Essays on South Africa:
Exchange Rates, Bilateral Trade and Inflation

by

Peter Kariuki Kinyua

A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
May 6, 2012

Keywords: economics, exchange rates, real foreign sector, metals, inflation, South Africa

Approved by

Henry L. Thompson, Chair, Professor of Economics
John D. Jackson, Professor of Economics
Richard O. Beil, Associate Professor of Economics
Asheber Abebe, Associate Professor of Mathematics and Statistics
Brenda M. Allen, University Reader, Assistant Professor of Forestry and Wildlife Sciences

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Abstract

South Africa shows how natural resources can be harnessed to build a successful economy. This success gives rise to peculiar macroeconomic issues that warrant analysis. Chapter one of this dissertation investigates the effects of exchange rate volatility on South Africa's export of metals, using monthly data for the period 1980:01 to 2011:07. The study uses squared residuals from the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) process to generate a measure of exchange rate volatility, which is then tested in a model of South Africa's metal exports. Utilizing conventional cointergration techniques, the study estimates both the short-run and long-run impacts of exchange-rate volatility (and other macro-variables) on South Africa's export volumes of 11 major metals. Results suggest that exchange rate volatility increases export demand for South Africa's base metals both in the short-run and in the long-run.

Chapter two proceeds with an examination of relationships between South Africa's bilateral trade volumes with 42 of its major trading partners. Annual data for the period 1970 to 2010 is used in the context of a gravity equation. The select variables represent importer/exporter's real income, population, export prices, unemployment, real effective exchange rate, exchange rate volatility, and a set of dummy variables representing involvement in a Preferential Trade Area (PTA) and a dummy variable signifying a change in South Africa's international trade pattern. Results show that real foreign sector has a significant impact on South Africa's bilateral trade. Exchange rate volatility yields mixed results for import demand and

depresses trade for exports. PTAs are found to be building blocks to trade, while income inequality within a PTA results to trade diversion. Finally, inclusion of the gravity equation's intangible attributes such as language, colonial ties, and culture is justified.

Lastly, the causes of rising demand pull inflation in South Africa are examined with an eye on the international price of gold given the importance of gold mining in the country. Effects of the money supply, exchange rate, foreign income, and an index of political stability are included in the model. Results show that money supply, exchange rates, and the price of gold and world income to be the major determining factors of inflation levels. The evolving monetary regime and political stability are also found to positively influence inflation levels.

Acknowledgments

I would like to offer special thanks to my academic advisor, Prof. Henry Thompson, for his guidance and insightful comments that have brought this work to a successful completion. I would also like to thank my committee members, Prof. John Jackson, Prof. Richard Beil, Prof. Asheber Abebe, and Prof. Brenda Allen for their invaluable comments and criticisms. Special thanks to Prof. Curtis Jolly, Chair of Agricultural Economics and Rural Sociology, and to Prof. Overtoun Jenda, Associate Provost for Diversity & Multicultural Affairs at Auburn University for providing full funding for my doctoral studies. Finally, I owe my family a big debt of gratitude and appreciation for their patience and support during these four and a half years. I however bear full responsibility for any opinions and/or errors in this dissertation.

Table of Contents

Abstract.....ii

Acknowledgments.....iv

List of Tables..... vii

List of Figures ix

List of Abbreviations.....xi

Chapter 1. Exchange Rate Volatility and South Africa's Metal Exports.....1

1. Introduction.....1

1.1. Outline of the Study.....2

2. Literature Review 2

2.1. An Overview of South Africa's Economy.....3

2.2. Export Markets.....4

2.3. Export Prices, Exchange Rates, and Volatility.....6

2.4. South Africa's Economic Sanctions.....12

3. Model Specification.....12

3.1. Data Sources and Variables.....16

3.2. Data Plots.....17

4. Empirical Results 18

4.1. Stationarity Analysis.....18

4.2. Model Estimation.....19

5. Summary and Conclusion... 23

Chapter 2. Exchange Rate Volatility and South Africa's Bilateral Trade.....44

1. Introduction 44

1.1. Outline of the Study.....45

2. Literature Review 45

2.1. The Gravity Model.....45

2.2. Unemployment……..48
2.3. Preferential Trade Agreements……..51
2.4. Gross Domestic Product……..56
2.5. Export Prices……..57
2.6. Information/Information Costs……..58
3. Model Specification……59
3.1. Model Selection Criteria……64
3.2. Data Sources and Variables……65
3.3. Data Plots……65
4. Empirical Results and Discussion……66
4.1. Import Demand……68
4.2. Export Demand……70
4.3. Unemployment……71
4.4. Intangible Effects……72
5. Summary and Conclusion……72
Chapter 3. World Gold Prices and Demand Pull Inflation in South Africa……114
1. Introduction ……114
1.1. Outline of Study……115
2. Literature Review ……115
2.1. Gold Mining and South Africa's Economy……115
2.2. Inflation……118
2.3. Monetary Regimes……120
2.4. Exchange Rates and the Rand……120
2.5. Gross Domestic Product……122
3. Model Framework……122
3.1. Deriving the Inflation Equation……123
3.2. Data Plots and Sources……128
4. Empirical Results and Discussion ……129
4.1. Stationarity Analysis……129
4.2. Model Estimation……129
5. Summary and Conclusions……131

References……140

List of Tables

Table 1.1. Stationarity Analysis for Commodities……...……..24

Table 1.2. Levels Model for Commodities……...……27

Table 1.3. ECM Model for Commodities……..……29

Table 1.4. Derived Effects for Commodities……...…….……31

Table 1.5. Short-Run Estimates for Aggregate and Disaggregated Data……...……...……33

Table 1.6. Summary Chronology of Trade Sanctions against South Africa……..35

Table 2.1. Stationarity Analysis for South Africa's Bilateral Trade…...…….…..75

Table 2.2. Stationarity Analysis for USA and South Africa Bilateral Trade……...…….…….81

Table 2.3. Stationarity Analysis for Australia and South Africa Bilateral Trade……....…….83

Table 2.4. Stationarity Analysis for Taiwan and South Africa Bilateral Trade…....……84

Table 2.5. Stationarity Analysis for Japan and South Africa Bilateral Trade…...…….85

Table 2.6. Results for South Africa's Imports…...……...…….87

Table 2.7. Results for South Africa's Exports..…97

Table 2.8. Levels Model for South Africa's Bilateral Trade……...…..……..106

Table 2.9. ECM Model for South Africa's Bilateral Trade…....……...…….107

Table 2.10. Derived Effects on South Africa's Bilateral Trade…...……108

Table 3.1. Stationarity Analysis……...……...…….133

Table 3.2. Inflation Model in Levels……...……..……..….134

Table 3.3. ECM for Inflation……...……135

Table 3.4. Derived Inflation Effects……...……...…..136

Table 3.5. Macro Policy and Inflation…...……..……...…….137

List of Figures

Figure 1.1. Coal Exports and Corresponding Export Price……..……..……37

Figure 1.2. Iron Ore Exports and Corresponding Export Price....…….……....37

Figure 1.3. Chromium Exports and Export Price…….…….……...….38

Figure 1.4. Copper Exports and Corresponding Export Price……..……..…38

Figure 1.5. Manganese Ore Exports and Corresponding Export Price…….....……..39

Figure 1.6. PGM Exports and Corresponding Export Price…….…..……39

Figure 1.7. Nickel Exports and Corresponding Export Price…...…….…..……..40

Figure 1.8. Gold Exports and Corresponding Export Price……..……..…40

Figure 1.9. Granite Exports and Corresponding Export Price……..……...…..41

Figure 1.10. Limestone Exports and Corresponding Export Price…...……...…..41

Figure 1.11. All Metals Exports and South Africa's Producer Price Index…….…..…….42

Figure 1.12. All Metals without Gold and South Africa's Producer Price Index…….....42

Figure 1.13. Nominal and Real Effective Exchange Rate…….……43

Figure 1.14. Rand – USD Exchange Rate Volatility…….……43

Figure 2.1. SA and USA Bilateral Trade…….……109

Figure 2.2. S.A. and U.S.A. Unemployment Rates Comparisons……..…….……109

Figure 2.3. S.A. and Australia Bilateral Trade……...……...……..110

Figure 2.4. S.A. and Australia Unemployment Rates…….....……...……..110

Figure 2.5. S.A. and Taiwan Bilateral Trade Flows……..……..……111

Figure 2.6. Comparing Unemployment Rates between S.A. and Taiwan...……..……..111

Figure 2.7. S.A. and Japan Bilateral Trade Flows..……..……...…112

Figure 2.8. South Africa's Exports to Regional Markets……..……..……..…....112

Figure 2.9. South Africa's Imports from Regional Markets..……...……..…….113

Figure 3.1. Aggregate Demand-Aggregate Supply Curve ……...……..…….138

Figure 3.2. Cost Push Inflation……...……...…..……138

Figure 3.3. IS-LM-BP Equilibrium……...……..……...…..……127

Figure 3.4. Variable Series ……...……...……139

List of Abbreviations

AR (1) – Autoregressive Model of Order One

ARCH (1) - Autoregressive Conditional Heteroskedasticity of Order One

DF – Dickey Fuller

DFc – Dickey Fuller with a Constant

DFt – Dickey Fuller with a Time Trend

ADF – Augmented Dickey Fuller

ADF (2) – Augmented Dickey Fuller of the Second Order

ARCH – Autoregressive Conditional Heteroskedasticity

ARIMA – Autoregressive Integrated Moving Average

BGS – Balance of Goods and Services

BOT – Balance of Trade

COMTRADE - Commodity Trade Statistics Database

ECM – Error Correction Model

EG – Engle-Granger

EMU – European Monetary Union

ERV – Exchange Rate Volatility

FDI – Foreign Direct Investment

GARCH – Generalized Autoregressive Conditional Heteroskedasticity

GDP- Gross Domestic Product

IMF- International Monetary Fund

LDC – Least Developed Countries

OPEC – Organization of the Petroleum Exporting Countries

PGM – Platinum Group of Metals

PTM- Price-to-Market

RER – Real Effective Exchange Rates

RGDP – Real Gross Domestic Product

SAB – South Africa Central Bank

WTO – World Trade Organization

DC – Developed Countries

LDC – Least Developed Countries

PTA – Preferential Trade Area

FTA – Free Trade Area

ROW – Rest of World

NAFTA – North American Free Trade Agreement

EU – European Union

SADC – Southern African Development Community

ASEAN - Association of Southeast Asian Nations

AGM – Augmented Gravity Model

H-O-S - Heckscher-Ohlin-Samuelson

C-H-O - Chamberlin-Heckscher-Ohlin

GVAR – Global Vector Auto regression

CGE - Computable General Equilibrium

CAFTA – China-ASEAN Free Trade Area

CARICOM - Caribbean Community and Common Market

COMESA - Common Market for Eastern and Southern Africa

GATT – General Agreement on Trade and Tariffs

CEES - Central and Eastern European Countries

AD – Aggregate Demand

SBC – Schwartz Bayesian Criterion

AIC – Akaike Information Criteria

CFA - Communauté française d'Afrique, French Community of Africa

CLS – Continuous Linked Settlement

SARB – South African Reserve Bank

CHAPTER 1

Exchange Rate Volatility and South Africa's Metal Exports

1. Introduction

This chapter seeks to determine the effects of exchange rate volatility on South Africa's export of raw metals. South Africa is a primary producer of metals, historically in great demand in industrialized countries and emerging markets. The study determines whether exchange rate volatility has exerted any impact on export volumes of eleven major metal exports and if so, the magnitude and direction of the impacts. The metals studied are gold, diamond, copper, manganese, iron, platinum group of metals (PGMs[1]), nickel, chromium, coal, granite and limestone. Other macroeconomic variables such as export price and world GDP are included in the model. A structural break is also included in the model to test for the effects of trade sanctions.

The metals studied are primarily exported in their raw form for use in building and construction, heavy and light industrial manufacturing, weapons and electronics. Gold, platinum, and diamonds are also held for financial speculation purposes. This diverse demand for South Africa's exports, coupled with a dynamic international market, sets the stage for this application of international trade theory.

Disaggregated macroeconomic data for all variables is analyzed in a time series framework. The period under consideration is 1980:01 to 2011:07. All variables are monthly series. The model specified in the chapter is a hybrid derived from other past studies on

[1] PGM refers to "Platinum Group of Metals". This group includes Ruthenium, Rhodium, Palladium, Osmium, Iridium, and Platinum. They have similar physical and chemical properties, and tend to occur together in the same deposits.

international trade. All variables are pretested for cointergration using conventional time series methods. An error correction model is further developed and results in the form of elasticities derived.

1.1. Outline of Study

This study is organized as follows: Section 2 provides detailed theory, an overview of past literature and justification of variables used, while section 3 describes the data and the methodology used in the study. Sections 4 and 5 provide the discussion of results, and concluding remarks respectively, while the index includes all the results tables, explanation for abbreviations and data plots.

2. Literature Review

Most of the studies available on export markets are based on developed countries such as the United States, the European Union, and Japan. The majority of these have employed aggregate trade data i.e., the imports and exports of one country with the rest of the world. Most studies fall within this category. Arize, Osang and Slottje (2006), and Weliwita, Ekanayake and Hiroshi (1999), studied Japanese export performance for manufactures, while Fountas and Bredin (2006), Caporale and Doroodian (2002), and Kenen and Rodrick (1986), examine U.S. sectoral exports.

Because of the aggregation bias problem, the second group of studies has concentrated on using trade data at the bilateral level, i.e., import and export data between two countries. In this category, Choudhry (2008), Mckenzie (1999), Sercu and Vanhulle (1992), and Broll and Eckwert (1999) use cointergration analysis on U.S. - Canada bilateral trade.

The last category includes only a few studies that have disaggregated the trade data between two countries and have looked at the impact of exchange rate volatility on sectoral data. In this category, Onafowora and Owoye (2011) studied Nigerian export demand for oil and agricultural sectors, while Bleany and Greenaway (2001), and Bah and Amusa (2003) use panel data on South Africa's export market for different sectors. Ekanayake and Thaver (2011), and Edwards and Lawrence (2006) use cointergration analysis on South Africa's sectoral exports. This chapter utilizes similar models but goes further by disaggregating data by commodities within a sector. This has an advantage in that it allows the analysis to pay special attention to commodity attributes. This is how the present study intends to contribute to existing literature.

2.1. An overview of South Africa's economy

South Africa's economic performance over the past 40 years has been rather disappointing. GDP per capita rose to a historical peak in the early 1980s and declined thereafter until a moderate return to growth after political transition in the early 1990s. Even with this recent improvement, GDP per capita as of 2011 remained only 40 percent higher than it was in 1960. Growth in South Africa's exports during this period has been even more dismal. Although exports have grown in absolute terms over the past 40 years, exports per capita in constant dollars in 2011 are no higher than they were 40 years earlier. Over that period the data are volatile because of price swings in gold, which was over one-third of total exports, and also because of misreporting of exports due to international trade sanctions, but overall export performance is clearly dismal.

One may attribute this weak export performance to South Africa's status as a natural resource exporter, notwithstanding recent evidence from OPEC countries such as Canada and Russia that such an endowment is often an economic blessing .This is not simply due to bad luck

in international prices of South Africa's primary exports, as the country's relative performance in export volumes is equally poor compared to other natural resource exporters such as China and Australia.

Looking across sectors, it seems that there has been a lack of structural transformation in South Africa. The country remains highly concentrated in mining. Even today, the only sectors with large net exports in South Africa are gold, coal, other mining and basic iron and steel. Yet while the endowment of mines is relatively fixed, the country's population has been rising significantly, from 17 million in 1960 to 50 million today, and as a result, mining output per capita today is less than half its value in 1960 (IMF). At the same time, other sectors of the economy have not picked up the slack. Manufacturing output per capita today is lower than its levels in the 1970s (IMF).

2.2. Export Markets

In International trade, the economy of South Africa continues to be heavily dependent on the export of gold and other metals. In 2010, gold accounted for 28 per cent of total South Africa merchandise exports (Mineral Bureau. 2011:5). Given South Africa's dependence on commodity-based manufactures such as iron, steel and non-ferrous metals, the conventional separation of primary and manufactured goods does not suffice when studying its export performance.

Other minerals which provide substantial foreign exchange earnings include platinum, and other platinum group of metals, coal, uranium, diamonds, copper, iron ore, manganese, chrome, nickel, asbestos, fluorspar, aluminosilicates, such as andalusite and heavy minerals (titanium, vanadium, and zirconium). Metals other than gold have contributed to foreign exchange earnings of nearly 20 per cent of total commodity export receipts over the last decade.

The direct contribution of the mining sector to the South African GDP in 2010 is estimated to have been about 13 per cent (Chamber of Mines, 2011: No 5).

Known gold reserves in South Africa are considered to be approximately equivalent to what has already been mined for more than a century (Chamber of Mines, 2011, No. 4: 2). The extent to which this growth potential can be effectively exploited depends on a number of factors such as the international price of gold, the exchange rate, the tax structure, institutional environment, and development of new technologies.

Since 1980, export-led growth has been a key element of the South African Government's Growth, Employment and Redistribution strategy. Exports have been promoted through various supply-side measures and incentives, a program of tariff reductions and reforms, and the relaxation of exchange controls (Coetzee & Naude, 2004).

Recent research into South Africa's export performance by Edwards and Alves (2006) has, however, shown that the success of these policies has been mixed. Although the growth in exports seems impressive at first glance, it has not been enough to generate an export-led boom. South African exports remain resource-based or concentrated in products with a declining share in world markets.

The policies and economic environments that promote exports can be examined at two levels. The first is an economy-wide level. For example, exchange rate depreciations show a positive relationship with export performance as these depreciations raise the profitability of export supply (Todani and Munyama, 2005). Similarly, tariff liberalization leads to improved export performance by reducing intermediate input costs and lowering the incentive to produce for the domestic market (Harding and Rattso, 2005). Edwards and Alves (2006) also find that

the availability of skills and infrastructure appears to be an important determinant of export growth.

Skills and infrastructure are however, not only relevant at the aggregate, economy-wide level but also inseparable from the location of the exporter. The physical location of exporter is significant to the extent that the region determines the natural endowments available to and the distance faced by the exporter. Policy interventions in the form of human capital formation and infrastructure investment are also place specific. Recent research by Matthee (2007), and Matthee and Naude (2008) found that the regions in South Africa that have experienced faster export growth are those with higher GDP per capita, faster population growth, higher levels of skills, greater export diversification and shorter distances to ports.

2.3. Export Prices, Exchange Rates, and Volatility

Among the many troubles of developing countries such as South Africa in recent years have been fluctuations in world prices of the commodities that they produce, especially mineral, oil and agricultural commodities, as well as fluctuations in the foreign exchange values of major currencies, especially the dollar, yen and euro. Some countries see the currency to which they are linked moving in one direction, while their principal export commodities move in the opposite direction.

Frankel (2003) suggests a proposal, called PEP (peg the export price). The idea is most relevant for a country such as South Africa that is specialized in the production and export of a particular mineral commodity. The proposal is to commit to a monetary policy that fixes the local-currency to the price of the export commodity. It is not an attempt to stabilize the dollar price of the commodity because that would be futile, given the fact that South Africa is too small to affect the metal prices on world markets. This is implemented by the exporter's central bank

announcing daily, an exchange rate against the dollar that varies perfectly with the daily dollar price of the metal in question on world markets, and to intervene to defend that exchange rate. That technique would be equivalent to fixing the price of the commodity in terms of local currency.

The international price of any commodity should be determined by market forces including the exchange rate, industrial structure etc. This introduces a problem into trade between two countries when left to the forces of demand and supply. Fluctuation in the exchange rate introduces uncertainty (volatility) which could have a detrimental effect on trade flows. Volatility represents the extent to which a variable changes over time. The larger the magnitude of a variable change, or the more quickly it changes over time, the more volatile it is.

Numerous research has been done on exchange rate volatility, and its effect on international trade, specifically relative prices and trade volumes. Majority of the researchers have confidently agreed to an inverse relationship between increased volatility in exchange rates and trade volumes, with the magnitude of the effect being small. A good number of research mostly using data from industrialized economies have posted different results ranging from a positive ERV – trade relationship, no relationship at all, to ambiguous findings. Several reasons may explain the lack of a concrete consensus on this issue.

First, even for risk-averse firms, the availability of hedging techniques makes it possible for traders to avoid most of the risk at insignificant costs (Cote, 1994). Secondly, ERV may actually offset some other forms of business risk, while creating profitable trading and investment opportunities (Arize, 1997) and (de Grauwe, 1988). In addition; an increase in risk resulting from ERV, does not necessarily lead to a reduction in the risky activity (Maskus, 1986). Lastrapes and Koray (1990) find that volatility has only a small effect on bilateral international

trade flows suggesting that the choice of exchange rate system on trade flows may be insignificant. Other studies such as Onafowora and Owoye (2011), Bleany and Greenaway (2001) and Bah and Amusa (2003) do show a negative relationship between exchange rate volatility and foreign direct investment. De Grauwe (1988) on the other hand finds a positive relationship arguing that in risky environment traders may trade more in order to avoid substantial decline in their revenue.

Clarida and Gali (1994) identify the sources of ERV to be monetary shocks to money supply, and demand for real money balances. They find that demand shocks explain most of the variance in real exchange rate fluctuations, whereas supply shocks explain very little. In a similar study to this, Ekanayake and Thaver (2011) find that the long-run ERV has a negative and significant effect on the US exports to South Africa.

Lastrapes and Koray (1990) used the moving average representation for ERV in U.S. multilateral trade and found extremely small quantitative effects on trade. Tenreyro (2007) finds no significant impact on trade, caused by nominal exchange rate variability. This is in contradiction to Kim and Lee (2007)'s study on Korea's data; they find statistically significant impact on real exports' volume and prices, caused by fluctuations in nominal exchange rates. They further explain that the magnitude of the effect is stronger for volumes than quantities since Korean exporters prefer pricing to maintain market share rather than adjust export prices to reflect exchange rate changes.

Betts and Devereux (2000) did an empirical investigation between price and exchange rate flexibility. The results showed that Pricing to Market (PTM[2]) increases exchange rate

[2] Pricing-to-market (PTM) behavior implies that exporters adjust their prices to the prevailing prices in their export markets. For the importing country, PTM effects can be interpreted as a measure of the stability of domestic prices against foreign price and exchange rate developments. PTM behavior can be attributed to the level of competitiveness and price stickiness in the importing country.

volatility relative to one set price. Weliwita, Ekanayake and Hiroshi (1999), Fountas and Bredin (2006), Caporale and Doroodian (2002), Kenen and Rodrick (1986) and Dell'Ariccia (1999) and Pozo (1992) found that short - term ERV depresses trade. In addition; their results conclude that volatility has not diminished even after markets have gained experience with floating exchange rates.

Choudhry (2005) and Chou (1999) suggests that ERV (from Chinese data) has especially large negative effects on manufactured exports than raw exports, whereas Kroner and Lastrapes (2003) determine that the magnitude of the effect is stronger for export prices than quantities. Arize (1997) uses data from eight Latin America countries with results showing very significant negative impacts on export demand caused by ERV both in the short and long run, with effects resulting in reallocation of resources by markets. Onafowora and Owoye (2011), Bleany and Greenaway (2001), and Bah and Amusa (2003) finds that real exchange rate instability for primary product exporters such as sub-Saharan African countries depresses investment in those sectors rather than export growth.

Mckenzie (1999) finds that ERV significantly differ between traded goods sectors, thus the need to disaggregate trade data, while Hau (2002) found strong evidence that economic openness reduces ERV thereby reducing the resulting depressing effects on trade. In addition; Baccetta and Wincoop (2000) found no relationship between trade levels and welfare across exchange rate regimes.

In unusual findings, Klein (2002) uses U.S. sectoral export data to seven major industrial economies. Results provide evidence that risk – neutral firms increase supply of elastically demanded exports in response to an increase in ERV, thereby posting a significant positive relationship between increased ERV and export volumes. These are similar findings to

McKenzie and Brooks (1997), which used Germany – U.S. trade flows. Rey (2006) found similar results for Israel and Morocco's export volumes to the E.U., whereas Algeria, Egypt, Tunisia, and Turkey posted negative impacts on export volumes to the E.U. viz a viz ERV.

Schnabl (2008) studied growth in the same countries (in addition to others in the EMU periphery) and found a strong negative relationship between their export growth and ERV viz the euro. In a subsequent study, Schnabl (2009) argues that real exchange rate stability reduces transaction costs for international trade, causes less uncertainty for international capital flows, and enhances macroeconomic stability. In addition, Schnabl (2009) isolates macroeconomic instability as the adverse cause of negative growth in emerging economies. Sercu and Vanhulle (1992), and Broll and Eckwert (1999) similarly conclude that increased ERV positively affects the value of exporting firms, which makes an exporting strategy more attractive relative to direct investment.

Sauer and Bohara (2001) identified LDC exports from Africa and Latin America as being more sensitive to exchange rate uncertainties than those from Asian LDCs industrialized countries, while Vergil (2004) employs the less common measure of ERV: the standard deviation of the percentage change in the real exchange rate, and still found the expected results of depressed trade on Turkey's export demand to U.S. and the E.U. In addition; Devereux and Lane (2003) explain that developing countries' bilateral exchange rate volatility (relative to creditor countries) is strongly negatively affected external debt.

Exchange rate volatility also negatively affects U.S.'s foreign direct investment (FDI) (Campa, 1993), especially for firms bearing high sunk investments, for example, Japanese auto makers. Serven (2006) finds similar results on LDCs, especially in small open economies with less developed financial systems.

Sercu and Vanhulle (1992) and Daly (1998) found ERV to have ambiguous effects on trade volumes, using Japan's bilateral trade flows, while Belke and Setzer (2003) find that ERV lowers employment growth in European markets and suggests that elimination of ERV could be a viable substitute for a removal of employment protection legislation. Belke and Kaas (2005) find this effect to be stronger in the E.U. than U.S.

Hayakawa and Kimura (2009) using East Asian data determine that intermediate goods trade in international production is more sensitive to ERV compared to other types of trade. They additionally find ERV to have greater impacts than tariffs and smaller impact than distance-related costs.

Kulatilaka and Kogut (1994) suggest that hysteresis (lagging effect) in the export prices caused by ERV is responsible for the persistence in U.S. current account deficit. In contrast, Gutiérrez (1992) finds ERV to have no significant effect on trade volumes and prices on U.S. - Canada bilateral trade. DeVita and Abbott (2004) uses U.K. – E.U. bilateral trade data to support Gutiérrez (1992) findings, while Aristotelous (2001) uses U.K. – U.S. bilateral trade data. They argue U.K. exports are unaffected by short-term ERV and relative price, but are largely income elastic. Long-term measure of ERV however yields negative and significant impact on trade volumes.

Choudhry (2008) finds strongly positive impacts of exchange rate volatility on real imports using U.K. import data from Canada, Japan, and New Zealand, while Jung (2008) finds an interesting negative relationship between ERV and unemployment in Germany's post-unification era. In addition; Canzoneri and Diba (2002) determine that higher currency substitution actually reduces ERV within the European Monetary Union (EMU).

2.4. South Africa's Economic Sanctions

From 1948 to 1994, the Nationalist party governed South Africa and enacted the apartheid system of laws. The system faced growing international criticism prompting some countries to restrict trade with South Africa. Restrictions on overseas investments in South Africa were first enacted by Sweden in 1979 (Table 1.6). This was followed by a sequence of measures against the importation of specific South African goods and services.

In October 1985, the United States imposed a ban on the importation of some minerals. In the same month six Nordic countries imposed a ban in trade of almost all goods. Denmark specifically imposed a total ban of any form of trade with South Africa. In 1986, trade sanctions against South Africa reached a peak when the Commonwealth Group of Nations, the European Community, and the United States imposed measures that would reduce their imports from South Africa. As a result of these measures, and in response to adverse public opinion, many leading multinational firms reduced or completely sold off their investments in South Africa.

Multinationals without their former South African subsidiaries ceased or reduced sourcing parts, components and raw materials from South Arica. Table 1.6 provides a chronological summary of sanctions against South African exports and foreign investments into South Africa. These events had significant adverse effects in South Africa export volumes, warranting the testing of a structural break in the time series analysis.

3. Model Specification

The objective of this chapter is to examine the effects of exchange rate volatility on disaggregated South Africa's mineral exports for the period 1980:01 through 2011:07, in monthly data series. Drawing on the existing empirical literature in this area, the study specifies that a standard long-run export demand function for commodity *i* may take the following form,

as suggested in Weliwita, Ekanayake and Hiroshi (1999), Fountas and Bredin (2006), Caporale and Doroodian (2002), Kenen and Rodrick (1986), Dell'Ariccia (1999) and Pozo(1992):

$$\ln X_{it} = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln P_{it} + \beta_3 \ln RER_t + \beta_4 \ln ERV_t + \varepsilon_t \qquad (1.1),$$

where X_{it} is real export volume in tons of commodity i in period t. The commodities studied in this paper are coal, iron ore, chromium, copper, manganese ore, PGMs, nickel, gold, granite, and limestone. Y_t is the real world GDP in period t, P_{it} is the relative price of exports of commodity i in period t, RER_t is the real exchange rate between the U.S. dollar and the South African rand, ERV_t is a measure of exchange rate volatility, and ε_t is a white-noise disturbance term.

Economic theory suggests that the real income level of the domestic country's trading partners would have a positive effect on the demand for its exports. Therefore, it is expected that $\beta_1 > 0$. If the relative price of exports rise (fall), domestic goods become less (more) competitive than foreign goods, causing the demand for exports to fall (rise). Therefore, one would expect that β_2, which measures the competitiveness of South Africa's exports relative to world production, to be negative. Similarly, if a real depreciation of the rand, reflected by a decrease in the RER, is to increase export earnings of commodity i, a negative coefficient estimate for β_3 is expected. Consequently, a real depreciation of the rand, reflected by a decrease in the RER will at the same time imply that the import demand for commodity i is elastic. If, however, the import demand for commodity i were inelastic, it is expected that β_3 will be positive. The last explanatory variable is a measure of exchange rate volatility. Various measures of real ERV have been proposed in the literature. Some of these measures include (1) the averages of absolute changes, (2) the standard deviations of the series, (3) the deviations from the trend, (4) the squared residuals from the ARIMA or ARCH or GARCH processes, and (5) the moving sample standard deviation of the growth rate of the real exchange rate. Since the effects of ERV on

exports have been found to be empirically and theoretically ambiguous (Ekanayake and Thaver, 2011), β_4 could be either positive or negative.

Following Ekanayake and Thaver (2011), the real effective exchange rate, RER_t is constructed as: $RER_t = E\ P_{SA}/P_{US}$ where RER is the real effective exchange rate, E is the bilateral nominal exchange rate of rand per U.S. dollar at time t, P_{SA} is the consumer price index (2005=100) of South Africa at time t, and P_{US} is the consumer price index (2005=100) of the U.S. at time t.

Exchange rate volatility (ERV) is obtained from the squared residuals from the GARCH process which takes the following form:

$$\Delta \ln RER_t = \beta_0 + \beta_1 \ln REER_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim N(0, \varepsilon_t^2) \qquad (1.2)$$

$$\varepsilon t^2 = \alpha_0 + \varepsilon_{t-1}^2 + \mu_t \qquad (1.3)$$

The estimated conditional variance (εt^2) is used as the measure for ERV.

Equations such as (1.1), where variables enter at their level and there is no lagged variable, are usually referred to as long-run relationships. Any estimate obtained for βs are long-run estimates. In obtaining these long-run estimates, recent developments in time series analysis require incorporating the short-run adjustment process into the estimation procedure and making sure that when the adjustment takes place, the equilibrating error term (ε_t) decreases over time. The procedure to account for short-run dynamics is one of expressing (1.1) in an error-correction modeling format. The Engle-Granger (1987) error-correction representation theorem requires Equation (1.1) to be expressed as;

$$\Delta ln\, X_t = \alpha_0 + \beta_i \Delta ln\, X_{t-i} + \gamma_i \Delta ln Y_{t-i} + \delta i \Delta ln P_{t-i} + \eta_i \Delta ln RER_{t-i} + \varphi_i \Delta ln ERV_{t-i} + \lambda_0 ln X_{t-i} +$$

$$\lambda_1 ln P_{t-i} + \lambda_2 ln Y_{t-i} + \lambda_3 ln RER_{t-i} + \lambda_4 ln ERV_{t-i} + \tau_{ECM} \qquad (1.4),$$

where Δ is the difference operator and the other variables are as defined earlier.

Ekanayake and Thaver (2011) use bounds testing approach to cointegration, which is based on two procedural steps. The first step involves using an F-test or Wald test to test for joint significance of the no cointegration hypothesis H_0: $\lambda_0 = \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ against an alternative hypothesis of cointegration, H_1: $\lambda_0 \neq 0$ or $\lambda_1 \neq 0$ or $\lambda_2 \neq 0$ or $\lambda_3 \neq 0$ or $\lambda 4 \neq 0$. This test is performed using Equation (1.4). The advantage of this approach is that there is no need to test for unit roots, as is commonly done in cointegration analysis (although the latter has still been done in this study to compare alternatives). Ekanayake and Thaver (2011) provide two sets of critical values for a given significance level with and without time trend. One assumes that the variables are stationary at the levels or I (0), and the other assumes that the variables are stationary at the first difference or I (1). If the computed F-values exceed the upper critical bounds value, then H_0 is rejected signaling cointegration among the independent variables. If the computed F-value is below the critical bounds values, then fail to reject H_0. Finally, if the computed F-statistic falls within the boundary, the result is inconclusive. After establishing cointegration, the second step involves estimation of the long-term elasticities and the error-correction model. Akaike Information Criteria (AIC) and the Schwartz Bayesian Criterion (SBC) for model selection are used to aid in model selection.

Without a lagged error-correction term, Equation (1.1) is just a vector autoregressive (VAR) specification that is usually used to test Granger causality, a short-run concept. The addition of ε_{t-1} is designed to test whether, in the long run, the equilibrating error shrinks. If it does, the estimate of ω must be negative and significant. Note that a negative and significant ω

will also indicate that the dependent and independent variables in (1.1) are converging or, alternatively, they are cointegrated. The only requirement is that all variables must be non-stationary in levels or stationary when first differenced. The short-run effects of exchange rate volatility on exports is inferred by the sign, size and significance of estimated φ_i , and its long-run effects by the estimate of λ_4 that is normalized on λ_0.

Derived coefficients are calculated by multiplying the error correction coefficients in Equation (1.4) by each of the levels coefficients in Equation (1.1) respectively. The reported t-statistics are derived through error propagation procedure. This chapter estimates the short-run estimates of ERV effects on export volumes of all metals combined, combined volume without gold and diamonds, export volumes of gold, and those of diamonds. Only the long-run effects of the rest of metals are estimated.

3.1. Data Sources and Variables

Equation 1 uses monthly time series data for the period 1980:01 to 2011:07. Data for mineral export volumes is obtained from the Central Bureau of Statistics of South Africa. These series are updated monthly and are available online at www.statssa.co.za and World Trade Organization (WTO)'s Commodity Trade Statistics Database (COMTRADE). Data for corresponding prices is available from IMF commodity index reports, also available online at http://www.imf.org/external/np/res/commod/index.aspx . Annual real GDP for South Africa and World are available at the World Bank's portal and also at the Foreign Trade Division of the U.S. Census Bureau, while monthly series for South Africa and U.S. are available at South Africa's Central Bank (SAB) and the Federal Reserve Bank of St. Louis (FRED II) respectively. Annual series for consumer and producer price indices are available at the IMF, while the monthly series for South Africa and U.S. are available at SAB and FRED II respectively. Data

for the nominal exchange rates viz a viz South Africa is available at SAB, Pacific Exchange Rate Service, *Main Economic Indicators* published by the OECD, and International Monetary Fund's *International Financial Statistics*.

3.2. Data Plots

Figures (1.1) through (1.12) show data plots for export volumes of the eleven metals and their respective export prices from 1980 through 2011. Export volume of coal (Figure 1.1) rises steadily through the years, registering only slight dips in 1983 through 1986, possibly because of economic sanctions. Corresponding coal prices show a sluggish trend but over the years, but start rising from 1983 through 2011.

Export volume for iron ore and gold (Figure 1.2 and 1.8) shows a similar trend as coal, but the prices starts high in 1980, dropping to the lowest level in 1986 to 1989. The prices remain sluggish through 2002, then rises steadily through 2011. A good explanation for this would be increasing demand for iron ore as a raw material for the construction boom in India and China, and oil-induced construction boom in sub-Saharan Africa.

Chromium, copper, manganese ore, Nickel and limestone (Figures 1.3, 1.4, 1.5, 1.7 and 1.10 respectively) show consistently rising export volume over the years, with sticky prices from over the years under consideration. The increase in PGM export volume (Figure 1.6) has not been as remarkable as other metals, largely due to their rarity. Their prices also show a falling trend from 1980 through early 2000, then rises slowly over the last decade to its highest in 2010. Granite (Figure 1.9) show export volume rising steadily, reaching a peak in 2003, and then falling to the lowest level in 2011. Corresponding prices show a similar trend. Falling export

volumes for granite maybe due to new building and construction technologies using recycled material, or due to diminishing granite resources within South Africa.

4. Empirical Results

4.1. Stationarity Analysis

Variables in a time series regression should be stationary, converging to a dynamic equilibrium, or the standard errors would be understated (Enders, 1995). Therefore, prior to estimating the model, the study tests each series for a unit root using the Dickey-Fuller (Dickey and Fuller 1981) and the Phillips and Peron (1988) unit root tests. These tests verify that each series that enters the model is stationary.

The analysis also checks for the presence of auto correlation and normality of the error terms. Durbin Watson statistics show that the models' error terms do not suffer from auto correlation. Inspection of the residual plots for several series concludes that the errors are normally distributed. Then, Shapiro-Wilk W-test, which is the ratio of the best estimator of the variance to the usual corrected sum of squares estimator of the variance (Shapiro and Wilk 1965) is applied. The test results confirm the visual inspection of the residual plots that the errors are normally distributed. Finally, to avoid problems that may arise from heteroscedasticity, the study uses ARCH (1) tests and reports robust standard errors.

Table (1.1) provides a summary of stationarity analysis. All variables are difference stationary with white noise residuals (Table 1.1). All residuals are checked for white noise with zero means, low auto correlation by Durbin Watson statistics (DW>1.26 for lack of positive autocorrelation and DW>2.74 for lack of negative auto correlation), and homoskedasticity by ARCH (1) tests.

Chromium export volumes and export prices for coal, nickel, PGM, and gold are difference stationary by Dickey Fuller tests with no constant (DF), while chromium's export price is difference stationary by Dickey Fuller tests with a constant (DFc). The series for real effective exchange rate (RER) is difference stationary by Dickey Fuller tests with a time trend (DFt). The rest of the series are difference stationary by Peron test.

4.2. Model Estimation

Regressions in levels produce spurious results but variables are cointegrated by Engle-Granger EG tests. These results are reported in Table (1.2). ECM results are reported in Table (1.3). Relative prices for copper, nickel and gold bear positive and significant coefficients, while ERV yields negative and significant coefficient for coal, and a positive and significant coefficient for copper. The insignificant difference coefficients for the rest of the variables in Table (1.3) imply no transitory effects but the significant error correction terms imply adjustment relative to the dynamic equilibrium.

Effects of exogenous variables on S.A.'s export of metals are reported in Table (1.4). Coefficients are derived by multiplying the error correction coefficients in Table (1.3) by each of the levels coefficients in Table (1.2). The reported standard errors are derived through error propagation calculation: $\sigma_\gamma = \gamma((\sigma_\alpha/\alpha)^2 + (\sigma_\beta/\beta)^2)^{.5}$, where, if $\gamma = \alpha \pm \beta \Rightarrow \sigma_\gamma = (\sigma_\alpha^2 + \sigma_\beta^2)^{.5}$, and if $\gamma = \alpha\beta$ or $\gamma = \alpha/\beta \Rightarrow \sigma_\gamma = \gamma((\sigma_\alpha/\alpha)^2 + (\sigma_\beta/\beta)^2)^{.5}$. In Tables (1.2, 1.3, and 1.4), coefficient estimates are reported with standard errors in the parenthesis, and the corresponding t-statistics.

For all metal exports combined, rising world income positively affects exports with an elasticity of 0.61, while rising export prices depress trade with an elasticity of -0.11. Appreciation of the rand relative to the U.S. dollar reduces export volumes with an elasticity of -0.04, while exchange rate volatility depresses exports. The export volumes for all metals

combined without gold are adversely affected by rising world prices and rand appreciation, and exchange rate volatility, with elasticities of -0.1, -0.04, and -27.68.

An increase in world income increases the export volumes for iron, copper, manganese, gold, and limestone, with elasticities of 0.61, 1.09, 0.88, 1.54, 1.75, and 0.5 respectively, consistent with Lastrapes and Koray (1990), and Ekanayake and Thaver (2011). The rest of the metals yield insignificant estimates, or estimates with wrong signs. An increase in export prices reduces export volumes for chromium, copper, manganese, nickel, and gold, with elasticities of -0.46, -0.64, -0.64, and -0.45 respectively. The rest of the metals yield insignificant estimates, or estimates with wrong signs. Appreciation of the rand, caused by an increase in RER, reduces export volumes for coal, iron, copper, nickel, gold, and granite, with elasticities of -0.04, -0.04, -0.01, -0.58, -0.43, -0.7, and -0.66 respectively. Iron, copper, manganese, PGMs, and limestone are not sensitive to currency appreciation since all yield insignificant estimates. All metals except chromium, PGMs, and limestone are sensitive to fluctuations in exchange rates. Coal, iron, PGMs, nickel, gold and granite yield significant negative estimates for ERV consistent with Ekanayake and Thaver (2011), Vergil (2004), Shnabl (2008), Weliwita, Ekanayake and Hiroshi (1999), Fountas and Bredin (2006), Caporale and Doroodian (2002), Kenen and Rodrick (1986), Dell'Ariccia (1999), Pozo (1992), Choudhry (2005), Chou (1999) and Arize, Osang, and Slottje (2006), meaning that their export volumes are depressed by fluctuations in exchange rates. ERV on the contrary improves the export volumes for Copper and manganese, since they yield positive estimates, consistent with Kim and Lee (2007), Klein (2002), Choudhry (2008), Sercu and Vanhulle (1992), and Broll and Eckwert (1999).

Table (1.5) reports results for the short-run estimates (similar to Edwards and Lawrence (2006), and Ekanayake and Thaver (2011)), alongside the long-run estimates for all metal export

volumes combined, gold, and diamond. The effects of trade sanctions are also reported. Results in levels are spurious, and the ECM models produce insignificant estimates. For the derived effects, aggregate export volumes with and without gold decline with an increase in export prices, with elasticities of -0.39 and -0.06 respectively, while gold and diamond exports also decline with elasticities of -0.02, and -0.52 respectively. Rand appreciation in the short-run also depresses exports of all metals with an elasticity of -0.33, and reduces gold and diamond exports with an elasticity of -0.27 and -0.08. Exchange rate volatility in the short-run also depresses trade volumes in all metals combined, all without gold, diamond and gold individually, with elasticities of -0.33, -0.17, -0.27, and -0.08 respectively. Ekanayake and Thaver (2011) found similar results in mining sector, where data was an aggregate of the entire sector.

Economic sanctions imposed on South Africa prior to 1994 by majority of its trading partners are found to depress export volumes of all metals combined, with and without gold, with elasticities of -0.04, and -0.02, consistent with Hufbauer, Elliott and Schott (2002) . Gold and diamond are not sensitive to those restrictions. Plausible explanation would be that most of the trade partners that imposed restrictions, allowed unrestricted trade in gold and diamonds due to their high value, but restricted trade in the rest of the metals.

Although the above results are generally consistent with listed previous studies, direct comparison would not be appropriate, owing to various differences in the models. First, to generate a proxy of exchange rate volatility, one can pursue different methodologies. One of the most commonly employed methods to proxy for exchange rate volatility is the moving standard deviation of exchange rate changes. This methodology contains substantial correlation. Vergil (2004), Shnabl (2008), Caporale and Doroodian (2002), Kenen and Rodrick (1986) use this proxy in their models on studies predicting ERV's effects on US exports. This chapter uses

squared residuals from the GARCH process as an alternative, similar to Ekanayake and Thaver (2011) and Edwards and Lawrence (2006), which use cointergration analysis in their studies.

Alves and Edwards (2006) and Edwards and Golub (2004) use the GARCH process on South Africa's non-gold merchandise exports using panel data for 28 manufacturing sectors. They obtain fixed effects and General Method of Moments (GMM) estimators, while Tsikata (1999) estimates ERV in both short and long-run in a reduced form export function OLS and 2SLS models. Bhorat (2008) estimates a similar model for South Africa's paper and paper products export.

Secondly, Dell'Ariccia (1999), Pozo (1992), Broll and Eckwert (1999). Estimate extended models that include tariffs, capacity utilization and infrastructure among other variables. Additional variables to a model lead to a loss in the degrees of freedom. Thirdly, difference in data frequency and period of analysis on similar studies will yield different results. Except for Kim and Lee (2007), and Klein (2002) that use monthly series on US sectoral exports, the rest of the studies use either annual or quarterly with differing period of analysis.

Lastly, most of past studies in this area use aggregate data that leads to aggregation bias. This chapter adopted Ekanayake and Thaver (2011), Onafowora and Owoye (2011), Bleany and Greenaway (2001), and Bah and Amusa (2003). These studies use disaggregated trade data that looks at the impact of exchange rate volatility on disaggregated sectoral data for South Africa's exports. This chapter goes further by considering individual commodities within a specific sector, which provides specific commodity attributes.

5. Summary and Conclusion

This chapter examines the relationship between South Africa's metal exports and the fluctuations in exchange rates among other macroeconomic variables, with monthly time series data for the period 1980:01 to 2011:07. Both short-run and long-run estimates are examined, as well as effects of trade sanctions on export volumes.

Besides providing important commodity attributes lacking in previous studies, cointegration results clearly show that there exist both long and short-run equilibrium relationships between real exports and real foreign economic activity, relative prices, real exchange rate, and real exchange rate volatility in the eleven commodities. All the specifications yielded expected signs for the coefficients. Most of the coefficients in all the models considered are statistically significant.

In the long-run, importer's income is found to be important, having a positive impact on export volumes of five of the eleven metals. Export price and real effective exchange rates are also critical in determining export volumes, while ERV is perhaps the most important factor. All metals except chromium and limestone are found to be highly sensitive to exchange rate fluctuations.

In the short-run, similar results are obtained for gold and diamond. Trade sanctions imposed on South Africa prior to 1994; appear to have depressed exports for all other metals except for gold and diamond, possibly due to gold and diamond's high value and rarity.

Tables

Table 1.1. Stationarity Analysis for Commodities

Y-VARIABLE	**DF -1.95<T<0 F<5.18**	**DFc -3.00<T<0 F<5.18**	**DFt -3.60<T<0 F<5.68**	**ADF -3.60<T<0 F<7.24**	**ADF(2) -3.60<T<0 F<7.24**	**PERON $(a_1-1)/se$ TP<0**
All	ARCH(1)=4.63	ARCH(1)=4.79	F=28.56 T=7.55	F=33.01 T=5.33	F=39.89 T=3.59	TP=-8.52
All w/o gold	ARCH(1)=3.177	ARCH(1)=3.164	F=19.7 T=6.27	F=13.43 T=-6.12	F=23.05 T=-3.55	TP=-6.97
Coal	ARCH(1)=5.24	ARCH(1)=4.85	F=21.39 T=-6.52	F=45.95 T=-4.25	F=36.2 T=-3.69	TP=-6.9
Iron	ARCH(1)=8.02	ARCH(1)=7.42	F=24.85 T=-7.03	F=58.99 T=-3.61	F=13.46 T=-7.05	TP=-7.44
Chromium	F=0.15 T=0.396 DW=2.85 ARCH(1)=2.73					
Copper	ARCH(1)=6.92	F=10.02 T=-3.17	F=38.9 T=-5.66	F=44.09 T=-4.04	F=44.09 T=-4.04	TP=-9.23
Manganese	ARCH(1)=5.13	F=12.85 T=-3.59	51.47 T=10.14	F=62.93 T=-5.87	F=59.09 T=-4.16	TP=-10.3
PGM	ARCH(1)=7.49	ARCH(1)=6.88	F=19.42 T=-6.23	F=39.23 -3.75	F=35.81	TP=-6.48
Nickel	ARCH(1)=6.27	F=6.34 T=-2.51	F=32.73 T=-8.09	F=41.12 T=-5.22	F=33.56 T=-4.29	TP=-8.25
Gold	ARCH(1)=5.91	F=13.99 T=-3.74	F=53.68 T=-10.36	F=50.9 T=-6.79	F=70.88 T=-3.90	TP=-10.85
Granite	DW=3.03	F=10.98 T=-3.31	F=14.96 T=-5.44	F=49.14	F=41.67	TP=-5.79
Limestone	ARCH(1)=8.22	ARCH(1)=5.39	F=33.97 T=8.24	F=39.44 T=-5.57	F=31.46 T=-4.76	TP=-8.47

PManganese	ARCH(1)=5.51	ARCH(1)=6.36	ARCH(1)=8.18	F=9.023 T=-3.32	F=7.11 T=-3.35	TP=-2.9
PCoal	F=1.24 T=1.11 DW=1.39 ARCH(1)=2.76					
	DF -1.95<T<0 F<5.18	DFc -3.00<T<0 F<5.18	DFt -3.60<T<0 F<5.68	ADF -3.60<T<0 F<7.24	ADF(2) -3.60<T<0 F<7.24	PERON $(a_1-1)/se$ TP<0
PCopper	ARCH(1)=8.25	ARCH(1)=8.61	ARCH(1)=9.31	F=21.77	F=17.77	TP=-2.35
PIron	ARCH(1)=6.21	ARCH(1)=6.16	ARCH(1)=5.74	F=9.08 F=-2.44	F=6.8 T=-2.32	TP=-0.05
PGranite	ARCH(1)=8.47	ARCH(1)=8.28	ARCH(1)=8.22	F=18.89	F=14.14	TP=-2.72
PLime	ARCH(1)=5.5 DW=1.5	ARCH(1)=3.5 DW=1.5	DW=1.5 ARCH(1)=4.15	F=11.28	F=8.77 T=3.02	TP=-2.2
PNickel	F=0.48 T=0.69 ARCH(1)=1.42 DW=1.32					
PPGM	F=0.23 T=0.48 ARCH(1)=1.76 DW=1.4					
PChromium	ARCH(1)=4.12	F=1.14 T=-1.06 DW=1.42 ARCH(1)=2.38				
PGold	F=1.28 T=1.13 DW=1.7 ARCH(1)=1.75					
SA-PPI	F=207.13 T=14.93	F=19.20 T=-4.38	F=10.09	F=14.32	F=11.2	TP=-1.86

USA-PPI	F=297.03 T=17.23	F=57.81 T=-7.6	F=45.2 T=6.31	F=336 T=5.78	F=65535	TP=-1.39
SA-US-RER	F=12.6 T=3.56	F=6.45 T=-2.54	F=3.21 T=-0.68 DW=1.29 ARCH(1)=2.04			
ERV	F=353.25 T=-18.79	F=370.4 T=-19.24	F=184.9 T=19.23	F=122.67 T=-13.72	F=91.51 T=-11.16	TP=-19.25

Table 1.2. Levels Model for Commodities

Y-Variable	Constant	GDP	Price	RER	ERV	AdjR^2	F	DW	ARCH(1)	Coint?
All	-17.4* (1.45) -12.15	-2.76 (0.18) 14.74	0.49 (0.08) 5.63	0.2 (0.04) 4.37	149.01# (0.04) 1.60	0.96	2366.9*	2.47	2.1	YES
All w/o Gold	-26.7* (1.38) -19.27	3.69* (0.17) 20.69	0.55 (0.08) 6.60	0.2 (0.04) 5.19	148.9^ (77.4) 1.92	0.97	4386.2*	2.46	1.68	YES
Coal	-10.65* (3.34) -3.18	1.55* (0.17) 8.64	0.95 (0.08) 11.25	0.11 (0.04) 2.3	228.2* (89.04) 2.56	0.97	3563.9*	2.69	1.28	NO
Iron	-44.15* (3.35) -13.16	-5.01 (0.43) -11.62	1.83 (0.2) 9.04	-1.2* (0.1) -11.1	105.47 (213.5) 0.49	0.91	1061.7*	2.62	5.13	YES
Chromium	-24.12* (2.7) -8.93	2.62* (0.34) 7.56	1.52 (0.16) 9.32	-0.6* (0.08) -7.36	355.03# (171.9) 2.06	0.92	1140.9*	2.44	2.41	YES
Copper	6.14* (1.81) 3.42	-1.02 (0.23) -4.42	-1.02* (0.23) 24.69	-0.67 (0.04) -14.76	-214.8# (107.9) -1.99	0.94	1519.4*	2.02	0.70	YES
Manganese	-32.9* (4.34) -7.54	-3.67 (0.57) -6.41	0.55 (0.13) 4.07	0.04 (0.11) 0.41	-468.8^ (290.3) -1.61	0.80	390.4*	2.47	2.98	YES
PGM	-35.03* (2.32) -15.07	4.4* (0.3) 14.24	0.18 (0.03) 4.6	0.2 (0.06) 3.03	91.17 (123.9) 0.73	0.97	3431.1*	2.53	3.6	YES
Nickel	-13.52* (2.38) -5.67	0.97* (0.3) 21.99	0.83 (0.03) 21.47	0.83 (0.06) 9.49	85.67 (141.1) 0.60	0.95	2234.9*	2.08	6.08	YES
Gold	19.12* (1.21)	-1.84 (0.15)	0.47 (0.02)	0.73 (0.03)	27.6 (73.17)	0.92	1121.9*	2.0	0.61	YES

	15.73	-11.85	19.24	22.62	0.37					
Granite	20.89 (2.71) 7.69	-2.78 (0.31) -8.93	0.68 (0.08) 8.4	1.31 (0.07) 17.81	53.58 (185.7) 0.29	0.90	922.5*	2.32	1.48	YES
Limestone	-17.94# (1.04) -17.20	-2.21 (0.12) -17.83	0.32 (0.02) 12.84	0.123 (0.02) 4.47	6.99 (75.65) 0.09	0.97	3152.2*	2.40	5.85	NO

INDEX * significant at 1% level
 # significant at 5% level
^ significant at 10% level
N=376
Standard errors in parenthesis

Table 1.3. ECM Model for Commodities

Y-Variable	Constant	ΔGDP	ΔPrice	ΔRER	ΔERV	ε_{t-1}	AdjR^2	F	DW	ARCH(1)
All	0.002 (0.007) 0.37	-1.92 (0.97) 1.97	0.801 (0.66) 1.20	0.32 (0.14) 2.20	-17.75 (39.25) -0.45	-0.2* (0.03) -6.45	0.13	12.46	2.54	2.31
All w/o Gold	0.007 (0.006) 1.17	-1.34 (0.84) -1.59	0.379 (0.56) 0.665	0.299 (0.12) 2.35	-46.62 (34.003) -1.37	-0.2* (0.02) -6.40	0.11	11.1	2.53	3.11
Coal	0.004 (0.006) 0.72	-1.05 (0.82) -1.28	0.71 (0.54) 1.30	0.35 (0.123) 2.89	-77.01^ (33.41) -2.30	-0.2* (0.02) -6.17	0.129	12.16	2.78	4.55
Iron	0.03^ (0.017) 1.77	-7.01 (2.26) -3.09	-0.62 (1.51) -0.41	0.309 (0.34) 0.90	-101.1 (91.27) -1.1	-0.2* (0.03) -6.83	0.12	11.74	2.38	5.38
Chromium	-0.002 (0.016) -0.17	-3.50 (2.12) -1.43	3.07 (1.43) 2.15	-0.13 (0.31) -0.42	35.11 (85.95) 0.40	-0.3* (0.03) -8.12	0.14	13.8	2.47	2.62
Copper	0.008 (0.01) 0.77	-3.50 (1.85) -1.89	0.17 (0.16) 1.05	0.59 (0.27) 2.18	168.7# (74.74) 2.25	-0.9* (0.05) -17.1	0.44	61.33	2.02	1.03
Manganese	0.02 (0.024) 0.81	-7.39 (4.01) -1.84	-0.53 (0.39) -1.33	0.61 (0.57) 1.05	166.3 (161.9) 1.02	-0.4* (0.04) -10.2	0.21	21.36	2.47	2.64
PGM	0.007 (0.009) 0.75	0.37 (1.54) 2.46	0.01 (0.15) 0.11	0.34 (0.22) 1.51	14.22 (62.34) 0.22	0.29* (0.03) -8.10	0.14	14.02	2.53	3.74
Nickel	-0.004 (0.014) 0.27	2.78 (2.40) 1.15	0.57 (0.15) 3.62	0.73 (0.34) 2.12	110.8 (96.43) 1.14	-0.8* (0.05) -15.2	0.39	49.7^	2.07	6.50
Gold	-0.003 (0.008) -0.38	-0.96 (1.28) -0.74	0.61 (0.17) 3.42	0.79 (0.19) 4.15	54.4 (52.32) 1.03	-0.9* (0.05) -18.3	0.49	75.8^	2.02	0.57

Granite	-0.007 (0.01) -0.43	3.88 (2.80) 1.38	-0.01 (0.24) -0.07	0.65 (0.40) 1.62	2.68 (112.7) 0.02	-0.5* (0.04) -11.2	0.25	26	2.33	1.93
Limestone	0.01* (0.005) 3.34	-4.29 (0.82) -5.20	0.04 (0.07) 0.62	0.065 (0.12) 0.54	14.29 (33.0) 0.43	-0.2* (0.03) -6.96	0.18	17.39	2.50	4.12

INDEX * significant at 1% level
 # significant at 5% level
^ significant at 10% level
N=374
Standard errors in parenthesis

Table 1.4. Derived Effects for Commodities

Y-Variable	Constant	GDP	Price	RER	ERV
All	3.92* (1.44) 2.72	0.61# (0.09) -1.96	-0.11* (0.009) 12.22	-0.04# (0.02) -1.97	-33.05* (7.65) 4.65
All w/o Gold	4.97 (4.24) 1.17	-0.68 (0.43) 1.59	-0.103* (0.015) 6.86	-0.04# (0.02) -2.14	-27.68* (6.02) 4.59
Coal	1.83 (2.55) 0.71	-0.26 (0.21) 1.26	-0.16 (0.12) 1.29	-0.01^ (0.009) -1.80	-39.26^ (22.91) 1.71
Iron	9.66^ (5.50) 1.75	1.09* (0.36) -2.99	-0.40 (0.97) 0.41	0.26 (0.28) 0.90	-23.09* (5.20) 4.44
Chromium	7.34^ (4.56) 1.65	-0.79 (0.56) 1.41	-0.46# (0.22) 2.09	0.19 (0.46) 0.42	-108.02 (69.53) -1.55
Copper	-5.33 (7.07) 0.75	0.88^ (0.50) 1.74	-0.64* (0.061) 10.49	-0.58# (0.27) 2.16	186.7* (25.05) 7.45
Manganese	13.87# (7.20) 1.92	1.54^ (0.87) -1.77	-0.23 (0.18) 1.27	-0.02 (0.05) 0.38	197.5* (28.01) -7.05
PGM	10.48* (3.94) 2.65	-1.31 (5.34) 0.24	-0.05 (0.48) 0.11	-0.06 (0.04) 1.35	-27.27 (25.17) 1.08
Nickel	10.36 (8.40) 1.23	-0.74 (0.68) 1.08	-0.64* (0.17) 3.57	-0.43# (0.21) 2.07	-65.64* (22.21) 2.95
Gold	-18.24* (6.87) 2.65	1.75* (0.36) 4.86	-0.45* (0.13) 3.37	-0.70* (0.17) 4.08	-26.34 (74.28) 0.35

Granite	-10.60* (4.33) 2.44	1.41 (1.03) 1.36	-0.34 (4.7) 0.07	-0.66^ (0.41) 1.69	-27.18* (11.46) 2.37
Limestone	4.08* (1.24) 3.28	0.503* (0.1) -5.00	-0.07 (0.11) 0.62	-0.02 (0.05) 0.54	-1.59 (17.61) 0.09

INDEX * significant at 1% level
 # significant at 5% level
^ significant at 10% level
Standard errors in parenthesis

Table 1.5. Short-Run Estimates for Aggregate and Disaggregated Data.

	S.R. ESTIMATES			L.R. ESTIMATES							MODEL FITNESS				
Y-VAR	**PRICE**	**RER**	**ERV**	**C**	**GDP**	**PRICE**	**RER**	**ERV**	**STR**	**ε_{ECM}**	**F**	**R^2**	**DW**	**ARCH(1)**	**AIC/ SBC**
MODEL IN LEVELS															
ALL	0.41 (0.05)	0.11 (0.05)	0.35* (0.05)	-3.03* (1.06)	-0.38 (0.16)	0.15 (0.14)	0.01 (0.02)	-32.76 (50.17)	-0.04 (0.02)		410.2	0.98	2.16	0.26	461.3 492.7
W/O GOLD	0.09 (0.04)	-0.01 (0.04)	0.24* (0.03)	7.89* (0.60)	-0.77 (0.12)	0.20 (0.10)	0.02 (0.01)	-18.13 (34.78)	-0.03 (0.02)		763.4	0.99	2.08	1.40	189.6 224.9
GOLD	0.02 (0.05)	-0.07 (0.05)	0.27* (0.04)	14.82* (1.78)	-1.43 (0.20)	0.37 (0.04)	0.59 (0.06)	30.31 (69.72)	-0.03 (0.03)		615.1	0.92	2.02	0.29	710.9 442.2
DIAMOND	0.53 (0.05)	0.11 (0.06)	0.08 (0.05)	-4.43* (1.56)	-0.76 (0.22)	0.13 (0.03)	0.14 (0.04)	67.4 (76.16)	-0.02 (0.03)		68.6	0.59	2.00	1.67	773.7 805.1
ERROR CORRECTION MODEL (ECM)															
ALL	0.38 (0.25)	0.13 (0.14)	0.44 (0.11)	-0.02^ (0.01)	-0.62 (0.87)	3.51 (1.75)	0.57 (0.12)	-46.33 (34.46)	0.01 (0.01)	-0.93* (0.26)	23.14	0.34	2.11	-0.17	533.5 557.1
W/O GOLD	0.02 (0.05)	-0.04 (0.04)	0.26 (0.04)	0.001 (0.01)	-0.32 (0.60)	0.40 (1.23)	0.18 (0.09)	6.52 (23.9)	0.001 (0.01)	-0.71* (0.07)	81.6	0.68	2.13	0.24	251.9 279.4
GOLD	0.07 (0.09)	0.01 (0.09)	0.40 (0.06)	-0.01 (0.01)	-0.06 (1.22)	0.65 (0.18)	0.89 (0.18)	54.53 (49.08)	0.001 (0.01)	-0.98* (0.11)	53.77	0.56	2.08	0.08	326.1 396.8
DIAMO	0.52	0.11	0.08	0.001	1.38	-0.20	0.08	-	0.001	-0.99*	10.5	0.18	1.99	0.4	432.6

ND	(0.16)	(0.08)	(0.06)	(0.01)	(1.36)	(0.20)	(0.06)	66.69 (54.77)	(0.01)	(0.17)	1			1	474.8
DERIVED EFFECTS															
ALL	-0.39* (-0.06)	-0.10 (-0.12)	-0.33* (-0.09)	2.81 (1.93)	0.35* (0.02)	-0.14 (0.05)	0.11* (0.02)	30.43* (5.80)	0.04* (0.01)						
W/O GOLD	-0.06* (-0.01)	0.01 (0.03)	-0.17 (0.04)	-5.64 (-9.37)	0.55* (0.03)	-0.29 (-0.89)	-0.12* (0.01)	12.96 (53.57)	0.02# (0.01)						
Y-VAR	PRICE	RER	ERV	C	GDP	PRICE	RER	ERV	STR						
GOLD	-0.02* (-0.005)	0.07* (0.02)	-0.27* (-0.06)	-14.56 (-21.03)	1.41* (0.02)	-0.36* (-0.11)	-0.58* (-0.13)	-29.80* (7.36)	2.08* (0.03)						
DIAMOND	-0.52* (-0.17)	-0.11* (-0.01)	-0.08 (-0.08)	4.39 (90.25)	0.75* (0.07)	-0.12* (0.03)	-0.14* (0.05)	66.82* (9.34)	1.97* (0.02)						

INDEX :
**** significant at 1% level***
 # significant at 5% level
^ significant at 10% level
N=376
Standard errors in parenthesis

Table 1.6. Summary Chronology of Trade Sanctions against South Africa

Time	Events
November 11, 1962	United Nations General Assembly passes a non-binding resolution (number 271) to break diplomatic relations with South Africa, to close ports to South African vessels, to forbid vessels flying their flags to enter South African ports, to boycott South African trade, and to suspend landing rights for South African aircraft.
May-June, 1963	Organization of African Unity is formed and recommends, amongst other actions, economic sanctions against South Africa.
July 1, 1979	A law comes into force in Sweden that prohibits the formation of any new Swedish companies in South Africa or Namibia. Existing Swedish owned multinationals are forbidden to make further investments in fixed assets.
July 24-26, 1985	France proposes a UN Security Council Resolution, which is subsequently passed, that calls for voluntary sanctions against South Africa. These sanctions include, among others, bans on new investments and bans on the imports of some minerals.
October 1, 1985	United States bans the imports of some minerals.
October. 1985	Foreign ministers of the Nordic Council (Denmark, Sweden, Finland, Iceland and Norway) impose sanctions on new investments and on certain imports from South Africa.
Early 1986	Denmark bans imports of coal from South Africa, and then bans 'all' trade in goods and services, except imports of raw phosphate, vermiculite and tanning extracts.
August 4, 1986	Seven members of the commonwealth group of nations meet in London. Six of the seven agree to restrict their imports of South African agricultural goods, uranium, and coal, iron and steel. The United Kingdom was the nation that did not agree to these sanctions.
September 16, 1986	The European Community (Now European Union) votes to ban imports of South African iron, steel, gold and coins. They also ban new investments in South Africa, but permit the reinvestment of retained earnings.
September 19, 1986	Japan bans the imports of South African iron and steel, but not iron ore or coal.
October 2, 1986	United States' Senate votes to override President Reagan's veto of the Comprehensive Anti-Apartheid Act (CAAA). Amongst other measures, this bans the imports into the United States of South African iron, steel, uranium, textiles, agricultural products and goods produced by South African government owned-firms (unless they are regarded as strategic materials for the American military.)
Autumn 1986	Many international companies divest their assets in South Africa, including Barclays Bank (the UK's largest investor in South Africa).
1987	Sweden and Norway impose nearly comprehensive trade and investment bans on South Africa, but (like Denmark noted above) makes limited exceptions for imports of some raw materials.

February 20, 1990	In the wake of Nelson Mandela's release from prison ten days earlier, the British Prime Minister unilaterally lifts the ban on new investments in South Africa. The other members of the European Community do not follow suit.
February, 1991	The European Community's foreign ministers agree to lift economic sanctions against South Africa once the latter's parliament follows president de Klerk's request and repeal three central laws to the apartheid regime.
June, 1991	South Africa's Parliament repeals the Land Act, the Group Areas Act, and the Population Registration Act. The South African Government releases several political prisoners.
July 10, 1991	President Bush lifts American CAAA-based sanctions against South Africa.
October 23, 1991	Japan lifts economic sanctions against South Africa.
April 7, 1992	The European Community lifts its sanctions against South Africa such that the only remaining in force relate to arms sales.
February 3, 1993	Norway partially lifts her economic sanctions against South Africa, but maintains her embargo on oil and arms sales.
Source: Hufbauer, Elliott and Schott (2002)	

Figures

Figure 1.1. Coal Exports and Corresponding Export Price

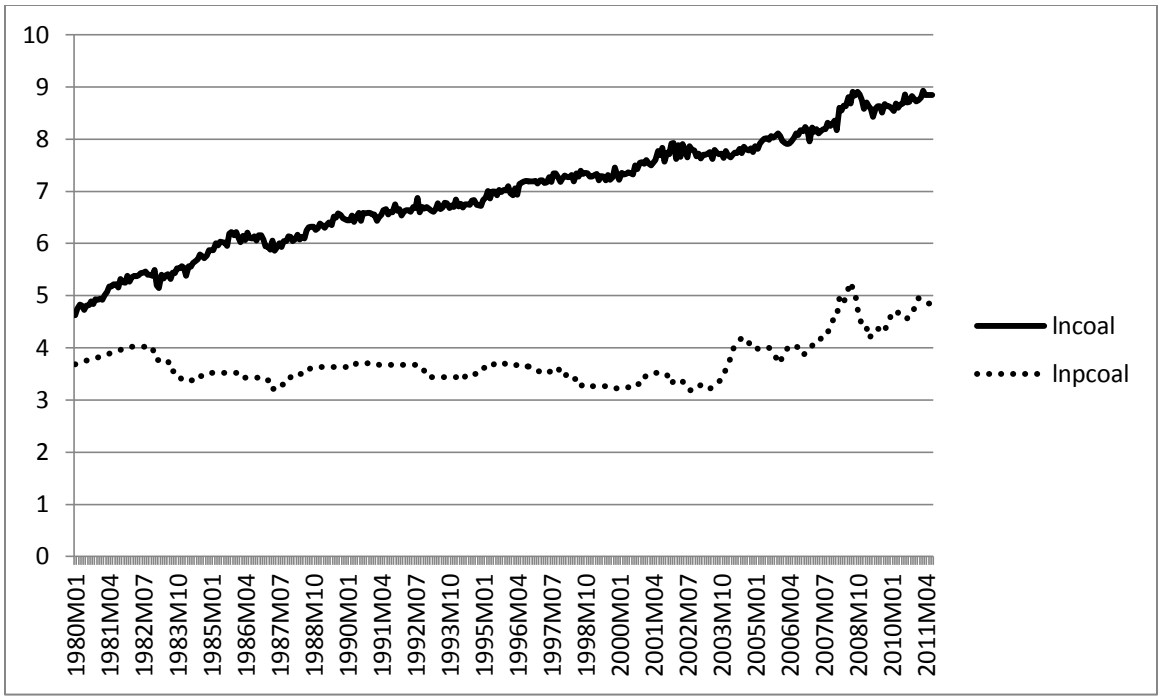


Figure 1.2. Iron Ore Exports and Corresponding Export Price

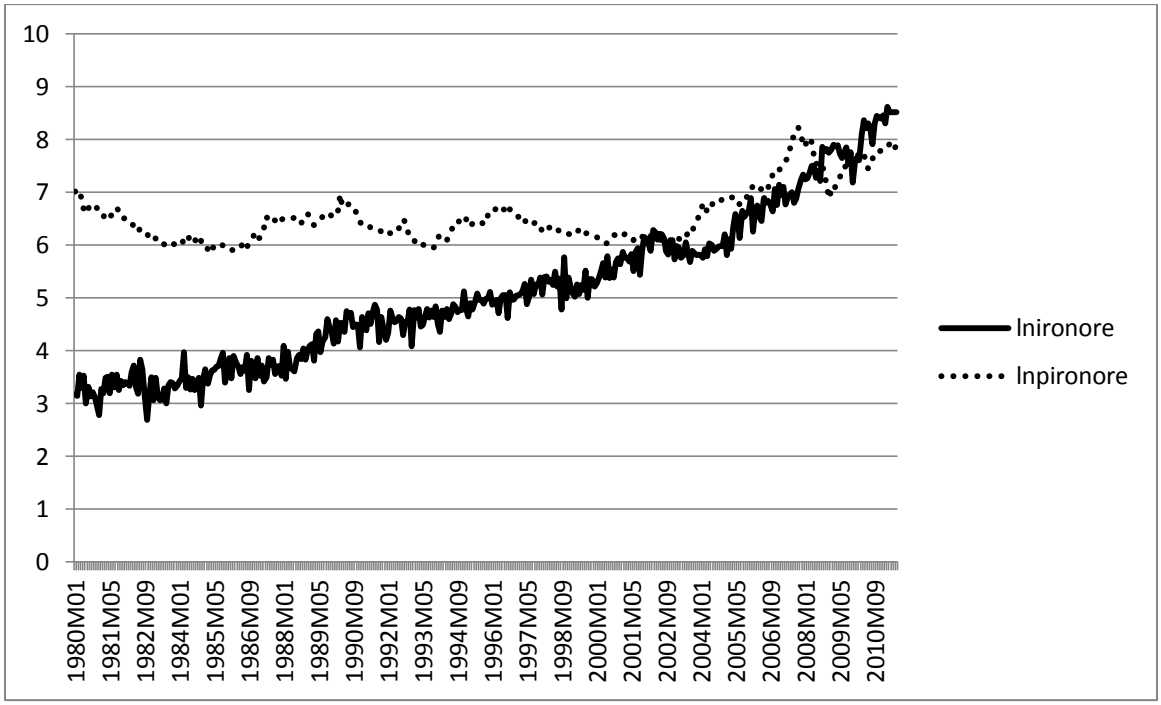


Figure 1.3. Chromium Exports and Export Price

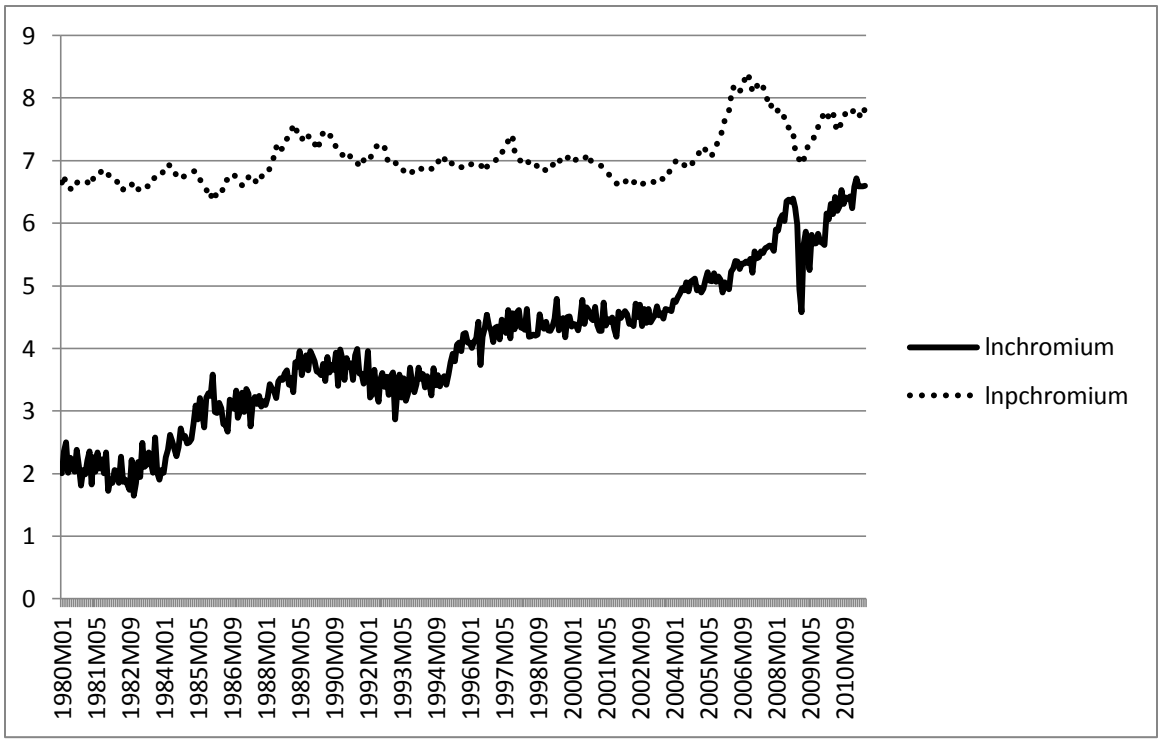


Figure 1.4. Copper Exports and Corresponding Export Price

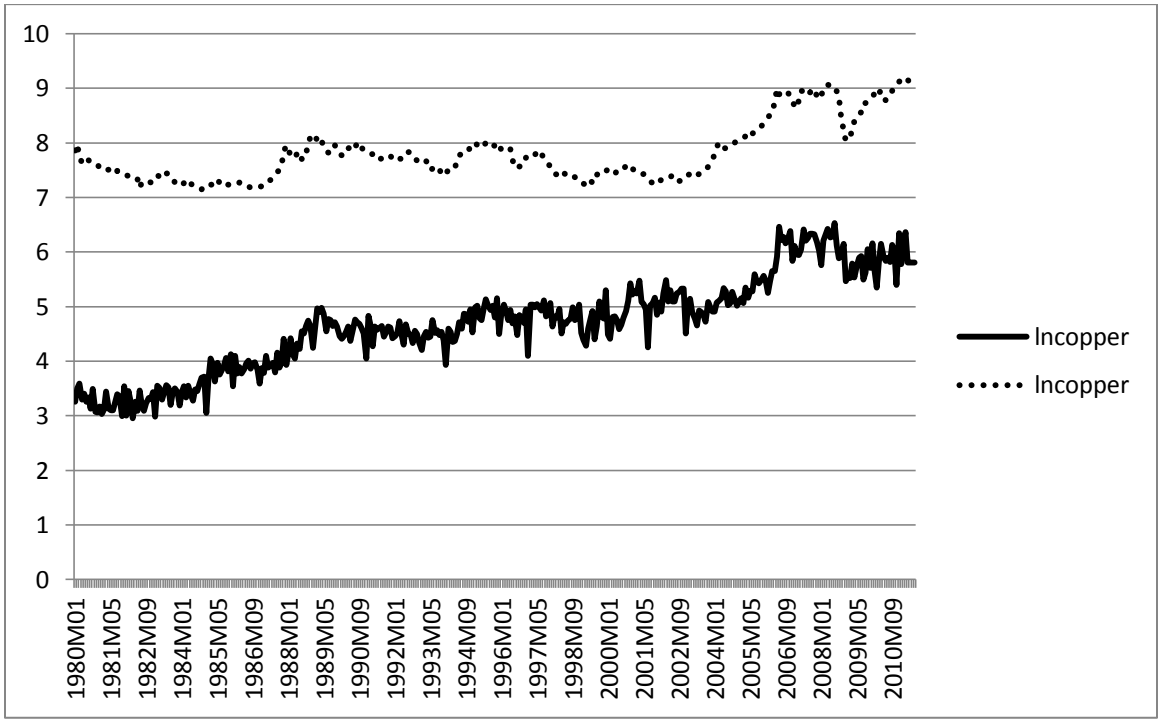


Figure 1.5. Manganese Ore Exports and Corresponding Export Price

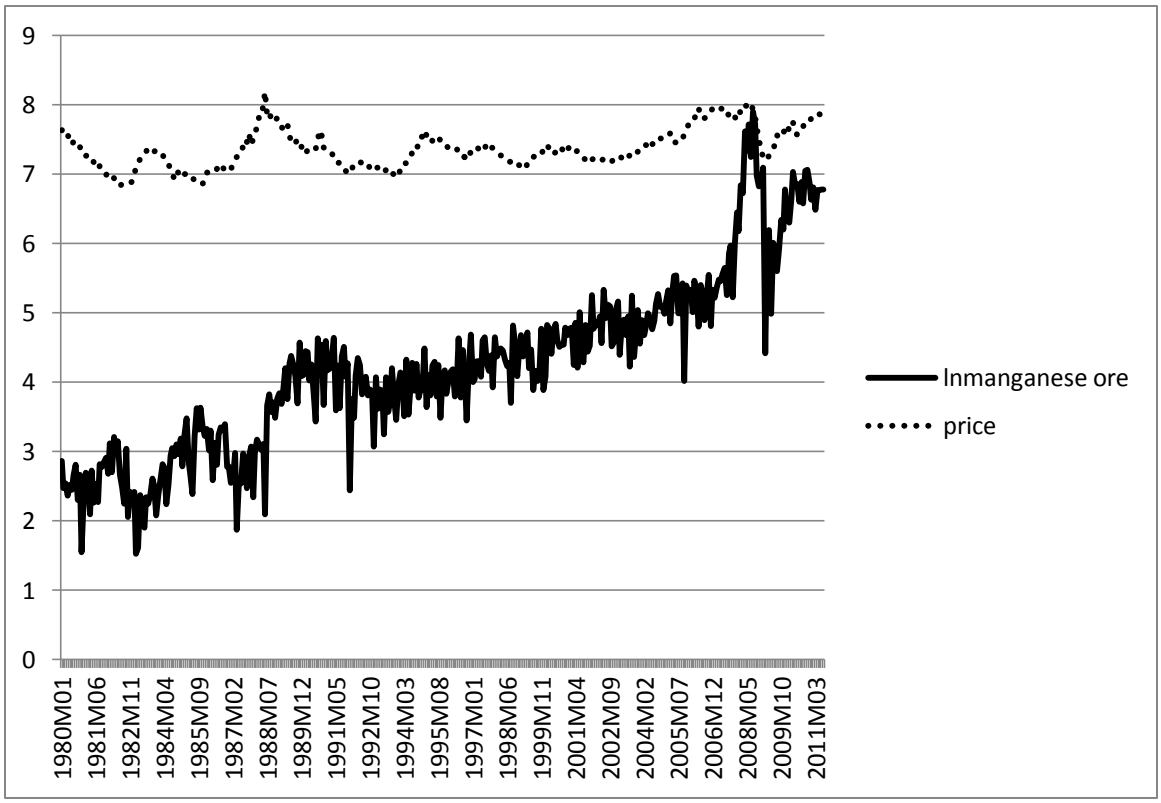


Figure 1.6. PGM Exports and Corresponding Export Price

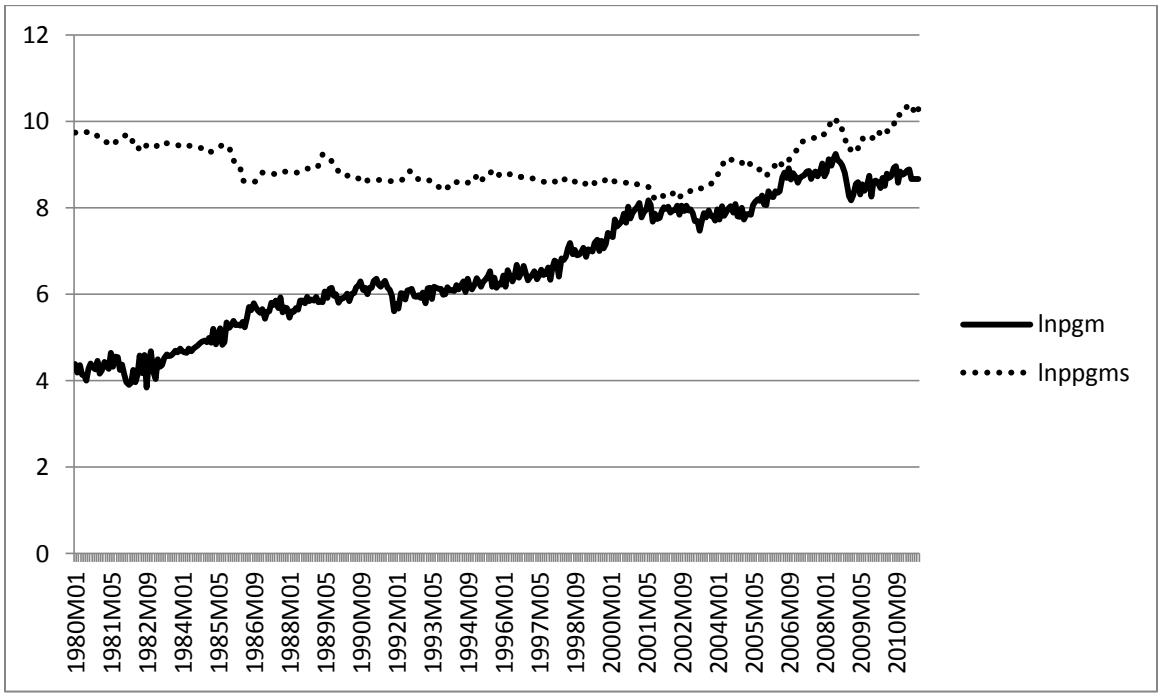


Figure 1.7. Nickel Exports and Corresponding Export Price

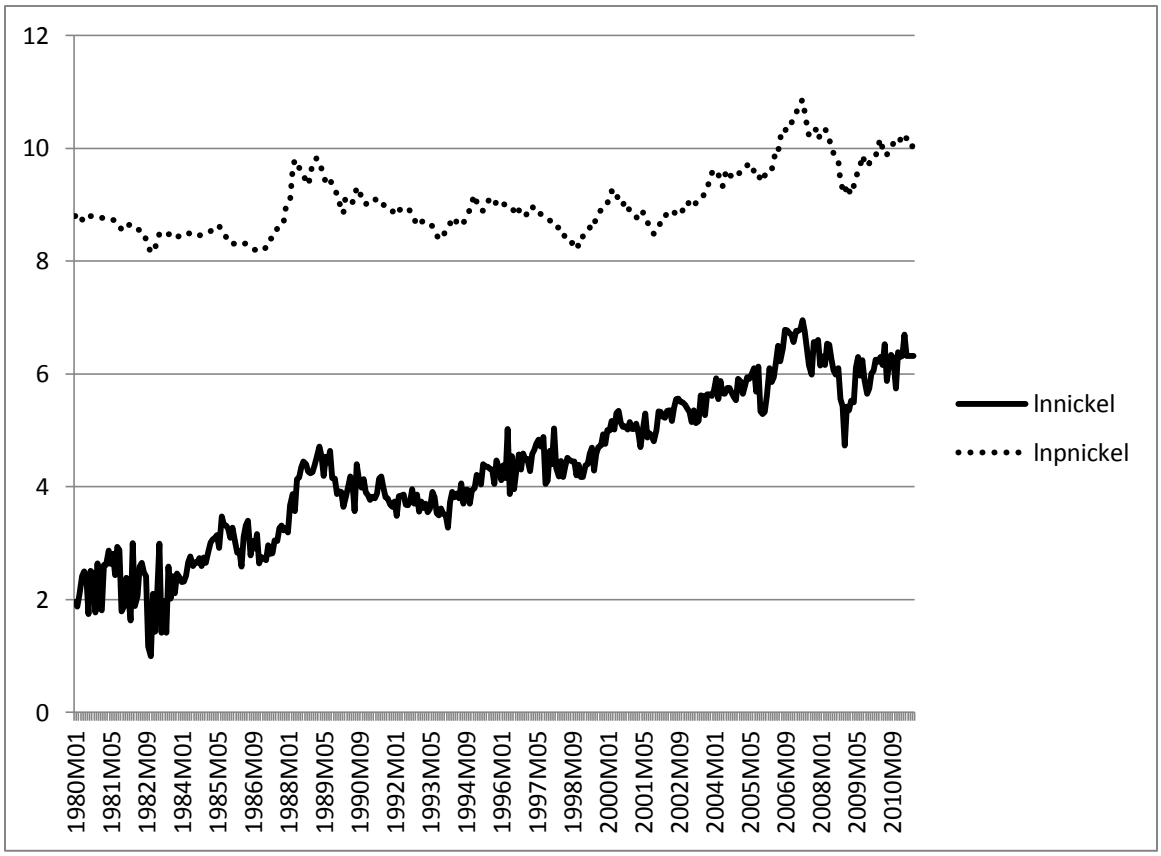


Figure 1.8. Gold Exports and Corresponding Export Price

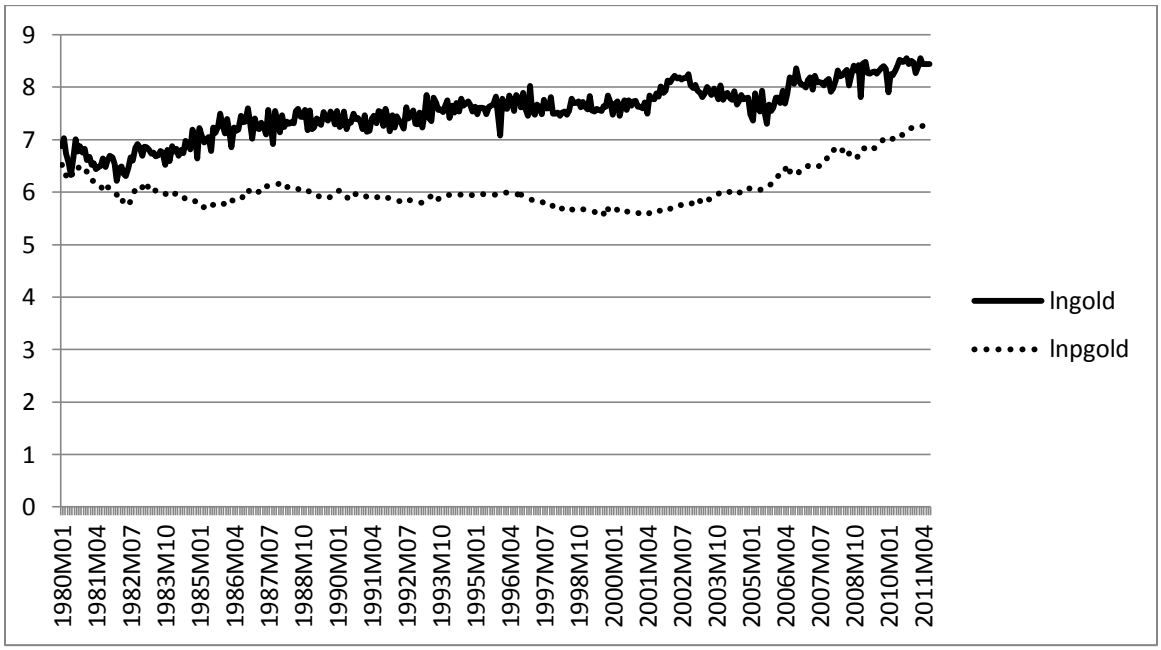


Figure 1.9. Granite Exports and Export Price

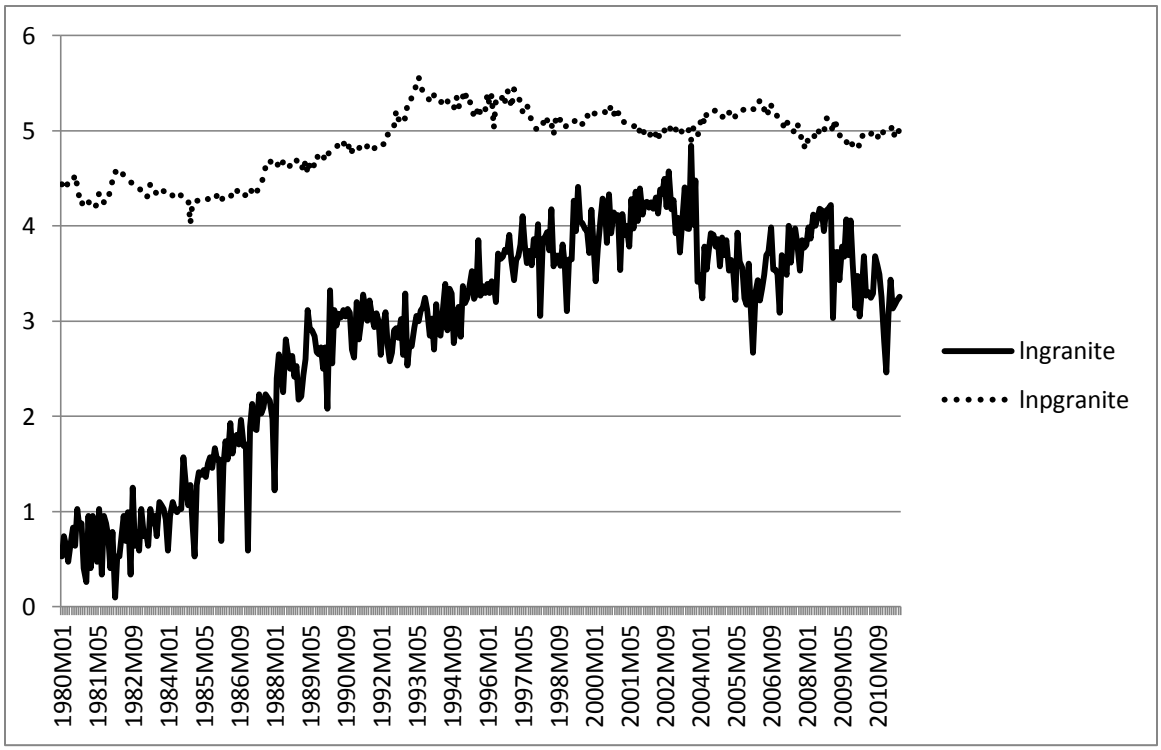


Figure 1.10. Limestone Exports and Export Price

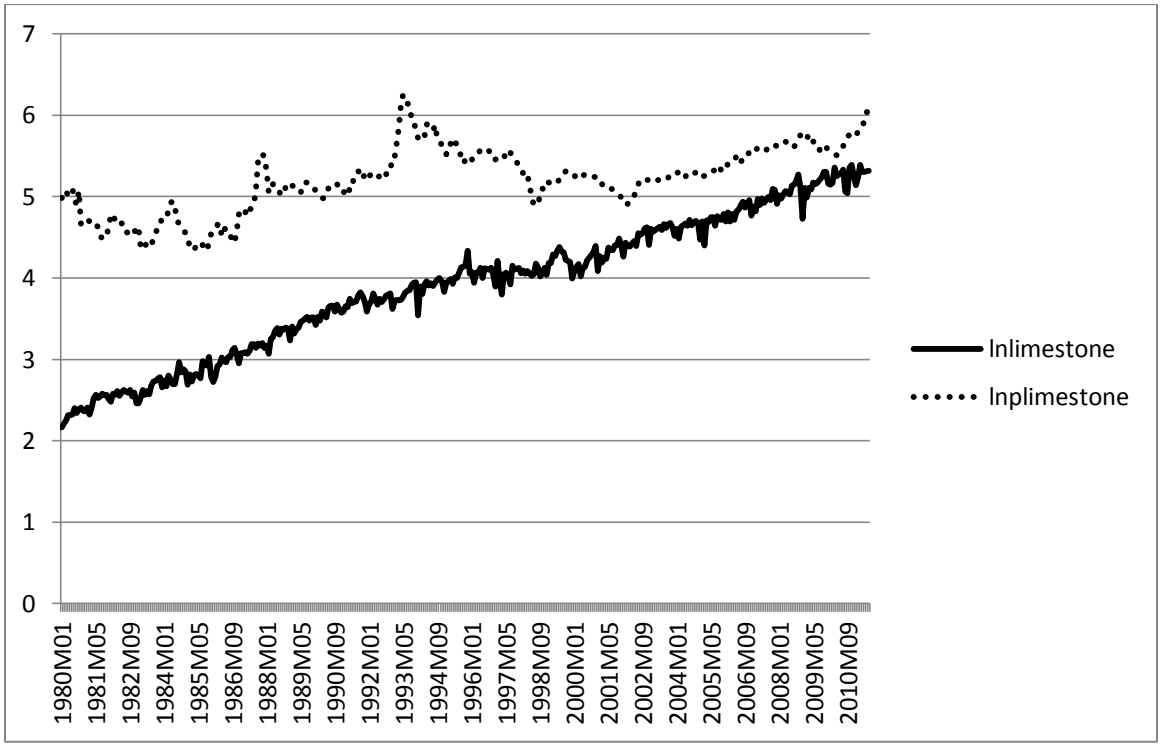


Figure 1.11. All Metals Exports and South Africa's Producer Price Index

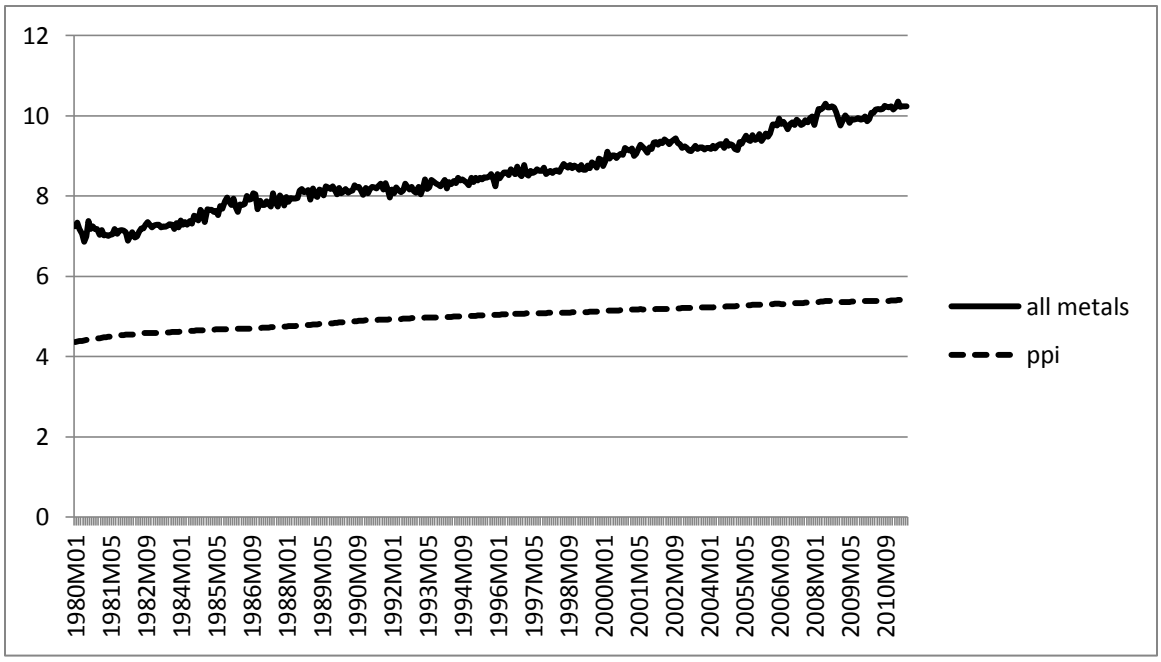


Figure 1.12. All Metals Exports Without Gold and South Africa's Producer Price Index

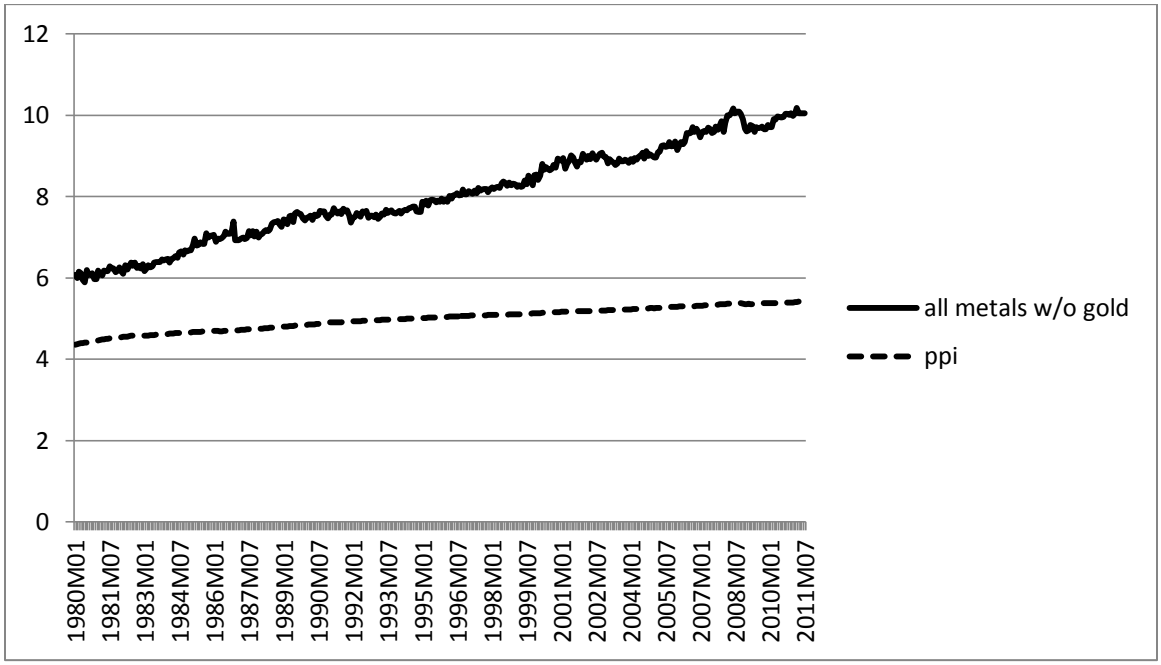


Figure 1.13. Nominal and Real Effective Exchange Rates

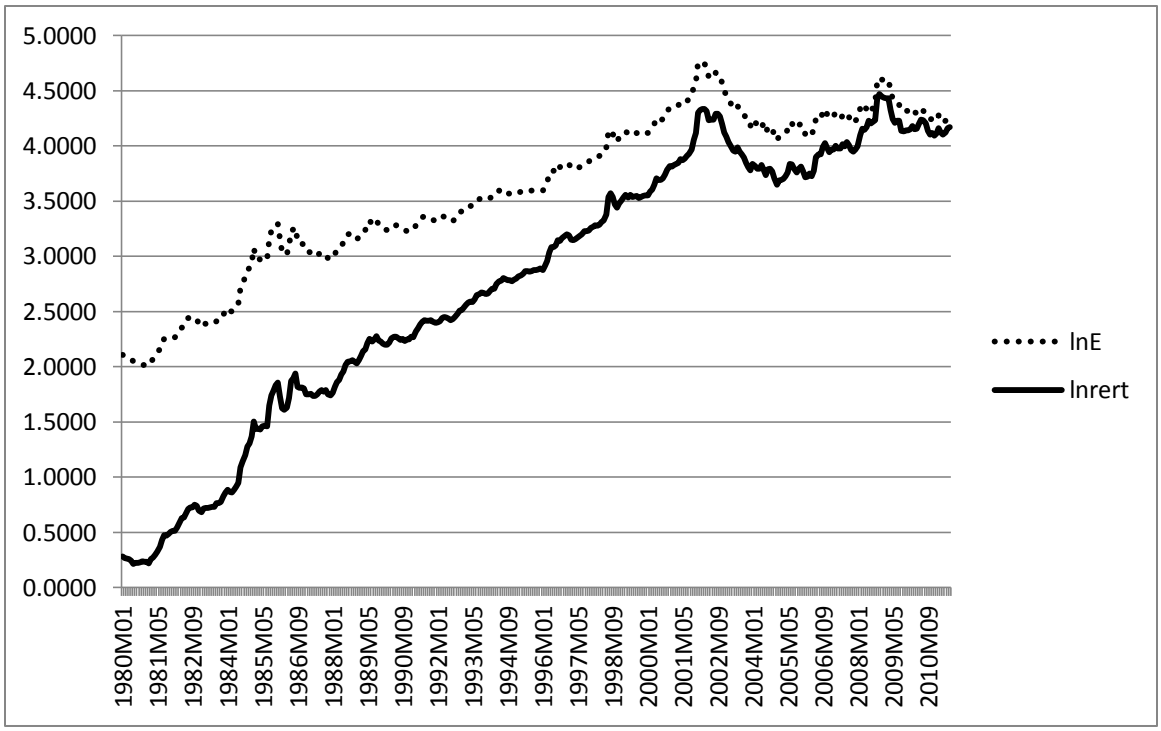
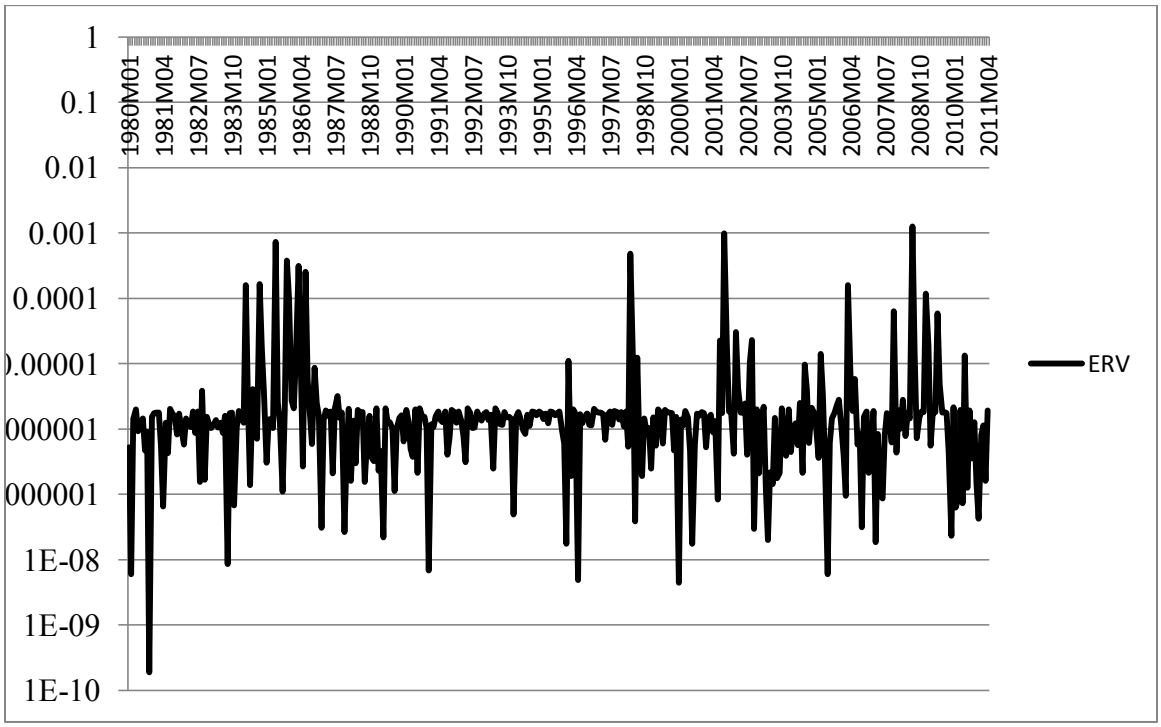


Figure 1.14. Rand – USD Exchange Rate Volatility



CHAPTER 2

Exchange Rate Volatility and South Africa's Bilateral Trade

1. Introduction

This chapter examines bilateral trade relations between South Africa and 42 of its top trading partners with annual aggregate data for the period 1970 to 2010. The trade partners are further grouped into their respective Preferential Trade Ares (PTA) to determine the PTA's impact on trade. The PTAs considered in the model are the North America Free Trade Agreement (NAFTA), The European Union (EU), The Southern African Development Community (SADC) and The Association of Southeast Asian Nations (ASEAN). The rest of the countries are grouped as the Rest of the World (ROW).

The chapter further distinguishes between short-run and long-run effects of export prices, real effective exchange rates, and exchange rate volatility for trade between South Africa and all other countries, of those countries that belong to PTAs, and the rest of the world. Only long-run effects are estimated for individual countries.

This analysis employs the gravity model of bilateral trade. The model considers trade between any two countries as an increasing function of their national incomes and a decreasing function of their geographical distance. Other variables that relate to the two countries enter the model such as population size, relative prices of exports, real effective exchange rate, exchange rate volatility, and dummy variables testing for trade sanctions, and participation in trade agreements. The conventional gravity model in majority of past literature also includes land area, contiguity, language and culture, religion, among other non-tangible variables. These additional variables are not tested in this chapter, but their peculiarity is revealed in the results.

Aggregate macroeconomic data for all variables is analyzed in a time series framework. All variables are annual series. The model specified in the chapter is a hybrid derived from several past studies on international trade. All variables are pretested for cointergration using conventional time series methods. An error correction model is further developed and results in the form of elasticities derived.

1.1. Outline of Study

This study is organized as follows: Section 2 provides an overview of past literature, while section 3 describes the data and the methodology used in the study. Sections 4 and 5 provide the discussion of results, and concluding remarks respectively, while the appendix includes all the results tables, explanation for abbreviations and data plots.

2. Literature Review

International trade plays an important role in economic growth. It promotes competition, specialization and scale economies, in addition to helping resource allocation based on comparative advantage. It has recently greatly enhanced research and knowledge spillovers across borders (Wei and Liu, 2010). South Africa has of late made numerous attempts to diversify its economy from overreliance on mining in the face of declining mineral resources. The economy has made impressive development in agriculture notably horticulture for its export markets. This however has not enabled the country to improve its export earnings because of relying mostly on the European Union market for its exports.

2.1. The Gravity Model

The gravity equation was pioneered by Beckerman (1956), Tinbergen (1962), Poyhonen (1963), and Pulliainen (1963). The basic formula derived by Anderson (1979) is as follows:

$$M_{ij} = A Y_i^{\beta 1} Y_j^{\beta 2} L_i^{\beta 3} L_j^{\beta 4} D_{ij}^{\beta 5} e^{u}_{ij}$$

where

M_{ij} = current value of sales from country i to country j

A = constant

Y = current value of income

L = population

D_{ij} = distance between i and j

u_{ij} = normal random error.

One of the best characteristics of the model according to Anderson (1979) and Bergstrand (1985) is its general validity, since it can be equally applied to any pair of countries. It is also symmetric since it provides the trade flows in both directions by changing country i variables for those in country j. Its empirical success is largely due to the fact that it can explain some real phenomena that the conventional factor endowment theory of international trade cannot, such as intra-industry trade, and effects of trade liberalization. It has so far been the most important tool in empirical analysis of international trade.

The original form of the gravity equation consisted of GDP and geographic distance (Tinbergen, 1962), but has been expanded to include other variables notably Research and Development (R&D), foreign direct investment (FDI) accumulation, trade and economic openness, relative factor endowment, effective exchange rates and their volatility, labor variables, language, history and colonial ties (Martinez-Zarzoso and Nowak-Lehmann, 2003).

Sanso, Cuairan, and Sanz (1993) and Srivastava and Green (1986) refute the general consensus on distance arguing that many countries that are geographically proximate are in fact hostile to one another citing the examples of India and Pakistan, Iran and Iraq, and U.S. and Russia (formerly USSR). In addition, they downgrade the relevancy of some gravity model

variables such as language, religion and cultural similarity arguing that major international trade partners such as the United States, South Africa and Belgium among others are characterized by multiple languages, cultures, and religions. There is no consensus however on which other variables should be included in the extended gravity model.

The gravity equation has additionally been employed in studying the determinants of bilateral trade and predicting trade volumes. The equation has further been used recently in evaluating trade effects of various forms of regional economic integration ranging from customs union formation to the adoption of a single currency (Aitken, 1973; Polak, 1996; Chieslik, 2009). Although the gravity equation in its most basic form succeeds in explaining bilateral trade flows, there is still however a huge variation in trade that its unable to explain, leading to Helpman and Krugman (1985) statement that " the gravity model has gone from an embarrassment of poverty of theoretical foundations, to an embarrassment of riches".

Studies done by Anderson (1979), Anderson and Wincoop (2003), and Roberts (2004) derived the gravity model from a Heckscher-Ohlin, Ricardian, and the New International Trade Theory. Carillio and Li (2002) showed how a classification into differentiated and homogenous product categories had different impacts on trade flows. The gravity models according to these studies assume complete specialization in production. This leads to a misleading impression that complete specialization is a necessary condition for deriving the gravity equation.

While complete specialization models succeed in explaining trade within a group of developed economies such as North-North-Trade, (Roberts, 2004). They may not be appropriate for studying trade between developed and developing economies (North-South-Trade), Carillio and Li (2002). In addition, while specialization characterizes manufactures, it's not presumably a feature of homogenous primary goods that are exported by many developing economies such as

South Africa. It is in this problematic background that many recent empirical studies have assumed complete specialization, even though it is known that they might not be appropriate when observations for the middle and low income countries are included.

The lack of control for factor proportions in the estimated gravity equations may result in parameter estimates that suffer from the omitted variable bias and may eventually lead to incorrect policy inference according to Cielsik (2009). This problem is particularly important in evaluating the effects of trade liberalization between countries that differ significantly in terms of their relative factor endowments.

Cieslik (2009) solved this problem by deriving the augmented gravity model (AGM). AGM derives from the three basic theoretical models for international trade assuming complete specialization in production: Heckscher-Ohlin-Samuelson (H-O-S) for homogenous goods, Chamberlin-Heckscher-Ohlin (C-H-O), that assumes capital abundance in country A and labor abundance in country B, and the pure monopolistic competition model in which all goods are differentiated.

The findings concerning the impact of factor proportion variables on the volume of bilateral trade in the H-O-S model is that the volume of bilateral trade when both goods are homogenous increases with differences in capital-labor ratios of trading partners but decreases with sums of their capital-labor ratios. The C-H-O determines that the volume of bilateral trade when one good is differentiated and the other homogenous increases with both differences and sums of capital-labor ratios of trading partners. The monopolistic competition model according to Krugman (1991) proposes that the volume of bilateral trade when both goods are differentiated is independent of differences and capital-labor ratios of trading partners.

2.2. Unemployment

This chapter additionally attempts to determine whether labor variables have any impact on bilateral trade relations with South Africa. The gravity model includes the unemployment levels of four selected trading partners and estimates their impact on bilateral trade volumes. Numerous past studies have tested effects of various trade policies on labor variables. Bilateral trade involving South Africa in the past two decades would largely be characterized by trade liberalization, which involves inflows of foreign capital and a reduction in protection for domestic industries, while integrating domestic markets into global markets. Trade liberalization was initially associated with falling employment levels in the 1990s (Chaudhuri, 2005 and Chao and Yu, 1997).

Since domestic formal sectors were unable to cope with foreign competition, governments in developing countries such as South Africa tried to mitigate this problem by raising the level of subsidies on import competing sectors. These policies have however decreased significantly in the face of developing economies' commitments to lending institutions such as IMF and the World Bank, leaving unemployment spiraling out of control in situations such as South Africa. This justifies the inclusion of a labor variable in the estimation of the gravity model.

Most research on trade effects on labor market variables revolve around the Heckscher-Ohlin-Samuleson and Stopler-Samuelson models where comparative advantage is due to differing factor intensities, whereby countries export goods that intensively utilize the factors of production, which they are relatively abundantly endowed, and import goods that use intensively factors that are scarce at home, Helpman and Krugman (1985). Trade openness narrows the wage gap between industrialized and developing countries. Mining sectors usually characterized by intensive low-skilled labor will decline in the face of increased integration with fellow

developing countries that are abundant in low-skilled labor (Hungerford (2001) and Chen and Gopinath (2003). These models however do not predict employment effects of trade, thereby yielding the motivation for including labor market in the model.

Leibrecht and Scharler (2008) find that FDI flows resulting from international trade are significantly higher in countries with relatively low unit labor costs. Economic theories posit that rising unemployment tend to push the wage level downwards and thus lower unit labor costs. These in turn lowers unit production cost and thereby export prices.

Quintieri and Bella (2000) and Matusz (1994) find a similar relationship of falling employment due to increased exposure to competition in European manufacturing sectors, in addition to industry's demand shocks, taking effect through employment changes. South Africa would however posit different results given the fact that it is a net exporter of raw metals, whose demand and world prices have been rising exponentially, coupled with a fledging manufacturing sector. Vansteenkiste and Hiebert (2010) use the Global Vector Auto regression (GVAR) method to determine the effect of trade openness on labor market variables. Their results show that increased trade openness have a significant negative effects on real compensation, higher labor productivity, but negligible effect on employment levels.

Silva and Leichenko (2004) considered sectoral distribution of industries between urban and rural South Africa. They find that lower export prices are associated with increased manufacturing employment in both rural and urban counties, whereas lower import prices are associated with reduced rural employment, but increased urban employment. In addition, their data showed that greater emphasis on exports would result in higher unemployment, with import orientation showing mixed effects.

Kreickmeier (2005) and Oslington (2005) use computable general equilibrium models (CGE) to quantify effects of unemployment on trade volumes, with results showing falling trade volumes in the face of rising unemployment.

2.3. Preferential Trade Agreements

Besides the conventional basic variables in a gravity model, this study will further consider the effects of preferential trade agreements (PTAs[3]) resulting from the creation of free trade areas (FTAs). There have been numerous debates among economists as to whether proliferation of preferential trade agreements (PTAs) improve bilateral trade between members and non-members, or impose an impediment. Trade theory suggests that when a country A joins a PTA with another country B, it will switch some of its purchases away from high cost domestic producers to low cost domestic producers. The net effect is trade creation, unambiguously beneficial due to a more efficient resource allocation in both countries. Trade creation is associated with the portion of the new trade between member countries that is "new", resulting in an improvement in the international resource allocation (Aitken, 1973).

If another country C is introduced, that does not belong to the original PTA, country A may switch some of its purchases from low cost producers in C to higher cost producers in B, to take advantage of reduced tariffs. This creates trade diversion with mixed welfare effects in both A and C. Trade diversion refers to the part of the "new" trade between PTA member countries that is only a substitute for trade with third countries. It describes situations where the preferential trade causes higher-cost production from the new partner country to replace imports

[3]A Preferential trade area (also preferential trade agreement, PTA) is a trading bloc which gives preferential access to certain products from the participating countries. This is done by reducing tariffs, but not by abolishing them completely. A PTA can be established through a trade pact. It is the first stage of economic integration. The line between a PTA and a Free trade area (FTA) may be blurred, as almost any PTA has a main goal of becoming a FTA in accordance with the General Agreement on Tariffs and Trade.

from low-cost sources in the rest of the world, worsening resource allocation (Aitken, 1973 and Bergstrand, 1985). Consumers are well off due to lower prices in this case, but there are losses due to switching to less efficient producers, as well as lost tariff revenues. Trade diversion and creation refers to producers and consumer within a PTA only. Trade diversion has been found to seriously depress trade volumes between PTA members and ROW (Martinez-Zarzoso, 2003).

The most efficient PTA would be the one with the least trade diversion, which forms the core principle of the world trade organization (WTO). In the absence of non-discriminatory barriers, each country will import from the lowest cost producer, leading to a worldwide efficiency in resource allocation. PTAs thus create inefficiency since they are discriminatory to the rest of the world in favor of members. The present study derives from this piece of theory to determine if by engaging in trade with well-established trading blocs such as North America Free Trade Agreement (NAFTA[4]), The European Union (EU[5]), The Southern African Development Community (SADC[6]) and The Association of Southeast Asian Nations (ASEAN[7]), South

[4] The North American Free Trade Agreement or NAFTA is an agreement signed by the governments of Canada, Mexico, and the United States, creating a trilateral trade bloc in North America. The agreement came into force on January 1, 1994. It superseded the Canada – United States Free Trade Agreement between the U.S. and Canada.

[5] The European Union (EU) is an economic and political union of 27 independent member states which are located primarily in Europe. The EU traces its origins from the European Coal and Steel Community (ECSC) and the European Economic Community (EEC), formed by six countries in 1958. In the intervening years the EU has grown in size by the accession of new member states, and in power by the addition of policy areas to its remit. The Maastricht Treaty established the European Union under its current name in 1993. The last amendment to the constitutional basis of the EU, the Treaty of Lisbon, came into force in 2009.

[6] The Southern African Development Community (SADC) is an inter-governmental organization headquartered in Gaborone, Botswana. Its goal is to further socio-economic cooperation and integration as well as political and security cooperation among 15 southern African states. It complements the role of the African Union.

[7] The Association of Southeast Asian Nations, commonly abbreviated ASEAN is a geo-political and economic organization of ten countries located in Southeast Asia, which was formed on 8 August 1967 by Indonesia, Malaysia, the Philippines, Singapore and Thailand. Since then, membership has expanded to include Brunei, Burma (Myanmar), Cambodia, Laos, and Vietnam. Its aims include the acceleration of economic growth, social progress, cultural development among its members and the protection of regional peace and stability.

Africa's bilateral trade volumes are significantly different from those of the rest of the world (ROW).

Countries with larger average tariff reduction than their trading partners tend to experience a real-exchange depreciation of their currencies in order to maintain constant trades balance, such that countries experience mixtures of both expanding and contracting sectors. These changes cause increased worldwide demand for all sectors in an individual economy thereby pushing up world prices for the sectors where trade barriers fall the most. The net change for these events is a positive or a negative trade balance for individual countries (Eichegreen and Irwin, 1995).

Countries that are net exporters of goods with the highest degree of liberalization enjoy increases in their terms of trade as the world prices of their exports rise relative to their imports. The reverse is true for net exporters of trade-restricted goods. A mixture of these terms of trade does have an effect on individual country's welfare. On average, it is expected that the world will gain from multilateral liberalization as resources are allocated to those sectors in each country where there is comparative advantage (Aitken, 1973).

Individual countries thus rush to join PTAs to take advantage of numerous benefits such as lower tariffs among other benefits. Berdel and Ghoshal (2007) on a study of NAFTA determined that the first four years of NAFTA were associated with trade expansion rather than trade diversion for non-members. They found that GDP shares and income-expenditure elasticities for NAFTA partners rose as expected and those of ROW registered a slight but significant improvement, thereby designating NAFTA as a building block rather than a stumbling block for multilateral trade. In contrast, Marques and Spies (2009) in a study on trade effects of Europe agreements find evidence that FTAs with the Central and Eastern European

Countries (CEECs) have substantially increased intra-group trade, at the expense of ROW. In addition, subsequent to CEEC members joining the EU has resulted in a significant relative increase in EU's total imports from CEECs as compared to imports from ROW. Additionally, Rojid (2006) on a study on the COMESA[8] found that the FTA has certainly created more trade within the block than it has diverted for ROW, making it a building block to trade.

Zhu and Lai, (2004) consequently argue that trade liberalization would shift trade from rich countries to poor countries and from local PTAs to intercontinental trading partners, whereas Roberts (2004) on a study of the newly established China – ASEAN Free Trade Area (CAFTA) finds that member economies need to converge their income levels to reap maximum benefit from CAFTA, following the "Linder Hypothesis" that stipulates that countries with similar demand patterns and therefore similar per capita incomes are likely to trade more with each other. Differences in demand patterns would have to be alleviated, leading to equalization in factor prices. Roberts (2004) and Bun, Klaassen and Tan (2009) however conclude that FTA impact on trade is driven by other developments taking place at the same time as FTA's formation and in the same region, not necessarily by the presence of FTA itself.

Sandberg, Seale and Taylor (2006) on a study of the Caribbean Community and Common Market (CARICOM[9]) concludes that exporters with larger populations have a larger productive

[8] The Common Market for Eastern and Southern Africa is a free trade area with nineteen member states stretching from Libya to Zimbabwe. COMESA formed in December 1994, replacing a Preferential Trade Area which had existed since 1981. Nine of the member states formed a free trade area in 2000 (Djibouti, Egypt, Kenya, Madagascar, Malawi, Mauritius, Sudan, Zambia and Zimbabwe), with Rwanda and Burundi joining the FTA in 2004 and the Comoros and Libya in 2006.

[9] The Caribbean Community (CARICOM) is an organization of 15 Caribbean nations and dependencies. CARICOM's main purposes are to promote economic integration and cooperation among its members, to ensure that the benefits of integration are equitably shared, and to coordinate foreign policy. Its major activities involve coordinating economic policies and development planning; devising and instituting special projects for the less-developed countries within its jurisdiction; operating as a regional single market for many of its members

base, have more opportunities for scale economies, and thus have a greater ability to export goods to the world markets than do smaller countries. They further found the effect of population size on importing country to be positive, though the effect is more dominant for exports than imports. Membership in CARICOM was found to have strong effect on intra-CARICOM trade in Goyal and Joshi (2006. By extending unilateral trade preferences based on historical factors (colonial, language, religion etc.), the U.K. has effectively dampened CARICOM's members initiatives to undertake economic reforms needed to lessen their dependence on traditional agricultural exports. Removing those preferences would have a devastating effect on these economies.

Goyal and Joshi (2006) argues that when a country forms a trade agreement, the domestic firm is negatively affected in the home market because of increased competition. On the positive side, the domestic firm gains greater access to the foreign market. The negative effect of increased competition is shared by the domestic firm with the other currently active (foreign) firms in the home market. As a country forms more trade agreements and more foreign firms become active in its home market, this negative effect on the domestic firm's profits falls in magnitude and is more than offset by its profit gains in the foreign market. This makes free trade sustainable. They further find that if a pair of countries signs a bilateral free-trade agreement, then this induces them to lower tariffs on third countries. This in turn leads to an increase in the welfare of such countries. Thus bilateral agreements are consistent with the spirit of GATT[10]

(CARICOM Single Market), and handling regional trade disputes. The secretariat headquarters is based in Georgetown, Guyana.

[10] The General Agreement on Tariffs and Trade (GATT) was negotiated during the UN Conference on Trade and Employment and was the outcome of the failure of negotiating governments to create the International Trade Organization (ITO). GATT was signed in 1947 and lasted until 1993, when it was replaced by the World Trade

where tariffs on third countries are a declining function of the number of free-trade agreements a country has: This suggests that bilateralism is consistent with one important element of GATT.

Polak (1996), Brown, Deardorff and Stern (2003) uses the New Trade Theory to conclude that trade liberalization permits all countries to expand their export sectors at the same time that all sectors compete more closely with a larger number of competing varieties abroad, resulting to countries gaining from lower costs due to increasing returns to scale, lower monopoly power, reduced costs and increased utility due to greater product variety. Markets respond to trade liberalization in the same way that they would with perfect competition. That is when tariffs or other trade barriers are reduced in a sector, domestic buyers, both final and intermediate substitute towards imports and the domestic competing industry reduces production while foreign exporters expand.

Polak (1996) and Brown, Deardorff and Stern (2003) further find that while regional and bilateral FTAs may be welfare enhancing for the member countries, these gains are relatively smaller than those resulting from multilateral trade liberalization, and usually accrue primarily to the large industrialized countries. The benefits of FTAs to developing countries appear quite ambiguous because of intersectoral shifts in output and employment.

2.4. Gross Domestic Product

Gross domestic product (GDP) inclusion into the gravity model is justified by trade theories based upon the Heckscher-Ohlin (H-O) model (de Groot, 2004). Macroeconomic theory suggests that a country's GDP positively impacts its imports. In the case of bilateral trade, GDP levels of both countries should positively influence trade volumes. Bahmani-Oskooee (2003) identifies

---

Organization in 1995. The original GATT text (GATT 1947) is still in effect under the WTO framework, subject to the modifications of GATT 1994.

economies of scale as an important determinant of bilateral trade. The study in addition argues that GDP levels can be used as a proxy for countries' respective economies of scale. At a larger scale of operation, a greater division of labor and specialization becomes possible. This allows the introduction of more specialized and productive machinery than would be allowable in a small scale operation.

Demand side economics suggest that "preference similarity or overlapping demands hypothesis" (Wei and Liu, 2010 and Rojid, 2006) determines that bilateral trade in manufactures is largest among countries with similar incomes and taste levels—thereby justifying inclusion of GDP in the estimation. The general view thus is that the higher the levels of GDP, the higher the trade flows between trade partners, and the more the similarity of GDP, the higher the intra-industry trade and hence the trade between partners.

Zarzoso and Lehman (2003) and Zarzoso (2003) finds that the income elasticity of the exporter is higher than that corresponding to the importer, indicating the importance of a country's production capacity in fostering exports. Their studies additionally obtained negative coefficients for the exporter population variable showing an absorption effect; the greater the size of the exporter, the lower the exports. Zarzoso (2003) further found negative coefficients for the importer population up until 1990. The signs turned positive for 1991 onwards signifying the growing importance of the role played by scale economies and market-size effects in international trade.

2.5. Export Prices

The extended gravity model has also suggested that transport costs are a critical component (Wei and Liu, 2010). The problem however is that data on transport costs are only available for periods 1980-84, thereby reducing the sample size in time series estimation. Export prices

proxied by the producer price index of the exporting country has been used in lieu of transport costs in Sanso and Sanz (1993), Tongzon and Felmingham (1998), Srivastava and Green (1986), Spies and Marques (2009), Sandberg, Seale and Taylor (2006). Similarly; de Groot (2004) uses export prices as a proxy for the institutional determinants of bilateral trade (information costs). Rojid (2006), and Sandberg, Seale and Taylor (2006) alternatively use distance as a proxy for transportation and information costs with the expected negative effect on trade.

2.6. Information/Institutional Costs

Although variously proxied by export prices, information costs are critical to the gravity model. These take the form of information costs associated with physical and cultural distances. These unobservable barriers to trade are often related to incomplete or asymmetrical information. Because of these costs, countries form institutions. de Groot (2004) defines institutions as "humanly devised constraints that shape human interaction". These institutions are designed to reduce uncertainty in exchange, and lower transaction costs.

The logic behind consideration of information costs in the gravity model according to de Groot (2004) stems from the fact that poor governance entails negative externalities for private transactions and consequently raises transaction costs, with negative effects on trade volumes. International trade usually involves multiple and usually very complex governance systems. The effectiveness of these domestic institutions in securing and enforcing property rights in cross border trade is an important determinant of trade costs. A low quality of governance increases the transaction costs that are incurred in trade. Countries with similar levels of institutional quality maybe familiar with each other's business and practices, thereby reducing transaction costs.

de Groot (2004) additionally finds that income per capita is found to have a positive correlation with the institutional quality, giving rise to the explanation why high income countries trade disproportionately amongst each other, while the same does not hold for low income countries. Good governance lowers transaction costs for trade between high income countries, and does the opposite for low income countries due to high insecurity and transaction costs.

3. Model Specification

This chapter assesses how various macroeconomic variables such as exchange rate volatility, real income and real effective exchange rates affect bilateral trade flows between South Africa and 42 of its major trading partners for the period 1980 through 2010, using annual data, in a gravity model context. Three gravity model equations are estimated in this study: The first is an import demand equation that is depicted as follows:

$$\ln X_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln P_{it} + \beta_3 \ln POP_{it} + \beta_4 \ln RER_{it} + \beta_4 \ln ERV_{it} + \beta_5 STR_{it} + \beta_6 PTA_{it} + \varepsilon_t \qquad (2.1)$$

as proposed by Anderson (1979), Sanso, Cuairan and Sanz (1991) and Srivastava and Green (1986),where X_{it} is the real import volume from country i into South Africa in period t. Y_{it} is the real GDP of South Africa in period t, P_{it} is the relative price of exports of the exporter in period t, POP_{it} is the population of South Africa in period t, $RERi_t$ is the real exchange rate between the bilateral partner and the South African rand, ERV_{it} is a measure of exchange rate volatility[11], STR_{it} is a dummy variable taking the value of 0 for pre 1994 period, and 1 for post 1994 period. This dummy variable distinguishes the periods under which South Africa was under

[11] Kim and Lee (2007), Klein (2002), Choudhry (2008), Sercu and Vanhulle (1992), and Broll and Eckwert (1999) find that ERV yields a positive impact on bilateral trade volumes, whereas others including Ekanayake and Thaver (2011), Vergil (2004), Shnabl (2008), Weliwita et al (1999), Fountas and Bredin (2006), Caporale and Doroodian (2002), Kenen and Rodrick (1986), Dell'Ariccia (1999), Pozo (1992), Choudhry (2005), Chou (1999) and Arize et al (2006) find negative or mixed results.

internationally UN imposed trade sanctions in response to apartheid rule, and the period of trade liberalization. PTA_{it} also represents a dummy variable taking the values of 2 if the trade partner belongs to a well-established PTA and 0 otherwise, while ε_t is a white-noise disturbance term.

The second equation also proposed by Anderson (1979), Sanso, Cuairan and Sanz (1991) and Srivastava and Green (1986) is an export demand function, taking the form of:

$$\ln X_{jt} = \beta_0 + \beta_1 \ln Y_{jt} + \beta_2 \ln P_{jt} + \beta_3 \ln POP_{jt} + \beta_4 \ln RER_{jt} + \beta_4 \ln ERV_{jt} + \beta_5 STR_{jt} + \beta_6 PTA_{jt} + \varepsilon_t \qquad (2.2)$$

where X_{it} is the real export volume to country j from South Africa in period t. Y_{it} is the real GDP of country j in period t, P_{it} is the relative price of exports of South Africa in period t, POP_{it} is the population of country j in period t, $RERi_t$ is the real exchange rate between the bilateral partner and the South African rand, ERV_{it} is a measure of exchange rate volatility, STR_{it} and PTA_{it} are as defined in equation (2.1), whereas ε_t is a white-noise disturbance term.

The short-run effects of relative export price, real effective exchange rates and exchange rate volatility are also determined for aggregate bilateral trade between South Africa and the rest of the world, aggregation of PTA member countries, and an aggregation of non-PTA member countries. This takes the following functional form:

$$ln\, X_t = \alpha_0 + \beta_i ln\, X_{t-i} + \gamma_i lnY_{t-i} + \delta i lnP_{t-i} + \pi i lnPOP_{t-i} + \eta_i lnRER_{t-i} + \varphi_i \Delta lnERV_{t-i} + \lambda_0 lnX_{t-i} + \lambda_1 lnP_{t-i} + \lambda_2 lnRER_{t-i} + \lambda_3 lnERV_{t-i} + \omega\varepsilon_{t-i} \qquad (2.3),$$

where sign and the magnitude of λ_1, λ_2, and λ_3 represents the short-run effects.

This study additionally assesses the impact of labor situation on bilateral trade volumes between South Africa and U.S., Australia, Japan and Taiwan. These are four countries with which South Africa has recently bolstered trade relations within the last decade. Population and

the dummy variables have been dropped from the estimation, and only long-run effects are considered in the following relationship:

$$\ln X_{t(SA)} = \beta_0 + \beta_1 \ln Y_{t(i)} + \beta_2 \ln P_t + \beta_3 \ln REER_{t(SA/i)} + \beta_4 \ln ERV_t + \beta_5 \ln UNEMP_i + \theta_t \quad (2.4)$$

$$\ln X_{t(i)} = \beta_0 + \beta_1 \ln Y_{t(SA)} + \beta_2 \ln P_{SAt} + \beta_3 \ln REER_{t(i/SA)} + \beta_4 \ln ERV_t + \beta_5 \ln UNEMP_{SA} + \theta_t \quad (2.5)$$

Equation (2.4) is an export demand equation, while equation (2.5) is an import demand equation. *UNEMP* is the unemployment level in the importing country.

Economic theory suggests that the real income level of the domestic country's trading partners would have a positive effect on the demand for its exports. Therefore, it is expected that coefficients representing income be positive. On the other hand, if the relative price of exports rise (fall), domestic goods become less (more) competitive than foreign goods, causing the demand for exports to fall (rise). Therefore, one would expect that coefficients representing price, which measures the competitiveness of South Africa's exports relative to bilateral partner's domestic production, to be negative. Similarly, if a real depreciation of the S.A. rand, reflected by a decrease in the RER, is to increase export earnings, one would therefore expect an estimate of that coefficient to be negative. Consequently, this will at the same time imply that the import demand is elastic. If, however, the import demand were inelastic, it is expected that coefficient estimates will be positive.

Various measures of real ERV have been proposed in the literature. Some of these measures include (1) the averages of absolute changes, (2) the standard deviations of the series, (3) the deviations from the trend, (4) the squared residuals from the ARIMA or ARCH or GARCH processes, and (5) the moving sample standard deviation of the growth rate of the real

exchange rate. Since the effects of ERV on exports have been found to be empirically and theoretically ambiguous (Ekanayake and Thaver, 2011), estimates for ERV could be either positive or negative.

Following Ekanayake and Thaver (2011), the real effective exchange rate, RER_t is constructed as: $RER_t = E\ P_{SA}/P_{US}$ where RER is the real effective exchange rate, E is the bilateral nominal exchange rate between the United States and South Africa defined as number of rand per U.S. dollar at time t, P_{SA} is the consumer price index (2005=100) of South Africa at time t, and P_{US} is the consumer price index (2005=100) of the U.S. at time t.

Exchange rate volatility (ERV) is obtained from the squared residuals from the GARCH process which takes the following form:

$$\Delta \ln RER_t = \beta_0 + \beta_1 \ln RER_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim N(0, \varepsilon_t^2) \qquad (2.6)$$

$$\varepsilon t^2 = \alpha_0 + \varepsilon_{t-1}^2 + \mu_t \qquad (2.7)$$

The estimated conditional variance (εt^2) is used as the measure for ERV.

The unemployment level ($UNEMP_t$) will likely capture the effect of macroeconomic environment in the importing country on trade volumes. Economic theory would suggest the coefficient β_5 to be negative. The dummy variable STR_{it} representing a structural break in South Africa's international trade trends could bear positive or negative coefficients. For trading partners that adhered to the imposed trade sanctions, one would expect a negative estimate, and otherwise for trade partners who ignored sanctions.

PTA dummy (PTA_{it}) not only separately captures the effects of intra-bloc and extra-bloc trade, but also distinguish between extra-bloc effects on imports and extra-bloc effects on exports. A positive coefficient on this dummy variable indicates that the formation of a PTA enhances intra-bloc trade. A negative coefficient on this dummy variable indicates export

diversion. Depending on the net trade effects, a PTA can be categorized as a building block or a stumbling block to free trade. A positive value would indicate a building block, that is, the bloc liberalized trade more internally than have diverted trade from the rest of the world. Economic theory expects PTA_{it} to yield positive estimates agreeing with the positive impact of free trade agreements on trade volumes, consistent with Berdel and Ghoshal (2007); Zhu and Lai, (2004), Sandberg, Seale and Taylor, (2006) and Goyal and Joshi (2006).

Standard time series econometric procedures capture both short-run and long-run effects. This entails cointegration tests and estimation of equations (2.1) through (2.5) in error correction form, and finally calculating the derived effects and accompanying standard errors by error propagation. The following ECM models are estimated:

$$\Delta ln\, X_{it} = \beta_0 + \beta_1 \Delta ln\, X_{it-1} + \beta_2 \Delta lnY_{it-1} + \beta_3 \Delta lnP_{it-1} + \beta_4 \Delta lnPOP_{it-1} + \beta_5 \Delta lnRER_{it-1} + \beta_6 \Delta lnERV_{it-1} + \beta_7 STR_{it} + \beta_8 PTA_{it} + \varepsilon ECM \qquad (2.8)$$

$$\Delta ln\, X_{jt} = \beta_0 + \beta_1 \Delta ln\, X_{jt\,-1} + \beta_2 \Delta ln \Delta Y_{jt\,-1} + \beta_3 \Delta lnP_{jt\,-1} + \beta_4 \Delta lnPOP_{jt\,-1} + \beta \Delta_5 lnRER_{jt\,-1} + \beta_6 \Delta lnERV_{jt\,-1} + \beta_7 STR_{jt} + \beta_8 PTA_{jt} + \varepsilon ECM \qquad (2.9)$$

$$\Delta ln\, X_t = \alpha_0 + \beta_i \Delta ln\, X_{t-1} + \gamma_i \Delta lnY_{t-1} + \delta_i \Delta lnP_{t-1} + \pi_i \Delta lnPOP_{t-1} + \eta_i \Delta lnRER_{t-1} + \varphi_i \Delta lnERV_{t-1} + \lambda_0 lnX_{t-1} + \lambda_1 lnP_{t-1} + \lambda_2 lnRER_{t-1} + \lambda_3 lnERV_{t-1} + \varepsilon ECM \qquad (2.10)$$

$$\Delta ln\, X_{t(SA)} = \beta_0 + \beta_1 \Delta ln\, X_{t(SA)-1} + \beta_2 \Delta lnY_{t(i)-1} + \beta_3 \Delta lnP_t + \beta_4 \Delta lnRER_{t(SA/i)-1} + \beta_5 \Delta lnERV_{t\,-1} + \beta_6 \Delta lnUNEMP_{i-1} + \varepsilon ECM \qquad (2.11)$$

$$\Delta ln\, X_{t(i)} = \beta_0 + \beta_1 \Delta ln\, X_{t(i)-1} + \beta_2 \Delta lnY_{t(SA)-1} + \beta_3 \Delta lnP_{SAt\,-1} + \beta_4 \Delta lnRER_{t(i/SA)-1} + \beta_5 \Delta\, lnERV_{t\,-1} + \beta_6 \Delta lnUNEMP_{SA-1} + \varepsilon ECM \qquad (2.12)$$

Derived coefficients are obtained by multiplying εECMs from equations (2.8) to (2.12), by each of the level coefficients in equations (2.1) to (2.5). Robust standard errors are obtained

by error propagation, using the following formula: $\sigma_\gamma = \gamma((\sigma_\alpha/\alpha)^2 + (\sigma_\beta/\beta)^2)^{.5}$ (2.13). Full empirical results and arising discussion are provided in chapter 4.

3.1. Model Selection Criteria

With many alternative models available in this chapter, an important question is how well any given model fits the data. Adding additional lags for *y* and/or *x* will reduce the sum of squares of the estimated residuals. However, adding such lags entails the estimation of additional coefficients and an associated loss of degrees of freedom. Moreover, the inclusion of extraneous coefficients reduces the forecasting power of the fitted model. This study uses the Akaike Information Criteria (AIC) and the Schwartz Bayesian Criterion (SBC) for model selection described in Enders (1995).

$$\text{AIC} = T\ln(\text{sum of squared residuals}) + 2n \qquad (2.14)$$

$$\text{SBC} = T\ln(\text{sum of squared residuals}) + n\ln(T) \qquad (2.15)$$

Where: n = number of parameters estimated ($x + y$ + constant term), T = number of usable observations.

When a model is estimated using lagged variables, some observations are lost. To adequately compare the alternative models, T should be kept fixed; otherwise both criteria will compare the performance of the models over different sample periods. The ideal model will produce AIC and SBC that is smallest possible (both can be negative). As the fit of the model improves, the AIC and SBC approaches - ∞. Of both criteria, SBC has superior large sample properties. It is asymptotically consistent, while AIC is biased towards selecting over parametized model. AIC however works better in small samples than SBC. Since this study involves many datasets, it is not possible to select a model that clearly dominates all others; therefore all results from all alternative models are reported.

3.2. Data Sources and Variables

Data on aggregate bilateral trade volumes for all world economies was obtained from The Ohio State University's Department of Agricultural and Resource Economics. The department has a free program that updates the dataset regularly, and makes it a user friendly one-stop-source for all bilateral trade flows. Annual real GDP for South Africa and World are available at the World Bank's portal, the Foreign Trade Division of the U.S. Census Bureau, South Africa's Central Bank (SAB) and the Federal Reserve Bank of St. Louis (FRED II).

Annual series for consumer and producer price indices are available at the IMF, SAB and FRED II. Data for the nominal exchange rates viz a viz South Africa is available at SAB, Pacific Exchange Rate Service, *Main Economic Indicators* published by the OECD, and International Monetary Fund's *International Financial Statistics*.

3.3. Data Plots

Figures (2.1 through 2.9) in the appendix describe some of the datasets used in this chapter. Figures (2.1 and 2.2) show bilateral trade between U.S. and South Africa, and comparisons in their unemployment situations. Both their import volumes have been almost equal (Figure 2.1), with U.S. imports rising slightly higher than South Africa's imports from 2000 through 2010. U.S. unemployment (Figure 2.2) has been falling from 1980 through 2006, with a few upward spikes in 1983 and 1995, and then rising steadily from 2006 onwards to 2010. South Africa's unemployment levels show a consistent upward trend from 1980 through 2010.

Trade volumes have been almost equal between with Australia, dropping to the lowest in 1992, and rising to the highest in 2010 (Figure 2.3). Unemployment has been taking opposite directions (Figure 2.4), with Australia's unemployment generally falling and South Africa's recording an upward trend over the years. Taiwan and Japan record similar trends in trade

volumes (Figure 2.5 and 2.7), while it's unemployment levels have been fluctuating, with lowest levels in 1992, and highest in 2003 (Figure 2.6).

Figures (2.8 and 2.9) show trends in exports and imports to (from) South Africa respectively. The European Union takes the largest share of South Africa's exports followed by SADC. NAFTA's imports from South Africa were low up to 1994, after which the levels rose exponentially following total removal of trade sanctions. An export to ASEAN has been consistently low, owing to long distance between South Africa and the East Asian countries, coupled with differences in language and culture. Figure (2.8) reveals the importance of non-tangible variables in the gravity model, considering ASEAN trade levels, and comparing those with EU and SADC. NAFTA's trend also justifies the testing of a structural break.

South Africa's aggregate imports from regional markets (Figure 2.9) show a similar trend. There is a clear evidence of positive changes in trade volumes in the early 1990s, especially for NAFTA and ASEAN. Figures (2.1, 2.3, 2.5, and 2.7) also show a dramatic increase in trade from the early 1990s for the four countries, confirming the argument on trade sanction's removal.

4. Empirical Results and Discussion

Variables in a time series regression should be stationary[12], converging to a dynamic equilibrium, or the standard errors would be understated (Enders, 1995). Therefore; prior to estimating the models, the study tests each series for a unit root using the Dickey-Fuller (Dickey and Fuller 1981) and the Phillips and Peron (1988) unit root tests. These tests verify that each series that

[12] One potentially important problem in employing the unit root and cointegration tests is the sample size. The sample size used in this study is little under 40 observations, close to the lower bound necessary for unit root and cointegration testing (for unit root tests: Dickey and Fuller (1981); for cointegration tests: Toda (1994). The choice of the sample period is based on the availability of data and hence this study has ignored the small-sample problems associated with these test statistics.

enters the model is stationary. Table (2.1) reports stationarity analysis for both South Africa's exports and imports and the rest of the variables. For aggregate imports to South Africa, all imports combined (world) series is stationary by DFc.

Stationarity analysis for S.A. and Australia bilateral trade is reported in Table (2.3) with all series being difference stationary. Trade flows, unemployment situations and ERV are DF stationary. Australia's GDP and RER are DFc stationary. Tables (2.4 and 2.5) report stationarity analysis for S.A.'s bilateral trade with the East Asian countries of Taiwan and Japan respectively. All bilateral trade flows, Taiwan's and unemployment are DF stationary, while Japan's RGDP is DFc stationary. Japan's unemployment is ADF stationary, while the rest of the series in Tables (2.4 and 2.5) are difference stationary by the Augmented Dickey Fuller tests of the second order ((ADF (2)). Variables for aggregate export/imports, export prices, GDP, population, real effective exchange rate, and exchange rate volatility for the combined series defined above are all stationary either by Dickey – Fuller or Peron. All data series for individual countries are determined to be stationary given the above results.

Long-run results for Equation (2.1), (import demand in levels), Equation (2.6), (import demand in ECM) and the corresponding derived effects are reported in Table (2.6). Results for Equation (2.2), (export demand in levels), Equation (2.7), (export demand in ECM) and the corresponding derived effects are reported in Table (2.7). Results for the short-run estimation of import and export demand Equations (2.3 and 2.4) for levels, and Equations (2.7 and 2.8) for ECM, and their corresponding derived effects are reported in Tables (2.8 and 2.9) respectively, while results for unemployment effects, Equations (2.4 and 2.5) in levels and Equations (2.8 through 2.10) for ECM are reported in Table (2.10), with their computed derived effects. Tables (2.6 to 2.10) also report model attributes such as the F statistics, adjusted R-squared (R^2), Durbin

Watson (DW) statistics, Auto Regressive Conditional Heteroskedasticity of the first order (ARCH(1)) statistics, Akaike Information Criteria (AIC), and the Schwartz Bayesian Criterion (SBC) for model selection.

Results in levels for all the equations are largely spurious, and the ECM yields negative and highly significant error terms for all countries and PTAs implying adjustment relative to the dynamic equilibrium. The insignificant difference coefficients for most of the variables in Tables (2.6 through 2.10) imply no transitory effects. The computed derived effects provide elasticities that yield critical country and/or PTA—specific information regarding bilateral trade with South Africa.

4.1. Import Demand

In Table (2.6), (import demand), South Africa's GDP is found to be significant for imports from NAFTA members; U.S., Canada, Mexico, E.U. members; U.K., Netherlands, Luxembourg, France, Portugal, Germany, Finland and Norway[13]. GDP is largely not significant for SADC and ASEAN countries except Mauritius. Other trade partners for which GDP is important are Turkey, Saudi-Arabia, China, India, and Australia. Similarly, population yielded positive estimates for U.S., Netherlands, Norway, Malawi, China and India. These countries export mostly durable household goods to South Africa (except Malawi and Saudi Arabia), whose demand increase directly with an increase in population and income. Malawi exports food products and Saudi Arabia exports oil and natural gas, which have similar demand patterns. These findings are consistent with Sanso Cuairan and Sanz (1991) and Srivastava and Green (1986). Their studies examined U.S. imports for durable household goods.

Export price for South Africa's imports yield the expected negative coefficients for

[13] Norway, Sweden and Switzerland are not E.U. members, but have similar trade policies similar to those of the E.U.

imports from U.S., Canada, U.K., Netherlands, Germany, Austria, Luxembourg, Spain, Zambia, Thailand, Indonesia, Saudi Arabia, India and Japan. The rest of the countries yielded insignificant estimates. Real effective exchange rate (RER) varies negatively with import volumes from U.S., Canada, Mexico, U.K., Netherlands, Germany, Norway, Saudi Arabia, and Sri-Lanka.

Exchange rate volatility (ERV) improves import volumes from U.S., Canada, Finland, Zambia, Saudi Arabia and Pakistan, consistent with Kim and Lee (2007), Klein (2002), Choudhry (2008), Sercu and Vanhulle (1992), and Broll and Eckwert (1999), but depresses import volumes from the U.K., Netherlands, Belgium, Portugal, Germany, Norway, Switzerland, Colombia, Argentina, and New Zealand, consistent with Ekanayake and Thaver (2011), Vergil (2004), Shnabl (2008). Ekanayake and Thaver (2011) however found negative impact on U.S., imports into South Africa for computers and related software, chemicals, and motor vehicles. Vergil (2004) and Shnabl (2008) studies U.S., sectoral imports from Japan.

Lifting of trade Sanctions on South Africa in 1994 had a positive impact on import volumes from U.S., Canada, U.K., Netherlands, Luxembourg, France, Portugal, Denmark, Norway, Saudi Arabia, Pakistan, Colombia, Argentina and New Zealand. The rest of the countries are found not to have enforced trade sanctions on South Africa, owing to the insignificant estimates.

The effect of PTAs on import volumes is found to be important in relation to SADC. SADC members; DRC, Zambia, Malawi, Mauritius, and Seychelles are found to have taken advantage of preferential trade terms provided in SADC to increase their exports to South Africa, with elasticities of 1.30, 0.52, 0.11, 0.37 and 0.17 respectively. This is a clear evidence of trade creation and trade diversion caused by a PTA, consistent with Zhu and Lai (2004) and Berdel

and Ghoshal (2007). Malawi and Seychelles have traditionally traded with India, France and U.K., especially in imports of manufactures, owing to language (France and U.K.) and proximity (India) but the creation of SADC appear to have "diverted" trade away from those three countries in favor (trade creation) of South Africa. Malawi and Zambia also have traditionally exported their agricultural produce to U.K., due to colonial ties and language. SADC appears to have diverted trade from U.K., and created trade in favor of South Africa for Malawi and Zambia. The rest of the PTAs yield insignificant estimates.

The short-run estimates for import demand are reported in Table (2.8). Import prices in the short run are only important for imports from countries not affiliated to any major PTA with an elasticity of -1.45. The fact that these countries provide no trade preferences in the form of reduced tariffs to South Africa, may explain why their export prices significantly vary inversely with their export volumes to South Africa. Real effective exchange rate is found to be very significant in the short-run for all world imports, imports from PTAs, and those from Non-PTA members, with elasticities of -0.73, -0.69, and -0.71. Exchange rate volatility is found to be unimportant due to insignificant coefficient estimates.

4.2. Export Demand

Results for long-run export demand are reported in Table (2.7). Importers' (of South Africa's exports) GDP is found to be important in determining export volumes to the U.S., U.K., Netherlands, Belgium, France, Finland, Sweden, Norway and Zambia, while importers' population yields positive and significant estimates for Canada, U.K., Netherlands, Luxembourg, Sweden, Mauritius, Zambia, Indonesia and Taiwan. The rest of the countries yield insignificant estimates.

An increase in export prices for South African goods and services reduce export volumes

to U.S., Canada, France, Germany, Finland, Sweden, and Thailand, while rand's appreciation (increase in the real effective exchange rate) depresses export volumes to Canada, France, Austria, Italy, Finland, Sweden, Denmark, Mauritius and Sri Lanka. Exchange rate volatility improves South Africa's exports to Canada, Ireland, Zambia and Pakistan, but depresses export volumes to the U.S., Mexico, U.K., Belgium, Luxembourg, Spain, Portugal, Finland and Denmark.

Elimination of trade sanctions against South Africa (STR) increased export volumes Canada, Netherlands, Belgium, France, Austria, Finland, Indonesia and India with elasticities of between 0.12 to 3.00. Similar to the import demand, SADC creation is found to improve South Africa's export to SADC members; DRC (0.64), Zambia (0.05), Malawi (0.10), Mauritius (0.02), Seychelles (0.18). The rest of the PTAs yield insignificant estimates meaning that their existence is of little significance to South Africa's exports, largely because South Africa mostly exports metals with little or no import substitution within those PTAs. Table (2.9) reports the long run effects of export price, real effective exchange rates, and exchange rate fluctuations for aggregate data. Export volume is only sensitive to corresponding prices in the short-run, with an elasticity of -2.1 and -0.94 for PTA blocs and non-PTA members.

4.3. Unemployment

Table (2.10) reports results for the effects of unemployment levels on bilateral trade. Income, price, RER and ERV are also included in the model, but this discussion focuses on importer's unemployment (UNEMP) only. The analysis features bilateral trade with South Africa and four countries only that includes U.S., Australia, Taiwan and Japan. Unemployment is found to be an important factor determining trade volumes. U.S.'s unemployment levels are found to reduce imports from South Africa with an elasticity of -1.80, while South Africa's imports from U.S.,

also fall in the face of rising unemployment in South Africa (-9.19).

Australia unemployment levels reduce import volumes from South Africa with an elasticity of -2.92, while Japan's unemployment levels reduce South African imports with an elasticity of -0.73. Australia's export volume to South Africa is not affected by the latter's unemployment levels. South Africa's imports from Taiwan are not affected by its unemployment levels, but its exports to Taiwan decline in the face of Taiwan's unemployment, with an elasticity of -0.37. Chaudhuri (2005) and Chao and Yu (1997) found similar results on U.S.—China bilateral trade, while Quintieri and Bella (2000), and Matusz (1994) found similar results on bilateral trade relations between original and new members of the European Union.

4.5. Intangible Effects

In both import and export demand equations, all variables for U.S., U.K., Canada, and the Netherlands bear highly significant estimates. South Africa share colonial, cultural, language and religious ties with Netherlands and the U.K. South Africa also shares similarities with U.S. and Canada in the form of language, religion and culture. Most of the multinational companies doing business in South Africa are either from those four countries, with the largest share of FDI. This gives credibility to the inclusion of intangible variables such as language, culture, religion, colonial ties etc., in a gravity model as discussed in Tinbergen (1962), Poyhonen (1963) and Pulliainen (1963), who are the pioneers of the gravity equation, and lately by Martinez-Zarzoso and Nowak-Lehmann, (2003).

5. Summary and Conclusion

This study examines the relationship between South Africa's bilateral trades with 42 of its major trading partners. Annual data for the period 1970 to 2010 is used in a gravity equation. The selected variables represent importer/exporter's real income, population, export prices,

unemployment, real effective exchange rate, exchange rate volatility, and a set of dummy variables representing involvement in a PTA and a structural break signifying lifting of trade sanctions against South Africa.

The cointegration results clearly show that there exists a long-run equilibrium relationship between real exports/imports and real foreign economic activity, relative prices, real exchange rate, and real exchange rate volatility in most of the trade partners, with all the specifications yielding expected signs for the coefficients . Most of the coefficients are statistically significant.

In the import demand equation, South Africa's GDP and population are found to vary positively with import volume, while rising export prices and rand appreciation reduce imports. Exchange rate volatility yields mixed results, while lifting of trade embargo in 1994 increased imports. Formation of SADC is found to have diverted trade from India and France and created trade for SADC members. In the short-run, import volume is only found to be sensitive to the real effective exchange rate.

In the export demand equation, South Africa's exports are found to vary positively with importer's income, population and the lifting of trade sanctions, but negatively with export prices and rand appreciation. Exchange rate volatility yields mixed results, while South Africa's membership in SADC appears to have created trade in favor of SADC members. In the short-run, South Africa exports are only sensitive to export prices. Unemployment is also found to depress bilateral trade volume, making it an important determinant of bilateral trade.

Despite the exclusion of intangible variables such as language, religion, culture and colonial ties in the gravity models estimated in this chapter, the results justify their inclusion due

to the highly significant estimates of all coefficients in relations to U.S., U.K., Netherlands and Canada.

Tables

Table 2.1. Stationarity Analysis for South Africa's Bilateral Trade

DICKEY-FULLER TESTS SOUTH AFRICA'S IMPORTS						
VARIABLES	**DF**	**DFc**	**DFt**	**ADF**	**ADF(2)**	**PERON**
WORLD	F=10.65	F=4.96 T=0.85 DW=2.01 ARCH (1)=0.77				
PTA	ARCH(1)=7.49	ARCH(1)=8.22	T=6.27	F=1.24 T=0.11 DW=2.39 ARCH(1)=1.76		
NON-PTA	T=6.78	F=.67 T=1.28 DW=2.16 ARCH(1)=0.89				
NAFTA	T=4.89	T=4.76	T=3.89	T=3.92 F=7.09	T=3.02	T_P=-2.9
SADC	F=10.11	F=9.62	F=10.56	F=7.22	F=5.01 T=1.43 DW=2.16 ARCH(1)=0.02	
ASEAN	F=3.62 T=0.17 DW=2.26 ARCH(1)=0.76					
EU	ARCH(1)=5.56	ARCH(1)=4.26	F=1.43 T=0.24 DW=1.96			

			ARCH(1)=1.18			
SOUTH AFRICA'S TRADE EXPORTS						
	DF	**DFc**	**DFt**	**ADF**	**ADF(2)**	**PERON**
WORLD	T=3.89	F=.67 T=1.13 DW=1.79 ARCH(1)=0.86				
PTA	F=20.76	F=20.02	F=17.64	F=8.26	F=5.11 T=0.27 DW=1.86 ARCH(1)=0.77	
NON-PTA	T=6.32	T=3.15	F=2.16 T=1.72 DW=1.89 ARCH(1)=0.24			
NAFTA	F=3.07 T=0.46 DW=1.99 ARCH(1)=0.62					
SADC		T=9.67	T=6.32	T=6.88	T=6.102	T_P=-3.66
ASEAN	ARCH(1)=3.42	ARCH(1)=3.01	ARCH(1)=2.76	F=2.04 T=0.27 DW=2.19 ARCH(1)=1.77		
EU	F=3.13 T=0.96 DW=1.72					

	ARCH(1)=1.32					
GDP						
WORLD	T=4.32	T=3.89	F=0.26 T=1.43 DW=1.97 ARCH(1)=0.42			
PTA	F=2.86 T=1.11 DW=2.04 ARCH(1)=1.77					
	DF	**DFc**	**DFt**	**ADF**	**ADF(2)**	**PERON**
NON-PTA	F=46.2	F=42.82	F=37.77	F=26.22	F=15.99	T_P=-2.89
NAFTA	DW=1.36	F=2.62 T=0.34 DW=1.71 ARCH(1)=0.24				
SADC	T=6.23	T=4.11	F=3.89 T=1.96 DW=2.02 ARCH(1)=0.02			
ASEAN	F=15.09	F=11.42	F=10.61	F=10.72	F=5.11 T=1.12 DW=2.46 ARCH(1)=1.17	
EU	T=3.46	T=2.99	T=2.13	F=0.26 T=1.97 DW=2.07 ARCH(1)=0.09		
EXPORT PRICE						
WORLD	F=21.4	F=26.89	F=20.89	F=17.17	F=17.02	TP=-6.27
PTA	F=6.32	F=5.89	F=2.89 T=1.16			

			DW=2.02 ARCH(1)=0.09			
NON-PTA	F=0.36 T=0.04 DW=2.02 ARCH(1)=0.89					
NAFTA	ARCH(1)=3.24	ARCH(1)=4.24	ARCH(1)=3.11	ARCH(1)=2.24	F=4.77 T=0.24 DW=1.78 ARCH(1)=1.42	
	DF	**DFc**	**DFt**	**ADF**	**ADF(2)**	**PERON**
SADC	T=5.42	T=4.38	T=3.11	F=2.17 T=1.88 DW=2.24 ARCH(1)=0.08		
ASEAN	DW=1.36	F=4.48 T=1.32 DW=1.77 ARCH(1)=0.42				
EU	F=4.79 T=1.96 DW=2.24 ARCH(1)=0.08					
POPULATION						
WORLD	F=3.24 T=0.64 DW=2.13 ARCH(1)=0.09					
PTA	DW=1.27					
NON-PTA	F=3.86 T=0.94 DW=2.01 ARCH(1)=1.42					

NAFTA	F=6.27		F=5.24 T=0.37 DW=1.88 ARCH(1)=0.31			
SADC	T=3.33	T=3.08	T=2.41	F=4.20 T=1.91 DW=2.31 ARCH(1)=1.11		
ASEAN	F=4.41 T=0.34 DW=1.89 ARCH(1)=1.17					
	DF	**DFc**	**DFt**	**ADF**	**ADF(2)**	**PERON**
EU	ARCH(1)=3.42	F=5.08 T=0.41 DW=2.22 ARCH(1)=1.41				
RER						
WORLD	T=5.46	T=6.32	T=3.49	T=3.86	T=2.14	T_P=-4.46
PTA	T=8.62	T=7.99	T=7.46	T=4.14	T=4.49	T_P=-.64
NON-PTA	T=5.16	T=4.13	T=4.27	T=3.86	F=3.66 T=1.98 DW=2.16 ARCH(1)=0.04	
NAFTA	F=11.02	F=9.36	F=9.67	F=6.12	F=6.88	T_P=-1.17
SADC	ARCH(1)=4.16	F=1.49 T=0.08 DW=2.44 ARCH(1)=1.22				
ASEAN	T=2.99	T=2.81	T=2.13	F=1.18 T=1.88 DW=2.22 ARCH(1)=0.09		

EU	T=9.42	T=8.81	T=8.64	T=8.39	T=7.71	T_P=-5.09
ERV						
WORLD	T=6.44	T=5.17.	T=5.09	T=4.27	F=3.09 T=1.71 DW=2.41 ARCH(1)=0.08	
	DF	**DFc**	**DFt**	**ADF**	**ADF(2)**	**PERON**
PTA	T=3.14	T=3.28	T=3.76	T=3.11	T=4.01	T_P=-3.08
NON-PTA	T=11.01	T=9.94	T=8.62	T=9.77	T=6.32	T_P=-7.06
NAFTA	ARCH(1)=3.33	F=3.08 T=1.49 DW=2.11 ARCH(1)=1.77				
SADC	T=3.16	T=3.79	T=3.14	T=3.26	T=2.48	T_P=-0.48
ASEAN	F=28.39	F=26.42	F=11.08 DW=1.04	F=5.89 T=0.34 DW=1.68 ARCH(1)=0.28		
EU	F=5.69 T=1.59 DW=1.93 ARCH(1)=1.44					

Table 2.2. Stationarity Analysis for USA and South Africa Bilateral Trade

VARIABLES	**DF** **-1.95<T<0** **F<5.18**	**DFc** **-3.00T<0** **F<5.18**	**DFt** **-3.60<T<0** **F<5.68**	**ADF** **-3.60<T<0** **F<7.24**	**ADF(2)** **-3.60<T<0** **F<7.24**	**PERON** **(a1-1)/se** **TP<0**
USA-INFLOW	F=0.87 T=0.933 DW=2.21 ARCH(1)=-0.21					
SA-INFLOW	F=0.89 T=0.94 DW=1.92 ARCH(1)=-0.51					
USA-GDP	F=48.99 T=6.99	F=2.43 T=-1.56 DW=1.49 ARCH(1)=-0.39				
SA-GDP	F=1.61 T=1.27 DW=1.51 ARCH(1)=-0.39					
SA-PRICE	F=65.44 T=8.08	F=54.31 T=-7.37	F=26.32	F=26.11	F=21.96	TP=-1.44
USA-PRICE	F=6.54 T=-1.04 DW=1.94 ARCH(1)=0.104					
SA-USA-RER	DW=1.05	F=9.19	F=4.46 T=-0.96 DW=1.65 ARCH(1)=1.422			

USA-UNEMP	F=0.138 T=-0.37 DW=1.47 ARCH(1)=0.52					
SA-UNEMP	F=2.4 T=1.55 DW=1.89 ARCH(1)-0.045					
DF -1.95<T<0 F<5.18	DFc -3.00T<0 F<5.18	DFt -3.60<T<0 F<5.68	ADF -3.60<T<0 F<7.24	ADF(2) -3.60<T<0 F<7.24	PERON (a1-1)/se TP<0	
SA-USA-ERV	F=19.49 T=-4.41	F=25.34 T=-5.03	F=12.22 T=-4.94	F=7.64 T=-3.25 DW=2.02 ARCH(1)=-0.33		

Table 2.3. Stationarity Analysis for Australia and South Africa Bilateral Trade

VARIABLES	**DF -1.95<T<0 F<5.18**	**DFc -3.00<T<0 F<5.18**	**DFt -3.60<T<0 F<5.68**	**ADF -3.60<T<0 F,7.24**	**ADF(2) -3.60<T<0 F<7.24**	**PERON (a1-1)/se Tp<0**
AUST-INFLOW	F=4.55 T=2.13 DW=1.619 ARCH(1)=-0.219					
AUST-GDP	F=8.4	F=0.34 T=0.58 DW=1.67 ARCH(1)=-0.97				
AUST-PRICE	F=51.71 T=7.19	F=43.62 T=-6.6	F=23.35 T=-3.93	F=20.45	F=11.13	TP=-2.44
SA-AUST-RER	F=23.57 T=4.85	F=0.0005 T=-0.02 DW=2.3 ARCH(1)=1.28				
AUST-UNEMP	F=0.138 T=-0.37 DW=1.5 ARCH(1)=0.52					
SA-AUST-ERV	F=7.21 T=-3.34 DW=1.97 ARCH(1)=-0.25					

Table 2.4. Stationarity Analysis for Taiwan and South Africa Bilateral Trade

VARIABLES	**DF** **-1.95<T<0** **F<5.18**	**DFc** **-3.00<T<0** **F<5.18**	**DFt** **-3.60<T<0** **F<5.68**	**ADF** **-3.60<T<0** **F<7.24**	**ADF(2)** **-3.60<T<0** **F<7.24**	**PERON** **(a1-1)/se** **TP<0**
TAIWAN-INFLOW	F=3.21 T=1.79 DW=2.13 ARCH(1)=0.48					
TAIWAN-GDP	F=3.48 T=-0.79 DW=1.66 ARCH(1)=0.806					
TAIWAN-PRICE	F=15.3 T=3.91	F=7.51 T=2.74	T=-2.55	DW=1.26	F=3.4 T=-1.44 DW=2.28 ARCH(1)=-0.43	
SA-TAIWAN-RER	F=15.14 T=3.89	F=13.84 -3.72	F=8.29 T=-2.55	T=-2.76	F=2.39 T=-2.02 DW=1.95 ARCH(1)=2.18	
TAIWAN-UNEMP	F = 0.66 T=0.81 DW=1.5 ARCH(1)=-0.46					
TAIWAN-SA-ERV	F=22.86 T=-4.78	F=25.73 T=-5.07	F=12.94 T=-5.07	F=7.93 T=-3.54	F=5.46 T=-2.9 DW=2.01 ARCH(1)=0.22	

Table 2.5. Stationarity Analysis for Japan and South Africa Bilateral Trade

VARIABLES	**DF -1.95<T<0 F<5.18**	**DFc -3.00<T<0 F<5.18**	**DFt -3.60<T<0 F<5.68**	**ADF -3.60<T<0 F,7.24**	**ADF(2) -3.60<T<0 F<7.24**	**PERON (a1-1)/se TP<0**
JAPAN-INFLOW	F=4.30 T=2.07 DW=1.61 ARCH(1)=-1.03					
JAPAN-GDP	F=6.21 T=2.49	F=4.13 T=-2.03 DW=1.45 ARCH(1)=-0.36				
JAPAN-PRICE	F=9.92	F=33.34 T=-5.77	F=18.05	F=11.64	F=7.75 T=-1.08 DW=2.12 ARCH(1)=0.85	
SA-JAPAN-RER	F=17.67 T=4.2	F=9.8 T=-3.1	DW=1.38	DW=1.38	F=5.77 T=-2.34 DW=2.21 ARCH(1)=0.072	
JAPAN-UNEMP	DW=1.08	DW=1.06	DW=1.02	F=4.64 T=-2.42 DW=2.08 ARCH(1)=0.55		
SA-JAPAN-ERV	F=19.38	F=30.13	F=15.03	F=9.94	F=7.28	

	T=-4.4	T=-5.48	T=-5.47	T=-4.24	T=-3.66 DW=2.06 ARCH(1)=-0.24	

Table 2.6. Results for South Africa's Imports

	PARAMETERS													
	LONG-RUN ESTIMATES									MODEL FITNESS				
Y-VAR	**C**	**GDP**	**POP**	**PRICE**	**RER**	**ERV**	**STR**	**PTA**	ε_{ECM}	**F**	**R^2**	**DW**	**AR**	**AIC /SBC**
MODEL IN LEVELS														
NAFTA														
USA	-75.36* (33.25)	-0.59 -(0.57)	-4.79 (2.11)	2.77 (0.87)	0.78 (0.27)	-31.14 (45.54)	-0.07 (0.20)	0.007 (0.108)		44.98	0.88	1.48	0.89	34.78 47.88
CANADA	-80.21^ (48.93)	-3.60 (0.84)	-4.20 (3.12)	-2.28 (1.11)	2.21 (0.73)	35.01 (51.69)	-0.82* (0.36)	-0.13 (0.15)		11.55	0.66	2.01	1.44	56.51 67.9
MEXICO	-164.16 (-139.9)	-12.59 (3.55)	-12.97 (9.05)	0.49 (0.43)	0.58 (1.27)	-33.33 (26.17)	0.32 (0.93)	-0.06 (0.59)		14.2	0.71	1.98	3.14	148.66 160.12
EU														
UK	14.76 (15.61)	-1.65 (0.73)	-1.10 (0.96)	0.53 (0.30)	0.84 (0.28)	-602.7 (429.2)	0.001 (0.13)	-0.06 (0.17)		37.06	0.86	1.80	-0.40	11.97 23.43
IRELAND	159.79 (135.62)	-0.84 (3.76)	-1.72 (2.99)	0.39 (0.92)	8.47 (8.05)	-0.12 (0.56)	0.26 (0.35)	-0.35 (0.48)		72.23	0.45	1.49	-0.06	85.83 98.93
HOLLAND	13.03* (9.03)	-1.75 (0.83)	1.13 (0.66)	1.81 (0.43)	0.02 (0.20)	0.02 (0.02)	0.47* (0.15)	0.16^ (0.10)		91.13	0.94	1.82	-0.13	13.90 25.36
BELGIUM	-10.06 (12.71)	-2.06 (0.69)	-0.33 (0.83)	2.72 (0.43)	0.02 (0.17)	259.3# (118.8)	0.49* (0.15)	0.20* (0.09)		149.6	0.96	1.77	0.012	9.51 20.97
LUX	25.76^ (15.26)	-3.38 (0.86)	-2.06 (1.00)	2.23 (0.51)	0.11 (0.20)	72.75* (14.4)	-0.46 (0.18)	0.29* (0.10)		116.9	0.95	1.96	1.10	26.71 38.3
FRANCE	-72.63* (24.82)	-1.78 (1.02)	-4.84 (1.21)	2.19 (0.46)	0.0002 (2.31)	73.7 (40.3)	-0.47 (0.28)	0.29^ (0.12)		60.87	0.91	1.91	-0.21	35.54 47.0
SPAIN	-67.75* (24.82)	-0.53 (1.05)	-4.11 (1.49)	1.84 (0.36)	0.75 (1.53)	-18.17 (14.7)	-0.74 (0.24)	0.24^ (0.13)		126.3	0.95	1.99	1.62	37.66 48.82
PORTUGA	-71.14	-0.51	-4.04	1.09	2.24	72.09*	-0.68	0.17		46.3	0.89	2.07	0.03	55.8

L	(61.59)	(1.20)	(3.61)	(0.55)	(2.12)	(31.3)	(0.33)	(0.16)						66.7
GERMANY	-33.14* (14.27)	-1.38 (0.79)	-2.25 (0.97)	4.91 (0.81)	0.22 (1.15)	97.8 (110.4)	-0.14 (0.15)	0.24* (0.09)		118.1	0.95	1.75	-0.01	13.85 25.32
AUSTRIA	-29.16# (13.03)	-0.54 (0.67)	-2.12 (0.86)	2.70 (0.57)	1.07 (1.09)	20.86^ (11.3)	-0.48 (0.13)	0.20* (0.08)		192.3	0.97	1.95	-1.36	2.19 13.65
ITALY	-11.95 (24.7)	-0.34 (0.81)	-0.34 (1.34)	0.97 (0.33)	3.60 (2.76)	10.78 (7.38)	-0.48 (0.21)	0.18 (0.11)		76.15	0.93	1.68	-0.06	24.9 36.3
FINLAND	-173.7^ (93.61)	-16.56 (-5.05)	-15.04 (6.16)	0.77 (2.01)	2.99 (1.60)	-178.9# (89.6)	-0.22 (1.23)	-0.85 (0.68)		8.03	0.56	1.99	0.61	163.3 174.8
SWEDEN	-171.3 (125.2)	-8.88 (-2.63)	-12.69 (7.88)	1.51 (2.58)	1.62 (0.87)	679.4^ (404.6)	-1.09 (0.82)	-0.30 (0.38)		9.89	0.62	1.49	0.95	120.5 132.1
DENMARK	82.83* (38.35)	-3.99 (1.97)	-6.17 (2.41)	1.79 (0.96)	0.37 (0.54)	372.3 (415.8)	-0.79 (0.45)	-0.08 (0.25)		16.9	0.74	1.80	-0.79	88.56 100.2
NORWAY	-649.7* (113.6)	-11.52 (2.88)	-43.36 (7.19)	11.58 (2.52)	1.59 (1.31)	36.62 (27.17)	-1.81 (0.89)			9.56	0.57	1.54	0.87	133.6 143.4
SWISS	-6.72 (20.23)	-0.50 (0.56)	-1.08 (-1.51)	2.85 (0.99)	1.73 (1.10)	15.4 (24.8)	0.007 (0.14)			68.7	0.91	1.75	0.74	32.4 42.2
SADC														
DRC	-72.7 (53.63)	-13.39 (6.51)	-7.78 (3.85)	0.30 (1.19)	1.54 (0.58)	0.11 (0.11)	-2.92 (1.19)	-0.54 (0.63)		7.90	0.55	1.88	1.77	170.1 181.7
ZAMBIA	361.09* (35.57)	-10.19 (2.07)	-24.52 (2.58)	1.19 (0.20)	2.23 (0.47)	-21.32# (10.08)	-1.81* (0.60)	-0.60 (0.35)		21.76	0.79	2.00	0.06	97.2 108.7
MALAWI	-98.94* (10.42)	-1.11 (1.02)	-6.05 (0.74)	0.0001 (0.15)	0.48 (0.40)	-12.72 (16.17)	-0.02 (0.30)	-0.04 (0.16)		119.1	0.95	1.83	-0.40	51.49 63.13
MAURITIUS	-20.24 (81.04)	-4.30 (-1.69)	-2.21 (4.89)	0.12 (1.18)	0.50 (0.97)	-17.29 (21.66)	-0.24 (0.56)	-0.33 (0.30)		7.43	0.54	2.02	0.10	113.4 124.9
SYCHELLES	-53.86 (56.46)	-1.19 (5.33)	-3.33 (4.32)	2.29 (1.10)	1.39 (1.93)	10.13 (19.50)	-0.53 (0.68)	-0.05 (0.33)		2.15	0.22	1.67	0.30	78.24 87.6
ASEAN														
THAILAND	-563.57*	-16.43	-38.85	6.27	1.04	45.35*	-3.85#	1.70*		21.49	0.78	1.97	-0.17	178.7

	(168.43)	(-5.35)	(11.51)	(3.42)	(3.66)	(12.76)	(1.83)	(0.61)						190.4
MALAYSIA	-95.73 (204.27)	-6.50 (5.19)	-6.96 (13.68)	1.51 (6.38)	2.36 (3.76)	-102.4 (263.6)	-8.01* (1.80)	0.05 (0.59)		21.3	0.78	1.99	-0.43	176.8 188.3
PHILLIPINES	-476.1 (325.9)	-4.49 (-4.40)	-29.80 (20.11)	4.32 (3.63)	1.40 (2.09)	572.4 (557.9)	-3.07* (1.21)	1.23* (0.48)		13.64	0.69	1.61	0.81	162.5 173.9
INDONESIA	-319.77# (165.52)	-7.18 (4.01)	-21.77 (10.31)	2.82 (2.02)	1.82 (1.32)	2.81 (2.71)	-0.85 (1.55)	0.59^ (0.34)		29.3	0.83	2.00	-0.13	136.5 147.7
OTHERS														
TURKEY	-142.45* (47.31)	-7.68 (1.82)	-10.67 (3.03)	0.49 (0.14)	-2.76* (0.50)	5.53 (101.53)	-0.76 (0.58)			152.6	0.95	1.88	-0.68	102.4 112.3
ISRAEL	-109.3* (37.44)	-0.20 (1.10)	-6.45 (2.41)	0.06 (0.09)	1.76 (0.51)	-352.3 (276.9)	-0.46* (0.22)			87.5	0.93	1.82	-0.43	63.01 72.9
SAUDI-A	-104.1 (244.8)	-5.84 (5.03)	-10.07 (15.81)	21.12 (7.19)	-5.86 (7.20)	-83.9 (342.4)	5.81* (1.26)			14.5	0.67	2.03	-0.35	194.2 204.2
CHINA	-93.21* (35.3)	-7.40 (1.26)	-7.90 (2.43)	2.81 (0.46)	-0.18 (0.47)	-12.74 (10.48)	1.33 (0.29)			323.4	0.98	1.94	0.19	70.11 80.1
TAIWAN	-78.10* (24.24)	-2.47 (1.17)	-4.93 (1.57)	2.33 (0.56)	-0.17 (0.79)	7.96 (95.76)	0.55 (0.36)			138.9	0.96	1.82	1.01	81.6 91.6
INDIA	-471.92* (121.26)	-2.64 (5.00)	-27.66 (7.90)	7.39 (2.56)	0.88 (2.80)	24.71 (16.48)	4.97* (0.94)			41.9	0.86	2.02	-0.20	150.2 160.1
PAKISTAN	-26.86 (41.18)	-2.17 (0.91)	-2.33 (2.57)	0.99 (0.62)	0.55 (0.54)	-28.42* (6.84)	-0.26 (0.26)			95.9	0.93	1.99	1.34	48.29 58.12
SRI-LANKA	-32.74 (26.65)	-0.30 (0.51)	-1.80 (1.57)	0.19 (0.35)	0.48 (0.21)	-5.70 (3.88)	0.22^ (0.12)			4.25	0.33	1.98	-0.35	4.80 14.79
COLOMBIA	-57.11 (140.76)	-8.04 (2.32)	1.08 (8.82)	0.68 (0.89)	0.23 (0.80)	287.5* (76.29)	1.15^ (0.69)			27.8	0.80	2.01	-0.85	117.4 127.4

ARGENTINA	-129.75 (91.86)	-1.32 (2.26)	-8.03 (5.82)	0.01 (0.09)	0.20 (0.23)	1.25* (0.47)	0.45 (0.32)			70.55	0.91	1.84	-0.03	94.15 103.9
NZ	-4.81 (20.82)	-1.68 (-0.98)	-0.12 (1.39)	0.22 (0.29)	0.06 (0.26)	0.71* (0.27)	0.87* (0.25)			37.57	0.84	1.51	0.54	70.80 80.78
AUSTRALIA	-13.77 (38.49)	-3.04 (1.12)	-1.44 (2.39)	0.16 (0.78)	0.18 (0.51)	-212.78 (186.68)	0.94* (0.31)			62.88	0.90	1.86	0.27	56.89 66.87
JAPAN	-1.48 (11.86)	-1.15 (0.63)	-0.20 (0.79)	1.62 (0.32)	-0.17 (0.31)	79.26 (60.51)	-0.04 (0.17)			84.1	0.92	1.68	-1.05	33.33 43.31
ERROR CORRECTION MODEL (ECM)														
NAFTA														
USA	-0.35 (0.29)	2.61 (1.81)	15.99 (11.21)	-0.98 (1.45)	0.28 (0.26)	-25.52 (24.11)	0.03 (0.17)	0.07 (0.08)	-0.54 (0.16)	2.21	0.20	1.53	0.63	13.19 27.69
CANADA	-0.02 (0.49)	3.04 (2.37)	13.53 (18.75)	-5.77* (2.57)	1.83 (1.22)	4679.7^ (2948.8)	0.09 (0.27)	-0.07 (0.14)	-0.81* (0.20)	4.06	0.39	2.00	0.16	79.4 86.28
MEXICO	-0.83 (1.61)	-3.43 (9.00)	39.95 (63.52)	-0.12 (0.92)	-2.04 (1.45)	-13.00 (18.05)	1.40 (1.07)	-0.27 (0.44)	-0.95* (0.18)	4.53	0.43	2.18	1.58	160.24 196.4
EU														
UK	-0.07 (0.22)	-1.36 (1.25)	4.55 (8.79)	0.42 (0.68)	0.52 (0.32)	60.45 (263.7)	0.09 (0.13)	0.03 (0.09)	-0.7 (0.17)	2.49	0.24	1.71	0.31	1.12 14.01
IRELAND	-0.24 (0.36)	-3.89 (1.93)	9.34 (14.61)	1.15 (1.16)	-1.25* (0.44)	312.29* (136.7)	0.27 (0.22)	-0.39 (0.17)	-0.44* (0.11)	4.66	0.47	1.72	-0.88	33.24 47.74
HOLLAND	0.05 (0.15)	-0.98 (1.41)	-0.24 (1.41)	-0.24 (6.57)	0.84 (1.14)	-0.03 (0.28)	0.0001 (0.01)	0.0001 (0.10)	-0.69* (0.07)	2.58	0.25	1.69	0.0008	8.11 20.99
BELGIUM	0.001 (0.17)	-2.20 (1.51)	-0.51 (8.15)	2.97 (1.31)	0.27 (0.30)	184.8^ (93.67)	0.06 (0.12)	0.09 (0.08)	-0.90* (0.22)	3.34	0.33	2.03	1.20	16.53 29.41
LUX	0.07	-1.96	-3.04	2.91	0.30	132.7	-0.04	0.09	-0.65*	1.94	0.16	1.95	0.90	32.62

	(0.21)	(1.68)	(10.16)	(1.78)	(0.37)	(116.5)	(0.14)	(0.08)	(0.22)					45.72
FRANCE	0.03 (0.23)	2.47 (1.94)	-5.68 (12.57)	2.05 (1.71)	0.66 (2.48)	22.5 (22.2)	-0.02 (0.15)	0.17^ (0.09)	-0.57* (0.19)	2.49	0.24	1.79	-0.22	24.9 42.2
SPAIN	-0.01 (0.22)	-1.68 (2.16)	-4.23 (11.53)	2.52 (1.24)	-1.69 (2.43)	-97.11 (99.41)	0.16 (0.15)	0.09 (0.10)	-0.72* (0.21)	2.27	0.21	1.93	0.99	36.78 49.6
PORTUGAL	0.25 (0.27)	3.13 (2.555)	-29.44 (15.52)	3.40 (1.19)	1.46 (2.88)	60.49 (198.6)	-0.05 (0.18)	0.05 (0.12)	-0.82* (0.18)	4.55	0.43	1.80	0.44	47.33 60.22
GERMANY	-0.22^ (0.13)	-1.28 (1.22)	12.05# (5.88)	1.47 (1.68)	-1.54 (1.34)	82.09 (53.63)	0.14 (0.09)	0.12 (0.06)	-0.63* (0.16)	3.98	0.39	1.79	-0.09	-2.43 10.45
AUSTRIA	0.06 (0.14)	-0.09 (1.37)	-2.75 (6.38)	1.92 (1.45)	-0.53 (1.65)	93.7 (72.6)	0.03 (0.10)	0.07 (0.06)	-0.62* (0.20)	1.81	0.14	1.88	-0.80	3.42 16.3
ITALY	0.02 (0.18)	2.28 (1.81)	-1.60 (9.44)	0.96 (0.91)	2.93 (2.93)	41.19 (44.1)	0.01 (0.12)	0.08 (0.08)	-0.57* (0.19)	2.33	0.22	1.48	0.05	18.82 31.71
FINLAND	0.71 (0.79)	13.39# (6.89)	-31.92 (38.7)	-1.84 (4.35)	0.92 (1.49)	-122.7* (38.5)	0.75 (0.53)	0.09 (0.36)	0.21^ (0.13)	2.13	0.19	1.33	0.79	129.2 142.1
SWEDEN	-0.07 (0.43)	1.78 (3.65)	32.63 (24.37)	-9.99* (3.99)	0.57 (0.8)	731.9* (169.8)	-0.11 (0.29)	0.15 (0.19)	-0.22^ (0.13)	4.05	0.39	2.16	1.20	82.2 95.1
DENMARK	0.17 (0.36)	4.50 (3.11)	-11.88 (18.52)	1.41 (2.70)	-0.42 (0.61)	131.69 (203.4)	-0.15 (0.23)	0.001 (0.15)	-0.24^ (0.14)	0.87	-0.02	1.68	-0.25	66.8 79.6
NORWAY	0.58 (0.65)	13.14* (4.93)	-62.67 (38.02)	9.76 (6.27)	-0.07 (1.30)	87.2 (121.9)	-0.46 (0.41)		-0.24^ (0.13)	2.01	0.16	2.22	0.70	104.6 115.9
SWISS	-0.31 (0.25)	-0.86 (1.51)	18.21# (9.49)	-1.04 (1.24)	0.49 (1.05)	47.12 (108.4)	0.18 (0.15)		-0.63 (0.15)	3.78	0.34	1.95	1.46	9.39 20.67
SADC														
DRC	0.42 (1.46)	9.80 (7.86)	-23.02 (55.22	-0.19 (1.00)	-1.39^ (0.79)	0.04 (0.10)	-0.19 (0.97)	0.10 (0.44)	-0.52* (0.15)	3.45	0.34	2.31	1.21	146.6 159.7

			)											
ZAMBIA	1.59# (0.79)	3.06 (4.74)	-73.00 (30.76)	0.59 (1.00)	1.99 (0.60)	-21.38* (5.70)	0.0001 (0.49)	-0.37 (0.20)	-0.86* (0.17)	6.53	0.54	2.08	0.04	78.72 91.6
MALAWI	-0.54 (0.46)	-2.38 (2.00)	28.12 (18.74)	-0.28 (0.51)	0.24 (0.50)	-9.78 (7.81)	0.22 (0.29)	0.08 (0.12)	-0.67* (0.18)	2.51	0.24	1.67	-0.18	42.6 55.7
MAURITIUS	0.73 (1.21)	-2.30 (5.49)	-26.08 (46.02)	0.42 (1.86)	0.23 (1.79)	-583.8 (1381.1)	-0.31 (0.65)	0.03 (0.30)	-1.12* (0.19)	5.05	0.46	1.99	-0.12	110.1 123.1
SYCHELLES	0.96 (0.92)	-4.19 (5.61)	-37.52 (27.32)	1.39 (3.81)	-2.00 (1.65)	468.94 (982.8)	-0.60 (0.47)	0.18 (0.32)	-0.49* (0.19)	1.71	0.17	1.74	1.27	60.71 71.1
ASEAN														
THAILAND	1.43 (2.29)	12.80 (11.65)	-96.44 (85.4)	9.35 (5.68)	3.16 (4.29)	1703.93 (1262.2)	-0.83 (0.91)	0.09 (0.53)	-0.76* (0.20)	3.57	0.35	2.36	0.14	174.5 187.6
MALAYSIA	3.90 (3.16)	-6.98 (16.00)	-142.8 (115.5)	-2.78 (10.79)	6.18 (4.52)	-323.5^ (201.8)	-0.42 (1.11)	-0.55 (0.66)	-0.63* (0.25)	1.94	0.17	2.07	0.23	181.9 194.8
PHILLIPINES	0.57 (1.66)	-4.16 (7.60)	-11.15 (65.77)	-1.93 (2.43)	0.35 (1.78)	240.8 (236.7)	-0.40 (0.55)	0.19 (0.35)	-0.14 (0.15)	0.80	-0.04	1.21	0.33	126.8 139.7
INDONESIA	1.20 (1.30)	8.79 (6.51)	-84.7 (49.05)	6.04 (1.91)	3.71 (1.12)	-0.92 (1.48)	-0.52 (0.48)	-0.18 (0.31)	-1.12* (0.23)	4.77	0.44	1.78	-0.42	118.8 131.7
OTHERS														
TURKEY	0.87 (0.56)	-9.92 (3.85)	-13.66 (19.47)	-0.21 (0.43)	-1.04 (0.70)	-8.17 (54.91)	-0.29 (0.32)		-0.64* (0.20)	1.98	0.15	2.07	0.71	90.02 101.5
ISRAEL	-0.39 (0.27)	-0.83 (1.94)	26.29# (12.64)	-0.18 (0.18)	0.29 (0.56)	-164.25 (148.5)	0.20 (0.17)		-0.15* (0.14)	2.97	0.26	1.77	-0.11	41.63 53.09
SAUDI-A	0.19 (1.94)	11.83 (15.06)	-16.02 (84.9)	-27.14* (14.08)	5.01 (12.81)	-374.3 (532.12)	0.29 (1.19)		-0.86* (0.22)	3.13	0.28	1.79	0.16	193.4 204.9
CHINA	-0.12	3.49	0.67	3.09	-0.69	-1.59	0.24		-0.75*	4.59	0.39	2.00	1.20	66.59

	(0.58)	(2.65)	(19.86)	(1.95)	(0.67)	(7.88)	(0.37)		(0.18)				78.1
TAIWAN	0.21 (0.30)	1.09 (2.86)	-4.42 (12.37)	1.72 (0.88)	1.19 (0.81)	-17.73 (47.83)	0.22 (0.21)		-0.49* (0.18)	2.54	0.22	1.86	0.65	61.8 73.2
INDIA	-1.53 (1.11)	-4.67 (9.58)	68.64 (42.63)	0.57 (4.23)	2.29 (3.10)	2601.5* (161.9)	1.37# (0.70)		-1.18* (0.20)	6.58	0.51	2.30	-0.16	150.21 161.5
PAKISTAN	-0.24 (0.26)	-0.36 (2.03)	16.91^ (9.70)	-0.28 (1.08)	-0.15 (0.46)	-16.99* (5.42)	0.17 (0.16)		-1.15* (0.18)	8.65	0.59	2.32	0.89	37.76 49.03
SRI-LANKA	-0.20 (0.15)	0.35 (1.19)	5.03 (5.94)	0.50 (0.57)	0.35 (0.28)	-4.08 (2.76)	0.10 (0.10)		-0.92* (0.18)	4.10	0.36	1.76	-0.30	40.68 63.18
COLOMBIA	-0.13 (0.81)	-3.88 (4.78)	2.72 (25.27)	1.01 (2.44)	-2.01 (1.38_	2762.8* (492.4)	0.42 (0.51)		-1.01* (0.17)	10.97	0.64	2.20	-0.38	108.8 120.2
BRAZIL	0.43 (0.43)	-1.23 (2.87)	-8.36 (14.98)	-0.09 (0.08)	0.36 (0.41)	-6.64 (9.50)	0.17 (0.29)		-0.49* (0.17)	1.67	0.11	1.74	0.04	54.24 65.51
ARGENTINA	0.36 (0.46)	-0.75 (4.36)	-8.10 (19.99)	-0.04 (0.15)	0.20 (0.24)	0.78* (0.28)	-0.16 (0.30)		-0.87* (0.19)	4.96	0.42	1.75	1.90	85.37 96.7
NZ	0.11 (0.26)	-3.05 (2.08)	-1.20 (10.36)	0.04 (0.19)	0.02 (0.19)	0.70* (0.14)	0.12 (0.17)		-0.63* (0.14)	6.84	0.51	1.35	0.04	49.57 61.03
AUSTRALIA	0.13 (0.24)	3.12 (2.27)	-8.95 (11.70)	1.22 (1.77)	0.91 (0.62)	-124.40 (109.6)	0.001 (0.16)		-0.56* (0.17)	1.85	0.13	1.62	1.13	43.37 54.83
JAPAN	-0.08 (0.17)	-0.57 (1.43)	5.04 (6.86)	1.07 (0.82)	-0.93* (0.31)	33.69 (32.42)	0.09 (0.11)		-0.79* (0.16)	4.74	0.40	1.90	0.48	15.21 26.68
DERIVED EFFECTS														
NAFTA														
USA	40.97* (8.61)	0.33* (0.09)	2.61# (1.16)	-4.51* (1.28)	-0.43* (0.03)	16.93* (9.15)	0.04# (0.09)	0.001 (0.06)						
CANADA	65.37 (69.7)	2.93# (1.39)	5.51 (4.46)	-8.16* (2.58)	-0.49 (0.08)	9.46* (2.16)	0.08* (0.02)	0.071 (0.11)						
MEXICO	156.39* (30.11)	11.99* (3.69)	12.35 (21.45)	-0.47 (3.62)	0.55# (0.27)	31.76 (50.67)	-0.30 (0.91)	0.05 (0.55)						
EU														
UK	10.27* (3.01)	1.15* (0.18)	0.77 (1.62)	-0.37* (0.03)	-0.59* (0.04)	-41.93# (18.53)	0.09* (0.001)	-0.04 (0.16)						
IRELAND	70.61*	0.37	0.76	-0.17	-3.74	0.05	-0.12	0.15						

	(22.47)	(1.67)	(1.77)	(0.44)	(3.95)	(0.25)	(0.18)	(0.22)
HOLLAND	8.93[#] (4.03)	1.20* (0.08)	0.78* (0.08)	-1.24^ (0.70)	-0.18* (0.01)	-0.11 (0.04)	0.32* (0.09)	-0.11 (0.14)
Y-VAR	C	GDP	POP	PRICE	RER	ERV	STR	PTA
BELGIUM	9.07* (2.22)	1.86 (1.42)	0.30 (4.76)	-2.45[#] (1.15)	-0.02 (0.15)	-23.39^ (15.97)	-0.44 (0.88)	-0.18 (0.18)
LUX	16.74* (5.91)	2.20[#] (0.97)	1.34 (4.53)	-1.45^ (0.95)	-0.07 (0.16)	-177.42 (181.9)	1.18* (0.30)	-0.19 (0.15)
FRANCE	41.07 (65.2)	1.00* (0.08)	2.74 (6.10)	-1.24 (1.07)	-0.002 (1.31)	-41.7 (47.0)	2.18* (0.27)	-0.16 (0.11)
SPAIN	48.72* (19.1)	-0.38 (0.90)	2.95 (8.12)	-1.33^ (0.70)	-0.54 (1.31)	13.07 (17.06)	0.53 (0.54)	-0.17 (0.22)
PORTUGAL	58.45 (82.66)	0.42* (0.04)	3.32 (3.44)	-0.90 (0.55)	-1.84 (4.01)	-59.23^ (32.26)	2.09* (0.56)	-0.14 (0.35)
GERMANY	21.02 (15.49)	0.87* (0.07)	1.43 (0.93)	-3.11[#] (1.45)	-0.74* (0.14)	-62.05* (8.09)	0.09 (0.11)	-0.15 (0.10)
AUSTRIA	18.13 (40.25)	0.32 (0.90)	1.32 (3.11)	-1.68* (0.31)	-0.66 (2.19)	-129.7 (122.9)	0.30 (1.04)	-0.12 (-0.12)
ITALY	6.83 (7.57)	0.19 (1.33)	0.50 (3.06)	-0.55 (0.56)	-2.05 (2.59)	-61.6 (77.2)	0.27 (3.15)	-0.10 (0.12)
FINLAND	36.85 (45.97)	3.51* (1.10)	3.19 (4.08)	-0.16 (0.58)	-0.63 (1.09)	379.4^ (225.4)	0.05 (0.26)	0.18 (0.72)
SWEDEN	37.20^ (22.4)	1.93 (4.00)	2.76 (2.68)	-0.33 (0.57)	-0.35 (0.53)	-147.5 (94.25)	-0.24 (0.63)	0.07 (0.12)
DENMARK	20.06 (44.22)	0.97 (0.82)	1.49 (2.40)	-0.43 (0.86)	-0.09 (0.18)	-90.17 (171.9)	0.19* (0.02)	0.02 (0.66)
NORWAY	157.4* (17.8)	2.79[#] (1.26)	10.51^ (6.61)	-2.81 (1.90)	-7.22* (0.38)	-88.7* (28.65)	0.44* (0.05)	
SWISS	4.23 (13.16)	0.32 (0.66)	0.68 (1.02)	-1.79 (2.22)	-1.09 (2.44)	-94.7* (26.83)	0.001 (0.09)	
SADC								
DRC	38.05*	7.01	4.07	0.16	-0.81	-0.06	1.53	1.30*

	(13.61)	(6.57)	(9.97)	(1.03)	(0.55)	(0.17)	(7.64)	(0.28)
ZAMBIA	311.58[#] (158.56)	8.80 (13.75)	21.16* (9.19)	-1.03^ (0.64)	-1.92 (0.70)	18.4[#] (9.99)	1.56 (2.18)	0.52* (0.12)
MALAWI	66.15 (57.63)	0.74 (0.92)	-4.04 (2.74)	0.0002 (0.10)	-0.32 (0.72)	8.50 (12.77)	0.02 (0.20)	0.11* (0.02)
MAURITIUS	22.69* (9.25)	4.82* (1.66)	2.48 (7.02)	0.13 (1.45)	-0.56 (4.39)	19.38 (51.89)	0.27 (0.85)	0.37* (0.07)
SYCHELLES	26.61 (37.71)	0.59 (2.75)	1.65 (2.45)	-1.13 (3.15)	-0.69 (1.11)	-50.09 (42.53)	0.26 (0.40)	0.17* (0.03)
ASEAN								
THAILAND	-430.7 (704.1)	12.56 (12.13)	29.69 (27.72)	-4.79* (1.91)	-0.80 (3.00)	-34.66 (27.46)	2.94 (3.53)	-1.30 (7.61)
MALAYSIA	60.10* (13.72)	4.08 9.91	4.37 9.29	0.95 5.43	1.48 2.60	64.30 170.3	5.03 13.25	-0.03 0.37
PHILLIPINES	68.49* (20.34)	0.65 (1.34)	4.29 (25.48)	-0.62 (0.94)	-0.20 (1.07)	-82.42 (114.09)	0.44 (0.62)	-0.18 (0.33)
INDONESIA	358.11 (428.5)	8.04 (7.47)	24.38 (18.23)	-3.16^ (1.47)	-2.04 (1.60)	-3.15 (5.91)	0.95 (1.94)	-0.66 (1.19)
OTHERS								
TURKEY	91.55 (66.72)	4.94[#] (2.25)	-6.86 (9.97)	-0.31 (0.65)	1.78 (1.24)	-3.55 (69.48)	0.49 (0.66)	
ISRAEL	59.7 (48.81)	0.11 (0.65)	3.52 (2.15)	0.03 (0.06)	-0.96 (1.88)	192.37 (23.04)	0.25 (0.24)	
SAUDI-A	89.09* (9.22)	5.00* (1.69)	8.63 (47.68)	18.10^ (11.23)	-5.02* (1.25)	719.3[*] (31.68)	-4.97 (20.17)	
CHINA	70.05[#] (35.23)	5.56* (2.34)	5.94* (1.75)	-2.11 (1.38)	0.13 (0.38)	9.58 (48.26)	-1.00 (1.52)	
TAIWAN	38.44 (55.50)	1.21 (3.25)	2.43 (6.84)	1.15^ (0.56)	0.08 (0.39)	-3.92 (48.30)	-0.27 (0.31)	
INDIA	555.8 (428.7)	-3.11 (8.68)	32.58* (2.27)	8.71^ (4.97)	-1.04 (3.58)	-29.24 (23.79)	-5.86^ (3.18)	
PAKISTA	30.82	2.49	2.67	-1.14	-0.63	32.60[#]	0.29	

N	(58.15)	(13.94)	(3.32)	(4.54)	(2.03)	(13.02)	(0.41)	
SRI-LANKA	30.15 (33.35)	0.28 (1.05)	1.66 (2.43)	-0.17 (0.38)	-0.44* (0.40)	5.25 (5.03)	-0.20 (0.22)	
COLOMBIA	57.79 (38.66)	8.14 (10.32)	1.10 (1.35)	0.69 (1.90)	0.84 (0.83)	-29.12* (9.32)	-1.16 (1.57)	
BRAZIL	22.64 (26.24)	1.27 (3.05)	1.05 (2.09)	0.0001 (0.01)	-0.15 (0.24)	3.64 (8.99)	0.04 (0.19)	
ARGENTINA	112.32 (162.51)	1.14 (6.97)	-6.95 (17.88)	0.01 (0.09)	-0.17 (0.29)	-1.08^ (0.56)	-0.39 (0.80)	
NZ	3.01 (14.82)	1.05 (0.94)	0.07 (1.08)	-0.14 (0.71)	-0.04 (0.46)	-0.44* (0.19)	-0.53 (0.76)	
AUSTRALIA	7.65 (25.91)	1.69* (0.38)	0.80 (1.69)	-0.09 (0.45)	-0.10 (0.29)	11.825 (14.66)	-0.52 (80.24)	
JAPAN	11.17 (19.66)	-0.91 (2.35)	0.16 (2.35)	-1.28* (1.01)	-1.41 (0.25)	-2.59 (7.31)	0.03 (0.14)	

INDEX :
**** significant at 1% level***
 # significant at 5% level
^ significant at 10% level
N=40
Standard errors in parenthesis

Table 2.7. Results for South Africa's Exports

	LONG-RUN ESTIMATES									MODEL FITNESS				
Y-VAR	**C**	**GDP**	**POP**	**PRICE**	**RER**	**ERV**	**STR**	**PTA**	**ε_{ECM}**	**F**	**R^2**	**DW**	**ARCH(1)**	**AIC /SBC**
MODEL IN LEVELS														
NAFTA														
USA	-33.39* (13.19)	-4.33 (2.79)	-19.59 (7.96)	0.54 (0.32)	0.02 (0.41)	80.69 (64.31)	-0.40 (0.30)	-0.63 (0.16)		37.2	0.87	2.16	0.61	65.41 78.42
CANADA	-52.32* (13.88)	-0.15 (1.74)	-31.13 (8.79)	-2.36* (0.48)	2.92 (0.45)	-47.63 (379.7)	-1.26 (0.23)	-0.34 (0.14)		55.5	0.90	2.24	1.39	32.30 43.7
MEXICO	-29.77 (36.18)	6.42 (4.54)	-0.08 (21.68)	-2.40 (3.16)	0.11 (1.08)	12.38 (29.40)	-0.77 (0.94)	-0.01 (0.66)		1.77	0.12	1.99	-0.26	157.14 168.6
EU														
UK	-15.43 (18.47)	-0.02 (1.72)	-9.06 (10.84)	0.15 (0.22)	0.07 (0.40)	50.88 (56.72)	-0.12 (0.18)	-0.53 (0.22)		26.26	0.82	2.04	-0.96	35.60 43.52
IRELAND	- 118.52* (24.63)	-0.81 (0.53)	-7.89 (1.72)	-0.31* (0.15)	0.36 (0.28)	142.5 (212.4)	-0.31 (0.20)	-0.22 (0.22)		90.2	0.94	2.10	-0.51	28.13 39.6
HOLLAND	-63.71* (11.49)	-8.45 (1.59)	-41.96 (7.37)	0.30 (0.62)	0.11 (0.27)	0.04 (0.02)	-0.82 (0.25)	-0.20 (0.10)		158.6	0.96	2.10	-0.51	28.13 39.6
BELGIUM	-31.34* (15.80)	-3.87 (1.23)	-0.94 (9.96)	-0.11 (0.23)	0.48 (0.26)	20.37 (16.02)	-0.22 (0.20)	-0.07 (0.10)		67.6	0.92	1.89	1.06	33.84 45.30
LUX	-10.23 (10.68)	-2.42 (2.29)	-7.71 (8.57)	1.84 (0.51)	0.15 (0.72)	38.19 (45.26)	-0.38 (0.71)	-0.11 (0.27)		7.31	0.53	1.90	2.55	115.6 127.2
FRANCE	-11.15 (18.29)	-1.06 (2.45)	-6.18 (10.94)	-1.10* (0.30)	3.29 (2.39)	35.4 (35.6)	-0.29 (0.26)	-0.15 (0.11)		76.5	0.94	1.56	-0.31	27.95 41.05
SPAIN	- 130.14* (41.25)	-0.22 (1.12)	-7.82 (2.56)	0.47 (0.19)	0.69 (1.80)	79.06 (124.1)	-0.05 (0.24)	-0.001 (0.11)		122.6	0.95	1.87	-0.09	30.03 41.4
PORTUGAL	-	-2.21	-12.63	0.08	2.82	78.72	-0.92*	-0.08		61.57	0.91	1.94	-0.52	64.15

	215.13* (59.28)	(1.38)	(3.90)	(0.34)	(2.39)	(35.57)	(0.20)	(0.15)						75.6
GERMANY	-147.6^ (79.54)	7.31^ (2.10)	-10.92 (4.15)	0.56 (0.38)	27.24 (15.22)	-0.13 (0.19)	-0.03 (0.11)	-0.04 (0.54)		47.9	0.89	2.09	-0.51	40.84 52.3
AUSTRIA	-33.83 (46.71)	5.69* (1.04)	-4.07 (2.88)	0.32 (0.22)	3.29 (1.69)	25.92^ (14.9)	-0.62 (0.17)	-0.04 (0.09)		95.8	0.94	1.89	-0.606	23.83 35.29
ITALY	-29.52 (260.53)	11.06* (3.79)	-7.17 (16.01)	0.88 (0.56)	14.08 (4.94)	12.86 (13.4)	-1.14 (0.23)	-0.07 (0.16)		59.3	0.91	1.87	0.94	71.8 83.3
FINLAND	- 308.82^ (165.09)	12.29* (5.00)	-198.28 (108.04)	9.14 (3.56)	2.44 (2.06)	-27.99* (11.14)	-0.85 (1.29)	-0.63 (0.68)		4.36	0.38	1.86	3.07	176.7 188.25
SWEDEN	85.81# (41.44)	30.18* (5.14)	-63.71 (25.77)	3.65 (1.21)	3.93 (1.25)	775.4 (530.8)	-0.91 (0.99)	-0.76 (0.71)		6.39	0.53	1.95	0.86	171.2 184.3
DENMARK	-28.92 (66.02)	33.77* (12.98)	-13.74 (44.72)	6.60 (1.47)	4.80 (1.80)	480.8 (1265.8)	-0.13 (1.61)	-0.72 (0.71)		15.15	0.72	1.82	1.04	141.7 153.1
NORWAY	-134.1 (135.6)	9.53* (1.13)	-6.18 (9.10)	2.40 (0.30)	0.49 (0.43)	-1220.2 (836.1)	-0.32 (0.31)			51.1	0.88	1.94	-0.33	41.13 5.09
SWISS	-58.29 (126.4)	-0.68 (2.99)	-3.97 (8.84)	1.37 (0.27)	0.26 (1.63)	52.5 (43.2)	-1.18 (0.38)			56.9	0.89	2.04	-0.12	83.51 93.34
SADC														
DRC	-377.7* (133.73)	-9.13 (2.46)	-24.99 (8.46)	2.94 (1.57)	1.45 (0.53)	-0.15^ (0.09)	-3.42 (1.21)	-1.67 (0.47)		14.74	0.71	1.95	1.53	138.7 150.3
ZAMBIA	-87.4^ (49.11)	2.08 (1.67)	-5.52 (3.45)	1.55 (0.78)	0.67 (0.26)	-15.25* (5.18)	-0.53 (0.27)	-0.07 (0.14)		30.42	0.84	2.13	0.01	51.72 63.19
MALAWI	-157.5* (37.25)	2.82* (0.83)	-10.56 (2.47)	3.73 (0.61)	0.63 (0.49)	5.19 (20.4)	-0.84 (0.38)	-0.43 (0.20)		72.2	0.92	1.59	1.81	71.51 83.15
MAURITIUS	-78.38 (58.14)	-0.30 (0.80)	-6.39 (4.31)	0.77 (0.37)	2.50 (0.52)	97.47 (102.5)	-0.17 (0.25)	-0.03 (0.15)		87.6	0.94	1.60	-0.62	55.26 66.72
SYCHELLES	-5.68 (47.38)	-0.16 (0.97)	-0.91 (0.97)	0.17 (0.40)	1.26 (0.60)	73.1 (57.8)	-0.19 (0.21)	-0.25 (0.12)		52.9	0.92	1.88	-0.92	14.03 23.36
ASEAN														
THAILAND	-421.71 (332.5)	-17.57 (7.05)	-20.84 (19.23)	14.71 (4.70)	6.50 (4.08)	-11.38 (17.93)	-4.08 (1.51)	-0.20 (0.91)		7.24	0.52	2.00	0.87	193.9 205.6

MALAYSIA	-259.8 (192.7)	-4.10 (5.08)	-16.87 (12.37)	1.68 (3.25)	0.18 (4.23)	-28.44 (26.25)	-4.79 (1.97)	-0.18 (0.56)		14.55	0.71	1.94	1.307	176.3 187.7
PHILLIPINES	-198.6 (311.8)	-6.59 (5.29)	-12.83 (18.84)	1.70 (3.15)	0.18 (2.48)	96.61 (63.04)	-4.23 (1.27)	-1.06 (0.60)		12.11	0.67	2.00	-0.35	170.3 181.8
INDONESIA	-350.4* (104.4)	-2.92 (0.94)	-19.42 (5.67)	1.28 (0.86)	0.13 (0.30)	0.33 (0.77)	-2.72 (0.31)	-0.19 (0.12)		318.7	0.98	1.87	1.68	39.76 51.22
OTHERS														
TURKEY	-170.52 (273.9)	5.47 (5.15)	-8.43 (14.61)	1.51 (2.03)	1.45 (1.22)	23.67 (199.9)	-1.21 (0.68)			27.75	0.80	2.06	-0.15	161.7 171.7
ISRAEL	-143.8* (48.08)	-5.62 (1.89)	-11.13 (3.61)	1.27 (0.35)	3.07 (0.54)	-66.73# (30.23)	-0.47 (0.33)			88.5	0.93	2.07	0.11	70.5 80.5
SAUDI-A	-41.72 (108.8)	-3.50 (2.30)	-3.69 (7.55)	1.54 (1.53)	7.46 (5.24)	-118.6 (200.8)	-5.69 (0.62)			41.71	0.86	2.03	-0.27	15.3 16.3
CHINA	-208.8* (104.9)	-2.15 (0.51)	-9.84 (5.09)	1.46 (0.99)	1.00 (0.52)	-6.80 (10.50)	-2.02 (0.28)			298.1	0.97	2.03	1.94	67.86 77.84
TAIWAN	-470.5* (75.49)	-1.60 (1.74)	-29.19 (4.79)	0.76 (0.92)	1.17 (0.93)	-20.69 (115.9)	-0.09 (0.47)			100.6	0.93	1.82	-0.40	97.5 107.5
INDIA	-112.68 (328.8)	-3.99 (2.54)	-6.59 (16.52)	1.03 (2.98)	0.49 (2.81)	-13.82 (16.23)	-2.39 (0.80)			53.6	0.89	2.10	-0.09	144.7 154.5
BRAZIL	-87.73 (202.7)	-5.45 (2.34)	-3.10 (11.78)	1.44 (1.42)	1.85 (0.59)	11.51 (25.79)	-0.35 (0.40)			36.37	0.84	1.96	-0.55	113.5 122.9
ARGENTINA	-370.9* (125.72)	-2.51 (1.28)	-22.65 (7.63)	0.64 (0.25)	1.52 (0.89)	-0.04 (0.44)	0.17 (0.34)			30.91	0.85	1.77	-0.64	93.6 103.4
NZ	-258.3* (78.58)	-1.51 (1.96)	-17.85 (5.68)	0.75 (0.26)	0.58 (0.31)	-0.67# (0.30)	-0.42 (0.31)			36.12	0.84	2.10	0.59	75.55 85.53
AUSTRALIA	-391.3* (99.73)	-0.48 (2.36)	-23.97 (6.65)	2.41 (0.53)	1.45 (0.54)	12.41 (191.8)	-0.09 (0.35)			79.73	0.92	1.61	-0.94	57.31 67.29
JAPAN	-213.5* (62.36)	-1.52 (1.32)	-11.12 (3.72)	0.26 (0.28)	0.45 (0.28)	57.02 (57.71)	-0.03 (0.16)			94.6	0.93	1.69	0.97	29.28 39.26
ERROR CORRECTION MODEL (ECM)														
NAFTA														
USA	0.51^ (0.33)	-0.24 (1.76)	-54.18 (29.9)	1.04 (1.32)	0.22 (0.29)	2.69 (26.98)	0.07 (0.20)	0.04 (0.09)	-0.22* (0.13)	0.71	-0.06	1.34	0.13	25.58 40.08

CANADA	0.42 (0.33)	1.98 (2.72)	-0.86 (21.11)	3.25^ (1.63)	-2.42* (0.96)	1104.6 (2652.9)	-0.09 (0.24)	-0.06 (0.11)	-0.82* (0.22)	1.21	0.08	2.42	0.81	32.30 43.76
MEXICO	-1.28 (2.43)	4.72 (6.65)	41.99 (74.68)	0.92 (9.03)	-0.88 (1.63)	12.59 (20.71)	0.55 (1.34)	0.002 (0.51)	-0.81* (0.20)	2.65	0.26	2.04	-0.29	156.9 169.8
EU														
UK	0.30^ (0.18)	-20.29 (25.75)	-1.69 (1.31)	0.85 (1.13)	86.87 (329.1)	-0.09 (0.11)	0.11 (0.13)	-0.77 (1.27)	-0.42* (0.16)	0.63	0.07	2.56	3.02	170.7 28.34
IRELAND	-0.07 (0.33)	-2.34 (2.36)	13.00 (9.68)	0.88 (1.13)	-0.44 (0.50)	37.34 (161.4)	0.23 (0.18)	-0.19 (0.22)	-0.65* (0.24)	0.92	0.01	2.29	-0.18	43.58 54.47
HOLLAND	-0.17 (0.14)	-0.75 (2.19)	30.20 (20.51)	1.68 (2.34)	1.15 (0.75)	0.001 (0.01)	0.18 (0.12)	0.06 (0.08)	-0.66* (0.09)	1.28	0.05	2.87	0.33	18.69 31.5
BELGIUM	0.02 (0.19)	0.03 (1.79)	-10.91 (26.67)	0.75 (1.21)	0.07 (0.28)	51.65 (87.27)	0.02 (0.11)	0.07 (0.07)	-0.55* (0.16)	2.14	0.19	2.08	-0.0	11.39 24.28
LUX	-0.08 (0.43)	-2.60 (2.48)	10.58 (19.55)	1.56 (2.97)	0.29 (0.76)	5.93 (238.3)	-0.35 (0.27)	0.38# (0.18)	-0.35* (0.16)	2.51	0.24	2.43	2.89	88.88 109.9
FRANCE	-0.06 (0.23)	-0.62 (2.50)	-13.55 (24.90)	0.31 (1.24)	13.14 (6.03)	246.7 (183.0)	0.20 (0.13)	0.04 (0.08)	-0.62* (0.05)	2.39	0.25	2.16	0.26	18.33 32.83
SPAIN	-0.01 (0.17)	8.61 (9.69)	0.56 (1.24)	1.53 (2.11)	21.4 (74.3)	0.0001 (0.12)	0.14 (2.16)	0.02 (0.08)	-0.69* (0.18)	2.56	0.22	2.01	-0.42	22.49 33.77
PORTUGAL	-0.05 (0.25)	1.71 (1.99)	7.13 (8.73)	0.84 (1.83)	4.41 (3.09)	60.10 (182.1)	-0.05 (0.18)	0.16 (0.12)	-0.48* (0.18)	2.23	0.21	1.89	0.03	48.72 61.6
GERMANY	0.18 (0.14)	-0.24 (1.99)	-11.38 (9.49)	-0.60 (1.08)	0.23 (1.57)	30.10 (66.5)	-0.08 (0.11)	0.05 (0.07)	-0.37* (0.16)	0.80	-0.04	1.61	-0.65	9.45 22.3
AUSTRIA	0.02 (0.16)	2.54 (1.94)	0.93 (9.24)	0.12 (1.17)	5.35 (4.87)	14.8^ (8.74)	-0.04 (0.11)	0.05 (0.08)	-0.31* (0.07)	0.82	-0.03	2.57	0.015	18.72 31.6
ITALY	-0.26 (0.22)	-0.49 (2.32)	27.05 (21.66)	2.85 (1.63)	4.35 (9.68)	-60.8 (48.3)	0.08 (0.16)	0.10 (0.10)	-0.82* (0.36)	0.93	-0.01	1.54	2.49	30.40 43.29
FINLAND	1.37 (1.62)	3.77 (13.16)	101.3 (193.8)	-15.85 (11.91)	2.38 (10.48)	-3162.9* (854.3)	-0.94 (1.08)	-0.02 (0.77)	-0.68* (0.24)	2.14	0.19	2.20	0.94	185.1 198.3
SWEDEN	0.97 (0.64)	20.53* (6.78)	-21.4 (5.78)	-4.83 (4.55)	3.23 (1.26)	1169.9* (258.1)	-0.71^ (0.44)	-0.06 (0.29)	-0.54* (0.16)	7.09	0.56	1.80	0.55	115.1 127.9

DENMARK	0.20 (1.76)	7.15 (14.17)	72.38 (147.6)	-5.52 (11.5)	3.16 (2.36)	197.4 (722.2)	-0.20 (0.88)	-0.03 (0.51)	-0.48* (0.17)	1.36	0.08	1.78	1.13	157.9 172.4
NORWAY	0.08 (0.44)	5.22^ (2.96)	15.28 (40.91)	-2.20 (2.09)	0.43 (0.56)	-766.2 (498.9)	-0.08 (0.20)		0.91* (0.19)	5.05	0.43	2.00	-0.42	40.51 51.7
SWISS	0.21 (0.30)	-2.33 (3.22)	9.90 (15.39)	-0.18 (2.38)	2.76 (2.21)	-80.28 (245.6)	-0.18 (0.20)		-0.53* (0.07)	1.93	0.14	1.48	-0.42	68.54 79.82
SADC														
DRC	-0.71 (1.04)	-3.46 (3.10)	17.49 (30.66)	3.42 (5.39)	-0.72 (0.65)	-0.07 (0.08)	1.21^ (0.74)	-0.48 (0.35)	-0.38* (0.17)	1.02	0.005	1.58	1.24	130.1 143.2
ZAMBIA	0.83 (0.54)	0.22 (1.18)	-23.62 (19.7)	-0.60 (1.80)	0.36 (0.28)	-9.52* (3.12)	0.03 (0.22)	-0.04 (0.10)	-0.74* (0.18)	3.21	0.32	1.45	-0.45	38.34 51.23
MALAWI	0.67* (0.18)	0.58 (0.77)	-12.68 (3.61)	-0.42 (1.51)	0.75 (0.27)	-15.72* (6.64)	-0.11 (0.18)	-0.13 (0.07)	-0.22* (0.04)	4.07	0.39	2.15	-0.34	17.99 31.09
MAURITIUS	-0.49# (0.22)	0.48 (0.64)	29.52* (10.73)	2.07 (1.06)	-0.35 (0.37)	776.7* (331.4)	0.06 (0.15)	0.03 (0.06)	-0.53* (0.12)	3.92	0.38	1.58	-0.74	5.09 17.98
SYCHELLES	-0.27 (0.24)	0.72 (0.54)	13.12 8.47)	1.18 (1.26)	-0.05 (0.49)	396.8 (288.9)	-0.16 (0.11)	0.08 (0.07)	-0.71* (0.17)	3.61	0.43	1.56	-0.67	-5.09 5.26
ASEAN														
THAILAND	-0.76 (2.59)	6.64 (7.06)	49.18 (77.04)	-6.95 (11.14)	-0.58 (4.23)	-1798.8 (1382.2)	0.28 (1.46)	0.25 (0.55)	-0.86* (0.18)	3.45	0.34	2.42	0.35	177.8 190.9
MALAYSIA	1.05 (2.38)	-8.92 (8.68)	45.06 (85.16)	-14.81 (11.46)	9.82 (4.02)	-381.2# (181.6)	-0.87 (1.15)	0.14 (0.37)	-0.75* (1.19)	3.79	0.37	2.13	1.45	174.1 187.0
PHILLIPINES	0.93 (4.60)	-3.67 (6.64)	41.26 (159.6)	-17.25 (9.01)	8.01 (2.68)	387.3 (361.2)	-1.22 (0.86)	0.30 (0.42)	-0.90* (0.18)	3.83	0.38	2.05	0.002	157.4 170.3
INDONESIA	-2.88* (1.10)	0.71 (1.68)	135.5* (50.21)	1.20 (1.93)	1.76 (0.30)	0.52 (0.59)	0.86* (0.28)	0.20# (0.10)	-0.79* (0.22)	10.07	0.66	1.33	-0.69	51.07 63.9
OTHERS														
TURKEY	-0.45 (1.62)	1.93 (4.26)	-31.13 (70.18)	11.10 (6.35)	0.38 (1.40)	126.3 (117.2)	0.40 (0.66)		-0.78*	3.45	0.31	2.17	-0.01	148.6 160.8

									(0.16)					
ISRAEL	0.58# (0.32)	-1.70 (2.05)	-9.33 (8.75)	-0.98 (1.79)	-0.12 (0.71)	-145.5 (168.5)	-0.28^ (0.15)		-0.38* (0.19)	2.02	0.15	1.84	-0.21	43.11 54.6
SAUDI-A	-0.78 (1.03)	2.10 (3.63)	-10.97 (15.20)	9.02 (7.21)	5.38 (6.12)	-675.8 (2832.4)	0.88 (0.64)		-0.97* (0.19)	4.51	0.39	2.15	0.26	149.5 160.9
CHINA	0.31 (0.62)	1.01 (2.11)	-1.03 (20.49)	-1.96 (2.92)	-0.36 (0.74)	-0.04 (9.44)	-0.05 (0.37)		-0.43* (0.25)	0.94	0.09	1.54	1.47	79.8 91.3
TAIWAN	-0.06 (0.38)	-0.96 (1.28)	32.21* (14.92)	-0.63 (2.27)	1.09 (0.92)	27.7 (55.37)	-0.08 (0.25)		-0.82* (0.16)	5.08	0.43	1.99	-0.20	133.6 144.9
INDIA	-1.59# (0.79)	6.63 (5.99)	2.50 (5.05)	11.36 (5.88)	2.18 (2.54)	-740.5 (923.8)	1.01# (0.49)		-0.82* (0.15)	2.68	0.23	1.91	-0.43	72.48 83.94
BRAZIL	0.61 (0.73)	-2.00 (2.47)	24.5 (27.13)	-7.84 (3.40)	2.87 (0.79)	-11.57 (13.58)	-0.49 (0.37)		-0.76* (0.17)	3.64	0.33	2.35	-0.45	83.9 95.16
ARGENTINA	0.34 (0.73)	-2.94 (1.32)	18.66 (44.23)	-0.40 (0.18)	-3.73 (2.56)	0.13 (0.24)	-0.22 (0.30)		-0.38* (0.16)	2.24	0.19	1.82	-0.72	73.88 85.16
NZ	-0.19 (0.31)	-5.54 (2.71)	3.00 (11.62)	2.77 (2.25)	0.56 (0.21)	-0.23^ (0.17)	0.26 (0.17)		-0.93* (-0.18)	5.22	0.43	1.85	1.17	58.31 69.78
AUSTRALIA	-0.32 (0.32)	0.91 (2.69)	18.13 (14.75)	0.93 (1.46)	0.76 (0.49)	-85.65 (98.91)	0.20 (0.13)		-0.44* (0.15)	1.61	0.10	1.65	-1.15	33.93 45.39
JAPAN	-0.09 (0.15)	3.75* (1.32)	-1.76 (8.91)	0.40 (0.95)	-0.33 (0.25)	43.11^ (26.00)	0.08 (0.10)		-0.55* (0.16)	2.75	0.24	1.47	1.87	2.75 14.21
DERIVED EFFECTS														

NAFTA								
USA	74.75* (5.63)	0.97* (0.07)	4.39 (3.01)	-0.12* (0.07)	-0.01 (0.09)	-18.07* (1.81)	0.09 (0.28)	0.14 (2.69)
CANADA	43.43* (3.59)	0.12 (1.46)	25.83* (6.24)	-1.96* (0.06)	-2.42* (1.04)	39.52* (3.15)	0.12* (0.03)	0.28 (0.54)
MEXICO	25.76* (3.16)	5.56 (8.76)	0.07 (18.76)	-2.08 (2.03)	0.10 (0.95)	-10.72* (3.95)	-0.67 (1.83)	0.001 (0.58)
EU								
UK	11.83* (1.59)	1.32* (0.01)	6.95* (1.92)	-0.11 (0.23)	0.05 (0.73)	-38.99* (6.41)	0.09 (0.18)	0.41 (0.70)
IRELAND	77.2* (35.29)	0.53 (0.63)	5.14 (3.99)	-0.20 (0.51)	0.24 (0.33)	92.83# (42.55)	0.20 (0.20)	0.14 (0.22)
HOLLAND	38.18* (3.54)	1.48* (0.51)	2.51* (0.76)	-0.02 (0.04)	-0.01 (0.02)	0.0001 (0.02)	0.05* (0.02)	0.01 (0.02)
BELGIUM	17.37 (21.89)	2.15^ (1.13)	-0.52 (5.67)	-0.06 (0.16)	-0.27 (1.03)	-11.38* (2.17)	1.12* (0.67)	0.04 (0.07)
LUX	36.48 (206.9)	0.86 (1.15)	2.73# (5.89)	-0.65 (1.25)	0.05 (0.29)	-13.56* (5.42)	0.14 (0.27)	0.04 (0.1)
FRANCE	11.87* (4.85)	11.31* (5.75)	65.67 (167.5)	11.72* (4.67)	-34.88* (3.01)	-37.6 (47.1)	3.08* (0.43)	1.55 (3.45)
SPAIN	89.57* (10.28)	0.15 (0.79)	5.39 (12.09)	-0.32 (0.46)	0.47 (2.06)	-54.4* (13.06)	0.04 (0.22)	0.001 (0.08)
PORTUGAL	10.24* (4.95)	1.05 (1.39)	6.00 (7.58)	-0.04 (0.18)	-1.34 (1.48)	-37.4^ (20.35)	0.44 (1.65)	0.04 (0.08)
GERMANY	54.88* (5.42)	2.72 (2.29)	4.06 (3.72)	-0.21* (0.04)	-0.96 (6.75)	-10.13 (23.09)	0.05 (0.10)	0.01 (0.04)
AUSTRIA	14.58 (12.02)	24.54 (19.26)	17.54 (174.9)	-1.38 (13.42)	-14.18* (1.82)	-11.18 (9.18)	2.66* (0.64)	0.19 (0.48)
ITALY	24.22 (21.88)	9.08 (43.3)	5.88 (13.96)	-0.72 (0.62)	-11.55* (2.64)	-10.56 (11.10)	0.93 (1.80)	0.06 (0.14)
FINLAND	20.62 (26.8)	82.1* (28.86)	13.24 (26.33)	- 61.06*	-16.31* (7.34)	-183.4# (89.4)	5.65* (1.79)	4.20 (157.9)

				(5.16)					
SWEDEN	46.65 (38.09)	16.41* (6.10)	34.66# (16.83)	-1.98 (1.98)	-2.14# (1.07)	-42.16 (30.32)	0.49 (0.62)	0.41 (2.08)	
DENMARK	14.17* (3.42)	16.55 (33.4)	6.73 (25.8)	-3.24 (6.77)	-2.35^ (1.17)	-23.5 (106.1)	0.06 (0.84)	0.35 (6.15)	
NORWAY	12.28^ (7.16)	8.68^ (5.03)	5.63 (17.2)	-2.19^ (1.10)	-0.45 (0.70)	11.12 (10.53)	0.30 (0.82)		
SWISS	30.62* (8.06)	0.32 (1.65)	2.08 (5.66)	-0.72 (9.54)	-0.14 (0.86)	-27.6 (87.4)	0.62 (0.69)		
SADC									
DRC	14.89* (2.17)	3.48 (3.26)	9.52 (17.00)	-1.12 (1.86)	0.55 (0.54)	0.06 (0.07)	1.30 (0.93)	0.64* (0.05)	
ZAMBIA	64.79* (5.51)	1.54* (0.41)	-4.09 (4.26)	-1.15 (3.47)	-0.50 (0.43)	11.31# (5.34)	0.39 (3.37)	0.05* (0.01)	
MALAWI	34.92* (12.41)	0.62 (0.84)	2.34* (0.86)	-0.83 (2.95)	-0.14 (0.12)	-1.15 (4.55)	0.19 (0.33)	0.10* (0.03)	
MAURITIUS	41.84 (36.31)	0.16 (0.48)	-3.41 (2.61)	-0.41 (0.29)	-1.33* (0.46)	-52.03 (59.17)	0.09 (0.28)	0.02 (0.09)	
SYCHELLES	4.03 (3.33)	0.11 (0.70)	-0.65 (3.03)	-0.12 (0.31)	-0.89 (8.44)	-51.88 (55.82)	0.14 (0.18)	0.18* (0.03)	
ASEAN									
THAILAND	36.85* (12.62)	15.04 (17.09)	-17.84 (32.43)	-12.58* (2.58)	-5.57 (41.06)	-5.57 (9.45)	3.49 (18.49)	0.17 (0.86)	
MALAYSIA	19.49* (4.61)	3.08 (4.85)	-12.66 (25.67)	-1.26 (2.63)	-0.11 (3.18)	21.32 (22.16)	3.59 (4.98)	-0.13 (0.54)	
PHILLIPINES	17.92^ (9.35)	5.94 (11.77)	-11.58 (47.92)	-1.54 (2.95)	-0.16 (2.24)	-87.19 (99.26)	3.81 (2.92)	-0.96 (1.44)	
INDONESIA	27.39# (13.31)	2.29 (5.50)	-15.26 (7.20)	-1.01 (1.76)	-0.10 (0.24)	-0.26 (0.67)	2.13* (0.73)	-0.15 (0.12)	
OTHERS									
TURKEY	13.32* (5.16)	4.27 (10.24)	-6.59 (18.73)	-1.18 (1.72)	-1.13 (4.27)	-18.49 (23.18)	0.95 (1.67)		

ISRAEL	54.25 (34.96)	2.12 (2.65)	4.20 (4.17)	-0.48 (0.88)	-1.16 (6.84)	25.18 (31.31)	0.81 (0.16)	
SAUDI-A	40.64* (118.69)	3.41 (6.32)	3.59 (8.88)	-1.89 (2.12)	-7.26 (9.71)	11.56 (52.24)	5.44 (3.98)	
CHINA	90.13* (11.27)	0.93 (17.96)	4.25 (66.5)	0.63 (4.55)	-0.43 (9.02)	2.94 (7.19)	0.87 (27.3)	
TAIWAN	27.34# (14.51)	0.81 (1.39)	14.76# (7.25)	0.39 (1.46)	-0.59 (0.69)	10.46 (62.24)	0.05 (0.28)	
INDIA	91.85* (27.18)	3.25 (3.59)	5.39 (17.21)	-0.84 (2.47)	-0.40 (2.34)	11.29 (19.33)	1.96^ (1.15)	
BRAZIL	66.80* (17.33)	4.15 (5.42)	2.36 (9.34)	1.10 (1.18)	-1.41 (0.60)	-8.76 (22.17)	0.27 (0.37)	
ARGENTINA	14.25 (30.77)	0.96 (0.66)	8.70 (20.84)	0.25 (0.15)	-0.59 (0.53)	0.02 (0.17)	0.07 (0.16)	
NZ	23.92 (41.18)	1.40 (2.00)	16.54 (64.28)	0.70 (0.62)	-0.54 (0.36)	0.62 (0.43)	0.39 (0.38)	
AUSTRALIA	17.24 (18.19)	0.21 (1.21)	10.57 (9.09)	1.06 (1.68)	-0.64 (0.48)	-5.47 (8.41)	0.04 (0.16)	
JAPAN	11.77 (19.57)	0.83 (0.79)	6.13 (31.01)	0.14 (0.38)	-0.25 (0.24)	-31.40 (36.99)	0.02 (0.09)	

INDEX :
**** significant at 1% level***
 # significant at 5% level
^ significant at 10% level
N=40
Standard errors in parenthesis

Table 2.8. Levels Model for South Africa's Bilateral Trade

Y-Variable	C	Importer GDP	Exporter PRICE	RER	Importer UNEMP	ERV	AdjR^2	F	DW	ARCH(1)
US←S	-49.9* (13.64) -3.65	-7.44 (1.45) -5.12	1.65 (0.43) 3.76	0.18 (0.26) 0.69	3.05 (2.62) 1.16	0.83 (0.64) 1.28	0.88	42.6^	2.14	0.35
S←US	-6.28 (3.93) -1.59	-0.06 (0.28) -0.23	3.54 (1.27) 2.77	0.3 (0.24) 1.28	10.26 (1.32) 7.73	1.65* (0.23) 7.12	0.90	57.5^	1.85	0.77
AU←S	-2.95 (8.44) -0.34	-0.67 (-0.52) 1.28	1.42 (0.35) 3.83	1.99 (0.27) 7.19	3.80 (4.42) 0.85	-1.02 (1.06) -0.96	0.94	93.7*	1.98	2.77
S←AU	-10.27^ (5.39) -1.90	-0.26 (0.38) -0.67	1.65 (1.20) 1.37	1.59 (0.23) 6.68	1.19 (4.85) 0.24	0.16 (0.76) 0.21	0.92	71.8*	1.83	0.23
JP←S	-14.36* (3.71) -3.86	-1.19 (0.38) -3.10	0.96 (0.57) 1.68	0.11 (0.35) 0.33	2.51 (1.38) 1.81	-1.2# (0.59) -2.08	0.72	15.8#	1.30	0.11
S←JP	-16.94* (-3.87) 4.36	-0.98 (0.12) -8.19	3.77 (1.01) 3.73	0.23 (0.065) 3.61	0.61 (1.45) 0.42	0.07 (0.24) 0.31	0.90	52.18*	1.80	-0.57

INDEX * significant at 1% level
 # significant at 5% level
^ significant at 10% level
All cointergrated except SA-IMPORTS FROM JAPAN
N=28
Standard errors in parenthesis

Table 2.9. ECM Model for South Africa's Bilateral Trade

Y-variable	**C**	**ΔImp-GDP**	**ΔExp-PRICE**	**ΔRER**	**ΔImp-UNEMP**	**ΔERV**	**ε_{t-1}**	**AdjR^2**	**F**	**DW**	**ARCH(1)**
US←S	0.21* (0.08) 2.62	3.99 (1.56) 2.55	-3.08 (0.71) -4.28	0.03 (0.18) 0.20	1.51 (2.58) 0.58	-0.25 (0.62) -0.41	-0.59* (0.15) -3.77	0.51	5.64#	2.63	1.91
S←US	0.16^ (0.09) 1.69	-0.98 (0.59) -1.66	2.74 (1.56) 1.75	-1.16# (0.48) -2.40	-7.73 (2.91) -2.64	1.27* (0.48) 2.62	-0.89* (0.24) -3.69	0.55	6.71^	1.94	0.58
AU←S	0.24# (0.12) 2.02	0.42 (0.45) 0.93	-2.31 (1.00) -2.31	0.53 (0.46) 1.17	7.47 (4.58) 1.62	-2.03^ (1.11) -1.83	-0.76* (0.22) -3.48	0.45	4.78^	1.58	0.55
S←AU	0.26# (0.11) 2.51	-0.10 (0.38) -0.26	-5.93 (1.94) -3.04	0.63 (0.48) 1.31	7.91 (6.20) 1.27	-1.29 (1.02) -1.25	-0.89* (0.22) -4.00	0.38	3.81	1.75	0.36
JP←S	0.12# (0.06) 2.15	-0.03 (0.25) -0.14	-0.71 (0.68) -1.05	0.03 (0.18) 0.15	2.54 (1.11) 2.27	-1.38* (0.51) -2.73	-0.29# (0.13) -2.21	0.29	2.85	2.13	-0.2
S←JP	0.02 (0.04) 0.57	0.52# (0.22) 2.30	-8.94 (2.11) -4.23	0.35 (0.14) 2.38	6.81 (3.07) 2.21	-1.2# (0.51) -2.29	-1.51* (0.24) -6.12	0.78	17.5#	1.95	-0.36

INDEX * significant at 1% level
 # significant at 5% level
^ significant at 10% level
N=27
Standard errors in parenthesis

Table 2.10. Derived Effects on South Africa's Bilateral Trade

Y-Variable	**C**	**Importer-GDP**	**Exporter-PRICE**	**RER**	**Importer-UNEMP**	**ERV**
US←SA	29.49# (13.84) 2.13	4.39# (1.92) 2.28	-0.97* (0.34) -2.83	-0.11 (0.55) -0.19	-1.80* (0.46) 3.91	-0.49# (0.23) 2.13
SA←US	5.63# (4.84) 1.98	0.05 (0.25) 0.23	-3.18 (2.14) -1.48	-0.27 (0.24) -1.13	-9.19* (3.66) -2.51	-1.48# (0.60) 2.46
AU←SA	2.26 (1.59) 1.42	0.52* (0.09) 5.77	-1.09# (0.56) -1.97	-1.53 (1.32) -1.15	-2.92* (0.85) -3.43	0.78 (0.92) 0.85
SA←AU	9.18* (3.05) 3.01	0.23 (0.93) 0.24	-1.48 (1.18) -1.25	-1.42 (1.10) -1.29	-1.07 (4.41) -0.24	-0.14 (0.69) 0.21
JP←SA	4.19^ (2.22) 1.88	0.35 (2.43) 0.14	-0.28 (0.31) -0.89	-0.03 (0.25) -0.13	-0.73* (0.21) -1.41	0.36^ (0.22) 1.66
SA←JP	25.67 (45.33) 0.57	1.49# (0.69) 2.22	-5.72* (2.04) -2.80	-0.36# (0.18) -1.99	-0.94 (2.24) -0.41	-0.11 (0.37) 0.303

INDEX * significant at 1% level
 # significant at 5% level
^ significant at 10% level
Standard errors in parenthesis

Figures

Figure 2.1. S.A. and U.S.A. Bilateral Trade

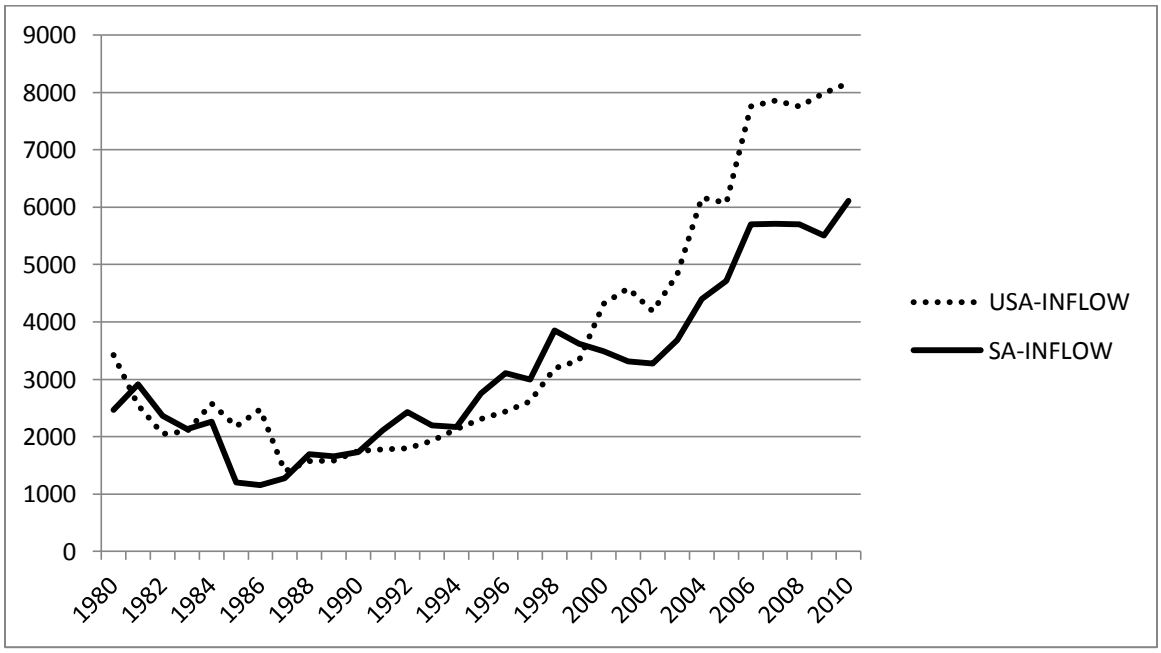


Figure 2.2. S.A. and U.S.A. Unemployment Rates Comparisons

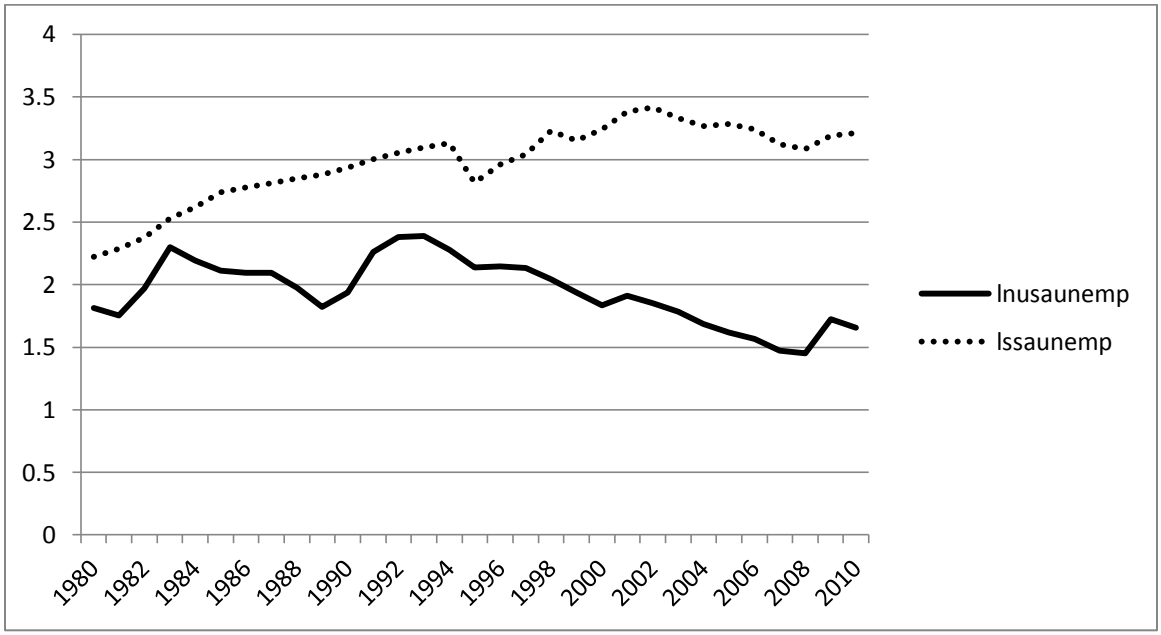


Figure 2.3. S.A. and Australia Bilateral Trade

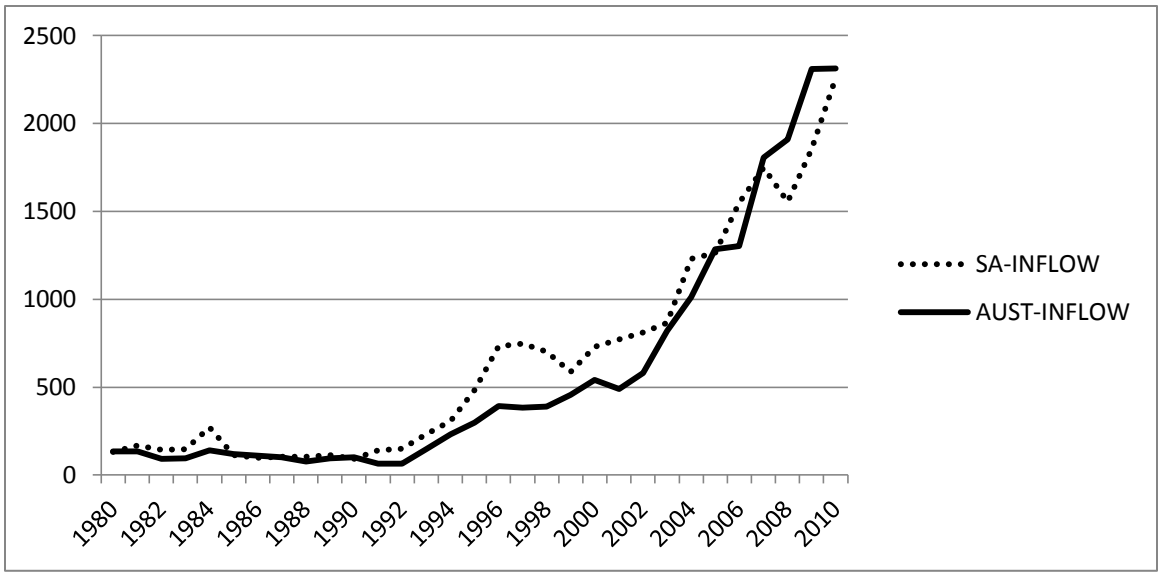


Figure 2.4. S.A. and Australia Unemployment Rates

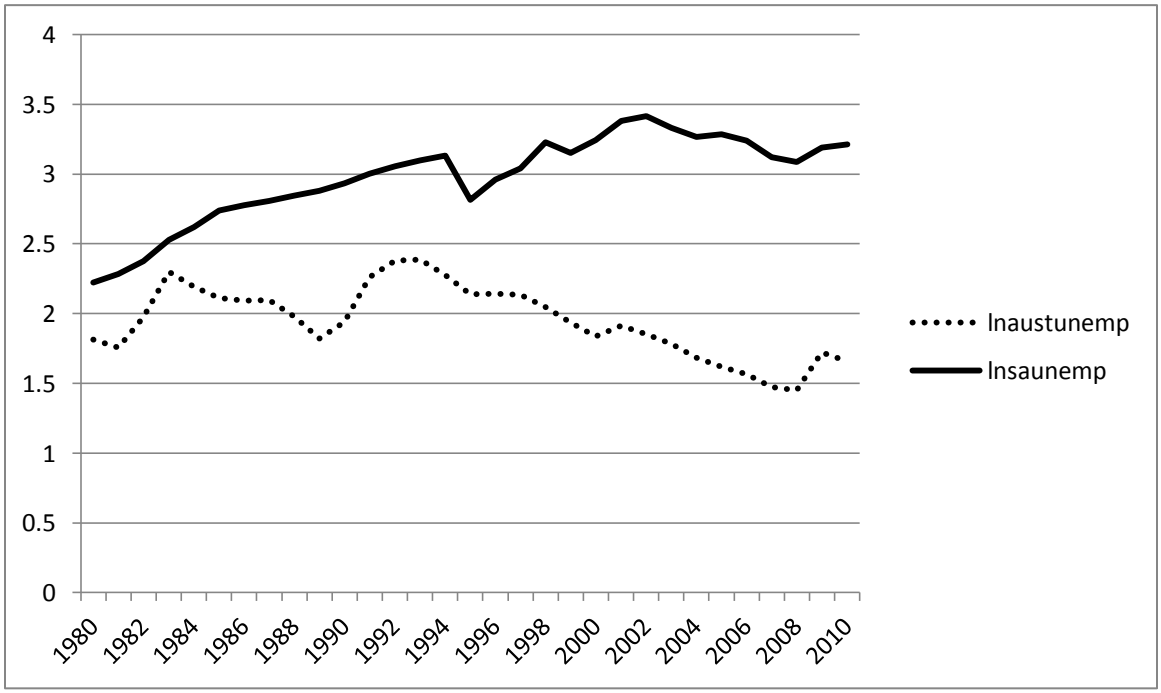


Figure 2.5. S.A. and Taiwan Bilateral Trade Flows

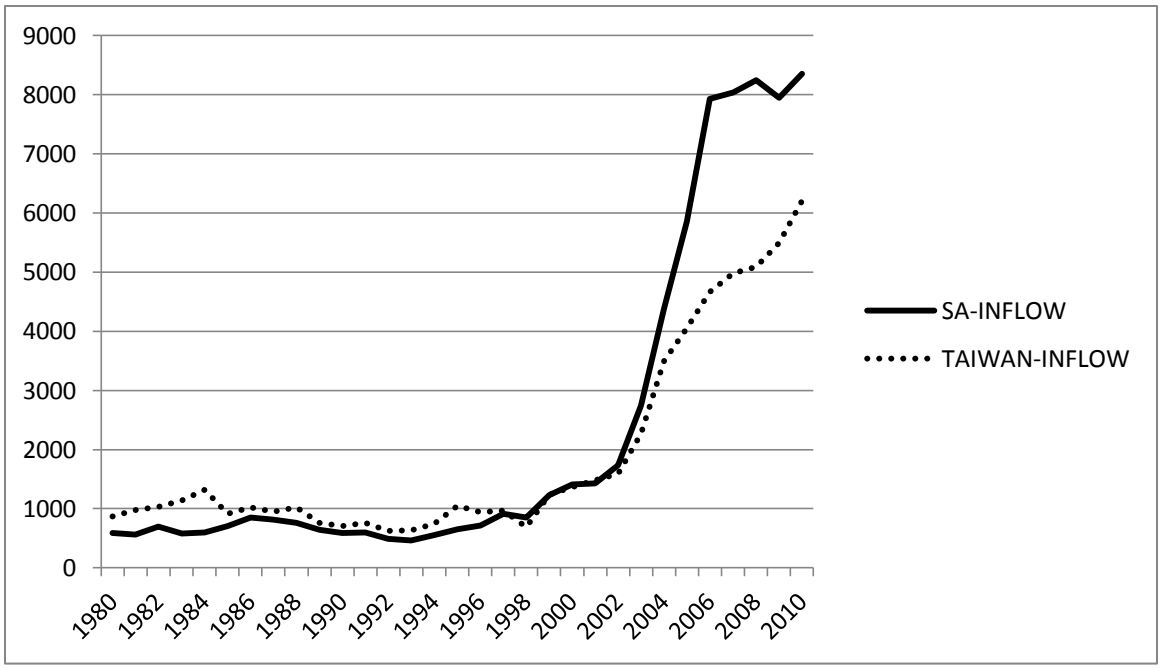


Figure 2.6. Comparing Unemployment Rates between S.A. and Taiwan

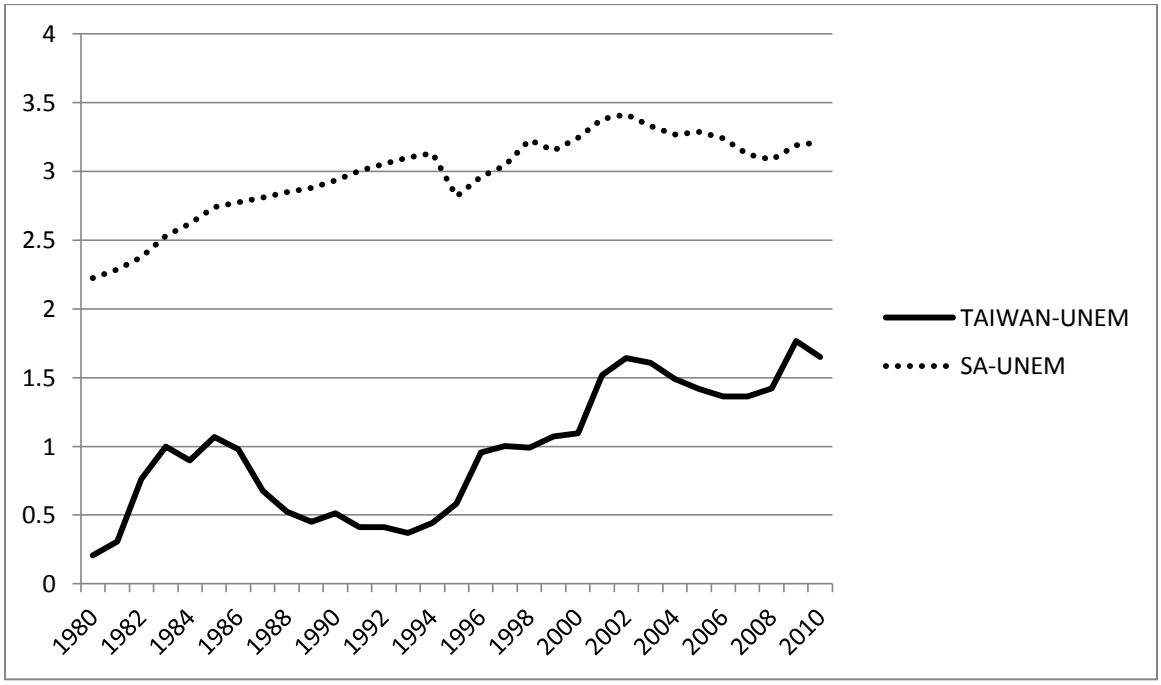


Figure 2.7. S.A. and Japan Bilateral Trade Flows

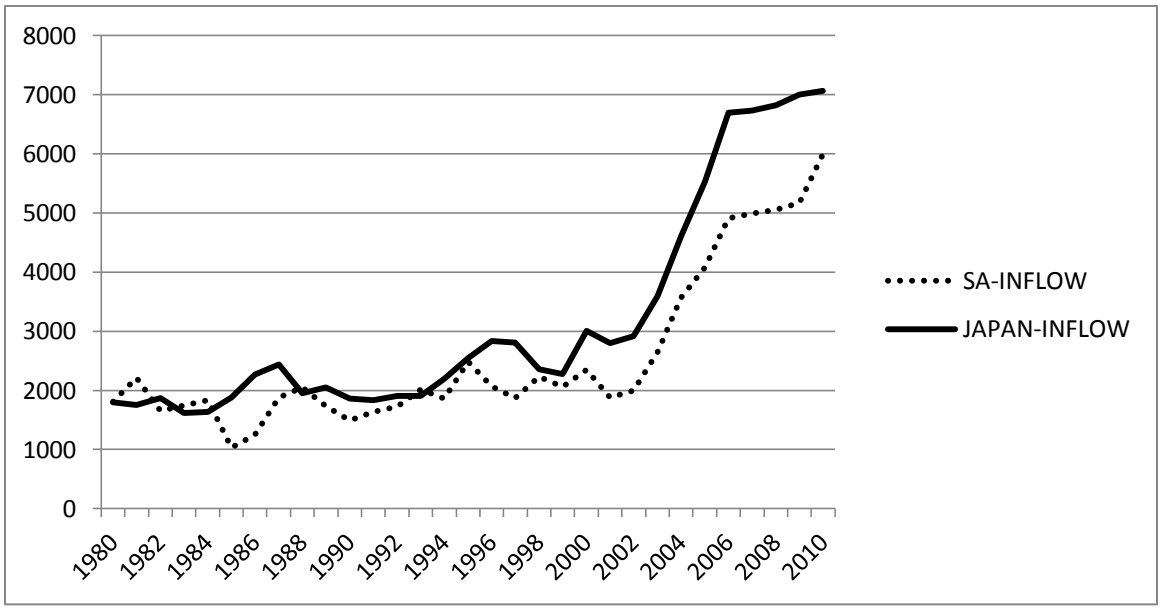


Figure 2.8. South Africa's Export to Regional Markets

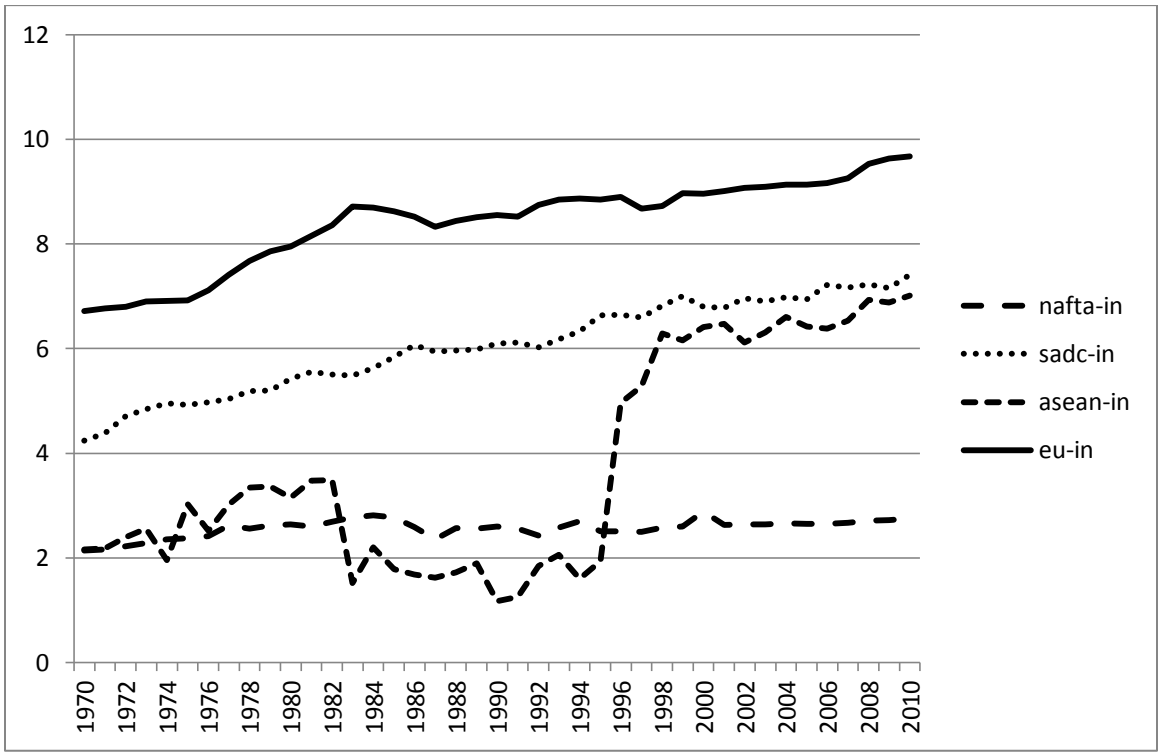
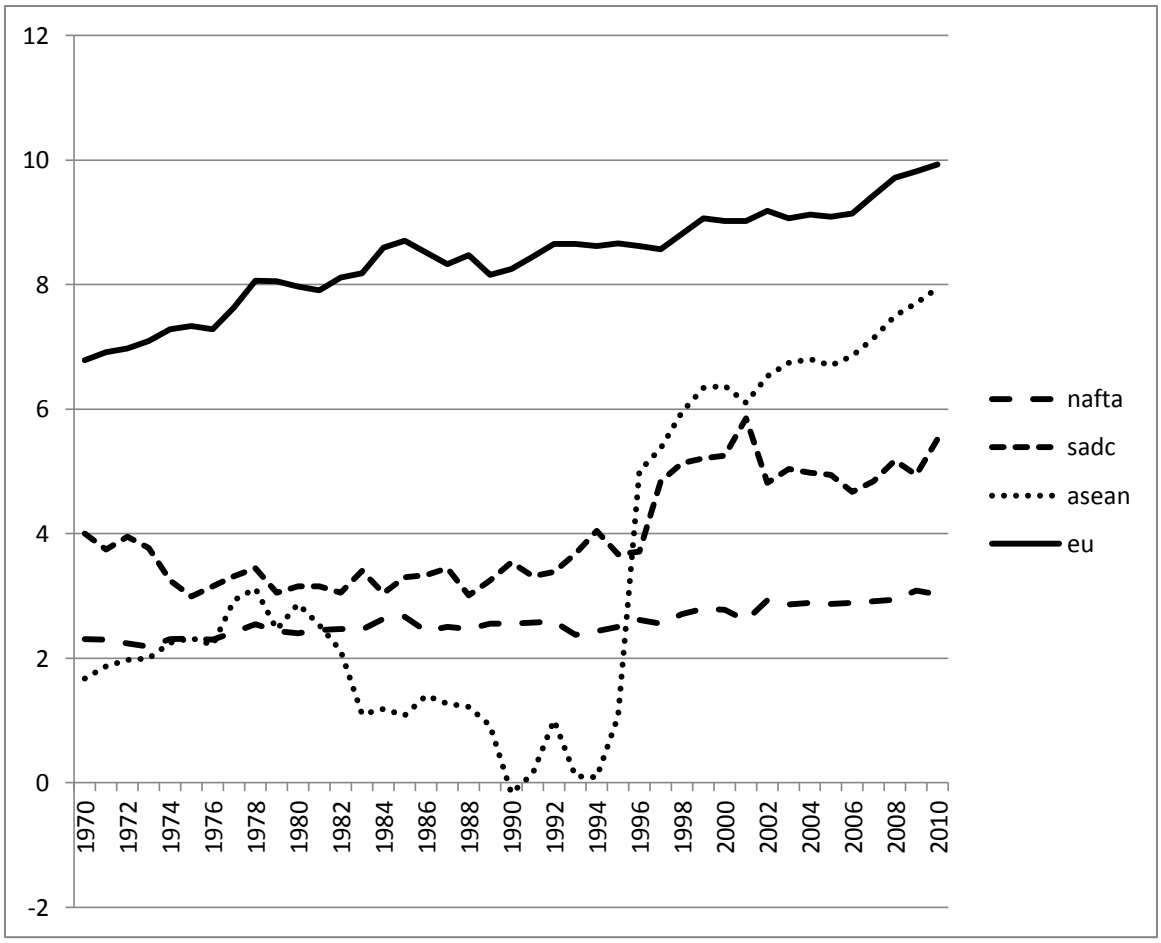


Figure 2.9. South Africa's Imports from Regional Markets.



CHAPTER 3

World Gold Prices and Demand Pull Inflation in South Africa

1. Introduction

This chapter seeks to examine the causes of rising demand pull inflation in South Africa between the years 1973 to 2011. Inflation is a rise in the general level of prices of goods and services in an economy over a period of time. When the general price level rises, each unit of currency buys fewer goods and services. This reflects erosion in the purchasing power of money, signifying a loss of real value in the unit of currency in the economy. The most common measure of price inflation is the inflation rate, which is the annualized percentage change in a general price index (usually the Consumer and Producer Price Indices) over time.

Demand-pull inflation consequently describes a situation where the rate of inflation rises whenever aggregate demand is increased beyond the ability of the economy to produce. Hence, any factor that increases aggregate demand can cause inflation. This chapter therefore investigates the effect of exchange rates, price of gold, money supply and world's GDP in an inflation equation derived from the Mundell-Fleming (IS-LM-BP) model. Dummy variables representing the lifting of South Africa's trade sanctions and the three monetary regimes are also included in the model.

Aggregate macroeconomic data for all variables is analyzed in a time series framework. The period under consideration is 1973 to 2011. All variables are annual series. All variables are pretested for cointergration using conventional time series methods. An error correction model is further developed and results in the form of elasticities derived.

1.1. Outline of Study

This study is organized as follows: Section 2 provides detailed theory, an overview of past literature and justification of variables used, while section 3 describes the data and the methodology used in the study. Sections 4 and 5 provide the discussion of results, and concluding remarks respectively, while the index includes all the results tables, explanation for abbreviations and data plots

2. Literature Review

2.1 Gold Mining and South Africa's Economy

South Africa's gold industry has been the principal revenue earner, resulting in a robust economy with modern financial systems. Revenues from mining have provided South Africa with a vibrant infrastructure and a manufacturing sector comparable to developed countries. With the recent increase in the price of gold and the worldwide economic slowdown, investment in gold has increased, with investors seeking safe haven investments. Demand for gold has also increased in the past ten years, particularly from India and China.

Up until a few years back, South Africa was the world's largest gold producer. China surpassed South Africa as the world's largest producer in 2007. China continues to increase gold production and remained the leading gold-producing nation in 2009, followed by Australia, South Africa, and the United States. According to the US Geological Survey, South Africa produced 210 metric tons of gold in 2009.

South Africa's mineral industry operates on a free enterprise market-driven basis. Historically, mineral rights were owned by either the government or private entities. Under the new Minerals and Petroleum Resources Development Act (2004), existing mineral rights revert

to the government unless companies act within 5 years to convert “old order” exploration and mining rights into “new rights” under terms specified in the new legislation, according to the South Africa Department of Minerals and Energy (2007).

South Africa is estimated, by the US Geological Survey, to have 6000 metric tons of gold reserves. A full 95% of South Africa's gold mines are underground operations, reaching depths of over 2.5 miles. Coupled with declining grades, increased depth of mining, and a slide in the gold price, costs have begun to rise, resulting in the steady fall in production. The future of the gold industry in South Africa therefore depends on increased productivity.

The main gold producing area is concentrated on the Archaean Witwatersrand Basin. The Witwatersrand Basin, which has been mined for more than 100 years and has produced more than 41,000 tons of gold and remains the greatest unexploited source of gold in the world. Major new projects, new technology, new approaches to the organization of work, better labor relations and some commercial innovations are starting to reshape this industry, requiring a significant investment in research.

Besides gold, South Africa is a leading producer of other precious metals such as platinum, as well as base metals and coal. According to the South Africa Department of Minerals and Energy (2007), South Africa produced more than 59 different mineral commodities from about 920 mines and quarries, which included 116 diamond, 59 coal, 42 gold, and 21 platinum-group metals (PGM) operations. South Africa ranked first in the world production of aluminosilicates (andalusite), chromite, ferrochrome, gold, manganese, PGM, vanadium, and vermiculite, and second in production of titanium minerals (chiefly ilmenite) and zirconium. It is the world's fourth-largest producer of diamonds and experts believe there is still considerable

potential for the discovery of other world-class deposits in areas that have yet to be fully exploited.

The Rand is South Africa's official currency. According to the Bloomberg Currency Scorecard, the South African Rand was the most actively traded emerging market currency in the world as of December 2010 and it was the best-performing currency against the United States dollar (USD) between 2002 and 2005. It has consequently joined an elite club of fifteen currencies, the continuous linked settlement[14] (CLS), where forex transactions are settled immediately, lowering the risks of transacting across time zones.

Principal international trading partners of South Africa besides other African countries include Germany, the United States, China, Japan, the United Kingdom and Spain. Other major exports besides minerals include corn, fruits, sugar, and wool. Machinery and transportation equipment make up more than one-third of the value of the country's imports. Other imports include chemicals, manufactured goods, and petroleum.

Since minerals are a finite resource, the government of South Africa has made efforts to diversify the economy. South Africa presently has a large agricultural sector and is a net exporter of farming products. There are almost one thousand agricultural cooperatives and agribusinesses throughout the country, and agricultural exports have constituted 8% of South African total exports for the past five years. The agricultural industry contributes around 10% of formal employment, relatively low compared to other parts of Africa, as well as providing work for

[14] Continuous Linked Settlement is a process by which a number of the world's largest banks manage settlement of foreign exchange amongst themselves (and their customers and other third-parties). The process is managed by CLS Group Holdings AG and its subsidiary companies and includes CLS Bank, a settlement bank regulated by the Federal Reserve Bank of New York.

casual laborers and contributing around 2.6% of GDP. However; due to the aridity of the land, only 13.5% can be used for crop production, and only 3% is considered high potential land.

Manufacturing is relatively small, providing just 13.3% of jobs and 15% of GDP. Labor costs are low, but not nearly as low as in most other emerging markets, and the cost of transport, communications and general living is much higher. The South African automotive industry accounts for about 10% of South Africa's manufacturing exports, contributes 7.5% to the country's GDP and employs around 36,000 people. Other important economic activities includes off shore fishing and tourism.

Despite these positive attributes, South Africa has an extreme income inequality with the majority of residents living in informal settlements, and a high health cost burden due to a high HIV/AIDS prevalence. Other issues facing the South African economy includes high unemployment rates, crime, illegal immigration and electricity

2.2. Inflation

Various studies have been done specifically on the relationship of major macro variables such as exchange rate and inflation and economic growth in South Africa. Khamfula (2004) suggests that the domestic nominal interest rate, corporate income tax, level of money supply, domestic savings and imports chiefly determine economic growth in South Africa. Among these factors, Khamfula (2004) explains that import shocks have a negative effect, while external shocks such as global income do not affect the long-run path of economic growth.

Looking at inflation in South Africa, Van Der Merwe (2004) concludes that a high inflation rate negatively affects economic growth by discouraging domestic savings (and encouraging consumption and investment in non-productive goods). Households and firms turn

to debt financing, while low domestic savings negatively affect the balance of payments. Van Der Merwe however puts an inflationary floor level of 8%, explaining that levels of inflation lower than this may not have any significant negative effect. This is disputed by Elbadawi (1997) arguing that "unpredictability of price changes" associated with inflation can be detrimental to economic growth even at low levels of inflation.

Despite these conflicting views, Van Der Merwe (2004) and Elbadawi (1997) agree that South Africa should maintain its inflation levels at par with its major trading partners, mainly countries in the South Africa Development Community (SADC). In addition, South Africa also needs to maintain a parity in inflation levels with its competitors (large producers of gold and diamond such as Botswana and Namibia), to maintain its price competitiveness.

Looking at the inflation levels in South Africa (Figure 6), a consistent downward trend is observed from 1990, which Aaron (2004) attributes to increased exposure to international competition, lower world inflation, increased unionization of workers (affecting expectations), high real interest, exchange rate, wage, oil price, and terms of trade shocks. In disagreement, Khamfula (2004) looks at the causal effect of foreign inflationary shocks on South Africa's inflation levels, rejecting the hypothesis that external shocks have any significance.

In estimating an inflation equation, Gordon (1981) adopts the "Lucas-Sargent approach" that estimates the inflation rate as the dependent variable rather than the wage, excluding variables representing the labor market situation.

Belonging to a monetary union can significantly lower inflation rate for a small open economy like South Africa (Bleany and Fielding (1999). On a study of the CFA[15] countries (Communauté française d'Afrique, French Community of Africa), Bleany and Fielding (1999) find evidence of a lower inflation level and greater output, compared to similar countries with a floating exchange rate regime.

2.3. Monetary Regimes

South Africa has had three monetary policy regimes since 1960 according to Aaron (2004). The period 1960 to 1970 was based on liquid asset ratios with controls on interest rates and credit, and 1970 to 1985 had a system based on cash reserves. After 1985, the discount rate was used by the South African Reserve Bank (SARB) to influence the market interest rates. A modification to the third regime was in 1998 when SARB introduced a requirement that the repurchase interest rate be determined at an auction and earlier imposed direct controls were removed. Aaron (2004) however notes no significant change in the behavior of interest rates across the three regimes.

2.4. Exchange Rates and the Rand

Khamfula (2004) and Aaron and Muellbauer (2000) explain that the growth in domestic money stock causes an exchange rate appreciation through rising domestic prices while domestic interest rates and import expenditures positively influence net investments. Aaron (2004) examines how the exchange rate equation enters the interest rate effect. The first channel is a

[15] The CFA franc is the name of two currencies used in Africa which are guaranteed by the French treasury. The two CFA franc currencies are the West African CFA franc and the Central African CFA franc. Although theoretically separate, the two CFA franc currencies are effectively interchangeable. Both CFA Francs currently have a fixed exchange rate to the euro: 100 CFA francs = 1 former French franc = 0.152449 euro; or 1 euro = 655.957 CFA francs.

deflationary effect through interest rate differentials between South Africa and US, where a rise in domestic interest rates appreciates the currency. A second channel is a deflationary effect through the current account surplus. In this case, a rise in domestic interest rates by controlling demand, will increase the surplus, and hence appreciate the currency. A third channel is also a deflationary effect where expected producer inflation is reduced by a rise in interest rates, appreciating the currency. The last channel is an inflationary effect, from a weaker growth in South Africa, relative to other industrial countries.

Until 1979, the South African Rand was pegged to the British Sterling Pound with greater flexibility introduced after 1979 with a dual-currency exchange rate (Aaron 2004). SARB announced a commercial exchange rate on a daily basis and a financial exchange rate applied to all non-resident transactions. The dual-currency exchange rate system did a good job in establishing parity between domestic and foreign interest rates, and also to prevent capital outflows.

In 1983, the dual rates were unified, the Rand was set to be free-floating, and all controls on capital movements were removed. The new currency remained stable until 1985, when international banks recalled their loans following a political instability. The financial Rand was re-introduced following debt re-scheduling, and the dual-currency system continued until 1995, when SARB declared the currency fully free-floating, (Aaron 2004).

Elbadawi (1997) argues that the real exchange rate is directly and positively influenced by the stock of foreign exchange reserves, and Khamfula (2004) argues that it is negatively related to changes in the money stock but positively related to changes in domestic nominal interest rates and the foreign price.

Afekheina (2004) and Gordon (1981) explain that currency depreciation improves the current account but is inflationary, and when coupled with a restrictive financial and fiscal policy it leads to a sustainable growth rate. Gordon (1981) adds that past changes in the money supply are the dominant influence on inflation.

2.5. Gross Domestic Product

Khamfula (2004) finds that income is positively influenced by gross domestic savings, changes in the money stock variable and total mining production while it is negatively related to imports, total government expenditure, tax, USA interest rate, changes in US CPI, and changes in the South Africa's nominal interest rate.

Edwards and Alves (2005) and Khamfula (2004) provide contrasting scenarios of terms of trade between South Africa and the East Asian economies, which in the absence of abundant natural resources have successfully restructured production towards dynamic high technology products. The inability of South Africa to do the same explains the relatively poor export performance. In addition, Naude and Rossouw (2008) find evidence that export diversification leads to a higher GDP and employment growth. Gumede (2000) explains that with a high demand elasticity and trade liberalization, whenever South Africa's economy grows, imports rise exponentially hence eroding the already insufficient foreign exchange resulting in a lower GDP via a multiplier effect.

3. Model Framework

The setting is a small open economy model with variables; money supply, effective real exchange rate, world gold prices, world's GDP, and inflation. The study looks specifically at demand pull inflation where aggregate demand in an economy outpaces aggregate supply. It

involves inflation rising as real gross domestic product rises and unemployment falls, as the economy moves along the *AD-AS* (Figure 3.1). The flipside to demand-pull inflation is the cost-push inflation described in Figure (3.2) in an aggregate supply – aggregate demand model where aggregate supply (AS) shifts to AS' causing price level to increase while output shrinks.

Falling unemployment rates may be associated with higher aggregate demand and perhaps an increase in the price level. Firms have an output capacity that restricts the increase in output. As a result, price increases at a higher rate than output (Figure 3.1). As the unemployment rate falls, aggregate demand rises, shifting upwards and rightwards from *AD1* to *AD2*. This increases output *Y* from *Y1* to *Y2*. The price level increases from *P1* to *P2*. The increase in demand and output creates an even higher demand for workers, shifting *AD* again from *AD2* to *AD3*. Due to capacity constraints stated earlier, less output is produced than in the previous shift, but the price level has now risen from *P2* to *P3*, which is much higher than the previous shift (*P1* to *P2*). This study however adopts the "Lucas-Sargent approach" developed by Gordon (1981), focusing directly on inflation (rather than wage) as the dependent variable. The demand pull inflation is therefore estimated as:

3.1. Deriving the Inflation Equation

The Mundell-Fleming (*IS-LM-BP*) model is used to derive the inflation equation. The model is based on the following equations.

$$Y = C + I + G + NX \text{ (the } IS \text{ curve)} \qquad (3.1)$$

where *Y* is GDP, *C* is consumption, *I* is physical investment, *G* is government spending and *NX* is net exports.

$$M/P = L\ (i,\ Y)\ \text{(the } LM \text{ curve)} \qquad (3.2)$$

where M is the nominal money supply, P is the price level, L is liquidity preference (real money demand), and i is the nominal interest rate. A higher interest rate or a lower income (GDP) level leads to lower money demand.

$$BP = CA + KA\ \text{(The Balance of Payments Curve)} \qquad (3.3)$$

where BP is the balance of payments surplus, CA is the current account surplus, and KA is the capital account surplus. Equation (3.1) is further broken down into the following components:

$$C = C(Y - T(Y),\ I - E\ (\pi)) \qquad (3.4)$$

where C is consumption, Y is GDP, T is taxes, i is the nominal interest rate, and $E(\pi)$ is the expected rate of inflation. Higher disposable income or a lower real interest rate (nominal interest rate minus expected inflation) leads to higher consumption spending.

$$I = I\ (I - E\ (\pi),\ Y_{-1})) \qquad (3.5)$$

where I is physical investment and Y_{-1} is GDP in the previous period. Higher lagged income or a lower real interest rate leads to higher investment spending. G, government spending, is an exogenous variable.

$$NX = NX\ (e,\ Y,\ Y^*) \qquad (3.6)$$

where NX is net exports, e is the nominal exchange rate (the price of domestic currency in terms of units of the foreign currency), Y is GDP, and Y^* is the combined GDP of countries that are foreign trading partners. Higher domestic income (GDP) leads to more spending on imports and

hence lower net exports; higher foreign income leads to higher spending by foreigners on the country's exports and thus higher net exports.

A higher *e* (more expensive domestic currency in terms of foreign currency, and equivalently less expensive foreign currency in terms of domestic currency) leads to more purchasing of foreign goods due to the lesser cost of acquiring the foreign currency to pay for them, and also leads to less purchasing of the country's exports by foreigners since they find it more costly to acquire the country's currency with which to pay for them; for both reasons, higher *e* leads to lower net exports.

Equation (3.3) is made up of the following components:

$$CA = NX \qquad (3.7)$$

where *CA* is the current account and *NX* is net exports. That is, the current account is viewed as consisting solely of imports and exports.

$$KA = z\,(i - i^*) + k \qquad (3.8)$$

where i^* is the foreign interest rate, *k* is the exogenous component of financial capital flows, *z*(.) is the interest-sensitive component of capital flows, and the derivative of the function *z* is the degree of capital mobility (the effect of differences between domestic and foreign interest rates upon capital flows *KA*). This derivative is positive if there is any capital mobility (since a higher relative domestic interest rate makes funds more prone to flow into the country), and it is infinitely positive if there is perfect capital mobility.

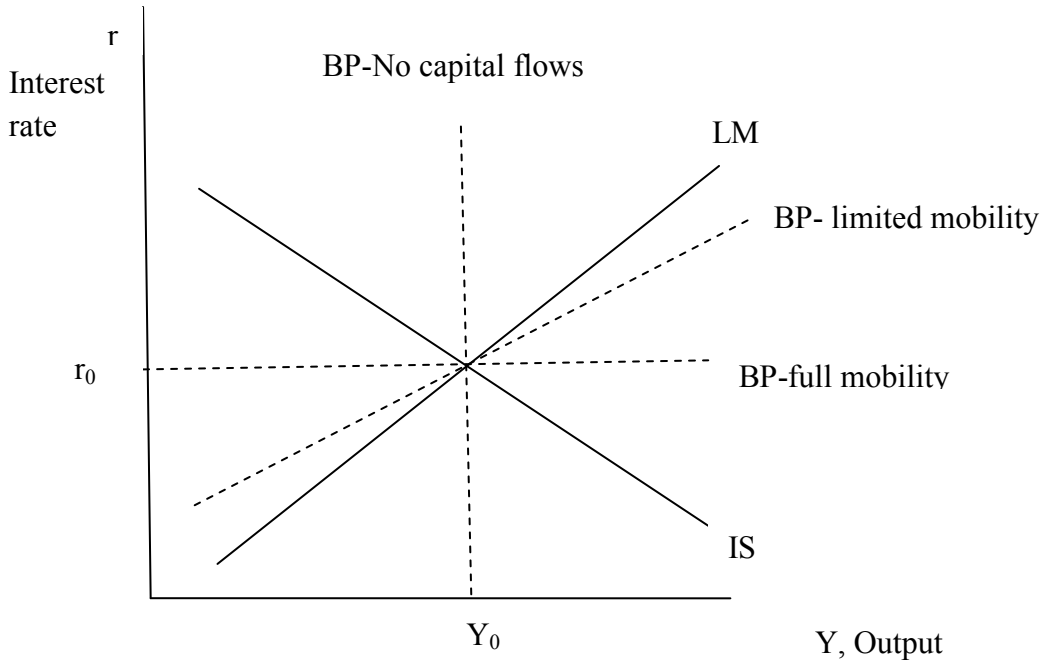
After the subsequent equations are substituted into the first three equations above, one has a system of three equations in three unknowns, two of which are GDP and the domestic interest rate. Under flexible exchange rates, the exchange rate is the third endogenous variable while *BP* is set equal to zero. In contrast, under fixed exchange rates, *e* is exogenous and the balance of payments surplus is determined by the model.

Under both types of exchange rate regime, the nominal domestic money supply *M* is exogenous. Under flexible exchange rates, the nominal money supply is completely under the control of the central bank. But under fixed exchange rates, the money supply in the short run (at a given point in time) is fixed based on past international money flows, while as the economy evolves over time these international flows cause future points in time to inherit higher or lower (but pre-determined) values of the money supply. Table (3.5) shows the macro policy and inflation under both floating and fixed exchange rates.

The model's workings can be described in term of an *IS-LM-BP* graph (Figure 3.3) with the domestic interest rate plotted vertically and real GDP plotted horizontally. The IS curve is downward sloped and the *LM* curve is upward sloped, as in the closed economy *IS-LM* analysis; the *BP* curve is upward sloped unless there is perfect capital mobility, in which case it is horizontal at the level of the world interest rate.

In Figure (3.3), under less than perfect capital mobility the positions of both the *IS* curve and the *BP* curve depend on the exchange rate, since the *IS-LM* graph is actually a two-dimensional cross – section of a three- dimensional space involving all of the interest rate, income, and the exchange rate. However, under perfect capital mobility the *BP* curve is simply horizontal at a level of the domestic interest rate equal to the level of the world interest rate.

Figure 3.3. *IS-LM-BP* Equilibrium.



In this model, the more restricted are capital flows, the larger the rise in the interest rate, for a given change in output. By virtue of being an open economy, South Africa is assumed to have full capital mobility thus, setting *BP* to zero. Since the rand is free floating, and following the Lucas Sargent approach, the following equation determines the inflation level. The equation arbitrarily uses the international price of gold in lieu of domestic interest rates, owing to the importance of gold export in South Africa.

$$\pi = \beta_0 + \beta_1 Ms + \beta_2 e + \beta_3 Y + \beta_4 Gp + \beta_5 STR + \beta_6 MR1 + \beta_7 MR2 + \beta_8 MR3 + \varepsilon\pi \quad (3.9)$$

The variable *Ms* is the real money supply in South Africa, *Ms = nominal Ms/SACPI*. This variable is expected to yield a positive coefficient consistent with Gordon (1981). The variable *e* is the effective real exchange rate where *e = E Psa/Pus.* E is the nominal Rand rate in terms of

dollars $/ra. *Psa* is South Africa's price level, and *Pus* is the US price level[16]. The variable *e* is expected to yield a negative coefficient since depreciation of the Rand viz a viz the US dollar makes SA's exports cheaper, thereby raising GDP through (*X-M*) given Marshall-Lerner condition[17]. Rising domestic incomes raise aggregate demand, thereby pushing the price level higher, consistent with Afekheina (2004). The variable *Y* is the real world disposable income, used as a proxy for world GDP. Rising global income would raise demand for SA's goods, specifically gold. Therefore, *Y* is expected to yield a positive coefficient.

The variable *Gp* is the world gold prices. Gold is South Africa's major export, accounting for over 50% of its export revenue (South Africa Reserve Bank 2007). A rise in gold prices would have the same effect as depreciating the Rand resulting in higher inflation. *X* would rise as *BP* curve shifts out. *AD* curve then shifts out, so price level could rise.

The study also introduces four dummy variables. *STR* representing an end to trade embargo in response to the apartheid rule. MR_1, MR_2 and MR_3 are dummy variables that represent the distinct monetary regimes that South Africa has had over the period of analysis.

3.2. Data Plots and Sources

Data for *E*, *USCPI*, and *Y* was collected from the St. Louis Federal Reserve Bank Database (FRED II). Data for *SACPI*, *SAPPI* and *Ms* was collected from the South Africa Reserve

[16] The USD and U.S. price levels are used because gold is traded internationally in U.S. dollars.
[17] The Marshall–Lerner condition (after Alfred Marshall and Abba P. Lerner) provides as a technical reason why a reduction in value of a nation's currency need not immediately improve its balance of payments. The condition states that, for a currency devaluation to have a positive impact on trade balance, the sum of price elasticity of exports and imports (in absolute value) must be greater than 1. As a devaluation of the exchange rate means a reduction in the price of exports, quantity demanded for these will increase. At the same time, price of imports will rise and their quantity demanded will diminish.

Bank(SARB).Data for world gold prices was collected from the World Gold Council. All data has been converted into log form. Figure (3.4) shows the data plots, Money supply and real effective an exchange rate shows a consistent increase albeit in small percentages. Gold prices show a pronounced increase from 2000 through 2011, consistent with rising global incomes in the same period. Inflation rates fluctuate through the years, although the general trade shows a decline over the years.

4. Empirical Results and Discussion

4.1. Stationarity Analysis

Variables in a time series regression should be stationary, converging to a dynamic equilibrium, or standard errors would be understated (Enders 1995). Autoregressive AR (1) stationarity tests are reported in Table (3.1). Inflation π is stationary with white noise residuals. All residuals are checked for white noise with zero means, low autocorrelation by Durbin Watson statistics (DW > 1.26 for lack of positive autocorrelation and DW < 2.74 for lack of negative autocorrelation), and homoskedasticity by ARCH(1) tests. The rest of the variables are nonstationary.

All variables are difference stationary by Dickey-Fuller DF tests (Table 3.1). The real exchange rate *e* is difference stationary with the Dickey Fuller test with a constant DFc. Inflation (π) and world gold prices (*Gp*) are stationary with the Dickey Fuller test without a constant DF. US disposable income *Y* is difference stationary with Augmented Dickey Fuller test ADF, and money supply *Ms* is stationary with the Dickey Fuller test with a constant DFc.

4.2. Model Estimation

Regression in levels produces spurious results and variables are cointegrated by an Engle-Granger EG test. This regression is reported in Table (3.2),

$$\pi = \beta_0 + \beta_1 Ms + \beta_2 e + \beta_3 Y + \beta_4 Gp + \beta_5 STR + \beta_6 MR_1 + \beta_7 MR_2 + \beta_8 MR_3 + \varepsilon\pi$$

(3.10)

The residual επ from the spurious model is stationary by the Engle-Granger EG test, satisfying the critical t-statistic -3.18. Analysis proceeds with an error correction model ECM. The residual επ from the spurious model is included in the ECM

$$\Delta\pi = \delta_0 + \delta_1 \Delta Ms + \delta_2 \Delta e + \delta_3 \Delta Y + \delta_4 \Delta Gp + \delta 5 STR + \delta_6 MR_1 + \delta_7 MR_2 + \delta_8 MR_3 + \delta\gamma\varepsilon\pi + \varepsilon ECM. \quad (3.11)$$

Regressions in levels produce spurious results but variables are cointegrated by Engle-Granger EG tests. These results are reported in Table (3.2). ECM results are reported in Table (3.3). Only gold prices and the error correction term yield significant estimates. The insignificant difference coefficients for the rest of the variables in Table (3.3) imply no transitory effects but the significant error correction terms imply adjustment relative to the dynamic equilibrium.

Effects of exogenous variables on S.A.'s rate of inflation are reported in Table (3.4). Coefficients are derived by multiplying the error correction coefficients in Table (1.3) by each of the levels coefficients in Table (1.2). The reported standard errors are derived through error propagation calculation: $\sigma_\gamma = \gamma((\sigma_\alpha/\alpha)^2 + (\sigma_\beta/\beta)^2)^{.5}$, where, if $\gamma = \alpha \pm \beta \Rightarrow \sigma_\gamma = (\sigma_\alpha^2 + \sigma_\beta^2)^{.5}$, and if $\gamma = \alpha\beta$ or $\gamma = \alpha/\beta \Rightarrow \sigma_\gamma = \gamma((\sigma_\alpha/\alpha)^2 + (\sigma_\beta/\beta)^2)^{.5}$. In Tables (1.2, 1.3, and 1.4), coefficient estimates are reported with their corresponding standard errors.

An increase in the Money supply increases the rate of inflation, with an elasticity of 0.64 consistent with Gordon (1981). The -0.78 effective real exchange rate e elasticity is evidence that appreciation/depreciation of the Rand has a negative/positive effect on the domestic price level. Higher global gold prices have a positive effect on the rate of inflation with an elasticity of 0.54

reflecting the importance of gold as South Africa's major export. Khamfula (2004) tested the effects of various metal prices on inflation, obtaining a similar result. Rising world income also raises inflation (with an elasticity of 0.54) level by raising the aggregate demand for gold and other exports.

The lifting of trade sanctions by trade partners is also reported to increase the rate of inflation with an elasticity of 0.12. Export demand rose exponentially in 2004, surpassing aggregate supply as shown in Figure (3.1), thereby raising the general level. The first and second monetary regimes yield insignificant estimates, but the third one positively affects inflation levels with an elasticity of 0.19. This is the period from 1998 when SARB introduced a requirement that the repurchase interest rate be determined at an auction and earlier imposed direct controls were removed. This is inconsistent with Aaron (2004) since he found no change in interest rates across the three monetary regimes.

5. Summary and Conclusion

The analysis concludes that money supply, the real effective exchange rate, gold prices, world income, and lifting of trade sanctions is important in determining the rate of inflation in South Africa. Elimination of direct controls by SARB in determining domestic interest rates is also found to be important.

The data plots in Figure (3.4) show a general declining trend in South Africa's inflation levels. This could have been as a result of the Growth, Employment and Redistribution (GEAR), a policy developed by South Africa's government that included Inflation targeting. That is a monetary policy in which a central bank attempts to keep inflation in a declared target range, typically by adjusting interest rates.

According to the South Africa Reserve Bank (2000), adjusting interest rates will raise or lower inflation through the adjustment in money supply, because interest rates and money supply have an inverse relationship. SARB also publicly declares the forecasted interest rates such that if inflation appears to be above the target, SARB would raise interest rates and vice versa.

Tables

Table 3.1. Stationarity Analysis

	AR(1) Coef+2(se)<1	DF -1.95<t<0 DW(1.217,1.322	DFc -3.00<t<0 F<5.18	DFt -3.60<t<0 F<5.68	ADF -3.60<t<0 F<7.24	PERON a_1-1/se t_p=-3.76
Π	0.6+2(0.13)=0.8 8 DW=1.82 ARCH(1) = 0.18	t=-0.77 DW=2.12 ARCH(1)=0.35				
Ms	1.02+2(0.03)=1. 1	t=2.56	t=0.59	t=-2.27 DW=2.01 ARCH(1)=1.3 F=0.43		
E	0.77+2(0.11)=0.98 DW=1.58 ARCH(1)=1.54 F=0.78	t=-0.2 F=0.03 DW=1.69 ARCH(1)=0.18				
Y	0.97+2(0.06)=1.09	t =0.29	t =0.72	t =0.87	t =-1.91 F=0.68 DW=1.45 ARCH(1)=0.63	
Gp	0.83+2(0.09)=1. 03	t=-0.2 F=0.03 DW=1.69 ARCH(1)=0.18				

Table 3.2. Inflation Model in Levels

Variable	Coefficient	Standard Errors
C	-4.87	(3.02)
Ms	-0.96	(0.91)
e	1.09	(0.41)
Y	-0.64	(0.63)
Gp	-0.77	(0.31)
STR	-0.17	(0.36)
MR_1	-0.08	(0.35)
MR_2	-0.001	(0.30)
MR_3	-0.27	(0.72)
EG t = -3.99 DW = 1.83 ARCH(1) = 0.97 AdjR^2 = 0.45	*10% **5% ***1%	

Table 3.3. ECM for Inflation

Variable	Coefficient	Standard Errors
C	-0.29	(1.72)
Ms	-0.56	(1.15)
e	1.55	(0.48)
Y	-0.96	(1.13)
Gp	0.81**	(0.39)
STR	-0.03	(0.24)
MR_1	0.13	(0.31)
MR_2	-0.02	(0.24)
MR_3	-0.55	(0.47)
ε_{ECM}	0.71***	(0.19)
DW = 2.03 ARCH(1) = 0.71 AdjR^2 = 0.41	*10% **5% ***1%	

Table 3.4. Derived Inflation Effects

Variable	Coefficient	Standard Errors
C	3.47***	(0.27)
Ms	0.64***	(0.06)
e	-0.78*	(0.43)
Y	0.46**	(0.21)
Gp	0.54***	(0.15)
STR	0.12*	(0.07)
MR_1	0.06	(0.28)
MR_2	0.001	(0.22)
MR_3	0.19***	(0.04)
	*10% **5% ***1%	

Table 3.5. Macro Policy and Inflation

Monetary *expansion*	***e***	***Y***	***r***	***π***	***i***	
Floating *e*	↑	↑*	↓	↑	↓	(or ↑ but less than π)
Fixed *e*	**0**	**0**	**0**	**0**	**0**	
Fiscal *expansion*						
Floating *e*	↑	↑*	↑	↑	↑	(more than *r* ↑)
Fixed *e*	**0**	↑*	↑**	↑	↑	(more than *r* ↑)
*Close to zero near full employment **Larger than with floating *e*						

Figures

Figure 3.1. Aggregate Demand - Aggregate Supply Curve

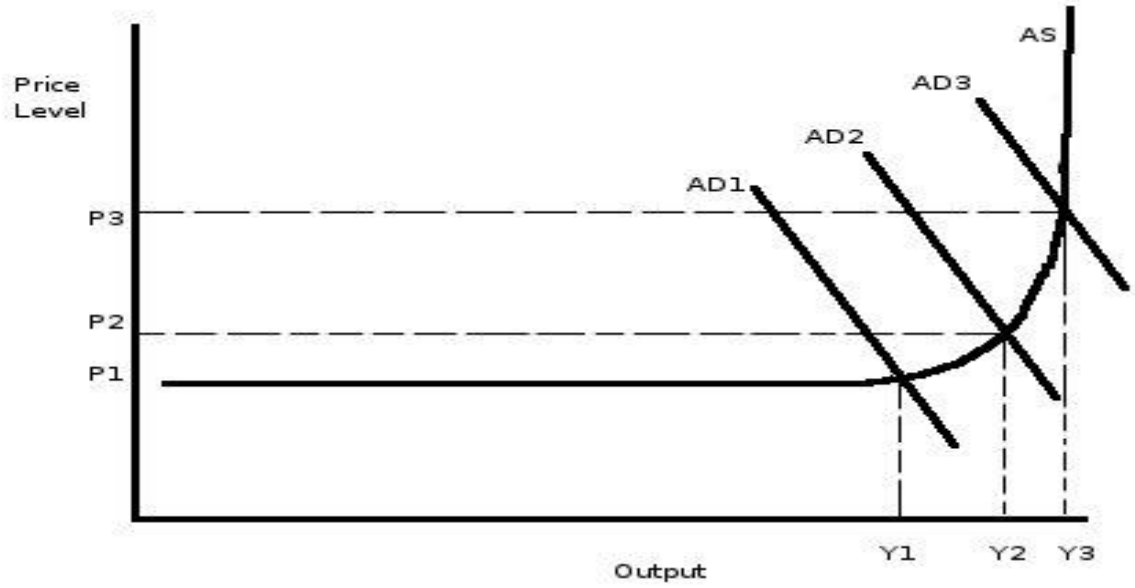


Figure 3.2. Cost Push Inflation

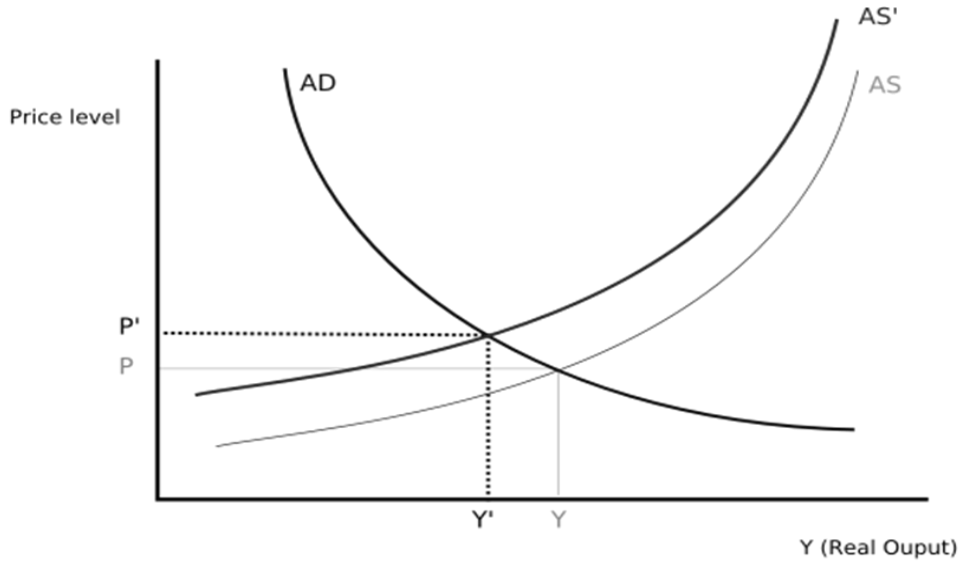
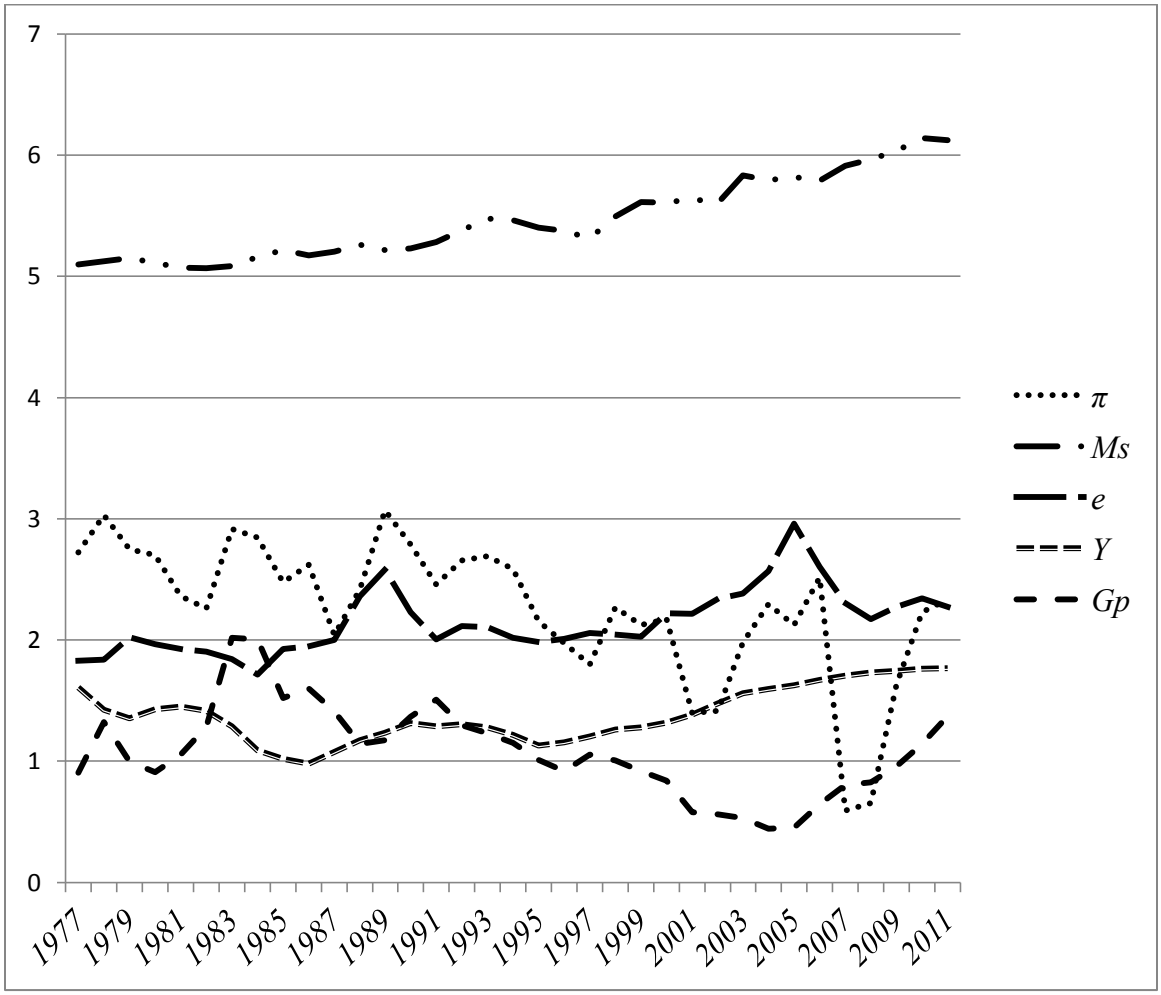


Figure 3.4. Variable Series



References

Afekeina Jerome (2004), 'A survey of Macroeconomic Models for Policy Analysis and Forecasting in South Africa', National Institute for Economic Policy (*working paper*) www.niep.org.za.

Aitken, N. (1973), 'The Effect of EEC and EFTA on European trade: a temporal cross sectional analysis', *American Economic Review*, 63, 881-92.

Anderson, J.E. 1979, 'A Theoretical Foundation for the Gravity Equation', *American Economic Review*, 69, 1, pp. 106-116.

Anderson, J. E. and von Wincoop, E. (2003), 'Gravity with Gravitas: a Solution to the Border Puzzle', *American Economic Review*, 93, pp. 170-92.

Aristotelous Kyriacos (2001), 'Exchange Rate Volatility, Exchange Rate Regime, and Trade Volume: Evidence from the UK – US Export Function (1889-1999)', *Economic Letters*, Volume 72, Issue 1, pp. 87-94.

Arize C. Augustine (1997), 'Conditional Exchange-Rate Volatility and the Volume of Foreign Trade: Evidence from Seven Industrialized Countries', *Southern Economic Journal,* Vol. 64, No. 1, pp. 235-254.

Arize C. Augustine, Thomas Osang, and Daniel J. Slottje (2008), 'Exchange Rate Volatility in Latin America and its Impact on Foreign Trade', *International Review of Economics & Finance*, Volume 17, Issue 1, pp. 33-44.

Bacchetta Philippe and Wincoop Van Erick (2000), 'Does Exchange Rate Stability Increase Trade and Welfare?' *The American Economic Review*, Vol. 90, No. 5, pp. 1093-1109.

Bah I. and Amusa H.A. (2003), 'Real Exchange Volatility and Foreign Trade: Evidence from South Africa's Exports to the United States', *African Finance Journal*, Vol. 5, Issue 2, pp. 1-20.

Baharumshah, A. (2001), 'the Effect of Exchange Rate on Bilateral Trade Balance: New Evidence from Malaysia and Thailand', *Asian Economic Journal*, 15, 3, pp. 291-312.

Bahmani-Oskooee, M, Ardalani, Z, and Bolhasani, M. (2010), 'Exchange Rate Volatility and US Commodity Trade with the Rest of the World', *International Review Of Applied Economics*, 24, 5, pp. 511-532.

Bahmani-Oskooee, M, and Wang, Y. (2007), 'The Impact of Exchange Rate Volatility on Commodity Trade between the U.S. and China', *Economic Issues*, 12, 1, pp. 31-52.

Bahmani-Oskooee, M, and Harvey, H. (2006), 'How Sensitive Are Malaysia's Bilateral Trade Flows to Depreciation?' *Applied Economics*, 38, 11, pp. 1279-1286.

Belanger Denis, Gutierez Sylvia, Racette Daniel, and Raynauld Jacques (1992), 'The Impact of Exchange Rate Variability on Trade Flows: Further Results on Sectoral U.S. Imports from Canada', *The North American Journal of Economics and Finance*, Vol. 3, Issue No. 1, pp. 61-82.

Bella, M, & Quintieri, B. (2000), 'The Effect of Trade on Employment and Wages in Italian Industry', *Labour*, 14, 2, pp. 291-309.

Belke Ansgar and Kaas Leo (1999), 'the Impact of Exchange Rate Volatility on Labor Markets: Europe versus United States', *Working Paper Series*, University of Vienna.

Belke Hubertus Ansgar and Ralph Setzer (2003), 'Exchange Rate Volatility and Employment Growth: Empirical Evidence from CEE Economies', *CESifo Working Paper Series* No. 1056.

Berdell, J, & Ghoshal, A. (2007), 'Gains and Losses from Preferential Trade Agreements: Some Evidence from NAFTA', *International Trade Journal*, 21, 2, pp. 191-228.

Bergstrand, J. H. (1989), 'Generalized Gravity Equation, Monopolistic Competition and the Factors Proportions Theory in International Trade', *Review of Economics and Statistics*, 71, pp 143-153.

Betts Caroline and Michael B. Devereux (2000), 'Exchange Rate Dynamics in a Model of Pricing-to-Market', *Journal of International Economics*, Vol. 50, Issue 1, pp. 215-244.

Bleany Michael and Greenaway David (2001), 'The Impacts of Terms of Trade and Real Exchange Rate Volatility on Investment and Growth in sub-Sahara Africa', *Journal of Development Economics*, Vol. 65, Issue 2, pp. 491-500.

Broll Udo and Eckwert Bernhard (1999), 'Exchange Rate Volatility and International Trade', *Southern Economic Journal*, Vol. 66, No. 1, pp. 178-185.

Brown, D, Deardorff, A, and Stern, R. (2003), 'Multilateral, Regional and Bilateral Trade-Policy Options for the United States and Japan', *World Economy*, 26, 6, pp. 803-828.

Bun, M, Klaassen, F, and Tan, G. (2009), 'Free Trade Areas and Intra-regional Trade: The Case of ASEAN', *Singapore Economic Review*, 54, 3, pp. 319-334.

Caglayan, M, and Di, J. (2010), 'Does Real Exchange Rate Volatility Affect Sectoral Trade Flows?' *Southern Economic Journal*, 77, 2, pp. 313-335.

Campa Manuel Jose (1993), 'Entry by Foreign Firms in the United States under Exchange Rate Uncertainty', *the Review of Economics and Statistics*, Vol. 75, No. 4, pp. 614-622.

Canzoneri B. Mathew and Diba T. Behzad (1993), 'Currency Substitution and Exchange Rate Volatility in the European Community', *Journal of International Economics*, Vol. 35, Issues 3-4, pp. 351-365.

Caporale Tony and Doroodian Khosrow (1994), 'Exchange Rate Volatility and the Flow of International Trade', *Economic Letters*, Vol. 46, Issue 1, pp. 49-54.

Carillo, C., and Li, C. A. (2002), 'Trade Blocks and the Gravity Model: Evidence from Latin American Countries', *University of Essex Working Paper*, University of Essex, Wivenhoe Park, Colchester UK.

Chaudhuri, S, Yabuuchi, S, & Mukhopadhyay, U. (2006), 'Inflow of Foreign Capital and Trade Liberalization in a Model with an Informal Sector and Urban Unemployment', *Pacific Economic Review*, 11, 1, pp. 87-103.

Cieslik, A. (2009), 'Bilateral Trade Volumes, the Gravity Equation and Factor Proportions', *Journal of International Trade and Economic Development*, 18, 1, pp. 37-59.

Chen, H. (2001), 'Taiwan's Exports and Trade Imbalance against US and Japan: An Empirical Analysis', *Applied Economics*, 33, 10, pp. 1283-1287.

Chou W. L. (2000), 'Exchange Rate Variability and China's Exports', *Journal of Comparative Economics*, Vol. 28, Issue 1, pp. 61-79.

Choudhry Taufiq (2005), 'Exchange Rate Volatility and the United States Exports: Evidence from Canada and Japan', *Journal of Japanese and International Economies*, Vol. 19, Issue 1, pp. 51-71.

Choudhry Taufiq (2008), 'Exchange Rate Volatility and United Kingdom Trade: Evidence from Canada, Japan and New Zealand', *Journal of Empirical Economics*, Vol. 35, Issue No. 3, pp. 607-619.

Clarida Richard and Gali Jordi (1994), 'Sources of Real Exchange Rate Fluctuations: How Important are Nominal Shocks?' *Carnegie-Rochester Conference Series on Public Policy*, Vol. 41, pp. 1-56.

Clark Peter, Natalia Tamirisa, Shang – Jin Wei, Azim Sadikov, and Zeng Li (2004), 'Exchange Rate Volatility and Trade Flows – Some New Evidence', *IMF Working Paper Series*.

Cote Agathe (1994), 'Exchange Rate Volatility and Trade: A Survey, Bank of Canada', *Working Paper* 94-5.

Daly Kevin (1997), 'Does Exchange Rate Volatility Impede the Volume of Japan's Bilateral Trade?', *Japan and the World Economy*, Vol. 10, Issue No. 3, pp. 333-348.

de Groot, H.F. (2004), 'The Institutional Determinants of Bilateral Trade Patterns', *Kyklos*, 57, 1, pp. 103-123.

Dell'Ariccia Giovanni (1999), 'Exchange Rate Fluctuations and Trade Flows: Evidence from the European Union', *IMF Staff Paper*, Vol. 46, No. 3.

Devadoss, S. (2006), 'Why Do Developing Countries Resist Global Trade Agreements?', *Journal of International Trade and Economic Development*, 15, 2, pp. 191-208.

Devereux Michael and Lane R. Phillip (2003), 'Understanding Bilateral Exchange Rate Volatility', *Journal of International Economics*, Vol. 60, Issue No. 1, pp. 109-132.

Dickey, David A., and Wayne A. Fuller (1981), 'Likelihood ratio statistics for autoregressive time series with a unit root', *Econometrica* 49:1057-72.

Edwards, L, and Lawrence, R. (2008), 'A Symposium on Fostering Growth in South Africa: South African Trade Policy Matters: Trade Performance and Trade Policy', *Economics Of Transition*, 16, 4, pp. 585-608.

Eichegreen, B. and Irwin, D. A. (1995), 'Trade blocs, currency blocs and re-orientation of the world trade in the 1930s', *Journal of International Economics*, 38, 1-24.

Ekanayake E. M. and Thaver Ranjini (2011), 'The Impact of Dollar-Rand Volatility on U.S. Exports to South Africa', *the International Journal of Business and Finance Research*, Vol. 5, Issue No. 3.

Enders Walter (1995), 'Applied Econometric Time Series, 2nd Edition', *ISBN: 978-81-265-1564-6.*

Evenett, S.J. (2002), 'The Impact of Economic Sanctions on South African Exports', *Scottish Journal of Political Economy*, 49, 5, pp. 557-573.

Fountas Stilianos and Bredin Donal (1998), 'Exchange Rate Volatility and Exports: the Case of Ireland', *Applied Economics Letters*, Vol. 5, Issue No. 5, pp. 301-304.

Frankel, J. (2003), 'a Proposed Monetary Regime for Small Commodity Exporters: Peg the Export Price (PEP)', *International Finance*, 6, 1, pp. 61-88.

Gopinath, M, and Chen, W. (2003), 'Foreign Direct Investment and Wages: A Cross-Country Analysis', *Journal of International Trade and Economic Development*, 12, 3, pp. 285-309.

Goyal, S, and Joshi, S. (2006), 'Bilateralism and Free Trade', *International Economic Review*, 47, 3, pp. 749-778.

Grauwe De Paul (1988), 'Exchange Rate Variability and the Slowdown in Growth of International Trade', Staff Papers, *International Monetary Fund*, Vol. 35, Issue No. 1, pp. 63-84.

Greenaway, D, and Milner, C. (1995), 'the World Trade System and the Uruguay Round: Global Employment Implications', *International Labor Review*, 134, 4-5, pp. 497-519.

Hau Harald (2002), 'Real Exchange Rate Volatility and Economic Openness: Theory and Evidence', *Journal of Money, Credit and Banking*, Vol. 34, No. 3, pp. 611-630.

Hausmann, R, and Klinger, B. (2008), 'A Symposium on Fostering Growth in South Africa: South Africa's Export Predicament', *Economics of Transition*, 16, 4, pp. 609-637.

Hayakawa Kazunobu and Kimura Fukunari (2009), 'The Effect of Exchange Rate Volatility on International Trade in East Asia', *Journal of Japanese and International Economies*, Vol. 23, Issue No. 4, pp. 395-406.

Helpman, E., and Krugman, P. (1985), 'Market Structure and Foreign Trade', *MIT Press*, Cambridge, MA.

Hiebert, P, and Vansteenkiste, I. (2010), 'International Trade, Technological Shocks and Spillovers in the Labour Market: A GVAR Analysis of the US Manufacturing Sector', *Applied Economics*, 42, 22-24, pp. 3045-3066.

H.S. Houthakker and Stephen P. Magee (1969), 'Income and Price Elasticities in the World Trade', *the review of Economics and Statistics*, Vol. L1 No. 2.

Hungerford, T.L. (1995), 'International Trade, Comparative Advantage and the Incidence of Layoff Unemployment Spells', *Review Of Economics and Statistics,* 77, 3, pp. 511-521.

Hufbauer, G.C., Schott, J., and Elliott K.A. (1990), 'Economic Sanctions Reconsidered, 2nd edition', *Institute for International Economics*, Washington DC.

Janine Aaron, John Muellbauer and Benjamin W. Smit (2004), 'Modeling the Inflation Process in South Africa', *South Africa Reserve Bank* JEL codes: C22, C32, C51, C52, E31, E52.

Janine Aaron and John Muellbauer (2000), 'Estimating Monetary Policy Rules for South Africa', Central Bank of Chile *Working Papers No. 89*.

Janine Aaron, Ibrahim Elbadawi and Brian Kahn (1997), 'Determinants of the Real Exchange Rate in South Africa', *WPS/97-16.*

JM Geyser and GA Lowies (2001), 'The Impact of Inflation and Stock Prices in two SADC Countries', *Meditari Accountancy Research* volume 9, p 109-122.

Jung Alexandar (1996), 'is there a Casual Relationship between Exchange Rate Volatility and Unemployment?', *Intereconomics*, Vol. 31, No. 6, pp. 281-282.

Kenen B. Peter and Rodrik Dani (1986), 'Measuring and Analyzing the Effects of Short-Term Volatility in Real Exchange Rates', *The Review of Economics and Statistics*, Vol. 68, No. 2, pp. 311-315.

Kim Kiehung and Lee WooRhee (2007), 'The Impact of Korea's Exchange Rate on Korean Trade', *Asian Economic Journal*, Vol. 9, Issue No. 1, pp. 45-60.

Klein W. Michael (1990), 'Sectoral Effects of Exchange Rate Volatility on United States Exports', *Journal of International Money and Finance*, Vol. 9, Issue No. 3, pp. 299-308.

Koray, F, and Lastrapes, W. (1989), 'Real Exchange Rate Volatility and U.S. Bilateral Trade: A VAR Approach'*, Review of Economics and Statistics*, 71, 4, pp. 708-712.

Kreickemeier, U. (2005), 'Unemployment and the Welfare Effects of Trade Policy', *Canadian Journal of Economics*, 38, 1, pp. 194-210.

Kroner F. Kenneth and Lastrapes D. William (1993), 'The Impact of Exchange Rate Volatility on International Trade: Reduced Form Estimates Using the GARCH-in-Mean Model', *Journal of International Money and Finance*, Vol. 12, Issue No. 3, pp.298-318.

Krugell, W, and Matthee, M. (2009), 'Measuring the Export Capability of South African Regions', *Development Southern Africa*, 26, 3, pp. 459-476.

Krugman, P. (1991), 'Geography and Trade', *MIT Press*, London.

Krugman R. Paul and Obstfeld Maurice (2000), 'International Economics, Theory and Practice, 5th Edition', *ISBN: 0-321-03387-6.*

Kulatilaka Nalin and Kogut Bruce (1996), 'Direct Investment, Hysteresis, and Real Exchange Rate Volatility', *Journal of the Japanese and International Economies*, Vol. 10, Issue 2, pp. 12-36.

Lai, H, and Zhu, S. (2004), 'The Determinants of Bilateral Trade', *Canadian Journal of Economics*, 37, 2, pp. 459-483.

Lastrapes D. William and Koray Faik (1990), 'Exchange Rate Volatility and U.S. Multilateral Trade Flows', *Journal of Macroeconomics*, Vol. 12, Issue 3, pp. 341-362.

Lawrence Edwards, (2004), 'Exchange Rate Depreciation and the Trade Balance in South Africa', *working paper series*, School of Economics, University of Cape Town.

Lawrence Edwards and Phil Alves (2005), 'South Africa's Export Performance: Determinants of Export Supply. Africa Region', *Working Paper Series No. 95*, School of Economics, University of Cape Town.

Lee, H, and Song, B. (2008), 'Quantitative Estimates of the Economic Impacts of a Korea-United States Free Trade Agreement', *Asian Economic Papers*, 7, 2, pp. 52-73.

Leibrecht, M, and Scharler, J. (2009), 'How Important Is Employment Protection Legislation for Foreign Direct Investment Flows in Central and Eastern European Countries?' *Economics of Transition*, 17, 2, pp. 275-295.

Leichenko, R, and Silva, J. (2004), 'International Trade, Employment and Earnings: Evidence from US Rural Counties', *Regional Studies*, 38, 4, pp. 355-374.

Liwan Audrey and Lau Evan (2007), 'Managing Growth: The Role of Export, Inflation and Investment in Three ASEAN Neighboring Countries', *Munich Personal RePEc Archive (MPRA)* Paper No. 3952, http://mpra.ub.uni-muenchen.de/3952.

Mainardi, S. (1999), 'Supply Determinants of Mining Companies: Evidence for Gold and Other Minerals in South Africa', *African Development Review/Revue Africaine De Developpement*, 11, 1, pp. 31-53.

Markusen R. James, Melvin R. James, Kaempfer H. William, and Maskus E. Keith (1995), 'International Trade, Theory and Evidence, 1st Edition, *ISBN: 0-07-040-447-X.*

Martinez-Zarzoso, I. (2003), 'Gravity Model: An Application to Trade between Regional Blocs', *Atlantic Economic Journal*, 31, 2, pp. 174-187.

Martinez-Zarzoso, I, and Nowak-Lehmann, F. (2003), 'Augmented Gravity Model: An Empirical Application to Mercosur-European Union Trade Flows', *Journal of Applied Economics*, 6, 2, pp. 291-316.

Martinez-Zarzoso, I. (2003), 'Gravity Model: An Application to Trade between Regional Blocs', *Atlantic Economic Journal*, 31, 2, pp. 174-187.

Maskus E. Keith (1986), 'Exchange Rate Risk and U.S. Trade: A Sectoral Analysis, Economic Review', *Federal Reserve Bank of Kansas City*.

Matusz, S.J. (1994), 'International Trade Policy in a Model of Unemployment and Wage Differentials', *Canadian Journal of Economics*, 27, 4, pp. 939-949.

Mckenzie D. Michael (1998), 'The Impact of Exchange Rate Volatility on Australian Trade Flows', *Journal of International Financial Markets, Institutions and Money*, vol. 8, Issue 1, pp. 21-38.

McKenzie D. Michael and Brooks D. Roberts (1997), 'The Impact of Exchange Rate Volatility on German-U.S. Trade Flows', *Journal of International Financial Markets, Institutions and Money*, Vol. 7, Issue 1, pp. 73-87.

Michael Bleaney and David Fielding (1999), 'Exchange Rate Regimes, Inflation and Output Volatility in Developing Countries', *Center for Research in Economic Development and International Trade, University of Nottingham*, CREDIT Research Paper No. 99/4.

Mordechai E. Kreinin (1998), 'International Economics, a Policy Approach', 8th Edition, *ISBN: 0-03-024581-8.*

Onafowora A. Olugbenga and Owoye Oluwole (2008), 'Exchange Rate Volatility and Export Growth in Nigeria', *Applied Economics*, Vol. 40, Issue 12, pp. 1447-1556.

Oslington, P. (2005), 'Unemployment and Trade Liberalization', *World Economy*, 28, 8, pp. 1139-1155.

Parsley, D, and Wei, S. (1993), 'Insignificant and Inconsequential Hysteresis: The Case of U.S. Bilateral Trade', *Review of Economics and Statistics*, 75, 4, pp. 606-613.

Patrick Honohan and Philip R. Lane (2004), 'Exchange Rates and Inflation under EMU: an Update Economic Policy', http://www.economic-policy.org/commentaries.asp

Phillips, Peter C. B., and Pierre Peron (1988), 'Testing for a unit root in time series regressions', *Biometrika* 75:335 46.

Polak, J. J. (1996), 'Is APEC a Natural Regional Trading Bloc? A Critique of the Gravity Model of International Trade', *World Economy* 19(5): 533-43.

Pozo Susan (1992), 'Conditional Exchange Rate Volatility and the Volume of International Trade: Evidence from the Early 1900s', *the Review of Economics and Statistics*, Vol. 74, Issue 2, pp. 325-329.

Poyhonen, Peutti, (1963), 'A Tentative Model for the Volume of Trade between Countries', *Weltwirtschafthches Archive* 90, Heft 1 (1963).

Pullianen, Kyosti, (1963), 'A World Trade Study: An Econometric Model of the Pattern of the Commodity Flows of International Trade in 1948 – 60', *Economiska Samfundets, Tidscrift* 16 (1963), 78-91.

Robert J. Gordon (1981), 'Inflation, Flexible Exchange Rates, and the Rate of Unemployment, '*National Bureau of Economic Research* (*NBER Working Paper Series*), Working Paper No. 708.

Rojid, S. (2006), 'COMESA Trade Potential: A Gravity Approach', *Applied Economics Letters*, 13, 14, pp. 947-951.

Roy, J. (2010), 'Do Customs Union Members Engage in More Bilateral Trade than Free-Trade Agreement Members?' *Review of International Economics*, 18, 4, pp. 663-681.

Rey Serge (2006), 'Effective Exchange Rate Volatility and MENA Countries' Exports to the EU', *Journal of Economic Development*, Vol. 31, Issue No. 2.

Sabelhaus, J. (1997), 'Public Policy and Saving in the United States and Canada', *Canadian Journal of Economics*, 30, 2, pp. 253-275.

Sandberg, H, Seale, J., and Taylor, T. (2006), 'History, Regionalism, and CARICOM Trade: A Gravity Model Analysis', *Journal of Development Studies*, 42, 5, pp. 795-811.

Sanso, M, Cuairan, R, and Sanz, F. (1993), 'Bilateral Trade Flows, the Gravity Equation, and Functional Form', *Review Of Economics And Statistics*, 75, 2, pp. 266-275.

Sauer Christine and Bohara K. Alok (2001), 'Exchange Rate Volatility and Exports: Regional Differences Between Developing and Industrialized Countries', *Review of International Economics*, Vol. 9, Issue 1, pp. 133-152.

Schnabl Gunther (2000), 'Exchange Rate Volatility and Growth in Emerging Europe and East Asia', *Open Economic Review*, Vol. 20, Issue No. 4, pp. 565-587.

Schnabl Gunther (2008), 'Exchange Rate Volatility and Growth in Small Open Economies at the EMU Periphery', *Economic Systems*, Vol. 32, Issue No. 1, pp. 70-91.

Sercu Piet and Vanhulle Cynthia (1992), 'Exchange Rate Volatility, International Trade, and the Value of Exporting Firms', *Journal of Banking and Finance*, Vol. 16, Issue No. 1, pp. 155-182.

Serven Luis (2006), 'Real-Exchange Rate Uncertainty and Private Investment in LDCs', *The Review of Economics and Statistics*, Vol. 85, No. 1, pp. 212-218.

Spies, J, and Marques, H. (2009), 'Trade Effects of the Europe Agreements: A Theory-Based Gravity Approach', *Journal of International Trade and Economic Development*, 18, 1, pp. 11-35.

Srivastava, R, and Green, R. (1986), 'Determinants of Bilateral Trade Flows', *Journal of Business, 59*, 4, pp. 623-640.

Staff (2007), the Mineral Industry of South Africa, South Africa Department of Minerals and Energy.

Taylor John (1990), 'the Reorganization of Mine Labor Recruitment in Southern Africa: Evidence from Botswana', *International Migration Review*, Vol. 24, No. 2, Special Issue: Labor Recruiting Organizations in the Developing World (summer, 1990), pp. 250-272.

Tenreyro Silvana (2007), 'On the Trade Impact of Nominal Exchange Rate Volatility', *Journal of Development Economics*, Vol. 82, Issue No. 2, pp. 485-508.

Thompson Henry (2006), 'International Economics, Global Markets and Competition, *2nd Edition, ISBN: 981-256-346-6.*

Thompson Henry (2007), 'an Introduction to Time Series Regression', *Auburn University.*

Tongzon, J, and Felmingham, B. (1998), 'Bilateral Trade in the Asia-Pacific: A Case Study for Australia, USA, Japan and Singapore', *Asian Economic Journal*, 12, 4, pp. 379-394.

Tinbergen, Jan, (1962), 'Shaping the World Economy; Suggestions for an International Economic Policy (*New York; the Twentieth Century Fund*).

Van Der Merwe R.J., (2007), 'Inflation Targeting in South Africa. South Africa Reserve Bank', Occasional Paper No. 19*, ISSN: 1811-735X*, http://www.reservebank.co.za

Varian Hal (1992), 'Microeconomic Analysis', 3rd edition, W.W. Norton & Company, Inc. *ISBN 0-393-95735-7.*

Vergil Hassan (2005), 'Exchange Rate Volatility in Turkey and its Effect on Trade Flows', *Journal of Economic and Social Research*, Vol. 4, Issue 1, pp. 83-99.

Vita De Glauco and Abbott Andrew (2004), 'The Impact of Exchange Rate Volatility on UK Exports to EU Countries', *Scottish Journal of Political Economy*, Vol. 51, issue 1, pp. 62-81.

Vusi Gumede (2000), 'Import Performance and Import Demand Functions for South Africa', Department *of Trade and Industry*, Republic of South Africa.

Wang, C, Wei, Y, and Liu, X. (2010), 'Determinants of Bilateral Trade Flows in OECD Countries: Evidence from Gravity Panel Data Models', World Economy, 33, 7, pp. 894-915.

Weliwita Ananda, Ekanayake E. M. and Tsujii Hiroshi (1999), 'Real Exchange Rate Volatility and the Developed Countries', 1978-96, *Journal of Economic Development*, Vol. 24, Issue No. 1.

Wim Naude and Riaan Rossouw (2008), 'Export Diversification and Specialization in South Africa: Extent and Impact', *World Institute for Development Economics Research*, Version 22 JEL codes F10, F14, O24, O14, O55.

Yohane Khamfula (2004), 'Macroeconomic Policies, Shocks and Economic Growth in South Africa', *Global Development Network*, Working Paper.