Analysing and Modelling International Trade Patterns of the Australian Wine Industry in the World Wine Market

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A thesis submitted in partial fulfilment of
the requirements for the degree of

Doctor of Business Administration

School of Applied Economics

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Victoria University

Australia

August 2008

ABSTRACT

Since the mid-1980s, trade liberalisation has encouraged the growth of Australia's international trade. The Australian wine industry has been successful in the world wine market, achieving a significant growth in production and export sales since the 1990s. In this context, this thesis attempts to provide a comprehensive analysis of the patterns and determinants of Australia's international trade in wines for the period 1980-2004. The general aim of this thesis is to analyse the Australian wine industry based on the economic theories of inter-industry trade and intra-industry trade and to model wine export and import relationships.

Indicators of Australia's trade performance in wines in terms of trade specialisation index, export propensity, import penetration, and the ratio of exports to imports indicate that Australia has become a net-exporter and has experienced a specialisation in wine trade since 1987. This signifies a high degree of international trade competitiveness in Australia's wines. The results of Balassa's revealed comparative advantage index and Vollrath's revealed competitive advantage indexes suggest that, among the wine producing countries, Australia has a comparative advantage and competitive advantage in wines. The significant year was 1987 when Australia first experienced comparative and competitive advantage. The important explanation for this turning point is Australia's trade liberalisation policy in the mid-1980s.

Based on econometric concepts of unit root and cointegration, the unrestricted error correction model is applied to analyse the determinants of Australia's wine exports and imports separately in the models of export supply, export demand, and import

demand. The results suggest that the relative price of wine exports and the long-run production capacity have had a positive influence on the supply of wine exports. However, Australia's wine exports are not very responsive to changes in export price. Although the trade liberalisation shows a positive impact on the supply of wine exports, it is not statistically significant. Foreign demand for Australia's wine exports has had a significant negative response to changes in the relative price of exports and a significant positive response to the depreciation of the Australian dollar in both the short run and long run. A low value of the price elasticity of foreign demand may reveal that Australia has some market power in relation to its exports of differentiated or unique wines to the world market. The demand for wine imports by Australia is inelastic with respect to the relative price of wine imports but more elastic to Australia's income.

The standard Grubel-Lloyd index is used to examine the extent of intra-industry trade of Australia and major world-wine trading countries. The index is also applied to Australia's bilateral intra-industry trade in wines with its major trading countries. To measure the growth of intra-industry trade for Australia's wines, the concept of marginal intra-industry trade is applied, together with Menon-Dixon's approach. The results indicate that the world wine industry is more likely to be characterised by inter-industry trade which is based on the significance of comparative advantage and factor endowments rather than intra-industry trade. Australia has a relatively small intra-industry trade in wines. This is due to the fact that the values of Australia's wine exports are very much higher than those of its imports. The extent of bilateral intra-industry trade in wines between Australia and its major trading partners is also small. However, the levels of bilateral intra-industry trade between Australia and New

Zealand are relatively high. The growth of intra-industry trade in wines between Australia and most of the major wine-producing countries is due to the contributions of export growth to the growth in intra-industry trade, which imply that Australia is a net importer of wines from these countries. On the other hand, the percentage growth of intra-industry trade in wines between Australia and Germany, the U.S., the U.K., New Zealand, Canada, and Japan is due to the contributions of import growth to the growth in intra-industry trade, which imply that Australia is a net exporter of wines to these countries.

The extent of Australia's intra-industry trade with the rest of the world will be higher when the industry gains more scale economies. Contrary to the theoretical suggestions, product differentiations, degree of trade openness, and exchange rate have had negative relationships with Australia's intra-industry trade in wines. With regard to Australia's bilateral intra-industry trade with its nine major wine trading partners (France, Italy, Spain, Germany, the U.S., South Africa, New Zealand, the U.K. and Japan), the intensity of intra-industry trade in wines is statistically and positively related to the ratio of capital to labour, trade openness, common culture, and the regional trade arrangements.

The policy implications of the analysis of the determinants of Australia's intra-industry trade in wines are that the government policy should be oriented towards increases in the production capacity of the Australian wine industry in order to achieve higher economies of scale. In addition, the Australian government should promote regional economic integration and trade liberalisation involving wine trade between close and economically similar economies.

DECLARATION

"I, Jumpoth Boriraj, declare that the DBA thesis entitled, 'Analysing and Modelling International Trade Patterns of the Australian Wine Industry in the World Wine Market' is no more than 65,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, 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."

Jumpoth Boriraj Date

ACKNOWLEDGEMENT

Writing a thesis is time-consuming work. This thesis would not have been completed without the comments, suggestions, and contributions from several people. First of all, I would like to express my deep appreciation to my principal supervisor, Dr. Kandiah Jegasothy from School of Applied Economics, Victoria University who has provided invaluable advice, especially in econometric issues. I also extend my appreciation to Dr. P. J. Gunawardana from School of Applied Economics, Victoria University who has provided his extensive knowledge in the areas of international economics and international trade analysis.

I am also indebted to Dr. Hubert Fernando and Dr. Muhammad Mahmood who have given me the invaluable experience of being a teaching member at Victoria University. My special thanks go to all staff in the School of Applied Economics and Victoria Graduate School of Business. I also extend my appreciation to relevant officers from ABARE and ABS for their assistances with my data.

Finally and most importantly, I must thank my family. I dedicate this thesis to my grandparents (Mrs. Kim Thariya and Mr. Cha-Vien and Mrs. Ubol Boriraj) and my aunt (Dr. Vinita Boriraj). The completion of this thesis would not have been possible without their inspiration. I express my deepest gratitude to Ms. Sa-Ngiam Thariya, my aunt whom I treat as my second mother. And lastly, I wish I could find a word to express my gratitude to my parents (Mr. Voravit and Mrs. Permporn Boriraj) for their wonderful love and incredible encouragement and support.

LIST OF ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australia Bureau of Statistics
AC	*Appellation Controlee* (of France)
ADF	Augmented Dickey-Fuller (Test)
ANZCERTA	Australia - New Zealand Closer Economic Relations Trading Agreement
AOC	*Appellation d'Origine Controlee* (of France)
APEC	Asia-Pacific Economic Cooperation
AR	Autoregressive Process
ARMA	Autoregressive Moving Average
ASEAN	Association of South East Asian Nations
ASIC	Australian Standard Industrial Classification
AVA	Approved Viticultural Area (of America)
AWBC	Australian Wine and Brandy Corporation
BC	Before Christ
CEEs	Central and Eastern European countries
CEI	Closer Economic Integration
CER	Closer Economic Relations
CGE	Computable General Equilibrium
CN	Combined Nomenclature
COD	*Controlled Original Denomination* (of Argentina)
CPI	Consumer Price Index
CRDO	*Consejo Regulador de la Denominacion de Origen* (of Spain)
DAFF	Department of Agriculture, Fisheries, and Forestry
DF	Dickey-Fuller (Test)
DFAT	Department of Foreign Affairs and Trade
DGP	Data Generating Process
DO	*Denominacion de Origen* (of Spain)
DO	*Denomination of Origin* (of Chile)
DOC	*Denominacao de Origem Controlada* (of Portugal)

DOC	*Denominazione di Origine Controllata* (of Italy)
DOCa	*Denominacion de Origen e Calificada* (of Spain)
DOCG	*Denominazione di Origine Controllata e Garantita* (of Italy)
DW	Durbin-Watson (Test)
ECM	Error Correction Model
EEC	European Economic Community
EG	Engle-Granger (Test)
EIR	Export/Import Ratio
EOS	Economies of Scale
EPI	Export Propensity Index
EU	European Union
FAO	Food and Agriculture Organisation
FDI	Foreign Direct Investment
FTA	Free Trade Area
FTAs	Free Trade Agreements
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GCOD	*Guaranteed Controlled Original Denomination* (of Argentina)
GDP	Gross Domestic Production
GI	Geographical Indication
G-L	Grubel and Lloyd
GNE	Gross National Expenditure
GNI	Gross National Income
GNP	Gross National Product
GST	Goods and Services Tax
GWRDC	Grape and Wine Research and Development Corporation
H-O	Heckscher-Ohlin
IGT	*Indicazione Geografica Tipica* (of Italy)
IIT	Intra-Industry Trade
INAO	*Institut National des Appellations d'Origine* (of France)
INDO	*Instituto Nacional de Denominaciones* (of Spain)
IPR	*Indicacao de Proveniencia Regulamentada* (of Portugal)
ISIC	International Standard Industrial Classification

LAFTA	Latin American Free Trade Association
LDCs	Less-Developed Countries
LIP	Label Integrity Programme
LM	Lagrange Multiplier (test)
MES	Minimum Efficient Scale
MIIT	Marginal Intra-Industry Trade
MNCs	Multinational Corporations
MPI	Import Penetration Index
NAFTA	North American Free Trade Agreement
NECs	Newly Exporting Countries
NICs	Newly Industrialised Countries
NIEs	Newly Industrialised Economies
NZ	New Zealand
OAPs	Offshore Assembly Provisions
OD	*Original Denomination* (of Argentina)
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PP	Phillips-Perron (Test)
QbA	*Qualitatswein bestimmter Anbaugebiete* (of Germany)
QmP	*Qualitatswein mit Pradikat* (of Germany)
R&D	Research and Development
RC	Revealed Competitiveness Index
RCA	Revealed Comparative Advantage Index
RESET	Regression Specification Error Test
RMA	Relative Import Advantage Index
RTA	Relative Trade Advantage Index
RTAs	Regional Trade Arrangements
RXA	Relative Export Advantage Index
SIC	Standard Industrial Classification
SITC	Standard International Trade Classification
TO	Trade Overlap
TSI	Trade Specialisation Index
UECM	Unrestricted Error Correction Model

UK	United Kingdom
UN	United Nations
US	United States of America
VAR	Vector Autoregression
VAT	Value Added Tax
VC	*Vino Comarcal* (of Spain)
VdlT	*Vino de la Tierra* (of Spain)
VdM	*Vino de Mesa* (of Spain)
VDQS	*Vins Delimites de Qualite Superieure* (of France)
VR	*Vinho Regional* (of Portugal)
WET	Wine Equalisation Tax
WLS	Weighted Least Squares
WMWM	World Multi-Sectoral Wine Model
WFA	Winemakers' Federation of Australia
WTO	World Trade Organisation

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

The world wine industry provides a fascinating situation as there have been dramatic increases in outputs and international trade volumes, especially in the New World exporters[1] over the last two decades (Anderson *et al.* 2001 and Wittwer *et al.* 2001). Since the late 1980s, the share of wine production that is traded internationally has nearly doubled. The New World group's export shares grew from just three percent in the late 1980s to twenty percent in 2001 (Anderson 2004). The increased percentage of wines being exported was due primarily to the strategic policies that wineries placed on exporting as a growth strategy (Spahni 1999 and GWRDC[2] 2004).

In Australia, the wine industry has been successful in the world wine market, achieving a significant growth in production and export sales since the 1990s (Department of Industry, Science and Resource 2000). ABS[3] (2004) also acknowledges the wine industry as a significant contributor to the Australian economy as it is among the top five agricultural exports. Australia is the fourth-largest wine exporter by value, following France, Italy, and Spain, respectively (Anderson 2004). Continuing growth in Australian wine exports has been impressive by a compounding growth rate of fifteen percent annually in volume and more than twenty percent in terms of value over the last two decades (Anderson and Berger 1999).

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[1] Australia, New Zealand, South Africa, the U.S., Argentina, and Chile
[2] Grape and Wine Research and Development Corporation
[3] Australian Bureau of Statistics

1.2 REVIEW OF LITERATURE

In general, empirical studies have so far concentrated on the impact of industry policies, especially the tax structures in the Australian wine industry. Wittwer and Anderson (1998) initially investigated the impact of tax reform on the Australian wine industry after changes in the Australian taxation system in the late 1990s. They provided empirical estimates of the effects of various tax options. This study was later revised by Wittwer and Anderson (1999) to analyse the impact of the Goods and Services Tax (GST) and the Wine Equalisation Tax (WET) by using a Computable General Equilibrium (CGE) model. Berger and Anderson (1999a; 1999b) examined import taxes in the world wine market and their impact on the world wine consumption. Zhao *et al.* (2002) developed a Multi-Sectoral Partial Equilibrium model focusing on the aggregate returns from different types of research and promotion investments by the Australian wine industry and their participants in the market. Up to this point, there are a limited number of econometric studies of the Australian wine industry, especially on the supply and demand of export and import.

Osmond and Anderson (1998) provided qualitative and descriptive approaches to examine trends and cycles in the Australian wine industry. Their study identified the fundamental causes of 'boom and bust' cycle in the Australian wine history. Spahni (1999) developed bilateral wine trade matrices by dividing wine exporting and importing countries into fifteen groups, yet did not study the Australian bilateral intra-industry trade in wines. Some empirical studies focused more on modelling the world wine market rather than examining international wine trade patterns for a particular country. For example, Wittwer *et al.* (2001) proposed a World Multi-Sectoral Wine Model (WMWM) to examine the rapid growth in premium wine production among the New World producers and the changing global consumers' tastes from non-premium to premium wines. Similar works conducted by Anderson and Wittwer (2001a; 2001b) applied the WMWM to examine the effects of the Asian demand growth on the global wine market for premium wine.

Thus, there has been no comprehensive study so far on international trade patterns and determinants of Australian wines in the world wine market, particularly using international trade theories to explain the comparative and competitive advantage of the Australian wine industry. Moreover, there has been no empirical study undertaken so far to econometrically examine the determinants of demand and supply of exports and imports for Australia's wines. The previous works have not particularly modelled Australia's intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major trading partners.

1.3 OBJECTIVES OF THE STUDY

The broad objective of this thesis is to analyse the patterns and determinants of Australia's international trade in wine for the period 1980-2004. The thesis provides a systematic analysis of both inter- and intra-industry trade flows in Australia's wines associated with the effect of trade liberalisation in the mid-1980s. The thesis attempts to accomplish four specific aims:

- To examine Australia's comparative advantage and competitiveness in wines and also to investigate Australia's trade performance in wines;

- To develop econometric models of Australia's export supply, export demand, and import demand of wines, in order to identify the patterns and determinants of Australia's wine exports and imports associated with supply and demand conditions and to estimate the price and income elasticities;

- To examine the extent of Australia's intra-industry trade in wine, and the growth of bilateral intra-industry trade in wine between Australia and its major trading partners and;

- To develop econometric models of the determinants of Australia's intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major trading partners.

1.4 SIGNIFICANCE AND CONTRIBUTION OF THE RESEARCH

Since the wine industry is one of the significant sectors among Australia's agricultural exports, it is important to understand the patterns and determinants of international trade in this industry in order to design and implement appropriate policies and strategies to expand trade at both company and national levels, and in particular to promote Australian wine exports. The significance of this thesis is to develop a framework for the analysis of the comparative and competitive advantage of the Australian wine industry and to develop comprehensive models for export supply and import demand of Australian wines.

This thesis provides three important contributions. Firstly, comprehensive patterns of Australia's international wine trade in terms of both inter- and intra-industry trade are revealed. Secondly, it describes the significant factors influencing on exports and imports of Australia's wines. Finally, this thesis synthesises the theoretical framework and methodology for analysing the international trade patterns and determinants of Australia's wines. It also extends the knowledge of international economics and trade. Therefore, this thesis is useful for grape growers, wine makers, wine importers and exporters, and policy makers concerned with Australia's international wine trade. It is also beneficial to those wishing to undertake academic research in the international trade of agricultural products.

1.5 OUTLINE OF THE THESIS

The thesis is organised into seven chapters. Chapter Two describes an overview of the wine industry and trade, including the world wine industry, the pattern of the world trade in wines, the Australian wine industry, and Australia's international trade in wines.

Chapter Three firstly reviews the principle of comparative advantage in order to provide the theoretical framework for the analysis of Australia's comparative and competitive advantage in wines. Then, the thesis provides an investigation of Australia's trade performance in wines by using a set of measurements of trade specialisation, export propensity, import penetration, and export/import ratio. In the final section measures are provided to describe the degree of Australia's comparative advantage and competitive advantage in wines comparing to its major competitors by applying Balassa's (1965) index of 'revealed comparative advantage' index and Vollrath's (1991) index of 'revealed competitive advantage'.

Chapter Four analyses export supply, export demand, and import demand for Australia's wines. Separate models are developed and estimated econometrically. The short run and long run relationships among the variables are identified, and price and income elasticities are also derived.

Chapter Five presents a review of the theory and measurements of intra-industry trade. Next, this chapter provides the analysis of the extent and growth of Australia's intra-industry trade in wines with the rest of the world as well as bilateral intra-industry trade with its major trading partners.

Chapter Six focuses on the analysis of factors influencing Australia's intra-industry trade in wines. It begins with a review of theoretical literature and empirical studies regarding to the determinants of intra-industry trade. Then, separate models of intra-industry trade's determinants are developed and estimated econometrically, for Australia's intra-industry trade in wines with the rest of the world, and Australia's bilateral intra-industry trade in wines with its major trading partners. The major findings of the thesis and suggestions for implications and further research in relation to Australia's international trade in wines are provided in Chapter Seven.

CHAPTER TWO

WINE INDUSTRY AND TRADE: AN OVERVIEW

2.1 INTRODUCTION

The world wine market has changed remarkably since the late 1980s (Anderson and Norman 2003). The dominance of European producers in the global wine export market has declined with dramatic increases in exports from the New World producers[4]. Between 1990 and 2001, these new producers' combined share of world wine exports grew from three to twenty percent in value terms. Over the same period, the decline in Europe's share of global wine exports was even greater, with a fall from eighty eight to sixty four percent. However, the share of wine production that is traded internationally has nearly doubled in the same period (Anderson 2004).

The purpose of this chapter is to provide the necessary background for the empirical analysis to be conducted in Chapters Three to Six, by providing an overview of the world wine industry, the pattern of world wine trade, the Australian wine industry, and Australia's international trade in wines. Section 2.2 focuses on the patterns and trends in the world wine market. This section also provides a general description of major-wine producing countries. In section 2.3, an overview of the Australian wine industry is presented. This section provides the history of the Australian wine industry, its structure, and some major wine policies. Next, Section 2.4 examines

[4] Australia, New Zealand, the U.S., Chile, Argentina, and South Africa

Australia's wine trade position in the world wine market. A summary of the world wine market and the Australian wine industry is presented in Section 2.5.

2.2 THE GLOBAL WINE INDUSTRY

The wine industry has experienced remarkable global changes in production and trade during the last two decades. This industry has played an important role in many countries' economies, including that of Australia (Domine 2004). Even though the earliest clear evidence of winemaking goes back to about five thousand years BC, the international trade in wines began around the seventeenth century and the real growth in the world wine industry started after the Second World War due to industrialisation and mass production (Johnson 1989).

An improvement in wine quality has driven the world wine market into becoming more global in recent decades (Mayne 1986). The New World producers have achieved a technological advance in their vineyards and wine production, consequently creating good quality wines (Halliday 1996). Nowadays, the world wine market is significantly larger and with more wine varieties. Improvements in international transportation have increased trade in wine varieties globally (Domine 2004). Moreover, on the demand side, there are changes in the consumers' tastes towards something new and different from the traditional European wines. This has created an international market opportunity for the New World wines (Halliday 1996).

2.2.1 WINE INDUSTRY OVERVIEW

Historically, wine production and consumption had been mainly in France, Italy, Portugal, Spain, and Germany, known as the Old World producers. But currently, countries such as Argentina, Australia, Chile, South Africa, and the U.S. known as the New World producers, have a large and growing wine production and consumption (Labys and Cohen 2004). Anderson and Norman (2003) also reported that the New World producers have gained increasing market shares outstandingly at the same time as a decline in the Old World's market shares.

Table 2.1: World Wine Production (million litres)

Country	1993	2003	% Change	Volume Change
France	5,328.50	4,735.30	-11.13	-593.20
Italy	6,267.50	4,408.60	-29.66	-1858.90
Spain	2,650.70	3,600.00	35.81	949.30
US	1,585.00	2,350.00	48.26	765.00
Argentina	1,447.00	1,180.00	-18.45	-267.00
China	500.00	1,120.00	124.00	620.00
Australia	461.80	1,085.00	134.95	623.20
Germany	992.00	828.90	-16.44	-163.10
South Africa	881.10	761.00	-13.63	-120.10
Portugal	460.70	680.00	47.60	219.30
Chile	380.60	575.20	51.13	194.60
Romania	583.90	546.10	-6.47	-37.80
Top 12 Countries	21,538.80	21,870.10	1.54	331.30
World	25,291.00	25,932.00	2.53	641.00

Source: Anderson (2004) and Domine (2004).

France and Italy compete for the world's leading position in terms of production, and often change places, mainly depending on the climate of a particular year (Labys and Cohen 2004). According to Table 2.1, Italy was the largest world wine producer in 1993 but France took the lead in 2003. From 1993 to 2003, Italy had the largest reduction in wine production reducing by about 30 percent or 1,858.90 million litres.

Germany and France also had high reductions in their wine production. On the other hand, Australia had the most increase in wine production among the world wine producers increasing by about 135 percent. The U.S. and Chile also experienced increases in their wine production. Overall, in 2003, the top twelve world wine producers produced 21,870.10 million litres out of total world wine production of 25,930 million litres, which accounted for more than 80 percent of total world wine production (see also Table 2.2).

Table 2.2: Share of World Wine Production in terms of volume (%)

Country	1993	2003
France	21.1	18.1
Italy	24.8	16.8
Spain	10.5	13.7
US	6.3	9
Argentina	5.7	4.5
China	2	4.3
Australia	1.8	4.1
Germany	3.9	3.2
South Africa	3.2	2.9
Portugal	1.8	2.6
Chile	1.5	2.2
Romania	2.3	2.1
Top 12 Countries	84.9	83.5

Source: Anderson (2004) and Domine (2004).

According to Table 2.2, major European wine producing countries still led the world wine production in 1993 and 2003. However, a decade from 1993 to 2003, the world's share of wine production shifted significantly more to Australia, Chile, the U.S., and those from the New World producers.

Table 2.3: World Grapevines (hectares[5])

Country	1993	2003	% Change	Volume Change
Spain	1,281,000	1,166,000	-8.98	-115.00
Italy	979,000	868,000	-11.34	-111.00
France	940,000	852,000	-9.36	-88.00
Turkey	567,000	565,000	-0.35	-2.00
USA	324,000	386,000	19.14	62.00
China	142,000	383,000	169.72	241.00
Romania	251,000	223,000	-11.16	-28.00
Portugal	360,000	220,000	-38.89	-140.00
North Africa	223,000	214,000	-4.04	-9.00
Argentina	205,000	201,000	-1.95	-4.00
Chile	112,000	168,000	50.00	56.00
Australia	63,000	144,000	128.57	81.00
Top 12 Countries	5,447,000	5,390,000	-1.05	-57.00
World	8,027,000	7,504,000	-6.52	-523.00

Source: Wittwer and Anderson (2004).

From 1993 to 2003, the world wine grape-growing areas decreased by 523 hectares or 6.52 percent. Table 2.3 shows that Spain was the largest wine grape-growing country, followed by Italy and France. Portugal had the largest reduction in its grape-growing areas during a decade from 1993 to 2003. On the other hand, during the same period, Australia had a significant increase in growing wine grapes at 128.57 percent. The U.S. and Chile also experienced increases in their grapevines.

Table 2.4 shows that most wine-producing countries were also wine-consuming countries. However, Table 2.5 shows that the U.K. and Germany had the greatest imbalance. On the other hand, Spain had the most surplus, followed by France and Italy during a three-year period of 2001 to 2003. Table 2.5 also indicates that most of the major wine-producing countries experienced wine surpluses, except Argentina, the U.S., and Germany.

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[5] One hectare is equal to 10,000 square metres or 2.471 acres

Table 2.4: World Wine Consumption, 2001 to 2003

Country	Wine consumed (ML)	Wine consumed (litres per capita)
France	3,332.80	56.00
Italy	2,904.90	50.30
US	2,567.30	8.90
Germany	1,993.90	24.20
Argentina	1,360.70	35.90
Spain	1,196.80	29.70
Russia	1,165.40	8.10
UK	1,160.10	19.50
Romania	565.60	25.30
Portugal	444.80	43.80
Australia	402.70	20.50
South Africa	400.10	9.00
Top 12 Countries	17,495.10	331.20
World	24,327.90	3.90

Source: Wittwer and Anderson (2004).

Table 2.5: World Wine Production and Consumption, million litres, 2001 to 2003

Country	Production	Consumption	Surplus/Shortage
Spain*	3,268.80	1,196.80	2,072.00
France*	5,365.90	3,332.80	2,033.10
Italy*	4,922.60	2,904.90	2,017.70
China*	1,106.70	256.60	850.10
Australia*	1,127.30	402.70	724.60
South Africa*	756.20	400.10	356.10
Chile	580.10	243.70	336.40
Moldova	385.90	50.50	335.40
Portugal*	684.20	444.80	239.40
Hungary	493.50	363.10	130.40
Greece	435.90	363.70	72.20
Austria	249.00	237.80	11.20
Brazil	315.00	330.30	-15.30
Romania	533.60	565.60	-32.00
Argentina*	1,326.20	1,360.70	-34.50
Switzerland	110.50	306.40	-195.90
USA*	2,343.30	2,567.30	-224.00
Japan	106.70	340.30	-233.60
Canada	48.00	329.50	-281.50
Russia	353.70	1,165.40	-811.70
Germany*	875.70	1,993.90	-1,118.20
UK	1.30	1,160.10	-1,158.80
World	27,398.80	24,327.90	3,070.90

Source: Wittwer and Anderson (2004).
Note: * Top ten world wine-producing countries.

2.2.2 MAJOR WINE-PRODUCING COUNTRIES

This section provides a concise history and characteristics of major producers in the world wine market. Recent issues or concerns among these countries are also discussed.

2.2.2.1 The Old World Producers

Generally, the Old World group refers to those countries where their grapevines and wines are considered as traditional wine producers in the Western European countries (Murphy 2000). An Old World wine is labelled carrying the name of one of the regulated quality designations listed in Table 2.6. Division One comprises the best quality wines. Division Two is the middle rank. Division Three includes just table wines, which are not allowed to claim any geographical superiority since they simply are the surplus of wine production (Robinson 2003).

Table 2.6: Comparison of Official Categories of the Old World Wine

Country	Division One	Division Two	Division Three
France	*Appellation d'Origine Controlee* (AOC)	*Vin de Pays*	*Vin de Table*
Italy	*Denominazione di Origine Controllata* (DOC)	*Indicazione Geografica Tipica* (IGT)	*Vino da Tavola*
Spain	*Denominacion de Origen* (DO)	*Vino de la Tierra*	*Vino de Mesa*
Germany	*Qualitatswein mit Pradikat* (QmP)	*Qualitatswein bestimmter Anbaugebiete* (QbA)	*Deutscher Tafewein*
Portugal	*Denominacao de Origem Controlada* (DOC)	*Vinho Regional* (VR)	*Vinho de Mesa*

Source: Adapted from Arkell (2003) and Robinson (2003).

France: The history of French wines started when the Roman planted the first vineyards in France in the sixth centuries BC (Domine 2004). A number of factors such as location, climate, soils, natural resources, and cultural factors with allowances for different techniques and tastes make that France has a leading position in the world wine market (Johnson 1989 and Robinson 1994). Muschamp (1977) claimed that no country could produce such high quality wines similar to those of France.

In 1932, the *Institut National des Appellations d'Origine* (INAO) was founded to regulate the entire quality wine industry. The *Appellation Controlee* (AC) system created in 1936 covers the areas of production, wine production and storage methods, and minimum alcohol content (Anderson 2004). The AC is France's principal and quality designation system, which is used to protect producers from imitators and to guarantee authenticity to consumers. At present, there are three classification categories for all the wines of France. Firstly, *Appellation d'Origine Controlee* (AOC) is the certified quality wine designation that guarantees origin and authenticity. Secondly, *Vins Delimites de Qualite Superieure* (VDQS) is the second rank of appellations that was instituted in 1945 for regions with worthwhile identities and traditions producing minor wines. Lastly, the second tier after the AOC is *Vin de Pays* while *Vin de Table* is described as basic wines (Robinson 2003). Spain, Italy and Portugal all based their own systems on France's AC system (Jukes 2005).

Italy: Italy has also had a very old and established wine industry since the time of the ancient Greek settlers (Anderson 2004). Quality designations in Italy have four levels. Firstly, *Denominazione di Origine Controllata e Garantita* (DOCG) is the super-DOC category wines that are guaranteed among Italy's better bottles reserved for the twenty three top wines (Robinson 2003). Secondly, *Denominazione di Origine Controllata* (DOC) is the standard quality designation. The DOC is an equivalent to the France's AOC (Johnson 1997). Thirdly, *Indicazione Geografica Tipica* (IGT) categories regional or country wines which are high quality wines that cannot apply DOC (Arkell 2003). Lastly, *Vino da Tavola* status is used for table wines (Johnson 1997).

The basic trouble encountered with Italian wines is that the Italian wine makers do not willingly submit to regulation (Robinson 2003). Recently, there has been conflict in Italian winemaking because the traditional Italian grapes are being replaced with grapes that are identified with those grown in France. Some Italian winemakers insisted on making wine only from those grapes that have been traditional to Italy, which inturn are weaknesses in the Italian wine competitiveness (Schmid 2004).

Spain: Spain first cultivated the vine around 3000 BC (Robinson 1994). In 1970, Spain created the *Instituto Nacional de Denominaciones* (INDO) for the purposes of regulating and controlling quality wines in Spain (Albisu 2004). Spanish wines are produced under a system similar to France's AC known as *Consejo Regulador de la Denominacion de Origen* (CRDO) (Muschamp 1977). Currently, there is a five-tier quality control system for Spanish wines. Firstly, *Denominacion de Origen e Calificada* (DOCa) is a superior category reserved for the very top wines. There are two regions qualified for the top rank, namely Rioja and Priorato. DOCa equates with Italy's DOCG. Secondly, *Denominacion de Origen* (DO) is the standard quality designation, which is Spain's parallel to France's AOC. Thirdly, *Vino Comarcal* (VC) gives regional status to some table wine producers who fall outside the DO. Fourthly, *Vino de la Tierra* (VdlT) is designed for county or district wines, which is Spain's parallel to France's *Vin de Pays*. Lastly, *Vino de Mesa* (VdM) is just a basic wine, which is Spain's parallel to France's *Vin de Table* (Arkell 2003 and Robinson 2003).

Even though Spain had the biggest vineyard area in the world, Spain came the third (after France and Italy) in terms of wine production in 2003. The main reason for the low yield is that much of the soil is infertile; many of the vines are old and in need of replacement, and the vineyards are often split up among smallholders who have few resources or little expertise to draw on (Robinson 1994 and Read 2003). Spain's main problems are not only in the vineyard but also in the cellar. It is extremely rare for wine producers to grow all their own grapes. Almost all of the top companies in the top regions depend on local farmers. Consequently, they do not provide a stable quality of wines (Robinson 2003).

Germany: The history of German wines began more than 4000 years ago in the Rhine valley (Storchmann and Schamel 2004). The Wine Law divided all German wines into three levels. *Deutscher Tafewein* or table wine is the lowest level, which is subject to relatively few controls and is also excluded from claiming any specific vineyard origin. The second categorical level is called *Qualitatswein bestimmter Anbaugebiete* (QbA). The term means quality wine from a designated region. The highest level is *Qualitatswein mit Pradikat* (QmP). QmP refers to the highest quality wines that are qualified in ascending order of natural grape ripeness (Johnson 1997 and Robinson 1994).

Robinson (2003) contended that the German wine business has been on a downturn. Only a minority of local wine producers are classified as QmP. In addition, the

German Wine Law of 1971 allowed a wine producer to label his wine with deluxe names, which reflected almost no relation to its origin. It also permitted the use of word ‘quality’ with no restriction on yields. More disastrously, it proclaimed that wine quality could be measured with the refractometer, with which vine-growers checked the sugar content of their grapes. To qualify as a higher grade, the grape juice simply had to be sweeter. Consequently, the degraded quality caused the price of German wines to plummet to some of Europe’s lowest levels (Johnson 1997).

Portugal: Portugal has a four-tier appellation system. The best wines are qualified in the first tier, called the *Denominacao de Origem Controlada* (DOC) status, which is Portugal’s equivalent of France’s AOC. *Indicacao de Proveniencia Regulamentada* (IPR) is the next tier down, which is Portugal’s parallel to France’s VDQS. The third is the *Vinho Regional* (VR) categorising county or district wines, which is at the same level as France’s *Vin de Pays*. The fourth distinction is *Vinho de Mesa* meaning basic table wines (Arkell 2003; Robinson 2003; and Johnson 1997). Most Portuguese wines are made from completely indigenous grape varieties with their own individuality in fruit, maturity, acidity and aging potential, which in turn has ensured that Portugal has become a unique wine-producing country (Arkell 2003 and Domine 2004).

2.2.2.2 The New World Producers

Murphy (2000) defined the ‘New World’ countries in the world wine market as those countries discovered by the European explorers during the sixteenth century. Major wine-producing countries in the New World group are the U.S., Argentina, Australia, South Africa, and Chile.

U.S.: The history of the U.S. wine industry started from European settlement in the late sixteenth century (Walton 1999). The international image of the U.S. wine industry was of a low quality wine producer until the mid-1970s. In 1976, during a wine-tasting contest in Paris, California wines from Napa valley won over several well-known European wines. Since the 1990s, the U.S. wine industry has focused heavily on developing high-quality wines in competition with the Old World wines (Sumner *et al.* 2004).

The American Approved Viticultural Area (AVA) is an American system of original appellations developed in the early 1970s similar to the European systems of controlled appellations of Europe. However, the AVA is concerned only the specified geographical boundaries around more or less standardised areas (Robinson 2003). It imposes no vinification parameters, grape yield limits or rules on varieties planted, which contrasts with the European systems (Jukes 2005). The system implies no degree of quality. In fact, the system permits a wine to carry an AVA name if at least 85 percent of that wine comes from grapes grown in the mentioned AVA (Johnson 1997).

Argentina: The history of making wine in Argentina started when the first vine had arrived from Spain in 1541. The production of wine in Argentina has increased steadily. However, the overall quality of Argentine wines is relatively low compared to the European wines as a result of the small area of land in Argentina that is capable of producing high-quality grapes (Robinson 1994). Nonetheless, Argentina has a price competitive advantage in wines since it has the lowest average export prices among the New World countries (Foster and Valdes 2004).

In recent years, Argentina has developed several organisations to help improve the quality of its wines so that it can increase its competitiveness in the world wine market. These organisations, including the *Original Denomination* (OD), *Controlled Original Denomination* (COD), and *Guaranteed Controlled Original Denomination* (GCOD), have the task of regulating the production and labelling of Argentina's wines to create a higher-quality image (Anderson 2004).

South Africa: A wine history of South Africa commenced in 1652 when the first vines were planted by the Dutch in Cape Town (Arkell 2003). Despite hundred years of the wine history, South Africa entered the New World group in the mid-1970s, a decade after the U.S. and Australia (Johnson 1997). The "Wine of Origin", created in 1973, is South Africa's parallel to France's AC system, authenticating the grape variety specified on the label, the vintage and the wine's origin (Arkell 2003 and Robinson 2003).

South Africa's prosperous period began in the mid-1990s when its production and exports increased rapidly (Robinson 2003). In addition, new policy programmes were initiated in 1996 including land reforms, laws protecting workers in agricultural sectors, the liberalisation of international trade, a new rural development policy, institutional restructuring in the public sector, and the Marketing of Agricultural Products Act (Vink *et al.* 2004).

Chile: The first vines were introduced to Chile in 1548 by Spanish missionaries (Robinson 1994). However, the first real quality development began in the early 1850s when some landowners were interested in vineyards by ordering vine cuttings from Bordeaux, France (Johnson 1997). Due to political and economic instability, the Chilean wine industry was not able to develop and take on a global perspective until 1979, when Chile began to focus on exporting natural resources to strengthen its economy (Robinson 1994).

Chile's prosperous period occurred around the late 1990s when the rest of the world wine producers suffered from phylloxera (Robinson 2003). In 1996, the Chilean government took an active role in maintaining the quality of wine export by implementing the *Denomination of Origin* (DO). It is a set of laws that regulated the origin and grape varieties used in wine, as well as restricted the labelling of varieties to develop a consistent system (Anderson 2004).

2.2.3 THE PATTERNS OF INTERNATIONAL TRADE IN WINE

International wine-market concentration is fairly high within the top-ten wine exporting and importing countries. The top ten wine exporters account for about ninety percent of the total world wine exports in terms of value and volume and are the world's largest wine importers in terms of value. Table 2.7 shows that, in terms of value, France was the largest wine exporter during a three-year period from 1999 to 2001, followed by Italy, Spain, and Australia. However, in terms of volume, Italy was the largest wine exporter, followed by France, Spain, and Australia. Thus, Australia was the fourth-largest wine exporter during a three-year period from 1999 to 2001 in terms of both value and volume.

Table 2.7: World Wine Exports, 1999-2001

Country*	Wine exports (million US dollars)	Wine exports ('000 hl)
1. France	5,696.50	17,125.00
2. Italy	2,471.00	19,336.00
3. Spain	1,349.00	10,237.00
4. Australia	844.10	3,146.00
5. Chile	588.30	2,703.00
6. U.S.A.	518.50	2,762.00
7. Portugal	487.80	1,845.00
8. Germany	393.80	2,492.00
9. South Africa	224.70	1,487.00
10. Argentina	161.60	1,092.00
Rest of world	1,078.60	7,721.00
World total	13,813.90	69,946.00

Source: Anderson (2004) and Anderson *et al.* (2001).
Note: * Sorted by wine export values

Table 2.8: World Wine Imports, 1999-2001

Country*	Wine imports (million US dollars)	Wine imports ('000 hl)
1. U.K.	2,617.10	11,365.00
2. U.S.	2,074.30	5,195.00
3. Germany	2,050.50	13,669.00
4. Netherlands	786.10	3,997.00
5. Japan	770.40	2,096.00
6. Switzerland	635.80	1,956.00
7. Canada	577.30	2,344.00
8. France	483.90	6,618.00
9. Denmark	373.20	1,840.00
10. Sweden	272.60	1,320.00
Rest of world	3,173.90	36,121.00
World total	13,815.1	69,961.00

Source: Anderson (2004) and Anderson *et al.* (2001).
Note: * Sorted by wine import values

According to Table 2.8, the U.K. was the world's largest wine importer in terms of value and the second in terms of volume since the U.K. had a very small domestic wine industry and its domestic wine market was open (Jukes 2005). Germany was the world's largest wine importer in terms of volume during the period 1999 to 2001. The world wine imports are quite highly concentrated, but not as intense as the world wine exports. The top ten wine importers accounted for 77 percent in a three-year period from 1999 to 2001. Japan was the only Asian nation that was ranked in the top ten-world wine importers.

2.3 THE WINE INDUSTRY IN AUSTRALIA

2.3.1 SIGNIFICANCE OF THE AUSTRALIAN WINE INDUSTRY

The Australian wine industry has been successful in the world wine market, achieving a significant growth in production and export sales since the 1990s. Australia Bureau of Statistics (ABS) (2004) also acknowledges the wine industry as a significant industry to the Australian economy as the industry accounted for the top five agricultural exports as shown in Table 2.9.

Table 2.9: Value of Top Five Agricultural Exports, Australia, selected years from 1988-2003 (Billion Australian Dollars).

	1988-89	1993-94	1998-99	2001-02	2002-03
Wool	6.0	3.4	3.0	3.7	3.8
Wheat	2.1	2.3	3.5	4.6	3.0
Beef	1.7	3.3	2.9	4.3	4.0
Dairy	0.6	1.3	2.3	3.2	2.7
Wine	0.1	0.4	1.0	2.1	2.4

Source: ABS (2004) obtained from the original source available at www.abare.gov.au.

One of the strengths of the Australian wine industry is its high technological advance in wine production (Arkell 2003). The success of Australian wine companies is largely a result of the high standard of Australian viticulture, relatively inexpensive land and favourable weather conditions. The combination of these factors allows Australian winemakers to produce large amounts of high quality wine at relatively low cost (Bailey and Powrie 2002 and Arkell 2003).

The Australian wine industry's success is not only the result of having a quality product but also about having knowledge of and responding to consumer needs, applying expert marketing, recognising the importance of R&D, and having an innovative approach for making and sales of wines (Department of Industry, Science and Resource 2000 and House of Representatives Standing Committee on Industry, Science, and Resources 2001). In addition, AWBC[6] (2004) pointed out that the industry was largely unaffected by government intervention, which inturn encouraged the innovation in the industry. Apart from the quality and innovative technology influencing on Australian wine exports, there has been a considerable merger and acquisition of wine companies over the last fifteen years. This has resulted in at least four companies[7] being large enough to compete in global marketplaces through the advantage of scale economies (DAFF[8] 2005).

2.3.2 HISTORY OF THE AUSTRALIAN WINE INDUSTRY

The first grapevines obtained from South Africa were first introduced to Australia and planted in New South Wales in 1788 by the first Governor of New South Wales, Captain Arthur Phillip (Johnson 1989; Halliday 1996; and Beeston 2001). The first commercial vineyard was planted by John Macarthur in 1822. When James Busby brought vines from Europe in 1832, these vines became the foundation of the Australian wine industry. From these beginnings, the wine-making tradition started to spread throughout Australia (Murphy 2000 and Faith 2003).

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[6] Australian Wine and Brandy Corporation
[7] For details refer to the structure of the Australian wine industry in Section 2.3.3.
[8] Department of Agriculture, Fisheries and Forestry

The Australian wine industry was truly born in the 1860s when European immigrants added the skilled workforce necessary to develop the commercial infrastructure. By the 1880s, Australia sent a numerous volume of wines to the U.K., including wines that were achieved critical approval and winning awards at European wine shows and agricultural exhibitions (Murphy 2000). During 1925-1940, it was the first significant period of Australia's wines exporting to the U.K. (Beeston 2001).

The winemaking industry in Australia was stagnant until the 1960s when several key factors positively transformed the industry. Rapid arrivals of European migrants at the end of the Second World War created a strong wine culture. Another factor was innovative techniques that improved the quality of Australian wine, while keeping costs down. And given the position to produce quality wines at various price ranges, domestic and international demand began to rise dramatically (Halliday 1994).

From 1955 to 1985 was a time of declining exports and of increasing domestic consumption of table wine. The golden era of wine exports, 1985 to 2004, followed. This period also marked a fundamental shift in the size of the nation's vineyards (Halliday 2005). Anderson and Osmond (1998) and Anderson (2004) divided the development of Australia's wines into five business cycles: the first boom occurred during 1854-1871; the second boom happened during 1881-1896; the third boom took place during 1915-1925; the fourth boom arose during 1968-1975; and the recent boom started from 1987 to 2003.

2.3.3 STRUCTURE OF THE AUSTRALIAN WINE INDUSTRY

Table 2.10 shows that Australia's grape production and wine grape production had steadily increased over the period of 1993 to 2003.

Table 2.10: Australian Grape Production, 1993-2003.

Year	Total Grape Production (tonnes)	Wine Grape Production (tonnes)
1993	791,000	545,000
1994	920,000	662,000
1995	767,000	575,000
1996	1,087,000	783,000
1997	935,000	736,000
1998	1,097,000	856,000
1999	1,266,000	1,076,000
2000	1,343,000	1,111,000
2001	1,425,000	1,391,100
2002	1,753,900	915,300
2003	1,771,000	813,800

Source: Witter and Anderson (2004).

Table 2.10 shows that Australia's wine production and wine production per capita had also constantly increased over the period of 1993 to 2003.

Table 2.11: Volume of Australia's wine production

Year	Wine Production (million litres)	Wine Production (litres per capita)
1993	461.8	26.1
1994	587.4	32.9
1995	502.8	27.8
1996	673.4	36.8
1997	617.4	33.3
1998	741.5	39.5
1999	851.1	44.8
2000	859.2	44.8
2001	1,076.5	55.5
2002	1,220.4	62.3
2003	1,085.0	55.4

Source: Witter and Anderson (2004).

Table 2.12 shows a steady growth in winery numbers over the past two decades. In 1983, there were only 344 wineries; however, the number of wineries reached 1798 wineries in 2004.

Table 2.12: Winery Numbers by State (selected years).

Year	Total wineries	**NSW/ ACT**	**VIC**	**QLD**	**SA/NT**	**WA**	**TAS**
1983	344	76 (22.0%)	66 (19.2%)	15 (4.4%)	111 (32.3%)	73 (21.2%)	3 (0.8%)
1990	620	144 (23.2%)	169 (27.2%)	17 (2.7%)	172 (27.7%)	96 (15.5%)	22 (3.5%)
1992	701	161 (23%)	204 (29.1%)	19 (2.7%)	184 (26.2%)	108 (15.4%)	25 (3.6%)
1996	892	178 (20%)	274 (30.7%)	29 (3.2%)	212 (23.7%)	149 (16.7%)	50 (5.6%)
2000	1197	273 (22.8%)	336 (28.1%)	48 (4%)	276 (23.1%)	195 (16.3%)	69 (5.7%)
2002	1465	331 (22.6%)	416 (28.4%)	74 (5.1%)	353 (24.1%)	220 (15%)	70 (4.8%)
2004	1798	392 (21.8%)	521 (29%)	101 (5.6%)	432 (24%)	269 (15%)	83 (4.6%)

Source: Australian Bureau of Rural Science (2002) and DAFF (2005).

According to Table 2.13, the principal wine production areas are located in the states of South Australia (SA), New South Wales/Australian Capital Territory (NSW/ACT) and Victoria (VIC). All major wine-producing states experienced increases in their wine grape production from 2003 to 2004.

Table 2.13: Australia's Wine Grape Production by State, 2004

State	**Tonnes**	**Share of Total (%)**	**Change from 2003 (%)**
SA	880,075	48.4	36
VIC	384,896	21.2	36.3
NSW/ACT	450,516	24.8	24.3
WA	87,523	4.8	39.6
QLD	5,162	0.4	61.3
TAS	7,861	0.3	22.8
Total Australia	1,816,556	100	36.6

Source: ABS (2004), Australian Wine and Grape Industry, category no. 1329.0.

According to Table 2.14, despite a large number of wineries, the largest four wine companies accounted for about 80 percent of market shares in the Australian wine sales in 2002.

Table 2.14: Market Shares in the Australian Wine Industry, 2002

Market Shares	Company	Main Labels (Core brands)
33 %	Southcorp Holdings	Penfolds, Lindemans
22%	BRL Hardy	Hardys, Stanley
15%	Orlando Wyndham Group	Jacobs Creek, Wyndham Estate
10%	Mildara Beringer Blass	Wolf Blass, Yellow glen
17%	90 producers exceeding 250,000 litres/year	Rosemount, Yalumba, Brown Brothers, Peter Lehmann, etc.
3%	Other small wineries	

Source: AWBC (2004).

2.3.4 MAJOR WINE INDUSTRY POLICIES AND BODIES

In the late 1980s Australia started to remove tariffs gradually. This is the real beginning of Australia's trade liberalisation policies (Anderson 1995). Because Australia's agriculture industry, including wine industry, relies heavily on export, the industry has much to gain from trade liberalisation (ABARE 2006). Wine trade is also affected by Australia's free trade agreements (FTAs) with other countries and commitments entered into under the World Trade Organisation (WTO). Both tariff issues and non-tariff barriers such as wine labelling, product standards and import certification have been addressed in the FTAs. Currently, Australia has FTAs with Singapore, New Zealand, Thailand, the U.S., and Chile while FTAs are under negotiation or consideration with Malaysia, ASEAN, China, Japan, Korea, the Gulf Cooperation Council, India, and Indonesia. In addition, being the WTO members, subsidies, including for wine, in the European Union are cut significantly and strict product limits have been imposed (AWBC 2004). Thus, trade liberalisation will allow higher market access for Australia's wines.

Australia does not have an appellation system similar to that used in Europe; however, it also has two quality designations: Geographic Indications (GI) system and Label Integrity Programme (LIP). First, the GI system provides a hierarchy of viticulture into four levels, namely, super zones, zones, regions and subregions (Arkell 2003). Its main purpose is to protect the use of the regional name under international law, limiting its use to describe wines produced from wine grape grown within that GI. Although the system can be likened to the European Appellation system, it is much less restrictive in terms of viticultural and winemaking practices. The only restriction is that wine, which carries the regional name, must contain a minimum of eighty five percent fruit from the region (Iland and Gago 2002). Second, the LIP, launched in 1990, guarantees the source of the wine, vintage and grape varieties used. It is required that wineries keep detailed records of grapes received, wine made and blended and subsequently sold (Robinson 1994 and Arkell 2003). These two quality designations are under the control of the Australian Wine and Brandy Corporation (Arkell 2003).

The Australian Wine and Brandy Corporation (AWBC) is a statutory authority of the Australian Commonwealth Government established in Adelaide in 1980, governed by a board comprising of one Chairman and seven members. It also includes the Australian Wine Export Council dealing with the promotion of wine at the international level as well as providing wine export approval arrangement for Australian wine exporters (AWBC 2004).

The Winemakers’ Federation of Australia (WFA) is the summit industry body, established in 1990, representing Australia’s winemakers on dealing with political and policy issues confronting the industry in order to protect the interests of Australia's winemakers on national and international levels. At present, more than ninety percent of wine producers in Australia are voluntary members (WFA 2004).

The Grape and Wine Research and Development Corporation (GWRDC) is a statutory authority, founded in 1991, jointly funded by the Australian Government and the Australian wine grape and wine industry. It is governed by an expertise-based board, which consists mostly of industry practitioners. It conducts R&D programs aimed at assisting the Australian wine and wine grape industry. The five-year plans have been formulated with continuous reference to the stated objectives in the industry’s five- and thirty-year plans (Department of Industry, Science, and Resources 2000 and DAFF 2005).

2.4 AUSTRALIAN WINES IN THE WORLD WINE MARKET

Table 2.15 shows the growth of the Australian wine industry in exports and imports in terms of values and volumes. Australia experienced a significant increase in its wine exports over the last ten years.

Table 2.15: Exports and Imports of Australia's Wines

Period	Exports		Imports	
	Quantity (million litres)	Value ($A million)	Quantity (million litres)	Value ($A million)
1990-91	54.156	179.588	8.999	46.779
1991-92	78.679	243.526	8.703	45.649
1992-93	102.832	293.157	7.832	46.984
1993-94	125.464	366.574	8.341	47.637
1994-95	113.663	385.704	14.057	61.057
1995-96	129.671	471.576	20.256	60.478
1996-97	154.393	603.297	13.589	66.503
1997-98	192.404	873.847	25.622	92.926
1998-99	216.149	1,067.979	24.255	102.498
1999-00	284.935	1,372.768	19.607	113.868
2000-01	338.289	1,752.082	12.773	92.096
2001-02	418.393	2,105.139	14.478	115.473
2002-03	518.642	2,423.468	17.112	139.034

Source: ABS (2004), Sales of Australian Wine and Brandy, category no. 8504.0.

Table 2.16: Exports of Australian Wine, by destination, 2002-03

Principal country/region	Quantity		Value	
	Litres ('000s)	%	A$'000	%
New Zealand	32,228	6.2	100,903	4.2
Total Oceania and Antarctica	33,583	6.5	108,184	4.5
Belgium-Luxembourg	6,172	1.2	19,505	0.8
Denmark	10,819	2.1	33,917	1.4
France	3,935	0.8	12,721	0.5
Germany	18,987	3.7	58,284	2.4
Ireland	8,847	1.7	49,427	2.0
Netherlands	12,797	2.5	44,253	1.8
Sweden	7,798	1.5	32,202	1.3
U.K.	209,547	40.4	876,607	36.1
Total EU	281,550	54.3	1,140,372	47.0
Switzerland	4,961	1.0	29,683	1.2
Total Europe	28,9901	55.9	1,183,770	48.8
Total Middle East and North Africa	1,590	0.3	5,486	0.2
Singapore	3,063	0.6	25,493	1.1
Total South-East Asia	7,239	1.4	52,298	2.2
Hong Kong	2,018	0.4	15,778	0.7
Japan	5,283	1.0	31,293	1.3
Total North-East Asia	9,212	1.8	58,322	2.4
Canada	24,456	4.7	169,075	7.0
U.S.	150,945	29.1	839,662	34.6
Total Northern America	175,441	33.8	1,008,987	41.6
Total other regions	1,676	0.3	6,421	0.3
Total exports	**518,642**	**100.0**	**2,423,468**	**100.0**

Source: ABS (2004), International Trade, category no. 5465.0.

Table 2.16 shows that the European Union (EU) was a significant regional destination for Australian wine exports in 2002-03. Table 2.16 also indicates that the principal destinations for Australian wine exports in 2002-03 were the U.K., the U.S., New Zealand, Canada and Germany. Australia's largest wine export market in 2002-03 was the U.K. followed by the U.S. and New Zealand.

Table 2.17 shows major sources of Australian wine imports from 2000-01 to 2002-03. France, Italy, New Zealand, and Spain were the major wine exporters to Australia. Wine imports from Italy in 2002-03 were the greatest in terms of volume, while wine imports from France were the greatest in terms of value. Other wine-producing countries were also major sources of Australia's wine imports such as Portugal, South Africa, Chile, and the U.S.

Table 2.17: Australia's Wine Imports, by country of origin.

Countries	2000-01		2001-02		2002-03	
	Quantity (litres '000s)	**Value (A$ '000s)**	**Quantity (litres '000s)**	**Value (A$ '000s)**	**Quantity (litres '000s)**	**Value (A$ '000s)**
France	2,528	36,582	2,716	43,442	2,728	49,255
Germany	414	1,797	371	1,810	368	1,905
Greece	356	949	407	972	357	833
Italy	5,364	24,043	4,983	24,905	4,844	24,512
Spain	354	1,639	386	2,234	501	2,735
Portugal	430	1,813	484	2,049	463	1,911
U.K.	22	228	5	125	400	1,371
South Africa	80	453	142	775	195	713
Chile	195	989	264	1294	179	814
U.S.	89	752	239	878	104	841
New Zealand	2,523	20,973	3,894	34,852	4,928	47,601
Others	418	1,879	588	2,136	2,045	6,544
Total imports	**12,773**	**92,096**	**14,478**	**115,473**	**17,112**	**139,034**

Source: ABS (2004), Sales of Australian Wine and Brandy, category no. 8504.0.

2.5 CONCLUSION

The wine industry has experienced remarkable global changes in production and trade during the last two decades. Since the 1980s the dominance of European producers in the global wine export market has declined with dramatic increases in exports from the New World wine producers, such as Australia, the U.S., Argentina, South Africa, and Chile.

The world wine production, consumption, exports and imports are concentrated in a few countries. The major world wine-producing countries are France, Italy, Spain, the U.S., and Argentina. The major world wine-consuming countries are France, Italy, the U.S., Germany, and Argentina. The major world wine-exporting countries are France, Italy, Spain, Australia, and Chile. The major world wine-importing countries are the U.K., the U.S., the Netherlands, and Japan.

In relation to the quality system, the Old World producers have similar quality designations, usually with three to five levels; however, the New World group does not have a complex appellation system. For instance, Australia has two quality designations, namely, the Geographic Indications (GI) system and the Label Integrity Programme (LIP).

In the late 1980s Australia started to eliminate all tariffs. Later on, all trade barriers have been removed as a result of economic and regional trade arrangements. The Australian wine industry has been very successful in the world wine market with continual strong growth in production and exports since the 1990s. The success of the

Australian wine industry is largely a result of its factor endowments, advancement in wine production technology and trade liberalisation. The combination of these factors allows Australian winemakers to produce a large amount of high quality wines at relatively low cost. The Australian wine industry has consequently become very competitive in the world wine market. The principal destinations of Australia's wine exports are the U.K., the U.S., New Zealand, Canada and Germany, while; major sources of Australian wine imports are from France, Italy, New Zealand, and Spain.

Since the Australian wine industry plays an important role to the Australian economy. A comprehensive study of Australia's international trade in wines will be undertaken in Chapters three to six of the thesis to analyse and set out the economic models for the trade patterns and determinants of the Australian wine industry in the world wine market. An analysis of Australia's international comparative and competitive advantage in wines will be conducted in the next chapter using various indicators to discuss the trade in terms of comparative advantage theories.

CHAPTER THREE

AUSTRALIA'S COMPARATIVE AND COMPETITIVE ADVANTAGE AND TRADE PERFORMANCE IN WINES

3.1 INTRODUCTION

The studies of Mayne (1986), Johnson (1989), Boon *et al.* (1999), Downer (2001), Oliver (2001), Faith (2003) and Halliday (2005) summarise the factors that lead to Australian wines in gaining an international comparative and competitive advantage over the majority of its European competitors. These factors include a suitable climate for a growing season; abundantly available land for viticulture; unpolluted environment; advanced winemaking technologies; and the absence of excessively restrictive trade regulations. As discussed in Chapter Two, the Australian wine industry is a significant industry in the Australian economy. The Australian wine industry has been successful in the world wine market, achieving a significant growth in production and export sales since the 1990s. Therefore, it is important to analyse Australia's comparative and competitive advantage in wines relative to other wine producing countries.

The aim of this chapter is to examine the trade performance of Australian wines and to analyse the degree of Australia's comparative and competitive advantage in wines relative to other wine producing countries. The structure of this chapter is as follows: Section 3.2 provides an overview of international trade theories based on absolute advantage and comparative advantage. In Section 3.3, a set of indicators is used to identify Australia's wine trade performance. Section 3.4 discusses Australia's comparative advantage in general and then, the Balassa's revealed comparative advantage index is used in the analysis of Australia's comparative advantage in the wine trade. In analysing the extent to which Australia's wine industry has been competitive in the world wine market, the Vollrath's revealed competitive advantage index is used in Section 3.5. A conclusion is presented in Section 3.6.

3.2 LITERATURE REVIEW ON COMPARATIVE ADVANTAGE

3.2.1 ABSOLUTE ADVANTAGE THEORY

In 1776, Adam Smith developed the absolute advantage theory, published in his book "An Inquiry into the Nature and Causes of the Wealth of Nations" which was generally accepted by economists as a revolution in economic thinking (Salvatore 1993 and Root 1994). Smith explained that when one country is more efficient than (or has an absolute advantage over) another country in the production of one commodity but is less efficient than (or has an absolute disadvantage with respect to) the other country in producing a second commodity, then both countries can gain in international trade by each country specialising in the production of the commodity of its absolute advantage and exchanging part of its output with the other country for the commodity of its absolute disadvantage (Salvatore 1993).

If we assume a production of two commodities i.e. X and Y, are produced in two countries i.e. A and B, then X_L^A and Y_L^A are the labour units used by country A in producing commodity X and Y, respectively. Similarly, X_L^B and Y_L^B are the labour units used by country B in producing commodity X and Y, respectively. Then, country A having an absolute advantage in the production of commodity X can be expressed as:

$$X_L^A < X_L^B \tag{3.1}$$

This implies that country A takes fewer units of labour to produce one unit of commodity X than country B. On the other hand, country B having an absolute advantage in the production of commodity Y is:

$$Y_L^A > Y_L^B \tag{3.2}$$

This implies that country B takes fewer units of labour to produce one unit of commodity Y than country A. Assuming that both commodities are consumed by these two countries, trade can occur on the basis of absolute advantage (Yarbrough and Yarbrough 1994).

Even though Smith's theory of absolute advantage serves as the basis of international trade, it fails to explain trade occurring between two countries where one country has an absolute advantage in all commodities (Salvatore 1993). Therefore, this situation can be explained by the theory of comparative advantage in the following section.

3.2.2 COMPARATIVE ADVANTAGE THEORY

Ricardo developed the theory of comparative advantage, published in his book "Principles of Political Economy and Taxation" in 1817. According to Ricardo, even if one country has an absolute advantage in the production of all commodities over other countries, there is still a basis for trade if differences in relative efficiency in production exist (Salvatore 1993).

To illustrate the comparative advantage, Ricardo used England and Portugal producing two commodities, wine and cloth. He supposed that Portugal could produce a particular quantity of wine with eighty workers and a particular quantity of cloth with ninety workers. On the other hand, to produce the same amount of wine as did Portugal, England would require one hundred and twenty workers and one hundred workers to produce the same amount of cloth as did Portugal. Obviously, Portugal had an absolute advantage in the production of all commodities. But, Ricardo pointed out that the relative number of hours required to produce wine was less than the relative number required to produce cloth. Thus, Portugal was relatively more efficient in the production of wine than cloth and England had a smaller relative disadvantage in the production of cloth[9]. This would imply that Portugal had a comparative advantage in the wine production and England had a comparative advantage in the cloth production. As a result, Portugal would be better of if it specialised in the production of wine and exported wine to England, while England would specialise in the production of cloth and export to Portugal (Baugh 1985 and Sanderston and Reed 1994).

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[9] Since the ratio of workers used in the production of Portuguese wine to English wine (80:120) is less than the ratio of workers used in the production of Portuguese cloth to English cloth (90:100).

Ricardo explained the theory of comparative advantage based on the labour theory of value[10] that is the price of a commodity derived from the amount of labour going into the production of the commodity. This is a common fallacy to explain the comparative advantage since it would isolate developing countries from international trade because of their low labour productivity relative to developed countries. Hence, in 1936, Heeler attempted to explain the theory of comparative advantage based on the opportunity cost theory instead of the labour theory of value (Yarbrough and Yarbrough 1994). Haberler (1936) explained that the opportunity cost can be measured by the proportion of the number of units of labour required to produce one unit of the commodity to the number of units of labour required to produce one unit of the other commodity.

If we assume a production situation where two commodities i.e. X and Y, are produced from two countries i.e. A and B, then country A has a comparative advantage in production of commodity X when fewer units of commodity Y must be given up to produce an additional unit of commodity X in country A than to produce the additional unit of commodity X in country B. As a result, country A is better off by specialising in production of commodity X and exports to country B. On the other hand, Country B has a comparative advantage in production of commodity Y when fewer units of commodity X must be given up to produce an additional unit of commodity Y in country B than to produce the additional unit of commodity Y in country A. As a result, country B is better off by specialising in production of commodity Y and exports to country A. (Yarbrough and Yarbrough 1994).

[10] Labour is the only factor of production. An output is measured by units of labour requirements per unit of production.

3.2.3 THE HECKSCHER-OHLIN MODEL

Eli Heckscher, in 1919[11] and Bertil Ohlin, in 1933[12] attempted to provide an alternative explanation of comparative advantage. They argued that comparative advantage arises from differences in relative factor endowments among countries and this proposition formed the basis for the Heckscher-Ohlin theory[13] or briefly, the H-O theory (Hill 2003). The H-O theory is called the 2 x 2 x 2 model in which there are two countries (A and B), two factors of production (labour, denoted as L and capital, denoted as K), and two commodities (labour-intensive and capital-intensive commodities). The model presumes that countries differ in factor abundance and commodities differed in factor intensity[14] (Williamson and Milner 1991). According to the H-O theory, a country should specialise in the production and export of those commodities that use intensively its relatively abundant factor. Thus, a country that is relatively labour abundant should specialise in the production of relatively labour-intensive commodities and export the labour-intensive commodities in exchange for capital-intensive commodities and vice versa (Salvatore 1993).

Leontief conducted the first empirical test of the H-O model in 1951 using the U.S. trade data in 1947. He used input-output tables[15] for two hundred industries by comparing the capital/labour ratios in the U.S. export industries and in the U.S. industries producing import-competing goods (Husted and Melvin 1990). Since the U.S. was considered as the most capital abundant nation in the world, Leontief

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[11] In an article entitled "The Effect of Foreign Trade on the Distribution of Income"
[12] In his book "Interregional and International Trade", this was refined Heckscher's work in 1919.
[13] It is also known as the "factor proportions theory".
[14] Factor inputs required producing those commodities.
[15] Input-output tables describe the flows of goods and services between every sector of the economy (Husted and Melvin 1993). They also show the origin and destination of each product in the economy (Salvatore 1993).

expected to find that it exported capital-intensive commodities and imported labour intensive commodities. However, the result was contradictory to the H-O theory. The finding was that the U.S. exports were more labour-intensive and less capital-intensive than the U.S. exports as the capital/labour ratio in the export industries was lower than the ratio in the import-competing industries (Salvatore 1993). Leontief (1956) found a similar empirical finding when he revisited the U.S. trade data in 1951. The second study showed that the U.S. exports were six percent more labour-intensive than the U.S. import substitutes. These empirical evidences were known as the 'Leontief paradox' (Husted and Melvin 1990 and Salvatore 1993).

The Leontief paradox has stimulated economists to search for explanations for the contradiction to the H-O theory (Root 1994). The explanations of Leontief paradox can be categorised into six major causes: (1) a demand or consumption bias in the U.S. in favour of capital-intensive goods[16] (Valvanis-Vail 1954; Jones 1956; Brown 1957; Houthakker 1957; Travis 1964; Leamer 1980); (2) factor-intensity reversal[17] (Jones 1956; Brown 1957; Minhas 1962; Leontief 1964; Kenen 1989); (3) the U.S. import restrictions[18] (Kravis 1956; Travis 1964; Baldwin 1971); (4) a scarcity of natural resources in the U.S. (Diab 1956; Vanek 1963); (5) the relative abundance of highly skilled and trained labour and human capital in the U.S. (Kravis 1956; Kreinin 1965; Keesing 1966; Baldwin 1971; Branson and Monoyios 1977; Stern and Maskus 1981; Leamer 1984; Lane 1985; Charos and Simos 1988); and (6) the U.S.

[16] Appleyard *et al.* (2001) called this situation as 'demand reversal'.
[17] When capital-intensive products in one country are labour-intensive in the other. Factor-intensity reversal occurs when a commodity has different relative factor intensity at different relative factor prices (Appleyard *et al.* 2001).
[18] Restrictions include both tariff and non-tariff barriers.

comparative advantage in technology-intensive industries (Chacholiades 1978; Root 1994).

In contrast to the Leontief paradox, Bharadwaj (1962) found that India exported labour-intensive goods and imported capital-intensive goods with the rest of the world as in accordance with the H-O theory. Williams (1970), Leamer (1980; 1984), and Clifton and Marxsen (1984) employed the Leontief's model to explain trade patterns for many countries and their results showed that the H-O theory was still valid in many cases. Leamer (1980), Bowen *et al.* (1987), Davis and Weinstein (1996), and Song (1996) contended that the H-O theory with some assumptions that explained the Leontief's paradox, could still be a valid model in predicting international trade patterns.

3.3 AUSTRALIA'S TRADE PERFORMANCE IN WINES

This section presents a set of four indicators, namely trade specialisation index, export propensity index, import penetration index, and export/import ratio, to measure Australia's overall trade performance in wines for the period 1980-2004. Annual time-series data on Australia's wine exports and imports for the analysis in this section were obtained from the UN Comtrade database at four-digit level of SITC for the period 1980-2004. Data on the domestic wine sales in Australia were collected from dX EconData-ABS time-series Statistics Plus, while data on the domestic wine production in Australia were gathered from AWBC's Winefacts.

3.3.1 TRADE SPECIALISATION INDEX

Balassa (1966) suggested that a country's trade advantage in a particular industry can be obtained by calculating the trade specialisation index (TSI) as a ratio of net trade to the total trade in the commodity category. Values of the TSI range between minus one and plus one. A positive value of the TSI indicates that a country specialises in the production of a commodity, and it is a net-exporter of that commodity. Thus, the country has a comparative advantage in the trade of the commodity. In contrast, a negative value of the TSI indicates that the country has a comparative disadvantage in the trade of the commodity, and it is a net-importer of that commodity.

Specifically, the TSI applied to the Australian wine industry is defined as follows:

$$TSI_{wa} = \left(X_{wa} - M_{wa}\right) \big/ \left(X_{wa} + M_{wa}\right) \tag{3.3}$$

where, TSI_{wa} is the trade specialisation index of Australia's wines; X_{wa} is the exports of Australia's wines; and M_{wa} is the imports of wines by Australia.

3.3.2 EXPORT PROPENSITY INDEX

The export propensity index (EPI) for a particular industry is defined as a proportion of exports over domestic production of that industry. A higher ratio of the EPI in a particular commodity indicates that a country has a higher degree of specialisation and comparative advantage in that commodity.

In particular, the EPI for Australia's wine industry is the percentage ratio of Australia's wine exports divided by its domestic production of wines, that is:

$$EPI_{wa} = \left(X_{wa} \big/ DP_{wa} \right) \times 100 \qquad (3.4)$$

where, EPI_{wa} is the export propensity index of Australia's wines; X_{wa} is the exports of Australia's wines; and DP_{wa} is the domestic production of wines in Australia.

3.3.3 IMPORT PENETRATION INDEX

The import penetration index (MPI) indicates the degree to which the international competition threatens a domestic industry. The MPI measures the percentage share of imports to total domestic sales of a commodity. The MPI for Australia's wine industry is defined as the percentage ratio of wine imports divided by total domestic wine sales in Australia as follows:

$$MPI_{wa} = \left(M_{wa} \big/ DS_{wa} \right) \times 100 \qquad (3.5)$$

where, MPI_{wa} is the import penetration index of Australia's wines; M_{wa} is the imports of wines by Australia; and DS_{wa} is the total domestic sales of wines in Australia.

However, Cleveland (1985) argued that, in an industry with increasing exports as well as imports, the degree of measured import penetration deteriorates because the total domestic sales depends upon the extent of both imports and exports. To overcome this problem, Athukorala and Hazari (1988) proposed an alternative import penetration index (MP_i) as the percentage ratio of imports (M_i) to domestic production (DP_i) of commodity *i*. That is:

$$MP_i = \left(M_i \middle/ DP_i \right) \times 100 \tag{3.6}$$

A higher import penetration ratio indicates that a country has a high degree of comparative disadvantage in a particular industry. Based on Cleveland (1985) and Athukorala and Hazari (1988), hence, the MP for the Australia wine industry is defined as the percentage ratio of Australia's wine imports divided by total production of Australia's wines.

3.3.4 EXPORT/IMPORT RATIO

Verdoorn (1960) introduced the exports to imports ratio in order to identify a country's international trade competitiveness. The export/import ratio of Australia's wines is calculated as:

$$EIR_{wa} = \left(X_{wa} \middle/ M_{wa} \right) \times 100 \tag{3.7}$$

where, EIR_{wa} is the export/import ratio of Australia's wines; X_{wa} is the exports of Australia's wines; and M_{wa} is the imports of wines by Australia. The higher value of the ratio, the more a country has international trade competitiveness in a particular industry.

Sheehan *et al.* (1994) suggested the export/import ratio by taking natural logarithm (*Ln*) to the ratio. That is:

$$LnEIR_{wa} = Ln\left(X_{wa} \big/ M_{wa} \right) \times 100 \qquad (3.8)$$

A positive value of this index indicates international trade competitiveness of a country in a particular industry. On the other hand, a negative value of the index implies that a country does not have international trade competitiveness in that industry.

Table 3.1: Australia's Trade Performance in Wines, 1980-2004.

Year	**TSI**	**EPI**	**MPI**	**MP**	**EIR**	**LnEIR**
1980	-0.32	1.60	2.77	1.70	51.88	-65.63
1981	-0.23	2.70	2.86	2.07	62.77	-46.56
1982	-0.31	3.11	2.96	2.10	53.18	-63.14
1983	-0.19	3.86	2.53	2.23	67.41	-39.44
1984	-0.31	3.45	3.00	2.39	52.27	-64.88
1985	-0.49	2.84	3.80	2.73	33.95	-108.02
1986	-0.23	5.37	3.71	3.17	62.42	-47.13
1987	0.35	10.98	2.34	1.91	206.65	72.59
1988	0.43	14.33	2.78	2.20	248.03	90.84
1989	0.32	14.33	3.66	2.23	194.92	66.74
1990	0.46	18.87	3.50	2.33	273.15	100.48
1991	0.63	24.70	2.89	2.20	436.02	147.25
1992	0.68	27.72	2.57	1.65	534.26	167.57
1993	0.76	40.54	2.46	1.70	751.36	201.67
1994	0.74	31.56	3.35	1.79	668.60	190.00
1995	0.71	36.85	7.10	4.35	586.00	176.82
1996	0.79	34.93	4.41	2.12	879.26	217.39
1997	0.78	43.85	6.18	3.37	796.61	207.52
1998	0.80	42.45	8.41	3.85	901.26	219.86
1999	0.83	48.31	5.00	2.17	1055.51	235.66
2000	0.86	36.21	4.41	1.91	1311.37	257.37
2001	0.89	34.95	3.66	1.30	1786.33	288.28
2002	0.89	38.65	3.94	1.29	1712.42	284.05
2003	0.88	49.42	3.96	1.49	1604.09	277.51
2004	0.87	43.93	5.27	1.52	1475.42	269.15

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db, dXEconData-ABS time-series Statistics Plus, and AWBC's Winefacts, available at www.wineaustralia.com.

Table 3.1 shows Australia's overall trade performance in wines for the period 1980-2004. In general, Australia has performed spectacularly in international trade in wines over the last two decades. According to the TSI index shown in Table 3.1, Australia did not specialise in wine trade and was a net-importer of wines reflecting its comparative disadvantage in wines during 1980 to 1986. However, Australia has specialised in wine trade and become a net-exporter of wines since 1987. The degree of Australia's specialisation in wine trade has increased over time. This is shown by decreases in negative values of the TSI during 1980-1986 and increases in the positive values of the index afterwards. As the maximum value of the TSI is one, Australia has the values of the TSI over 0.8 since 1998; hence, it can be concluded that Australia has a significantly high degree of specialisation in wines.

The degree of export propensity of the Australian wine industry has risen steadily since 1980. This implies that the Australian wine industry has steadily become more capable of exporting wines from the amount it can produce. In 1980, it was only 1.6 percent of the domestic wine production being exported. However, in 2003, it was approximately half of the domestic wine production being sold abroad. Therefore, Australia has a high degree of specialisation and comparative advantage in the wine industry.

Values of the MPI and MP indicate that the Australian wine industry has a low degree of international competition threatening to the domestic sales and production of wines. While the magnitude of import penetration is slightly higher when it is defined as a proportion of imports to domestic sales (MPI), the overall patterns of the MPI and MP are similar. The degree of import penetration is stable and low throughout the analysis period. On average, the impact of wine imports have fluctuated around two to four percent on domestic wine sales and about one to three percent on domestic wine production in Australia. Thus, it can be concluded that Australia has a comparative advantage of wines as a result of the low values of import penetration.

According to Table 3.1, the values of the EIR have been increasing during 1980-2004. In 1980-1986, negative values of the LnEIR imply that Australia did not have international trade competitiveness in wines. However, since 1987, increases in positive values of the LnEIR indicate that the Australian wine industry has gained international trade competitiveness in wines.

In conclusion, prior to 1987, Australia had a comparative disadvantage in wines as it did not have a specialisation and international trade competitiveness in wines. However, Australia has gained trade specialisation and international trade competitiveness in wines, and become a net-exporter since 1987. Thus, at present, Australia has a comparative advantage in wines.

3.4 AUSTRALIA'S COMPARATIVE ADVANTAGE IN WINES

3.4.1 AUSTRALIA'S COMPARATIVE ADVANTAGE IN GENERAL

Hook and Riley (1995), Song (1996), Chatterjee (1996), Huey (1998), Crompton *et al.* (2002), and Lewis *et al.* (2006) concluded that Australia has a comparative advantage in such industries as agriculture, mining, education services and tourism, on the other hand, Australia has a comparative disadvantage in the production of manufactured goods.

Song (1996) showed that there has been a substantial increase in the number of skilled labourers in Australia since 1965. Chatterjee (1996) used input-output tables of Australian exports and imports in 1978 and 1987 to confirm that Australia is a natural resource abundant country relative to its trading partners and therefore exports natural resource intensive commodities. On the other hand, a study by Huey (1998) concluded that Australia has comparative advantage in the production of human capital-intensive and technology-intensive commodities. Leamer (1987) showed that Australia is abundantly endowed with natural resources per worker, relative to the rest of the world. Parry and Kemp (2002) indicated that Australia continues to have comparative advantage in primary commodity production, specifically agricultural and mineral products because of its high land per population ratio and substantial mineral riches. Therefore, Australia has traditionally been a major exporter of agricultural and mineral commodities and an importer of manufactured goods.

3.4.2 AUSTRALIA'S REVEALED COMPARATIVE ADVANTAGE IN WINES

3.4.2.1 Balassa's Index of Revealed Comparative Advantage

The theoretical foundations discussed so far have been based on pre-trade relative prices. They explain differences in relative costs and prices among countries to describe gains in international trade or predict the international trade patterns among trading countries. However, an empirical method[19] of finding the commodities in which a country has comparative advantage is the "revealed comparative advantage" (RCA) (Balassa 1965). Balassa's RCA index is measured by the ratio of export share held by a country over the world export share for a particular commodity as follows:

$$RCA_{ij} = \frac{(X_{ij}/X_j)}{(X_{iw}/X_w)} \tag{3.9}$$

where, RCA_{ij} is the Balassa's revealed comparative advantage index of country j in commodity i; X_{ij} is the exports of commodity i by country j; X_j is the exports of all commodities by country j; X_{iw} is the exports of commodity i by all countries in the world; and X_w is the exports of all commodities by all countries in the world.

The Balassa's index indicates that if country j's export share of commodity i in the country's exports of all commodities is greater than share of exports of commodity i in the world commodity market, country j has comparative advantage in commodity i. Then, the value of the index is greater than one. On the other hand, the index value of less than one implies that the commodity's share in the country's exports is less than its share in world trade. This indicates that the country has revealed comparative disadvantage in the trade of that commodity.

Balassa's RCA index has been used extensively in empirical studies of Balassa (1977; 1979; 1989), Roemer (1977), Kunimoto (1977), Hillman (1980), Aquino (1981), Bowen (1983), Yeats (1985), Crafts and Thomas (1986), Ballance *et al.* (1987),

[19] This method measures post-trade relative prices observed in the real world.

Balassa and Bauwens (1988), Van Hulst *et al.* (1991), Tan (1992), Sheehan *et al.* (1994), Son and Wilson (1995), Lim (1997), Huey (1998), Kalirajan and Shand (1998), Laursen (1998), Proudman and Redding (2000), Isogai *et al.* (2002), De Benedicts and Tamberti (2002; 2004), Havrila and Gunawardana (2003), and Ferto and Hubbard (2003) as a measure of a country's comparative advantage either in a particular industry or for a commodity.

However, Yeats (1985) and Huey (1998) argued that the RCA index should be interpreted as a dichotomous measure only since it fails to hold ordinal and cardinal interpretations.[20] Ballance *et al.* (1987) found inconsistencies associated with the use of the RCA index as ordinal and cardinal measures. In addition, De Benedicts and Tamberti (2002; 2004) stressed that dichotomous interpretation is the most commonly used in empirical studies rather than cardinal or ordinal interpretations.

3.4.2.2 Revealed Comparative Advantage in Wines

This section provides the Balassa's RCA index of revealed comparative advantage, which is generated for the Australian wine industry and major wine producers in the world wine market. The analysis is based on the annual time-series data on wine exports and imports of Australia and major wine-producing countries, gathered from the UN Commodity Trade Statistics (Comtrade) database at four-digit level of SITC.

[20] The dichotomous interpretation is used to determine whether a particular country has comparative advantage or disadvantage over the rest of the world in the production of a particular commodity. In cardinal terms, the index quantifies the magnitude of comparative advantage possessed by a country, while ordinal interpretation is used to rank countries ordered according to higher or lower values of the index.

Table 3.2: Revealed Comparative Advantage index for wines in Australia and other major wine-producing countries, 1980-2004.

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**
1980	0.22	6.72	4.96	8.14	0.75	21.79	1.45	0.06	0.58	0.19	1.90	0.21	0.09
1981	0.30	7.20	5.29	7.23	0.87	21.91	1.85	0.08	0.54	0.19	1.88	0.23	0.08
1982	0.25	6.91	5.34	6.67	0.83	19.15	1.77	0.08	0.59	0.21	1.30	0.22	0.07
1983	0.31	7.33	4.65	6.63	0.87	16.49	1.79	0.07	0.41	0.21	1.09	0.24	0.08
1984	0.31	8.10	4.91	5.70	0.91	15.01	1.79	0.05	0.44	0.19	1.28	0.24	0.16
1985	0.23	8.28	4.63	5.69	0.82	13.27	3.12	0.05	0.30	0.15	1.24	0.22	0.14
1986	0.34	8.36	3.22	5.74	0.62	12.92	2.80	0.06	0.37	0.16	1.24	0.15	0.14
1987	0.77	8.31	3.18	5.43	0.52	12.52	2.88	0.09	0.54	0.17	1.37	0.14	0.24
1988	1.14	8.36	3.45	5.20	0.52	12.60	2.19	0.10	0.54	0.21	1.31	0.14	0.38
1989	1.08	8.60	3.67	5.03	0.53	11.31	3.31	0.12	0.73	0.26	1.83	0.15	0.46
1990	1.32	8.07	3.66	4.33	0.50	10.11	3.30	0.13	0.74	0.16	2.46	0.15	0.56
1991	1.74	7.90	3.79	4.94	0.45	10.61	2.54	0.14	0.77	0.34	4.02	0.14	0.64
1992	2.01	7.43	3.64	5.57	0.49	11.04	3.20	0.16	1.11	0.82	4.98	0.14	1.06
1993	2.82	7.95	3.94	5.86	0.50	12.54	3.11	0.17	1.12	0.84	6.36	0.14	1.07
1994	2.89	7.69	4.29	5.24	0.55	11.20	2.98	0.16	1.01	1.22	5.85	0.14	0.99
1995	2.82	7.32	4.26	5.00	0.47	9.57	3.32	0.18	1.69	3.00	5.30	0.18	1.07
1996	3.29	7.25	4.02	4.90	0.43	9.92	2.80	0.21	1.50	3.40	8.38	0.24	1.36
1997	3.79	7.71	3.99	4.96	0.38	9.31	2.79	0.25	2.09	3.53	10.99	0.33	1.77
1998	4.43	7.32	3.88	4.66	0.32	8.09	2.72	0.28	2.35	3.48	13.72	0.25	1.95
1999	5.77	7.73	4.26	4.90	0.32	8.03	2.53	0.28	2.34	3.24	13.31	0.26	2.33
2000	7.04	8.17	4.76	4.91	0.31	9.19	2.61	0.33	2.90	3.85	15.59	0.30	3.25
2001	7.48	7.57	4.60	4.97	0.31	8.20	2.31	0.33	2.67	3.75	16.03	0.28	3.24
2002	8.72	7.57	4.68	4.47	0.30	7.90	1.97	0.33	2.19	5.28	15.09	0.30	3.79
2003	9.42	7.54	4.42	4.39	0.31	7.70	2.24	0.35	2.37	6.19	13.76	0.31	3.91
2004	10.50	7.28	4.65	4.63	0.29	8.03	2.25	0.40	2.86	5.80	11.95	0.27	5.25

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db

Table 3.2 indicates that Australia's wine trade has experienced a revealed comparative advantage since 1988. Although Australia had values of the RCA less than one during 1980-1987, the trend over this time period had been increasing. This implies that Australia was continually and gradually gaining comparative advantage in wines. The value of the RCA was only 0.22 in 1980; the index rose to 0.77 in 1987, then in the next year Australia had a revealed comparative advantage in wines with an RCA value of 1.14.

Table 3.2 indicates that from 1988 onwards, the degree of revealed comparative advantage in Australia's wine trade has increased steadily. In 2004, the value of the RCA index for Australia's wine trade reached 10.50, which is relatively high among wine-producing countries. Thus, Australia had a higher export share of wines, which exceeded its share in the total world exports. This improvement of the revealed comparative advantage seems to be associated with Australia's trade liberalisation, abundant factor endowments, and technological advancement in wine production.

The results presented in Table 3.2 also show that countries with a relatively high degree of revealed comparative advantage in wines are France, Italy, Spain, Portugal, Greece, Argentina, South Africa, Chile, and New Zealand since the values of their RCA indexes are greater than one in 2004. On the other hand, Germany, the U.S., and the U.K. have a relatively high degree of revealed comparative disadvantage. The countries having a revealed comparative advantage are major wine-exporting countries, while those countries having a revealed comparative disadvantage are major wine-importing countries as mentioned in the previous chapter. All countries from the Old World wine-producing countries, except Germany, have experienced a revealed comparative advantage since 1980. In contrast, all countries from the New World wine-producing countries, except Chile, had a revealed comparative disadvantage in 1980. However, most of the New World countries have experienced a revealed comparative advantage since the early 1990s.

Even though most of the Old World countries have a revealed comparative advantage, their magnitudes have been decreasing since the early 1990s.[21] Portugal has obviously experienced a significant decrease in its degree of revealed comparative advantage. The Portugal's RCA index in 1980 was as high as 21.79. But, it has dropped to a level lower than 10 since 1995 and to 8.03 in 2004. France had an average value of the RCA index at about 8 during 1984-1990, and then it has slightly decreased to a value of 7 since 1991. Italy and Spain have also experienced a decrease in the degree of their revealed comparative advantage. Italy had an average value of the RCA index at about 5 during 1980-1982, and then it dropped to at about 3 in the late 1980s and the early 1990s, and has remained at about 4 since 1999. Spain had a relatively high degree of revealed comparative advantage in 1980 at the RCA index of 8.13, and then the index values dropped to 5.7 in 1984, and since 1996 Spain has had an average value of the RCA index at around 4. It is also important to note that Germany is the only country from the Old World group that has never experienced a revealed comparative advantage throughout the analysis period and, in addition, has experienced increasing degrees of revealed comparative disadvantage. The U.S. has also never experienced a revealed comparative advantage throughout the analysis

[21] This empirical result is consistent with the claim made by Anderson and Norman (2003) that while the European producers are still leading the world wine market; the New World producers have begun to challenge thier dominance.

period; however, it has experienced decreasing degrees of revealed comparative disadvantage since 1985.

Chile is the only country in the New World group that has experienced a revealed comparative advantage since 1980. Moreover, in 2004, Chile had a relatively high degree of revealed comparative advantage among major wine-producing countries with the RCA index of 11.95. Like Australia, New Zealand and South Africa had RCA index values of 0.09 and 0.19, respectively in 1980 reflecting their comparative disadvantage in the wine trade. However, New Zealand and South Africa have experienced revealed comparative advantage since 1992 and 1994, respectively.

3.5 AUSTRALIA'S COMPETITIVE ADVANTAGE IN WINES

In this section, Australia's relative trade advantage and competitiveness in wines are examined using an alternative index introduced by Vollrath (1991). Annual time-series data on wine exports and imports of Australia and major wine-producing countries gathered from the UN Commodity Trade Statistics (Comtrade) database at 4-digit level of SITC for the period 1980-2004 are used in the analysis.

3.5.1 VOLLRATH'S INDEX OF COMPETITIVE ADVANTAGE

Vollrath (1991) pointed out that the Balassa's index of revealed comparative advantage has a problem of double counting since country *j*'s exports of commodity *i* is not excluded from the world exports of commodity *i*, or from total world exports.

Vollrath suggested the "Revealed Competitiveness" (RC) index as a preferred measure of a country's or a commodity's competitive advantage because both exports and imports are taken into account while constructing the index. Further, the RC index corrects the problem of double counting since the index takes a country's commodity share of exports or imports over all traded commodities other than that commodity. Vollrath described a country's revealed competitiveness in terms of three measures, namely, relative export advantage index (RXA)[22], relative trade advantage index (RTA)[23], and revealed competitiveness index (RC). The indices are defined as follows:

$$RTA_{ij} = RXA_{ij} - RMA_{ij} \tag{3.10}$$

$$RXA_{ij} = \left(X_{ij} / X_{nj}\right) \Big/ \left(X_{ir} / X_{nr}\right) \tag{3.11}$$

$$RMA_{ij} = \left(M_{ij} / M_{nj}\right) \Big/ \left(M_{ir} / M_{nr}\right) \tag{3.12}$$

$$RC_{ij} = Ln\left(RXA_{ij}\right) - Ln\left(RMA_{ij}\right) \tag{3.13}$$

where, RTA_{ij} is the relative trade advantage of country *j* in commodity *i*; RXA_{ij} is the relative export advantage of country *j* in commodity *i*; RMA_{ij} is the relative import advantage of country *j* in commodity *i*; RC_{ij} is the revealed competitiveness index of country *j* in commodity *i*; X_{ij} is the exports of commodity *i* by country *j*; M_{ij} is the

[22] It is derived from Balassa's RCA index by taking consideration of double counting (Utkulu and Seymen 2004).

[23] The difference between relative export advantage (RXA) and relative import advantage (RMA)

imports of commodity i by country j; X_{nj} is the exports of all commodities excluding commodity i by country j; M_{nj} is the imports of all commodities excluding commodity i by country j; X_{ir} is the exports of commodity i by all countries in the world excluding country j; M_{ir} is the imports of commodity i by all countries in the world excluding country j; X_{nr} is the exports of all commodities excluding commodity i, by all countries in the world excluding country j; M_{nr} is the imports of all commodities excluding commodity i by all countries in the world excluding country j; and Ln is the natural logarithm.

If the RXA_{ij} has a value greater than one, it reveals that country j has a competitive advantage in exports of commodity i. On the other hand, if the $RXAij$ has a value less than one, it reveals a competitive disadvantage. If the RMA_{ij} has a value lower than one, it means that country j has a competitive advantage in imports of commodity i, and higher than one when it has a competitive disadvantage. An RTA_{ij} value greater than zero indicates a net competitive advantage or lower than zero indicates a net competitive disadvantage of country j. Thus, a positive value of the RTA and RC indicates that there is a revealed competitive advantage, while a negative value of these indices explains a revealed competitive disadvantage.

Recent applications of Vollrath's RC index to analyse competitive advantage of an industry of a country can be found in Vollrath (1991), Chuankamnerdkarn (1997), Havrila and Gunawardana (2003), Ferto and Hubbard (2003), Sassi (2003), Havrila (2004), Utkulu and Seymen (2004), and Khorchurklang (2005). However, Utkulu and Seymen (2004) noted that Balassa and Vollrath indices are based on different perspectives and should not be compared[24] or used as a substitute. Therefore, this study considers both Balassa's RCA and Vollrath's RC indices in the analysis of comparative and competitive advantage of the Australian wine industry in the world wine market.

3.5.2 AUSTRALIA'S REVEALED COMPETITIVE ADVANTAGE IN WINES

This section provides the index of revealed competitive advantage using Vollrath's RC index. Table 3.3, 3.5, and 3.6 indicate that, in general, Australia has experienced a relatively high degree of revealed competitive advantage in wines during 1980-2004. At present, most of the major wine producers also have a revealed competitive advantage in wines; however, Germany, the U.S., and the U.K. have a revealed competitive disadvantage in wines.

[24] Balassa assumes that the commodity pattern of exports reflects relative costs of production; therefore, the structure of exports should be able to depict the comparative advantage (Goldin 1990).

Table 3.3: Relative Export Advantage (RXA) index for wines in Australia and other major wine-producing countries, 1980-2004.

Year	Australia	France	Italy	Spain	Germany	Portugal	Greece	U.S.	Argentina	South Africa	Chile	U.K.	N.Z.
1980	0.22	11.14	6.15	9.06	0.73	24.27	1.45	0.05	0.58	0.19	1.90	0.20	0.09
1981	0.30	11.85	6.63	7.92	0.86	24.22	1.85	0.07	0.54	0.19	1.88	0.21	0.08
1982	0.25	11.12	6.85	7.30	0.81	21.05	1.78	0.07	0.59	0.21	1.30	0.21	0.07
1983	0.31	12.53	5.75	7.26	0.86	17.95	1.80	0.06	0.41	0.21	1.09	0.22	0.08
1984	0.31	14.42	6.07	6.18	0.90	16.23	1.80	0.05	0.44	0.18	1.28	0.23	0.16
1985	0.22	15.23	5.69	6.18	0.80	14.27	3.16	0.05	0.30	0.14	1.24	0.21	0.14
1986	0.34	17.49	3.70	6.26	0.58	14.01	2.83	0.06	0.36	0.16	1.25	0.15	0.13
1987	0.76	17.56	3.66	5.91	0.48	13.59	2.91	0.08	0.54	0.17	1.37	0.13	0.23
1988	1.14	17.44	4.00	5.65	0.48	13.69	2.21	0.09	0.54	0.21	1.31	0.13	0.37
1989	1.08	17.47	4.30	5.43	0.49	12.18	3.35	0.10	0.73	0.26	1.84	0.14	0.46
1990	1.33	16.32	4.33	4.64	0.46	10.87	3.34	0.12	0.74	0.16	2.48	0.14	0.56
1991	1.76	15.42	4.50	5.39	0.42	11.42	2.56	0.13	0.77	0.33	4.09	0.13	0.64
1992	2.04	13.62	4.26	6.15	0.46	11.95	3.24	0.14	1.11	0.81	5.09	0.13	1.06
1993	2.89	14.12	4.64	6.48	0.47	13.56	3.14	0.15	1.12	0.84	6.53	0.14	1.07
1994	2.96	13.24	5.16	5.74	0.52	12.01	3.01	0.14	1.01	1.22	6.00	0.13	0.99
1995	2.89	12.30	5.14	5.46	0.44	10.18	3.35	0.16	1.70	3.05	5.42	0.17	1.07
1996	3.40	11.60	4.79	5.36	0.40	10.57	2.83	0.19	1.51	3.45	8.72	0.23	1.36
1997	3.94	12.58	4.67	5.44	0.35	9.87	2.81	0.22	2.11	3.59	11.62	0.32	1.78
1998	4.63	12.03	4.54	5.11	0.29	8.53	2.74	0.26	2.37	3.53	14.73	0.24	1.96
1999	6.12	12.79	5.04	5.38	0.29	8.45	2.54	0.26	2.37	3.30	14.25	0.25	2.35
2000	7.59	12.90	5.65	5.33	0.29	9.66	2.62	0.30	2.94	3.92	16.79	0.29	3.28
2001	8.13	11.54	5.47	5.44	0.28	8.58	2.33	0.30	2.70	3.83	17.40	0.27	3.28
2002	9.63	11.62	5.60	4.86	0.28	8.27	1.98	0.30	2.20	5.42	16.25	0.29	3.84
2003	10.43	11.61	5.24	4.79	0.28	8.07	2.25	0.33	2.39	6.42	14.72	0.30	3.96
2004	11.80	10.71	5.54	5.06	0.27	8.40	2.26	0.38	2.89	6.00	12.75	0.26	5.35

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db

Table 3.4: Relative Import Advantage (RMA) index for wines in Australia and other major wine-producing countries, 1980-2004.

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**
1980	0.48	1.05	0.38	0.04	1.87	0.01	0.03	1.40	0.25	0.06	0.14	2.64	0.56
1981	0.44	1.06	0.35	0.05	2.04	0.01	0.04	1.48	0.08	0.09	0.23	3.11	0.74
1982	0.43	1.00	0.25	0.05	1.92	0.01	0.03	1.60	0.04	0.10	0.03	2.70	0.70
1983	0.48	0.90	0.22	0.07	1.92	0.01	0.05	1.75	n.a.	0.13	0.02	2.93	0.74
1984	0.60	0.90	0.24	0.05	1.72	0.01	0.04	1.63	n.a.	0.17	0.02	3.02	1.05
1985	0.66	0.97	0.35	0.05	1.72	0.01	0.04	1.50	0.00	0.10	0.02	3.30	0.70
1986	0.51	0.70	0.38	0.10	1.74	0.04	0.04	1.17	n.a.	0.08	0.02	3.62	1.00
1987	0.36	0.66	0.41	0.15	1.85	0.05	0.08	0.96	0.00	0.07	0.02	3.48	0.78
1988	0.42	0.75	0.42	0.15	1.97	0.06	0.11	0.87	0.00	0.06	0.02	3.42	1.27
1989	0.48	0.77	0.50	0.15	1.90	1.74	0.19	0.86	0.02	0.07	0.02	3.45	1.39
1990	0.45	0.67	0.49	0.14	1.91	0.23	0.25	0.74	0.05	0.07	0.02	3.71	1.46
1991	0.39	0.74	0.51	0.14	1.95	0.14	0.31	0.78	0.16	0.07	0.02	3.86	1.36
1992	0.37	0.77	0.47	0.16	1.92	0.16	0.24	0.86	0.19	0.07	0.04	3.83	1.26
1993	0.36	0.84	0.40	0.20	2.02	0.38	0.30	0.79	0.42	0.08	0.03	4.00	1.80
1994	0.39	0.89	0.37	0.27	1.93	1.20	0.28	0.74	0.44	0.09	0.03	4.40	1.88
1995	0.44	0.94	0.39	0.58	2.05	1.06	0.27	0.76	0.30	0.09	0.02	4.26	1.55
1996	0.35	0.83	0.33	0.28	2.02	0.67	0.25	0.81	0.23	0.22	0.03	4.18	1.54
1997	0.45	0.84	0.35	0.15	1.89	0.57	0.23	0.84	0.27	0.20	0.19	4.33	1.63
1998	0.43	0.71	0.35	0.26	1.79	1.05	0.20	0.76	0.34	0.10	0.17	4.16	1.81
1999	0.45	0.74	0.37	0.29	1.85	1.54	0.28	0.81	0.44	0.22	0.15	4.41	1.86
2000	0.47	0.72	0.38	0.24	1.73	1.43	0.29	0.89	0.33	0.14	0.13	4.34	2.12
2001	0.43	0.70	0.32	0.19	1.78	1.02	0.39	0.91	0.29	0.10	0.05	4.29	2.16
2002	0.47	0.66	0.35	0.19	1.69	0.88	0.63	1.02	0.09	0.13	0.04	4.41	2.14
2003	0.48	0.63	0.38	0.20	1.51	0.87	0.29	1.13	0.04	0.15	0.02	4.55	2.18
2004	0.59	0.66	0.40	0.22	1.50	0.91	0.31	1.07	0.03	0.09	0.03	5.04	2.18

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db (note: n.a. stands for ‘not applicable’ due to data unavailability from the UN and FAO).

Table 3.5: Relative Trade Advantage (RTA) index for wines in Australia and other major wine-producing countries, 1980-2004.

Year	Australia	France	Italy	Spain	Germany	Portugal	Greece	U.S.	Argentina	South Africa	Chile	U.K.	N.Z.
1980	-0.26	10.09	5.77	9.03	-1.14	24.27	1.42	-1.35	0.33	0.13	1.77	-2.44	-0.46
1981	-0.15	10.79	6.28	7.87	-1.18	24.20	1.81	-1.41	0.46	0.10	1.65	-2.89	-0.66
1982	-0.18	10.11	6.60	7.26	-1.11	21.04	1.75	-1.53	0.55	0.11	1.27	-2.50	-0.63
1983	-0.17	11.63	5.52	7.19	-1.07	17.95	1.75	-1.69	n.a.	0.08	1.07	-2.71	-0.65
1984	-0.29	13.51	5.83	6.13	-0.83	16.21	1.75	-1.59	n.a.	0.01	1.26	-2.78	-0.90
1985	-0.44	14.26	5.33	6.13	-0.92	14.26	3.12	-1.46	0.29	0.05	1.23	-3.09	-0.56
1986	-0.17	16.79	3.32	6.16	-1.16	13.98	2.79	-1.11	n.a.	0.08	1.22	-3.47	-0.87
1987	0.41	16.90	3.25	5.76	-1.37	13.54	2.84	-0.88	0.54	0.09	1.35	-3.35	-0.54
1988	0.72	16.69	3.58	5.49	-1.49	13.63	2.09	-0.78	0.54	0.14	1.30	-3.29	-0.89
1989	0.60	16.70	3.79	5.28	-1.41	10.44	3.16	-0.76	0.71	0.18	1.82	-3.31	-0.93
1990	0.87	15.65	3.84	4.49	-1.45	10.64	3.09	-0.63	0.68	0.09	2.46	-3.57	-0.90
1991	1.37	14.68	3.99	5.25	-1.54	11.28	2.25	-0.65	0.61	0.27	4.06	-3.72	-0.72
1992	1.67	12.85	3.78	5.99	-1.46	11.79	3.00	-0.72	0.92	0.75	5.05	-3.70	-0.20
1993	2.53	13.29	4.24	6.27	-1.55	13.18	2.84	-0.64	0.70	0.76	6.50	-3.86	-0.73
1994	2.57	12.34	4.79	5.48	-1.41	10.81	2.73	-0.60	0.57	1.13	5.97	-4.27	-0.89
1995	2.45	11.36	4.75	4.88	-1.61	9.12	3.08	-0.60	1.40	2.96	5.40	-4.09	-0.48
1996	3.05	10.77	4.47	5.08	-1.62	9.90	2.58	-0.61	1.27	3.24	8.69	-3.95	-0.18
1997	3.49	11.73	4.33	5.29	-1.53	9.30	2.58	-0.62	1.84	3.39	11.43	-4.00	0.15
1998	4.20	11.32	4.19	4.85	-1.49	7.48	2.54	-0.50	2.03	3.43	14.56	-3.92	0.14
1999	5.67	12.05	4.67	5.09	-1.55	6.91	2.27	-0.56	1.92	3.08	14.11	-4.16	0.48
2000	7.12	12.18	5.26	5.09	-1.44	8.24	2.33	-0.59	2.61	3.79	16.66	-4.05	1.15
2001	7.70	10.84	5.16	5.26	-1.50	7.56	1.94	-0.61	2.41	3.72	17.34	-4.01	1.12
2002	9.17	10.97	5.25	4.66	-1.41	7.39	1.35	-0.72	2.12	5.29	16.21	-4.12	1.70
2003	9.95	10.98	4.86	4.58	-1.22	7.20	1.96	-0.80	2.36	6.27	14.70	-4.25	1.78
2004	11.21	10.05	5.14	4.84	-1.23	7.49	1.96	-0.69	2.86	5.91	12.73	-4.78	3.17

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db (note: n.a. stands for 'not applicable' due to data unavailability from the UN and FAO).

Table 3.6: Revealed Competitive Advantage (RC) index for wines in Australia and other major wine-producing countries, 1980-2004.

Year	Australia	France	Italy	Spain	Germany	Portugal	Greece	U.S.	Argentina	South Africa	Chile	U.K.	N.Z.
1980	-0.77	2.36	2.79	5.48	-0.94	7.86	3.88	-3.32	0.84	1.14	2.62	-2.59	-1.79
1981	-0.40	2.41	2.93	5.05	-0.87	7.47	3.86	-3.05	1.89	0.77	2.09	-2.67	-2.24
1982	-0.55	2.40	3.30	5.08	-0.86	7.34	4.03	-3.19	2.72	0.74	3.73	-2.57	-2.25
1983	-0.45	2.63	3.24	4.70	-0.81	7.67	3.66	-3.36	n.a.	0.47	4.23	-2.57	-2.17
1984	-0.67	2.77	3.24	4.87	-0.65	7.28	3.70	-3.53	n.a.	0.08	3.99	-2.56	-1.89
1985	-1.08	2.75	2.78	4.88	-0.76	7.47	4.32	-3.49	5.81	0.38	4.24	-2.76	-1.61
1986	-0.40	3.22	2.27	4.13	-1.09	5.97	4.36	-3.05	n.a.	0.71	3.96	-3.21	-2.01
1987	0.76	3.28	2.19	3.70	-1.35	5.55	3.65	-2.50	5.71	0.83	4.07	-3.28	-1.20
1988	1.00	3.15	2.25	3.60	-1.41	5.44	2.98	-2.26	5.97	1.18	4.35	-3.24	-1.22
1989	0.81	3.12	2.15	3.58	-1.35	1.94	2.89	-2.12	3.40	1.25	4.68	-3.20	-1.11
1990	1.07	3.20	2.19	3.47	-1.42	3.85	2.61	-1.84	2.65	0.84	5.10	-3.25	-0.96
1991	1.50	3.04	2.17	3.65	-1.55	4.40	2.12	-1.81	1.58	1.59	5.15	-3.36	-0.76
1992	1.70	2.87	2.20	3.64	-1.43	4.33	2.62	-1.83	1.77	2.50	4.98	-3.36	-0.17
1993	2.09	2.83	2.44	3.45	-1.46	3.56	2.34	-1.67	0.99	2.32	5.41	-3.38	-0.52
1994	2.02	2.70	2.63	3.07	-1.31	2.30	2.38	-1.64	0.84	2.61	5.43	-3.52	-0.64
1995	1.89	2.57	2.59	2.24	-1.53	2.26	2.50	-1.57	1.73	3.56	5.63	-3.23	-0.37
1996	2.27	2.63	2.69	2.96	-1.61	2.76	2.42	-1.43	1.88	2.77	5.78	-2.90	-0.13
1997	2.16	2.70	2.60	3.59	-1.68	2.85	2.50	-1.33	2.06	2.91	4.14	-2.60	0.09
1998	2.38	2.83	2.57	2.99	-1.80	2.10	2.62	-1.09	1.93	3.52	4.46	-2.87	0.08
1999	2.62	2.85	2.61	2.92	-1.84	1.70	2.21	-1.15	1.68	2.72	4.57	-2.87	0.23
2000	2.78	2.89	2.69	3.08	-1.77	1.91	2.20	-1.08	2.20	3.35	4.85	-2.71	0.43
2001	2.95	2.80	2.85	3.38	-1.84	2.13	1.79	-1.11	2.22	3.63	5.83	-2.75	0.42
2002	3.02	2.88	2.76	3.23	-1.80	2.24	1.15	-1.22	3.22	3.71	6.05	-2.73	0.58
2003	3.07	2.91	2.63	3.17	-1.67	2.23	2.05	-1.24	4.18	3.77	6.56	-2.73	0.60
2004	3.00	2.79	2.64	3.14	-1.71	2.22	2.00	-1.04	4.58	4.22	6.10	-2.95	0.90

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db (note: n.a. stands for 'not applicable' due to data unavailability from the UN and FAO).

In particular, Table 3.3 shows that, as positive values of the RXA index, Australia has experienced a revealed competitive advantage in exports of wines since 1988. Although Australia had a competitive disadvantage in exports of wines during 1980-1987, the degree of competitive disadvantage decreased since the values of the index continually increased. In recent times, Australia has experienced a relatively high degree of revealed competitive advantage among the major wine-exporting countries. Table 3.3 also indicates that France, Italy, and Spain, have a stable degree of revealed competitive advantage in wine exports with small fluctuations throughout the analysis period. Nevertheless, these three countries showed a decreasing trend in the RXA index. Portugal had the highest degree of revealed competitive advantage in wine exports in 1980; however, it has experienced the largest reduction in its revealed competitive advantage in wine exports since 1981. Germany exhibited a relatively low value of the RXA index reflecting a revealed competitive disadvantage for the German wine exports. The New World countries, except Chile, had a revealed competitive disadvantage in exports of wines during the 1980s, but most of them have experienced competitive advantage in wine exports since the early 1990s, for instance Argentina and New Zealand in1992, South Africa in 1994. The U.S. and the U.K. have recorded an increasing degree of the RXA index, yet never experienced a revealed competitive advantage throughout the analysis period.

As shown in Table 3.4, Australia, Italy, Spain, Greece, Argentina, South Africa, and Chile have had a competitive advantage in their wine imports during 1980-2004. These countries are marked with a relatively strong competitive advantage in wine imports as they have low values of the RMA index. In 1980-1982, France had a competitive disadvantage in wine imports; however, France has experienced a competitive advantage since 1983. New Zealand had a competitive advantage in wine imports during 1980-1987; however, it has experienced a competitive disadvantage in wine imports since 1988. Major wine importers such as Germany and the U.K. have a competitive disadvantage in wine imports throughout the analysis period. The U.S. had a competitive disadvantage in imports of wines during 1980-1986, then gained a competitive advantage in the 1990s, but experienced a competitive disadvantage after 2001.

The results presented in Table 3.5 and 3.6 indicate that during 1980-1986, Australia had a net revealed competitive disadvantage in wines, and subsequently, Australia has experienced a net revealed competitive advantage with positive values of the RTA and RC indexes since 1987 showing a dramatically increasing trend. In addition, Australia's values of the RTA and RC indexes in 2004 are relatively higher than other major wine-producing countries. New Zealand has a similar pattern but it has experienced net revealed competitive advantages only since 1997. Table 3.5 and 3.6 also report that France, Italy, Spain, Portugal, Greece, Argentina, South Africa, and Chile have net revealed competitive advantage in wines throughout the analysis period. Therefore, in general, the Old World wine producers, except Germany, had a relatively high degree of revealed competitive advantage in the 1980s and subsequently experienced decreasing values of the RTA and RC indexes while the New World wine producers, except the U.S. experienced the opposite direction.

Table 3.5 and 3.6 also indicate that Germany, the U.S., and the U.K. have net revealed competitive disadvantage in wines throughout the analysis period. The U.K. has experienced an increasing degree of competitive disadvantage but the U.S. has experienced a decreasing degree of competitive disadvantage.

In conclusion, Australia has a high degree of *comparative and competitive advantage in wines* based on the Balassa's revealed comparative advantage index and Vollrath's revealed competitive advantage index. Australia's strong comparative and competitive position in the world wine market may have resulted from trade liberalisation commenced in the mid-1980s, and a relatively high quality wine as a result of its abundant factor endowments and advancement in wine production technology as mentioned in the previous chapter. Thus, the empirical results of Australia's comparative and competitive advantage in wines in this thesis are also consistent with the significance of the Australian wine industry claimed by several authors and institutions in the previous chapter.

3.6 CONCLUSION

This chapter examined the trade performance of Australia's wines and analysed the degree of Australia's comparative advantage and competitive advantage in wines relative to other wine producing countries.

The measures of trade specialisation index, export propensity, import penetration, and the ratio of exports to imports were used as indicators of Australia's trade performance in wines. The results indicated that Australia has become a net-exporter and has experienced a specialisation in wine trade since 1987. This signifies the high international trade competitiveness in Australia's wines. These results also reflect the effect of Australia's trade liberalisation commenced in the mid-1980s.

The Balassa's revealed comparative advantage index and the Vollrath's revealed competitive advantage indexes were used to determine Australia's comparative and competitive advantage in wines, respectively. The results suggested that, among the wine producing countries, Australia has a comparative advantage and competitive advantage in wines. The significant year was 1987 when Australia first experienced a comparative and competitive advantage in wines. The important explanation of this turning point is Australia's trade liberalisation policy in the mid-1980s.

The next chapter, Chapter Four, will examine major factors influencing demand and supply of exports and imports for Australia's wines. Economic models for export supply, export demand, and import demand will be developed with the application of econometric estimation procedures.

CHAPTER FOUR

EXPORT SUPPLY, EXPORT DEMAND, AND IMPORT DEMAND FOR AUSTRALIA'S WINES

4.1 INTRODUCTION

Since a country's income and price elasticity of demand and supply for imports and exports determine the country's trade balance (Johnson 1958 and Houthakker and Magee 1969), it is essential for policy makers to comprehend the elasticities with respect to domestic and foreign economic activities, especially when they make decisions on export promotion and/or import substitution strategies (Koshal *et al.* 1992 and Sawyer and Sprinkle 1999). Thus, it is important to examine the determinants of demand and supply of exports and imports for Australia's wines and to consider the implications of estimated elasticities with respect to relative prices, income, and other factors influencing Australia's wine exports and imports.

In this chapter, estimated models of export supply of and export demand for Australia's wines, and import demand for wines by Australia will be developed. This chapter is organised as follows. Section 4.2 examines the theoretical background, provides a review of empirical studies on the determinants of export supply, and develops a model of Australia's export supply of wines. Section 4.3 reviews the theory of export demand and empirical studies on the determinants of export demand, and then a model of foreign countries' demand for Australia's wine exports is developed. Section 4.4 examines the theoretical background of import demand, presents a review of empirical studies on the determinants of import demand, and develops a model of Australia's import demand for wines. In section 4.5, the variables, data, and sources of data are described. Section 4.6 discusses econometric methodology and model estimation procedures, with a focus on the time-series analysis in relation to the concepts of stationarity and cointegration. Results and findings of the Australian export supply, export demand, and import demand for wines are provided in Section 4.7. Section 4.8 summarises major findings of the analysis.

4.2 AUSTRALIA'S EXPORT SUPPLY OF WINES

This section is divided into two parts. The first part provides literature on the determinants of export supply by reviewing the theoretical background and some empirical studies on export supply. The second part presents a model of Australia's export supply of wines based on the literature review.

4.2.1 LITERATURE REVIEW ON THE DETERMINANTS OF EXPORT SUPPLY

4.2.1.1 Theoretical Background of Export Supply

Theoretically, exportable surplus of a particular commodity exists when the domestic production is greater than its consumption. Accordingly, the quantity of domestic supply is in excess of the quantity demanded, and then the country becomes an exporter of that commodity (Kreinin 2002). This implies that the country's export supply curve is derived as a difference between the domestic supply and demand. At the domestic level, an equilibrium price is generated where domestic supply is equal to domestic demand, and therefore the country has no excess quantity for export supply. But at higher world prices above the domestic equilibrium price, the country would be willing to supply more for export. The factors that determine changes in the domestic supply (a shift its curve)[25] also lead to changes in export supply (Gunawardana and Karn 1998).

Given that the quantity of exports is the difference between the quantity supplied and quantity demanded domestically, the price elasticity of export supply can be derived as:

$$\varepsilon_s^x = \frac{Q_s^h}{Q_x} \times \varepsilon_s^h + \frac{Q_d^h}{Q_x} \times \varepsilon_d^h \tag{4.1}$$

where, ε_s^x is the price elasticity of export supply, Q_s^h is the quantity supplied domestically, Q_x is the quantity of exports, ε_s^h is the price elasticity of domestic supply, Q_d^h is the quantity demanded domestically, and ε_d^h is the price elasticity of domestic demand. Equation 4.1 expresses that the price elasticity of export supply of a product is positively related to the elasticities of domestic demand and supply, but negatively related to the quantity of exports as a proportion in the quantity of domestic supply and demand (Kreinin 1967; Houthakker and Magee 1969; Jones and Berglas 1977; and Goldstein and Khan 1985).

[25] Such as technological changes, domestic taxes or subsidies on production, weather conditions, and prices of related goods.

However, Gunawardana and Karn (1998) and Havrila (2004) pointed out some difficulties involved in the estimation of price elasticity of export supply as given in Equation 4.1. The complexity in obtaining the price elasticities of domestic supply and demand arises due to unreliable information on domestic consumption and production. Since, the estimation of the price elasticity of export supply as proposed by the above theory is difficult, international economists attempted to estimate the export supply model directly and obtain elasticities with respect to various factors.

4.2.1.2 A Review of Empirical Studies on Export Supply

Studies such as Goldstein and Khan (1978), Arize (1987), Moller and Jarchow (1990), Koshal *et al.* (1992), and Bullock *et al.* (1993) estimated export supply and demand in simultaneous equation models, while studies by Ali (1978), Athukorala and Jayasuriya (1994), Gunawardana *et al.* (1995), Chuankamnerdkarn (1997), Gunawardana and Karn (1998), Tambi (1999), Aydin *et al.* (2004), and Havrila (2004) used separate single equation models. Ali (1978) suggested that the choice of the single equation or the simultaneous model would depend on the nature of export price. If export price is determined exogenously (the 'price taker' assumption), a separate single-equation model is appropriate. On the other hand, if export price is determined endogenously (the 'price setter' assumption), the export demand and export supply functions should be estimated simultaneously (Thursby and Thursby 1984 and Muscatelli *et al.* 1992).

Gunawardana *et al.* (1995) estimated a single model of export supply response of the Australian citrus industry using quarterly data for the period 1983-1993. They specified the quantity of fresh citrus exported as a function of relative price of exports that is the ratio of the Australian dollar price index of citrus exports[26] to the Australian domestic wholesale price index of citrus. They also added a time trend dummy variable as a proxy of the production capacity in the long run and seasonal dummy variables in order to capture the seasonal variations in the Australian citrus exports. Their results showed that the Australian supply of citrus exports was price-inelastic in both the short run and long run. A statistical significance and positive relationship were obtained for the domestic production capacity variable. They concluded that Australia was a price taker in the world citrus market and suggested that trade policies should focus on shifting the domestic supply curve of citrus.

Gunawardana and Karn (1998) conducted an analysis of Australia's export supply of pharmaceutical products using annual time series data for the period 1975-1992. Their results of a single-equation model revealed that coefficients of the ratio of Australia's export price index to domestic price index and the domestic production capacity were positive and significantly related to the volumes of exports supplied in both the short run and long run. The estimated long run price elasticity being low indicates that the Australia's quantity of pharmaceutical exports supplied is not very responsive to changes in the relative price.

Aydin *et al.* (2004) examined the supply for the Turkish commodity exports using a single-equation model. The study used quarterly data from 1987 to 2003 and a log-log regression form of the real exports on the real income (proxied by real GDP), export

[26] This index is calculated from the unit value of citrus exports, which is total Australian dollar export values divided by total export volumes of citrus. Chuankamnerdkarn (1997) and Khorchurklang (2005) also followed this approach.

price index, unit labour cost, and a dummy variable for seasonal variations. All explanatory variables were found to be statistically significant. Real income exhibited a positive relationship while export price index and unit labour cost showed a negative impact. The study also concluded that the export supply is significantly determined by unit labour cost, export prices, and income in both the short run and long run.

The empirical studies reviewed previously have concentrated mainly on the impact of prices on the quantity of export supply. The quantity of a country's export supply for a particular commodity is generally estimated as a function of relative price and a production capacity variable in response to the long run effect. Therefore, the basic function of a country's export supply[27] for a particular commodity can be specified as:

$$X_{it}^{s} = f\left(\frac{PX_{it}}{PD_{it}}, TIME\right) \tag{4.2}$$

where, X_{it}^{s} is the quantity of a country's export supply of commodity *i* in time period *t*; PX_{it} is a country's export price of commodity *i* in time period *t*; PD_{it} is a country's domestic price of commodity *i* in time period *t*; and *TIME* is a time-trend dummy variable representing the long run changes in the production capacity. Variables in Equation 4.2 are hypothesised that, *ceteris paribus*[28], the relative export price and production capacity are positively related to the country's exports supplied. The production for export becomes more profitable when the export price to domestic

[27] Given the 'small country' assumption is held, the single-equation model is an appropriate approach for the estimation of export supply.
[28] Other factors (that shift the supply and demand curve) remain the same or other things are constant.

price ratio increases and the quantity of export supply increases. The country's export supply is also likely to rise with an increase in a country's production capacity resulting from technological improvements over time, *ceteris paribus*. Some empirical studies included other factors to account for export incentives such as an exchange rate variable and other trade policies.[29]

4.2.2 THE MODEL OF AUSTRALIA'S EXPORT SUPPLY FOR WINES

According to the review of empirical studies on export supply in the previous section, Australia's export supply of wines is hypothesised to depend primarily upon relative prices of export and production capacity using a time-trend dummy variable. Another dummy variable is added to account for the effect of trade liberalisation that reflects Australia's comparative and competitive advantage in wine trade since 1987.[30] Thus, the model of Australia's export supply of wines can be specified as:

$$XS_{wt} = f(RPX_{wt}, Time, DCA) \tag{4.3}$$

where, XS_{wt} is the real exports of wines (nominal exports of wines in current dollars deflated by export price index)[31]; RPX_{wt} is the relative price of wine exports (export price index of wines divided by domestic producer price index of wines

[29] See, for example, Moller and Jarchow (1990), Athukorala and Jayasuriya (1994) Gunawardana and Karn (1998), and Tambi (1999).
[30] Refer to the results presented in Chapter 3.
[31] Haynes and Stone (1983) estimated export models of the U.K. and the U.S. using both export quantities and export prices as dependent variables. They concluded that the supply-price equation is more preferred approach. In addition, Goldstein and Khan (1985) claimed that indexes based on international price transactions are rarely available, therefore, the best deflator may be the actual transactions of export and import prices that are unit value indexes of exports and imports.

manufacturing at factory as a proxy for costs of production of wine exports, that is PX_{wt}/PD_{wt}); *TIME* is a dummy time-trend variable representing for the long-run changes in the production capacity; and *DCA* is dummy variable for the Australian trade liberalisation period (zero for 1980-1987 and one for 1988-2004).

Although economic theories of international trade provide no guidance as to the appropriate functional form in the estimations of export and import of supply and demand equations, the commonly used functional forms for the estimations of export and import models are linear and log-log formations (Krenin 1967; Houthakker and Magee 1969; and Leamer and Stern 1970). Khan and Ross (1975) suggested that a linear function is convenient in a forecasting purpose, while a log-log function is preferable for examining the relationship between the dependent variable in response to the movement or direction of explanatory variables over time. In addition, Khan and Ross (1977), Boylan *et al.* (1980), Boylan and Cuddy (1987), and Gunawardana and Karn (1998) contended that the estimated slope coefficients of price and income in the log-log form refer directly to their elasticities. Moreover, the heteroscedasticity[32] problem is likely to be solved by estimating the regression in the log-log form (Maddala 1992).

Having reviewed the major empirical studies on determinants and functional form, the empirical equation for the estimation of Australia's export supply of wines model is specified in the log-log form, as follows:

[32] It is a condition that occurs when the errors do not have a constant variance (Maddala 1992).

$$LXS_{wt} = \alpha_0 + \alpha_1 LRPX_w, \alpha_2 TIME + \alpha_3 DCA + \varepsilon_{wt} \quad (4.4)$$

Equation 4.4 indicates the logarithm of the dependent and explanatory variables where α_0 is the intercept; α_1, α_2, and α_3 are the slope coefficients; and ε_{wt} is an error term. The coefficient α_1 is expected to be positive because an increase in export price relative to domestic price will induce Australian producers to supply winesfor the overseas instead of domestic market. The hypothesised sign of parameter estimate for α_2 is positive as it represents the expansion in production capacity (through improvements in technology, infrastructure development and R&D) in the long run. The coefficient of a dummy for trade liberalisation (α_3) is expected to be positive as a result of higher market openness and trade levels are expected to increase.

4.3 EXPORT DEMAND FOR AUSTRALIAN WINES

This section consists of two parts. The first part presents a review of literature on the determinants of export demand by reviewing the theoretical background and some empirical studies on export demand. The second part presents a model of export demand for Australia's wines based on the literature review.

4.3.1 LITERATURE REVIEW ON THE DETERMINANTS OF EXPORT DEMAND

4.3.1.1 Theoretical Background of Export Demand

The international demand for a country's exports of a particular commodity is derived from the import demand of foreign countries for that commodity. Theoretically, export demand for a given commodity is the total demand for the commodity by all other countries[33] that import the given commodity from the exporting country, minus the exports of the commodity [34] to those importing countries by the remaining exporting countries.[35] Based on the small country assumption, each importing country has an insignificant share in the world market. An importing country's demand for a country's export of a given commodity is given by the difference between the importing country's domestic demand and its domestic supply (subtracting the domestic supply from the domestic demand curve) at any given world price. Thus, a change[36] in importing countries' domestic demand and supply schedules will shift the export demand curve of the exporting countries (Kreinin 1967; Houthakker and Magee 1969; and Goldstein and Khan 1985).

According to the above theoretical explanation, the price elasticity of foreign demand for a country's exports of a particular product is expressed in Equation 4.5 below.

$$\varepsilon_d^x = \frac{Q_d^w}{Q_d^w - Q_x^r} \times \varepsilon_d^w + \frac{Q_x^r}{Q_d^w - Q_x^r} \times \varepsilon_s^r \qquad (4.5)$$

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[33] Import demand
[34] Export supply
[35] The exporting country's competitors
[36] Such a change in income levels, prices of related goods, and consumer tastes and preferences.

where, ε_d^x is the price elasticity of export demand; Q_d^w is the quantity of exports demanded in the world; Q_x^r is the quantity exported by other (competing) countries; ε_d^w is the price elasticity of world demand for exports; and ε_s^r is the price elasticity of export supply from other countries (Kreinin 1967; Houthakker and Magee 1969; Goldstein and Khan 1985; and Kreinin 2002). Thus, the price elasticity of foreign demand for a country's exports of a given product is negatively related to its competitors' share of the world market.

However, Gunawardana and Karn (1998) pointed out some difficulties involved in the estimation of price elasticity of foreign demand for a country's exports of a commodity as given in Equation 4.5. The complexity in obtaining the price elasticities of world demand for exports and export supply from other countries arises due to unreliable information on the world demand and competitors' supply. Since, the estimation of the price elasticity of export demand as proposed by the above theory is difficult, international economists attempted to estimate the export demand model directly and obtain elasticities with respect to various factors.

4.3.1.2 A Review of Empirical Studies on Export Demand

Khan (1974) examined the world export demand for various developing countries measured at the aggregate level for the period 1951-1969. Khan estimated the export demand model as a function of the ratio of unit value of exports to the world price level and the real world income. The results revealed that even though developing countries were the major exporters of primary commodities in the world market, they would not necessarily experience inelastic price demand for their exports. Hence, he emphasised the relative price as a significant determinant of demand for developing countries' exports.

Bond (1985) found that a country's export demand was significantly determined by the exporting country's real income[37], its export price relative to its competitors' prices, and its export price relative to the domestic price. From the estimated results, it can also be inferred that export price was positively related to the weighted average of the real effective exchange rates of trading partners.

Athukorala (1991) conducted an analysis for several developing countries' export demand (measured by real export values) regressed on four explanatory variables, namely, world demand, exchange rate, income, and price. The findings allow for the conclusion that the world demand would be an important determinant of export demand since the coefficients of the world demand variable were found to be statistically significant for all studied countries. Muscatelli *et al.* (1995) found a statistical significance for foreign income and the ratio of home country's export price to foreign countries' export prices on international demand for exports among the Asian Newly Industrialised Economies (NIEs).

Gunawardana and Karn (1998) investigated international demand for Australia's pharmaceutical exports with the log-log form of regression analysis on the relative price index of exports (the percentage ratio of Australia's export price index to the weighted average price index of manufactured exports of Australia's competing

[37] Measured by real GNP

countries) and total real income[38] of major importing countries. They concluded that, in the short run, the export demand was not responsive to both relative export price and foreign income. However, in the long run, both coefficients of relative export price and foreign real income were statistically significant. Thus, their estimates led them to conclude that Australia might have some market power as a result of the low estimated price elasticity of demand for its pharmaceutical exports. The quantity of Australia's pharmaceutical exports was significantly affected by the Australian trading partners' income since they found a high estimated income elasticity of demand for Australia's pharmaceutical exports.

Based on the above reviews of empirical studies, the quantity of a country's export demand[39] for a particular commodity is modelled as a function of relative price, income, and exchange rate. The export demand function is specified as:

$$X_{ijt}^{d} = f\left(\frac{PX_{ijt}}{PXW_{it}}, YW_{jt}, XR_{jt}\right) \tag{4.6}$$

where, X_{ijt}^{d} is the quantity of country *j*'s exports of commodity *i* demanded by foreign countries in time period *t*; PX_{ijt} is the price of country *j*'s exports of commodity *i* in time period *t*; PXW_{it} is the average export price of commodity *i* of other (competing) countries in time period *t*; YW_{jt} is the average income of foreign countries (or trading partners of country *j*) in time period *t*; and XR_{jt} is the exchange rate between

[38] Measured by real GDP
[39] The small country assumption is held; hence the single-equation model is applied for the estimation of export demand.

exporting country *j*'s currency and foreign currencies in time period *t*. This function hypothesises that when the exporting country *j*'s export price relative to the other (competing) countries' export price increases, foreign countries will demand less from the exporting country *j*, and then the quantity of exports demanded decreases. On the other hand, when foreign countries' average income increases, these foreign countries will demand more from exporting country *j*, and then the quantity of exports demanded increases. Similarly, if the exchange rate (defined as units of exporting country *j*'s currency for a unit of foreign currencies) increases, foreign countries will demand more from exporting country *j*, and then quantity of exports demanded increases.

4.3.2 THE MODEL OF EXPORT DEMAND FOR AUSTRALIA'S WINES

Based on the empirical studies reviewed in the previous section, the model of export demand for Australia's wines can be constructed as a function of Australia's export price index relative to competing countries' export price index, the average income of the countries that import Australia's wines, and exchange rates of Australian dollars for importing countries' currencies. Thus, the model of Australia's export demand for wines can be specified as:

$$XD_{wt} = f(RPXW_{wt}, GNIW_{wt}, XRI_{at}) \tag{4.7}$$

where, XD_{wt} is the real exports of wines (nominal exports of wines in current dollars deflated by export price index)[40]; $RPXW_{wt}$ is the relative price of wine exports (Australia's export price index of wines divided by competing countries' price index of wines[41], that is PX_{wt}/PXW_{wt}); $GNIW_{wt}$ is the average gross national income per capita of major importing countries[42] of Australia's wines; and XRI_{at} is the average exchange rate index of Australian dollars for major importing countries' currencies.

The export demand model in the log-log form[43] is given as:

$$LXD_{wt} = \beta_0 + \beta_1 LRPXW_{wt} + \beta_2 LGNIW_{wt} + \beta_3 LXRI_{at} + \varepsilon_{wt} \qquad (4.8)$$

Equation 4.8 indicates the logarithm of the dependent and explanatory variables where β_0 is the intercept coefficient; β_1, β_2 and β_3 are the slope coefficients; and ε_{wt} is an error term. The parameter estimate for β_1 is expected to be negative since an increase in export price relative to competitors' price means that the price of Australia's wines is higher than the prices of competitors' wines, and then major trading partners will import (demand) less wines from Australia. The parameter estimate for β_2 is expected to be positive as a rise in trading partners' income implies an increasing purchasing power, and then they will demand more wines from Australia. If the Australian dollar depreciates against foreign currencies, importing countries will pay less for Australian wines, and then they will demand more of

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40 See explanation in section 4.2.2.
41 Major competitors of Australia's wines are France, Italy, Spain, Germany, Portugal, Greece, U.S., Argentina, South Africa, Chile, and New Zealand.
42 The U.S., the U.K., Canada, New Zealand, Germany, and Japan.
43 See explanation in section 4.2.2.

Australia's wines. Thus, β_3 is expected to be positive since the exchange rate is defined as units of Australian dollar for a unit of foreign currencies.

4.4 AUSTRALIAN IMPORT DEMAND FOR WINES

This section is divided into two parts. The first part discusses literature on the determinants of import demand by reviewing the theoretical background and some critical empirical studies on import demand. The second part presents a model for Australia's import demand for wines based on the literature review.

4.4.1 LITERATURE REVIEW ON THE DETERMINANTS OF IMPORT DEMAND

4.4.1.1 Theoretical Background of Import Demand

Generally, a country imports a particular product from the rest of the world when its domestic demand is greater than its domestic supply of the product. Theoretically, with the 'price taker' assumption[44], a country's import demand curve is derived by subtracting that country's domestic supply curve from its domestic demand curve at various levels of world price. Thus, domestic supply, domestic demand, and import decisions of the small importing country are based on the world price. International economic theory also suggests that at the domestic equilibrium price where domestic demand is equal to domestic supply, the country's import demand is zero. At lower world prices which are below the domestic equilibrium price, the country will demand

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[44] A small importing country is assumed to have an insignificant share of the world imports and it cannot influence the demand and price in the world market.

larger quantities of imports (Jones and Berglas 1977 and Kreinin 2002). In addition, factors[45] that change in the importing country's domestic demand (a shift in the domestic demand curve) will also change the import demand (Havrila 2004).

Given that the quantity of imports demanded is the difference between the quantity demanded and quantity supplied domestically, the price elasticity of import demand is expressed as:

$$\varepsilon_d^m = \frac{Q_d^h}{Q_m} \times \varepsilon_d^h + \frac{Q_s^h}{Q_m} \times \varepsilon_s^h \qquad (4.9)$$

where, ε_d^m is the price elasticity of import demand; Q_d^h is the quantity demanded domestically; Q_m is the quantity of imports; ε_d^h is the price elasticity of domestic demand; Q_s^h is the quantity supplied domestically; and ε_s^h is the price elasticity of domestic supply (Kreinin 2002). Equation 4.9 indicates that the price elasticity of import demand of a product is positively related to the elasticities of domestic demand and supply but negatively related to the quantity of imports as a proportion in the quantity of domestic demand and supply.

However, Havrila (2004) pointed out some difficulties involved in the estimation of price elasticity of import demand as given in Equation 4.9. The complexity in obtaining the price elasticities of domestic demand and supply arises due to unreliable information on domestic consumption and production. Since, the estimation of the price elasticity of import demand as proposed by the above theory is difficult,

[45] Such as changes in consumer income, prices of related products, consumer tastes and preferences.

international economists attempted to estimate the import demand model directly and obtain elasticities with respect to various factors.

4.4.1.2 A Review of Empirical Studies on Import Demand

Houthakker and Magee (1969) conducted an analysis of import demand for several countries, mainly developed countries as a function of two explanatory variables, namely, the index of real GNP and the ratio of import prices to domestic wholesale prices. They pointed out the importance of income and price elasticities of import demand among trading countries. Houthakker and Magee also concluded that a country would experience relatively higher growth in its imports than exports when the country has higher income elasticity of demand for its imports than its foreign income elasticity of demand for its exports.

Wilkinson (1992) investigated Australia's demand for aggregate imports for the period 1974-1989 and found the importance of income and the ratio of import price to domestic price. Wilkinson also added relative export prices and a domestic production capacity variable in the import demand function. The estimated results showed that Australia's import demand was determined by economic activities (usually measured by national income) rather than by the variation in relative prices. Thursby and Thursby (1984), Dwyer and Kent (1993) and Athukorala and Menon (1995) also reported a similar conclusion.

Chuankamnerdkarn (1997) hypothesised Australia's import demand for pharmaceuticals on the price of imports relative to domestic price, Australia's national income (proxied by real GDP), and a dummy variable for Australia's trade liberalisation. The results showed that import demand for pharmaceuticals by Australia was highly elastic with respect to Australia's income, but inelastic with respect to the relative price of imports. Although the trade liberalisation variable showed a positive impact on the import demand for pharmaceuticals, its impact was not statistically significant.

Thus, the import demand function is determined by import prices, domestic prices, and national income. Even though some studies put import prices and domestic prices separately[46] (the split-price specification) in their import demand models, most of the empirical studies applied relative prices.[47]

A number of studies suggest that additional variables should be included in an import demand equation. For example, George *et al.* (1977) included foreign exchange reserve to test the effect of foreign currency convertibility by an importing country. Dwyer and Kent (1993) and Havrila (2004) used the effective rate of assistance to reflect the degree of market openness and trade protection. Athukorala and Menon (1995) and Havrila (2004) included the ratio of the commodity stock to average sales volume in order to observe the extent of domestic scarcity. Warner and Kreinin (1983), Agarwal (1984), Deyak *et al.* (1993), Sawyer and Sprinkle (1999), and Aydin

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[46] For example, see Murray and Ginman (1976), Stern *et al.* (1979), Wilson and Tackas (1979), Phaup (1981), Volker (1982), Warner and Kreinin (1983), Petoussis (1985), Dunlevy and Deyak (1989), Moffett (1989), Arize and Spalding (1991), Arize and Walker (1992), Deyak *et al.* (1993), and Doroodian *et al.* (1994).

[47] For instance, see Yadav (1975), Beenstock and Minford (1976), Goldstein and Khan (1976), Khan and Ross (1977), Weisskoff (1979), Akhtar (1980), Boylan *et al.* (1980), Goldstein *et al.* (1980), Hamilton (1980), Agarwal (1984), Thursby and Thursby (1984), Boylan and Cuddy (1987), Katayama *et al.* (1987), Faini *et al.* (1988), Kabir (1988), Cline (1989), Ohtani *et al.* (1990), Asseery and Peel (1991), Andersen (1993), Bosworth (1993), Bewley and Orden (1994), Athukorala and Menon (1995), Menon (1995), Amano and Wirjanto (1997), Chuankamnerdkarn (1997), Bahmani-Oskooee and Niroomand (1998), Ceglowski (1997) and Havrila (2004).

et al. (2004) added the exchange rate variable. Moreover, Marquez and McNeilly (1988) suggested the inclusion of a dummy variable to capture the effect of exogeneous factors on a country's demand for imports. A number of studies included a dummy variable in their import demand models. For example, Chuankamnerdkarn (1997) investigated the effects of trade liberalisation in Australia's pharmaceuticals by including a dummy variable to separate between the pre- and post-periods of trade liberalisation. Havrila (2004) used a dummy variable representing the effect of Asian economic crisis of 1997.

Most of the previous studies have concluded that demand for imports is generally influenced by the levels of the importing country's economic activities[48] and its international price competitiveness.[49] A model of a country's imports[50] is specified in Equation 4.10 as follows:

$$M_{ijt}^{d} = f\left(\frac{PM_{ijt}}{PD_{ijt}}, Y_{jt}\right) \tag{4.10}$$

where, M_{ijt}^{d} is the quantity of country *j*'s imports of commodity *i* in time period *t*; PM_{ijt} is the price of country *j*'s imports of commodity *i* in time period *t*; PD_{ijt} is the domestic price of commodity *i* in time period *t*; and Y_{jt} is the national income of country *j* in time period *t*.

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[48] commonly measured by GDP, GNP, GNI, or GNE
[49] usually measured by the relative prices of imports and domestic prices
[50] Holding the small country assumption, the single-equation method to estimate the import demand function is a suitable approach.

4.4.2 THE MODEL OF AUSTRALIA'S IMPORT DEMAND FOR WINES

According to the review of empirical studies on import demand in the previous section, Australia's import demand for wines is hypothesised to depend primarily upon price of imports relative to domestic price, Australia's national income, and the effects of trade liberalisation. Thus, the model of Australia's import demand for wines can be specified as:

$$MD_{wt} = f(RPM_{wt}, RGDP_t, DCA) \tag{4.11}$$

where, MD_{wt} is the real imports of wines (Australia's wine imports in current prices deflated by import price index of wines)[51]; RPM_{wt} is the relative price of imports of wines (the ratio of import price index of wines to domestic price index of wines, that is PM_{wt}/PD_{wt}); *RGDP* is the Australian real GDP (nominal GDP divided by GDP deflator); and *DCA* is a dummy variable for the Australian trade liberalisation period (zero for 1980-1987 and one for 1988-2004).

Australia's import demand function for wines is specified in the log-log form[52] as:

$$LMD_{wt} = \gamma_0 + \gamma_1 LRPM_{wt} + \gamma_2 LRGDP_t + \gamma_4 DCA_t + \varepsilon_t \tag{4.12}$$

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[51] Some studies used the import volumes as dependent variables (Thursby and Thursby 1984; Arize and Afifi 1987; and Thursby 1988). However, Haynes and Stone (1983) claimed the significance of real import values. See also explanation in section 4.2.2.

[52] See explanation in section 4.2.2.

Equation 4.12 indicates the logarithm of the dependent and explanatory variables where, γ_0 is the intercept; γ_1, γ_2, and γ_3 are the slope coefficients; and ε_t is an error term. It is expected that the relative price of imports (RPM_{wt}) has an inverse relationship with Australia's wine imports (MD_{wt}) as wine imports become more expensive, Australian consumers are likely to buy more of the relatively cheaper domestically produced wines. On the other hand, if the domestic prices of wines rise, wine imports become relatively cheaper, leading to an increase in demand for imported wines. When the national income increases, the marginal propensity to import is also expected to increase. Consequently, Australian consumers can afford to buy more of imported wines. Therefore, γ_1 is expected to be negative, and γ_2 is expected to be positive. The coefficient of the dummy variable for trade liberalisation (γ_3) is expected to be positive as greater market openness is expected to increase import demanded.

4.5 DATA AND DATA SOURCES

The estimations of export supply, export demand and import demand are based on the annual time-series data for the period 1980-2004. The export and import data are reported in current prices in the unit of U.S. dollars, gathered from the UN Commodity Trade Statistics (Comtrade) database at four-digit SITC level of aggregation (SITC1121 revision 3). A list of more detailed levels of disaggregation is provided in Table 4.1. To calculate the real value of exports and imports, the four-digit SITC trade data in current prices were converted into real values. The nominal exports for wines were deflated by using the export price index and the nominal imports for wines were converted into real imports by using the import price index as a deflator. The export price index and import price index were calculated from unit values of wine exports and imports provided by the FAO. Exchange rate index was calculated by the average indexes of major importer's currencies. Australia's real income was measured by the nominal GDP divided by the GDP deflator. Most of the other data were obtained from various databases provided by dXEcon data and ABARE. A more detailed list of data sources is given in Appendix 4.7. In addition, data series (as appeared in the models) for econometric estimations of export supply, export demand, and import demand for Australia's wines are presented in Appendix 4.1 to 4.6.

Table 4.1: Detailed Classification of wine products in SITC (rev. 3)

SITC Code	Description
1	Name: BEVERAGES AND TOBACCO Description: Beverages and tobacco
11	Name: BEVERAGES Description: Beverages
112	Name: ALCOHOLIC BEVERAGES Description: Alcoholic beverages
1121	Name: Wine of fresh grapes Description: Wine of fresh grapes (including fortified wine); grape must in fermentation or with fermentation arrested
11211	Name: Grape must in fermentation or with fermentation arrested otherwise than by the addition of alcohol Description: Grape must in fermentation or with fermentation arrested otherwise than by the addition of alcohol
11213	Name: Vermouth and other wines of fresh grapes flavoured with plants or aromatic substances Description: Vermouth and other wines of fresh grapes flavoured with plants or aromatic substances
11215	Name: Sparkling wine Description: Sparkling wine
11217	Name: Wine of fresh grapes (other than sparkling wine); grape must with ferment fermentation prevented or arrested by the addition of alcohol Description: Wine of fresh grapes (other than sparkling wine); grape must with fermentation prevented or arrested by the addition of alcohol

Source: the UN Comtrade database; available at http://comtrade.un.org/db

4.6 ECONOMETRIC PROCEDURES

This section discusses theoretical and methodological issues related to estimations of export supply, export demand, and import demand models.

4.6.1 STATIONARY AND NON-STATIONARY TIME SERIES

A time-series data is a set of observations on sequential numerical data in which each item of the variable is associated with a regular time intervals (Maddala 1992). A stochastic (random) time-series data is considered to be *stationary* when its mean and variance are constant over time and the value of covariance between any two time periods depends on the time difference (lag or gap) between the time periods but not the actual time itself. On the other hand, if the mean, variance, and autocovariance (at various lags) of a time series do not remain the same, they are 'time variant' or considered as a *non-stationary* time series (Gujarati 1995).

If a non-stationary time-series data is used in the regression analysis, the inferential statistics such as the *t*- statistics and *F*- tests are likely to provide misleading results (Phillips 1986). Granger and Newbold (1974) described this situation as a 'spurious regression', where the Ordinary Least Square (OLS) estimated parameters are highly significant and the coefficient of determination (R^2)[53] is very high. As a consequence, it is not possible to generalise the spurious results to other time periods. Hence, there is a need to identify the nature of time series used and to make required adjustments

[53] Yule (1926) pointed out that a high value of R-square may not reveal a true relationship between dependent and explanatory variables because the variables tend to move in the same direction. A non-stationary time series also increases the possibility of autocorrelation in the error term.

during the estimation. Most raw data in economic time series are non-stationary because they normally exhibit some trends, either upward or downward movements over time (Maddala 1992). Therefore, the widely used methods for testing whether a time-series data is stationary or non-stationary and remedial approaches will be discussed in the following sections.

4.6.2 UNIT ROOT TESTS

The concept of stationarity of a time series is strongly related to the characteristics of roots of that time series. A time series that contains unit root is known as non-stationary time series. The Data Generating Process (DGP) of a non-stationary series is generally structured as autoregressive (AR) process with a drift. Thus, the first order AR process or AR(1) of a non-stationary series Y_t is given as:

$$Y_t = \alpha + \rho Y_{t-1} + \varepsilon_t \tag{4.13}$$

where, α is the intercept or constant term and ρ is the autoregressive (AR) coefficient. The DGP of Y_t is stationary if ρ lies between +1 and -1. It will be non-stationary if ρ is greater than 1 or less than -1. For economic time series, ρ is generally equal to or greater than unity (Maddala 1992). Then, the obvious hypotheses for testing stationarity are; H_o: $\rho = 1$ against H_a: $\rho < 1$.

Unfortunately, the above procedure is likely to face two estimated problems. Firstly, the process of Y_{t-1} as the explanatory variable in Equation 4.13 that leads to a downward bias. Secondly, the test statistics is non-normal even when the sample size is large. To overcome the first problem, Dickey and Fuller (1979) formulated Equation 4.13 as the first difference equation:

$$\Delta Y_t = \alpha + \rho^* Y_{t-1} + \varepsilon_t \tag{4.14}$$

where, $\Delta Y_t = Y_t - Y_{t-1}$ and $\rho^* = \rho - 1$. In this structure, testing of H_o: $\rho = 1$ against H_a: $\rho < 1$ in Equation 4.13 is equivalent to testing of H_o: $\rho^* = 0$ against H_a: $\rho^* < 1$. Then, to avoid the second problem, Dickey and Fuller (1979) generated a new set of critical values (τ) to conduct the test instead of using conventional t-statistics (Maddala 1992). Therefore, the above procedure is known as the Dickey-Fuller (DF) test (Gujarati 1995).

In applying the DF test, the error term (ε_t) is assumed to be uncorrelated. To handle a general case if ε_t is serially correlated, Dickey and Fuller developed a modified version of the DF test, which is known as the 'Augmented Dickey-Fuller' (ADF) test. Under the ADF method, the DGP of Y_t is specified as follows:

$$\Delta Y_t = \alpha + \beta T + \rho^* Y_{t-1} + \sum_{i=1}^{k} \theta_i \Delta Y_{t-i} + e_t \tag{4.15}$$

where, e_t is pure white noise; $\Delta Y_t = Y_t - Y_{t-1}$; and $\Delta Y_{t-i} = Y_{t-i} - Y_{t-i-1}$. The factor, $\sum_{i=1}^{k} \theta_i \Delta Y_{t-i}$, represents the lagged terms, with the length of the lag structure *k* or the '*k*' number of lagged difference terms. The main purpose in adding these terms into the model is to allow for Autoregressive Moving Average (ARMA) error processes to avoid the serial correlation problem. The statistics of DF and ADF tests have the same asymptotic distribution, and therefore, the same significance (critical) tables can be applied (Dickey and Fuller 1979; Maddala 1992; and Gujarati 1995).

Although the DF and the ADF tests are extensively used applications of testing unit roots, Gujarati (1995) claimed their shortcomings in terms of the size (the level of significance) and power (the probability of rejecting the null hypothesis when it is false) of these tests.[54] However, Gujarati also contended that there is no uniformly and universally consistent test of the unit roots. Due to the shortcomings of the ADF test, Phillips and Perron (1988) proposed an alternative non-parametric method, known as the PP test, for controlling the serial correlation when testing a unit root. While the ADF test rectifies for higher order serial correlation by adding lagged differenced terms on the right-hand side, the PP method remedies the *t* statistic (the modification of the ADF *t* statistics) of the ρ coefficient from the AR(1) regression to account for the serial correlation in ε_t so that serial correlation does not affect the asymptotic distribution of the test statistic. The error term in the DF model follows the first order moving average process as in Equation 4.16, that is:

$$\hat{\varepsilon}_t = \varepsilon_t + \theta\varepsilon_{t-1} \tag{4.16}$$

where, θ is the moving average component and ε_t is assumed to be white noise.

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[54] For detailed arguments see Schwert (1989), Agiakoglou and Newbold (1992), Banerjee *et al.* (1993), Pesaran and Pesaran (1997), Maddala and Kim (1998).

In conclusion, it is obvious from the earlier review that it is important to examine a time-series data for non-stationary pattern or unit roots prior to running the regression analysis in order to avoid the problem of spurious regression. If the null hypothesis of testing unit roots is rejected, the standard regression methods can be used properly. However, if the hypothesis cannot be rejected, there is an existence of spurious autocorrelation; the series should be transformed or differenced before further analysis. Alternatively, the series may be cointegrated, which will be discussed in the next section.

4.6.3 COINTEGRATION

In economics terms, the concept of cointegration arises to identify the existence of long-run equilibrium between two or more time-series variables that are individually non-stationary at their level form, that is *I(0)* (Gujarati 1995). Granger (1981) and Engle and Granger (1987) proposed that even if two time-series variables, such as Y_t and X_t, are subject to non-stationary patterns and have unit roots at their level form[55], there may be a stationary linear combination between them over time. Suppose Y_t and X_t are regressed as follows:

$$Y_t = \alpha + \beta X_t + u_t \tag{4.17}$$

where, β is the cointegrating parameter. If Equation 4.17 is rearranged as follows:

$$u_t = Y_t - \alpha - \beta X_t \tag{4.18}$$

[55] Note that they are stationary at the first-order difference, that is *I(1)*.

From Equation 4.17, Y_t and X_t are considered to be cointegrated when the two series are integrated at the same order and a random walk (u_t) from Equation 4.18 must be stationary at the level form, that is $u_t = I(0)$. The concept of cointegration expects their error terms (u_t) to be linearly related. Thus, according to Equation 4.17 and 4.18, it can be concluded that although Y_t and X_t are individually *I(1)*, they have stochastic trends since their linear combination in Equation 4.18 is *I(0)*. Therefore, there is a long run equilibrium relationship between the two variables, or, these two series are cointegrated as they do not drift far apart (their variance may be finite) from each other over time (Engle and Granger 1987).

Testing the cointegration of time series is also a fundamental method for a correct time-series model. It does not only identify the spurious regression, but also examines the long-run adjustments and relationships in the series (Granger and Newbold 1974). Basically, to test the cointegration is to investigate whether two or more time-series variables have a linear combination over time and whether the residuals have a unit root[56]. The commonly used techniques of testing cointegration will be provided in the following sections.

4.6.3.1 Engle-Granger (EG) Test

Engle and Granger (1987) suggested a technique based on the DF and ADF tests on the residuals to examine the long-run movement of any two variables in order to test for cointegration, known as the 'Engle-Granger (EG) two-step procedure'. The first

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[56] H_o: e_t has a unit root (that is Y_t and X_t are not cointegrated), against H_a: e_t does not have a unit root (that is Y_t and X_t are cointegrated).

step is to examine whether a stochastic trend exists between the variables that is to investigate the long-run relationship between them. This step is based on the unit root test by running the OLS regression in a level form, *I(0)*, that is $Y_t = \alpha + \beta X_t + u_t$. The regression of Y_t and X_t is known as the cointegrating regression and the slope parameter (β) is the cointegrating parameter. Then, in the second step, the residuals obtained from this regression are examined for a unit root using the following model as presented in Equation 4.19.

$$\Delta u_t = \alpha_0 + \beta u_{t-1} + \varepsilon_t \tag{4.19}$$

where, u_t is the term for fitted residuals from the cointegrating regression. If $|\beta|$ is less than 1, then u_t is stationary and integrated at order zero or level form, [*I(0)*]. Hence, Y_t and X_t , are cointegrated and their regression is not spurious, even though the two variables are individually non-stationary. On the other hand, Y_t and X_t are not cointegrated when $|\beta|$ is 1, and then u_t is stationary at order one, [*I(1)*], in the differenced form. Therefore, to identify the cointegration between time-series variables is to find no unit root in the residuals.

Even though the EG two-step procedure is relatively simple and widely used, it has some drawbacks. The EG technique is limited to an analysis of cointegration for only two variables; hence, it is not practical when more than two variables are included in the model. It is also not applicable to a model with cointegrating vector autoregression (VAR). Besides, the OLS cointegrating regression may be subject to a considerable bias in relation to a small-sample observation (Banerjee *et al.* 1986; Stock 1987; Johansen 1988; Menon 1995; and Hatanaka 1996).

4.6.3.2 Error Correction Model (ECM)

Sargan (1964) initially proposed the error correction model (ECM) to describe a relationship between the short-run dynamics and the long-run equilibrium. Granger and Weiss (1983) and Engle and Granger (1987) pointed out that if two variables are cointegrated at the first differenced order, their relationships can be expressed as the ECM by taking past disequilibrium as explanatory variables in the dynamic behaviour of current variables, known as the 'Granger representation theorem' (Maddala and Kim 1998). The ECM method corrects the disequilibrium (equilibrium error) in one period by the next period, which is illustrated as the following equation:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 u_{t-1} + \varepsilon_t \tag{4.20}$$

where, Δ is the first difference operator or changes from period *t-1* to *t*; α_1 and α_2 are the dynamic adjustment coefficients; u_{t-1} is the one-period lagged value of the residual that represents the short run disequilibrium adjustment or the estimate of the long-run equilibrium error term; and ε_t is the random error term (Gujarati 1995).

4.6.3.3 Unrestricted Error Correction Model (UECM)

If all variables in the model are not integrated at the same order, either in the level form, [*I(0)*], or in the first differenced form, [*I(1)*], the cointegration estimation is not applicable since there is no cointegrating relationship among the variables. In this situation, a more appropriate approach should be employed to estimate the short run and long run relationships between the dependent and explanatory variables in the economic model, known as the 'unrestricted error correction model' (UECM). The UECM is generally specified as the following form:

$$\Delta Y_t = \beta_0 + \sum_{i=0}^{k}\left(\beta_1 \Delta X_{t-i} + \beta_2 \Delta Y_{t-i}\right) + \sum_{i=0}^{k}\left(\beta_3 X_{t-1-i} + \beta_4 Y_{t-1-i}\right) + \varepsilon_t \qquad (4.21)$$

where, Δ is the first difference operator, i is the length of the lag, and k is the number of lags. The coefficients β_1 and β_2 represent the short run relationships, while, β_3 and β_4 represent the long run relationships. Thus, the long run elasticity of Y with respect to X is measured by $-\left(\beta_3 / \beta_4\right)$ (Cuthbertson *et al.* 1992).

The UECM is subject to the 'general to specific' approach[57]. The procedure starts with a general dynamic model, which has more lags than necessary, then the model is progressively simplified by reducing the length of lags until a 'parsimonious' estimation is derived, based on the results of diagnostic and statistical tests[58] (Cuthbertson *et al.* 1992). Cuthbertson *et al.* (1992) also contended that the UECM is a preferable technique[59] for a small sample size. Athukorala and Jayasuriya (1994) and Athukorala and Rajapatirana (2000) pointed out that the UECM does not only minimise the problem of spurious regression, but also provide the short-run and long-run relationships.

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[57] Hall *et al.* (1992) also contended that the 'general to specific' approach performs better statistical results than the 'specific to general' approach.
[58] The tests comprise of Serial correlation test (Godfrey 1978a; 1978b), Ramsey's RESET test for functional form (Ramsey 1969), Normality test (Jarque and Bera 1980), and Heteroscedasticity test (White 1980; 1982).
[59] A number of empirical studies such as Bullock *et al.* (1993), Athukorala and Menon (1994), Gunawardana *et al.* (1995), Chuankamnerdkarn (1997), Senhadji (1998), Athukorala and Rajapatirana (2000), Gunawardana and Vojvodic (2002), Havrila (2004), and Khorchurklang (2005) applied this technique to construct their export and/or import models.

4.7 RESULTS AND FINDINGS

In the previous review of the estimation of time-series regression models, the need for a preliminary examination of the time-series properties of the variables was discussed. This section presents an econometric analysis of the time series properties of data used in the estimations of export supply of, export demand for, and import demand for Australia's wines and their results.

At the preliminary stage of analysis, it is important to examine the pattern within a time series to see whether it possesses a trend or not, hence a plot of each time-series variable was done. Depending on the characteristics of the series, a unit root test either with or without trend was conducted. Since none of the variables concentrated around zero, all unit root tests included a constant. The estimation procedure used in this analysis starts with testing the time series properties of the data using the Augmented Dickey-Fuller (ADF) test and the non-parametric Phillips-Perron (PP) test to measure whether the variables in the models are stationary. For the ADF test, the Eviews econometric programme automatically selects and recommends the Schwarz criterion for selecting the order of augmentation.

4.7.1 RESULTS OF TESTS FOR UNIT ROOTS

The ADF and PP tests for each of the variables in the models of export supply, export demand and import demand are summarised in Table 4.2, 4.3 and 4.4, respectively. All variables were tested in the logarithm form and the patterns of time series are presented in the parentheses. If a time-series variable has no trend pattern, then the ADF and PP tests take only an intercept in the test procedure. On the other hand, if a time-series variable shows a trend pattern, the ADF and PP tests take both an intercept and a linear trend in the test procedure. The null hypothesis is set as a time-series variable contains a unit root. If the null hypothesis can be rejected, we can conclude that the time-series variable is stationary. However, if the null hypothesis cannot be rejected, the series is non-stationary, and then the series is repeatedly tested at the first difference.

Table 4.2: Unit Root Test Results, Export Supply.

Variable	Test	Form	Test statistic	P-value	Conclusion
RXS (Trend)	ADF	• Level	-3.3079	0.0899	Significant at 10%, Stationary.
	PP	• Level	-2.537	0.3092	Non-stationary.
		• 1st Difference	-4.688	0.0056	Significant at 1%, Stationary.
RPX (No trend)	ADF	• Level	-2.6786	0.0923	Significant at 10%, Stationary.
	PP	• Level	-2.7055	0.0877	Significant at 10%, Stationary.

Table 4.3: Unit Root Test Results, Export Demand

Variable	Test	Form	Test statistic	P-value	Conclusion
RXD (Trend)	ADF	• Level	-3.3079	0.0899	Significant at 10%, Stationary.
	PP	• Level	-2.537	0.3092	Non-stationary.
		• 1st Difference	-4.688	0.0056	Significant at 1%, Stationary.
RPXW (No trend)	ADF	• Level	-3.9326	0.0067	Significant at 1%, Stationary.
	PP	• Level	-2.947	0.0547	Significant at 10%, Stationary.
GNIW (Trend)	ADF	• Level	-2.8928	0.1825	Non-stationary.
		• 1st Difference	-2.9769	0.16	Non-stationary.
	PP	• Level	-1.5333	0.788	Non-stationary.
		• 1st Difference	-1.8341	0.6549	Non-stationary.
XRI (Trend)	ADF	• Level	-2.9168	0.1756	Non-Stationary.
		• 1st Difference	-3.7819	0.0376	Significant at 5%, Stationary.
	PP	• Level	-1.8469	0.6499	Non-stationary.
		• 1st Difference	-2.9022	0.1798	Non-stationary.

Table 4.4: Unit Root Test Results, Import Demand

Variable	Test	Form	Test statistic	P-value	Conclusion
RMD (Trend)	ADF	• Level	-2.5035	0.3235	Non-stationary.
		• 1st Difference	-4.3443	0.0116	Significant at 5%, Stationary.
	PP	• Level	-2.6324	0.2705	Non-stationary.
		• 1st Difference	-4.3468	0.0116	Significant at 5%, Stationary.
RPM (No trend)	ADF	• Level	-5.9775	0.0001	Significant at 1%, Stationary.
	PP	• Level	-2.4726	0.1342	Non-stationary.
		• 1st Difference	-6.0023	0.0001	Significant at 1%, Stationary.
RGDP (No trend)	ADF	• Level	2.9831	0.0515	Significant at 5%, Stationary.
	PP	• Level	-0.8334	0.7912	Non-stationary.
		• 1st Difference	-3.1055	0.0402	Significant at 5%, Stationary.

From the ADF test results, real exports, relative export prices (for both relative to domestic price and world price), and relative import prices are stationary at their level forms. Other variables become stationary after the first differencing, except the major trading partners' income variable that remains non-stationary. However, as discussed previously, the PP test is the preferred method of unit root test. From the PP test results, only relative export prices are stationary at their level forms. Other variables have no unit root after the first differencing, except the major trading partners' income variable and the exchange rate index. Thus, the modelling of levels form of data can lead to the problems of spurious regression. Therefore, further investigation of cointegrating relationships between the variables is undertaken in the following section.

4.7.2 RESULTS OF TESTS FOR COINTEGRATION

As mentioned earlier, when two variables are not stationary but integrated in the same order, either in the level form [*I(0)*] or the first difference form [*I(1)*], they are cointegrated and have a long-run relationship between them. From Table 4.2, 4.3, and 4.4, it can be seen that not all of the variables in each model are cointegrated at the same level (either the level or first difference form). In conclusion, there is no cointegrating relationship among the variables in the models of export supply, export demand, and import demand.

Therefore, the unrestricted error correction model (UECM) was used in this section to obtain the short-run and long-run relationships among variables in the models of Australia's exports and imports of wines. The models are estimated with difference and level forms of the variables. The slope coefficients associated with the variables in the differenced form indicate the short-run relationships, whereas the slope coefficients associated with the variables in the level form indicate the long-run relationships. The models are also estimated in the log-log functional form so that the estimated slope coefficients can be used to directly derive the elasticities. In addition, the 'general to specific' approach of the model selection is applied. The process is to start with higher lags, and then, depending on diagnostic tests[60], the lags are reduced progressively, until a 'parsimonious' model (preferred model) is derived for interpretation and discussion of the results.

In diagnostic tests, the null hypothesis statements are set as follows: there is no serial correlation for the Lagrange Multiplier (LM) test of serial correlation; the variance of the error term is constant for the heteroscedasticity test; the error has zero mean vectors (no specification error) for the test of functional form misspecification. For the normality test, the error is normally distributed when the Jarque-Bera probability is not significant. The estimates of the UECM for export supply, export demand, and import demand functions of Australia's wines are presented in the following sections, as well as the results of diagnostic tests.

[60] In terms of serial correlation, heteroscedasticity, functional form misspecification, and normality.

4.7.3 AUSTRALIA'S EXPORT SUPPLY FUNCTION FOR WINES

The parsimonious model of Australia's export supply function for wines based on the UECM estimation is reported in Table 4.5. The diagnostic statistics show that the estimated model of export supply performs statistically well.

Table 4.5: The Preferred UECM of Australia's Export Supply Function for Australia's wines.

Dependent Variable: Δ LRXS
Method: Least Squares
Sample(adjusted): 1982 2004
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	8.460284	3.047944	2.775735	0.0129
ΔLRPX	0.732233	0.333313	2.196833	0.0422**
TIME	0.100381	0.037040	2.710045	0.0149**
DCA	0.216298	0.234431	0.922652	0.3691
LRPX $_{(t-2)}$	0.224663	0.275648	0.815036	0.4263
LRXS $_{(t-2)}$	-0.581604	0.209950	-2.770199	0.0131**

R-squared	0.525614
Adjusted R-squared	0.386089
F-statistic	3.767163
Prob(F-statistic)	0.017690
Durbin-Watson stat	1.897852

Jarque-Bera Normality Test: 0.648374 (Prob. 0.723115)

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.775119	Probability	0.094310

White Heteroskedasticity Test:			
F-statistic	2.757798	Probability	0.047445

Ramsey RESET Test:			
F-statistic	1.597374	Probability	0.235011

- Long run price elasticity of export supply:

  -(0.224663/-0.581604) = + 0.3862817

Note: Δ is the first difference, L is natural logarithm, ** significant at 5 percent level.

According to Table 4.5, the short run coefficient of the first differenced relative price of wine exports (ΔLRPX) shows the expected positive sign and is significant at five percent level. However, the variable is not significant in the long run. This suggests that if Australia's export price relative to domestic price increases, *ceteris paribus*, wine producers may find the foreign markets more attractive and be willing to export instead of providing to the domestic market in the short run. The trade liberalisation variable has a positive impact on the quantity supplied, but it is not statistically significant. The coefficient of time variable indicates a significant positive relationship between the shift in production capacity and the long run supply of wine exports. The adjustment parameter of export supply ($LRXS_{t-2}$) indicates that about 58 percent of the total adjustment of supply is achieved within two years.

In the long run, the supply of wine exports is even more inelastic, that is less responsive to the relative price than the response in the short run. For example, a ten percent increase in the relative price, *ceteris paribus*, will result in only a 3.8 percent increase in the supply of wine exports in the long run. This situation may indicate that wine producers in Australia are satisfied with their domestic market. However, it should be subject to further investigation in a future study. In addition, owing to a low responsiveness of relative prices, future increases in wine export supplied should rely on domestic supply shifts which may be achieved by the implementation of appropriate domestic industry policies such as R&D or subsidies for small producers.

4.7.4 AUSTRALIA'S EXPORT DEMAND FUNCTION FOR WINES

The estimates of the UECM for export demand function of Australia's wines are reported in Table 4.6.

Table 4.6: The Preferred UECM of International Demand Function for Australia's wine Exports.

Dependent Variable: Δ LRXD

Method: Least Squares

Sample(adjusted): 1985 2004

Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-5.462759	1.579425	-3.458702	0.0047
Δ LRPXW	-1.036639	0.145765	-7.111725	0.0000***
Δ LGNIW	1.261398	0.437476	2.883355	0.0137**
Δ LXRI	1.718679	0.377009	4.558717	0.0007***
$LRXD_{(t-1)}$	-0.329773	0.102790	-3.208219	0.0075***
$LRPXW_{(t-4)}$	-0.471972	0.128978	-3.659310	0.0033***
$LGNIW_{(t-5)}$	0.082121	0.200228	0.410135	0.6889
$LXRI_{(t-1)}$	2.801983	0.520725	5.380926	0.0002***
R-squared	0.941301			
Adjusted R-squared	0.907060			
F-statistic	27.49048			
Prob(F-statistic)	0.000002			
Durbin-Watson stat	2.347892			

Jarque-Bera Normality Test: 4.888683 (Prob. 0.086783)

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.138036	Probability	0.168638
White Heteroskedasticity Test:			
F-statistic	0.404852	Probability	0.916339
Ramsey RESET Test:			
F-statistic	1.383909	Probability	0.294725

- Long run price elasticity of export demand: -(-0.471972/-0.329773) = - 1.4312
- Long run income elasticity of export demand: -(0.082121/-0.329773) = +0.249

Note: Δ is the first difference; L is natural logarithm; *** significant at 1 percent level; ** significant at 5 percent level.

From Table 4.6, most of the coefficients are statistically significant, except the adjustment coefficient of the major importer's income ($LGNIW_{t-5}$). The overall results of the diagnostic tests are satisfactory and the explanatory power of the model is high. The coefficients associated with the differenced form of the relative price of wine exports to competitors' prices, major importers' incomes, and exchange rate are all statistically significant at 1, 5, and 1 percent level, respectively. In the short run, the quantity of wine exports is positively related to the income levels of trading partners and the depreciation of Australian dollar, but negatively related to the ratio of the prices of Australia's wines to its competitors' prices of wines. This indicates that if the ratio increases, *ceteris paribus*, foreign wine consumers may feel that the Australia's competitively priced wines are worth their money and want to buy more from Australia's competitors.

However, in the long run, the coefficient of importers' income is not significant, although it shows a positive relationship to wine exports. This indicates that in the long run, the quantity of Australia's wine exports demanded in the world market does not change significantly in response to changes in its importers' income levels. Relative price of wine exports and the depreciation of Australian currency still have significant impacts on Australia's export demand in the long run. The long run price elasticity of export demand (-1.43) indicates that a 1 percent increase in Australia's export price relative to competitors export price, *ceteris paribus*, will result in a 1.43 percent decrease in the exports of Australia's wines. A low value of price elasticity of foreign demand may reveal that Australia has some market power in relation to its exports of particular brands and differentiated wines in the world market.

4.7.5 AUSTRALIA'S IMPORT DEMAND FUNCTION FOR WINES

The 'parsimonious' model of import demand function of Australia's wines is presented in Table 4.7 after estimating and testing alternative specifications.

Table 4.7: The Preferred UECM of Australia's Import Demand Function for wines.

Dependent Variable: Δ LRMD
Method: Least Squares
Sample(adjusted): 1981 2004
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.117200	5.657004	0.197490	0.8457
Δ LRPM	-0.271308	0.237108	-1.144238	0.2675
Δ LRGDP	1.224613	0.453216	2.702052	0.0146**
$LRPM_{(t-1)}$	-0.440299	0.250677	-1.756439	0.0960*
$LRGDP_{(t-1)}$	0.810076	0.419743	1.929934	0.0695*
$LRMD_{(t-1)}$	-0.533592	0.194635	-2.741496	0.0134**

R-squared	0.461069
Adjusted R-squared	0.311366
F-statistic	3.079892
Prob(F-statistic)	0.035076
Durbin-Watson stat	1.909210

Jarque-Bera Normality Test: 1.07218 (Prob. 0.585031)

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.260161	Probability	0.774126
White Heteroskedasticity Test:			
F-statistic	0.462363	Probability	0.886503
Ramsey RESET Test:			
F-statistic	0.273016	Probability	0.764556

- Long run price elasticity of import demand:

  -(-0.440299/-0.533592) = - 0.82516

- Long run income elasticity of import demand:

  -(0.810076/-0.533592) = +1.518156

Note: Δ is the first difference; L is natural logarithm; ** significant at 5 percent level; * significant at 10 percent level.

Diagnostic statistics show that the model performs statistically well; however, the explanatory power is low. The variable DCA that was intended to capture the effect of trade liberalisation on import demand was dropped out from the final version of the model because of coefficient inconsistency and statistical insignificance.

The outcomes of the model reveal that, in the short run, the import demand for wines does not respond significantly to the relative price of wine imports to domestic price of wines. However, the import demand of wines appears to be influenced by changes in relative price in the long run. Income levels of the Australian consumers have a positive and significant impact on the quantity of wines imported in both the short run and long run.

The long run price elasticity of import demand (-0.825) indicates that the quantity of wine imports demanded by Australian consumers is not very responsive to changes in the relative prices. It reveals that a 1 percent increase in the relative price (import price to domestic price) of wine imports, *ceteris paribus*, will result in a 0.825 percent decrease in the demand for wine imports. Therefore, it can be concluded that, in the long run, import demand for wines by Australia is inelastic with respect to the relative price. On the other hand, the long-run income elasticity of import demand (1.518) suggests that the import demand for wines is relatively elastic with respect to Australian consumers' income levels. Therefore, taking into consideration the price inelasticity and the income elasticity, it may be concluded that wines are considered as luxury goods. Thus, in the environment of the relatively high income elasticity of import demand and the fact that wines are considered as luxury goods, it is strongly recommended that the Australian wine producers pay attention to their costs of production, production capacities, and unique selling points in order to become more competitive in the world wine market.

4.8 CONCLUSION

This chapter developed estimated models of export supply, export demand, and import demand for Australia's wines. Based on the econometric concepts of unit roots and cointegration, the results of the ADF and the PP tests indicated that there was no cointegrating relationship among the variables in the models as these variables are integrated at different orders. In the absence of cointegration, the 'general to specific' UECM was applied to reveal both short run relationships and long run elasticities of export supply, export demand, and import demand.

From the results, it can be concluded that the relative price of wine exports (the ratio of Australia's export price to domestic price) and the long-run production capacity have a positive influence on the supply of wine exports. However, the long run price elasticity of export supply is (0.386) less than one, suggesting that Australia's wine exports are not very responsive to changes in export price. This figure may indicate that a large proportion of wine production is sold domestically. Although the trade liberalisation appeared to have had a positive influence on wine exports, it is not statistically significant.

In the short run, foreign demand for Australia's wine exports has a significant negative response on changes in the relative price of exports (Australia's export price relative to competitors' export prices) and a significant positive response to income levels and the depreciation of Australian dollar. In the long run, only the relative price of export and exchange rate have a significant impact on the international demand for Australia's wines. A low value of price elasticity of foreign demand (-1.432) may be used to infer that Australia has some market power in relation to its exports of differentiated or unique wines to the world market.

The demand for wine imports by Australia is inelastic with respect to the relative price of wine imports (the ratio of wine import prices to domestic price of wines), but more elastic with respect to Australians' incomes. The long run price elasticity (-0.83) and the long run income elasticity (1.52) may be concluded that wines are considered as luxury goods in the Australian market.

In the previous chapter, the analysis shows that the Australian wine market has gained a relatively comparative and competitive advantage based on its factor endowments. However, trade in wines may also occur in a competitive environment based on product differentiation and scale economies, which create a different trade pattern. Therefore, the rest of this thesis examines and analyses Australia's intra-industry trade in wines.

CHAPTER FIVE

INTRA-INDUSTRY TRADE IN WINES

5.1 INTRODUCTION

A significant proportion of world trade consists of intra-industry trade[61] (IIT) arising from the early 1960s during the high trade growth, especially in manufactured products among industrialised countries (Verdoorn 1960; Balassa 1966; Grubel 1967; Caves 1981; and Appleyard *et al.* 2001). Krugman and Obstfeld (1991) articulated that about one-fourth of the world trade is characterised by simultaneous exports and imports within the same industry or commodity group. Schamel (2000) and Anderson (2003) contended that the wine industry is characterised by a wide range of differentiated product lines and qualities. In addition, Schamel (2000) and Croser (2002) claimed that product differentiation is a key aspect of the wine industry. Thus, it is important to examine the extent of intra-industry trade in the world wine industry.

The purpose of this chapter is to examine Australia's intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major trading partners. The rest of the chapter is organised as follows. Section 5.2 reviews the literature on intra-industry trade based on the concepts of economies of scale, product differentiation, and imperfect competition. Section 5.3 focuses on the measurements of intra-industry trade. In Section 5.4, a review of empirical studies on

[61] Lloyd and Grubel (2003) give the definition of IIT as "the two-way exchange between nations of related products or two-way exchange of products with the same or similar factor intensities in production or two-way exchange of similar products, that is, products that are close substitutes in demand".

intra-industry trade is presented. Section 5.5 examines the extent of Australia's intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major trading partners. The growth of Australia's intra-industry trade in wines is also analysed. Major findings of this chapter are summarised in Section 5.6.

5.2 THEORETICAL LITERATURE ON INTRA-INDUSTRY TRADE

Linder (1961) argued that international trade in product differentiation is based on overlapping demand similarity. Lancaster (1966) pointed out that consumer preferences are different and the trade of products reflects these preferences. Lancaster (1980) also argued that trade can occur even between countries that have identical factor endowments. Countries can exchange the same products with different characteristics which lead to intra-industry trade.

In addition, Linder (1961), Helpman (1981), and Flam and Helpman (1987) suggested that intra-industry trade is likely to increase when countries have similar income levels and the levels of intra-industry trade will be more intense as income per capita of nations increases. When people gain a higher income, they will demand higher qualities or different styles. Consequently, these products tend to be differentiated and cause intra-industry trade to become an important part of world trade (Appleyard *et al.* 2001).

Williamson and Milner (1991) and Salvatore (1993) suggested that trade between similar economies tends to be intra-industry trade, while trade between dissimilar economies tends to be inter-industry trade.[62] They claimed that trade based on comparative advantage is likely to be larger when the difference in factor endowments among countries is greater, while intra-industry trade is likely to be larger among economies of similar size and factor proportions. However, even in the case of intra-industry trade, Lancaster (1980) claimed that the explanation offered by comparative advantage is still applicable.[63] Inter-industry trade reflects natural comparative advantage, while intra-industry trade reflects acquired comparative advantage[64] (Salvatore 1993).

Grubel and Lloyd (1975) emphasised product differentiation and economies of scale (EOS) as potential causes of intra-industry trade. Haberler (1936), Viner (1937), and Helpman and Krugman (1985) argued that a larger industry is more likely to gain specialisation within the industry, known as the ‘external’ EOS[65]. Krugman and Obstfeld (1991) argued that when a country gains EOS, it is not able to produce a wide range of products by itself. Under imperfect competition, a limited number of differentiated products are produced to satisfy a majority of domestic consumer tastes and preferences, and differentiated products in the same commodity group are imported to fulfil unsatisfied domestic needs. As a result, the country can produce on a larger scale at lower costs by engaging in intra-industry trade. On the other side, consumers also benefit from increases in product varieties.

[62] Similar economies mean similar factor endowments, while dissimilar economies refer to different factor endowments (Williamson and Milner 1991).
[63] Davis (1995) also contended that comparative advantage could explain some parts of IIT.
[64] Natural comparative advantage is based on abundant factor endowments while acquired comparative advantage is derived from technological advance (Salvatore 1993).
[65] The importance of external EOS leading to gains from international trade is found by Kemp and Negishi (1970) and Eaton and Panagariya (1979).

In addition, Krugman (1979) studied the monopolistic competition[66] as another important factor to explain intra-industry trade. Krugman explained that each producer is able to set his own price by differentiating products through various aspects of product attributes such as branding, styling, labelling, and packaging. Thus, non-price competition creates monopolistic market structure and also a basis for intra-industry trade. Ethier (1982) studied monopolistic competition but provided an alternative interpretation. While Krugman (1979) classified the product varieties produced in both countries as different 'final' products, Ethier interpreted trade flows as 'intermediate' products in the production process of final products. Dixit and Grossman (1982) also found that intra-industry trade is based on trade in intermediate products.

Horizontal product differentiation refers to products that have the same quality but different characteristics (Nielsen and Luthje 2002). Dixit and Stiglitz (1977) formulated a production model at the firm level to show the benefits from 'internal' EOS under monopolistic competition. They explained that increasing returns to scale in production limits product varieties. The Dixit-Stiglitz's model, thus, explains the incidence of horizontal differentiated products leading to increases in intra-industry trade. Krugman (1979; 1980) contended that, under monopolistic competition, each country focuses on a limited range of products in a specific industry, since EOS constrain the production of a wide range of products. As a result, each country specialises in a few product varieties but produces them in large quantities. Thus, international trade consists of horizontal product differentiation.

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[66] His work is based on Chamberlin's model (1933) of monopolistic competition.

Vertical differentiation refers to products that differ only in their quality. Under no budget constraint, most consumers prefer a high quality product to a low quality product. Hence, the demand for differentiated products is related to the different income levels of consumers (Gandolfo 1994). Linder (1961) argued that people from a high-income country are more likely to demand high-quality product varieties, while, people from a low-income country are more likely to demand low-quality product varieties. The premise of Linder's argument is that countries trade same product types with differentiated product qualities according to varying income levels.

Falvey (1981) and Falvey and Kierzkowski (1987) explained that the extent of vertical intra-industry trade is derived from differences in factor endowments. A country exports products that intensively use their relatively abundant factors and import products that intensively use their relatively scarce factors. A high-quality product needs high capital intensity in its production that is a high ratio of capital to labour. Hence, a capital-intensive country exports high-quality products, while a labour-intensive country exports low-quality products. Thus, if factor endowments are different between countries, vertical intra-industry trade can occur. The greater differences in the relative ratio of capital to labour, the greater the shares of intra-industry trade in their trade flows.

Flam and Helpman (1987) and Stockey (1991) explained vertical intra-industry trade in terms of differences in technological advancement. They claimed that the source of quality differentiation is derived from the technology used in the production, not from the amount of capital or labour available. A country with technological advancement has a comparative advantage in producing and exporting high quality products, while importing low quality products.

Several empirical studies have attempted to explain intra-industry trade based on horizontal product differentiation such as Kojima (1964), Balassa (1967), Grubel (1967), Kravis (1971), Dixit and Stiglitz (1977), Krugman (1979; 1980), Lancaster (1966; 1979; 1980), Dixit and Norman (1980), and Venables (1984). On the other hand, vertical product differentiation has been studied by Linder (1961), Falvey (1981), Falvey and Kierzkowski (1987), Falm and Helpman (1987), Caves (1981), Abd-el-Rahman (1991), Stockey (1991), Greenaway *et al.* (1995) and Hellvin (1996). However, a number of empirical studies (Luey 1978; Drabek and Greenaway 1984; Menon 1994b; Chuankamnerdkarn 1997; Matthews 1998; Isemonger 2000; Sharma 2002; Erlat and Erlat 2003; Kalbasi 2003; Sassi 2003; Havrila 2004; and Carreras-Marin 2005) have confirmed significances on measuring total intra-industry trade rather than analysing horizontal and vertical intra-industry trade separately. Following these works, this thesis does not attempt to analyse horizontal and vertical intra-industry trade separately but focuses on the total intra-industry trade in wines.

Intra-industry trade may not generally be positively related with the product differentiation when the differentiation is derived from marketing activities, especially advertising. If product differentiation is heavily based on advertising expenditures to distinguish the product abroad, natural barriers such as language and culture may obstruct the growth of intra-industry trade (Caves 1981).

Apart from product differentiation, Grubel (1981) noted that intra-industry trade can occur among countries that produce similar or homogeneous products. Grubel identified four main costs that encourage intra-industry trade among countries producing homogeneous products. Those costs are transportation costs,[67] storage costs,[68] selling costs,[69] and information costs.[70] Deardorff (1984) described four types of trade that could give rise to intra-industry trade in homogeneous products, namely, border trade (to avoid transportation costs), re-export trade (to take advantages of host investment and lower labour costs), cyclical or seasonal trade, and strategic trade (to dispose of excess supply and excess demand).[71]

5.3 MEASUREMENTS OF INTRA-INDUSTRY TRADE

The reasons for and the significance of intra-industry trade in world trade since the 1960s, stimulated a number of economists to find a reliable measurement of intra-industry trade. Early attempts to measure the phenomenon of intra-industry trade were made by Verdoorn (1960), Balassa (1966), and Grubel and Lloyd (1975) (Grubel 1981).

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[67] Krugman (1980) claimed that transportation costs could reduce the volume of IIT. In addition, Krugman and Venables (1990) described a negative relationship between IIT and trade costs. Fujita *et al.* (1999) and Neary (2001) extended the model of monopolistic competition by considering transportation costs.

[68] IIT will increase if storage costs are high, especially in perishable agricultural goods (Grubel 1981).

[69] These costs refer to packaging, sorting, cleaning, and blending of goods that are still unchanged from their original form (Grubel 1981).

[70] These costs are especially high in IIT in services because companies buy information from both domestic and international companies (Grubel 1981).

[71] This is also called "reciprocal dumping" as a result of strategic firms' behaviour based on oligopolistic competition (Brander and Krugman 1983).

Verdoorn (1960) used the ratio of exports to imports of the same product group to measure intra-industry trade. That is:

$$V_i = \frac{X_i}{M_i} \tag{5.1}$$

where, V_i is the Verdoorn's index, X_i is the exports of commodity group i, and M_i is the imports of commodity group i. If the Verdoorn's index is closer to 1, it indicates that the commodity group is involved in higher levels of intra-industry trade. However, Grubel and Lloyd (1975) argued that the Verdoorn's index does not in practice identify the extent of intra-industry trade in a particular product group.[72]

Balassa (1966) proposed an average of the ratio of absolute trade balance or net trade to total trade of a particular number of product groups in order to measure the extent of intra-industry trade. That is:

$$B_j = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{|X_i - M_i|}{(X_i + M_i)}\right]\times 100 \tag{5.2}$$

where, B_j is the Balassa's intra-industry trade index of country j, X_i is the exports of commodity group i in the total of n industry groups, and M_i is the imports of commodity group i in the total of n industry groups. If the index value is close to zero, the commodity trade is considered to be intra-industry trade and if the value is close to 100, the commodity trade is considered to be inter-industry trade.

[72] This index is better used as a measure of international competitiveness as discussed in Chapter 3.

However, Grubel and Lloyd (1975) have argued that Balassa's index of intra-industry trade should be treated as a measure of inter-industry trade. Since, it fails to take into account the individual industries' share in total trade or to correct for aggregate trade imbalances. Hence, they proposed an alternative index to measure the extent of intra-industry trade. They presumed that intra-industry trade is measured as a ratio of trade overlap (TO_i)[73] to total trade (X_i + M_i). Thus, the Grubel-Lloyd's index or G-L index (GL_i) is expressed as:

$$GL_i = \left(\frac{TO_i}{X_i + M_i} \right) \times 100 \tag{5.3}$$

or

$$GL_i = \left[\frac{(X_i + M_i) - |X_i - M_i|}{X_i + M_i} \right] \times 100 \tag{5.4}$$

Grubel and Lloyd (1975) explained that the inter-industry trade index is the ratio of the absolute value of differences in exports and imports to total trade of a particular industry or commodity group. Then, the intra-industry trade index can be obtained by subtracting the inter-industry trade from the value of one. Thus, the level of intra-industry trade for a particular industry or commodity group is measured as follows:

$$GL_i = \left(1 - \frac{|X_i - M_i|}{X_i + M_i} \right) \times 100 \tag{5.5}$$

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[73] Trade overlap is defined as $(X_i + M_i) - |X_i - M_i|$ (Bowen *et al.* 1998).

where, X_i and M_i represent, respectively, the value of exports and imports of a particular industry or commodity group (i) and the vertical bars (|) in the numerator of the index denote the absolute value. The G-L index can be expressed in percentage terms in which values range between 0 (no trade overlap) and 100 (complete trade overlap) (Bowen *et al.* 1998). When the index is exactly equal to zero, it means that a country only exports or only imports for a given industry or commodity group (there is no intra-industry trade or inter-industry trade is at a maximum). In contrast, if the index is exactly equal to 100, it means that a country's exports equal its imports for a given industry or commodity group (intra-industry trade is at a maximum) (Root 1994).

The level of bilateral intra-industry trade between two countries can be measured by the G-L index as shown in equation 5.6:

$$GL_j^k = \left[1 - \frac{\sum_{i=1}^{n} \left| X_{ij}^k - M_{ij}^k \right|}{\sum_{i=1}^{n} \left(X_{ij}^k + M_{ij}^k \right)} \right] \times 100 \tag{5.6}$$

where, X_{ij}^k and M_{ij}^k are the exports and imports of commodity i of country j with country k, respectively. Equation 5.6 can be generalised to obtain the level of intra-industry trade of one country to the rest of the world (w) by substituting k with w.

$$GL_j^w = \left[1 - \frac{\sum_{i=1}^{n} \left| X_{ij}^w - M_{ij}^w \right|}{\sum_{i=1}^{n} \left(X_{ij}^w + M_{ij}^w \right)} \right] \times 100 \tag{5.7}$$

where, X_{ij}^{w} and M_{ij}^{w} are the exports and imports of commodity *i* of country *j* to the rest of the world (*w*), respectively.

However, Grubel and Lloyd (1975) pointed out that the G-L index may introduce a downward bias in the measure of intra-industry trade when a country has a large trade imbalance. The greater the trade imbalance the greater will be the share of net trade in a commodity and the smaller the share of intra-industry trade (Bowen *et al.* 1998). Therefore, they formulated a modified index to solve the problem that adjusts for any trade imbalance:

$$GL_i^{adj} = \left[\frac{\sum_{i=1}^{n}(X_i + M_i) - \sum_{i=1}^{n}|X_i - M_i|}{\sum_{i=1}^{n}(X_i + M_i) - \left|\sum_{i=1}^{n} X_i - \sum_{i=1}^{n} M_i\right|} \right] \times 100 \tag{5.8}$$

However, Aquino (1978) challenged the modified G-L index as he claimed it fails to correct for the imbalance in a country's overall trade. Aquino criticised the adjusted index (GL_i^{adj}) from equation 5.8 as it is a weighted average of the individual commodity group ratio (that is GL_i from equation 5.5) by itself. If the average value of intra-industry trade is downward biased, then the individual commodity group index is also downward biased. Hence, Aquino suggested that each individual commodity group index should be adjusted for the trade imbalance, not just the average summary index.

In order to correct the G-L index for the above argument, Aquino proposed a two-step procedure to generate an intra-industry trade index adjusted for trade imbalance. The first step is to calculate an estimate of expected export values (X_i^e) and expected import values (M_i^e) for each commodity group *i* on the assumption of total trade balance (that is when total exports are equal to total imports), and then to calculate the average value of intra-industry trade by using the adjusted individual commodity group ratio. Aquino's indexes can be expressed as follows:

$$X_i^e = X_i \times \frac{1}{2}\left[\frac{\sum_{i=1}^{n}(X_i + M_i)}{\sum_{i=1}^{n} X_i}\right] \tag{5.9}$$

$$M_i^e = M_i \times \frac{1}{2}\left[\frac{\sum_{i=1}^{n}(X_i + M_i)}{\sum_{i=1}^{n} M_i}\right] \tag{5.10}$$

Based on Aquino's assumption that is $\sum_{i=1}^{n} X_i = \sum_{i=1}^{n} M_i = \frac{1}{2}\sum_{i=1}^{n}(X_i + M_i)$ making the same equi-proportionate adjustment in each industry, the Aquino's index of intra-industry trade (A_i) is shown as:

$$A_i = \frac{\sum_{i=1}^{n}(X_i^e + M_i^e) - \sum_{i=1}^{n}\left|X_i^e - M_i^e\right|}{\sum_{i=1}^{n}(X_i^e + M_i^e)} \tag{5.11}$$

However, Aquino's approach faces numerous critiques. For example, Greenaway and Milner (1981) argued that the Aquino's approach is just a different concept of intra-industry trade, not the real adjustment followed in the Grubel-Lloyd's approach since Aquino's index is the G-L weighted average index, but using export and import proportions substituted for the export and import values of the G-L index. Greenaway and Milner (1986) also questioned the consistency of the results obtained by using Aquino's index in the area of adjustment to industry or sub-group indexes. Balassa (1986b) insisted that Aquino's index should be used only to calculate intra-industry trade for the whole economy, but not for a particular industry.

Bergstrand (1983) argued that intra-industry trade should be measured as a proportion of a country's bilateral trade instead of the country's multilateral trade. He proposed an alternative approach for a bilateral intra-industry trade index adjusted for each country's multilateral trade imbalance. Bergstrand expresses his model as follows:

$$G_{ij}^{k} = 1 - \left| \frac{\left| X_{ij}^{k*} - X_{ji}^{k*} \right|}{X_{ij}^{k*} + X_{ji}^{k*}} \right| \tag{5.12}$$

where;

$$X_{ij}^{k*} = \frac{1}{2} \left| \frac{(X_i + M_i)}{2X_i} + \frac{(X_j + M_j)}{2M_j} \right| \times X_{ij}^{k} \tag{5.13}$$

$$X_{ji}^{k*} = \frac{1}{2} \left| \frac{(X_j + M_j)}{2X_j} + \frac{(X_i + M_j)}{2M_i} \right| \times X_{ji}^{k} \tag{5.14}$$

X_{ij}^{k} is the value of bilateral exports from country i to country j in industry k (or another way of saying that it is the value of bilateral imports from country j from country i in industry k). On the contrary, X_{ji}^{k} is the value of bilateral exports from country j to country i (or another saying that it is the value of bilateral imports from country i to country j in industry k). If country i's overall trade is balanced and X_{ij}^{k} = X_{ji}^{k}, G_{ij}^{k} is equal to 1 and it means that all trade between these two countries are perfectly intra-industry trade.

However, Bergstrand's approach has also been criticised. For instance, Greenaway and Milner (1983) and Vona (1991) questioned the validity of the economic theories related to imposing an equilibrium condition in total trade. Vona (1991) argued that a country's trade deficits in particular industries could be offset with surpluses from other industries. In addition, cyclical factors may also influence a country's overall trade and consequently the multilateral imbalance for any one particular year should not be used as a measure of long-term disequilibrium (Grimwade 2000).

Lloyd and Lee (2002) admitted that there is no consensus approach on how empirical researchers should treat national trade imbalances. Greenaway and Milner (1981; 1986), Kol (1988), Kol and Mennes (1989), and Clark (1993) argued that the best practice of measuring intra-industry trade should not make an adjustment or correction for a country's overall trade imbalances. Vona (1991) showed a preferable result using the unadjusted G-L index and concluded this index is the best measure of intra-industry trade. Given the advantages and disadvantages of including adjusted trade imbalances for measuring intra-industry trade, the unadjusted Grubel-Lloyd index seems to be widely acknowledged as the measure of intra-industry trade (Root 1994; Grimwade 2000; and Appleyard *et al.* 2001). Therefore, this thesis applies the unadjusted G-L index to measure Australia's intra-industry trade in wines.

5.4 EMPIRICAL STUDIES ON INTRA-INDUSTRY TRADE

A significant number of empirical studies have measured the extent of intra-industry trade in various economic structures from several countries. For example, developed economies were studied by Grubel and Lloyd (1975)[74], Aquino (1978), Tharakan (1983), Culem and Lundberg (1986), Greenaway and Milner (1986), Tharakan and Kol (1989), Aturupane *et al.* (1997), Brulhart and Hine (1999), Ruffin (1999), Blanes and Martin (2000), Gullstrand (2002), and Diaz Mora (2002).

Willmore (1972), Ballance and Forstner (1990), Lee and Lee (1993), Chow *et al.* (1994), Hellvin (1994), Isemonger (2000), Pombo (2001), Isogai *et al.* (2002), Petersson (2002), Erlat and Erlat (2003), Kalbasi (2003), and Zhang and Li (2006) investigated developing economies. Drabek and Greenaway (1984), Greenaway (1989), Hellvin (1996) and Algieri (2004) examined the levels of intra-industry trade in centrally planned economies. Lee and Lloyd (2002), Li *et al.* (2003), Shelburne and Gonzalez (2004), and Sichei (2005) studied intra-industry trade in service sectors whereas Chen and Trewin (1999) and Carreras-Marin (2005) particularly analysed patterns of intra-industry trade in agricultural products.

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[74] Root (1994), Gandolfo (1994), and Grimwade (2000) claimed this study as an early comprehensive study of intra-industry trade.

Initially, Verdoorn (1954), Balassa (1967), and Grubel (1967) found that the patterns of trade in the European Economic Community (EEC) were not consistent with the H-O theory as predicted. The prevalence of intra-industry trade became obvious when tariffs and other trade barriers were removed among members of the EEC (Thompson 2001).

Grubel and Lloyd (1975) calculated weighted averages of the standard G-L index for ten industrial countries in OECD[75] covering 160 product groups at the three-digit level of SITC. The overall values of the index showed an increasing trend for intra-industry trade among the OECD countries. In 1967, they found that nearly half of all the trade among these countries involved the exchange of differentiated products within the same industry. Culem and Lundberg (1986) also found increasing levels of intra-industry trade in eleven developed countries during 1970-1980 by applying the standard G-L index at a four-digit level of SITC.

Chen and Trewin (1999) focused more on the intra-industry trade of agricultural products, mainly on processed food products, rather than manufactured products. They claimed that the processed food industry is an interesting sector for analysing intra-industry trade because the industry is in between agricultural and manufactured products.[76] They used the unadjusted G-L index for eighteen APEC[77] countries for the period 1970-1996. Their results showed low levels of intra-industry trade in processed food in APEC countries as a whole implying that the trade pattern of processed food in this region was characterised by inter-industry trade. However,

[75] The U.S., Canada, Japan, Belgium-Luxembourg, the Netherlands, Germany, France, Italy, the U.K., and Australia.
[76] Chen and Trewin (1999) also noted that wine industry is a sub-group in processed food sector.
[77] Asia-Pacific Economic Cooperation.

there was an increasing trend in total intra-industry trade in the processed food sector for most of the APEC countries.

Petersson (2002) also observed changes in trade flows of South Africa as a consequence of trade liberalisation since the South African Customs Union after 1994. South Africa's intra-industry trade in manufacturing products increased steeply from forty four percent in 1993 to seventy nine percent in 1998. The same trade patterns were also found in resource-based and labour-intensive industries. Erlat and Erlat (2003) also found that raw material-intensive and labour-intensive goods experienced high levels of intra-industry trade (above 80 percent) after Turkey's trade liberalisation in the 1980s.

Hellvin (1996) examined intra-industry trade in a transition economy by focusing on trade between China and the OECD countries during 1980-1992. He found that levels of the unadjusted G-L index at three-digit SITC levels increased from twelve percent of total manufacturing trade in 1980 to about twenty percent in 1992. He concluded that China exported labour-intensive lower quality varieties in exchange for capital-intensive higher quality varieties from the OECD countries. In addition, he claimed that trade barriers, especially tariffs on import-competing goods in China's main exporting sectors, resulted in low levels of intra-industry trade proportion between China and the OECD countries. Algieri (2004) found high levels (more than seventy percent) and increasing patterns for Russia's intra-industry trade during the period 1993 to 2003 as a result of the continuing liberalisation process.

Lee and Lloyd (2002) pointed out the importance of intra-industry trade in services[78] and measured intra-industry trade in services among twenty OECD countries for the period 1992-1996 by using the standard G-L index for nine service categories.[79] On average, financial service sector showed the highest level of intra-industry trade (eighty percent) among the OECD countries. Transportation, insurance, and communication also experienced high levels of intra-industry trade. They also found that most of the OECD countries had high levels of intra-industry trade in services (more than fifty percent) during the studied period.

More specifically, there are several empirical studies that attempt to analyse the phenomenon of Australia's intra-industry trade such as Siriwardana (1990), Lowe (1991), Hamilton and Kniest (1991), Ratnayake and Jayasuriya (1991), Ratnayake and Athukolara (1992), Menon (1994a; 1994b), Matthews (1995), Menon and Dixon (1996b), Chuankamnerdkarn (1997), Matthews (1998), Sharma (2000; 2002; 2004), and Havrila (2004).

Siriwardana (1990) used the standard G-L index for one hundred and thirty three industries at four-digit Australian Standard Industrial Classification (ASIC) for the period 1968-1982[80] and found that Australia had one of the lowest levels of intra-industry trade among the OECD countries. This result was concurrent with a study by OECD (1987), which claimed the low levels of Australia's intra-industry trade was a result of high levels of trade protection. However, Ratnayake and Athukorala (1992)

[78] It arises from the creation of the General Agreement on Trade in Services (GATS) in the WTO's Uruguay negotiation round.
[79] They are transportation, travel, communication, construction, insurance, financial, computer and information, other business, and personal cultural and recreational services.
[80] This study is consistent with Grubel and Lloyd's study (1975) claiming a low proportion of intra-industry trade in Australian manufactured trade.

pointed out that protection in Australia has been substantially reduced since the 1980s leading to increases in the levels of Australia's intra-industry trade.

Hamilton and Kniest (1991) claimed that both inter- and intra-industry trade between Australia and New Zealand increased due to the reduction of trade barriers. Similarly, Menon (1994b) examined changes in Australia's intra-industry trade in the 1980s in response to the Closer Economic Relations (CER) agreement[81] with New Zealand. He used the standard G-L index for Australia's multilateral total trade and bilateral trade for period 1981 to 1991 using data at three- and four-digit level of the SITC. He found increasing levels in Australia's intra-industry trade as a percentage of total trade and as increase in the bilateral intra-industry trade with New Zealand. Matthews (1995; 1998) found that the reduction of trade barriers had increased the levels of Australia's intra-industry trade, although the intensity of Australia's intra-industry trade was relatively low. Sharma (2000) found a steady growth in Australian manufacturing sectors during the late 1970s to the early 1990s as a result of the outward-oriented policy commenced in the mid-1980s. In addition, Menon (1994b) and Sharma (2000) concluded that industries that previously experienced high levels of protection had improved their share of intra-industry trade significantly.

Chuankamnerdkarn (1997) used the standard G-L index to measure the extent of Australia's intra-industry trade in pharmaceuticals at the three-digit level of SITC with the rest of the world and the bilateral intra-industry trade between Australia and

[81] The main purpose of this agreement is to eliminate all tariff barriers between these two countries.

its twenty major trading partners[82] for the period 1975 to 1992. He found that Australia had relatively low levels of intra-industry trade in pharmaceuticals compared to the other eleven OECD countries. Most of the net-exporters of pharmaceuticals had relatively high levels of intra-industry trade. On the other hand, most of the net-importers of pharmaceuticals had relatively low levels of intra-industry. The results also showed that most bilateral intra-industry trade indexes between Australia and each individual country were low. In conclusion, he claimed that Australia's pharmaceutical trade is based on trade complementarity which is derived from gains in inter-industry trade.

Sharma (2002) claimed that most of the intra-industry trade studies focused on manufactured goods and ignored the processed food sectors. However, he showed that the share of processed food in the world agricultural trade had increased from twenty percent in the late 1960s to over sixty percent in the late 1980s. Sharma used the standard G-L index for the Australian processed food sectors at the four-digit level of ASIC and found that intra-industry trade in the Australian processed food sectors grew from about five percent in 1980 to eight percent in 1993. Most of the Australian processed food products had increasing patterns of intra-industry trade.

Havrila (2004) used the standard G-L index to examine the extent of Australia's intra-industry trade in textiles and clothing sectors at the three-digit level of SITC for the period 1965 to 1999. The results showed that Australia had experienced a relatively low intra-industry trade in textiles and clothing with the rest of the world compared to

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[82] Eleven OECD countries (Belgium, France, Germany, Italy, the Netherlands, Switzerland, the U.K., the U.S., Canada, New Zealand, and Japan), and China, Korea, Taiwan, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, and Thailand.

its trading partners[83] over the studied period. However, Havrila found a steadily increasing trend for Australia's intra-industry trade in textiles and clothing with the rest of the world since the late 1980s. For bilateral intra-industry trade Australia generally experienced low levels from the 1960s to 1980s. However, since the 1990s, the bilateral intra-industry trade in most categories of textiles and clothing between Australia and Hong Kong, New Zealand, the U.K. and the U.S. had increased significantly. In conclusion, Havrila argued that Australia's textiles and clothing sectors have traded internationally, based on product differentiation and improved quality rather than comparative advantage since the 1990s.

In summary, intra-industry trade has been shown to be occurring in various economic structures, including developed, developing, and centrally planned economies. The increasing trends of intra-industry trade have been empirically observed in several product categories such as manufacturing, agricultural, and service sectors.

[83] China, Hong Kong, India, Japan, Korea, New Zealand, Taiwan, the U.K., and the U.S.

5.5 AUSTRALIA'S INTRA-INDUSTRY TRADE IN WINES

5.5.1 EXTENT OF INTRA-INDUSTRY TRADE IN WINES

In this section, the standard (unadjusted) Grubel-Lloyd index is used to measure the extent of Australia's and its major trading countries' intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major wine-trading countries.

The analysis of Australia's intra-industry trade in wines is based on the annual time-series data on wine exports and imports obtained from the UN Commodity Trade Statistics (Comtrade) database at four-digit level of SITC (SITC1121 rev.1) for the period 1980-2004. By examining the extent of the total bilateral trade between Australia and the major wine exporters and importers for the period 1980 to 2004, the following countries are identified as Australia's major trading partners in wines. The set of countries consists of the Old world wine producers including France, Italy, Spain, Germany, Portugal, and Greece; the New world wine producers including the U.S., Argentina, South Africa, Chile, and New Zealand; and the major importers of Australia's wines including the U.K., Canada, and Japan.

Table 5.1: Intra-Industry Trade in Wines (%), Australia and Australia's Major Wine-Trading Partners with the Rest of the World, 1980-2004.

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**	**Canada**
1980	68.31	31.53	18.00	1.51	62.33	0.17	8.16	7.32	72.08	37.42	15.10	15.92	28.70	1.31
1981	77.13	29.89	15.20	2.25	66.45	0.30	8.47	9.35	27.23	64.29	34.75	15.08	18.71	1.39
1982	69.44	30.32	10.49	2.10	70.36	0.33	7.90	8.36	8.70	61.69	3.99	16.25	18.06	1.27
1983	80.53	24.71	10.15	2.90	71.32	0.18	10.47	6.54	n.a.	65.04	2.09	15.61	20.55	1.93
1984	68.65	21.96	10.55	2.04	77.78	0.23	9.32	4.76	n.a.	89.88	3.24	15.22	24.07	0.82
1985	50.69	22.37	15.83	2.01	75.44	0.16	5.70	4.55	0.26	63.25	2.08	13.53	32.88	1.50
1986	76.86	16.20	21.58	4.40	67.16	0.70	4.88	6.19	n.a.	50.10	2.68	8.45	23.92	1.97
1987	65.22	15.97	23.67	7.34	57.55	1.19	9.68	10.71	0.58	46.65	2.56	7.89	47.40	1.51
1988	57.47	17.96	23.30	8.56	54.60	1.52	20.58	14.94	0.29	41.32	1.78	7.25	52.96	1.84
1989	67.82	17.85	25.45	9.17	56.23	36.38	21.17	18.16	2.82	37.93	1.47	7.63	50.99	0.61
1990	53.60	17.13	24.92	10.18	50.03	6.83	30.95	22.85	4.56	47.67	1.04	7.75	55.44	0.92
1991	37.31	18.78	25.70	8.69	41.62	4.24	46.84	25.39	25.11	26.75	1.03	7.04	69.55	1.78
1992	31.53	19.27	23.82	8.64	46.79	4.53	29.48	25.27	33.90	13.21	1.35	7.24	95.37	1.01
1993	23.49	18.07	15.95	8.56	47.79	8.85	38.17	27.79	62.92	13.18	1.02	6.84	80.33	1.27
1994	26.02	19.84	13.88	11.92	51.11	26.78	34.36	27.52	72.91	11.17	0.88	6.71	71.24	1.07
1995	29.15	20.90	14.00	24.62	47.06	25.97	31.20	30.19	27.92	5.08	0.66	8.90	83.17	2.18
1996	20.42	19.75	12.43	12.87	42.66	17.60	34.70	33.14	26.17	13.56	0.71	11.64	93.00	1.90
1997	22.31	18.94	14.31	7.05	39.36	16.54	33.65	35.51	26.01	14.32	3.73	15.41	97.98	3.63
1998	19.97	17.03	14.85	12.90	36.35	32.82	33.94	41.07	29.71	7.87	2.87	11.62	93.02	2.06
1999	17.31	16.74	14.88	14.57	35.61	46.47	46.09	36.72	33.73	12.79	1.95	11.52	94.62	2.07
2000	14.17	16.56	14.76	12.62	35.25	39.82	46.02	37.08	19.32	6.11	1.54	12.94	80.69	2.50
2001	10.60	17.28	12.52	9.61	35.51	33.58	62.68	35.98	15.45	4.58	0.55	12.01	78.03	2.82
2002	11.03	15.95	13.69	10.85	38.69	29.00	97.40	31.66	2.75	5.50	0.45	12.61	73.78	2.99
2003	11.74	15.59	15.49	11.46	42.69	27.94	58.73	30.48	1.39	5.03	0.26	12.16	75.87	2.56
2004	12.70	17.22	15.56	12.51	42.18	28.92	63.18	34.63	1.31	3.47	0.34	9.67	59.50	3.19

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db; n.a. = unavailable data from the source.

Table 5.1 presents the levels of intra-industry trade in wines for Australia with the rest of the world and each of Australia's major trading partners with the rest of the world for the period 1980 to 2004. In the 1980s, Australia did not specialize and had a comparative disadvantage in the wine trade; therefore, high levels of intra-industry trade in Australia's wines occurred during this period. However, since the 1990s, Australia has experienced comparative advantage in the wine trade and the degree of intra-industry trade in Australia's wines was lower, exhibiting a decreasing trend. This is due to the value of Australia's export of wines being very much higher than those of its import as shown in Chapter Three.

From the results presented in Table 5.1, we can see that most of the major world-wine producers had low levels of intra-industry trade over the analysis period. France, Italy, Spain, Argentina, South Africa, and Chile also had low levels of intra-industry trade. Although both exports and imports of those major wine-producing countries increased over time, their wine exports were significantly greater than their imports, resulting in lower levels of intra-industry trade among these countries. On the other hand, Greece and New Zealand showed an overall increasing trend and relatively high levels of intra-industry trade; particularly in the 1990s when New Zealand had the highest level of intra-industry trade.

Germany experienced high levels of intra-industry trade in wines in the 1980s; however, the extent of Germany's intra-industry trade in wines has been declining since 1990. Other net-importers of wines such as the U.K., Canada and Japan, which are also Australia's major importers, experienced low levels of intra-industry trade in wines throughout the analysis period.

The levels and historical trend of Australia's bilateral intra-industry trade in wines with its fourteen major wine-trading countries are shown in Table 5.2. An examination of the G-L values over the entire study period indicates that New Zealand is the most significant trading partner of Australia's intra-industry trade in wines. However, during 1987-1994, Germany was a key trading partner of Australia in intra-wine trade. Recently, since 1997 and 2003, Greece and South Africa have become significant trading partners with Australia in the intra-industry trade in wines.

From Table 5.2, it can also be seen that, in general, most bilateral intra-industry trade levels between Australia and the major wine-trading countries are very low. A closer investigation of the original data (presented in appendix 5.1) shows that the values of Australia's wine exports to its major importers such as the U.K., the U.S., Canada, Germany, and Japan are considerably higher in comparison with wine imports to Australia from these countries. On the other hand, the value of Australia's wine imports from the countries to which it is a major exporter such as France, Italy, Spain and Portugal are significantly higher in comparison with wine exports from Australia to these countries. As a result, the levels of intra-industry trade in wines between Australia and these countries are very low.

Table 5.2 Bilateral Intra-Industry Trade in Wines (%) between Australia and its Major Wine-Trading Partner Countries, 1980-2004.

Year	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**	**Canada**	**Japan**
1980	1.23	0.31	0.00	23.44	0.00	2.49	27.15	0.00	10.55	16.37	16.35	22.20	0.07	14.64
1981	0.43	0.18	3.48	26.15	0.00	2.82	18.15	0.00	10.11	0.00	32.77	3.50	0.00	0.22
1982	0.31	0.23	0.37	19.53	0.00	5.23	15.75	0.00	9.17	0.00	23.80	6.05	5.69	1.82
1983	0.26	0.34	1.21	15.73	2.97	3.87	12.42	0.00	40.33	0.00	12.55	16.35	14.32	0.42
1984	0.29	0.18	0.83	4.25	0.00	2.98	16.70	0.00	58.65	8.19	8.42	27.31	0.00	0.27
1985	0.49	0.11	0.18	4.32	0.18	0.00	10.20	34.83	22.64	0.00	19.67	56.57	0.00	0.32
1986	1.53	0.07	0.23	10.32	0.09	0.70	2.52	16.14	25.19	17.39	7.66	45.62	0.00	0.82
1987	0.77	0.09	0.38	63.86	0.17	0.00	1.83	0.00	7.14	0.00	2.32	45.92	0.00	0.05
1988	5.21	0.12	0.00	39.14	0.22	1.81	1.31	22.62	0.00	0.00	1.16	35.33	0.14	0.03
1989	1.77	0.49	6.59	51.53	0.26	3.56	3.70	10.82	0.00	0.00	1.59	37.97	0.05	0.23
1990	3.69	0.85	15.95	67.01	0.32	6.16	2.00	9.99	45.38	0.00	0.29	31.58	0.19	0.41
1991	3.39	0.29	11.70	74.98	0.00	0.00	1.51	20.20	0.00	0.00	0.22	35.71	0.00	0.32
1992	12.57	0.08	3.76	92.57	0.20	3.20	1.05	0.00	26.68	0.00	0.17	26.50	0.00	0.00
1993	12.28	1.35	34.39	85.89	0.39	0.00	3.13	0.00	61.15	2.13	0.16	18.55	0.31	0.02
1994	5.82	0.23	10.89	48.82	0.43	0.00	3.19	0.00	20.18	1.77	0.18	18.75	0.01	0.03
1995	5.49	2.52	0.67	33.55	0.51	10.27	6.52	0.68	56.34	0.18	0.06	31.19	0.00	0.00
1996	6.42	0.63	0.80	27.46	0.00	9.95	1.48	0.00	62.72	2.74	0.14	33.72	0.01	0.03
1997	11.02	4.06	0.14	19.23	1.57	1.77	1.21	8.06	99.98	0.11	0.41	41.43	0.01	0.01
1998	14.45	2.10	0.51	15.14	0.16	1.46	0.86	7.08	16.32	0.14	0.19	45.09	0.00	0.05
1999	18.45	3.77	5.14	7.82	0.22	1.70	0.72	5.16	95.01	0.68	0.24	44.41	0.02	0.46
2000	27.45	5.03	3.85	7.61	0.09	0.47	0.51	20.90	37.67	0.00	0.08	57.33	0.03	0.02
2001	58.85	10.58	47.93	5.48	1.30	2.22	0.35	12.58	63.99	7.60	0.05	53.58	0.03	0.15
2002	39.79	9.32	34.92	7.90	0.32	19.85	0.26	7.01	28.75	1.76	0.31	64.52	0.05	0.20
2003	35.09	9.94	37.48	6.48	0.35	64.19	0.53	1.16	20.88	0.90	0.08	61.39	0.03	0.15
2004	34.91	20.35	35.64	5.50	0.71	42.10	0.79	15.23	52.84	0.93	0.14	84.50	0.08	0.17

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

In summary, the world wine industry is more likely to be characterised by inter-industry trade, which reflects the significance of comparative advantage and factor endowments, rather than intra-industry trade. Most major wine-producing countries have relatively low levels of intra-industry trade. The levels of bilateral intra-industry trade between Australia and its major trading partners are also low.

5.5.2 GROWTH OF INTRA-INDUSTRY TRADE IN WINES

To examine the importance of intra-industry trade growth as a result of trade liberalisation and/or regional economic integration, a comparison of movements in the value of the G-L index is widely used in the empirical studies of Grubel and Lloyd (1975), Drabek and Greenaway (1984), Bano and Lane (1987), and Globerman and Dean (1990).

However, Hamilton and Kniest (1991) contended that the comparison of the G-L index, as a measurement of structural changes in intra-industry trade over time, is not appropriate since increases in inter-industry trade can reduce trade imbalances and lead to higher values of the G-L index. Menon (1994a) and Menon and Dixon (1994; 1995; 1996a; 1996b) argued that values of the G-L index can increase despite the share of intra-industry trade contributing less than net trade to the growth in total trade. Thus, the G-L index may lead to misleading conclusions when it is used to infer the growth of intra-industry trade since it does not indicate the contribution of intra-industry trade to the growth in total trade. In addition, analyses of the structural adjustments of trade liberalisation should consider the changes of intra-industry trade, rather than the levels the G-L index provides (Greenaway and Torstensson 1997).

Hamilton and Kniest (1991) investigated the impact of trade liberalisation between Australia and New Zealand under the Closer Economic Relations agreement and found that trade after the agreement was more influenced by inter-industry trade than intra-industry trade. This was due to a high adjustment cost of factors of production. They used an index of marginal intra-industry trade (MIIT) to measure the additional levels of intra-industry trade as follows:

$$MIIT_{HK} = \frac{X_t - X_{t-n}}{M_t - M_{t-n}} \text{ ; when } M_t - M_{t-n} > X_t - X_{t-n} > 0 \tag{5.15}$$

$$MIIT_{HK} = \frac{M_t - M_{t-n}}{X_t - X_{t-n}} \text{ ; when } X_t - X_{t-n} > M_t - M_{t-n} > 0 \tag{5.16}$$

$$MIIT_{HK} = 1\text{; when } X_t - X_{t-n} = M_t - M_{t-n} > 0 \tag{5.17}$$

$$MIIT_{HK} = undefined\text{ ; when } X_t - X_{t-n} < 0 \text{ or } M_t - M_{t-n} < 0 \tag{5.18}$$

where, $MIIT_{HK}$ is the Hamilton-Kniest Index of marginal intra-industry trade, X_t and M_t are the exports and imports in year *t*, respectively; X_{t-n} and M_{t-n} are the exports and imports in year *t-n*, respectively, while *n* is the time period (the number of years) over which liberalisation is implemented. The index is equal to one when trade created under liberalisation is intra-industry trade, and zero or undefined when it is inter-industry trade.

However, Greenaway *et al.* (1994) argued that the $MIIT_{HK}$ index has a drawback when the index is undefined. A decrease in either exports or imports leads to an exclusion of some significant observations and does not provide any information regarding any structural changes of the intra-industry trade as the index is undefined. Greenaway *et al.* (1994) suggested an alternative MIIT measure ($MIIT_{GHME}$), which is defined as follows:

$$MIIT_{GHME} = \left[(X+M)-|X-M|\right]_t - \left[(X+M)-|X-M|\right]_{t-n} \tag{5.19}$$

or:

$$MIIT_{GHME} = \Delta\left[(X+M)-|X-M|\right] \tag{5.20}$$

Unlike the $MIIT_{HK}$ index, the $MIIT_{GHME}$ index is always defined since it reports absolute values and not a ratio. Brulhart (1994) highlighted the advantage of the $MIIT_{GHME}$ index. The index makes it easy to scale the gross trade levels, production, and sales in a particular industry. He also argued that this measure is just a modified replication of the G-L index in response to the difference in the levels of intra-industry trade between two periods. Hence, it does not provide information regarding structural changes in trade patterns and the proportion of MIIT in comparison with inter-industry trade. Furthermore, Brulhart mentioned that the $MIIT_{GHME}$ index is difficult to compare since the index does not report a simple result such as 0, 1or 100 in terms of percentages.

Brulhart (1994) also pointed out that the G-L index is a "static" measure of intra-industry trade, which needs comparisons measured at different points of time to determine the structural decomposition of trade flows. He formulated a "dynamic" index of the MIIT which measures the pattern of changes in trade flows. The Brulhart's MIIT index is specified as follows:

$$MIIT_i = \left\{ 1 - \left[\frac{\left| (X_t - X_{t-n}) - (M_t - M_{t-n}) \right|}{\left| (X_t - X_{t-n}) + (M_t - M_{t-n}) \right|} \right] \right\} \times 100 \qquad (5.21)$$

or in short:

$$MIIT_i = \left[1 - \frac{|\Delta X - \Delta M|}{|\Delta X| + |\Delta M|} \right] \times 100 \qquad (5.22)$$

where, ΔX and ΔM are the differences of exports and imports of a particular industry, respectively. The values of the Brulhart's MIIT index range from zero and one hundred. If the index is closer to zero, it means that the marginal trade in the industry is higher inter-industry trade. On the other hand, when the index is closer to one hundred, the marginal trade in the industry is higher intra-industry trade.

The following tables present the measurements of the MIIT as introduced by Hamilton and Kniest (1991), Greenaway *et al.* (1994), and Brulhart (1994) for changes of trade patterns in five-year periods. The analysis of the MIIT is based on the annual time-series data on wine exports and imports of Australia and major wine-producing countries, gathered from the UN Commodity Trade Statistics (Comtrade) database at four-digit level of SITC (SITC1121 rev.1) for the period 1980-2005.

Table 5.3: Hamilton and Kniest's Marginal Intra-Industry Trade of Australia's wines and major wine producers, five-year periods from 1980-2005.

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**
1980-1985	0.0303	undefined	undefined	undefined	undefined	undefined	0.0150	undefined	undefined	undefined	undefined	undefined	0.2803
1985-1990	0.0765	0.0669	0.2149	0.1061	0.1534	0.0616	0.3412	undefined	0.0311	0.0877	0.0038	0.0173	0.4570
1990-1995	0.0442	0.4199	undefined	0.2781	0.1357	0.7836	0.1935	0.3664	0.2200	0.0106	0.0026	0.1020	0.5481
1995-2000	0.0272	undefined	0.1239	undefined	undefined	undefined	undefined	0.2857	0.0532	0.0494	0.0097	0.1437	0.2700
2000-2005	0.0837	0.0999	0.1027	0.0856	0.4864	undefined	0.7001	0.0556	undefined	0.0174	undefined	0.0308	0.1987

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Table 5.4: Greenaway *et al.*'s Marginal Intra-Industry Trade of Australia's wines and major wine producers, five-year periods from 1980-2005.

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**
1980-1985	798,088	-175,531,680	-30,469,184	577,876	35,134,016	-123,542	489,204	-6,272,560	-12,537,514	-148,338	-3,152,688	-7,257,976	1,423,960
1985-1990	64,013,724	313,007,904	293,276,240	58,591,494	277,136,000	29,452,946	22,637,044	207,598,260	1,059,576	667,440	307,900	35,692,840	22,789,994
1990-1995	16,501,274	273,334,464	-116,622,816	213,349,216	61,240,000	118,312,340	5,146,228	191,722,788	24,432,250	3,745,514	676,326	40,596,688	37,434,870
1995-2000	32,098,672	-163,700,994	53,547,648	-121,912,576	-339,911,984	85,017,840	6,001,676	623,282,556	8,625,558	5,605,700	7,843,500	172,042,594	56,972,816
2000-2005	202,941,734	388,274,714	324,235,956	139,408,548	715,460,000	-31,416,874	35,374,404	178,451,586	-29,374,868	12,270,562	-1,450,960	105,224,584	96,532,072

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Table 5.5: Brulhart's Marginal Intra-Industry Trade of Australia's wines and major wine producers, five-year periods from 1980-2005.

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**
1980-1985	5.88	0.00	55.95	0.00	0.00	0.21	2.95	0.00	90.03	2.40	27.87	0.00	43.79
1985-1990	14.22	12.54	35.38	19.18	26.60	11.61	50.87	0.00	6.02	16.13	0.75	3.40	62.73
1990-1995	8.47	59.14	0.00	43.51	23.90	87.87	32.42	53.63	36.07	2.09	0.52	18.51	70.81
1995-2000	5.29	0.00	22.05	0.00	36.20	0.00	0.00	44.45	10.11	9.41	1.93	25.13	42.52
2000-2005	15.45	18.16	18.63	15.77	65.45	0.00	82.36	10.52	0.00	3.42	0.00	5.97	33.16

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

The results presented in Table 5.3 reveal that Australia's marginal intra-industry trade has been at a relatively low level and definable at each five-year period. This means that either exports or imports have been increasing over time, but only with small proportional changes. Another important observation concerns the period associated with Australia's trade liberalisation. The index of MIIT rose to about 7.6 percent in the period of 1985-1990 from only 3 percent in the period of 1980-1985. Recently, the proportional change in Australia's intra-industry trade in wines has increased from 2.7 percent in the period of 1995-2000 to about 8.4 percent in the period of 2000-2005. In general, the world wine industry has a relatively small value using the Hamilton and Kniest's MIIT index. This implies that the proportional changes in trade patterns of Australia's and other major wine producers are more associated with inter-industry trade than with intra-industry trade. In addition, Table 5.3 also shows that the MIIT index cannot be defined for several periods for most of the Old World countries, which indicates that the proportional changes occur in trade patterns of inter-industry trade. This result implies that major world wine producers have experienced either a reduction in exports or imports over the analysis period. From Table 5.1, we can see that Greece and New Zealand have had relatively high levels of intra-industry trade, hence the proportional changes in their wine trade patterns are also high additional levels of intra-industry trade as the values of MIIT index are relatively higher than other major world-wine producers. From the negative values in Table 5.4 it can be inferred that changes in the wine trade patterns of France, Italy, Portugal, Argentina, and Chile were more likely to have been the result of inter-industry trade.

As shown in Table 5.5, Australia has low values of the Brulhart's MIIT index throughout the analysis period, which indicates that Australia's marginal trade in wines is based on inter-industry trade. These results are consistent with the results of the Hamilton and Kniest's MIIT index estimated in Table 5.3. Undefined values of the Hamilton and Kniest's MIIT index correspond with 'zero' values of the Brulhart's MIIT index suggesting that marginal trade in wines follows a completely inter-industry trade pattern. New Zealand has had a relatively high degree of marginal intra-industry trade over the last two decades since it has high values of the Brulhart's MIIT index. Although there are some high values of the Brulhart's MIIT index for some periods, for instance, France in the period of 1990-1995; Italy in the period of 1980-1985; Germany in the period of 2000-2005; Portugal in the period of 1990-1995; Greece in the period of 2000-2005; the U.S. in the period of 1990-1995; Argentina in the period of 1980-1985; the overall marginal changes in the world wine industry can be considered to reflect patterns of inter-industry trade.

Menon (1994b) and Menon and Dixon (1995; 1996b) examined the effect of Regional Trading Arrangements (RTAs), in particular that of the Australia–New Zealand Closer Economic Relations Trading Agreement (ANZCERTA). They developed an alternative set of indices to allow for the decomposition of total trade growth into the contributions of growth in net trade and intra-industry trade. Total trade for a particular commodity in any year is calculated as the sum of net trade and intra-industry trade, as shown in the following equations:

$$TT_{ijk} = NT_{ijk} + IIT_{ijk} \tag{5.23}$$

where,

$$TT_{ijk} = X_{ijk} + M_{ijk} \tag{5.24}$$

$$NT_{ijk} = \left| X_{ijk} - M_{ijk} \right| \tag{5.25}$$

$$IIT_{ijk} = \left(X_{ijk} + M_{ijk} \right) - \left| X_{ijk} - M_{ijk} \right| \tag{5.26}$$

where, TT_{ijk} is the total trade between country *k* and *j* of commodity i, NT_{ijk} is the net trade between country *k* and *j* of commodity i, IIT_{ijk} is the intra-industry trade between country *k* and *j* of commodity i, X_{ijk} is the exports between country *k* and *j* of commodity *i*, and M_{ijk} is the imports between country *k* and *j* of commodity *i*.

The percentage growth in total trade (tt_{ijk}) between country *k* and *j* of commodity *i* over any period can be decomposed to the contribution of growth in net trade (Cnt_{ijk}) and the contribution of growth in IIT ($Ciit_{ijk}$) as follows:

$$tt_{ijk} = Cnt_{ijk} + Ciit_{ijk} \tag{5.27}$$

where,

$$Cnt_{ijk} = \left(1 - GL_{ijk}\right) \times nt_{ijk} \tag{5.28}$$

$$Ciit_{ijk} = GL_{ijk} \times iit_{ijk} \tag{5.29}$$

$$GL_{ijk} = \frac{IIT_{ijk}}{TT_{ijk}} \tag{5.30}$$

where, nt_{ijk} and iit_{ijk} are the percentage changes in NT_{ijk} and IIT_{ijk}, respectively. GL_{ijk} refers to the Grubel-Lloyd index of intra-industry trade at the beginning of an analysis period, i.e. $GL_{ijk} = 1 - \frac{|X_{ijk} - M_{ijk}|}{X_{ijk} + M_{ijk}}$.

Menon (1994b) and Menon and Dixon (1994; 1995; 1996b) also offered a procedure that measures the contributions of exports and imports to the growth in total trade, net trade, and intra-industry trade. These measures are as follows:

$$tt_{ijk} = Cmtt_{ijk} + Cxtt_{ijk} \tag{5.31}$$

$$nt_{ijk} = Cmnt_{ijk} + Cxnt_{ijk} \tag{5.32}$$

$$iit_{ijk} = Cmiit_{ijk} + Cxiit_{ijk} \tag{5.33}$$

where, tt_{ijk} is the percentage change in total trade, nt_{ijk} is the percentage change in net trade, and iit_{ijk} is the percentage change in intra-industry trade .

where,

$$Cmtt_{ijk} = \left(\frac{M_{ijk}}{TT_{ijk}} \right) \times m_{ijk} \tag{5.34}$$

$$Cxtt_{ijk} = \left(\frac{X_{ijk}}{TT_{ijk}} \right) \times x_{ijk} \tag{5.35}$$

$$Cmnt_{ijk} = \left(\frac{M_{ijk}}{M_{ijk} - X_{ijk}} \right) \times m_{ijk} \tag{5.36}$$

$$Cxnt_{ijk} = \left(\frac{X_{ijk}}{X_{ijk} - M_{ijk}} \right) \times x_{ijk} \tag{5.37}$$

$$Cmiit_{ijk} = \delta_{ijk} \times m_{ijk} \tag{5.38}$$

$$Cxiit_{ijk} = (1 - \delta_{ijk}) \times x_{ijk} \tag{5.39}$$

Note:

if X_{ijk} > M_{ijk}, then $\delta_{ijk} = 1$,

if X_{ijk} < M_{ijk}, then $\delta_{ijk} = 0$.

where, $Cmtt_{ijk}$ is the contributions of import growth to growth in total trade in commodity *i* between country *j* and country *k*; $Cxtt_{ijk}$ is the contributions of export growth to growth in total trade in commodity *i* between country *j* and country *k*; $Cmnt_{ijk}$ is the contributions of imports growth in net trade in commodity *i* between country *j* and country *k*; $Cxnt_{ijk}$ is the contributions of export growth to growth in net trade in commodity *i* between country *j* and country *k*; $Cmiit_{ijk}$ is the contributions of import growth to growth in intra-industry trade in commodity *i* between country *j* and country *k*; $Cxiit_{ijk}$ is the contributions of export growth to growth in intra-industry trade in commodity *i* between country *j* and country *k*; TT_{ijk} is the total trade for commodity *i* between country *j* and country *k*; M_{ijk} is the imports of commodity *i* of country *j* from country *k*; X_{ijk} is the exports of commodity *i* of country *j* to country *k*; m_{ijk} is the percentage growth rates over the period in M_{ijk}, i.e. $(\Delta M_{ijk}/M_{ijk})\times 100$; and x_{ijk} is the percentage growth rates over the period in X_{ijk}, i.e. $(\Delta X_{ijk}/X_{ijk})\times 100$.

Menon and Dixon (1994) suggested that the above equations can be assumed to be no status switch, which means that both increases in imports and decreases in exports make positive contributions to net trade for net import products and negative contributions to net trade for net export products. Hence, the import growth can be explained as the growth in intra-industry trade for net export products, while the export growth can be explained as the growth in intra-industry trade for net import products.

Menon and Dixon (1994) explained that status switches occur when products switch from net imports to net exports or from net exports to net imports. The status switch for net import products ($M_{ijk} > X_{ijk}$) can be defied as follows:

$$m_{ijk} < \left(\frac{X_{ijk}}{M_{ijk}} - 1\right) + \left(\frac{X_{ijk}}{M_{ijk}} \times x_{ijk}\right) \qquad (5.40)$$

Status switch for net export products ($X_{ijk} > M_{ijk}$) can be defied as follows:

$$x_{ijk} < \left(\frac{M_{ijk}}{X_{ijk}} - 1 \right) + \left(\frac{M_{ijk}}{X_{ijk}} \times m_{ijk} \right) \tag{5.41}$$

Furthermore, they also provided alternative measurements for the case of status switch. However, the case of status switch is beyond the scope of this study.

The following tables report a set of indices that allows for decomposition of total trade growth into the contributions of growth in net trade and intra-industry trade as suggested by Menon (1994b) and Menon and Dixon (1994; 1995; 1996b). The analysis is based on the annual time-series data on wine exports and imports of Australia and major wine-producing countries, gathered from the UN Commodity Trade Statistics (Comtrade) database at four-digit level of SITC (SITC1121 rev.1) for the period 1980-2004.

Table 5.6: Percentage Growth in Total Trade, Net Trade, and Intra-Industry Trade for Australia's wines, 1980-2004.

Year	tt	Cmtt	Cxtt
1980-1985	28.23	27.40	0.83
1985-1990	70.85	5.04	65.81
1990-1995	54.16	2.29	51.87
1995-2000	62.78	1.66	61.12
2000-2004	54.70	3.14	51.56

Year	nt	Cmnt	Cxnt
1980-1985	53.88	55.56	-1.68
1985-1990	130.98	-10.86	141.83
1990-1995	69.98	-3.24	73.22
1995-2000	69.28	-1.93	71.22
2000-2004	55.46	-3.59	59.06

Year	iit	Cmiit	Cxiit
1980-1985	3.28	0	3.28
1985-1990	18.80	18.80	0
1990-1995	15.73	15.73	0
1995-2000	23.43	23.43	0
2000-2004	49.43	49.43	0

Year	tt	Cnt	Ciit
1980-1985	28.23	26.57	1.66
1985-1990	70.85	60.78	10.07
1990-1995	54.16	49.58	4.59
1995-2000	62.78	59.46	3.32
2000-2004	54.70	48.42	6.28

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Note:

tt = Cmtt + Cxtt, where *Cmtt* and *Cxtt* are the contributions of import growth and export growth to the growth in total trade, respectively;

nt = Cmnt + Cxnt, where *Cmnt* and *Cxnt* are the contributions of import growth and export growth to the growth in net trade, respectively;

iit = Cmiit + Cxiit, where *Cmiit* and *Cxiit* are the contributions of import growth and import growth to the growth in intra-industry trade, respectively; and

tt = Cnt and Ciit, where *Cnt* and *Ciit* are the contributions of net trade growth and intra-industry trade growth to the growth in total trade, respectively.

Table 5.6 shows the estimated contributions of exports and imports to the growth in Australia's wine trade for a five-year period from1980 to 2004.[84] With respect to the percentage growth in Australia's total wine trade (tt), the contributions of export growth to total trade (Cxtt) are all positive and higher than the contributions of import growth to total trade (Cmtt), except the period of 1980-1985. This reflects the strong growth in wine exports which contributed to the growth of Australia's total wine trade during 1985 to 2004. The growth of the total wine trade increased from 28.22 percent in the period of 1980-1985 to about 54.7 percent in the period of 2000-2004. Export contributions also rose from 0.83 percent to 51.56 percent, respectively. It is important to note that in the period of 1985-1990, Australia had the highest percentage change in its total wine trade at about 71 percent, of which 65.8 percent was contributed by the export growth, while in the period of 1980-1985, the percentage growth in Australia's total wine trade was contributed largely by the growth of imports. These figures are consistent with the period of trade liberalisation when Australia started to gain a comparative advantage in the wine trade as mentioned in Chapter Three.

With respect to the percentage growth in Australia's net wine trade (nt), the contributions by export growth have been positive since the period of 1985-1990. In the period of 1985-1990, Australia had the highest value of percentage growth in net trade of wines at about 131 percent, derived from the positive growth rate of exports at 141.83 percent and the negative percentage change of import growth at 10.85 percent. The contributions of export growth to the growth in intra-industry trade (Cxiit) are all zero, except for the period of 1980-1985. The contributions of import

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[84] The last period is a four-year period due to limitation of data availability.

growth in intra-industry trade (Cmiit) increased from 18.79 percent in the period of 1985-1990 to 49.43 percent in the period of 2000-2004. This means that the percentage growth of intra-industry trade in Australia's wines is mainly due to the contributions of import growth rather than the contributions of export growth. Taking both the effects of percentage growth in net trade and percentage growth of intra-industry trade into consideration, the last column specifies that the overall percentage growth in the total trade of Australia's wines has contributed more to the growth in net trade than the growth in intra-industry trade.

Since, Menon-Dixon's indexes are not valid under a status switch in the data, this study attempts to examine the trade data to see whether there has been a status switch. The results are presented in Appendix 5.2 and show that there are some status switches in the trade data in some periods.

The following table, Table 5.7, summarises the percentage growth in total trade (tt) and its contributions of import and export growth to the growth in total trade for Australia's bilateral trade in wines with fourteen major trading countries.

Table 5.7 (a): Percentage Growth in Total Trade with contributions of import and export growth for Australia's Bilateral Trade in wines, 1980-2004.

	1980-1985			1985-1990			1990-1995			1995-2000			2000-2004		
Country\Year	**tt**	**Cmtt**	**Cxtt**	**tt**	**Cmtt**	**Cxtt**	**tt**	**Cmtt**	**Cxtt**	**tt**	**Cmtt**	**Cxtt**	**tt**	**Cmtt**	**Cxtt**
France	57.55	57.57	-0.02	12.21	10.58	1.63	n.a	n.a.	n.a.	34.85	22.92	11.94	46.37	36.28	10.09
Italy	51.95	51.97	-0.02	40.50	40.11	0.39	32.46	31.49	0.97	n.a.	n.a.	n.a.	22.49	14.26	8.23
Spain	51.92	51.95	-0.03	44.42	37.07	7.35	32.04	31.79	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	n.a.	n.a	n.a	n.a	n.a	n.a	56.61	-12.07	68.69	75.52	-0.30	75.82	41.06	0.50	40.55
Portugal	5.56	5.47	0.09	n.a	n.a	n.a	n.a	n.a.	n.a.	n.a.	n.a.	n.a.	16.92	16.61	0.32
Greece	n.a	n.a	n.a	40.21	37.13	3.08	3.75	1.58	2.17	16.01	20.09	-4.08	n.a.	n.a.	n.a.
U.S.	24.06	-5.21	29.27	89.04	0.44	88.60	68.45	2.94	65.50	77.09	-0.49	77.59	63.11	0.30	62.81
Argentina	79.73	82.59	-2.86	72.37	72.19	0.18	87.16	87.46	-0.30	n.a.	n.a.	n.a.	88.90	82.45	6.45
South Africa	60.27	51.05	9.22	n.a	n.a	n.a	99.48	71.42	28.05	n.a.	n.a.	n.a.	39.52	24.49	15.03
Chile	75.66	75.66	0.00	64.64	64.64	0.00	94.23	94.14	0.09	n.a.	n.a.	n.a.	20.09	19.62	0.47
U.K.	30.32	4.14	26.18	96.06	-0.24	96.30	74.93	-0.01	74.94	63.18	0.03	63.15	46.42	0.05	46.37
N.Z.	n.a	n.a	n.a	87.00	12.11	74.89	36.77	5.61	31.16	49.37	20.77	28.60	n.a.	n.a.	n.a.
Canada	n.a	n.a	n.a	90.95	0.10	90.86	18.51	0.00	18.51	71.71	0.02	71.69	69.01	0.04	68.97
Japan	62.61	-2.58	65.18	79.54	0.17	79.37	n.a.	n.a.	n.a.	65.34	0.01	65.33	46.77	0.08	46.69

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Note: n.a. = not applicable as a result of status switch from Appendix 5.2.

Table 5.7 (b): Percentage Growth in Total Trade with contributions of net trade and intra-industry trade growth for Australia's Bilateral Trade in wines, 1980-2004.

	1980-1985			1985-1990			1990-1995			1995-2000			2000-2004		
Country\Year	**tt**	**Cnt**	**Ciit**	**tt**	**Cnt**	**Ciit**	**tt**	**Cnt**	**Ciit**	**tt**	**Cnt**	**Ciit**	**tt**	**Cnt**	**Ciit**
France	57.55	57.59	-0.04	12.21	8.95	3.27	n.a.	n.a.	n.a.	34.85	10.98	23.88	46.37	26.18	20.19
Italy	51.95	51.99	-0.04	40.50	39.71	0.79	32.46	30.52	1.94	n.a.	n.a.	n.a.	22.49	6.04	16.45
Spain	51.92	51.98	-0.06	44.42	29.71	14.70	32.04	31.53	0.52	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	56.61	80.76	-24.15	75.52	76.12	-0.60	41.06	40.05	1.01
Portugal	5.56	5.38	0.18	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	16.92	16.29	0.63
Greece	n.a.	n.a.	n.a.	40.21	34.05	6.16	3.75	-0.60	4.35	16.01	24.17	-8.16	n.a.	n.a.	n.a.
U.S.	24.06	34.48	-10.42	89.04	88.16	0.88	68.45	62.56	5.89	77.09	78.08	-0.99	63.11	62.51	0.60
Argentina	79.73	85.44	-5.72	72.37	72.01	0.36	87.16	87.76	-0.61	n.a.	n.a.	n.a.	88.90	76.00	12.91
South Africa	60.27	41.82	18.45	n.a.	n.a.	n.a.	99.48	43.37	56.10	n.a.	n.a.	n.a.	39.52	9.47	30.05
Chile	75.66	75.66	0.00	64.64	64.64	0.00	n.a.	n.a.	n.a.	-208.41	-208.41	0.00	20.09	19.16	0.93
U.K.	30.32	22.04	8.28	96.06	96.55	-0.49	74.93	74.94	-0.02	63.18	63.12	0.06	46.42	46.33	0.10
N.Z.	n.a.	n.a.	n.a.	87.00	62.77	24.23	36.77	25.55	11.22	49.37	7.83	41.54	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	90.95	90.76	0.19	18.51	18.51	0.00	71.71	71.68	0.03	69.01	68.94	0.07
Japan	62.61	67.76	-5.16	79.54	79.20	0.35	n.a.	n.a.	n.a.	65.34	65.32	0.02	46.77	46.61	0.16

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Note: n.a. = not applicable as a result of status switch from Appendix 5.2.

The results presented in Table 5.7(a) quite vary with each individual country. The percentage growth in Australia's total wine trade with France increased from 34.85 percent in the period of 1995-2000 to 46.37 percent in the period of 2000-2004, while the growth rates in Australia's total wine trade with Portugal and Argentina increased from 5.56 percent and 79.73 percent in the period of 1980-1985 to 16.93 percent and 88.90 percent in the period of 2000-2004, respectively. On the other hand, Italy and Spain experienced a decreasing trend of the percentage growth in Australia's total wine trade throughout the entire period. The percentage growth in Australia's total wine trade with Germany and Greece increased from 56.61 percent and 3.75 percent in the period of 1990-1995 to 75.52 percent and 16 percent in the period of 1995-2000, respectively, while trade with the U.S. increased from 68.44 percent to 77.09 percent in the same period.

Major export destinations of Australia's wines such as New Zealand and Canada have recorded an increasing rate of percentage growth in total trade with Australia since 1990. In the period of 1985-1990, most of the major importers of Australia's wines had their highest growth rates in total wine trade with Australia, for example, the U.K. at 96.05 percent, Canada at 90 percent, the U.S. at 89 percent, New Zealand at 87 percent, and Japan at 79.54 percent.

Another important period is in the period of 1990-1995 when the percentage growth in total trade for Australia's bilateral trade in wines with South Africa and Chile reached very high levels at 99.47 and 94.23 percent, respectively. This time period coincides with the changes in trade policy in terms of the reduction of trade barriers and the openness of Australia's trade to the rest of the world.

Table 5.7(a) indicates that the percentage changes in Australia's total wine trade with major wine-exporting countries (France, Italy, Spain, Portugal, Greece, Argentina, South Africa, and Chile) are mainly contributed by the percentage changes in import growth (Cmtt) rather than by the contributions of export growth (Cxtt). On the other hand, the contributions of export growth in total trade are more influenced by the percentage changes in Australia's total wine trade with Germany, the U.S., the U.K., New Zealand, Canada, and Japan.

The results in Table 5.7(b) reveal that the percentage growth in total trade for Australia's bilateral trade in wines with its 14 major trading countries is mostly influenced by the contributions of growth in net trade. In only a few periods the percentage growth in total trade for Australia's bilateral trade in wines was contributed to the growth of intra-industry trade, for instance, France and New Zealand in the period of 1995-2000, Italy and South Africa in the period of 2000-2004, and Greece and South Africa in the period of 1990-1995.

Table 5.8: Percentage Growth in Net Trade for Australia's Bilateral Trade in wines, 1980-2004.

Country\Year	1980-1985			1985-1990			1990-1995			1995-2000			2000-2004		
	nt	**Cmnt**	**Cxnt**	**nt**	**Cmnt**	**Cxnt**	**nt**	**Cmnt**	**Cxnt**	**nt**	**Cmnt**	**Cxnt**	**nt**	**Cmnt**	**Cxnt**
France	57.87	57.85	0.02	9.29	10.99	-1.70	n.a.	n.a.	n.a.	15.13	31.59	-16.46	40.23	55.73	-15.51
Italy	52.04	52.03	0.02	40.06	40.45	-0.40	31.31	32.30	-1.00	n.a.	n.a.	n.a.	7.58	17.91	-10.33
Spain	52.07	52.04	0.03	35.35	44.10	-8.75	31.74	32.00	-0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	121.54	18.17	103.37	82.39	0.32	82.07	42.38	-0.53	42.91
Portugal	5.39	5.48	-0.09	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	16.41	16.73	-0.32
Greece	n.a.	n.a.	n.a.	36.29	39.57	-3.28	-0.67	1.76	-2.42	24.28	20.18	4.10	n.a.	n.a.	n.a.
U.S.	38.39	5.80	32.59	89.96	-0.45	90.41	66.92	-3.15	70.07	78.48	0.50	77.98	63.01	-0.30	63.31
Argentina	131.11	126.72	4.38	80.00	80.20	-0.20	88.36	88.06	0.30	n.a.	n.a.	n.a.	89.65	97.26	-7.61
South Africa	54.06	65.99	-11.92	n.a.	n.a.	n.a.	99.34	163.59	-64.25	n.a.	n.a.	n.a.	20.08	51.93	-31.86
Chile	75.66	75.66	0.00	64.64	64.64	0.00	94.22	94.31	-0.09	n.a.	n.a.	n.a.	19.34	19.81	-0.47
U.K.	27.44	-5.15	32.59	96.82	0.25	96.58	74.99	0.01	74.98	63.17	-0.03	63.21	46.39	-0.05	46.44
N.Z.	n.a.	n.a.	n.a.	91.75	-17.71	109.46	37.13	-8.15	45.29	18.35	-48.69	67.04	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	90.93	-0.10	91.03	18.51	0.00	18.51	71.70	-0.02	71.72	68.99	-0.04	69.03
Japan	67.98	2.59	65.39	79.53	-0.17	79.70	n.a.	n.a.	n.a.	65.34	-0.01	65.35	46.69	-0.08	46.77

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Note: n.a. = not applicable as a result of status switch from Appendix 5.2.

Results presented in Table 5.8 show the percentage growth in net trade (nt) and its contributions of import and export growth to the growth in net trade for Australia's bilateral trade in wines with its 14 major trading countries. The results vary quite widely with each individual country, but show a consistency with the results of growth in total trade. This also confirms that the contributions of growth in net trade are more influenced by the percentage growth in total trade than by the contributions of growth in intra-industry trade.

Table 5.8 indicates that the growth in net trade between Australia and the Old World wine-producing countries, except Germany, is due to the contributions of import growth to the growth in net trade (Cmnt). Since the contributions of export growth to growth in net trade (Cxnt) between Australia and the Old World countries nearly all show negative values, Australia is considered a net importer of wines from these countries. The percentage growths in net trade between Australia and Argentina, South Africa, and Chile are also mainly contributed to the import growth due to negative values of the contributions of export growth to the growth in net trade (Cxnt). In contrast, the percentage growths in net trade between Australia and Germany, the U.S., the U.K., New Zealand, Canada, and Japan are attributable to the contributions of export growth to the growth in net trade (Cxnt). The contributions of import growth to the growth in net trade (Cmnt) between Australia and these countries show mostly negative values. This implies that Australia is a net exporter of wines to these countries.

Table 5.9: Percentage Growth in Intra-Industry Trade for Australia's Bilateral Trade in wines, 1980-2004.

Country\Year	1980-1985			1985-1990			1990-1995			1995-2000			2000-2004		
	iit	**Cmiit**	**Cxiit**	**iit**	**Cmiit**	**Cxiit**	**iit**	**Cmiit**	**Cxiit**	**iit**	**Cmiit**	**Cxiit**	**iit**	**Cmiit**	**Cxiit**
France	-7.90	0.00	-7.90	88.46	0.00	88.46	n.a.	n.a.	n.a.	86.97	0.00	86.97	57.83	0.00	57.83
Italy	-33.42	0.00	-33.42	92.16	0.00	92.16	77.09	0.00	77.09	n.a.	n.a.	n.a.	80.85	0.00	80.85
Spain	-33.42	0.00	-33.42	92.16	0.00	92.16	77.09	0.00	77.09	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-71.98	-71.98	0.00	-7.86	-7.86	0.00	18.32	18.32	0.00
Portugal	100.00	0.00	100.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	89.73	0.00	89.73
Greece	n.a.	n.a.	n.a.	100.00	0.00	100.00	42.30	0.00	42.30	-1732.44	0.00	-1732.44	n.a.	n.a.	n.a.
U.S.	-102.19	-102.19	0.00	44.08	44.08	0.00	90.33	90.33	0.00	-194.52	-194.52	0.00	76.26	76.26	0.00
Argentina	-16.41	0.00	-16.41	3.65	0.00	3.65	-89.38	0.00	-89.38	n.a.	n.a.	n.a.	84.77	0.00	84.77
South Africa	81.49	0.00	81.49	n.a.	n.a.	n.a.	99.58	0.00	99.58	n.a.	n.a.	n.a.	56.88	0.00	56.88
Chile	-100.00	0.00	-100.00	0.00	0.00	0.00	100.00	0.00	100.00	n.a.	n.a.	n.a.	100.00	0.00	100.00
U.K.	42.09	42.09	0.00	-170.34	-170.34	0.00	-27.26	-27.26	0.00	75.03	75.03	0.00	68.12	68.12	0.00
N.Z.	n.a.	n.a.	n.a.	76.71	76.71	0.00	35.98	35.98	0.00	72.46	72.46	0.00	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	100.00	100.00	0.00	-100.00	-100.00	0.00	100.00	100.00	0.00	87.96	87.96	0.00
Japan	-1607.46	-1607.46	0.00	84.12	84.12	0.00	n.a.	n.a.	n.a.	100.00	100.00	0.00	92.27	92.27	0.00

Source: Calculations based on the UN Comtrade database; available at http://comtrade.un.org/db.

Note: n.a. = not applicable as a result of status switch from Appendix 5.2.

Table 5.9 reports the percentage growth in intra-industry trade (iit) and its contributions of import and export growth to the growth in intra-industry trade for Australia's bilateral trade in wines with its fourteen major trading countries. The results presented in Table 5.9 indicate that the growth in intra-industry trade between Australia and the Old World wine-producing countries, except Germany, is due to the contributions of export growth to the growth in intra-industry trade (Cxiit). Since the contributions of import growth to the growth in intra-industry trade (Cmiit) between Australia and the Old World countries all show zero values, Australia is a net importer of wines from these countries. The percentage changes in intra-industry trade between Australia and Argentina, South Africa, and Chile are also mainly contributed to the export growth. On contrary, the percentage growths in intra-industry trade between Australia and Germany, the U.S., the U.K., New Zealand, Canada, and Japan are attributable to the contributions of import growth to the growth in intra-industry trade (Cmiit). The values of export growth contributing to intra-industry trade growth (Cxiit) between Australia and these countries are all zero. This implies that Australia is a net exporter of wines to these countries.

5.6 CONCLUSION

In this chapter the fundamental theories and measurements of intra-industry trade have been reviewed. Although there are several different methods of measuring intra-industry trade, the standard Grubel-Lloyd (G-L) index of intra-industry trade is the most widely used and acceptable method. Therefore, this thesis employs the standard G-L index in order to examine the extent of Australia's and its major trading partners' intra-industry trade in wines. The G-L index is also used to examine Australia's bilateral intra-industry trade in wines with its major trading countries. To measure the growth of intra-industry trade for Australia's wines, the concept of marginal intra-industry trade is applied, together with the Menon-Dixon's approach.

The world wine industry is more likely to be characterised by inter-industry trade, rather than intra-industry trade, which is based on the significance of comparative advantage and factor endowments. Australia has a relatively small extent of intra-industry trade in wines. This is due to the value of Australia's exports of wines being very much higher than those of its imports. In addition, most of the major wine-producing countries have low levels of intra-industry trade. The extent of bilateral intra-industry trade in wines between Australia and its major trading partners is also small. However, the levels of intra-industry trade in wines between Australia and New Zealand are relatively high.

The concept of marginal intra-industry trade reveals that additional levels of intra-industry trade or proportional changes in the trade patterns of Australia's and other major trading partners' wines has been more associated with inter-industry trade, rather than intra-industry trade over the last two decades. Greece and New Zealand have greater values of the MIIT indexes than other major world-wine producers. Thus, the proportional changes in their wine trade patterns have high additional levels of intra-industry trade.

In the period of 1985-1990, Australia had the highest percentage change in total wine trade at about 71 percent, of which 65.8 percent was contributed to the growth of exports, while in the period of 1980-1985, the percentage growth of Australia's total wine trade was contributed to the growth of imports. These results are consistent with the impact of trade liberalisation after which Australia experienced a comparative advantage in wines and specialisation in wine trade. The percentage growth in net trade is contributed by the export growth of Australia's wines, while the percentage growth in intra-industry trade is contributed to the import growth of Australia's wines. Overall, the percentage growth in total trade of Australia's wines is more influenced by the contributions of growth in net trade than the contributions of growth in intra-industry trade.

The results of the percentage growth in total trade for Australia's bilateral trade in wines with its fourteen major trading countries vary with each individual country. Generally, with France, Italy, Spain and Germany it has a decreasing growth rate, while with Portugal and Argentina it has an increasing growth rate in total trade with Australia's wines. The contributions of import growth in total trade are more influenced on the percentage changes in Australia's total wine trade with France, Italy, Spain, Portugal, Greece, Argentina, South Africa, and Chile. Conversely, the contributions of export growth in total trade are more influenced on the percentage changes in Australia's total wine trade with Germany, the U.S., the U.K., New Zealand, Canada, and Japan. In addition, the percentage growth in total trade for Australia's bilateral trade in wines with its major trading countries is mostly attributed to the contributions of growth in net trade.

The results of the percentage growth in net trade for Australia's bilateral trade in wines with its major trading countries also vary widely with each individual country, but the directions are consistent with the results of the percentage growth in total trade. This also confirms that the contributions of growth in net trade are more likely to influence the percentage growth in total trade than the contributions of growth in intra-industry trade.

The growth of intra-industry trade in wines between Australia and most of the major wine-producing countries is due to the contributions of export growth to growth in intra-industry trade. This means that Australia is a net importer of wines to these countries. On the other hand, the percentage growth of intra-industry trade in wines between Australia and Germany, the U.S., the U.K., New Zealand, Canada, and Japan is due to the contributions of import growth to growth in intra-industry trade. This means that Australia is a net exporter of wines to these countries.

The next chapter, Chapter Six, will focus on the theories and empirical studies of the determinants of intra-industry trade. Specifically, econometric analyses of the determinants of Australia's intra-industry trade in wines with the rest of the world and its major trading partners will be conducted.

CHAPTER SIX

DETERMINANTS OF INTRA-INDUSTRY TRADE IN WINES

6.1 INTRODUCTION

In the previous chapter it was argued that the results of intra-industry indexes showed that the intensity of intra-industry trade in the world wine market is small and the levels of bilateral intra-industry trade of wines between Australia and major trading partners are also low. However, the extent of Australia's intra-industry trade in wines varies across its trading partners. Thus, it is important to identify the fundamental characteristics that influence the extent of Australia's intra-industry trade in wines.

The purpose of this chapter is to analyse the determinants of Australia's intra-industry trade in wines. In this chapter two separate models are developed: Australia's intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major trading partners. The measurements of determinants of intra-industry trade are reviewed in Section 6.2 and in section 6.3 the empirical studies on determinants of intra-industry trade. In Section 6.4, the econometric models of the determinants of intra-industry trade in wines are developed. Data and the sources of data are provided in Section 6.5. The results of Australia's intra-industry trade in wine with the rest of the world and Australia's bilateral intra-industry trade in wine with its major trading partners are presented and discussed in Section 6.6. A conclusion of major findings is presented in Section 6.7.

6.2 MEASUREMENTS OF DETERMINANTS OF INTRA - INDUSTRY TRADE

The factors influencing intra-industry trade are commonly divided into two types, known as country-specific and industry-specific determinants (Loertscher and Wolter 1980 and Balassa and Bauwens 1987).

6.2.1 COUNTRY-SPECIFIC DETERMINANTS

Generally, country-specific determinants can be divided into 5 factors: (1) economic development; (2) country size; (3) geographical proximity; (4) economic integration; and (5) barriers to trade (Sichei 2005). These factors are discussed in detail in the following sections.

6.2.1.1 Levels of Economic Development

Intra-industry trade levels among countries are high if their levels of economic development are also high (Loertscher and Wolter 1980). People in a country with a higher per capita income are likely to demand more product varieties from both domestic and international markets. Consequently, countries are able to trade more differentiated products which, in turn, increase the levels of intra-industry trade (Linder 1961). On the supply side, firms in developed economies also have the ability to produce more varieties than less developed economies (Krugman 1991). Thus, most empirical studies[85] on the determinants of intra-industry trade have normally included GDP[86] per capita or average GDP per capita as a major explanatory variable and expected it to have a positive influence.

Linder (1961) argued that countries with similar levels of per capita income have similar demand patterns. When a country produces goods for domestic demand, it is also expected to export its goods to countries with similar per capita incomes, which reflect similar tastes and preferences. In turn, the country also imports from countries with similar per capita incomes, and consequently their mutual demand for varieties increases. This situation results in a greater opportunity for economies of scale and higher levels of intra-industry trade between countries of similar economic levels.

On the other hand, a negative relationship is generally expected between intra-industry trade and differences in the levels of economic development of two countries (Linder 1961). Some empirical studies[87] have used the absolute difference of per capita incomes[88] between countries. Instead of taking the absolute values of differences in per capita incomes, however, Balassa and Bauwens (1987) suggested a measure of relative differences[89] as shown in the following equation:

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[85] For example, see Loertscher and Wolter (1980) Balassa (1986a), Balassa and Bauwens (1987), Bergstrand (1990), Ballance *et al.* (1992), Narayan and Dardis (1994), Hellvin (1994; 1996), Somma (1994), Stone and Lee (1995), Thorpe (1995), Pieri *et al.* (1997), Matthews (1998), Hu and Ma (1999), Mora (2002), Carreras-Marin (2005), Ferto (2005), Thorpe and Zhang (2005).
[86] GDP, GNP, GNI, and GNE are used interchangeably.
[87] For example, see Loertscher and Wolter (1980), Hellvin (1994), Clark and Stanley (1999), Hu and Ma (1999), Gullstrand (2002), Carreras-Marin (2005), Ferto (2005), and Leitao and Faustino (2006)
[88] Per capita income is usually calculated by GDP or GNP at current market price divided by total population.
[89] Pieri *et al.* (1997), Matthews (1998), Blanes and Martin (2000), Li *et al.* (2003), Turkcan (2003), Thorpe and Zhang (2005), and Zhang and Li (2006) also used this measure in their empirical studies.

$$DIFF_{BB} = 1 + \frac{[w \ln w + (1-w)\ln(1-w)]}{\ln 2} \qquad (6.1)$$

where, $DIFF_{BB}$ refers to the relative differences in country characteristics, which takes values between zero to one, w refers to the ratio of a particular country characteristic (per capita GDP or GDP) in country j to the sum of this characteristic in country j and partner country k, that is $w = \frac{PCGDP_j}{PCGDP_j + PCGDP_k}$ or $w = \frac{GDP_j}{GDP_j + GDP_k}$.

Differences in per capita incomes can also arise from differences in factor endowments. A country that has a higher proportion of capital-labour endowment may demand more differentiated products because differentiated products are likely be more capital-intensive than labour-intensive standardised products (Helpman and Krugman 1985). In general, consumers prefer high quality varieties, but are constrained by their incomes. Thus, consumers from a country with averagely higher incomes are expected to demand products of higher quality, that is more capital-intensive product varieties, while consumers from a country with averagely lower incomes are expected to demand products of lower quality, that is more labour-intensive product varieties (Dixit and Norman 1980; Krugman 1980; and Helpman 1981). Therefore, the levels of intra-industry trade are higher among countries that have similar factor endowments, and lower among countries that have greater differences in factor endowments (Helpman 1981 and Hellvin 1994).

6.2.1.2 Country Size

A country that experiences economies of scale is likely to expand its domestic market size and supply more differentiated products (Lancaster 1980). Balassa (1986b) also pointed out that larger economies would demand more differentiated products from other countries. Thus, the level of intra-industry trade is positively related to country's market size. The levels of intra-industry trade are also higher among countries with similar market sizes (Lancaster 1980; Helpman 1981; Balassa 1986b; Hellvin 1994; and Somma 1994).

Loertshcer and Wolter (1980) suggested using GDP or average GDP as a proxy for a country's market size, which is expected to have a positive impact on the intensity of intra-industry trade. A number of studies[90] found a positive relation between GDP and the level of intra-industry trade. For bilateral intra-industry trade determinants, similarity of countries' market sizes is measured by the average GDP between trading partners. The level of bilateral intra-industry trade increases when the average size of both countries increases[91] (Balassa 1986b).

In contrast, larger differences in market size among countries lead to lower levels of intra-industry trade. Thus, intra-industry trade is negatively related to differences in country size (Lancaster 1980; Helpman 1981; Balassa 1986b; Hellvin 1994; and Somma 1994). Loertscher and Wolter (1980) proposed using the absolute difference of

[90] For example, see Balassa and Bauwens (1987), Narayan and Dardis (1994), Somma (1994), Hellvin (1994; 1996), Clark and Stanley (1999), Carreras-Marin (2005), Thorpe and Zhang (2005), and Leitao and Faustino (2006)

[91] Helpman and Krugman (1985), Berstrand (1990), and Zhang and Li (2006) found a high level of intra-industry trade between countries of similar economic size.

GDP between two trading partners as a proxy for the differences in market size and expected a negative effect. In addition, the greater relative differences in countries' market sizes would imply larger relative differences in factor endowments and, consequently, lower levels of intra-industry trade (Helpman and Krugman 1985).

The trade intensity index is also commonly used to represent a market concentration related to product differentiation and intra-industry trade (Li *et al.* 2003). Krugman (1980; 1991) explained that as trade volume increases, there are opportunities for more differentiated products to be traded. Thus, a positive relationship is expected between intra-industry trade and trade intensity. Grubel and Lloyd (1975), Toh (1982), Lee and Lee (1993), and Li *et al.* (2003) applied the trade intensity index in their studies and defined the index as the ratio of country *j*'s exports to (X_{jk}) and imports from country *k* (M_{jk}) to total industry exports (X_t) and imports (M_t). Equation 6.2 measures the trade intensity (*TIN*):

$$TIN = \frac{X_{jk} + M_{jk}}{X_t + M_t} \tag{6.2}$$

If trade is highly intense among countries with similar high per capita incomes, the levels of intra-industry trade are likely to be high.

Greenaway and Milner (1984) used the ratio of a country's trade (exports plus imports) of a particular industry to the world's trade of that industry in order to capture the effect of intra-industry trade on the country's economic size. If a country's share of a particular product in the world market is large, the country is more likely to be involved in more intra-industry trade. There is expected to be a positive relationship between the ratio of a country's trade to the world trade and intra-industry trade.

Lee and Lee (1993), Somma (1994), and Stone and Lee (1995) suggested including the trade imbalance index[92] in order to avoid any possible bias in estimated coefficients of the determinants of intra-industry trade that may be caused by a trade imbalance correlated with any of the explanatory variables, since the value of an unadjusted G-L index is smaller if the level of trade imbalance increases. The trade imbalance index ($TIMB_{ij}$) is defined as the absolute value of exports minus imports divided by total trade flows, as shown in equation 6.3:

$$TIMB_{ij} = \frac{|X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} \tag{6.3}$$

where, X_{ij} and M_{ij} are the total exports from country i to country j and the total import of country i from country j, respectively. The trade imbalance index is expected to have a negative influence on the level of intra-industry trade (Grubel and Lloyd 1975).

6.2.1.3 Geographical Proximity

Countries that are geographically close to their trading partners tend to have a high level of intra-industry trade as a result of an advantage in transport costs. On the other hand, a large geographical distance between trading countries tends to reduce the

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[92] Pieri *et al.* (1997), Matthews (1998), Clark and Stanley (1999), Li *et al.* (2003), and Thorpe and Zhang (2005) also included trade imbalance index in their studies.

intensity of intra-industry trade (Grubel and Lloyd 1975). Distance between trading partners can also reflect the cost of information, especially for non-standardised or differentiated products. The consumption of differentiated products requires more information than that of standardised products. When distances between trading countries increase, then product information is less available, and thus costs of gathering information are higher, which in turn lower the levels of intra-industry trade (Balassa 1986c; Balassa and Bauwens 1987; and Clark and Stanley 1999). A number of empirical studies[93] have used distance, usually in kilometres or miles, between the capital cities of two countries to capture geographic proximity. The level of intra-industry trade is expected to have an inverse relationship as distance increases.

6.2.1.4 Economic Integration

Fundamentally, any form of economic integration aims to reduce or eliminate trade barriers, leading to lower transaction costs of trade among membership countries. Thus, regional trade arrangements (RTAs) such as a free trade area (FTA) or a customs union have a significant impact on increasing the intensity of intra-industry trade (Culem and Lundberg 1986). Several empirical studies[94] found results to support the idea that economic integration leads to a higher level of intra-industry trade among membership countries. In most studies, the economic integration variable is proxied by

[93] See, for example, Balassa and Bauwens (1987), Hellvin (1994), Pieri *et al.* (1997), Clark and Stanley (1999), Carreras-Marin (2005), Thorpe and Zhang (2005)
[94] For example, Grubel and Lloyd (1975), Kreinin (1979), Glejser (1983), Balassa and Bauwens (1987) found support for studies of trade in the European Community; Menon and Dixon (1995) found support for studies of trade between Australia and New Zealand; Thorpe (1995) found support for studies of trade among Asian countries.

a dummy variable by using the value of one if two countries have formed any regional trade arrangements and a positive relationship is expected (Sichei 2005).

6.2.1.5 Barriers to Trade

Generally, trade barriers can be divided into two types, namely, natural and artificial trade barriers (Caves 1981). Geographical distance, language, and culture are common forms of natural trade barriers. Tariff and non-tariff restrictions, immigration policies, and capital controls, which are created by either the host or home government, are common artificial trade barriers. Trade barriers increase the prices of foreign goods, which in turn increase the domestic demand for local products and decrease the demand for differentiated products from abroad. The net result is a fall in intra-industry trade (Falvey 1981). Hence, the levels of intra-industry trade will be higher if tariff rates among them are lower and vice versa (Loertscher and Wolter 1980). A number of empirical studies[95] have confirmed the inverse relationship between trade barriers and intra-industry trade.

A dummy variable is widely used to measure natural trade barriers by taking a value of 1 if two countries share a common border or use the same language. On the other hand, nominal tariff rates or average tariff rates are commonly used as a proxy for artificial trade barriers (Turkcan 2003 and Sichei 2005). However, Caves (1981) used standard

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[95] See, for instance, Pagoulatos and Sorensen (1975), Loertscher and Wolter (1980), Caves (1981), Toh (1982), Balassa (1986a), Balassa and Bauwens (1987), Kim (1992), Clark (1993), Narayan and Dardis (1994), Matthews (1995), Stone and Lee (1995) Thorpe (1995), and Hellvin (1996).

deviation of tariff rates[96] instead of nominal tariff rates since he claimed that the levels of intra-industry trade would decrease if the variance of tariff rates increased.

Gray and Martin (1980), Drabek and Greenaway (1984), Greenaway and Milner (1986), and Globerman and Dean (1990) claimed that the intensity of intra-industry trade is positively related to trade liberalisation. Thus, a high degree of market openness should increase the intensity of intra-industry trade. Havrila (2004) used the ratio of a country's trade to its GDP as the index of market openness and found a positive relationship. A higher ratio can be interpreted as suggesting there is a greater degree of market openness and also a higher level of intra-industry trade.

Balassa (1986a) and Balassa and Bauwens (1987) suggested the Trade Orientation Index to represent the extent of trade barriers since information of tariff rates and non-tariff barriers are usually not available for several countries. They defined the Trade Orientation Index as the percentage deviations of actual values from hypothetical values of per capita exports (X/P). The Trade Orientation Index is expected to have a positive relationship with the level of intra-industry trade because a positive value of the trade orientation index represents a low degree of trade restrictions. Alternatively, Matthews (1998) used a regression on per capita trade[97] ($X+M/P$), instead of considering only export trade. Stone and Lee (1995), Clark and Stanley (1999), and Zhang and Li (2006) applied the Trade Orientation Index as a proxy for trade restrictions by using the residuals of a regression of per capita trade on per capita income (Y/P) and population (P) in their calculation.

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[96] Balassa and Bauwens (1987) also used this method.
[97] Per capita trade is measured by exports plus imports divided by number of population.

It is also important to consider the impact of exchange rate on the extent of intra-industry trade (Thorpe and Zhang 2005). Since Anderson (2004) claimed the depreciation of the Australian dollar as one of the major factors leading to the remarkable growth of the Australian wine industry. An increase in the value of the nominal currency, which means the depreciation in home currency, leads to an increase in trade (Thorpe and Zhang 2005). This claim is confirmed by empirical studies of Sichei (2005) and Thorpe and Zhang (2005) that included a nominal exchange rate variable in their models and found that exchange rate had a positive effect on intra-industry trade.

6.2.2 INDUSTRY-SPECIFIC DETERMINANTS

In general, there are four major industry-specific determinants influencing the levels of intra-industry trade: (1) product differentiation, (2) economies of scale, (3) market structure, and (4) the role of multinational corporations (Sichei 2005). These factors are discussed in detail in the following sections.

6.2.2.1 Product Differentiation

The intensity of intra-industry trade is positively related to the extent of product differentiation. Generally, a greater the degree of product differentiation leads to a higher level of intra-industry trade. The simplest measure for product differentiation within an industry is the number of product categories of the UN SITC within that industry (Sichei 2005). For example, Loertscher and Wolter (1980) and Caves (1981) applied disaggregating product listings in each category of the SITC to estimate the extent of product differentiation. Balassa (1986c) used the number of four-digit product sub-categories in each three-digit category of the SITC to measure the extent of product differentiation. Sharma (2004) used the number of five-digit in each four-digit category of the ANZSIC. The three- or four- digit level of SITC in each previous level of that category is commonly used (Sichei 2005).

Pieri *et al.* (1997) used another approach to measure product differentiation by using the unit value of exports. They claimed that a country selling products at higher prices would sell more differentiated product varieties. They used two variables to represent product differentiation: (1) the average export unit values, which are expected to have a positive influence on intra-industry trade; (2) differences in average export unit values between two countries, which are expected to have a negative influence on the level of intra-industry trade.

Greenaway and Milner (1984) suggested that advertising expenditure would be directly related to the level of consumer's preferences of product varieties. If an industry spent more resources on advertising, consumers would be able to perceive more differentiated varieties in the industry. Thus, Greenaway and Milner (1984) used the advertising to sales ratio[98] as a measure of product differentiation by attributes. On the other hand, Balassa (1986a), Greenaway and Milner (1984) and Hu and Ma (1999) used the proportion of R&D expenditure to net output (sales) as a measure of product

[98] This proxy is also used by Caves (1981), Balassa (1986a), Kim (1992), Ratnayake and Athukorala (1992), Clark (1993), Hartman *et al.* (1993), Clark and Stanley (1999).

differentiation by qualities. Blanes and Martin (2000) and Sharma (2000; 2002; 2004) hypothesised the technological intensity has a positive effect on intra-industry trade and used the proportion of R&D staff to total employment as the proxy. Krugman and Obstfeld (1991) explained that higher spending on R&D could create more sophisticated and differentiated goods.

6.2.2.2 Economies of Scale

On the supply side, economies of scale allow firms to experience decreasing average costs as production levels increase and consequently this encourages firms to produce a output but within a limited range. On the demand side, imports and exports of differentiated products to satisfy the demand for varieties may force firms to achieve economies of scale. Thus, the effect of both supply and demand for varieties is related to economies of scale and positively related to intra-industry trade (Thorpe and Zhang 2005). The average value added per establishment is commonly used as a proxy for economies of scale (Loertscher and Wolter 1980; Hellvin 1994; Sharma 2000; 2002; 2004). Turkcan (2003) and Thorpe and Zhang (2005) used the ratio of gross fixed capital formation to value added in an industry.

Clark and Stanley (1999) and Hu and Ma (1999) used the minimum efficient scale (MES) ratio that is measured by the ratio of the average sales per firm (value of product shipments) of the largest fifty percent of industry shipments to total industry shipments. A positive relationship is expected between MES and intra-industry trade.

Greenaway and Milner (1984) proposed an index to measure economies of scale by examining the effect of relative cost advantage of larger firms compared to smaller firms. They used a ratio of average value added per employee in the largest five firms (ranked by sales or value of product shipments) relative to average value added per employee in the rest of the industry. If the index's value is high, it can be interpreted as suggesting that other smaller firms have difficulty in entering the market. This leads to more standardised products and less differentiated products are available in the market. Thus, the index is inversely related to intra-industry trade. Aturupane *et al.* (1997) applied the Greenaway and Milner's economies of scale index, but used the largest four firms, instead of the largest five firms in their analysis.

6.2.2.3 Market Structure

Balassa (1986a) argued that the number of firms in an industry is limited when the industry has highly concentrated firms, and consequently product standardisation increases and lower product varieties are provided in the market. Therefore, the seller concentration is inversely related to the levels of intra-industry trade. On the other hand, industries with many establishments or firms will produce a larger number of differentiated products. Thus, product standardisation is related to the concentration of sellers but product differentiation is related to the number of establishments within an industry (Clark and Stanley 1999).

Aturupane *et al.* (1997) and Clark and Stanley (1999) used the concentration ratio of the sales of the largest four firms while Greenaway and Milner (1984) used the concentration ratio of the sales of the largest five firms as a proxy for the negative influence of the concentration of sellers on the intra-industry trade. Ethier (1982), Chuankamnerdkarn (1997), Clark and Stanley (1999), Turkcan (2003), and Sharma (2004) used the number of establishments or firms within an industry to capture the positive influence of market structure on intra-industry trade.

Toh (1982) suggested the internationally adjusted concentration ratio[99] for a particular industry be used as a proxy to indicate the extent of internationally oligopolistic competition. The ratio is defined as the four-firm concentration ratio in a particular industry, divided by the import share in that industry. Toh pointed out that this index takes both domestic and foreign market influences into account. The four-firm concentration ratio is an indicator of domestic market power while the import share represents the degree of foreign competition in accessing the domestic market.

The relationship between market structure, measured by the number of firms, and intra-industry trade remains unclear. Some studies have suggested that oligopolistic competition could lead to high levels of intra-industry trade, while others have argued that intra-industry trade could occur more in a higher competitive environment with a large number of firms (Borkakoti 1988). For example, Lancaster (1980) claimed that the degree of intra-industry trade would be at its highest level under monopolistic competition. Krugman (2000) suggested that intra-industry trade could arise in a market with perfect competition. Caves (1981) contended that highly concentrated firms under oligopolistic competition could provide a considerable level of intra-

[99] Balassa (1986a) and Balassa and Bauwens (1987) also used this ratio in their studies.

industry trade. Brander and Krugman (1983) pointed out that an oligopolistic market structure of highly concentrated firms could create reciprocal dumping behaviour by both domestic and foreign firms, which in turn increase the degree of intra-industry trade.

6.2.2.4 The Role of Multinational Corporations

Multinational corporations (MNCs) play an important role in influencing the extent of intra-industry trade through their activities of foreign direct investment (FDI) (Greenaway and Milner 1987). While, tariff and non-tariff barriers create more costs of trade to MNCs, they overcome the costs by establishing their subsidiaries and affiliates in foreign countries and then generating trade through the host countries (Markusen and Venables 1998). FDI may lead to greater product specialisation by MNCs taking advantage of locating themselves in different state-of-the-art-countries, consequently increasing the degree of intra-industry trade (Aturupane *et al.* 1997). Therefore, FDI is positively related to the degree of intra-industry trade (Helpman and Krugman 1985; Aturupane *et al.* 1997; and Markusen and Venables 1998).

Generally, most empirical studies have used the volume of FDI in a particular industry or country by its trading partners (Li *et al.* 2003; Turkcan 2003; and Sichei 2005). Some studies used different methods to capture the positive effect of FDI on intra-industry trade. For example, Sharma (2000; 2002) defined FDI as value-added shares of foreign owned companies in each product category; Leitao and Faustino (2006) used net inflows of FDI that originated from trading partners as a percentage of GDP.

Conversely, Caves (1981) argued that FDI could be negatively associated with intra-industry trade since it might provide a potential for home firms to produce and provide goods in local foreign markets rather than export them. Balassa (1986a) and Tharakan and Kerstens (1995) pointed out that if the size of the host country market expanded, FDI could replace a host country's imports by oligopolistic firms and then the effects of FDI would be inversely related to intra-industry trade. Balassa and Bauwens (1987) also contended that FDI could replace a host country's export sales of differentiated products; hence FDI could affect intra-industry trade negatively.

Table 6.1 briefly summarises the determinants of intra-industry trade as follows:

Table 6.1: A summary of the determinants of intra-industry trade

Country-specific characteristics	Expected effect on IIT
1. Economic development	
Proxied by:	
- GDP or average GDP per capita;	+
- Differences in GDP or average GDP per capita (in absolute values);	-
- Balassa and Bauwens' index of relative differences;	-
- Ratio of capital to labour.	+
2. Country/Market size	
Proxied by:	
- GDP or average GDP;	+
- Differences in GDP or average GDP (in absolute values);	-
- Trade intensity index;	+
- Ratio of a country's trade to the world trade;	+
- Trade imbalance.	-
3.Geographical proximity	
Proxied by:	
- Distance (in miles or kilometres).	-
4. Economic integration	
Proxied by:	
- Regional Trade Arrangements (RTAs) (dummy variable).	+

5. Barriers to trade Proxied by: - Language (dummy variable); - Border (dummy variable); - Nominal tariff rates; - Standard deviation of tariff rates; - Ratio of country trade to GDP (openness index); - Trade orientation index; - Exchange rate (in nominal values).	 + + - - + + +

Industry-specific characteristics	Expected effect on IIT
1. Product differentiation Proxied by: - Number of product categories; - Unit values of exports; - Differences in unit values of exports; - Ratio of advertising expenditures to sales; - Ratio of R&D to net output (or sales).	 + + - + +
2. Economies of scale Proxied by: - Value-added per establishment; - Ratio of gross fixed capital formation to value-added; - Ratio of average size (product shipments) of the largest 50% of industry shipments to total industry shipments; - Ratio of value-added per employee of top 4 or 5 firms to that of the rest of industry.	 + + + -
3. Market structure Proxied by: - Number of establishments; - Largest 4- or 5-firms concentration ratio; - International adjusted concentration ratio.	 + - -
4. MNCs activities Proxied by: - FDI from abroad; - Value-added share of foreign owned companies; - Proportion of net inflows of FDI from trading partners to GDP.	 + + +

Source: adapted from various sources as reviewed previously.

In order to have an insight on variables that influence intra-industry trade, important empirical studies will be reviewed in the following section.

6.3 EMPIRICAL LITERATURE ON THE DETERMINANTS OF INTRA-INDUSTRY TRADE

A number of the empirical studies of determinants of intra-industry trade have focused on manufactured goods in developed countries (Loertscher and Wolter 1980; Caves 1981; Toh 1982; Greenaway and Milner 1984; Balassa 1986a; Balassa and Bauwens 1987; Ratnayake and Athukorala 1992; Greenaway *et al.* 1994; and Leitao and Faustino 2006). Specifically, the determinants of Australia's intra-industry trade were investigated by Menon and Dixon (1994; 1995), Chuankamnerdkarn (1997), Matthews (1998), Menon *et al.* (1999), Sharma (2000; 2002; 2004), and Havrila (2004).

However, some studies recognised the importance of intra-industry trade between developed and developing countries.[100] Differences in characteristics such as differences in income distribution, differences in per capita income, and average market size, as well as factor endowments and levels of technological development are supportive of this situation (Falvey 1981; Havrylyshyn and Civan 1983; Tharakan 1984; Helpman and Krugman 1985; Culem and Lundberg 1986; Flam and Helpman 1987; Falvey and Kierzkowski 1987; Ballance *et al.* 1992; Stone and Lee 1995; Thorpe 1995; Hellvin 1996; Aturupane *et al.* 1997; Clark and Stanley 1999; and Blanes and Martin 2000).

Hellvin (1994), Dias (1998), Hu and Ma (1999), Pombo (2001), Algieri (2004), Thorpe and Zhang (2005), and Zhang and Li (2006) particularly emphasised the study of the

[100] This trade pattern is also called 'the North-South' intra-industry trade.

determinants of intra-industry trade of developing countries with their trading partners. In addition, Hartman *et al.* (1993), Pieri *et al.* (1997), Sharma (2002), and Ferto (2005) noted the importance of studying intra-industry trade determinants on agricultural sectors, instead of manufactured products. Due to the growing significance of trade in services, Lee and Lloyd (2002), Li *et al.* (2003) and Sichei (2005) investigated the determinants of intra-industry trade in services.

Greenaway and Milner (1984) examined the determinants of intra-industry trade in the U.K. manufacturing industries in 1977 with various explanatory variables based on three aspects, namely, aggregation effects, the exchange of differentiated goods, and firms' market power estimated by the Ordinary Least Squares (OLS) procedure. The overall results showed that values of R-square and F-statistics were higher when the unadjusted G-L index was the dependent variable. Product heterogeneity and the ratio of advertising to sales as proxies for product differentiation by attributes were consistent with the theory (positive signs and significant), except for an insignificant estimate shown in the log-linear model of adjusted index. The concentration ratio was negative and significant in the linear OLS estimation model only. The overlapping tastes variable was positive and significant only for the unadjusted G-L index. In conclusion, Greenaway and Milner claimed the importance of horizontal product differentiation and market structure on the extent of intra-industry trade in the U.K. manufacturing industries.

Balassa and Bauwens (1987) analysed bilateral trade flows of manufactured products among thirty eight exporting countries.[101] They tested fifteen hypothesis statements specified in terms of both country-specific and industry-specific characteristics. They used the adjusted G-L index in the logistic transformation estimated by the non-linear least squares procedure. They found that the extent of intra-industry trade was positively correlated with average income levels, average country size, trade orientation, and sharing national borders, while negatively correlated with differences in income and country size, and the distance between countries. They also found a positive relationship for the adjusted G-L index between members of RTAs.[102] In addition, they showed from their results that product differentiation, marketing costs, and the variability of profit rates could encourage intra-industry trade. Conversely, the EOS, seller concentration, FDI and tariff differences were negatively related to the levels of intra-industry trade. All coefficients of the variables were highly significant statistics, except for the income inequality variable in trade among developed countries and among developing countries. Finally, they concluded that a relatively similar economic structure, especially between developed countries, had driven the levels of intra-industry trade.

Chuankamnerdkarn (1997) examined both country-specific and industry specific determinants of Australia's intra-industry trade in pharmaceuticals with the rest of the world and investigated only country-specific determinants of Australia's bilateral intra-

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[101] 18 developed countries and 20 developing countries.

[102] RTAs in this study comprise of the European Common Market, the European Free Trade Association, and the Latin American Free Trade Association.

industry trade in pharmaceuticals with its major trading partners[103] for the period 1975-1992. He used the standard G-L index in the logistic transformation with the log-linear form for the model of Australia's intra-industry trade with the rest of the world and the log-log form for the model of Australia's bilateral intra-industry trade. These results were interpreted as showing that economies of scale, market structure, and the degree of the economic development had a significantly positive influence, while trade barriers had a significantly negative influence on Australia's intra-industry trade in pharmaceuticals with the rest of the world. For the model of Australia's bilateral intra-industry trade, the average GNP and a common language showed a positive and significant impact, while the difference in GNP and distance showed a negative and significant impact.

Matthews (1998) analysed country-specific determinants of intra-industry trade in manufacturing industries between Australia and its fourteen trading partners[104] for the period 1978-1992. Matthews used the unadjusted G-L index in the Logit transformation as a dependent variable and classified five determinants[105] estimated by the Weighted Least Squares (WLS) method. The results were reasonably supportive of the theory (most of the coefficients showed expected signs) and high adjusted R-squared values. An expected positive relationship was found with the average per capita incomes, while relative differences in per capita income, distance, and trade imbalance were negatively related to intra-industry trade. On contrary, the average

[103] France, Germany, the Netherlands, the U.K., the U.S., Canada, New Zealand, Japan, Italy, Belgium, Switzerland, Korea, the Philippines, and Thailand.

[104] Australia's trading partners in this study were divided into two groups, namely traditional partners group (Japan, the U.S., Canada, New Zealand, and the U.K.) and the Asian Pacific group (China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand).

[105] Five determinants are classified as the demand for differentiated products; taste or cultural similarity; economies of scale; geographical distance; and trade barriers.

economic size and trade orientation variables showed negative signs for the Asia-Pacific countries, but positive signs for the traditional trading group. Matthews also concluded that economies of scale might not be an essential influence on Australia's intra-industry trade. A reduction of trade barriers, as the evidence of trade orientation, would lead to higher levels of intra-industry trade between Australia and its traditional trading partners. On contrary, a reduction of trade barriers it might not encourage an intensity of intra-industry trade between Australia and the Asia-Pacific countries due to a high adjustment cost of factors of production for Australia.

Hellvin (1996) hypothesised that China produces labour-intensive goods and exports lower quality products to the OECD countries in exchange for capital-intensive goods and higher quality varieties. He used the unadjusted G-L index as the dependent variable in the Logit transformation method regressed with four explanatory variables[106] tested by the WLS estimation. All explanatory coefficients showed highly statistical significances with the overall explanatory power at fifty four percent. He found that the levels of China's intra-industry trade rose with increases in national market size and per capita income of the higher-income trading partners. For industry variables, the index of quality differences also showed a positive coefficient as expected. The tariffs variable had a negative coefficient suggesting that a reduction in tariffs would significantly encourage intra-industry trade between China and the OECD countries. In conclusion, Hellvin (1996) claimed that the pattern of intra-industry trade between China and the OECD countries is consistent with the theory of the North-

[106] They are two variables from country-specific and two variables from industry-specific determinants.

South intra-industry trade[107] that views intra-industry trade between developed and developing countries as a consequence of vertical product differentiation based on quality differences rather than horizontal product differentiation.

Thorpe and Zhang (2005) investigated bilateral intra-industry trade patterns among ten East Asian countries from a pooled panel of data of twenty four industries at the three-digit level of ISIC for the period 1970-1996 as there were significant impacts of trade liberalisation and trade expansion within the region. Using the unadjusted G-L index, they applied a linear model using the OLS estimation regressed on nine independent variables. The overall results were consistent with the intra-industry trade theory since most coefficients of the explanatory variables, except trade orientation and trade imbalance, obtained expected signs and were statistically significant. They concluded that when the levels of economic development and income of both countries increased, the levels of bilateral intra-industry trade would expand significantly. In contrast, the intensity of bilateral intra-industry trade would be lower when there were larger differences in economic size and income. Transportation costs would also weaken the levels of intra-industry trade. A depreciation of home currency and economies of scale would also encourage the levels of intra-industry trade.

Pieri *et al.* (1997) claimed that most studies of determinants on intra-industry trade overlooked agricultural industries. Therefore, they examined bilateral intra-industry trade in dairy products of ten countries in the EU during 1988-1992, using both

[107] As suggested by Falvey (1981), Helpman and Krugman (1985), Flam and Helpman (1987), and Falvey and Kierzkowski (1987) that the North (developed countries) could gain a comparative advantage in capital-intensive goods, and would produce and export high quality products, while the South (developing countries) could specialise in the production of labour intensive goods, and would produce and export lower quality products.

country- and industry-specific factors to investigate the components of these industry trade flows. They measured the logistic and linear functions of the unadjusted G-L index as a dependent variable. The equations were separated into four models, which were models of country-specific factors only and models of both country- and industry-specific factors for both linear and logistic forms estimated by the WLS estimation. Except for the market size variables, all independent variables were statistically significant. The results showed that all the inequality variables[108] were negatively related to the intensity of intra-industry trade in dairy products. On the other hand, positive signs of product differentiation, industry concentration, and economies of scale implied that when larger firms took benefit of the relative cost advantage over smaller firms, it would encourage intra-industry trade in dairy products. In conclusion, they contended that the extent of intra-industry trade of dairy products would be larger if the countries shared more economic similarities.

6.4 MODEL SPECIFICATION FOR AUSTRALIA'S INTRA-INDUSTRY TRADE IN WINES

In this section, the determinants of Australia's intra-industry trade in wines are discussed through the estimation of two separate models, namely Australia's intra-industry trade in wines with the rest of the world, and Australia's bilateral intra-industry trade in wines with its major trading partners.

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[108] They are differences in incomes, trade imbalance, differences between average export unit values, and differences in per capita raw materials availability.

Some empirical studies[109] have been conducted by using either the country-specific characteristics or the industry-specific characteristics of intra-industry trade. Hu and Ma (1999) recommended using country-specific variables as determinants for a country's intra-industry trade with the rest of the world, but using industry-specific variables as determinants for a country's bilateral intra-industry trade. Nevertheless, a significant number of empirical studies[110] have analysed both industry- and country-specific determinants simultaneously. Therefore, this study also tests both country-specific and industry-specific characteristics simultaneously as explanatory variables in the regression models of determinants of intra-industry trade in wines.

A number of empirical works[111] have proved the reliability and validity of the unadjusted G-L index of intra-industry trade used as the dependent variable. The unadjusted G-L index was also used in several empirical studies[112] in their estimations of intra-industry trade and its determinants. In addition, Pieri *et al.* (1997) contended that the unadjusted G-L index is more suitable for a study of single industry. Therefore, this study also uses the unadjusted G-L index as the dependent variable in the regression models of determinants of the intra-industry trade in wines.

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[109] For example, see Greenaway and Milner (1984), Globerman and Dean (1990), Matthews (1995), Stone and Lee (1995), Ferto (2005), and Zhang and Li (2006).
[110] See, for instance, Pagoulatos and Sorensen (1975), Caves (1981), Toh (1982), Greenaway and Milner (1984), Balassa (1986a), Balassa and Bauwens (1987), Ratnayake and Athukorala (1992), Clark (1993), Hartman *et al.* (1993), Hughes (1993), Hellvin (1994), Narayan and Dardis (1994), Somma (1994), Thorpe (1995), Hellvin (1996), Aturupane *et al.* (1997), Pieri *et al.* (1997), Clark and Stanley (1999), Hu and Ma (1999), Blanes and Martin (2000), Sharma (2000), Pombo (2001), Li *et al.* (2003), and Thorpe and Zhang (2005).
[111] For example, see Greenaway and Milner (1981), Tharakan (1983), Bano and Lane (1987), Vona (1991), Ratnayake and Jayasuriya (1991), Ballance *et al.* (1992), and Clark (1993).
[112] For example, see Toh (1982), Greenaway and Milner (1984), Hartman *et al.* (1993), Greenaway *et al.* (1994), Stone and Lee (1995), Hellvin (1996), Pieri *et al.* (1997), Matthews (1998), Clark and Stanley (1999), Sharma (2000; 2002; 2004) Li *et al.* (2003), Turkcan (2003), Carreras-Marin (2005), Ferto (2005), Thorpe and Zhang (2005), and Leitao and Faustino (2006).

6.4.1 AUSTRALIA'S INTRA-INDUSTRY TRADE IN WINES WITH THE REST OF THE WORLD

According to the previous reviews of measures and empirical studies of determinants of intra-industry trade, the empirical model of Australia's intra-industry trade in wines with the rest of the world is specified as:

$$IIT_{ar} = f(PD_{ar}, EOS_{ar}, NOW_{ar}, OPN_{ar}, XRI_{ar}, KL_{ar}, TIMB_{ar})_t \quad (6.4)$$

where, IIT_{ar} is the standard G-L index of intra-industry trade between Australia and the rest of the world; PD_{ar} is the product differentiation in wines (proxied by unit value of exports); EOS_{ar} is the economies of scale (proxied by the ratio of value added to wine producers); NOW_{ar} is the number of wine producers (as a proxy for the industry's establishments); OPN is the trade openness (measured by the ratio of Australia's commodity trade to its GDP); XRI_{ar} is the exchange rate index (measured by the average index in terms of Australian dollar against US dollar, British pound, New Zealand dollar, and Japanese Yen); KL_{ar} is the ratio of capital to labour (measured by the ratio of gross fixed capital formation to the number of employees in agriculture); TMB_{ar} is the trade imbalance (measured by the proportion of Australia's absolute values of exports minus imports divided by its exports plus imports); and t is time period.

According to Table 6.1, the expected signs of the coefficients in function 6.4 are presented as follows:

$$IIT_{ar} = \alpha_0 + \alpha_1 PD_{ar} + \alpha_2 EOS_{ar} + \alpha_3 NOW_{ar} + \alpha_4 OPN_{ar} + \alpha_5 XRI_{ar}$$

(+) (+) (+) (+) (+)

$$+ \alpha_6 KL_{ar} + \alpha_7 TIMB_{ar} + \varepsilon_t$$

(+) (-) (6.5)

6.4.2 AUSTRALIA'S BILATERAL INTRA-INDUSTRY TRADE IN WINES WITH TRADING PARTNERS

According to the previous reviews of measures and empirical studies of determinants of intra-industry trade, the empirical model of bilateral intra-industry trade in wines between Australia and its major trading partners is modelled by the following function:

$$IIT_{aj} = f\begin{pmatrix} API_{aj}, DPI_{aj}, ARI_{aj}, DRI_{aj}, KL_{aj}, TIN_{aj}, DIS_{aj}, OPN_{aj}, AUV_{aj}, DUV_{aj}, \\ FDI_{aj}, LNG_{aj}, TRA_{aj} \end{pmatrix}_t \tag{6.6}$$

where, IIT_{aj} is the G-L bilateral intra-industry trade index between Australia and trading partner j; API_{aj} is the average per capita income of Australia and trading partner j (measured by average GNI per capita); DPI_{aj} is the absolute difference in per capita income of Australia and trading partner j (measured by the absolute difference between Australia's GNI per capita and its trading partners' GNI per capita); ARI_{aj} is the average national real income of Australia and trading partner j (measured by average GNI deflated by CPI); DRI_{aj} is the absolute difference in national real income of Australia and trading partner j (measured by difference in average real GNI); KL_{aj} is the average index of capital-labour ratio between Australia and trading partner *j*; TIN_{aj} is the trade intensity of Australia and trading partner *j* (measured by ratio of bilateral wine trade to total industry trade); DIS_{aj} is the distance in kilometres between Australia and trading partner *j*; OPN_{aj} is the trade openness (measured by ratio of country wine trade to world wine trade as a proxy for trade barriers between Australia and trading partner *j*); AUV_{aj} is the average export unit value of wines (as a proxy for product differentiation between Australia and trading partner *j*); DUV_{aj} is the absolute difference in unit value of wine exports (as a proxy for product differentiation between Australia and trading partner *j*); FDI_{aj} is the average net direct investment between Australia and trading partner *j*; LNG_{aj} is a dummy variable for an English-speaking country (as a proxy for a common culture between Australia and trading partner *j*); TRA_{aj} is the membership in trade agreement between Australia and trading partner *j*; and *t* is time period.

According to Table 6.1, expected signs of the coefficients in function 6.6 are:

$$IIT_{aj} = \underset{}{\beta_0} + \underset{(+)}{\beta_1 API_{aj}} + \underset{(-)}{\beta_2 DPI_{aj}} + \underset{(+)}{\beta_3 ARI_{aj}} + \underset{(-)}{\beta_4 DRI_{aj}} + \underset{(+)}{\beta_5 KL_{aj}} + \underset{(+)}{\beta_6 TIN_{aj}} + \underset{(-)}{\beta_7 DIS_{aj}}$$

$$+ \underset{(+)}{\beta_8 OPN_{aj}} + \underset{(+)}{\beta_9 AUV_{aj}} + \underset{(-)}{\beta_{10} DUV} + \underset{(+)}{\beta_{11} FDI_{aj}} + \underset{(+)}{\beta_{12} LNG_{aj}} + \underset{(+)}{\beta_{13} TRA_{aj}} + \varepsilon_t \qquad (6.7)$$

6.5 DATA DESCRIPTIONS AND SOURCES

The data for the analysis in this chapter were obtained from various sources. Annual time-series data on wine exports and imports were gathered from the UN Commodity Trade Statistics (Comtrade) database at a four-digit level of SITC (SITC1121 rev.1) for the period 1980-2004. Most of the data for independent variables were obtained from the World Bank, World Tables, available in the dXEconData. The data series used in the analysis are presented in Appendix 6.1 and 6.2. The details of data sources are described in Appendix 6.3.

6.6 ECONOMETRIC ESTIMATION PROCEDURES AND RESULTS

There has been no *a priori* universal standard for the choice of functional form of the relationship between dependent and independent variables in the determinants of intra-industry trade. This study selected either log-linear or log-log functions based on testing the diagnostic statistics. It was concluded that the log-log function is suitable to model Australia's intra-industry trade in wines with the rest of the world, whereas the log-linear is preferable to model Australia's bilateral intra-industry trade in wines with its nine major trading partners.

Given that the G-L index is the dependent variable with results ranging between zero and one, the linear or log-linear forms may give estimated values that lie outside the zero and one range. Maddala (1983) suggested a logistic function (also known as the

Logit method) to rectify this shortcoming since this function guarantees that the predicted values will lie between zero and one. The logistic transformation of the G-L index is also applied in this study and measured as follows:

$$LIIT_{ar,aj} = \ln\left[\frac{IIT_{ar,aj}}{100 - IIT_{ar,aj}}\right] \tag{6.8}$$

Nevertheless, the Logit approach cannot cope with the values of exactly zero and one. Some studies (Loertscher and Wolter 1980; Tharakan 1984; Balassa 1986a; Balassa and Bauwens 1987; and Lee and Lee 1993) used the non-linear OLS method based on the logistic transformation in order to permit the inclusion of zero values. On the other hand, Clark and Stanley (1999) and Sharma (2004) applied a version of the Probit model, known as Tobit censored method. Having investigated the bilateral G-L index between Australia and trading partners, there are some zero values were found for the dependent variable. Thus, following Havrila's study (2004), the model of Australia's bilateral intra-industry trade in wines with its nine major trading partners is estimated by the Pooled OLS method with small values (0.000001) substituted for zero values of the dependent variable. The results are by and large the same as if the model is estimated using the Tobit approach (Havrila 2004).

6.6.1 AUSTRALIA'S INTRA-INDUSTRY TRADE IN WINES WITH THE REST OF THE WORLD

The estimated coefficients of the function of Australia's intra-industry trade in wines with the rest of the world are reported in Table 6.2. Two variables (trade imbalance and number of wine producers) were omitted from the final model and consequently the model is satisfactory in diagnostic tests.

Table 6.2: Intra-Industry Trade in Wines: Australia and the Rest of the World.

Dependent Variable: LIIT (log-log model)
Method: Least Squares
Sample: 1980 2004
Included observations: 25

Variable	Coefficient	Expected Sign	t-Statistic	Prob.
C	-10.73491		-1.121546	0.2760
LPD	-0.839992	+	-2.289625	0.0337**
LEOS	1.652804	+	3.706931	0.0015***
LOPN	-3.364054	+	-2.645038	0.0160**
LXRI	-1.455602	+	-1.928141	0.0689*
LKL	0.076988	+	0.172312	0.8650

R-squared	0.929457
Adjusted R-squared	0.910893
F-statistic	50.06780
Prob(F-statistic)	0.000000
Durbin-Watson stat	1.914278

Jarque-Bera Normality Test: 0.25476 (probability 0.880399)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.893515	Probability	0.180959

White Heteroskedasticity Test:

F-statistic	0.932248	Probability	0.533545

Ramsey RESET Test:

F-statistic	1.309093	Probability	0.295948

Note: *** significant at 1 percent level; ** significant at 5 percent level; * significant at 10 percent level.

Economies of scale variable (LEOS) is considered the key determinant of Australia's intra-industry trade in wines since it is the only single variable that has a predicted positive sign and statistical significance. This result is consistent with the fundamental theory of intra-industry trade. However, product differentiation (LPD) is shown to be negative. One explanation for this unexpected result is that the unit value of exports may be a poor proxy for product differentiation.

Trade openness (LOPN) and exchange rate (LXRI) variables are statistically significant but show opposite to those expected signs. This may be consistent with the results of the analysis of comparative advantage in Chapter 3 leading to the conclusion that a higher degree of trade openness may lead Australia to gain more comparative advantage from inter-industry trade, rather than intra-industry trade. There is no statistical support for the capital-labour ratio (LKL) variable, even though it has an expected positive influence on the intensity of Australia's intra-industry trade in wines with the rest of the world.

6.6.2 AUSTRALIA'S BILATERAL INTRA-INDUSTRY TRADE IN WINES WITH MAJOR TRADING PARTNERS

The regression results for the model of Australia's bilateral intra-industry trade in wines with its nine major trading partners[113] are presented in Table 6.3. In the initial estimation, the serial correlation in the model was detected, and therefore, the model was re-estimated for the first order serial correlation by applying the Cochrane-Orcutt method of correcting the OLS estimation errors. Four variables (average per capita income, average real income, average unit value of exports and average net investment) were omitted from the final model and consequently the model is satisfactory in diagnostic tests.

[113] France, Italy, Spain, Germany, the U.S., South Africa, the U.K., New Zealand, and Japan

Table 6.3: Bilateral Intra-Industry Trade in Wines: Australia and its major trading partners.

Method: Pooled Least Squares
Sample: 1980 2004
Included observations: 25
Number of cross-sections used: 9
Total panel (balanced) observations: 225

Variable	Coefficient	Expected sign	t-Statistic	Prob.
C	-7.446334		-4.703904	0.0000
DPI	-0.000168	-	-2.685242	0.0078***
DRI	-2.19E-07	-	-1.594810	0.1122
KL	0.027861	+	5.257770	0.0000***
TIN	-0.157716	+	-5.929733	0.0000***
DIS	7.51E-05	-	0.669683	0.5038
OPN	0.170809	+	3.713337	0.0003***
DUV	-0.411544	-	-2.121774	0.0350**
LNG	3.273708	+	5.740135	0.0000***
TRA	2.733623	+	1.983392	0.0486**

R-squared	0.370589
Adjusted R-squared	0.344242
F-statistic	14.06548
Prob(F-statistic)	0.000000
Durbin-Watson stat	1.782441

Note: *** significant at 1 percent level; ** significant at 5 percent level.

From Table 6.3, most of the coefficients of the explanatory variables show expected signs, except for distance (DIS) and trade intensity (TIN). Trade openness (OPN) in wines gives rise to the levels of Australia's bilateral intra-industry trade in wines. In general the greater the inequality in national income is the greater the dissimilarity between countries and therefore the lower the magnitude of bilateral intra-industry trade. The differences in both per capita income (DPI) and real income (DRI) show negative influences on Australia's bilateral intra-industry trade in wines, but there is statistical evidence only for differences in per capita income. The positive effect of capital-labour ratio (KL) is statistically significant.

As expected, the coefficient of common language (LNG) is positive and statistically significant, indicating that Australia and other countries using English as a common language are involved in more bilateral intra-industry trade in wines. This result may also imply that intra-industry is higher among countries with a common culture. The coefficient of the TRA is also significant with the positive expected sign indicating the closer economic relations and the greater intensity of bilateral intra-industry trade.

In summary, industry-specific determinants have more impact on Australia's intra-industry trade in wines with the rest of the world, while country-specific determinants play a more important role in Australia's bilateral intra-industry trade in wines with its major trading partners. The model of Australia's intra-industry trade in wines with the rest of the world indicates that the government policy should be oriented towards increases in the production capacity of the Australian wine industry in order to achieve higher economies of scale. The model of Australia's bilateral intra-industry trade in wines with its major trading partners indicates that the Australian government should promote regional economic integration and trade liberalisation involving wine trade between close and economically similar economies.

6.6 CONCLUSION

In this chapter empirical models were developed for estimating the determinants of Australia's intra-industry trade in wines with the rest of the world and Australia's bilateral intra-industry trade in wines with its major trading partners. The results of diagnostic statistics suggest that the log-log form is suitable to model Australia's intra-industry trade with the rest of the world, while the log-linear form is more appropriate to model Australia's bilateral trade in wines.

The results of Australia's intra-industry trade in wines with the rest of the world indicate that scale economies variable is the only determinant that has a significant influence on increasing the levels of intra-industry trade. The ratio of capital to labour has a positive effect on Australia's intra-industry trade, but no statistical support. Therefore, the government policy should be oriented towards increases in the production capacity of the Australian wine industry in order to increase the levels of Australia's intra-industry trade in wines with the rest of the world.

With regard to Australia's bilateral intra-industry trade in wines, the major explanation of the intensity of intra-industry trade is significantly based on a common culture and regional trade arrangements. There is no statistical evidence for geographical distance. The difference in national income may lead to a lower degree of bilateral intra-industry trade. The levels of Australia's bilateral intra-industry trade in wines are higher in situations where Australia is more integrated with the world wine market. Thus, the

Australian government should promote regional economic integration and trade liberalisation involving wine trade between close and economically similar economies.

It can be concluded from the empirical results in this chapter that the intensity of Australia's intra-industry trade in wines with the rest of the world is more influenced by industry-specific determinants. On the other hand, the intensity of Australia's bilateral intra-industry trade in wines is more influenced by country-specific determinants.

In Chapter Seven the conclusions and limitations of this study are presented. Some suggestions for further research will also be provided.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The purpose of this chapter is to provide a synopsis of the analytical findings from the empirical study on the patterns and determinants of Australia's international trade in wines for the period 1980-2004. This chapter is organised as follows: Section 7.2 outlines the structure of the study; Section 7.3 summarises the principle findings and their implications for grape growers, wine makers, wine importers and exporters, and policy makers concerned with international trade in Australia's wines. The limitations of the study are discussed in Section 7.4. Some suggestions for further research are presented in Section 7.5.

7.2 SUMMARY OF THE THESIS DEVELOPMENT

Chapter One was concerned with outlining the context of research, the specification of the research problem, and the objectives and significance of this thesis. The general aim of this study was to focus mainly on two essential concepts of international economics, but having theoretically different fundamentals, known as comparative advantage or inter-industry trade and intra-industry trade.

In Chapter Two, an overview of the world wine market was presented, followed by an investigation of the pattern of the world trade in wines. Next, the Australian wine industry and its international trade patterns in wines were examined. Trends and major policies on the trade of Australia's wines were also discussed.

Chapter Three reviewed the major theories of inter-industry trade based on the concept of comparative advantage. Then, the trade performance of Australia's wines was measured by a set of measures including the trade specialisation index, the export propensity index, the import penetration ratio, and the export/import ratio. Next, an analysis of Australia's comparative and competitive advantage in wines was compared with its major competitors by applying Balassa's index of revealed comparative advantage and Vollrath's indexes of revealed competitiveness.

In Chapter Four the models of Australia's export supply, export demand, and import demand of wines were analysed. The purpose of this chapter was to identify macro-level determinants of supply and demand. The chapter firstly provided a literature review of the determinants of export supply, export demand, and import demand in order to build a conceptual framework. Then, the time-series econometric methodology was reviewed before selecting a suitable estimation procedure and model. The models were estimated econometrically, using the unrestricted error correction model. The short run and long run relationships among quantities of wine exports and imports and elasticities of price and income were identified; other important determinants such as exchange rates were also estimated.

In Chapter Five an examination of the extent of Australia's intra-industry trade in wines and the growth of bilateral intra-industry trade in wines between Australia and its major trading partners, was presented. The chapter provided a review of the fundamental literature and empirical studies on intra-industry trade and appropriate measures of intra-industry trade. Then, Australia's intra-industry trade in wines with the rest of the world was analysed and also the bilateral intra-industry trade between Australia and its major trading partners. The standard Grubel-Lloyd index of intra-industry trade was used, while the concept of marginal intra-industry trade and the Menon-Dixon indexes were applied to examine the growth of Australia's bilateral intra-industry trade over time.

The purpose of Chapter Six was to analyse the determinants of Australia's intra-industry trade in wines. An overview of the theoretical literature and the major results of empirical studies on determinants of intra-industry trade were provided. Then, two separate econometric models were developed, the first of Australia's intra-industry trade in wines with the rest of the world; and the second of Australia's bilateral intra-industry trade in wines with its nine major trading partners.

7.3 CONCLUSIONS AND RECOMMENDATIONS

The Australian wine industry has been very successful in the world wine market, achieving a significant growth in production and export sales since the 1990s. The combination of Australia's factor endowments and its advancement in wine production technology encourage Australia to produce a large amount of high quality wines at relatively low cost. The Australian wine industry has consequently become very competitive in the world wine market. Prior to the 1980s, European countries had dominated the world wine market; however, Europe's dominance had begun to weaken as a result of the challenge from the New World wine producers such as Australia, the U.S., Argentina, South Africa, and Chile. The principal destinations of Australia's wine exports were the U.K., the U.S., New Zealand, Canada and Germany; while, major sources of Australian wine imports in recent years have been France, Italy, New Zealand, and Spain.

The set of measurements of Australia's trade performance in wines indicate that Australia has become a net-exporter and has a specialisation in wine trade reflecting high international trade competitiveness in wines since 1987. The analysis based on Balassa's revealed comparative advantage index and Vollrath's revealed competitive advantage indexes suggests that, among the wine producing countries, Australia has a comparative advantage and competitive advantage in wines. The significant year was 1987, when Australia began to experience a comparative and competitive advantage in wines. The important explanation for this turning point is Australia's trade liberalisation policy commenced in the mid-1980s.

Australia's export price relative to domestic price has had a positive impact on the supply of Australia's wine exports. However, Australia's supply of wine exports appears to respond slowly to changes in the relative price of exports as a result of low and less than one value of the long run price elasticity (0.386). An increase in the long run production capacity in terms of infrastructure and technological development leads to a significant increase in Australia's export supply of wines. Although trade liberalisation has had a positive impact on wine export supply, it is not statistically significant.

The international demand for Australia's wine exports shows a greater response to the relative price and the depreciation of the Australian dollar. This indicates that an appreciation of foreign currencies and/or a decrease in the relative price will result in an increase of foreign demand for Australia's wines. On the other hand, Australia's demand for wine imports is responsive to Australia's income, but not to the price of wine imports relative to the domestic price of wines. The long run price elasticity of import demand is -0.825 indicating that import demand for wines by Australia is inelastic with respect to the relative price. However, the long run income elasticity of import demand by Australia is relatively higher (1.518) indicating that wines are considered as luxury goods in the Australian market.

Results of the analysis of Australia's intra-industry trade in wines based on the Grubel-Lloyd index reveal that the world wine industry is more likely to be characterised by inter-industry trade, which is based on the significance of comparative advantage and factor endowments, rather than intra-industry trade. Australia has a relatively small extent of intra-industry trade in wines. This is due to the value of Australia's export of wines being very much higher than those of its import. In addition, most of the major wine-producing countries have low levels of intra-industry trade. The extent of bilateral intra-industry trade in wines between Australia and its major trading partners is also small. However, the levels of bilateral intra-industry trade in wines between

Australia and New Zealand are relatively high. The concept of marginal intra-industry trade also confirms that additional levels of intra-industry trade or proportional changes in trade patterns of Australia's and other major trading partners' wines are more associated with inter-industry trade, rather than with intra-industry trade patterns over the last two decades. The Menon-Dixon indexes reveal that the growth in intra-industry trade between Australia and other major wine-producing countries is due to the contributions of export growth to the growth in intra-industry trade, which implies that Australia is a net importer of wines from these countries. On the other hand, the percentage growth in intra-industry trade between Australia and Germany, the U.S., the U.K., New Zealand, Canada, and Japan is due to the contributions of import growth to the growth in intra-industry trade, which implies that Australia is a net exporter of wines to these countries.

Australia's intra-industry trade in wines with the rest of the world is significantly influenced by economies of scale. With regard to Australia's bilateral intra-industry trade in wines, the major explanation of the intensity of bilateral intra-industry trade is significantly based on a common culture and regional trade arrangements. Differences in national income may lead to lower degree of bilateral intra-industry trade. The levels of Australia's bilateral intra-industry trade in wines would be higher if Australia were more integrated in the world wine market.

The policy implications of this analysis of Australia's intra-industry trade in wines are that the government policy should be oriented towards increases in the production capacity of the Australian wine industry in order to achieve higher economies of scale.

In addition, the Australian government should promote regional economic integration and trade liberalisation involving wine trade between close and economically similar economies.

7.4 LIMITATIONS OF THE STUDY

The most important limitation of this thesis is the availability of data used in the analysis. The initial intention was to investigate a considerable number of countries involved in the world wine trade; however, some constraints arose in the data collection. Since the analysis is based on secondary data and information regarding wine exports and imports in terms of both values and volumes, and the world-wide sources such as the UN, the WTO, and the FAO could not provide a comprehensive full set of required cross-sectional data. The data collection was done in 2007 and the latest time frame provided by the above sources is up to only 2005. Moreover, specific data on the wine industry only such as numbers of labour in wine manufacturing is also limited.

Another limitation is due to the availability of time-series data. The study found difficulties in investigating more time frames, even within the period studied as some variables were not available for all countries in the analysis. A number of explanatory variables such as the trade imbalance, the number of wine producers, the average per capita income, the average real income, the average unit value of exports, and the average net investment, which are theoretically important as determinants of

Australia’s wine exports and imports, were omitted from the analysis mainly due to the unavailability of data and insignificant statistical results.

Unit roots in time series have low power when testing stationarity, especially when the sample is small. This error is higher when more independent variables and cointegration tests are used. Theoretically, econometric procedures require a sufficiently large sample in order to produce a better statistical result. The author acknowledges that the sample in this thesis is relatively small and it may lessen the robustness of the econometric tests in Chapters Four and Six. One way to eliminate possible adverse effects for small sample biases would be to resort some form of iterative weighted least squares or bootstrapping procedure and compare these results to the non-weighted regression. This may be a useful method in subsequent research.

7.5 SUGGESTIONS FOR FURTHER RESEARCH

An insight to the determinants of export and import patterns in regard to supply and demand conditions is important information for making appropriate policies, strategies, and production decisions. The results suggest that Australia’s export supply of wines is not very responsive to changes in the relative price in the long run. The study suggests that future increases in wine export supplied should rely on domestic supply shifts which may be achieved by the implementation of appropriate domestic industry policies such as R&D or subsidies for small wine producers. A further investigation should be conducted on the factors influencing low price responsiveness of export supply. In the environment of relatively high income elasticity of import demand and the fact that wines are considered as luxury goods, the study strongly recommends that Australian wine producers should be concerned about their costs of production, production capacities, and unique selling points in order to become more competitive in the world wine market. Since the Australian dollar appreciated in relation to foreign currencies during 2005-2008, the export demand model should be re-estimated.

Our dependent variable, which is the G-L index, groups together both horizontal and vertical intra-industry trade. In fact, the determinants of these two different types of intra-industry trade may be different. A future study may focus on a more disaggregate category in the SITC levels of wine section in order to reveal more patterns of intra-industry trade in wines since in this thesis it is shown that at the four-digit level of SITC showed a low intensity in Australia's intra-industry trade. Yet, the contribution of this result may be further improved if an analysis of the patterns and trends of intra-industry trade focuses on a more detailed classification of the wine categories. Moreover, instead of analysing intra-industry trade in wines for each individual country, it is also better to divide such Table 5.1 and 5.2 to regions or groups, for example, the Old World wine producers, the New World wine producers, and the world wine importers.

The findings from the examination of the effect of trade liberalisation in the context of comparative and competitive advantage of Australia's wines confirms that free trade or low trade barriers will result in more competitive world markets. Thus, trade policies should promote a freely competitive environment.

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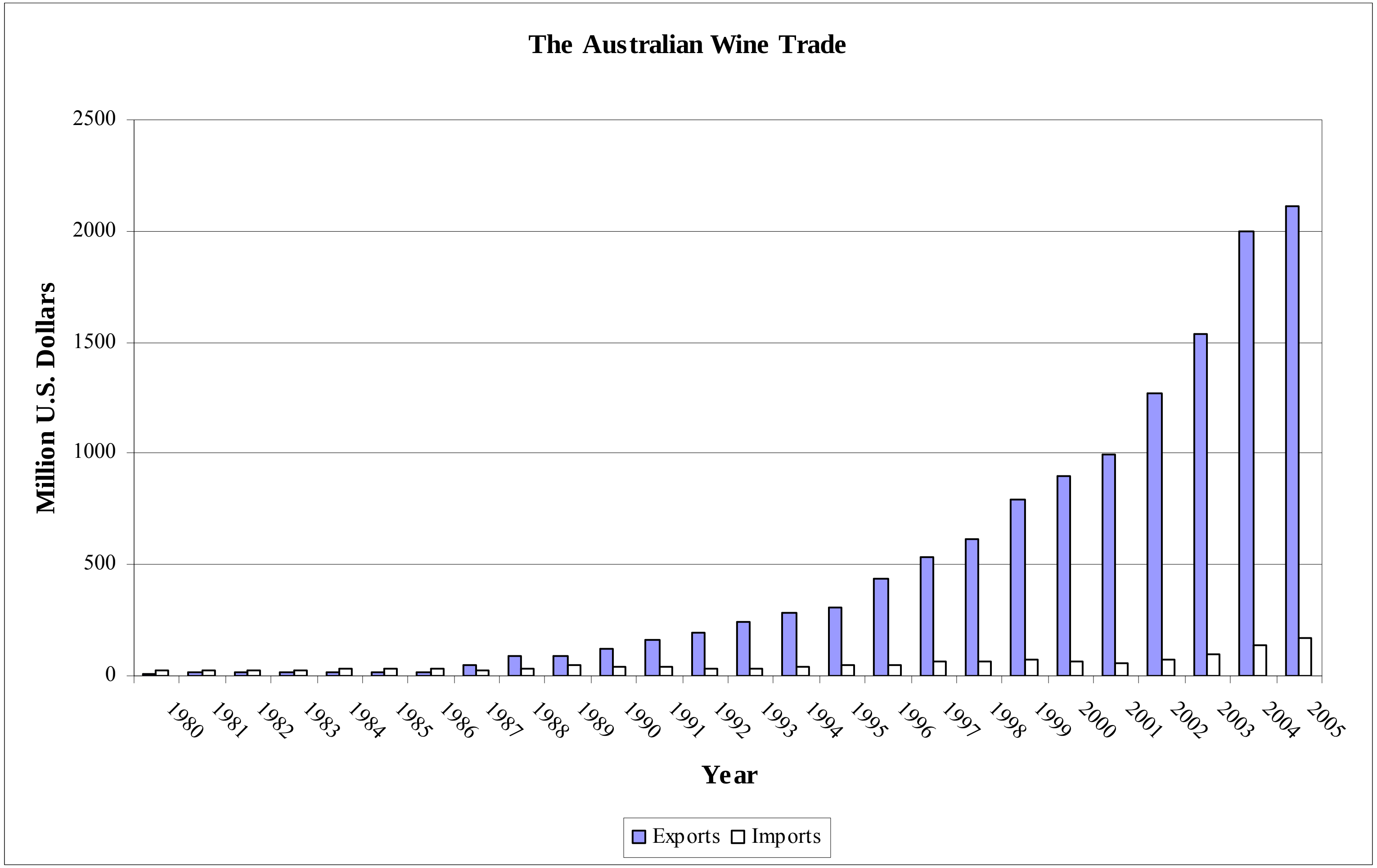
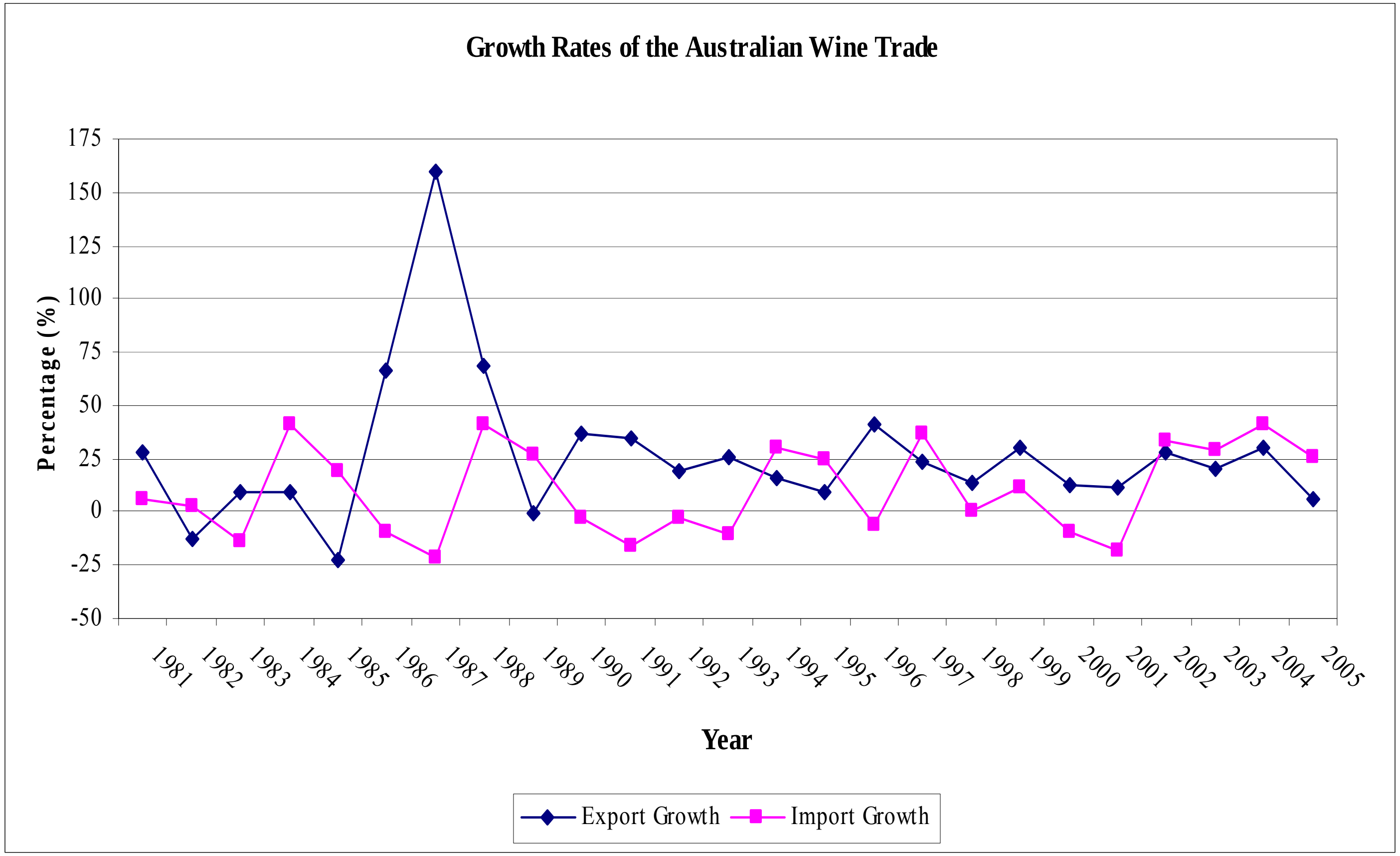
APPENDICES

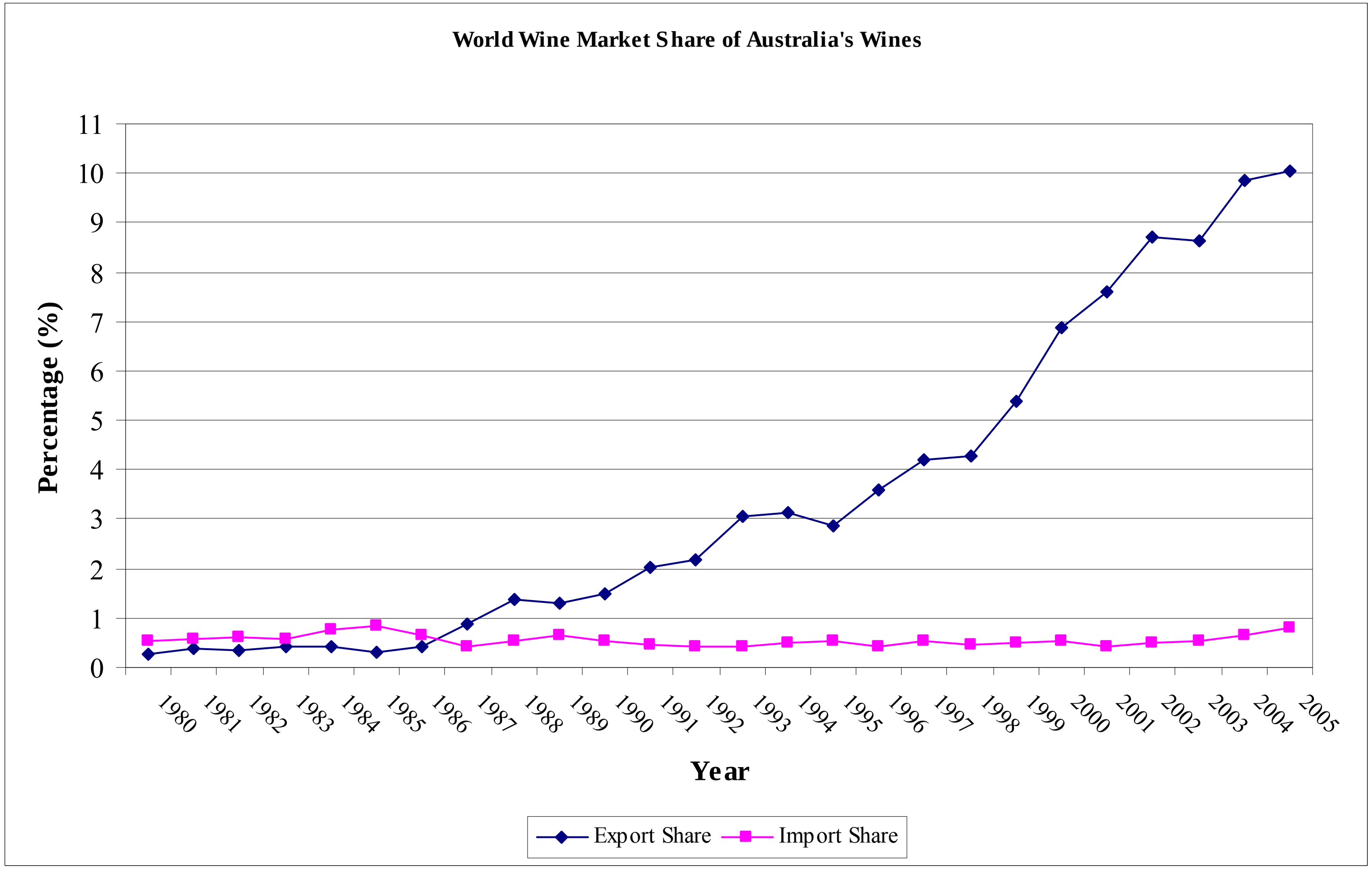
Appendix 2.1: The Australian Wine Trade Growth, 1980-2005.



Appendix 2.2: The Growth Rates of the Australian Wine Trade, 1980-2005.



Appendix 2.3: The World Wine Market Share of Australia's Wines, 1980-2005.



Appendix 3.1: Data Series used in the Analysis of Comparative and Competitive Advantage

Appendix 3.1.1: Wine Exports (Xw) and Wine Imports (Mw) for Australia and Major Wine Trading Countries (in U.S. $ million)

Year	Australia		France		Italy		Spain		Germany		Portugal		Greece	
	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw
1980	11,784,222	22,715,492	1,775,398,784	332,228,896	918,887,360	90,868,792	404,129,440	3,081,363	344,601,984	761,216,000	240,453,152	208,160	17,770,494	755,740
1981	15,037,130	23,954,540	1,647,120,256	289,430,528	899,308,288	73,971,072	332,296,736	3,788,159	344,923,008	693,272,000	206,914,608	315,727	17,728,644	783,565
1982	13,114,945	24,659,544	1,541,584,384	275,490,816	946,088,640	52,373,692	326,314,720	3,459,110	353,495,008	651,374,976	192,862,384	313,933	18,381,828	755,822
1983	14,317,074	21,239,328	1,552,215,680	218,816,928	784,744,256	41,937,964	303,422,848	4,458,912	342,643,008	618,251,008	176,213,488	159,177	18,351,300	1,013,706
1984	15,701,363	30,039,900	1,683,074,432	207,553,648	803,180,864	44,746,056	296,034,080	3,043,412	347,520,000	546,083,968	174,368,096	197,858	19,434,944	950,277
1985	12,183,266	35,884,108	1,941,297,664	244,463,056	879,668,416	75,634,200	332,657,024	3,370,301	362,168,992	597,926,976	181,516,256	146,389	34,100,400	1,000,342
1986	20,213,036	32,382,996	2,681,957,376	236,396,960	848,116,480	102,580,408	421,346,432	9,472,354	405,480,000	802,014,016	249,398,256	875,215	42,652,732	1,067,204
1987	52,520,776	25,415,422	3,221,885,696	279,635,648	1,006,138,944	135,066,176	501,322,496	19,087,564	410,787,008	1,016,691,008	311,007,744	1,869,357	50,707,540	2,578,525
1988	88,761,818	35,786,547	3,504,773,888	345,846,144	1,140,076,928	150,315,232	544,016,576	24,312,120	430,390,016	1,146,091,008	358,273,376	2,737,184	30,787,846	3,531,482
1989	88,447,949	45,376,646	3,611,956,224	354,032,480	1,255,344,384	183,040,976	544,704,960	26,173,876	437,443,008	1,118,518,016	352,875,264	78,450,088	60,816,028	7,198,263
1990	120,704,982	44,190,128	4,281,094,400	400,967,008	1,561,936,384	222,272,320	608,839,522	32,666,048	500,736,992	1,501,101,952	420,514,816	14,872,862	67,278,112	12,318,864
1991	161,909,048	37,133,520	4,120,821,504	427,122,464	1,574,267,136	232,148,880	728,592,256	33,081,052	442,040,000	1,682,375,040	425,324,352	9,218,157	53,772,328	16,446,782
1992	193,514,704	36,220,817	4,264,967,424	454,761,920	1,610,868,352	217,780,592	888,652,608	40,105,832	526,952,992	1,725,512,960	508,384,160	11,776,562	78,073,232	13,495,823
1993	243,067,075	32,350,331	3,646,926,848	362,294,432	1,477,491,584	128,049,600	796,135,680	35,618,240	422,128,992	1,344,348,032	431,144,736	19,963,340	60,909,200	14,364,721
1994	281,010,532	42,029,748	3,973,928,192	437,595,136	1,808,550,400	134,836,224	849,845,376	53,879,940	496,703,008	1,447,021,952	446,948,192	69,093,968	62,178,804	12,896,136
1995	307,303,297	52,440,765	4,606,603,776	537,634,240	2,178,453,248	163,960,912	992,457,600	139,340,656	531,356,992	1,726,722,944	496,007,424	74,029,032	80,576,928	14,891,978
1996	433,007,243	49,246,717	4,814,782,976	527,672,352	2,372,325,888	157,218,832	1,164,160,640	80,096,312	526,417,664	1,941,475,328	539,343,296	52,042,124	78,074,160	16,388,713
1997	536,089,268	67,296,401	5,211,230,208	545,059,200	2,270,041,088	174,933,888	1,256,147,200	45,888,972	459,812,640	1,876,387,200	523,082,880	47,171,064	74,282,912	15,027,979
1998	611,007,900	67,795,025	5,936,182,784	552,661,248	2,537,829,632	203,587,504	1,373,827,200	94,733,184	466,976,000	2,102,397,952	528,974,944	103,856,824	79,763,384	16,300,740
1999	794,357,036	75,257,949	6,126,334,976	559,486,720	2,680,984,891	215,528,419	1,459,570,609	114,700,133	460,351,520	2,125,381,248	526,510,040	159,343,989	74,638,862	22,348,429
2000	898,158,552	68,490,101	5,048,526,051	455,783,743	2,394,550,784	190,734,736	1,163,766,528	78,384,368	361,401,000	1,689,163,000	468,727,584	116,537,952	59,860,576	17,892,816
2001	997,428,043	55,836,564	4,815,107,584	455,323,328	2,466,052,608	164,674,896	1,268,515,968	64,040,824	383,314,000	1,775,660,000	433,954,354	87,560,987	52,405,856	23,923,074
2002	1,274,231,680	74,411,248	5,422,410,240	469,899,232	2,798,539,520	205,561,376	1,322,867,968	75,912,200	437,509,000	1,823,871,000	480,058,746	81,414,317	49,903,720	47,371,568
2003	1,538,974,976	95,940,464	6,634,094,592	560,868,288	3,255,717,733	273,312,001	1,705,697,894	103,688,499	564,799,000	2,081,067,000	602,999,052	97,931,994	75,203,800	31,260,724
2004	1,998,372,050	135,444,412	6,953,646,147	654,920,384	3,794,246,278	320,070,488	1,954,695,857	130,455,582	621,406,000	2,325,331,000	662,819,719	112,038,675	79,239,647	36,591,247
2005	2,110,600,714	169,960,968	6,992,388,920	649,921,100	3,973,055,679	352,852,714	1,977,863,458	148,088,642	719,131,000	2,424,590,000	657,312,417	100,829,515	72,244,062	35,580,018

Year	U.S.		Argentina		South Africa		Chile		U.K.		N.Z.		Canada	
	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw
1980	29,816,716	785,206,976	11,139,550	6,276,724	11,831,842	2,723,169	20,714,848	1,691,522	57,205,192	661,240,704	1,219,903	7,280,352	887,628	134,379,840
1981	41,796,852	852,714,240	11,220,571	1,768,831	9,106,433	4,313,718	15,874,812	3,338,095	52,045,252	638,307,584	1,003,853	9,729,390	970,430	138,800,352
1982	38,362,340	879,652,992	10,944,944	497,930	9,071,389	4,045,886	11,210,901	228,136	50,954,456	576,124,480	977,187	9,844,034	975,157	152,419,712
1983	32,250,800	954,587,776	7,495,067	n.a.	9,235,135	4,450,994	9,503,521	100,236	50,403,724	595,261,312	1,029,668	8,991,140	1,279,173	131,600,544
1984	26,493,276	1,085,928,448	8,024,824	n.a.	6,939,131	5,663,341	10,204,242	167,943	51,516,040	625,418,880	1,967,155	14,378,978	715,999	172,916,496
1985	26,680,436	1,146,307,200	6,006,975	7,967	5,727,000	2,649,000	10,978,885	115,178	53,576,204	738,387,968	1,931,883	9,820,273	1,145,623	151,909,344
1986	35,744,120	1,119,662,464	6,747,180	n.a.	7,973,000	2,665,000	13,267,762	180,071	44,374,800	1,005,400,768	2,161,297	15,912,879	1,869,979	188,045,792
1987	60,518,544	1,069,187,776	9,363,555	27,462	9,703,000	2,952,000	17,933,768	232,763	49,252,628	1,199,872,896	4,578,167	14,739,135	1,611,245	212,432,560
1988	84,538,832	1,046,818,496	12,849,459	18,969	11,893,000	3,097,000	23,062,280	206,900	52,900,739	1,405,893,380	8,524,040	23,664,566	1,995,920	215,400,714
1989	102,861,382	1,029,689,163	17,125,204	245,318	13,965,000	3,268,000	35,667,712	264,742	55,345,216	1,395,240,320	9,896,827	28,919,382	877,263	286,542,108
1990	130,479,566	1,011,564,640	23,071,674	537,755	9,530,490	2,982,720	51,612,920	269,128	71,422,624	1,770,979,584	13,326,880	34,753,895	1,407,260	305,682,968
1991	146,210,023	1,005,491,487	22,548,437	3,237,995	19,213,390	2,966,690	84,367,056	438,219	60,395,384	1,654,220,032	15,134,831	28,388,314	2,618,763	291,204,793
1992	171,070,827	1,182,941,492	33,553,224	6,846,807	42,575,348	3,010,848	119,297,408	810,833	65,928,688	1,756,441,984	25,602,477	28,088,390	1,541,596	303,784,510
1993	170,702,200	1,057,714,008	32,758,334	15,037,785	45,554,376	3,214,259	128,580,072	660,110	54,356,888	1,535,007,104	24,842,803	37,005,727	1,862,340	292,203,763
1994	182,348,759	1,142,709,278	35,255,008	20,225,174	69,384,960	4,103,470	143,687,504	633,042	61,569,828	1,773,383,936	26,332,726	47,594,569	1,687,510	313,382,524
1995	226,340,960	1,273,208,704	78,597,048	12,753,880	186,442,304	4,855,477	182,432,448	607,291	91,720,968	1,969,965,440	32,044,315	45,013,112	3,665,348	332,819,537
1996	308,735,751	1,554,527,372	83,732,752	12,607,311	185,002,688	13,451,705	294,372,032	1,044,430	141,907,280	2,296,128,000	45,076,471	51,865,308	3,704,978	385,312,095
1997	399,399,465	1,850,241,941	132,004,176	19,733,038	189,438,784	14,615,010	427,929,984	8,139,524	221,983,568	2,659,145,984	58,948,840	56,618,008	7,779,553	420,390,504
1998	515,514,252	1,995,120,217	167,341,488	29,189,904	183,895,744	7,534,849	539,752,896	7,861,946	180,082,672	2,919,263,744	63,105,528	54,871,064	5,131,573	493,477,072
1999	523,153,973	2,326,640,262	145,774,453	29,570,879	201,209,104	13,748,625	547,615,040	5,403,856	185,323,681	3,031,980,003	77,333,675	69,434,268	5,892,772	563,114,752
2000	537,982,238	2,363,887,269	159,636,721	17,066,659	243,218,337	7,658,327	585,036,736	4,529,041	177,742,265	2,568,495,079	89,509,469	60,530,723	7,431,163	588,121,799
2001	521,672,328	2,378,453,729	155,495,416	13,014,302	230,426,224	5,404,030	652,264,768	1,803,475	170,249,272	2,663,982,935	97,229,049	62,197,565	8,443,337	590,471,409
2002	531,707,685	2,826,724,706	131,585,200	1,834,136	286,139,840	8,096,579	610,017,216	1,379,631	202,860,992	3,014,276,096	127,085,200	74,286,144	9,424,218	621,732,347
2003	617,486,623	3,434,533,731	174,010,873	1,217,185	478,984,640	12,354,105	669,906,304	870,292	232,143,595	3,586,996,705	157,693,936	96,382,151	10,751,359	830,225,037
2004	754,448,756	3,603,309,632	227,359,619	1,503,190	535,631,753	9,466,795	845,208,360	1,448,263	218,275,650	4,298,011,308	244,868,999	103,693,627	14,905,494	918,402,657
2005	627,208,031	3,970,243,190	308,816,158	2,379,225	595,853,698	13,793,608	884,660,927	3,803,561	230,354,557	4,277,893,171	332,390,969	108,796,759	18,494,691	1,052,872,839

Source: UN Commodity Trade Statistics Database (COMTRADE) avaliable at http://comtrade.un.org

where, Xw = Wine Exports and Mx = Wine Imports, n.a. is no data available from the UN and FAO.

Note: Exports and imports of South Africa's wines during 1985-1991 were obtained from the FAO, available at http://fao.stat.fao.org

Appendix 3.1.2: Total Exports of All Commodities by Country (in U.S. $ million)

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**
1980	21,984,814,082	110,865,424,384	77,640,409,088	20,826,669,056	192,218,349,568	4,628,968,448	5,141,659,648
1981	22,239,095,351	101,246,222,336	75,246,288,896	20,336,523,264	175,781,396,480	4,179,962,880	4,249,456,384
1982	21,415,356,948	92,358,033,408	73,437,577,216	20,271,353,856	176,245,817,344	4,170,936,064	4,296,664,576
1983	19,841,018,388	91,144,388,608	72,669,724,672	19,711,045,632	169,289,777,152	4,601,505,280	4,412,226,560
1984	22,719,562,446	93,163,847,680	73,357,836,288	23,282,982,915	171,593,416,704	5,207,680,000	4,864,150,528
1985	22,292,103,312	97,456,463,872	78,943,395,840	24,306,835,456	183,832,707,072	5,685,386,240	4,536,164,352
1986	21,837,664,874	119,070,597,120	97,814,962,176	27,250,386,944	243,189,940,224	7,159,883,264	5,660,157,952
1987	25,283,441,837	143,076,491,264	116,582,219,776	34,098,765,824	294,263,128,064	9,166,736,384	6,489,336,832
1988	30,116,168,058	162,089,041,920	127,899,181,056	40,457,535,488	322,555,054,000	10,997,566,464	5,430,243,328
1989	33,736,631,520	172,276,826,112	140,466,438,144	44,449,812,480	340,536,805,000	12,797,382,656	7,543,156,224
1990	36,102,543,005	209,490,477,056	168,523,104,256	55,606,890,496	397,845,438,002	16,425,594,880	8,059,467,776
1991	37,910,891,462	212,867,792,896	169,364,635,648	60,152,770,560	401,741,085,000	16,346,337,280	8,647,141,376
1992	38,795,342,284	231,451,312,128	178,348,949,504	64,307,535,872	429,643,001,000	18,564,489,216	9,838,260,224
1993	38,696,613,295	205,827,620,864	168,363,245,568	60,919,754,752	379,395,183,000	15,417,014,272	8,783,551,488
1994	43,831,981,055	232,865,316,864	189,913,169,920	73,023,971,328	406,248,628,000	17,980,035,072	9,398,562,245
1995	49,099,648,753	283,600,289,792	230,367,363,072	89,446,711,296	507,603,208,000	23,369,635,840	10,947,621,888
1996	56,105,729,386	283,317,829,632	251,986,247,680	101,416,558,592	523,111,066,000	23,179,722,752	11,879,015,424
1997	59,163,290,771	282,944,339,968	238,161,248,256	106,087,809,024	511,763,677,184	23,509,762,048	11,160,857,600
1998	51,008,031,207	300,371,935,232	241,987,851,328	109,048,889,344	542,969,298,944	24,209,176,576	10,866,680,832
1999	51,431,151,183	295,831,011,328	234,804,479,949	111,314,006,895	542,247,976,960	24,480,836,225	11,034,621,066
2000	60,902,175,094	295,173,011,671	240,290,152,448	113,244,635,136	548,931,716,000	24,356,544,512	10,963,979,264
2001	60,664,763,793	289,311,981,568	243,961,004,032	116,075,667,456	570,734,770,000	24,081,519,336	10,302,570,496
2002	62,118,269,916	304,571,973,632	254,220,124,160	125,774,495,744	615,269,793,000	25,834,651,247	10,765,710,336
2003	66,429,567,744	357,661,573,120	299,199,411,733	158,119,468,736	747,848,602,000	31,826,550,742	13,671,062,528
2004	82,290,878,552	413,259,428,282	353,045,947,600	182,652,743,787	911,062,911,000	35,708,877,767	15,223,647,678
2005	101,309,680,140	434,048,924,234	372,323,917,539	192,716,725,959	976,283,309,000	38,083,037,028	17,434,436,941

Year	**U.S.**	**Argentina**	**South Africa**	**Chile**	**U.K.**	**N.Z.**	**Canada**
1980	216,916,388,556	8,019,175,936	25,538,899,377	4,583,913,472	114,421,719,040	5,453,700,608	63,105,052,672
1981	230,506,315,776	9,141,251,072	20,813,511,644	3,744,826,624	102,136,224,000	5,567,161,344	68,281,192,448
1982	210,928,812,032	7,623,215,616	17,791,602,688	3,579,004,160	96,577,148,140	5,479,309,824	66,976,993,280
1983	199,143,702,528	7,836,058,624	18,551,685,120	3,769,160,448	91,768,546,300	5,269,890,560	72,142,168,064
1984	216,007,507,968	8,107,400,704	16,783,906,631	3,567,101,184	94,306,158,900	5,508,130,304	84,843,806,720
1985	211,418,300,416	8,395,986,432	16,293,000,000	3,674,120,448	101,173,526,000	5,731,084,288	85,737,013,248
1986	211,896,631,296	6,852,208,128	18,385,000,000	3,954,621,184	106,628,634,866	5,936,982,528	84,381,261,824
1987	252,567,191,552	6,360,155,136	21,219,000,000	4,845,196,288	131,128,370,115	7,179,399,168	92,885,680,128
1988	316,819,374,080	9,134,186,496	21,871,000,000	6,794,216,960	145,274,389,205	8,785,268,736	111,363,846,849
1989	361,207,022,372	9,565,434,880	22,191,000,000	8,006,335,488	153,236,078,592	8,830,500,864	114,041,885,643
1990	389,860,108,274	12,351,521,792	23,579,328,000	8,292,096,000	185,499,500,544	9,427,547,608	125,058,171,511
1991	418,218,405,313	11,974,937,339	23,360,832,000	8,551,949,824	174,516,322,304	9,689,539,320	124,818,522,217
1992	443,237,780,077	12,234,938,368	21,024,817,152	9,646,394,368	190,480,812,233	9,728,501,660	132,062,469,372
1993	455,693,864,008	13,114,391,552	24,242,675,712	9,068,677,120	171,550,130,528	10,430,368,920	142,331,351,394
1994	506,660,347,474	15,803,245,568	25,607,788,544	11,059,749,888	202,764,263,563	12,040,373,239	163,655,620,040
1995	577,866,235,904	20,962,545,664	28,039,127,040	15,530,119,168	234,116,481,024	13,553,202,925	189,041,560,427
1996	616,112,850,167	23,809,601,536	23,226,396,672	14,979,210,240	253,384,294,400	14,177,016,545	199,759,711,749
1997	681,838,618,381	26,429,618,176	22,473,895,936	16,296,120,320	278,783,857,743	13,935,587,328	213,667,066,530
1998	675,027,386,488	26,406,297,600	19,570,331,648	14,566,403,072	270,202,245,363	12,003,486,720	212,481,232,147
1999	687,558,813,842	23,223,162,918	23,161,053,184	15,371,269,120	265,250,124,395	12,390,135,690	237,070,314,623
2000	774,316,426,045	26,244,851,702	30,186,534,236	17,921,015,808	282,853,495,659	13,168,721,009	275,406,760,414
2001	726,124,960,086	26,510,801,085	27,922,886,656	18,505,846,784	272,578,146,152	13,633,918,520	259,615,594,942
2002	689,863,526,336	25,595,936,056	23,039,399,936	17,182,494,720	288,646,627,328	14,271,219,712	250,868,106,317
2003	718,776,099,413	29,827,825,554	31,450,329,088	19,794,323,456	307,700,829,855	16,397,794,444	270,215,569,318
2004	813,478,122,799	34,436,225,078	39,940,697,723	30,581,043,967	348,237,429,160	20,186,564,462	314,281,698,832
2005	898,796,738,617	39,963,954,009	46,658,892,944	38,257,991,747	384,364,970,472	21,554,729,008	356,748,114,248

Source: UN Commodity Trade Statistics Database (COMTRADE) avaliable at http://comtrade.un.org

Note: Exports of South Africa's commodities during 1985-1991 were obtained from FAO, available at http://fao.stat.fao.org

Appendix 3.1.3: Total Imports of All Commodities by Country (in U.S. $ million)

Year	**Australia**	**France**	**Italy**	**Spain**	**Germany**	**Portugal**	**Greece**
1980	19,870,325,340	134,328,221,696	98,118,549,504	33,900,593,152	187,469,660,160	9,292,931,072	10,531,291,136
1981	23,485,714,296	120,278,622,208	88,996,200,448	32,081,254,400	163,639,869,440	9,945,967,616	8,780,635,136
1982	23,671,771,809	115,453,722,624	83,834,085,376	31,281,516,544	155,155,251,200	9,605,106,688	10,012,186,624
1983	19,116,200,452	105,271,812,096	78,322,466,816	28,925,573,120	152,694,734,848	8,256,691,712	9,499,584,512
1984	22,658,700,649	103,612,727,296	81,970,905,088	28,606,631,936	152,872,058,880	7,975,284,224	9,610,998,784
1985	23,094,077,233	107,588,091,904	88,592,515,072	30,066,493,440	158,360,780,800	7,649,671,680	10,137,927,680
1986	24,339,667,199	127,853,944,832	99,774,619,648	35,406,471,168	190,635,507,712	9,393,249,280	11,240,485,888
1987	26,833,853,746	157,523,673,088	122,210,607,104	49,008,738,304	228,219,420,672	13,437,494,272	12,908,119,040
1988	32,946,146,984	177,186,275,328	135,497,768,960	60,434,051,072	248,979,737,000	17,884,776,448	12,228,484,096
1989	39,693,951,745	190,185,832,448	149,425,831,936	71,298,007,040	268,496,382,000	19,043,121,152	16,102,823,936
1990	38,299,299,370	232,524,611,584	176,152,870,912	87,486,431,232	341,122,871,000	25,332,541,441	19,743,246,336
1991	37,784,197,150	230,257,393,664	178,240,012,288	93,084,172,288	387,773,610,004	26,328,578,048	21,552,160,768
1992	39,788,758,963	238,299,103,232	184,509,677,568	99,483,025,408	407,024,230,000	30,482,415,616	23,420,157,952
1993	41,685,097,928	200,298,823,680	143,954,771,968	79,620,087,808	341,130,306,000	24,118,976,512	21,962,610,688
1994	49,351,257,830	227,611,492,352	163,801,579,520	92,279,455,744	380,274,952,000	26,935,724,032	21,448,990,683
1995	56,880,482,413	272,595,501,056	197,949,472,768	113,060,839,424	441,850,486,000	33,393,664,000	25,881,706,496
1996	60,896,685,725	274,088,443,904	204,058,263,552	122,841,522,176	457,325,515,000	33,978,904,576	28,396,871,680
1997	61,243,947,115	266,164,535,296	204,098,142,208	124,070,232,064	444,352,200,704	34,338,093,056	26,950,897,664
1998	58,780,912,678	285,645,242,368	211,475,562,496	134,151,061,504	469,744,058,368	36,986,552,320	30,248,630,272
1999	63,905,172,641	286,168,186,880	216,437,199,706	147,523,519,550	472,601,264,128	39,784,959,491	30,419,398,655
2000	70,306,032,270	303,435,019,963	234,563,239,936	152,391,811,072	500,115,229,000	39,785,889,792	29,811,988,480
2001	59,562,592,768	293,546,688,512	232,626,880,512	154,481,475,584	485,212,451,000	39,311,571,323	28,181,471,232
2002	67,878,238,731	303,476,408,320	243,313,901,568	165,504,385,024	489,827,159,000	39,894,964,871	32,511,805,440
2003	82,592,265,685	362,189,029,376	294,224,891,242	210,363,381,186	601,116,377,000	47,003,117,144	44,833,378,304
2004	101,957,036,825	433,936,983,352	351,669,921,914	258,710,754,265	717,260,942,000	54,776,509,031	52,767,722,124
2005	116,787,761,221	475,534,932,211	381,380,913,756	289,106,915,329	778,702,308,000	61,091,879,584	54,861,062,345

Year	U.S.	Argentina	South Africa	Chile	U.K.	N.Z.	Canada
1980	250,280,367,408	10,539,222,016	18,551,386,566	5,123,127,808	117,632,245,760	5,514,682,368	57,707,180,032
1981	271,212,658,688	9,430,204,416	20,990,619,195	6,277,176,832	101,152,720,000	5,731,509,248	65,405,407,232
1982	253,033,037,824	5,336,886,272	16,939,042,816	3,076,482,560	99,100,887,532	5,900,477,952	54,469,697,536
1983	267,970,985,984	4,504,094,720	14,480,023,552	2,753,926,912	99,443,865,800	5,326,889,472	60,362,924,032
1984	338,189,352,960	4,584,591,872	14,993,863,361	3,189,975,552	105,687,460,000	6,180,521,984	72,934,096,896
1985	358,704,709,632	3,814,128,640	11,319,000,000	2,742,483,968	109,414,520,000	5,981,720,576	75,404,009,472
1986	381,362,405,376	4,723,411,456	12,992,000,000	2,914,301,184	125,608,452,269	6,131,414,016	79,630,581,760
1987	422,407,077,888	5,817,781,760	15,277,000,000	3,793,209,344	154,406,322,777	7,254,528,000	86,809,755,648
1988	459,016,667,136	5,321,524,224	18,723,000,000	4,730,974,208	189,699,183,317	7,304,231,936	105,921,802,804
1989	491,511,497,147	4,200,510,464	18,498,000,000	6,495,663,616	199,195,328,512	8,756,564,992	113,172,510,654
1990	516,442,091,251	4,076,657,920	17,076,368,000	7,022,270,976	224,771,489,792	9,466,003,036	115,936,694,404
1991	507,019,585,328	8,275,253,449	17,499,904,000	7,452,623,872	204,819,693,568	8,493,652,689	117,638,005,133
1992	551,590,966,380	14,863,667,200	18,372,874,240	9,455,486,976	221,658,145,019	9,199,806,789	121,857,983,084
1993	601,137,438,118	16,772,907,008	18,025,531,392	10,541,854,720	211,666,379,017	9,648,652,872	130,391,465,225
1994	687,096,044,799	21,581,033,472	21,103,841,280	11,149,038,592	224,296,259,813	11,896,055,290	147,579,533,082
1995	768,667,222,016	20,121,620,480	26,740,248,576	14,903,021,568	261,303,779,328	13,952,025,138	163,859,240,460
1996	814,888,154,168	23,761,522,688	26,864,625,664	16,809,972,736	282,550,435,840	14,715,634,890	169,863,372,357
1997	894,995,115,602	30,349,375,488	30,866,462,720	18,110,799,872	305,074,115,001	14,507,970,560	196,017,717,413
1998	940,776,008,344	31,377,190,912	26,616,983,552	17,082,405,888	311,806,149,311	11,325,768,704	200,354,775,809
1999	1,056,183,546,325	25,507,919,608	24,087,033,856	13,891,472,384	315,282,379,884	14,309,947,228	214,909,055,882
2000	1,255,416,479,128	25,280,427,712	26,784,511,438	16,619,683,840	339,444,722,315	13,897,887,180	239,521,877,941
2001	1,177,993,600,528	20,321,127,094	24,187,371,520	16,136,113,152	337,958,013,725	13,300,303,920	221,173,175,290
2002	1,199,853,357,904	8,989,544,710	26,207,852,544	15,383,366,656	351,708,446,720	15,032,827,904	221,774,096,344
2003	1,302,157,847,102	13,850,765,826	34,539,810,816	17,375,883,264	393,507,140,487	18,543,760,957	239,671,686,840
2004	1,521,270,045,962	22,445,239,316	47,594,053,222	22,401,037,703	460,394,445,634	21,294,924,736	272,395,443,224
2005	1,727,885,956,929	28,688,603,789	55,022,622,439	29,857,180,167	515,782,184,687	26,207,146,310	312,147,682,320

Appendix 3.1.4: Total World Exports and Imports of Wines (SITC1121 rev.1: Wine of fresh grapes) (in US $)

Year	**Total World Exports of Wines**	**Total World Imports of Wines**
1980	4,159,809,121	4,290,419,076
1981	3,927,192,244	4,093,306,931
1982	3,800,185,274	3,934,617,436
1983	3,516,732,127	3,740,106,273
1984	3,650,557,374	3,877,630,160
1985	4,058,721,314	4,210,781,365
1986	4,934,158,737	5,064,520,256
1987	5,875,479,767	5,980,435,543
1988	6,461,292,986	6,693,834,201
1989	6,831,929,208	6,937,509,859
1990	8,097,553,911	8,342,502,291
1991	8,045,861,302	8,344,176,712
1992	8,858,474,645	8,940,486,847
1993	7,909,265,163	7,701,476,880
1994	8,952,863,154	8,709,165,106
1995	10,682,345,239	10,160,164,924
1996	12,024,300,094	11,916,197,679
1997	12,724,942,964	13,019,782,907
1998	14,267,010,129	14,372,773,412
1999	14,707,927,438	14,697,436,847
2000	13,040,815,156	13,199,000,462
2001	13,145,282,928	13,463,146,926
2002	14,640,216,706	14,813,353,423
2003	17,836,256,694	17,822,775,605
2004	20,292,450,673	20,316,825,369
2005	21,042,239,394	21,560,800,389

Source: UN Commodity Trade Statistics Database (COMTRADE) avaliable at http://comtrade.un.org

Appendix 3.1.5: Total World Exports and Imports of All Commodities (in US $)

Year	Total World Exports of All Commodities	Total World Imports of All Commodities
1980	1,744,963,245,209	1,812,918,994,352
1981	1,737,832,548,900	1,795,705,288,538
1982	1,574,051,658,269	1,654,953,383,704
1983	1,514,091,619,389	1,633,273,410,568
1984	1,636,772,891,373	1,757,817,351,032
1985	1,686,610,052,625	1,799,692,777,974
1986	1,830,573,989,347	1,950,863,919,924
1987	2,168,205,436,467	2,284,350,586,101
1988	2,498,740,018,277	2,617,358,436,959
1989	2,802,461,071,007	2,917,469,196,435
1990	3,199,064,047,156	3,304,373,199,914
1991	3,281,838,591,302	3,379,645,180,851
1992	3,569,715,608,768	3,673,393,123,029
1993	3,547,666,375,796	3,592,222,733,978
1994	4,033,702,779,729	4,064,801,243,844
1995	4,816,873,662,427	4,865,617,126,217
1996	5,128,222,097,329	5,198,025,045,686
1997	5,327,386,242,255	5,411,519,533,054
1998	5,281,517,542,906	5,358,763,707,505
1999	5,493,535,485,888	5,621,444,522,586
2000	6,226,552,848,742	6,400,092,485,203
2001	5,979,551,461,889	6,174,105,585,466
2002	6,224,392,949,507	6,380,255,976,209
2003	7,252,522,668,421	7,446,388,757,002
2004	8,776,411,809,800	9,049,571,795,872
2005	10,048,597,467,567	10,333,435,318,568

Source: UN Commodity Trade Statistics Database (COMTRADE) avaliable at http://comtrade.un.org

Appendix 3.2: Data Series used in the Analysis of Australia's Trade Performance in Wines

Year	**Domestic Wine Production in Australia (Litres)**	**Domestic Wine Sales in Australia (Litres)**
1980	414,237,000	253721000
1981	374,273,000	271137000
1982	402,653,000	285392000
1983	340,076,000	299820000
1984	396,244,000	315419000
1985	451,211,000	324366000
1986	389,190,000	332572000
1987	401,060,000	328116000
1988	47,772,000	322903000
1989	499,933,000	304241000
1990	444,584,000	296549000
1991	399,909,000	304030000
1992	480,771,000	309441000
1993	461,836,000	320146000
1994	587,377,000	313477000
1995	502,796,000	307904000
1996	673,445,000	323787000
1997	617,379,000	336165000
1998	741,547,000	339845000
1999	851,143,000	370033000
2000	859,166,000	372053000
2001	1,076,538,000	381964000
2002	1,220,372,000	398178000
2003	1,085,985,000	409512000
2004	1,471,228,000	425285000

Source: Domestic Wine Production in Australia, from www.wineaustralia.com.

Source: Domestic Wine Sales in Australia, from dXEcon, time-ABS Time Series Statistics Plus.

Appendix 4: Data Series for Econometric Estimation of Export Supply, Export Demand and Import Demand for Australia's wines

Appendix 4.1: Australia's Export Supply of Wines

Year	**Wine Exports**	**Wine Exports**	**Unit values of Australia's wine exports**	**Export Price Index of Australia's wines**	**Producer Price Index**
1980	11,784,222	6,619,745	1.780162529	123.7216	60.000
1981	15,037,130	10,100,284	1.48878289	103.4707	62.150
1982	13,114,945	12,535,806	1.046198785	72.7110	65.775
1983	14,317,074	13,129,878	1.090419424	75.7843	69.625
1984	15,701,363	13,689,444	1.146968642	79.7145	72.425
1985	12,183,266	12,831,591	0.949474309	65.9886	71.950
1986	20,213,036	20,916,400	0.966372607	67.1631	73.825
1987	52,520,776	44,051,536	1.192257541	82.8621	77.925
1988	88,761,818	58,442,179	1.518797203	105.5567	90.200
1989	88,447,949	71,666,086	1.234167428	85.7748	97.750
1990	120,704,982	83,890,165	1.438845447	100.0000	100.000
1991	161,909,048	98,788,587	1.638944871	113.9069	100.750
1992	193,514,704	133,282,696	1.451911687	100.9081	103.950
1993	243,067,075	187,237,275	1.298176739	90.2235	106.900
1994	281,010,532	185,400,948	1.515690912	105.3408	112.475
1995	307,303,297	185,285,419	1.658540098	115.2688	118.900
1996	433,007,243	235,205,120	1.840977114	127.9482	123.675
1997	536,089,268	270,692,198	1.980438564	137.6408	127.725
1998	611,007,900	314,820,013	1.940816577	134.8871	129.175
1999	794,357,036	411,210,278	1.931753846	134.2572	128.825
2000	898,158,552	311,069,043	2.887328624	200.6698	130.100
2001	997,428,043	376,296,351	2.650645005	184.2203	131.800
2002	1,274,231,680	471,640,000	2.701704012	187.7689	134.925
2003	1,538,974,976	536,644,800	2.867772083	199.3106	131.575
2004	1,998,372,050	646,297,997	3.092028846	214.8965	128.975

Note: Wine Exports (by value, US$), Wine Exports (by volume, litres), Unit values of Australia's wine exports (US$/litre).

Appendix 4.2: Data Series used in Econometric Estimation of Export Supply

Year	RXS	RPX	TIME	DCA
1980	19,329,515	206.20266	1	0
1981	20,552,110	166.48538	2	0
1982	18,033,049	110.54503	3	0
1983	22,812,720	108.84644	4	0
1984	23,205,079	110.06491	5	0
1985	19,957,956	91.714557	6	0
1986	37,247,828	90.976036	7	0
1987	93,221,590	106.33571	8	0
1988	121,913,822	117.02512	9	1
1989	94,757,563	87.7492	10	1
1990	120,704,982	100	11	1
1991	156,661,996	113.059	12	1
1992	203,239,061	97.073695	13	1
1993	302,988,183	84.399908	14	1
1994	423,033,862	93.657055	15	1
1995	306,326,180	96.946018	16	1
1996	327,992,197	103.4552	17	1
1997	387,467,402	107.76341	18	1
1998	482,192,515	104.42197	19	1
1999	540,930,613	104.21674	20	1
2000	774,881,888	154.24275	21	1
2001	942,913,506	139.77259	22	1
2002	1,184,058,189	139.16537	23	1
2003	1,345,329,118	151.48063	24	1
2004	1,617,791,188	166.61874	25	1

Appendix 4.3: Foreign Demand for Australia's Wine Exports

Year	UVX of Australia	UVX of France	UVX of Italy	UVX of Spain	UVX of Germany	UVX of Portugal	UVX of Greece	UVX of U.S.	UVX of Argentina	UVX of South Africa	UVX of Chile	UVX of N.Z.
1980	1.529	1.956	0.559	0.698	1.864	1.495	0.698	1.017	0.887	0.946	1.296	2.139
1981	1.835	1.821	0.433	0.539	1.688	1.511	0.801	1.059	0.651	0.809	0.907	1.893
1982	1.824	1.687	0.444	0.672	1.579	1.447	0.763	1.121	0.552	0.825	0.841	1.867
1983	1.574	1.451	0.524	0.515	1.301	1.26	0.918	1.126	0.382	0.805	0.719	1.611
1984	1.697	1.489	0.467	0.445	1.115	1.182	0.433	1.134	0.244	0.743	0.964	2.022
1985	1.531	1.651	0.48	0.488	1.244	1.286	0.252	1.182	0.287	0.738	0.993	1.764
1986	1.361	2.071	0.731	0.778	1.6	1.671	0.439	1.313	0.316	0.899	1.094	2.124
1987	1.413	2.393	0.84	1.086	1.555	1.976	0.709	1.402	0.575	1.134	1.226	2.416
1988	1.826	2.671	0.812	1.202	1.555	2.171	0.742	1.372	0.689	1.317	1.245	2.66
1989	2.341	2.76	0.86	1.082	1.507	2.227	0.567	1.282	0.572	1.396	1.251	2.89
1990	2.508	3.457	1.187	1.311	1.777	2.705	0.696	1.348	0.375	1.419	1.197	2.704
1991	2.592	3.358	1.202	1.113	1.788	2.534	0.896	1.36	0.634	1.538	1.302	2.689
1992	2.388	3.726	1.291	1.269	1.77	1.983	1.219	1.394	0.774	1.547	1.611	2.76
1993	2.012	3.407	1.05	0.824	1.411	1.998	1.113	1.446	0.975	1.848	1.483	3.015
1994	1.666	3.556	0.98	1.039	1.528	2.362	1.079	1.519	1.04	1.318	1.212	2.985
1995	2.516	4.002	1.147	1.52	1.892	2.916	1.37	1.684	0.344	1.441	1.409	3.346
1996	3.311	3.729	1.588	1.626	1.968	2.76	1.472	1.886	0.54	1.556	1.444	3.66
1997	3.47	3.414	1.672	1.303	1.856	2.137	1.513	1.934	0.939	1.854	1.318	4.046
1998	3.178	3.6	1.557	1.256	1.955	2.35	1.277	2.032	1.279	1.719	1.46	3.388
1999	3.683	3.842	1.345	1.573	1.884	2.732	1.41	1.978	1.454	1.501	1.492	4.316
2000	2.907	3.403	1.519	1.449	1.459	2.5	1.351	1.916	1.615	1.44	1.434	2.349
2001	2.653	3.085	1.489	1.258	1.498	2.721	0.817	1.808	1.58	1.378	1.325	4.434
2002	2.699	3.512	1.705	1.348	1.663	2.325	1.639	1.98	0.983	1.359	1.754	4.969
2003	2.869	4.386	2.333	1.359	1.997	1.972	1.997	1.852	0.876	1.799	1.696	5.796
2004	3.098	4.822	2.473	1.357	2.184	2.112	2.243	1.924	1.385	2.04	1.784	6.035

Where: UVX = Unit value of wine exports

Year	**GNI of U.S.**	**GNI of U.K.**	**GNI of Canada**	**GNI of N.Z.**	**GNI of Germany**	**GNI of Japan**	**AUD/USD**	**AUD/NZD**	**AUD/JPY**	**AUD/GBP**
1980	12,980	8,410	11,170	7,480	12,580	10,430	0.897387483	0.883148424	0.003852562	2.002202423
1981	13,940	9,409	11,870	8,110	12,020	10,610	0.861215175	0.810936839	0.004027697	1.967551805
1982	13,780	9,395	11,460	7,920	10,590	10,070	0.905141202	0.727713769	0.003885614	1.664747601
1983	14,110	8,659	11,750	7,350	9,580	9,720	1.065728825	0.749953132	0.004298202	1.721812505
1984	15,750	8,184	12,620	7,020	9,460	9,940	1.104148839	0.723586823	0.004718103	1.603977865
1985	17,010	8,069	13,340	6,770	9,410	10,980	1.291878402	0.620828806	0.005193344	1.577598107
1986	18,580	9,077	13,930	7,550	10,790	13,320	1.432818713	0.774893452	0.007132095	2.0611474
1987	20,760	11,190	15,620	9,180	13,710	17,410	1.513164547	0.81265026	0.00991629	2.307470436
1988	22,830	14,160	17,900	11,660	17,940	23,920	1.377046936	0.89162983	0.01029791	2.408429523
1989	23,070	15,245	19,110	12,620	19,040	26,090	1.22861443	0.768245843	0.009385669	2.109333817
1990	23,330	16,282	19,840	12,840	20,560	26,960	1.304276947	0.767980344	0.008889525	2.127131593
1991	23,480	16,919	20,110	11,820	22,120	27,730	1.278091394	0.76712364	0.009344897	2.370651336
1992	24,780	18,622	20,470	11,730	25,010	29,680	1.304872617	0.724865299	0.009955616	2.29390681
1993	25,470	18,544	20,250	11,950	25,200	32,690	1.435033178	0.765655746	0.012110468	2.237071405
1994	26,630	18,996	19,960	12,740	26,590	36,150	1.451557884	0.817070899	0.01369617	2.175038389
1995	27,910	19,305	19,970	14,330	28,630	40,820	1.353093917	0.855626687	0.014294766	2.137240779
1996	28,970	20,407	19,910	15,790	30,010	41,880	1.32403157	0.885111626	0.01298303	2.051029617
1997	29,910	21,708	20,380	16,530	29,280	39,110	1.281867219	0.887861337	0.011123715	2.071053711
1998	30,620	22,847	20,000	15,350	27,170	33,660	1.471256792	0.875880698	0.011687065	2.425030192
1999	32,260	24,050	20,560	14,770	26,130	33,000	1.598151259	0.84644118	0.012895712	2.627713443
2000	34,400	25,283	21,810	13,680	25,510	35,140	1.588549734	0.801583287	0.01473251	2.534199016
2001	34,800	25,194	22,100	13,430	24,000	35,670	1.854919339	0.789644912	0.016282463	2.698370724
2002	35,230	25,551	22,660	13,540	23,030	33,640	1.909198518	0.823106238	0.015174642	2.757859901
2003	37,780	28,233	24,560	15,650	25,700	33,860	1.712798027	0.892452352	0.014337007	2.720496219
2004	41,440	33,648	28,310	19,990	30,690	37,050	1.405886447	0.885236991	0.012729537	2.44665078

Where: GNI = Gross National Income, World Bank, Atlas method; USD = the U.S. dollar, NZD = New Zealand dollar, JPY = Japanese Yen, and GBP = the British pound

Appendix 4.4: Data Series used in Econometric Estimation of Export Demand

Year	RXD	RPXW	GNIW	XRI
1980	19,329,515	68.194229	10,508.33	80.316192
1981	20,552,110	94.556406	10,993.17	77.35744
1982	18,033,049	97.889796	10,535.83	71.531835
1983	22,812,720	93.434081	10,194.83	77.164887
1984	23,205,079	115.95615	10,495.67	76.838997
1985	19,957,956	104.33441	10,929.83	78.118749
1986	37,247,828	73.631951	12,207.83	96.970968
1987	93,221,590	61.10132	14,645.00	110.46511
1988	121,913,822	73.310835	18,068.33	112.68685
1989	94,757,563	98.64778	19,195.83	99.744494
1990	120,704,982	100	19,968.67	100
1991	156,661,996	95.301484	20,363.17	103.6129
1992	203,239,061	79.533596	21,715.33	103.56616
1993	302,988,183	68.093779	22,350.67	112.78099
1994	423,033,862	56.750903	23,511.00	118.50184
1995	306,326,180	84.943351	25,160.83	119.10882
1996	327,992,197	100.88108	26,161.17	114.80935
1997	387,467,402	99.857359	26,153.00	109.09706
1998	482,192,515	88.684845	24,941.17	118.08179
1999	540,930,613	96.2351	25,128.33	125.33691
2000	774,881,888	80.364413	25,970.50	127.75918
2001	942,913,506	75.550559	25,865.67	138.76467
2002	1,184,058,189	74.070701	25,608.50	138.47799
2003	1,345,329,118	71.777908	27,630.50	134.17605
2004	1,617,791,188	67.849056	31,854.67	120.31921

Appendix 4.5: Australia's Import Demand of Wines

Year	Wine Imports (by value, US$)	Wine Imports (by volume, litres)	Unit values of Australia's wine imports (US$/litre)	Domestic Price Index of Wines	Nominal GDP (US$, mil)	GDP Deflator
1980	22,715,492	7,031,613	3.23048	52.88	167,195	47.3623
1981	23,954,540	7,752,957	3.08973	56.8	200,859	52.1688
1982	24,659,544	8,454,000	2.91691	60.45	205,662	58.4994
1983	21,239,328	7,598,000	2.79538	65.80	197,179	63.5404
1984	30,039,900	9,475,000	3.17044	70.68	210,205	67.2919
1985	35,884,108	12,336,000	2.90889	75.63	198,202	70.8089
1986	32,382,996	12,345,000	2.62317	77.67	195,814	75.2638
1987	25,415,422	7,667,000	3.31491	83.86	211,487	81.2427
1988	35,786,547	8,977,458	3.98627	89.03	263,382	88.8628
1989	45,376,646	11,139,113	4.07363	96.02	323,669	95.3107
1990	44,190,128	10,372,137	4.26047	100.00	313,591	100.0000
1991	37,133,520	8,798,503	4.22044	100.90	326,265	102.1102
1992	36,220,817	7,950,128	4.55600	103.70	335,694	103.8687
1993	32,350,331	7,860,893	4.11535	105.60	320,538	105.1583
1994	42,029,748	10,514,377	3.99736	110.40	335,211	105.8617
1995	52,440,765	21,861,382	2.39879	116.00	382,943	107.7374
1996	49,246,717	14,289,583	3.44634	122.03	412,177	110.0821
1997	67,296,401	20,778,048	3.23882	124.30	450,454	111.6061
1998	67,795,025	28,571,593	2.37281	128.58	413,159	112.0750
1999	75,257,949	18,498,064	4.06842	130.28	403,687	112.7784
2000	68,490,101	16,423,643	4.17021	130.73	433,943	117.2333
2001	55,836,564	13,976,080	3.99515	137.78	396,666	121.9226
2002	74,411,248	15,694,541	4.74122	141.75	410,014	124.9707
2003	95,940,464	16,221,628	5.91435	143.20	489,404	129.4256
2004	135,444,412	22,398,430	6.04705	146.60	634,137	133.8804

Appendix 4.6: Data Series used in Econometric Estimation of Import Demand

Year	RMD	RPM	RGDP	DCA
1980	30,220,968	143.40223	353,013.91	0
1981	30,636,399	127.67772	385,017.77	0
1982	34,818,970	113.24964	351,562.21	0
1983	31,048,504	99.72145	310,319.95	0
1984	46,890,156	105.28210	312,378.34	0
1985	61,108,832	90.28288	279,911.23	0
1986	44,798,481	79.27077	260,170.35	0
1987	27,937,199	92.77718	260,315.47	0
1988	39,592,188	105.08799	296,391.31	1
1989	43,498,333	99.57510	339,593.33	1
1990	44,190,128	100.00000	313,591.37	1
1991	34,679,950	98.17686	319,522.83	1
1992	35,775,694	103.12129	323,190.79	1
1993	29,272,408	91.47152	304,814.40	1
1994	41,274,542	84.98595	316,649.93	1
1995	56,776,201	48.53739	355,441.22	1
1996	58,341,703	66.28788	374,427.47	1
1997	84,876,292	61.15880	403,610.42	1
1998	83,651,959	43.31615	368,645.02	1
1999	84,238,758	73.30068	357,947.06	1
2000	65,762,690	74.87600	370,153.36	1
2001	53,400,391	68.06218	325,342.21	1
2002	64,689,651	78.50727	328,088.07	1
2003	64,808,827	96.94097	378,135.88	1
2004	90,539,244	96.81720	473,658.92	1

Note for Appendix 4.2:

RXS = real exports of wines supplied (nominal exports of wines / export price index of wines based on UV from FAO)

RPX = relative price of wine exports (export price index of wines / domestic producer price index of wines)

TIME = time trend variable representing long run changes in production

DCA = dummy variable for trade liberalisation (0: 1980-1987, 1:1988-2004)

Note for Appendix 4.4:

RXD = real exports of wines demanded (nominal exports of wines / export price index of wines based on UV from FAO)

RPXW = relative price of wine exports (export price index of wines / competitors' average export price index of wines)

GNIW = Gross National Income per capita (US$) of major importers of Australia's wines (U.S., U.K., Canada, N.Z., Germany, Japan)

XRI = average exchange rate index (defined as units of AUD against USD, NZD, JPY, GBP)

Note for Appendix 4.6:

RMD = real imports of wines (nominal Australia's imports of wines divided by import price index of wines)

RPM = relative prive of imports of wines (import price index of wines / domestic price index of wine)

RGDP = real GDP (nominal GDP / GDP deflator)

DCA = dummy variable for trade liberalisation (0: 1980-1987, 1:1988-2004)

Appendix 4.7: Description of Data Series and their sources used in Econometric Models of Export Supply, Export Demand, and Import Demand.

Data Series	Unit	Sources
Australia's wine exports and imports	U.S. dollars, current prices	The UN Comtrade database, available at http://comtrade.un.org
Australia's wine exports and imports	litres	The UN Comtrade database, available at http://comtrade.un.org
Export price index[114]	1990 = 100	FAO, available at http://fao.stat.fao.org
Import price index[115]	1990 = 100	FAO, available at http://fao.stat.fao.org
Domestic Producer Price Index	1990 = 100	dXEcon Data, ABS Time-Series Plus, Producer Price Index, wine manufacturing at factory.
Unit values of wine exports and imports	U.S. dollars per litre	FAO, available at http://fao.stat.fao.org
Gross National Income (GNI) (Australia and its trading partners)	U.S. dollars, current prices	dXEcon Data, World Bank, World Tables.
Average exchange rate index (USD, GBP, NZD, JPY)	1990 = 100	Australian Bureau of Agricultural and Resource Economics, available at www.abareconomics.com
Domestic price index	1990 = 100	Australian Bureau of Agricultural and Resource Economics, available at www.abareconomics.com
Gross Domestic Production (GDP)	U.S. dollars, current prices	dXEcon Data, World Bank, World Tables.
GDP deflator	1990 = 100	dXEcon Data, IMF Financial Statistics.

114 Calculated from unit values of wine exports.
115 Calculated from unit values of wine imports.

Appendix 5.1: Data Series used in the Analysis of the Extent and Growth of Intra-Industry Trade

Appendix 5.1.1: Wine Exports (Xw) and Imports (Mw) for Australia and its major trading countries (in U.S. $ million)

Year	Australia		France		Italy		Spain		Germany		Portugal		Greece	
	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw
1980	11,784,222	22,715,492	1,775,398,784	332,228,896	918,887,360	90,868,792	404,129,440	3,081,363	344,601,984	761,216,000	240,453,152	208,160	17,770,494	755,740
1981	15,037,130	23,954,540	1,647,120,256	289,430,528	899,308,288	73,971,072	332,296,736	3,788,159	344,923,008	693,272,000	206,914,608	315,727	17,728,644	783,565
1982	13,114,945	24,659,544	1,541,584,384	275,490,816	946,088,640	52,373,692	326,314,720	3,459,110	353,495,008	651,374,976	192,862,384	313,933	18,381,828	755,822
1983	14,317,074	21,239,328	1,552,215,680	218,816,928	784,744,256	41,937,964	303,422,848	4,458,912	342,643,008	618,251,008	176,213,488	159,177	18,351,300	1,013,706
1984	15,701,363	30,039,900	1,683,074,432	207,553,648	803,180,864	44,746,056	296,034,080	3,043,412	347,520,000	546,083,968	174,368,096	197,858	19,434,944	950,277
1985	12,183,266	35,884,108	1,941,297,664	244,463,056	879,668,416	75,634,200	332,657,024	3,370,301	362,168,992	597,926,976	181,516,256	146,389	34,100,400	1,000,342
1986	20,213,036	32,382,996	2,681,957,376	236,396,960	848,116,480	102,580,408	421,346,432	9,472,354	405,480,000	802,014,016	249,398,256	875,215	42,652,732	1,067,204
1987	52,520,776	25,415,422	3,221,885,696	279,635,648	1,006,138,944	135,066,176	501,322,496	19,087,564	410,787,008	1,016,691,008	311,007,744	1,869,357	50,707,540	2,578,525
1988	88,761,818	35,786,547	3,504,773,888	345,846,144	1,140,076,928	150,315,232	544,016,576	24,312,120	430,390,016	1,146,091,008	358,273,376	2,737,184	30,787,846	3,531,482
1989	88,447,949	45,376,646	3,611,956,224	354,032,480	1,255,344,384	183,040,976	544,704,960	26,173,876	437,443,008	1,118,518,016	352,875,264	78,450,088	60,816,028	7,198,263
1990	120,704,982	44,190,128	4,281,094,400	400,967,008	1,561,936,384	222,272,320	608,839,522	32,666,048	500,736,992	1,501,101,952	420,514,816	14,872,862	67,278,112	12,318,864
1991	161,909,048	37,133,520	4,120,821,504	427,122,464	1,574,267,136	232,148,880	728,592,256	33,081,052	442,040,000	1,682,375,040	425,324,352	9,218,157	53,772,328	16,446,782
1992	193,514,704	36,220,817	4,264,967,424	454,761,920	1,610,868,352	217,780,592	888,652,608	40,105,832	526,952,992	1,725,512,960	508,384,160	11,776,562	78,073,232	13,495,823
1993	243,067,075	32,350,331	3,646,926,848	362,294,432	1,477,491,584	128,049,600	796,135,680	35,618,240	422,128,992	1,344,348,032	431,144,736	19,963,340	60,909,200	14,364,721
1994	281,010,532	42,029,748	3,973,928,192	437,595,136	1,808,550,400	134,836,224	849,845,376	53,879,940	496,703,008	1,447,021,952	446,948,192	69,093,968	62,178,804	12,896,136
1995	307,303,297	52,440,765	4,606,603,776	537,634,240	2,178,453,248	163,960,912	992,457,600	139,340,656	531,356,992	1,726,722,944	496,007,424	74,029,032	80,576,928	14,891,978
1996	433,007,243	49,246,717	4,814,782,976	527,672,352	2,372,325,888	157,218,832	1,164,160,640	80,096,312	526,417,664	1,941,475,328	539,343,296	52,042,124	78,074,160	16,388,713
1997	536,089,268	67,296,401	5,211,230,208	545,059,200	2,270,041,088	174,933,888	1,256,147,200	45,888,972	459,812,640	1,876,387,200	523,082,880	47,171,064	74,282,912	15,027,979
1998	611,007,900	67,795,025	5,936,182,784	552,661,248	2,537,829,632	203,587,504	1,373,827,200	94,733,184	466,976,000	2,102,397,952	528,974,944	103,856,824	79,763,384	16,300,740
1999	794,357,036	75,257,949	6,126,334,976	559,486,720	2,680,984,891	215,528,419	1,459,570,609	114,700,133	460,351,520	2,125,381,248	526,510,040	159,343,989	74,638,862	22,348,429
2000	898,158,552	68,490,101	5,048,526,051	455,783,743	2,394,550,784	190,734,736	1,163,766,528	78,384,368	361,401,000	1,689,163,000	468,727,584	116,537,952	59,860,576	17,892,816
2001	997,428,043	55,836,564	4,815,107,584	455,323,328	2,466,052,608	164,674,896	1,268,515,968	64,040,824	383,314,000	1,775,660,000	433,954,354	87,560,987	52,405,856	23,923,074
2002	1,274,231,680	74,411,248	5,422,410,240	469,899,232	2,798,539,520	205,561,376	1,322,867,968	75,912,200	437,509,000	1,823,871,000	480,058,746	81,414,317	49,903,720	47,371,568
2003	1,538,974,976	95,940,464	6,634,094,592	560,868,288	3,255,717,733	273,312,001	1,705,697,894	103,688,499	564,799,000	2,081,067,000	602,999,052	97,931,994	75,203,800	31,260,724
2004	1,998,372,050	135,444,412	6,953,646,147	654,920,384	3,794,246,278	320,070,488	1,954,695,857	130,455,582	621,406,000	2,325,331,000	662,819,719	112,038,675	79,239,647	36,591,247
2005	2,110,600,714	169,960,968	6,992,388,920	649,921,100	3,973,055,679	352,852,714	1,977,863,458	148,088,642	719,131,000	2,424,590,000	657,312,417	100,829,515	72,244,062	35,580,018

Year	U.S.		Argentina		South Africa		Chile		U.K.		N.Z.		Canada		Japan	
	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw	Xw	Mw
1980	29,816,716	785,206,976	11,139,550	6,276,724	11,831,842	2,723,169	20,714,848	1,691,522	57,205,192	661,240,704	1,219,903	7,280,352	887,628	134,379,840	349,018	62,488,976
1981	41,796,852	852,714,240	11,220,571	1,768,831	9,106,433	4,313,718	15,874,812	3,338,095	52,045,252	638,307,584	1,003,853	9,729,390	970,430	138,800,352	279,330	59,083,216
1982	38,362,340	879,652,992	10,944,944	497,930	9,071,389	4,045,886	11,210,901	228,136	50,954,456	576,124,480	977,187	9,844,034	975,157	152,419,712	213,115	64,237,096
1983	32,250,800	954,587,776	7,495,067	n.a.	9,235,135	4,450,994	9,503,521	100,236	50,403,724	595,261,312	1,029,668	8,991,140	1,279,173	131,600,544	217,932	70,704,368
1984	26,493,276	1,085,928,448	8,024,824	n.a.	6,939,131	5,663,341	10,204,242	167,943	51,516,040	625,418,880	1,967,155	14,378,978	715,999	172,916,496	224,497	75,334,152
1985	26,680,436	1,146,307,200	6,006,975	7,967	5,727,000	2,649,000	10,978,885	115,178	53,576,204	738,387,968	1,931,883	9,820,273	1,145,623	151,909,344	148,813	79,372,728
1986	35,744,120	1,119,662,464	6,747,180	n.a.	7,973,000	2,665,000	13,267,762	180,071	44,374,800	1,005,400,768	2,161,297	15,912,879	1,869,979	188,045,792	183,396	81,469,600
1987	60,518,544	1,069,187,776	9,363,555	27,462	9,703,000	2,952,000	17,933,768	232,763	49,252,628	1,199,872,896	4,578,167	14,739,135	1,611,245	212,432,560	304,320	144,123,307
1988	84,538,832	1,046,818,496	12,849,459	18,969	11,893,000	3,097,000	23,062,280	206,900	52,900,739	1,405,893,380	8,524,040	23,664,566	1,995,920	215,400,714	486,383	231,154,844
1989	102,861,382	1,029,689,163	17,125,204	245,318	13,965,000	3,268,000	35,667,712	264,742	55,345,216	1,395,240,320	9,896,827	28,919,382	877,263	286,542,108	563,976	331,145,140
1990	130,479,566	1,011,564,640	23,071,674	537,755	9,530,490	2,982,720	51,612,920	269,128	71,422,624	1,770,979,584	13,326,880	34,753,895	1,407,260	305,682,968	788,206	417,787,431
1991	146,210,023	1,005,491,487	22,548,437	3,237,995	19,213,390	2,966,690	84,367,056	438,219	60,395,384	1,654,220,032	15,134,831	28,388,314	2,618,763	291,204,793	738,999	348,097,096
1992	171,070,827	1,182,941,492	33,553,224	6,846,807	42,575,348	3,010,848	119,297,408	810,833	65,928,688	1,756,441,984	25,602,477	28,088,390	1,541,596	303,784,510	608,828	342,762,873
1993	170,702,200	1,057,714,008	32,758,334	15,037,785	45,554,376	3,214,259	128,580,072	660,110	54,356,888	1,535,007,104	24,842,803	37,005,727	1,862,340	292,203,763	825,347	275,757,420
1994	182,348,759	1,142,709,278	35,255,008	20,225,174	69,384,960	4,103,470	143,687,504	633,042	61,569,828	1,773,383,936	26,332,726	47,594,569	1,687,510	313,382,524	941,560	374,161,089
1995	226,340,960	1,273,208,704	78,597,048	12,753,880	186,442,304	4,855,477	182,432,448	607,291	91,720,968	1,969,965,440	32,044,315	45,013,112	3,665,348	332,819,537	1,164,979	484,420,297
1996	308,735,751	1,554,527,372	83,732,752	12,607,311	185,002,688	13,451,705	294,372,032	1,044,430	141,907,280	2,296,128,000	45,076,471	51,865,308	3,704,978	385,312,095	1,356,378	523,538,623
1997	399,399,465	1,850,241,941	132,004,176	19,733,038	189,438,784	14,615,010	427,929,984	8,139,524	221,983,568	2,659,145,984	58,948,840	56,618,008	7,779,553	420,390,504	2,517,676	669,062,761
1998	515,514,252	1,995,120,217	167,341,488	29,189,904	183,895,744	7,534,849	539,752,896	7,861,946	180,082,672	2,919,263,744	63,105,528	54,871,064	5,131,573	493,477,072	1,846,379	1,330,670,160
1999	523,153,973	2,326,640,262	145,774,453	29,570,879	201,209,104	13,748,625	547,615,040	5,403,856	185,323,681	3,031,980,003	77,333,675	69,434,268	5,892,772	563,114,752	1,851,288	902,419,704
2000	537,982,238	2,363,887,269	159,636,721	17,066,659	243,218,337	7,658,327	585,036,736	4,529,041	177,742,265	2,568,495,079	89,509,469	60,530,723	7,431,163	588,121,799	2,238,893	811,000,229
2001	521,672,328	2,378,453,729	155,495,416	13,014,302	230,426,224	5,404,030	652,264,768	1,803,475	170,249,272	2,663,982,935	97,229,049	62,197,565	8,443,337	590,471,409	2,743,426	797,588,398
2002	531,707,685	2,826,724,706	131,585,200	1,834,136	286,139,840	8,096,579	610,017,216	1,379,631	202,860,992	3,014,276,096	127,085,200	74,286,144	9,424,218	621,732,347	2,258,309	810,291,981
2003	617,486,623	3,434,533,731	174,010,873	1,217,185	478,984,640	12,354,105	669,906,304	870,292	232,143,595	3,586,996,705	157,693,936	96,382,151	10,751,359	830,225,037	3,130,799	910,527,720
2004	754,448,756	3,603,309,632	227,359,619	1,503,190	535,631,753	9,466,795	845,208,360	1,448,263	218,275,650	4,298,011,308	244,868,999	103,693,627	14,905,494	918,402,657	1,901,773	1,062,729,184
2005	627,208,031	3,970,243,190	308,816,158	2,379,225	595,853,698	13,793,608	884,660,927	3,803,561	230,354,557	4,277,893,171	332,390,969	108,796,759	18,494,691	1,052,872,839	1,776,852	1,039,099,540

Source: UN Commodity Trade Statistics Database (COMTRADE) avaliable at http://comtrade.un.org

where, Xw = Wine Exports and Mx = Wine Imports, n.a. is no data available from the UN and FAO.

Note: Exports and imports of South Africa's wines during 1985-1991 were obtained from the FAO, available at http://fao.stat.fao.org

Appendix 5.1.2: Bilateral Wine Trade between Australia and its Trading Partners

Bilateral Wine Trade between Australia and its Major Trading Partners (in USD)

Year	France		Italy		Spain		Germany		Portugal		Greece	
	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from
1980	55,268	8,898,492	4,783	3,056,685	0	801,667	817,764	6,158,335	0	1,940,683	4,147	328,306
1981	20,889	9,612,684	3,662	4,127,008	10,743	606,742	894,111	5,945,153	0	2,132,394	4,644	325,107
1982	16,407	10,600,434	4,698	4,144,690	1,519	826,960	579,954	5,358,971	0	2,267,009	10,591	394,071
1983	12,797	9,924,470	6,873	4,045,546	2,584	424,205	304,168	3,564,414	25,847	1,717,075	6,203	314,221
1984	24,026	16,702,128	4,784	5,235,378	2,498	601,937	91,962	4,238,923	0	1,653,733	4,528	299,589
1985	51,222	21,039,652	3,585	6,367,531	627	692,383	83,000	3,762,720	1,887	2,053,068	0	312,602
1986	151,080	19,576,170	1,822	5,366,639	772	674,966	167,072	3,072,285	883	1,862,608	936	266,459
1987	53,639	13,935,173	2,453	5,335,215	1,224	639,684	853,096	1,818,680	1,106	1,299,659	0	227,736
1988	554,046	20,720,960	3,968	6,701,277	0	755,761	585,652	2,407,304	1,795	1,658,458	2,939	321,822
1989	240,022	26,953,326	21,670	8,837,116	30,454	893,623	843,679	2,431,130	2,387	1,847,081	7,771	429,301
1990	443,846	23,581,703	45,746	10,662,109	101,736	1,173,629	1,148,287	2,279,066	3,055	1,902,169	16,104	506,756
1991	302,457	17,542,930	14,657	10,216,149	46,696	751,455	1,184,968	1,975,892	0	2,000,611	0	480,294
1992	1,164,025	17,355,732	4,545	10,961,677	17,249	899,830	1,247,935	1,448,314	1,731	1,746,872	8,317	511,491
1993	1,072,517	16,390,235	54,108	7,983,474	150,023	722,561	1,965,051	1,479,018	2,688	1,359,373	0	445,273
1994	622,489	20,775,385	11,753	9,997,478	53,598	930,452	4,378,596	1,413,935	3,894	1,809,528	0	631,252
1995	603,827	21,398,770	199,655	15,654,710	6,123	1,826,644	6,574,164	1,325,228	3,710	1,464,332	27,908	515,316
1996	693,117	20,912,550	42,806	13,459,254	5,968	1,483,519	7,593,496	1,208,464	0	1,308,932	30,572	583,886
1997	1,666,535	28,566,309	344,435	16,616,509	2,645	3,867,836	10,874,048	1,156,780	15,348	1,933,763	5,308	595,013
1998	2,167,345	27,828,826	162,737	15,325,242	18,925	7,347,752	12,637,718	1,034,771	879	1,077,313	4,497	610,827
1999	3,871,686	38,097,799	273,067	14,226,625	104,559	3,966,991	29,916,145	1,216,976	1,704	1,524,530	7,498	874,259
2000	4,635,842	29,138,756	379,659	14,717,556	50,701	2,585,670	31,041,638	1,228,672	543	1,243,189	1,523	645,222
2001	8,815,634	21,146,170	746,887	13,367,310	325,536	1,032,945	27,595,015	777,752	6,079	930,763	6,991	623,787
2002	7,302,182	29,402,548	635,138	13,000,547	328,849	1,554,419	28,206,712	1,160,138	1,784	1,114,213	51,250	465,125
2003	9,151,860	43,008,036	760,220	14,536,781	465,075	2,016,695	38,467,484	1,289,083	2,375	1,364,337	263,097	556,708
2004	10,992,198	51,984,385	1,982,068	17,495,647	541,660	2,498,306	53,245,228	1,504,301	5,285	1,491,830	151,684	568,844

	U.S.		Argentina		South Africa		Chile		U.K.		N.Z.		Canada		Japan	
Year	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from	Export to	Import from
1980	1,269,224	199,357	2,859	0	2,234	40,125	1,035	11,611	886,174	78,880	1,501,951	187,548	2,096,464	738	466,156	36,830
1981	1,925,292	192,133	4,838	0	3,746	70,369	0	44,520	718,848	140,874	2,942,764	52,417	1,770,380	0	578,138	641
1982	1,253,551	107,123	1,700	0	6,648	138,313	2,416	0	928,947	125,481	2,412,328	75,305	1,787,361	52,306	524,307	4,803
1983	1,727,843	114,391	2,159	0	20,754	82,174	0	38,460	975,487	65,334	2,743,565	244,269	1,288,029	99,340	1,237,113	2,618
1984	1,713,892	156,186	3,329	0	24,496	59,034	1,684	39,464	1,227,713	53,974	3,192,319	504,745	1,787,700	0	1,361,139	1,827
1985	1,835,248	98,600	2,456	11,647	12,070	94,555	0	47,702	1,248,810	136,220	1,675,984	661,061	1,064,387	0	1,342,968	2,157
1986	3,872,863	49,330	1,028	11,707	9,135	63,387	1,060	11,128	2,887,378	114,979	2,712,573	801,649	2,040,175	0	1,223,017	5,057
1987	14,643,615	135,581	0	25,980	2,198	59,341	0	0	10,267,413	120,534	4,648,313	1,385,279	4,544,546	0	2,973,111	680
1988	15,963,273	105,238	1,821	14,277	3,137	0	0	83,915	22,673,075	132,362	10,053,629	2,156,966	7,067,343	4,970	6,587,948	853
1989	13,863,073	260,980	1,985	34,699	4,707	0	0	132,229	22,758,816	182,022	11,377,631	2,666,316	8,133,241	2,098	6,759,332	7,750
1990	17,474,004	176,332	2,549	48,501	648	2,208	0	134,899	35,068,497	50,389	15,138,662	2,838,959	11,750,090	11,169	6,562,127	13,583
1991	23,687,074	179,652	2,122	18,889	0	0	0	218,819	56,804,310	62,268	13,761,222	2,991,514	12,268,915	0	6,387,736	10,078
1992	31,621,619	166,890	0	17,947	82,152	12,648	0	202,346	78,743,350	65,769	14,317,731	2,186,772	13,657,402	0	5,802,910	0
1993	29,008,286	460,738	0	11,560	96,241	218,509	1,482	137,966	109,081,027	84,803	23,179,152	2,369,575	15,234,106	23,745	5,345,811	581
1994	43,462,582	705,264	0	42,065	209,440	1,866,721	1,830	204,700	130,870,528	118,549	26,081,197	2,697,277	15,355,986	868	6,922,762	1,024
1995	54,116,587	1,822,938	1,346	396,168	153,316	390,946	2,157	2,336,853	140,032,376	39,595	23,999,384	4,434,140	14,418,385	0	6,144,620	0
1996	77,275,555	576,612	0	361,036	151,152	330,833	20,045	1,444,310	198,027,282	137,228	30,957,047	6,278,599	22,514,553	758	8,872,154	1,354
1997	113,961,970	692,766	1,461	34,776	363,688	363,529	823	1,452,433	232,201,864	471,676	36,096,062	9,430,649	24,158,865	1,321	10,410,657	562
1998	140,815,856	607,521	1,747	47,631	125,803	1,415,639	607	873,354	279,244,553	262,331	33,796,787	9,838,706	26,940,418	0	20,650,517	4,724
1999	176,859,201	642,093	31,360	830	238,715	263,797	2,353	692,346	366,335,135	435,177	43,411,451	12,391,543	36,318,786	2,766	16,196,560	37,586
2000	243,575,404	618,957	3,544	30,365	77,575	334,262	0	757,708	380,310,313	158,543	40,062,742	16,100,384	50,955,444	8,004	17,728,392	2,180
2001	282,612,290	499,294	45,724	3,069	160,882	341,938	25,267	639,913	423,913,148	106,198	42,971,756	15,724,740	58,165,051	10,095	16,336,741	12,418
2002	418,084,864	550,626	728	20,029	71,970	428,701	3,854	435,313	499,268,544	781,765	51,646,832	24,596,672	78,764,896	20,778	17,441,422	17,559
2003	545,373,632	1,454,002	192	32,889	48,265	414,112	2,132	471,949	518,503,392	206,285	66,601,424	29,497,256	121,101,112	20,937	23,216,598	17,180
2004	659,379,364	2,606,859	23,264	282,315	179,891	501,056	4,429	943,769	709,631,032	497,357	71,137,549	52,048,292	164,376,047	66,469	33,278,141	28,209

Source: UN Commodity Trade Statistics Database (COMTRADE), available at http://comtrade.un.org

Appendix 5.2: Results of Status Switch Test

France

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	21090874	20988430	-20988430	-7.8989497	57.7060875	0.002434546	-1.01679581	no switch
85 and 90	24025549	23137857	-23137857	88.4595107	10.7797601	0.018821626	0.683773475	no switch
90and 95	22002597	20794943	-20794943	26.4945092	-10.201208	0.028217837	-0.224164426	switch
95 and 00	33774598	24502914	-24502914	86.9748149	26.5625135	0.159095399	12.99638825	no switch
00 and 04	62976583	40992187	-40992187	57.826069	43.9470987	0.21145192	11.43888522	no switch

Italy

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	6371116	6363946	-6363946	-33.417015	51.9957579	0.000563013	-1.018251187	no switch
85 and 90	10707855	10616363	-10616363	92.1632492	40.2788792	0.004290521	-0.600281145	no switch
90and 95	15854365	15455055	-15455055	77.0874759	31.8920057	0.01275367	-0.004098128	no switch
95 and 00	15097215	14337897	-14337897	47.4120197	-6.3675926	0.025796335	0.248852663	switch
00 and 04	19477715	15513579	-15513579	80.845309	15.8787554	0.113289208	8.272190277	no switch

Spain

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	693010	691756	-691756	-33.417015	51.9957579	0.000905568	-1.029355817	no switch
85 and 90	1275365	1071893	-1071893	92.1632492	40.2788792	0.086684975	7.07585389	no switch
90and 95	1832767	1820521	-1820521	77.0874759	31.8920057	0.003352049	-0.738246963	no switch
95 and 00	2636371	2534969	-2534969	47.4120197	-6.3675926	0.019608457	-0.050714974	switch
00 and 04	3039966	1956646	-1956646	80.845309	15.8787554	0.216810911	16.74495602	switch

Germany

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	3845720	3679720	-3679720	-885.25783	-63.667108	0.022058511	-20.50541098	switch
85 and 90	3427353	1130779	-1130779	92.7718419	-65.099212	0.503841047	46.24610301	switch
	TT	M-X	X-M	xijk	mijk	since X>M; M/X	Switch line	Switch if x<line
90and 95	7899392	-5248936	5248936	82.5333381	-71.975388	0.20158122	-15.30730539	no switch
95 and 00	32270310	-29812966	29812966	78.8214655	-7.858566	0.039581416	-1.271471757	no switch
00 and 04	54749529	-51740927	51740927	41.7006196	18.3227293	0.028252316	-0.454088149	no switch

Portugal

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	2054955	2051181	-2051181	100	5.47400281	0.000919112	-0.90716966	no switch
85 and 90	1905224	1899114	-1899114	38.2324059	-7.9329965	0.001606061	-0.936990352	switch
90and 95	1468042	1460622	-1460622	17.6549865	-29.900118	0.002533578	-0.952736128	switch
95 and 00	1243732	1242646	-1242646	-583.24125	-17.788365	0.00043678	-1.254311291	switch
00 and 04	1497115	1486545	-1486545	89.7256386	16.6668454	0.003542629	-0.678592735	no switch

Greece

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	312602	312602	-312602	-100	-5.0236403	0	-1	switch
85 and 90	522860	490652	-490652	100	38.3131132	0.031778607	2.209639353	no switch
90and 95	543224	487408	-487408	42.2961158	1.66111667	0.054157061	1.344790381	no switch
95 and 00	646745	643699	-643699	-1732.436	20.1335354	0.002360428	-5.08692977	no switch
00 and 04	720528	417160	-417160	98.9959389	-13.42688	0.266653072	25.66422429	switch

U.S.

Year	TT	M-X	X-M	xijk	mijk	since X>M; M/X	Switch line	Switch if x<line
80 and 85	1933848	-1736648	1736648	30.8418263	-102.18763	0.053725709	-6.436376991	no switch
85 and 90	17650336	-17297672	17297672	89.4972669	44.082753	0.010091104	-0.545065229	no switch
90and 95	55939525	-52293649	52293649	67.7104471	90.3270435	0.033685384	2.076386506	no switch
95 and 00	244194361	-242956447	242956447	77.782409	-194.51771	0.002541131	-1.491753851	no switch
00 and 04	661986223	-656772505	656772505	63.0598989	76.2565985	0.003953504	-0.694565723	no switch

Argentina

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	14103	9191	-9191	-16.408795	100	0.210869752	-4.249248734	no switch
85 and 90	51050	45952	-45952	3.6484896	75.9860621	0.052555617	-0.755695759	no switch
90and 95	397514	394822	-394822	-89.375929	87.7574665	0.003397549	-1.300261505	no switch
95 and 00	33909	26821	-26821	62.020316	-1204.6863	0.116713321	6.35531039	switch
00 and 04	305579	259051	-259051	84.7661623	89.2442839	0.082404406	6.067509697	no switch

South Africa

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	106625	82485	-82485	81.4913007	57.5643805	0.127650574	9.530061869	no switch
85 and 90	2856	1560	-1560	-1762.6543	-4182.3822	0.293478261	-518.0072464	switch
90and 95	544262	237630	-237630	99.5773435	99.4352161	0.392166693	38.44308421	no switch
95 and 00	411837	256687	-256687	-97.635836	-16.957955	0.232078429	-23.42709312	switch
00 and 04	680947	321165	-321165	56.8766642	33.2884947	0.359023742	19.77909655	no switch

Chile

Year	TT	M-X	X-M	xijk	mijk	since M>X; X/M	Switch line	Switch if m<line
80 and 85	47702	47702	-47702	-100	75.6593015	0	-1	no switch
85 and 90	134899	134899	-134899	0	64.6387297	0	-1	no switch
90and 95	2339010	2334696	-2334696	100	94.227322	0.000923036	-0.90677334	no switch
95 and 00	757708	757708	-757708	-100	-208.41076	0	-1	switch
00 and 04	948198	939340	-939340	100	19.7146759	0.004692886	-0.526018549	no switch

U.K.

Year	TT	M-X	X-M	xijk	mijk	since X>M; M/X	Switch line	Switch if x<line
80 and 85	1385030	-1112590	1112590	29.0385247	42.093672	0.109079844	3.70065102	no switch
85 and 90	35118886	-35018108	35018108	96.4389406	-170.33678	0.001436874	-1.24331556	no switch
90and 95	140071971	-139992781	139992781	74.956865	-27.261018	0.000282756	-1.007425461	no switch
95 and 00	380468856	-380151770	380151770	63.1794429	75.0257028	0.000416878	-0.968306558	no switch
00 and 04	710128389	-709133675	709133675	46.4073165	68.1228976	0.000700867	-0.951554039	no switch

N.Z.

Year	TT	M-X	X-M	xijk	mijk	since X>M; M/X	Switch line	Switch if x<line
80 and 85	2337045	-1014923	1014923	10.3839297	71.6292445	0.39443157	27.64726692	switch
85 and 90	17977621	-12299703	12299703	88.9291141	76.714669	0.187530378	13.57386122	no switch
90and 95	28433524	-19565244	19565244	36.9206226	35.9749805	0.184760576	5.831518676	no switch
95 and 00	56163126	-23962358	23962358	40.0955032	72.4594146	0.401879232	28.52181316	no switch
00 and 04	123185841	-19089257	19089257	43.6827069	69.0664508	0.731657089	50.26461543	switch

Canada

Year	TT	M-X	X-M	xijk	mijk	since X>M; M/X	Switch line	Switch if x<line
80 and 85	1064387	-1064387	1064387	-96.96445	-100	0	-1	switch
85 and 90	11761259	-11738921	11738921	90.9414566	100	0.000950546	-0.903994863	no switch
90and 95	14418385	-14418385	14418385	18.5061989	-100	0	-1	no switch
95 and 00	50963448	-50947440	50947440	71.7039361	100	0.000157078	-0.984135081	no switch
00 and 04	164442516	-164309578	164309578	69.0006878	87.9582963	0.000404372	-0.964027794	no switch

Japan

Year	TT	M-X	X-M	xijk	mijk	since X>M; M/X	Switch line	Switch if x<line
80 and 85	1345125	-1340811	1340811	65.2891208	-1607.4641	0.001606144	-3.580212634	no switch
85 and 90	6575710	-6548544	6548544	79.5345625	84.1198557	0.002069908	-0.823809719	no switch
90and 95	6144620	-6144620	6144620	-6.7946757	-100	0	-1	switch
95 and 00	17730572	-17726212	17726212	65.3402294	100	0.000122967	-0.987580374	no switch
00 and 04	33306350	-33249932	33249932	46.7266155	92.2719699	0.000847674	-0.920935818	no switch

Appendix 6.1: Data Series used in Australia's IIT in wines with the Rest of the World

Appendix 6.1.1: Data Series explained in Australia's IIT in wines with the Rest of the World

Year	Gross Fixed Capital Formation	Employment	Value Added	Number of wine producers	Exchange Rate Index	Trade Imbalance	Unit values of wine exports	Net FDI
1980	4,057,000,000	364,000	9,034	292	80.31619231	31.68510324	1.529	1,409
1981	4,053,000,000	367,000	9,503	328	77.35743961	22.87003865	1.835	1,614
1982	4,311,000,000	363,000	7,501	344	71.53183453	30.56189324	1.824	1,666
1983	3,239,000,000	374,000	11,692	515	77.16488735	19.46837591	1.574	2,464
1984	4,960,000,000	367,000	11,777	506	76.83899724	31.34705091	1.697	-1,032
1985	5,246,000,000	361,000	11,638	596	78.11874929	49.30754486	1.531	183
1986	4,441,000,000	385,675	12,564	562	96.97096806	23.13855159	1.361	2,009
1987	4,224,000,000	376,825	15,091	534	110.4651089	34.7789021	1.413	148
1988	5,986,000,000	375,125	17,808	553	112.6868544	42.53389517	1.826	1,554
1989	7,132,000,000	384,300	18,081	620	99.74449374	32.18489322	2.341	4,367
1990	6,827,000,000	380,650	13,642	617	100	46.40213649	2.508	7,098
1991	5,102,000,000	386,575	13,441	701	103.6129042	62.68786082	2.592	3,102
1992	4,743,000,000	367,225	15,001	737	103.5661583	68.46737775	2.388	554
1993	4,549,000,000	359,850	16,135	802	112.7809916	76.50814343	2.012	2,376
1994	5,083,000,000	363,325	15,284	845	118.5018421	73.97863325	1.666	2,184
1995	5,539,000,000	356,625	18,188	892	119.1088165	70.84551461	2.516	8,760
1996	5,465,000,000	369,850	18,399	934	114.8093517	79.57643852	3.311	-871
1997	5,697,000,000	374,975	18,268	998	109.0970612	77.69373571	3.47	1,263
1998	6,421,000,000	378,200	19,309	1104	118.0817856	80.0251229	3.178	2,611
1999	6,567,000,000	365,750	20,862	1197	125.3369146	82.69166233	3.683	3,733
2000	6,803,000,000	385,200	24,980	1318	127.7591777	85.82937021	2.907	10,343
2001	7,260,000,000	373,375	29,876	1465	138.7646723	89.39742898	2.653	-3,706
2002	7,532,000,000	385,175	23,171	1624	138.4779908	88.96501862	2.699	9,704
2003	7,124,000,000	323,100	27,010	1798	134.1760485	88.26355643	2.869	-6,778
2004	8,965,000,000	319,200	27,047	1899	120.3192096	87.30496138	3.098	24,769

Appendix 6.1.2: Data Series used in the Econometric Estimation of Australia's IIT in wines with the Rest of the World

Year	IIT(G-L)	Logistic IIT	PD	EOS	KL	TMB	Open	Now	XRI
1980	68.31490	0.7682812	1.529	30,938,356	11145.604	31.685103	25.033677	292	80.316192
1981	77.12996	1.2156641	1.835	28,972,561	11043.597	22.870039	22.764607	328	77.35744
1982	69.43811	0.8206819	1.824	21,805,233	11876.033	30.561893	21.922944	344	71.531835
1983	80.53162	1.4198586	1.574	22,702,913	8660.4278	19.468376	19.757318	515	77.164887
1984	68.65295	0.7839439	1.697	23,274,704	13514.986	31.347051	21.587587	506	76.838997
1985	50.69246	0.0277	1.531	19,526,846	14531.856	49.307545	22.898941	596	78.118749
1986	76.86145	1.2005043	1.361	22,355,872	11514.877	23.138552	23.582239	562	96.970968
1987	65.22110	0.6287721	1.413	28,260,300	11209.447	34.778902	24.643234	534	110.46511
1988	57.46610	0.300894	1.826	32,202,532	15957.348	42.533895	23.943314	553	112.68685
1989	67.81511	0.7452878	2.341	29,162,903	18558.418	32.184893	22.68696	620	99.744494
1990	53.59786	0.1441637	2.508	22,110,211	17935.111	46.402136	23.72573	617	100
1991	37.31214	-0.5188491	2.592	19,174,037	13197.956	62.687861	23.200465	701	103.6129
1992	31.53262	-0.7753348	2.388	20,354,138	12915.787	68.467378	23.40944	737	103.56616
1993	23.49186	-1.1807434	2.012	20,118,454	12641.378	76.508143	25.07716	802	112.78099
1994	26.02137	-1.0448583	1.666	18,087,574	13990.229	73.978633	27.798393	845	118.50184
1995	29.15449	-0.8878929	2.516	20,390,135	15531.721	70.845515	27.675163	892	119.10882
1996	20.42356	-1.3600288	3.311	19,699,143	14776.261	79.576439	28.386416	934	114.80935
1997	22.30626	-1.2479071	3.47	18,304,609	15193.013	77.693736	26.730206	998	109.09706
1998	19.97488	-1.3878653	3.178	17,490,036	16977.79	80.025123	26.573048	1104	118.08179
1999	17.30834	-1.5639304	3.683	17,428,571	17954.887	82.691662	28.570725	1197	125.33691
2000	14.17063	-1.8011898	2.907	18,952,959	17660.955	85.82937	30.236279	1318	127.75918
2001	10.60257	-2.1319954	2.653	20,393,174	19444.258	89.397429	30.309486	1465	138.76467
2002	11.03498	-2.0871729	2.699	14,267,857	19554.748	88.965019	31.705388	1624	138.47799
2003	11.73644	-2.0176285	2.869	15,022,247	22048.901	88.263556	30.449627	1798	134.17605
2004	12.69504	-1.928196	3.098	14,242,759	28085.84	87.304961	29.054927	1899	120.31921

Note:

IIT	= Intra-Industry Trade Index (the unadjusted G-L index)
PD	= Product Differentiation (proxy by unit value of wine export)
EOS	= Economies of Scale (Ratio of value added per wine producers)
KL	= Capital-Labour Ratio (Ratio of gross fixed capital formation to employees in agriculture)
TMB	= Trade Imbalance (the proportion of Australia's absolute values of exports minus imports divided by its exports plus imports)
Open	= Openness (Ratio of Australia's commodity trade to GDP)
Now	= Number of Wine Producers (proxy for industry establishments)
XRI	= Exchange Rate Index (average of AUD/ USD, GBP, NZD, and JPY)

Appendix 6.2: Data Series used in Australia’s Bilateral IIT in wines with its Major Trading Countries

Appendix 6.2.1: Data Series explained in Australia’s Bilateral IIT in wines with its Major Trading Countries

Trading partner: **France**

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, Bordeaux	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	1,299,323	13,090	101.413	23,952,600	16,402	1.956	0.482	705,289	54.28127668	24.9416658	0
1981	1,155,539	13,120	111.362	24,084,000	16,402	1.821	0.362	710,868	61.51830599	24.1450157	-2
1982	940,334	11,890	122.992	24,202,100	16,402	1.687	0.355	647,767	68.8869392	23.4921984	-1
1983	748,294	10,310	128.525	24,203,400	16,402	1.451	0.392	564,246	75.40429669	24.4050165	0
1984	655,113	9,680	135.299	24,230,100	16,402	1.489	0.346	531,887	81.19012615	25.1139875	0
1985	615,752	9,590	143.592	24,387,800	16,402	1.651	0.347	529,080	85.92430997	26.4315861	0
1986	698,509	11,110	155.529	24,546,900	16,402	2.071	0.566	615,427	88.10585222	29.187399	-2
1987	866,205	14,170	168.441	24,578,900	16,402	2.393	0.65	788,277	91.00350944	29.5339605	-4
1988	1,084,060	18,130	189.199	24,528,700	16,402	2.671	0.608	1,013,177	93.46130134	29.2708689	-6
1989	1,107,949	18,990	208.597	24,830,500	16,402	2.76	0.607	1,071,720	96.73005786	28.8028342	-9
1990	1,143,778	20,160	221.868	24,795,800	16,402	3.457	0.869	1,143,778	100	28.4795949	-22
1991	1,159,250	21,000	224.653	24,779,700	16,402	3.358	0.767	1,196,538	103.2165892	27.748221	-9
1992	1,262,847	23,310	222.161	24,955,300	16,402	3.726	0.756	1,334,311	105.658968	26.5168805	-9
1993	1,233,733	23,160	208.341	25,067,800	16,402	3.407	0.63	1,331,005	107.8843783	25.6824517	0
1994	1,253,365	23,840	212.924	25,162,100	16,402	3.556	0.637	1,374,638	109.6758513	24.9774446	-9
1995	1,306,885	25,220	216.423	25,295,200	16,402	4.002	0.833	1,458,826	111.6261975	24.6814706	8
1996	1,350,411	26,500	219.602	25,611,500	16,402	3.729	0.995	1,537,689	113.8682064	22.3155566	-8
1997	1,328,474	26,300	221.262	25,596,100	16,402	3.414	0.914	1,530,870	115.2352272	22.3591016	-12
1998	1,270,557	25,240	237.115	25,769,200	16,402	3.6	0.941	1,473,966	116.0094375	22.6567496	-16
1999	1,248,481	24,830	256.749	26,003,400	16,402	3.842	0.905	1,455,609	116.5903917	22.7367416	-88
2000	1,215,553	24,470	280.668	26,162,600	16,402	3.403	0.975	1,441,185	118.5620791	20.9769378	-132
2001	1,143,240	23,280	291.636	26,379,600	16,402	3.085	0.83	1,377,990	120.5337665	19.8073729	-37
2002	1,092,006	22,510	290.552	26,644,500	16,402	3.512	0.958	1,341,573	122.8540264	20.0054168	-1
2003	1,207,197	25,220	300.452	26,778,300	16,402	4.386	1.096	1,513,906	125.4066679	20.177112	-10
2004	1,431,779	30,370	318.397	26,969,100	16,402	4.822	1.276	1,833,741	128.0743147	18.736031	-38

Trading partner: **Italy**

Year	real GNI	per capita GNI	Gross fixed capital formation (000b)	labour force	distance, Rome	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	1,113,129	7,870	52.008	22,019,800	15,332	0.559	4.643	444,136	39.89972482	11.9494542	-163
1981	979,776	8,150	62.584	22,224,200	15,332	0.433	4.196	460,491	46.99966863	12.1348976	-265
1982	796,985	7,710	69.597	22,287,900	15,332	0.444	3.6	435,954	54.70039908	12.9086981	-352
1983	645,937	7,160	76.533	22,440,300	15,332	0.524	2.434	404,998	62.69936175	11.3917683	-832
1984	591,009	7,260	86.879	22,563,200	15,332	0.467	3.039	410,749	69.49963261	11.2633608	-561
1985	562,206	7,540	95.709	22,664,400	15,332	0.48	1.089	426,711	75.89937904	11.5521169	-664
1986	619,530	8,790	102.139	23,061,600	15,332	0.731	2.117	497,479	80.29938481	9.50822492	-2,628
1987	765,237	11,370	111.745	23,390,900	15,332	0.84	2.595	643,565	84.10004466	9.62561802	2,081
1988	956,424	14,930	126.448	23,590,900	15,332	0.812	4.134	845,471	88.39919895	9.80904359	2,098
1989	974,107	16,140	139.127	23,818,200	15,332	0.86	2.611	914,686	93.89992652	10.4462161	6
1990	988,045	17,420	154.722	23,907,400	15,332	1.187	3.136	988,045	100	10.8528139	-983
1991	1,012,759	18,970	165.874	23,891,800	15,332	1.202	3.034	1,076,566	106.3003357	11.0214266	-5,133
1992	1,083,729	21,290	170.059	23,973,100	15,332	1.291	2.987	1,210,528	111.7002118	10.2739081	-1,043
1993	975,263	19,950	156.311	23,249,200	15,332	1.05	3.088	1,138,128	116.6995635	10.2848486	-3,580
1994	908,091	19,300	162.352	23,034,200	15,332	0.98	5.394	1,102,416	121.3992422	11.0031905	-3,040
1995	854,708	19,090	180.586	22,915,700	15,332	1.147	7.646	1,092,024	127.7658517	11.2386375	-2,182
1996	869,051	20,120	190.153	23,005,400	15,332	1.588	5.3	1,154,486	132.8444438	10.5659654	-5,151
1997	873,716	20,590	198.38	23,057,200	15,332	1.672	2.466	1,184,399	135.5587892	9.49699363	-6,714
1998	856,613	20,560	210.55	23,251,000	15,332	1.557	2.272	1,184,009	138.2198274	9.57205955	-9,772
1999	834,898	20,350	221.299	23,389,800	15,332	1.345	4.319	1,173,096	140.5077151	9.85028882	220
2000	807,248	20,160	242.028	23,527,700	15,332	1.519	3.27	1,163,030	144.0735351	9.85252929	1,098
2001	758,692	19,470	253.778	23,611,000	15,332	1.489	2.337	1,123,516	148.0859831	9.88681977	-6,884
2002	726,558	19,110	270.889	23,798,200	15,332	1.705	2.344	1,102,456	151.7368065	10.1994457	-2,548
2003	800,349	21,630	271.776	24,046,500	15,332	2.333	1.811	1,246,883	155.7924765	9.89659423	7,552
2004	950,209	26,280	286.477	24,246,600	15,332	2.473	1.897	1,513,018	159.230071	10.1314704	-2,372

Trading partner: **Spain**

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, Madrid	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	561,812	6,170	21.791	14,164,800	16,668	0.698	3.985	230,672	41.05851702	4.81893262	1,182
1981	501,505	6,250	24.32	14,235,400	16,668	0.539	3.033	235,881	47.03463013	4.19032391	1,436
1982	396,978	5,630	27.685	14,381,600	16,668	0.672	2.332	213,619	53.81136384	4.26350668	1,272
1983	303,760	4,810	30.662	14,564,100	16,668	0.515	2.079	183,362	60.36415796	4.24264319	1,379
1984	258,685	4,540	31.711	14,657,300	16,668	0.445	1.669	173,759	67.17016481	3.97276889	1,524
1985	236,984	4,510	36.185	14,682,600	16,668	0.488	0.823	173,220	73.09358625	4.06345264	1,718
1986	259,144	5,350	42.527	14,812,000	16,668	0.778	2.271	206,077	79.5219695	4.30875705	3,073
1987	325,221	7,050	50.337	15,354,200	16,668	1.086	2.961	272,193	83.69485671	4.38945494	3,826
1988	411,840	9,340	60.619	15,685,100	16,668	1.202	3.454	361,374	87.74626036	4.32020678	5,786
1989	438,962	10,610	71.823	15,767,800	16,668	1.082	2.776	411,328	93.70480958	4.14598469	6,955
1990	469,527	12,090	80.785	15,999,600	16,668	1.311	3.735	469,527	100	3.90208867	10,462
1991	498,503	13,570	86.06	16,149,800	16,668	1.113	3.354	528,090	105.9351307	4.64717231	8,051
1992	539,139	15,510	85.324	16,273,700	16,668	1.269	5.073	604,983	112.2127572	5.21804848	11,084
1993	498,280	14,960	81.154	16,451,500	16,668	0.824	3.208	584,682	117.3399491	5.32808702	6,493
1994	460,954	14,470	85.697	16,711,200	16,668	1.039	0.902	566,399	122.8755013	5.11676973	5,165
1995	453,008	14,860	96.25	16,856,300	16,668	1.52	0.547	582,661	128.6203565	5.43023967	3,368
1996	461,044	15,610	101.463	17,088,100	16,668	1.626	0.616	614,097	133.1972132	5.1972894	2,560
1997	460,887	15,750	109.992	17,314,100	16,668	1.303	2.822	625,984	135.8215509	5.05748703	-5,370
1998	442,290	15,350	124.333	17,577,800	16,668	1.256	0.936	611,744	138.3126958	5.12769373	-6,089
1999	432,964	15,240	142.462	17,894,800	16,668	1.573	0.815	612,678	141.5078598	5.35368556	-25,530
2000	423,911	15,320	162.806	18,468,600	16,668	1.449	1.189	620,460	146.3657387	4.73384003	-18,576
2001	403,789	15,030	176.507	18,398,000	16,668	1.258	2.69	612,232	151.6217324	5.0080249	-4,725
2002	398,897	15,110	191.004	19,111,700	16,668	1.348	2.922	623,363	156.2717719	4.74910227	6,339
2003	455,214	17,450	211.334	19,872,900	16,668	1.359	3.675	732,952	161.0125582	5.07413207	-3,152
2004	554,029	21,530	233.647	20,343,100	16,668	1.357	3.904	919,116	165.8967829	5.13466784	-36,712

Trading partner: **Germany**

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, Bonn	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	1,273,496	12,580	207.141	35,296,000	15,775	1.864	0.837	985,052	77.35018915	13.08625	-4
1981	1,157,880	12,020	207.164	35,806,500	15,775	1.688	0.69	942,584	81.40602208	12.9442692	-4
1982	978,468	10,590	203.603	36,090,000	15,775	1.579	0.668	829,568	84.78232511	12.9915399	-2
1983	856,562	9,580	214.706	36,158,700	15,775	1.301	0.653	748,409	87.3735517	13.2412211	-2
1984	822,101	9,460	220.782	35,762,700	15,775	1.115	0.605	736,423	89.57816966	11.8701077	-4
1985	799,810	9,410	225.636	35,890,200	15,775	1.244	0.637	731,138	91.41396772	11.6100811	-5
1986	911,757	10,790	236.413	36,299,100	15,775	1.6	0.916	838,685	91.98557926	12.0765355	-8
1987	1,148,646	13,710	244.468	36,625,800	15,775	1.555	1.077	1,067,186	92.90822196	12.0402177	-7
1988	1,486,317	17,940	260.704	36,806,800	15,775	1.555	1.222	1,401,903	94.32064798	11.9837764	-13
1989	1,544,100	19,040	286.915	37,247,900	15,775	1.507	1.243	1,499,438	97.10755073	11.3001046	-8
1990	1,633,142	20,560	322.985	38,328,400	15,775	1.777	1.517	1,633,142	100	12.1765943	-21
1991	1,703,972	22,120	356.75	39,916,500	15,775	1.788	1.515	1,769,910	103.8696441	12.9616236	-18
1992	1,863,418	25,010	387.81	39,854,900	15,775	1.77	1.701	2,016,406	108.2100969	12.6550414	-21
1993	1,830,075	25,200	381.19	39,828,700	15,775	1.411	1.401	2,045,131	111.7512422	11.3157787	-17
1994	1,899,452	26,590	401.83	39,795,700	15,775	1.528	1.371	2,167,510	114.1124011	11.0051062	-12
1995	2,018,697	28,630	404.95	39,798,000	15,775	1.892	1.636	2,337,410	115.7881005	10.8340114	-27
1996	2,109,537	30,010	399.85	40,023,700	15,775	1.968	1.699	2,458,179	116.5269262	10.3084448	-44
1997	2,046,204	29,280	402.37	40,282,100	15,775	1.856	1.779	2,403,039	117.4388957	9.07447938	-30
1998	1,896,852	27,170	414.5	40,538,300	15,775	1.955	1.633	2,229,217	117.5219098	8.97134557	-66
1999	1,822,946	26,130	428.42	40,429,900	15,775	1.884	1.652	2,144,933	117.6630338	8.79340498	-53
2000	1,768,403	25,510	442.43	40,377,900	15,775	1.459	1.68	2,097,177	118.5916061	7.8147043	150
2001	1,645,466	24,000	422.88	40,550,700	15,775	1.498	1.467	1,975,992	120.0870462	8.11387223	-13
2002	1,569,223	23,030	392.9	40,554,500	15,775	1.663	1.43	1,900,159	121.0891453	7.67777892	34
2003	1,738,639	25,700	384.38	40,283,200	15,775	1.997	1.717	2,121,304	122.0094162	7.4199041	26
2004	2,057,175	30,690	384.94	40,823,900	15,775	2.184	1.753	2,532,416	123.1016449	7.25631503	-23

Trading partner: **U.S**.

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, San Francisco	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	4,676,751	12,980	565.2	112,384,000	12,986	1.017	1.841	2,949,381	63.0647372	9.64499032	-2
1981	4,597,890	13,940	625.4	114,125,200	12,986	1.059	1.77	3,198,756	69.57008804	11.1528107	16
1982	4,322,369	13,780	614.8	115,728,200	12,986	1.121	1.712	3,192,330	73.85602826	11.8686328	13
1983	4,327,457	14,110	656.8	117,013,300	12,986	1.126	1.964	3,298,805	76.22963783	13.5987399	3
1984	4,670,798	15,750	767.6	118,728,700	12,986	1.134	2.047	3,714,244	79.5205335	14.7767536	12
1985	4,914,408	17,010	824.1	120,807,600	12,986	1.182	2.266	4,047,087	82.35146818	14.1845003	6
1986	5,318,927	18,580	858.2	122,727,000	12,986	1.313	2.914	4,461,671	83.88291423	11.5555923	11
1987	5,780,126	20,760	884.5	124,588,200	12,986	1.402	3.368	5,029,920	87.02092888	9.52863014	23
1988	6,167,210	22,830	935.8	126,258,600	12,986	1.372	3.558	5,581,912	90.50951553	8.60012459	35
1989	6,001,481	23,070	989.1	128,345,600	12,986	1.282	3.681	5,694,114	94.87848595	8.22510299	25
1990	5,823,705	23,330	1,003.40	129,304,300	12,986	1.348	4.087	5,823,705	100	6.94671716	11
1991	5,698,681	23,480	966.6	130,116,200	12,986	1.36	4.413	5,939,994	104.2345406	7.02683855	-15
1992	5,918,875	24,780	1,016.50	132,182,400	12,986	1.394	4.493	6,356,417	107.3923243	7.60725461	-28
1993	5,987,716	25,470	1,102.10	133,595,300	12,986	1.446	4.406	6,620,137	110.5619695	7.86904431	-33
1994	6,176,639	26,630	1,208.00	135,768,600	12,986	1.519	4.284	7,007,045	113.4443039	7.50229825	-34
1995	6,372,290	27,910	1,301.60	137,585,500	12,986	1.684	4.554	7,431,819	116.6271285	7.19466922	-41
1996	6,501,135	28,970	1,410.70	139,473,700	12,986	1.886	4.413	7,804,344	120.0458643	7.78289215	-5
1997	6,638,221	29,910	1,533.70	141,948,600	12,986	1.934	4.106	8,155,171	122.8517581	8.73826126	1
1998	6,770,383	30,620	1,664.70	143,824,100	12,986	2.032	4.924	8,446,649	124.758817	8.76624806	36
1999	7,060,909	32,260	1,807.10	145,734,400	12,986	1.978	5.657	9,001,830	127.4882703	9.69140939	65
2000	7,366,426	34,400	1,944.20	147,886,400	12,986	1.916	5.222	9,708,506	131.7939797	11.0590316	162
2001	7,326,725	34,800	1,929.60	148,892,100	12,986	1.808	4.959	9,929,066	135.5184775	10.8992754	25
2002	7,379,520	35,230	1,869.70	150,098,000	12,986	1.98	4.808	10,159,240	137.6680373	11.4024628	-70
2003	7,803,521	37,780	1,961.30	150,755,200	12,986	1.852	5.604	10,986,802	140.7928726	11.363237	-86
2004	8,417,875	41,440	2,188.70	153,702,200	12,986	1.924	5.577	12,169,063	144.5621804	10.7309433	-111

Trading partner: **South Africa**

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, Cape Town	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	271,592	2,510	16.244	10,764,300	10,173	0.946	3.26	69,216	25.48520822	0.172244	0
1981	283,763	2,950	19.947	10,967,200	10,173	0.809	4.405	83,352	29.37394008	0.16732314	0
1982	249,517	2,900	22.674	11,356,200	10,173	0.825	3.054	84,019	33.67250801	0.16958771	0
1983	208,296	2,650	24.576	11,786,400	10,173	0.805	2.593	78,769	37.81562088	0.1885963	0
1984	192,395	2,660	26.518	12,076,000	10,173	0.743	1.852	81,143	42.17542868	0.1674038	0
1985	153,194	2,400	29.099	12,524,400	10,173	0.738	2.457	75,139	49.04842661	0.10128783	-500
1986	130,257	2,360	29.35	12,928,500	10,173	0.899	2.872	75,806	58.19672131	0.10639405	-121
1987	130,072	2,670	31.168	13,279,500	10,173	1.134	4.452	87,931	67.6017524	0.10673997	-304
1988	145,545	3,290	40.701	13,612,800	10,173	1.317	3.515	110,965	76.2412851	0.11394797	93
1989	141,163	3,580	50.856	13,968,800	10,173	1.396	4.764	123,478	87.47173544	0.12515397	-364
1990	119,328	3,390	55.485	14,366,900	10,173	1.419	4.78	119,328	100	0.07611416	-104
1991	103,437	3,320	56.954	14,797,600	10,173	1.538	4.502	119,298	115.3335218	0.13532659	48
1992	92,750	3,320	58.255	15,279,800	10,173	1.547	4.795	121,814	131.3359714	0.25611717	-1,936.00
1993	89,979	3,460	62.601	15,714,400	10,173	1.848	5.233	129,660	144.0997739	0.31240434	-281
1994	88,038	3,610	73.045	16,110,300	10,173	1.318	4.528	138,202	156.97899	0.41608149	-887
1995	85,759	3,740	87.042	16,507,600	10,173	1.441	1.072	146,309	170.6048615	0.91782506	-1,246.00
1996	82,118	3,760	100.632	16,886,700	10,173	1.556	0.795	150,400	183.1519691	0.82894848	-232
1997	75,720	3,680	113.221	17,327,100	10,173	1.854	0.729	150,608	198.9000377	0.79260426	1,487.00
1998	64,648	3,280	126.913	17,776,200	10,173	1.719	2.277	137,432	212.5847937	0.66840796	-1,084.00
1999	60,468	3,150	125.754	18,231,300	10,173	1.501	1.206	135,207	223.6009045	0.73101536	-81
2000	56,976	3,050	139.647	18,632,400	10,173	1.44	0.956	134,200	235.5379687	0.95609157	692
2001	50,937	2,830	153.525	18,958,400	10,173	1.378	1.172	126,818	248.9683437	0.88629902	10,785.00
2002	43,880	2,630	175.594	19,108,100	10,173	1.359	1.432	119,257	271.7825513	0.99898388	1,137.00
2003	45,398	2,850	198.904	19,278,500	10,173	1.799	1.721	130,613	287.7072734	1.3778802	230
2004	56,634	3,630	225.316	19,417,200	10,173	2.04	5.411	165,198	291.6925758	1.34230058	-604

Trading partner: **U.K.**

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, London	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	893,782	8,410	43.238	27,493,400	16,259	3.219	1.728	473,735	53.00342863	8.50208869	-1
1981	894,217	9,409	43.331	27,522,600	16,259	3.636	1.466	530,263	59.29915499	8.60735499	-6
1982	821,285	9,395	47.394	27,641,600	16,259	3.991	1.347	528,854	64.39350989	8.10723892	-2
1983	723,926	8,659	51.49	27,922,500	16,259	3.869	1.406	487,640	67.36049243	8.89733243	-3
1984	652,997	8,184	58.589	28,172,700	16,259	3.613	1.259	461,651	70.69733539	8.99200394	-8
1985	608,561	8,069	64.4	28,380,800	16,259	3.642	1.385	456,334	74.98582652	9.57692624	-5
1986	663,419	9,077	68.546	28,559,900	16,259	5.721	1.785	514,521	77.55595151	10.4991426	-8
1987	786,945	11,190	78.996	28,710,700	16,259	7.457	1.958	635,637	80.77265733	10.5358843	-16
1988	951,094	14,160	96.243	28,978,100	16,259	6.586	2.159	805,931	84.73718312	11.0891677	-15
1989	952,571	15,245	111.324	29,354,200	16,259	6.263	2.156	870,124	91.34472611	10.5348194	-4
1990	931,933	16,282	114.3	29,448,900	16,259	9.185	2.631	931,933	100	11.2067878	13
1991	918,064	16,919	105.179	29,342,000	16,259	9.593	2.49	971,810	105.8543236	10.4613267	0
1992	976,590	18,622	100.583	29,127,400	16,259	9.93	2.504	1,072,348	109.8053508	10.2386348	-3
1993	959,660	18,544	101.027	28,947,200	16,259	9.497	2.216	1,070,248	111.523717	10.18122	-11
1994	961,755	18,996	108.314	28,944,500	16,259	6.923	2.282	1,099,147	114.2855214	10.3892585	-24
1995	947,822	19,305	117.448	28,933,500	16,259	4.175	2.655	1,120,173	118.1839043	9.89173757	-27
1996	980,321	20,407	126.273	29,025,100	16,259	3.537	2.888	1,186,953	121.0779947	10.1837284	-9
1997	1,013,761	21,708	133.587	29,174,400	16,259	5.008	2.862	1,265,880	124.8697389	11.1911448	-23
1998	1,034,536	22,847	150.938	29,149,800	16,259	5.184	3.347	1,335,978	129.1379822	10.8218221	-48
1999	1,076,163	24,050	155.486	29,430,000	16,259	7.315	3.46	1,411,350	131.1465673	10.9412135	-113
2000	1,102,944	25,283	161.81	30,123,100	16,259	8.029	2.866	1,488,815	134.9855565	10.4659171	-124
2001	1,083,566	25,194	165.667	29,869,900	16,259	9.398	2.789	1,489,293	137.4436435	10.6516327	-8
2002	1,085,073	25,551	172.558	29,994,400	16,259	7.772	2.947	1,515,736	139.6898032	10.9227407	-25
2003	1,169,583	28,233	175.946	30,276,600	16,259	9.952	3.117	1,681,388	143.7596177	10.7101625	-38
2004	1,360,140	33,648	190.352	30,353,700	16,259	7.965	3.274	2,013,294	148.0211117	11.1213186	-20

Trading partner: **New Zealand**

Year	real GNI	per capita GNI	Gross fixed capital formation (m)	labour force	distance, Wellington	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	64,895	7,480	4,860.50	1,498,700	3,226	2.139	3.324	23,285	35.88118482	0.10059202	71
1981	61,627	8,110	6,776.80	1,533,400	3,226	1.893	3.132	25,506	41.38792109	0.13382263	171
1982	52,399	7,920	8,029.10	1,562,100	3,226	1.867	3.498	25,194	48.08019311	0.139903	259
1983	45,879	7,350	9,067.90	1,592,200	3,226	1.611	3.402	23,682	51.61777471	0.13808779	100
1984	41,657	7,020	10,503.10	1,613,900	3,226	2.022	3.293	22,836	54.81884015	0.21713238	841
1985	35,018	6,770	12,601.80	1,638,100	3,226	1.764	3.217	22,151	63.25671546	0.14211442	957
1986	34,546	7,550	13,120.60	1,639,700	3,226	2.124	4.323	24,741	71.61848817	0.18076564	622
1987	36,602	9,180	14,407.70	1,656,200	3,226	2.416	5.183	30,340	82.89118518	0.16293387	849
1988	44,299	11,660	14,030.10	1,644,500	3,226	2.66	5.013	39,061	88.17674828	0.24468487	1,344
1989	45,244	12,620	15,249.00	1,642,700	3,226	2.89	3.723	42,883	94.78102667	0.28190116	-269
1990	44,272	12,840	14,922.70	1,674,900	3,226	2.704	3.629	44,272	100	0.29246114	141
1991	40,632	11,820	12,523.90	1,700,300	3,226	2.689	3.138	41,311	101.6706898	0.26554633	600
1992	40,335	11,730	13,092.30	1,709,500	3,226	2.76	2.255	41,430	102.7147223	0.30165168	2,907
1993	40,974	11,950	15,563.80	1,731,000	3,226	3.015	1.656	42,685	104.1761299	0.39619212	1,332
1994	43,230	12,740	18,355.00	1,777,800	3,226	2.985	1.263	46,119	106.6815701	0.41856628	811
1995	47,559	14,330	20,599.60	1,821,600	3,226	3.346	2.144	52,634	110.6710109	0.3697128	3,796
1996	52,050	15,790	21,539.40	1,876,400	3,226	3.66	2.167	58,928	113.2145023	0.404928	3,904
1997	54,578	16,530	21,408.30	1,892,400	3,226	4.046	2.371	62,516	114.5451086	0.44889524	2,546
1998	50,474	15,350	20,742.20	1,896,700	3,226	3.388	1.978	58,560	116.0195964	0.41193255	388
1999	48,883	14,770	22,888.00	1,910,800	3,226	4.316	1.703	56,643	115.8745258	0.49911962	383
2000	44,384	13,680	23,595.10	1,928,200	3,226	2.349	1.495	52,777	118.910306	0.57180353	3,171
2001	42,711	13,430	25,846.40	1,965,900	3,226	4.434	1.544	52,122	122.0328906	0.59915829	1,012
2002	42,565	13,540	27,748.60	2,021,500	3,226	4.969	1.836	53,334	125.2993567	0.68369078	1,354
2003	49,210	15,650	31,527.30	2,057,000	3,226	5.796	2.025	62,741	127.4968191	0.71251537	1,925
2004	62,246	19,990	34,922.50	2,115,400	3,226	6.035	2.714	81,179	130.4172563	0.85833253	3,664

Trading partner: **Japan**

Year	real GNI	per capita GNI	Gross fixed capital formation (000b)	labour force	distance,Tokyo	unit value exports	unit value imports	nominal GNI	CPI	Openness (%)	Net FDI
1980	1,492,031	10,430	77.058	56,421,900	7,821	2.075	1.652	1,218,036	81.63613262	0.74362482	-2
1981	1,457,455	10,610	80.237	57,065,400	7,821	2.22	1.62	1,248,245	85.6455589	0.7401353	-5
1982	1,355,601	10,070	80.94	57,899,700	7,821	2.325	1.514	1,192,781	87.98909679	0.83324958	-4
1983	1,293,079	9,720	79.548	58,970,900	7,821	2.519	1.331	1,159,197	89.64629736	0.97731679	-3
1984	1,301,207	9,940	83.331	59,325,500	7,821	2.417	1.393	1,192,979	91.68250383	1.0036765	-6
1985	1,417,486	10,980	90.164	59,613,500	7,821	2.517	1.62	1,325,879	93.53735217	0.96162422	-6
1986	1,719,423	13,320	94.219	60,324,000	7,821	1.733	2.2276	1,618,273	94.11726377	0.81663784	-14
1987	2,255,653	17,410	101.042	61,004,800	7,821	2.483	2.597	2,125,604	94.23454927	1.21819044	-19
1988	3,091,573	23,920	114.744	61,766,300	7,821	2.775	2.833	2,932,903	94.86767373	1.76084369	-36
1989	3,310,384	26,090	128.163	62,616,700	7,821	3.309	3.809	3,212,096	97.03093948	2.40902418	-47
1990	3,330,558	26,960	142.233	63,911,400	7,821	2.996	4.684	3,330,558	100	2.54607181	-49
1991	3,328,503	27,730	149.051	64,968,300	7,821	2.778	4.475	3,436,329	103.2394687	2.1283422	-30
1992	3,510,783	29,680	146.776	65,861,800	7,821	2.037	4.861	3,687,117	105.0226426	1.92916705	-15
1993	3,827,233	32,690	142.002	66,209,300	7,821	2.882	4.117	4,071,082	106.3714258	1.77174644	-14
1994	4,216,969	36,150	138.67	66,582,100	7,821	2.684	4.072	4,517,340	107.1229217	2.12378014	-17
1995	4,786,013	40,820	138.089	66,839,400	7,821	3.819	4.354	5,120,420	106.9871746	2.32978308	-22
1996	4,916,262	41,880	142.813	67,395,400	7,821	4.25	4.725	5,266,871	107.1316095	2.19249828	-23
1997	4,524,800	39,110	141.459	68,024,400	7,821	4.311	4.453	4,931,419	108.9864579	2.60861366	-23
1998	3,878,650	33,660	130.184	68,078,800	7,821	2.642	4.001	4,254,961	109.7021166	4.65267671	-21
1999	3,822,759	33,000	126.415	67,845,500	7,821	3.548	4.663	4,179,450	109.3307125	3.07519058	-10
2000	4,105,255	35,140	126.511	67,576,900	7,821	2.539	4.758	4,458,212	108.5976782	3.09925624	-23
2001	4,206,878	35,670	122.649	67,535,700	7,821	3.169	4.608	4,535,084	107.8016572	3.00781304	-32
2002	4,012,285	33,640	114.047	67,047,700	7,821	3.902	4.766	4,285,702	106.8145043	2.75874974	-23
2003	4,054,346	33,860	112.489	66,963,800	7,821	4.454	5.611	4,319,622	106.5430101	2.56220783	-23
2004	4,443,316	37,050	113.369	66,959,600	7,821	4.553	6.306	4,733,656	106.5343223	2.62164476	-23

Appendix 6.2.2: Data Series used in the Econometric Estimation of Australia's Bilateral IIT in wines with its Major Trading Countries

France

Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	1.23452047	12410	1360	837598.991	923448.3401	47.31778694	25.95314268	16402	24.94166584	1.7425	0.427	704.5	0	0
1981	0.43367087	12841.5	557	764152.1903	782773.0413	51.67635342	24.70674634	16402	24.14501569	1.828	0.014	806	0	0
1982	0.30907499	12022.5	265	635252.0363	610163.6056	56.79462926	28.10584943	16402	23.49219842	1.7555	0.137	832.5	0	0
1983	0.25755572	11140.5	1661	523831.4923	448924.6232	59.34644251	27.9478981	16402	24.40501649	1.5125	0.123	1232	0	0
1984	0.28728661	10911	2462	475373.9536	359477.819	62.40549559	36.56688273	16402	25.11398755	1.593	0.208	-516	0	0
1985	0.48572667	10708.5	2237	444579.7046	342343.7595	65.80230032	43.87773295	16402	26.43158609	1.591	0.12	91.5	0	0
1986	1.5316884	11540	860	477935.4549	441147.1643	70.81058503	37.507107	16402	29.18739904	1.716	0.71	1003.5	0	0
1987	0.76688428	13600	1140	564200.8281	604008.6758	76.58942775	17.94905623	16402	29.5339605	1.903	0.98	72	0	0
1988	5.20842156	16715	2830	687952.9611	792214.7984	86.20406809	17.08172243	16402	29.2708689	2.2485	0.845	774	0	0
1989	1.76529937	18005	1970	707466.4485	800964.9609	93.887127	20.3201422	16402	28.80283419	2.5505	0.419	2179	0	0
1990	3.69478342	18935	2450	722999.375	841556.45	100	14.57020102	16402	28.4795949	2.9825	0.949	3538	0	0
1991	3.38974997	19510	2980	730490.9184	857517.5617	101.321039	8.965613325	16402	27.74822099	2.975	0.766	1546.5	0	0
1992	12.5706293	20968.5	4683	787733.6616	950226.5101	99.49207366	8.061338064	16402	26.51688047	3.057	1.338	272.5	0	0
1993	12.283482	20782.5	4755	770055.9917	927354.0603	92.88422878	6.340467821	16402	25.68245167	2.7095	1.395	1188	0	0
1994	5.81823222	21202	5276	779935.3277	946858.445	94.57169839	6.623902753	16402	24.97744462	2.611	1.89	1087.5	0	0
1995	5.48868845	22385	5670	809554.8226	994659.7262	95.62000267	6.116180731	16402	24.68147059	3.259	1.486	4384	0	0
1996	6.41606667	23850	5300	842366.4078	1016089.563	95.82630284	4.480142994	16402	22.31555659	3.52	0.418	-439.5	0	0
1997	11.0246658	24136.5	4327	839013.3011	978922.0369	96.6087564	5.010533984	16402	22.35910158	3.442	0.056	625.5	0	0
1998	14.4508111	23225	4030	804301.715	932509.6918	102.8351412	4.418980811	16402	22.65674956	3.389	0.422	1297.5	0	0
1999	18.4500048	22790	4080	789081.6331	918799.0794	110.3473938	4.826214557	16402	22.73674161	3.7625	0.159	1822.5	0	0
2000	27.4516487	22265	4410	762140.3111	906825.7331	119.8934493	3.493989041	16402	20.97693777	3.155	0.496	5105.5	0	0
2001	58.8458158	21570	3420	720017.771	846443.675	123.5538786	2.844660667	16402	19.80737285	2.869	0.432	-1871.5	0	0
2002	39.7887793	21085	2850	690298.1388	803415.9679	121.8708249	2.721604751	16402	20.00541682	3.1055	0.813	4851.5	0	0
2003	35.0915577	23655	3130	763221.2201	887952.5596	125.3936525	3.190372708	16402	20.17711199	3.6275	1.517	-3394	0	0
2004	34.9088422	28733	3274	909310.7656	1044935.622	131.9428831	2.951358944	16402	18.73603096	3.96	1.724	12365.5	0	0

Italy

Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	0.31246448	9800	3860	744502.1262	737254.6104	36.49531027	8.873893853	15332	11.94945425	1.044	0.97	623	0	0
1981	0.1773078	10356.5	4413	676270.6504	607009.9616	43.5128428	10.59372425	15332	12.13489758	1.134	1.402	674.5	0	0
1982	0.22644303	9932.5	4445	563577.8584	466815.2498	48.25048092	10.98463039	15332	12.90869812	1.134	1.38	657	0	0
1983	0.33920481	9565.5	4811	472652.9816	346567.6018	52.69875511	11.39715711	15332	11.39176835	1.049	1.05	816	0	0
1984	0.18258977	9701	4882	443321.9762	295373.8642	59.49690817	11.45609381	15332	11.26336075	1.082	1.23	-796.5	0	0
1985	0.11253915	9683.5	4287	417807.1477	288798.6455	65.25124906	13.25455391	15332	11.55211689	1.0055	1.051	-240.5	0	0
1986	0.06787793	10380	3180	438445.9746	362168.2036	68.43565743	10.20696961	15332	9.508224923	1.046	0.63	-309.5	0	0
1987	0.0919128	12200	1660	513716.7934	503040.6064	73.817859	6.848766218	15332	9.625618016	1.1265	0.573	1114.5	0	0
1988	0.11835511	15115	370	624134.6765	664578.2294	82.82238493	5.383647549	15332	9.809043589	1.319	1.014	1826	0	0
1989	0.48923182	16580	880	640545.6559	667123.3757	90.25738778	6.619699466	15332	10.44621609	1.6005	1.481	2186.5	0	0
1990	0.85443817	17565	290	645133.065	685823.83	100	6.49373714	15332	10.8528139	1.8475	1.321	3057.5	0	0
1991	0.28652679	18495	950	657245.6879	711027.1007	107.2777668	5.140009046	15332	11.02142664	1.897	1.39	-1015.5	0	0
1992	0.0828909	19958.5	2663	698174.9369	771109.0606	109.6113941	4.773411596	15332	10.27390809	1.8395	1.097	-244.5	0	0
1993	1.34637507	19177.5	1545	640820.9321	668883.9411	103.8871436	2.918327537	15332	10.2848486	1.531	0.962	-602	0	0
1994	0.23484322	18932	736	607298.7205	601585.2307	108.9092549	3.098446732	15332	11.00319055	1.323	0.686	-428	0	0
1995	2.51861238	19320	460	583466.2466	542482.5743	121.7674546	4.407123473	15332	11.23863749	1.8315	1.369	3289	0	0
1996	0.63406621	20660	1080	601686.175	534729.097	127.718459	2.79978209	15332	10.56596544	2.4495	1.723	-3011	0	0
1997	4.06150743	21281.5	1383	611634.0452	524163.525	132.9448739	2.810962353	15332	9.49699363	2.571	1.798	-2725.5	0	0
1998	2.10146204	20885	650	597330.0322	518566.3262	139.9245397	2.281660616	15332	9.572059552	2.3675	1.621	-3580.5	0	0
1999	3.76652139	20550	400	582290.0454	505215.9041	146.1952359	1.667369152	15332	9.850288818	2.514	2.338	1976.5	0	0
2000	5.02952366	20110	100	557987.6074	498520.3258	158.9521532	1.561809966	15332	9.852529292	2.213	1.388	5720.5	0	0
2001	10.5834856	19665	390	527743.9138	461895.9606	166.0809676	1.340042845	15332	9.886819773	2.071	1.164	-5295	0	0
2002	9.31582095	19385	550	507574.0753	437967.841	175.8844873	1.011067104	15332	10.19944571	2.202	0.994	3578	0	0
2003	9.9394646	21860	460	559796.7944	481103.7082	174.6383046	0.935644782	15332	9.896594233	2.601	0.536	387	0	0
2004	20.3521614	26688	816	668525.9694	563366.0291	182.5657012	0.912811169	15332	10.13147036	2.7855	0.625	11198.5	0	0

Spain

Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	0	8950	5560	468843.3427	185937.0435	30.46808157	2.323691727	16668	4.818932619	1.1135	0.831	1295.5	0	0
1981	3.47959869	9406.5	6313	437135.5774	128739.8154	33.83547608	1.58363312	16668	4.190323915	1.187	1.296	1525	0	0
1982	0.36669608	8892.5	6525	363573.944	66807.42098	38.12551495	2.19322358	16668	4.263506677	1.248	1.152	1469	0	0
1983	1.21090281	8390.5	7161	301564.461	4390.560475	41.69607958	1.200315487	16668	4.242643187	1.0445	1.059	1921.5	0	0
1984	0.82655703	8341	7602	277160.2299	36949.62848	42.84837504	1.321421754	16668	3.972768886	1.071	1.252	246	0	0
1985	0.18094977	8168.5	7317	255195.8957	36423.85835	48.80946028	1.441747161	16668	4.063452641	1.0095	1.043	950.5	0	0
1986	0.22849092	8660	6620	258253.0856	1782.425698	56.86295692	1.284769923	16668	4.30875705	1.0695	0.583	2541	0	0
1987	0.3819581	10040	5980	293708.8646	63024.74886	64.92897266	0.822349584	16668	4.389454938	1.2495	0.327	1987	0	0
1988	0	12320	5960	351842.6335	119994.1434	76.5420116	0.606801221	16668	4.320206775	1.514	0.624	3670	0	0
1989	6.59122562	13815	6410	372972.97	131978.004	90.21335503	0.690513579	16668	4.145984693	1.7115	1.259	5661	0	0
1990	15.954021	14900	5620	385874.195	167306.09	100	0.773440158	16668	3.902088668	1.9095	1.197	8780	0	0
1991	11.701044	15795	4450	400117.7176	196771.1601	105.5389063	0.400995128	16668	4.647172309	1.8525	1.479	5576.5	0	0
1992	3.76172609	17068.5	3117	425879.8471	226518.8811	103.8396695	0.399189031	16668	5.218048482	1.8285	1.119	5819	0	0
1993	34.3859159	16682.5	3445	402329.5582	191901.1934	97.69735919	0.316822387	16668	5.328087017	1.418	1.188	4434.5	0	0
1994	10.8933489	16517	4094	383729.919	154447.6276	101.5632004	0.304621455	16668	5.116769732	1.3525	0.627	3674.5	0	0
1995	0.66817004	17205	4690	382616.5168	140783.1145	113.0880934	0.509464142	16668	5.430239674	2.018	0.996	6064	0	0
1996	0.80134973	18405	5590	397682.6782	126722.1035	117.5959373	0.308859465	16668	5.197289396	2.4685	1.685	844.5	0	0
1997	0.13667552	18861.5	6223	405219.5967	111334.6281	125.8170718	0.641460545	16668	5.057487031	2.3865	2.167	-2053.5	0	0
1998	0.51380018	18280	5860	390168.5531	104243.368	140.0877919	1.085245324	16668	5.127693727	2.217	1.922	-1739	0	0
1999	5.1360784	17995	5510	381323.1844	103282.182	157.6705505	0.468201454	16668	5.353685561	2.628	2.11	-10898.5	0	0
2000	3.84627202	17690	4740	366319.0628	115183.2367	174.5881756	0.272733117	16668	4.733840032	2.178	1.458	-4116.5	0	0
2001	47.9264708	17445	4830	350292.5139	106993.1609	190.0070498	0.128978131	16668	5.008024898	1.9555	1.395	-4215.5	0	0
2002	34.9232292	17385	4550	343743.4623	110306.6148	197.9345183	0.139641707	16668	4.749102271	2.0235	1.351	8021.5	0	0
2003	37.479299	19770	4640	387229.6699	135969.4593	210.6136535	0.151798065	16668	5.074132068	2.114	1.51	-4965	0	0
2004	35.6359249	24313	5566	470435.8004	167185.6912	227.4686086	0.142466142	16668	5.134667845	2.2275	1.741	-5971.5	0	0

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Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	23.4447361	12155	850	824685.5237	897621.4054	69.64323151	20.22074444	15775	13.08624996	1.6965	0.335	702.5	0	0
1981	26.1464099	12291.5	543	765323.0262	785114.713	68.65793749	17.54032079	15775	12.94426924	1.7615	0.147	805	0	0
1982	19.5306053	11372.5	1565	654318.957	648297.4471	66.9476948	15.72205252	15775	12.99153995	1.7015	0.245	832	0	0
1983	15.7250383	10775.5	2391	577965.6579	557192.9544	70.46439214	10.88012786	15775	13.24122108	1.4375	0.273	1231	0	0
1984	4.24679944	10801	2682	558868.0954	526466.1027	73.26080736	9.468223473	15775	11.8701077	1.406	0.582	-518	0	0
1985	4.3164869	10618.5	2417	536608.9807	526402.3116	74.60550088	8.000686703	15775	11.6100811	1.3875	0.287	89	0	0
1986	10.3151335	11380	1180	584559.5245	654395.3034	77.28831402	6.158937997	15775	12.07653548	1.4805	0.239	1000.5	0	0
1987	63.8598445	13370	680	705421.1508	886449.3213	79.20876407	3.428157991	15775	12.04021772	1.484	0.142	70.5	0	0
1988	39.1353565	16620	2640	889081.0342	1194470.945	84.05391958	2.403047202	15775	11.98377638	1.6905	0.271	770.5	0	0
1989	51.5253867	18030	2020	925542.1844	1237116.433	91.40917684	2.447090537	15775	11.30010465	1.924	0.834	2179.5	0	0
1990	67.007221	19135	2850	967681.815	1330921.33	100	2.078504936	15775	12.17659429	2.1425	0.731	3538.5	0	0
1991	74.9775694	20070	4100	1002852.082	1402239.889	106.0595706	1.588032164	15775	12.96162363	2.19	0.804	1542	0	0
1992	92.5682309	21818.5	6383	1088019.119	1550797.424	115.4717151	1.173631743	15775	12.65504144	2.079	0.618	266.5	0	0
1993	85.8878263	21802.5	6795	1068226.826	1523695.728	113.5752508	1.250490682	15775	11.31577871	1.7115	0.601	1179.5	0	0
1994	48.8192467	22577	8026	1102979.12	1592946.03	119.8242022	1.793129637	15775	11.00510616	1.597	0.138	1086	0	0
1995	33.5526582	24090	9080	1165460.785	1706471.651	120.7475958	2.195836661	15775	10.83401144	2.204	0.624	4366.5	0	0
1996	27.458975	25605	8810	1221929.526	1775215.799	118.5545435	1.825171119	15775	10.30844478	2.6395	1.343	-457.5	0	0
1997	19.2302641	25626.5	7307	1197877.928	1696651.291	118.5364254	1.993886931	15775	9.074479378	2.663	1.614	616.5	0	0
1998	15.1365417	24190	5960	1117449.559	1558805.381	121.3381417	2.014205964	15775	8.97134557	2.5665	1.223	1272.5	0	0
1999	7.8178863	23440	5380	1076313.937	1493263.687	125.7492509	3.580104016	15775	8.793404982	2.7835	1.799	1840	0	0
2000	7.61487572	22785	5450	1038565.045	1459675.202	130.0286868	3.338370141	15775	7.814704302	2.183	1.448	5246.5	0	0
2001	5.48238386	21930	4140	971131.1681	1348670.469	123.7533964	2.693792881	15775	8.113872227	2.0755	1.155	-1859.5	0	0
2002	7.90100402	21345	3370	928906.7927	1280633.276	114.9691484	2.17751114	15775	7.677778925	2.181	1.036	4869	0	0
2003	6.48488085	23895	3610	1028942.137	1419394.393	113.2335588	2.431720077	15775	7.419904101	2.433	0.872	-3376	0	0
2004	5.49521074	28893	3594	1222008.887	1670331.864	111.8965992	2.565803103	15775	7.256315028	2.641	0.914	12373	0	0

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Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	27.149609	12355	1250	2526312.73	4300875.818	64.80918178	4.25679181	12986	9.644990325	1.273	0.512	703.5	1	0
1981	18.1477974	13251.5	1377	2485327.777	4225124.214	70.61796464	5.430454761	12986	11.15281072	1.447	0.776	815	1	0
1982	15.745579	12967.5	1625	2326269.515	3992198.563	68.45946981	3.602097701	12986	11.86863281	1.4725	0.703	839.5	1	0
1983	12.4187264	13040.5	2139	2313413.301	4028088.241	72.33305159	5.181159781	12986	13.59873986	1.35	0.448	1233.5	1	0
1984	16.7036883	13946	3608	2483216.687	4375163.285	83.31402654	4.088382955	12986	14.77675362	1.4155	0.563	-510	1	0
1985	10.1972854	14418.5	5183	2593907.973	4641000.296	87.90721643	4.023202932	12986	14.18450034	1.3565	0.349	94.5	1	0
1986	2.51542951	15275	6610	2788144.536	5061565.326	90.11296152	7.457203235	12986	11.55559234	1.337	0.048	1010	1	0
1987	1.83475475	16895	7730	3021161.42	5517929.859	91.48708639	18.96319859	12986	9.528630143	1.4075	0.011	85.5	1	0
1988	1.30986623	19065	7530	3229527.934	5875364.745	95.51266046	12.90142267	12986	8.60012459	1.599	0.454	794.5	1	0
1989	3.6955398	20045	6050	3154232.496	5694497.056	99.31116765	10.55415337	12986	8.225102994	1.8115	1.059	2196	1	0
1990	1.99805828	20520	5620	3062962.87	5521483.44	100	10.70397782	12986	6.946717164	1.928	1.16	3554.5	1	0
1991	1.50545994	20750	5460	3000206.531	5396948.787	95.73137357	11.99076471	12986	7.026838553	1.976	1.232	1543.5	1	0
1992	1.05000206	21703.5	6153	3115747.463	5606254.113	99.09976414	13.83700216	12986	7.607254612	1.891	0.994	263	1	0
1993	3.12693084	21937.5	7065	3147047.567	5681337.211	106.3086722	10.69976819	12986	7.869044307	1.729	0.566	1171.5	1	0
1994	3.19356303	22597	8066	3241572.669	5870133.128	114.6585553	13.67255068	12986	7.50229825	1.5925	0.147	1075	1	0
1995	6.51753121	23730	8360	3342257.538	6060065.156	121.9112388	15.54981191	12986	7.194669223	2.1	0.832	4359.5	1	0
1996	1.48129981	25085	7770	3417728.513	6166813.773	130.3410499	16.14339611	12986	7.782892155	2.5985	1.425	-438	1	0
1997	1.20843852	25941.5	7937	3493886.504	6288668.443	139.2349217	19.0018991	12986	8.738261255	2.702	1.536	632	1	0
1998	0.85915216	25915	9410	3554214.831	6432335.924	149.1568439	20.83423212	12986	8.76624806	2.605	1.146	1323.5	1	0
1999	0.7234798	26505	11510	3695295.408	6731226.629	159.7934522	20.4114806	12986	9.691409388	2.8305	1.705	1899	1	0
2000	0.506938	27230	14340	3837576.577	7057698.265	169.4148878	25.26195637	12986	11.05903162	2.4115	0.991	5252.5	1	0
2001	0.35271888	27330	14940	3811760.551	7029929.235	167.0069351	26.87943581	12986	10.89927543	2.2305	0.845	-1840.5	1	0
2002	0.26305749	27445	15570	3834054.904	7090929.498	160.5224921	31.04124015	12986	11.40246285	2.3395	0.719	4817	1	0
2003	0.53179536	29935	15690	4061383.12	7484276.359	167.6527177	33.44684506	12986	11.36323701	2.3605	1.017	-3432	1	0
2004	0.78758709	34268	14344	4402358.824	8031031.739	183.5037843	31.0235784	12986	10.7309433	2.511	1.174	12329	1	0

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Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	10.5479355	7120	9220	323733.3581	104282.9257	39.07461128	0.122780728	10173	0.172243999	1.2375	0.583	704.5	1	0
1981	10.108615	7756.5	9613	328264.1245	89003.09039	47.09440375	0.19007906	10173	0.167323139	1.322	1.026	807	1	0
1982	9.17212216	7527.5	9255	289843.8665	80652.734	51.69905304	0.383753702	10173	0.169587713	1.3245	0.999	833	1	0
1983	40.327219	7310.5	9321	253832.8209	91072.71973	53.99051884	0.289478109	10173	0.188596304	1.1895	0.769	1232	1	0
1984	58.6519813	7401	9482	244014.8845	103240.3192	56.85977548	0.182614109	10173	0.1674038	1.22	0.954	-516	1	0
1985	22.6400938	7113.5	9427	213300.8649	120213.92	60.16010887	0.221824059	10173	0.101287832	1.1345	0.793	-158.5	1	0
1986	25.1923554	7165	9610	193809.657	127104.4317	58.78241768	0.137884926	10173	0.106394055	1.13	0.462	944	1	0
1987	7.14343749	7850	10360	196134.3624	132124.2556	60.77356185	0.078960742	10173	0.106739966	1.2735	0.279	-78	1	0
1988	0	9295	12010	218695.1115	146300.9008	77.41856094	0.0025187	10173	0.113947967	1.5715	0.509	823.5	1	0
1989	0	10300	13440	224073.5149	165820.9062	94.26936412	0.003517291	10173	0.125153973	1.8685	0.945	2001.5	1	0
1990	45.3781513	10550	14320	210774.575	182893.15	100	0.00173201	10173	0.076114156	1.9635	1.089	3497	1	0
1991	0	10670	14700	202584.5797	198295.1158	99.65989514	0	10173	0.135326593	2.065	1.054	1575	1	0
1992	26.6835443	10973.5	15307	202685.2058	219870.4016	98.71951553	0.041264842	10173	0.256117167	1.9675	0.841	-691	1	0
1993	61.1539317	10932.5	14945	198179.1558	216399.6115	103.1504069	0.114281085	10173	0.312404336	1.93	0.164	1047.5	1	0
1994	20.1756993	11087	14954	197272.2013	218467.8079	117.4016888	0.642694156	10173	0.416081488	1.492	0.348	648.5	1	0
1995	56.3390426	11645	15810	198991.9143	226466.0903	136.5313559	0.151291448	10173	0.917825058	1.9785	1.075	3757	1	0
1996	62.7206241	12480	17440	208219.6129	252204.0272	154.3045721	0.099944229	10173	0.828948483	2.4335	1.755	-551.5	1	0
1997	99.9781358	12826.5	18293	212636.285	273831.9953	169.1954123	0.12052275	10173	0.79260426	2.662	1.616	1375	1	0
1998	16.3227679	12245	17930	201347.4775	273398.7832	184.8649854	0.227082404	10173	0.66840796	2.4485	1.459	763.5	1	0
1999	95.0086764	11950	17600	195075.1485	269213.8899	178.6041924	0.057785573	10173	0.731015358	2.592	2.182	1826	1	0
2000	37.6726715	11555	17010	182851.6982	251751.4925	194.0663733	0.042604622	10173	0.956091566	2.1735	1.467	5517.5	1	0
2001	63.9918858	11345	17030	173866.6585	245858.55	209.6838115	0.047739191	10173	0.886299024	2.0155	1.275	3539.5	1	0
2002	28.7494183	11145	17030	166234.9241	244710.4615	237.9466776	0.037124059	10173	0.998983885	2.029	1.34	5420.5	1	0
2003	20.8769035	12470	19240	182321.3488	273847.1829	267.1515853	0.028281402	10173	1.377880198	2.334	1.07	-3274	1	0
2004	52.8355364	15363	23466	221738.5625	330208.7846	300.4643201	0.031912164	10173	1.34230058	2.569	1.058	12082.5	1	0

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Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	16.3472718	10070	3320	634828.5949	517907.5479	40.51911895	2.79728116	16259	8.502088692	2.374	1.69	704	1	0
1981	32.7719891	10986	3154	633491.2406	521451.1418	40.56318987	2.204886326	16259	8.60735499	2.7355	1.801	804	1	0
1982	23.8007716	10775	2760	575727.3894	491114.3119	44.17565861	2.791375947	16259	8.107238924	2.9075	2.167	832	1	0
1983	12.5543201	10315	3312	511647.6836	424557.0057	47.51070109	2.927239376	16259	8.897332425	2.7215	2.295	1230.5	1	0
1984	8.42233712	10163	3958	474315.8642	357361.6403	53.58095645	2.802036752	16259	8.992003944	2.655	1.916	-520	1	0
1985	19.6703321	9948	3758	440984.2326	335152.8154	58.46340167	2.881434713	16259	9.57692624	2.5865	2.111	89	1	0
1986	7.65924905	10523.5	2893	460390.2752	406056.8049	61.83698139	5.708333663	16259	10.49914262	3.541	4.36	1000.5	1	0
1987	2.32065104	12110	1840	524570.9753	524748.9701	70.88986786	13.32878337	16259	10.53588434	4.435	6.044	66	1	0
1988	1.16079337	14730	1140	621469.9553	659248.7869	85.57011036	18.31050693	16259	11.08916773	4.206	4.76	769.5	1	0
1989	1.58688187	16132.5	1775	629777.6203	645587.3045	97.71053712	17.14246772	16259	10.53481938	4.302	3.922	2181.5	1	0
1990	0.28696241	16996	1428	617076.992	629711.684	100	21.29771222	16259	11.20678777	5.8465	6.677	3555.5	1	0
1991	0.21899682	17469.5	1101	609898.0705	616331.8659	92.35537404	28.57005844	16259	10.46132666	6.0925	7.001	1551	1	0
1992	0.16690708	18624.5	5	644605.1096	663969.4061	88.97043455	34.30428114	16259	10.23863484	6.159	7.542	275.5	1	0
1993	0.15536547	18474.5	139	633019.4421	653280.9611	89.91947073	39.63650358	16259	10.18122001	5.7545	7.485	1182.5	1	0
1994	0.18100593	18780	432	634130.4805	655248.7506	96.41428604	40.54883713	16259	10.38925845	4.2945	5.257	1080	1	0
1995	0.05653522	19427.5	245	630023.3018	635596.6846	104.5845424	38.93656235	16259	9.891737568	3.3455	1.659	4366.5	1	0
1996	0.13849907	20803.5	793	657321.2059	645999.1588	112.0881292	41.09131836	16259	10.18372844	3.424	0.226	-440	1	0
1997	0.40544017	21840.5	265	681656.4803	664208.3953	117.9736756	38.56133017	16259	11.19114481	4.239	1.538	620	1	0
1998	0.18770987	22028.5	1637	686291.2058	696488.6733	133.4092242	41.17644072	16259	10.82182207	4.181	2.006	1281.5	1	0
1999	0.23730219	22400	3300	702922.3053	746480.4238	136.1206066	42.17617202	16259	10.94121349	5.499	3.632	1810	1	0
2000	0.08334086	22671.5	5223	705835.5894	794216.2897	138.3975944	39.35958063	16259	10.46591708	5.468	5.122	5109.5	1	0
2001	0.05009111	22527	5334	690181.0873	786770.3078	142.8976498	40.25762787	16259	10.65163267	6.0255	6.745	-1857	1	0
2002	0.31267454	22605.5	5891	686831.6074	796482.9052	148.2237398	37.0780359	16259	10.92274069	5.2355	5.073	4839.5	1	0
2003	0.07953775	25161.5	6143	744413.9814	850338.0822	149.7252827	31.72700339	16259	10.71016249	6.4105	7.083	-3408	1	0
2004	0.14007523	30372	6552	873491.5054	973297.1011	161.5729497	33.27973149	16259	11.12131857	5.5315	4.867	12374.5	1	0

New Zealand

Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	22.2016112	9605	4250	220385.1127	310979.4166	36.40053062	4.897139147	3226	0.100592017	1.834	0.61	740	1	1
1981	3.50008898	10336.5	4453	217196.1124	311139.1145	49.60331303	7.681591991	3226	0.133822631	1.864	0.058	892.5	1	1
1982	6.05434966	10037.5	4235	191284.5955	277771.2759	57.68986318	6.585484187	3226	0.139903	1.8455	0.043	962.5	1	1
1983	16.3509084	9660.5	4621	172624.0721	253490.2173	63.92203269	8.403083079	3226	0.138087793	1.5925	0.037	1282	1	1
1984	27.3051805	9581	5122	168646.1824	253977.7235	73.04363089	8.082557755	3226	0.217132383	1.8595	0.325	-95.5	1	1
1985	56.5723809	9298.5	5057	154213.0732	238389.5034	86.34429479	4.862019298	3226	0.142114423	1.6475	0.233	570	1	1
1986	45.623128	9760	4420	145953.9553	222815.835	89.81125669	6.681534455	3226	0.180765639	1.7425	0.763	1315.5	1	1
1987	45.9188822	11105	3850	149399.2864	225594.4077	97.63900634	7.741706877	3226	0.162933873	1.9145	1.003	498.5	1	1
1988	35.3294168	13480	3640	168072.0441	247547.0356	95.75652189	9.803898269	3226	0.244684871	2.243	0.834	1449	1	1
1989	37.9710348	14820	4400	176114.0011	261739.934	104.1896506	10.49429442	3226	0.281901164	2.6155	0.549	2049	1	1
1990	31.5832556	15275	4870	173246.735	257948.83	100	10.90245854	3226	0.292461135	2.606	0.196	3619.5	1	1
1991	35.7137366	14920	6200	171182.1009	261100.0733	82.6714416	8.416659898	3226	0.265546333	2.6405	0.097	1851	1	1
1992	26.4990954	15178.5	6897	176477.8867	272285.0398	85.9583989	7.184131965	3226	0.301651684	2.574	0.372	1730.5	1	1
1993	18.5494565	15177.5	6455	173676.6116	265404.7	100.9160046	9.276366142	3226	0.396192121	2.5135	1.003	1854	1	1
1994	18.7451009	15652	5824	174868.22	263275.7703	115.881194	8.908633313	3226	0.418566282	2.3255	1.319	1497.5	1	1
1995	31.1895212	16940	5220	179892.0086	264665.9017	126.9250211	7.903820244	3226	0.369712796	2.931	0.83	6278	1	1
1996	33.7235938	18495	5410	193185.8713	282271.5103	128.8396842	7.721169568	3226	0.404928001	3.4855	0.349	1516.5	1	1
1997	41.4290811	19251.5	5443	202065.1547	294974.2559	126.9728059	7.545209199	3226	0.448895236	3.758	0.576	1904.5	1	1
1998	45.0949689	18280	5860	194260.6582	287572.4218	122.7432583	6.428300674	3226	0.411932555	3.283	0.21	1499.5	1	1
1999	44.4117497	17760	5980	189282.5491	280799.0886	134.4417282	6.416977049	3226	0.499119622	3.9995	0.633	2058	1	1
2000	57.3343585	16870	6380	176555.8441	264343.2008	137.3444828	5.810086822	3226	0.57180353	2.628	0.558	6757	1	1
2001	53.5798253	16645	6430	169753.6151	254084.6367	147.563896	5.572815759	3226	0.599158293	3.5435	1.781	-1347	1	1
2002	64.5213578	16600	6120	165577.7326	246024.8445	154.0667088	5.653349928	3226	0.683690782	3.834	2.27	5529	1	1
2003	61.3895134	18870	6440	184227.3389	270035.2028	172.0259489	5.877899104	3226	0.712515373	4.3325	2.927	-2426.5	1	1
2004	84.5036923	23543	7106	224544.4255	324597.0586	185.2909894	5.773028899	3226	0.858332529	4.5665	2.937	14216.5	1	1

Japan

Year	IITaj	APIaj	DPIaj	ARIaj	DRIaj	KLj	TINaj	DISaj	OPNaj	AUVaj	DUVaj	FDIaj	LANGaj	TRAaj
1980	14.6445428	11080	1300	933952.8211	1116156	61.36885024	1.457942521	7821	0.743624817	1.802	0.546	703.5	0	0
1981	0.22150078	11586.5	1953	915110.2178	1084689.096	63.18002265	1.484365763	7821	0.740135305	2.0275	0.385	804.5	0	0
1982	1.8155015	11112.5	2085	842885.8179	1025431.169	62.81521452	1.400707234	7821	0.833249579	2.0745	0.501	831	0	0
1983	0.42234969	10845.5	2251	796224.1096	993709.8578	60.61351502	3.486660433	7821	0.977316789	2.0465	0.945	1230.5	0	0
1984	0.26809179	11041	2202	798420.8925	1005571.697	63.11653475	2.979729703	7821	1.003676498	2.057	0.72	-519	0	0
1985	0.32071369	11403.5	847	845446.9382	1144078.227	67.96205625	2.798415824	7821	0.961624224	2.024	0.986	88.5	0	0
1986	0.82356601	12645	1350	988392.2025	1462060.659	70.18209367	2.334917585	7821	0.816637838	1.547	0.372	997.5	0	0
1987	0.04573287	15220	4380	1258924.677	1993456.374	74.42449337	3.815673687	7821	1.218190441	1.948	1.07	64.5	0	0
1988	0.02589242	19610	8620	1691709.056	2799726.988	83.47498691	5.290154552	7821	1.76084369	2.3005	0.949	759	0	0
1989	0.22904998	21555	9070	1808683.852	3003399.769	91.97090278	5.056680351	7821	2.409024176	2.825	0.968	2160	0	0
1990	0.41312649	22335	9250	1816389.335	3028336.37	100	3.987813829	7821	2.546071813	2.752	0.488	3524.5	0	0
1991	0.31504511	22875	9710	1815117.819	3026771.362	103.0887686	3.214294341	7821	2.128342196	2.685	0.186	1536	0	0
1992	0	24153.5	11053	1911701.53	3198162.248	100.1381152	2.525908912	7821	1.929167054	2.2125	0.351	269.5	0	0
1993	0.02173428	25547.5	14285	2066805.76	3520853.597	96.37256665	1.94119612	7821	1.771746444	2.447	0.87	1181	0	0
1994	0.02957919	27357	17586	2261737.436	3910462.661	93.58429813	2.143319712	7821	2.123780143	2.175	1.018	1083.5	0	0
1995	0	30185	21270	2549118.93	4473787.942	92.83345256	1.70805321	7821	2.329783084	3.1675	1.303	4369	0	0
1996	0.03051781	31540	20680	2625291.846	4581940.44	95.21720908	1.840007286	7821	2.192498276	3.7805	0.939	-447	0	0
1997	0.01079605	30541.5	17137	2437176.033	4175247.501	93.44236558	1.725466735	7821	2.608613665	3.8905	0.841	620	0	0
1998	0.04574142	27435	12450	2108348.186	3540602.635	85.92581896	3.042892162	7821	4.652676711	2.91	0.536	1295	0	0
1999	0.46304869	26875	12250	2076220.706	3493077.225	83.72507057	1.866819947	7821	3.075190578	3.6155	0.135	1861.5	0	0
2000	0.0245903	27600	15080	2206991.308	3796527.727	84.12168903	1.834231284	7821	3.099256237	2.723	0.368	5160	0	0
2001	0.15190995	27765	15810	2251836.781	3910081.695	81.60345875	1.552236626	7821	3.007813044	2.911	0.516	-1869	0	0
2002	0.20114576	26650	13980	2150437.59	3723694.869	76.43247834	1.294559193	7821	2.758749742	3.3005	1.203	4840.5	0	0
2003	0.14788813	27975	11770	2186795.241	3735100.601	75.48278685	1.421099675	7821	2.562207834	3.6615	1.585	-3400.5	0	0
2004	0.16939112	32073	9954	2415079.295	4056472.681	76.07805937	1.560881669	7821	2.621644759	3.8255	1.455	12373	0	0

Note:

IITaj	= Bilateral intra-industry trade between Australia and major trading partners (France, Italy, Spain, Germany, US, South Africa,UK, New Zealand, and Japan)
APIaj	= Average per capita gross national income
DPIaj	= Absolute difference in per capita gross national income
ARIaj	= Average real gross national income (deflated by consumer price index)
DRIaj	= Absolute difference in real gross national income
KLj	= Capital-Labour ratio index (1990 = 100)
TINaj	= Trade Intensity (ratio of bilateral wine trade to total industry trade)
DISaj	= Distance (kilometres)
OPNaj	= Degree of trade openness in wines (ratio of country wine trade to world wine trade)
AUVaj	= Average unit values of wine exports
DUVaj	= Absolute difference in unit value of wine exports
FDIaj	= Average net FDI
LANGaj	= Language dummy variable (1 for English-speaking countries)
TRAaj	= Regional Trade Agreement dummy variable (1 for New Zealand, also reflecting proxy for common border variable)

Appendix 6.3: Variables and Sources Data used in Econometric Estimations 0f Australia's Intra-Industry Trade.

Data Series	Unit	Sources
Gross fixed capital formation in agriculture	Local currencies	dXEcon Data, World Bank, World Tables.
Employment in farm, including wineries.	Number of workers	dXEcon Data, ABS Time-Series Plus
Value added in agriculture, at factor costs	Local currencies	dXEcon Data, World Bank, World Tables.
Number of wine producers	establishments	www.winebiz.com.au
Gross national income (GNI)	U.S. dollars, current price	dXEcon Data, World Bank, World Tables.
GNI per capita	U.S. dollars, current price	dXEcon Data, World Bank, World Tables.
Consumer price index (CPI)	1990 = 100	dXEcon Data, World Bank, World Tables.
Labour force	Number of workers	dXEcon Data, World Bank, World Tables.
Unit values of wine exports (UVX)	U.S. dollars per litre	FAO, available at http://fao.stat.fao.org
Distance (between Adelaide and major trading cities)	Kilometres	*Direct-Line Distances* from G. L. Fitzpatrick and M. J. Modlin.
Net direct investment	U.S. dollars, millioin	dXEcon Data, World Bank, World Tables.