

The UNIVERSITY of CANBERRA

**Country-Specific Determinants of Vertical and Horizontal
Intra-Industry Trade: *An Empirical Analysis of South Africa***

A Thesis submitted for the Degree of
Doctor of Philosophy of the University of Canberra

By

Nasser Al-Mawali

April 2006

ABSTRACT

The principal purpose of this study is to provide a refined empirical investigation concerning country-specific determinants of horizontal and vertical intra-industry trade (IIT) in relation to South Africa using the gravity model of trade in a panel data setting. Prior to investigating the case of South Africa's intra-industry trade a critical review of the relevant theoretical, methodological, and empirical literature is provided. The study operationalises the theoretical distinction between horizontal and vertical IIT using the latest methodology of decomposing total IIT into horizontal intra-industry trade (HIIT) and vertical intra-industry trade (VIIT).

This study makes several advances on earlier empirical studies of intra-industry trade determinants. These include the introduction of new country-specific determinants of intra-industry trade that previous studies have not examined. Furthermore, it is the first empirical study that traces the relationship between intra-industry trade flows and intellectual property rights (IPRs). Moreover, to ensure the sensitivity and robustness of the results, several econometric approaches have been used in estimating the gravity model of South Africa's intra-industry trade: the consistent coefficient approach, the fixed effects approach, the random effects approach, and the between effects approach.

The econometric results are generally satisfactory in terms of economic interpretation and statistical significance and thus offer new empirical validation to the theoretical explanatory variables. The key findings suggest the following: the volume of South Africa's IIT has increased during the study period and its VIIT exceeds its HIIT. The latter result reflects the nature of South Africa's trade as it imports high valued added products and exports primary and mineral products. South Africa's intra-industry trade and its two components are positively related to market size and standard of living, and negatively related to geographical distance. Furthermore, separately, the IPRs and the imitation ability of South Africa's trading partners are not important factors in determining IIT flows; however, the interaction between them is an important factor. This study also reveals South Africa should pursue its intra-industry trade with rest of world concentrating on local industries that produce most competitive varieties, absorbing labor and other resources from the production of other varieties.

ACKNOWLEDGEMENTS

“In The Name of Allah, Most Gracious, Most Merciful”, praises and thanks are first and foremost due to the Almighty Allah, the Lord of the Universe, who gave me the strength, patience, and the ability to complete this thesis.

There are many people have shared the long journey of writing up this thesis and helped in bringing it to fruition. It is my pleasure to acknowledge the generosity and kindness of a number of people. My special gratitude is extended to Dr. Michael Francis (an external member of the supervision panel, Bank of Canada). Although he resides in Canada, his guidance, constructive criticism and much-needed encouragement were unfailing. Dr. Francis went beyond the call of duty as an external supervisor, giving freely of his time and providing priceless advice. He also taught me how to think clearly and critically about my writing; my work is the immensely better for his tutelage. I would also like to thank my PhD supervisor at the University of Canberra Dr. Craig Applegate, for carefully reading the manuscript and locating any inconsistencies. His willingness to listen to my questions and provide answers and advice were highly valued and greatly appreciated. Sincere gratitude and deep appreciation are also due to, the chair of supervisory panel, Professor Phil Lewis, for his unstinting help, advice, and encouragement, which have been invaluable in the preparation of this thesis.

I am also indebted to Associate Professor Anne Daly for her helpful comments on an earlier draft of the thesis. Her kindness, understanding and encouragement are acknowledged. I am also grateful to Professor David Pederson and Dr. Shuangzhe Liu for sharing with me their profound knowledge on econometrics. I profited greatly from their invaluable comments and suggestions at different stages of my work.

I would also like to gratefully acknowledge the editorial advice that has been sought from the staff* of the Academic Skills Program at the University of Canberra. Their** support in providing

* It is worth noting that the staff of the Academic Skill Program made no change to intellectual content of the thesis, as the advice was restricted to matters of presentation and form only.

editorial advice and valuable guidance on the requirements of post-graduate academic writing are highly valued.

Words are inadequate to express my full and sincere gratitude to my wife, Eiman Al-Hinai, who has sustained me with her love and understanding during all the trials and tribulations encountered in completing this thesis. She provided me with endless support and encouragement when it was most required, indeed without her care and patience, this thesis would not have been completed. I wish also to thank my parents; Rashid and Moza as they bore me, raised me, taught me, loved me, and backed me during my study. Finally, I would like to gratefully acknowledge the impressive inspiration that have I received from my beautiful “Australian” newborn daughter (Rhand)*** who always inspires me with her gorgeous charming smiles, she brought me so much of joy and love that was much needed during the final touches of writing up my thesis.

Nasser Al-Mawali
Canberra – Australia, April 2006

** In particular, I would like to thank Sue Prentice, Judy Couchman, and Garry Collins for their assistance with editorial advice and academic writing.

*** The beautiful Rhand was born on Monday, 17th of October 2005 (i.e. 13th Ramadan 1426H) at Canberra Hospital in Canberra, Australia.

TABLE OF CONTENTS

Country-Specific Determinants of Vertical and Horizontal Intra-Industry Trade: *An Empirical Analysis of South Africa*

I	Title page.....	i
II	Form B: Certificate of authorship of thesis.....	ii
III	Form C: Retention and use of the thesis by the university	iii
IV	Abstract.....	iv
V	Acknowledgements.....	v
VI	Table of contents.....	vii
VII	List of acronyms and abbreviations.....	xiii
VIII	List of figures	xvi
IX	List of tables	xvii

Introductory Chapter

CHAPTER 1 Introduction

1.1	Overview.....	1
1.2	Research objectives.....	4
1.3	Justification of the study.....	6
1.4	Scope of the study.....	8
1.5	Outline of the study.....	8
1.6	Conclusion.....	11

PART I: Literature Review

CHAPTER 2

Theoretical Literature Review

2.1	Introduction.....	12
2.2	Horizontal intra-industry trade (HIIT).....	14
2.2.1	Monopolistic competition HIIT models.....	15
2.2.2	Oligoplistic market structure models of HIIT.....	31
2.3	Vertical intra-industry trade (VIIT).....	33
2.3.1	VIIT in neo-Heckscher-Ohlin models.....	33
2.3.2	VIIT in oligopolistic market structures.....	39
2.4	Conclusion.....	42

CHAPTER 3

Empirical Literature Review

3.1	Introduction.....	44
3.2	Early studies of intra-industry trade.....	45
3.3	Econometric studies of intra-industry trade.....	49
3.3.1	The main country-specific determinants of intra-industry trade.....	52
3.3.2	The main industry-specific determinants of intra-industry trade.....	64
3.4	Industry-specific studies of intra-industry trade.....	74
3.4.1	Intra-industry trade in the steel industry.....	75
3.4.2	Intra-industry trade in the automobile industry.....	76
3.4.3	Intra-industry trade in the beer brewing industry.....	76
3.4.4	Intra-industry trade in the meat industry.....	77
3.4.5	Intra-industry trade in the liquid pumps industry.....	78
3.4.6	Intra-industry trade in the computer industry.....	79
3.4.7	Intra-industry trade in the dairy products industry.....	80
3.4.8	Intra-industry trade in the toy industry.....	80
3.4.9	Intra-industry trade in the wheat industry.....	81
3.4.10	Intra-industry trade in the food/processed food industry.....	82
3.4.11	Concluding observations concerning industry-specific intra-industry trade.....	84
3.5	Conclusion.....	85

PART II: Miscellaneous Issues of IIT

CHAPTER 4

Reviewing Methods of Measuring Intra-Industry Trade

4.1	Introduction.....	86
4.2	Early measures of IIT.....	86
4.2.1	Verdoorn index.....	87
4.2.2	Michaely index.....	87
4.2.3	Balassa index.....	88
4.3	The standard measures of IIT.....	89
4.4	Latest developments in measuring IIT.....	91
4.4.1	Disentangling total IIT into vertical IIT and horizontal IIT.....	91
4.4.1.1	G-H-M method.....	92
4.4.1.2	CEPII method.....	93
4.4.1.3	Kandogan method.....	95
4.4.2	Measuring marginal IIT.....	97
4.4.2.1	Hamilton and kniest index.....	98
4.4.2.2	Brühlhart index.....	99
4.4.2.3	Thom and McDowell (1999) index.....	101
4.4.2.4	Azhar and Elliott index of MIIT.....	102
4.5	Conclusion.....	102

CHAPTER 5

Intra-Industry Trade: Unresolved Issues and Product Classification Nomenclatures

5.1	Introduction.....	103
5.2	Unresolved issues.....	104
5.2.1	The categorical aggregation problem.....	104
5.2.2	Trade imbalance problem.....	109
5.2.3	Outstanding theoretical deficiencies.....	111
5.3	Product classification nomenclatures.....	113
5.3.1	The standard international trade classification (SITC).....	114
5.3.2	The international standard industry classification (ISIC).....	115
5.3.3	The combined nomenclature (CN).....	116
5.3.4	The Harmonized system (HS).....	116
5.4	Conclusion.....	117

PART III: South Africa's IIT

CHAPTER 6

A Descriptive Analysis of South Africa's Intra-Industry Trade

6.1	Introduction.....	118
6.2	South Africa: economic overview.....	118
6.3	South Africa's total international trade (1990 to 2000).....	124
6.4	South Africa's intra-industry trade (1994 to 2000).....	127
6.4.1	South Africa's manufacturing sector- An overview.....	129
6.4.2	South Africa's IIT across countries.....	132
6.4.3	South Africa's IIT across industries.....	138
6.5	South Africa's marginal intra-industry trade.....	148
6.6	Conclusion.....	152

CHAPTER 7

Intellectual Property Rights as a Determinant of Bilateral Intra-industry Trade Flows

7.1	Introduction.....	153
7.2	The status of intellectual property rights in South Africa.....	155
7.3	How does IPRs protection affect one-way trade flows?.....	156
7.4	Review of empirical studies of trade and IPRs protection.....	159
7.5	Measurement of IPRs protection.....	161
7.6	An intuitive conceptual framework.....	164
7.6.1	Horizontal IIT.....	165
7.6.1.1	Demand-side of HIIT.....	166
7.6.1.2	Supply-side of HIIT.....	168
7.6.1.3	Supply-demand synthesis.....	173
7.6.2	Vertical IIT.....	176
7.6.2.1	Demand-side of VIIT.....	177
7.6.2.2	Supply-side of VIIT.....	180
7.7	Conclusion.....	182

CHAPTER 8

The Empirical Hypotheses of South Africa's IIT: Description and Data Sources

8.1	Introduction.....	183
8.2	Joint market size hypothesis.....	185
8.3	Joint per capita income hypothesis.....	186
8.4	Per capita income gap hypothesis.....	188
8.5	Geographical distance hypothesis.....	189
8.6	Infringement of intellectual property rights hypothesis.....	190
8.7	Political risk hypothesis.....	190
8.8	Trade intensity hypothesis.....	192
8.9	Trade barriers hypothesis.....	193
8.10	Technological gap hypothesis.....	194
8.11	Human capital gap hypothesis.....	196
8.12	Economic integration hypothesis.....	197
8.13	Landlocked countries hypothesis.....	198
8.14	Conclusion.....	199

CHAPTER 9

Model Specifications and Econometric Estimations of South Africa's IIT

9.1	Introduction	200
9.2	General conceptual formwork	201
9.2.1	The Panel data method.....	201
9.2.2	The gravity model of trade	202
9.3	Econometric modeling	206
9.4	Econometric modeling results	209
9.4.1	The constant coefficient model approach.....	209
9.4.2	The fixed effects model approach.....	226
9.4.3	The between effects approach.....	233
9.4.4	The random effects model approach.....	235
9.4.5	Clustering approach.....	237
9.5	Conclusion.....	241

CHAPTER 10

The Empirical Effects of Intellectual Property Rights Protection on South Africa's Bilateral Intra-Industry Trade Flows

10.1	Introduction.....	243
10.2	Empirical methodology.....	244
10.3	Empirical modeling.....	247
10.3.1	Model specification.....	247
10.4	Data description and sources.....	253
10.4.1	Estimation issues.....	255
10.5	Empirical results.....	257
10.5.1	The OLS result.....	257
10.5.2	Fixed and random effects results.....	263
10.6	Robustness checks.....	269
10.7	Conclusion.....	271

Concluding Chapter

CHAPTER 11

Conclusion

11.1	The main issues revisited.....	273
11.2	Key empirical findings.....	275
11.3	Limitations of the study.....	279
11.4	Areas of further research.....	280

APPENDIXES

Appendix 1:	283
Appendix 2:	284
Appendix 3A:	290
Appendix 3B:	291
Appendix 4A	294
Appendix 4B:	302
Appendix 4C:	303
Appendix 4D:	303
Appendix 5:	304
Appendix 6:	306
Bibliography.....	309

List of Acronyms and Abbreviations

A-D-H (ADH)	Aturupane-Djankow-Hoekman
AGOA	African Growth and Opportunity Act
AIDS	Acquired Immune Deficiency Syndrome
ANZSIC	Australian New Zealand Standard Industrial Classification Codes
ASIC	Australian Standard Industry Classification
ATR	Ad valorem Tariff Rate
BLUE	Best Linear Unbiased Estimator
BSA	Business Software Alliance
B-P test	Breusch-Pagan Test
CACM	Central American Common Market
CCCN	Customs Cooperation Council Nomenclature
CCCN/HS	Customs Cooperation Council Nomenclature Harmonized System
CCMA	Consistent Coefficient Model Approach
CEPII	Centre d'Études Prospectives et d'Informations Internationales
CER	Closer Economic Relations
Ch	Chapter
CN	Combined Nomenclature
Dis	Distance
DGDPP	Difference in per Capita Income
DTI	Department of Trade and Industry
D-S (DS)	Dixit and Stiglitz
ECSC	European Coal and Steel Community
EEC	European Economic Community
EI	Economic Integration
Eq	Equation
EU	European Union
EU-SA-FTA	European Union-South African Free Trade Agreement
FDI	Foreign Direct Investment
FEMA	Fixed Effects Model Approach
F-H	Flam and Helpman
F-K	Falvey and Kierzkowski
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GDP*GDP	Joint Market Size
GDPP*GDPP	Joint Per Capita Income
GEAR	Growth, Employment and Redistribution
GEIS	General Export Incentive Scheme
G-H-M	Greenaway, Hine and Milner
GL (G-L)	Grubel-Lloyd
GLS	Generalized Least Square
GNP	Gross National Product
GP index	Ginarte and Park index
GSP	Generalised System of Preferences
Hgap	Human Capital Gap
HIIT	Horizontal Intra-Industry Trade
HIV	Human Immune-deficiency Virus
HK(H-K)	Hamilton and Kniest
H-O (HO)	Heckscher-Ohlin
H-O-R (HOR)	Heckscher-Ohlin-Ricardian
H-S (HS)	Harmonized System
H-O-S (HSO)	Heckscher-Ohlin-Samuelson
ICRG	International Country Risk Guide

IDZs	Industrial Development Zones
IEDB	International Economic Data Bank
IFS	International Financial Statistics
IMIT	Imitative Ability
ING	Internationale Nederlanden Group
INT	Inter-Industry Trade
Integ	Economic Integration
IOR	Indian Ocean Rim
IOR-ARC	Indian Ocean Rim Association for Regional Co-operation
IPP	Industrial Participation Program
IPRs	Intellectual Property Rights
IPS	Inter Press Service
IR	Increasing Returns
ISIC	International Standard Industry Classification
IIT	Intra-Industry Trade
LAFTA	Latin American Free Trade Association
LandL	Landlocked Country
LDCs	Least Developed Countries
LM Test	Lagrangian Multiplier Test
M.E	Market Expansion
M.E.S	Minimum Efficient Scale
MHIIT	Marginal Horizontal IIT
MI	Michael Index
MIIT	Marginal Intra-Industry Trade
M.P	Market Power
NA	Not Available
NTB	Non-Tariff Barrier
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
PCI	Per Capita Income
Prisk	Political Risk
PRS	Political Risk Services
RESET	Regression Specification Error Test
R&D	Research and Development
R.R index	Rapp and Rozek index
RSS	Residual Sum of Squares
SA	South Africa
SACU	South African Customs Union
SAH	Smooth Adjustment Hypothesis
SASOL	South African Synthetic Oil Limited
SIC	Standard Industry Classification
SIIA	Software and Information Industry Association
SIIC	Standard International Industrial Classification
SITC	Standard International Trade Classification
SPIP	Support Program for Industrial Promotion
S-S	Shaked and Sutton
TB	Trade Barriers
TI	Trade intensity
Tgap	Technology Gap
TT	Total Trade
TRAINS	Trade Analysis and Information System
TRIPs	Trade-Related Aspects of Intellectual Property Rights
UK	United Kingdom
UN	United Nations
UNAIDS	United Nations AIDS
UN COMTRADE	United Nations Commodity Trade Statistics Database
UNESCO	United Nations Educational, Scientific, and Cultural Organization

USA	United States of America
UVM	Unit Values of Imports
UVX	Unit Values of Exports
VIIT	Vertical Intra-Industry Trade
VIF	Variance Inflation Factor
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

List of Figures

Figure 2.1	Theoretical Classifications of Intra-industry Trade Models.....	14
Figure 2.2	Basic Krugman Diagram of Pre-International Trade.....	21
Figure 2.3	Basic Krugman Diagram of Post-International Trade.....	22
Figure 2.4	Product Spectrum Line.....	26
Figure 2.5	The Affects of Income Distribution on IIT.....	36
Figure 3.1	Organization of Chapter 3.....	45
Figure 5.1	Organization of Chapter 5.....	103
Figure 5.2	Geographical Bias Illustrations.....	105
Figure 6.1	South Africa's Macroeconomic Indicators	122
Figure 6.2	The Contribution of South Africa's Total International Trade to GDP.....	125
Figure 6.3	Distribution of South Africa's Total International Trade by Region.....	126
Figure 6.4	Distribution of South Africa's Total International Trade by Income Level.....	126
Figure 6.5	South Africa's IIT as a Percentage of its Total International Trade.....	128
Figure 6.6	The Manufacturing Sector as a Percentage of South Africa's GDP.....	131
Figure 6.7	South Africa/USA Foreign Exchange Rate	131
Figure 6.8	Distribution of South Africa's Intra-Industry Trade by Region.....	134
Figure 6.9	Distribution of South Africa's Intra-Industry Trade by Income Level	134
Figure 6.10	South African IIT with Low Income Countries (HIIT vs. VIIT).....	135
Figure 6.11	South African IIT with Middle Income Countries (HIIT vs. VIIT).....	136
Figure 6.12	South African IIT with High Income Countries (HIIT vs. VIIT).....	136
Figure 6.13	No. of South African IIT Products.....	139
Figure 6.14	South African IIT in Chemical and Related Products (SITC5).....	140
Figure 6.15	The Share of SITC 5 in Total SITC 5-8.....	141
Figure 6.16	Manufacturing Goods Classified Chiefly by Martial	142
Figure 6.17	The Share of SITC 6 in Total SITC 5-8.....	143
Figure 6.18	The Share of SITC 7 in Total SITC 5-8.....	145
Figure 6.19	Machinery and Transport Equipment (SITC7).....	146
Figure 6.20	The Share of SITC 8 in Total SITC 5-8.....	147
Figure 6.21	Miscellaneous Manufactured Articles (SITC 8).....	148
Figure 6.22	South Africa's Marginal Intra-Industry Trade	151
Figure 7.1	Trends of South Africa's IPRs (1994-2000).....	156
Figure 7.2	IIT-IPRs Intuitive Conceptual Framework	165
Figure 7.3	Supply-Side Approach	172
Figure 7.4	Supply and Demand Approaches (Supply and demand decreasing with IPRs).....	174
Figure 7.5	Supply and Demand Approaches (Supply and demand increasing with IPRs).....	176
Figure 10.1	The Effects of a Country's IPRs on Its Supply and Demand	245

List of Tables

Table 3.1	Summary of Empirical Results for Per Capita Income (PCI) and Taste Overlap.....	54
Table 3.2	Summary of Empirical Results for Transport Costs and Geographical Distance.....	56
Table 3.3	Summary of Empirical Results for Trade Barriers	58
Table 3.4	Summary of Empirical Results for Economic Integration and Openness.....	60
Table 3.5	Summary of Empirical Results for Market Size.....	61
Table 3.6	Summary of Empirical Results for Miscellaneous Factors.....	63
Table 3.7	Summary of Empirical Results for Product Differentiation	65
Table 3.8	Summary of Empirical Results for Economies of Scale.....	69
Table 3.9	Summary of Empirical Results for Foreign Direct Investment and Multinational Corporations	71
Table 3.10	Summary of Empirical Results for Market Structures.....	73
Table 4.1	Illustration of the Kandogan Method	96
Table 4.2	The Dynamics of the G-L Index for Pre-and Post Liberalization	98
Table 5.1	Aggregation Bias Illustrations	106
Table 5.2	Trade Imbalance Bias in the Unadjusted G-L Index.....	109
Table 5.3	Examples of Product Classification Nomenclatures.....	117
Table 6.1	The Top South African IIT Partners	133
Table 6.2	Top 10 IIT Products within SITC 5.....	141
Table 6.3	Top 10 IIT Products with SITC 6.....	143
Table 6.4	Top 10 IIT Products with SITC 7.....	144
Table 6.5	Top 10 IIT Products with SITC 8.....	147
Table 7.1	International Treaties Related to Intellectual Property Systems.....	155
Table 7.2.A	Horizontal IIT and IPRs Protection (Demand-Side Approach).....	168
Table 7.2.B	Horizontal IIT and IPRs Protection (Supply-Side Approach).....	172
Table 7.2.C	Possible Outcomes of Combining Supply and Demand Approaches	173
Table 7.2.D	Vertical IIT and IPRs protection (Demand-Side Approach).....	180
Table 7.2.E	Vertical IIT and IPRs protection (Supply-Side Approach)	181
Table 9.1	Expected Signs of Explanatory Variables	209
Table 9.2	Regression Results of the Constant Coefficient Model Approach.....	218
Table 9.3.A	Regression Results for Total IIT.....	222
Table 9.3.B	Regression Results for HIIT	223
Table 9.3.C	Regression Results for VIIT	224
Table 9.4.A	Results for the Breusch and Pagan Test.....	229
Table 9.4.B	Results for the Hausman Specification Test.....	229
Table 9.5	Results of the Fixed Effects (Within-Groups) Model.....	230
Table 9.6	Recovering the Coefficients of the Time-Invariant Variables	231
Table 9.7	Results of the Between Effects (Between-Groups) Model Approach	234
Table 9.8	Results for the Random Effects Model Approach	236
Table 9.9	Results of Chow Tests.....	239
Table 9.10	Results of Two-Sample T-Test	240
Table 10.1	Threats of Imitation Groups	251
Table 10.2	The Expected Signs for the Independent Variables	253
Table 10.3	Regression Results for Ordinary Least Square (OLS) Estimation (Total IIT).....	258
Table 10.4	Regression Results for Ordinary Least Square (OLS) Estimation (Horizontal IIT).....	259
Table 10.5	Regression Results for Ordinary Least Square (OLS) Estimation (Vertical IIT).....	260
Table 10.6	Estimation Results of Fixed and Random Effects Regressions (Equation 5)	266
Table 10.7	Estimation Results of Fixed and Random Effects Regressions (Equation 6).....	267