological innovation and trade flows supports the findings by a number of other studies, including Soete (1981), Audretsch and Yamawaki (1988), Buxton *et al.* (1991), and Magnier and Toujas-Berante (1994).

3. 3. 2 Australia's Revealed Comparative Advantage in TAC Products

As mentioned earlier, Australia is the world's largest producer of textiles fibres, however the majority of those commodities are exported in unprocessed form. These poor linkages result in a 'mismatch' of demand and supply in terms of wool characteristics, and consequently, in lower trade. Another reason is the disproportion of the scale of operation between the large number of woolgrowers and a small number of processors.

O'Regan and Wilkinson (1997) examined changes in relative prices of products within a number of manufacturing industries, including TAC and found that over the period between 1969 and 1994, relative prices in most manufacturing industries declined. However, the TAC industries experienced relative price improvement, mainly due to the effect of economic growth and consequent wage increases in some

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[36] Low technology industries are defined as those where R&D has historically been of less importance than other factors in determining product characteristics and firm competitiveness (Sheehan *et al.* 1995, p. 104).
[37] In order to reduce a potential bias into the analysis by the differences in various industry characteristics, seven disaggregated industry categories were specified (based primarily on the nature and impact of technology, p. 112),

of Australia's trading partners. However, given the economic crisis in a number of Asian countries since mid 1997, this expectation may have to be adjusted. To illustrate the relative position of Australia's TAC industries, with respect to comparative advantage, a number of indicators are used. Prior to the empirical analysis, a brief presentation of these measures, including some examples of their empirical application is provided below.

The Balassa Index of Revealed Comparative Advantage (RCA)

Given the difficulties in empirically explaining comparative advantage and testing the H-O theory[38] Balassa (1965) suggests that it may not be necessary to take into consideration all factors influencing comparative advantage. He proposes that comparative advantage may be 'revealed' by observed trade patterns that are assumed to reflect both relative costs and differences in non-price factors. Balassa reasons that cost differences reflect the availability and cost of raw materials in material-intensive commodities[39], whereas, for instance, labour costs appear to be the major factor determining the comparative advantage in textile products (p. 59). He applied net export data including 167 product categories to test the hypothesis that countries will export products that are intensive in the resources in which the country is relatively well endowed[40].

Balassa derived an index that measures a country's revealed comparative advantage (RCA) in trade of a particular product/industry by the share of that product/industry in the country's total exports relative to the product/industry's share in the total world

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[38] Some of the issues are discussed in Balassa (1989, p.42-44).

[39] With exceptions of woollen fabrics where quality differences, and synthetic fibres where technology may play an important role.

[40] In order to eliminate size effects Balassa 'normalised' the net exports by expressing the net export as the ratio of the sum of country's exports and imports in the industry (p. 32).

export. Thus, the aim is to identify whether a country has a comparative advantage rather than to specify the underlying sources of the comparative advantage. More formally, the index can be presented as:

$$RCA_{ij} = \left(x_{ij} / X_j \right) / \left(x_{iw} / X_w \right) \tag{3.1}$$

where, RCA_{ij} is the revealed comparative advantage index for industry i of country j, x_{ij} is exports of commodity group/industry i for country j, X_j is total export of country j, x_{iw} is the world export of commodity/industry i, and X_w is total world exports.

If the value of the index exceeds one (1), it is interpreted that the country has a RCA. In other words, the industry's share in the country's exports is greater than its share in the world trade. If the value is less than one, the country is said to have a comparative disadvantage in the product/industry[41]. Some researchers multiply the index by *100* and interpret it accordingly.

The index has been applied in a number of studies to various industry sectors, including Balassa (1977, 1979, 1989); Balassa and Bauwens (1987); Hillman (1980); Huey (1998); Roemer (1977); Sheehan *et al.* (1994); Son and Wilson (1995); Yeats (1985); Tan (1992); Yamazawa (1970, 1971): Kalirajan and Shand (1998).

Critics and Some Applications of the Balassa Index

The indirect nature of the RCA measure based on the post-trade data creates a problem related to the interpretation of the index. Most researchers interpret it as dichotomous, while others as ordinal or cardinal measures. In the dichotomous sense, the index is used to conclude whether there is or is not a comparative advantage.

[41] For example the ratio of 1.10 indicates that the country's share in the particular product category is 10 per cent higher than its share in total manufactured exports (p. 19).

Cardinal interpretation is used to measure the 'numeric' magnitude of RCA. Ordinal interpretation is to rank countries as having a 'higher' or 'lower' degree of RCA.

Yeats (1985) questions whether the RCA index should be treated as an ordinal measure or a cardinal measure. He argues that *the numeric values of the index need not provide an ordinal ranking of a country's comparative advantage if the underlying distributions of index values are different across industries* (p. 62-63). He contends that a cardinal index would be preferred since it would give some insight into the magnitude of the differences in comparative advantage among various industries. Yeats proposed a methodology that allows for testing the consistency of the traditional factor proportion theory and actual empirical results exhibited by the RC*A* indices. The methodology also provides some insights into the RCA of different sectors of an industry. Based on his empirical testing, Yeats claims that the *RCA* indices, when used in the traditional (dichotomous) fashion, do not provide either cardinal or ordinal dimension.

Aquino (1978) applied the standard deviation of the Balassa index of *revealed comparative advantage* to measure the trade intensity in manufactures. He defined the index as:

$$S_{ij} = \left[\left(X_{ij} / \sum_{i} X_{ij} \right) \Big/ \left(\sum_{i} X_{ij} / \sum_{i} \sum_{i} X_{ij} \right) \right] \times 100 \tag{3.2}$$

where, X_{ij} is the exports of commodity i for country j. The value of the index is greater than *100* for industries in which a country has a higher degree of specialisation and it is less than *100* for other industries. The index suggests that the greater the standard deviation, the higher the degree of specialisation.

Bowen (1983) challenges indices of trade intensity, in particular the interpretation that deviations of the index's value from one (or 100) indicate a country's comparative advantage/disadvantage. He considers, and illustrates, that an implicit assumption, that a country exports every commodity that underlines this interpretation, is economically inappropriate (p. 466-68). In light of this criticism, Bowen offers two alternative measures, based on net trade and on the assumption that each country's consumption is proportional to the world's consumption. Both indices are derived from actual trade, rather than from trade expected in a neutral environment with no relative advantages.

Vollrath (1991) expresses doubt about the underlying assumptions of Bowen's index. Firstly, it is the assumption of identical and homothetic preferences which leads to the index being expressed as the ratio of actual net trade to estimated consumption, *net trade intensity index*. Secondly, the assumption of identical relative factor endowments and technology and the resulting *production intensity index*. Vollrath maintains that these two do not measure comparative advantage since they are concerned with a single commodity and therefore, *do not fulfil the contrasting dimensions inherent in the principle of comparative advantage* (p. 272). Vollrath also disputes Bowen's argument of using net trade as the appropriate variable to reflect on comparative advantage. He suggests that Bowen's claim implies a focus on absolute, rather than comparative advantage.

Ballance *et al.* (1985) empirically tested Bowen's proposition of the homothetic preferences. While they acknowledge Bowen's attempt to link production, consumption, and trade in a commodity and to relate these to the situation with neutral comparative advantage[42], based on their results, they challenge the validity of the indices proposed by Bowen. In order to investigate the reasons, Ballance's *et al.* take into account deviations of actual levels from expected levels of production and consumption. They argue that '*due to special circumstances a country may produce and/or consume more or less than expected'* (p. 349). They detected a very strong positive relationship between actual production and actual consumption which leads them to conclude that index of comparative advantage based entirely on production data fails to properly describe the patterns of comparative advantage among countries. Ballance *et al.* (1985) take the view that the index of comparative advantage depends on both production and consumption phenomena.

In his reply to comments by Ballance *et al.* (1985), Bowen (1985) clarifies his assumption pertaining to preferences (being identical, however, not necessarily homothetic). Bowen defends his indices by the argument that the validity of the '*proposed index measures of comparative advantage cannot be judged solely on the finding that the assumption of identical and homothetic preferences across countries is violated. The indices' validity can only be judged by their ability to predict actual comparative advantages.* Furthermore, Bowen claims that *any index that uses neutral comparative advantage as a reference point is a biased measure of a country's true specialisation,* (p. 353-354). In their 1987 study, Ballance *et al.* examined the uniformity of various revealed comparative advantage measures and reveal substantial inconsistency (Ballance *et al.*, 1987).

[42] The situation in which countries have the same pre-trade prices.

While Balassa (1965; 1977) developed the measure which includes imports, Balassa raises the question of likely bias in the measurement, in particular of imports, that is generated by the diversity of the level of protection (and tastes). Thus, the index based on export-import data may not give a reliable picture of actual comparative advantage. Consequently, Balassa (1979; 1989) considers comparative advantage exclusively from the product composition of exports[43]. Balassa (1989) examined the relationship between accumulation of physical and human capital, as a consequence of economic development, and resulting changing patterns of comparative advantage in manufactured products[44]. He associated countries' revealed comparative advantage in 184 manufactured product categories with the relative capital intensity[45] (capital-labour ratio) and estimated the elasticity of comparative advantage with respect to capital intensity[46].

Balassa (1989) takes into consideration two points. First, in light of the criticism[47] that revealed comparative advantage based on exports is not consistent with the trade theory, he employed a *normalised* net export index *(NX')*[48] that facilitates an aggregate level of trade imbalances. Secondly, due to a rising perception that the net export index involves some bias generated by the effect of import protection he derived both export and net export indices.

[43] Other studies using the same approach include, for instance, Hillman (1980).
[44] Balassa contemplates that as countries accumulate capital, their comparative advantage and, consequently patterns of trade change.
[45] Capital intensity is defined as the sum of physical and human capital per worker. It has been expressed in terms of both stocks and flows. More information on the subject can be found in Balassa (1989, p. 20-21).
[46] More discussion, including suggested explanations may be found in Balassa (1989, p. 3-16).
[47] This approach was questioned by Bowen(1983) who holds the view that comparative advantage is a net trade concept and therefore, he comments, Balassa's index is not consistent with the theory.

$NX'_{ij} = NX_{ij} + [NX_{ij} \times NX_{Tj}]$ If $NX_{ij} < 0$; $NX'_{ij} = NX_{ij} + [NX_{ij} \times NX_{Tj}]$ If $NX_{ij} > 0$

where NX_{Tj} is the net export index of total trade for country j (Balassa 1989, p. 81), The other notations are as above.

An Application of Balassa's Index to Australia's TAC Products

In this section an empirical analysis of Australia's revealed comparative advantage in TAC is provided. The analysis is based on the annual time-series data on TAC exports and imports, extracted from the International Economic Data Bank (IEDB) compiled by the Australian National University (ANU). The data have been obtained by ANU from the United Nations (UN) trade statistics and they follow the Standard International Trade Classification (SITC). In this analysis, the two- and three-digit level of aggregation is used for the period 1965 to 1998[49].

First, the Balassa RCA index at the 2-digit level for Australia was calculated for both textiles and clothing. The following formula was applied:

$$RCA_{ia} = \left(x_{ia}/X_{a}\right)/\left(x_{iw}/X_{w}\right) \tag{3.3}$$

where, RCA_{ia} is the revealed comparative advantage index, for commodity group i, for Australia, x_{ia} is Australia's export of commodity group i (textiles or clothing), X_a is Australia's total export of all commodities, x_{iw} is the world export of commodity i, and X_w is total world export. Given the fact that TAC industries were protected heavily over the most of the period 1965 to 1998, the Balassa's index that is based on exports is less likely to be influenced by the system of protection than other measures that involves both exports and imports. The results are presented in Table 3.1.

As expected, the results reveal that Australia has a strong comparative disadvantage in both textiles and clothing (category 65 and 84, respectively). All values of the index in Table 3.1, columns *'Textiles'* and *'Clothing'* are less than one. It appears, however,

[49] Due to termination of the access to the database, the most recent available update (1999) has not been possible.

Table 3.1: **The Balassa RCA Index, Textiles and Clothing, Australia, 1965 to 1998**

Year	65 - Textile Yarn, Fabrics, Made-Up Articles, and Related Products								84 - Articles of Apparel and Clothing Accessories		
	Textile Yarn and Thread (651)*	Cotton Fabrics, Woven (652)	Woven Textiles, Non-cotton (653)	Lace, Ribbons, Tulle, etc (654)	Special Textile Products (655)	Textile Products n.e.s. (656)	Floor Coverage, Tapestry (657)	TEXTILES (65)	(841)	(842)	CLOTHING (84)
1965	1.31	0.62	0.76	0.89	2.32	0.002	0.47	0.10	0.96	3.58	0.06
1966	0.78	0.69	1.20	1.54	1.67	0.002	0.64	0.10	0.93	5.26	0.08
1967	0.88	0.64	1.03	0.81	2.19	0.001	0.84	0.08	0.99	1.33	0.10
1968	0.89	0.54	1.08	0.67	2.26	0.001	0.76	0.08	0.98	2.06	0.12
1969	0.91	0.67	1.04	0.74	1.80	0.002	0.68	0.09	0.98	2.02	0.11
1970	0.95	0.77	0.84	0.47	1.86	0.003	1.02	0.11	0.97	2.18	0.11
1971	0.93	0.65	0.95	0.68	1.69	0.002	1.12	0.10	0.97	2.44	0.10
1972	0.89	0.61	0.82	0.86	2.20	0.002	1.06	0.09	0.96	3.02	0.09
1973	0.80	1.13	0.76	0.75	1.69	0.003	1.25	0.10	0.98	2.02	0.09
1974	0.80	1.19	0.79	0.70	2.02	0.003	0.64	0.13	0.97	2.13	0.09
1975	0.75	1.10	0.73	1.02	2.60	0.002	0.65	0.09	0.96	2.63	0.06
1976	0.73	1.21	0.68	0.70	2.37	0.002	1.03	0.09	0.90	5.46	0.05
1977	0.62	1.01	0.66	0.74	2.68	0.001	1.38	0.08	0.86	5.88	0.05
1978	2.01	0.56	0.34	0.40	1.71	0.002	0.76	0.14	0.92	3.66	0.04
1979	2.51	0.37	0.28	0.26	1.38	0.001	0.83	0.19	0.97	1.97	0.05
1980	2.56	0.30	0.21	0.29	1.40	0.002	0.58	0.23	0.97	1.91	0.06

* SITC code.

Calculated from the data source: EIDB, ANU.

(Table 3.1 continued)

Year	65 - Textile Yarn, Fabrics, Made-Up Articles, and Related Products								84 - Articles of Apparel and Clothing Accessories		
	Textile Yarn and Thread (651)	Cotton Fabrics, Woven (652)	Woven Textiles, Non-cotton (653)	Lace, Ribbons, Tulle, etc (654)	Special Textile Products (655)	Textile Products n.e.s. (656)	Floor Coverage, Tapestry (657)	TEXTILES (65)	(841)	(842)	CLOTHING (84)
1981	2.66	0.30	0.25	0.22	1.47	0.001	0.52	0.24	0.93	3.20	0.04
1982	2.87	0.16	0.15	0.17	1.35	0.001	0.68	0.26	0.98	1.52	0.03
1983	2.60	0.24	0.20	0.16	1.44	0.001	0.78	0.22	0.90	4.22	0.03
1984	2.40	0.21	0.29	0.15	1.57	0.002	0.65	0.20	0.92	3.57	0.02
1985	2.47	0.24	0.28	0.13	1.18	0.002	0.85	0.21	0.95	2.84	0.02
1986	2.43	0.20	0.32	0.18	1.13	0.002	1.03	0.21	0.95	2.83	0.03
1987	2.35	0.17	0.30	0.27	1.01	0.003	1.13	0.22	0.94	3.01	0.04
1988	0.31	0.54	0.72	0.42	2.01	0.003	2.50	0.11	0.96	3.00	0.05
1989	0.32	0.55	0.71	0.40	1.99	0.004	2.03	0.11	0.96	2.83	0.06
1990	0.41	0.53	0.57	0.39	2.28	0.003	2.38	0.12	0.99	1.80	0.08
1991	0.44	0.53	0.54	0.27	2.45	0.004	1.81	0.12	0.99	2.16	0.08
1992	0.76	0.69	0.50	0.34	2.31	0.003	1.66	0.14	0.99	2.21	0.08
1993	0.82	0.80	0.57	0.25	2.00	0.004	1.59	0.18	0.98	2.51	0.09
1994	0.93	0.87	0.61	0.26	1.70	0.004	1.66	0.21	0.99	2.43	0.12
1995	0.95	1.12	0.57	0.21	1.76	0.004	1.34	0.24	0.99	2.52	0.11
1996	0.85	1.28	0.59	0.20	1.54	0.005	1.46	0.26	0.99	2.11	0.12
1997	0.99	1.06	0.64	0.31	1.39	0.005	1.51	0.26	0.99	1.88	0.12
1998	0.92	0.95	0.78	0.33	1.47	0.003	1.77	0.24	0.99	2.44	0.11

Calculated from the data source: EIDB, ANU.

that textiles industries have had a slightly better performance in terms of comparative advantage since the values of the index are slightly higher. The values of the index are much closer to zero in clothing than they are in textiles. A closer scrutiny of the values also reveals that overall trend of the index, in particular in clothing since the late 1980s has been increasing. This improvement in the revealed comparative advantage may be linked with the gradual dismantling of the tariff and non-tariff protections that have been in this sector and with implications on Australia's trade of changes taking place in the capital, human and technological endowments in various countries in the region.

In order to find out whether these conclusions are valid at a more disaggregated level of TAC, the RCA index was calculated for all subcategories at the 3-digit level. This is in line with Vollrath (1991) who pointed out that the application of post-trade data to examine countries' comparative advantage may induce some bias, that is likely to occur at a high level of aggregation. He further argues that the situation may occur when a country has an overall comparative disadvantage in a commodity group, yet a comparative advantage in a particular product within the 'composite' commodity (p. 267).

The results are presented in Table 3.1. The values unveils that, despite the overall revealed comparative disadvantage, there was both inter- and intra- group diversity in the magnitude of the index. With the exception of clothing made of fur (category 842) it seems that textile industries has performed slightly better. According to the data at the 3-digit level of aggregation, in some subcategories, at times Australia has experienced even a comparative advantage. Between 1965 and 1998, Australia maintained, although at a very variable degree, the revealed comparative advantage in categories 655-Special Textile Products and 842-Clothing made-of fur. However, in the other broad category of clothing, Non-of fur clothing, Australia has demonstrated a revealed comparative disadvantage through the entire period between 1965 and 1998. However, the values of the index, especially in the 1990s, were consistently very close to one (at 0.99).

From the values of the index it emerges that the degree of Australia's comparative disadvantage in TAC has been declining slightly. In category 652-Cotton Fabrics woven, since the mid 1990s, Australia has regained the comparative advantage enjoyed over a relatively short period between 1973 and 1977. Despite a slight improvement in some categories, Australia has maintained a rather strong comparative disadvantage in both textiles and clothing industries.

3. 4 Revealed Comparative Advantage in TAC - Australia's Trading Partners

In this section, a brief review of the revealed comparative advantage of Australia's major trading partners in TAC is presented. Based on the examination of the extent of the total bilateral trade (exports + imports) between Australia and the rest of the world (ROW) for the period 1965 to 1999, the following countries have been identified as Australia's major trading partners in TAC: China, Hong Kong, India, Japan, Korea, New Zealand, Taiwan, United Kingdom, the United States. The list includes some of the world's leading exporters and importers of TAC as discussed in Chapter 2. A summary of historical trends of RCA in TAC, at the two- digit level of aggregation between 1965 and 1999, based on the NAPES (National Asia Pacific Economic and Scientific) database, ANU database is presented in Tables 3.2 and 3.3 below.

According to the values of the index in Table 3.2, the countries with the relatively high degree of RCA in textiles are Hong Kong, China, India, Korea, and Taiwan. For these countries, the values of the index are greater than one. Overall, Hong Kong appears to have the strongest RCA over the entire period 1965 to 1999, implying that Hong Kong has a higher share of TAC in its exports than is its share in the total world exports.

India's second position occupied between 1965 and 1974 was taken over by China that, since 1975 has been improving significantly its RCA and it has not only became the close second but after 1995 overtook Kong Kong's top position in terms of RCA in textiles. Since 1990 India, Korea and Taiwan have maintained a similar level, with a steadily increasing rate of growth in the index indicating the RCA.

As revealed by the values of the index, Japan experienced RCA in textiles between 1965 and 1975. Since then however, it has been losing gradually its RCA in textiles. Both the United Kingdom and the United States show the revealed comparative disadvantage in textiles, although United Kingdom experienced a low level of RCA between 1974 and 1985.

With regards to the RCA in clothing, reported in Table 3.3, Hong Kong has maintained the top position over the entire period of 1965 to 1999. It is evident that

Table 3.2: **Revealed Comparative Advantage in Textiles, Australia's Trading Partners, 1965-1999**

Year	65-Textiles								
	China	**H-K**	**India**	**Japan**	**Korea**	**NZ**	**Taiwan**	**UK**	**USA**
1965	2.41	3.23	2.93	1.53	1.82	1.15	1.32	0.87	0.59
1966	2.18	3.62	2.71	1.52	1.79	1.09	1.59	0.84	0.58
1967	2.30	3.40	2.65	1.41	2.10	1.24	1.82	0.88	0.54
1968	2.49	3.50	2.58	1.41	1.98	1.17	1.82	0.88	0.52
1969	2.51	3.33	2.87	1.33	1.65	1.18	1.95	0.88	0.50
1970	2.42	3.50	2.80	1.26	1.85	1.19	2.23	0.93	0.52
1971	2.34	3.38	2.90	1.26	1.89	1.23	2.09	0.94	0.54
1972	2.38	3.36	3.25	1.19	1.77	1.11	1.98	0.93	0.53
1973	2.42	3.59	2.75	1.15	2.38	1.20	2.19	0.94	0.48
1974	2.31	3.76	2.70	1.01	1.98	1.66	1.97	1.06	0.51
1975	2.48	3.97	1.85	1.05	2.36	1.31	2.15	1.02	0.45
1976	3.13	4.02	2.21	1.01	2.47	1.43	2.24	1.02	0.49
1977	3.11	3.60	2.37	0.99	2.26	1.41	1.94	1.07	0.46
1978	2.98	3.51	1.97	0.96	2.22	1.41	1.79	1.08	0.45
1979	2.98	3.67	2.11	0.93	2.10	1.51	1.93	1.08	0.46
1980	3.39	3.91	2.05	0.90	2.36	1.42	1.87	1.03	0.48
1981	4.34	4.08	1.94	0.93	2.27	1.43	1.95	1.05	0.49
1982	3.83	3.79	2.00	0.92	2.20	1.50	1.84	1.02	0.45
1983	3.69	3.91	1.49	0.89	2.04	1.35	1.67	0.99	0.43
1984	3.87	4.01	1.83	0.84	1.89	1.57	1.74	0.97	0.45
1985	3.20	3.97	1.61	0.79	1.80	1.41	1.98	0.99	0.45
1986	3.46	3.85	1.49	0.73	1.94	1.32	1.77	0.94	0.45
1987	3.47	3.82	1.80	0.69	1.87	1.15	1.66	0.92	0.42
1988	3.32	3.41	1.65	0.68	1.81	1.05	1.62	0.93	0.41
1989	3.42	3.61	1.71	0.67	1.90	1.03	1.79	0.90	0.39
1990	3.46	3.49	1.72	0.62	1.91	0.91	1.91	0.88	0.41
1991	3.38	3.36	2.06	0.62	1.98	0.88	1.98	0.85	0.43
1992	3.02	3.10	1.97	0.62	2.13	0.87	1.89	0.84	0.44
1993	2.67	2.86	2.04	0.57	2.25	0.86	1.95	0.83	0.45
1994	2.83	2.88	2.20	0.57	2.27	0.81	2.16	0.83	0.43
1995	2.93	2.78	2.16	0.57	2.12	0.77	2.12	0.82	0.44
1996	2.92	2.84	2.52	0.61	2.16	0.77	2.23	0.82	0.46
1997	2.80	2.63	2.49	0.58	2.20	0.75	2.14	0.80	0.48
1998	2.62	2.53	2.32	0.55	2.24	0.74	2.02	0.79	0.50
1999	2.54	2.60	2.39	0.59	2.16	0.79	2.03	0.75	0.52

Source: Compiled from the NAPES, ANU, database.

Table 3.3: **Revealed Comparative Advantage in Clothing, Australia's Trading Partners, 1965-1999**

Year	84-Clothing								
	China	H-K	India	Japan	Korea	NZ	Taiwan	UK	USA
1965	1.15	9.47	0.20	1.19	2.27	0.17	1.42	0.68	0.95
1966	0.87	8.73	0.16	1.15	2.17	0.13	1.47	0.70	0.88
1967	0.88	8.85	0.17	0.98	2.78	0.13	2.00	0.79	0.86
1968	1.15	8.64	0.23	0.91	3.37	0.11	2.86	0.79	0.89
1969	1.11	8.05	0.36	0.82	3.43	0.12	2.93	0.78	0.93
1970	1.08	7.69	0.46	0.75	3.93	0.12	3.74	0.76	0.92
1971	1.13	7.89	0.47	0.64	4.30	0.11	4.77	0.77	0.92
1972	1.18	7.58	0.64	0.49	4.88	0.10	3.92	0.76	0.89
1973	1.32	7.40	0.76	0.58	4.71	0.10	4.01	0.84	0.81
1974	1.47	8.80	1.02	0.55	4.80	0.13	4.13	0.90	0.77
1975	1.20	9.54	0.95	0.40	4.84	0.15	4.09	0.91	0.75
1976	1.54	9.12	1.48	0.43	5.36	0.22	3.98	0.92	0.83
1977	1.83	8.27	1.31	0.42	4.74	0.27	3.52	0.94	0.85
1978	1.56	7.30	1.34	0.44	4.21	0.21	3.32	0.91	0.95
1979	1.86	7.22	1.55	0.47	3.79	0.24	2.66	1.00	0.84
1980	2.39	7.27	1.35	0.37	3.63	0.26	2.99	0.99	0.85
1981	2.80	7.17	1.51	0.38	3.86	0.28	3.06	1.06	0.88
1982	3.16	7.00	1.26	0.40	3.69	0.28	3.16	0.94	0.95
1983	3.29	6.64	1.26	0.34	3.19	0.29	2.86	0.85	1.05
1984	2.92	6.43	1.36	0.36	3.01	0.26	2.87	0.80	1.12
1985	2.34	6.20	1.40	0.35	2.80	0.24	2.67	0.77	1.16
1986	2.99	5.38	1.40	0.35	2.68	0.22	2.15	0.73	1.08
1987	1.96	4.82	1.64	0.43	2.60	0.22	1.75	0.73	1.06
1988	2.06	4.41	1.60	0.52	2.50	0.22	1.46	0.76	1.02
1989	2.30	4.66	1.90	0.62	2.36	0.29	1.32	0.73	1.06
1990	2.56	4.45	1.99	0.55	1.85	0.35	1.07	0.74	1.02
1991	2.55	4.03	2.06	0.51	1.42	0.38	0.98	0.77	0.97
1992	2.81	3.55	2.02	0.56	1.22	0.41	0.81	0.76	1.03
1993	2.63	3.38	1.94	0.60	1.08	0.41	0.72	0.75	1.06
1994	2.90	3.22	2.11	0.67	0.91	0.46	0.67	0.75	1.07
1995	2.68	2.98	1.97	0.75	0.71	0.49	0.58	0.77	1.10
1996	2.70	3.00	2.43	0.80	0.64	0.50	0.57	0.82	1.10
1997	2.94	3.00	1.90	0.66	0.61	0.55	0.54	0.81	1.12
1998	2.69	3.22	2.05	0.64	0.68	0.55	0.52	0.81	1.15
1999	2.49	3.48	1.97	0.67	0.64	0.56	0.47	0.82	1.14

Source: Compiled from the NAPES, ANU, database.

Hong Kong's strong RCA in clothing has been declining at a rather remarkable rate and in the late 1990s it was only about half of its 1965 level. On the other hand, China has been improving its RCA from a relatively low level and it is currently, the second in terms of RCA among the considered countries. India has also made a significant progress it has overcome its relative comparative disadvantage and since 1975 has maintained a steadily increasing degree of RCA in clothing.

Korea and Taiwan have experienced similar patterns of RCA, although Korea at a slightly higher level. Both countries increased their RCA between the mid 1960s and the early 1970s. Since then, however RCA in clothing has deteriorated to the point that in the 1990 both countries experienced revealed comparative disadvantage in clothing.

For the most of the examined period, Japan, New Zealand, the United Kingdom and the United States experienced the revealed comparative disadvantage in clothing. The values of the index for Japan and New Zealand, however, have shown a very small increase in the past few years. The United States has comparative advantage (RCA index is greater than one for 1983 to 1990 and 1992 to 1998).

3. 5 Australia's Revealed Competitiveness in TAC Products

In this section, Australia's relative trade advantage and competitiveness in TAC are examined using an alternative measure introduced by Vollrath (1991).

3. 5. 1 Vollrath's Index of Revealed Competitive Advantage

Vollrath (1991) pointed out that appraising of revealed comparative advantage at aggregate and disaggregated levels can *'identify the overall direction and drive in which a country's investment and trade should take in order to exploit international differences in product and factor supply and demand'* as well as *'to evaluate socially desirable specialisation patterns along narrow product lines'* (p. 265). He further argues that the estimation of comparative advantage may be particularly beneficial when considering trade between countries with different factor endowments.

Vollrath (1991) pointed out some factors that may limit an accurate inference from post-trade data to actual revealed comparative advantage (p. 266-267). Vollrath stresses that it is important to differentiate between two-countries' trade links and their economic associations with the rest of the world. As a result of his review, and building on Kunimoto (1977), Vollrath (1991) offers the measures that enable the estimation of comparative advantage in an environment exposed to various degrees of distortion. He developed the concept of revealed *competitive* advantage and global trade intensity indices, in particular the relative trade advantage index *(RTA)*, relative export advantage index *(RXA)*, and relative competitiveness index *(RC)*. These are as follows:

$$RTA_{ij} = RXA_{ij} - RMA_{ij} \tag{3.4}$$

$$RXA_{ij} = \left(X_{ij} / X_{nj}\right) / \left(X_{ir} / X_{nr}\right) \tag{3.5}$$

$$RMA_{ij} = \left(M_{ij} / M_{nj}\right) / \left(M_{ir} / M_{nr}\right) \tag{3.6}$$

$$RC_{ij} = \ln\left(RXA_{ij}\right) - \ln\left(RMA_{ij}\right) \tag{3.7}$$

where,

RTA_{ij} = relative trade advantage of country j in commodity i

RXA_{ij} = relative export advantage of country j in commodity i

RMA_{ij} = relative import advantage of country j in commodity i

RC_{ij} = revealed competitiveness index of country j in commodity i (TAC)

X = exports

M = imports

n = rest of the commodities

r = rest of the world

ln = natural logarithm.

According to Vollrath (1991), positive values of the three indices reveal comparative advantage, whereas negative values indicate comparative disadvantage. Vollrath claims that an important feature of these measures is that they allow distinguishing between a specific commodity/country and the rest of the commodities/countries. In this way, the indices eliminate country and commodity double counting in the world trade. Thus, Vollrath suggests that the revealed competitiveness index (RC) may be preferable because of the supply and demand balance embodied in the index. It therefore provides a better picture of the actual comparative advantage of a commodity/country (p. 276).

However, the RC index has some limitations. In particular, its application is restricted when a bilateral trade in the same commodity does not occur, that is either export or import is zero. It is also very sensitive to small values of exports and imports (p. 277). On the other hand, the relative trade advantage index, RTA, has the embodied potential to weigh the relative contribution of export and import advantages in the overall revealed competitive advantage in a particular commodity group/industry. Considering the shortcomings of the above three indices, Vollrath admits that the RXA index that reduces the effects of distortions is more widely used in practice.

Given a notable diversity in the rate of assistance to the TAC industries, Vollrath's measures are considered to be appropriate for the estimation of the comparative advantage for Australia's trade in textiles and clothing. The results of the investigation into the competitive advantage in TAC, applying Vollrath' indices of the relative trade advantage, relative export advantage and revealed competitiveness indices are presented in Table 3.4. While all three indices deteriorated in the early 1970s, most of the indices have been consistently, albeit at a small rate, improving since. According to Vollrath's interpretation of the revealed competitiveness index (RC), since 1992 Australia has even recorded a competitive advantage in textiles, first time since 1965. While the absolute values of the index are very small, they have been improving steadily.

Positive values of the revealed competitiveness index in the clothing category (column RC 84) since 1978 may be the result of a strong positive effect of category 842 - Clothing made of fur, as indicated by the Balassa's index (Table 3.3) based on a higher degree of data disaggregation. Main observations identified from a closer examination of Table 3.4 are summarised below.

Table 3.4: **Vollrath Competitiveness Indices, Textiles and Clothing, Australia, 1965-1998**

Year	RTA		RC		RXA	
	65	84	65	84	65	84
1965	-1.82	-0.38	-0.55	0.88	-2.41	-2.78
1966	-1.77	-0.33	-0.53	0.97	-2.34	-2.59
1967	-1.95	-0.40	-0.63	0.80	-2.64	-2.32
1968	-1.79	-0.35	-0.55	0.87	-2.55	-2.14
1969	-1.79	-0.33	-0.54	0.93	-2.45	-2.23
1970	-1.79	-0.37	-0.53	0.86	-2.24	-2.28
1971	-1.89	-0.41	-0.59	0.77	-2.32	-2.30
1972	-2.14	-0.56	-0.72	0.53	-2.51	-2.45
1973	-2.30	-0.67	-0.78	0.36	-2.32	-2.49
1974	-2.28	-1.21	-0.75	-0.18	-2.06	-2.46
1975	-1.83	-1.04	-0.56	-0.03	-2.48	-2.79
1976	-2.16	-1.11	-0.72	-0.10	-2.45	-2.97
1977	-2.00	-1.07	-0.65	-0.06	-2.53	-3.07
1978	-1.91	-0.99	-0.58	0.01	-1.99	-3.25
1979	-1.91	-0.82	-0.55	0.19	-1.68	-2.98
1980	-1.92	-0.77	-0.54	0.25	-1.51	-2.91
1981	-1.64	-0.80	-0.39	0.21	-1.45	-3.31
1982	-1.57	-0.77	-0.35	0.26	-1.36	-3.70
1983	-1.70	-0.73	-0.44	0.30	-1.53	-3.48
1984	-1.78	-0.72	-0.49	0.33	-1.62	-3.83
1985	-1.53	-0.64	-0.35	0.44	-1.62	-3.89
1986	-1.33	-0.51	-0.23	0.64	-1.59	-3.63
1987	-1.31	-0.49	-0.21	0.67	-1.54	-3.25
1988	-1.35	-0.45	-0.27	0.74	-2.29	-3.02
1989	-1.19	-0.44	-0.15	0.76	-2.23	-2.91
1990	-1.06	-0.44	-0.04	0.73	-2.17	-2.63
1991	-1.05	-0.47	-0.03	0.67	-2.14	-2.62
1992	-0.99	-0.46	0.02	0.69	-2.02	-2.56
1993	-1.00	-0.51	0.02	0.60	-1.74	-2.41
1994	-0.93	-0.51	0.08	0.59	-1.61	-2.19
1995	-0.82	-0.53	0.18	0.56	-1.47	-2.22
1996	-0.80	-0.56	0.20	0.51	-1.37	-2.20
1997	-0.71	-0.55	0.29	0.52	-1.34	-2.09
1998	-0.75	-0.60	0.25	0.46	-1.39	-2.23

Source: Calculated from the EIDB, ANU database.

Most of the values in Table 3.4 are negative, implying that Australia has a relative disadvantage, thus an insignificant market share of the textile and clothing world market. Despite an overall relative trade disadvantage between 1965 and 1998 and some deterioration in the 1970s, since the mid 1980s, Australia's relative trade disadvantage in textiles has been declining at a steady rate. Similarly, the clothing industry experienced a decline in the relative trade disadvantage in the early 1970s. The late 1970s through 1980s was the period of a significant decrease in Australia's relative trade disadvantage in clothing. The 1990s were marked with a rather stable RTA index, with a moderate reduction in the values over the past few years. Judging from the values of the RTA index, the relative trade disadvantage is also evident in clothing industry (all values of the RTA index are negative), however, the negative values of the index are notably lower than the values for the textile industry.

Based on the comparison of the values for the two industries, it appears that Australia's relative trade 'advantage' in clothing (category 84) is relatively stronger than in textiles (category 65). However, comparing the overall trend, textile industry has gained a steadier and more significant improvement in the RTA than clothing industries.

In terms of the relative export advantage both industries are marked with a strong disadvantage (high negative values of the RXA index). The textile industry displayed high and rather volatile values between the late 1960s and the late 1970s, when the absolute values of the index declined sharply, this trend continued until 1988 when the index regained its 1970s' level.

After a short-lived rise in the value of the RXA index in the late 1960s, clothing industry experienced a rather prolonged deterioration in the relative export advantage. Since the mid 1980s, however, both industries have shown signs of a steady and significant improvement in the values of the index.

The examination of the values in Table 3.4 reveals an interesting link between the RTA and RC indices. While the actual values of the two indices differ, their overall trend is very similar. The year-to-year variation of the values based on Vollrath's index and Balassa's index differs. This is likely due to the fact that they are based on different concepts, and hence are not strictly comparable. However, in the two-digit aggregate categories of textiles and clothing, the two types of indices show the same broad results indicating that Australia lacks comparative advantage and competitiveness in both aggregate product categories. Another reason may be, as mentioned earlier, a strong sensitivity of the Vollrath index to small values of exports and imports.

3. 6 Australia's Trade Performance in TAC Products

3. 6. 1 Indices of Trade Performance

In this section Australia's overall trade performance of textile and clothing industries, based on empirical evidence over the period 1970 to 1996[50], is presented. The reason for excluding the period 1965 to 1969 was the unavailability of the data for some of the variables required in calculating some of the indices. Prior to empirical analysis, a brief summary of commonly used measures to analyse the trade performance is presented.

[50] The examination of data revealed that the data were unreliable, mainly due to the 'estimated' output of TAC it was, therefore, decided to delete data for years 1997-1998.

Trade specialisation Index (TSI)

First, Balassa's (1966) trade specialisation index *(TSI)* is calculated based on SITC data. The index is the ratio of net trade to the total trade in the commodity category. It is defined as:

$$TSI_i = \frac{|X_i - M_i|}{(X_i + M_i)} \tag{3.8}$$

where,

X_i is exports of the *ith* industry

M_i is imports of the *ith* industry.

The TSIs for the period 1970-1996 are presented in Table 3.5. The indices confirm that Australia does not specialise in TAC exports, and is a net-importer of these products. This fact is reflected in the negative values of the index. A closer inspection of the values, however, reveals that the net imports, as a proportion of the total trade in TAC have been decreasing over time, especially since the mid 1980s. This is shown by the decreasing negative values of the index. This trend has been more pronounced in textiles than in clothing.

Export propensity

The export propensity index *(EPI)* measures the exports as a percentage of domestic production of a particular commodity, and is derived as:

$$EPI_i = \frac{X_i}{Q_i} * 100 \tag{3.9}$$

where,

X_i is exports of the *ith* commodity (textiles, clothing)

Q_i is domestic production of textiles and clothing.

Table 3.5: **Australia's Competitiveness in Textiles and Clothing, 1970-1996**

Year	TSI_SITC		EPI		MPI_1		MPI_2*		X/M ratio	
	321**	322***	321	322	321	322	321	322	321	322
1970	-0.54	-0.66	8.76	1.16	24.38	5.38	29.41	5.62	29.77	20.73
1971	-0.66	-0.67	6.51	1.29	25.51	6.13	32.02	6.45	20.33	20.01
1972	-0.55	-0.70	9.06	1.34	25.64	7.10	31.36	7.54	28.90	17.76
1973	-0.56	-0.74	10.41	1.52	29.10	9.19	36.77	9.97	28.32	15.24
1974	-0.66	-0.88	8.21	1.19	30.77	15.35	40.80	17.91	20.13	6.64
1975	-0.89	-0.88	9.64	1.11	27.41	13.79	34.13	15.82	28.24	7.01
1976	-0.90	-0.90	11.32	1.05	30.00	16.19	38.01	19.12	29.78	5.50
1977	-0.91	-0.91	12.31	1.01	30.92	17.45	39.25	20.92	31.37	4.85
1978	-0.86	-0.93	13.91	0.90	32.86	17.92	42.13	21.64	33.01	4.18
1979	-0.80	-0.88	15.75	1.20	34.60	16.22	44.57	19.13	35.34	6.30
1980	-0.78	-0.87	16.58	1.21	34.26	15.36	43.47	17.92	38.15	6.77
1981	-0.78	-0.92	17.12	0.81	32.65	16.77	40.19	19.99	42.59	4.06
1982	-0.76	-0.95	15.47	0.59	32.56	17.55	40.81	21.16	37.90	2.79
1983	-0.78	-0.92	15.75	0.83	32.53	16.40	40.63	19.45	38.76	4.29
1984	-0.81	-0.94	16.29	0.67	35.75	18.41	46.57	22.41	34.98	3.01
1985	-0.79	-0.94	19.62	0.75	37.01	19.41	47.22	23.90	41.55	3.14

Source: Calculation based on World Bank International Database, from IEDB, ANU database. *Based on Athukorala and Hazari (1988). **321-Manufacture of Textiles. ***322-Manufacture of Wearing Apparel. [a] Calculation of the indices for 1993 to 1996 is based on estimated output.

(Table 3.5 contintinued)

Year	TSI		EPI		MPI_1		MPI_2*		X/M ratio	
	321**	322***	321	322	321	322	321	322	321	322
1986	-0.78	-0.92	21.98	1.12	37.23	19.61	46.28	24.12	47.49	4.64
1987	-0.76	-0.88	24.20	1.75	38.05	20.38	46.55	25.14	51.99	6.96
1988	-0.87	-0.84	24.48	2.31	35.74	19.44	42.00	23.57	58.28	9.82
1989	-0-.86	-0.84	20.19	2.47	33.84	20.28	40.83	24.81	49.45	9.96
1990	-0.83	-0.79	18.36	3.47	32.25	21.63	38.86	26.64	47.25	13.02
1991	-0.81	-0.78	21.48	3.99	33.93	23.36	40.32	29.27	53.28	13.64
1992	-0.80	-0.78	27.13	4.43	33.41	26.31	43.93	34.12	61.76	12.99
1993[a]	-0.75	-0.78	24.03	4.63	32.28	28.79	39.72	36.04	60.50	12.84
1994	-0.73	-0.75	29.74	6.15	36.61	32.00	45.02	40.14	66.07	15.32
1995	-0.68	-0.77	33.72	6.48	36.97	35.00	45.42	43.98	74.24	14.73
1996	-0.64	-0.76	34.33	7.26	36.78	37.63	45.17	47.37	76.02	15.33

Source: Calculation based on World Bank International Database, from IEDB, ANU database. *Based on Athukorala and Hazari (1988). **321-Manufacture of Textiles. ***322-Manufacture of Wearing Apparel. [a] Calculation of the indices for 1993 to 1996 is based on estimated output.

It is evident from Table 3.5, that whereas the EPI index for clothing more-less stagnated between 1970 and 1985, since then it has maintained a steady increase. On the other hand exports as a proportion of domestic production in textiles recorded, with some fluctuation, an increasing overall trend during the entire period. This is mainly due to a significantly greater rate of increase in exports compared to the rate of increase in production. Again, it is apparent that between 1970 and 1996 both the value of the index and the rate of increase in the index have been greater in textiles than in clothing.

Import penetration

The import penetration index *(MPI)* measures the percentage share of imports to total domestic sales of a commodity. Domestic sales are defined as domestic production (Q_i) less exports (X_i) plus imports (M_i) of the i^{th} commodity (textiles and clothing).

$$MPI_i = \frac{M_i}{Q_i - X_i + M_i} \times 100 \tag{3.10}$$

The MPI is often regarded as an indicator of import competition faced by the particular domestic industry. Some economists, including Cleveland (1985), argue that the index may not be an appropriate indicator of import competition if both exports and imports increase over time. To overcome this problem, Athukorala and Hazari (1988) express the import penetration index as the share of imports as a percentage of total domestic production (Equation 3.11). In this study, both measures are applied. The values of the indices for the period 1970 to 1996, based on the International Standard Industrial Classification (ISIC) are presented in Table 3.5. The MPI1 is based on the derived domestic sales, while MPI2 is based on domestic production, as suggested by Athukorala and Hazari (1988). The ISIC trade data have been used to derive these indicators as they match production data to allow calculation of the variables such as apparent consumption and market penetration ratios.

$$MPI_i = \frac{M_i}{Q_i} \times 100 \qquad (3.11)$$

From a thorough examination of the values in Table 3.5 a number of summary points can be made. First, while the magnitude of the index is slightly higher if imports are expressed as a proportion of an apparent consumption, an overall trend of the two indices is almost identical. Second, both indices rose in the early 1970s and maintained a similar and moderate increase until the late 1980s. Since 1988, the two industries have shown a different trend.

As indicated by the greater magnitude of the increase in the value of the index in category 322-Clothing, compared to 321-Textiles, domestic clothing producers have been facing more pressure from the international competitors. Whereas the proportion of imports of textiles in domestic apparent consumption, as well as production, more-less stagnated, the share of imports in the total domestic production and consumption of clothing rose significantly over that period. This dissimilar performance of the index in the two industries has been very apparent in particular since about 1995 where first time during the observed period 1970 and 1996, the clothing industry MPI has been greater than the index for the textile industry. One explanation for this trend in the index may be a diverse effect of abolition of the quota restrictions in 1993.

An alternative and broader indicator of the development in the competitiveness of Australia's TAC industries, the export to import ratio (X/M) is also provided in Table 3.5. A closer examination of the ratio reveals that after a brief decline in the early

1970s and again in the early 1980s, textiles have a significant overall increase in the export to import ratio. A notable drop, however, occurred in 1989-90. The period was marked by a very moderate improvement in trade performance by the clothing industry as well, albeit from a low base. After a considerable drop in the values of the index in the early 1970s from around 0.20 to around 0.03 the index has maintained a very low level through to the mid 1980s. A higher level of the index has been maintained since the mid 1980s.

3. 7 Conclusion

In this chapter, a theoretical review and an empirical analysis of comparative advantage were presented. The chapter began with a discussion of major theoretical explanations for how and why countries trade with each other as well as the factors that influence their specialisation in production and trade. It continued with a review of empirical studies testing the theory, with the emphasis on comparative advantage as the basis for trade. Australia's relative competitive position in the global market of textiles and clothing was examined, employing Balassa's revealed comparative advantage index and Vollrath's measures of revealed competitiveness. Australia's trade performance in TAC was examined using a number of indicators, including the Trade Specialisation Index, Export Propensity and Import Penetration Indices. The empirical analysis was based on international trade data according to the Standard International Trade Classification at two and/or three-digit level of aggregation.

The results indicate that Australia has experienced some structural changes in trade over the past three to four decades. The most dramatic is the decline in traditional dominance of agriculture and in narrowing the gap between exports and imports in manufacture. However, TAC industries still record a very strong comparative disadvantage. There are some indications that the trade performance and comparative advantage in particular is some subcategories, such as 'special' textiles, have slightly improved. Overall, Australia has not been and is not likely to be a significant player on the supply side of the international market in textiles and clothing products. Thus, despite high levels of assistance, the industries were unable to become competitive.

As apparent from the values of revealed comparative advantage index, there have also been structural changes in the TAC global market. The loss of the revealed comparative advantage by some countries may create some opportunities for other countries, including Australia to strengthen their competitiveness. It may be argued, that due to Australia's traditionally strong position in primary products, and furthermore, its relative disadvantage against low labour cost countries, Australia cannot be successful in this challenge. However, it may also be argued that in the current, increasingly global market, Australia may exploit other forms of competition, such as product differentiation, in terms of quality and design. As a high quality fibre producer, with growing number of Australian retailing firms penetrating foreign markets and by implementing an effective promotion Australia may potentially improve its comparative advantage in at least some categories of TAC products. There is at least some indication in the findings that this suggestion may be valid in the long-run. The values of the comparative advantage indices have been 'improving' thus, they declined in the negative value or in some cases the values even changed from negative to positive.

The outcomes of the analysis suggests that while information regarding a country's comparative advantage and relative comparative advantage with respect to the rest of the world may be extremely useful in implementing and evaluating of policy and investment decisions, there are other determinants of trade, such as economies of scale, product differentiation, and imperfect competition. These are the subjects of the investigation in Chapters 7 and 8 of this thesis. An analysis of Australia's export supply of and import demand for TAC products will be provided in chapters 4, 5, and 6.

Chapter 4

EXPORT SUPPLY OF AND IMPORT DEMAND FOR TAC: THEORY, REVIEW OF EMPIRICAL STUDIES AND MODELS

4. 1 Introduction

A proper understanding of demand and supply of exports and imports and relevant elasticities is a prerequisite for policy decisions in relation to export promotion strategies and/or import substitution (Koshal *et al.*, 1992). Johnson (1958) and Houthakker and Magee (1969) stress that a country's trade balance is determined by the country's income and price elasticities of demand for exports and imports.

The purpose of this chapter is to develop export supply and import demand models for Australia's TAC products. The study does not include an analysis of export demand or import supply. The reason is that Australia is a very minor player on the world export and import markets for TAC. Between 1965 and 1999, Australia's share of textiles in the world textile exports (category 65 of SITC) was on average 0.17 percent and Australia's share in the world imports was just over 2 percent[51]. Australia's contribution to the world trade in clothing is even less significant. For the same period (1965-1998) clothing (category 84 of the SITC) contributed on average around 0.10 percent to the world exports and 0.85 percent to the world imports.

The insignificant shares of Australia's exports and imports of TAC in the world market propose a 'small country assumption' when considering rest of the world's

[51] The calculation is based on the UN Trade Statistics extracted from the IEDB, ANU database at the two-digit level of the Standard International Trade Classification (SITC).

export demand for Australia's TAC and rest of the world's supply of imports of TAC to Australia. Thus, it is assumed that Australia is not able to influence world prices of exports and imports, that is, rest of the world's export demand and import supply curves are assumed to be perfectly elastic. These propositions are illustrated in Figures 4.1 and 4.2. In view of this, the thesis will examine only Australia's supply of exports and its demand for imports of TAC.

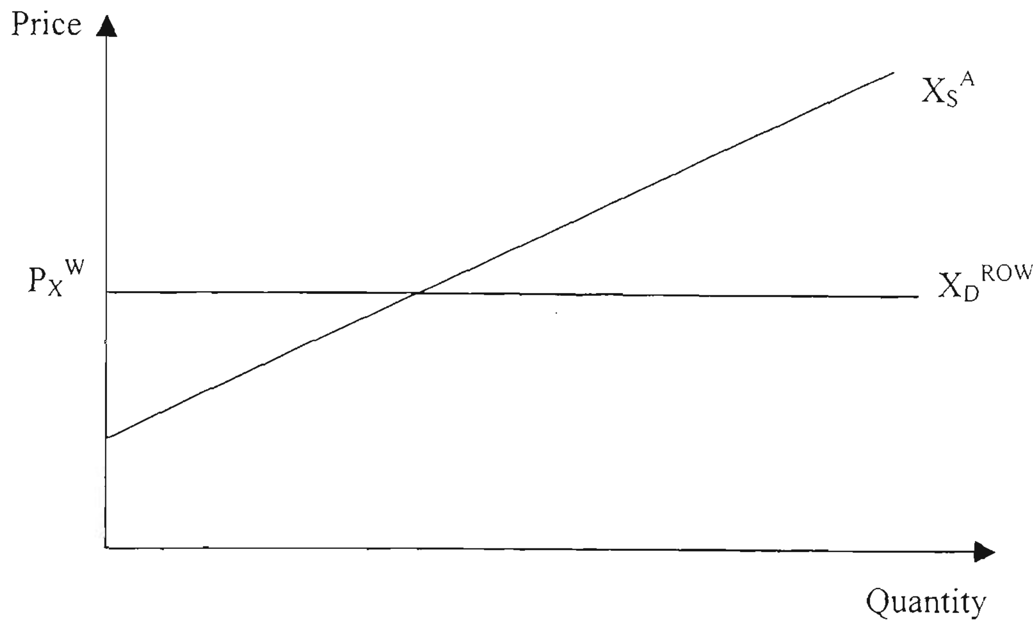
Section 4.2 will focus on the theoretical background (Subsection 4.2.1), a review of empirical studies (Subsection 4.2.2) and the specification of the models for Australia's export supply of TAC (Subsection 4.2.3). The variables and hypotheses will also be described in Subsection 4.2.3. Following a similar structure, Section 4.3 will concentrate on the same aspects for Australia's import demand for TAC.

4. 2 Supply of Exports

4. 2. 1 Theoretical Background

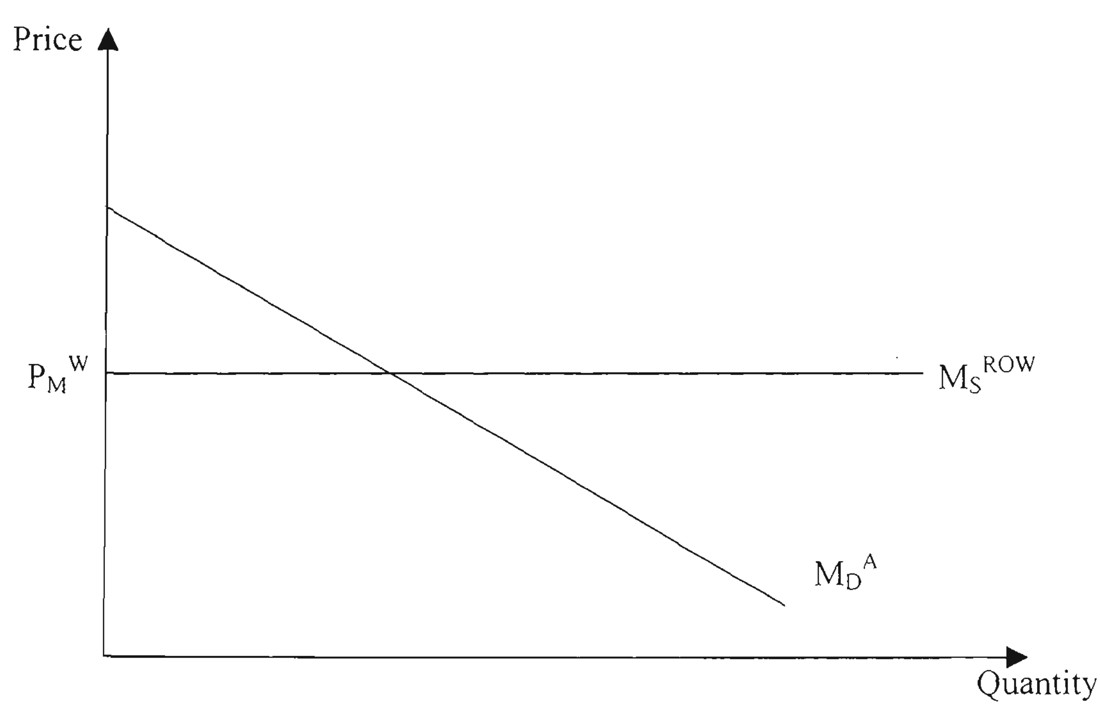
International economic theory suggests that the quantity of exports supplied at each price is the excess of the quantity supplied over the quantity demanded domestically at that price (Kreinin, 2002). Thus, whether or not a country experiences an exportable surplus of a commodity, depends on the level of domestic production and consumption. It can be, therefore, argued that if the country cannot influence the world price (a small country), its production, consumption and export decisions are based on the world price. Any factors that lead to changes in the domestic production and consumption are also expected to alter the export supply.

Figure 4. 1: **Australia's Export Supply of TAC**



P_X^W = world export price of TAC, X_S^A = Australia's export supply of TAC, X_D^{ROW} = rest of the world's demand for Australia's TAC exports.

Figure 4. 2: **Australia's Import Demand for TAC**



P_M^W = world import price of TAC, M_D^A = Australia's import demand for TAC, M_S^{ROW} = rest of the world's import supply of TAC to Australia.

Considering that the volume of exports is the difference between the quantity supplied and quantity demanded domestically, the price elasticity of export supply is expressed as:

$$\varepsilon_s^X = \frac{Q_s^h}{Q_x} \times \varepsilon_s^h + \frac{Q_d^h}{Q_x} \times \varepsilon_d^h \qquad (4.1)$$

ε^X_s	=	the price elasticity of export supply
Q^h_s	=	the quantity supplied domestically
Q_x	=	the volume of exports
ε^h_s	=	the price elasticity of domestic supply
Q^h_d	=	the quantity demanded domestically
ε^h_d	=	the price elasticity of domestic demand.

Thus, the price elasticity of export supply of a product is positively related to the elasticities of domestic demand and supply and negatively related to the share of exports in domestic production and consumption.

However, the lack of reliable information on domestic consumption and production, as well as the difficulty of deriving elasticity of domestic supply and demand, prevent this approach to the estimation of export supply elasticities. In order to obtain elasticity estimates, empirical studies, as discussed below, rely on the direct estimation of export supply equations. The next section reviews empirical studies dealing with export supply, both of aggregate exports and of various products or product categories.

4. 2. 2 A Review of Empirical Studies

The literature on export supply is not as extensive as it is on import demand and export demand[52]. One of the reasons may be that many empirical studies of international trade flows concentrate on the demand side for imports and exports, and on the supply side they assumed infinite or very high price elasticity for exports (Houthakker and Magee, 1969; Hickman and Lau, 1973; Taplin, 1973; Murray and Ginman, 1976; Khan and Ross, 1977; Boylan, *et al.*, 1980; Melo and Vogt, 1984; Bond, 1985; Boylan and Cuddy, 1987).

However, a number of studies, including Goldstein and Khan (1978) and Möller and Jarchow (1990) pointed out that while this assumption may be appropriate for the imports supplied by the 'rest of the world', it is, however, improper for the exports supplied by an individual country. Goldstein and Khan argue that unless export production is subject to constant or increasing returns to scale, an increase in the demand for a country's exports cannot be met without generating a rise in the price of exports, and consequently the supply of exports. To eliminate a potential bias arising from the mutual effect between export quantities and export prices, Goldstein and Khan (1978) consider a simultaneous equation model of export demand and supply, using quarterly data. They hypothesise that, as the price of exports increases relative to domestic prices, export production becomes more profitable and supply of exports will rise.

Goldstein and Khan (1978) estimated two models, an *equilibrium model,* which assumes instantaneous adjustment and a *disequilibrium* model that allows for excess

[52] One of the earliest studies that emphasised a lack of econometric analysis of the supply side is by Orcutt (1950).

demand and supply[53]. Following the Houthakker and Taylor (1969) adjustment process[54], Goldstein and Khan estimated structural coefficients simultaneously. Based on the estimated price elasticities of demand and supply, Goldstein and Khan conclude that price elasticity of demand for exports varies once export supply relationships are explicitly taken into account. They also argue that instead of excess demand, the quantity of exports is related to excess supply in which case, the excess demand would determine the change in the price of exports. Based on the estimation results of both models, Goldstein and Khan suggest that the supply side of the export market may have a more monopolistic market structure than the demand side, thus exporters are price-setters rather than price-takers. However, in reality both export quantity and export price may adjust to excess demand (p. 277).

A number of other studies estimated simultaneously export demand and export supply, some at the aggregate level, while others at a commodity or a group of commodity level. These include Ball *et al.* (1966), Leamer and Stern (1970), Basevi (1973), Rhomberg (1973), Khan (1974), Khan and Ross (1975), Dunlevy (1980), Arize (1987a), and Gafar (1988).

Möller and Jarchow (1990) applied the simultaneous equation approach of Goldstein and Khan (1978), with some modification in the price and time lag variables, to estimate the West German export supply. They found that, in the short run, the supply of exports responds positively and it is elastic with respect to changes in export price. However, it reacts peculiarly to changes in the exchange rate in the short-run, the net

[53] A similar approach was adopted by Ali (1978).

[54] $\Delta \log X_t = \gamma [\log X_t^d - \log X^d_{t-1}]$ where, γ is the coefficient of adjustment (assumed positive) and Δ is a first-difference operator, $\Delta \log X_t = \log X_t^d - \log X^d_{t-1}$ (Goldstein and Khan, 1978c, p. 277).

exports decline with a depreciation and rise due to an appreciation. In the long run the reaction of the trade balance to changes in exchange rate becomes normal.

Koshal *et al.* (1992) estimated a simultaneous supply and demand equation model for Indian exports using annual data. They specified the supply of exports as a function of the ratio of export price to the domestic price index[55], but they did not specify a variable accounting for the effect of domestic production capacity or any other explanatory variables. However, they considered the adjustment process, arguing that an adjustment within one period is unfeasible. Koshal *et al.* found that export supply tends to be highly sensitive to price movements. This phenomenon is justified by a large domestic market, which allows for necessary supply transfers between domestic and foreign markets. An almost perfectly elastic long-run supply estimate suggests that the quantity of exports is determined by the demand in the long-run.

Grimes (1993) maintains that export supply and export demand should be estimated in separate single equation models, in order to obtain structural estimates of export supply and export demand. Gunawardana *et al.* (1995) applied this approach to analyse the export supply response of the Australian citrus products, and Gunawardana and Karn (1998) to estimate export supply of Australia's pharmaceutical products.

Ali (1978) estimated a single equation model of aggregate exports of India[56]. Ali makes the point that in making the supply decisions exporters consider exchange rate and the degree of subsidy that they receive. Combining these two factors leads to the

[55] The domestic price index was used as a proxy for the cost of production of export commodities.
[56] Other studies using a single equation approach include Houthakker and Magee (1969), Aggarwala (1970), Gafar (1981), Bahmani-Oskooee (1984).

consideration of 'effective exchange rate' that includes both official exchange rate and the value of subsidy. Ali further argues that since the domestic market is an alternative for exports, the domestic price is expected to be an influential factor on exports. Thus, the ratio of price of exports to domestic price *(RP)* can be expressed as:

$$RP = \frac{R(1+S)P_x}{P_d} \qquad (4.2)$$

where, R is the official exchange rate, S is the ad valorem rate of export subsidy, P_x is export price, and P_d is domestic price (See also Thursby and Thursby, 1984, p.4).

Ali (1978) emphasises that whether the export price is considered as an endogenous or exogenous variable would determine the nature of the model. If export prices were assumed to be exogenously determined, the relevant model to estimate the export supply function would be a single equation model. However, if export prices are endogenously determined, a simultaneous system equation should be used to estimate the export demand and export supply functions.

Athukorala and Jayasuriya (1994) used a single equation model to estimate the short-run response of Sri Lankan commodity exports for eight subcategories of products for the period 1965 to 1985. They attempted to explain the link between export incentives, measured by the real exchange rate, and export performance. Similar to Ali (1978), they derived the real effective exchange rate as a composite variable that incorporate changes in the nominal exchange rate[57], the effective value of financial incentives, and domestic and world market prices. To isolate a potential effect of shifts in the country's production capacity on exports, thus, to capture the net effect of

[57] Athukorala and Riedel (1994) employed a similar variable, however, they took into account a reduction of export price by the export tax rate (p. 125).

changes in the real effective exchange rate on exports, Athukorala and Jayasuriya employed two alternative variables, production lagged one year (for three categories of products) and time trend in the remaining categories.

Following the argument that the positive effect of trade liberalisation on export performance is not confined to relative price aspects captured in the real exchange rate, Athukorala and Jayasuriya (1994) take into account other factors associated with a liberalisation policy that may contribute to a rise in exports. In order to assess the effect of liberalisation on export performance, Athukorala and Jayasuriya included a dummy variable in the model.

A similar model was used by Athukorala and Rajapatirana (2000) to estimate the export supply of total manufacturing goods and selected categories, in particular, clothing exports and non-clothing manufactured exports for Sri Lanka for the period 1968 to 1994. Tambi (1999) applied a similar approach to estimate Cameroon's export supply of cocoa, coffee, and cotton from Cameroon. In addition to a commonly specified export supply function with the price ratio and the capacity variable, Tambi included the exchange rate as an explanatory variable. He assumed a positive relationship between the export supply and exchange rate, explaining that an increase in the exchange rate due to a devaluation of local currencies is expected to push the price of exports up in terms of domestic currencies leading to an increase in exports by domestic suppliers.

The studies by Ball *et al.* (1966), Artus (1970), and Suss (1974) also deal explicitly with the export demand and supply. They are concerned with the effect of domestic demand on export supply, but they focus on the short-run adjustment process and do not derive estimates of the price elasticity of export supply. Instead of including the relative price ratio, Murray and Ginman (1976), Wilson and Takacs (1979), Phaup (1981), and Haynes and Stone (1983a) separated the price ratio into export price and domestic price variables.

Haynes and Stone (1983a) also pointed out that changes in exogenous variables affect both quantity and price and, therefore, it is unclear *a priori* whether the supply response is more appropriately specified in terms of quantity or in terms of price. In order to examine this proposition, Haynes and Stone estimated both supply-quantity and supply-price equations for aggregate exports of the United Kingdom and the United States by comparing the lag patterns of both specifications. They found that a supply-price specification was more appropriate where prices respond to quantities lagged.

In order to capture the interaction among domestic demand, price and exports, Newman *et al.* (1995) developed a model which regards the goods destined to the domestic consumption and goods for export as imperfect substitutes and domestic prices as an endogenous variable. Newman *et al.* maintain that failure to take this interaction into account can introduce a bias in export response to price changes. They also pointed out that without modelling the demand side, it is not possible to obtain estimates of the net effect of changes in export prices on exports and output. Newman *et al.* arrived at the conclusion that exports respond positively to increases in export prices and negatively to increases in import prices.

Following the above review of empirical studies the basic supply function for exports including the most important variables that influence export supply is specified as:

$$X_{it}^{s} = f\left(P_{it}^{x} / P_{it}^{h}, DP_{it}\right) \quad (4.3)$$

where

X^{s}_{it} = the quantity of exports supplied of product i, in period t

P^{x}_{it} = the price index of exports of product i, in period t

P^{h}_{it} = the domestic price index of product i, in period t

DP_{it} = the domestic production capacity of product i, in period t.

It is hypothesised that, as the price of exports rises relative to domestic prices, production for export becomes more profitable and the supply of exports is likely to rise. Similarly, other things being constant, an increase in a country's production capacity is expected to increase the country's supply of exports.

As noted earlier, some studies modified this basic model by including dummy variables, such as a variable accounting for export incentives and other policies encouraging value added enhancement. Some studies, for instance, Gunawardana *et al.* (1995) estimated a model that included a time trend variable representing the production capacity as well as technological improvements over time.

4. 2. 3 Australia's Export Supply Functions: Textiles and Clothing

Considering the economic theory of export supply and previous empirical studies on export supply response, models to analyse the determinants of export supply for Australia's TAC are presented in this section.

As mentioned earlier, if export prices are exogenously determined, the relevant model to estimate the export supply function is a single equation model (Thursby and Thursby, 1984). The insignificant share of Australia's exports of TAC in the world exports, provides justification for the implied 'small country assumption' and in view of that, single equation models are specified to estimate the export supply of Australia's TAC. For that reason, in this study, a perfectly elastic export demand for TAC is assumed (see the graphical presentation in Appendix 4.1).

In specifying a supply function, it is important to take into account any exogenous factors that may impose a bias on the parameter estimates. In this case, it is considered to be important to include a dummy variable accounting for the effects of the Asian crisis from 1997. It is expected that the Asian crisis will have a negative effect on Australia's export supply of TAC.

The basic export supply equation (as in 4.3) have been modified to suit the specific case of Australian TAC export supply as in Equation 4.4 and 4.5:

$$XST = f\left(RPT^{x},\ CAPT,\ ERAT,\ DAC\right) \tag{4.4}$$

$$XSC = f\left(RPC^{x},\ CAPC,\ ERAC,\ DAC\right) \tag{4.5}$$

where,

XST	=	Real exports of textiles (nominal exports of textiles deflated by export price index)
XSC	=	Real exports of clothing (nominal exports of clothing deflated by export price index)
RPT^{x}	=	Relative price of exports (export price index of textiles divided by domestic price index of textiles)

RPC^x	=	Relative price of exports (export price index of clothing divided by domestic price index of clothing)
$CAPT$	=	Domestic production capacity of textiles
$CAPC$	=	Domestic production capacity of clothing
$ERAT$	=	Effective rate of assistance to textile industries
$ERAC$	=	Effective rate of assistance to clothing industries
DAC	=	Dummy variable representing Asian crisis of 1997.

In view of the fact that suppliers of TAC exports have the choice of either exporting or selling domestically, it is reasonable to expect that suppliers' export decisions are guided by the price of exports relative to domestic price. Therefore, the relative price of exports is considered to be the key explanatory variable in the export supply functions. If the relative price of exports increases, exports become more profitable, thus the positive parameter estimates for the variables RPT^x and RPC^x are expected.

As pointed out by Athukorala and Jayasuriya (1994) and Athukorala and Rajapatirana (2000), the relative price variable is expected to capture the effect of changes in relative prices on export supply, thus, the movement along the supply curve. In reality, even if relative prices remain constant, exports may change due to the shifts in the country's production capacity of the product. In view of this, a variable representing production capacity, CAP, of TAC is included in the model. A direct effect of the production capacity on the export supply of TAC is anticipated, thus, the positive expected sign of the corresponding parameter estimate.

On the other hand, if Australia imposes trade barriers, such as tariffs, imports are expected to reduce. Consequently, Australia's exports of TAC are also expected to decline. More TAC will be directed to the domestic market as a substitute for restricted imports from other countries. This proposition justifies the inclusion in the models a variable accounting for the effective rate of assistance (*ERA*). An inverse relationship between the *ERA* and the export supply is expected, thus the negative sign of the coefficient for the variable *ERA*.

4. 3 Demand for Imports

In this section, the modelling of the demand for imports, both generally and for TAC, will be discussed. In Section 4.3.1 the theoretical background and in Section 4.3.2 a review of empirical studies related to import demand will be presented. Section 4.3.3 will be concerned with the specification of import demand functions for TAC, as well as the definition of the variables and the discussion of hypotheses.

4. 3. 1 Theoretical Background

International economic theory suggests that if an importing country accounts for an insignificant share of world imports, a change in imports by that country is unlikely to influence the demand and price in the world market.

Given that a small country's *import demand* for a product is the difference between its domestic quantities demanded (Q_d) and supplied (Q_s) on the domestic market at the world price, the price elasticity of demand for imports can be expressed as[58]:

[58] A detailed derivation of elasticities of import demand can be found in Kreinin (2002, Ch.4, Appendix 4. 1),

$$\varepsilon^{M} = \frac{Q_d^h}{Q_m} \times \varepsilon_d^h + \frac{Q_s^h}{Q_m} \times \varepsilon_s^h \qquad (4.6)$$

ε^{M} = the price elasticity of import demand

$Q^h{}_d$ = the quantity demanded domestically

Q_m = the volume of imports

$\varepsilon^h{}_d$ = the price elasticity of domestic demand

$Q^h{}_s$ = the quantity supplied domestically

$\varepsilon^h{}_s$ = the price elasticity of domestic supply.

Thus, the elasticity of import demand for a product is positively related to the domestic demand and supply elasticities and inversely related to the share of imports in domestic consumption and production. A shift in importing country`s domestic demand (due to changes in consumer income, price of substitutes, tastes) and/or domestic supply (due to the factors such as changes in weather, price of alternative products, technical change, R&D) will also shift the import demand.

However, limitations in data on some of the components in Equation 4.6, such as domestic consumption and production, as well as the difficulty of estimating domestic demand and supply, constrain the application of this approach to derive the import demand elasticity for traded commodities. Therefore. as an alternative approach, it is common to generate import demand elasticity estimates from the estimation of demand models directly.

4. 3. 2 A Review of Empirical Studies

Earlier studies by Balassa (1963, 1967) attempted to explain changes in the trend and pattern of European trade in the early 1960s based on a model specified exclusively on income as the independent variable[59]. Balassa compared income elasticities of import demand for intra- and extra area trade prior- and post-integration[60]. Postulating that the income elasticities of demand would have remained unchanged in the absence of integration, Balassa (1967) hypothesised that a rise in the income elasticity of demand would indicate gross trade creation. However, Balassa found that this approach was unable to capture the full impact of the European Economic Cooperation on trade flows.

Houthakker and Magee (1969) estimated income and price elasticities for imports, for groups of commodities as well as total imports, mainly for developed countries. They expanded Balassa's model by specifying an import demand equation as a function of the country's income (an index of the real gross national product, GNP), and the ratio of import prices to domestic wholesale prices.

The findings of Houthakker and Magee (1969) indicate the importance of relative elasticities between the trading partners and their impact on the balance of trade. The most noticeable differences in income elasticities of demand for imports were observed in Japan, the United Kingdom and the United States. The results suggest that

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[59] A seminal paper by Orcutt (1950) has been followed by a large number of empirical studies presenting trade elasticity estimates for various countries/product categories. A comprehensive survey covering elasticities in relation to international trade can be found in Cheng (1959), Leamer and Stern (1970), Magee (1975) Stern (1976), Goldstein and Khan (1985) (addresses data and econometric issues) and a more recent one in Sawyer and Sprinkle (1999). Sawyer and Sprinkle provide almost one thousand estimates of import and export demand elasticities covering eighty-two countries.
[60] Prior- and post-formation of the Regional Integration Agreement (RIA),

the United States demand is more income-elastic for the products of the developed countries than for those of less-developed countries. In particular, the estimate of income elasticity of demand for imported finished manufactures by the U.S. was markedly higher than the demand of other countries for United States finished manufactures. The estimates of price elasticities for total imports were relatively low, yet much higher for United States imports from individual countries. Based on their findings, Houthakker and Magee stressed that a country with higher income elasticity of demand for its imports than the foreign income elasticity of demand for its exports is likely to experience relatively higher growth in imports than in exports.

George *et al.* (1977) modified Balassa's model by including a variable representing the foreign exchange balance of the importing country (lagged by one year)[61] and the variable for economic integration. The variable pertaining to the condition of the foreign exchange reserve was designed to capture the effect of the limitations in foreign exchange faced by an importing country. The variable for trade liberalisation was intended to account for the effect of the discriminatory elimination of trade barriers.

Wilkinson (1992) estimated Australia's demand for aggregate imports over the period 1974 and 1989 using the production function approach[62]. She modified the common specification of the import demand function by adding relative export prices and a domestic production capacity constraint. Wilkinson reported that primarily movements in domestic economic activities and relative prices determine trends in aggregate imports. However, according to the estimation results, imports are more

[61] The cumulative total number of trade concessions at the end of the preceding year was used as a proxy.
[62] For an extensive discussion of this approach see Kohli (1991).

responsive to changes in economic activities than to the variation in relative prices[63]. More specifically, the long-run elasticity estimates indicate a 1 per cent improvement in domestic economic activity increases imports by about 1.9 per cent, and a 1 per cent increase in relative price of imports, reduces imports by about 0.5 per cent.

Wilkinson (1992) also found that, although not considerably, Australia's imports are influenced by the relative price of exports (the elasticity estimate was in the range of -0.1 to -0.5). Wilkinson made an important observation that while the demand elasticity appears to be insensitive to the choice of either the activity variable or the import variable, the choice of activity variable appears to have an effect on the import price elasticity. The specification of the activity variable in terms of GDP inflates the estimated price elasticity by about 0.3 to 0.5, compared to its specification in terms of gross national expenditure, GNE.

In estimating the aggregate import demand function for a large number (77) of developed and developing countries, Senhadji (1998) employed a similar approach as previous studies, but he specified the activity variable as GDP minus exports. The relative price of imports was specified as the ratio of the import deflator to the GDP deflator. Senhadji pointed out that specification of the activity variable depends on the level of aggregation, and warned about the potential problem with the availability of import prices for highly disaggregated import demand for developing countries. Senhadji's results are consistent with economic theory, thus, both price and income elasticities have the expected signs. The average price elasticity was estimated to be close to zero in the short-run and slightly higher in the long-run. Senhadji made the

[63] Similar results were obtained by Goldstein (1985) and Athukorala and Menon (1995).

observation that it takes five years for the average price elasticity to achieve ninety per cent of its long-run level. Imports also responded relatively slowly to changes in domestic income, the short-run elasticities were on average lower than 0.5, while the long-run elasticities are around 1.5. The findings also indicate that developed countries tend to have notably lower price elasticities and higher income elasticities than developing countries.

A number of studies argued that additional variables be included in an import demand equation. For instance, Leamer and Stern (1970), and George *et al.* (1977) argue for the inclusion of a variable representing the level of foreign exchange reserve[64], or 'a proxy for the restraints on imports'. Silvapulle and Phillips (1985) tested this proposition, however, the variable was found insignificant in explaining import demand, or had the 'wrong' sign. They also proposed a variable accounting for capacity utilisation during the period of excess demand, where import demand may increase regardless of prices and income. Silvapulle and Phillips (1985) defined capacity utilisation as actual domestic production as a proportion of estimated maximum feasible production for the industry per year.

Silvapulle and Phillips (1985) explored the determinants of Australian import demand for ASEAN manufactured goods and estimated the elasticity of substitution of eight commodity groups, including clothing (841) and textiles, yarn and thread (651) from various countries for the period 1968 and 1982. However, the results of the analysis with respect to some variables did not conform to theoretical expectation. For instance, the coefficient for the variable representing foreign reserves was negative

[64] Defined as $F_A = F_{-1}/V_A$ where F_{-1} is foreign reserve in the previous period, and V_A value of imports in the current period (p.113),

and highly significant. Coefficients for capacity utilisation gave mixed signals, they were positive for some but negative for some other industries, including textiles, yarn and thread and clothing. Silvapulle and Phillips provided two explanations, either imports in those industries did not respond positively to capacity utilisation or higher imports triggered capacity under-utilisation in the domestic industries. While the analysis produced positive and high income elasticities for all considered commodity groups, only three commodities, including clothing, responded to changes in the border (import) price to domestic price ratio.

Based on the estimates of the elasticity of substitution, the study of Silvapulle and Phillips (1985) also indicates that, probably due to the relatively higher border price with European Community, the relative market share of imports for textiles, yarn and thread from ASEAN countries increased over the estimated period. Australian import demand also rose for furniture, clothing, and footwear. One of the shortcomings of the study by Silvapulle and Phillips was that no consideration was given to the level of protection that played an important role in international trade, in particular in the TAC industries, for instance the import quota restrictions that applied between 1974/75 and 1993.

Athukorala and Menon (1995) estimated import demand functions for Australian total manufactured imports as well as for nine subdivisions for the period 1981 to 1991. Their model deviates from the conventional import demand models. To capture the cyclical effect on demand, Athukorala and Menon (1995) and Menon (1995) used the ratio of stocks to average sales volume to measure the general scarcity of domestic supplies. The relative price in the model was specified as the ratio of the tariff augmented import price and the price of the domestic competing commodity. An important finding relevant to this thesis is that whereas the long-run price elasticity estimates for eight categories were in the range of -0.37 to -2.10 (for total imports -0.67), the estimate for clothing and footwear was not statistically different from zero. Athukorala and Menon suggest that this result is due to the effect of binding quantitative restrictions on price-quantity relationship (p. 4). Other studies that attempted to capture cyclical effects on imports (or exports) include Arize (1987a), Haynes and Stone (1983b), Murray and Ginman (1976), Thursby and Thursby (1984), Thursby (1988), and Wilkinson (1992).

International economic theory suggests that demand for imports is directly influenced by the level of domestic income and international competitiveness, shown by the relative prices of imported and domestically produced goods (Leamer and Stern, 1970; Goldstein and Khan, 1985; Gafar, 1988). Thus, in most empirical work[65] a general form of the import demand is usually specified as:

$$M_{it} = f\left(P_{it}^{m} / P_{it}^{d}, Y_{t}^{d}\right) \tag{4.7}$$

where,

M_{it}	=	the quantity of imports
P_{it}^{m}	=	the import price index
P_{it}^{d}	=	the domestic price index
Y_{t}^{d}	=	the consumer income
i	=	the product
t	=	the time period.

[65] (See for instance Khan and Ross, 1977; Kravis and Lipsey, 1978; Weisskoff, 1979; Akhtar, 1980; Hamilton, 1980; Boylan and Cuddy, 1987; Katayama, et al. 1987; Arize and Afifi 1987c; Asseery and Peel, 1991; Wilkinson, 1992; Andersen, 1993; Bewley and Orden, 1994; Athukorala and Menon, 1995; Menon, 1995; Bahmani-Oskooe and Niroomand, 1998).

Since the late 1970s, some researchers have advocated a split-price specification (inclusion of P_{it}^m and P_{it}^d separately) instead of the price ratio[66]. They argue that this form of specification could be useful in analysing changes in foreign prices and changes in the exchange rate or domestic trade barriers that would affect the import price only. Based on their survey, Sawyer and Sprinkle (1999) indicated that for many countries the demand functions in fact may not be homogeneous in which case using a single price elasticity in empirical analysis of trade flows may yield, to some extent, inappropriate results (p. 13). In this specification, the relationship between imports and the respective variables can be expressed symbolically as in Equation 4.8. The definitions of the variables are as in Equation 4.7.

$$M_{it} = f\left(P_{it}^m, P_{it}^d, Y_t^d\right) \tag{4.8}$$

With regard to import demand specification, Sawyer and Sprinkle (1999) pointed out that if the issue of responsiveness of imports to changes in the exchange rate is crucial, a further split, that is, two prices and the exchange rate (XR_t) is used (Wilson and Takacs, 1979; Warner and Kreinin, 1983; Deyak *et al.* 1993b; Sawyer and Sprinkle, 1997). The expected sign associated with the exchange rate will be positive if the exchange rate is defined in terms of foreign currency per unit of domestic currency and negative if the exchange rate is defined in terms of domestic currency per unit of foreign currency. Symbolically, the model can be expressed as follows (the definition of the variables as above).

$$M_{it} = f\left(P_{it}^m, P_{it}^d, Y_t^d, XR_t\right) \tag{4.9}$$

[66](Murray and Ginman, 1976; Haynes and Stone, 1983b; Arize, 1987a; Arize, 1987b; Gafar, 1988; Dunlevy and Deyak, 1989; Deyak *et al.* 1990; Asseery and Peel, 1991; Asseery and Perdikis, 1991; Koo, *et al.* 1991; Clark, 1992; Deyak, Sawyer *et al.* 1993a; Deyak *et al.* 1993b; Carone, 1996).

4. 3. 3 Australia's Import Demand for Textiles and Clothing

Following the theoretical insights and the review of empirical studies dealing with the specification of import demand, import demand models for Australia's TAC are developed in this section. The definition of the variables and hypotheses are also included. The main purpose of estimating the models is to derive the parameter estimates of price and income elasticities of import demand. First, some considerations in the inclusion of potential determinants of TAC import demand, with reference to other studies, are presented.

It is expected that a rise in the relative price of imports (import prices, relative to the domestic prices) would result in a decrease in the quantity of imports demanded. As imports become more expensive, consumers are likely to turn to relatively cheaper domestically produced products. On the other hand, if the domestic price of TAC rises, imports become relatively cheaper, leading to an increase in demand for imported products.

It is conventional to regard the national income of the importing country as the main determinant of its imports. As the national income (measured by GDP or GNP) rises, the marginal propensity to import is also expected to rise. Consumers can afford to buy more of imported (and domestic) products, often leading to a degree of substitution of imported for domestic products.

If a small importing country reduces or eliminates its tariff on TAC, it lowers the domestic price of TAC and that is expected to lead to higher consumption. The effect of the domestic price reduction on consumption would depend on the price elasticity of domestic demand. Domestic producers, however, are likely to lower the domestic quantity supplied, and the effect of the tariff reduction on domestic production depends on the price elasticity of domestic supply. Consequently, imports of TAC are likely to increase and the extent of increase depends on the price elasticity of import demand. Since a small importing country, like Australia, accounts for an insignificant share of world imports, an increase in its imports does not influence the demand, supply and price prevailing in the world market. As explained in Chapter 2, given historically high level of protection of the TAC industries relative to other industries (except motor vehicles), and extensive trade policy reforms in the 1990s, it was decided to include the average effective rate of assistance, (*ERA*), to the TAC industries as an explanatory variable in the models.

Athukorala and Menon (1995) included the ratio of stocks to average sales volume to justify a potential effect of the general scarcity of domestic supplies on imports in modelling manufactured imports. However, while the coefficient with the variable was found significantly different from zero in clothing and footwear category, it was not significantly different from zero in the case of textiles. The present study will attempt to test this issue over a longer time span[67] by incorporating the variable accounting for the effect of domestically held inventory (*SST* and *SSC*), on imports of textiles and clothing, respectively.

Marquez and McNeilly (1988) suggested the inclusion of a dummy variable to account for possible one-time effects on imports of exogenous factors. Chuankamnerdkarn (1997) specified a dummy variable to separate the periods with

[67] Athukorala and Menon tested the effect of this variable based on quarterly data for the period 1981 to 1991.

significant differences in the level of trade liberalisation. Boylan and Cuddy (1987) divided the time series into two sub-periods, in order to test whether the income elasticity and the price elasticity of demand for imports increased over time.

Considering that a significant proportion of Australia's imports of TAC originate from Asia, an attempt is made to test a possible effect of the recent East Asian financial and economic crisis on Australia's imports of TAC since the mid 1997, by including an intercept dummy variable in the model (See Equation 4.10 and 4.11).

Based on the above discussion, the models of Australia's imports for TAC are specified as:

$$MDT = f\left(RPT^{m}, Y, ERAT, SST, DAC\right) \tag{4.10}$$

$$MDC = f\left(RPC^{m}, Y, ERAC, SSC, DAC\right) \tag{4.11}$$

where,

MDT	=	Australia's real imports of textiles
RPT^{m}	=	the relative price of imports of textiles (the ratio of import price of textiles to domestic price of textiles)
RPC^{m}	=	the relative price of imports of clothing (the ratio of import price of clothing to domestic price of clothing)
Y	=	Australia's real national income (real GDP)
$ERAT$	=	the effective rate of assistance for textiles
$ERAC$	=	the effective rate of assistance for clothing
SST	=	the stocks to sales ratio of textiles
SSC	=	the stocks to sales ratio of clothing
DAC	=	the dummy variable representing the Asian crisis.

An inverse relationship is expected between the level of imports and the relative prices of imports, RPT^m and RPC^m, respectively.

A hypothesised positive relationship between the variable representing income, Y and import demand is based on the assumption that imported TACs are normal goods. Thus, with rising incomes, consumers are assumed to increase the quantity demanded of imported TACs.

Other things being constant, an increase in the rate of assistance (*ERA*) to Australia's domestic TAC industries leads to a reduction in imports. Therefore, a negative relationship is expected between *ERA* and imports of TAC.

A negative relationship is also expected between the stocks to sales ratio, *SST* and *SSC*, and the demand for imports of TAC. If the ratio increases, the demand for imports of TAC is expected to decline.

The effect of the Asian crisis on Australia's imports of TAC cannot be predicted with *a priori* confidence for two reasons. Firstly, for an insufficient period of data coverage since the crisis began (in mid 1997) and secondly, for a possible counterbalancing effect of imports from the rest of the world (Lang, 1998). Nevertheless, if the effect of those factors is disregarded, it is plausible to expect a positive effect of the Asian crisis on Australia's imports of TAC. This is because of the appreciation of the Australian dollar against the East Asian currencies during the Asian crisis.

4. 4 Conclusion

Having specified the models of export supply and import demand for Australia's TAC products, the next chapter (Chapter 5) will focus on the empirical estimation of those models. Prior to the estimation, data and data sources will be described and a review of econometric procedures will be undertaken.

Chapter 5

EXPORT SUPPLY OF AND IMPORT DEMAND FOR TAC: DATA AND ECONOMETRIC PROCEDURES

Considering that the analysis in this study is based on econometric estimation using time series data, this chapter focuses on data and data sources, and theoretical and empirical issues related to time series analysis. In Section 5.1, the data and data sources employed in this study are discussed. Section 5.2 highlights some theoretical aspects and specific methodological issues that may arise in empirical analysis when dealing with time series data. Section 5.3 presents the results of unit root tests of data series and specific methods used in econometric estimation of Australia's export supply of and import demand for TAC products.

5. 1 Data and Data Sources

Econometric estimation in this study uses annual time series data for the period from 1970 to 1999. Most of the data were obtained from various databases provided in dxEconData. The data on imports and exports of TAC were obtained from the International Economic Data Bank (IEDB) maintained by the Australian National University (ANU). The effective rates of assistance were provided by the Productivity Commission in Canberra.

Due to the seasonality in the demand for some TAC products, in particular clothing, quarterly time-series data would have been desirable. However, the sources do not provide quarterly series, so the estimation of the models is based on an annual time-series data at the 2-digit Standard International Trade Classification (SITC)[68] level of aggregation. For some of the variables the data were not available at the same level of classification as for export and import data, thus there was a problem in matching the trade classification (SITC) with industrial classification (ISIC). This led to the question of what to include in the definition of the category of textiles and clothing. It was decided to base the analysis on the category 65 -Textiles Yarn, Fabrics, Made-up Articles and Related Products and 84 - Articles of Apparel and Clothing Accessories. These were the product categories as defined in the ANU EIDB database. A list of more detailed three-digit level of disaggregation is provided in Table 5.1.

Table 5.1: **Classification of Textiles and Clothing, SITC**

65 - Textiles Yarn, Fabrics, Made-up Articles and Related Products	
651	Textile yarn and thread
652	Cotton fabrics, woven
653	Woven textiles, non-cotton
653	Lace, ribbons, tullee, etc.
655	Special textile products
656	Textile products, not elsewhere specified
657	Floor coverage, tapestry, etc.
84 - Articles of Apparel and Clothing Accessories	
841	Clothing not of fur
842	Clothing made of fur

Source: The EIDB, ANU trade database.

Furthermore, it was not possible to obtain data for all variables included in the econometric models from the databases mentioned above, so other data sources have been utilised. These include:

[68] The data on exports and imports are provided on a 'commodity basis' according to the codes and descriptions of the third revision of the United Nations' classification (SITC Rev3),

- The Australian Bureau of Statistics (ABS) database that commonly applies the ANZSIC[69] (Australian and New Zealand Standard Industrial Classification) in its reporting.

- The National Asia Pacific Economic and Scientific Database (NAPES) maintained by the ANU and Victoria University (VU).

It is reasonable to argue that Australia's import demand for textiles is more related to the GDP, while the demand for imports of clothing is more reflected in private final consumption expenditure on clothing. This is because many textiles are inputs to production, while clothing is a final product. Therefore, the activity variable in the textile models is approximated by GDP deflated by the GDP deflator, and by private final consumption expenditure deflated by the CPI for Clothing. It must be pointed out that this approximation is somewhat limited by the fact that it also includes private final consumption expenditure on footwear and drapery.

Sources of data are given in Appendix 5.1. A description of the methods applied in data transformation is presented in footnotes below Appendix 5.1. A complete listing of the data series (in the order as they appear in the models) is presented in Appendix 5.2.

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[69] Closely based on the UN's International Standard Industrial Classification (ISIC),

5. 2 Econometric Procedures – Theoretical Issues

5. 2. 1 Stationary and Non-Stationary Time Series

In regression analysis, the important assumptions associated with the error term are that its mean and the variance remain constant over time and the autocovariances depend on the time lag but not on time itself[70]. Such an error term is known as a *white noise* and the time series is said to be *stationary*. If these conditions are violated, a time series is said to be *non-stationary*. The most popular tests for the presence of the violation of the fundamental assumptions in the analysis of time series, its consequences and possible remedies are discussed in this section.

Since the variance of a non-stationary series is not constant, the conventional asymptotic theory does not apply for such time series. Thus, the statistical inference from regression results, using the standard *t*- and *F*- tests, may be misleading (Phillips, 1986). The OLS estimation tends to produce highly significant parameter estimates, linked with high values of the coefficient of determination, R^2, that may not be due to a true relationship between the variables but because the variables tend to move in the same direction[71]. This possibility increases if the error term is autocorrelated, as first pointed out by Yule (1926). While the OLS regression technique may still be applied to non-stationary series, alternative modelling strategies must be considered. A challenge of regressions using data in level forms, mainly due to spurious regressions, began in the 1970s. The focus of attention began to shift towards the need to have properly specified models with dynamic structures (Banerjee *et al.*, 1993).

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[70] If the mean, variance and covariances do not depend on time, this also means that the first order autoregressive process, *AR(1)* is stationary (Holden and Perman, 1994; p. 51),

[71] To identify the problem of spurious regression in practice, the rule of thumb suggested by Granger and Newbold, (1974) is often used. If $R^2 >$ DW d statistic, a spurious correlation may be present.

The theoretical rationale for stationary time series is closely related to the characteristics of models with unit roots[72]. Therefore, prior to testing the model itself, the time series will be tested for the presence or otherwise of unit roots. The concept of unit roots and its consequences can be explained as follows:

If a variable Y_t is generated by the following process:

$$Y_t = Y_{t-1} + \varepsilon_t \tag{5.1}$$

where, Y_t is the value of the variable at time t ($t = 1, \ldots, n$) and it equals to its value in the previous period (Y_{t-1}) plus a random shock (ε_t), then the variance of the dependent variable $Var(Y_t) = Var(Y_{t-1}) + Var(\varepsilon_t)$ goes to infinity as time goes to infinity.

After running regression ($Y_t = \alpha + \delta Y_{t-1} + \varepsilon_t$) the issue of whether the coefficient with the lag-dependent variable, δ, is less than one or equals one is, therefore, critical. It has important economic and statistical implications. If the coefficient is less than one a time series follows trend-stationary process and the effect of any shock to the series is gradually eliminated. However, if the coefficient with the lag-dependent variable equals one, the effect of the shock is permanent. It is incorporated in the error term, and consequently, the value of the dependent variable in Equation 5.1 increases by 'a shock'. The variable Y_t is said to have a unit root.

5. 2. 2 Unit Root Tests

An obvious objective is to make the residuals stationary. The non-stationary series can be transformed to the stationary series by differencing once, or being integrated of

[72] Testing for unit roots in time series has attracted a great number of theoretical and empirical studies. Good reviews of this literature can be found in Banerjee *et al.* (1993), Hamilton (1994), Johansen (1995), and Hatanaka (1996).

order one, $I(1)$. Thus, $\Delta Y_t = Y_t - Y_{t-1} = \varepsilon_t$[73]. Since the error term, ε_t, is assumed to be independent and normally distributed, the first difference of Y_t is stationary and such a series is said to be *a random walk*. However, if the series needs to be differenced k times to become stationary, the series is said to be $I(k)$ or a difference-stationary process (Maddala and Kim, 1998, p. 24). Thus, it can be deduced that testing of the hypothesis $\delta = 1$ in the first order autoregressive equation, as specified above, is in fact testing for unit roots[74]. The most commonly used tests for testing for the presence of unit roots in time series data, are derivatives[75] of the Dickey-Fuller tests (Dickey, 1976; Dickey and Fuller, 1979).

Dickey and Fuller (1979) designed a test for the hypothesis concerning the coefficient with the lag-dependent variable, under the assumption that the error terms are white noise processes. They derived critical values of the Dickey-Fuller statistics, tabulated by Fuller (1976, p. 373) for alternative model specifications, in particular the model without the constant term[76] (that is without drift), $Y_t = \delta Y_{t-1} + \varepsilon_t$, with the constant term (a random walk with drift) $Y_t = \alpha + \delta Y_{t-1} + \varepsilon_t$, and a random walk with both drift and trend, $Y_t = \alpha + \beta T + \delta Y_{t-1} + \varepsilon_t$. Thus, the test allows checking whether the specific variable is trend stationary or difference-stationary (Nelson and Plosser, 1982; Schmidt and Phillips, 1992)[77].

[73] This is not completely recommended as important parts of the potential relationship may be lost. As Granger (1990) suggests a better approach is to include in the model a sufficiently complex dynamic specification, including lagged dependent and independent variables, so that the true relationship might be discovered (p. 247), Park (1990) and Inder (1993) also tested the model with the lagged dependent variable included as a regressor.
[74] The term 'unit root' refers to the root of the polynomial in the lag operator (Gujarati, 1995, p. 718),
[75] The Dickey-Fuller tests were developed for simple random walks while the derivates were aimed at detecting the presence of a unit root in a general integrated process of order one (Phillips and Hansen, 1990; Said and Dickey, 1984; Phillips, 1987; Phillips and Perron, 1988).
[76] The error term is assumed to be a succession of independently and identically distributed random variables (Holden and Perman, 1994, p. 50),
[77] In empirical work, the common practice is to include the trend variable and/or successive differences in the model. However, Nelson and Plosser (1982), and Stock and Watson (1988) emphasise that the

The Dickey-Fuller (DF) test for the presence of unit roots, or for order of integration is based on the estimation of the model that can be expressed as:

$$Y_t = \alpha + \beta T + \delta Y_{t-1} + \varepsilon_t \tag{5.2}$$

where, the null hypothesis is that $\beta = 0$ and $\delta = 1$, against the alternative hypothesis $\delta < 1$. In testing the hypothesis of the existence of a unit root the critical values of the Dickey-Fuller unit root distribution rather than the standard normal distribution are used.

Holden and Perman (1994) pointed out that since in reality the values of the intercept and the coefficient with the trend variable are unknown, it is necessary to test jointly for these coefficients as well as for the presence of a unit root. Dickey and Fuller, cited in Bera and Jarque (1981), developed the *Augmented Dickey-Fuller (ADF)* test, for both the coefficient with the trend and with the lag-dependent variable. The test involves the estimation of the unrestricted model, Equation 5.3, and the restricted model:

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + \sum_{i=1}^{k} \phi_i \Delta Y_{t-i} + \varepsilon_t \tag{5.3}$$

where, $\Delta Y_t = Y_t - Y_{t-1}$, T is a time trend, and $\sum_{i=1}^{k} \phi_i \Delta Y_{t-i}$ represent the lagged terms where k is sufficiently large to ensure that ε_t is white noise, $t = 1, 2, \ldots, n$. The main purpose of adding the lag terms into the model is to allow for autoregressive moving average (ARMA) process and to remove the effects of serial correlation in the

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explicit inclusion of the trend variable (de-trending the series) is appropriate only if the trend variable is deterministic, that is fully predictable, rather than stochastic[77]. Based on a number of empirical studies Nelson and Plosser maintain that the difference-stationary process is applicable to most economic time series.

residuals. Dickey and Fuller give evidence that both DF and ADF tests have the same asymptotic distribution, therefore, the same critical values can be applied.

Despite its widespread application, Dickey-Fuller methodology has its shortcomings. Firstly, it is limited to pure autoregressive integrated moving average, ARIMA (1,0,0) processes. Secondly, empirical evidence shows that with increasing importance of the moving average components, higher lags of ΔY_t are required as explanatory variables in the autoregressive correction, reducing the degrees of freedom and the power of the test (Schwert, 1989; Agiakoglou and Newbold, 1992; Banerjee, *et al.* 1993; Pesaran and Pesaran, 1997; Maddala and Kim, 1998)[78]. Schwert (1989) first presented Monte Carlo evidence to point out the size distortion problems of the commonly used unit root tests. He emphasises the importance of correct specification of the ARIMA processes prior to testing for the presence of unit roots.

Cochrane (1991) argues that a low power of unit root tests in small samples is due to arbitrarily small variance of the random walk component. He shows that there are unit root processes whose likelihood function and autocorrelation functions are arbitrarily close to those of any given stationary processes and *vice versa*. He maintains that the results of unit root tests do not necessarily provide the answer to the question of which distribution theory provides a better small sample approximation (p. 283).

Some important questions in relation to the unit root testing were raised by Maddala and Kim (1998). They pointed out that if, as it is commonly believed, the unit root tests are a precondition to cointegration analysis, they should be regarded as pre-tests. Therefore,

[78] A review of the issues in unit root testing as well as some solutions and alternatives can be found in Maddala and Kim (1998).

instead of the 1 percent or 5 percent significance levels, much higher significance levels (say 25 percent) are appropriate. The other argument is that if the null hypothesis of a unit root cannot be rejected at the 1 percent or 5 percent level of significance, it does not mean that the unit root null hypothesis is valid, thus, there is a nonzero probability that the process is a stationary process.

Since the introduction of the Dickey-Fuller tests, a number of modified testing procedures have been developed for unit roots where the serial correlation and some heteroscedasticity of errors are allowed (Said and Dickey, 1984; Phillips, 1987; Phillips and Perron, 1988).

Phillips and Perron (1988) modified the DF test using a non-parametric method to account for serial correlation. They derived *z*-statistics when the assumption of white noise residuals is relaxed, thus the DF test is not valid. Both tests are founded on an asymptotic theory that requires the knowledge of how well the limiting distributions approach the finite sample distribution of the relevant statistic. Phillips and Perron assume that the error term in the DF specification ($Y_t = \alpha + \delta Y_{t-1} + \varepsilon_t$) follows a first order moving average process that can be expressed as:

$$\hat{\varepsilon}_t = \varepsilon_t + \theta \varepsilon_{t-1} \qquad (5.4)$$

where θ is the moving average component. It is assumed that ε_t is white noise. Phillips and Perron conclude that if θ is positive, in terms of the power of the test, the PP test is preferred. However, when the coefficient is negative the conclusion is not so straightforward. In order to make the decision, Phillips and Perron advise to get support from the diagnostic tests, more specifically, if the diagnostic statistics are significant, the PP tests may be more appropriate. Phillips and Perron also point out the advantage of the z tests in relation to potential problem stemming from the misspecification of the number of lags in the DF model, which is not required under the PP tests. However, if the coefficient of the moving average component is negative they warn that one should avoid employing the PP test.

Other modifications include Sargan and Bhargava (1983), Choi (1992), Leybourne (1995), Yap and Reinsel (1995), Elliott *et al.* (1996), and Perron and Ng (1996). Some tests have been introduced that use stationarity rather than non-stationarity as a null hypothesis (Park, 1990; Tanaka, 1990; Kwiatkowski, Phillips *et al.*, 1992; Bewley and Orden, 1994; Choi, 1994; Leybourne and McCabe, 1994)[79]. Stock (1994) pointed out that the reason there are so many unit root tests is that there is no uniformly powerful test for the unit root hypothesis.

A test for unit roots that seems to dominate the Dickey-Fuller test (and others) in terms of power is the Weighted Symmetric (WS) test (Pantula, *et al.*, 1994). The idea behind the symmetric estimators is that if a normal stationary process satisfies the equation $(Y_t = \alpha + \delta Y_{t-1} + \varepsilon_t)$, *where* $t = 2, \ldots, T$, it also satisfies the equation: $(Y_t = \alpha + \delta Y_{t+1} + \varepsilon_t)$[80].

It is apparent from the above discussion that because of potential problem of spurious regression, it is crucial to test the time-series for non-stationarity. If non-stationarity can be rejected, standard regression methods can be applied safely. However, if

[79] A detailed discussion of these tests can be found in Maddala and Kim (1998).
[80] A detailed discussion of WS estimators in non-stationary models can be found in Fuller (1996), Ch. 10.

stationarity is rejected, the data series may be either transformed to stationary, or cointegrating relationships between the series may be investigated.

5. 2. 3 Cointegration

The concept of cointegration is in some way linked to the notion that if two variables are associated by a theoretical economic relationship, they should not part away in the long-run. Such variables may drift apart in the short run because of seasonal effects or policy reasons, but the divergence must be stochastically bounded and, at some point, diminishing over time. From the practical standpoint, the process of cointegration allows to identify the existence of equilibrium[81] between time series that are individually non-stationary.

Granger (1981, 1986) and Engle and Granger (1987) developed a test that can, potentially, maintain an underlying long-run relationship between two series that are not stationary when involved in regression at their level form. Even if two variables, such as X_t and Y_t are non-stationary, there may be a specific linear combination of these variables, expressed as $X_t - \alpha Y_t = u_t = I(0)$, that is stationary, where α is the cointegrating parameter and u_t is a random walk[82]. Consequently, their error terms are also expected to be linearly related. Thus, instead of producing an increasing variance, their variance may be finite and the two series do not drift apart over time. In such situations it can be concluded that there is a long-run equilibrium relationship between the two variables, or, that the series are cointegrated.

[81] An equilibrium state is defined as one in which there is no inherent tendency to change. The long-run equilibrium is the equilibrium relationship to which a system converges over time. It involves a systematic co-movement among economic variables (Banerjee *et al.* 1993, p. 2-3).
[82] For a more detailed proof see, for instance, Banerjee *et al.* (1993, Ch. 5).

The concept of cointegration is crucial to developing a correct economic model. As it was mentioned earlier, regression involving levels of non-stationary variables is sensible only if the variables are cointegrated. While testing for cointegration facilitates the identification of 'spurious' regression (Granger and Newbold, 1974; 1977), however, it does not discard potential information about long-run adjustments that the data may hold.

A number of techniques have been developed to test for cointegration. In essence, the testing involves examining whether the residuals have/have not a unit root. Because the process is similar to testing for unit root in a variable included in the model, it seems plausible to include DF and ADF among the testing procedures, although critical values for the tests are different. Other alternatives include the tests described below.

Cointegrating Regression Durbin-Watson (CRDW) Test

This test is based on the examination of the Durbin-Watson *(d)* statistic produced by the cointegrating regression. The null hypothesis is, however, stated as $d=0$ rather than $d=2$ as is the case with the standard DW test for serial correlation in residuals. The obtained d value is compared against critical values developed by Sargan and Bhargava (1983). Thus, if the null hypothesis is rejected, the two variables appear to have a steady long-run relationship, so they are cointegrated. Based on their empirical evidence Engle and Granger (1987) claim that the DW critical values for cointegrating regression are not stable across various empirical studies[83]. However, they suggest that the ADF test performs better.

Engle and Granger (1987) recommend the estimation of a static cointegration regression, that is, estimating a model that does not include any lags, and then, to employ a two-stage procedure, using the estimated coefficient from the cointegrating regression. Alternatively, all the short-run parameters can be estimated in one step simultaneously with other parameters in the model specification. Engle and Granger (1987) and Stock (1987) maintain that both methods provide consistent estimates.

Lagging variables and including them as regressors often has the same effect as providing a cointegrated set of regressor variables (Banerjee, *et al.*, 1993, p. 167). It is, however, important that a possibility of transforming in such a way that the regressors are integrated of the same order as the regressand. As Banerjee, *et al.* (1993) pointed out such a possibility is enhanced in a dynamic model as the probability of a cointegrated set being present is increased. Thus, the 'general to specific' modelling method is effective since the inclusion of several variables and their lags as regressors increases the chances of obtaining a cointegrated set of regressors (p. 168).

Error Correction Model (ECM)

As discussed, if two variables are cointegrated, there appears to be a long-run equilibrium relationship between them. Therefore, if we identify that two variables are cointegrated, the 'link' can be made between the short-run dynamics and the long-

[83] Phillips and Ouliaris (1990) provide a theoretical analysis, highlighting the major features and differences and recommendations of various tests.

run equilibrium. This can be done by introducing past disequilibrium as explanatory variables in the dynamic behaviour of current variables. (Maddala and Kim, 1998 p. 35). Maddala and Kim pointed out that the recent revival in the popularity of the ECMs has followed the demonstration by Granger and Weiss (1983) that if two variables are integrated of order 1, and are cointegrated, they can be considered as being generated by an ECM.

The essence of the Engle-Granger method rests on including the error correction variable estimated by the residuals from cointegration regression equation that may be viewed as the estimate of the long-run equilibrium error term. The technique may be best illustrated using the following specification:

$$Y_t = \alpha + \beta X_t + u_t \qquad (5.5)$$

so,

$$\Delta Y_t = \alpha + \beta_1 \Delta X_t + \beta_2 u_{t-1} + \varepsilon_t \qquad (5.6)$$

where, Δ denotes the first difference, u_{t-1} is the one-period lagged residual from the cointegration regression, and ε_t is the error term with the usual properties.

Engle and Granger Two-Step Procedure

As it follows from the above discussion, if the long-run components are modeled as stochastic trends and if they move together, they can be cointegrated. The long-run movement of any two variables can be examined using the two-step method for cointegration proposed by Engle and Granger (1987). The first step examines whether each of the involved variables has a stochastic trend. This is accomplished by conducting a unit root test on the concerned variables. Based on the conclusion of the test, with respect to the stochastic trend, in the second step, the residuals from the cointegrating regressions are examined for a unit root, in other words, whether there is a relationship between the stochastic trends in the variables. If the results of these tests indicate no unit root in residuals, however, the presence of a unit root in each of the variables, it is concluded that the dependent and explanatory variables are cointegrated[84].

Johansen Maximum Likelihood Procedure

Whereas in the bivariate case the concept of cointegration is rather straightforward, in the multivariate case the prospect of several cointegrating vectors must be taken into account. If there is more than one cointegrating relationship between the variables, the Engle-Granger approach may generate biased estimates. In order to test for the possible presence of more than one cointegrating relationships, an alternative Johansen maximum likelihood method is also applied.

The specification of the model in the level form can be written as:

$$Y_t = \alpha + \beta_1 Y_{t-1} + \ldots + \beta_{k-1} Y_{t-k+1} + \beta_k Y_{t-k} + \varepsilon_t \qquad (5.7)$$

or, in the error-correction form:

$$\Delta Y_t = \alpha + \beta_1 \Delta Y_{t-1} + \ldots + \beta_{k-1} \Delta Y_{t-k+1} + \beta_k Y_{t-k} + \varepsilon_t \qquad (5.8)$$

where, α is the intercept that may or may not be included, depending on whether drift is considered; $\beta_1, \beta_2 \ldots \beta_{k-1}$ are the parameters to be estimated; ΔY_t is assumed to be an *I(0)* vector; k is the number of lags that must be determined, and ε_t is the white noise error term.

84 Mehra (1994) stresses that the specification of the cointegrating regressions should include only non-stationary variables, otherwise, inconsistent parameter estimates are produced (p. 150).

The test allows for restrictions being imposed on a single or all the cointegrating vectors, thus, equilibrium relationships. However, the mode of specification must be carefully considered when deriving the degrees of freedom for the test. In general, the degrees of freedom can be determined as: $(p\text{-}v)\ v_l$. Where, p is the number of variables, v is the number of cointegrating vectors, v_l is the number of fixed vectors.

Banerjee *et al.* (1993) emphasises that because the number of cointegrating vectors is unknown in empirical modelling, it should first be determined from the data. It is because of their potentially serious consequences for estimation and inference. He argues that under-estimation leads to the omission of empirically relevant error-correction terms, while over-estimation implies the non-standard distributions of statistics (p. 262).

Johansen (1988; 1995) and Johansen and Juselius (1994) suggest that hypothesis involving the cointegrating vectors can be tested using a likelihood ratio test that compares restricted and unrestricted estimations. Successive regressions are run and the maximised value of the log likelihood function is obtained. Johansen shows that the distribution under the null hypothesis is of the χ^2 form[85].

Holden and Perman (1994) suggest that if the model is specified in the vector autoregression (*VAR)* Equation (5.7), and the outcomes of the likelihood ratio tests indicate the presence of cointegrating relationships between the variables and the

[85] Menon (1995) derived disaggregated elasticities, employing the Johansen Full-Information Maximum Likelihood procedure for estimating cointegration vectors.

presence of unit roots, in these circumstances the tests for unit roots may be omitted (p. 89).

Hatanaka (1996) examined a large number of empirical studies that employed the Johansen ML method and recognises that the major difficulties facing researchers in applying the Johansen ML method are due to the possibility of structural breaks in the model. A comprehensive discussion of this test can be found, for instance, in Harvey (1990); Cuthbertson (1992); Hall *et al.* (1992) and Hatanaka (1996).

Unrestricted Error Correction Model (UECM)

In the case of the Engle-Granger two-step procedure, Banerjee *et al.* (1993) maintain that ignoring lagged terms in a static equation (the first step OLS estimation) may lead to substantial biases in the estimation of the long-run parameters. In order to estimate the long-run relationships, Banerjee *et al.* recommend an unrestricted error correction model (UECM) to estimate the long-run parameters. The general form of the UECM can be expressed as:

$$Y_t = \alpha + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{i=0}^{k} \gamma_i X_{t-i} + \varepsilon_t \qquad (5.9)$$

where α is a constant, Y_t is a $(n \times 1)$ vector of endogenous variables, X_t is a $(m \times 1)$ vector of explanatory variables, and β_i and γ_i are $(n \times n)$ and $(n \times m)$ matrices of parameters.

In order to separate the short-run and long-run relationships, Equation (5.9) is modified by including differences and lags as:

$$\Delta Y_t = \alpha + \sum_{i=1}^{k-1} \beta_i^* \Delta Y_{t-i} + \sum_{i=0}^{k-1} \gamma_i^* \Delta X_{t-k} + \delta_0 Y_{t-k} + \delta_1 X_{t-k}\ \varepsilon_t \qquad (5.10)$$

where

$$\delta_0 = -\left(I - \sum_{i=1}^{k} \beta_i\right), \quad \delta_1 = \left(\sum_{i=0}^{k} \gamma_i\right) \tag{5.11}$$

The long-run relationships are presented by δ_1/δ_0. The long-run elasticity of Y with respect to X, for instance, can be derived by $\delta_1/-\delta_0$.

This method was supported by Hendry (1995) using a large number of Monte Carlo studies[86]. The essence of the method is to start with a sufficiently large number of lags and to progressively simplify it. The advantage of the method is that it minimises chances of deriving spurious relationships while retaining long-run information (Athukorala and Jayasuriya, 1994; Athukorala and Rajapatirana, 2000). It is also considered to be superior in small samples as it offers an insight to the short-run and long-run responses in the same model. First, the unrestricted equations are estimated, using OLS method. Then, in light of the regression diagnostics, a more specific (parsimonious) model is gradually derived. The serial correlation test (Godfrey, 1978a; Godfrey, 1978b), normality test (Jarque and Bera, 1980; Bera and Jarque, 1981), and heteroscedasticity test (White, 1980; White 1982) are employed to perform the diagnostic testing of the model. The approach was applied, for instance, by Senhadji (1998) in estimating the structural import demand model and by Athukorala and Rajapatirana (2000) in estimating the supply of Sri Lankan manufacturing exports, and in the studies of Gunawardana (1995), Gunawardana and Vojvodic (2002), and Muscatelli and Hurn (1992).

[86] See Maddala and Kim (1998) and Athukorala and Rajapatirana (2000).

Autoregressive Distributed Lag (ARDL) Model

An alternative methodology proposed by some researchers is based on Autoregressive Distributed Lag *(ARDL)* model. Pesaran *et al.* (1996) and Pesaran and Shin (1998) suggested testing the existence of long-run relationships using ARDL, that permits making inferences that are robust regardless of whether the variables under consideration are level-stationary or difference-stationary. This approach avoids the pre-testing problems associated with standard cointegration analysis that requires the classification of the series into I(0) or I(1). Furthermore, this approach does not depend on assumptions about the exogeneity condition[87] or otherwise of the relevant variables.

The ARDL procedure involves two steps. The *first* step is concerned with testing the existence of the long-run relation between the variables under investigation, employing the *F*-test for testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. The asymptotic distribution of the *F*-statistic is, however, non-standard, regardless of whether variables are I(0) or I(1). Pesaran (1996) tabulated the critical values for various numbers of regressors, both I(0) and I(1), and accounted for the inclusion of an intercept and/or trend. However, if the test statistic is within the critical value band, at this stage, unit root tests on the variables should be carried out. If the outcome of the first stage indicates the existence of a non-spurious long-run relationship, then in the *second* stage, the parameter estimates of that relationship is derived, using the appropriate ARDL model.

[87] Maddala and Kim (1998) argue that if it is known that a variable in the model is weakly exogenous, ignoring this information can result in a loss of power. Such a variable must not be error correcting (p. 188),

Having discussed econometric procedures associated with the analysis involving time series data, in the following section the estimation procedures applied in this study are discussed.

5. 3 Application of Econometric Procedures

The preceding discussion of the econometric issues involved in the estimation of models employing time series data drew attention to a preliminary testing of time series properties of the variables specified in a model. This section presents an econometric analysis of the time series properties of data used in the estimation of export supply of and import demand for Australia's textiles and clothing products.

5. 3. 1 Unit Root Tests of Data Series

The estimation of models specified in Chapter 4 embraces a number of steps. Prior to the estimation of the equations (to be discussed in Chapter 6), all variables were tested for the presence or otherwise, of a unit root, using Time Series Processor (TSP) econometric interactive software (Hall and Cummins, 1997). The TSP offers three unit root tests: Augmented Weighted Symmetric (tau) test (WS)[88], Augmented Dickey-Fuller (ADF) test and the non-parametric Phillips-Perron (PP) test. As mentioned earlier, the WS test seems to dominate the Dickey-Fuller test (and others) in terms of power (Pantula, *et al.*, 1994).

As a starting point, in order to examine whether a series forms a trend, the plot of each time series was produced. Depending on the behaviour of the series, the unit root test

[88]See Pantula *et al.* (1994) for more details.

with a non-linear, linear and without trend was performed. Because none of the variables concentrated around zero, all unit root tests included a constant.

Pesaran and Pesaran (1997) pointed out that empirical evidence shows that the size and power properties of the ADF test are responsive to the number of lags. Therefore, before carrying out the unit root tests, it is important that an appropriate value for the order of augmentation, k, of the test is chosen. Pesaran and Pesaran suggest that because the true order is unknown, the two-step procedure might be used. First, model selection criteria such as the Akaike information criterion (AIC) or the Schwarz-Bayesian criterion (SBC) should be applied in selecting the order of the regression, and then, the test should be performed.

Hall (1994) discussed two sequential procedures in the situation of pure autoregressions. The first procedure is so-called 'general to specific' rule that suggests to start with a large value of k and reduce it gradually until a significant statistic is encountered. The second rule, the specific to general rule suggests the reverse process. Hall found the performance of the general to specific approach to be superior.

Ng and Perron (1995) compared AIC, SBC, and Hall's general to specific approach and suggests that Hall's approach is preferable to the others. The reason is that Hall's criterion tends to choose higher values of k that result in lower size distortions. DeJong *et al.* (1992) also show that increasing k usually results in a modest decrease in power but a substantial decrease in size distortions. While Stock (1994) found some opposite evidence arguing in favour of SBC, he suggests that one could use either method.

For selecting the order of augmentation in unit root tests in this study the Akaike information criterion (AIC) was applied by the TSP. The results of the unit root tests are presented in Tables 5.2 to 5.5. It is important to note that P-values represent finite-sample values that are more accurate than the asymptotic values, in particular in case of small samples (Hall and Cummins, 1997). However, in some cases (in the tables designated by dot, ‘‘,”) TSP does not report P-values for WS test since, as pointed out by Hall and Cummins, these P-values are fine for testing at the 5% and 10% levels, but they are not accurate for testing at other levels” (p.45). For that reason and because, as pointed out in Section 5.2 none of the unit root tests has superior qualities, the results of all three tests are presented. The column ‘conclusion’ indicates the outcome of the test.

If the null hypothesis of a unit root test was accepted, that is, if a series was found non-stationary, the unit root test was repeated with the first difference series. In the case of a differenced series, the order of trends was reduced. Thus for instance, if the original series have a constant and a quadratic trend, the differenced series have a constant and a linear trend (see column ‘Trend’ in the tables).

Irrespective of the order of the augmentation chosen for the test, if the absolute values of the test statistics are above the 95 per cent critical value, or alternatively, P-value is less then 0.05, the hypothesis that the variable has a unit root is to be rejected. In order to make a statistical inference regarding the presence or otherwise, of a unit root, P-values are employed. The values presented in Tables 5.2 to 5.5 indicate inconsistent results produced by various tests. Generally, it can be concluded that with a very few exceptions, for the involved variables, the null hypothesis of a unit root cannot be rejected, concluding that the time series follow a non-stationary process.

5. 3. 2 Model Estimation Procedures

As discussed earlier, if a variable is not stationary but is integrated with another variable in the model in the same order, either in level form [I(0)] or in the first difference form (Phillips and Hansen, 1990), the two variables may be co-integrated, that is there is a long-run relationship between them. Thus, in the short-run the variables may diverge due to policy or other reasons. As it is evident from Table 5.2 through Table 5.5, most variables are non-stationary at the level form. Although some become stationary at the first difference, a number of variables persist to be non-stationary even after the first difference[89]. These results are consistent in all estimated models. Thus, it is concluded that there is no co-integrating relationship between the variables in the estimated models.

If variables become stationary in the first difference form, it may be tempted to include those stationary variables in that form in the model. However, such variables only demonstrate the short-run relationship, ignoring any long-run information embodied in the modelled relationship. We, therefore, are reluctant to give up the identification and estimation of potential long-run effects, and model each variable in both level and difference forms.

Therefore, the procedure referred to as an unrestricted error correction model (UECM or ECM) that includes both short-run dynamics and long-run responses is employed in

[89] Unit root tests were not performed at the second difference. It would be unfeasible to interpret the results.

this analysis. This procedure was applied in the studies by Athukorala and Jayasuriya (1994), Gunawardana *et al.* (1995), Menon (1995), Athukorala and Rajapatirana (2000), and Gunawardana and Vojvodic (2002). This approach is considered to be superior, in particular if the analysis is based on a small sample, as is the case in this study. First, the model is estimated with all variables in their level and difference forms with higher lags. Then, depending on diagnostic tests, the lags are reduced progressively. A 'parsimonious' model is selected for interpretation and discussion of the results.

5. 4 Conclusion

In this chapter, data and data sources were presented first. After reviewing the theoretical issues relating to time-series data analysis, the preliminary testing of time series properties of data was carried out, using various unit root tests. A careful examination of the results reveals the absence of co-integrating relationships among the variables in all models for export supply and import demand for textiles and clothing. In the absence of co-integration, it was decided to employ the UECM procedure that incorporates both short-run dynamics and long-run responses embodied in the models. The estimation of the models specified in Chapter 4 will be undertaken in Chapter 6.

Table 5. 2: **Unit Root Test Results, Export Supply, Textiles**

Variable	Test	Level form				First Difference			
		Test statistic	P-value	Conclusion	Trend	Test statistic	P-value	Conclusion	Trend
XST	WS	-2.70	.	.	T^2	-3.13	0.06	S_{10}	T
	ADF	-2.38	0.64	NS		-2.79	0.20	NS	
	PP	-11.40	0.62	NS		-26.45	0.02	S_5	
RPT	WS	-2.56	0.04	S_5	No	-3.13	.	.	No
	ADF	-2.45	0.13	NS		-3.16	0.00	S_1	
	PP	-8.88	0.18	NS		-24.97	0.00	S_1	
CAPT	WS	-2.70	.	.	T^2	-3.39	0.03	S_5	T
	ADF	-3.35	0.16	NS		-3.83	0.03	S_5	
	PP	-11.41	0.62	NS		-23.23	0.04	S_5	
ERAT	WS	-1.58	.	.	T^2	-3.03	0.08	S_5	T
	ADF	-3.01	0.29	NS		--2.88	0.17	NS	
	PP	-7.56	0.86	NS		-21.28	0.05	S_5	

Note: WS - weighted symmetric; ADF - augmented Dickey-Fuller; PP - Phillips-Perron; T^2 - quadratic trend; T – linear trend; No – no trend; S_1 – significant at the 1% level; S_5 – significant at the 5% level; S_{10} – significant at the 10% level.

Table 5. 3: **Unit Root Test Results, Export Supply, Clothing**

Variable	Test	Level form				First Difference			
		Test statistic	P-value	Conclusion	Trend	Test statistic	P-value	Conclusion	Trend
	WS	-1.30	.	.		-2.07	0.06	S_{10}	
XSC	ADF	-1.15	0.98	NS	T^2	-1.85	0.20	NS	T
	PP	-5.54	0.94	NS		-19.35	0.02	S_5	
	WS	-2.67	0.03	S_5		-.3.20	.	.	
RPC	ADF	-2.47	0.13	NS	No	-3.00	0.00	S_1	No
	PP	-9.17	0.16	NS		-29.88	0.00	S_1	
	WS	-2.55	.	.		-3.61	0.01	S_1	
CAPC	ADF	-3.62	0.08	S_{10}	T^2	-4.02	0.02	S_5	T
	PP	-11.45	0.62	NS		-20.76	0.06	S_{10}	
	WS	-2.21	.	.		-3.47	0.02	S_5	
ERAC	ADF	-3.37	0.15	NS	T^2	-.3.34	0.07	S_{10}	T^2
	PP	-11.47	0.62	NS		-30.97	0.01	S_5	

Note: WS - weighted symmetric; ADF - augmented Dickey-Fuller; PP - Phillips-Perron; T^2 - quadratic trend; T – linear trend; No – no trend; S_1 – significant at the 1% level; S_5 – significant at the 5% level; S_{10} – significant at the 10% level.

Table 5. 4: **Unit Root Test Results, Import Demand, Textiles**

Variable	Test	Level form				First Difference			
		Test statistic	P-value	Conclusion	Trend	Test statistic	P-value	Conclusion	Trend
MDT	WS	-2.68	0.19	.	T	-3.38	0.00	S_1	No
	ADF	-2.64	0.26	NS		-4.11	0.00	S_1	
	PP	-23.57	0.03	S_5		-35.60	0.00	S_1	
RPT^m	WS	-1.52	0.50	S_5	No	-3.09	.	.	No
	ADF	-2.42	0.14	NS		-2.90	0.01	S_1	
	PP	-6.34	0.32	NS		-32.63	0.00	S_1	
GDPT	WS	-1.75	.	.	T	-3.17	0.01	S_1	No
	ADF	-1.94	0.16	NS		-2.94	0.05	S_5	
	PP	-6.46	0.62	NS		-32.16	0.00	S_1	
ERAT	WS	-1.58	.	.	T^2	-3.03	0.08	S_5	No
	ADF	-3.01	0.29	NS		-2.88	0.17	NS	
	PP	-7.56	0.86	NS		-21.28	0.05	S_5	
SST	WS	-2.82	0.13	NS	T	-2.08	0.15	NS	No
	ADF	-0.04	0.98	NS		-1.99	0.25	NS	
	PP	-17.37	0.12	NS		-26.92	0.00	S_1	

Note: WS - weighted symmetric; ADF - augmented Dickey-Fuller; PP - Phillips-Perron; T^2 - quadratic trend; T – linear trend; No – no trend; S_1 – significant at the 1% level; S_5 – significant at the 5% level; S_{10} – significant at the 10% level.

Table 5. 5: **Unit Root Test Results, Import Demand, Clothing**

Variable	Test	Level form				First Difference			
		Test statistic	P-value	Conclusion	Trend	Test statistic	P-value	Conclusion	Trend
MDC	WS	-2.19	.	.	T^2	-2.64	0.21	S_{10}	T
	ADF	-4.01	0.03	NS		-2.56	0.29	NS	
	PP	-5.89	0.92	NS		-30.95	0.01	S_5	
RPC^m	WS	-2.67	0.03	S_5	No	-3.20	.	.	No
	ADF	-2.47	0.13	NS		-3.00	0.00	S_1	
	PP	-9.17	0.16	NS		-29.88	0.00	S_1	
YC	WS	-2.35	0.39	NS	T	-2.56	0.05	S_5	No
	ADF	-3.33	0.07	S_{10}		-2.72	0.08	S_{10}	
	PP	-7.71	0.60	NS		-15.41	0.04	S_5	
ERAC	WS	-2.21	.	.	T^2	-3.47	0.08	S_5	No
	ADF	-3.37	0.15	NS		-3.34	0.17	S_{10}	
	PP	-11.47	0.62	NS		-30.97	0.05	S_1	
SSC	WS	-2.82	0.13	NS	T	-2.08	0.15	NS	No
	ADF	-0.04	0.98	NS		-1.99	0.25	NS	
	PP	-17.37	0.12	NS		-26.92	0.00	S_1	

Note: WS - weighted symmetric; ADF - augmented Dickey-Fuller; PP - Phillips-Perron; T^2 - quadratic trend; T – linear trend; No – no trend; S_1 – significant at the 1% level; S_5 – significant at the 5% level; S_{10} – significant at the 10% level.

Chapter 6

EXPORT SUPPLY OF AND IMPORT DEMAND FOR TAC: EMPIRICAL ESTIMATION, RESULTS AND DISCUSSION

In the previous chapter the results obtained from the preliminary testing of time series properties of individual variables included in the models were discussed. It was concluded that the series employed in this study are non-stationary processes with the absence of cointegration. This chapter focuses on the empirical estimation of export supply and import demand for Australia's textiles and clothing products, based on the models specified in Chapter 4. Section 6.1 presents the results of export supply of textiles and clothing while Section 6.2 provides the results of import demand for textiles and clothing. Summary and conclusion of the analysis are presented in Section 6.3.

The purpose of the analysis is, mainly, to answer two questions. First, to analyse whether TAC exports and imports depend on both their own past behaviour and on the behaviour of relevant exogenous factors. Second, to examine the long-run relationship between the dependent variables and exogenous variables. The models will be estimated separately for textiles and clothing. While it would have been desirable to estimate the models at a more disaggregated level within each category, in order to uncover potential differences in export supply and import demand for subcategories, it was not possible to obtain the data for all relevant variables at a disaggregated level. Therefore, the analysis is based on a 2-digit level of aggregation for both textiles and clothing.

The export supply and import demand models were estimated using the 'general to specific' approach, that is sometimes referred to as the Hendry method or the unrestricted error correction method or UECM (see Hendry and Mizon, 1978; Mizon and Hendry, 1980; Hendry and Richard, 1982; Hendry, 1995). Economic and econometric justification for using UECM (Unrestricted Error Correction Model) is discussed in Chapter 5, Section 5.2.3 and Section 5.3.2. This approach minimises the likelihood of arriving at spurious relationships while preserving long-run information. The economic theory motivation is that, in the same model both short-run responses and long-run adjustment of exporters and importers to changes in economic variables can be derived. It is particularly superior for small samples, as is the case in this analysis. First, the unrestricted equations are estimated using the OLS method. Taking into consideration the regression diagnostics, a more specific (parsimonious) model is gradually derived. Banerjee *et al.* (1993, p. 167) suggest that 'lagging' variables and including them as regressors often has the same effect as providing a cointegrated set of regressor variables. He maintains that such a possibility is enhanced in a dynamic model as the probability of a cointegrated set being present is increased. Following Banerjee *et al.*, the models were estimated with different lag structures.

In order to evaluate the appropriateness of the models, the results of standard diagnostic tests that are part of the regression output from Microfit 4.0 (Pesaran and Pesaran, 1997) were considered. These include testing for residual serial correlation (Godfrey, 1978a; Godfrey, 1978b), normality (Jargue and Bera, 1980; Bera and Jarque, 1981) functional form misspecification (Ramsey, 1969), and heteroscedasticity (White, 1980).

Since economic theory does not offer any *a priori* criteria for preferred functional form, the choice of the function usually becomes an empirical matter. Khan and Ross (1977) advise that when there is no convincing evidence regarding the functional form, the final decision should be discretionary. The most commonly applied functional forms for export supply and import demand relationships in international trade are linear and log-linear functions (Kreinin, 1967; Houthakker and Magee, 1969; Leamer and Stern, 1970). A number of studies, including Khan and Ross (1977), Boylan *et al.* (1980), Salas (1982), Boylan and Cuddy (1987), and Gunawardana and Karn (1997) pointed out that the preference for the log-log form is due to the advantage that the estimated slope coefficients can be used to directly derive the elasticity values with respect to specified variables. The log-log form also automatically corrects for heteroscedasticity. In order to take advantage of the above properties, in this study, all variables included in the models were specified in logarithmic form. Thus, the estimated long-run coefficients can be used to directly derive the long-run elasticity estimates.

In the following sections the empirical models are presented and the results from the estimation of each of the models are presented and discussed.

6. 1 Export Supply

6. 1. 1 Textiles

The following empirical model of the Australia's export supply of textiles was initially specified, based on Equation 4.4 of Chapter 4.

$$XST_t = \alpha_0 + \alpha_1 RPT_t^x + \alpha_2 CAPT_t + \alpha_3 ERAT_t + \alpha_4 DAC + \varepsilon_t \qquad (6.1)$$

where,

XST_t	=	Australia's real exports of textiles to the rest of the world
RPT^x_t	=	relative price of textile exports (the ratio of Australia's export price of textiles to domestic price of textiles)
$CAPT_t$	=	domestic production capacity of textiles
$ERAT_t$	=	effective rate of assistance to textiles
DAC	=	dummy variable representing the Asian crisis since the mid 1997 (DAC = 0 for 1970-1996; DAC = 1 for 1997 onwards)
ε_{it}	=	the error term assumed to have standard properties.

The hypothesised signs of parameter estimates are as follows[90]: $\alpha_1 > 0$, $\alpha_2 > 0$, $\alpha_3 < 0$, $\alpha_4 < 0$. Export prices were not adjusted for *ERA*, and the impact of the effective rate of assistance on exports of textiles was captured by including the variable *ERA* in the model.

Equation (6.1) assumes that the export supply responds immediately to changes in the explanatory variables. In reality, however, there may be factors that influence the adjustment process so domestic suppliers may not react straight away to changes, for instance, in prices or costs. Therefore, in supply response models it is important to allow for lags in the long-run. In order to allow for an adjustment of actual supply, some studies estimated a dynamic form, thus, including the lagged dependent variable as an explanatory variable. This approach was used for instance in Thursby and Thursby (1984), Goldstein and Khan (1985), Athukorala and Menon (1995), Pesaran and Pesaran (1997), and Senhadji (1998).

[90] For more detailed explanation of hypotheses in relation to all the models and the description of the respective variables see Chapter 4 and Appendix 5.1, respectively.

In this analysis, when a partial adjustment process was considered the following model was initially estimated with different lag structures:

$$\Delta XST = \alpha_0 + \alpha_1 \Delta RPT_t^x + \alpha_2 \Delta CAPT_t + \alpha_3 \Delta ERAT_t + \alpha_4 XST_{t-i} + \alpha_5 RPT_{t-i}^x + \alpha_6 CAP_{t-i} + \alpha_7 ERAT_{t-i} + \alpha_8 DAC + \varepsilon_t \tag{6.2}$$

After estimating and testing alternative specifications, the 'parsimonious' version of the model was selected with the results presented in Table 6.1. The variable *DAC* that was intended to capture the effect of Asian crisis on export supply performance was omitted from the final version of the model because the coefficient performed inconsistently and was found to be statistically insignificant. This outcome is not surprising, given the rather short data coverage for the period after the crisis.

The coefficients associated with the variables in the differenced form indicate short-run relationships, whereas the coefficients with the variables in the level form unveil the long-run relationships. Using the estimated coefficients, the long-run elasticities of export supply for Australia's textiles and clothing, with respect to associated explanatory variables were derived. The value of the elasticity was calculated as the ratio of the coefficient with a variable in its lagged form and the coefficient with the lagged dependent variable. More formally, the long-run price elasticity of export supply can be expressed as, for instance, $[\alpha_5/-(\alpha_4)]$, thus $[0.95/(-(-0.52)] = 1.83$. This value indicates that if the relative price of textiles ruses by 1 percent, the exporters of textiles are expected to increase the supply of textiles by 1.83 percent and *vice versa,* in the long-run.

It should be pointed out that the results from this analysis give support to inferences from the above-cited studies that a dynamic alternative specification outperforms the static model.

Table 6.1: **The Parsimonious Model of Export Supply of Textiles**

Dependent variable = ΔXST				
Regresssor	**Coefficient (α)**	***t* - ratio**	**Long-run Elasticity**	**t - ratio**
CONSTANT	30.52	3.31^{***}	.	.
$\Delta RPT^{x}_{(t-1)}$	1.29	2.41^{**}	.	.
$\Delta CAPT_t$	-0.38	-1.35	.	.
$\Delta ERAT_t$	-0.91	-2.29^{**}	.	.
$XST_{(t-1)}$	-0.52	-3.79^{***}	.	.
$RPT^{x}_{(t-2)}$	0.95	1.79^{*}	1.83	2.03^{***}
$CAPT_{(t-1)}$	-1.64	-2.84^{***}	-3.15	-4.05^{***}
$ERAT_{(t-1)}$	-0.80	-2.81^{***}	-1.54	-4.09^{***}
$R^2 = 0.44$	*Adj.* $R^2 = 0.24$	$F(7, 19) = 2.17$	$DW = 1.85$	
$AIC = -2.37$	$LL = 5.63$	$SBC = -7.56$		
LMS F(1, 18) = 0.10	RESET F(1, 18) = 0.10	JBN, $\chi^2(2) = 3.08$	HSC (1, 25) = 0.59	

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.
LMS - Lagrange multiplier test for serial correlation.
RESET - Ramsey's test for functional from misspecification.
JBN - Jarques-Bera test for the normality of residuals (based on the χ^2 distribution).
HSC -Heteroscedasticity test based on the regression of squared residuals on squared fitted values.
The degrees of freedom are given in parentheses.

As it is evident from Table 6.1, most of the coefficients are statistically significant, at the 1 percent or 5 percent level, however, the adjustment coefficient of the variable RPT^x is significant at the 10 percent level, while the coefficient of $\Delta CAPT$ is not statistically significant. In general, the results of the diagnostic tests are satisfactory, however, the value of the R^2 is low.

The adjustment parameter estimates indicate that 52 percent of the total adjustment of supply is achieved within one year. The response of supply with respect to the relative price is slightly weaker. It can be concluded with 90 percent confidence that 95 percent of supply adjusts to changes in the relative price within two years. These results are in accordance with other studies. For instance, in the analysis of aggregate export supply for eight countries, Arize (1987a) calculated average time lag as the inverse of the coefficient of the lagged dependent variable and found that in five countries the average time lag was around one year (p. 1244). Arize, however, pointed out that export supply response to changes in income and prices is subject to recognition lags, decision lags, delivery lags and production lags. Junz and Rhomberg (1973) argue that these lags may be substantially shorter.

As shown by the estimated coefficient associated with the relative price, RPT^x, in the short-run, there is a significant positive (at the 5 percent level) relationship between the relative price and export supply of textiles. As expected, the long-run price elasticity coefficient of 1.83 points to an even greater responsive export supply of textiles to the changes in relative price in the long-run. Thus, the coefficient indicates that if the relative price of exports rises, Australian textile producers would find it more profitable to supply to the world market than to the domestic market and *vice versa*.

Gunawardana and Karn (1998) estimated both short-run and long-run elasticities of export supply for pharmaceutical products and obtained the short-run price elasticity of 0.24 and the long-run elasticity of 0.82 and 0.95 (from two slightly different specifications). From the estimation of export supply for Australian citrus products, Gunawardana *et al.* (1995) report the short-run price elasticity of supply of 0.72 and the long-run elasticity of 0.73.

Goldstein and Khan (1978) estimated the aggregate export price elasticities of supply for seven European countries, Japan and the United States and report considerable inter-country variation, within the range of -0.1 (Japan) and 3.9 (the United States). In eight African countries, Arize (1987a) estimated the long-run price elasticity of export supply between 0 and 2.3.

The relatively high, but negative long-run elasticity with respect to production capacity is difficult to explain and is contrary to expectation. While it is not statistically different from zero in the short-run it is statistically significant at the one percent level and relatively high in the long-run. Gunawardana *et al.* (1995) report a positive and statistically significant relationship between the change in production capacity and the long-run supply of citrus exports.

Export supply of textiles with respect to the effective rate of assistance is close to unity in the short-run (coefficient of the variable ΔERA is -0.91). In the long-run the export supply is relatively more responsive. The long-run elasticity coefficient indicates that a 1 percent rise in the rate of assistance generates a 1.54 percentage decrease in export supply of textiles, and *vice versa*, within one year.

6. 1. 2 Clothing

The following model for Australia's export supply of clothing is specified initially, based on Equation 4.5 of Chapter 4.

$$XSC_t = \beta_0 + \beta_1 RPC^x{}_t + \beta_2 CAPC_t + \beta_3 ERAC_t + \beta_4 DAC + \varepsilon_t \qquad (6.3)$$

where,

XSC_t	=	Australia's real exports of clothing to the rest of the world
$RPC^x{}_t$	=	relative price of clothing exports (the ratio of Australia's export price of clothing to domestic price of clothing)
$CAPC_t$	=	domestic production capacity of clothing
$ERAC_t$	=	effective rate of assistance to clothing
DAC	=	dummy variable representing the Asian crisis since the mid 1997 (DAC = 0 for 1970-1996; DAC = 1 for 1997 onwards)
ε_t	=	the error term assumed to have standard properties.

The hypothesised signs of parameter estimates are as follows: $\beta_1>0$, $\beta_2>0$, $\beta_3<0$, $\beta_4<0$.

An attempt to adjust the export price index for the effective rate of assistance failed even more with clothing where the effective rates of assistance are higher than in textile industries. Therefore, the exogenous variable, *ERA*, was initially included in the model.

The model was initially estimated in the following form:

$$\begin{aligned}\Delta XSC = {} & \beta_0 + \beta_1 \Delta RPC^x_t + \beta_2 \Delta CAPC_t + \beta_3 \Delta ERAC_t + \beta_4 XSC_{t-i} + \\ & \beta_5 RPC^x_{t-i} + \beta_6 CAPC_{t-i} + \beta_7 ERAC_{t-i} + \beta_8 DAC + \varepsilon_t\end{aligned} \qquad (6.4)$$

Preliminary regression attempts revealed that the effective rate of assistance does not influence significantly the export supply, and therefore, it was eliminated from the model. Similarly, the dummy variable, *DAC*, aimed at capturing the effect of Asian crisis on export supply performance of clothing, was omitted from the final version of the model for the same reason as it was in textiles.

Australia's export supply of clothing was hypothesised to respond to changes in production capacity represented by the variable *CAPC*. The parameter estimate associated with the variable, however, was insignificant and performed inconsistently. Consequently, an alternative variable, time trend (T) was specified to account for changes in production capacity.

After re-specifying the model in accordance with the above changes and the outcomes of the preliminary diagnostic testing, the 'parsimonious' dynamic form of the model was estimated and the results are presented in Table 6.2. All the diagnostic tests (presented in the lower part of Table 6.2) performed satisfactorily. While the model as a whole passed the F-test, a better fit of the model demonstrated by the coefficient of determination, R^2, would have been desirable.

The results indicate that the most important determinants of export supply of clothing are the relative price and the time factor. The adjustment of supply with respect to the relative price is relatively stronger, 43 percent of export supply adjust to changes in the relative price within one year.

In the short-run the export supply of clothing does not appear to be highly responsive to relative price. The coefficient for the difference of relative price variable, $\Delta RPC^x_{(-1)}$ is negative, that is contrary to the expectation, although it is not statistically significant. The reason may be less dynamic channels of information, or due to Australia being an insignificant exporter of clothing.

Table 6.2: **The Parsimonious Model of Export Supply of Clothing**

Dependent variable = ΔXSC				
Regresssor	**Coefficient (β)**	**t – ratio**	**Long-run Elasticity**	**t – ratio**
CONSTANT	0.11	0.11	.	.
$\Delta RPC^{x}_{(t-1)}$	-0.32	-1.42	.	.
$XSC_{(t-2)}$	-0.21	-3.15^{***}	.	.
$RPC^{x}_{(t-1)}$	0.41	2.22^{**}	2.05	2.07^{**}
T	0.02	2.95^{***}	.	
$R^2 = 0.49$	$Adj.\ R^2 = 0.39$	$F(4, 21) = 5.03$	$DW = 2.35$	
$AIC = 6.01$	$LL = 11.01$	$SBC = 2.87$		
LMS F(1, 20) = 0.71	RESET F(1, 20) = 0.09	JBN, $\chi^2(2) = 0.11$	HSC (1, 24) = 0.18	

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.
LMS - Lagrange multiplier test for serial correlation.
RESET - Ramsey's test for functional from misspecification.
JBN - Jarques-Bera test for the normality of residuals (based on the χ^2 distribution).
HSC - Heteroscedasticity test based on the regression of squared residuals on squared fitted values.
The degrees of freedom are given in parentheses.

In the long-run, however, the relative price emerges as a significant explanator of export supply. The long-run price elasticity of export supply is 2.05, suggesting that in the long-run, a change in the relative price generates about twice the response in export supply of clothing. Thus, suppliers are able to shift products from the domestic market to export market, or *vice versa*, in response to small changes in relative price.

Although positive and statistically significant, however, very low value of the parameter estimate for the variable T implies that an increase in the factors such as production capacity or technological change are likely to result in only a slight improvement in export supply of clothing, on average by about 2 percent annually.

6. 2 Import Demand

This section concentrates on the estimation of import demand for Australia's textiles and clothing. In Section 6.2.1 the import demand for textiles and in Section 6.2.2 the import demand for clothing will be discussed.

6. 2. 1 Textiles

The following import demand equation for Australia's textiles was specified initially, based on Equation 4.10 of Chapter 4.

$$MDT_t = \delta_0 + \delta_1 RPT_t^m + \delta_2 GDP_t + \delta_3 ERAT_t + \delta_4 SST_t + \delta_5 DAC + \varepsilon_t \qquad (6.5)$$

where,

MDT_t	=	Australia's real imports of textiles
RPT_t^m	=	the relative price of imports of textiles (the ratio of import price of textiles to domestic price of textiles)
GDP_t	=	Australia's real national income (real GDP)
$ERAT_t$	=	the effective rate of assistance to textiles
SST_t	=	the stocks to sales ratio of textiles
DAC	=	the dummy variable capturing the effect of the Asian crisis since the mid 1997 (DAC = 0 for 1970-1996; DAC = 1 for 1997 onwards).

The hypothesised signs of parameter estimates are as follows: $\delta_1<0$, $\delta_2>0$, $\delta_3<0$, $\delta_4<0$, $\delta_5>0$.

The following empirical form was initially estimated:

$$\Delta MDT = \delta_0 + \delta_1 \Delta RPT_t^m + \delta_2 \Delta GDP_t + \delta_3 \Delta ERAT_t + \delta_4 \Delta SST_t + \delta_5 MDT_{t-i} + \delta_6 RPT_{t-i}^m + \delta_7 GDP_{t-i} + \delta_8 ERAT_t + \delta_9 SST_{t-1} + \delta_{10} DAC + \varepsilon_t \quad (6.6)$$

Taking into account the outcome of diagnostic tests and of the *t*-tests from the regression, eventually, a 'parsimonious' model was derived. The results of the estimation are reported in Table 6.3.

Table 6.3: **The Parsimonious Model of Import Demand for Textiles**

Dependent variable = ΔMDT				
Regresssor	**Coefficient (δ)**	**t – ratio**	**Long-run Elasticity**	**t – ratio**
CONSTANT	12.29	4.53***	.	.
ΔRPT^m	-0.25	-1.64	.	.
$\Delta GDP_{(t-1)}$	-0.14	-0.08	.	.
$MDT_{(t-1)}$	-0.93	-4.37***	.	.
$RPT^m_{(t-3)}$	-0.21	-1.73*	-0.22	-1.69*
$GDP_{(t-1)}$	0.77	3.32***	0.83	5.90***
$R^2 = 0.58$	$Adj.\ R^2 = 0.48$	$F(5, 21) = 5.74$	$DW = 1.68$	
$AIC = 13.87$	LL = 19.87	$SBC = 9.98$		
LMS F(1, 20) = 1.76	RESET F(1, 20) = 0.27	JBN, $\chi^2(2) = 0.1C$	HSC (1, 23) = 3.56	

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.
LMS - Lagrange multiplier test for serial correlation.
RESET - Ramsey's test for functional from misspecification.
JBN - Jarques-Bera test for the normality of residuals (based on the χ^2 distribution).
HSC - Heteroscedasticity test based on the regression of squared residuals on squared fitted values.
The degrees of freedom are given in parentheses.

The outcomes of the regression indicate that, in the short-run, the import demand for textiles does not respond significantly to either the relative price or income. In the long-run, however, the import demand for textiles appears to be influenced by changes in both the relative price and income. The long-run coefficients with the relative price and income are significantly different from zero and they have expected signs. The calculated values of the elasticity coefficients, however, are less than one, indicating that the demand for imports of textiles is less than proportionally responsive to changes in those variables.

The coefficient of the price elasticity of import demand (-0.22) suggests that a one percent increase in import price relative to domestic price of textiles will result in only 0.22 percent reduction in imports of textiles and *vice versa*. The demand seems to adjust to changes in the relative price within three years.

While the long-run income elasticity is higher than the long-run price elasticity, the import demand is nevertheless inelastic with respect to changes in income. The demand for import of textiles changes by 0.83 percent as a result of a one percent change in income within one year. In the long-run, textiles can be classified as normal goods, more specifically as a 'necessity' since the elasticity of income is positive and less than one.

Leamer and Stern (1970) pointed out that during the periods of excess demand, import demand may increase irrespective of prices and income. In the short-run, the suppliers may find it difficult to satisfy the excess demand at prevailing prices.

O'Regan and Wilkinson (1997) examined the effect of internationalisation of the Australian economy and its impact on the pricing behaviour using disaggregated industry-level data. For 27 of the 30 industries, the long-run price elasticity of import demand estimates were significantly greater than zero, and for 21 of these industries, the elasticities were significantly less than one. For the 27 industries, the estimated elasticities ranged between 0.33 and 1.15, with an average of 0.67. O'Regan and Wilkinson derived the long-run price elasticity of import demand for textiles that is higher (0.86) than the estimated price elasticity in this study (0.22). Their estimate for textiles is, however, not comparable directly with the estimate in this study because they used a different classification of textiles. They included both, the category 26-Textiles fibres and wastes and 65 – Textile yarn, fabrics, while in this study the textiles include category 65 only. O'Regan and Wilkinson suggest that the low values of the price elasticity of import demand were influenced by declining relative prices in most manufacturing industries over the 25 years between 1969 and 1994.

Other estimates of the price elasticity and income elasticity of import demand, based on annual data for the period 1960 and 1990 include Andersen (1993) for goods and services (-0.38, 1.25)[91], Katayama, *et al.* (1987) for total Australia's imports (-2.24, 1.83), and Wilkinson (1992) for total imports (-0.63, 1.85). The studies by Bewley and Orden (1994) and Bahmani-Oskooee and Niroomand (1998) derived an equal estimate of the price elasticity (-0.57). Their estimates of income elasticity are, however, 1.61 and 1.10, respectively. The latter studies are based on quarterly data covering various periods between 1960 and 1992.

Athukorala and Menon (1995) estimated Australia's import demand for nine product categories as well as for total manufactures based on quarterly data for the period between 1981 and 1991. For individual categories the long-run price elasticity ranged from 0.32 to 2.1. The estimated value of the long-run activity elasticity coefficient of

[91] Unless stated otherwise, the first value in the bracket indicates the price elasticity and the second value indicates the income elasticity of import demand.

0.34 indicates that, over the covered period, textiles were less responsive to changes in activity variable measuring the effect of domestic economic activity[92]. Athukorala and Menon derived the long-run price elasticity estimates for textiles of 0.64.

Warner and Kreinin (1983) specified the price variable in a 'split-form', that is, they estimated separately, the elasticity of import price (-0.55) and the elasticity of domestic price (0.95). They derived an income elasticity of 0.15, notably lower than in most of the cited studies.

Comparing the above-presented estimates of various elasticities, it is evident that the extensive dispersion exists in the elasticity values. It may be argued that the differences in the obtained values from the previous studies may, to a degree, reflect the difference in the periods of analysis, sample sizes and methods of estimation.

6. 2. 2 Clothing

The following model was specified initially for Australia's import demand for clothing, based on Equation 4.11 of Chapter 4.

$$MDC_t = \phi_0 + \phi_1 RPC_t^m + \phi_2 Y_{tt} + \phi_3 ERAC_t + \phi_4 SSC_t + \phi_5 DAC + \varepsilon_t \qquad (6.7)$$

where,

MDC_t = Australia's real imports of clothing

$RPC^m{}_t$ = the relative price of imports of clothing (the ratio of import price of clothing to domestic price of textiles)

Y_t = Private final consumption expenditure for clothing [93]

[92] The variable was represented by Private consumption of clothing, footwear and drapery (Athukorala and Menon, 1995, p. 11).

$ERAC_t$ = the effective rate of assistance to clothing

SSC_t = the stocks to sales ratio of clothing

DAC = the dummy variable capturing the effect of the Asian crisis. since the mid 1997 (DAC = 0 for 1970-1996; DAC = 1 for 1997 onwards).

The hypothesised signs of parameter estimates can be symbolised as follows: $\phi_1 < 0$, $\phi_2 > 0$, $\phi_3 < 0$, $\phi_4 < 0$, $\phi_5 > 0$.

The import demand model for clothing was empirically estimated as:

$$\Delta MDC_t = \phi_0 + \phi_1 \Delta RPC_t^m + \phi_2 \Delta Y_t + \phi_3 \Delta ERAC_t + \phi_4 \Delta SSC_t + + \phi_4 MDC_{t-i} + \\ + \phi_5 RPC_{t-i}^m + \phi_6 Y_{t-i} + \phi_7 ERAC_{t-i} + \phi_8 DAC_t + \varepsilon_t \quad (6.8)$$

The results from a 'parsimonious' version of the model in Equation 6.8 are shown in Table 6.4.

The findings show that, with the exception of the relative price, the short-run relationships in demand for imports of clothing are not significant. The long-run relationships as well as the dynamic factor, represented by the lagged dependent variable are, however, statistically significant. Signs of the coefficients are in accordance with theoretical expectations.

The derived values of the long-run elasticities are indicative of an inelastic import demand for clothing with respect to price and effective rate of assistance. Respective absolute values of the elasticity are 0.56 and 0.40.

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[93] including footwear and drapery.

Table 6.4: **Parsimonious Model, of Import Demand for Clothing**

Dependent variable = ΔMDC_t				
Regresssor	**Coefficient (ϕ)**	***t* – ratio**	**Long-run Elasticity**	***t* – ratio**
CONSTANT	2.44	1.71^{*}	.	.
ΔRPC^{m}	-0.43	-2.36^{**}	.	.
ΔY	0.49	0.40	.	.
$\Delta ERAC$	-0.19	-1.23	.	.
$MDC_{(t-1)}$	-0.57	-4.09^{***}	.	.
$RPC^{m}_{(t-2)}$	-0.32	-1.78^{*}	-0.56	-1.94^{*}
$Y_{(t-2)}$	1.67	3.06^{***}	2.93	6.24^{***}
$ERAC_{(t-2)}$	-0.23	-2.83^{***}	-0.40	-3.33^{***}
Adj. R^2 = 0.59 *AIC* = 9.46	*Adj.* R^2 = 0.45 *LL* = *17.46*	*F(7, 20) = 4.17* *SBC* = 4.13		*DW* = 2.34
LMS F(1, 19) = 1.67	RESET F(1, 19) = 0.72	JBN, $\chi^2(2)$ = 38.05		HSC (1, 26) = 2.66

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.
LMS - Lagrange multiplier test for serial correlation.
RESET - Ramsey's test for functional from misspecification.
JBN - Jarques-Bera test for the normality of residuals (based on the χ^2 distribution).
HSC - Heteroscedasticity test based on the regression of squared residuals on squared fitted values.
The degrees of freedom are given in parentheses.

In contrast to the price and the effective rate of assistance, import demand for clothing appear to be highly responsive to changes in consumer income. One percent change in income is likely to result in almost 3 percent change in import demand for clothing. With a positive and greater than one (2.93) coefficient of the long-run income elasticity, imported clothing can be classified as a luxury good. The results indicate that the adjustment period to all three variables (price, income and the effective rate of assistance) is around two years[94].

[94] In an extensive survey Sawyer and Sprinkle (1999) identified that with regard to the import demand function the lags on the relative price variables may take ten to twelve quarters to influence imports. For both functions, the lag on the income term appears to be less than two quarters.

Houthakker and Magee (1969) estimated the price and income elasticities of import demand for the United States by country of origin and by commodity class (for 5 major commodity classes). The results indicate generally higher income and price elasticity estimates for the United States imports[95]. The price and income elasticities of import demand from Australia were –4.69 and 2.23 respectively. In comparison with the results in this study while the price elasticity coefficient is distinctly higher, the income elasticity are rather close.

The results in this study support the findings by Wilkinson (1992) who concludes that imports are more responsive to changes in economic activities than to the variation in relative prices[96]. The long-run elasticity estimates (however, for Australia's aggregate imports) derived by Wilkinson are 1.9 with respect to economic activity and 0.5 with respect to relative price. In another study O'Regan and Wilkinson (1997) derived the long-run price elasticity of import demand for clothing of 0.81, that is, relatively higher than the estimate in this study (0.56).

Athukorala and Menon (1995) found that the long-run price elasticity estimates for the combined clothing and footwear category was not statistically different from zero. With regard to activity variable, Athukorala and Menon derived a unit long-run elasticity (1) for clothing.

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[95] Feenstra (1994) suggests that high income elasticities indicated by studies on the US imports may be due to omitting new product varieties from the import price index. While correcting for this omission reduces the value of the coefficients, they still remain greater than one.
[96] Similar results were obtained by Goldstein (1985) and Athukorala and Menon (1995).

Menon (1995) examined the relationship between manufactured imports to Australia and relative prices and domestic economic activity over the period 1981 and 1992, based on quarterly data. The price elasticity estimates for individual categories ranged from 0.24 to 1.75, with almost two thirds of price elasticities of less than 1 and the remainder between 1 and 2. The relative price elasticity for total manufactured imports was estimated at 0.66. With respect to the activity elasticities, Menon found that most of the estimates were between 1 and 2. These results are in line with the findings by some other studies in Australia (Gordon, 1986)[97] and overseas (Goldstein and Khan, 1985). The activity elasticity for total imports was 1.87. The import demand for the category of textiles was found inelastic with respect to both price and activity variable. The respective elasticity estimates were -0.24 and 0.33. The import demand for apparel and clothing accessories was found unitary elastic with respect to price, however, inelastic with respect to the activity variable (0.64). Thus, the estimated price elasticity for textiles is in accordance with the findings in this study, while the estimates for clothing differ rather significantly.

Silvapulle and Phillips (1985) estimated Australian import demand for goods from ASEAN over the period 1968 to 1981. Contrary to expectation, the price elasticity is positive and the coefficient of time, *T*, negative for textile, yarn and thread (while negative for other groups). Silvapulle and Phillips suggest that this may be due to simultaneous-equation bias and multicollinearity.

Similar conclusions can be drawn from a comparison with the study by Wilkinson (1992). Wilkinson obtained the price elasticity estimate of 0.71 and activity elasticity

[97] In the survey of 16 studies by Gordon, the medium-run price elasticity of import demand ranged between 0.35 and 1.8, with an average of 1.3 and standard deviation of 1.2.

estimate of 1.96. O'Regan and Wilkinson (1997) derived the estimate of the long-run import price elasticity for clothing of 0.81.

It must be emphasised that while the above quoted studies may to some degree assist as an indicator, our elasticity estimates and those reported in previous Australian and other studies are not strictly comparable. Different studies obtained diverse elasticity estimates generated by differences with regard to critical aspects such as model specification, time period coverage, data sources, the level of disaggregation and the method of estimation.

6. 3 Summary and Conclusions

The purpose of this chapter was to identify factors that influence the export supply of and import demand for Australia's textiles and clothing products. To the researcher's knowledge, this is the first study to analyse the export supply of Australia's textiles and clothing. Deriving the short-run and the long-run elasticities of export supply with respect to the associated explanatory variables is, therefore, a significant contribution of this thesis.

The models estimated and the hypotheses tested in this chapter were developed in Chapter 4 on the basis of economic theory and recent empirical studies. The statistical properties of the annual data employed in the analysis were examined in Chapter 5. It was recognised that the time series follow non-stationary processes with the absence of cointegration. Based on this information the 'general to specific' unrestricted error correction modelling procedure was applied to estimate the long-run elasticities with respect to the specified variables. Prior to deriving a 'parsimonious' version of individual models, the outcomes of the preliminary regressions and associated diagnostic tests were taken into account and the empirical models were re-specified accordingly.

The results suggest that, in the short-run, the influential factors on the export supply of textiles are the relative price and the effective rate of assistance. In the long-run, in addition to those, the export supply of textiles appears to be influenced by the production capacity. In the long-run, the effect of all three variables is relatively strong. The long-run elasticity estimates with reference to the relative price, production capacity, and the effective rate of assistance are greater than one. The most influential factor appears to be the production capacity, followed by the price and the effective rate of assistance.

With regard to the export supply of clothing, a dominant effect seems to come from the relative price. The long run price elasticity estimate of 2.05, that is greater than the estimate for textiles (1.83), implies that exporters of clothing are highly responsive to changes in the relative price in the long-run. While the coefficient of the time trend variable, representing changes in production capacity in clothing, is positive and significant, the value of the coefficient itself is very low (0.02), which means that the magnitude of the effect is very small.

In the long-run, Australia's import demand for textiles is inelastic with respect to the relative price of imports and Australia's income. The long-run elasticity values are 0.22 and 0.83, respectively. In contrast to the import demand for textiles, the import demand for clothing was found highly responsive to changes in income. A change in income is likely to bring a three-fold impact on import demand for clothing. However, the import demand for clothing is inelastic with respect to the relative price and the effective rate of assistance, both elasticity coefficients being less than one.

It was also detected that the Asian economic crisis from the mid-1997 has not affected significantly, either the supply of exports or the demand for imports of textiles and clothing. This may be due to a very limited coverage of annual time series since the crisis.

Chapters 4 to 6 of this thesis examined the key factors that are deemed to influence the export supply of and import demand for textiles and clothing in Australia. The findings are expected to be beneficial to suppliers of exports as well as importers of textiles and clothing. They may also serve as an important indicator to retailers of how the demand at retail for imported textiles and clothing may change if various factors influencing the export supply and import demand alter.

It is, however, important to bear in mind that the trade in textiles and clothing also takes place in a competitive environment that is based on product differentiation and economies of scale. This kind of trade generates another trade pattern that suggests that countries can benefit by exchanging differentiated products of the same industry. These issues will be addressed in Chapters 7 and 8 of this thesis.

Chapter 7

THEORY, MEASUREMENT, AND DETERMINANTS OF INTRA-INDUSTRY TRADE: A REVIEW

7. 1 Introduction

Since mid 1960s an increasing share of world trade has been in products belonging to the same industry. In those circumstances, each country would export as well as import the products from the same commodity group, or industry, so it would be involved in *intra-industry* trade (IIT) based on intra-industry specialisation[98]. Most of the empirical work on IIT so far has been primarily of a cross-section character and further work is needed, in particular, based on time-series data.

A number of researchers analysed the patterns of IIT in Australia's manufacturing (Grubel and Lloyd, 1975; Siriwardana, 1990; Ratnayake and Jayasuriya, 1991; Ratnayake and Athukorala, 1992; Menon, 1994; Menon and Dixon, 1996b). However, only the studies by Ratnayake and Jayasuriya (1991), Ratnayake and Athukorala (1992), and most recently, Sharma (2000) provide an econometric analysis of the subject. Although Menon (1994) covers the period of the early 1990s, his analysis focuses on the trends in IIT rather than the econometric aspect of the determinants of IIT within the framework of trade liberalisation.

The fact that Australia has a low incidence of IIT among the OECD countries[99], a limited number of studies concentrating on IIT within the Australian context, and that

[98] This trend appears to reflect the increasing globalisation of the world economy, with growing specialisation in particular products or components and greater cooperation (Sheehan, *et al.* 1994).
[99] See for instance Ratnayake and Athukorala (1992).

Australia has experienced a substantial reduction in protection since the 1980s provide a valid rationale for this study. This study is an important contribution to the field in two aspects. Firstly, the analysis covers the period after the trade liberalisation and secondly, it aims at establishing the patterns and determinants of IIT based on the data covering an extensive period of 1965 to 1998, thus, covering both pre- and post-liberalisation periods. The analysis of IIT is the subject of Chapters 7 and 8. In Chapter 7 the theory of IIT, the methods of measurement of the extent, and the determinants of IIT are presented. Chapter 8 provides an analysis of the extent of Australia's IIT in TAC with the rest of the world and bilateral IIT in TAC with major trading partners, as well as an econometric analysis of the determinants of IIT in TAC.

The rest of the Chapter is organised as follows. Section 7.2 provides the theoretical background of IIT, highlighting the distinction between inter- and intra-industry trade. In Section 7.3, a review of studies concerned with the measurement of the extent of IIT and some of the related problems are presented. Empirical studies dealing with the measurement of IIT are reviewed in Section 7.4. In Section 7.5 the determinants of IIT and empirical studies on those aspects are reviewed. The final section (7.6) presents a summary of the major issues discussed.

7. 2 Theoretical Concepts and Background of IIT

The traditional theory of trade suggests that trade volume is directly related to differences in countries' resource endowments and that each firm produces homogenous products, at constant returns to scale. Thus, for every commodity each country is either an exporter or an importer, depending on whether it has a comparative advantage or disadvantage in production of a particular product. Grubel and Lloyd (1975) pointed out that while these assumptions are reasonable in explaining inter-industry trade, they do not explain the simultaneous export and import of goods from the same industry. Thus, it is clear that the theoretical aspect of IIT cannot be explained within the neo-classical, factor proportions, framework. A number of explanations have been proposed by trade theorists to justify the phenomenon of IIT. All, however, require relaxing of some underlying assumptions associated with the neo-classical trade theory.

As already pointed out, one of the restrictions of the traditional trade theory is the assumption of homogenous products. However, much of real-world trade, in particular between industrialised economies, involves differentiated products, that is the exchange of different varieties of the same product (Caves, 1981). Grimwade (2000) pointed out that while there are some cases where IIT takes place in homogenous products, most IIT occurs in heterogenous products, thus, the products that are close, but not perfect, substitutes for each other. Grimwade (2000) summarised a number of reasons when IIT in *identical* products may take place. Those includes aggregation bias, differentiation in time that involves 'seasonal goods'; joint production and joint consumption, that involves excess supply of some and excess demand of other products; cross-shipping by multinational companies, involving relocating the final assembly stages of production to another country in order to take advantage of lower labour costs.

Grimwade (2000) explains that product differentiation can take the form of *horizontal* differentiation, based on the amounts and various combinations of the same characteristics embodied in the product, or *vertical* differentiation, based on different qualities of the same product[100]. Nielsen and Lüthje (2002) state that two products are horizontally differentiated when both have a positive demand when offered at the same price (p. 587).

One of the earlier studies by Haberler (1936) tried to explain intra-industry trade by *'product heterogeneity within aggregates and border trade'* (p. 34). A number of empirical studies, including Hesse (1974),Vernon (1966), Balassa (1966) Grubel (1970), and Caves (1981), however, consider Haberler's claim as insufficient[101].

A theoretical model aimed at explaining IIT that is based on *horizontal* differentiation, and is linked to demand-side factors, was developed by Lancaster (1980). The origin of the model is in his earlier studies (Lancaster, 1966; 1979). Lancaster argues that traditional trade theory based on perfect competition is not feasible under conditions of diverse preferences and unlimited product qualifications. Lancaster views products as bundles of characteristics. Consumers are assumed to have preferences based on characteristics of products rather than on products themselves. He maintains that differences in consumers' tastes and preferences create demand for variety. Each variety is assumed to be the same quality of a differentiated product. All products within a 'group' are assumed to possess the same essential characteristics. So product

[100] Greenaway (1984) distinguishes also *technological differentiation* which takes place when some of the essential characteristics of the product are modified and result in new, technically improved products which are considered superior to existing products by all consumers, in all quality grades (p. 232), Krugman (1979) uses the terms *new* and *old* products that may be interpreted as vertical or technological product differentiation.

[101] For instance, Grubel and Lloyd (1975) detected a significant IIT even at the seven-digit level of aggregation. To this aspect Ethier (1982) adds that IIT seems to occur even with adequate disaggregation to eliminate relative cost differences between sectors as a likely determinant of IIT (p. 390),

differentiation can be identified by the mix of those characteristics in a given quality grade.

Lancaster (1980) applied the characteristics approach of demand theory to international trade. He established that when preferences differ and manufactured products can be continuously differentiated, market structure not only generates a large amount of intra-industry trade but also allows such trade to take place even between countries that are the same in all aspects, i.e. technology, resource endowments, population, consumer preferences and income. Each country exchanges different varieties of the same product. However, Lancaster argues that internal economies of scale[102] limit the consumption of the 'most preferred' combination of characteristics. In this context, Lancaster demonstrates how the link between product differentiation and increasing returns to scale, that give rise to intra-industry trade, can contribute to increasing consumer welfare.

Helpman (1981) extended the model further and illustrated how and why both inter- and intra-industry bilateral trade can take place between the same type of countries. He also showed that, as the differences in factor endowments increase between the two countries, the share of intra-industry trade in total trade will decline and the share of inter-industry trade will rise.

[102] *Internal* economies of scale occur when the cost per unit depends on the size of an industry's firm but not necessarily on that of the industry. In contrast, *external* economies of scale occur when the cost per unit depends on the size of the industry but not necessarily on the size of a firm (Krugman and Obstfeld, 1994, p. 115-116). While both influence international trade, their implications differ. If *external* economies of scale are active, the industry is likely to have a large number of small firms. However, with internal economies of scale, the industry is likely to consist of a small number of large firms that benefit from a cost advantage and produce differentiated products.

An alternative model based on *horizontally* differentiated products was put forward by Dixit and Stiglitz (1977). Instead of consumers' preferences for one variety over another variety, the model emphasises consumers' preferences for the consumption of the variety *per se*. In their analytical study, Dixit and Stiglitz (1977) challenge the view with regard to excess capacity and diversity in monopolistically competitive markets. They argue that while the problem of quantity versus diversity has often been elevated, ignoring the interaction between various intra- and inter-sector interactions usually leads to belief of excessive product diversity. Using the concept of utility elasticity, Dixit and Stiglitz demonstrate that in equilibrium it may be more reasonable to expect a smaller number of larger firms. They focussed on commodities in a group or sectors that are good substitutes among themselves, however, poor substitutes for the other commodities. They illustrate that the resource allocation between sectors is associated with the inter-sector elasticity of substitution. However, it is the magnitude of utility elasticity rather than demand elasticity that is relevant to determine the equilibrium conditions. Dixit and Stiglitz show that when variety is desirable, it may not be optimal to exhaust fully economies of scale.

Krugman (1979; 1980; 1981) expands on the model of monopolistic competition developed by Dixit and Stiglitz (1977). Building on some empirical studies, including (Grubel, 1967; Balassa, 1967; 1970; Kravis, 1971) and using Chamberlinian monopolisitic competition theory, Krugman (1980) develops a simple theoretical model that explains some empirical tendencies in IIT and is based on horizontal differentiation approach. In this model all varieties of the product are assumed to use only one kind of labour, which is mobile between varieties, however, immobile between products. Thus, the model is *a mixture* of the Ricardian and the exchange model and the differences between factor endowments of types of labour and in countries' size influence the patterns of trade. Krugman demonstrates that international trade, in addition to improving allocation of resources, creates greater product variety. Krugman (1981) suggests that because of economies of scale, each country is likely to concentrate on the production of only a limited number of products in each industry. The industry structure of each country would, however, depend on its factor endowment. Accordingly, each country is likely to be involved in both inter-industry and intra-industry trade. By trading, countries can benefit even if they do not differ in their resource endowments or technology. Other theoretical studies that developed models of trade that adopt horizontal differentiation approach include Dixit and Norman (1980) and Venables (1984).

Falvey (1981) developed a model that illustrates that if two countries have different factor endowments, the country that has the higher ratio of capital to labour endowments, and the higher income, is predisposed to produce the higher quality, capital-intensive variety of a product. On the other hand, the country with relatively higher labour-intensive endowments and lower income is likely to specialise in low-quality products. Thus, the model pays no attention to the demand-side factors.

Falvey and Kierzkowski (1987) added the demand side to this supply-side model. They assumed that all consumers have the same underlying preferences, but consume different qualities because their incomes differ. They determined that the two constituents might create conflicting effects. They demonstrate that if per capita income is higher in the capital-abundant country, the price of high quality varieties may be higher than in the labour-abundant country, leading to a potentially lower trade. However, if the trade takes place it will be the intra-industry trade. Flam and Helpman (1987) and Stockey (1991) refined these models to include the importance of technical progress and human capital.

The model of IIT in vertically differentiated products proposed by Linder (1961) emphasises a significant role of demand-side factors. The assumption is that a country may engage in trade of slightly differentiated products in order to satisfy domestic market segmented by income levels, and therefore, demanding various quality of the same products. Linder stresses that in countries with high per capita income, demand is oriented towards high-quality varieties of the same products, whereas in countries with low per capita income, consumers' preferences are biased towards low-quality varieties of the same product.

Caves (1981) arrives at the conclusion that product differentiation does not necessarily result in greater IIT. He distinguishes between product differentiation associated with the structure of production, 'complexity', which is hypothesised to favour trade and product differentiation based on advertising, 'information', which is postulated to discourage international trade. Caves suggests that, if product differentiation requires substantial advertising expenditures to inform customers about product characteristics, language and cultural barriers to advertising in a foreign country may make product differentiation an impediment to IIT. Ballance *et al.* (1992) claim that IIT is activated when the quality range of products that a country produces does not match the range that is demanded by consumers. They associate this argument with both the level of consumer income and some overlap in income between trading countries.

The phenomenon of IIT suggests that economies of scale play a significant role in trade[103]. It is argued that a larger industry can take more benefit from within-industry specialisation (Knight, 1924; Haberler, 1936; Viner, 1937; Helpman and Krugman, 1985). Kemp and Negishi (1970) developed the theoretical framework of gains from trade based on the national economies of scale. Kemp and Negishi (1970), Eaton and Panagariya (1979), and show that gains from trade can be achieved if the output of the products produced with increasing returns to scale is greater under trade than prior the trade. Helpman (1985) made the point that gains from trade are likely to be higher if international, rather than national economies of scale are present. In the presence of transportation costs, the larger the home market, the greater the possibility of taking advantage of economies of scale Krugman (1980).

Ethier (1982) developed a model that links the relationship between international and national returns to scale and resource endowment theory of international trade[104]. Ethier argues that external economies of scale should be related to the international market, since a firm enjoys a reduction in costs if world output increases as a result of intra-industry trade. As world output of a product increases, there is a scope for greater specialisation that can give rise to economies of scale even if national output remains the same.

Bergstrand (1990) expanded earlier theoretical studies by proposing a theoretical framework, using resembling a gravity type model, that explains the relationship

[103] Economies of scale give rise to a proportionately greater increase in output with increasing level of all inputs.
[104] A more explicit discussion of international economies of scale can be found in Ethier (1982).

between the share of IIT in total trade and factor endowments as well as income. Empirical testing of the model revealed that important determinants of the share of IIT in total bilateral trade are differences in total and per capita income, average capital-labour endowment ratios as well as their differences.

An important new development in the theoretical literature on IIT was the parallel focus on product differentiation and economies of scale and the presence of trade costs (Krugman and Venables, 1990; Krugman, 1991). According to these studies, countries with a large domestic market will be net exporters of scale-intensive products, and as a result may benefit from higher factor returns. Krugman and Venables (1990) propose a potential non-linear relationship between IIT and trade costs. More specifically, they demonstrated that a reduction in trade costs might increase concentration of production and consequently, reduce a share of IIT.

Another significant theoretical contribution was the development of the models in a dynamic setup. For instance Grossman and Helpman (1990; 1991) show that if a country has a comparative advantage in product innovation, it is likely to be a net exporter in industries with evident IIT. As the new developments in the theory of trade occurred, some studies, including Davis (1995) promote the role of comparative advantage in explaining IIT[105].

Because IIT is two-way trade with both exports and imports of different varieties within a differentiated product category, it is apparent that IIT is closely related to product differentiation. However, economists distinguish various types of product

[105] For a more detailed review of the literature on theory, measurement and related issues see Greenaway and Tortensson (1997).

differentiation. Furthermore, they claim that the determinants (and adjustment costs) of different kinds of product differentiation to some extent differ. Therefore, as Greenaway and Torstensson (1997) emphasised, failing to differentiate between them may result in non-robust empirical inferences.

While theoretical separation of horizontal and vertical product differentiation has been defined, the literature addressing the methods to isolate trade into horizontally and vertically differentiated products in empirical work has not been so easy. Abd-el-Rahman (1991) proposed how to separate IIT into horizontal and vertical components. A number of studies followed (Greenaway *et al.* 1994; Greenaway *et al.* 1995; Fontagné and Freudenberg, 1997; Greenaway, *et al.* 1999; Nielsen and Lüthje, 2002)[106]. In the studies by Fontagné and Freudenberg and Greenaway *et al.* the separation was based on calculated unit values, more specifically, on the restriction of a dispersion factor for the unit value ratio between exports and imports to a specific value[107]. The unit value is an approximation of the price, and on the other hand, price assumed to be an indicator of quality. Thus price differences are assumed to reflect the quality differences. Based on these assumptions, it is further postulated that if differences in the unit values between exported and imported products are sufficiently large it is assumed that the products are vertically differentiated.

Fontagné and Freudenberg (1997) showed that intra European Union IIT increased from 1980 to 1994 as a result of vertical IIT at the expense of inter-industry trade, while horizontal IIT remained almost constant. Greenaway *et al.* (1994, 1995, 1999)

[106] In the work by Fontagné and Freudenberg (1997) trade was divided into three types, IIT, horizontally differentiated IIT and vertically differentiated IIT.

[107] Abd-el-Rahman (1991), Fontagné and Freudenberg (1997), and Greenaway *et al.* (1994, 1995, 1999) used a dispersion limit of 15 or 25 percent.

concluded that for the UK vertical IIT appears to be the more important type of IIT. They also established, based on the cross-sectional analysis that determinants of horizontal and vertical IIT do differ.

Nielsen and Lüthje (2002) examined whether methods used in the empirical IIT studies to separate trade into vertical and horizontal are constructive. In order to avoid aggregation problems across countries, they compared the bilateral trade pattern between France and Germany only. Nielsen and Lüthje addressed a number of questions, including the stability of the classification of trade as well as the stability of export and import unit values for various products over time. Based on their analysis, Nielsen and Lüthje conclude that although there is an apparent stability of the aggregate distribution over time of the three types of trade (inter-, horizontal-intra- and vertical-intra-industry trade), there are considerable changes with respect to which products belong to the different categories.

Consequently, Nielsen and Lüthje (2002) challenge the method of separation applied in the above-mentioned studies as using uncertain indicators for quality and prices. They argue that using indices for revealed comparative advantages combined with the degree of intra-industry trade as measured by the Grubel-Lloyd index might be a more fruitful method empirically to make the separation (Nielsen and Teit, 2002, p. 602). Following this, the present study will not attempt to analyse separately horizontal and vertical IIT but concentrate on total IIT in TAC.

7.3 Measurement of Intra-Industry Trade

A significant increase in intra-industry trade over the past few decades raised the importance of reliable measurement of intra-industry trade. Greenaway and Milner (1983) maintain that accurate measurement of intra-industry trade may give some insight into the determinants of international trade other than relative factor proportions. A number of measures of intra-industry trade have been developed and applied.

In order to estimate the extent of intra-industry specialisation in the European Community, Balassa (1967) applied the formula that calculates the average of the ratios of trade balance to total trade for a considered number of product groups. The formula can be written as:

$$B_j = \frac{1}{n}\sum \frac{|X_i - M_i|}{(X_i + M_i)} \times 100 \qquad (7.1)$$

where, B_j is the Balassa's intra-industry trade index, j is the j^{th} country, i is the i^{th} product group in the total of n industry groups, and X and M are the exports and imports. The index has a propensity towards zero when all trade is intra-industry trade and towards *100* when all trade is inter-industry trade. Thus, Balassa interpreted a drop in the index as a tendency towards intra-industry specialisation.

Grubel and Lloyd (1971, 1975) challenged Balassa's index for failing to take into account the individual industries' share in total trade as well as to correct for aggregate trade imbalances. Grubel and Lloyd modified the Balassa index by taking into account these suggestions and introduced the index which measures the extent of IIT:

$$GL_i = \left[\frac{(X_i + M_i) - |X_i - M_i|}{X_i + M_i}\right] \times 100 \qquad (7.2)$$

or in the more concise form:

$$GL_i = \left[1 - \frac{|X_i - M_i|}{(X_i + M_i)}\right] \times 100 \qquad (7.3)$$

where, GL_i is the Grubel-Lloyd index, i is the i^{th} industry at a given level of aggregation (usually at the three-digit level of the *SITC* - Standard International Trade Classification) and X and M are the exports and imports, respectively. The index may take the value $0 \leq GL_i \leq 100$. The value of 0 indicates that all trade is inter-industry trade. When a proportion of intra-industry trade of total trade increases the value of the index rises. In extreme cases, when exports equal imports, the value of the index equals 100[108].

However, Grubel and Lloyd observed that if the aggregate IIT is calculated and the country's total commodity or some industries' trade is unbalanced (a highly expected phenomenon) the index is biased downward and some adjustment to the index is necessary. To solve this problem, Grubel and Lloyd adjusted the denominator of the formula so as to deduct the trade imbalance:

$$\overline{GL_i^a} = \left[\frac{\sum_{i=1}^{n}(X_i + M_i) - \sum_{i=1}^{n}|X_i - M_i|}{\sum_{i=1}^{n}(X_i + M_i) - \left|\sum_{i=1}^{n}X_i - \sum_{i=1}^{n}M_i\right|}\right] \times 100 \qquad (7.4)$$

where $\overline{GL_i^a}$ is the Grubel-Lloyd adjusted index and other variables are as defined above.

108 It was noted by Somma (1994) that, in reality, the index cannot reach the value *100* since exports cannot counterpart imports in every industry, regardless of the pattern of trade (p.788).

Aquino (1978) argues that, unless correcting for imbalancing effect is done, the G-L indices may provide a very misleading picture about IIT not only at the aggregate level but also at the industry level. He continues that a more precise analysis of IIT would necessitate a substantial reclassification of products to secure greater homogeneity within groups, however, a greater heterogeneity between groups, in terms of product characteristics. He claims that otherwise IIT index suffers from both a downward and an upward bias.

Aquino (1978) considers to be unrealistic to assume the overall imbalance without also assuming some imbalancing effect on the single commodities' trade flows. Consequently, he suggests an index that, he claims, is free of these limitations. The index measures the proportion of IIT that corrects for the trade imbalance assuming the equi-proportional effect in all industries. The proposed method requires an 'estimate' of the likely values of exports and imports assuming the situation of trade balance, that is, when total exports equal to total imports. Aquino proposes that these theoretical values can be obtained as:

$$X_{ij}^{e} = X_{ij} \frac{\frac{1}{2}\sum_{i}\left(X_{ij} + M_{ij}\right)}{\sum_{i} X_{ij}}; \qquad M_{ij}^{e} = M_{ij} \frac{\frac{1}{2}\sum_{i}\left(X_{ij} + M_{ij}\right)}{\sum_{i} M_{ij}} \tag{7.5}$$

and consequently, derived the formula to measure the proportion of IIT in the j^{th} trade of the i^{th} commodity as:

$$Q_{j} = \left[\frac{\sum_{i}\left(X_{ij} + M_{ij}\right) - \sum_{i}\left|X_{ij}^{e} - M_{ij}^{e}\right|}{\sum_{i}\left(X_{ij} + M_{ij}\right)}\right] \times 100 \tag{7.6}$$

where, X^e and M^e are theoretical (hypothetical) values of exports and imports derived on the assumption that total trade is balanced and Q_j is the Aquino's index. However, this equally-spread imbalance across the industries was challenged by some economists.

Some researchers have questioned the requirement for correction[109], even if trade is unbalanced. Greenaway and Milner (1983) and Vona (1991), for instance, argue that there are no theoretical grounds for imposing the equilibrium condition in trade. Vona maintains that a country can sustain, even for a longer time, a deficit in one sector while earning surpluses in other sectors. In a similar vein Greenaway and Milner (1986) argue that *'equilibrium' can be compatible with imbalance on any particular set of international transactions including trade imbalance on manufactured goods* (p.258).

Bergstrand (1983) challenges all the above presented methods for their multilateral approach in measuring the extent of IIT in a country's total trade. He maintains that IIT should be calculated as a proportion of a country's bilateral trade. With regard to the trade imbalance, Bergstrand takes the view that the index should be corrected for each country's multilateral trade imbalance. Similar to Aquino's index, in the case of trade imbalance in the total trade, the Bergstrand method involves the derivation of hypothetical export and import values for each flow of bilateral trade and consequently, faces the same criticism as the Aquino's index.

[109] Some studies have applied the 'unadjusted' IIT indices (Pagoulatos and Sorenson, 1975; Caves, 1981; Lundberg, 1982; Tharakan, 1986; Greenaway, 1989; Globerman and Dean, 1990; Hamilton and Kniest, 1991; Vona, 1991; Ballance, *et al.* 1992; Clark, 1993; Hughes, 1993; Somma, 1994). Other studies made some adjustment for trade imbalances (Aquino, 1978; Loertscher and Wolter, 1980; Bergstrand, 1983; Balassa, 1986a; Balassa and Bauwens, 1987).

Vona (1991) considered the pros and cons of the implications of trade imbalance on measuring IIT and he argues against the proposed corrections on both theoretical and empirical bases. He demonstrates, with an example, the superiority of the Grubel-Lloyd uncorrected index over the corrected indices discussed earlier. Vona strongly recommends the uncorrected Grubel-Lloyd index for analysing the extent of IIT. His recommendation appears to be accepted by some recent studies that did not correct IIT indices for the overall trade imbalance (see Footnote 109, p.170).

In 1991, in an effort to test the effect of trade liberalisation on the level of IIT, Hamilton and Kniest developed an index of marginal IIT. A number of empirical studies tested whether the level of protection is one of the determinants of IIT by comparing the industries with different levels of IIT. The index developed by Hamilton and Kniest, however, permits measurement of the degree of IIT in additional trade generated by trade liberalisation. The method resolves some problems encountered in comparing G-L indices over time. Caves (1981), for instance, pointed out that if countries involved in IIT divide the increase in exports equally, their IIT increases in absolute terms but the proportion of IIT remain constant[110]. In this context, Greenaway and Torstensson (1997) also stress that in order to evaluate the relationship between IIT and structural adjustment, one needs to consider the change, rather than the level of IIT.

Hamilton and Kniest (1991) define the marginal IIT (MIIT) index as:

$$\text{for } M_t - X_{t-n} > X_t - X_{t-n} > 0$$

[110] Problems with measuring IIT are discussed in Aquino, 1978; Greenaway and Milner, 1983; Tharakan, 1983; Ratnayake and Athukorala 1992; Menon and Dixon, 1995, 1996a.

$$MIIT = \begin{cases} \dfrac{X_t - X_{t-n}}{M_t - M_{t-n}} \\ \\ \dfrac{M_t - M_{t-n}}{X_t - X_{t-n}} & \text{for } X_t - X_{t-n} > M_t - M_{t-n} > 0 \\ \\ undefined \\ & \text{for } X_t < X_{t-n} \text{ or } M_t < M_{t-n} \end{cases} \tag{7.7}$$

where, X_t and M_t are exports and imports in year t and X_{t-n} and M_{t-n} are exports and imports in year $t-n$, so n is the time period in years between the two measurements. As follows from the formula, if changes in exports or imports are negative, the index is undefined. Greenaway *et al.* (1994), however, pointed out that while the index provides some indication regarding IIT in new trade, it does not offer any information with reference to the amount, the initial level of trade or the value of production in the industry considered.

Brülhart (1994) proposed a dynamic version of the Grubel-Lloyd (1975) index to assess the role of IIT during the process of adjustment associated with trade liberalisation. The index is based on the concept of marginal IIT (MIIT). While the conventional Grubel-Lloyd index measures changes in the structure of trade flows, Brülhart's index decomposes the structure of changes into proportions attributable to intra- and inter-industry trade. The index can be expressed as follows:

$$MIIT_i = \left\{ |\Delta X_i| + |\Delta M_i| \right\} - |\Delta X_i - \Delta M_i| \tag{7.8}$$

where Δ is the first-difference operator. If the expression in Equation (7.8) is divided by the change in total trade flows, the index, that is in fact the Grubel-Lloyd dynamic index can be written as:

$$A_i = 1 - \frac{|\Delta X_i - \Delta M_i|}{|\Delta X_i| + |\Delta M_i|} \quad (7.9)$$

The value of the index varies between *0* and *1*, with higher values indicating higher marginal IIT (A_i). The advantage of the index is that, compared to the conventional Grubel-Lloyd index, it indicates the proportion of changes in total trade attributable to IIT. However, the limitation of the index is that it does not have the capacity to separate inter-industry trade and vertical IIT. The reason is that the index regards each sub-sector of an industry as a separate industry whereas and index of vertical IIT is concerned with the industry level.

Using the Brülhart index (7.8) complemented by the aggregate index that reflects adjustment at the industry level (Equation 7.12). Thom and McDowell (1999) managed to separate all three types of trade. Equation 7.10 measures the extent of horizontal IIT and Equation 7.12. measures the total IIT. Thus the difference between the two indicates vertical IIT.

$$A_w = \sum_{i=1}^{N} w_i A_i \quad (7.10)$$

where (A_w) is the average industry index, w_i are weights calculated as follows (see Brülhart, 1994, p. 605):

$$w_i = \frac{|\Delta X_i| + |\Delta M_i|}{\sum_{i=1}^{N} \left(|\Delta X_i| + |\Delta M_i|\right)} \quad (7.11)$$

where N is the number of sub-sectors in the industry *J*. If $X_J = \Sigma_i^N X_i$ and $M_J = \Sigma_i^N M_i$, the industry index can be defined as:

$$A_j = 1 - \frac{|\Delta X_j| - |\Delta M_{ji}|}{\sum_{i=1}^{N} |\Delta X_i| + \sum_{i=1}^{N} |\Delta M_i|} \quad (7.12)$$

Thom and McDowell applied these indices to decompose trade between the EU and three Central and Eastern European countries for the period 1989 to 1995. The results indicate that failure to distinguish between vertical IIT and inter-industry trade may result in underestimating the extent of IIT, and other things constant, overestimating the importance of adjustment costs associated with the process of trade liberalisation.

One of the recent contributions to the measurement of bilateral IIT growth over time has been made by Menon (1994, 1996). Dixon and Menon (1995) show that in the presence of opposite sign imbalances[111] the G-L indices may be misleading as measures of IIT growth. To overcome the problems in using the G-L index, Dixon and Menon proposed a method that allows for decomposition of total trade growth *(TT)* into the contributions of growth in net trade *(NT)* and intra-industry trade *(IIT)*.

$$TT_{ijk} = NT_{ijk} + IIT_{ijk} \quad (7.13)$$

where,

$$TT_{ijk} = X_{ijk} + M_{ijk} \quad (7.14)$$

$$NT_{ijk} = | \ NT_{ijk} - IIT_{ijk} \ | \quad (7.15)$$

and

$$IIT_{ijk} = \left(X_{ijk} + M_{ijk}\right) - \left|X_{ijk} - M_{ijk}\right| \quad (7.16)$$

where, X_{ijk} and M_{ijk} are exports and imports between country k and country j of commodity i.

[111] Opposite signed imbalances in trade can occur, for instance, if a policy adoption results in significant trade diversion (Menon and Dixon, 1996b, p.4),

The percentage growth in total trade (tt_{ijk}) between the countries can be decomposed to the contribution in net trade (Cnt_{ijk}) and the contribution in IIT $(Ciit_{ijk})$ as:

$$Cnt_{ijk} = (1 - GL_{ijk})nt_{ijk} \tag{7.17}$$

$$Ciit_{ijk} = GL_{ijk}\, iit_{ijk} \tag{7.18}$$

$$GL_{ijk} = \frac{IIT_{ijk}}{TT_{ijk}} \tag{7.19}$$

where, nt_{ijk} and iit_{ijk} are the percentage changes in NT and IIT over the period[112].

Furthermore, Dixon and Menon (1995) offer a procedure that measures the contribution (C) of exports (x) and imports (m) to growth in total (tt), net (nt) and intra-industry trade (iit):

$$tt_{ijk} = Cmtt_{ijk} + Cxtt_{ijk} \tag{7.20}$$

where,

$$Cmtt_{ijk} = \left(\frac{M_{ijk}}{TT_{ijk}}\right)m_{ijk} \tag{7.21}$$

$$Cxtt_{ijk} = \left(\frac{X_{ijk}}{TT_{ijk}}\right)x_{ijk} \tag{7.22}$$

$$Cmnt_{ijk} = \left(\frac{M_{ijk}}{\left(M_{ijk} - X_{ijk}\right)}\right)m_{ijk} \tag{7.23}$$

$$Cxnt_{ijk} = \left(\frac{X_{ijk}}{\left(X_{ijk} - M_{ijk}\right)}\right)x_{ijk} \tag{7.24}$$

$$Cmiit_{ijk} = \delta_{ijk} m_{ijk} \quad \text{and} \quad Cxiit_{ijk} = \left(1 - \delta_{ijk}\right)x_{ijk}$$

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[112] $GL_{ijk} = 1 - \left[\left|X_{ijk} - M_{ijk}\right| / (X_{ijk} + M_{ijk})\right]$ is the Grubel-Lloyd index.

where, m_{ijk} and x_{ijk} are growth rates over the period in M_{ijk} and X_{ijk}.[113] δ_{ijk} is 1 if $X_{ijk}>M_{ijk}$ and 0 if $X_{ijk}<M_{ijk}$; C is the contribution measure.

One of the major problems in measuring the extent of IIT is the aggregation problem. The problem is usually associated with grouping the products for the purposes of compiling international trade statistics within the Standard International Trade Classification as well as with the different aspects of grouping followed by statisticians and economists. Therefore, in measuring IIT, it is important to select the proper level of aggregation. In empirical analysis the three-digit level is usually considered as appropriate. It is often argued that on the one hand, over-aggregation leads to an over-estimation of the true extent of IIT, while on the other hand, the higher levels of disaggregation might result in separating the products that in essence products of the same industry. Thus, as Aquino (1978) suggests, accurate analysis of the phenomenon of IIT would require a comprehensive reclassification of products to obtain groups homogenous inside and heterogenous between them from the aspect of the important commodity characteristics.

In order to test whether IIT reduces or is being eliminated with lower level of aggregation, Greenaway and Milner (1983) observed the average level of IIT for the United Kingdom at the three-, four- and five-digit level of aggregation within the SITC classification. The results confirmed that while the extent of IIT declines with the level of aggregation, the bias is not as significant as generally claimed. Furthermore, Greenaway and Milner suggest that the three-digit level of aggregation usually provides a realistic estimate of IIT.

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[113] It is assumed that rate of growth in exports and imports are determined independently. The assumption is based on the low value of the correlation coefficient, a common practice.

Greenaway and Milner (1983) proposed the following formula (GM_j) to test the level of aggregation bias:

$$GM_j = 1 - \frac{\sum |X_{ij} - M_{ij}|}{\sum (X_{ij} + M_{ij})} \times 100 \qquad (7.25)$$

GM is the Greenaway and Milner index, j is the j^{th} of n industries, i is the subgroup of the industry, and X and M are the exports and imports. Thus, the index differs from the Grubel-Lloyd index in that the numerator uses the absolute value of the trade balances that they claim is the measure of the aggregation bias. In empirical testing, Greenaway and Milner found that values of the IIT index using their formula were consistently lower than the values of the G-L index, however, the discrepancies were very low.

7. 4. Empirical Studies on the Extent of IIT

A significant number of studies measured the level of IIT in various countries. Grubel and Lloyd (1975) estimated the average level of IIT in ten OECD countries comprising 160 product groups at the three-digit SITC level of aggregation. The results show that the average level of IIT increased from 36 percent in 1959 to 48 percent in 1967 with the highest level of IIT in manufactured products.

Aquino (1978) measured the level of IIT for twenty-five manufactured products in twenty six countries. In an effort to eliminate aggregation bias, Aquino applied the three- and four-digit level of aggregation. The highest level of IIT was recorded for the West European countries, and lower for the United States, Australia and Japan. A common feature of the studies is that IIT tends to be generally higher for the developed, industrialised countries (for instance 87.4 percent for France, almost 82 percent for United Kingdom) and some newly industrialising countries. In 1972, the level of IIT, as a proportion of total trade in manufactured products for Australia was 58.5 percent. Between 1964 and 1974 IIT ratios for trade in manufactures among OECD countries rose by almost 7 percent, however, for Australia it was only 3 percent. However, the gap has been slightly declining. In 1970, the index for Australia was 21.1 percent while the OECD average was 54.6 percent. By 1985, Australia's index rose to 30.6 percent while for OECD to 64.5 percent.

Culem and Lundberg (1986) employed the Grubel-Lloyd index to estimate the level of IIT, at the four-digit level of SITC, in eleven industrialised countries between 1970 and 1980. The results showed even further rise in IIT in most countries. Culem and Lundberg also observed that while IIT was lower when developed countries traded with less developed countries, the intensity of growth in IIT was higher than the growth of trade between developed countries.

A contrasting observation was reported by Globerman and Dean (1990) who detected that the trend of IIT in the late 1970s and 1980s began to slow down. This conclusion was based on a sample of OECD countries using the Grubel-Lloyd index. Greenaway and Hine (1991) pointed out that the results by Globerman and Dean may be challenged since they are based on a small sample size, on the period when the trade in manufactures slowed down and consequently deterred the growth of IIT. In order to prove the claim, Greenaway and Hine applied two different measures to analyse movement in IIT for twenty-two OECD countries over the period 1970 to 1985. The results show that the average level of IIT maintained the upward trend during the 1980s, however, the rate of growth was relatively lower, in particular in the original EC countries. Out of twenty-two countries, only eight countries experienced a reduction in IIT.

Somma (1994) attempted to test the hypotheses pertaining both country- and industry-specific determinants of IIT in the computer market. He follows Aquino's (1978) suggestion to reduce the bias stemming from classification and regrouped the data according to the *'technology intensity'* criterion to form a more homogeneous product group.

Siriwardana (1990) calculated the Grubel Lloyd IIT index for 133 four-digit Australian Standard Industrial Classification (ASIC) industries for the period of 1968/69 to 1981/82. Although the index varied within the industries, it was however, significantly lower than in most of the OECD countries that experienced on average the incidence of IIT for the period of over 50 percent[114]. Australia lags behind the most of OECD countries also in terms of trend. While the share of most of the OECD countries shows an increasing trend, Australia's IIT share was marginally declining. In addition, Siriwardana (1990) reported the index for fifteen industries with high and fifteen industries with low values of the index for 1982. According to the results, 53 percent of the industries experienced declining levels of IIT during the period 1968 to 1982, and only for about 45 percent of the industries included in the analysis IIT accounts for 25 percent or more of total industry trade in 1982. Two explanations

[114] The results are consistent with the study by Grubel and Lloyd (1975) who reported a low incidence of IIT in Australian manufactures.

have been quoted for the weak performance in Australia's IIT. First, the high level of protection that resulted in a less competitive position of Australia's manufacturing industries in the world market. Second, the lack of specialisation that prevented domestic manufacturers from reaping potential benefits of economies of scale and product differentiation (OECD, 1987).

Menon and Dixon applied the methodology that they developed (see Menon, 1994; Menon, 1995; Menon and Dixon, 1996a, b) to measure the effect of Regional Trading Agreements (RTAs), in particular of the Australia-New Zealand Closer Economic Relations Trading Agreement (ANZCERTA) on Australian and New Zealand trade. To examine the link and importance of IIT to RTAs the previous studies applied the G-L index (see for instance, Balassa, 1966; Grubel and Lloyd, 1975; Drabek and Greenaway, 1984; Globerman and Dean, 1990), Menon and Dixon, however, argue that the methods applied can lead to misleading conclusions pertaining growth in IIT. For instance the movement in the value of the G-L index is consistent with the inverse movement in IIT, but it does not provide the information regarding the IIT contribution to the growth in total trade.

Dixon and Menon (1995) emphasise the importance to isolate the contribution of IIT because of its implications for adjustment costs. These are expected to be lower because it creates industry specialisation without much inter-industry factor movements. However, if growth in trade takes place through net trade, factor movement from import-competing to export-oriented industries is reasonable expectation.

Menon and Dixon (1996b) pointed out that previous studies often failed to relate export and import performance to overall trade as well as the relationship between intra- and extra-RTS trade and the trade imbalances at the multilateral level. They claim that if the intra- and extra-RTA trade imbalances have the same sign as the imbalance at the multilateral level, a bias will be introduced into the measured IIT.

Hamilton and Kniest's (1991) results indicate a strong tendency towards IIT in manufactures between New Zealand and Australia. However, the study shows that elimination of trade barriers boost both inter- and intra- industry trade. They have not found much support for the proposition that trade liberalisation increases IIT.

Using the Grubel-Lloyd index, Hellvin (1994) studied the extent of intra-industry trade between various groups of ten Asian countries. He found that the intra-industry trade is the most substantial in manufactures between as well as within newly industrialised countries (NICs) and newly exporting countries (NECs). The lowest share of intra-industry trade was detected in trade among less developed countries (LDCs). Similar results were reported by Lee (1987), Ballance and Forstner (1990) and Chow *et al.* (1994).

Menon *et al.* (1999) measured the extent of IIT in bilateral trade between Australia and UK. In the analysis, IIT is separated in to horizontally differentiated products and vertically differentiated products. Following the assumption that the determinants of the two types of IIT differ, the study consequently estimates two separate models for each country's industry-specific characteristics. Menon *et al.* addressed the limitations in previous cross-country studies that often use one country's industry characteristics as a proxy for other trading partners' characteristics. Menon *et al.* also take into account market structures in both countries.

7. 5. Determinants of Intra-Industry Trade

Since the 1960s, when the concept of IIT was raised in the studies of the impact of economic integration on trade patterns and specialisation in the European Economic Community (Verdoorn, 1960; Grubel, 1967), much of the theoretical and empirical work has been devoted to identifying the phenomenon and sources of growing IIT. The purpose of this section is to review empirical studies dealing with various aspects of determinants of IIT.

Most of the empirical studies on IIT concentrated on the incidence of IIT in industrialised countries[115], thus without taking into account possible differences between developed and developing countries. However, some studies have indicated that IIT between developed and developing countries is also noteworthy and it should be treated separately (Lundberg, 1982; Havrylyshyn and Civan, 1983; Tharakan, 1984; Culem and Lundberg, 1986; 1986; Stone and Lee, 1995; Hu and Ma, 1999; Nilsson, 1999). The rationale behind this argument is possible differences in crucial characteristics such as factor endowments and level of technological progress.

[115] For instance, Pagoulatos and Sorensen (1975) Caves (1981) Balassa (1986a) for the United States, Lundberg (1982) for Sweden, Greenaway (1983; 1999), Tharakan (1986) for Benelux, Loertscher (1980) for the OECD countries, Ratnayake and Athukorala (1992) and Menon *et al.* (1999) for Australia.

Earlier empirical work on IIT was directed mostly towards testing the effect of country-specific or industry-specific characteristics in cross-sectional analysis[116]. Hesse (1974) attempted to explain the growth of IIT in the 1960s from a trade flow matrix for selected classes of manufactured products among thirteen industrial countries (nine European countries, the United States, Canada, and Japan) for the period between 1953 and 1970. Caves (1981) expanded Hesse's Standard International Trade Classification (SITC) categories by additional 48 manufacture categories, making a sample of 94 and tested the determinants of IIT from a cross-sectional U.S. data for 1970.

Balassa and Bauwens (1987) extended the analysis by Balassa (1986a) on the U.S. IIT, including a number of developing countries. They tested the effect of various explanatory variables, specified in terms of both country and industry characteristics on the extent of IIT in manufactures in a multi-industry and multi-country environment. Balassa and Bauwens found the results for the developed countries, in terms of the explanatory power of the model superior, in particular for the country characteristics. Greenaway and Torstensson (1997), however, expressed some concern regarding these results. Firstly, they argue that 'satisfactory' inferences from the analysis might be influenced by large-scale databases that include both countries and industries. Secondly, they challenged Balassa and Bauwens for using some of the U.S. data to proxy industrial characteristics in all other countries included in the analysis. Nevertheless, this approach, with some modifications, has been applied repeatedly in a number of studies over the years. The factors that are claimed to explain differences in the level of IIT among countries are discussed below.

[116] A number of studies, including Greenaway and Milner (1984; 1986; 1987), however, emphasised the importance of understanding the dynamics of the IIT and note a lack of time-series studies concerned with changes and their determinants in IIT.

Balassa and Bauwens (1987) found that the extent of IIT is positively correlated with average income, average country size, trade orientation, and the existence of common borders and negatively correlated with income and country size differences, and the distance between the countries. The results also indicate a positive relationship between the extent of IIT and the membership of various trading agreements and associations, product differentiation, marketing costs, the variability of profit rates. However, a negative relationship was observed between the level of IIT and economies of scale, representing product standardisation, industrial concentration, foreign direct investment and foreign associations and the tariff dispersion[117]. Balassa and Bauwens tested the effect of country and industry characteristics separately as well as simultaneously and pointed out advantages of the simultaneous testing of both types of characteristics. Loertscher and Wolter (1980) also attempted to analyse the inter-country and inter-industry determinants of IIT in a multilateral framework.

Country characteristics include some common to all countries (average per capita income, differences in income, average country size and its differences, distance, common borders, and average trade orientation) as well as specific to some countries (participation in economic integration schemes and common language). With respect to industry characteristics, Balassa and Bauwens (1987) tested the effect of product differentiation, marketing costs, variability of profit rates, economies of scale, industrial concentration, foreign investment, foreign affiliates, tariff dispersion, and offshore assembly (p. 923). Balassa (1986c) applied the same country characteristics in an analysis of intra-industry specialisation in a multi-country environment, while

[117] A negative, and highly significant sign for the variable representing the tariff dispersion was obtained also by Pagoulatos and Sorensen (1975),

Balassa (1986a) studied bilateral trade between the United States and the thirty-seven trading partners.

Narayan and Dardis (1994) examined the patterns and determinants of IIT in a specific industry, textiles, in thirty-nine countries divided into two groups, one including both developed and developing countries, while the other one grouping exclusively developed countries, for three different years, 1977, 1982, and 1987. In their model, Narayan and Dardis defined country-specific characteristics (mainly similar to those employed in other studies) as well as industry-specific characteristics (industry heterogeneity, product differentiation and standardisation). The findings by Narayan and Dardis for the developed countries indicate that despite the low economies of scale in the textile industry, there is a significant IIT present. They found that country-specific characteristics, in particular, average income, capital-labour ratio, a common border, a common language, and membership in the same customs union have a positive and significant effect on IIT, while the difference in per capita income, the distance and trade restrictions have a negative impact on IIT. The results support the hypothesis that industry heterogeneity has a positive effect, however, product standardisation and differentiation have a negative effect on IIT in textiles. With a minor variation, mainly in the significance level, similar results were observed for the total sample (including both developed and developing countries). Overall results show that IIT varies by industry groups signifying the importance of product differentiation and product standardisation.

7. 5. 1 Industry-Specific Determinants of Intra-Industry Trade

Industry Diversity

It is usually argued that IIT is greater in markets with larger number of firms. The argument is associated with the notion that product differentiation is likely to occur under conditions of monopolistic competition. As Lancaster (1980) suggested this market environment allows the diversity in consumer preferences and the emergence of economies of scale in production that encourage IIT.

The level of categorisation in the industry classification system is often assumed to reflect the industries' diversity, or heterogeneity. A positive relationship is usually assumed between this phenomenon and the extent of IIT. It has been suggested that IIT would disappear at the finest level of disaggregation (Finger, 1975; Lipsey, 1976; Pomfret, 1979).

Grubel and Lloyd (1975) argued that while IIT declines with the level of disaggregation, it does not dissipate completely. In their analysis of IIT they detected that Australia's IIT declined from 43 percent at the one-digit level of aggregation to only 6 percent at the seven-digit level. Deardorff (1984) also conveyed that the level of aggregation and the definition of the industry cannot be separated. However, Bergstrand (1983) in his analysis of IIT reported a notable level of IIT even at the eight-digit level of the United States Standard Industrial Classification.

Product Differentiation

It is generally proposed that the greater the degree of product differentiation, the higher the incidence of IIT. A number of different variables have been applied to test the effect of product differentiation on IIT.

Greenaway (1984) expresses the need for 'an ideal index' of IIT that would measure the volume of trade in differentiated products and would provide an indication of the relative importance of trade in differentiated products rather than just indicate the existence of the relationship with proxy variables employed to account for product differentiation. Product differentiation has been pictured in alternative ways. Greenaway (1984) summarises the most frequently used 'proxies' for product differentiation. A brief discussion of those measures is provided below.

Hufbauer Index

Hufbauer (1970) introduced the index that is in fact the coefficient of variation based on the ratio of export price dispersion (unit values) reflecting product differentiation and the mean value of export prices:

$$H = \frac{\sigma_{ij}}{M_{ij}} \tag{7.26}$$

where,

σ_{ij} is the standard deviation of export unit values for shipments of good i to country j,

and M_{ij} is unweighted mean of the unit values.

Despite some challenges by some researchers, including Kravis and Lipsey (1971) Gray and Martin (1980) and Greenaway (1984) who argue that export unit values may vary due to other forces, such as the composition of trade within product categories, level of protection, or market power, the index has been widely used in empirical studies. A number of studies applied the index to account for vertical and technological[118] differentiation (Helleiner, 1973, 1976; Caves, 1981). Pagoulatos and Sorensen (1975) and McAleese (1979) used it as a proxy for overall product differentiation.

Advertising Intensity

Use of advertising intensity as a proxy for product differentiation is based on the postulate that when product differentiation is present, sellers have strong incentives to inform buyers about distinguishing characteristics of products. It is then reasonable to argue that the greater the number of product varieties, the greater advertising intensity is expected. Some ambiguity, however, arises as to what aspect of product differentiation is measured. Inter-industry differences in the ratio of advertising intensity to industry sales (Goodman and Ceyham, 1976; Helleiner, 1976; Caves, 1981; Greenaway, 1982) or advertising intensity to consumption ratio by Tharakan *et al.* (1978) to approximate differences in inter-industry product differentiation have been used.

Caves (1981) distinguishes two types of product differentiation. The first, *complexity* is created by complex, objective combination of various attributes embodied in the product that are usually produced under conditions of increasing returns to scale. Thus, suppliers cannot produce all the varieties that consumers demand. So this situation would generate a growth in IIT. The second type of product differentiation is based more on consumers' perception of various distinguishing characteristics of

[118] Technological differentiation takes place when some of the essential characteristics are modified and result in new, technically improved products (Greenaway, 1984, p.232),

otherwise similar products. This type of product differentiation is usually associated with high levels of advertising to sales ratios, though lower level of IIT. Based on this distinction Caves argues that advertising expenditures might have a negative effect on IIT. Balassa and Bauwens (1987), however, found a positive relationship between both measures and the extent of IIT.

Census Classification

Some researchers applied disaggregation of product categories to estimate the extent of product differentiation (Loertscher and Wolter, 1980; Caves, 1981; Greenaway, 1982). Caves (1981) pointed out that the reliability of the method may be, to a great degree, influenced by the level of aggregation and the base selected.

Hedonic Price Indices

While proxy variables discussed above capture the number of products in the market or the variables that are related to product differentiation, hedonic price indices are based on the price differences that are assumed to reflect the presence and the amount of intrinsic characteristics of the product[119].

Gray and Martin (1980) endorse an alternative approach to measuring product differentiation based on hedonic price indices[120] that employ identifiable characteristics of products, the approach developed by Lancaster (1966, 1971, 1979). A change in the amount of characteristics of a product results in a 'change in quality' of the product. Implicit values of those characteristics can be derived by estimating

[119] For the application of the method in various fields see, for instance, Lancaster (1966; 1971; 1971; 1975; Ladd and Suvannunt, 1976; 1979; Gray and Martin, 1980).
[120] For a more detailed discussion of hedonic price indexes see (Griliches, 1971; Deaton and Muellbauer, 1984).

regression equations specified with price being a function of identifiable characteristics of the product.

Greenaway (1984) argues that while the hedonic price technique may be appropriate to measure vertical differentiation in products, it is inappropriate to express horizontal differentiation where price differences across varieties are absent (p.238). He also raises the question of interpretation and other factors' effect on implicit price of characteristics.

Siriwardana (1990) based on the analysis of Australia's IIT in manufactures, observed that industries with a substantial incidence of IIT include some that produce highly differentiated consumer goods. In their analysis, Ratnayake and Athukorala (1992) and Sharma (2000) also noted that product differentiation has a positive influence on IIT. However, Marvell and Ray (1987) found that the U.S. industries producing highly differentiated consumer goods were associated with the low values of IIT index.

Flam and Helpman (1987) and Ballance *et al.* (1992) incorporated the concept of product differentiation, more specifically the effect of quality differences, into the analysis of bilateral IIT between the North and the South. Based on the assumption that the North produces and exports higher-quality products while the South produces and exports lower quality products, the assumption that is closely associated with income differences as well as price differences. The quality differences are expected to increase the share of bilateral IIT between the two groups of countries. A distinguishing feature of the empirical model is that Ballance *et al.* (1992) empirically tested the effect on bilateral IIT of both the extent and the direction[121] of quality differences between the two groups of countries. The findings validate the assumptions that IIT is positively influenced by the direction of quality differences and, to a lesser degree, the extent of quality differences.

The study by Thorpe (1995) is one of few contributions to the analysis of IIT in developing countries, concentrating on Malaysia. He examined the nature and changes in IIT and its country and industry specific determinants for the period 1970 to 1989, the period of significant economic growth and structural adjustments. The study shows that Malaysia experienced not only significant IIT with both, developed and other developing countries but also changes in trade patterns and in trading partners. The results are in line with the view that as development progresses, tastes and industrial structures of developed and developing countries converge leading to an increase in IIT those countries in both horizontally and vertically differentiated products. Thorpe observed that as a country develops further, the influence of demand overlap becomes more important and products traded become more sophisticated (p. 29). The findings endorse previous studies of IIT that proved the role of industry-specific characteristics associated with product differentiation and economies of scale as well as some country-specific characteristics.

Hu and Ma (1999) examined the extent of vertical and horizontal IIT and empirically tested various country- and industry-specific hypotheses with regard to determinants of bilateral IIT between China and 45 trading partners of various industrial groups, for 1995. With regards to the determinants of the cross-country IIT, the share of

[121] measured by a dummy variable that takes value one if the ratio of unit values exceeds one and zero otherwise (p. 334),

manufactured goods in exports, the product differentiation, the trading partners' incomes appear to be significant positive contributors to IIT. With respect to the cross-industry IIT, proxy variables representing product differentiation and the economies of scale are identified as stimulating factors of China's IIT.

A study by Gullstrand (2002) revealed the importance of focusing on IIT in horizontally differentiated products that he defined as an exchange of similar products within somewhat similar unit values. However, Gullstrand communicates some robustness problems associated with the arbitrary limit value[122] to separate horizontal IIT. Greenaway *et al.* (1994; 1995) restricted the value to both 15 percent and 25 percent and found out that even at the value of 25 percent, vertical IIT was still very significant. However, using the 15 percent limit value, vertical IIT was shown to be the major type of IIT in UK trade.

A study by Hughes (1993) analysed primarily industry characteristics on IIT in six largest OECD countries in the 1980s and it is based on the panel data. Following Balassa and Bauwens (1987) Hughes also tested the interaction of country- and industry-specific characteristics. The findings support previous studies in relation to the effect of product differentiation, heterogeneity and economies of scale on IIT. In addition, the results suggest that while industry-specific factors are principal determinants of IIT, their effect is complemented by country-specific characteristics. Hughes also noted that the structure of the labour force, in particular, professional and technical staff may be an explanatory variable in influencing IIT.

[122] Greenaway and Torstensson (1997) pointed to the importance of the limit value of within which IIT is defined as horizontal, otherwise, it is defined as vertical (p. 255),

Economies of Scale

Although in most theoretical studies the presence of the economies of scale is considered to be essential for IIT to occur, Ethier (1982) argues that it does not follow that the volume of IIT should be positively related to the degree of economies of scale. It has been suggested that while some degree of economies of scale is crucial to generate country's specialisation and therefore IIT, it has been also noted that a very large economies of scale may result in the standardisation and consequently restraining IIT (Caves, 1981; Greenaway and Milner, 1984; Somma, 1994; Davis, 1995; Greenaway, *et al.* 1995). The rationale for this is that if the minimum efficiency scale of production is large relative to the total market, there is likely to be lower number of producers and consequently a lower degree of product differentiation and the *vice versa*. In other words, the relationship between the minimum efficiency scale and the size of the market is important.

Gullstrand (2002) argues that economies of scale are needed to activate IIT flows, however, this will only have a positive effect on IIT if the level of economies of scale does not become too restrictive on the number of firms within the industry.

Greenaway and Milner (1984) suggest an index that is intended to capture the effect of relative cost advantage of larger firms compared to smaller firms. It can be written as follows:

$$ES_{ij} = \frac{VA_{ij}^{l} / N_{ij}^{l}}{VA_{ij}^{n-l} / N_{ij}^{n-l}} \times 100 \qquad (7.27)$$

where ES_{ij} is the index of economies of scale, VA^{l} is the value added per employee for the largest (usually top five) firms of the industry and VA^{n-l} is the value added for the remaining firms in the industry, N is the number of firms. Thus, the presence of a larger number of firms within the industry will encourage product differentiation and therefore, IIT. They found that IIT was directly related to the number of firms, indirectly related to scale economies and the degree of market concentration.

Greenaway *et al.* (1995) challenged the approach of testing the relationship between the degree of IIT and the economies of large plant size that is commonly used in empirical studies. They applied various measures of market structure, such as the number of firms in an industry, the importance of economies of scale and the degree of market concentration to test the effect.

Gullstrand (2002) hypothesised, and found empirically, that the relationship between economies of scale and the share of IIT is non-linear. The reason behind this hypothesis is that if IIT is generated by economies of scale, however, these economies of scale are relatively small, a large number of firms would exist within the industry. Thus, the larger the economies of scale, the smaller the number of firms, and therefore, the smaller share of IIT in total trade (p. 319).

The Type of Market Structure

The relationship between market structure, measured by the number of firms, and IIT is unclear. Some studies suggest high levels of IIT in industries operating in an oligopolistic market structure while others propose that IIT be greater in a competitive environment with a large number of firms. Grimwade (2000) pointed out that the lack of empirical evidence with respect to a positive relationship between the level of IIT and variables representing oligopolistic market structure may be due to inappropriate measures. He stresses the importance of accounting for the effect of concentration in a global market, rather than a domestic market in analysing the determinants of IIT for a particular industry. Grimwade implies that this may be the reason for the inconsistency of the results in empirical studies. He states that the degree of oligopoly may not be an important determinant of the level of IIT. Balassa and Bauwens (1987) found a negative but and statistically significant relationship between industrial concentration and the level of IIT.

Industry-Specific Tariff Rates

Grimwade (2000) suggests that there is no specific evidence to support the notion that the incidence of IIT is inversely related to the level of trade barriers. The reason for this is that reducing trade barriers is likely to have impact on both inter- and intra-industry trade. However, it is proposed that because of the variation in tariff rates within the industry between countries there may be some effect on IIT (Caves,1981; Balassa and Bauwens, 1987).

Foreign Direct Investment (FDI)

It is generally argued that FDI has a positive effect on the level of IIT. However, Tharakan and Kerstens (1995) pointed out that if foreign direct investment replaces imports, the opposite might be the case. Balassa and Bauwens (1987) argue that FDI represents the replacement of the export sales of differentiated products, thus, leading to a negative effect on IIT. Ratnayake and Athukorala (1992) report a negative and significant effect of FDI on IIT. Markusen (1995) and Sharma (2000) argue that the effect of FDI on IIT would depend on the motive behind the investment. If the aim is to divide the production process geographically by stage of production, the effect of FDI would be more on inter-industry rather than intra-industry trade. In relation to

IIT, Sharma (2000) argues that in the presence of demand for differentiated varieties of the same products, the production of which is subject to economies of scale, there may be a propensity for a complementary relationship between FDI and IIT. Measured as the value-added share of a foreign-owned company, Sharma (2000) observed a negative effect on IIT of FDI in the pre-liberalisation period while no significant effect on IIT in the post-liberalisation period. He attributes this indication to increased competition after the liberalisation. Blanes and Martin (2000) proxied FDI by the proportion of foreign share holding in the sector's total share capital and found that FDI has a positive influence on IIT.

7. 5. 2 Country-Specific Determinants of Intra-Industry Trade

Income and Differences in Income

Income is usually hypothesised to influence the share of IIT in total trade between two countries in two ways, by its level and by differences in per capita incomes. Per capita income is assumed to reflect relative factor endowments while the differences in per capita income are believed to reflect the ratio of capital-labour endowments (Helpman and Krugman, 1985). It is suggested that if a country is characterised by a higher capital-labour endowment its demand for more differentiated products increases since differentiated products are assumed to be more capital-intensive than standardised products (Dixit and Norman, 1980; Krugman, 1980; Helpman, 1981; Krugman, 1981). In other words, it is argued that on the supply side high-quality products require more capital-intensive production processes, while on the demand side consumer's demand is determined by their individual incomes. While every consumer prefers high-quality varieties, they are restricted by their incomes. Thus, high-income consumers are expected to demand higher-quality, more capital-intensive products, while low-income consumers demand would be oriented more towards lower quality, more labour-intensive varieties of products. Ballance and Forstner (1990) for instance, examined the differences in proportions of IIT between and within different country groups and found a strong correlation between the proportion of IIT and income levels.

Linder (1961) argues that the higher country's per capita income is expected to generate a greater demand for goods, including imports. He suggests that rising income creates a demand for a greater variety of products. This consequently, leads to a higher degree of product differentiation and the rising IIT (Loertscher and Wolter, 1980; Balassa, 1986a; 1987; Bergstrand, 1990; Ballance *et al.*, 1992; Narayan and Dardis, 1994; Somma, 1994; Stone and Lee, 1995; Thorpe, 1995; Sharma, 2000; Mora, 2002).

Instead of assuming that differentiated products are capital-intensive in production, in the study by Bergstrand (1990) it is assumed that manufactured goods are luxury in consumption, thus as income increases the demand for a luxury good would also rise, leading to an increase in IIT. On the other hand Linder (1961) argues that *differences* in per capita income are associated with differences in tastes, or demand for the diversity of quality (vertically differentiated products), and as a result, tend to reduce IIT. Linder (1961) takes the view that differences in per capita incomes reflect differences in demand conditions. If per capita incomes in the countries are similar their demands are likely to be similar and consequently their mutual demand for varieties (IIT) increases. In view of that, the pattern of demand will be similar in countries with similar per capita income. Once a country satisfies domestic demand, it is likely to export to countries with similar per capita incomes, and therefore similar demand, and as a result, it creates the opportunities to exploit economies of scale.

Nilsson (1999) pointed out that a higher level of per capita income indicates a higher level of economic development. Thus, the greater the inequality in per capita income, the smaller the proportion of IIT in total trade. Nilsson (1999) examined country determinants of the EU countries' IIT with developing countries over the period of 1980-1992. The results of the study support the hypotheses that IIT increases with greater capital intensity in production and with larger average market size, however decreases with differences in factor endowments (measured by differences in per capita income), differences in economic size (proxied by average per capita income) and with the level of transport and transaction costs (proxied by the distance) between two trading countries.

Mora (2002) focused on the extent and determinants of vertical IIT in the twelve EU member states, in thirteen manufacturing sectors, for the period 1985-1996. The findings indicate that exports from southern (lower income) countries, are of lower price-quality range, whilst the countries with higher incomes per capita are positioned at the higher end of the range.

Chow *et al.* (1994) analysed IIT of the four East Asian Newly Industrialised Countries with European markets, Japan, and the United States over the period 1965-90. Chow *et al.* (1994) empirically tested the Linder's hypothesis that per capita income differences between the trading partners inversely affect the level of IIT and found that the results do not conform to the Linder hypothesis. Furthermore, Chow *et al.*

demonstrated that from the mid 1960s to 1990 a shift was evident shift towards IIT in those countries. Chow *et al.* (1994) hypothesise that a growth in GNP has a positive impact on IIT since it provides greater scope for diversification and technological progress. They argue that a high degree of specialisation may be associated with insufficient industrial infrastructure that cannot sustain a large number of products. However, as the economy advances the scope for diversification is likely to increase.

The Stage of Economic Development

Another, closely related issue to the level of a country's income is the stage that a country has accomplished in its economic development (Havrylyshyn and Civan, 1983; Chow *et al.*, 1994; Somma, 1994). A number of studies contend that advanced developed countries have a higher share of IIT than less developed countries. An often claimed reason for this observable phenomenon is that IIT is the highest in manufacturing products, thus the countries that are more industrially developed are likely to have higher IIT. Another contributing factor is their usually higher per capita income. However, as Grimwade (2000) warned, it is possible that these two factors may not be consistent. A country may have a high per capita income but remain at a relatively lower stage of economic development. Thus, it can also be hypothesised that the greater the difference between countries in the level of economic development, the lower the level of IIT. This is because the stage of economic development influences the capital-labour ratio. More developed countries tend to have higher capital-labour ratio and therefore, higher IIT, while the opposite is usually true about less developed countries. However, as pointed out by Chow *et al.* (1994) it has been also manifested that as developing countries grow, their production diversifies and the share of IIT with developed countries increases.

Country Size

The level of IIT is likely to be influenced by the country's *size* since it allows for economies of scale and the opportunities for product differentiation and for expansion of IIT. Larger economies, with larger domestic market, are also expected to have a higher demand for imported (differentiated) products and higher IIT. (McAleese, 1979; Lancaster, 1980; Helpman, 1981; Glejser, 1983; Balassa, 1986b; Hellvin, 1994; Somma, 1994). On the other hand, the countries that have large *differences* in the market size tend to have a small extent of IIT.

Balassa and Bauwens (1987), for instance, tested this proposition involving 152 product groups in thirty-eight countries and observed a positive relationship between the level of IIT and the average size of a country, however, a negative correlation between the level of IIT and the differences in country size. Helpman and Krugman (1985) and Bergstrand (1990) also observed that the volume of IIT is greatest between countries with similar size.

Helpman (1987) examined the effect of size dispersion on the trade intensity and the incidence of IIT for a group of fourteen developed countries. He applied a 'size similarity index', defined as a negative function of the variance of a country's GNP share in total GNP of the group. Helpman found both GNP similarity and trade intensity increasing over the estimated period of 1956 to 1981. He concludes that both country size and similarity are significant positive contributors to the level of IIT.

Grimwade (2000) emphasised that it is the magnitude of a country's GDP, not its geographical size, or size of population that matters. Thus, the larger the GDP the greater the scope for selling manufactured products. It can be equally argued that the larger the country, the greater the economies of scale, and thus, the lower costs of production and specialisation in differentiated products leading to greater share of IIT. Grimwade, however, mentioned that this phenomenon is not manifested uniformly in all countries, which may be due to the offsetting effect of other factors.

Some support to this argument was provided by McAleese (1979) in the study of trade of the Republic of Ireland. McAleese relates a relatively low IIT to the size of Ireland. The study by Glejser (1983) also provides indication of this notion. Grimwade (2000) suggests that this proposition may be reversed if the role of natural resources, that is usually associated with inter-industry trade, offsets the effect of the country's size effect on IIT. Australia is a good example of this phenomenon. While being a relatively large country, Australia, however, has a relatively low incidence of IIT (see for instance Siriwardana 1990).

Distance

Balassa (1986c) relates the extent of IIT to another factor, the *distance*. He emphasised the role of information in markets for differentiated products and associated it with geographical proximity[123]. Balassa maintains that consumption of heterogenous products requires higher level of information than consumption of less differentiated products. Since search for information is costly, Balassa takes the view that as the average distance between trading partners increases, the availability of

[123] Similar view was taken by Lee and Lee (1993).

information diminishes while the cost of information rises, both leading to a decline in the extent of IIT. In fact, Balassa and Bauwens (1987) found that proximity and a common border have a positive and significant effect on the level of IIT. As the rising average distance from the country's trading partners is assumed to inflate associated transaction costs, the level of IIT is hypothesised to be inversely related to the average distance (Balassa, 1986a; Balassa and Bauwens, 1987; Hellvin, 1994).

Krugman (1980) suggests that while higher transportation costs are likely to inversely influence IIT, inter-industry trade will be also discouraged. Grubel and Lloyd (1975) showed that high transportation costs lower IIT. Based on the analysis of Malaysian IIT in manufactured products, Thorpe (1995) found that transportation costs have a negative effect on IIT. Ratnayake and Athukorala (1992) pointed out that, because of Australia's geographically distant position from its trading partners this factor may play potentially a significant negative role in Australia's trade. In the study of Australia's IIT by Siriwardana (1990), a considerable growth in IIT with Asian countries was recognised. Among other factors, Siriwardana this associated with the effect of the geographical proximity.

Loertscher and Wolter (1980) and Helpman (1981) suggest that geographical closeness often means similarity in preferences and habits that stimulate IIT. Gray and Martin (1980) suggest that since demand elasticities for differentiated products are high, IIT is expected to be more responsive to variation in transportation costs. Venables and Limão (2002) for instance believe that distance and geographical location are vital explanatory variables in determining trade flows. They analysed the trade and production patterns of countries located at varying distances from 'economic centre' and found that production and trade patterns depend not only on factor endowments and factor intensities but also on the country's location and the transport intensities of different products. Venables and Limão argue that remoteness in particular, through implications on transport costs and prices, leads to a reduction of real income.

Trade Barriers and Trade Liberalisation

Sharma (2000) pointed out that there are two types of country-specific barriers that influence trade, *natural* trade barriers generated by geographical distance and consequently influencing transport costs, language or cultural barriers, and *artificial* trade barriers generated by tariff and non-tariff restrictions, immigration policies and capital controls.

The above arguments are based on the assumption of absence of distortions in the market. However, Falvey (1981) showed that a rise in the price of foreign goods due to a tariff imposition, leads to an increase in demand for domestically produced varieties and consequently to a reduction of trade in differentiated products. Greenaway and Milner (1984) also pointed out that if the artificial trade barriers are present tradable goods become non-tradable, leading to a reduction in IIT.

Much attention has been given to the effect of trade barriers on IIT. Some studies conclude that the lower and more similar are the barriers between trading countries, the higher is the incidence of IIT among those countries (Hufbauer and Chilas, 1974; Pagoulatos and Sorenson, 1975; Caves, 1981; Kim, 1992; Clark, 1993; Stone and Lee, 1995; Thorpe, 1995). Loertscher and Wolter (1980) also hypothesise that the incidence of IIT among countries is higher if barriers to trade are low.

Whereas reduced barriers to trade are expected to have a positive effect on both inter- and IIT, there is a widespread belief that IIT will be positively related to trade liberalisation (Gray and Martin, 1980; Drabek and Greenaway, 1984; Greenaway *et al*., 1989). The earliest empirical studies by Balassa (1966) and Grubel (1975) showed that tariff reductions promote IIT. Trade liberalisation expands the markets and allows for increasing returns to scale as well as for a greater variety of products offered to the market (Tharakan, 1986). A number of empirical studies tested the effect of trade liberalisation on the level of IIT (Caves, 1981; Balassa and Bauwens, 1987; Marvell and Ray, 1987). Globerman and Dean (1990) take the view that, assuming other factors constant, trade liberalisation should raise IIT.

Globerman (1992) studied the effect of the formation of the North American Free trade Agreement on the patterns of trade between the U.S. and Mexico. Given the differences in factor endowments that are likely to generate adjustment costs associated with reallocation of resources, Globerman proposes a stronger effect on inter-industry trade. However, the findings from the analysis of U.S.-Mexico trade patterns over the 1980s show that freer trade between the two countries resulted in a growth of IIT. Clark (1993) maintains that trade liberalisation by broadening markets increases the country's exports and imports. IIT is therefore expected to be greater in industries producing differentiated products at increasing returns. Marvel and Ray (1987) argue that trade liberalisation may, through increased imports result in the exit of some domestic firms from the market, and consequently to an increase in inter-industry trade. Or, alternatively, it may result in an increased export of more limited varieties and therefore, in an increase of IIT.

Caves (1981) suggests that there is no obvious relation between the volume of IIT in manufactures and the level of trade liberalisation. In the study of the determinants of IIT in the industrial countries, Caves (1981) postulates that artificial trade restrictions dampen IIT. He, however, suggests that the effects of policy changes on trade should be considered carefully. If countries engaged in mutual trade and both reduce tariff rates, the volume of IIT may increase, but the proportion may remain the same. Caves implies that the link between IIT and trade liberalisation may be a short-run phenomenon and accordingly it may not be explicit in the cross-sectional data. Caves comments that IIT may be justified by the structures and the conduct of international product markets rather than by the trade controls.

Matthews (1995) investigates the determinants of IIT as well as the differences in determinants between the groups of trading partners, in particular between Australia's traditional and newly emerging trading partners. The study suggests that relative per capita incomes, relative factor endowments, the level of trade barriers and distance are influential factors of trends in IIT. According to the results Australia can expect a significant improvement in the IIT with Asia-Pacific countries as the incomes in those countries rise. The study also indicates that reduction in trade barriers would encourage IIT for all trading partners. Sharma (2000) examined the recent trends in IIT in Australian manufacturing and identified the determinants of inter-industry variations in IIT in both the pre- and post-liberalisation periods. The findings indicate an increase in IIT from 28 percent in the late 1970s to 37 percent in the early 1990s.

The results also reveal that the industries that experienced a significant reduction in protection are the industries with the higher incidence of IIT.

Capital and Labour Endowments

It is usually claimed that the more similar are countries in their factor endowments, the greater the level of IIT between them. On the other hand, the greater the differences in relative capital-labour factor endowments, the lower the share of IIT (Krugman, 1981; Helpman, 1981; Hellvin, 1994). However, empirical studies testing the effect of a country's endowment on IIT provide inconclusive results. For instance, Clark (1993) reports and inverse relationship between the capital-labour ratio and IIT, Narayan and Dardis (1994) found a positive relationship between the two. Torstensson (1991) empirically tested the hypothesis of the direct relationship between capital endowments, being approximated by per-capita income, and the quality of traded goods. Although his findings provide empirical support for the theory, he maintains that more empirical tests, in particular at a disaggregated or industry level are needed.

Torstensson (1991) tested whether vertical IIT can be explained by differences in factor proportions. Based on 23 countries he found that there is a relationship between the quality of trade in vertically differentiated products and the factor endowments. In his later study Torstensson (1996b) examined a separate effect of physical and human capital. The findings indicate that human capital has a stronger effect than a physical capital in determining the quality of products.

Mora (2002) found that differences in technological and human capital endowments are important determinants of countries' specialisation over the quality range within industries in intra-EU intra-industry trade. Mora detected, in industries with a demand growth and an average technological content, a positive relationship between an abundant endowment of human capital and the level of quality of exports.

The Degree of Integration between Countries

A number of empirical studies support the hypothesis that countries that are close geographically, or reduced or mutually eliminated the trade barriers, experience relatively higher level of IIT (see for instance, Grubel and Lloyd, 1975; Kreinin, 1979; Glejser, 1983; Balassa and Bauwens, 1987) for the effect of the membership in European Community. However, this phenomenon was observed in other regions too, also including some developing countries. Balassa (1979) for instance found a relatively higher IIT between the Latin America Free Trade Area and the Central American Common Market than between these countries and the rest of the world. Balassa and Bauwens (1987) noted that the formation of the European Economic Community and Latin America Free Trade Area had a positive and highly significant impact on the level of IIT.

Menon and Dixon (1996b) examined the effect of Regional Trading Agreements (RTAs), in particular of the Australia-New Zealand Closer Economic Relations Trading Agreement (ANZCERTA)[124] on Australian and New Zealand trade. They found that while the contribution of IIT to the growth in trans-Tasman trade has been important in both periods, its contribution is particularly significant during the period

[124] The ANZCERTA was signed on 1 January 1983, it included all goods traded between the two countries (Ibid, p. 5),

1986 to 1991. They further report that while intra RTA trade contributes only 4.55 percent of the growth in Australia's total multilateral trade between 1986 and 1991, intra RTA trade contributes a markedly high share of 29.58 percent to the overall growth in IIT of 165.75 percent. The contribution of intra RTA trade to the growth in New Zealand's IIT is even greater.

Thorpe (1995) tested the effect of the ASEAN on the level of Malaysian IIT in manufactured products and found a positive and significant relationship between the two. Other studies that examined the link and importance of IIT to Regional Trading Agreements (ATAs) include Balassa (1963), Grubel and Lloyd (1975), Drabek and Greenaway (1984), Globerman and Dean (1990). Ratnayake and Athukorala (1992) observed that product differentiation, overseas investment and close economic relationship with New Zealand to be the variables favourably influencing IIT in Australia.

The Existence of Large Trade Imbalances between Countries

Grimwade (2000) mentioned that if the method of measuring IIT fails to account for trade imbalances, significant trade imbalances between countries are likely to result in lower IIT ratios. Lee and Lee (1993) examined the extent of Korea's bilateral IIT in manufactures from 1977 to 1986 for 144 industries, at a three-digit level of SITC and observed that, during that period, the share of aggregate IIT increased and the pattern shifted toward that of developed countries. Lee and Lee also tested the effect of a number of country-specific characteristics on IIT. In addition to commonly tested characteristics with respect to income, the country size, and the distance, they estimated the effect of the trade intensity with trading partners. The rationale for that is that as trade volume with a country increases, there is more opportunity for trade in more differentiated products, and consequently for IIT. In order to avoid potential bias in estimating the determinants of IIT, they specified a variable representing the effect of trade imbalances on IIT. The findings of the analysis conform to a priori expectations with respect to all tested hypotheses. Lee and Lee noted a negative relationship between the extent of trade imbalances and IIT.

7. 6 Summary and Conclusion

In this chapter various theoretical and empirical approaches to IIT have been discussed. The growing incidence of IIT in total trade has encouraged a number of researchers to concentrate on various aspects of IIT. Some focussed on theoretical justification, others dealt with the measurement, empirical analysis of pattern and the determinants of IIT. The evidence of considerable incidence of IIT between similar countries challenged the traditional trade theory, and as a response, an alternative trade theory emerged in the late 1970s and the early 1980s. A common feature of this literature is the potential effect of domestic market structure on the patterns and the extent of trade. A number of explanations have been forwarded to justify the incidence of IIT. Based on the empirical evidence, it appears that the diversity of consumer tastes and preferences, heterogeneity of products, economies of scale are regarded as main constituents in significant growth in IIT in the past decades.

Researchers offer a number of explanations to rationalise IIT. The major explanation focuses on product differentiation. It is based on the assumption that consumers view products from the same industry as close, however, not perfect substitutes. Yet, the fact that a limited number of varieties are supplied to the market suggests that demand side argument is not sufficient to explain growth in IIT. Economies of scale in production, which result in reduction of costs with an increase in output, limit the number of varieties and consequently encourage trade amongst various varieties of the same products. Thus, even if the countries have the same factor endowments, economies of scale discourage each country from producing a self-sufficient level of output. However, if economies of scale are involved it is important to distinguish between the local and world markets. While prior the trade the relative size of the local market is important to benefit from specialisation, once the trade is involved, the size of the world market becomes more relevant.

A number of empirical studies have demonstrated that, in the presence of demand similarity between countries and preference diversity between consumers, product differentiation leads to IIT between countries. A positive effect of product differentiation can be based on differences in attributes (horizontal product differentiation), on differences in qualities (vertical product differentiation) and on improved product variety (technological differentiation).

The emergence of several different theories of IIT led to different adaptations of the empirical methods of measuring IIT. A number of methods to measure the extent of IIT, their limitations and applications were also discussed. Various views on the issue of the inclusion of trade imbalances in calculating intra-industry trade indices were unveiled. The problem of aggregation in assigning products to classification groups within the Standard International Trade Classification was addressed.

The review of empirical studies of IIT indicates their variation in many aspects, including the hypotheses tested, specification of the variables, methods of measurement of IIT, countries considered and of the time period analysis. Despite this diversity, some consistent findings pertaining the factors influencing IIT have emerged, however, no complete consensus regarding the determinants of IIT has been reached. The studies addressing bilateral trade revealed that, in accordance with theoretical models, similarity in industrial structure, demand patterns and size of countries are important 'country-specific' characteristics. There is an apparent evidence that that IIT tends to be higher among countries that are similar with respect to market size, income and factor endowments. However, the role of other factors, such as trade barriers, foreign direct investment (FDI), transportation costs have been less pronounced. In multilateral trade studies the size of countries and their average income have been highlighted as positive influential factors, while membership in formal trade arrangements effect is unclear. Generally, it is claimed that the industrial countries have higher incidence of IIT than developing countries, although there appears to be a degree of variation even within these groups. It also appears that there is better knowledge of the country pattern of IIT than of its industry pattern.

The focus of the next chapter (Chapter 8) is on the empirical analysis of the extent, trend and determinants of Australia's intra-industry trade in textiles and clothing. Econometric analyses of the determinants will be carried out first for Australia's IIT in TAC with the rest of the world, and next for IIT in TAC between Australia and its major trading partners.

Chapter 8

AUSTRALIA'S INTRA-INDUSTRY TRADE IN TAC – AN ANALYSIS OF EXTENT AND DETERMINANTS

8. 1 Introduction

A review of theoretical and empirical studies on various aspects of IIT was provided in Chapter 7. The purpose of Chapter 8 is to present an empirical analysis of the extent and determinants of Australia's IIT in TAC. First, the extent of Australia's IIT in TAC with the rest of the world (ROW) is examined. For comparison purposes, the extent of IIT in TAC of Australia's major trading partners is presented. Second, the historical trend of bilateral IIT between Australia and its trading partners is discussed. Third, the determinants of Australia's IIT in TAC are examined. The chapter is structured as follows. In Section 8.2, the extent of IIT in Australia's TAC is presented and compared with the extent of IIT of Australia's major trading partners in TAC. The section also includes the analysis of the bilateral IIT in TAC between Australia and its major trading partners. Econometric models of determinants of IIT in TAC and hypotheses to be tested are presented in Section 8.3. Two separate models are developed for each group, one for IIT between Australia and the ROW and another for Australia and its major trading partners. Prior to the estimation, in Section 8.4, the data and data sources are discussed. Section 8.5 focuses on the presentation and discussion of results of econometric estimation of the models concerned with the determinants of IIT in TAC. Major findings of the analysis are summarised in Section 8. 6.

8. 2 Australia's IIT in TAC Products

This section presents an overview of the extent and trend of IIT in TAC. The time series of IIT was compiled from the NAPES database. At the time of the analysis, a complete data set for TAC was available for the period 1965 to 1999.

Based on the examination of the extent of the total bilateral trade (exports + imports) between Australia and the ROW for the period 1965 to 1999, the following countries have been identified as Australia's major trading partners in TAC: China, Hong Kong, India, Japan, Korea, New Zealand, Taiwan, United Kingdom, the United States. Table 8.1 presents Australia's IIT in TAC with the ROW for each year during 1965 to 1999, based on the three-digit SITC. Table 8.2 compares IIT in textiles and clothing for Australia with the ROW and each of Australia's major trading partners with the ROW for five-year intervals during 1965 to 1999[125]. Indicators of the bilateral IIT between Australia and its trading partners are shown in Table 8.3.

From Table 8.1 it is apparent that Australia's IIT has been generally low over the period 1965 to 1999. 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-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.

125 The last period is for four years instead for five years.

Table 8. 1: **Intra-Industry Trade, Textiles and Clothing, Australia and the Rest of the World (ROW), (%), 1965-1999**

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)[126]	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
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

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

(Table 8.1 continued)

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)[127]	Fur Clothing (842)
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

Compiled from the NAPES database.

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

An overall comparison of IIT indices for textiles and clothing reveals that whereas Australia's IIT in clothing in 1965 were almost four times higher, 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 between 5-10 percent in the 1960s to between 30-50 percent in the 1990s.

When the individual subcategories are considered, it is evident that Special textile products (SITC 655) has maintained the highest level of IIT over the period. However, based on the comparison of the index values it can be observed that the highest increase 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.

The values of the intra-industry trade index in Table 8.2 reveal that, compared to its trading partners, Australia has experienced a relatively low extent of IIT in TAC with the ROW between 1965 and 1999. A closer scrutiny of the values in Table 8.2 indicates that overall in textiles the highest level of IIT, in particular in the 1990s, tends to be in category 655-Special textile products, followed by categories 657-Floor coverage, tapestry etc. In the clothing industry it is apparent that the extent of IIT in category 842-Fur-clothing is significantly greater in both absolute as well as in relative terms than in the category 841-Not-of-fur clothing.

Table 8.2 also reveals that, overall, most countries have experienced an increase in the extent of IIT with the rest of the world, some to a higher degree (such as China, Japan, New Zealand, and India in textiles and Hong-Kong and Taiwan in clothing) and others to a moderate degree (Korea, United Kingdom, the United States in textiles). Some countries, however, marked a reduction in IIT between 1965 and 1999 (Hong Kong and Taiwan in textiles and the United Kingdom and the United States in clothing). For instance, while in general, Japan's IIT in textiles has risen significantly, in clothing IIT rose between the 1970s and 1980s since 1990 it has been declining. A similar pattern can be observed in clothing, where the decline is even more pronounced.

New Zealand's IIT marked a steady increase in all textile categories over the period. Whereas Taiwan has demonstrated an overall reduction in IIT in textiles, it has shown a considerable increase in the level of IIT in clothing, from a very low level (around 0.5 percent) during the 1970s and 1980s, in the 1990s it has increased the level of IIT in clothing to a remarkable near 50 percent. An almost reverse situation occurred in the United Kingdom and the United States. While both countries experienced a notable increase in IIT in textiles (category 65), their IIT in clothing marked a near half reduction.

The level and historical trend of Australia's bilateral IIT in TAC with its trading partners are presented in Table 8.3. An examination of the values over the entire period reveals that New Zealand is Australia's major trading partner in intra-industry trade of both textiles and clothing, while the United States is the major intra-industry trading partner in clothing.

Generally, between the 1960s and 1980s, Australia experienced a low level of bilateral IIT in both textiles and clothing. 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.

In summary, Australia is a country with a relatively low level of IIT in TAC trade. However, since the mid 1980s, the values of the index indicate a rising proportion of intra-industry trade in most categories of TAC. Thus, it may be argued that Australia may attempt to exploit forms of competition other than comparative advantage, such as product differentiation and improved quality and design. With a growing number of Australian retailing firms penetrating foreign markets, Australia may potentially improve its competitiveness in at least some categories of TAC production by implementing an effective promotion strategy. Whether Australia has necessary expertise or scope to acquire such expertise in order to further increase product differentiation and improve quality and design in TAC products is a question which falls outside the scope of this study and thus requires further research.

Table 8. 2: **Intra-Industry Trade, Australia's Trading Partners and the ROW, Textiles and Clothing, (%), Selected Years**

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)[128]	Fur Clothing (842)
	AUSTRALIA and the ROW										
1965	7.58	15.90	3.55	10.90	3.31	13.80	3.84	3.38	29.10	29.00	37.80
1970	14.70	20.00	6.16	19.00	15.60	24.00	16.90	9.19	40.70	40.40	65.50
1975	10.80	13.00	4.07	11.90	14.00	35.30	9.28	5.06	12.80	12.30	70.90
1980	12.30	19.50	2.41	9.53	10.00	35.10	6.32	10.60	13.70	12.40	99.00
1985	15.60	24.60	4.60	9.20	11.00	31.40	10.40	20.30	8.91	8.26	39.40
1990	21.00	8.92	13.20	15.70	12.10	48.90	29.60	42.00	29.00	28.70	59.50
1995	35.40	33.30	35.40	25.80	22.50	53.80	37.70	50.50	30.00	29.80	63.70
1999	37.90	34.90	32.00	36.10	42.70	44.20	34.00	54.90	34.40	34.20	73.10
	CHINA and the ROW										
1965	22.90	98.00	2.84	25.90	28.30	57.60	11.20	1.68	2.30	2.30	0.00
1970	22.80	90.30	0.22	21.20	2.77	58.10	5.84	1.22	2.81	2.85	0.19
1975	17.80	53.10	1.06	35.00	4.99	38.20	2.52	0.48	0.14	0.15	0.02
1980	43.90	81.60	16.60	75.10	34.40	88.40	2.95	1.18	2.43	2.52	0.53
1985	61.70	86.20	29.90	87.40	94.80	55.20	4.36	8.58	5.31	5.33	3.15
1990	59.30	62.60	75.80	66.20	89.50	34.70	6.48	12.80	1.30	1.28	2.01
1995	72.00	98.00	61.30	91.00	75.60	51.90	3.64	9.62	7.63	7.57	13.00
1999	71.90	98.80	74.10	86.60	69.60	53.00	1.84	8.98	7.02	7.00	9.00

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

(Table 8. 2 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
					HONG KONG and the ROW						
1965	64.80	63.80	85.30	11.90	33.20	46.00	95.70	92.30	22.10	22.10	56.70
1970	42.20	25.90	75.00	18.50	30.00	21.20	80.50	55.40	12.40	12.30	89.50
1975	56.70	34.20	91.80	39.10	31.40	22.50	80.10	39.60	9.92	9.86	14.60
1980	46.90	20.30	95.20	26.90	31.80	31.80	57.90	78.70	26.00	26.50	10.60
1985	38.00	14.70	81.20	21.30	48.20	37.70	70.10	50.50	45.70	46.70	17.50
1990	35.20	14.60	76.40	26.40	49.10	29.80	35.10	26.60	86.10	86.80	53.00
1995	19.40	6.61	48.40	14.20	38.90	10.50	14.60	5.35	86.00	86.00	86.60
1999	17.70	6.83	47.00	8.71	39.30	5.41	11.90	0.83	78.90	79.10	42.10
					INDIA and the ROW						
1965	7.57	67.70	0.13	0.82	11.60	82.30	3.04	4.15	0.80	0.80	.
1970	3.93	16.00	0.05	0.23	9.44	89.20	4.25	0.24	1.61	1.61	0.00
1975	4.84	61.50	0.10	0.54	7.55	45.30	1.14	0.02	0.26	0.26	0.00
1980	10.80	94.30	0.03	0.60	5.68	94.50	0.42	0.05	0.07	0.06	28.90
1985	16.80	89.30	1.42	9.02	29.10	51.50	9.54	0.00	0.21	0.21	4.29
1990	20.20	56.50	10.40	13.90	37.80	73.40	0.95	0.00	0.08	0.05	59.30
1995	13.70	17.40	4.28	19.50	67.40	74.60	0.38	0.26	0.14	0.14	0.00
1999	17.60	20.10	4.39	29.10	30.50	81.20	6.99	1.78	0.64	0.64	0.32

(Table 8. 2 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
JAPAN and the ROW											
1965	8.32	5.35	1.70	12.00	23.80	9.33	6.18	15.10	5.10	5.03	61.50
1970	22.70	16.00	27.60	22.40	51.00	24.80	22.30	48.20	32.50	32.40	48.80
1975	41.80	50.40	49.90	33.50	64.50	28.50	98.20	97.90	76.20	79.50	3.65
1980	46.60	56.20	62.70	34.50	57.40	45.90	64.20	92.20	49.20	52.20	0.91
1985	52.60	82.40	59.10	31.30	77.80	53.60	60.80	78.10	53.50	57.60	0.71
1990	67.10	92.90	72.30	61.10	99.80	67.60	23.60	16.40	12.20	12.70	0.56
1995	57.90	88.90	77.90	55.60	64.90	61.30	9.13	5.07	5.49	5.52	1.62
1999	52.70	97.20	64.60	39.30	53.20	67.20	9.76	6.20	5.52	5.55	1.53
KOREA and the ROW											
1965	38.70	21.80	37.20	66.20	13.20	55.90	21.70	9.27	4.25	4.25	0.00
1970	49.30	37.30	23.20	65.00	81.30	77.30	36.60	11.00	0.47	0.46	14.90
1975	56.30	39.50	51.50	70.60	32.10	81.30	9.94	3.72	0.66	0.65	1.41
1980	31.40	30.10	46.80	32.20	24.20	44.10	5.24	12.80	0.91	0.82	3.48
1985	40.30	49.90	53.10	35.90	25.30	67.60	3.63	29.10	0.72	0.69	1.60
1990	48.60	85.40	64.40	37.10	31.80	50.60	12.90	87.10	3.72	3.56	12.50
1995	44.90	90.80	82.30	30.70	28.80	35.40	26.00	60.00	34.90	34.30	68.90
1999	41.00	99.40	63.80	23.70	13.10	23.90	19.40	88.30	27.10	26.90	61.00

(Table 8. 2 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
NEW ZEALAND and the ROW											
1965	2.16	3.16	0.01	0.06	0.10	1.46	1.49	36.40	10.40	10.40	0.00
1970	10.90	37.00	0.09	2.80	0.51	5.57	10.70	33.90	77.20	77.60	58.20
1975	13.70	46.30	0.33	4.30	3.52	7.01	22.00	15.30	97.70	100.00	11.90
1980	29.70	94.50	0.97	5.80	12.10	14.60	30.50	25.70	66.60	78.70	1.63
1985	36.90	80.80	0.77	10.50	62.40	13.50	91.00	29.60	80.80	96.80	4.13
1990	42.10	82.50	5.15	14.40	46.40	25.90	39.80	75.50	44.90	48.50	2.37
1995	43.30	77.90	18.60	19.30	61.90	26.60	45.90	79.20	49.60	52.30	4.26
1999	51.20	98.00	16.30	31.60	68.10	27.50	32.60	83.70	40.80	41.30	16.20
TAIWAN and the ROW											
1965	44.80	64.60	0.14	97.90	23.30	77.30	40.60	3.57	2.95	2.95	0.00
1970	51.60	61.60	8.83	94.90	44.60	46.10	22.10	5.74	0.60	0.55	48.10
1975	28.20	25.30	6.99	37.60	44.40	61.70	9.03	4.42	0.46	0.45	11.20
1980	28.00	14.70	25.80	37.80	34.70	37.80	26.20	10.90	0.49	0.49	2.76
1985	26.20	19.50	27.60	32.80	36.20	29.50	6.98	22.10	0.45	0.42	12.90
1990	28.40	37.90	34.40	21.70	17.40	27.00	24.00	72.60	13.80	13.70	57.60
1995	26.90	44.70	43.60	19.70	21.20	14.70	28.30	96.50	43.20	43.20	31.80
1999	23.70	65.80	32.10	8.91	11.60	16.30	36.70	92.90	45.60	45.80	3.00

(Table 8. 2 continued)

	TEXTILES								CLOTHING		
YEAR	65	651	652	653	654	655	656	657	84	841	842
					UK and the ROW						
1965	61.70	52.70	77.60	53.40	81.40	33.20	91.60	86.30	92.80	93.80	52.60
1970	70.30	68.80	66.70	65.80	89.30	81.90	99.60	65.70	95.90	96.60	65.00
1975	84.40	90.10	54.40	99.20	87.50	79.60	80.40	67.20	68.90	68.40	98.10
1980	87.00	92.10	64.40	90.90	86.30	88.60	78.20	94.60	79.30	80.30	43.20
1985	71.10	79.70	45.00	68.10	75.60	86.70	68.10	77.90	72.20	72.20	70.40
1990	76.90	89.50	59.60	69.70	73.30	97.80	73.20	68.30	60.80	60.70	72.90
1995	77.40	74.00	63.20	76.80	70.60	100.00	76.60	75.00	69.80	69.90	67.00
1999	75.80	73.30	64.30	81.00	83.40	99.50	56.00	61.10	51.10	51.10	81.30
					USA and the ROW						
1965	66.60	66.80	88.90	48.40	87.80	95.70	81.30	48.80	41.50	41.20	85.30
1970	69.40	78.90	78.60	46.50	84.30	97.90	89.40	76.10	27.30	27.10	62.30
1975	81.00	60.80	74.20	93.30	75.90	94.80	69.40	82.10	27.30	26.50	99.70
1980	82.40	41.30	89.30	94.80	72.80	74.10	94.60	96.40	28.90	27.30	96.40
1985	61.00	89.20	37.10	54.10	94.30	98.80	23.60	63.80	8.54	8.15	21.40
1990	70.90	73.90	60.90	71.10	97.70	82.90	42.20	91.20	16.50	16.30	35.20
1995	74.60	98.90	65.40	80.60	98.50	77.20	35.50	81.90	26.70	26.50	65.40
1999	73.30	93.10	84.10	81.20	90.30	80.90	29.50	69.30	23.60	23.50	52.70

Table 8. 3: **Bilateral Intra-Industry Trade, Textiles and Clothing, Australia and Major Trading Partners, (%), Selected Years**

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
AUSTRALIA and CHINA											
1965	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.02	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.0	.
1975	0.07	0.00	0.00	2.10	0.00	0.00	0.00	0.00	0.35	0.4	0.0
1980	3.31	35.00	0.00	2.50	1.32	1.37	0.01	0.00	0.22	0.2	0.0
1985	8.4	27.4	0.0	0.2	7.8	16.7	0.0	0.1	0.2	0.2	0.0
1990	10.0	25.8	15.6	9.7	0.4	32.6	0.0	8.1	0.0	0.0	0.0
1995	18.1	86.8	6.8	15.2	24.6	63.8	1.0	59.0	1.4	1.4	10.4
1999	11.4	28.8	7.1	15.4	30.9	43.2	0.4	17.3	2.4	2.4	2.7
AUSTRALIA and HONG KONG											
1965	4.8	11.3	0.5	39.4	5.8	43.5	14.3	67.5	5.7	5.7	0.0
1970	16.2	75.3	0.4	43.1	67.9	40.7	13.3	96.3	10.1	9.9	26.7
1975	5.1	3.5	1.0	27.3	39.1	69.4	10.4	72.4	2.2	2.2	50.0
1980	5.8	4.9	2.0	10.0	26.1	21.7	3.5	96.7	2.6	2.4	91.3
1985	7.7	3.3	1.5	25.6	78.9	8.1	22.5	42.8	1.7	1.7	4.0
1990	21.8	33.5	4.6	19.6	16.4	81.8	70.8	87.0	11.9	11.9	2.2
1995	50.6	68.3	30.8	49.1	65.0	52.9	92.2	9.6	41.0	41.0	26.8
1999	69.5	72.8	45.1	89.3	38.1	83.4	74.0	25.0	86.6	86.6	18.2

(Table 8. 3 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
AUSTRALIA and INDIA											
1965	0.1	0.0	0.0	0.0	0.0	33.3	0.2	0.0	0.0	0.0	.
1970	0.4	0.0	0.0	0.0	0.0	82.7	0.0	0.0	0.0	0.0	.
1975	0.1	0.0	0.0	0.0	0.0	23.5	0.1	0.0	0.1	0.1	0.0
1980	2.3	27.1	0.0	0.0	0.0	64.1	0.0	0.0	0.0	0.0	0.0
1985	0.8	0.0	0.0	0.1	0.0	95.2	0.0	0.0	0.0	0.0	0.0
1990	2.5	11.9	0.0	0.9	1.7	70.2	0.3	0.0	0.1	0.1	.
1995	10.8	1.1	2.6	67.1	67.9	86.6	0.1	0.0	0.0	0.0	.
1999	2.9	1.9	0.4	3.8	11.4	57.4	0.8	0.7	0.4	0.4	.
JAPAN											
1965	0.5	0.7	0.0	1.3	0.0	0.1	2.6	0.9	4.1	3.8	60.0
1970	2.2	0.0	0.2	2.2	0.2	5.9	2.0	36.2	15.5	14.6	49.4
1975	1.6	0.0	0.3	0.7	1.1	20.2	2.2	16.3	6.1	5.7	10.2
1980	1.2	0.1	0.5	0.3	0.1	7.8	4.3	64.5	21.4	23.7	0.0
1985	0.9	0.2	0.0	0.0	0.1	6.7	27.3	6.6	6.8	6.7	9.8
1990	5.5	3.5	1.4	1.3	3.6	24.8	82.8	83.3	65.1	68.9	1.1
1995	14.9	20.1	12.3	2.5	5.2	45.8	66.9	63.2	65.7	67.8	2.0
1999	20.0	15.6	12.0	15.7	2.9	29.8	65.6	80.5	71.6	71.7	31.3

(Table 8. 3 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
AUSTRALIA and KOREA											
1965	23.0	0.0	0.0	84.7	0.0	0.0	.	.	34.8	34.8	.
1970	12.3	33.3	0.0	2.8	0.0	5.7	28.6	100.0	0.7	0.7	.
1975	0.6	0.0	0.0	0.0	.	6.6	0.0	0.0	0.1	0.1	0.0
1980	2.9	0.0	0.0	0.9	4.9	58.4	0.0	7.1	0.0	0.0	0.0
1985	5.3	1.0	0.0	0.8	0.0	63.3	0.0	16.1	0.0	0.0	0.0
1990	4.1	0.5	0.7	0.8	0.1	40.1	1.7	48.4	0.6	0.3	24.9
1995	8.6	9.6	21.9	2.0	9.9	60.4	23.8	61.6	11.0	10.5	49.6
1999	7.1	8.4	4.2	2.0	4.5	17.8	35.5	17.9	7.2	7.2	0.0
AUSTRALIA and NEW ZEALAND											
1965	5.9	3.3	0.0	3.4	17.2	14.6	13.0	18.1	24.8	24.6	40.0
1970	31.5	77.7	0.3	42.7	35.7	15.1	49.8	6.2	34.0	34.2	0.0
1975	38.8	90.0	5.7	55.7	99.1	25.0	84.5	1.3	16.8	17.8	0.0
1980	31.9	30.9	17.8	56.5	83.4	43.8	45.3	20.3	39.3	41.6	2.1
1985	29.4	25.4	4.3	65.6	37.6	47.5	12.7	23.9	25.5	31.5	4.1
1990	56.8	37.3	6.4	61.8	70.0	54.6	91.6	62.6	87.8	90.2	3.7
1995	70.1	55.0	21.4	88.7	65.1	75.9	88.2	63.2	93.5	95.3	4.1
1999	69.9	37.7	18.7	90.6	74.5	81.1	94.1	70.3	99.4	99.6	36.3

(Table 8.3 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
					AUSTRALIA and TAIWAN						
1965	0.9	51.1	0.0	0.0	66.7	0.0	0.0	0.0	0.0	0.0	.
1970	2.7	38.4	0.0	24.3	0.0	0.0	21.8	0.0	0.0	0.0	.
1975	0.7	0.4	0.1	1.3	0.0	7.2	0.5	0.0	0.0	0.0	.
1980	3.4	0.0	0.0	2.0	2.4	34.5	0.2	3.8	0.0	0.0	0.0
1985	6.1	5.7	0.0	0.9	0.0	49.0	0.1	4.1	0.1	0.0	25.6
1990	6.5	0.2	6.0	1.6	0.1	60.6	13.1	16.9	2.0	1.9	55.3
1995	12.0	13.7	12.0	3.6	1.3	33.3	30.1	85.6	24.8	24.9	1.9
1999	8.4	18.7	1.9	1.4	2.5	26.3	15.5	75.9	6.6	6.6	10.0
					AUSTRALIA and UK						
1965	1.5	3.2	1.1	1.2	1.9	0.4	1.6	0.3	22.1	21.9	25.5
1970	2.2	0.6	0.7	2.4	1.1	1.7	19.7	1.2	19.5	19.4	51.2
1975	1.6	0.9	1.7	4.3	1.3	0.6	2.2	0.4	18.1	18.1	40.9
1980	1.7	1.3	1.2	1.5	2.5	1.5	5.2	1.9	5.2	5.0	88.0
1985	2.8	1.0	6.0	4.7	0.7	1.3	3.9	13.2	8.3	8.2	90.9
1990	17.4	21.6	10.1	21.4	4.1	3.9	55.3	5.7	64.5	64.6	40.0
1995	53.6	94.4	64.1	31.8	10.5	27.8	65.9	49.0	64.6	64.6	0.0
1999	54.8	59.5	67.3	45.5	9.5	14.5	86.7	90.7	74.3	74.3	73.3

(Table 8.3 continued)

	TEXTILES								CLOTHING		
YEAR	**65**	**651**	**652**	**653**	**654**	**655**	**656**	**657**	**84**	**841**	**842**
					AUSTRALIA and USA						
1965	1.2	0.7	0.4	1.6	0.0	0.4	6.6	2.0	51.9	51.2	71.6
1970	6.3	29.4	0.2	3.3	0.0	0.1	24.4	2.4	67.5	69.6	9.0
1975	1.4	1.3	0.2	1.2	0.7	4.0	3.5	0.3	18.2	18.0	36.0
1980	2.2	3.6	0.3	1.1	1.3	3.0	2.5	3.4	73.9	78.5	11.9
1985	14.2	3.9	3.4	12.5	7.9	5.1	46.9	71.3	87.3	92.8	5.1
1990	18.1	0.5	16.1	13.4	8.3	26.8	74.6	18.7	55.5	56.8	0.9
1995	37.6	36.9	51.3	31.6	1.5	15.5	92.4	49.2	72.6	73.9	8.0
1999	41.4	36.9	19.5	27.8	28.7	23.3	89.0	87.7	36.9	37.5	1.7

Compiled from the NAPES database.

8. 3 Econometric Analysis of the Determinants of IIT in TAC

The outcome of the analysis of the extent and trend of IIT in TAC presented in the earlier sections indicates an increase in the level of IIT in recent years. In this section, econometric models specifying the determinants of IIT in TAC and the hypotheses to be tested are developed. Data and data sources are described in Section 8. 4. Empirical results obtained from the estimation of determinants of IIT between Australia and the rest of the world, and bilateral IIT between Australia and its major trading partners in TAC are presented and discussed in Section 8.5. The major findings and the conclusions drawn from the analysis are summarised in Section 8.6.

As it was observed earlier in this chapter, the extent of Australia's IIT in TAC varies across trading partners. Therefore, the hypotheses concerning the effect of various country characteristics on the extent of bilateral IIT flows are examined. The potential determinants and the hypotheses to be tested are derived from a wide range of theoretical and empirical studies reviewed in Chapter 7.

8. 3. 1 Empirical Specification of Models

Most of the previous empirical studies on IIT have used a version of the Grubel-Lloyd index of IIT as the dependent variable in their models. Following the suggestion by Vona (1991) and Somma (1994) that when dealing with a single industry, the assumption that the imbalance is consistent with disequilibrium, the 'unadjusted' Grubell-Lloyd index is adopted here as the dependent variable.

The choice of independent variables, (country- and industry-specific variables) stems mainly from the studies by Bergstrand (1990), Ratnayake and Athukorala (1992), Lee and Lee (1993), Narayan and Dardis (1994), Somma (1994), Matthews (1995), Stone and Lee (1995), Thorpe (1995), Torstensson (1996a), Nilsson (1999), Blanes and Martin (2000), Sharma (2000), and Sharma (2002).

The models specifying the determinants of intra-industry trade in Australia's textiles and clothing are presented below. Two types of models are specified for each industry group, the models of IIT between Australia and the rest of the world during 1970-1999 (Equations 8.1 and 8.2) and the models of bilateral IIT between Australia and its eleven major trading partners during the same period (Equations 8.3 and 8.4).

$$IITT_t = f\left(PD_t, RD_t, ERA_t, DED_t\right) + \varepsilon_t \tag{8.1}$$

$$IITC_t = f\left(PD_t, RD_t, ERA_t, DED_t\right) + \varepsilon_t \tag{8.2}$$

$$IITT_{it} = f\begin{pmatrix} ANI_{it}, DANI_{it}, ACI_{it}, DACI_{it}, AKL_{it}, DKL_{it}, \\ DIST_{it}, OPEN_{it}, TAGR_{it} \end{pmatrix} + \varepsilon_{it} \tag{8.3}$$

$$IITC_{it} = f\begin{pmatrix} ANI_{it}, DANI_{it}, ACI_{it}, DACI_{it}, AKL_{it}, DKL_{it}, \\ DIST_{it}, OPEN_{it}, TAGR_{it} \end{pmatrix} + \varepsilon_{it} \tag{8.4}$$

where,

$IITT_t$ = Grubel-Lloyd intra-industry trade index in textiles between Australia and the rest of the world in period t

$IITC_t$ = Grubel-Lloyd intra-industry trade index in clothing between Australia and the rest of the world in period t

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

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

PD_t = product differentiation in TAC in period t

RD_t = research and development expenditure in TAC in period t

ERA_t = effective rate of assistance for TAC in period t

DED_t = Australia's degree of economic development 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

$OPEN_{i\,t}$ = trade barriers 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.

Product Differentiation (PD)

It is argued that consumers' taste and preference diversities create demand for differentiated products, and both textile and clothing industries are typical examples of this circumstance. Another closely related factor influencing IIT is economies of scale. Economies of scale result in decreasing cost as production expands and thus, sustain specialisation in production of various varieties of the product. Given consumers' diversity in tastes and preferences both exports and imports are encouraged, leading to a greater level of IIT. However, the fact that TAC industries consist of a large number of relatively small firms, the economies of scale may not be significant, but a larger number of firms in the industry is likely to encourage product differentiation and hence IIT. Therefore, the decision was made to include only one variable representing product differentiation. It is expected that product differentiation is likely to generate more intra-industry specialisation and consequently a higher IIT. This hypothesis suggests a *positive* correlation between the extent of product differentiation and IIT.

Research and Development Intensity (RD)

It is generally believed that IIT tends to be higher in manufacturing industries involving a high degree of research and development activities. R&D activity can lead to a wide range of innovative outcomes and it can give the industry a technological advantage. Due to the relatively small-scale business operations, TAC industries may not be large enough to sustain expenses associated with research, development and innovation activities. However, R&D intensity[129] in the textile and clothing industries has been noticeably increasing in recent years (Sheehan *et al.*, 1995). Hence, R&D intensity is expected to be *positively* associated with IIT in TAC.

Effective Rate of Assistance[130] (ERA).

It is hypothesised that the extent of trade barriers restricts the volume and the range of products to be traded, and consequently the extent of IIT. Thus, highly assisted industries, such as textiles and clothing, are expected to have a lower share of IIT. The

[129] Usually measured as the ratio of R&D to value added.
[130] It measures the net assistance effect of government interventions for the industry (IC, 1997, p. 202). See also Chapter 2 of this thesis.

demand for imported varieties of products tends to be lower due to an effect of tariff rates, as well as other trade barriers. Therefore, a *negative* sign of the coefficient for *ERA* is anticipated.

Degree of Economic Development (DED)

The degree of economic development is directly related to the growth of a country's per capita income. On the other hand, the composition of demand is predetermined by the level of per capita income. A country with the higher per capita income would be more oriented towards higher 'quality' products. Thus, the degree of economic development is expected to be *positively* related to the level of IIT.

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 average GNP of Australia and its trading partners, the greater 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 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 with the variable representing the difference in the level of per capita income is therefore expected.

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

As pointed out by Dixit and Norman (1980), Helpman (1981) and Krugman (1980; 1981), 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)

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[131] 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.

[131] Siriwardana (1990) for instance, observed a considerable growth in IIT with Asian countries that he associates with Australia's growing importance in trade of developing countries and the effect of the geographical proximity in increasing trend of IIT.

Openness (OPEN)

It is hypothesised that the extent of trade barriers between countries restrict the volume and the range of products to be traded, 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[132]. While a *negative* relationship between the extent of the trade barriers is expected, given the indirect measure of this factor applied in this study, 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. Siriwardana (1990) for instance, examined bilateral IIT between Australia and a number of individual and grouped trading partners and found

[132] 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.

significant differences in the level of IIT among Australia's trading partners. As an example, while in 1968/69 East Asia was the major partner in IIT, in the early 1980s it was New Zealand. Siriwardana attributes a growing share in bilateral IIT to the very strong economic relations between the two countries.

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), 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 is a member 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 member 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. G.6-G.7). The membership in regional trading agreements, customs unions and the like, is expected to have a *positive* influence on IIT in textiles and clothing.

Having discussed the hypothesised relationships between IIT in textiles and clothing and the determinants, the models, variables and expected signs of the coefficients are presented below:

$$IIT_t = \alpha_o + \alpha_1 PD_t + \alpha_2 RD_t + \alpha_3 ERA_t + \alpha_4 DED_t + \varepsilon_t \qquad (8.5)$$
$$\qquad (+) \qquad (+) \qquad (-) \qquad (+)$$

$$IITC_t = \beta_o + \beta_1 PD_t + \beta_2 RD_t + \beta_3 ERA_t + \beta_4 DED_t + \varepsilon_t \qquad (8.6)$$
$$\qquad (+) \qquad (+) \qquad (-) \qquad (+)$$

$$IITT_{it} = \delta_0 + \delta_1 ANI_{it} + \delta_2 DANI_{it} + \delta_3 ACI_{it} + \delta_4 DACI_{it} + \delta_5 AKL_{it} +$$
$$\qquad (+) \qquad (-) \qquad (+) \qquad (-) \qquad (+) \qquad (8.7)$$
$$+ \delta_6 DKL_{it} + \delta_7 DIST_t + \delta_8 OPEN_{it} + \delta_9 TAGR_{it} + \varepsilon_{it}$$
$$(-) \qquad (-) \qquad (+) \qquad (+)$$

$$IITC_{it} = \phi_0 + \phi_1 ANI_{it} + \phi_2 DANI_{it} + \phi_3 ACI_{it} + \phi_4 DACI_{it} + \phi_5 AKL_{it} +$$
$$\qquad (+) \qquad (-) \qquad (+) \qquad (-) \qquad (+) \qquad (8.8)$$
$$+ \phi_6 DKL_{it} + \phi_7 DIST_t + \phi_8 OPEN_{it} + \phi_9 TAGR_{it} + \varepsilon_{it}$$
$$(-) \qquad (-) \qquad (+) \qquad (+)$$

8.4 Data and Data Sources

The data for the analysis presented in this chapter were obtained from various sources. 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 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 variable description and the sources of data used are discussed below and summarised in Appendix 8.1.

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 1965 and 1999. The examination of the data showed that while some countries have been significant trading partners in TAC throughout the entire 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[133].

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.

As discussed in Chapter 7, a number of proxy variables have been used in empirical studies to capture the effect of *product differentiation* on IIT. Caves (1981) used the level of marketing cost as a measure of product differentiation, Hellvin (1994) applied advertising and promotional expenditure per value added, while Ratnayake and Athukorala (1992) used advertising expenditure per sales. Narayan and Dardis (1994) derived the Hufbauer index, based on the coefficient of variation for export unit values. In the studies by Greenaway and Millner (1984), Balassa (1986c), Kim (1992), and Loertscher (1980) the number of four digit SITC product subcategories in

[133] Initially, Taiwan was also included, however the data limitation on some of the critical explanatory variables prevented its inclusion in further analysis.

each three-digit category of the SITC classification was used to measure the extent of product differentiation. Hughes (1993) attempted to measure product differentiation by a ratio of professional and technical staff to total employment. Either due to the data unavailability or because the measure is considered to be inappropriate (such as one used by Hughes) none of the above proxies could have been applied in this study. Therefore, in the present study the ratio of value added to output is used as a proxy variable for product differentiation[134]. It is argued that the higher the value added ratio, the higher the degree of product differentiation. The data for the value added per output for the period 1970 to 1992 were obtained from NAPES. The data set did not exhibit any trend, and a complete set of the data for 1970 to 1999 was generated via exponential smoothing. Moreover, the data set is a joint series for textiles and clothing. This should not generate a major bias since it is believed that there is not a significant difference between the two industries with respect to the value added per output.

It was intended to measure a potential effect of R&D activities *(RD)* on IIT by the business expenditure on R&D. However, the historical data for these activities are available for a very limited number of years (1988, 1990-1995). Even those are presented for TAC industries together. Therefore, it was decided to use the number of patents registered in textiles and clothing industries as an indicator of R&D activities. This information is also available jointly for TAC industries.

In the model of IIT between Australia and the rest of the world (Equations 8.5 and 8.6), the effective rate of assistance *(ERA)* is used to measure the effect of trade

[134] Other measures, such as R&D expenditure per value added might have been more appropriate, however, the data limitation on R&D expenditure in TAC industries this measure could not be applied.

restrictions on the IIT in TAC. The *ERA* data were obtained from the Productivity Commission, Canberra Office on personal request. In the model of bilateral IIT between Australia and its trading partners (Equations 8.7 and 8.8) the trade restrictions are proxied by the ratio of total trade to GDP *(OPEN)*, expressed in percentages. The information was obtained from the dXEconData, the Penn World Tables.

The variable representing the degree of Australia's economic development is measured by the level of annual per capita national income. It is expressed in the 1995 $US and was extracted from the dXEconData, World Bank 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[135] between Sydney, Australia and the capital city of the relevant countries. 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.

Complete sets of data used in the estimation of econometric models of IIT are presented in Appendices 8.2 and 8.3.

8. 5 Estimation Procedures and Results

In analysing the determinants of IIT, there is 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 $0 \leq IIT \leq 100$. 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.

[135] Often a nautical mile is used. One nautical mile = 1.852 kilometres.

However, Balassa and Bauwens (1987) and Lee and Lee (1993) 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, including (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.]

The general form of the logit model can be written as[136]:

$$\ln\left[\tfrac{P}{1-P}\right] = \beta_0 + \beta_i X_i + \varepsilon_i \tag{8.10}$$

where P is the value of the dependent variable between *0* and *1* (or *0* and *100*). In terms of the IIT index the logistic regression equation can be expressed as:

$$IIT_{ij} = \frac{1}{1 + exp\left[-\left(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n\right)\right]} + \varepsilon_{ij} \tag{8.11}$$

The crucial assumption in logistic regression analysis is that ln(odds) is linearly related to independent variables (Arize and Afifi, 1987, p. 321; Ramanathan, 1995, p. 280-81). The suitability of this approach was challenged by Greenaway and Milner (1984) and Balassa (1986a) who pointed out that the interpretation of the dependent variable as the proportion of successes in a trial is not relevant.

In the present study, while there are no values of the dependent variable equal to zero in the models of determinants of IIT between Australia and the rest of the world, there are some zero values for the IIT between Australia and some of its trading partners. In fact, there are four (1.21 percent) observations with the value of the dependent

[136] $\ln\left[\tfrac{P}{1-P}\right]$ is the logarithm of odds (Gujarati, 2003, p. 625).

variable equal to zero in the textile model and twenty three (6.97 percent) observations in the clothing model. Thus, these models cannot be specified in a logarithmic form (the logarithm of zero is undefined). To take this fact into account, different estimation techniques are applied to the two types of models.

8. 5. 1 Australia's IIT in TAC with the Rest of the World

As stated earlier, there are no *a priori* criteria for selection of the functional form of the relationship between the dependent and independent variables. Thus, initially, both linear and log-linear functional forms of the determinants of IIT between Australia and the rest of the world were estimated by the ordinary least-squares method, using the EViews econometric package. As the results indicated a more-less similar outcome in terms of the signs and the significance of the parameters, in order to decide between the two functional forms of the models, a test proposed by MacKinnon, White, and Davidson (*MWD*) was applied (MacKinnon *et al.*, 1983). The following steps were involved: First, the hypothesis that the true model is linear was tested. Both models were estimated and the estimated values (*Yf* and *ln f*) were obtained. Then, Z_1 = (*ln Yf - ln f*) were derived and used as the additional explanatory variable in estimating the linear form of the model. Since the coefficient of Z_1 was not statistically significant at the 5 percent level (the *P* value of the estimated *t* statistics is 0.230), the null hypothesis that the true model of IIT for textiles is linear could not be rejected.

Similarly, the hypothesis that the true model is log-linear was tested. The log model was estimated, adding Z_2 = (*antilog* of *ln f-Yf*) as the additional regressor. The coefficient of Z_2 is statistically significant (the *P* value of the estimated *t* statistics is

0.012), thus, the null hypothesis that the true model is log-linear was rejected at the 5 percent level of significance.

In the same way, the MWD (test was performed on the model for clothing. The null hypothesis of the log-linear specification was rejected (P value of Z_2 = 0.015). The P value corresponding to the null hypothesis of the linear specification leads to the conclusion that the true model for is linear (P value = 0.539). On the basis of the MWD test the linear functional form of both models, for textiles and clothing was adopted for the analysis of the determinants of IIT between Australia and the rest of the world.

In order to check for potential deficiencies in the data a number of preliminary diagnostic testing procedures were applied. The results of these tests are presented in Table 8.4 and 8.5. To test for the presence of heteroscedasticity, the White test was applied (White, 1980). On the basis of the test, the null hypothesis of no heteroscedasticity cannot be rejected at the 5 percent level of significance (the P value = 0.096 for textiles and 0.223 for clothing). Thus, it can be concluded that there is no evidence of heteroscedasticity in the error variance in these models, at the 5 percent level of significance.

Table 8. 4: **Diagnostic Test Results, Textiles**

	***F* statistics**	***P* value**
White heteroscedasticity test	2.012	0.096
Breusch-Godfrey serial correlation test	5.064	0.015
Ramsey RESET test	3.499	0.074

Next, the models were tested for the first and the second order autocorrelation using the Breusch-Godfrey test (BG) based on the Lagrange Multiplier principle (LM). As the F statistics and the P values in Tables 8.4 and 8.5 indicate, the null hypothesis of no autocorrelation in the model of the determinants of IIT for textiles can be rejected at the 5 percent level of significance (P value = 0.015). However, based on the test results, it can be concluded that there is no autocorrelation present in the model for clothing (P value = 0.313).

The Ramsey RESET test was applied to test the models for omitted variables and incorrect functional forms. As none of the F statistics is significant at the 5 percent level, it can be concluded that neither of the models is mis-specified.

Table 8. 5: **Diagnostic Test Results, Clothing**

	***F* statistics**	***P* value**
White heteroscedasticity test	1.498	0.223
Breusch-Godfrey serial correlation test	1.224	0.313
Ramsey RESET test	3.050	0.094

In the initial estimation, the autocorrelation in the residuals in the model for textiles was detected, thus, while the parameter estimates are unbiased, consistent and asymptotically normally distributed, they are, however, not efficient (Gujarati 2003, p. 484-485). Thus, the statistical inference would be inappropriate. In view of that, the model for textiles was re-estimated applying the Newey-West method of correcting the OLS standard errors to become heteroscedasticity- and autocorrelation-consistent (Newey and West, 1987). The results from the estimation for textiles are presented in Table 8.6. The estimation results for clothing are presented in Table 8.7.

In terms of the F-test both models (textiles and clothing) expressing the relationship relating IIT and its determinants between Australia and the rest of the world are statistically significant at the one percent level. Considering the fact that a number of zero observations reduces the coefficient of determination, and limitations associated with the measurement of several of the variables, the explanatory power of the regression may be considered adequate. There are some surprising, however, consistent in both models, results with regards to the individual variables.

Table 8. 6: **Intra-Industry Trade in Textiles, Australia and the Rest of the World, 1970-1999**

Dependent Variable: IITT			
Variable	**Coefficient**	***t*-ratio**	***P*-value**
Constant	-23.162	-1.769	0.089
PD	-0.047	-0.159	0.875
RD	0.386	1.056	0.301
ERAT	-0.116	-4.689	0.000***
DED	0.003	8.295	0.000***

R^2	0.931	Mean dependent variable	21.380
Adjusted R^2	0.919	S.D. dependent variable	10.012
Standard error of regression	2.841	Akaike info criterion	5.077
Sum of squared residuals	201.741	Schwarz criterion	5.310
Log likelihood	-71.155	F-statistic	83.823
Durbin-Watson statistics	0.860	Probability (F-statistic)	0.000

***Significant at the 1 percent level.

Table 8. 7: **Intra-Industry Trade in Clothing, Australia and the Rest of the World, 1970-1999**

Dependent Variable: IITT			
Variable	**Coefficient**	***t*-ratio**	***P*-value**
Constant	102.892	2.219	0.0358
PD	-1.260	-1.198	0.2422
RD	2.289	1.537	0.1368
ERAC	-0.122	-3.527	0.0017***
DED	0.0003	0.490	0.6286

R^2	0.524	Mean dependent variable	46.036
Adjusted R^2	0.448	S.D. dependent variable	10.823
Standard error of regression	8.044	Akaike info criterion	7.159
Sum of squared residuals	1617.623	Schwarz criterion	7.392
Log likelihood	-102.381	F-statistic	6.876
Durbin-Watson statistics	1.495	Probability (F-statistic)	0.001

***Significant at the 1 percent level.

Contrary to our expectations, in both models the coefficient for the variable representing product differentiation is shown to be negative, and statistically insignificant. The negative effect and/or insignificant effect of product differentiation were also found by Caves (1981), Greenaway and Milner (1984), Tharakan (1984), Narayan and Dardis (1994), Chuankamnerdkarn (1997), and Sharma (2002). One explanation for this unexpected result may be that TAC industries are characterised by low economies of scale that limit product specialisation in production (Toh, 1982). Another explanation for this unsatisfactory result may be, as commonly claimed, the difficulties of adequately measuring product differentiation. The ratio of VAD to production adopted in this study may be a poor proxy for product differentiation. Or, as suggested by some recent studies, including Greenaway and Tharakan (1986), Greenaway, *et al.* (1994), Greenaway and Torstensson (1997), and Blanes and Martin (2000), there is a need to distinguish between the horizontal and the vertical product differentiation since the determinants of these two types of IIT may differ. Thus, it can be suggested that further research, employing better empirical counterparts for the theoretical concept of product differentiation may be more successful in supporting the hypothesis emphasised in the theoretical literature on the determinants of IIT.

No support is found for the hypothesis that research and development intensify IIT in TAC. While the coefficients in both models have expected positive signs, they are statistically insignificant. The insignificant effect of research and development suggests that TAC industries are relatively unskilled labour intensive and therefore, the effect of further innovation tends to be weak. Or alternatively, the limitation in the measure of the variable itself may impose some 'bias' on the result.

In line with the theoretical proposition there is strong empirical support for the hypothesis that the effective rate of assistance has a negative effect on the level of IIT in TAC. In fact, the effective rate of assistance appears to be the most important determinant of Australia's IIT with the rest of the world in both textiles and clothing. The coefficients are negative and statistically highly significant. The results imply that a high level of protection of TAC industries may be one of the key factors of the low level of Australia's IIT in relation to other countries. These results are in accordance with the findings of other studies that despite the difference in measuring the level of protection found a negative relationship between barriers to trade and IIT. The studies include Loertscher and Wolter (1980), Havrylyshyn and Civan (1983), Globerman and Dean (1990), Kim (1992), Ratnayake and Athukorala (1992), Thorpe (1995), Chuankamnerdkarn (1997), and Sharma (2000). Despite the variation in the measurement approach of the level of protection and the industry studied, all these studies detected a negative correlation between the barriers to trade and the level of IIT.

There are differences in the coefficients for the degree of economic development *(DED)* between textiles and clothing. Measured by the level of per capita income, the coefficient for the variable *DED* in the model for textiles is, as expected, positive and statistically significant at the 1 percent level. This finding is consistent with the view of Linder (1961) and Barker (1977) who argue that an increase in income is likely to lead to an increase in demand for a variety of products. In the model for clothing the parameter estimate, while also positive, it is not statistically significant.

In summary, the results of the analysis of the determinants of Australia's IIT with the rest of the world consistently indicate that the level of protection is the most influential factor of the intensity in IIT in TAC. Thus, it appears that in order to increase IIT in TAC, the government policy should be oriented towards reduction in the level of assistance to TAC industries.

8. 5. 2 Australia's Bilateral IIT in TAC with Trading Partners

The fact that there are some zero values for the dependent variable in the models of determinants of bilateral IIT between Australia and its trading partners necessitates a modified estimation approach. To ignore these limit 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[137] 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. The analysis is based on the pooled data across countries and time.

Statistically, the Tobit model can be expressed as:

$$y_i^* = x_i'\beta + \sigma\varepsilon_i \qquad (8.12)$$

where y_i^* is the latent variable, σ is a scale parameter and is estimated along with the 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:

$$y_i = \begin{cases} l_i & if \quad y_i^* \le l_i \\ y_i^* & if \quad l_i < y_i^* \le r_i \\ r_i & if \quad r_i < y_i^* \end{cases} \qquad (8.13)$$

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 8.8 and 8.9. As it can be observed from the tables, in addition to results for the regression coefficients, Eviews reports an

[137] Even if the value of the dependent variable is zero, there exist corresponding values for the explanatory variables (Kennedy, 2003, p. 282).

additional coefficient, SCALE, which is the estimated scale factor σ. This scale factor may be used to estimate the standard deviation of the residual[138].

The results from the estimation of the determinants of the bilateral IIT in *textiles* is, to a large extent, in accordance with expectations (Table 8.8). 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), 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.

On the other hand, the greater *inequality in national income* indicates greater dissimilarity between the countries. Using 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 (1986c), Culem and Lundberg (1986), Balassa and Bauwens

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

(1987), Narayan and Dardis (1994), Stone and Lee (1995), Nilsson (1999), and Blanes and Martin (2000).

Table 8. 8: **Intra-Industry Trade in Textiles, Australia and Eleven Trading Partners, 1970-1999**

Dependent Variable: IITT			
Variable	**Coefficient**	**z-ratio**[a]	**P-value**
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 dependent variable	21.846
Adjusted R-squared	0.654	S.D. dependent variable	17.227
S.E. of regression	10.137	Akaike information criterion	7.465
Sum squared residuals	32679.19	Schwarz criterion	7.592
Log likelihood	-1216.974	Hannan-Quinn criterion	7.515
Avg. log likelihood	-3.699		
Left censored observations	4	Right censored observations	0
Uncensored observations	326	Total observations	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.

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 (1986), Balassa and Bauwens (1987), Narayan and Dardis (1994), Stone and Lee (1995), and Blanes and Maring (2000).

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 Balassa (1979), Ratnayake and Athukorala (1992), Narayan and Dardis (1994), and Thorpe (1995). Sharma (2000; 2002), 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 (1995) 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 8. 9, 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.

Table 8. 9: **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 dependent variable	18.984
Adjusted R-squared	0.433	S.D. dependent variable	18.484
S.E. of regression	13.918	Akaike information criterion	7.7436
Sum squared residuals	61795.93	Schwarz criterion	7.870
Log likelihood	-1266.70	Hannan-Quinn criterion	7.794
Avg. log likelihood	-3.838		
Left censored observations	23	Right censored observations	0
Uncensored observations	307	Total observations	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.

The effect of the country size, measured by the average national income of the trading partners vary 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.

Similar to textiles, the membership in trade agreements seem 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.

8. 6 Summary and Conclusion

The purpose of this chapter was to explore the determinants of Australia's IIT in textiles and clothing. The analysis focused on the examination of Australia's IIT with the rest of the world and Australia's bilateral IIT in TAC with its major trading partners. At the outset, the extent and trend of Australia's IIT generally, and in TAC were presented and discussed. The Grubel-Loyd index of intra-industry trade was provided for seven categories of textiles and two categories of clothing. With regard to the share of IIT in TAC, Australia appears a rather atypical industrial country, with one of the lowest IIT index among the OECD countries. However, the results show a rising trend in intra-industry trade in some of these categories of TAC products in recent years, implying that Australia increasingly exports and imports differentiated TAC products. The empirical evidence indicates that 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.

Then, an attempt was made to identify, and test empirically, the relevant factors explaining the extent of IIT in TAC between Australia and the rest of the world and of the bilateral IIT between Australia and a number of its trading partners. The relationship between various industry and country characteristics and IIT was considered and tested empirically. In order to investigate the effect of various determinants, a number of hypotheses were developed, utilising a number of previous theoretical and empirical studies. These hypotheses were integrated into econometric specifications of separate models for textiles and clothing. Prior to empirical testing of the models, a number of diagnostic tests were performed. In particular, the models were tested for heteroscedasticity and autocorrelation in residuals, the functional form and the omission of the relevant variables. In view of the results, appropriate remedial techniques were applied.

The results of the econometric estimation of the specified models, addressing the determinants of Australia's IIT with the rest of the world support a number of proposed hypotheses, while contradict some others. Contrary to our expectations, there seems to be no correlation between product differentiation and research and development and IIT. On the other hand, there is strong empirical support for the hypothesis that the effective rate of assistance has a negative effect on the level of IIT in TAC. The results imply that a high level of protection of TAC industries might be one of the crucial contributing factors to consistently low levels of Australia's IIT in the past.

Taking into account a number of zero values of the dependent variable in the data on bilateral IIT, the Tobit models were specified to test the determinants of Australia's IIT in TAC. The findings from the estimation of the model for textiles are, in essence, in accordance with our expectations. All but one estimates (the difference of the capital to labour ratio), have expected signs and are statistically significant at the 1 percent level.

The results indicate that the intensity of the bilateral IIT between Australia and its eleven major trading partners is influenced by a number of determinants tested. The intensity of IIT in textiles between Australia and its trading partners is likely to increase with an increasing level of level of economic development, or average market size, as indicated by the level of average national incomes, a decreasing distance, decreasing differences in the market size and income levels, and the participation in trade agreements and other cooperation forms. In other words, IIT is more likely to occur between countries with similar characteristics.

With regard to Australia's bilateral IIT in clothing the major explanation of the extent of IIT focuses on the average of 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, the limitations in data and the measurement methods.

Chapter 9 provides a summary of the thesis, its findings and conclusions, limitations and suggestions for further research.

Chapter 9

SUMMARY AND CONCLUSIONS

9. 1 Introduction

This final chapter of the thesis contains a summary of the objectives, analytical methods employed and findings from the research on the patterns and determinants of Australia's international trade in textiles and clothing (TAC). This chapter provides an overview of the purpose and major findings of each previous chapter. The final section presents some policy implications and suggestions for further research.

9. 2 Summary and Conclusions

The general aim of this thesis was to provide a comprehensive analysis of the patterns and determinants of Australia's international trade in textiles and clothing over the period from 1970 to 1999. On a more specific scale, the study's aims were: to examine Australia's comparative advantage in TAC; to develop and estimate econometric models of Australia's export supply and import demand for TAC; to analyse the extent and trends in intra-industry trade in TAC, and to develop and test the hypotheses regarding the determinants of intra-industry trade in TAC between Australia and the rest of the world and of the bilateral intra-industry trade between Australia and its major trading partners.

Chapter 2 of the study reviewed both global and domestic environment of TAC industries, their position in the Australian and the world economy, recent trends and likely future developments. It was observed that textiles and clothing industries in Australia experienced significant structural changes in recent years. It is mainly in response to competitive pressures from suppliers in developing countries, shifts in consumer spending patterns, technological progress, and reductions in protection. Given a long history of the high level protection of Australia's TAC industries, Chapter 2 also provided a chronological description of implementation of various policy instruments towards TAC sectors from the 1960s to 2000. A common feature of these strategies was the protection of domestic producers from intense competition from low-labour-cost producers in developing countries. While various forms of government assistance during the transition period towards lower protection have been helping those that have potential to become internationally competitive, it appears that there were some inefficient producers that found it difficult to survive competitive pressures and, therefore, left the industries. As a result of this, as well as the consequence of the rationalisation process, the output and employment in textiles and clothing industries have declined in recent years. On the other hand, many firms rationalised their production and have become internationally competitive. An overall outcome of all these developments is that Australia has experienced an increasing level of both exports and imports of TAC.

After a review of theoretical and empirical studies of international trade theories, with particular focus on comparative advantage as the basis for trade, an analysis of Australia's comparative advantage in general and in textiles and clothing were presented in *Chapter 3*. The analysis was based on international trade data according to the Standard International Trade Classification at two and three-digit level of aggregation for the period of 1965 to 1998[139]. Australia's relative competitive position in the global market of textiles and clothing was analysed employing Balassa's

[139] Due to the termination of the access to the database the analysis in this chapter could not cover the period beyond 1998.

revealed comparative advantage index and Vollrath's measures of revealed competitiveness. Australia's trade performance in TAC was examined using a number of indicators, including the Balassa Trade Specialisation Index, Export Propensity and Import Penetration Indices.

The results of the analysis show that Australia has strong comparative disadvantage in TAC. There are some indications, however, that the trade performance and comparative advantage in particular in some subcategories, such as 'special' textiles, have slightly improved over recent years. Overall, Australia has not been and is not likely to be a significant player on the supply side of the international market in textiles and clothing products.

Any effort to improve the position of TAC in the Australia's economy and in the world market may be destined to failure if the conditions and factors influencing Australia's supply of exports of TAC to the world market as well as Australia's demand for imports of TAC are not taken into account. This study recognised the role of these factors in trade in TAC and examined the aspects of export supply and import demand in Chapters 4 and 5. Given Australia's relatively insignificant position in the world market for TAC, it was presumed that Australia does not have the capacity to influence world prices of exports and imports in relation to textiles and clothing products. In other words, we assumed the perfectly elastic demand for Australia's exports of TAC by the rest of the world as well as the supply of imports of TAC by the rest of the world to Australia.

Prior to developing empirical models of Australia's export supply of and import demand for TAC, a review of theoretical and empirical studies on modelling export supply and import demand was provided in *Chapter 4*. Despite a large number of empirical studies dealing with a wide spectrum of industries, we have not identified a separate study that would deal exclusively with the import demand for or export supply of textiles and clothing. Based on the theoretical framework and the outcomes of previous empirical studies, separate models identifying the most important determinants of Australia's export supply of and import demand for TAC were developed.

It was hypothesised that the most important determinants of Australia's export supply of TAC are the relative price of exports (Australia's export price relative to domestic price), domestic production capacity (in terms of infrastructure and technological improvement), and effective rate of assistance. The import demand for Australia's TAC was hypothesised be influenced by the relative price (Australia's import price relative to domestic price), Australia's national income, effective rate of assistance, and the stock to sales ratio. In addition, the effect of Asian crisis that occurred in the mid 1997 on both export supply of and import demand for TAC was tested.

In *Chapter 5*, data and data sources were presented first. Given that the analysis of export supply and import demand are based on time series data, theoretical and empirical issues in relation to the properties of time series data and their testing were reviewed. The results of the tests revealed that the time series follow non-stationary processes with the absence of co-integration among the variables in all models for export supply and import demand for textiles and clothing. Based on this information it was decided to employ the unrestricted error correction modelling (UECM) procedure that incorporates both short-run dynamics and long-run responses embodied in the models.

The estimation of the econometric models of Australia's export supply of and import demand for TAC was carried out in *Chapter* 6. The analysis was directed towards identifying significant factors that influence the export supply of and the import demand for textiles and clothing products. After taking into consideration the results of the associated diagnostic tests, a 'parsimonious' version of each model was derived.

The estimation results suggest that, in the short-run and in the long-run, the most influential factors in the export supply of *textiles* are the relative price (Australia's export price relative to domestic price) and the effective rate of assistance. Contrary to expectations, the effect of production capacity of the textiles sector is negative in the short-run and in the long-run. The elasticity estimates with reference to the relative price, and the effective rate of assistance are 1.83 and -1.54, respectively. The long-run relative price elasticity coefficient of 1.83 shows that export supply of textiles increases by nearly two percent in response to one percent increase in relative price of exports in the long-run. A reduction in the effective rate of assistance by one percent would increase textile export supply by 1.54 percent in the long-run.

With respect to the export supply of *clothing*, the long-run price elasticity of 2.05 indicates that, in the long-run, the response of export suppliers is the most triggered by changes in the relative price of exports. Thus, a one percent increase in Australia's export price relative to domestic price seems to generate more than two percent increase in export supply. Whereas the coefficient for the time trend variable, representing the production capacity as well as technological improvements over time is positive and highly significant, the value of the coefficient itself is very low (0.02) which means that the magnitude of the effect is very small.

On the other hand, the estimated low value (-0.22) of the long-run relative price elasticity of import demand for textiles suggests that responsiveness of import demand for textiles is extremely low to changes in Australia's import price relative to Australia's domestic price. Australia's import demand for textiles also shows a relatively weak positive response to changes in Australia's income. The estimated income elasticity of import demand for textiles is 0.83.

The elasticity estimates with respect to the relative price of imports (-0.56) and the effective rate of assistance (-0.40) suggest that Australia's import demand for clothing is proportionately less responsive to changes in those variables.

Australia's import demand for *clothing* appears to be highly responsive to changes in Australia's income. The value of the long-run elasticity of income of 2.93 reveals that one percent increase in Australia's income is likely to result in almost three percent increase of Australia's import demand for clothing.

The tests for the effect of Asian economic crisis from the mid-1997 has failed to provide support for the hypothesis that the crisis has a negative impact on either the supply of exports or a positive effect on the import demand for textiles and clothing.

However, it may be that the time period included in the analysis since the crisis is not sufficient enough to show a possible effect.

Taking into consideration the growing incidence of intra-industry trade of TAC (the exchange of differentiated products of the TAC industries) in the world trade, an analysis of Australia's intra-industry trade in TAC was carried out in Chapter 7 and 8.

A number of researchers have studied various aspects of IIT. Some concentrated on theoretical rationale, others focused on the measurement and empirical analysis of patterns and the determinants of IIT. A number of explanations have been put forward to justify the incidence of IIT. A review of these studies was presented at the start of *Chapter 7*. Australia's low incidence of IIT compared to other OECD countries has prompted several researchers to examine IIT within the Australian setting. A small number of studies examined the patterns of IIT in Australia's manufacturing, however a very few concentrated on the econometric aspect of the determinants of IIT. To our knowledge there is no econometric study of the determinants of IIT in Australia's textiles and clothing (TAC) products.

A review of the studies on the theoretical aspects, the measurement, and determinants of IIT revealed that the emergence of several different theories of IIT led to different adaptations of the empirical methods of measuring IIT. It was noted that a more accurate analysis of IIT would require a comprehensive reclassification of products on the basis of the intrinsic characteristics. A considerable diversity was also noted in the approach to study the determinants of IIT. This fact was reflected in model specifications in both the bilateral trade between countries and between individual countries and the rest of the world. Despite this diversity, the empirical evidence suggests that IIT tends to be influenced by a number of country- and industry-specific characteristics.

Chapter 8 focused on the examination of Australia's IIT with the rest of the world and Australia's bilateral IIT in TAC with its major trading partners. Prior to exploring the determinants of IIT in TAC, useful insight into the extent and trend of Australia's IIT in TAC was provided on the basis of the Grubel-Lloyd index. The analysis was based on the 3-digit level of aggregation, according to the Standard International Trade Classification, and it was presented for seven categories of textiles and two categories of clothing. There are two important outcomes from the analysis. First, in accordance with the findings of earlier studies that in terms of the share of IIT, Australia is a rather atypical industrial country, with one of the lowest IIT index among the OECD countries. The second observation is a rising trend in Australia's IIT in recent years, in almost all categories of textiles and clothing. It was also established that in *textiles* overall, the highest level of IIT, in particular in the 1990s, tends to be in category 655-Special textile products, followed by categories 657-Floor coverage, tapestry etc. The highest level of IIT was recorded in the *clothing* industry, in the category 842-Fur clothing. 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.

The next step of the analysis was to identify, and test empirically, the relevant factors influencing the extent of IIT in TAC between Australia and the rest of the world and of the bilateral IIT between Australia and a number of its trading partners. The selected partner countries are China, Hong Kong, India, Japan, Korea, New Zealand, Taiwan, the United Kingdom, and the United States. In order to investigate the effect of various variables on IIT in Australia's TAC, a number of hypotheses were developed and appropriate measures/proxies were defined to measure the effect of these variables. The specified hypotheses were integrated into econometric specifications of separate models for textiles and clothing. To identify the significant determinants of Australia's IIT in TAC with the rest of the world, the following variables were included: product differentiation, research and development (R&D), effective rate of assistance and degree of economic development. The extent of the bilateral IIT between Australia and its major trading partners was hypothesised to be determined by the market size (the average level of the countries income) and their difference, the average per capita income and their difference, the average and the difference in the capital to labour ratio, the distance (as an indicator of the measure of transportation and communication cost), the openness and the participation in regional trade and economic agreements.

Prior to empirical testing of the models, a number of diagnostic tests were performed. In particular, the models were tested for heteroscedasticity and autocorrelation in residuals, the functional form and the omission of the relevant variables. While there was no evidence of heteroscedasticity or misspecification error, the autocorrelation in the residuals in the model for textiles was detected. In view of that the model was re-estimated using applying the Newey-West method of correcting the standard errors to become heteroscedasticity- and autocorrelation-consistent. On the basis on the MacKinnon-White-Davidson (MWD) test results, the linear functional form of the model specifications was applied in order to estimate the determinants of IIT between Australia and the rest of the world.

The empirical results from the econometric estimation of the specified models, addressing the determinants of Australia's IIT with the rest of the world support a number of proposed hypotheses. In accordance with the theoretical expectation there is a strong negative effect of the effective rate of assistance on the level of IIT in both textiles and clothing. However, contrary to our expectations, there is no empirical support for the correlation between product differentiation and the extent of IIT or between R&D and IIT. Thus, the results imply that the high level of protection of TAC industries might be one of the contributing factors to consistently low levels of Australia's IIT in the past. This suggestion is supported by the fact that more or less an increasing trend in IIT began in the late 1980s and continued through the 1990s when the level of assistance to TAC industries was reduced.

In order to incorporate the fact that Australia was not involved in any bilateral IIT with some of its trading partners in a number of years, the Tobit models were specified to test the determinants of the bilateral IIT in TAC between Australia and its trading partners. The findings from the estimation of the model for *textiles* are, in essence, in accordance with our expectations. All but two of the variables, the average and the difference of the capital to labour ratio (measured as the gross capital formation per capita and its absolute difference), are important determinants of Australia's bilateral IIT in textiles, as indicated by statistically significant coefficients at the 1 percent level, with expected signs. Thus, based on the empirical evidence of this study, it can be concluded that the intensity of Australia's bilateral IIT is likely to increase with an increasing level of the average market size (assumed to be generated by the level of national income), a decreasing distance, decreasing differences in the market size and income levels, and the participation in trade and other agreements between Australia and its trading partners. These indications imply that the bilateral IIT in textiles is more likely to occur between countries with similar characteristics. On the contrary, bilateral IIT in textiles appears to be discouraged by the differences in national incomes, an increasing distance, and the level of barriers to trade.

According to the results in this study, the key determinants of Australia's bilateral IIT in *clothing* are the average per capita income, its differences and trading agreements between trading partners. Contrary to our expectations, the results do not provide support for the role of distance, openness, and the capital to labour ratio.

9. 3 Implications and Suggestions for Further Research

It is reasonable to expect that the extent to which the process of penetration to the world market will be successful will depend on the trends of domestic and world demand as well as on the capacity of Australia to respond to emerging changes in market forces. This study examined some important factors in relation to the trade in textiles and clothing, the sectors in which value may be added to primary products, in particular wool and cotton fibres that Australia is endowed well.

A better understanding of the determinants of export supply, import demand, and intra-industry trade is an important prerequisite for making appropriate policy, strategy, and production decisions. The findings from the analysis of the key factors that are deemed to influence the export supply of and import demand for Australia's textiles and clothing are expected to be beneficial to suppliers as well as importers of Australia's textiles and clothing in their operational and planning decisions. In the environment of high income elasticity of import demand and resultant high import penetration with increases in national income, it is necessary that Australian producers are more concerned about reducing cost of production and increasing productivity to become more competitive. Indirectly the results may also serve as an important indicator to retailers of how the demand at retail for textiles and clothing may be affected if the export supply and import demand is influenced by changes such as income or the rate of assistance to the industries.

The study, with its thorough insight into Australia's inter- and intra-industry trade flows and by identifying the determinants of intra-industry trade in textiles and clothing, some of which may be controlled by industry management, may be a valuable tool in improving the trade performance.

The findings from the examination of the effect of trade liberalisation (effective rate of assistance) in the context of export supply, import demand, and intra-industry trade in textiles and clothing might be utilised by the concerned industry participants, trade analysts, and policy makers in the development of policies and strategies targeted at improving trade performance of TAC industries. The elasticity estimate with regard to the effective rate of assistance (greater than one) implies that the Government should promote trade liberalisation policy in order to increase export of textiles.

In the past, not enough emphasis was placed on high value added capital-intensive products, product differentiation, innovation and export orientation of TAC industries.

Thus, Australia should concentrate on the rationalisation of production, in order to benefit from economies of scale and consequently be more involved in product differentiation of TAC products. The implementation of the strategies targeting further enhancement in the performance and international competitiveness of Australia's TAC, however, might be slowed down by the small size of Australian TAC firms. Thus, there is a scope for improvement in both the industry, through further rationalisation and investment, and in subsequent research into the industry. It is clear that the disadvantages in labour costs restrict Australia from competing internationally in activities in which labour costs are a crucial aspect of competitiveness. Therefore, in these activities Australia must address other competitive criteria, such as quality, service, and distinctive characteristics of products or brand names.

Moreover, the review of the literature on the theoretical aspects and empirical analysis of the patterns and determinants of trade in textiles and clothing this study may be of assistance to researchers intending to undertake future research in the field. Some further suggestions, as well as some of the difficulties encountered during the process of the current research are outlined in the next section.

It should not be surprising that during the process of the analysis addressing multiple aspects as was the case in this study, some limitations have been encountered. One of the drawbacks of this study emerges from the nature of the data used in the analysis. The analysis is based on secondary data obtained from various sources and, as described in the text in relevant sections, a number of proxy variables had to be used in order to examine the effect of explanatory variables specified in the models. This might brought some bias into the estimation of the true effect of these variables.

Another problem occurred due to, on one hand, an effort to cover in the analysis a period as long as possible, and on the other hand the shortcomings in the data collection arising from either the unavailability of the data for the entire period or the termination or the modification in reporting the data by the ABS, WTO and other data collecting organisations. After examining the pattern of the concerned data series, appropriate types of extrapolation were applied to generate complete data sets. It is possible that some bias in the estimates may have occurred due to the use of data that were jointly reported (for textiles and clothing).

A challenging area for further researchers may be to study in greater depth the effect of product differentiation on intra-industry trade. Of particular value would be to study the determinants of horizontal and vertical product differentiation on IIT in TAC. While this study is an original attempt at separating the analysis of clothing into two broad categories, '841-Clothing made-of-fur' and '842-Non-fur clothing', the contribution of the results could be further improved if an analysis of the patterns and trends of IIT is based on a more detailed classification of the category.

APPENDICES

Appendix 2.1 : **Australia's Top Ten TAC Trading Partners Ranking, 1965-1999, Selected Years**

Ranking	1965	1975	1985	1995	1999
TEXTILES					
1	Japan	Japan	Japan	USA	China
2	UK	UK	New Zealand	China	USA
3	India	Hong Kong	Taiwan	New Zealand	New Zealand
4	USA	USA	China	Korea	Korea
5	China	New Zealand	USA	Taiwan	Taiwan
6	Hong Kong	China	Hong Kong	Indonesia	Indonesia
7	Pakistan	Germany	Korea	Japan	Pakistan
8	Italy	Taiwan	UK	UK	Hong Kong
9	New Zealand	India	Germany	India	UK
10	Germany	Italy	Italy	Pakistan	India
CLOTHING					
1	UK	Hong Kong	Hong Kong	China	China
2	Hong Kong	UK	Taiwan	New Zealand	USA
3	Japan	China	China	USA	New Zealand
4	USA	Taiwan	Korea	India	Hong Kong
5	Italy	Korea	New Zealand	Italy	Italy
6	China	New Zealand	Italy	Hong Kong	India
7	Canada	Italy	India	UK	Indonesia
8	France	Singapore	USA	Indonesia	Malaysia
9	New Zealand	Japan	Japan	Thailand	Vietnam
10	Germany	India	UK	Malaysia	Thailand

UK=United Kingdom; USA = The United States of America Source: Compiled from the NAPES database

Appendix 2.2: **Share of Textiles and Clothing in Australia's Trade, (%)**

Year	Textiles (65)			Clothing (84)		
	Export	Import	Total*	Export	Import	Total
1965	0.13	3.35	1.75	0.14	0.83	0.49
1966	0.14	2.86	1.51	0.13	0.67	0.40
1967	0.22	3.17	1.71	0.88	0.84	0.86
1968	0.19	2.97	1.58	0.18	0.80	0.49
1969	0.18	2.71	1.45	0.17	0.68	0.43
1970	0.21	2.67	1.45	0.19	0.71	0.45
1971	0.19	2.59	1.39	0.18	0.72	0.45
1972	0.16	2.36	1.26	0.15	0.73	0.45
1973	0.17	2.74	1.45	0.15	0.93	0.55
1974	0.17	3.10	1.63	0.12	1.76	0.96
1975	0.12	2.13	1.12	0.09	1.26	0.7
1976	0.11	2.47	1.29	0.07	1.34	0.72
1977	0.10	2.22	1.16	0.05	1.24	0.66
1978	0.10	2.16	1.13	0.05	1.13	0.61
1979	0.13	2.05	1.09	0.06	0.9	0.49
1980	0.13	2.05	1.09	0.07	0.82	0.46
1981	0.15	2.20	1.17	0.05	1.02	0.55
1982	0.22	2.31	1.26	0.04	1.04	0.56
1983	0.18	2.00	1.09	0.05	0.83	0.45
1984	0.15	2.30	1.23	0.04	0.90	0.48
1985	0.18	2.04	1.12	0.04	0.81	0.44
1986	0.17	1.74	0.96	0.04	0.64	0.35
1987	0.13	1.64	0.90	0.06	0.60	0.34
1988	0.16	1.69	0.94	0.07	0.61	0.36
1989	0.18	1.67	0.94	0.09	0.66	0.39
1990	0.16	1.34	0.76	0.12	0.61	0.38
1991	0.17	1.29	0.75	0.13	0.63	0.39
1992	0.17	1.23	0.71	0.12	0.61	0.38
1993	0.21	1.30	0.76	0.13	0.69	0.43
1994	0.24	1.31	0.78	0.15	0.74	0.46
1995	0.26	1.20	0.73	0.15	0.74	0.46
1996	0.31	1.24	0.78	0.16	0.80	0.50
1997	0.29	1.13	0.71	0.17	0.80	0.50
1998	0.26	1.07	0.67	0.15	0.78	0.48
1999	0.27	1.12	0.77	0.19	0.84	0.53

* exports + imports. Compiled from the NAPES ANU database.

Appendix 2.3: **Australia's Share in World Exports of Textiles and Clothing, (%)**

Year	Textiles								Clothing		
	65	651	652	653	654	655	656	657	84	841	842
1965	0.11	0.05	0.11	0.01	0.04	0.02	0.01	0.12	0.12	0.00	0.11
1966	0.10	0.05	0.11	0.02	0.05	0.03	0.02	0.12	0.12	0.00	0.10
1967	0.06	0.08	0.14	0.02	0.05	0.15	0.02	0.80	0.80	0.00	0.06
1968	0.08	0.06	0.14	0.01	0.08	0.09	0.02	0.20	0.19	0.00	0.08
1969	0.09	0.08	0.14	0.02	0.06	0.05	0.02	0.19	0.18	0.01	0.09
1970	0.11	0.06	0.16	0.02	0.07	0.06	0.03	0.21	0.20	0.01	0.11
1971	0.12	0.04	0.16	0.01	0.07	0.04	0.03	0.21	0.21	0.00	0.12
1972	0.08	0.03	0.11	0.01	0.06	0.04	0.04	0.20	0.19	0.01	0.08
1973	0.09	0.04	0.10	0.01	0.07	0.04	0.04	0.17	0.16	0.01	0.09
1974	0.10	0.04	0.10	0.01	0.08	0.03	0.02	0.14	0.13	0.01	0.10
1975	0.05	0.03	0.06	0.00	0.07	0.02	0.01	0.11	0.11	0.00	0.05
1976	0.05	0.02	0.05	0.01	0.07	0.01	0.03	0.09	0.08	0.01	0.05
1977	0.04	0.02	0.04	0.00	0.06	0.03	0.03	0.07	0.06	0.01	0.04
1978	0.07	0.01	0.04	0.00	0.08	0.02	0.03	0.08	0.07	0.01	0.07
1979	0.10	0.01	0.05	0.01	0.08	0.01	0.04	0.09	0.08	0.01	0.10
1980	0.10	0.01	0.06	0.00	0.08	0.02	0.03	0.10	0.09	0.01	0.10
1981	0.14	0.02	0.05	0.00	0.08	0.02	0.03	0.09	0.07	0.02	0.14
1982	0.21	0.02	0.05	0.00	0.08	0.02	0.04	0.07	0.06	0.01	0.21
1983	0.19	0.03	0.04	0.00	0.07	0.02	0.05	0.08	0.07	0.01	0.19
1984	0.10	0.02	0.05	0.01	0.08	0.02	0.03	0.07	0.06	0.01	0.10
1985	0.16	0.02	0.05	0.01	0.07	0.02	0.04	0.07	0.07	0.01	0.16
1986	0.17	0.03	0.08	0.01	0.07	0.03	0.07	0.11	0.10	0.01	0.17
1987	0.05	0.04	0.08	0.01	0.08	0.05	0.07	0.16	0.15	0.01	0.05
1988	0.04	0.05	0.10	0.01	0.08	0.06	0.07	0.17	0.16	0.01	0.04
1989	0.04	0.05	0.11	0.01	0.09	0.06	0.06	0.20	0.20	0.01	0.04
1990	0.04	0.04	0.09	0.01	0.10	0.07	0.06	0.30	0.29	0.01	0.04
1991	0.05	0.05	0.09	0.01	0.11	0.08	0.05	0.36	0.35	0.01	0.05
1992	0.08	0.04	0.09	0.01	0.11	0.08	0.05	0.36	0.35	0.01	0.08
1993	0.11	0.05	0.11	0.01	0.13	0.08	0.06	0.39	0.38	0.01	0.11
1994	0.14	0.07	0.15	0.01	0.14	0.09	0.07	0.46	0.45	0.01	0.14
1995	0.16	0.09	0.16	0.01	0.15	0.09	0.08	0.44	0.44	0.01	0.16
1996	0.16	0.13	0.16	0.01	0.13	0.10	0.08	0.46	0.45	0.01	0.16
1997	0.19	0.11	0.15	0.01	0.12	0.09	0.08	0.51	0.50	0.01	0.19
1998	0.17	0.08	0.17	0.02	0.11	0.09	0.07	0.50	0.49	0.01	0.17
1999	0.14	0.07	0.18	0.02	0.11	0.10	0.09	0.64	0.63	0.01	0.14

Compiled from the NAPES ANU database.

Appendix 2. 4: **Australia's Share in World Imports of Textiles and Clothing, (%)**

Year	Textiles								Clothing		
	65	651	652	653	654	655	656	657	84	841	842
1965	8.32	1.19	2.55	1.78	0.58	0.44	1.14	0.64	0.66	0.65	0.01
1966	7.85	1.08	2.44	1.68	0.42	0.48	1.06	0.69	0.64	0.64	0.00
1967	8.08	1.12	2.52	1.81	0.38	0.49	0.99	0.76	0.81	0.80	0.00
1968	7.50	1.06	2.35	1.67	0.29	0.53	0.78	0.80	0.81	0.81	0.00
1969	7.66	1.12	2.34	1.71	0.26	0.56	0.76	0.92	0.85	0.85	0.00
1970	7.28	1.11	2.10	1.75	0.22	0.60	0.73	0.77	0.92	0.91	0.00
1971	7.80	1.28	2.23	2.02	0.17	0.61	0.71	0.79	1.09	1.09	0.00
1972	8.63	1.41	2.75	2.24	0.16	0.53	0.78	0.75	1.49	1.48	0.00
1973	9.15	1.67	2.93	2.19	0.16	0.54	0.74	0.93	1.66	1.66	0.00
1974	7.69	1.32	2.23	1.72	0.11	0.50	0.89	0.93	2.33	2.32	0.01
1975	5.64	1.02	1.64	1.31	0.08	0.40	0.58	0.62	2.15	2.14	0.01
1976	6.66	1.24	1.91	1.55	0.10	0.46	0.62	0.77	2.46	2.45	0.01
1977	6.04	1.15	1.63	1.38	0.12	0.45	0.65	0.68	2.38	2.37	0.01
1978	6.08	1.17	1.63	1.52	0.12	0.44	0.56	0.64	2.35	2.34	0.01
1979	6.01	1.22	1.50	1.53	0.11	0.45	0.61	0.60	1.93	1.92	0.01
1980	5.55	1.17	1.23	1.35	0.09	0.44	0.68	0.59	1.71	1.69	0.01
1981	4.90	1.13	1.07	1.26	0.10	0.39	0.53	0.44	1.79	1.78	0.01
1982	4.68	1.05	1.04	1.20	0.12	0.38	0.53	0.36	1.79	1.76	0.02
1983	5.11	1.40	1.01	1.28	0.12	0.42	0.52	0.35	1.77	1.72	0.05
1984	5.32	1.35	1.22	1.30	0.13	0.44	0.51	0.36	1.86	1.82	0.05
1985	4.74	1.22	0.99	1.15	0.12	0.41	0.48	0.37	1.74	1.71	0.03
1986	4.72	1.35	0.92	1.12	0.12	0.44	0.44	0.32	1.71	1.69	0.01
1987	4.93	1.45	1.04	1.17	0.13	0.45	0.41	0.30	1.83	1.81	0.02
1988	4.49	1.24	0.85	1.13	0.13	0.39	0.45	0.29	1.66	1.65	0.01
1989	3.93	1.05	0.66	1.07	0.12	0.35	0.41	0.27	1.66	1.65	0.01
1990	3.60	0.90	0.52	1.08	0.12	0.33	0.40	0.25	1.80	1.79	0.01
1991	3.70	1.04	0.53	1.07	0.12	0.33	0.41	0.22	2.04	2.02	0.02
1992	3.56	0.95	0.53	1.04	0.10	0.33	0.41	0.20	2.12	2.11	0.01
1993	3.57	0.96	0.48	1.04	0.11	0.37	0.42	0.20	2.38	2.37	0.01
1994	3.49	0.96	0.45	1.03	0.10	0.36	0.38	0.21	2.32	2.31	0.01
1995	3.12	0.74	0.38	0.99	0.09	0.36	0.36	0.21	2.24	2.22	0.01
1996	2.96	0.65	0.40	0.90	0.08	0.35	0.37	0.21	2.34	2.32	0.01
1997	2.86	0.62	0.34	0.86	0.08	0.34	0.41	0.21	2.50	2.49	0.01
1998	2.75	0.61	0.33	0.80	0.08	0.36	0.40	0.19	2.60	2.59	0.01
1999	2.56	0.56	0.31	0.69	0.07	0.34	0.41	0.19	2.60	2.59	0.01

Compiled from the NAPES, ANU, database.

Appendix 2. 5: **Australia's Exports of Textiles and Clothing to APEC Countries, (%)**

Year	Textiles								Clothing		
	65	651	652	653	654	655	656	657	84	841	842
1965	0.60	0.20	0.09	0.19	0.02	0.06	0.04	0.02	0.12	0.11	0.00
1966	0.57	0.14	0.08	0.19	0.02	0.07	0.04	0.03	0.14	0.13	0.00
1967	0.83	0.10	0.13	0.23	0.03	0.08	0.24	0.03	1.30	1.30	0.00
1968	0.73	0.12	0.09	0.21	0.02	0.12	0.14	0.02	0.23	0.22	0.00
1969	0.62	0.11	0.12	0.21	0.03	0.08	0.05	0.03	0.19	0.18	0.01
1970	0.72	0.16	0.09	0.23	0.02	0.10	0.07	0.04	0.23	0.22	0.01
1971	0.71	0.19	0.07	0.25	0.02	0.09	0.05	0.05	0.23	0.23	0.01
1972	0.52	0.12	0.05	0.15	0.01	0.08	0.04	0.05	0.20	0.20	0.01
1973	0.52	0.12	0.06	0.14	0.01	0.09	0.05	0.06	0.16	0.15	0.01
1974	0.49	0.13	0.06	0.14	0.01	0.10	0.03	0.03	0.14	0.14	0.01
1975	0.33	0.08	0.04	0.08	0.01	0.09	0.02	0.02	0.11	0.10	0.01
1976	0.32	0.06	0.03	0.07	0.01	0.09	0.02	0.04	0.08	0.07	0.01
1977	0.25	0.05	0.02	0.05	0.00	0.08	0.01	0.04	0.07	0.06	0.01
1978	0.27	0.05	0.02	0.05	0.01	0.10	0.01	0.04	0.10	0.08	0.01
1979	0.35	0.09	0.02	0.06	0.01	0.10	0.01	0.06	0.11	0.09	0.02
1980	0.31	0.08	0.02	0.05	0.00	0.10	0.02	0.04	0.13	0.12	0.01
1981	0.37	0.13	0.02	0.06	0.00	0.10	0.02	0.03	0.11	0.08	0.03
1982	0.49	0.20	0.03	0.07	0.00	0.11	0.02	0.06	0.08	0.07	0.01
1983	0.43	0.17	0.03	0.06	0.00	0.09	0.03	0.06	0.10	0.08	0.01
1984	0.38	0.10	0.02	0.07	0.01	0.11	0.03	0.04	0.09	0.08	0.01
1985	0.47	0.19	0.03	0.07	0.01	0.09	0.03	0.05	0.09	0.08	0.01
1986	0.61	0.23	0.03	0.11	0.01	0.10	0.04	0.10	0.15	0.14	0.01
1987	0.45	0.04	0.05	0.10	0.01	0.11	0.05	0.10	0.21	0.19	0.02
1988	0.50	0.04	0.07	0.11	0.01	0.11	0.07	0.09	0.20	0.19	0.02
1989	0.51	0.05	0.05	0.14	0.01	0.11	0.06	0.08	0.25	0.24	0.01
1990	0.46	0.04	0.04	0.10	0.01	0.13	0.07	0.09	0.36	0.35	0.01
1991	0.47	0.06	0.05	0.09	0.01	0.12	0.08	0.06	0.42	0.41	0.01
1992	0.49	0.09	0.03	0.09	0.01	0.13	0.07	0.06	0.40	0.40	0.01
1993	0.56	0.12	0.04	0.10	0.01	0.14	0.07	0.08	0.41	0.40	0.01
1994	0.65	0.14	0.05	0.12	0.01	0.16	0.08	0.09	0.50	0.49	0.01
1995	0.63	0.14	0.05	0.12	0.01	0.13	0.09	0.09	0.47	0.46	0.01
1996	0.60	0.14	0.05	0.11	0.01	0.12	0.08	0.09	0.49	0.48	0.01
1997	0.63	0.17	0.06	0.09	0.01	0.11	0.09	0.10	0.57	0.56	0.01
1998	0.61	0.16	0.05	0.10	0.02	0.11	0.10	0.08	0.56	0.55	0.01
1999	0.62	0.12	0.05	0.11	0.02	0.11	0.10	0.10	0.77	0.76	0.01

Compiled from the NAPES, ANU database.

Appendix 5.1: **Sources of Data Used in Econometric Models of Export Supply and Import Demand**

Data series	Unit	Source
Exports of TAC[140] (XST, XSC)[141]	\$US (000), current prices	IEDB, ANU
Export price index[142] (for RPT, RPC)	1990 = 100	DxEconData, ABS Export Price Index (cat. 6405.0)
Domestic (producer) price index[143] (RPT, RPC)	1990 = 100	DxEconData, ABS Producer Price Index (cat. 6427.0)
Domestic production capacity of TAC (CAPT, CAPC)	\$US	NAPES database (ABS cat. 8301.0 and cat. 8125.03)
Average effective rate of assistance (ERAT, ERAC)	Percent	Provided by Productivity Commission, Canberra
GDP deflator[144]	1990 = 100	DxEconData, World Bank World Tables, Table 04
Average exchange rates	\$US/\$A	DxEconData, RBA, AES. Table 1.19a, (ABS cat. 5368.0)
Imports of TAC[145] (MDT, MDC)	\$US (000), current prices	IEDB, ANU
Import price index, textiles (RPT^m, RPC^m)	1990 = 100	DxEconData, ABS Import Price Index (cat. 6457.0)

140 Nominal exports of textiles (clothing) in \$US were first converted to \$A using the nominal exchange rates and then to real values by deflating nominal values of exports by export price indices for textiles (and clothing) respectively.

141 Symbols in brackets indicate the variable to which the series is related directly or indirectly, that is, used in construction of that variable.

142 A complete series for either textiles or clothing was not available, so proxy variables, the export price index for category 6-Manufactured products by material was used for textiles and category 8-Miscellaneous manufactured, where clothing is included, was used for clothing.

143 Due to the series limitation, the values of the index for period between 1970 and 1982 are those for articles produced, knit mills, clothing, and footwear.

144 Used in the calculation of the real GDP (nominal GDP/GDP deflator),

145 Nominal imports of textiles (clothing) in \$US were first converted to \$A using the nominal exchange rates and then to real values by deflating nominal values of imports by import price indices for textiles (and clothing) respectively.

(Appendix 5. 1 continued)

Data series	Unit	Source
CPI, Clothing[146] (Y)	1990 = 100	DxEconData, RBA, Australian Economic Statistics (AES), Table 5.7a
Gross domestic product (GDP)[147]	$US (bill.)	DxEconData, World Bank World Tables, Table 07
Private final consumption expenditure (Clothing, footwear, and drapery) (Y)	$A (mill.)	DxEconData, RBA, AES, Table 5.4 (ABS cat. 5206.0)
Stocks to sales ratio[148] (SST, SSC)	Ratio	DxEconData, RBA, AES, Table 5.14 (ABS cat. 5629.0)

[146] Used as a proxy for the variable (Yt) in estimating the import demand for clothing (Yt = Private final consumption expenditure deflated by CPI Clothing),
[147] Used as a proxy for the variable (Yt) in estimating the import demand for textiles (Yt = GDP deflated by the GDP deflator),
[148] The variable involves a degree of deficiency because the series includes stock and sales for total manufacture in preference to stock to sales ratio for TAC that was not available.

Appendix 5. 2: **Data Series Used in the Econometric Estimation of Export Supply and Import Demand**

Year	XST	RPT^x	CAPT	ERAT	XSC	RPC^x	CAPC
1970	97024	98.60	5872665	55.63	40993	104.32	3317075
1971	86150	109.72	5722503	55.73	44945	104.26	3338592
1972	71023	124.52	6391328	56.83	45469	108.86	3830119
1973	102791	138.52	8596995	59.03	56313	107.17	4930325
1974	108597	138.00	9579003	45.43	51973	97.32	5565839
1975	73896	110.19	5867311	49.33	38756	91.68	3972932
1976	92717	93.56	5846742	66.03	38532	86.66	3613348
1977	75148	99.47	5202743	77.40	31448	91.92	3190978
1978	138649	87.44	4636917	73.07	25495	90.93	2952536
1979	203234	69.33	3390340	76.60	35394	72.61	2217195
1980	189431	62.82	2717080	70.53	34252	60.18	1804447
1981	214131	52.38	2661091	79.33	23821	55.46	1718790
1982	254431	47.11	2302196	82.67	19675	47.46	1504058
1983	212216	101.92	4065660	89.40	22898	104.58	2601572
1984	229810	102.24	4143794	103.73	21840	101.88	2665628
1985	247086	101.84	3518311	121.20	19866	115.31	2178247
1986	280214	99.88	3469001	108.57	27529	124.83	2071274
1987	314342	96.21	3595797	106.80	45554	121.91	2195206
1988	140438	96.42	4004289	107.80	61601	111.09	2629669
1989	145926	102.05	4196413	105.93	76059	102.02	2803303
1990	173798	100.00	3945170	82.87	108966	100.00	2606435
1991	205902	94.71	3949630	79.17	123526	99.09	2516465
1992	283996	82.53	3716246	69.40	134412	104.11	2368024
1993	366717	85.43	3956713	57.90	150449	109.86	2929107
1994	479364	80.00	4177038	52.10	205564	104.98	3057138
1995	461564	95.72	4428466	48.47	198794	104.19	3202313
1996	524856	95.41	4710998	44.50	226653	99.77	3364634
1997	535663	103.04	5024633	42.10	278499	99.97	3544101
1998	482442	106.67	5369372	32.40	229521	109.86	3740713
1999	473192	111.21	5745215	27.70	217208	105.97	3954470

(Appendix 5. 2 continued)

Year	ERAC	MDC	RPC^m	SS[149]	Y	MDT	RPT^m	GDP
1970	102.50	181753	104	0.24	91.90	793260	190	8.867
1971	101.50	207855	104	0.24	95.86	832096	187	9.224
1972	101.00	248233	109	0.23	97.88	785417	199	9.226
1973	97.20	372165	107	0.23	104.98	1111138	198	9.527
1974	69.20	814408	97	0.23	109.06	1425031	184	9.671
1975	85.70	586122	92	0.22	106.69	870458	162	9.914
1976	93.60	735858	87	0.22	103.17	1222330	141	10.498
1977	146.50	706491	92	0.21	99.47	1134316	146	10.879
1978	140.60	679179	91	0.21	99.93	1141129	140	11.096
1979	139.60	556900	73	0.20	100.66	1162817	108	11.539
1980	136.70	502780	60	0.21	101.57	1128092	87	11.823
1981	134.70	589403	55	0.20	107.10	1177775	76	12.260
1982	215.60	701011	47	0.20	112.25	1278170	68	12.394
1983	224.40	555980	105	0.20	116.66	1220564	141	12.566
1984	223.10	737749	102	0.18	119.86	2007627	109	13.413
1985	243.80	669716	115	0.18	123.04	1683827	126	14.076
1986	137.50	638998	125	0.19	128.13	1640438	136	14.320
1987	168.80	710422	122	0.18	127.06	1804124	124	14.910
1988	169.50	731926	111	0.18	130.70	1903915	107	15.561
1989	157.90	866992	102	0.17	130.91	2068485	99	16.541
1990	105.40	922253	100	0.17	129.14	1841835	100	17.046
1991	105.40	1008336	99	0.16	125.28	1857748	103	16.924
1992	85.30	1110329	104	0.16	130.13	1977821	105	17.341
1993	67.20	1222801	110	0.16	129.73	1962985	111	18.078
1994	59.20	1421269	105	0.14	133.37	2250704	107	18.967
1995	54.20	1494842	104	0.14	138.76	2118516	109	19.571
1996	50.20	1636935	100	0.15	143.30	2138654	105	20.554
1997	37.30	1839755	100	0.14	146.04	2156961	107	21.404
1998	37.30	1940564	110	0.14	152.76	2138564	117	22.553
1999	33.00	2111199	106	0.13	161.23	2295628	111	23.566

[149] It is for SST and SSC.

Appendix 8. 1: **Variables and Sources of Data Used in the Econometric Estimation of IIT Models**

Variable/Proxy Variable	Mnemonics	Sign	Measure	Source
Dependent Variable:				
Intra-industry trade index	IIT_{ijk}		Grubel-Lloyd IIT index (%)	NAPES, ANU, VU
Independent Variables:				
Product differentiation	***PD***	+	Ratio of VAD to production in TAC	NAPES, Industrial Profiles
Research and development expenditure	***RD***	+	Number of patents in TAC industries	NAPES, Knowledge Indicators
Effective rate of assistance	***ERA***	-	Effective rate of assistance in TAC (%)	Productivity Commission
Degree of economic development	***DED***	+	Annual GDP per capita	DxEconData, WBWT
Average national income	***ANI***	+	Average GDP ($US mill. constant prices, base = 1995)	DxEconData, WBWT
Absolute difference in national incomes	***DANI***	-	Absolute difference in GDP ($US mill., base = 1995)	DxEconData, WBWT
Average per capita income	***ACI***	+	Average GDP per capita ($US)	DxEconData, WBWT
Absolute differences in per capita incomes	***DACI***	-	Absolute difference in GDP per capita, ($US)	DxEconData, WBWT
Average capital-labour ratio	***KL***	+	Gross capital formation (GCF) per capita	DxEconData, WBWT
Absolute difference in capital-labour ratios	***DKL***	-	Absolute difference in the GCF per capita	DxEconData, WBWT
Distance	***DIST***	-	Kilometres between Sydney and the capital city	http://www.indo.com
Openness	***OPEN***	+	Openness (export + import/GDP)*100; (%)	Penn World Tables
Participation in trading agreements	***TAGR***	+	Dummy variable = 1 if a member, zero otherwise	---

Appendix 8.2: **Data Series Used in the Econometric Estimation of IIT Models, Australia and the ROW**

TEXTILES					
YEAR	**IIT_T**	**PD**	**RD**	**ERA (%)**	**DED**
1970	15.84	42.58	4	55.63	13861
1971	15.25	43.48	4	55.73	13916
1972	15.73	43.50	2	56.83	14134
1973	14.78	43.20	1	59.03	14636
1974	11.97	43.37	2	45.43	14421
1975	13.23	44.53	4	49.33	14627
1976	11.40	45.67	2	66.03	14946
1977	10.75	44.79	2	77.40	14894
1978	11.42	44.77	4	73.07	15534
1979	14.33	43.30	2	76.60	15742
1980	13.35	42.17	2	70.53	16049
1981	13.13	42.32	2	79.33	16288
1982	16.66	42.94	2	82.67	15599
1983	16.19	42.15	2	89.40	16224
1984	13.89	42.39	1	103.73	16853
1985	15.93	41.63	3	121.20	17325
1986	18.28	42.49	4	108.57	17472
1987	18.44	43.36	5	106.80	18131
1988	20.10	43.32	3	107.80	18558
1989	21.34	43.47	3	105.93	18927
1990	24.35	43.54	2	82.87	18632
1991	27.03	43.00	3	79.17	18445
1992	27.07	48.92	5	69.40	18893
1993	29.49	48.39	2	57.90	19439
1994	33.20	44.07	4	52.10	20040
1995	37.00	47.96	4	48.47	20635
1996	40.56	44.46	4	44.50	21103
1997	41.67	47.61	5	42.10	21780
1998	39.19	44.78	5	32.40	22660
1999	39.83	47.33	5	27.70	23359

(Appendix 8.2 continued)

CLOTHING					
YEAR	IIT_C	PD	RD	ERA (%)	DED
1970	52.95	42.58	4	102.5	13861
1971	53.8	43.48	4	101.5	13916
1972	43.9	43.50	2	101	14134
1973	30.6	43.20	1	97.2	14636
1974	54.15	43.37	2	69.2	14421
1975	41.6	44.53	4	85.7	14627
1976	53.74	45.67	2	93.6	14946
1977	43.21	44.79	2	146.5	14894
1978	38.98	44.77	4	140.6	15534
1979	43.1	43.30	2	139.6	15742
1980	55.7	42.17	2	136.7	16049
1981	42.18	42.32	2	134.7	16288
1982	32.42	42.94	2	215.6	15599
1983	25.86	42.15	2	224.4	16224
1984	22.54	42.39	1	223.1	16853
1985	23.83	41.63	3	243.8	17325
1986	44.35	42.49	4	137.5	17472
1987	51.05	43.36	5	168.8	18131
1988	58.55	43.32	3	169.5	18558
1989	58.1	43.47	3	157.9	18927
1990	44.1	43.54	2	105.4	18632
1991	41.5	43.00	3	105.4	18445
1992	44.85	48.92	5	85.3	18893
1993	46.65	48.39	2	67.2	19439
1994	52.6	44.07	4	59.2	20040
1995	46.75	47.96	4	54.2	20635
1996	55.2	44.46	4	50.2	21103
1997	61.95	47.61	5	37.3	21780
1998	63.2	44.78	5	37.3	22660
1999	53.65	47.33	5	33.0	23359

Appendix 8.3: **Data Series Used in the Econometric Estimation of the Models of IIT, Australia and Trading Partners**

TEXTILES and CLOTHING												
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
CHINA												
1970	0.02	0.00	131432	83861	6985	13752	1488	2899	17	8928	0
1971	11.02	0.00	137898	84264	7015	13802	1764	3445	16	8928	0
1972	0.43	0.00	142825	86839	7125	14019	1626	3174	17	8928	0
1973	0.00	0.03	151546	88575	7379	14514	2388	4689	19	8928	0
1974	0.00	0.00	153810	88170	7272	14299	1745	3402	21	8928	0
1975	0.30	0.18	161241	83940	7379	14497	1545	2994	19	8928	0
1976	0.00	0.18	163550	92374	7536	14820	1723	3357	20	8928	0
1977	0.00	0.00	168828	85090	7514	14760	1504	2911	20	8928	0
1978	3.09	0.01	182044	81972	7841	15386	1878	3638	23	8928	0
1979	5.80	0.01	190128	76699	7950	15585	1836	3551	26	8928	0
1980	5.74	0.12	199702	72169	8108	15882	1946	3765	27	8928	0
1981	2.81	0.24	207626	71002	8231	16115	2158	4195	28	8928	0
1982	1.72	0.03	212277	48978	7893	15413	1580	3032	25	8928	0
1983	9.79	0.43	228803	41091	8214	16020	1954	3767	24	8928	0
1984	11.42	0.22	250941	22058	8542	16622	2114	4064	26	8928	0
1985	7.46	0.08	272653	704	8792	17066	2117	4025	27	8928	0
1986	7.02	0.48	288072	16382	8875	17194	1886	3552	27	8928	0
1987	25.95	0.00	312756	35747	9218	17826	2194	4157	30	8928	0
1988	16.65	0.00	337398	61186	9446	18224	2588	4924	31	8928	0
1989	20.03	0.00	350663	64831	9635	18585	2657	5062	30	8928	1
1990	13.17	0.00	357798	79675	9491	18282	1982	3716	30	8928	1
1991	17.36	0.00	376513	115409	9411	18068	1785	3305	32	8928	1
1992	18.47	0.01	413180	165394	9660	18467	2082	3869	36	8928	1
1993	39.13	2.58	453078	219484	9959	18961	2218	4072	34	8928	1
1994	32.01	3.13	495696	276079	10286	19508	2570	4723	35	8928	1
1995	36.74	5.91	536505	327546	10608	20054	2392	4309	35	8928	1
1996	33.84	0.96	576969	381070	10867	20473	2519	4532	36	8928	1
1997	26.23	8.32	619340	431409	11230	21101	2766	5003	37	8928	1
1998	26.15	3.66	662540	475276	11693	21935	3145	5734	38	8928	1
1999	20.44	2.57	703568	521047	12064	22590	3184	5784	38	8928	1

a Base year = 1995; IIT_T - IIT index for textiles; IIT_C – IIT index for clothing.

(Appendix 8.3 continued)

TEXTILES and CLOTHING

YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
HONG KONG											
1970	48.14	18.30	98402	149921	9904	7914	2148	1579	122	7262	0
1971	45.36	8.57	102604	154852	10096	7641	2568	1837	119	7262	0
1972	33.18	8.71	107096	158296	10485	7299	2486	1455	112	7262	0
1973	29.22	5.32	113664	164338	11092	7088	3329	2807	114	7262	0
1974	32.46	16.03	115024	165741	10982	6878	2672	1549	118	7262	0
1975	31.87	26.08	117746	170930	11016	7223	2456	1172	113	7262	0
1976	26.93	35.97	123786	171903	11731	6431	2884	1035	117	7262	0
1977	30.26	39.70	126876	168994	12146	5497	2820	279	113	7262	0
1978	21.74	0.76	134562	176937	12781	5507	3301	793	119	7262	0
1979	29.12	7.09	140009	176936	13047	5390	3373	477	124	7262	0
1980	23.55	46.86	146336	178899	13669	4760	3745	167	124	7262	0
1981	17.79	9.01	152671	180913	14220	4137	4081	348	127	7262	0
1982	20.62	5.95	150317	172898	13939	3321	3408	623	120	7262	0
1983	21.15	3.24	158625	181446	14536	3376	3672	331	129	7262	0
1984	19.84	4.32	168259	187422	15368	2971	3867	558	139	7262	0
1985	26.09	2.80	173847	198315	15507	3636	3728	802	139	7262	0
1986	32.88	4.54	181427	196907	16247	2451	3688	52	143	7262	0
1987	34.95	3.28	194303	201160	17463	1336	4272	1	153	7262	0
1988	37.73	4.24	203998	205614	18271	574	4830	441	165	7262	0
1989	40.34	15.02	211015	214464	18590	675	4781	814	164	7262	1
1990	44.81	7.05	212638	210644	18723	181	4309	937	166	7262	1
1991	48.11	22.75	215777	206065	19018	1146	4274	1674	171	7262	1
1992	54.60	21.10	225144	210677	19772	1758	4834	1636	179	7262	1
1993	49.76	18.52	235244	216184	20493	2108	4914	1319	190	7262	1
1994	46.53	20.35	245838	223637	21192	2304	5887	1912	198	7262	1
1995	52.55	33.90	255985	233494	21627	1983	6213	3333	206	7262	1
1996	50.90	40.55	265960	240947	21854	1502	6106	2641	215	7262	1
1997	58.57	41.10	278178	250916	22658	1755	6787	3040	224	7262	1
1998	59.80	45.25	284763	280277	22380	560	6489	953	234	7262	1
1999	61.10	52.40	296007	294075	22953	812	5903	346	244	7262	1

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
INDIA											
1970	11.81	0.00	145002	56720	7037	13648	1490	2896	19	10442	0
1971	12.54	1.08	149334	61393	7064	13704	1765	3442	18	10442	0
1972	1.99	1.12	152098	68293	7170	13928	1628	3170	18	10442	0
1973	1.06	0.02	158757	74151	7422	14428	2388	4688	19	10442	0
1974	0.89	0.02	160511	74768	7313	14216	1745	3402	21	10442	0
1975	3.38	0.07	168812	68799	7423	14408	1544	2996	21	10442	0
1976	0.01	0.00	173222	73030	7582	14728	1725	3353	22	10442	0
1977	16.33	0.01	178983	64779	7561	14666	1505	2908	22	10442	0
1978	8.15	0.11	189016	68029	7885	15298	1876	3643	23	10442	0
1979	24.13	0.00	187676	81601	7981	15523	1831	3560	26	10442	0
1980	13.03	0.00	196243	79085	8139	15821	1938	3781	25	10442	0
1981	22.67	0.00	204898	76458	8263	16051	2156	4199	25	10442	0
1982	5.66	0.02	204764	64004	7920	15359	1575	3042	23	10442	0
1983	10.31	0.00	217169	64358	8238	15972	1945	3785	23	10442	0
1984	24.60	0.00	227295	69351	8555	16596	2102	4089	25	10442	0
1985	13.61	0.00	238234	69542	8796	17059	2096	4067	25	10442	0
1986	16.11	0.11	246593	66577	8873	17199	1862	3600	25	10442	0
1987	11.28	0.00	258647	72473	9205	17853	2167	4210	25	10442	0
1988	7.86	0.00	275572	62467	9429	18258	2560	4981	25	10442	0
1989	7.13	0.00	289163	58167	9620	18615	2629	5118	26	10442	0
1990	12.15	0.06	296574	42773	9478	18308	1957	3766	27	10442	0
1991	8.68	0.00	298246	41126	9383	18125	1753	3369	27	10442	0
1992	12.01	0.05	311402	38162	9612	18562	2046	3941	38	10442	0
1993	16.79	0.11	324947	36778	9890	19098	2163	4182	30	10442	0
1994	24.69	0.01	343745	27824	10200	19680	2508	4847	30	10442	0
1995	32.20	0.00	363947	17569	10508	20254	2324	4445	31	10442	0
1996	19.44	0.21	383642	5585	10752	20702	2438	4695	31	10442	0
1997	18.00	0.02	400712	5849	11096	21368	2683	5169	32	10442	0
1998	16.76	0.28	424275	1255	11546	22229	3059	5907	32	10442	0
1999	10.92	0.39	446266	6445	11905	22909	3098	5957	33	10442	0

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
INDONESIA											
1970	19.39	66.70	104171	138382	7080	13563	1484	2908	28	5507	0
1971	8.30	44.40	108729	142603	7114	13605	1761	3450	29	5507	0
1972	5.45	50.70	113311	145866	7231	13807	1628	3171	30	5507	0
1973	17.16	44.10	120079	151508	7494	14285	2390	4684	34	5507	0
1974	15.36	73.80	122940	149910	7396	14050	1751	3391	40	5507	0
1975	24.91	43.60	127082	152259	7506	14243	1552	2980	37	5507	0
1976	21.59	20.10	131870	155734	7672	14549	1733	3337	38	5507	0
1977	16.03	12.30	135020	152706	7658	14472	1516	2886	37	5507	0
1978	23.47	3.16	143549	158962	7993	15083	1890	3615	37	5507	0
1979	19.16	4.68	148544	159865	8107	15270	1856	3511	44	5507	0
1980	18.47	7.63	155192	161188	8276	15546	1975	3706	44	5507	0
1981	15.51	6.05	161902	162450	8411	15755	2195	4121	43	5507	0
1982	11.99	6.73	159167	155199	8064	15070	1618	2957	40	5507	0
1983	5.17	3.20	168904	160888	8394	15661	1990	3695	41	5507	0
1984	5.03	6.86	178387	167166	8723	16261	2140	4013	41	5507	0
1985	10.80	3.05	185553	174904	8964	16723	2135	3989	39	5507	0
1986	2.63	1.73	191917	175929	9049	16846	1906	3513	37	5507	0
1987	12.85	2.88	202172	185421	9390	17483	2214	4117	41	5507	0
1988	4.59	6.62	211612	190386	9618	17881	2610	4881	40	5507	0
1989	5.82	5.74	222621	191252	9826	18202	2699	4979	41	5507	1
1990	10.83	6.00	228193	179533	9705	17855	2032	3616	44	5507	1
1991	20.65	4.13	234797	168024	9639	17613	1839	3196	45	5507	1
1992	25.68	5.15	246078	168810	9885	18016	2133	3767	47	5507	1
1993	30.35	2.43	258368	169936	10183	18513	2258	3993	46	5507	1
1994	22.31	6.95	272066	171182	10511	19059	2616	4631	46	5507	1
1995	22.95	9.08	287432	170600	10842	19586	2441	4211	47	5507	1
1996	35.70	33.13	302007	168854	11108	19990	2566	4439	47	5507	1
1997	35.50	3.74	315721	175829	11465	20630	2815	4904	48	5507	1
1998	28.35	4.32	311403	226999	11823	21675	3116	5793	49	5507	1
1999	24.64	12.35	321256	243575	12170	22379	3121	5910	49	5507	1

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
ITALY											
1970	1.06	38.22	375440	404156	7037	3131	2935	6	31	16319	0
1971	2.65	6.20	384359	408657	7064	3029	3107	758	30	16319	0
1972	7.44	2.05	396750	421012	7170	2967	2994	439	31	16319	0
1973	1.94	3.68	421429	451191	7422	2818	3926	1613	33	16319	0
1974	3.11	34.11	439531	483272	7313	2061	3423	46	38	16319	0
1975	5.37	0.04	435208	463994	7423	2592	2912	260	35	16319	0
1976	7.13	0.97	460251	501027	7582	2190	3255	292	38	16319	0
1977	2.76	0.25	469452	516157	7561	1892	2932	55	38	16319	0
1978	1.06	0.09	488561	531061	7885	2105	3334	726	38	16319	0
1979	2.15	23.22	512140	567325	7981	1611	3398	426	41	16319	0
1980	1.55	1.68	529633	587694	8139	1457	3636	385	40	16319	0
1981	0.65	13.00	536519	586783	8263	1600	3698	1114	41	16319	0
1982	0.93	19.67	535957	598381	7920	829	3091	11	39	16319	0
1983	0.84	26.26	547411	596126	8238	1277	3418	839	37	16319	0
1984	3.19	5.46	565383	606825	8555	1497	3656	981	40	16319	0
1985	2.46	13.30	583822	621633	8796	1517	3705	848	41	16319	0
1986	2.19	0.94	598559	637355	8873	1265	3487	351	37	16319	0
1987	18.86	38.56	619749	649731	9205	1442	3875	794	37	16319	0
1988	9.41	1.86	644360	675110	9429	1219	4339	1423	36	16319	0
1989	5.97	14.69	664179	691864	9620	1103	4476	1424	38	16319	0
1990	2.54	2.73	674006	712091	9478	471	3890	99	38	16319	0
1991	8.72	1.72	681590	725562	9383	42	3696	517	37	16319	0
1992	7.64	3.29	691399	721831	9612	386	3946	141	39	16319	0
1993	10.35	3.58	693175	699678	9890	1156	3788	933	35	16319	0
1994	18.23	5.10	711848	708381	10200	1377	4202	1459	34	16319	0
1995	15.59	7.70	734970	724476	10508	1454	4128	836	32	16319	0
1996	9.14	8.80	747818	722767	10752	1772	4236	1099	31	16319	0
1997	9.02	1.04	767657	728041	11096	2107	4535	1465	30	16319	0
1998	16.03	1.24	788441	727077	11546	2656	5009	2006	28	16319	0
1999	.	6.13	806687	727285	11905	3057	5160	1833	27	16319	0

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
JAPAN											
1970	6.69	32.00	1154414	1962104	17163	6604	4800	3724	42	7798	0
1971	6.79	18.95	1207921	2055782	17535	7237	5060	3148	41	7798	0
1972	13.44	3.00	1305084	2237679	18374	8480	5200	3973	40	7798	0
1973	18.63	11.00	1407230	2422794	19433	9593	6352	3240	42	7798	0
1974	9.14	18.35	1392219	2388647	18950	9058	5382	3871	47	7798	0
1975	5.84	7.97	1434859	2463296	19224	9194	4935	3785	44	7798	0
1976	4.61	5.76	1491119	2562764	19766	9639	5213	3624	46	7798	0
1977	5.85	4.80	1552798	2682850	20156	10524	5064	4210	45	7798	0
1978	4.08	5.57	1634917	2823774	21026	10983	5668	3941	43	7798	0
1979	11.07	13.63	1721185	2985416	21740	11995	5835	4447	46	7798	0
1980	11.08	11.85	1770117	3068661	22173	12247	5875	4093	48	7798	0
1981	5.91	6.00	1820868	3155481	22588	12600	6151	3791	48	7798	0
1982	5.63	6.59	1871110	3268688	22597	13996	5535	4877	47	7798	0
1983	1.79	4.18	1917154	3335612	23142	13836	5792	3909	45	7798	0
1984	2.73	3.72	1992226	3460511	23935	14163	6118	3943	48	7798	0
1985	5.84	8.23	2078974	3611937	24749	14847	6338	4417	47	7798	0
1986	12.44	9.73	2140111	3720459	25200	15455	6264	5204	44	7798	0
1987	28.56	15.86	2236916	3884066	26180	16097	6928	5312	43	7798	0
1988	26.15	36.85	2378902	4144193	27430	17743	7948	5795	43	7798	0
1989	27.51	31.41	2502178	4367862	28495	19136	8463	6550	44	7798	1
1990	28.67	34.99	2626965	4618010	29294	21323	8244	8807	45	7798	1
1991	32.13	36.90	2704349	4771080	29760	22629	8186	9497	44	7798	1
1992	27.40	42.55	2733762	4806558	30122	22458	8218	8403	45	7798	1
1993	30.13	44.85	2750948	4815224	30431	21983	8100	7692	43	7798	1
1994	33.47	37.43	2783810	4852305	30867	21653	8294	6725	42	7798	1
1995	30.86	34.91	2832239	4919014	31411	21551	8220	7348	41	7798	1
1996	29.96	35.51	2930897	5088925	32321	22435	8778	7986	40	7798	1
1997	32.96	53.23	2988788	5170303	32993	22426	9054	7574	39	7798	1
1998	28.35	42.57	2968770	5087736	33135	20949	9025	6026	38	7798	1
1999	31.73	51.50	2996289	5106489	33589	20459	8922	5692	37	7798	1

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
KOREA											
1970	24.34	0.74	123120	100484	8072	11578	1668	2540	50	8304	0
1971	6.16	0.71	129576	100907	8172	11489	1956	3060	51	8304	0
1972	1.83	0.52	134613	103263	8314	11640	1804	2819	53	8304	0
1973	4.17	0.25	144527	102613	8692	11889	2620	4225	63	8304	0
1974	1.59	0.08	149003	97785	8657	11528	2045	2802	66	8304	0
1975	0.95	0.07	154932	96559	8825	11604	1823	2439	64	8304	0
1976	1.55	0.15	164165	91143	9127	11638	2055	2692	65	8304	0
1977	6.00	0.04	170918	80911	9238	11311	1921	2076	65	8304	0
1978	11.57	0.01	182623	80813	9690	11687	2414	2566	65	8304	0
1979	7.91	13.84	190369	76216	9899	11685	2453	2317	66	8304	0
1980	10.19	0.01	192431	86710	9980	12139	2432	2793	72	8304	0
1981	10.64	0.01	200921	84412	10193	12189	2640	3230	73	8304	0
1982	13.37	0.04	203493	66546	9964	11271	2096	2000	69	8304	0
1983	19.48	0.16	218889	60918	10473	11503	2538	2599	68	8304	0
1984	15.72	0.19	232972	57997	10951	11805	2770	2752	70	8304	0
1985	11.59	0.02	245091	55828	11324	12003	2778	2702	69	8304	0
1986	10.64	0.06	260436	38890	11662	11620	2604	2116	70	8304	0
1987	11.51	0.01	281174	27419	12282	11698	3033	2478	72	8304	0
1988	12.21	6.59	301122	11365	12798	11520	3561	2978	70	8304	0
1989	7.45	7.83	315830	4835	13161	11532	3788	2801	67	8304	1
1990	13.20	12.58	329757	23594	13300	10665	3338	1004	65	8304	1
1991	10.62	1.42	345940	54261	13534	9823	3336	203	65	8304	1
1992	13.87	15.00	361920	62873	13951	9884	3596	841	55	8304	1
1993	16.75	46.94	379147	71621	14429	10020	3747	1015	58	8304	1
1994	18.99	44.70	403424	91535	15072	9935	4302	1258	55	8304	1
1995	27.02	30.05	430995	116526	15742	9785	4290	513	52	8304	1
1996	24.95	36.05	454359	135849	16288	9631	4564	442	49	8304	1
1997	28.23	38.00	476045	144819	16857	9845	4624	1287	46	8304	1
1998	17.57	16.95	468334	86865	16858	11604	4224	3577	42	8304	1
1999	12.91	3.58	505281	124474	17767	11185	4604	2944	38	8304	1

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
NEW ZEALAND											
1970	32.50	17.10	104899	136926	13391	940	2785	306	56	2218	0
1971	44.75	16.40	108923	142215	13583	666	3069	835	54	2218	0
1972	43.00	31.50	112998	146493	13916	436	2976	474	54	2218	0
1973	43.46	20.30	119342	152981	14567	139	4129	1207	56	2218	0
1974	39.99	21.52	121658	152475	14721	599	3843	793	60	2218	0
1975	51.62	8.90	123922	158578	14543	168	2923	239	59	2218	0
1976	43.44	3.15	127393	164689	14713	466	3160	482	61	2218	0
1977	43.35	4.71	127324	168098	14382	1024	2769	381	61	2218	0
1978	40.57	7.79	133017	180026	14657	1755	2946	1502	60	2218	0
1979	45.71	24.41	135726	185502	14783	1919	3050	1123	65	2218	0
1980	42.57	21.87	139573	192426	14989	2120	3062	1532	65	2218	0
1981	42.66	6.55	143949	198357	15262	2053	3499	1513	65	2218	0
1982	43.57	12.35	141735	190062	15141	916	3004	184	64	2218	0
1983	42.33	20.23	148666	201365	15559	1330	3435	805	63	2218	1
1984	39.51	20.48	156160	211620	16166	1374	3768	757	69	2218	1
1985	31.00	17.81	161872	222267	16417	1816	3680	898	67	2218	1
1986	40.37	34.65	165841	228080	16640	1665	3408	509	62	2218	1
1987	45.61	44.95	173449	242868	16909	2445	3641	1262	61	2218	1
1988	51.36	43.59	179375	254859	17019	3078	4004	2092	60	2218	1
1989	54.79	54.35	185242	266009	17156	3543	4291	1795	61	2218	1
1990	54.90	46.94	185094	265731	16916	3432	3441	799	62	2218	1
1991	58.71	52.30	185174	267269	16634	3623	2917	1041	63	2218	1
1992	57.10	43.32	191295	278375	16862	4063	3307	1419	66	2218	1
1993	54.83	42.54	199402	287868	17523	3833	3683	1143	61	2218	1
1994	58.96	50.18	208030	299253	18127	3826	4218	1427	60	2218	1
1995	65.36	49.71	216775	311914	18636	3998	4165	763	59	2218	1
1996	70.43	49.18	224548	323773	18987	4232	4339	892	58	2218	1
1997	65.10	55.75	233734	339805	19376	4809	4536	1463	56	2218	1
1998	70.89	62.20	244502	360801	19782	5757	4774	2477	55	2218	1
1999	66.71	67.95	255060	375968	20481	5757	5011	2131	54	2218	1

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
SINGAPORE											
1970	11.99	28.95	89383	167958	12537	2647	2582	712	127	6316	11.99
1971	25.54	31.30	93001	174058	13268	1296	3015	943	122	6316	25.54
1972	44.84	43.45	96445	179598	14219	169	2965	497	130	6316	44.84
1973	42.06	24.35	101545	188577	15274	1277	3793	1878	139	6316	42.06
1974	37.91	44.95	102757	190277	15705	2567	3404	84	175	6316	37.91
1975	29.66	25.85	105508	195407	16144	3034	3050	16	159	6316	29.66
1976	28.70	37.60	108997	201481	16938	3984	3300	202	172	6316	28.70
1977	30.82	36.85	110074	202599	17647	5505	2997	76	182	6316	30.82
1978	30.94	26.85	116220	213620	18842	6617	3586	223	188	6316	30.94
1979	39.04	22.15	119317	218320	19978	8471	3838	454	210	6316	39.04
1980	36.30	20.80	123395	224783	21305	10512	4245	834	229	6316	36.30
1981	45.75	29.25	127310	231634	22700	12824	4500	489	223	6316	45.75
1982	43.67	39.70	124260	225012	23356	15515	4149	2105	209	6316	43.67
1983	43.62	48.30	130951	236794	24941	17434	4772	1870	187	6316	43.62
1984	53.77	44.50	137657	248626	26655	19604	5136	1979	180	6316	53.77
1985	43.85	43.10	143057	259896	26596	18542	4739	1220	177	6316	43.85
1986	43.38	42.30	146653	266456	27081	19219	4268	1211	172	6316	43.38
1987	41.02	49.65	154696	280375	29195	22128	4722	899	189	6316	41.02
1988	39.15	40.20	161298	291014	31750	26384	4981	139	206	6316	39.15
1989	37.44	40.25	167528	301438	34097	30341	5290	203	202	6316	37.44
1990	51.39	42.90	167790	300340	36161	35057	4979	2277	204	6316	51.39
1991	49.93	46.75	168573	300473	37973	39056	4779	2684	196	6316	49.93
1992	41.83	38.45	174719	311528	40078	42369	5272	2511	189	6316	41.83
1993	37.21	21.00	182081	322510	44239	49600	5859	3210	178	6316	37.21
1994	42.68	11.00	190072	335171	48483	56885	6128	2394	171	6316	42.68
1995	33.23	13.10	198149	349167	51862	62454	6362	3631	164	6316	33.23
1996	29.76	10.95	205403	362062	55275	68343	6995	4419	156	6316	29.76
1997	28.11	39.10	214613	378046	59434	75309	7665	4795	147	6316	28.11
1998	27.46	29.45	224814	400176	59830	74340	7226	2428	137	6316	27.46
1999	34.53	24.25	234645	416798	63541	80365	7331	2509	127	6316	34.53

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
UNITED KINGDOM											
1970	3.92	35.30	416532	486340	12860	2003	2566	743	54	16997	0
1971	2.03	50.30	426732	493403	12979	1875	2831	1311	53	16997	0
1972	2.57	33.90	442023	511558	13287	1695	2679	1069	53	16997	0
1973	2.29	29.35	472095	552524	13974	1325	3635	2195	40	16997	0
1974	3.19	39.90	467197	538604	13759	1324	2899	1095	46	16997	0
1975	1.62	29.50	467807	529191	13827	1601	2551	983	41	16997	0
1976	1.43	12.30	481220	542965	14168	1557	2848	1107	45	16997	0
1977	1.80	32.60	490660	558573	14299	1191	2645	628	45	16997	0
1978	1.78	37.56	509364	572667	14849	1370	3031	1332	44	16997	0
1979	2.01	28.28	522462	587969	15130	1225	3026	1171	45	16997	0
1980	2.15	46.50	517532	563492	15119	1860	2947	1763	43	16997	0
1981	5.58	35.28	515359	544463	15132	2312	3066	2379	42	16997	0
1982	10.29	5.05	520005	566478	14931	1336	2583	1026	41	16997	0
1983	11.11	34.81	540815	582933	15494	1461	3058	1559	41	16997	0
1984	6.91	11.61	557664	591387	15978	1751	3308	1677	46	16997	0
1985	4.39	49.57	578576	611141	16462	1727	3339	1580	46	16997	0
1986	6.67	3.31	599462	639162	16819	1306	3131	1063	43	16997	0
1987	14.97	8.00	627665	665563	17489	1284	3552	1440	43	16997	0
1988	21.34	36.10	658572	703533	18117	882	4202	1696	42	16997	0
1989	17.51	22.40	675182	713869	18461	933	4322	1733	43	16997	0
1990	17.44	52.30	679103	722286	18352	560	3526	629	43	16997	0
1991	17.30	34.40	672359	707099	18106	678	3141	593	42	16997	0
1992	25.44	36.55	679364	697762	18326	1135	3461	1110	43	16997	0
1993	31.68	49.35	698603	710534	18799	1281	3612	1284	45	16997	0
1994	30.77	35.85	730312	745310	19503	1074	4079	1704	46	16997	0
1995	49.07	32.30	753837	762209	20060	1151	3924	1245	47	16997	0
1996	57.40	44.00	775577	778286	20533	1140	4078	1414	48	16997	0
1997	54.25	34.75	804241	801209	21199	1162	4462	1611	49	16997	0
1998	57.78	65.10	832889	815973	21930	1460	5079	1867	50	16997	0
1999	53.39	73.80	855150	824211	22488	1743	5133	1886	51	16997	0

(Appendix 8.3 continued)

TEXTILES and CLOTHING											
YEAR	IIT_T	IIT_C	ANI $US m.	DANI $US m.	ACI $US	DACI $US	AKL $US	DKL $US	OPEN %	DIST km	TAGR
UNITED STATES											
1970	8.55	39.31	1818681	3290638	15377	3032	2811	253	20	15989	0
1971	14.37	33.55	1881515	3402970	15585	3338	3198	577	20	15989	0
1972	12.36	9.40	1984122	3595756	16076	3884	3179	69	20	15989	0
1973	3.10	8.75	2100467	3809267	16768	4264	4071	1322	22	15989	0
1974	1.43	20.57	2090298	3784805	16522	4202	3305	282	24	15989	0
1975	1.60	27.00	2086206	3765989	16503	3751	2868	349	23	15989	0
1976	1.59	18.05	2201319	3983163	17088	4284	3247	308	24	15989	0
1977	1.14	22.40	2300687	4178627	17414	5039	3197	476	24	15989	0
1978	1.14	42.18	2428865	4411670	18178	5288	3741	87	25	15989	0
1979	1.40	16.08	2505939	4554923	18498	5512	3725	228	27	15989	0
1980	2.17	45.20	2503843	4536114	18525	4952	3633	391	28	15989	0
1981	2.22	27.64	2566014	4645773	18797	5018	3963	585	27	15989	0
1982	5.13	24.75	2512333	4551134	18133	5068	3120	48	25	15989	0
1983	15.66	48.75	2622374	4746052	18796	5143	3600	474	24	15989	0
1984	15.31	49.45	2810485	5097030	19789	5871	4201	109	27	15989	0
1985	21.58	48.96	2918253	5290495	20355	6059	4182	106	27	15989	0
1986	29.36	35.79	3015541	5471319	20711	6478	3933	541	26	15989	0
1987	22.28	25.84	3119692	5649617	21333	6404	4260	25	27	15989	0
1988	24.24	32.09	3249303	5884995	21941	6766	4664	772	27	15989	0
1989	20.12	36.06	3363474	6090453	22446	7038	4817	742	28	15989	1
1990	22.63	28.86	3419230	6202540	22387	7509	4080	480	28	15989	1
1991	27.20	24.61	3403455	6169291	22085	7280	3704	534	28	15989	1
1992	24.71	28.72	3508692	6356417	22552	7318	4124	216	30	15989	1
1993	34.22	36.17	3604468	6522264	23016	7153	4366	224	28	15989	1
1994	38.65	37.17	3751579	6787843	23687	7294	4947	32	28	15989	1
1995	39.77	40.97	3855566	6965668	24174	7078	4784	476	28	15989	1
1996	44.12	44.83	3994717	7216566	24725	7243	5078	585	28	15989	1
1997	37.65	35.51	4173318	7539364	25509	7457	5604	673	28	15989	1
1998	42.29	31.89	4355401	7860998	26387	7453	6259	493	28	15989	1
1999	44.70	19.61	4534872	8183656	27158	7597	6462	772	28	15989	1

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