

**DYNAMICS OF MACROECONOMIC VARIABLES IN
FIJI**

A Cointegrated VAR Analysis

A thesis submitted in partial fulfilment of the requirements for the Degree
of
Master of Commerce and Management

at
Lincoln University

by
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Lincoln University
Canterbury
New Zealand
2008

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The objective of this study is to examine how macroeconomic variables of Fiji interrelate with aggregate demand and co-determine one another using a vector autoregression (VAR) approach. This study did not use a prior theoretical framework but instead used economic justification for selection of variables. It was found that fiscal policy, which is generally used as a stabilisation tool, did not have a positive effect on real Gross Domestic Product (GDP) growth in the short term. Effects on GDP growth were positive over the long term but not statistically significant. Furthermore, expansionary fiscal policy caused inflationary pressures. Fiji has a fixed exchange rate regime, therefore, it was expected that the focus of monetary policy would be the maintenance of foreign reserves. It was, however, found that monetary expansion in the short term resulted in positive effects on real GDP growth and resulted in inflation. The long term effects of monetary policy on real GDP growth were negative, which are explained by the fixed exchange rate regime, endogenous determination of money supply by the central bank, an unsophisticated financial market and, perhaps, an incomplete transmission of the policy. Both merchandise trade and visitor arrivals growth were found to positively contribute to short term and long term economic growth. Political instability was found not to have significant direct effects on real GDP growth but caused a significant decline in visitor arrivals which then negatively affected economic growth in the short term.

Key words: macroeconomic, vector autoregression, VAR, cointegrated VAR, VECM, real GDP, monetary policy, fiscal policy, merchandise trade, visitor arrivals, government expenditure, export price index, stationarity, lag order selection, cointegration, impulse response functions, forecast error variance decomposition, Fiji

ACKNOWLEDGEMENTS

I owe significant gratitude to my supervisors, Associate Professor Amal Sanyal and Dr. Baiding Hu of the Commerce Division, Lincoln University for their supervision, intellectual inspiration, probing criticisms and constant encouragement. I owe significant gratitude to Mr. Bert Ward, Commerce Division, Lincoln University for introducing me to econometrics and generously imparting his knowledge and time. I owe significant gratitude to Ms Caitriona Cameron of the Student Learning Centre for imparting knowledge on thesis writing processes as well as on academic writing style. I also owe gratitude to Janette Busch for copy editing this document.

I wish to express my sincere thanks to all my friends and fellow students for their encouragement and company during this study.

I thank my wife for her encouragement and moral support during this study and my children for bearing with my long absences from home during the course of this study.

Finally, I wish to thank NZAid for their sponsorship and the Government of Fiji for granting me study leave for the duration of my study.

I dedicate this thesis to the memory of my mother who passed away in January 2006.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 STATEMENT OF PROBLEM

The aim of this study is to examine macroeconomic dynamics of Fiji, in particular, to explore how macroeconomic variables interrelate with aggregate demand and co-determine one another using an empirical method. The study will empirically determine how these variables respond to shocks to the system. Justification for using such a method is presented below.

The motivation of this study is derived from various studies on the Fijian economy that have found diverse and, at times, contradictory empirical evidence on the direction and magnitude of the effects of some variables on aggregate output. These findings have, at times, led to conflicting discussions on the direction of economic policy, which creates difficulties for policy makers in choosing an appropriate policy mix that will enable faster growth of aggregate output. Harmony between policy variables is necessary so they do not contradict one another.

Previous studies have focused on a particular variable or a specific set of variables that affect aggregate output based largely on prior theoretical frameworks. Diversity in theoretical frameworks used for the selection of variables in those studies causes difficulty in making a reasonable comparison of findings. Econometric theory allows comparison of model specifications based on the same theoretical framework; however, it does not provide a basis for comparison of models derived from different

theoretical frameworks. Studies of the economy without any implicit theoretical framework enable the examination of inter-related macroeconomic variables and their relationships with aggregate output without the imposition of any theoretical structure or any *a priori* restrictions. This is intended in our study.

An alternative to the use of models with imposed theoretical structures and restrictions was described by Sargent (1979). Sargent provided an introduction to the use of the vector autoregression (VAR) approach and described procedures for analysing inter-related time series. The vector autoregression approach was suggested as a better substitute for use of economic theory in structural specifications and the imposition of numerous restrictions. Alternatives were sought as a result of a growing belief that the *a priori* restrictions used in econometric models then, were not a result of good dynamic theory. Empirical interpretations of these models and policy implications based on numerous restrictions were, according to Sargent (1979), worth little since they were not even approximately correct. He also considered index models as another alternative to structural models; however, index model methods were rather complicated and involve technical intricacies in their implementation. Sargent's paper provided an introduction to the work of Christopher Sims of the University of Minnesota who used the VAR approach to demonstrate macroeconomic models of Germany and United States. Sims' (1980) work led to greater acceptance of the VAR approach by demonstrating the type of analysis that can be conducted using this method.

Large scale models perform useful forecasting and policy analysis functions. Sims (1980) suggested that restrictions imposed on such models are neither essential nor innocuous despite their identification. He discussed three categories of criticisms levelled against standard econometric methods saying that if there was only one serious criticism it would provide a reasonable basis on which to improve those models, but three were too many. The first criticism was about the numerous restrictions imposed on such models, as already been emphasised in the discussion above. The second criticism was that spurious restrictions are generated when it is assumed that adjustments in the economy are sluggish. To account for the sluggishness, lag lengths are introduced in the dynamic specification of the structural models, but the number of lags required is theoretically not known. The third

criticism of standard structural models was that expected future values are replaced by distributed lags which, according to Sims, “is an unsound practice” (1980, p. 6).

As a result of the criticisms discussed above, Sims (1980) suggested the use of the VAR approach for macroeconomic analysis. The VAR approach does not require any prior theoretical framework for model identification and allows every variable to influence the other variables. Unnecessary variables in a system can be eliminated using Granger causality tests as part of the method. The method also allows statistical determination of the number of distributed lag lengths using data of the variables selected for analysis. According to Sims, analysis conducted using VAR can be done on “systems comparable in size to large scale macro models” (1980, p. 16). He later (1986) explains that the VAR approach also has reasonable merit for use as a policy analysis tool apart from its forecasting ability since it uses data as its basis, in contrast to other methods.

Use of the VAR approach for examination of macroeconomic variables is a viable alternative to various structural macroeconomic models. This approach will enable the examination of how variables co-determine and inter-relate with one another and determine how a system of study variables responds to shocks. This is what is attempted in our study.

1.2 OBJECTIVES OF THE STUDY

Country specific studies are useful in the development of economic policies; however, existing macroeconomic studies of Fiji do not provide consistent findings that would be useful for policymaking. The main objective of this study is to examine how various macroeconomic variables in Fiji inter-relate with aggregate output and co-determine each other using the VAR approach. Specific objectives of the study are:

- (i) To identify a set of macroeconomic variables that provide a reasonable representation of Fiji’s economy and have a reasonable variability suited to the intended analysis. In this study aggregate output is looked at from the

expenditure perspective and not from the production perspective. This means that variables taken to move conjointly with output are expenditure related and not production inputs like capital and labour.

- (ii) To determine a model specification that is stable and allows every variable to influence every other variable. Such a specification will be determined using tests of stationarity, lag order selection, Granger causality and cointegration.
- (iii) To examine the dynamic interrelationships between the selected macroeconomic variables and analyse the system's response to typical random shocks with the use of impulse response functions and variance decompositions.
- (iv) To consider economic implications of this study.

1.3 OUTLINE OF THE STUDY

The remainder of the study is organised as follows:

- (i) Chapter 2 begins with a brief review of the literature on cross-sectional studies on economic growth to consider the relevance of such studies to individual countries. Macroeconomic literature relevant to Fiji is also reviewed with particular emphasis on those studies that explain factors that affect aggregate output. Literature on the use of the VAR approach for analysis as an alternative to standard macroeconomic modelling is also reviewed in this Chapter.
- (ii) In Chapter 3 the rationale for selection of variables for the study is outlined. Data used in the study is described within this chapter, including the calculation of the export price index in Fiji for years 1988-2005. The

empirical steps for the VAR approach used for the study are also described within this chapter.

- (iii) In Chapter 4 the results of the VAR analysis are presented and discussed.
- (iv) In Chapter 5 discussions include major findings from the study, limitations of the study, future research directions and a summary to conclude this study.

The remaining sections in this chapter provide a brief overview of Fiji's economy. The overview provides geographical, political and economic facts about Fiji, discusses the macro economy and briefly outlines major economic sectors. This provides a background to the empirical study. The background is not extensive, but intends to provide relevant facts about Fiji and highlight major aspects of the economy that relate to the analysis and discussions presented in later chapters.

1.4 AN OVERVIEW OF THE FIJI ECONOMY

COUNTRY FACTS

The Fiji Islands are situated north of New Zealand and north west of Australia in the Melanesian group of the South Pacific region. They are relatively small in size with a total land area of 18,272 square kilometres of which only 9.9 percent is arable (United Nations, 1998). There are three land ownership types: native, which is communally based, crown and freehold. Native ownership is 86 percent, freehold ownership is 8 percent, while the remaining 6 percent is in crown ownership (Prasad, 2006; M. Reddy & Lal, 2002). Fiji's Exclusive Economic Zone (EEZ)¹ has 1,290,000 square kilometres of sea.

¹ United Nations Law of the Sea Treaty (United Nations, 1983) has ratified that the EEZ is an area of ocean two hundred nautical miles beyond a country's territorial sea to which a country has exclusive rights to all economic resources (Bailey, 1997).

Fiji Islands was ceded to Great Britain in 1874 and regained independence in 1970. Since independence there have been four undemocratic changes to government. The first, a military coup, displaced a democratically elected government in 1987. The second, another military coup in the same year, displaced an interim regime appointed by the, then, Governor-General. In 2000, civilians held another democratically elected government hostage for a prolonged period resulting in the military taking over control for a third time. The military again took over control of the government in a coup in late 2006.

According to the 2007 population census, there were 827,900 people in Fiji (Fiji Islands Bureau of Statistics, 2007). There is no significant increase expected in the population, since the average annual growth rate has been 0.6 percent for the past 11 years. The population comprises two major ethnic groups: indigenous Fijians (57 percent), and Indo-Fijians (38 percent) (Fiji Islands Bureau of Statistics, 2007). There is mixed evidence that the indigenous Fijians who have inhabited Fiji for more than 3000 years were from coastal Asia (Gravelle, 1979.). The majority of the Indo-Fijians are descendants of indentured Indian labourers who were brought to Fiji by the British to work on plantations, while a minority are immigrants with business interests (Scarr, 1984).

The United Nations Human Development Index (HDI) ranks Fiji at 92nd position from a total of 177 countries (United Nations, 2008). The index is calculated using measures of life expectancy, education and standard of living. Life expectancy at birth in Fiji is 68.3 years. The education index² for Fiji is now 74.8 percent. Standard of Living in the HDI is measured using Gross Domestic Product (GDP) per capita, when Purchasing Power Parity (PPP) adjusted, GDP per capita in Fiji Islands is \$US 6,049 (United Nations, 2008).

Cotton and, later, sugar plantations were developed by early settlers. Since independence, the sugar industry has made significant contributions to the

² This index is calculated using both achievements in adult literacy and combined gross primary, secondary and tertiary education enrolment rates (United Nations, 2008).

development of the economy. The sugar industry still remains a strong contributor to economic activity, although there is increased manufacturing activity and the tourism industry has grown in importance as a source of economic growth.

MACROECONOMIC PERFORMANCE

Average Gross Domestic Product (GDP) growth rates in Fiji have been declining in recent years compared to the early years after independence. Average annual real GDP growth rates from independence (1970) to 1986 were 4.0 percent, from 1987 to 1999 they were 2.8 percent and from 2000 to 2005 they declined to just 1.8 percent³. GDP growth in 2006 and 2007 was estimated at 3.6 percent and -3.9 percent, respectively (Reserve Bank of Fiji, 2008). A recovery to 2.2 percent growth is expected in 2008, and 1.6 and 2.0 percent forecasted for 2009 and 2010, respectively (Reserve Bank of Fiji, 2008).

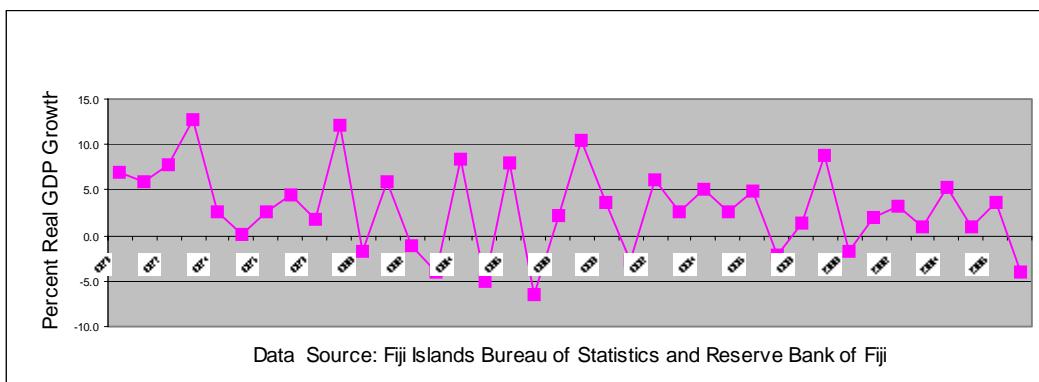


Figure 1.1: Real GDP Growth (1970-2007)

Figure 1.1, above, reflects the volatile nature of real GDP growth in Fiji. Growth rates are calculated from GDP in 1995 prices. Negative economic growth in recent years, particularly 1987, 1991 and 2000, have been a result of political uncertainties. Elected governments were displaced in 1987 and 2000, while the 1991 decline followed the adoption of a controversial constitution, which has since been amended.

³ Calculations are based on data collected from annual *Current Economic Statistics/Key Statistics* published by the Fiji Islands Bureau of Statistics.

Negative economic growth in 1997 was a result of the effects of the Asian financial crisis. Government response to the effects of the Asian crisis was through an expansionary fiscal policy to boost aggregate output and a devaluation of currency to ensure competitiveness of exports. High economic growth levels followed in 1999, but because of subsequent political crises, this result was not sustained.

Apart from the disturbances discussed above, declining sugar cane production has had a negative effect on GDP growth in recent years. Reasons for the decline in production and productivity within the industry are discussed later in this chapter. As a result of the decline and the continued growth in tourism industry, the tourism industry has become the most important industry for economic development in Fiji. The tourism industry, however, is subject to constant fluctuations as a result of domestic political uncertainties. Faced with these declines, government has made several attempts to revitalise the economy, as reflected in its fiscal, trade and monetary policies.

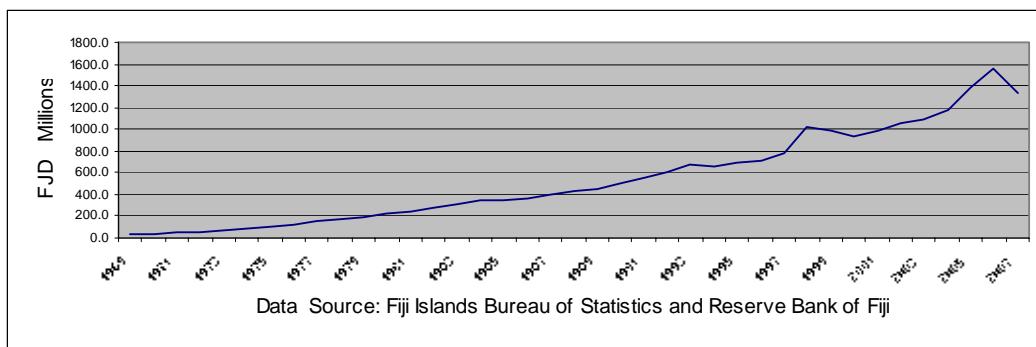


Figure 1.2: Government Expenditure (1969-2007)

Figure 1.2, above, reflects trends in government purchases with increases evident in 1998 and 2006, in response to the effects of the 1997 Asian financial crises and slow growth since 2000. The rate of growth of government purchases in recent years appears higher than in the early years after independence. Although government purchases have continually increased, average growth rates have declined.

The monetary policy of the government has remained in agreement with the fiscal and trade policies. Implementation of the policy is delegated to the Reserve Bank of Fiji, which has a legally mandated objective of maintaining inflation control. Inflation

control has a restraining effect on economic growth. There can be substantial costs to economic growth if inflation moves too far from reasonable levels and requires control (Waqabaca & Morling, 1999). To achieve control an output gap has to be maintained between money supply and GDP. According to Waqabaca and Morling (1999), to achieve a one percent reduction in inflation, an output gap of approximately 3.0 percent would have to be maintained for about one year. This output gap will control inflation but cause contraction of the GDP.

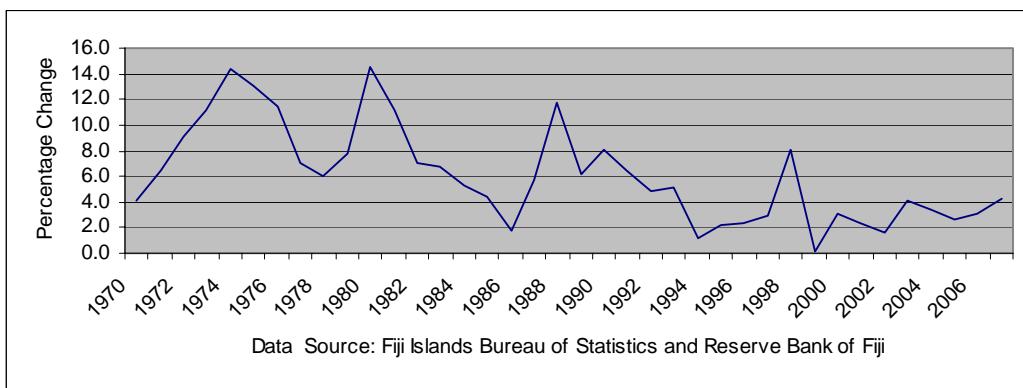


Figure 1.3: Inflation Rates (1970-2007)

There are three major stages in the transmission of monetary policy in Fiji; “(i) the flow on of changes in short-term money market rates to other interest rates in the economy, particularly commercial bank lending and deposit rates, (ii) the effects of changes in interest rate on economic activity and (iii) the effects of economic activity on inflation” (Waqabaca & Morling, 1999, p. 21). Figure 1.3, above, shows inflationary trends in Fiji for years 1970 – 2007, reflecting the key objective of monetary policy. It is evident that in the early years after independence, although real economic growth rates were high, inflation rates were high as well. Inflation has been actively controlled by the central bank, with the use of monetary policy, and reductions were observed in recent years; however, economic growth rates have also been low in these years. High inflation rate was observed in 1998, which was a result of currency devaluation in that year.

Figure 1.4, below, reflects the trend of narrow money supply (M1). Changes in money supply reflect the changes in interest rates in the economy. The interest rate is used as a monetary policy tool to achieve its ultimate objective of price stability.

Although monetary policy maintains the objective of price stability it has to be in harmony with fiscal and trade policies to ensure achievement of the intended objectives of government policies.

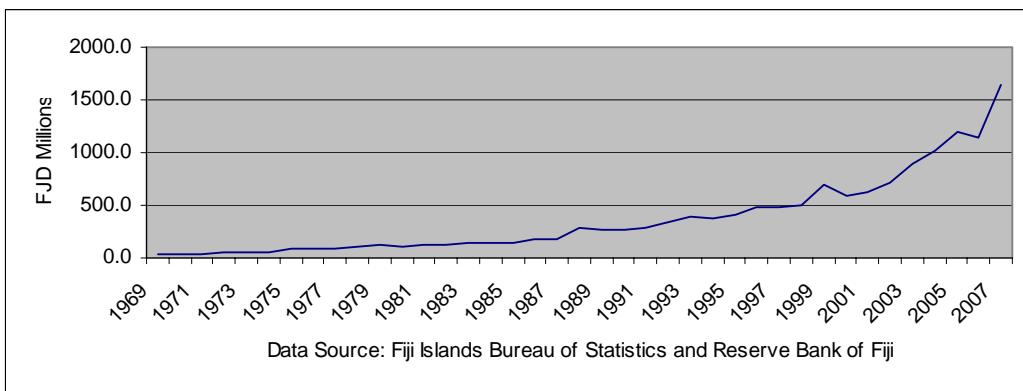


Figure 1.4: Narrow Money Supply (1969-2007)

Trade policy in Fiji from 1970 to 1986 focused on import substitution industries until a change in approach from 1987, when the government embarked on a significant trade liberalisation programme (Elek, Hill, & Tabor, 1993). This change in policy is represented by the changing trade proportions over the two periods, as shown in Figure 1.5 below. Levels of trade have improved since a trade liberalisation programme was adopted.

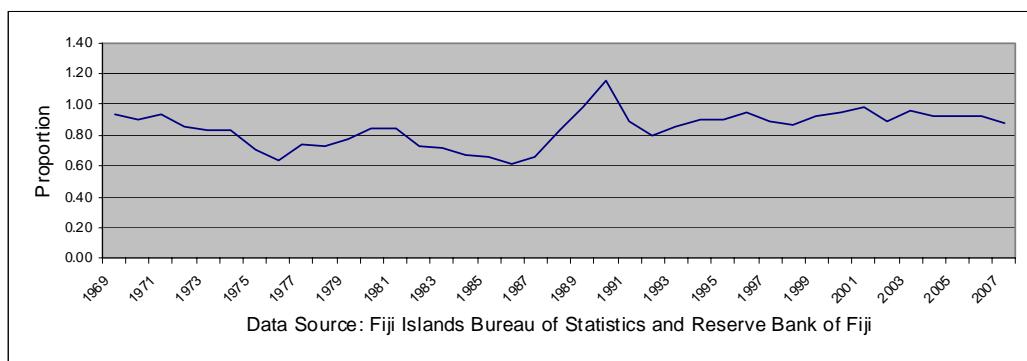


Figure 1.5: Merchandise Trade as a Proportion of GDP (1969-2007)

The Government of Fiji’s Ministry of Foreign Affairs and External Trade reports that the “last decade has seen Fiji adopt an export oriented, outward-looking approach to

trade relations. Restrictions (on imports) have been lifted in favour of export promotion and, as a result, Fiji now has a more open economy" (2008).

Trade policies adopted by the government are observed to improve levels of trade. They ensure that domestic industries are internationally competitive and the focus of the economy is on industries in which it has a comparative advantage. Prices received for exports from the country also determine the level of production for export purposes. Figure 1.6, below, reflects the percentage increases in prices for exports from Fiji. There have been reasonable levels of price increases until the early 1990's after which export prices have stabilized.

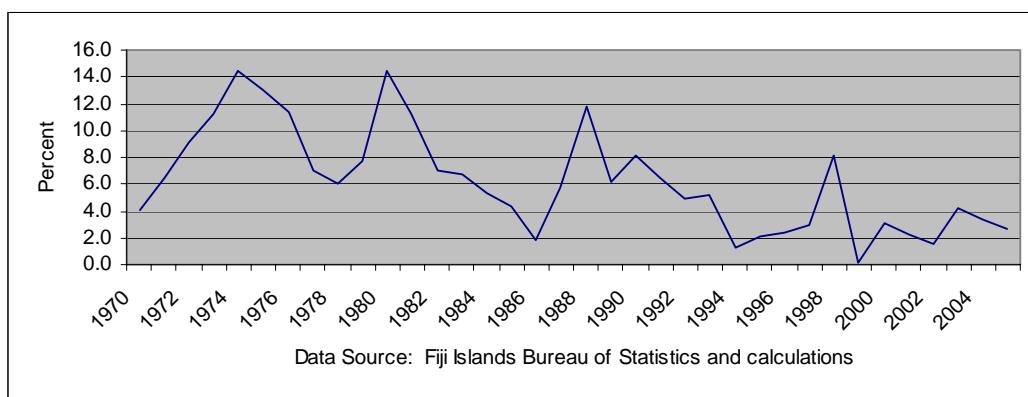


Figure 1.6: Export Inflation (1970-2005)

MAJOR ECONOMIC SECTORS

Tourism

The tourism industry has become the leading industry in Fiji after the recent decline of the sugar industry. Fiji has had strong growth in visitor arrivals in the last two decades, as shown in Figure 1.7, below. Visitor arrivals declined during periods of political uncertainties, 1987-1988 and 2000. Visitor arrival numbers, as a result of 2006-2007 political uncertainties, have not reduced as much as when the country was faced with the earlier political uncertainties. The impact of political uncertainties on visitor arrivals indicates that political stability is a significant factor for Fiji's tourism industry and, consequently, for economic growth.

The tourism industry contributes directly to the restaurants and hotels subsector and indirectly to most economic sectors, such as transport and communications, agriculture and fisheries, construction, electricity and water, and finance and insurance. Given these cross sectoral contributions, the tourism industry “is the country’s largest source of economic growth, investment and foreign exchange earnings” (Government of Fiji, 2006, p. 62). Negative economic growth when visitor arrivals decline, which also correlates with political uncertainties, shows the relative importance of tourism industry to economic development in Fiji.

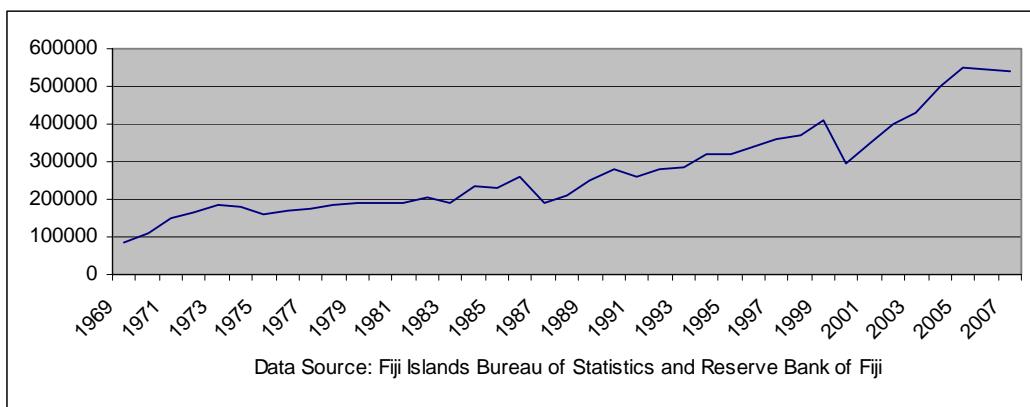


Figure 1.7: Visitor Arrivals (1969-2007)

Sugar

The sugar industry has been the backbone of the economy for a significant number of years. The contribution of this industry to economic development has declined as a result of reduced sugar cane production and the continued growth of the tourism industry. Figure 1.8, below, reflects the declining trend in the sugar industry in Fiji. Sugar production in 2007 was the lowest since 1970. There are external factors that have caused a decline of this industry; however, domestic factors have contributed the most.

A large proportion of sugar produced in Fiji is exported at preferential prices under various preferential trading arrangements (N. Reddy, 2003). Erosion of preferential trading arrangement, driven by the World Trade Organisation, has resulted in declining prices, particularly from the European Union (EU). The EU started reducing preferential prices from 5 percent in 2006/2007 to up to 39 percent by 2009/2010 (Government of Fiji, 2006). Declining prices is an external factor but,

internally, the industry is faced with declining farm and mill productivity, rising input costs, worker shortages, deteriorating rail infrastructure and expiring land leases (N. Reddy, 2003). The government has embarked on an industry restructuring plan aiming to improve productivity levels in cane and sugar production to ensure the survival of the industry without the previous high preferential prices (Government of Fiji, 2006). The success of this re-structuring plan is not known since it is in the early phases of implementation.

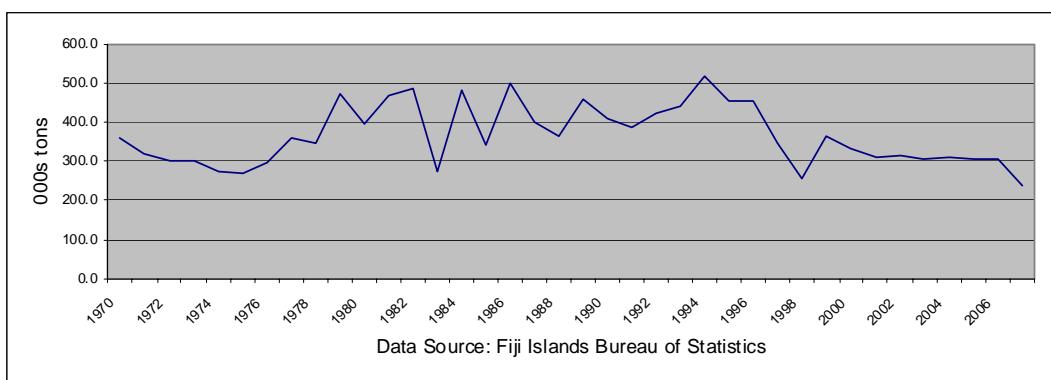


Figure 1.8: Sugar Production (1970-2007)

Fishing

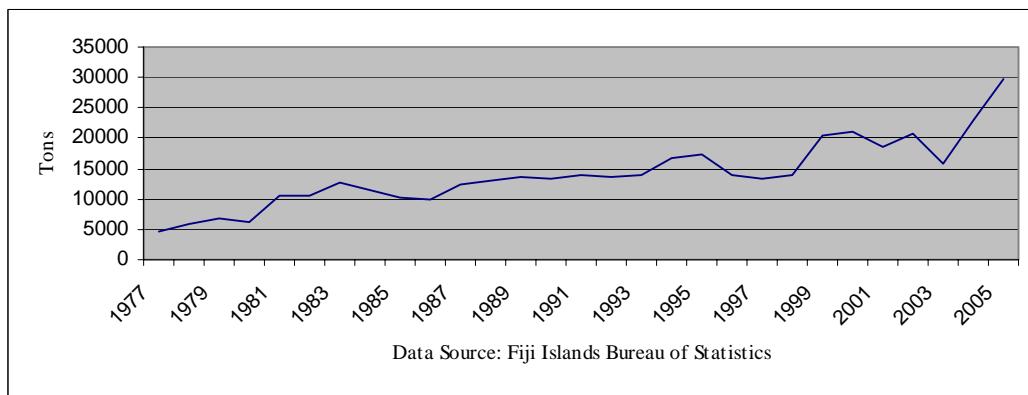


Figure 1.9: Fish Production (1977-2006)

The fishing industry includes fishing for domestic consumption, fresh fish exports and the tuna industry, which involves canning and processing of tuna for exports. Fiji has 1,290,000 square kilometres of sea within its EEZ; however, fish harvests have been relatively low. There have been increases in production from this industry in recent

years; therefore, a greater contribution from this industry is expected in the future economic development of Fiji. Figure 1.9, above, reflects the increasing production from this industry.

Garments

The development of the garment industry in Fiji resulted from preferential trading arrangements, low labour costs and tax concessions (Government of Fiji, 2006). This industry has been a significant source of export led growth in recent years, but lost its importance as a result of its inability to compete on prices, particularly in the Australian market. Fiji, through its own initiatives, developed a reasonably sized garment industry that thrived on economic incentives given to manufacturers and the preferential access provided under a regional trade agreement, South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) (Grynberg & Powell, 1995). SPARTECA is a trade treaty between Australia, New Zealand and Pacific Island Countries (PICs) (Forum Secretariat, 2008) which includes Fiji. SPARTECA provides PICs duty free or preferential access to Australia and New Zealand markets for all commodities produced in the PICs, except sugar from Fiji (Forum Secretariat, 2008). Figure 1.10, below, reflects the growth and decline of this industry over a thirteen year period.

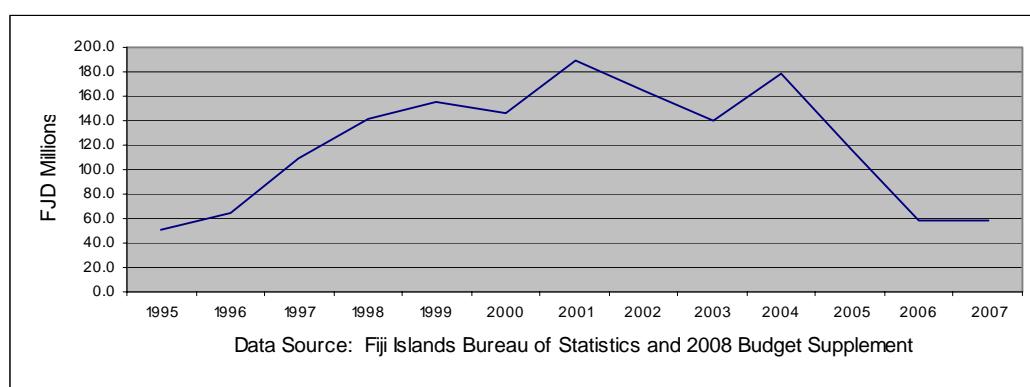


Figure1.10: Garment Production (1995-2007)

Preferential access to the Australian garment market has declined for Fiji as a result of reduction in tariff rates for imports from other countries. Under SPARTECA, Fiji garments had access to the Australian market at low rates of tariffs. Australia has

progressively reduced tariffs on garment imports from all other sources while the tariffs paid under SPARTECA have remained the same. This has reduced Fiji's competitiveness in the Australian market. United States also removed quota access for Fiji made garments (Government of Fiji, 2006). The garment industry in Fiji is currently concentrating on niche market products such as sports and business wear, which are smaller in volume but require faster turnarounds.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter has three purposes. First, it provides a very brief overview of multi-country cross-sectional studies on factors that affect economic growth and discusses the relevance of their findings to policy making, particularly in Fiji. Secondly, it surveys studies on the determinants of economic growth in Fiji based on prior theoretical frameworks. This survey intends to bring out diversity and, possibly, contradiction in findings about economic growth. Given the multiplicity in *a priori* theorisation and its implications for policy making, the third purpose of this chapter is to provide justification for the use of the intended empirical strategy in the study.

2.1 CROSS-SECTIONAL STUDIES OF ECONOMIC GROWTH

Seminal macroeconomic studies on economic growth by Kormendi and Meguire (1985)⁴, Barro (1991, 1997)⁵, Levine and Renelt (1992) and Sala-i-Martin (1997) have led to wide interest in determinants of economic growth. Such studies provide

⁴ Kormendi and Meguire (1985) in their exploratory cross-sectional study found that population growth rate was the only significant positive contributor to economic growth while openness was found to be a weak contributor. They found that initial per capita income, monetary variance and inflation contributed negatively to economic growth.

⁵ Studies by Barro (1991, 1997) found that investment-GDP ratio, initial human capital, political stability, low fertility rate, rule of law and changes in terms of trade were positive contributors to economic growth. He found that share of government consumption and initial per capita income contributed negatively.

insights into which variables positively or negatively contribute to economic growth across a cross section of countries. There is no agreed set of variables known to researchers that affect economic growth in a particular way. Selection of variables for such studies are dependent on the theoretical framework the researchers use and the motivation for their studies. The studies by Kormendi and Meguire (1985) and Barro (1991, 1997) have used different set of variables, except for initial per capita income⁶, to determine their effects on economic growth.

Variables used by Kormendi and Meguire (1985) and Barro (1991) were combined in a study by Levine and Renelt (1992). Their intention was to determine which variables were robust contributors to economic growth, and they identified only two variables. Levine and Renelt (1992) found that of the two robust variables, investment-GDP ratio contributed positively, while initial levels of per capita income contributed negatively, to economic growth. Their study indicates that the popular cross-country findings on determinants of growth are very sensitive to their theoretical frameworks.

Sala-i-Martin (1997) later suggested that Levine and Renelt used an “extreme test” of robustness in their study. Levine and Renelt also examined various fiscal and monetary variables and found that none contributed significantly to economic growth. Such results imply that relationships between macroeconomic variables may be more complicated than what has been examined in studies with prior theoretical frameworks and their implied restrictions. Sala-i-Martin (1997)⁷ found a comprehensive set of variables that significantly determine economic growth. Of the

⁶ Their findings on this variable are the same.

⁷ Sala-i-Martin (1997) had the following significant variables (direction of effect given in brackets): (i) Latin America dummy (negative), (ii) Sub-Saharan Africa (negative), (iii) Absolute latitude (negative), (iv) Rule of Law (positive), (v) Political Rights (positive), (vi) Number of Revolutions, Military Coups and War (negative), (vii) Confucian (positive), (viii) Buddhist (positive), (ix) Muslim (positive), (x) Protestant (negative), (xi) Catholic (negative), (xii) Real Exchange Rate Distortions (negative), (xiii) Standard Deviation of the Black Market Premium (negative), (xiv) Equipment Investment (positive), (xv) Non-Equipment Investment (positive), (xvi) Fraction of Primary Products in Total Exports (negative), (xvii) Fraction of GDP in Mining (positive), (xviii) Number of Years Economy has been Open (positive), (xix) Degree of Capitalism (positive) and, (xx) Former Spanish Colony (negative).

several variables he found to have significant effects on economic growth, it is apparent that countries do not have control over many of them. A country will not be able to change its geographical region, religion or who its historical colonisers were. There are also variables such as those of a political nature, market distortions, market performances and the structure of the economy that may prove difficult to change in the short term. Investment variables appear to be the only ones that could be affected in the short and the long term to contribute to economic growth.

Cross-sectional studies such as those discussed above are based on the assumption that economies have similar structures and, therefore, are comparable. However, factors found to induce economic growth in cross-sectional studies involving small economies such as Fiji, and large complex economies such as India, China and the United States (US), are not always relevant to all economies studied. For example, research and development (R&D) expenditure may not be a determinant of growth for small developing economies like Fiji because it has not fully utilised available technologies. A study by Goel and Ram (1994) found that the R&D expenditure variable is not a significant contributor to growth for a cross-section of countries but in a different study of the US economy, Goel, Payne and Ram (2008) found R&D to be a significant contributor to economic growth in the US. Such findings provide evidence that although cross-sectional studies provide useful insights on factors that affect economic growth, they are not very relevant to country-specific policy making. Given such limitations, there is a need for country specific studies to understand the nature of macroeconomic variables and their interrelationships in individual economies.

2.2 STUDIES OF ECONOMIC GROWTH IN FIJI

Studies of the Fiji economy, using macroeconomic models, have found investment (Gounder, 2002; Jayaraman & Choong, 2006; Narayan & Smyth, 2005), labour (Gounder, 2002), political stability (Chand, 2000; Gounder, 1999, 2001, 2002; Narayan & Smyth, 2005), foreign aid (Gounder, 2001), economic freedom (Gounder, 2002), education (Jayaraman & Choong, 2006; Narayan & Smyth, 2005), exports

(Narayan & Singh, 2007), openness (Jayaraman & Choong, 2006), military spending (Narayan & Singh, 2007), fiscal and monetary expansion (Dahalan & Jayaraman, 2006) and the tourism industry (Narayan, 2004) to be some of the significant factors that induce economic growth. Most of these studies use either a Solow type growth model or an underlying Cobb-Douglas production function. Not all these report consistent findings of factors that induce economic growth, although most of the studies have focused on determinants of economic growth from the production perspective. Inconsistencies or contradictions in such studies add to the confusion surrounding growth determinants rather than providing useful insights.

Two studies by Gounder (2001, 2002), using Solow type neoclassical growth models, report different findings on the effects of labour and investment ratio on economic growth. The first study, examining the effect of foreign aid on economic growth (2001), included labour, investment-output ratio as proxy for capital, export growth, foreign aid and coup dummies as explanatory variables. The second study, examining the effect of political and economic freedom and fiscal policy on economic growth (2002), included labour, investment-output ratio as proxy for capital, political freedom, economic freedom and fiscal policy as explanatory variables. The first study concluded that “domestic resources⁸ regressed with total aid did not contribute to economic growth” (Gounder, 2001, p. 1018) and, the second study, concluded that “labour force and investment contribute significantly to economic growth” (Gounder, 2002, p. 244). This is one of the instances in which contradictory findings relating to the same variable are reported in studies that used a prior theoretical framework.

Narayan and Smyth (2005) examine the effect of trade liberalisation on economic growth in Fiji. Their study includes labour, investment-output ratio as proxy for capital, exports, secondary school enrolment rates, tax on international trade and dummies for trade liberalisation and coups as explanatory variables. They find that investment contributes to economic growth but the contribution is not statistically significant. In addition, Narayan and Smyth (2005) do not find any conclusive empirical evidence on the contribution of labour to economic growth. In one of their three model specifications a positive coefficient is determined for labour while the

⁸ In this study, domestic resources refer to labour force and investment variables.

remaining two specifications estimate negative coefficients. This finding is different from Gounder's (2001, 2002) findings, the first of which finds no contribution while the second finds a significant positive contribution. These empirical results do not offer any clarification on the effects of these major production variables. Narayan and Smyth (2005) also find that exports have a statistically insignificant effect on GDP in the long term. They find a stronger short term relationship but these results are ambiguous. A similar finding, for exports, is reported by Dahalan and Jayaraman (2006) who studied the effects of fiscal and monetary policies and exports on the GDP.

Jayaraman and Choong (2006) studied growth constraints and determinants in Fiji. They examined production aspects of GDP as in the earlier studies discussed above. In their examination of gross capital formation, government expenditure on education and ratio of exports and imports to GDP, they find that not only did gross capital formation and government expenditure on education contribute significantly to growth but also the openness policy of Fiji is a significant contributor both in the short term and the long term. The writers find strong evidence of the contributions of the three variables on economic growth compared with the inconclusive evidence from Narayan and Smyth (2005) who considered a similar set of variables. The difference in their findings does not offer policy makers any conclusive evidence on the effect of the variables studied.

Perhaps the reliance of these studies on prior theoretical frameworks, their corresponding choice of variables and implied restrictions had led to diverse, and at times contradictory, findings. It is likely that new studies using the same approach may lead to additional findings that contradict earlier studies and will add to the current confusion. Econometric theory does not suggest any reasonable basis on which to compare the diverse findings of such studies. Such difficulties require study of macroeconomic variables and their relationships with one another without any prior theoretical framework. This would provide policy makers with an understanding of the macroeconomic variables and their interrelationships. The multivariate vector autoregression (VAR) method provides a feasible opportunity to study macroeconomic variables without any prior theoretical framework.

2.3 VECTOR AUTOREGRESSION METHOD

Thomas Sargent (1979) presented an introduction to the work of his colleague, Robert Litterman, at the Federal Reserve Bank of Minnesota, and Christopher Sims of University of Minnesota, on possible use of the vector autoregression (VAR) approach for macroeconomic analysis. The use of a VAR approach was suggested “as an alternative to using structural econometric models” that generally use a large number of restrictions (Sargent, 1979, p. 8). He emphasised that alternatives were sought because of inaccurate conclusions derived from the restricted structural models. He also claimed there were suspicions that model restrictions were not a result of the application of good dynamic theory. While making this introduction, Sargent was, however, cautious about the possible uses of the approach for macroeconomic analysis.

Sims (1980), following the introduction made by Sargent (1979), used this alternative strategy to estimate macroeconomic models of Germany and United States. He presented useful insights on the behaviour of macroeconomic variables relying on the information within the data rather than a prior theoretical framework. Sims’ justification for this alternative method was based on three major problems with structural models that appeared difficult to remedy. First, the reduced forms of the structural models assumed the same structure as the initial structure derived from their theoretical frameworks. Secondly, the dynamic nature of macroeconomic variables leads to many spurious restrictions. Thirdly, structural models use the unsound practice of using distributed lags for expected future values. The VAR approach offered “the opportunity to drop the standard baggage of standard but incredible assumptions macro econometricians have been used to carrying” (Sims, 1980, p. 33).

The VAR approach for analysis is not the only alternative to the structural models. The index model method was considered but proved to be too complicated, with technical intricacies for implementation. The rational expectations model is another alternative; however, the rational expectations models “renounce any claim to be able to produce estimates of immediate effects of policy actions” (Sims, 1982, p. 117).

Sims (1982) also suggested that assessments of the immediate effects of policy actions can undertaken using the VAR approach.

The use of the VAR approach for various macroeconomic studies has been critically examined by Leamer (1985) and Cooley and LeRoy (1985). These writers are critical of the common uses of the VAR approach; however, they note that the method has many uses. Leamer acknowledges that VAR is useful for forecasting or as a descriptive device without any underlying theoretical framework. He suggests that for VAR analysis to have any economic meaning variables have to be justified economically. This has been done in our study. Cooley and Leroy, in their critical examination of the VAR approach, note that it provides complete flexibility and generality in specifying the correlations between past, present and future realizations of the system of variables. They also note that VAR models can be used to generate stylised facts about causal orderings of macroeconomic variables and this seems to be robust empirically. Cooley and LeRoy note that the “appeal of VAR models is that they appear to offer a way to generate the same kind of output as structural models, but without the input of explicit economic theory” (1985, p. 306).

VAR analysis tries to isolate a set of independent shocks that can be regarded as the ultimate source of stochastic variation for all vectors of the variables (Amisano & Giannini, 1997). This method of analysis has led to research and analysis of dynamic interrelationships of various macroeconomic variables. The method does not depend on economic theory for classification of variables and does not need parameter restrictions to start with. It is a useful method to “analyze causation links among variables and guide which series are truly exogenous” (Amisano & Giannini, 1997, p. 13). Causation links can be examined using Granger (1969) causality tests. These causality tests can be used as a statistical basis for the elimination of some variables from the analysis.

The VAR approach has, in recent years, become quite a common tool for macroeconomic analysis. Jumah and Kunst (2008) have looked at the relationship between GDP, construction investment and equipment investment for the United Kingdom using cointegrated VAR without imposing restrictions. Cointegrated VAR, also called the vector error correction method (VECM), is used for analysis of non-

stationary time series. Balderas and Nath (2008) examined the variability of inflation and relative prices against remittances in Mexico using generalised impulse responses from the estimates using VAR. Todani (2007) studied the demand for M3 money in South Africa using cointegrated VAR without imposing restrictions on the model. Structural equation models and VAR were compared by Manera (2006) using manufacturing sector data series from the Italian economy. Manera found that the VAR method performed better than structural models in measuring long term substitutability among factors of production.

This chapter reviewed the applicability of cross-sectional studies to an individual country policy making and highlighted the difficulty of assuming a similar structure across a cross-section of countries such as India, China and Fiji. It also highlighted that all variables found significant or insignificant may not be applicable to all countries studied. There are also some variables considered which cannot be changed by countries that intend to improve their economy. In the case of Fiji, studies on economic growth have relied on prior theoretical frameworks to select variables and arrive at conclusions. The diversity in prior theoretical frameworks has resulted in diversity of findings and conclusions being made. Given this limitation, the possibility of a macroeconomic study without a theoretical framework is considered as an alternative to examine the behaviour of these variables and their influences on one another.

The proposed empirical strategy is based on the above justification for the use of the VAR approach and accounts for a critique of the method. Leamer (1985) suggested that the VAR approach will be economically meaningful if variables used in the analysis are economically justified. Economic justification for the selection of variables of this study is provided in the next chapter.

CHAPTER THREE

3.0 VARIABLE SELECTION, DATA AND METHOD

This chapter has three purposes. First, it will provide economic justification for selection of macroeconomic variables. Economic justification is necessary since this study diverges from reliance on a prior theoretical framework as the basis for analysis by the use of the empirical vector autoregression (VAR) approach. Critiques of the VAR approach emphasise that having economic justification for the selection of variables provides more meaning to the analysis. Secondly, this chapter provides a description of the data series used, their sources and relevant calculations undertaken. Thirdly, an outline of statistical steps and analytical components of the VAR approach is provided.

3.1 VARIABLES IN THE STUDY

Our study focuses on growth of Gross Domestic Product (GDP) from an expenditure perspective. From this perspective, GDP is accounted for by four major components: government purchases, consumption, investment and trade. Growth in these components will result in growth of GDP; however, these components are not autonomous but are affected by other fiscal, monetary and trade variables along with feedback from GDP. The fiscal, monetary and trade variables not only affect these expenditure components and GDP, they are expected to inter-relate with and co-determine each other. Variables in the VAR model are intended to consider both direct and indirect influences on GDP adequately. Inclusion of each additional

variable in a VAR system exponentially reduces the degrees of freedom. To avoid the loss of degrees of freedom, variables are not included unless they are necessary to represent a complete macroeconomic system. In addition to the natural logarithm of real GDP (LGDP), this study uses six variables such that they are representative of the macro economy. These variables are:

- (i) Natural Logarithm of Deflated Government Expenditure (LRGX)
- (ii) Natural Logarithm of Deflated Merchandise Exports and Imports (LRTT)
- (iii) Natural Logarithm of Narrow Money (LM1)
- (iv) Percentage Change in Consumer Price Index (INFL)
- (v) Percentage Change in Export Price Index (EINF)
- (vi) Natural Logarithm of Visitor Arrivals (LVA)

The following discussion provides justification for selection of these variables for this study.

Government Expenditure

Fiscal changes are reflected by alternative variables such as government expenditure, government revenue, fiscal deficit or government borrowings. Changes to government revenue are dependent on performance of GDP and changes in the structure of the taxation system. Fiscal deficit, on the other hand, reflects the financing approach taken by government but does not reflect changes to government expenditure; for example, if government increases spending, but finances this spending through a new tax, this will not be reflected by the fiscal deficit. The dynamics of increased government borrowing were expected to be captured by a money supply variable since monetary policy is expected to be accommodative of fiscal policy. Upward pressure on interest rates, as a result of increased borrowings, is expected to be offset by increases in money supply. Given, that government revenue reflects GDP performance rather than influences GDP performance; that the effects of fiscal deficit not being adequately representative of expenditure changes; that government domestic borrowing dynamics are captured by money supply, and; that the focus of the study is on expenditure components of GDP, government expenditure appears to be the most suitable fiscal variable.

Government expenditure includes government spending on infrastructure, the provision of various government services and transfer payments. When transfer payments are excluded, the remaining spending represents government purchases, which is a component of GDP from the expenditure perspective. Although government purchases are expected to have a direct influence on GDP, it is expected that transfer payments will also influence GDP. Influences from transfer payments on GDP are expected to be indirect through the consumption and investment components. Given the expected indirect influences, government expenditure is included as a variable in this study. Government expenditure has been deflated to determine how real shifts affect GDP and other macroeconomic variables and how they, in turn, influence government expenditure.

Merchandise Trade

Some trade theorists think that trade contributes positively to the economic growth of developing countries by encouraging capital formation and improving efficiency and productivity through improved access to foreign direct investments and new technologies (Bhagwati & Srinivasan, 2002). Other trade theorists think that these positive effects of increased trade are not being realised by developing countries. Dollar (2005) finds that the effects of openness are different for different countries; for example, India and China have benefited from openness while many African countries have not. Agenor (2004) also points out the higher degrees of openness hurts the poor in developing countries. Trade theorists are fairly divided in their opinions of the effects of increased trade on economic growth.

Trade can be represented by several variables, including imports, exports, sum of imports and exports, net exports, ratio of imports and exports to GDP as well as taxes on imports and exports. If imports are used as a variable, it reflects expenditure on imported consumption and investment goods and, if exports are used, it reflects domestic production consumed elsewhere. Apart from exports of primary production, a significant proportion of inputs for other export production are imported. Using either of the variables would not appropriately reflect the dynamics of trade. Use of net exports will also not appropriately reflect the dynamics of trade as increases in exports would be offset by increases in imports. The use of the ratio of imports and exports to GDP appears to be a reasonable variable to measure the openness of the

economy but a ratio may not result in a correct specification given that other variables differ in form. Taxes on imports and exports may reflect changes in trade policy; however, reduction in tax rates may be offset by an increase in trade volume which may not appropriately reflect the effects of a change. Sum of imports and exports appears to be a reasonable variable that will capture the effects of trade on GDP and other macroeconomic variables and be able to reflect feedback from these variables.

Trade, in general, includes both services and merchandise trade. Services trade and merchandise trade are expected to have different dynamics and influence macroeconomic variables differently; therefore, different variables are used to capture their dynamics separately. Trade in services is expected to be captured by the tourism industry while merchandise trade represents import and export of goods. Generally, trade volume is taken as a measure of openness of an economy; therefore, using sum of merchandise trade will also reflect how openness interacts with other macroeconomic variables. Both openness and the exchange rate reflect international influences on domestic economy. Exchange rate was found to significantly affect consumption and investment components of GDP by Kandil and Mirzaie (2006) and Acosta and Loza (2005). Although these studies find the exchange rate variable significant, it is felt that in the case of Fiji the exchange rate may not reflect actual market conditions in Fiji because the rate is pegged to a basket of currencies using a trade weighted index. Given this limitation, the deflated value of merchandise trade is used as one of the variables in this study.

Money Supply

In addition to interest rates, there are three money supply variables that could be used in this study as a monetary variable: narrow money ($M1$)⁹, quasi money ($M2$)¹⁰, and broad money ($M1+M2$; $M3$). We use narrow money as a variable since monetary policy is more easily able to affect the narrow money supply than the broad money supply. Quasi money or broad money would be more relevant as variables if GDP was considered from a production perspective. Money supply is determined by interest rate where increases in interest rate cause money supply decreases and decreases in interest rate cause money supply increases (R. E. Hall & Papell, 2005).

⁹ $M1$ includes currency in circulation, demand deposits and local bills payable.

¹⁰ $M2$ includes savings deposits and time deposits.

Given this relationship, the dynamics of interest rates are well captured within the dynamics of money supply and, as a result, both variables are expected to reflect similar dynamics. The effect of money supply on aggregate output is through shifts of investments in money to physical capital, which eventually leads to economic growth. In addition to its effect on output, money supply also affects inflation. Since price stability is a primary objective of monetary policy, money supply is used as a policy tool to control inflation.

There are two bases on which to consider on the use of money supply as either a real or a nominal variable. The work of Barro and Grossman (1976) provides justification that macroeconomic variables such as money supply should be considered in real terms. Their justification is based on the assumption that prices follow a particular path towards equilibrium values or are fixed. As a result of this price behaviour, economic agents are assumed to maximize their utilities based on the fixed prices. Since economic decisions of resource allocation are based on fixed prices, Barro and Grossman argue that macroeconomic variables should be considered in real terms.

On the other hand, a competing justification that money supply variables should be used as a nominal variable in macroeconomic studies is provided by Lucas (1972, 1975). He explains that nominal fluctuations such as changes to money supply cause changes to real aggregate output and, that economic agents momentarily misperceive increases in money supply as good opportunities. As a result of this misperception, there is increased real aggregate output until people realize that money supply increases are not such good opportunities as initially perceived. This misperception occurs due to the inability of economic agents to differentiate between nominal and real prices, and money supply. The use of price variables, as discussed below with nominal money supply variable, will provide insights on how these variables interrelate with each other and with other macroeconomic variables.

Prices

The tendency of individuals to think in nominal rather than in real terms when faced with economic decision making has been discussed in the paragraphs above. Individuals think in nominal terms since nominal values give a fairly reasonable indication of economic well being. This tendency is known as “money illusion”,

which has been part of economic discussions since Fisher (1928) wrote an entire book on the subject. Writers such as Fisher (1928) and Fischer and Modigliani (1978) assumed that individuals were confused because of inflation. Such an assumption implies that when there is no inflation there is no money illusion but Shafir, Diamond and Tversky argue that this is not the case because “money illusion influences reactions to nominal prices and wage cuts *per se*, the effects of money illusion are likely to extend to non-inflationary settings” (1997, p. 367).

Rational expectation advocates have been quite critical of assumptions about money illusion, to the extent that Tobin (1972) commented “an economic theorist can of course commit no greater crime than to assume money illusion”. Regardless of this, there is a need to understand the inter-relationship of inflation with other macroeconomic variables. We previously discussed that inflation control with the use of monetary policy may lead to contraction of aggregate output. Despite money illusion, prices significantly determine consumption. Higher prices have negative effects on consumption and are expected to also negatively affect GDP. Kormendi and McGuire (1985), in one of the earliest cross-sectional studies, found that inflation had significant negative effects on GDP growth. Barro (1995) also found that inflation had a significant negative effect on GDP growth; however, he concluded that the magnitude of the effect was quite small.

Our study includes GDP, government expenditure and merchandise trade variables in real terms and, given the notion of money illusion and the effect of prices on consumption, price variables need to be included so that their inter-relationships with these variables are examined. Price variables, from an expenditure perspective, include consumer prices and export prices both of which are included as variables in this study.

It is expected that, in addition to consumer prices, export price fluctuations have a significant effect on small open economies such as Fiji. The role of trade in Fiji is quite important, as shown by the relative proportions of trade to GDP in Figure 1.5. Deflated values of merchandise trade are included as a variable; therefore, effects of price changes are separated from that variable.

Visitor Arrivals

Fiji has a large dependence on trade, and merchandise trade dynamics are expected to be reasonably well captured by the deflated value of merchandise trade and the price indices. There is also a need to capture the dynamics of services trade, particularly in the tourism industry. The tourism industry is one of the major contributors to economic activity. Narayan (2004) reports that the tourism industry in Fiji earns more than \$F500 million in foreign exchange and employs more than five percent of the population. The industry has grown at rates of over ten per cent in the last decade; according to Narayan (2004), a ten percent increase in tourism spending in Fiji is expected to increase GDP by half a percent.

Dynamics of the tourism industry are expected to be adequately reflected by changes in visitor arrival numbers. Visitor arrivals are not only affected by domestic conditions such as political stability but also by global prosperity; therefore, economic growth in source markets is expected to increase tourism activity in Fiji. The tourism industry draws production from a large number of economic sectors such as agriculture and fisheries for food production, the construction sector for the provision of accommodation, the transport and communication sector for their services, as well as the entertainment industry. Given the expected effect of the industry on aggregate output, visitor arrival numbers are included as a variable in this study.

Our study considers factors that inter-relate with GDP from the expenditure perspective. Based on this perspective, deflated government expenditure and deflated merchandise trade represent the direct influence of government purchases and trade components on GDP. These variables are expected to also influence consumption and investment components along with narrow money supply, tourism arrivals and prices. These six variables provide a reasonable representation of the macro economy and will be sufficient for the purposes of examining dynamic inter-relationships in the macro economy. Those variables that are not necessary have been eliminated to preserve the degrees of freedom in the analysis. Natural logarithms of the variables are used with percentage changes of price variables so that estimation results are economically interpreted as elasticities.

3.2 DATA COLLECTION

This section provides details of data collected, particularly its sources, and describes calculations undertaken wherever applicable.

Real GDP and GDP deflator

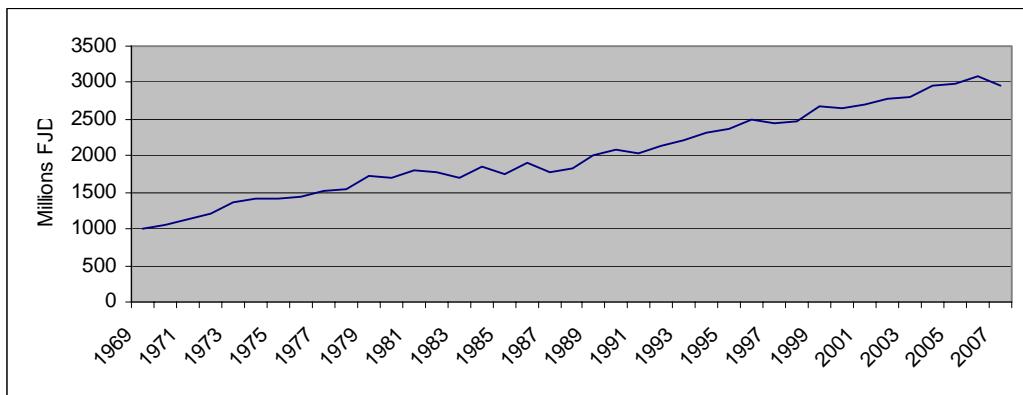


Figure 3.1: Real GDP 1969-2007 (1995 Prices)

Real GDP data (at factor cost) for 1969-2005 was obtained from the Current Economic Statistics (Key Statistics) 1976-2006, published by the Fiji Islands Bureau of Statistics, Suva Fiji. Copies of Current Economic Statistics were obtained from the libraries of the National Planning Office and Fiji Islands Bureau of Statistics, Departments of the Ministry of Finance and National Planning, Government of Fiji. The 2006 and 2007 data was obtained from Reserve Bank of Fiji Quarterly Review, March 2008. The Quarterly Review is available from the Reserve Bank of Fiji website¹¹. Data is available in 1968 prices for 1969-1977, 1977 prices for 1977-1989, 1989 prices for 1989-1995 and in 1995 prices for 1995-2007. The entire series was re-calculated so that various year base series were re-stated in the 1995 base year series. The 1995 base year series was chosen as it is the most recent base year used by the Fiji Islands Bureau of Statistics and the Reserve Bank of Fiji.

Nominal GDP data (at current factor cost) for the 1969-2007 period was also obtained from the Current Economic Statistics (Key Statistics) 1976-2006 and Reserve Bank of Fiji Quarterly Review, March 2008. For the purposes of this study, the GDP deflator

¹¹ http://www.rbf.gov.fj/docs/Mar-08%20QR_Statistical%20Tables.pdf

series was calculated as a proportion of the re-calculated real GDP (1995 prices at factor cost) and nominal GDP values (at factor cost) for 1969-2007. This calculated GDP deflator series, used to deflate nominal values of government expenditure and sum of exports and imports, is described within this section. Figure 3.2, below, reflects the computed GDP deflator.

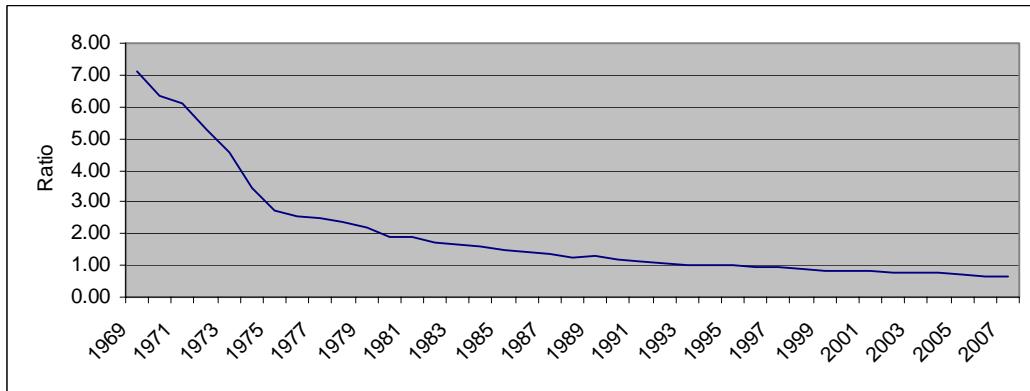


Figure 3.2: GDP Deflator (Base Year = 1995)

Deflated Government Expenditure

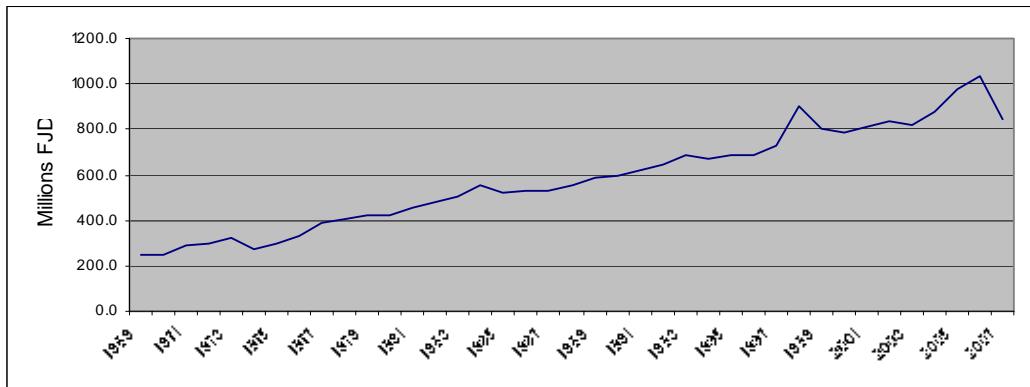


Figure 3.3: Deflated Government Expenditure (1969-2007)

Figure 1.2, in Chapter 1, shows trends in nominal government expenditure. Figure 3.3, above, reflects the same series deflated using the calculated GDP deflator described above and shown in Figure 3.2. The removal of inflationary trends resulted in more obvious fluctuations in the series. Nominal data for years 1969-2004 in the series was obtained from Current Economic Statistics (Key Statistics) 1974-2006,

published by the Fiji Islands Bureau of Statistics, Suva Fiji. Data for years 2005-2007 were obtained from Reserve Bank of Fiji Quarterly Review, March 2008.

Merchandise Imports and Exports

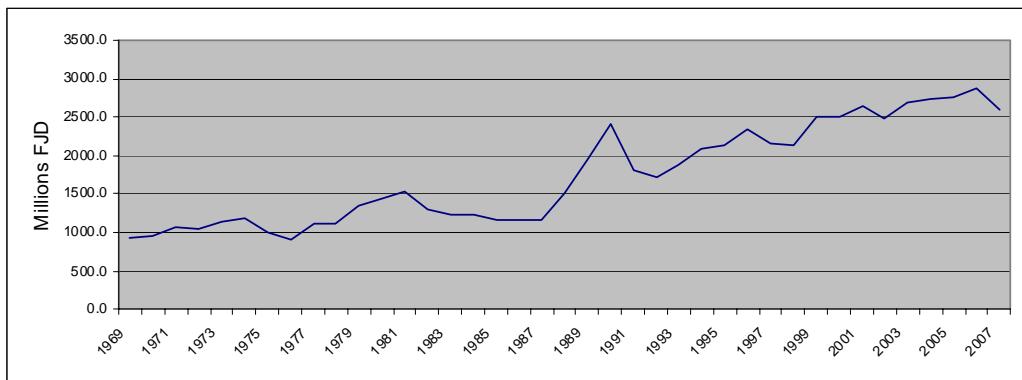


Figure 3.4: Deflated Merchandise Trade (1969-2007)

Figure 3.4, above, reflects trends in merchandise trade. There is an apparent increase in trade from the early 1990's, which quite possibly was as a result of trade liberalisation and development of garment industry. Nominal data for merchandise trade for years 1969-2005 in the series was obtained from Current Economic Statistics (Key Statistics) 1974-2006, published by the Fiji Islands Bureau of Statistics, Suva Fiji. Data for years 2006 and 2007 were obtained from Reserve Bank of Fiji Quarterly Review, March 2008. Nominal merchandise trade values have been deflated using the calculated GDP deflator.

Narrow Money

Figure 1.4, in Chapter 1, reflects changes to narrow money. Narrow money was not deflated for the purposes of this study. Data for narrow money from 1969-2005 were from the Current Economic Statistics 1979-2006, published by the Fiji Islands Bureau of Statistics, Suva Fiji. The 2006 and 2007 data were obtained from the Reserve Bank of Fiji Quarterly Review, March 2008. Narrow money includes notes and coins in circulation, net demand deposits and local bills payable.

Consumer Prices

Consumer prices are measured using index values, data (1969-2005) for which were collected from the Current Economic Statistics (Key Statistics) 1975-2006, published

by the Fiji Islands Bureau of Statistics, Suva Fiji. Indexes for 2006 and 2007 were obtained from the Reserve Bank of Fiji Quarterly Review, March 2008. The indexes over the years were calculated using 1968, 1974, 1979, 1985 and 1993 bases. To calculate a consistent series, the index for the entire period was recalculated with 1995 as the base year that was aligned with the real GDP and GDP deflator base years. Figure 3.5, below, reflects the re-calculated series.

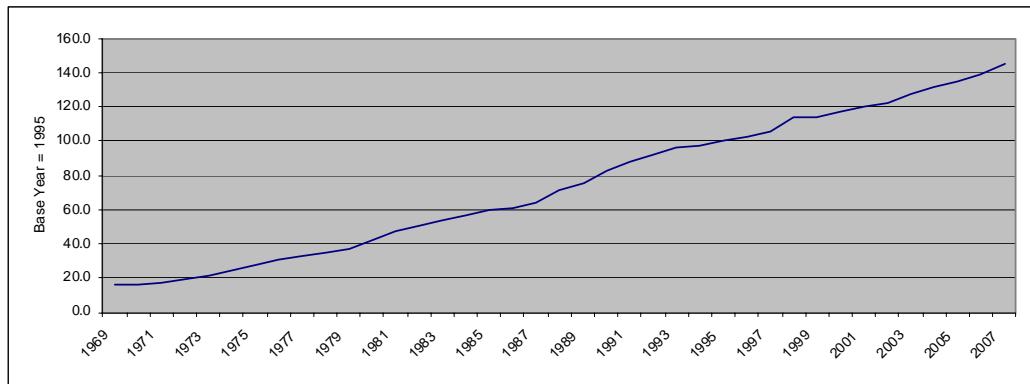


Figure 3.5: Consumer Price Index (1969-2007)

Visitor Arrivals

Data on visitor arrivals for years 1969-2002 were collected from the Current Economic Statistics (Key Statistics) 1971-2006, published by the Fiji Islands Bureau of Statistics, Suva Fiji. Arrival numbers for 2003-2007 were obtained from the Reserve Bank of Fiji Quarterly Review, March 2008. Figure 1.7, in Chapter 1, reflects the trend in visitor arrivals over the data period.

Political Instabilities

Visitor arrivals are significantly affected by the political stability of the country. Since there have been three major incidences of political instability that were expected to have significant effects on visitor arrivals and other macroeconomic variables, dummy variables were created to capture the effects. A single dummy variable for years in which coups occurred (1987, 2000 and 2007; 2007 was used instead of 2006 since the 2006 coup occurred late in the year and the effects were most likely felt in 2007) was created, which assumes an equal effect of each event on the system of variables.

Export Price Index

Export Price Index has been calculated by the Fiji Islands Bureau of Statistics (FIBOS) up to 1988. The indexes were obtained from Overseas Trade Fiji 1979-1988, published by FIBOS, Suva Fiji. Indexes for the years after 1988 were not calculated by FIBOS; therefore, export data for years 1988 to 2005 were used for the calculation. Electronic version of data was made available for the years 2000 – 2005 while 1988 – 1999 data was sourced from the respective years Trade Report published by the FIBOS. Trade data beyond 2005 was not available from the Fiji Islands Bureau of Statistics when the data were collected.

Table 3.1 below summarises the trade price index calculated by FIBOS for years 1970-1988.

Table 3.1: Export Price Index (1969-1988)

| Year | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | |
|-------------|------|------|------|-------|-------|-------|-------|-------|-------|------|-------|
| Price Index | 78.4 | 85.0 | 83.8 | 100.0 | 115.8 | 225.5 | 214.7 | 198.1 | 210.6 | 100 | 107.9 |

| Year | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Price Index | 106.9 | 143.7 | 126.5 | 123.9 | 131.0 | 129.6 | 116.7 | 156.7 | 214.2 | 204.7 |

Since the data used to establish the 1977 base are not available, 1988 data were used to re-commence the calculation of the series. Although 1988 was not a normal year for Fiji, as it was recovering from the effects of the first coup, another base year was not used until 1991, since reasonable price and quantity data were not available until then. 1995 and 2000 years were also used as bases to maintain reasonable coverage in the indexes.

There are three general methods of indexing: Laspeyres, Paasche and Fisher's method. The Laspeyres method uses base period weights while the Paasche method accounts for shifts in commodity compositions from the base period in using index year weights. Fisher's method is used for calculation of the indices when significant volatility is experienced (Afriat, 1977; Allen, 1975).

FIBOS publications refer to the use of Laspeyres method for the calculation of trade indexes. When calculating the price index assuming that for individual item i, price at the base period is p_{i0} , at the observation period to be p_{it} , and quantity at the base period is q_{i0} the following equation, called "Laspeyres formula", was used:

$$\frac{\sum_i p_{it} q_{i0}}{\sum_i p_{i0} q_{i0}} \quad (\text{Allen, 1975, p. 52}) \quad (3.1)$$

where, denominator and numerator are total expenditure for all items, at the base and the observation period, respectively, while assuming that consumers purchase the same amount of commodities both at the base period and the observation period. In this formula, quantities are fixed at the base period. For use in indexing, the above equation is transformed as follows:

$$\frac{\sum_i \frac{p_{it}}{p_{i0}} w_{i0}}{\sum_i w_{i0}} \quad \text{where} \quad w_{i0} = \frac{p_{i0} q_{i0}}{\sum_i p_{i0} q_{i0}} \quad \text{and} \quad \sum_i w_{i0} = 100 \quad . \quad (3.2)$$

This is the weighted average of price ratios of each item, weighted by expenditure at the base period. A similar transformed formula was also used for the quantity indices:

$$\frac{\sum_i \frac{q_{it}}{q_{i0}} w_{i0}}{\sum_i w_{i0}} \quad \text{where} \quad w_{i0} = \frac{p_{i0} q_{i0}}{\sum_i p_{i0} q_{i0}} \quad \text{and} \quad \sum_i w_{i0} = 100 \quad . \quad (3.3)$$

The following table summarises the calculated indices using formulae 3.2. Further details on the price series, and the quantity indices, are provided in Annex 2.

Table 3.2: Export Price Index (1988-2005)

| Year | 1988 | 1989 | 1990 | 1991 | 1991 | 1992 | 1993 | 1994 | 1995 | 1995 | 1996 |
|-------------|-------|-------|-------|-------|-------|------|------|------|------|-------|-------|
| Price Index | 100.0 | 100.1 | 102.6 | 103.6 | 100.0 | 95.2 | 92.2 | 97.2 | 94.7 | 100.0 | 125.2 |

| Year | 1997 | 1998 | 1999 | 2000 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|-------------|------|------|------|-------|-------|-------|-------|-------|-------|------|
| Price Index | 78.4 | 85.0 | 83.8 | 100.0 | 115.8 | 225.5 | 214.7 | 198.1 | 210.6 | 100 |

The next section discusses the necessary empirical steps in analysing the above data series using the VAR method.

3.3 VECTOR AUTOREGRESSION (VAR) APPROACH

This section provides an outline of the various statistical procedures that are necessary for a VAR approach. The first step in the approach is to determine if the data series are stationary or otherwise. If they are not stationary, then a cointegrated VAR (also called vector error correction – VEC) specification will be necessary. The second step will be to determine the number of lags necessary to appropriately capture the dynamics of the data. The third step would be to use Granger causality tests to determine the exogeneity of variables in the Granger causality sense. This step will assist in determining exogenous variables for imposition of restrictions for cointegrated VAR estimation. The next step requires testing for cointegration if any of the study variables are found to be non-stationary, which is quite likely in time series studies. If variables are found to be cointegrated, then the final step would be to examine their dynamic interrelationships using impulse response functions and variance decompositions. These steps are discussed in detail below.

STATIONARITY OF SERIES

The primary objective of the VAR approach is to determine the inter-relationships among macroeconomic variables and not estimate parameters. Given that this study examines inter-relationships it does not matter if we use of stationary or non-stationary data series in the system. If we use stationary data series then a standard VAR approach will be sufficient. Non-stationary data series may be made stationary by differencing; however, Sims (1980) recommends against differencing series as

doing so reduces information on the inter-relationships among the data series. If we do not difference non-stationary data series then a cointegrated VAR approach has to be used. Given the nature of data in this study, tests of stationarity become an integral part of the analysis so that it can be established if a standard VAR or a cointegrated VAR approach is used.

Time series data generally tend to be non-stationary in nature, or have unit roots. A non-stationary series may have a number of unit roots and is often referred to as integrated to the order of d [$I(d)$ where $d = 1, 2, \dots$]. A stationary series is said to be integrated to the order of 0 [$I(0)$]. There are important differences between non-stationary and stationary time series in terms of their responses to shocks. Shocks to a stationary time series are temporary, over time the effects of the shocks will dissipate and the series will revert to its long term equilibrium level. As such, forecasts of a stationary series will converge to the mean of the series. Shocks to a non-stationary series persist over time since the mean and variance of a non-stationary series are time dependent. As a result of non-stationarity, regressions with time series data are likely to result in spurious results.

The problems of spurious regression results have been highlighted by Granger and Newbold (1974). They point out that two different time series may not have any relationship but as a result of similar time trends they may appear to be highly correlated. Given this problem, there has been considerable research on methods to test for stationarity and econometric techniques that could be applied to non-stationary time series data. Tests of stationarity, commonly known as unit root tests were developed by David Dickey and Wayne Fuller (1979, 1981). Dickey and Fuller required testing for non-stationarity, if the current period observations were dependent on its immediately preceding period of observation. Their method, despite its limitations, has become a benchmark for comparison with other tests of unit roots. The equation form of unit root test is:

$$Y_t = \rho Y_{t-1} + \varepsilon_t \quad (3.4)$$

Where $-1 \leq \rho \leq 1$, t represents time and ε represents a random white noise error term.

If we conduct a regression analysis based on the above equation, we can estimate the value of ρ . Hypothesis testing of the value of ρ is the basis of the Dickey and Fuller unit root tests. To simplify, the above equation can be transformed as follows:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + \varepsilon_t \quad (\text{Subtracting } Y_{t-1} \text{ from both sides of Equation 3.4})$$

$$\Delta y_t = (\rho - 1)y_{t-1} + \varepsilon_t \quad (\text{The above is simplified as Equation 3.5 below})$$

$$\Delta y_t = \delta y_{t-1} + \varepsilon_t \quad \text{Where } \delta = \rho - 1$$

$$\text{If } \delta = 0 \text{ then } \rho = 1$$

Equation 3.2 is the most restricted form of the Dickey-Fuller unit root test. To test the null hypothesis that $\delta = 0$ against alternative hypothesis that $\delta < 0$ we expect the usual t-distribution to be used. However, this is not the correct distribution even in large samples. Dickey and Fuller have shown that the correct distribution of unit root statistics follows τ (tau) distribution. There are three different Dickey-Fuller test equations and they each have their own distribution (summarised in Table 3.3 below).

Table 3.3: Dickey-Fuller Test Equations

| Test Equation | Null Hypothesis | Test Statistic ¹² | Equation |
|--|--|--|----------|
| $\Delta y_t = \delta y_{t-1} + \varepsilon_t$ (random walk) | y_t is stationary with zero mean | τ Table 8.5.2 (Fuller, 1976, p. 373) | 3.5 |
| $\Delta y_t = \beta_1 + \delta y_{t-1} + \varepsilon_t$ (random walk with drift) | y_t is stationary with non-zero mean | τ_μ Table 8.5.2 (Fuller, 1976, p. 373) | 3.6 |
| $\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \varepsilon_t$ (random walk with drift and trend) | y_t is stationary around a deterministic trend | τ_τ Table 8.5.2 (Fuller, 1976, p. 373) | 3.7 |

In conducting the above Dickey-Fuller tests it is usually assumed that the error terms are uncorrelated. In the time series data used in this study, error terms are likely to be correlated so the Augmented Dickey-Fuller (ADF) tests need to be used. This test is

¹² Recent econometric software packages do not require comparison with critical values for unit root tests. Test results generally provide critical values for commonly used significance levels.

conducted by augmenting the previous three test equations (Equations 3.5-3.7) by adding lagged values of the dependent variables Δy_t (Dickey & Fuller, 1981). The ADF tests equations¹³ are given below.

$$\Delta y_t = \delta y_{t-1} + \alpha_i \sum_{i=1}^m \Delta y_{t-i} + \varepsilon_t \quad (3.8)$$

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \alpha_i \sum_{i=1}^m \Delta y_{t-i} + \varepsilon_t \quad (3.9)$$

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha_i \sum_{i=1}^m \Delta y_{t-i} + \varepsilon_t \quad (3.10)$$

If there are no significant lags of dependent variable in ADF tests, the test equations revert to those shown in Table 3.3. Distributions to test the null hypothesis that $\delta = 0$ in Equation 3.8-3.10 are in the same order as that for Equations 3.5 - 3.7. Distributions for testing joint restrictions ($\beta_1 = \delta = 0$ in Equation 3.9 and $\beta_2 = \delta = 0$ in Equation 3.10) are explained by Dickey and Fuller (1981). These distributions and relevant critical values are not discussed here since they are also available from recent econometric software packages that feature unit root tests.

Given that there are three test equations with Equation 3.10 being the least restricted and Equation 3.8 the most restricted, we follow the testing procedure suggested by Dolado, Jenkinson and Sosvilla-Rivero (1990). According to this procedure, we start with the least restricted equation (Equation 3.10) and check for significance of its deterministic terms. Deterministic terms include trend and intercept terms. If the trend and intercept terms are not statistically significant then a more restricted model is used. According to the procedure above, the results used in the analysis will be based on a specification that eliminates insignificant deterministic trends.

ADF testing requires the selection of lags for the augmented dependent variable. Alastair Hall (1994) suggests that performance of the ADF tests improves when the lag length is selected from the data being used by any one of the several commonly

¹³ Critical values for the ADF tests are provided by econometric software packages when unit root tests are conducted.

applied lag length criteria available in econometric software packages. Given Hall's suggestion, this study will use Hannan and Quinn (1979) criteria for lag length selection.

It is common practice to use a few alternative unit root tests since the power of these tests is low. This means that it is likely that the null hypothesis of unit root may be rejected for a variable by one test but not by another. An alternative test of unit root, developed by Phillips and Perron (1988), allows testing of data series that are weakly dependent and possibly heterogeneously distributed. The tests accommodate specifications with drift and time trend while the limit distributions of the tests are the same as those used in Dickey-Fuller tests. When compared with Dickey-Fuller tests the Phillips-Perron tests allow for more general time series specifications. Phillips-Perron test equations are as follows:

$$y_t = \alpha y_{t-1} + \mu_t \quad (3.11)$$

$$y_t = \hat{\mu} + \hat{\alpha} y_{t-1} + \hat{\mu}_t \quad (3.12)$$

$$y_t = \tilde{\mu} + \tilde{\beta}(t - \frac{1}{2}T) + \tilde{\alpha} y_{t-1} + \tilde{\mu}_t \quad (3.13)$$

When using this alternative test the same procedure will be applied as with the Dickey-Fuller test by starting with the least restricted equation and using more restricted models if the deterministic terms were insignificant. Whenever the tests contradict graphical plots of the data will be examined before deciding on whether the series is stationary or otherwise. Possible noise in the data will also be reduced by using logarithmic transformation, wherever necessary.

Once the number of unit roots (or the order of integration) in the series is determined the next step would be to determine an appropriate number of lags to be used in estimation.

LAG LENGTH SELECTION

Selection of an appropriate number of lag lengths for a VAR model is important because the use of long lags uses up degrees of freedom. One possibility to minimise this loss of degrees of freedom is to use different lag lengths for each variable in the system. However, Enders (1995) suggests that using different lag lengths causes asymmetry in the system. In order to preserve symmetry it is common to use the same lag length for all the variables. Maintaining the same lag length allows the efficient use of the ordinary least squares (OLS) estimation method. To compromise this efficiency, Enders (1995) suggests that there needs to be enough justification for using different lags for each variable.

When selecting lag lengths we have to be mindful that if lag length was too small the model may be mis-specified and if it was too large, degrees of freedom are wasted (Enders, 1995). Given these scenarios an appropriate lag selection criteria has to be used. In using such criteria, comparisons have to be made between the determinants of variance-covariance matrices (Σ_p) of VAR estimates using different lag lengths.

When different lag length VARs using the same variables are tested, the shorter length specification becomes the restricted version of the longer length specification; therefore, tests of cross-equation restrictions are most appropriate for lag length selection. Many tests of cross-equation restrictions can be applied in choosing lag lengths. Sims (1980) suggests that an appropriate criterion for lag selection would be a modified likelihood ratio test statistic. The test statistic is modified to account for short data series used in economic studies which is calculated as:

$$(T - c)(\log|\Sigma_{p-i}| - \log|\Sigma_p|) \text{ where} \quad (3.14)$$

T - Number of usable observations;

c - Number of parameters estimated in each equation in an unrestricted system;

$\log|\Sigma_i|$ - is the natural logarithm of the determinant of variance covariance matrix.

Different criteria for lag selection have been compared by Ozcicek and McMillin (1999). They suggest that the Akaike Information Criteria selects true lags for VAR more frequently than other criteria.

Eviews 6.0 is used in this study, and different lag selection criteria are available in this econometric software including likelihood ratio test suggested by Sims (1980) and Akaike Information criteria suggested by Ozcicek and McMillin (1999). We will use lag length as suggested by most of the available criteria and subsequently test for existence of any autocorrelation with the chosen lag length. If the chosen lag length does not have any problem of autocorrelation, then it will confirm that the selected lag specification is appropriate for the data used. The next step in the analysis will be to test for Granger causality and exogeneity of variables.

GRANGER CAUSALITY

Occasions where it is difficult to decide the direction of causality between related variables led to Granger's (1969) investigation on causality. He proposed testable definitions of causality using two variable examples, according to which a variable y is said to cause variable x if we are able to better predict the value of x using y . He also considered possible feedback among variables, which is the premise of this study, when explaining that x may be better predicted with inclusion of y and vice versa. He noted that a "feedback mechanism may be considered as the sum of (various) causal mechanisms and these causalities can be studied by decomposing cross or partial cross spectra" (Granger, 1969, p. 438).

Granger causality tests are useful for a VAR study since they are helpful in deciding whether to incorporate a variable into a system. Since we have provided economic justification for the selection of variables, the use of Granger causality tests may appear not to have a useful purpose for this study. Given the statistical nature of this test, they will serve to confirm if the selected variables are appropriate for the system. A test of causality in a VAR system will determine if distributed lags of one variable

will affect other variables in the system. To undertake such a test, a test of cross-equation restrictions is necessary of the form:

$$\alpha_{21}(1) = \alpha_{21}(2) = \alpha_{21}(3) = \dots = 0 \quad (3.15)$$

According to Enders (1995), Granger causality tests should be called ‘Block Exogeneity Tests’. A necessary condition for exogeneity of a variable x is that current and past values of other variables do not affect this variable x . In this study, the block exogeneity tests will determine whether lags of one variable cause any other variable in the system (equation form of the test is the same as Equation 3.11). The test follows a χ^2 distribution with the degrees of freedom equal to the number of restrictions in the test. Once the block exogeneity tests are undertaken, the next step will be the test for cointegration among the variables. Cointegration implies that there are stationary equilibrium relationships among the variables even though some or all of variables may be non-stationary.

COINTEGRATION

An equilibrium relationship among a set of non-stationary variables implies that their stochastic trends must be related. These non-stationary variables have a combination that is stationary and, as a result, are said to be cointegrated. The idea of cointegration testing in the study of time series data comes from the works of Granger, Weiss and Engle with the most prominent contribution made by Engle and Granger (1987). Engle and Granger suggested a two step approach to test for cointegration. The first step requires estimating a static version of the model and the second step requires tests for the existence of a unit root in the stochastic error term of the estimated static model. This two step method is not relevant for the purposes of this study because it requires one variable to be placed on the left hand side of an equation before stationarity of the system is tested in the second step.

Johansen (1988) built on the work of Engle and Granger (1987) to develop a maximum likelihood approach to estimate cointegration vectors for an autoregressive process with independent Gaussian errors. This method is a multivariate extension of

the Dickey-Fuller unit root test. This approach will be used to test if there are one or more cointegrating relationships among the variables, which will also determine if a valid error correction specification exists. The existence of a cointegrated VAR specification is implied by cointegration.

The Johansen procedure for cointegration is implemented on a cointegrated VAR counterpart to a standard VAR specification. This procedure does not require all variables to be integrated to the same order. According to Harris and Sollis (2003) it is possible that cointegration is present when there is a mix of I(0) and I(1) variables. In such instances the stationary I(0) variables play a key role in establishing long term equilibrium relationships. The VAR specification is as follows:

$$X_t = \mu + \Pi_1 X_{t-1} + \dots + \Pi_p X_{t-p} + \phi D_t + e_t \quad (3.16)$$

where:

X_t = a (7 x 1) vector containing observations on each of the variables [LGDP,

LRGX, LRTT, LM1, INFL, EINF, LVA, DCOUP]

μ = a (7 x 1) vector of intercept terms

Π_p = (7 x 7) matrices of parameters on the individual lags

ϕ = a (7 x 1) vector of parameters on the dummy variable

e_t = MVN (0, Ω) - a (7 x 1) vector of (white noise) error terms

The VEC counterpart to the VAR model is as follows:

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_p \Delta X_{t-p+1} + \Pi X_{t-p} + \phi D_t + e_t \quad (3.17)$$

where:

$$\Gamma_i = -I + \Pi_1 + \dots + \Pi_{p-1}$$

$$\Pi_i = -I + \Pi_1 + \dots + \Pi_p$$

The $p \times p$ Π matrix contains information about long term equilibrium relationships among the variables used in the study and the rank of Π gives the number of cointegrating relationships. The Π matrices also contain the short term adjustment parameters. If the rank of Π is 0, then there is no cointegration among the variables

but if $0 < [\text{rank}(\Pi)] = r < p$, then there is cointegration. With cointegration Π can be decomposed into the product of two $p \times r$ matrices α and β (shown as Equation 3.15 below) (Johansen, 1988).

$$\Pi = \alpha\beta' \quad (3.18)$$

The β matrix contains the long term parameters while the α matrix measures the speed of adjustment parameters. Their linear combinations are expected to be stationary. Johansen (1988, p. 236) specifies maximum likelihood functions for estimating optimal values for β matrix (shown as Equations 3.19 and 3.20 below).

$$L_{\max}^{-2/T} = |S_\infty| \prod_{i=1}^p (1 - \hat{\lambda}_i) \text{ (Without Equation 3.18 as constraint)} \quad (3.19)$$

$$L_{\max}^{-2/T} = |S_\infty| \prod_{i=1}^r (1 - \hat{\lambda}_i) \text{ (With Equation 3.18 as constraint)} \quad (3.20)$$

where

$$[\lambda S_{kk} - S_{k0} S_\infty^{-1} S_{0k}] = 0 \quad \text{and} \quad S_{ij} = T^{-1} \sum_{t=1}^T R_{it} R_{jt}' \quad \text{for } i, j = 0, \dots, k$$

Residual R_{0t} is obtained from regression of the ΔX_t vector on its lags and R_{kt} residuals are obtained from regression of X_{t-k} on lags of their first differences.

The above equations (Equations 3.19 and 3.20) determine the rank of Π matrix (r), which is also the number of statistically significant eigenvalues or the number of cointegrating vectors. The trace test used by Johansen (1988) for testing $H_0 : r = 0$ versus $H_a : r > 0$ is:

$$\text{Trace} = -T \sum_{i=r+1}^p \ln(1 - \hat{\lambda}_i) \quad (3.21)$$

The maximum Eigenvalue test suggested later by Johansen and Juselius (1990) for testing $H_0 : r = 0$ versus $H_a : r = 1, 2, \dots, p-1$ is:

$$\text{Max } \lambda = -T \ln(1 - \hat{\lambda}_r). \quad (3.22)$$

In addition to determining whether there are any cointegrating vectors among the variables, there is need to determine if there are any deterministic (intercept or trend) terms either in the data or in the cointegrating relations. The most restricted assumption is that there are no deterministic trends either in data or in the cointegrating relations, with the least restrictive alternative that there are deterministic trends both in data and cointegrating relations. In selecting between the various restricted and unrestricted model specifications, this study follows the Pantula Principle suggested by Johansen (1992). The Pantula Principle requires that all specifications are estimated before moving from the most restrictive specification to the least restrictive one. The procedure stops the first time a cointegrating relationship is found. The test statistic for hypothesis testing in such cases are specified by Osterwald-Lenum (1992).

INNOVATION ACCOUNTING

The VAR approach (standard or cointegrated) uses impulse response functions (IRFs) and forecast error variance decompositions (FEVD) to examine dynamic interrelationships among variables in the system. IRFs can be regarded as the ultimate source of stochastic variation of all vectors of the variables. FEVD is used in identifying the exogenous and endogenous variables in the VAR model (Enders, 1995). We will discuss each in turn.

Impulse Response Functions

Sims' (1980) method allows us to separate the time paths of current and past shocks on the variables in the system. VAR specification of the system of variables is:

$$X_t = \mu + \Pi_1 X_{t-1} + \dots + \Pi_p X_{t-p} + \phi D_t + e_t$$

where the column vector X_t includes the variables: LGDP, LRGX, LRTT, LM1, INFL, EINF, and LVA.

Moving average representation of the model, according to Enders (1995, p. 305) is:

$$X_t = \bar{X} + \sum_{i=0}^{\infty} \phi_i e_{t-i} \quad (3.23)$$

where $\phi_0 = I_n$ is an $n \times n$ identity matrix, n = number of variables in the system, $E(e_t) = 0$ and:

$$\phi_i = \sum_{p=1}^i \phi_{i-p} \Pi_p, i = 1, 2, \dots, \Pi_j = 0 \text{ for } j > p \quad (3.24)$$

From the moving average representation in Equation 3.31 the elements of the matrix ϕ_i can be interpreted as impulse responses to the system, provided there is no serial correlation among the error terms. If the elements of e_t are serially correlated, the Σ_e matrix is not diagonal. This problem is remedied by orthogonalisation of e_t , the error term (Sims, 1980).

Given that $\Sigma_e = PP'$ and P is assumed to represent a lower triangular matrix from which we construct an $n \times 1$ vector w_t where $w_t = P^{-1}e_t$; therefore, $\Sigma_w = E(w_t w_t') = I_n$.

The moving average representation in Equation 3.23 is transformed as:

$$X_t = \sum_{i=0}^{\infty} \theta_i w_{t-i} \text{ Where } \theta_i = \phi_i P \quad (3.25)$$

Impulse responses are given by:

$$\Psi_j = \sum_{i=0}^j \phi_i \quad \text{and} \quad (3.26)$$

$$\Xi_j = \sum_{i=0}^j \theta_i = \Psi_j P \quad (3.27)$$

And the accumulated impulse responses are given by:

$$\Psi_\infty = \sum_{i=0}^\infty \phi_i = (I_n - \Pi_1 - \dots - \Pi_p)^{-1} \text{ and} \quad (3.28)$$

$$\Xi_\infty = \Psi_\infty P \quad (3.29)$$

Equations 3.28 and 3.29 are useful tools for examining the interaction between variables in this study. The coefficients of the matrices can be used to examine the effects of e_{nt} shocks on the individual variables. Graphically representing the impulse response functions gives a practical visual representation of the series behaviour in response to shocks.

Forecast Error Variance Decomposition

The properties of forecast error are useful in understanding the inter-relationships among selected variables in the system.

Given the model specification $X_t = \mu + \Pi_1 X_{t-1} + \dots + \Pi_p X_{t-p} + \phi D_t + e_t$ the forecast of period $t+1$ would be: $X_{t+1} = \mu + \Pi_1 X_t + \dots + \Pi_p X_{t-p+1} + \phi D_{t+1} + e_{t+1}$ with the expectation that one period forecast error is:

$$X_{t+1} - E(X_{t+1}) = e_{t+1} \quad (3.30)$$

The forecast error for j -periods is given in terms of a vector moving average representation by:

$$X_{t+j} - E(X_{t+j}) = \sum_{i=0}^{j-1} \phi_i e_{t+j-i} \quad (3.31)$$

Equation 3.31 is based on the conditional expectation that future e is zero when shocks are serially uncorrelated. It is unlikely that shocks would be serially uncorrelated. Given that the forecast errors for the series LGDP, LRGX, LRTT, LM1, INFL, EINF, and LVA are the diagonal elements of the following matrix:

$$E[(X_t - E(X_{t+j}))(X_t - E(X_{t+j}))'] = \sum_{i=0}^{j-1} \phi_i \Sigma_e \phi_i' \quad (3.32)$$

where $\Sigma_e = E(e_t e_t')$

Since the elements of e_t are serially correlated, the Σ_e matrix is not diagonal. This problem is remedied by orthogonalisation of e_t , the error term.

Given that $\Sigma_e = PP'$ and P represents a lower triangular matrix from which we construct an nx1 vector w_t where $w_t = P^{-1}e_t$; therefore, $\Sigma_w = E(w_t w_t') = I_n$.

If ϕ_{ivs} is the v,s element in ϕ_i matrix and σ_s is the standard deviation for disturbance s where s = 1,...,n, the j steps forecast variance of the v-th variable is given by:

$$E(X_{vt+j} - E(X_{vt+j-i}))^2 = \sum_{i=0}^{j-1} \sum_{s=1}^n \phi_{ivs}^2 \sigma_s^2 \quad v=1,\dots,n \quad (3.33)$$

The forecast error variance decomposition (FEVD) is then written for j steps percent of variance for the variable v attributable to the k-th innovation as:

$$\text{FEVD}(v, k, j) = \frac{\sum_{i=0}^{p-1} \phi_{ivk}^2 \sigma_k^2}{\sum_{i=0}^{p-1} \sum_{s=1}^n \phi_{s=1}^2 \sigma_s^2} \times 100 \quad (3.34)$$

The numerator in Equation 3.34 decomposes the forecasting error variance for each variable into error due to shocks to error terms for all the series. If a proportion approaches 100 percent, inference can be made that the variable is exogenous and if it approaches zero then the variable is inferred to be endogenous (Enders, 1995). FEVD provides us with the proportion of movement in a variable due to a structural shock.

CHAPTER FOUR

4.0 SPECIFICATION AND RESULTS

This chapter presents the VAR specification and its empirical results. Correct specification requires statistical determination of stationarity and lag lengths, the results of which are presented and discussed. Subject to tests of stationarity, cointegration test results, which have led to a cointegrated VAR specification for this study, are discussed. Cointegrated VAR parameter estimates are discussed along with the innovation analysis from the specification. Economic policy implications from the analysis are discussed in Chapter 5.

4.1 VECTOR AUTOREGRESSION (VAR) SPECIFICATION

The VAR(p) specification in matrix notation for this study is:

$$X_t = \mu + \Pi_1 X_{t-1} + \dots + \Pi_p X_{t-p} + \phi D_t + e_t \quad (4.1)$$

where

X_t = a (7 x 1) vector containing observations on each of the variables [LGDP, LRGX, LRTT, LM1, INFL, EINF, LVA]

μ = a (7 x 1) vector of intercept terms

Π_p = (7 x 7) matrices of parameters on the individual lags

ϕ = a (7 x 1) vector of parameters on the dummy variable

e_t = a (7×1) vector of (white noise) error terms¹⁴ with a mean of ε and Σ as its variance covariance matrix

where in the variables:

LGDP = Natural Logarithm of Real Gross Domestic Product in 1995 prices.
 LRGX = Natural Logarithm of Deflated Government Expenditure
 LRTT = Natural Logarithm of Deflated Merchandise Trade
 LM1 = Natural Logarithm of Nominal Narrow Money
 INFL = Percentage Change in Consumer Price Index
 EINF = Percentage Change in Export Price Index
 LVA = Natural Logarithm of Visitor Arrivals
 DCOUP = Coup dummy, which is explained in Chapter 3

The system of equations is linear in parameters and variables. All variables in the system were economically justified with price variables in percentage changes and the remaining variables in natural logarithms. Logarithmic transformation results in data which are “stationary in variance” (Chang, Fang, & Wen, 2001, p. 1050). This transforms the data to percentage changes and makes interpretation of results, as elasticities, economically more meaningful. Price variables are usually measured as percentage changes and these have been retained as such so that price elasticities are measured. In addition, the stationarity of the series, the appropriate number of lag lengths and the cointegration needed to be empirically determined. The following discussion relates to the findings from these empirical tests.

STATIONARITY

The augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used in this study to test for stationarity of the series. The ADF unit root tests used Hannan Quinn

¹⁴ According to Enders (1995) the error terms in such specifications are usually contemporaneously correlated and their variance covariance matrices are non-diagonal.

criterion for lag order selection, while the PP unit root tests used Newey-West bandwidth and Bartlett-Kernel spectra. All tests are conducted with the least restricted test equation first and then tested for significance of deterministic trends. If the deterministic trends are found to be insignificant then a more restricted model is used, in accordance with the procedure suggested by Dolado, Jenkinson and Sosvilla-Rivero (1990). The same procedure is applied for both ADF and PP tests, the results of which are summarized in Table 4.1, below, with additional details given in Annex 3.

Table 4.1: Summary of Unit Root Tests

| Variable | Conclusion from Augmented Dickey Fuller test | Conclusion from Phillips Perron Test |
|---|--|--------------------------------------|
| Log of Real Gross Domestic Product (LGDP) | I(0) | I(0) |
| Log of Deflated Government Expenditure (LRGX) | I(1) | I(1) |
| Log of Deflated Merchandise Trade (LRTT) | I(0) | I(1) |
| Log of Narrow Money Supply (LM1) | I(0) | I(0) |
| Inflation (INFL) | I(0) | I(0) |
| Export Inflation (EINF) | I(0) | I(0) |
| Log of Visitor Arrivals (VA) | I(0) | I(0) |

The log of deflated merchandise trade was found to be an I(0) series using the ADF test, while using the PP test was found to be an I(1) series. In this instance we relied on the findings of PP test since the PP test allows testing of data series that are weakly dependent and, possibly, heterogeneously distributed (Holden & Perman, 2007). Figure 4.1, below, confirms that the natural log series of deflated merchandise trade indeed has deterministic trends and is non-stationary, compared to its first difference, shown as Figure 4.2 below, which appears to be a stationary series.

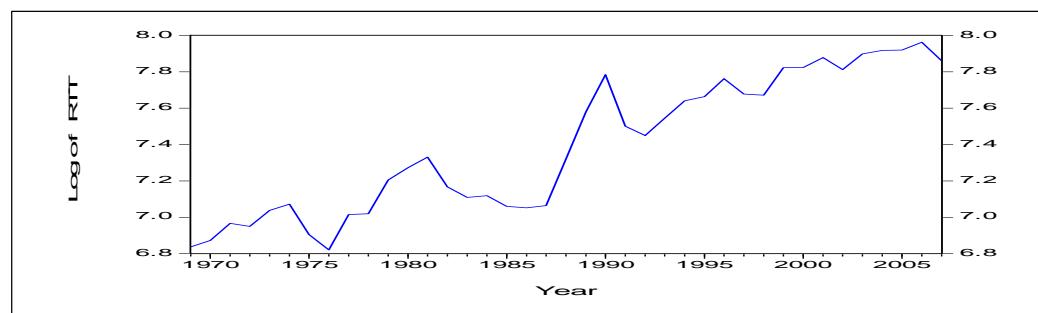


Figure 4.1: Log of Deflated Merchandise Trade (LRTT)

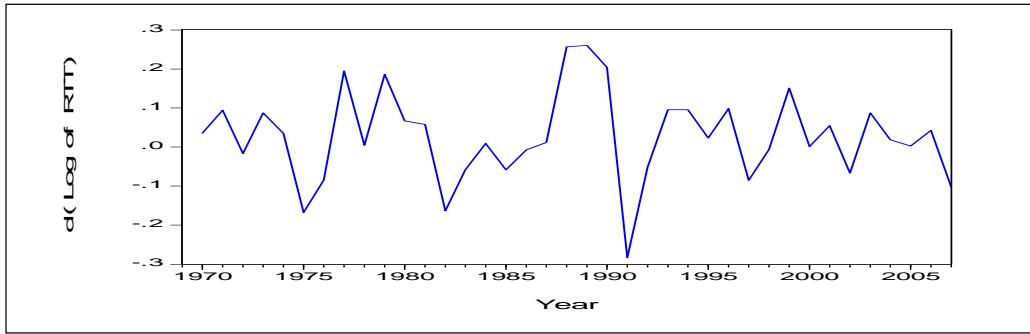


Figure 4.2: First Difference of LRTT

A sequential testing procedure was used for the unit root tests. According to this procedure, if the levels of the series were found to have unit roots, their first differences were tested for stationarity. All series, except the logs of deflated government expenditure (LGX) and merchandise trade (LRTT), were found to be stationary. All variables were found to have deterministic trends except the export inflation, EINF, variable.

Given that there is a mix of I(1) and I(0) variables, there are two options for deciding on a specification. As a first option the I(1) variables can be differenced then a standard VAR specification, as in Equation 4.1, could be used. However, the non-stationary, I(1), variables were not differenced since this would result in a loss of information (Sims, 1980). The second option is possible if the I(1) and I(0) variables are cointegrated, which implies that there are long term equilibrium relationships among the variables; so, given this, a cointegrated VAR is used. Stationary I(0) variables play a key role in establishing long term equilibrium relationships; therefore, a mix of I(0) variables with I(1) variables creates a desirable situation (Harris & Sollis, 2003). Before the cointegration tests were undertaken to complete the VAR specification, the lag length was selected using the available data.

LAG LENGTH

Lag length selection is important for VAR specification because choosing too few lags result in mis-specification and choosing too many lags result in unnecessary loss of degrees of freedom. To avoid this, lag lengths are selected using statistical tests,

which include the modified Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan-Quinn information criterion (HQ). These tests, instead of relying on any dynamic theory, use actual data to determine lag length.

The VAR representation, in Equation 4.1, was used to determine an appropriate lag length. Table 4.2 summarises the lag order suggestion based on the various tests for lag selection.

Table 4. 2: VAR Lag Order Selection Criteria

| Endogenous variables: LRGDP LRGX LRTT LM1 INFL EINF LVA Sample: 1969 2007 | | | | Exogenous variables: C DCOUP Included observations: 33 | | | |
|---|-----------|-----------|-----------|--|-----------|------------|--|
| Lag | LogL | LR | FPE | AIC | SC | HQ | |
| 0 | -80.16219 | NA | 7.10e-07 | 5.706799 | 6.341681 | 5.920418 | |
| 1 | 69.57744 | 217.8031 | 1.75e-09 | -0.398633 | 2.458336 | 0.562650 | |
| 2 | 144.3993 | 77.08921 | 6.17e-10 | -1.963596 | 3.115460 | -0.254648 | |
| 3 | 254.1651 | 66.52473* | 8.32e-11* | -5.646372* | 1.654771* | -3.189759* | |

* Indicates lag order selected by the criterion
 LR: sequential modified LR test statistic
 AIC: Akaike information criterion
 HQ: Hannan-Quinn information criterion

Each test at the 5% level of significance
 FPE: Final prediction error
 SC: Schwarz information criterion

Sims' (1980) modified Likelihood Ratio test and the Akaike Information Criteria recommended by Ozcicek and McMillin (1999) suggested lag order of three. The remaining criteria also suggested a lag order of three, which was also the maximum feasible lag length for the data used. Based on the lag order selected, a VAR(3) specification was used to determine cointegration among the variables. The selected lag order reduces by one for a cointegrated VAR since differenced series are used in that specification. This reduction is reflected in Equation 4.2, which is a cointegrated counterpart to Equation 4.1. The next step tested for the direction of causality for individual variables used in this study. This particular step is not relevant for the cointegration testing which follows; however, it is relevant for imposing restrictions on the cointegrated VAR.

GRANGER CAUSALITY

Variables were included in the following order: output (LGDP), fiscal (LRGX), merchandise trade (LRTT), monetary (LM1), prices (INFL and EINF) and visitor arrivals (LVA) for Granger causality testing. Granger causality tests statistically determine which variables can be exogenous in a cointegrated VAR system. A necessary condition for exogeneity of a variable is that current and past values of other variables do not affect this variable. Table 4.3 below summarises the Granger causality tests, which are also referred to as block exogeneity tests by Enders (1995).

Table 4.3: Summary of Block Exogeneity Tests

| Dependent Variable | Excluded Variable | Chi-Squared | Degrees of Freedom | P-Values |
|--------------------|------------------------------------|-------------|--------------------|----------|
| LRGDP | LRGX | 2.38 | 3 | 0.50 |
| LRGDP | LRTT | 0.59 | 3 | 0.90 |
| LRGDP | LM1 | 2.46 | 3 | 0.48 |
| LRGDP | INFL | 2.92 | 3 | 0.40 |
| LRGDP | EINF | 2.27 | 3 | 0.52 |
| LRGDP | LVA | 1.04 | 3 | 0.79 |
| LRGDP | LRGX, LRTT, LM1, INFL, EINF, LVA | 19.08 | 18 | 0.39 |
| LRGX | LRGDP, LRTT, LM1, INFL, EINF, LVA | 60.96 | 18 | 0.00 |
| LRTT | LRGDP, LRGX, LM1, INFL, EINF, LVA | 38.05 | 18 | 0.00 |
| LM1 | LRGDP, LRGX, LRTT, INFL, EINF, LVA | 62.55 | 18 | 0.00 |
| INFL | LRGDP, LRGX, LRTT, LM1, EINF, LVA | 31.95 | 18 | 0.02 |
| EINF | LRGDP, LRGX, LRTT, LM1, INFL, LVA | 45.06 | 18 | 0.00 |
| LVA | LRGDP, LRGX, LRTT, LM1, INFL, EINF | 32.11 | 18 | 0.02 |

The null hypotheses of the Granger causality tests in Table 4.3 are that the excluded variable(s) does (do) not Granger cause the dependent variable. These hypotheses would be rejected if the calculated p-values were less than 0.05, at the 5.0 percent level of significance. Given the finding that the GDP series was not Granger caused by any other variable and that these other variables did not jointly Granger cause GDP, the series was taken as an exogenous variable in the equilibrium relationship. According to Enders' (1995, pp. 396-400) illustrations of the Johansen (1988) procedure for cointegration, this finding can be used to impose a long-run relationship so that the equilibrium coefficients are normalised using the GDP coefficient. The block exogeneity tests confirmed that the economic justifications for the selection of variables were appropriate. The tests found that all variables, except the GDP, were jointly Granger caused by all other variables, additional details of which are contained in Annex 4. The next step in the analysis was to conduct tests for cointegration.

COINTEGRATION

Cointegration was an essential test in this study since two of the variables were found to be non-stationary. If the variables were cointegrated, a cointegrated VAR approach will be used; otherwise, non-stationary variables would be made stationary by differencing and a standard VAR approach will be used. The Johansen procedure, discussed in Chapter 3, was used to test for cointegration and the results obtained were summarised in Table 4.4, below.

Table 4.4: Summary of the Johansen Cointegration Test

Series: LRGDP LRGX LRTT LM1 INFL EINF LVA Exogenous series: DCOUP
 Lags interval: 1 to 2
 Selected (0.05 level*) Number of Cointegrating Relations by Model

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|-------------|--------------------------|-----------------------|-----------------------|--------------------|--------------------|
| Data Trend: | None | None | Linear | Linear | Quadratic |
| Coin. Eq. | No Intercept No Trend | Intercept No Trend | Intercept No Trend | Intercept Trend | Intercept Trend |
| Trace | 5 | 4 | 4 | 5 | 4 |
| Max-Eig | 4 | 4 | 3 | 4 | 4 |

*Critical values based on MacKinnon-Haug-Michelis (1999)

The Pantula Principle was used to determine the model specification (Pantula, 1989). According to this principle, the most restricted deterministic trend (Model 1 in table 4.4 above) has to be considered first. In this model there were four cointegrating relationships in the data, determined using the Maximum Eigenvalue test. In this specification there were no deterministic components either in the variables or in the cointegrating relations. This situation was unlikely to occur with economic variables, and, since unit root tests found at least an intercept for all variables except for export inflation, intercepts were seen to be appropriate for both variables and the cointegrating equation. Model 2 had no linear trends in variables but assumed that the cointegrating relationship had an intercept. Model 3 had linear trends in the variables and an intercept in the cointegrating relationship. Model 3 was used for this study

since it assumed that intercept terms in the equilibrium parameters and short term parameters combined to provide an overall intercept term (Johansen, 1992).

The Johansen procedure restricts the number of cointegrating vectors to one fewer than the number of I(1) variables used in the system ($r \leq n - 1$; where r is number of cointegrating vectors and n is the number of I(1) variables). Although only I(1) variables were considered in the initial study by Johansen, his procedure was “designed to handle I(1) and I(0) variables” (Harris & Sollis, 2003, p. 114). This study has only two I(1) variables, but the Johansen cointegration test found three¹⁵ cointegrating vectors¹⁶. The presence of I(0) variables were expected to induce additional cointegrating relationships in the VAR system but some cointegrating vectors may contain only one variable (Harris & Sollis, 2003). Therefore, additional cointegrating relationships were ignored and a cointegrated VAR specification was used with one cointegrating relationship, which is sufficient for the purposes of this study.

The final stage of the VAR method requires a cointegrated VAR (also called the Vector Error Correction –VEC model) specification, given as Equation 4.2 below, which, according to Harris and Sollis (2003), does not require all variables to be integrated of the same order. Cointegration requires restrictions on the VEC model, which involves normalising the exogenous variable to one (Enders, 1995). The real GDP (LGDP) series was, within the interpretation of Granger causality tests, found to be exogenous and was restricted to one. The error correction terms, apart from that for the cointegrating equation, were restricted to zero given that our interest was in estimating only one cointegrating relationship. Estimates of one cointegrating relationship were sufficient for the purposes of examining the dynamic inter-relationships among the study variables.

¹⁵ The Maximum Eigenvalue test found three cointegrating relationships while the Trace test found four cointegrating relationships.

¹⁶ It may be technically incorrect to interpret the results as suggesting three or four cointegrating vectors since the additional vectors induced by the I(0) variables may have only one variable (Harris & Sollis, 2003).

4.2 VECTOR ERROR CORRECTION (VEC) RESULTS

The following equation represents the VEC specification in matrix notation.

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \Pi X_{t-3} + \phi D_t + e_t \quad (4.2)$$

where

X_t = a (7 x 1) vector containing observations on each of the variables [LGDP, LRGX, LRTT, LM1, INFL, EINF, LVA]

μ = a (7 x 1) vector of intercept terms

Γ_i = (7 x 7) matrices of parameters on the differenced individual lags, where $i = 1, 2$

Π = (7 x 7) matrix of cointegrating terms where $\Pi = \alpha\beta'$ and (7 x 1) β matrix contains the long term parameters while the (7 x 1) α matrix measures the speed of adjustment parameters

ϕ = a (7 x 1) vector of parameters on the dummy variable

e_t = a (7 x 1) vector of (white noise) error terms with a mean of ε and Σ as its variance covariance matrix

LONG TERM PARAMETER ESTIMATES

Long term parameter (β) estimates, and the error correction term obtained from the cointegrated VAR analysis, are shown in Table 4.5, below. These long term estimates and the short term error correction coefficients (α) are components of the Π matrix, where $\Pi = \alpha\beta'$. The error correction coefficient reported was for the cointegrating equation, while the remaining components of the α vector of error terms were restricted to zero.

The short term parameters, including the error correction coefficients, represent the dynamic adjustment processes in the specification. These adjustment processes were captured within the lag order selected for the system of variables. The system of

variables achieved equilibrium when all dynamic adjustments were accounted for and complete, and the long term parameters estimated were obtained from the equilibrium achieved.

Table 4.5: Long Term Parameter Estimates

| Cointegration Restrictions: | | B(1,1)=1, A(2,1)=0, A(3,1)=0, A(4,1)=0, A(5,1)=0, A(6,1)=0, A(7,1)=0 | | | |
|--|--------------------------------------|---|--------------------------------------|------|--------------------------------------|
| Standard errors in () & t-statistics in [] | | | | | |
| Cointegrating Eq. 1 | | | Dependent Variable | | LGDP |
| C | -3.579806 | LRGX | 0.073158 (0.04959) [-1.47539] | LRTT | 0.380038 (0.03489) [-10.8926] |
| LM1 | -0.203139 (0.03602) [5.63929] | INFL | 0.007376 (0.00178) [-4.15337] | EINF | -0.008597 (0.00069) [12.5251] |
| LVA | 0.722363 (0.04958) [-14.5691] | ECM | -0.528758 (0.02025) [-26.1154] | | |

The estimated long term coefficient for deflated government expenditure showed that for every 1.0 percent increase in real government expenditure there was growth of only 0.07% of real GDP and even this was found to be statistically insignificant. This finding has significant policy implications, since the fiscal policy stance of the government involves increasing government expenditure when faced with declining GDP growth. Given the relatively small effect of government spending on the economy and the substantial financing costs of deficits to government, it is probable that constrained government spending will have negligible contractionary effects on GDP. Impulse responses examined in the next section will indicate whether there were any positive responses from government expenditure in the short term.

Visitor arrivals and trade estimates were found to have large and significant positive contributions to GDP. For every 1.0 percent growth in visitor arrivals, GDP grew by 0.72 percent. This finding implies that Fiji should increasingly promote its tourism industry and take measures to enhance the performance of the industry. Increased

trade was found to contribute 0.38 percent growth in GDP for every 1.0 percent increase in trade.

Export price inflation and domestic price inflation showed opposite effects on GDP. Inflation was estimated to positively contribute to GDP while export inflation was estimated to contribute negatively to GDP. The positive coefficient of inflation reflected the notion of money illusion, and that money illusion contributed to GDP growth in the long term. Narrow money supply was found to have a negative coefficient.

The error correction coefficient had a coefficient of -0.53 which implied that shocks to the economy persisted for approximately two (1.89) years. This coefficient was found to be statistically significant. Most of the short term parameter estimates, presented in Annex 6, were statistically insignificant.

SERIAL CORRELATION

It is likely that there would be serial correlation between residuals in this study. If this were the case then the impulse response functions and variance decompositions would need to be orthogonalised. The Lagrange Multiplier (LM) serial correlation test was used to determine if there was serial correlation in the residuals. The LM test results, given in Table 4.6 below, found that there was serial correlation at lag lengths 1-2 but none at lag length 3.

Table 4.6: VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order 1-3

| Lags | LM-Stat | Prob |
|------|----------|--------|
| 1 | 77.31956 | 0.0061 |
| 2 | 69.95148 | 0.0263 |
| 3 | 62.05278 | 0.0998 |

Probs from chi-square with 49 df.

In view of these results the impulse response functions and variance decompositions were orthogonalised to remedy the problem. The long term estimates were statistically valid since a cointegrating relationship implied that a combination of the variables was stationary, as a result, an equilibrium relationship existed in the long term.

IMPULSE RESPONSE FUNCTIONS

Impulse Response Functions (IRFs) are one of the useful tools of the VAR approach for examining the interaction between the variables in this study. They reflect how individual variables respond to shocks from other variables in the system. When graphically presented, the IRFs give a visual representation of the behaviour of variables in response to shocks. Since the LM test found serial correlation in the residuals, the impulse response functions were orthogonalised so that their true responses were reflected.

Figures 4.3 to 4.9 show the estimated accumulated impulse responses for the seven variables used in the study. Responses are shown over ten years on the horizontal axis. The responses shown are for orthogonalised innovations with the same order as that shown in the order of the graphs. The vertical axis provided the scale of the responses of each individual variable in the same units of measure (natural logarithms and percentage changes) used for the variables. The graphs provide a visual representation of accumulated responses, where an increasing graph shows positive responses while a decreasing graph reflects negative responses. Graphs in Annex 7 show impulse responses for individual years.

Shocks to GDP

Figure 4.3, below, gives the impulse responses of each of the seven variables to a shock to real GDP, with the behaviour of real GDP itself, as shown in the first graph. Real GDP responded positively to its own shock. Deflated government expenditure responded negatively which was, possibly, a result of the positive response from inflation which negated nominal increases in government expenditure. Money supply responded negatively initially, but in the long term responded positively to GDP shocks. The initial negative response possibly reflected the response of monetary policy to increasing inflation. Trade response was consistently positive, while export prices responses fluctuated but were positive in the long term. Visitor arrival numbers responded positively to GDP shocks.

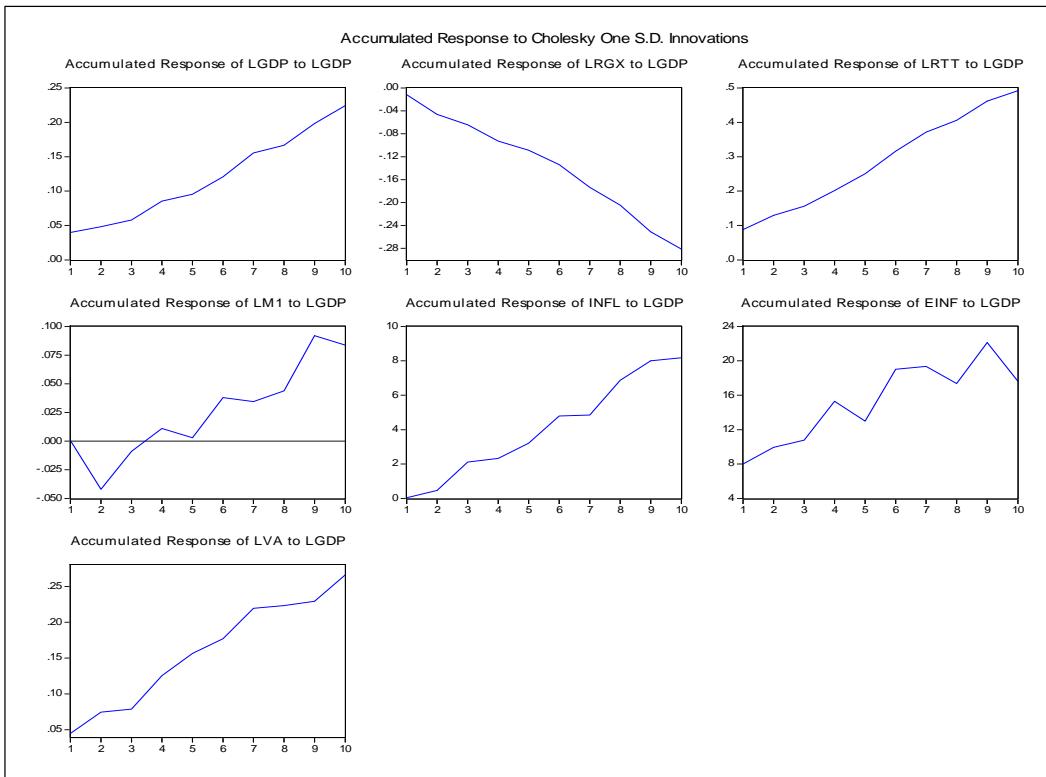


Figure 4.3: Impulse Responses to LGDP

Shocks to Government Expenditure

Figure 4.4, below, reflects the impulse responses of a shock to deflated government expenditure, with the positive response to the deflated government expenditure itself shown in the second graph. GDP initially responded negatively to government expenditure shock; however, the long term response was positive, although relatively small. Deflated merchandise trade responded positively but with a relatively small magnitude. Trade and prices reflected similar positive responses while the narrow money supply responded negatively. The negative response from money supply appeared to counter inflationary pressures as a result of government expenditure shocks. Visitor arrival numbers responded positively up to period four; however, responses from period five were negative, which resulted in negative accumulated responses over the long term.

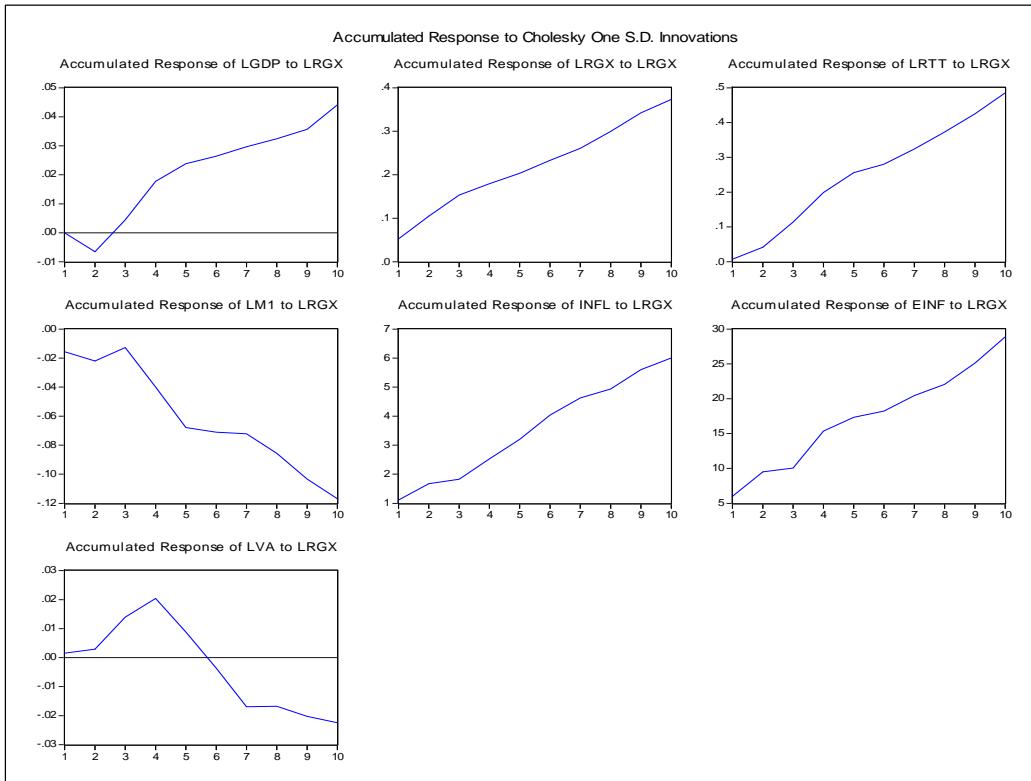


Figure 4.4: Impulse Responses to LRGX

Shocks to Merchandise Trade

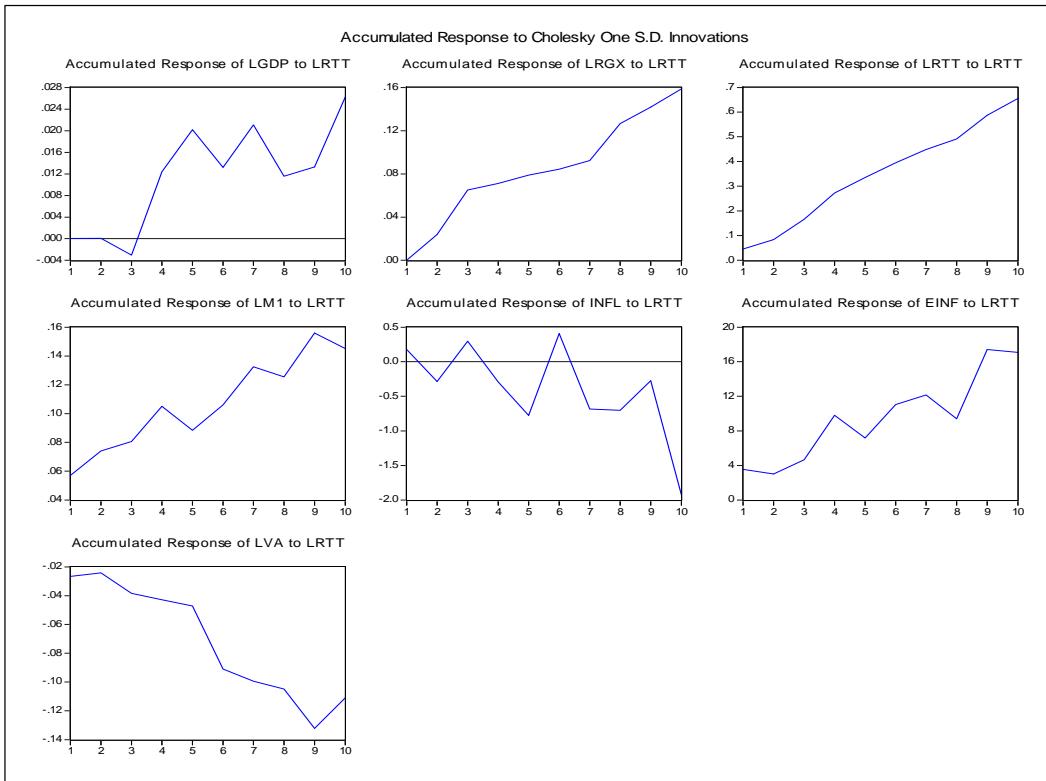


Figure 4.5: Impulse Responses to LRTT

Shocks to merchandise trade, shown in Figure 4.5, above, also reflected unique responses by individual variables. Trade responded positively to its own innovations. There was no response by real GDP for the first two periods, a negative response in the third period, and a fluctuating but on average positive response thereafter. Government expenditure and money supply responded positively to trade shocks. Inflation responses fluctuated; however, on average the response was negative over the long term. Export inflation responses fluctuated but were positive over the long term. Visitor arrivals responded negatively to merchandise trade shocks, which reflected a shift in focus of the economy from a service industry to merchandise industries.

Shocks to Narrow Money

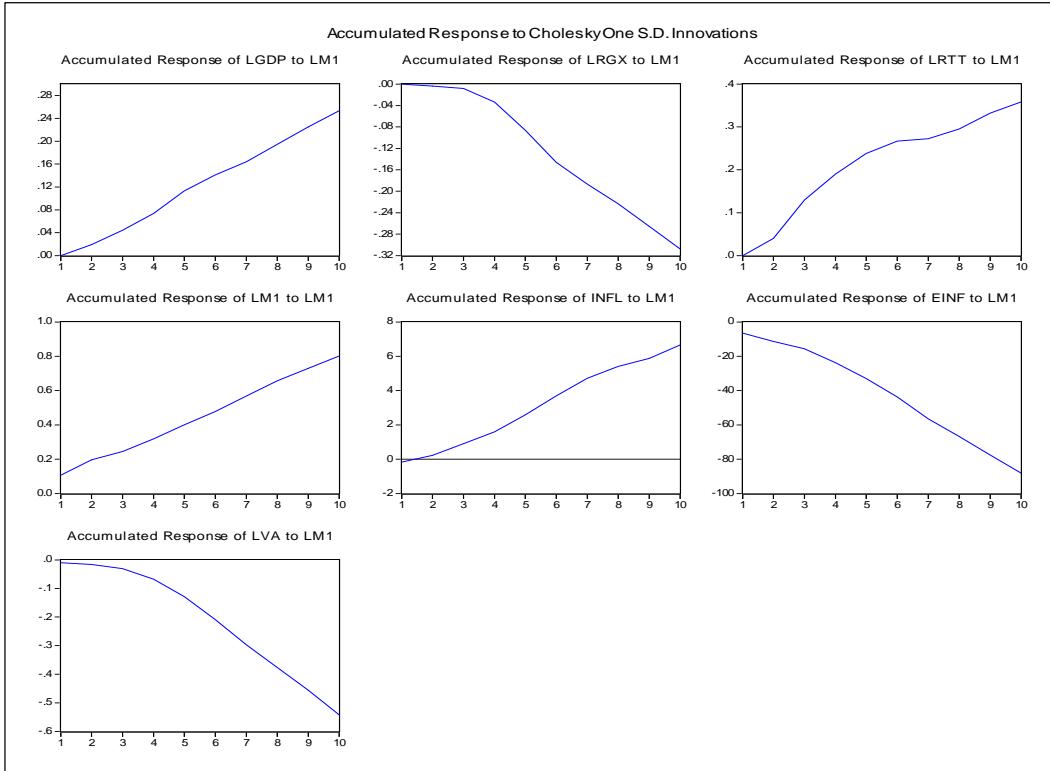


Figure 4.6: Impulse Responses to LM1

Shocks to narrow money supply, as shown in Figure 4.6, above, resulted in similar positive responses by itself, inflation and real GDP. Inflation had the strongest response while real GDP had a weaker response, although it was positive. The positive response from real GDP was consistent with the concept of money illusion whereby economic agents perceived such shocks as economic opportunities. Money supply shock also resulted in positive responses from deflated merchandise trade. Government expenditure, export prices and visitor arrivals had similar negative responses to narrow money supply shocks. Of these three, visitor arrival numbers had the strongest response.

Shocks to Inflation

Figure 4.7, below, shows the responses of individual variables to innovations from inflation. Inflation shocks resulted in positive responses from itself, narrow money supply, deflated merchandise trade and real GDP. These responses to the shock, particularly by deflated merchandise trade and real GDP, confirmed the existence of money illusion in the economy. Deflated government expenditure and visitor arrivals responded negatively to inflation shocks. Inflation could possibly be used as a correcting mechanism if there were concerns about high levels of government expenditure in the economy. The negative response of visitor arrivals was consistent with demand theory where demand for normal goods and services decreases with price increases. Export prices responded positively for the first two periods after the shock and negatively thereafter, which resulted in a negative response over the long term.

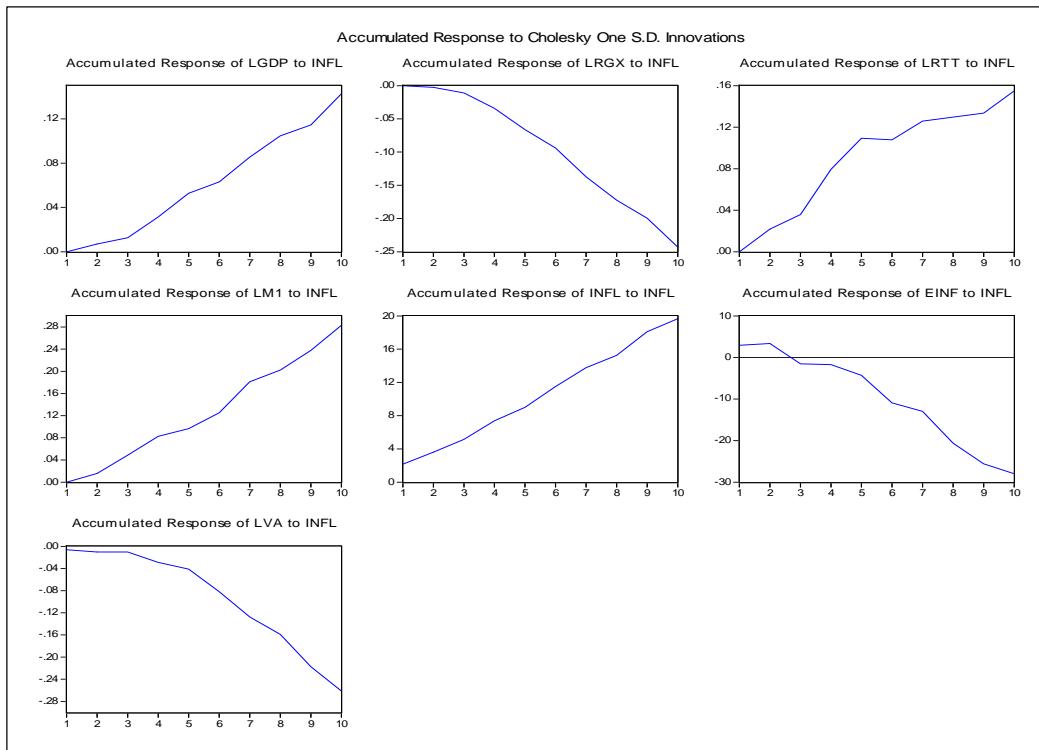


Figure 4.7: Impulse Responses to INFL

Responses to innovations from inflation were similar to responses to innovation from narrow money supply; however, their magnitudes differed. The magnitudes of responses to narrow money innovations were larger than those to inflation innovations. These variables responded positively to each others' innovations and were inter-related since monetary policy uses money supply as a tool to achieve its primary objective of inflation control.

Shocks to Export Inflation

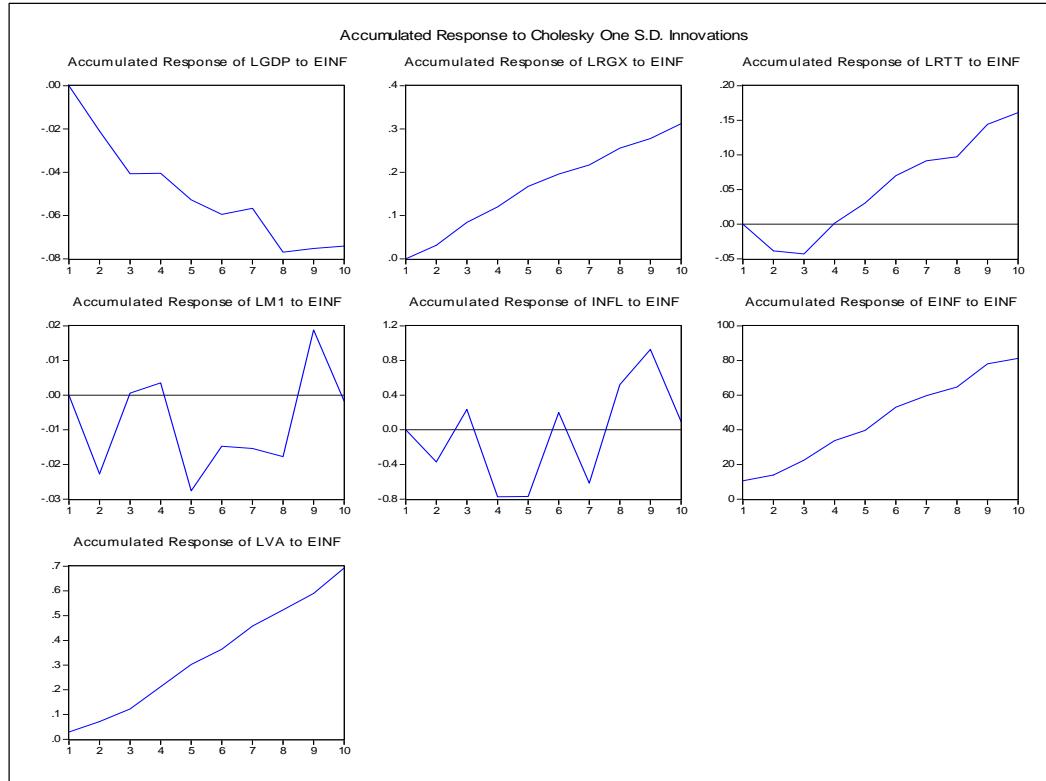


Figure 4.8: Impulse Responses to EINF

Responses by individual variables to innovations from export prices are shown in Figure 4.8, above. Export inflation responded positively to its innovations. The shock also caused positive responses from deflated government expenditure and visitor arrivals. Narrow money supply and inflation had mixed responses over time, with their accumulated responses almost zero after ten periods. The trade response was negative for the first three periods and positive thereafter. It appeared that increasing export prices resulted in a decrease in the quantity demanded; however, increasing prices eventually resulted in increased merchandise trade in the long term.

Regardless of positive response from merchandise trade, real GDP responses remained negative.

Shocks to Visitor Arrivals

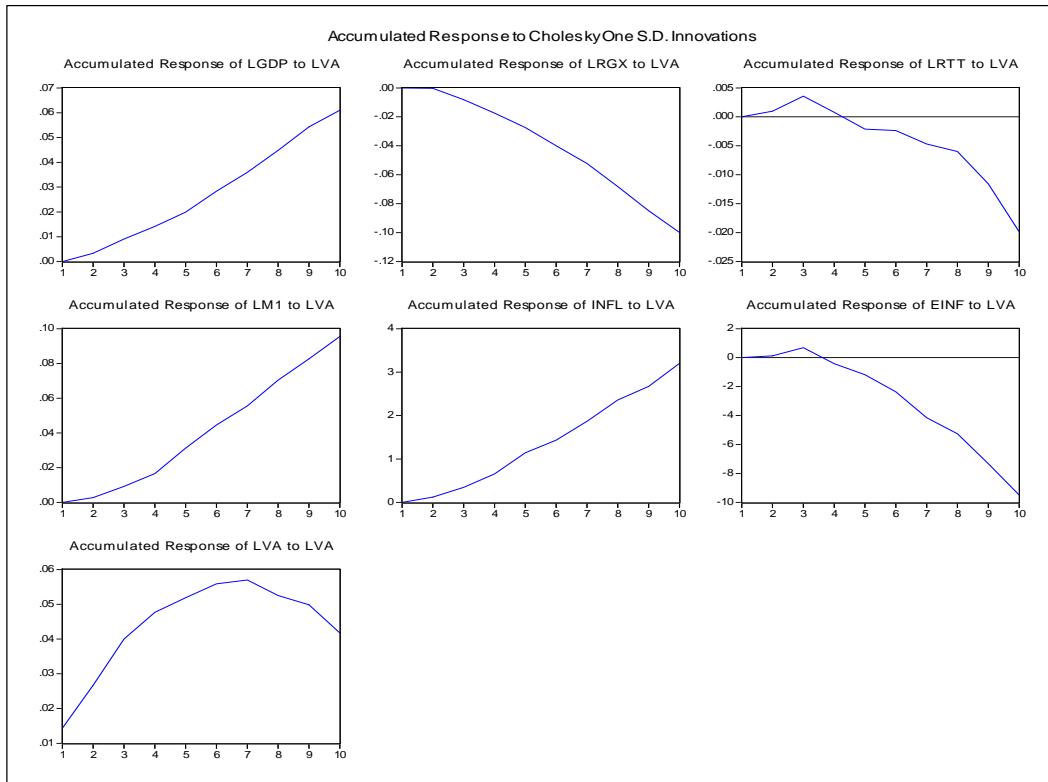


Figure 4.9: Impulse Responses to LVA

Figure 4.9 shows the responses of individual variables to innovations from visitor arrivals. Real GDP, narrow money supply and inflation responded positively to visitor arrival shocks. This is consistent with expectations since tourism is the most important industry in Fiji and contributes significantly to GDP. Deflated government expenditure responded negatively to visitor arrival shocks. Deflated merchandise trade and export prices responded positively to visitor arrival shocks for three periods only and responded negatively thereafter. Visitor arrivals did not respond consistently to its innovations. For the first seven periods arrivals responded positively and from the eighth period they responded negatively resulting in reduced accumulated responses. All other variables were found to respond positively and consistently to their own innovations.

VARIANCE DECOMPOSITIONS

Variance decompositions are presented in Tables 4.7 to 4.13, which help identify the main channels of influence for individual variables. Each table, below, reflects the contribution by other variables to the variance of each variable considered in turn. The numbers under each variable represent the percentage of variance of the variable analysed that was attributable to the particular variable over a 10 year period. The same information is shown as graphical plots in Annex 8.

Variance of Real GDP

Table 4.7: Variance Decomposition of LGDP

| Yr. | S.E. | LGDP | LRGX | LRTT | LM1 | INFL | EINF | LVA |
|-----|---------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 0.03985 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.05070 | 64.39400 | 1.642811 | 9.94E-05 | 14.43770 | 1.925427 | 17.18133 | 0.418629 |
| 3 | 0.06224 | 45.27762 | 4.181341 | 0.245600 | 25.59574 | 2.107338 | 21.43534 | 1.157018 |
| 4 | 0.07929 | 39.81894 | 5.384368 | 3.926426 | 29.67547 | 6.864746 | 13.20939 | 1.120668 |
| 5 | 0.09314 | 30.04946 | 4.331880 | 3.552209 | 39.37141 | 10.19471 | 11.30864 | 1.191696 |
| 6 | 0.10191 | 31.29356 | 3.680640 | 3.440828 | 40.45965 | 9.554139 | 9.883961 | 1.687225 |
| 7 | 0.11294 | 34.88802 | 3.079374 | 3.289268 | 37.08573 | 11.72716 | 8.108545 | 1.821906 |
| 8 | 0.12149 | 30.96612 | 2.713217 | 3.457717 | 38.32499 | 12.63768 | 9.789725 | 2.110550 |
| 9 | 0.13001 | 33.03525 | 2.433511 | 3.037478 | 38.95007 | 11.60379 | 8.567233 | 2.372674 |
| 10 | 0.13956 | 32.16209 | 2.476340 | 3.493115 | 37.97615 | 14.16585 | 7.441262 | 2.285195 |

Sims (1980) pointed out that a variable that is exogenous will start with a value of 1 (100% in this study). GDP was determined in the block exogeneity test to be an exogenous variable, in the Granger causality sense and, according to Table 4.7, accounted for its contemporary variance from its own innovations. There was little variation caused by government expenditure, trade and visitor arrivals; however, in later periods, money supply and price variables increasingly contributed to variations of real GDP. Money supply caused the most variations to GDP over the long term.

Variance of Deflated Government Expenditure

The variance of deflated government expenditure was largely accounted for by itself in the first year, with 5 percent caused by real GDP as shown in Table 4.8, below. Real GDP contributed, at most, 16 percent of its variation over the long term. Money supply and inflation contributed increasingly to variation in deflated government expenditure, while trade and export inflation caused more variation in the medium term but jointly caused around 30 percent of the variation between years 4 and 10.

Table 4.8: Variance Decomposition of LRGX

| Yr. | S.E. | LGDP | LRGX | LRTT | LM1 | INFL | EINF | LVA |
|-----|---------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 0.05372 | 4.767646 | 95.23235 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.09153 | 15.90128 | 65.12437 | 6.818719 | 0.168797 | 0.074291 | 11.91162 | 0.000920 |
| 3 | 0.12528 | 10.55423 | 49.82673 | 14.44494 | 0.226330 | 0.500995 | 24.04567 | 0.401110 |
| 4 | 0.14059 | 12.48673 | 43.09959 | 11.65962 | 3.397462 | 3.071318 | 25.53957 | 0.745703 |
| 5 | 0.16372 | 10.15185 | 33.85873 | 8.816225 | 12.88640 | 6.115117 | 27.24768 | 0.924000 |
| 6 | 0.18347 | 9.995516 | 29.58688 | 7.109394 | 20.88037 | 7.148655 | 24.07809 | 1.201101 |
| 7 | 0.20039 | 12.23251 | 26.70644 | 6.117142 | 21.60663 | 10.65331 | 21.29663 | 1.387326 |
| 8 | 0.21954 | 12.19655 | 25.43718 | 7.541902 | 20.81572 | 11.46879 | 20.86015 | 1.679704 |
| 9 | 0.23594 | 14.45827 | 25.26480 | 6.937982 | 21.20513 | 11.24823 | 18.93324 | 1.952347 |
| 10 | 0.25070 | 14.25964 | 23.88325 | 6.603607 | 21.56316 | 12.96531 | 18.63189 | 2.093135 |

Variance of Deflated Merchandise Trade

The deflated merchandise trade variations, shown in Table 4.9, below, were largely caused by real GDP in the short term, with more than 20 percent caused by its own innovations. In the medium to long term, around 20 percent of the variance was caused by deflated government expenditure and a similar proportion by real GDP. Money supply also contributed to its variations in the medium term but this contribution reduced over time. Prices, domestic and export, also made minor contributions to deflated merchandise trade variations.

Table 4.9: Variance Decomposition of LRTT

| Yr. | S.E. | LGDP | LRGX | LRTT | LM1 | INFL | EINF | LVA |
|-----|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 0.099020 | 78.34256 | 0.521877 | 21.13556 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.133391 | 52.92852 | 6.966539 | 20.03092 | 9.039017 | 2.662264 | 8.367296 | 0.005446 |
| 3 | 0.196494 | 26.23745 | 16.58941 | 26.68792 | 24.82413 | 1.739579 | 3.901701 | 0.019812 |
| 4 | 0.258306 | 18.29286 | 20.54334 | 32.17725 | 19.91451 | 3.864903 | 5.184219 | 0.022919 |
| 5 | 0.283576 | 18.13700 | 21.07859 | 31.69145 | 19.39426 | 4.306841 | 5.362119 | 0.029738 |
| 6 | 0.302053 | 20.71333 | 19.23872 | 31.77449 | 18.00888 | 3.798286 | 6.440029 | 0.026262 |
| 7 | 0.316153 | 21.98212 | 19.46166 | 31.92823 | 16.46504 | 3.795818 | 6.337706 | 0.029436 |
| 8 | 0.325504 | 21.87453 | 20.59155 | 31.87733 | 16.02536 | 3.593453 | 6.008444 | 0.029334 |
| 9 | 0.353004 | 21.08053 | 19.68282 | 34.50426 | 14.72425 | 3.067970 | 6.890059 | 0.050110 |
| 10 | 0.367701 | 20.09461 | 20.83791 | 35.17027 | 14.07525 | 3.165113 | 6.559594 | 0.097255 |

Variance of Narrow Money Supply

Narrow money supply variations, as shown in Table 4.10, below, were largely caused by their own innovations with less than 10 percent caused by real GDP. Inflation contributed increasingly, from 0 to 10 percent, over 10 years. Minor, but increasing, contributions were also made by export inflation. Deflated merchandise trade initially caused 22 percent of the variations but this contribution reduced to 7 percent over 10 years. Visitor arrival numbers and deflated government expenditure made very small contributions to the variance of narrow money supply.

Table 4.10: Variance Decomposition of LM1

| Yr. | S.E. | LGDP | LRGX | LRTT | LM1 | INFL | EINF | LVA |
|-----|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 0.121538 | 0.002680 | 1.663200 | 22.03814 | 76.29598 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.160478 | 7.050909 | 1.109544 | 13.76764 | 75.07885 | 0.959130 | 2.004420 | 0.029500 |
| 3 | 0.176211 | 9.361739 | 1.195872 | 11.55541 | 70.05157 | 4.266256 | 3.410154 | 0.159000 |
| 4 | 0.198367 | 8.406205 | 2.835233 | 10.64695 | 68.79171 | 6.344953 | 2.713849 | 0.261105 |
| 5 | 0.220715 | 6.921976 | 3.885245 | 9.172107 | 69.66155 | 5.513083 | 4.191410 | 0.654629 |
| 6 | 0.239316 | 8.011152 | 3.321700 | 8.338544 | 69.48040 | 6.123949 | 3.855934 | 0.868321 |
| 7 | 0.263731 | 6.612755 | 2.737072 | 7.871982 | 69.13921 | 9.575257 | 3.175721 | 0.888004 |
| 8 | 0.280122 | 5.971356 | 2.655198 | 7.040062 | 71.39798 | 9.045629 | 2.822094 | 1.067679 |
| 9 | 0.299850 | 7.782467 | 2.670036 | 7.175174 | 68.02720 | 9.295563 | 3.951938 | 1.097619 |
| 10 | 0.313275 | 7.198333 | 2.633343 | 6.689587 | 67.62332 | 10.62774 | 4.050653 | 1.177027 |

Variance of Inflation

Table 4.11: Variance Decomposition of INFL

| Yr. | S.E. | LGDP | LRGX | LRTT | LM1 | INFL | EINF | LVA |
|-----|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 2.431660 | 0.024258 | 20.89063 | 0.528739 | 0.467166 | 78.08921 | 0.000000 | 0.000000 |
| 2 | 3.006872 | 2.064962 | 17.16571 | 2.720323 | 1.981427 | 74.38548 | 1.519152 | 0.162951 |
| 3 | 3.922140 | 18.83599 | 10.24005 | 3.821241 | 4.127194 | 59.26052 | 3.284036 | 0.430968 |
| 4 | 4.782538 | 12.87871 | 9.022402 | 4.095794 | 4.896196 | 61.75180 | 6.660748 | 0.694351 |
| 5 | 5.304155 | 13.18868 | 8.940320 | 4.157814 | 7.458967 | 59.42600 | 5.415192 | 1.413027 |
| 6 | 6.430162 | 15.05113 | 7.794286 | 6.221138 | 8.071036 | 55.74128 | 5.951583 | 1.169550 |
| 7 | 7.066152 | 12.46979 | 7.143559 | 7.539536 | 8.743876 | 56.49948 | 6.259777 | 1.343981 |
| 8 | 7.633520 | 17.65948 | 6.288171 | 6.461030 | 8.327622 | 52.11385 | 7.582652 | 1.567198 |
| 9 | 8.298480 | 16.82329 | 5.966906 | 5.730931 | 7.359049 | 55.99671 | 6.656461 | 1.466660 |
| 10 | 8.707903 | 15.31986 | 5.631339 | 8.798037 | 7.501271 | 54.08577 | 6.959787 | 1.703935 |

Variance decomposition of inflation is given in Table 4.11, above. Variance of inflation was caused largely by its own innovations in the initial period with a 21 percent contribution from deflated government expenditure. The contributions of inflation itself and deflated government expenditure reduced over ten years with increasing contributions made by all the other variables. The real GDP contribution increased from 0 to 15 percent, trade from 1 to 9 percent, narrow money from 0 to 8 percent, export inflation from 0 to 7 percent and visitor arrivals from 0 to 2 percent. Trade and money contributions peaked in the seventh year while export inflation contributions peaked in the eighth year.

Variance of Export Inflation

Variance decomposition of export prices is given in Table 4.12, below. Export inflation accounted for less than 43 percent of its variation from its own innovations in any given period. Increasing variations were caused by money: between 15 and 37 percent over ten years. Merchandise trade causes between 3 and 6 percent of variation, while real GDP and deflated government expenditure innovations decreased over time. Variance due to inflation innovation fluctuated between 3 and 9 percent

over time while visitor arrivals made negligible contributions to variations in export prices.

Table 4.12: Variance Decomposition of EINF

| Yr. | S.E. | LGDP | LRGX | LRTT | LM1 | INFL | EINF | LVA |
|-----|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 16.57037 | 23.26719 | 13.03308 | 4.575113 | 15.40314 | 3.141074 | 40.58040 | 0.000000 |
| 2 | 18.06448 | 20.74464 | 14.78551 | 3.937262 | 20.38073 | 2.701683 | 37.44519 | 0.004978 |
| 3 | 21.17816 | 15.25017 | 10.81870 | 3.472516 | 18.74535 | 7.365217 | 44.27509 | 0.072958 |
| 4 | 26.72546 | 12.44385 | 10.74973 | 5.882955 | 20.98645 | 4.629481 | 45.09268 | 0.214854 |
| 5 | 29.29548 | 10.98257 | 9.404996 | 5.694149 | 27.41084 | 4.645355 | 41.61598 | 0.246112 |
| 6 | 35.36511 | 10.43574 | 6.516637 | 5.089870 | 28.07464 | 6.681939 | 42.92112 | 0.280053 |
| 7 | 38.35285 | 8.881080 | 5.880286 | 4.414811 | 34.89267 | 5.966062 | 39.50831 | 0.456783 |
| 8 | 40.94527 | 8.028606 | 5.311002 | 4.328100 | 36.98980 | 8.732964 | 36.13542 | 0.474109 |
| 9 | 45.78960 | 7.501956 | 4.698546 | 6.524869 | 35.07044 | 8.167231 | 37.45307 | 0.583887 |
| 10 | 47.57853 | 7.841387 | 4.975373 | 6.048688 | 37.44978 | 7.806028 | 35.13243 | 0.746321 |

Variance of Visitor Arrivals

Table 4.13: Variance Decomposition of LVA

| Yr. | S.E. | LGDP | Variance Decomposition of LVA: | | | | | |
|-----|----------|----------|--------------------------------|----------|----------|----------|----------|----------|
| | | | LRGX | LRTT | LM1 | INFL | EINF | LVA |
| 1 | 0.062607 | 51.37924 | 0.057005 | 18.08506 | 2.607906 | 0.914105 | 21.70062 | 5.256057 |
| 2 | 0.082463 | 42.70208 | 0.061404 | 10.50632 | 2.020025 | 0.794624 | 38.64032 | 5.275234 |
| 3 | 0.101082 | 28.59012 | 1.237908 | 8.957299 | 3.405031 | 0.528856 | 52.03257 | 5.248215 |
| 4 | 0.148980 | 22.94896 | 0.754897 | 4.211033 | 7.756426 | 1.843433 | 59.80464 | 2.680612 |
| 5 | 0.187677 | 17.20508 | 0.855726 | 2.708338 | 15.40513 | 1.571470 | 60.51517 | 1.739086 |
| 6 | 0.222938 | 13.03806 | 0.916252 | 5.752348 | 23.99656 | 4.433253 | 50.59886 | 1.264663 |
| 7 | 0.265332 | 11.74962 | 0.900987 | 4.163111 | 27.91592 | 6.132289 | 48.24347 | 0.894597 |
| 8 | 0.286375 | 10.10582 | 0.773491 | 3.610675 | 31.63826 | 6.466023 | 46.61344 | 0.792290 |
| 9 | 0.311330 | 8.585107 | 0.666642 | 3.821343 | 33.30555 | 8.984413 | 43.95915 | 0.677792 |
| 10 | 0.344811 | 8.143994 | 0.547589 | 3.495997 | 33.44930 | 8.949495 | 44.80546 | 0.608163 |

Variance decomposition of visitor arrivals is given in Table 4.16, above. Real GDP innovations initially caused 51 percent of variation in visitor arrivals; however, over 10 years this decreased to only 8 percent. Deflated government expenditure made negligible contributions to visitor arrival variance. Deflated merchandise trade contributed decreasingly from 18 percent to 3 percent. Money supply contributed increasingly from 3 percent to 33 percent. Inflation also contributed increasingly

from 1 percent up to 9 percent. The export inflation contribution to variance in visitor arrivals peaked in the fifth period at 61 percent, up from 22 percent, and declined to 45 percent by the tenth period. Visitor arrivals contribution to its variation from its own innovations was very low. Initially, it contributed only 5 percent to the variation and this reduced to a low of 1 percent by the tenth period.

4.3 SUMMARY

Since two of the study variables were found to be non-stationary, cointegration tests were necessary. Results from the Johansen (1988) cointegration test confirmed that there were long term equilibrium relationships among the study variables (LGDP, LRGX, LRTT, LM1, INFL, EINF, AND LVA). With confirmation that these variables were cointegrated, a counterpart to the standard VAR, the cointegrated VAR (VEC) approach, was used for analysis. We statistically determined the lag order of 3 for standard VAR; however, for the cointegrated VAR the lag order reduced by one since difference series were used in this specification. Granger causality tests found that LGDP series could be an exogenous variable in the system. This result was used as a basis to normalise LGDP to one for the equilibrium relationship in the cointegrated VAR specification. The cointegrated VAR specification was used to obtain IRFs and FEVDs, the economic implications of which are discussed in the next chapter.

CHAPTER FIVE

5.0 ECONOMIC IMPLICATIONS, FUTURE DIRECTIONS AND CONCLUSION

This chapter has three objectives. First, it considers the economic implications of the empirical results from the perspectives of fiscal policy, monetary policy and trade policy. Secondly, it highlights some limitations of the study and gives possible directions for future research. Finally, a summary concludes the study.

5.1 *ECONOMIC IMPLICATIONS*

Although an empirical approach has been used, the study variables were selected using economic justifications. Some of the variables selected in this study represent widely used indices of policy, for example, real government expenditure and money supply. The long term and the short term economic implications of these policies can be examined using the equilibrium coefficients and impulse response functions. This section now considers the economic implications of the empirical findings. The implications are considered from a policy perspective and are specific to Fiji. They are derived using post independence data (from 1970 to 2007) and, given the reliance on data and relevant statistical procedures, the implications are probabilistic.

FISCAL POLICY

Of several possible fiscal policy variables, deflated government expenditure was used in this study to examine the effects of fiscal policy on the economy. Examination of the data series showed periods in which deflated government expenditure (Figure 3.3) increased and then stabilised. A comparison with trends in real GDP (Figure 3.1) indicated that expenditure increased in response to negative or slow growth of real GDP. It became obvious from these observations that an expansionary fiscal policy was being implemented to boost economic growth when faced with negative or slow real GDP growth.

Short Term Effects

Analysis of the impulse response functions indicated that there were no significant positive effects on real GDP growth as a result of government expenditure shocks over the short term; however, there were small positive effects from year three onwards. The effects of government expenditure shocks on money supply were negative in the short term, which was expected, as monetary policy focuses on controlling inflation. Inflation was positively affected by government expenditure along with merchandise trade and export prices.

Long Term Effects

According to the long term estimates, a 1.0 percent growth in deflated government expenditure resulted in 0.073 percent growth in real GDP, which was statistically insignificant. This finding was similar to that of Gounder (2002). The finding of this study on fiscal policy differed from Dahalan and Jayaraman's (2006) finding that fiscal policy was a significant contributor to economic growth in Fiji. Our long term results are not particularly surprising since there is controversy in the literature on the direction of the effect of fiscal policy on GDP. A cross-sectional study of 113 countries, by Grier and Tullock (1989), found that, on average, government expenditure contributed negatively to economic growth. Other recent studies on fiscal policy could not establish an obvious direction for the effect on GDP (Hek, 2006; Masao, 2005; Woo, 2005). There are studies that also find positive effects of government expenditure on economic growth (Holmes & Hutton, 1990; Tulsidharan,

2006). Given the controversy, it is obvious that the effects depend on individual economies and their structure of taxation system and efficiency of government spending. If a government targets a significant proportion of its spending towards investments, particularly infrastructure development and facilitation of private investment, then government expenditure is expected to have a positive effect on economic growth.

Policy Implications

Government expenditure is generally used as a tool for economic stabilisation and for short term demand management. It may contribute to economic growth in the long term if it facilitates the supply side of the economy through infrastructure investment or expenditure that results in shifts in the aggregate production function. Our analysis showed that investment expenditure by government was not sufficient to cause significant positive effects on real GDP growth in the long term. Given this, if the government engaged in a reform programme to maintain or reduce expenditure, it was likely that there would not be any significant negative effects on long term GDP growth since there were no significant positive effects from increased expenditure. Maintaining government expenditure at current levels, or possibly with some reduction, may be beneficial to the economy since high expenditure levels were being financed through borrowings and significant financing costs were being incurred (Government of Fiji, 2007).

MONETARY POLICY

The objectives of monetary policy in Fiji are price stability and the maintenance of adequate foreign reserves (Waqabaca & Morling, 1999). These objectives are achieved through inflation, interest rates and exchange rate control. This study used narrow money supply and inflation to measure the effects of monetary policy on real GDP. Although there were other money supply variables, narrow money was used since it is more easily influenced by monetary policy changes. Exchange rate was not used as a variable since it was not expected to reflect true market dynamics, because of the fixed exchange rate regime in Fiji. As a result of the fixed exchange rate

regime, the focus of monetary policy was the maintenance of a stable exchange rate and insignificant effects were expected on the domestic market. The exchange rate was fixed to a basket of trading partner currencies, and adjusted in accordance with changing international market conditions, for example, the Fiji currency was devalued in response to the Asian Financial Crisis. Given this flexibility in the exchange rate regime, it was anticipated that it would have some effect on the domestic economy. Examination of graphical plots of narrow money supply (Figure 1.4) and real GDP (Figure 3.1) reflected that the rate of growth of money supply since the 1990s increased significantly, while the rate of growth of GDP declined. Given that one of the objectives of monetary policy is inflation control, it was apparent from a graphical plot (Figure 1.3) that there has been stability in domestic prices since the 1990s.

Short Term Effects

Impulse response functions for narrow money supply shocks indicated that money supply growth positively affected GDP growth in the short term. Trade growth was also positively affected, while inflation was negatively affected in the first year but was positively affected from the second year on. Deflated government expenditure, export price and visitor arrivals growth was negatively affected by money supply shocks.

Real GDP and trade growth were also positively affected by inflation shocks although magnitudes were smaller than that of the narrow money supply shocks. Inflation effects on deflated government expenditure, export prices and visitor arrivals were negative. Money supply and inflation were found to be positively affected by each other. The relationships between money supply and inflation confirm Friedman's (1968) pronouncement that inflation is a monetary phenomena. Friedman's (1968) "fooling model" suggested that inflation and money supply increase GDP in the short term, which was confirmed by the study's findings.

Export price shocks negatively affected real GDP and trade in the short term. Negative effects continued for real GDP, however, merchandise trade was positively affected from the fourth year. Domestic prices and money supply were negatively affected in the contemporaneous period but had mixed effects over the long term.

Long Term Effects

It was found that in the long term a 1.0 percent increase in narrow money supply contributed to a 0.203 percent decline in real GDP; a 1.0 percent growth in inflation caused real GDP to grow by 0.007 percent, while a 1.0 percent growth in export prices caused real GDP to grow by 0.009 percent; all the coefficients were statistically significant. It was found that the long term results did not conform to the classical proposition on neutrality of money, since money supply and export prices had significant negative effects on aggregate demand, while inflation had a significant positive effect.

Economic theory suggests that money supply growth and output growth generally complement one another. This study found that money supply growth positively affected demand growth in the short term and that demand growth affected money supply growth positively after some lag, but money supply over the long term contributed negatively. On the other hand, inflation contributed positively. The positive contribution of inflation to real GDP confirmed the existence of money illusion in the economy, although it was small. The significant negative effects of export prices could be explained by reduction in foreign demand as a result of increased prices. A study by Dahalan and Jayaraman (2006) found that monetary policy had a significant positive effect on real GDP. The finding of this study was different.

There were several possibilities that could explain the negative effects of money supply on real GDP in the long term. First, money supply was not determined by a particular rule, but was determined by the central bank that took into account factors such as output, price levels and reserve levels. As a result of the endogenous determination of this variable, the long term coefficient may not reflect its true effects on real GDP. Secondly, the money market in Fiji was not sophisticated, since there were few participants. Sophisticated markets with large numbers of players are efficient since there is competition for arbitrage and competition leads to greater responsiveness of markets to policy changes. Thirdly, Waqabaca and Morling (1999) have explained that monetary policy transmission was generally incomplete in Fiji. This was a result of the commercial banks not passing interest rate gains to deposits, which were a major source of funds for their lending. Given the low interest rates on

deposits and high interest rates on loans, both were expected to result in negative economic consequences: lower savings and lower investments. Apparently “moral suasion” (Waqabaca & Morling, 1999, p. 24) was not sufficient to complete the transmission of policy. The fourth possibility is based on the work of Lucas (1972) and our first explanation above. Since the central bank adjusted money supply based on economic conditions, and economic agents adjust their behaviour according to the same conditions, their expectations of monetary policy changes resulted in behaviour modification before the actual policy changes occurred. The policy changes did not result in any new information for the economic agents; therefore, the effects of the change were not as expected.

Policy Implications

Given the above, the findings of this study raised the question of whether monetary policy has the desired effects on the Fiji economy. A detailed study on transmission of monetary policy, with the dual objectives of price stability and maintenance of a stable exchange rate, was expected to provide greater insights on its effectiveness. Use of a similar empirical approach, as in this study, would provide insights of the interactions of various monetary variables with output. Furthermore, the negative effects of monetary expansion indicated that there should not be an emphasis on monetary policy for demand stabilisation purposes. The positive coefficient for inflation showed that over-emphasis on inflation control, at the expense of economic growth, may not be desirable for the economy, given that real economic growth rates have been low in recent years.

MERCHANDISE TRADE

Trade comprises merchandise trade and services trade. Merchandise trade has remained over 80 percent of GDP (shown as Figure 1.5) since the early 1990s and was expected to encourage growth in real GDP by encouraging capital formation and improving efficiency and productivity through access to foreign capital and technology. The high proportion of trade relative to GDP was possibly a result of the

trade liberalisation programme of the government. Merchandise trade dynamics in the economy were considered using deflated merchandise trade values.

Short Term Effects

Merchandise trade shocks did not cause any significant responses from real GDP in the first year; however, from the fourth year, there were positive effects on real GDP. The shocks caused growth in money supply and export prices. The variance of merchandise trade was largely caused by real GDP in the short term, but in the long term was caused by itself, real GDP and narrow money supply.

Long Term Effects

Merchandise trade was found to be a significant determinant of economic growth in the long term. For each 1.0 percent growth, merchandise trade was expected to cause real GDP growth by 0.38 percent. In an earlier study, Narayan and Smyth (2005) found that a 1.0 percent growth in real exports resulted in 0.05-0.07 percent growth in real GDP, compared to the 0.38 percent growth estimated in this study. The differences in results can be attributed to the different variables used; different methods and different perspectives. The findings of this study confirmed that openness, in Fiji's case, contributed to economic growth and development. This agreed with one group of trade theorists who suggested that trade was good for economic development.

Policy Implications

Fiscal and monetary expansions were found not to have the desired long term effects on economic growth. On the other hand, trade was found to be a significant positive contributor to economic growth, so trade promotion initiatives should be encouraged by policy makers. Since real GDP growth was directly affected by growth in trade, trade growth was expected to facilitate employment creation and economic development.

VISITOR ARRIVALS

The tourism industry has, in recent years, been a significant industry providing growth in employment and in aggregate output. Being a service industry, it draws production from a large number of other economic sectors such as agriculture and transport. Fiji has experienced continuous growth in visitor arrivals since independence and experienced significant declines in years of political instability (Figure 1.7). The declines in visitor arrivals coincided with the same years real GDP declined and recovery was over a short period. Visitor arrival numbers were used as an indicator to examine the effects of this industry on the economy.

Short Term Effects

Visitor arrivals were found to positively affect real GDP and cause growth in money supply and inflation in the short term. Visitor arrivals also caused growth in merchandise trade in the short term. These findings were expected since tourism industry increased aggregate demand and resulted in increased import of goods for the provision of services to the visitors. This study also found that political instability had significant negative effects on visitor arrivals in the short term. This short term effect resulted in negative consequences for economic growth.

Long Term Effects

Visitor arrivals were found to be the most significant contributor of economic growth in the long term. A 1.0 percent growth in visitor arrivals caused GDP to grow by 0.72 percent. It also had positive long term effects on money supply and inflation. Narayan (2004) used a computable general equilibrium model and found that a 1.0 percent increase in tourism expenditure resulted in 0.05 percent increase in real GDP. This study found a stronger relationship.

Policy Implications

Given that the contributions of the tourism industry were found to be statistically significant and large, further development of this industry should be facilitated through development of infrastructure and promotional activities. Since we found that political uncertainties have very significant effects on the tourism industry,

initiatives for the development and promotion of this industry could easily be undone by political instabilities. All possible initiatives should also be undertaken to avoid a repeat of such instabilities.

POLITICAL STABILITY

Although several previous studies of the Fiji economy have found that coups have significant long term effects on economic growth, for example, Chand (2000), Gounder (1999, 2001, 2002), and Narayan and Smyth (2005), the findings of this study differed. The method of this study took into account all possible influences on individual variables and estimated equilibrium coefficients on the assumption that all short term adjustments were complete. No effects of the coup were found in the long term relationship; however, a significant effect on visitor arrivals was determined in the short term. The direct effects of the coup on all other variables, including real GDP, were statistically insignificant even in the short term. Accordingly, the effects of coups were felt most by the tourism industry which eventually resulted in a significant decline in GDP. Short term estimates are shown in Annex 6.

5.2 *LIMITATIONS OF STUDY AND DIRECTIONS FOR FURTHER RESEARCH*

LIMITATIONS

A major limitation of the study has been data, in particular, the non availability of a complete (1969-2007) export price index series. Export price indexes were available up to 1988 after which indexes were calculated for the purposes of this study. Although export data were available up to 2005, a significant proportion was aggregated, which was of no use for generating the indexes. There was no documentation of the method for the construction of the past series. An attempt has

been made to calculate the indexes from 1988; however the accuracy of the indexes was dependent on the export data used.

In addition to the above, the quality of data have always been a subject of discussion among researchers in Fiji, as a result of occasional revisions to the series (Dahalan & Jayaraman, 2006; Williams & Morling, 2000). The results of the study were based on the collected and computed data series, future revisions of which may affect the expected implications. Although additional variables would have added insights to the findings, this was not possible due to a limited data series, which was reasonable for single equation analysis but not adequate for multi equation analysis.

DIRECTIONS FOR FUTURE RESEARCH

1. Country Specific VAR Study

Our study has considered variables from an expenditure approach to GDP, aimed to examine the transmission of policy to economic growth. A possible comprehensive study of the Fiji economy could consider aggregate consumption, aggregate investment, and the transmission of fiscal, monetary and trade policy components to GDP and examine their dynamic inter-relationships using the VAR approach. A second part to this comprehensive study could examine the dynamic inter-relationships of only the significant variables of the individual components with aggregate output. Such a study would provide additional insights into the Fiji economy and would be useful for policymakers in the country.

2. Cross Sectional Regional Study

A second possible research area would be a cross-sectional study of regional island countries that appear to have similar economic structures in order to examine their determinants of growth. Regional island countries have similar resources and share a common political history with a large number dependent on the tourism industry as a source of economic activity. The usual single equation empirical methods can be used for such a study. Such a study would be useful for regional organisations, such

as Forum Secretariat or the Asian Development Bank, which play a significant role in policy development of the island economies.

3. Country Specific Tourism Study

Given that the tourism industry was found to significantly affect economic growth in Fiji, this industry could be studied more closely to determine what other factors, in addition to political stability, affect it. It was noticed that the tourism industry recovered over a relatively short term after the political instabilities. This raises questions on what drives the tourism industry; whether it is specific to Fiji or rather Fiji is just one stop in an extended trip in the market for tourism for which answers may be sought. Given the importance of this industry, a specific study examining its domestic and international dynamics would provide useful insights for development of policy related to this industry.

5.3 SUMMARY

We set out to examine macroeconomic dynamics using an a-theoretical approach. The approach was motivated by the diverse and, at times, contradictory findings on what determines economic growth in Fiji. Our aim was to provide a different perspective for understanding the behaviour of macroeconomic variables. Behaviour of these variables is different for individual economies since they vary in structure. Cross sectional studies, however, assume similar economic structures across all countries. In addition to imposing similar structure, cross-sectional studies often use variables, such as geographic location, which are beyond an economy's control. For these reasons a country specific study was chosen.

An a-theoretical framework for studying macroeconomic dynamics was possible through the use of VAR approach. This approach was adopted by earlier scholars, such as Sargent (1979) and Sims (1980), since it provided a reasonable alternative to structural models that were based on prior theoretical frameworks. We have provided the necessary justification for the use of VAR approach in this study. A major criticism of VAR approach is that it does not have any economic meaning when there

are no economic justifications for the selection of variables. Our first objective, therefore, was to provide economic justification for the selection of the variables.

An appropriate model specification was necessary to estimate real, rather than spurious, relationships among the selected variables. To achieve this, the second objective was to conduct statistical tests of stationarity, lag order selection, causality and cointegration. The tests of stationarity found that two of the variables were non-stationary. There were two ways to deal with this situation. The first was to difference the non-stationary variables and proceed with the standard VAR approach. The second option was to find if the variables were cointegrated and, if they were, then use a cointegrated VAR approach. We chose to test for cointegration. Prior to cointegration tests we selected the lag order and tested for Granger causality. All the selection criteria available in Eviews 6.0 suggested the use of three lags for a stable system. The Granger causality tests found real GDP was Granger caused by variables neither jointly nor individually.

Since a VAR system is multivariate, we implemented the Johansen (1988) procedure to test for cointegration which also allows cointegration testing for variables integrated of different orders. The variables were integrated of order zero (stationary) and one (non-stationary with one unit root). The tests found multiple cointegrating relationships among the variables, which implied that the system was stable in more than one way. Based on the test results, a cointegrated VAR approach was used to analyse relationships between variables using the system's responses to random shocks. This analysis formed the basis of discussion of the economic implications.

This study found that fiscal policy did not provide the necessary impetus to improve growth over the long term, and monetary policy did not result in the expected direction of effect. It was found that investment expenditure by government was not sufficient to cause a significant long term economic growth. Reform of the government sector, resulting in a decrease in government expenditure but an increase in the proportion invested may result in positive long term contributions to economic growth. There is a lack of clarity on the effects of monetary policy changes as a result of dual objectives of the policy, price control and maintenance of the exchange rate. Given the lack of clarity, over emphasis on inflation control may not be desirable as a

result of the constraint placed on economic growth. Additional insights on the effects of monetary policy are necessary through a detailed study using a similar empirical method. Both merchandise trade and the tourism industry were found to be significant sources of economic growth. A focus of policy on trade development and expansion of the tourism industry is expected to contribute to economic development in the long term. Volatility in real GDP was apparently a result of volatility in visitor arrivals, which were susceptible to domestic political instability. Maintenance of political stability is apparently an important factor for the tourism industry and, as a result, for economic growth.

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ANNEXES

Annex 1

Data Series

| Year | GDP at Factor Cost 1995 Prices | GDP at Factor Cost Current Prices | GDP Deflator | Deflated Government Expenditure | Narrow Money (M1) | Deflated Exports and Imports | Export Price Index (1995 Prices) | Consumer Price Index (1995 Prices) | Annual Visitor Arrivals |
|------|--------------------------------|-----------------------------------|--------------|---------------------------------|-------------------|------------------------------|----------------------------------|------------------------------------|-------------------------|
| 1969 | 997.5 | 140.5 | 7.10 | 244.4 | 28.5 | 930.9 | 20.1 | 15.7 | 85163 |
| 1970 | 1065.9 | 168.9 | 6.31 | 251.5 | 33.34 | 964.4 | 19.8 | 16.4 | 110042 |
| 1971 | 1129.7 | 184.7 | 6.12 | 286.3 | 38.70 | 1059.9 | 23.6 | 17.4 | 152151 |
| 1972 | 1218.6 | 230.5 | 5.29 | 299.9 | 46.07 | 1042.2 | 27.4 | 19.0 | 165644 |
| 1973 | 1372.8 | 300.6 | 4.57 | 321.5 | 50.14 | 1137.4 | 53.3 | 21.2 | 186323 |
| 1974 | 1409.3 | 410.5 | 3.43 | 271.2 | 58.99 | 1177.8 | 54.0 | 24.2 | 181077 |
| 1975 | 1410.8 | 515.4 | 2.74 | 296.8 | 84.69 | 996.5 | 50.8 | 27.4 | 161707 |
| 1976 | 1448.7 | 570.6 | 2.54 | 329.2 | 88.10 | 915.5 | 46.8 | 30.5 | 168664 |
| 1977 | 1513.3 | 605.7 | 2.50 | 387.4 | 87.42 | 1112.6 | 49.8 | 32.6 | 173019 |
| 1978 | 1540.5 | 642.9 | 2.40 | 408.0 | 103.19 | 1117.8 | 53.7 | 34.6 | 184063 |
| 1979 | 1726.1 | 779.4 | 2.21 | 418.7 | 116.60 | 1346.3 | 53.2 | 37.3 | 188740 |
| 1980 | 1697.1 | 901.0 | 1.88 | 420.3 | 105.31 | 1439.7 | 71.6 | 42.7 | 189996 |
| 1981 | 1798.6 | 953.6 | 1.89 | 451.9 | 125.60 | 1525.6 | 63.0 | 47.5 | 189935 |
| 1982 | 1779.3 | 1020.5 | 1.74 | 476.4 | 130.50 | 1295.7 | 61.7 | 50.8 | 203636 |
| 1983 | 1708.6 | 1031.8 | 1.66 | 503.6 | 141.64 | 1222.4 | 65.2 | 54.2 | 191586 |
| 1984 | 1852.0 | 1151.7 | 1.61 | 553.8 | 142.31 | 1233.6 | 64.5 | 57.1 | 235227 |
| 1985 | 1758.1 | 1177.7 | 1.49 | 521.5 | 146.36 | 1163.5 | 58.1 | 59.6 | 228175 |
| 1986 | 1900.0 | 1326.1 | 1.43 | 531.5 | 178.65 | 1154.9 | 78.0 | 60.7 | 257824 |
| 1987 | 1777.6 | 1329.2 | 1.34 | 526.8 | 173.21 | 1168.4 | 106.7 | 64.1 | 189966 |
| 1988 | 1815.8 | 1433.3 | 1.27 | 550.6 | 279.47 | 1510.2 | 101.9 | 71.7 | 208155 |
| 1989 | 2005.9 | 1555.3 | 1.29 | 586.0 | 275.67 | 1958.8 | 102.0 | 76.1 | 250565 |
| 1990 | 2078.4 | 1742.0 | 1.19 | 597.3 | 273.77 | 2402.5 | 104.6 | 82.3 | 278996 |
| 1991 | 2022.4 | 1805.3 | 1.12 | 617.2 | 292.77 | 1809.5 | 105.6 | 87.7 | 259350 |
| 1992 | 2146.4 | 2009.8 | 1.07 | 641.4 | 337.11 | 1718.7 | 100.5 | 92.0 | 278534 |
| 1993 | 2202.2 | 2169.3 | 1.02 | 689.0 | 385.95 | 1891.7 | 97.4 | 96.7 | 287462 |
| 1994 | 2314.3 | 2293.4 | 1.01 | 670.0 | 367.50 | 2081.5 | 102.6 | 97.9 | 318874 |
| 1995 | 2373.0 | 2373.0 | 1.00 | 688.6 | 412.53 | 2129.8 | 100.0 | 100.0 | 318495 |
| 1996 | 2487.2 | 2578.4 | 0.96 | 684.6 | 481.86 | 2350.4 | 125.2 | 102.4 | 339560 |
| 1997 | 2432.7 | 2579.3 | 0.94 | 726.5 | 476.32 | 2159.1 | 104.4 | 105.4 | 359441 |
| 1998 | 2465.1 | 2815.1 | 0.88 | 901.5 | 493.93 | 2145.7 | 129.0 | 114.0 | 371342 |
| 1999 | 2682.3 | 3282.1 | 0.82 | 803.6 | 694.46 | 2495.8 | 123.4 | 114.1 | 409955 |
| 2000 | 2637.9 | 3138.2 | 0.84 | 786.4 | 593.74 | 2499.7 | 118.1 | 117.6 | 294070 |
| 2001 | 2690.5 | 3296.0 | 0.82 | 807.6 | 620.95 | 2640.6 | 132.4 | 120.3 | 348014 |
| 2002 | 2777.3 | 3484.0 | 0.80 | 834.9 | 711.96 | 2470.0 | 125.5 | 122.2 | 397859 |
| 2003 | 2806.7 | 3696.9 | 0.76 | 822.5 | 899.99 | 2695.7 | 134.9 | 127.3 | 430800 |
| 2004 | 2959.4 | 3989.5 | 0.74 | 875.4 | 1018.02 | 2746.2 | 123.1 | 131.6 | 498518 |
| 2005 | 2979.9 | 4237.9 | 0.70 | 978.0 | 1197.11 | 2753.1 | 118.2 | 135.1 | 549911 |
| 2006 | 3087.5 | 4647.7 | 0.66 | 1035.3 | 1142.40 | 2873.7- | | 139.4 | 545168 |
| 2007 | 2950.8 | 4664.4 | 0.63 | 844.2 | 1638.90 | 2593.7- | | 145.3 | 539255 |

Annex 2

Calculated Export Price Index

| Year | Price Index | Qty Index | Export Value | Coverage (%) | Notes |
|------|-------------|-----------|--------------|--------------|--|
| 1988 | 204.7 | 162.8 | 449,514,631 | 70 | Index was calculated on 1977 base year – This value was computed by FIBOS |
| 1988 | 100.0 | 100.0 | 449,514,631 | 91 | Base Year Data sourced from Trade Report for year. Items for which price and quantities not available or computable are excluded. |
| 1989 | 100.1 | 91.9 | 552,438,000 | 79 | Reduction in coverage was a result of unmatched categories and totalled values reported as others for which relevant details are not available. |
| 1990 | 102.6 | 118.2 | 754,168,000 | 79 | Similar coverage as in 1989 for the same reasons. |
| 1991 | 103.6 | 91.6 | 554,757,657 | 78 | Difference in classification of sugar taken to refer to the same product as Fiji produces only cane sugar: 061.100 – Raw Sugar; and 061.119 – Raw cane sugar |
| 1991 | 100 | 100 | 554,757,657 | 91 | Base Year Items for which price and quantities not available or computable are excluded. |
| 1992 | 95.2 | 90.6 | 556,500,000 | 83 | Reduction in coverage was, again, a result of unmatched categories and totalled values reported as others for which relevant details are not available. |
| 1993 | 92.2 | 107.4 | 593,500,000 | 83 | Similar coverage as in 1992 for the same reasons. |
| 1994 | 97.2 | 130.7 | 665,000,00 | 83 | Similar coverage as in 1991 and 1992 for the same reasons. |
| 1995 | 94.7 | 132.1 | 770,400,000 | 71 | Reduced coverage in 1995 as a result of large values for which unit prices are not available or computable. |
| 1995 | 100.0 | 100.0 | 770,400,000 | 83 | A large number of export quantities are not available from reports. This results in lower coverage for the following year indices. |
| 1996 | 125.2 | 103.6 | 823,400,000 | 80 | All items for which unit prices/quantities available have been included in the index. |
| 1997 | 104.4 | 96.4 | 757,630,000 | 76 | Large values are placed as other items under various categories for 1995, as well as 1997, resulting in low coverage. |
| 1998 | 129.0 | 106.1 | 905,500,000 | 67 | Several items of significant value do not have quantities/unit prices available; therefore, are not included in the index. |
| 1999 | 123.4 | 114.0 | 961,051,433 | 68 | F\$160m worth of garment exports are classified under others category which cannot be included in index. |
| 2000 | 118.1 | 140.2 | 992,799,000 | 72 | Data for 2000 was available in raw format leading to higher coverage than in previous years. |

| Year | Price Index | Qty Index | Export Value | Coverage (%) | Notes |
|-------------|--------------------|------------------|---------------------|---------------------|---|
| 2000 | 100.0 | 100.0 | 995,986,830 | 100 | Data available in HS and SITC codes without descriptions for years 2000-2005. Universal coverage as quantities available for every item. |
| 2001 | 112.1 | 96.2 | 990,707,867 | 96 | The only exclusions are the categories unmatched with base year exports. |
| 2002 | 106.3 | 97.9 | 874,096,376 | 96 | The only exclusions are the categories unmatched with base year exports. |
| 2003 | 114.2 | 100.6 | 958,322,775 | 95 | The only exclusions are the categories unmatched with base year exports. |
| 2004 | 104.2 | 107.2 | 950,701,227 | 91 | The only exclusions are the categories unmatched with base year exports |
| 2005 | 100.1 | 97.3 | 847,604,649 | 94 | Unmatched categories with base year exports are excluded |

Annex 3

Unit Root Tests

Table A3.1

Dickey Fuller Unit Root Tests

| Variable | Model | Lag length | t-statistic | 5% critical value | p-value | Conclusion (at 5% significance) |
|---|----------------------|------------|-------------|-------------------|---------|---------------------------------|
| Log of Real Gross Domestic Product (LGDP) - levels | Constant and Trend | 0 | -3.56 | -3.53 | 0.046 | No unit root - I(0) |
| Log of Deflated Government Expenditure (LRGX)-levels | Constant and Trend | 1 | -2.68 | -3.53 | 0.25 | Has unit root - I(1) |
| Log of Deflated Government Expenditure (1 st Difference) | Intercept Only | 1 | -5.02 | -2.94 | 0.00 | No unit root - |
| Log of Deflated Merchandise Trade (LRTT) - levels | Constant and Trend | 1 | -3.74 | -3.53 | 0.03 | No unit root - I(0) |
| Log of Narrow Money Supply (LM1) – levels | Constant and Trend | 0 | -3.81 | -3.53 | 0.03 | No unit root - I(0) |
| Inflation (INFL) – levels | Constant and Trend | 0 | -4.45 | -3.53 | 0.01 | No unit root - I(0) |
| Export Inflation (EINF) - levels | No Constant or Trend | 0 | -5.99 | -1.95 | 0.00 | No unit root - I(0) |
| Log of Visitor Arrivals (LVA) – levels | Constant and Trend | 0 | -4.58 | -3.53 | 0.00 | No unit root - I(0) |

Table A3.2**Phillips Perron Unit Root Tests**

| Variable | Model | Band width | t-statistic | 5% critical value | p-value | Conclusion (at 5% significance) |
|---|----------------------|-------------------|--------------------|--------------------------|----------------|--|
| Log of Real Gross Domestic Product (LGDP)- levels | Constant and Trend | 4 | -3.58 | -3.53 | 0.046 | No unit root – I(0) |
| Log of Deflated Government Expenditure (LRGX)- levels | Constant and Trend | 7 | -2.42 | -3.53 | 0.37 | Has unit root – I(1) |
| Log of Deflated Government Expenditure (1 st Difference) | Constant | 36 | -6.03 | -2.94 | 0.00 | No unit root |
| Log of Deflated Merchandise Trade (LRTT) - levels | Constant and Trend | 7 | -2.40 | -3.53 | 0.38 | Has unit root – I(1) |
| Log of Deflated Merchandise Trade – 1 st difference | No Constant or Trend | 10 | -4.97 | -1.95 | 0.000 | No unit root |
| Log of Narrow Money Supply (LM1) – levels | Constant and Trend | 1 | -3.72 | -3.53 | 0.03 | No unit root – I(0) |
| Inflation (INFL) – levels | Constant and Trend | 6 | -4.42 | -3.53 | 0.01 | No unit root – I(0) |
| Export Inflation (EINF) - levels | No Constant or Trend | 0 | -5.99 | -1.95 | 0.00 | No unit root – I(0) |
| Log of Visitor Arrivals (LVA) – levels | Constant and Trend | 2 | -4.59 | -3.53 | 0.00 | No unit root – I(0) |

Annex 4

Granger Causality Tests

VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 1969 2007

Included observations: 33

Dependent variable: LRGDP

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGX | 2.382757 | 3 | 0.4969 |
| LRTT | 0.590928 | 3 | 0.8985 |
| LM1 | 2.458905 | 3 | 0.4828 |
| INFL | 2.920581 | 3 | 0.4040 |
| EINF | 2.270265 | 3 | 0.5182 |
| LVA | 1.035652 | 3 | 0.7926 |
| All | 19.08265 | 18 | 0.3868 |

Dependent variable: LRGX

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGDP | 12.93290 | 3 | 0.0048 |
| LRTT | 4.189603 | 3 | 0.2417 |
| LM1 | 13.41400 | 3 | 0.0038 |
| INFL | 2.144353 | 3 | 0.5430 |
| EINF | 10.47803 | 3 | 0.0149 |
| LVA | 2.888843 | 3 | 0.4091 |
| All | 60.96003 | 18 | 0.0000 |

Dependent variable: LRTT

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGDP | 1.921960 | 3 | 0.5888 |
| LRGX | 6.111093 | 3 | 0.1063 |
| LM1 | 14.84929 | 3 | 0.0020 |
| INFL | 4.628163 | 3 | 0.2011 |
| EINF | 1.103778 | 3 | 0.7762 |
| LVA | 5.365853 | 3 | 0.1469 |
| All | 38.04813 | 18 | 0.0038 |

Dependent variable: LM1

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGDP | 0.569097 | 3 | 0.9035 |
| LRGX | 6.781292 | 3 | 0.0792 |
| LRTT | 15.12428 | 3 | 0.0017 |
| INFL | 1.643310 | 3 | 0.6496 |
| EINF | 24.49354 | 3 | 0.0000 |
| LVA | 11.54635 | 3 | 0.0091 |
| All | 62.54563 | 18 | 0.0000 |

Dependent variable: INFL

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGDP | 1.566194 | 3 | 0.6671 |
| LRGX | 3.305982 | 3 | 0.3468 |
| LRTT | 1.294055 | 3 | 0.7305 |
| LM1 | 3.751998 | 3 | 0.2895 |
| EINF | 6.848515 | 3 | 0.0769 |
| LVA | 4.009603 | 3 | 0.2604 |
| All | 31.94703 | 18 | 0.0223 |

Dependent variable: EINF

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGDP | 1.393361 | 3 | 0.7071 |
| LRGX | 1.839471 | 3 | 0.6064 |
| LRTT | 1.942254 | 3 | 0.5845 |
| LM1 | 1.127247 | 3 | 0.7705 |
| INFL | 19.28230 | 3 | 0.0002 |
| LVA | 2.016865 | 3 | 0.5689 |
| All | 45.05670 | 18 | 0.0004 |

Dependent variable: LVA

| Excluded | Chi-sq | df | Prob. |
|----------|----------|----|--------|
| LRGDP | 3.950933 | 3 | 0.2668 |
| LRGX | 0.773401 | 3 | 0.8558 |
| LRTT | 2.809472 | 3 | 0.4219 |
| LM1 | 2.925344 | 3 | 0.4033 |
| INFL | 5.011505 | 3 | 0.1710 |
| EINF | 2.726958 | 3 | 0.4357 |
| All | 32.11217 | 18 | 0.0213 |

Annex 5

Johansen Cointegration Test Results

Sample: 1969 2007

Included observations: 33

Series: LRGDP LRGX LRTT LM1 INFL EINF LVA

Exogenous series: DCOUP

Lags interval: 1 to 2

Selected (0.05 level*) Number of Cointegrating Relations by Model

| Data Trend: | None | None | Linear | Linear | Quadratic |
|-------------|--------------------------|-----------------------|-----------------------|--------------------|--------------------|
| Test Type | No Intercept No Trend | Intercept No Trend | Intercept No Trend | Intercept Trend | Intercept Trend |
| Trace | 5 | 4 | 4 | 5 | 4 |
| Max-Eig | 4 | 4 | 3 | 4 | 4 |

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

| Data Trend: | None | None | Linear | Linear | Quadratic |
|--|--------------------------|-----------------------|-----------------------|--------------------|--------------------|
| Rank or No. of CEs | No Intercept No Trend | Intercept No Trend | Intercept No Trend | Intercept Trend | Intercept Trend |
| Log Likelihood by Rank (rows) and Model (columns) | | | | | |
| 0 | 82.20641 | 82.20641 | 109.5015 | 109.5015 | 118.0673 |
| 1 | 137.2121 | 146.9690 | 174.1860 | 176.8269 | 183.8044 |
| 2 | 176.4771 | 186.9183 | 212.0430 | 231.8028 | 238.1536 |
| 3 | 208.7888 | 219.9212 | 229.4633 | 256.7556 | 262.5273 |
| 4 | 221.0974 | 237.2589 | 242.1144 | 274.1176 | 278.4227 |
| 5 | 228.8258 | 246.4872 | 249.4431 | 285.6020 | 288.0183 |
| 6 | 233.0964 | 252.8009 | 253.7090 | 292.9197 | 295.1118 |
| 7 | 233.4975 | 254.1651 | 254.1651 | 295.9001 | 295.9001 |
| Akaike Information Criteria by Rank (rows) and Model (columns) | | | | | |
| 0 | 0.957187 | 0.957187 | -0.272817 | -0.272817 | -0.367716 |
| 1 | -1.528008 | -2.058730 | -3.344606 | -3.444052 | -3.503298 |
| 2 | -3.059216 | -3.570804 | -4.790484 | -5.866837 | -5.948704 |
| 3 | -4.169018 | -4.661893 | -4.997774 | -6.470037 | -6.577415 |
| 4 | -4.066512 | -4.803572 | -4.916024 | -6.613189 | -6.692284* |
| 5 | -3.686415 | -4.453770 | -4.511703 | -6.400122 | -6.425353 |
| 6 | -3.096751 | -3.927329 | -3.921759 | -5.934526 | -6.006773 |
| 7 | -2.272576 | -3.100917 | -3.100917 | -5.206068 | -5.206068 |
| Schwarz Criteria by Rank (rows) and Model (columns) | | | | | |
| 0 | 5.401361 | 5.401361 | 4.488798 | 4.488798 | 4.711339 |
| 1 | 3.551048 | 3.065675 | 2.051891 | 1.997793 | 2.210640 |
| 2 | 2.654722 | 2.233831 | 1.240895 | 0.255240* | 0.400116 |
| 3 | 2.179801 | 1.822973 | 1.668487 | 0.332270 | 0.406287 |
| 4 | 2.917190 | 2.361525 | 2.385119 | 0.869349 | 0.926300 |
| 5 | 3.932169 | 3.391558 | 3.424322 | 1.762646 | 1.828113 |
| 6 | 5.156715 | 4.598229 | 4.649148 | 2.908473 | 2.881575 |
| 7 | 6.615772 | 6.104872 | 6.104872 | 4.317162 | 4.317162 |

Annex 6

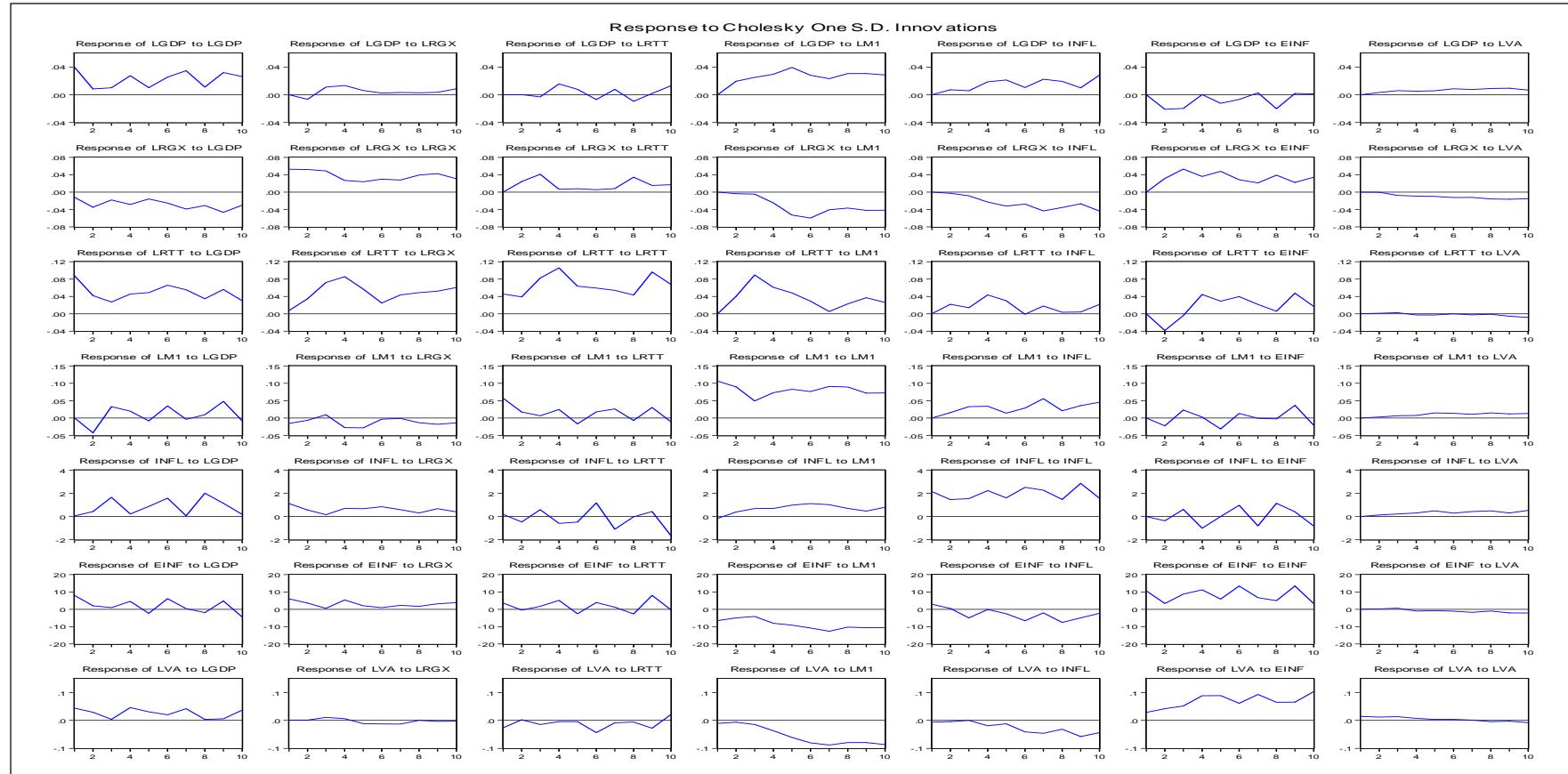
Short Term VEC Estimates

| | D(LGDP) | D(LRGX) | D(LRTT) | D(LM1) | D(INFL) | D(EINF) | D(LVA) |
|-------------|--------------------------------------|---------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| CointEq1 | -0.528758 (0.02025) [-26.1154] | 0.000000 (0.00000) [NA] | 0.000000 (0.00000) [NA] | 0.000000 (0.00000) [NA] | 0.000000 (0.00000) [NA] | 0.000000 (0.00000) [NA] | 0.000000 (0.00000) [NA] |
| D(LGDP(-1)) | -0.538320 (0.28697) [-1.87588] | -1.488210 (0.38688) [-3.84666] | -0.076665 (0.71307) [-0.10751] | -0.167558 (0.87523) [-0.19145] | 26.83088 (17.5111) [1.53223] | -25.21592 (119.328) [-0.21132] | -1.211433 (0.45085) [-2.68700] |
| D(LGDP(-2)) | -0.561924 (0.36544) [-1.53765] | -0.647451 (0.49268) [-1.31414] | -0.374102 (0.90806) [-0.41198] | 1.172984 (1.11456) [1.05242] | 23.02255 (22.2996) [1.03242] | -156.6597 (151.959) [-1.03093] | -1.610358 (0.57414) [-2.80484] |
| D(LRGX(-1)) | -0.045555 (0.17226) [-0.26445] | -0.214985 (0.23224) [-0.92570] | 0.691667 (0.42804) [1.61588] | 0.184413 (0.52538) [0.35101] | 2.145651 (10.5116) [0.20412] | 28.45119 (71.6304) [0.39719] | -0.146300 (0.27064) [-0.54058] |
| D(LRGX(-2)) | 0.243224 (0.15325) [1.58711] | -0.409895 (0.20661) [-1.98395] | 0.983258 (0.38080) [2.58210] | 0.128800 (0.46739) [0.27557] | -6.857073 (9.35136) [-0.73327] | -6.974674 (63.7242) [-0.10945] | -0.207548 (0.24076) [-0.86204] |
| D(LRTT(-1)) | 0.040818 (0.08461) [0.48239] | 0.120819 (0.11407) [1.05912] | -0.089600 (0.21025) [-0.42615] | -0.249058 (0.25807) [-0.96510] | -6.350306 (5.16324) [-1.22991] | 7.152667 (35.1845) [0.20329] | 0.283409 (0.13294) [2.13193] |
| D(LRTT(-2)) | 0.096898 (0.08075) [1.19999] | 0.038808 (0.10886) [0.35649] | 0.089579 (0.20065) [0.44645] | -0.252899 (0.24627) [-1.02690] | 1.937953 (4.92734) [0.39331] | 1.591530 (33.5770) [0.04740] | 0.032113 (0.12686) [0.25314] |
| D(LM1(-1)) | 0.161736 (0.08550) [1.89162] | 0.140915 (0.11527) [1.22247] | 0.173149 (0.21246) [0.81499] | -0.282084 (0.26077) [-1.08174] | 2.109803 (5.21734) [0.40438] | -28.22036 (35.5532) [-0.79375] | 0.122264 (0.13433) [0.91018] |
| D(LM1(-2)) | 0.070131 (0.07612) [0.92137] | 0.369278 (0.10262) [3.59856] | 0.464685 (0.18914) [2.45687] | -0.306036 (0.23215) [-1.31828] | 5.480869 (4.64469) [1.18003] | -1.093714 (31.6509) [-0.03456] | 0.110529 (0.11958) [0.92428] |
| D(INFL(-1)) | 0.003595 (0.00350) [1.02569] | -0.005378 (0.00472) [-1.13823] | 0.015574 (0.00871) [1.78848] | 0.011516 (0.01069) [1.07739] | -0.220852 (0.21385) [-1.03274] | -0.162903 (1.45727) [-0.11179] | -0.001794 (0.00551) [-0.32590] |
| D(INFL(-2)) | 0.001671 (0.00320) [0.52255] | -0.003262 (0.00431) [-0.75671] | -0.000669 (0.00794) [-0.08427] | 0.015526 (0.00975) [1.59229] | -0.192378 (0.19509) [-0.98612] | -2.584659 (1.32940) [-1.94423] | 0.003275 (0.00502) [0.65210] |

| | | | | | | | |
|---|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| D(EINF(-1)) | 0.001923 (0.00117) [1.64546] | 0.003046 (0.00158) [1.93284] | -0.003845 (0.00290) [-1.32370] | -0.002683 (0.00357) [-0.75255] | -0.058474 (0.07133) [-0.81978] | -0.713656 (0.48607) [-1.46822] | 0.001615 (0.00184) [0.87928] |
| D(EINF(-2)) | 0.000673 (0.00078) [0.86694] | 0.002957 (0.00105) [2.82517] | -0.001182 (0.00193) [-0.61287] | -0.000621 (0.00237) [-0.26239] | 0.048992 (0.04737) [1.03417] | -0.299884 (0.32282) [-0.92895] | 0.000691 (0.00122) [0.56680] |
| D(LVA(-1)) | -0.153398 (0.11438) [-1.34116] | -0.019343 (0.15420) [-0.12544] | 0.068583 (0.28421) [0.24131] | 0.192032 (0.34884) [0.55049] | 8.456537 (6.97938) [1.21165] | 8.879844 (47.5605) [0.18671] | -0.139058 (0.17969) [-0.77386] |
| D(LVA(-2)) | 0.004491 (0.08735) [0.05142] | -0.216727 (0.11777) [-1.84032] | 0.027260 (0.21706) [0.12559] | 0.324521 (0.26642) [1.21810] | 4.866310 (5.33030) [0.91295] | 50.16425 (36.3230) [1.38106] | 0.279956 (0.13724) [2.03995] |
| C | 0.036823 (0.02259) [1.62985] | 0.077780 (0.03046) [2.55358] | -0.086299 (0.05614) [-1.53721] | 0.117545 (0.06891) [1.70586] | -2.722601 (1.37865) [-1.97484] | 2.382708 (9.39468) [0.25362] | 0.119582 (0.03550) [3.36896] |
| DCOUP | -0.082065 (0.04505) [-1.82181] | -0.037037 (0.06073) [-0.60986] | 0.024776 (0.11193) [0.22135] | -0.114416 (0.13738) [-0.83282] | 0.799976 (2.74872) [0.29104] | 24.09376 (18.7309) [1.28631] | -0.432235 (0.07077) [-6.10762] |
| R-squared | 0.614480 | 0.714665 | 0.660419 | 0.569393 | 0.638444 | 0.687312 | 0.857198 |
| Adj. R-squared | 0.228960 | 0.429329 | 0.320838 | 0.138786 | 0.276888 | 0.374625 | 0.714396 |
| Sum sq. resids | 0.025408 | 0.046181 | 0.156879 | 0.236342 | 94.60753 | 4393.236 | 0.062714 |
| S.E. equation | 0.039850 | 0.053724 | 0.099020 | 0.121538 | 2.431660 | 16.57037 | 0.062607 |
| F-statistic | 1.593898 | 2.504648 | 1.944804 | 1.322302 | 1.765824 | 2.198081 | 6.002713 |
| Log likelihood | 71.46675 | 61.60807 | 41.43000 | 34.66823 | -64.20326 | -127.5317 | 56.55879 |
| Akaike AIC | -3.301015 | -2.703519 | -1.480606 | -1.070802 | 4.921410 | 8.759494 | -2.397502 |
| Schwarz SC | -2.530087 | -1.932591 | -0.709678 | -0.299874 | 5.692338 | 9.530422 | -1.626574 |
| Mean dependent | 0.027096 | 0.035820 | 0.029436 | 0.098714 | -0.173270 | -0.537579 | 0.036361 |
| S.D. dependent | 0.045382 | 0.071118 | 0.120153 | 0.130965 | 2.859566 | 20.95376 | 0.117149 |
| Determinant resid covariance (dof adj.) | | | 1.08E-11 | | | | |
| Determinant resid covariance | | | 6.81E-14 | | | | |
| Log likelihood | | | 155.0883 | | | | |
| Akaike information criterion | | | -1.762928 | | | | |
| Schwarz criterion | | | 3.951010 | | | | |

Annex 7

Impulse Response Functions



Annex 8

Variance Decomposition Graphical Plots

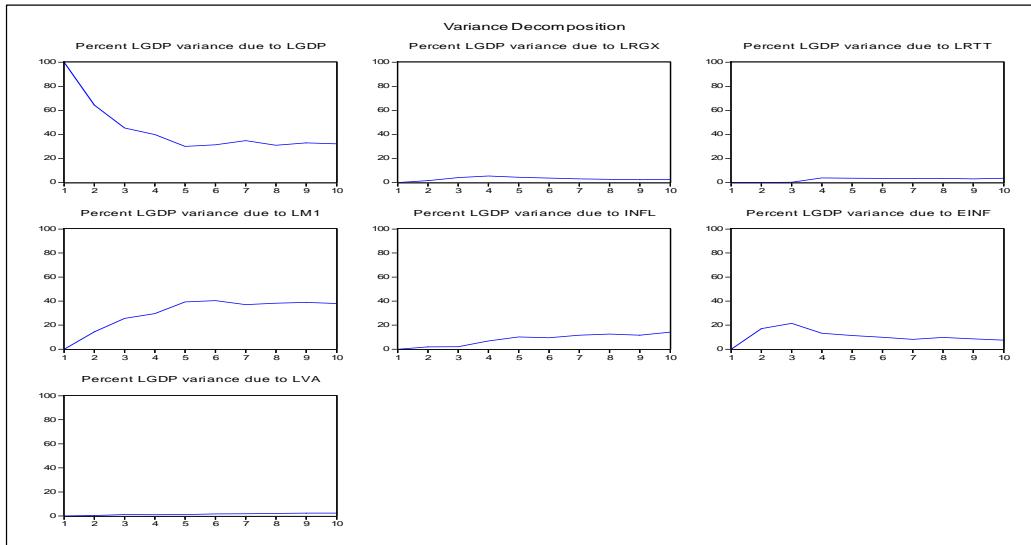


Figure A8.1

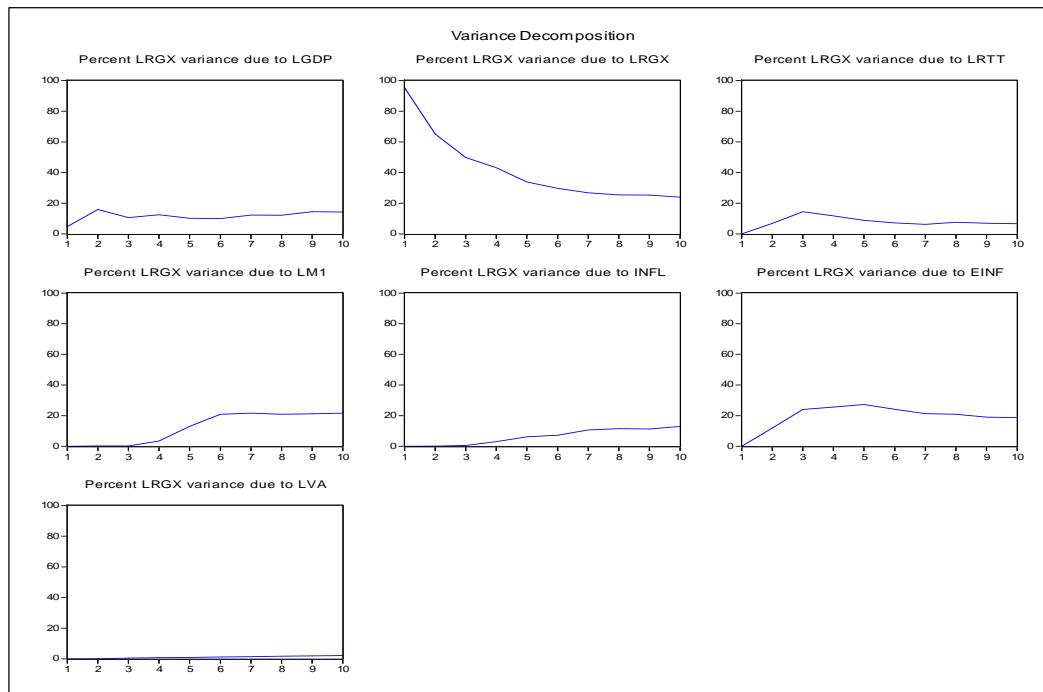


Figure A8.2

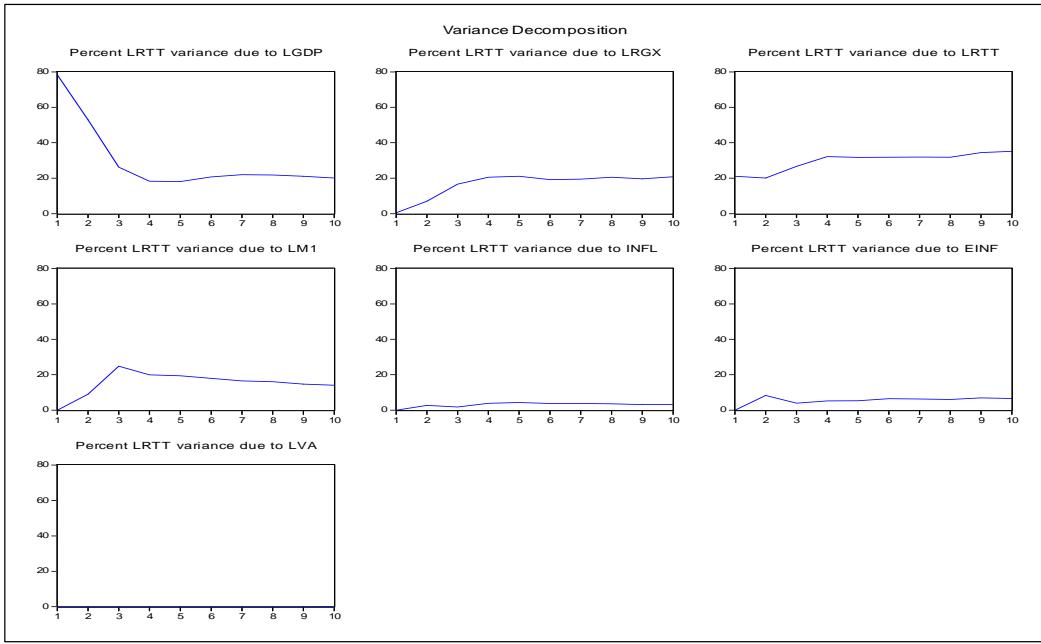


Figure A8.3

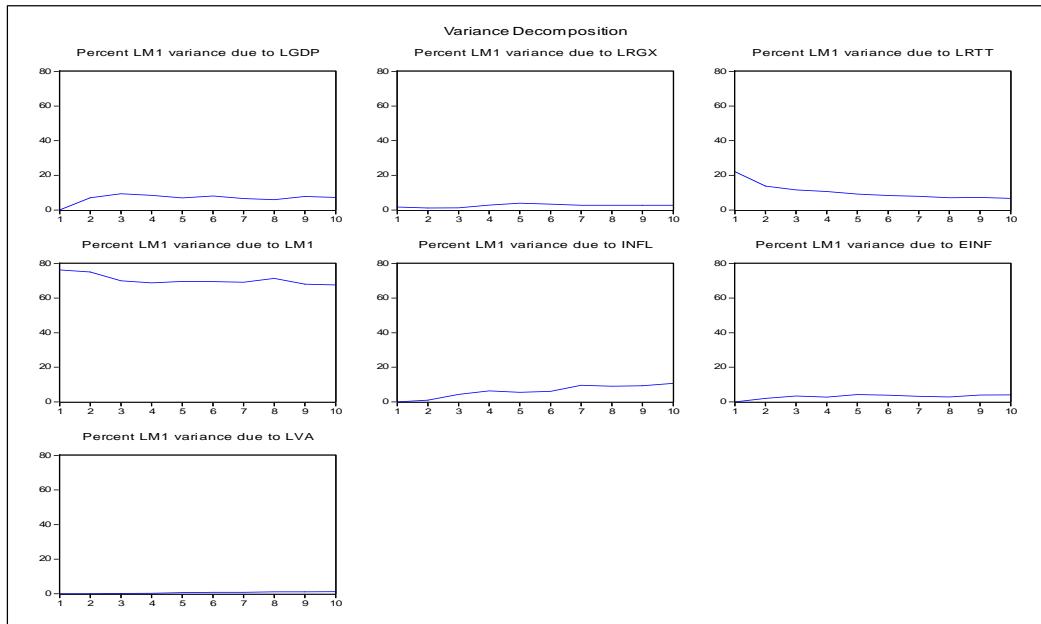


Figure A8.4

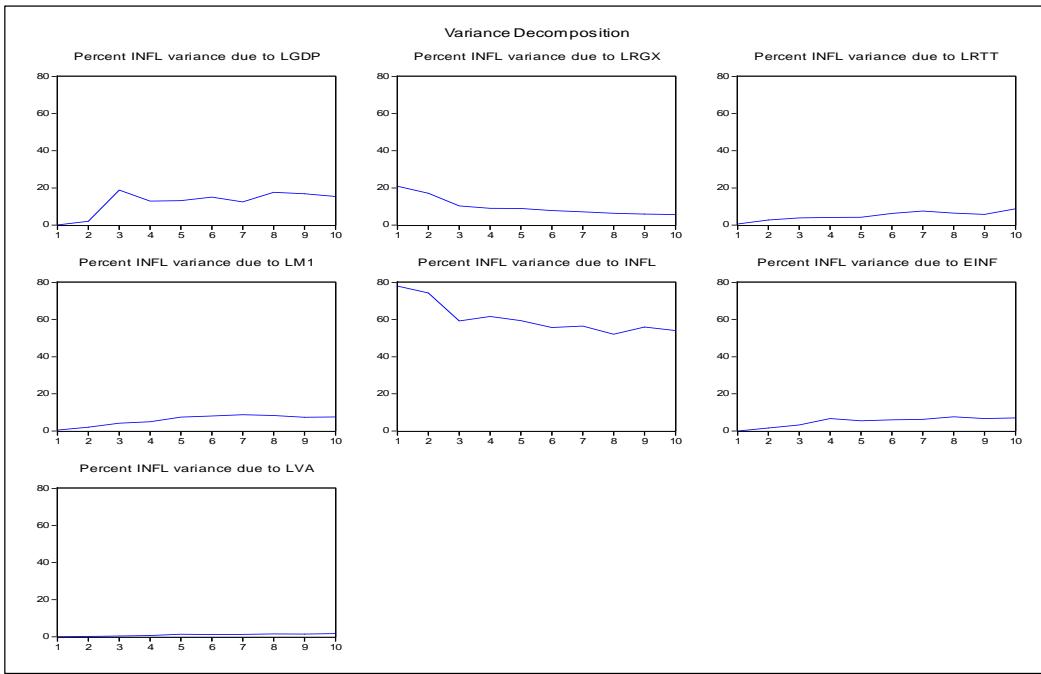


Figure A8.5

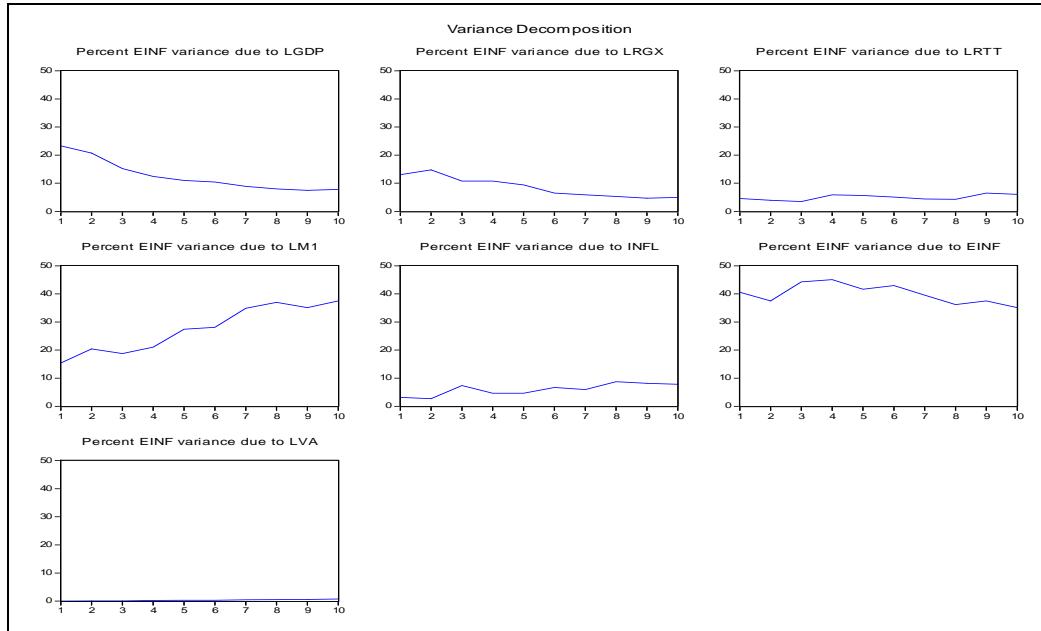


Figure A8.6

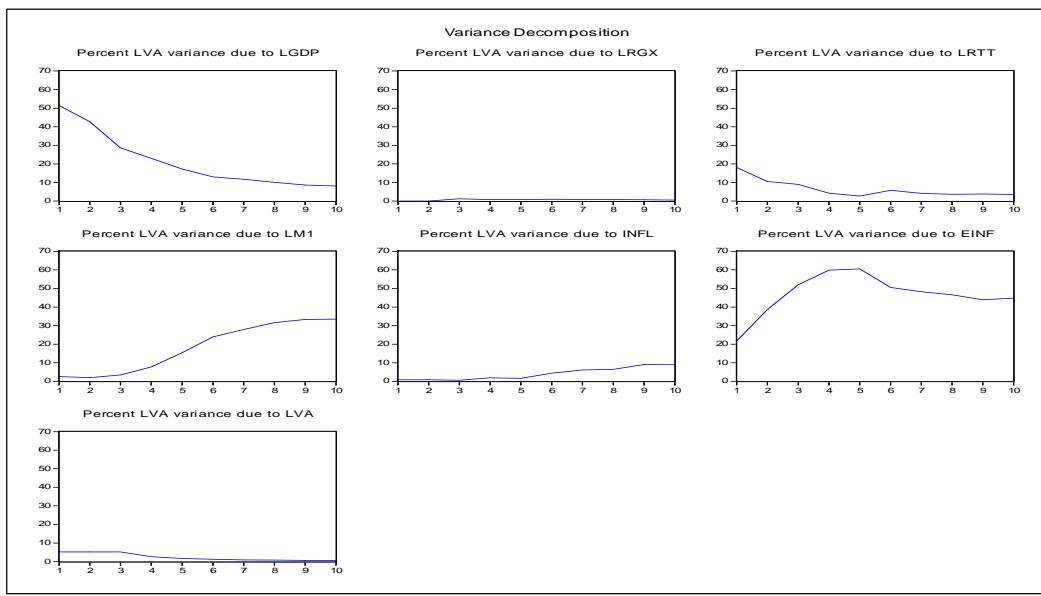


Figure A8.7