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AN ANALYSIS OF THE DETERMINANTS OF THE ECONOMIC GROWTH RATE IN KIRIBATI

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts

School of Economics
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AN ANALYSIS OF THE DETERMINANTS OF THE ECONOMIC GROWTH RATE IN KIRIBATI

DECLARATION OF ORIGINALITY

I, Toani B Takirua, declare that this thesis is my own work, and that to the best of my knowledge, it contains no material previously published, or substantially overlapping with materials submitted for the award of any other degree at any institution, except where due acknowledgement is made in the text.

Toani B Takirua

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Toani B Takirua

ABSTRACT

Kiribati is one of the least developed countries. With her increasing population, coupled with its poor resource endowment (with the exception of having huge Exclusive Economic Zone), the lack of foreign direct investment and the under-development of the private sector, create financial burden to the Government. Foreign exchange earnings from official development assistance, access fee, the revenue equalization reserve fund (RERF) and the remittances are significant to the economy. Only the RERF and the access fee have direct contribution to government revenues for its recurrent and development budgets. Aid and the remittances are channeled to unproductive investment and consumption and trade has been in a deficit. The growth accounting result shows that factor accumulation contributes much to growth than the total factor productivity (TFP). In econometric empirical analysis, none of the shift variables (aid, remittances and export) have permanent effects on output, except export having an effect in the short run.

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1. INTRODUCTION

1.1. Disparity in Economic Growth Performance and some Constraints

Economic growth has been a worldwide, significantly discussed topic among the Least Developed Countries (LDCs), following the success of the More Developed Countries (MDCs) in achieving a high standard of living through their high per capita income. In the South Pacific Countries, for example, sixteen (16) leaders had established the South Pacific Forum in 1971, later known now as the Pacific Islands Forum, in order to address common issues from a regional perspective and to give their collective views greater weight in the international community. Regional trade and economic issues, good governance, health and security are normally part of the Forum's agenda. [1]

The economic features of the MDCs and the LDCs are not comparable. In the context of the LDCs their economic features are a reflective of their constraints to economic development. Kiribati for instance, with its poor resource endowment (with the exception of huge Exclusive Economic Zone (EEZ)), distant from major markets, underdevelopment of the private sector, narrow export base, increasing labour force and low absorptive capacity of its economy faces major constraints in achieving economic growth.

Further more, both foreign direct and domestic private sector investments in heavy and light industries are the driving force and catalyst behind the success of the MDCs, creating employment opportunities, rendering income and export earnings, which the LDCs lack. Trade in value added products are the bulk of export by the MDCs,

[1] see Pacific Islands forum http://www.dfat.gov.au/geo/spacific/regional_orgs/spf.html

compared with only the primary resources available by the LDCs. The MDC economies are larger with rich resource endowment and high literacy of their population than the LDCs. Their advance research and development have created technological innovation, and further strengthened their capacity through rendering new ways to increase productivity or efficient production.

Seguino (2000) stressed that using new technologies effectively would require new ways of organizing the production process, a certain set of skills, and familiarity with new markets. Succeeding with new technologies requires not only entrepreneurial risk-taking and good management, but also a facilitating state role to move firms to invest in activities in which they might not otherwise take risks. In comparison, the distinguishing feature of successful East Asian economies is state policies directed at overcoming private market failure.

UNIDO (2001) discussed a number of problems in the LDCs, relating to the preparation of national plans, development of sectoral programs, and elaboration of appropriate policies and strategies of industrial development, to concerns relating to the technical processes to be employed in manufacturing any specific product. The issue to be considered by LDCs, is how best to exploit their natural resources and other comparative advantages, in order to ensure a worthwhile share for themselves in world production, and trade in manufactured products, including implementation of import substitution.

Poverty, inequality and environmental degradation characterized many of the LDCs. In some of the poor African countries, poverty and inequality are obvious. In the South Pacific countries including Kiribati, inequality and poverty are experienced within a small percentage of the total population, following the increasing population with few employment opportunities. ADB (2002) highlighted that the limited income prevailed in Kiribati made people depend on local produce, which are very healthy than manufactured foods, given the unstable and high prices of some of the imported commodities.

Environmental degradation is also prevailed in the South Pacific countries, due to the increasing population concentrated in urban areas. Poor sanitation causes health problems and one of the major causes of diseases.

Given the apparent social, economic, health and environmental problems facing the LDCs, provision of aid or official development assistance (ODA) by the MDCs is one way to solve such problems and to increase the quality of life in the LDCs.

The theories of economic growth are significant as they provide answers to the disparity in wealth and growth among countries. Solow (1956) for instance, had developed his growth model as an improvement and a major blow to the Harrod-Domar model. He stressed that the role of technical progress, which was exogenous in economic growth apart from capital accumulation, was a major factor that sustained the growth rates of MDCs. Since some countries lack such technologies, capital and skilled labour, render the answer to the different stages of economic growth and wealth among countries. Rich resource endowment is also important.

1.2. Purpose of study

What are the determinants of the economic growth rate in Kiribati? The core objective of this thesis is to analyze the determinants of the growth rate in Kiribati, using the econometric approach. The basic Solow growth model and the extension to the Solow model mainly on the export of copra, official development assistance, and the remittances will be analyzed to see their effects on Kiribati's output.

There are a number of observable economic variables that contribute to Kiribati's foreign exchange earnings. These are the access fee, reserve equalization reserve fund (RERF), aid and remittances. Two from these variables such as the access fee and the reserve fund are contributing directly to government's revenue, while as aid and remittances are channeled to unproductive investment and consumption.

The export earning is limited due to small-scale export sector such as only copra, fish, seaweed and handicraft. The trend on trade balance has been in a deficit in most of the years since 1980, reflecting its dependency on overseas suppliers.

We cannot confidently saying that such major foreign exchange earnings are the determinants of the growth rates, unless we can execute the growth accounting exercise and the extensions to the Solow model for regression analysis to examine their effects on output.

1.3. Contents of the thesis

Chapter 2 renders background information on Kiribati and its economy. It outlines its geographical location, its government, population and religion. It also presents information on government current account, component of expenditure and revenue, gross domestic product and its growth rates, trade, GDP per capita and employment, remittances, Official development assistance, fishing access fee, the revenue equalization reserve fund (RERF) and the gross national income per capita.

Chapter 3 provides a survey of growth theories. The Solow model is the basic theoretical growth model used and we also examines its relevancy in the MIRAB economies. Growth models are important as they assist in rendering answers to the disparity in wealth and growth rates among countries. Robert Solow (1957) had established his growth model, which was an improvement and a major blow to the Harrod-Domar model. He stressed that the role of technical progress, which was exogenous in economic growth apart from capital accumulation, was a major factor that sustained the growth rates of MDCs. Since some countries lack such technologies, furnishes the answer to the different stage of economic growth and wealth among countries in the long term.

Chapter 4 presents data and its sources and estimation procedures. The procedure in estimating and providing major sources of data for variables of interest such as the

GDP, capital, labour, aid, remittances and export earnings are presented. Also, such variables in their real values except for labour, the real GDP, real capital, labour, real official development assistance or aid, real remittances and the real export ratio are further analyzed and presented statistically to examine their growth rates and standard deviation. The capital-output ratio is also examined in order to get a picture of the economy, which can be used to compare with other countries. Data are inputted first into excel and then imported to Microfit 4.1 for regression analysis. The GETs and the Johansen VECM methods are also used including the Eview software for unit root testing.

Chapter 5 examines the growth accounting exercise for Kiribati. Durlauf and Kourtellos and Tan (2005) stressed that the aim of growth accounting was to estimate the relative portions of variation in cross-country output per worker, or growth, which could be assigned to variation in factor accumulation rates and that which accrues to total factor productivity (TFP). Solow (1956) argued that the residual and not factor accumulation accounted for the bulk of output growth in the US. Denison (1962), found that 60% of the growth in the advanced countries was due to total factor productivity or technical progress. It is interesting to examine the results of the growth accounting exercise for Kiribati, in order to be able to comprehend the contribution of both the total factor productivity and the factor accumulation into its growth rates.

Chapter 6 presents the empirical results both from the Solow model and its extensions for the growth performance analysis on Kiribati. The extension to the Solow model consists of the aid ratio, export ratio and the remittance ratio. The standard econometric specifications are also used from the literature. The results of the regression analysis based on data are presented to examine their short and long run effects on Kiribati's output.

Chapter 7 provides limitations, a summary and recommendations. Some of the limitations encountered during the execution of the study will be highlighted.

Moreover, it will provide a summary of findings and recommendations that may serve as ingredients for growth policies.

1.4. Conclusion

The intent of this research output is to provide further insight into the economic growth rate analysis and performance for Kiribati. It serves as a starting work in the applied econometric growth analysis on Kiribati, given its first execution on this topic. The results of the empirical study may assist in furnishing answers to the research question on: What are the determinants of the growth rates in Kiribati? It may also be used to compare with the results of other LDCs in the South Pacific Countries. The policy implication emerged from this study may also render some options for Kiribati to consider.

2. BACKGROUND INFORMATION ON KIRIBATI AND ITS ECONOMY

1. Introduction

The Republic of Kiribati is classified by the United Nations, as a Least Developed Country in terms of its low GDP per capita, their weak human assets and their high degree of economic vulnerability. Based on a list of countries sorted by their Gross Domestic Product (nominal) per capita for the year 2004, Kiribati is ranked 129th recording $701 (ADB.2002; SPC.2004).

This chapter is organized as follows: Section 2 provides a brief information on geography, government, population and religion. Section 3 concentrates on the macroeconomic indicators and in section 4 discusses foreign exchange earnings performances. It concludes in section 5.

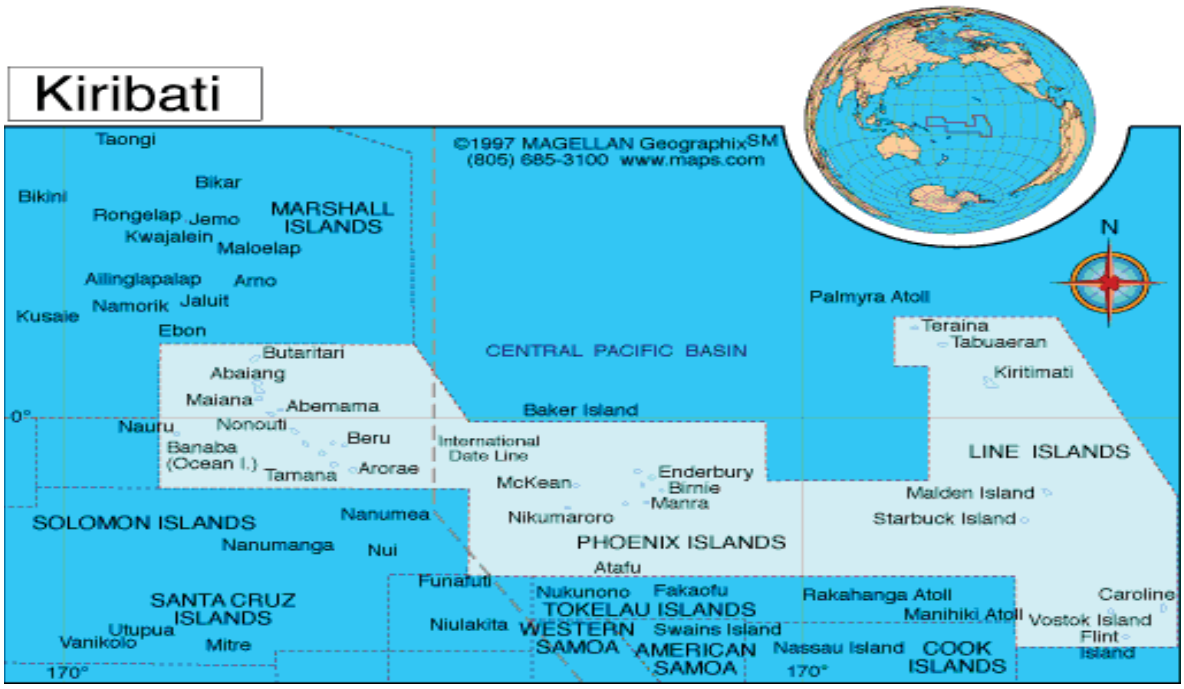
2. Geography, Government, Religion and Population

Kiribati consists of 33 atoll islands with a total land area of 811 square kilometers, lying astride the equator situated in a 3.6 million square kilometers of its Exclusive Economic Zone. It has the biggest EEZ in the South Pacific and it is the 188th in world area - land ranking of countries.

During the colonial administration, Kiribati was part of the Gilbert and Ellice Islands Colony in 1892 until the separation with the Ellice Islanders in 1976. Kiribati gained its independence in 1979. It was during this colonial administration where the economy was transformed to capitalism.

The constitution promulgated at independence establishes Kiribati as a sovereign democratic republic and guarantees the fundamental rights of its citizens. Its system of government is based on both the western and the United Stated models. Since Kiribati is a Republic, the Head of State and Head of Government is the Beretitenti (President).

Figure 1. Map of Kiribati **(in light blue shaded area).**



Source: Atlas: Kiribati - http://www.infoplease.com/atlas/country/kiribati.html

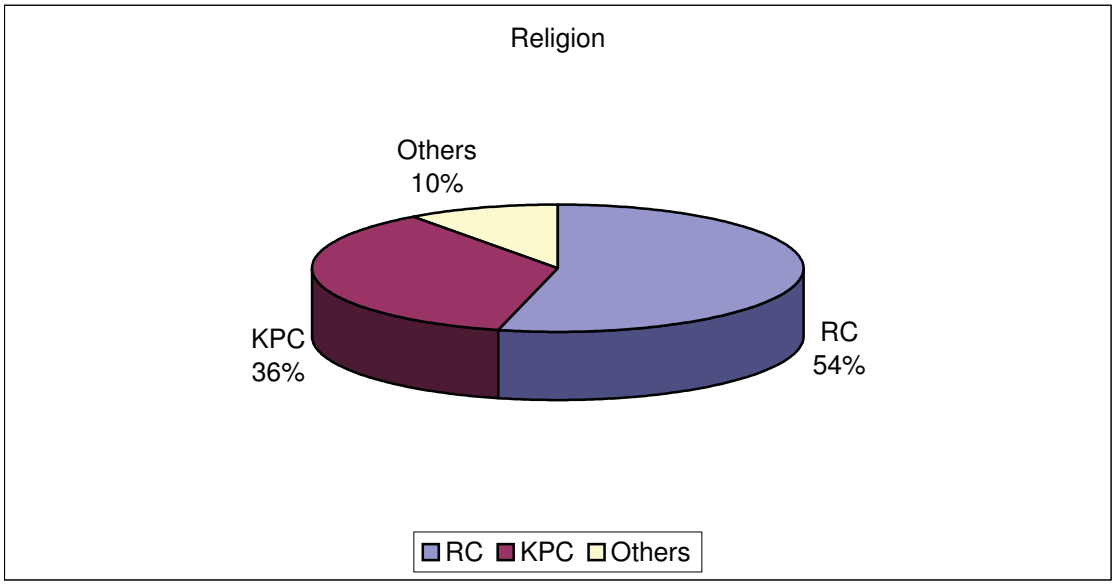
Kiribati latest population defacto census was done in 2000. It was reported that the total population stood at 84,494 people with a growth rate of around 2 percent. The indigenous population dominated the economy recording 98.8 percent of the total population. The demographic structure showed that 41% of the total population was less than 20 years old, meaning that it had a young population. The population by sex was 41,646 for men and 42,848 for women (Statistic Office.2002).

According to a forecast, it is estimated that by 2025, Kiribati will reach a total population of 140,000 to 145,000 people. About 70,000 people will settle in Tarawa, 20,000 in Kiritimati and 55,000 people will live in the rest of the Gilbert, Line and

Phoenix group (National Development Strategies 2004 – 2007(2003)). The population of Kiribati is expected to double over the next 20 years, exacerbating already serious environmental, urban management and health problems.

The two major Christian religions, the Roman Catholic Church (RC) and the Kiribati Protestant Church (KPC) dominate Kiribati. For example, the RC recorded 54% (members) of the total population and the Kiribati Protestant Church (KPC) 36%, as per the 2000 population census. Other religions such as the Church of Christ of Later Day Saints, the Seventh Day Adventists Church and so forth make up the other 10%. Figure 2 shows major religions with their total members.

Figure 2



Source: Kiribati Statistic Office (2000).

3. Macroeconomic Indicators

The macroeconomic indicators that will be discussed include: government current account, gross domestic product and its growth rates, inflation, trade, GDP per capita and employment.

3.1. Government Current Account

Acquiring alternative sustainable sources of government revenues, as well as prudent management of expenditures was a challenging issue for every government administration. M'Amanja and Morrissey (2005) recommended based on their empirical evidence in Kenya that policy makers should formulate expenditure and tax policies to ensure unproductive expenditures were curtailed while at the same time boosting public investment. The role of the Ministry of Finance and Economic Development in Kiribati for instance is crucial here in the provision of economic advices.

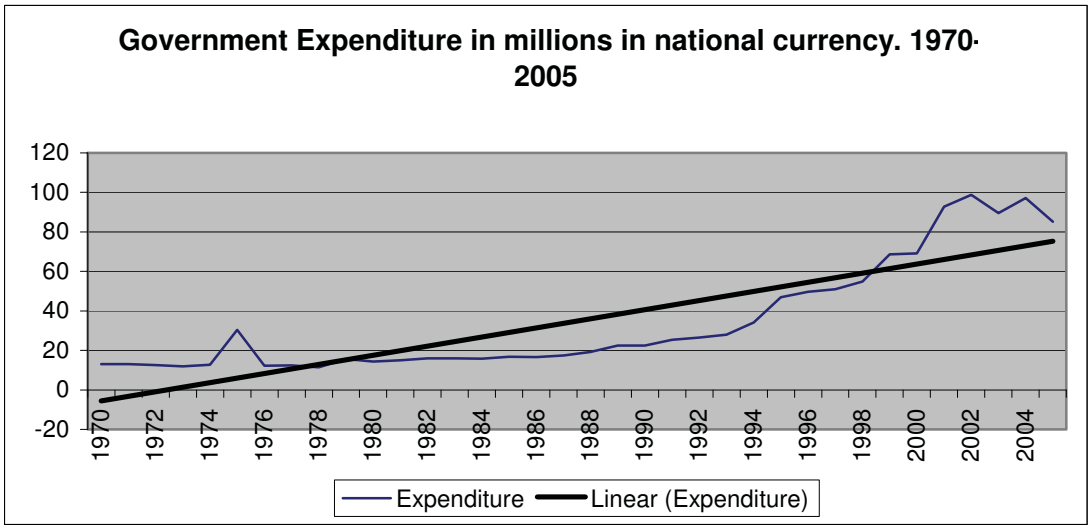
The major pattern and composition of expenditure items for every government are relatively similar. These include; the operational expenditures for its Ministries, its budget allocation to councils, development projects, and subsidies to some of its public enterprises. During the National Progressive Party (NPP) in power, the expenditure level was quite consistent from 1979 to 1992 of around $33 million. When the Maurin Te Maneaba Party (MTMP) took office it increased its budget to around $98 million in 2002 based on their policies and considered as expansionary. Part of the expenditures were dominated by the subsidized copra and seaweed prices, the JSS development projects, the increase in staff salaries arising from the job evaluation exercise, establishment of the copra mill and the lease agreement on Air Kiribati's ATR plane [1] and the continued increase in government ministries budgets.

Government expenditure on subsidies to its public enterprises (28 of them and 4 commercial joint ventures, but reduced to 3 after government fully took over the TSKL) were substantial. For instance, it totaled to $5.9 million from the Recurrent Budget and $2.2 million from the Development Fund in 2001 (ADB.2002).

[1] These are some of the expenditure items.

Unfortunately, the performances of some PEs were declining and some were closed down, such as the Abamakoro Trading Ltd and the Atoll Motor Marine Services (AMMS). Figure 3 presents government expenditures from 1970 to 2005.

Figure 3



Source: Kiribati Statistic Office .2001.

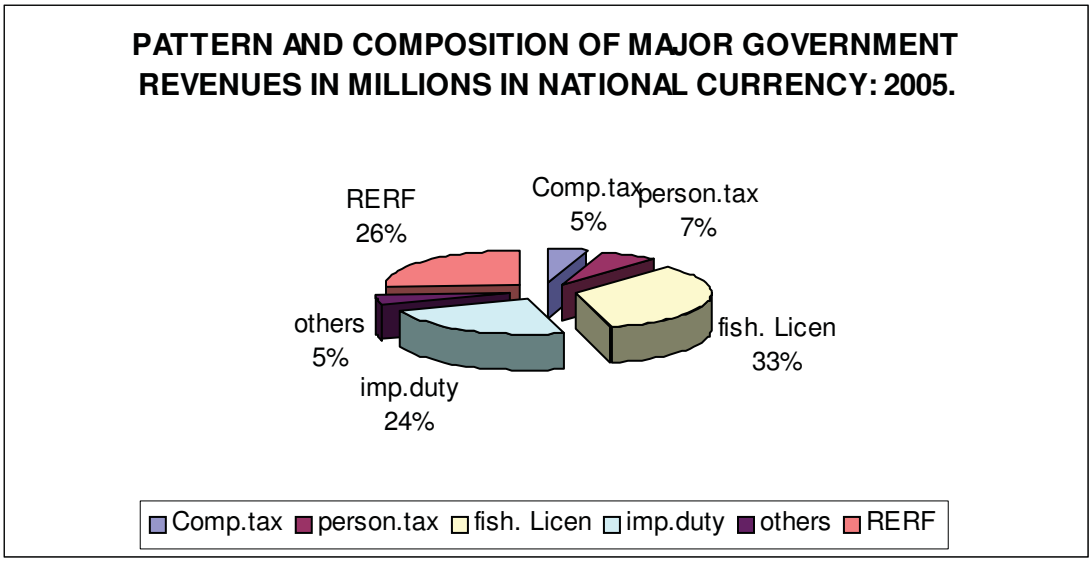
In 2003 onward when the Boutokan Te Koaua Party took office, the level of expenditure was quite similar with the 2002 expenditure level. This was due to the increased in government subsidized copra price to $0.60 cent per kilogram. In 2004, a new item was introduced and this was on the payment of a social welfare allowance of $40.00 per month to an elderly person reaching the age of 70 years. This provides some form of help to such old people.

It was argued that the increased in government expenditures were caused by political parties campaign promises, which had some cost implications on Kiribati financial resources. For instance, campaign promises include the increase in domestic price of copra or to increase the salaries of staff for the public service.

On the other hand, there was variation in the composition of government revenue. The MTMP had revenue from the lease fee on the Chinese tracking station established in

Tarawa, the green passports and the Norwegian Cruise Line operational fee and robust revenue from the access fee. In July 2003, the BTKP got lid off with the green passport and the lease fee from the Chinese tracking, as it had established diplomatic ties with Taiwan, which becomes one of the major aid donors to the country. Also, the revenue from the access fee was falling due to weather variation affecting the location of tuna species. Consequently, the drawdown from the interest earned from the RERF to balance government budget would be an alternative. Figure 4 below reflects the pattern or regular composition of government major sources of revenue in 2005.

Figure 4.



Source: Government of Kiribati (2004) – 2005 Budget.

The access fee (fishing license), the RERF and the import duty were the major sources of revenues contributing to 35 percent, 27 percent and 24 percent respectively of government total revenue in 2005, similar with previous years (Government of Kiribati budget 2004 and 2005). One should note that only 5 percent of the total revenue was acquired from company tax, a reflective of the underdevelopment of the private sector.

3.2. Gross Domestic Product (GDP) with its Average Growth Rates and Inflation

Government expenditure formed part of the GDP. There was a high GDP during the colonial administration with a peak of $92 million in 1975 and dramatically fell to $36 million in 1980 caused by the cessation of phosphate mining, which had great adverse effects to Tabai's government (NPP) in terms of insufficient government's revenues for recurrent and development expenditure purposes. More expansionary policies were experienced during the MTMP's terms in office from 1994 to 2002. For instance, the GDP level was increased from $54 million to $98 million for 1994 and 2002 respectively.

Government current expenditure was very large in relation to the overall economic activity, accounting to 90 percent of GDP at factor cost in 1995, due to high level of overseas earnings (Ministry of Finance and Economic Planning. 1997). The level of expenditure was exactly the same in 2002, given a high support price to copra and a pension welfare allowance.

The growth rate of GDP for Kiribati was fluctuated. After independence in 1980 it recorded a poor growth due to cessation of phosphate mining, a major export item, and gradually recovered in the late 1980s at low rate. In 1993 it stood at 1.7 percent, 1.6 percent in 2000 and in 2002 it recorded 0.9 per cent. In 2004, it had improved to 1.4%. The variation in the annual average GDP growth rate was caused by the fluctuations in the production sectors of the economy such as the revenue from the fishing licenses, earnings from export of copra and seaweed, fluctuation in government revenues and expenditures and business activities.

Inflation is quite low in the country however it is subjected to external forces particularly from major import sources such as Australia, Fiji, New Zealand and other international markets. For instance, the recorded inflation was averaged at 2 percent in 2003-04. (Kiribati national development strategy: 2003-2007). The increased in world oil price would also indirectly increase domestic prices. Government's imposition of

the price control on some major consumable imported foods and other commodity items also assist to suppress inflation domestically.

3.3. Trade Liberalization

Global integration in terms of trade liberalization dominates much of the World Trade Organization's (WTO) agenda in the 21st century. [2] It is designed to eliminate trade barriers (custom duty etc) globally as a foundation for free trade. The issue has undoubtedly emerged following the success of regional trading blocks such as free trade agreements between the Central American countries, the Dominican Republic, and the United States (CAFTA-DR) and so forth. Also the Pacific Island Countries Trade Agreement (PICTA) enters into force after six countries have ratified it.

The PICs together with Australia and New Zealand, have also signed the Pacific Agreements on Closer Economic Relations (PACER), which is an umbrella agreement for the PICTA. PACER is not fostering freer trade between PICs and Australia and New Zealand. Wadan (2004) stated that it was a reactive and essentially defensive agreement, protecting Australia and NZ interest in the PICs markets. For instance, if any PICs proceed with formal negotiation with other developed countries, then they should also have similar negotiation with Australia and NZ.

While the PICTA and PACER are already binding on those PICs signing and ratifying it, the Cotonou Agreement on trade aspects are in the process of negotiation between PICs with the European Union (EU), under the Economic Partnership Agreements (EPAs), expected to come into effect after 2007. This means that PICs will try to make agreements that will satisfy Australia and NZ as well as the EU countries (ibid).

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[2] Global integration is a widening, deepening and speeding up of interconnectedness in all aspects of contemporary social life in our case here is on economic activities. *Economic globalization* means the greater global connectedness of economic activities, through transnational trade, capital flows and migration. – see Glossary @ http://ucatlas.ucsc.edu/glossary.html

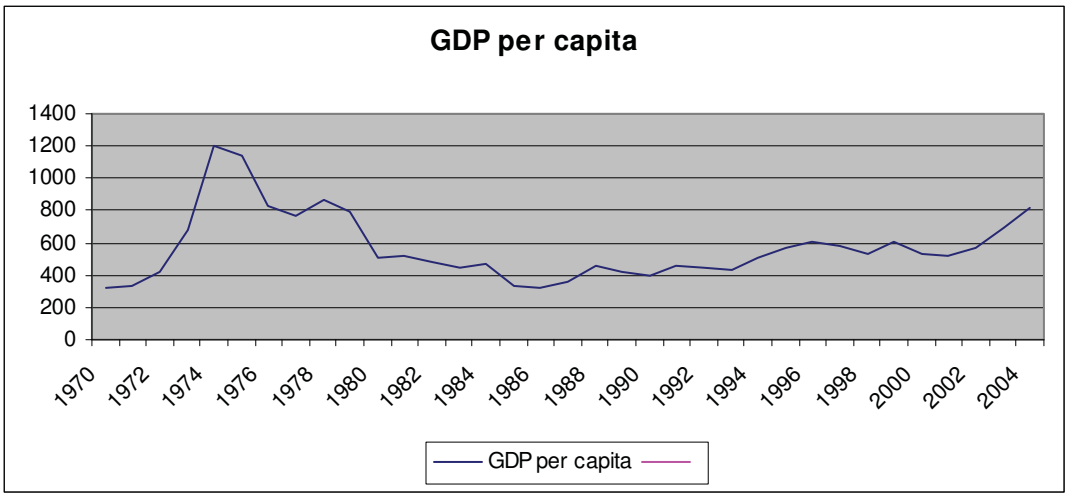
Is Kiribati benefited from free trade? The important issue that Kiribati is encountering now is how to substitute the loss of revenue from custom duties, which renders around $10 million dollars annually into the economy or about 10% of GDP in 2002, if free trade incorporated fully into the PICTA. Other forms of taxes such as the value added tax for instance is being considered as an alternative. Is this going to increase the cost of living and directly affecting the poor? Major arguments also suggest that the benefits from free trade outweigh cost in Kiribati, considering its dependency on import (it is normally in trade deficit), poor resource endowment and lack of investment in capital-intensive manufacturing industries. Also one should note that if the VAT is imposed, domestic price would also be increased on selected items.

Producers from the developed countries would also benefit from free trade. They can now access other markets for their products, which assist to maintain or increase their domestic employment and income.

3.4. Gross Domestic Product Per Capita and Employment

Given the low productive and absorptive capacity of Kiribati's economy due to the underdevelopment of the private sector, the adverse effect of the increasing population on the GDP per capita is greatly felt. It is measured in the United States currency in order to be able to compare with other countries. In 2000 to 2004, the GDP per capita for Kiribati rose from US$560 to US$800 respectively, due mainly from the increased in government expenditures, while as in 1974 coincidence with the high export earnings from phosphate and moderate increase in population, the per capita GDP reached $1,200. Also, after independence in 1980 there was a dramatic fall in per capita GDP recording US$500 and reached 300 in 1986 the lowest on record, due mainly to the cessation of phosphate mining. Figure 5 below shows the graph for GDP per capita.

Figure 5.

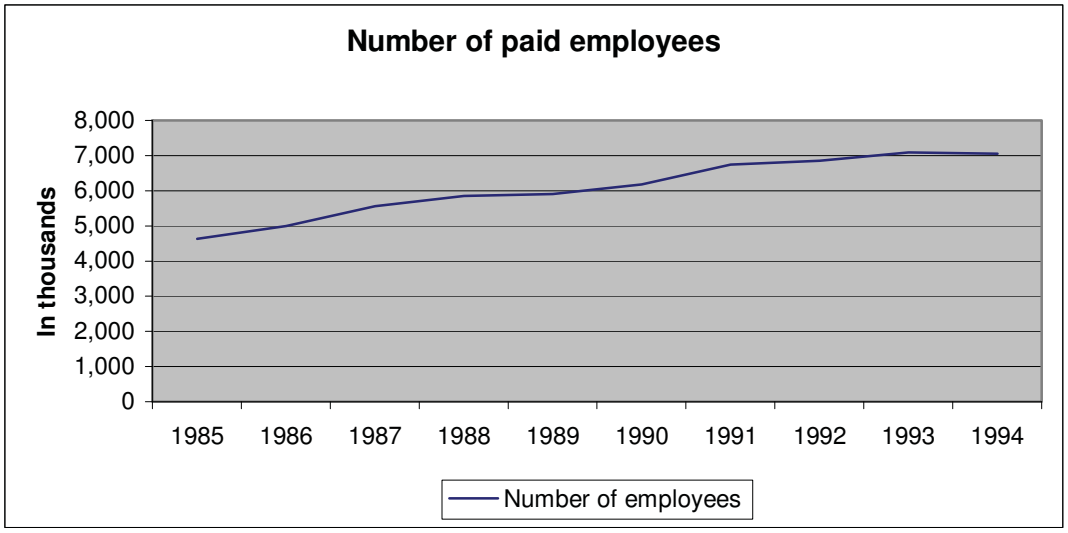


Source: United Nations Statistic Division (2006)

The trend in employment varies. Employment has been increased since 1985 totaling 4,635 and 7,053 in 1994 (refer to figure 6), but these figures are only minimal considering the increasing young active labour force available annually. Government and its public enterprises are the main providers of employment accommodating 77% of the total employees, while the private sector (consists mainly of churches, private business, foreign companies and embassies and regional organization) rendered 23% (MFEP.1997). In 1995 and 1999 Government accommodated 6,800 and 8,600 respectively, which accounted to 55% of the total employed workforce. Another 22% was employed by public enterprises and 23% by private businesses (National development strategies.2000-2003). In 2000 the public sector had employed 9,200 people (Toatu. 2004). It is also estimated that only 450-500 jobs become available for 1,700 to 2000 school leavers annually (ADB.2002).

Given that situation, it is significant that every government must diversify income - generating activities for the rural people and encouragement of the private sector development, in order to provide employment opportunities and income.

Figure 6.



Source: Ministry of Finance and Economic Planning (1997).

4. Major Foreign Exchange Earnings

4.1. Fishing Access Fee

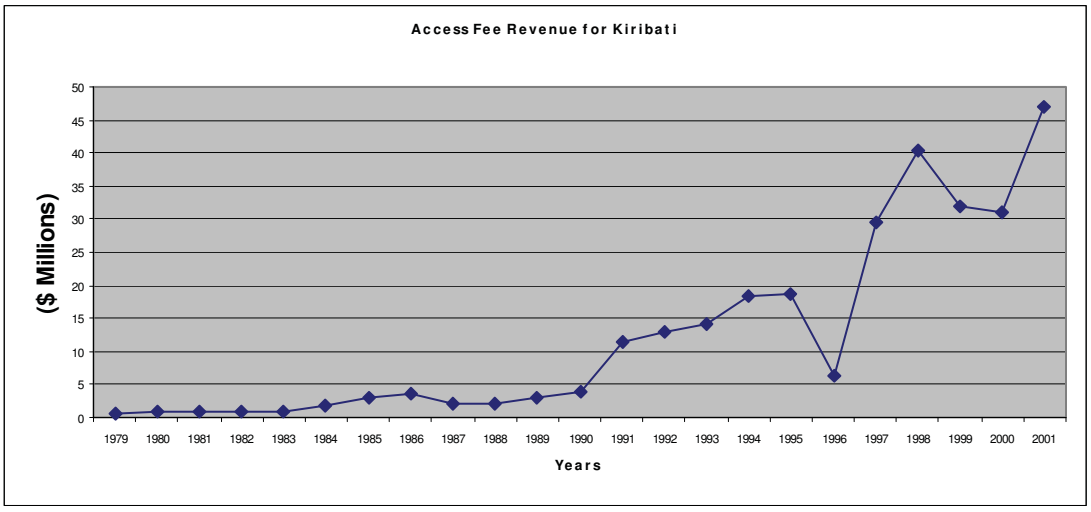
Given the prevailing very small-scale commercial tuna fishery sector (without canning factory) in Kiribati, it does not gain much from the export of raw tuna to overseas markets. However, its revenue from the access fee provides some financial means but at a consistent low level and subject to short run fluctuations from distance water fishing nations (DWFNs) economies.

The weather pattern is also affecting the movement of the tuna species and a major factor to determine the revenue from the access fee. For instance, there was a drop in the catch in 1994, which coincided with a strong La Ninã, followed by a strong El Ninõ in 1995 when the tuna stock returned to a high level in Kiribati but failed to return to the previous level in Fiji (Aaheim and Sygna.2001). After 1996 there was a big increase in access fee received amounting to $40 million in 1998 and fell in 1999 to 2000 at $31.5 million. The highest access fee revenue recorded was $46 million in 2001 or about 40 percent of GDP (ADB.2002).

The fluctuation of revenue from access fee is a major national issue. For example, Kiribati parliamentarians during their parliamentary budget session in 2004 debated on the reason for the fall in revenue from access fees. It was clarified that the negative effect of climate change (La Nina) was the responsible factor.

This unstable revenue creates some problem. How can they balance the recurrent budget when the revenue side continues to fluctuate or fall? Duncan (2004) argued that it would be extraordinarily difficult to have good fiscal management when the revenue side of the budget was so unstable. Figure 7 presents the revenue from the access fee.

Figure 7.



Source: ADB (2002): Government of Kiribati National Development Plan 1983-1986: Statistic Office.2001. Government Finance Statistic (GFS) 1985-2000;

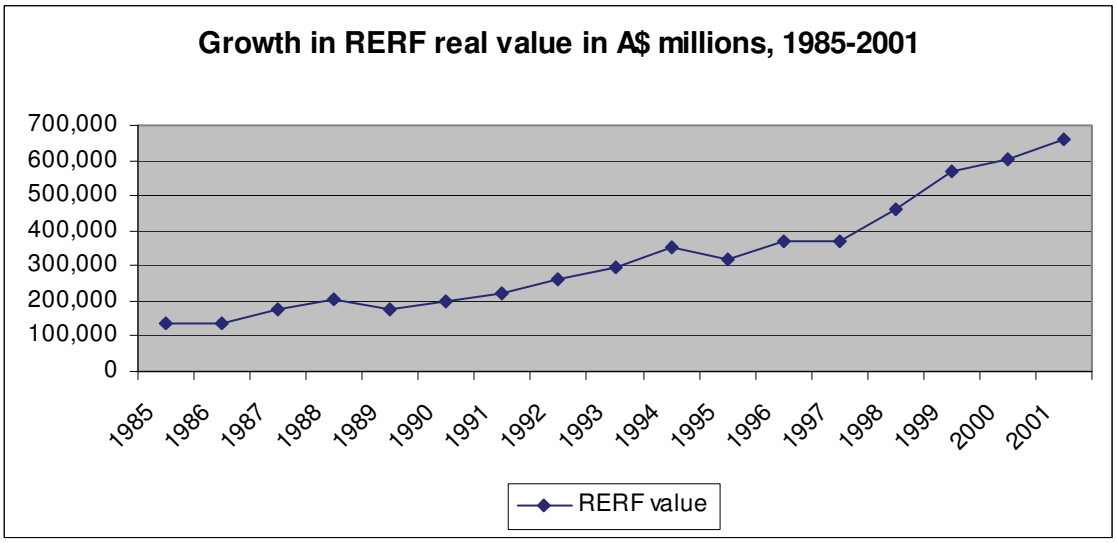
Given the fluctuation and low level of access fee received by Kiribati, it may consider adopting a joint venture with one or more of the DWFNs in order to earn bigger share from its EEZ and it is quite cheaper as they share the cost depending on their agreement.

Tuna farming that is, to keep tuna species in fence in the lagoon, just like milkfish ponds, is also significant considering Kiribati numerous lagoons in the outer islands. The advantage for this is that, it does not require fishing vessels.

4.2. Revenue Equalization Reserve Fund (RERF).

The RERF is really the backbone of the Kiribati's economy. It is normally used annually to balance government's budget. Obviously, there is a consistent increase in the real value of the RERF reaching A$658 million in 2001 (ADB.2002). The draw downs of the RERF has covered the current account deficit, but this can lead to apprehension that the RERF's value can be entering a long-term decline. Not only that, but it is also vulnerable to short run fluctuations from major international economies and financial markets. Figure 8 shows the growth in the RERF real value from 1985-2001.

Figure 8.



Source: Kiribati Statistic Office (2001).

Kohn (2005) stated that no financial system that was efficient and flexible was likely to be completely immune from episodes of financial instability from time

to time, and policymakers would be forced to make judgments about the costs and benefits of alternative responses with very incomplete information.

The open market operations should be used, as a first resource to staving off adverse economic effect of financial instability and to make sure aggregate liquidity is adequate. Adequate liquidity has two aspects: First, we must meet any extra demands for liquidity that might arise from a flight to safety; if they are not satisfied, these extra demands will tighten financial markets at exactly the wrong moment. This was an important consideration after the stock market crash of 1987, when demand for liquid deposits raised reserve demand; and again after 9/11 commonly known as the destruction to the world trade center, when the destruction of buildings and communication lines impeded the flow of credit and liquidity (ibid). Second, weighting the stance of monetary policy on the adjustment to counteract the effects on the economy of tighter credit supplies and other consequences of financial instability is worth considering. Rey and Martin (2002) also pointed out that emerging markets were more prone to financial crashes simply because they had a lower income level and not because of the existence of market failures (moral hazard or credit constraints), bad monetary policies or exchange rate regimes. The chain reaction resulted from such financial instability, could assist to explain why there were major losses to Kiribati's RERF real value in some years.

The diversification of the RERF investment in various currencies under different fund managers is a good measure to encourage competition and also to monitor performance of financial markets. This is vital for the management and development of the reserve fund. It is worth considering that such fund managers invest the reserve fund in currencies stronger than the national currency (Kiribati uses the Australian currency).

On the other hand, this arrangement may not be working if such fund managers work closely, which can be against the purpose of this arrangement where they are required to work independently.

Given the economic significant of the RERF, the vital and priority requirement to be implemented by the Ministry of Finance is to monitor and manage the fund properly in order to have sustainability in its real value for future generations.

4.3. Remittances

Employment opportunities overseas or labour mobility are the sources of remittance. Borovnik (2005) revealed that in 1999 the total number of seafarers registered with the South Pacific Marine Services was 1366 and 569 registered with the Kiribati Fisheries Services. Also, seafarers' remittances in Kiribati consisted of 57 per cent remitted to wives spent on basic needs, 30 per cent saved for investment and 13 per cent spent on school fees. At the social level, remittances have added to family incomes and boosted private consumption. At the national economic level, remittances have reduced, in some cases substantially, the current account deficit of many developing countries, boost imports and spur growth, increase a country's international credit worthiness and lead to lower borrowing cost (see ESCAP (2006); Walker and Nicholson and Matteo and Francesco (2005); Caroline and Nikola (2005)). In 1979 the amount of remittance was $1.4 million and increased to $7.3 million in 1993. On average the contribution of remittances to GDP was 15 percent for 1996-2000, an increase from 7.2 percent as earlier reported by McGall (1992).

Given the economic important of remittance, Kiribati should maintain its quality seafarers through supporting its marine training institutions' development and to provide incentives and to establish a good relation with the recruiting agencies based in the country, for the long term sustainability of the seafarers' employment and the remittance.

4.4. Official Development Assistance (ODA) or Foreign Aid.

It was noted that aid was frequently used to maintain or extend the strategic interests of the major powers. However, some aid donors had considered the interest of the recipient countries as well. For example, Japan, Australia and New Zealand and so

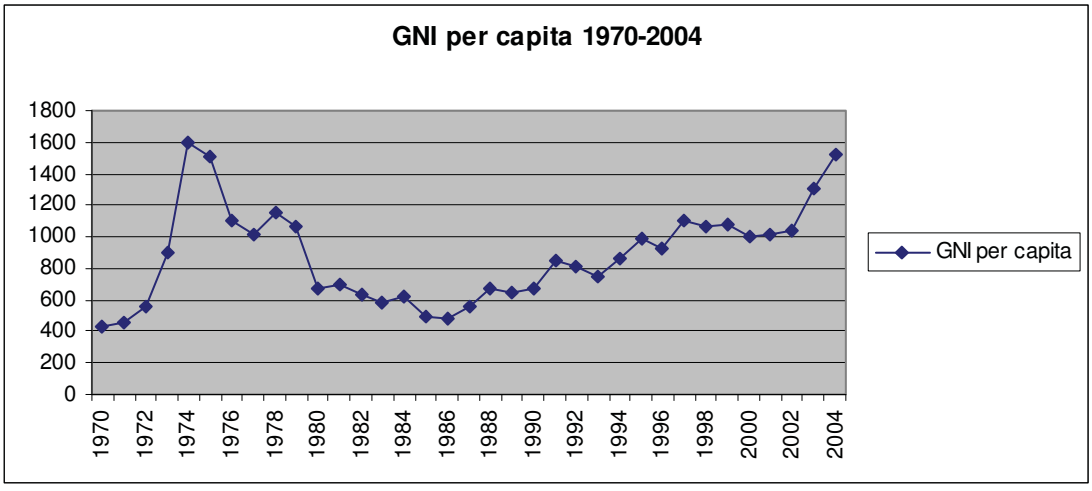
forth, take national interest as well as recipient country needs into account in allocating their aid.

However, the purpose of ODA remains, for most donors, the alleviation of poverty in developing countries through the promotion of economic and social development. Kiribati for instance had already received a total of US$593 million since 1970 (Hughes.2003). The major sources of foreign aid are mainly from bilateral and multilateral. For example the Public sector, which dominates the economy, relies on aid averaging 27 percent of GDP over the 1996-2000 periods. The issue is that where does this huge aid pour on? This is due to the fact that the level of development in Kiribati remains low. However, Kiribati will endlessly require aid in the long term, but it is important that aid donors will consider providing aid into productive investment.

4.5. Gross National Income Per Capita.

Kiribati's gross national income per capita varies. For example, it had been in the upward trend from 1970 reaching US$1,600 in 1974 with a major source of earning was from the export of phosphate including low population. Figure 9 presents the growth in per capita gross national income from 1970 to 2004.

Figure 9.



Source: United Nations Statistic Division (2006).

Since late in the 1970s, more foreign exchange earnings were acquired mainly from aid, access fee, the RERF and remittances. They really contribute to GNI per capita. For example, the gross national income per capita stood at US$1,100 in 1997 and further increased to US$1,500 in 2004, but fell in 2006 to US$1,390.00 (World Bank.2006).

5. Conclusion

Kiribati's foreign exchange earnings from the access fee, foreign aid, remittances and the draw down from the RERF and trade are important for the development and sustainability of Kiribati's economy. There is a potential of deriving revenue from the marine resource, given its huge EEZ, but currently there is no real investment in this sector. Foreign aid is considered imperative given Kiribati's financial constraints. Foreign aid will be required in the long run, however, it is very important that aid must create opportunities to contribute to productive investment rather than consumption. Its increasing population is also a burden, as it requires more budget to cater for their welfare. Unemployment is also a problem, thus labour mobility may be beneficial due to weak absorptive capacity of the economy. The remittance from seafarers is important to the families for their living and the economy at large. The RERF on the other hand, a source of funding for the recurrent and development budgets must be managed properly for the betterment of future generations. Although Kiribati may rely on foreign exchange earnings, such earnings are vulnerable to short run fluctuations from partner economies. Effort should also focus on the sustainability of government's expenditures given its limited financial resources. Trade liberalization may be beneficial to Kiribati, but this will eliminate revenue derived from the custom duty. Therefore, Kiribati must weigh carefully the positive and negative effects of free trade. Developments of the coconut and seaweed industries for domestic and overseas markets are essential. The concept of having import substitution industries (a foundation for the export led growth concept) may be worth considering in order to lower the high import bill for Kiribati and in the longer term can be engaged in the export led growth. Reducing barriers to

trade, investment, and marine development, environmental management and investing in human resources development could foster opportunities for development.

3. THEORIES OF ECONOMIC GROWTH

1. Introduction

Why are we so concerned with economic growth? Why are some countries wealthier than the others? Why do we have the so-called the more developed and Less developed countries? These questions cannot be satisfactorily answered without a clear understanding of the theories of economic growth. This chapter, therefore, briefly examines these theories and is organized as follows. Section 2 surveys growth models such as the Harrod Domar and the Robert Solow (1957) model and the usefulness of the growth accounting. Section 3 examines the significance of the model to the Small Pacific Island Countries, also known as the MIRAB (migration and remittances, aid-bureaucrat) economies and a re-look at the MIRAB model. Section 4 concludes.

2. Economic Growth Theories

2.1. A brief look at Harrod Domar Model

The Harrod-Domar model observed that the rate of economic growth would depend on the growth of capital, and on the proportion of income saved and invested. In other words, the rate of growth of an economy can only be increased when we increase investment (capital) and the saving rate to finance higher investment.

Furthermore, it stressed that investment would be "warranted" (that is, justified or reasonable) only if the businessmen could expect that it would be sufficiently profitable. Therefore, it reflects the fact that the rate of growth, which in this case is warranted, is constrained by businessmen's expectations of profits.

The model states that technology through (marginal) capital-output ratio ($\Delta k / \Delta y$) is fixed. The Harrod-Domar's specification is as follows:

$$\Delta \ln Y_t = s / g \qquad (1)$$

where $\Delta \ln Y_t$ = the rate of growth of output, s = saving rate and g = capital to output ratio.

The question that we may ask: Is this model useful for economic policies in the real world? Based on its specification, it may suit the high-per capita income countries such as the United States, Japan and so forth because they can increase their saving rate to finance higher investment. However, it is hard to increase the saving/investment rate in the developing countries where per capita incomes are low.

2.2. The Solow model

The Solow model (1956) extended the Harrod-Domar model by incorporating these assumptions: adding labour as a factor of production; the returns from labour and capital are diminishing separately and both have constant returns to scale; introduce technical progress variable as exogenous and dissimilar from capital and labour. Also, the capital-output and capital-labor ratios are not fixed as they are in the Harrod-Domar model. These refinements allow increasing capital intensity[1] to be distinguished from technological innovation.

[1] see Exogenous growth model-"http://en.wikipedia.org/wiki/Exogenous_growth_moel"

2.2.1. Specification of the Solow Model

2.2.1.1. Defining Capital Value

Let us start first with the capital stock (K), one of the inputs in the Solow model as conveyed in the Cobb-Douglas production function in equation 2.

$$Y = F(K, L, A) \qquad (2)$$

However, one should note that the use of tools and machinery make labor more effective, rising capital intensity or capital deepening thus pushes up the productivity of labor. A society that is more capital intensive tends to have a higher standard of living over the long run than one with low capital intensity. However, capital depreciates depending on the quality and life span of machineries. In other words, we can say that the capital stock (ΔK) can be acquired from gross investment less depreciation:

$$\Delta K = s \times Y - d \times K \qquad (3)$$

Where Y is output and s represents the proportion of income we save and invest i.e, assuming all savings are to be invested and d is depreciation rate.

We can arrange equation 3 in order to get the proportional change in K. Dividing both sides of the equation by K can do this;

$$\Delta K / K = s \times Y / K - d \times K / K \qquad (4)$$

For illustration, assume $Y = 1020,\ s = 0.25, K = 2000$ and $d = 0.05$,
So the change in capital ΔK = .25 x 1020 – 0.05 x 2000 = 155. In proportional terms, $(\Delta K / K) = (155/2000) \approx 7.7\%$.

Let us look at the balanced growth path (BGP), as it is important in the growth models. Assuming that the economy is on a BGP, the proportional change in K is zero as illustrated here [2].

$$\Delta K / K = 0 = s \times Y / K - d$$
$$d = s \times Y / K$$
$$K^* = (s \times Y) / d \qquad (5)$$

The K* is the capital when the economy is on its BGP. The assumption in equation 5 implicitly reflects the non-existence of technical progress and no growth in labour force. However, the opposite will happen, that is the BGP value of K* changes, if there is technical progress and growth of the labour force.

2.2.1.2. Defining Value and Growth Output

One important thing, which is an objective, is based on the assumption that when the economy is on BGP, we must find the value of its output and its growth. The value of capital (K*) has already been defined in equation 5 when the economy is on its BGP.

The value of output on the other hand, when the economy is on BGP can be obtained using a simple dominant device Cobb-Douglas production function (equation 6) with constant returns and non existence of technical progress and growth in employment, that is, these rates of growth are zero.

$$Y = K^{\alpha} L^{1-\alpha} \qquad (6)$$

Since we have already found the value of K*, we can use it to substitute into equation 7. This is illustrated below,

[2] Professor Bill Rao of the University of the South Pacific provided useful lecture notes on EC401 in 2006 for the application of the Solow model, which they are also referred to here.

$$Y^* = [sY^*/d]^{\alpha} L^{1-\alpha}$$

$$Y^* = (Y^*)^{\alpha}(s/d)^{\alpha} L^{1-\alpha}$$

$$Y^{*(1-\alpha)} = (s/d)^{\alpha} L1-\alpha$$

$$Y^* = (s/d)^{\alpha/(1-\alpha)} L \qquad (7)$$

Based on equation 7, we can find the proportional changes in output, but remember that s, d and L are constants. Therefore, (7) implies that:

$$\Delta Y^*/Y^* = 0 \qquad (8)$$

The conclusion here states that, when the economy is in BGP, the capital stock will remain constant.

2.2.1.3. Growth in Labour Force and Technical Progress

We assume now that employment and technical progress grow at the exogenous rates of n and g. Using the per worker capital stock $(k \equiv K/L)$ we get

$$\Delta k/k = \Delta K/K - \Delta L/L = \Delta K/K - n \qquad (9)$$

where n is an exogenously given rate of growth of employment.

Since we have known the value or expression of $\Delta K/K$, we can use it also to formulate the growth in employment and technological progress

$$\Delta k/k = [sY/K - d] - n, or \Delta k/k = sY/L/K/L - (d+n) = sy/k - (d-n) \qquad (10)$$

We can also use the per worker capital stock deflated by the stock of knowledge.

$$\overline{\Delta K}/\overline{K} = \left[sY/K - d\right] - n - g$$

$$= sY/LA/K/LA - \left(d+n+g\right) = s\overline{y}/\overline{k} - \left(d+n+g\right) \qquad (11)$$

where g, is exogenously given rate of growth of technology. This is important in finding the BGP values of output and its rate of growth.

When the economy is on BGP, $\overline{\Delta k} / \bar{k} = 0$, so we have this

$$s\bar{y} / \bar{k} - (d + n + g) = 0 \qquad (12)$$

The BGP value of $\bar{k}$ is $\bar{k}^* = s\bar{y} / d + n + g$ (13)

We must then substitute $\bar{k}$ into the production function, using the Harrod neutral technical progress as shown below.

$$Y = K^{\alpha} (LA)^{1-\alpha}$$

Dividing both side by LA

$$Y / LA = (K / LA)^{\alpha}$$

$$\bar{y} = \bar{k}^{\alpha} \qquad (14)$$

Substituting equation 13 into 14 gives equation 15. Equation 15 is a growth rate of $\bar{y}^*$.

$$\bar{y} = \left(s\bar{y} / d + n + g\right)^{\alpha}$$

$$\bar{y}^* = \left[s / (d + n + g)\right]^{\alpha/(1-\alpha)} \qquad (15)$$

Our next objective is to get the growth rate in per worker income y reflected in the following equations.

$$\bar{y}^* = \left[s / (d + n + g)\right]^{\alpha/1-\alpha} \times A \qquad (16)$$

$$\ln y^* = \left[\alpha / (1 - \alpha\right] \ln\left[(s / d + n + g)\right] + \ln A$$

$$\Delta \ln y^* = 0 + \Delta \ln A = g \qquad (17)$$

Equation 17 is important as it shows that when the economy is on a BGP, per worker income will grow at the rate of technical progress (g). If g = 0 then per worker income will not grow. We can say here that the growth in per worker income is depended on the rate of technical progress. The Solow model implies that the economy converges to a BGP because each variable is growing at a constant rate. The BGP implies that the growth rate of output per worker is determined by the rate of technical progress.

Therefore, it would be valuable to know (a) what the value of the rate of growth of technical progress is for each country; (b) what factors determine the size of this rate of growth of technical progress and (c) why it may differ from country to country. Needless to say answers to the questions are useful to develop growth policies.

However, Solow (1956) has no answers to these questions, except to show that while a country's growth rate may vary from year to year, in the long run, when an economy reaches its equilibrium growth path, its per worker income grows only if there is a positive technical progress. Subsequently, Solow (1957) showed how to estimate the rate of growth of technical progress by using the identity implied by the production function. This is known as growth accounting.

2.2.1.4. Usefulness of Growth Accounting

Durlauf and Kourtellos and Tan (2005) stressed that the aim of growth accounting was to estimate the relative portions of variation in cross-country output per worker, or growth, which could be assigned to variation in factor accumulation rates and that which accrues to total factor productivity (TFP).

It can be used to determine the relative importance of factor accumulation to growth, even though we do not know what determines the Solow residual. However, the results from growth accounting exercises are useful for designing growth policies (see also Herendorf and Vanlentinyi (2005), Bosworth and Collins and Chen (1995), Pinheiro and Serven and Thomas (2001)).

Musso and Westermann (2005) also provided concrete fact about growth accounting, stating that it does not aim to explain the fundamental underlying forces, such as preferences, institutions and economic policies, that drive the evolution of supply-side factors, nor does it take into account the linkages between developments in these factors. This is a useful contribution towards the understanding of growth accounting in terms of longer term growth process. It is a useful complement to model based approaches to estimating and assessing potential output, which is true for any production function based approach.

Senhadji (2000) stressed also that growth accounting framework had been used worldwide to examine the source of cross-country differences in total factor productivity (TFP) level. He highlighted that this exercise has been conducted for 88 countries for 1960 – 1994.

Several growth accounting exercises results had useful results. Solow (1956) argued that the residual and not factor accumulation accounted for the bulk of output growth in the US. Denison (1962), found out that 60% of the growth in the advanced countries was due to total factor productivity or technical progress. Therefore, this method of estimating technical progress is known as the residual method and often the residual attributed to technical progress is known as the Solow residual.

Some economists like Caselli and Rao call this Solow residual as a measure of our ignorance of the determinants of the growth rate. The reason for this is that, the Solow model does not offer any explanation of what factors e.g. like education, health, expenditure on research and development etc, determine this residual. Often in the empirical works it is assumed that it is a constant and can be estimated as the coefficient of time trend. For example if the production function is written as $Y= A_0 e^{gt} K^{\alpha} L^{(1-\alpha)}$, where A_0 is the initial stock of knowledge, then it is possible to estimate `g', say with OLS. However, this does not answer what factors determine `g'. All that this implies is whatever these determinants are, they are highly trended. Such an answer

does not help to develop growth policies. Therefore, Caselli and Rao are justified in calling the Solow residual as our measure of ignorance of the determinants of growth.

3. The MIRAB Economies and Growth model

3.1. What is the MIRAB?

The MIRAB is the acronyms for Migration, Remittances, Aid and Bureaucracy. Bertram's (1985) insights into the MIRAB model, by and large, is based on his experiences of working in such countries, collecting and studying macroeconomic statistics, which are considered to be the MIRAB economies stylised facts. He stressed that there were five components of the MIRAB economies.

The first was migration. Appleyard and Stahl (1995), Doumenge (1991) and McCall (1997) stressed that migration removed significant part of the workforce and highlighted the number of people migrated from some Pacific Island Countries. For instance, about 56,000 Cook Islanders migrated leaving only about 16,000 live in their homeland. Also there were 10,000 Niueans in the world and only about 2,000 actual live on Niue. The pattern of migration is a common feature of Polynesians, with lesser extend to Micronesians, but not of the larger islands of Melanesia.

The second component of MIRAB is remittances and it is bound up intimately with migration. These are payments in cash or kind sent by migrating relatives to their kin back home, which and are used to finance local development, for local constructions and for educational and other expenses of family. With Samoans and Tongans being so widespread in the USA, Australia and New Zealand, this has led some researchers to call this kind of activity "the trans-national corporation of kin". In Tonga, at the national level, remittances are the major source of foreign exchange and accounted in 2002 for about 50 percent of GDP. Seventy-five percent of all Tongan households report receiving remittances from overseas, making remittances the single most widespread source of income in Tonga (see Small and Dixon.2004). In the same year,

Samoa received US$57 million, Fiji US$53 million, Kiribati US$6 million, Solomon Islands US$15.9 million, Vanuatu US$30.6 million and Tuvalu US$4.9 million in 2001.

The third component of the MIRAB model is ODA, or "Official Development Assistance", known also as Aid. Since the 1970s, a total of US$49,258 million aid flows to the Pacific countries, which is equivalent to US$220 per capita.[3]

In order to administer the complexities of aid, a final component is added: a Bureaucracy is erected to fulfill the requirements of accountability & the provision "counterparts" for training (McCall.1997). Therefore, the MIRAB model shows the direct inter-relationship between migration and remittances, as well as for aid and bureaucracy.

3.1.1. A Re-Look at the MIRAB Model

As currently the case, the MIRAB economic model offers an explanation of the evolution and operation of some tiny Pacific island economies. Proponents of the model have argued that it describes an economic system that is durable and persistent, while others have opposing views. Since we have much on the good side of the MIRAB model, it is imperative to consider views against it. Treadgold (1999) argued that Norfolk Island possessed strong MIRAB characteristics from the end of World War II until the early 1960s, when the tourism-dominated economic growth erased these characteristics, or at least reduced them to insignificance, thus the island has achieved a sustained break-out from the MIRAB mould, but with some social costs incurred. Boland and Dollery (2005) in their study on Tuvalu stated that the greatest volumes of remittance are not from migrants but from a large number of seafarers.

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[3] *see* OECD *t*he Development Assistance Committee, *Development Co-operation Reports*, 1971-2000, OECD Paris. Aid flows include official development assistance (including the concessional elements of loans) from OECD countries, multilateral organisations and Arab countries. Hughes (2003).

The fact of the source of remittance in Kiribati is also not well researched. Since 1970 up to 1990s, permanent migration was only minimal and their contributions in terms of the remittance were also low as they migrated with their families. The large bulk of remittances now are coming from seafarers working on SPMS and DWFNs fishing vessels. However, since the early 2000s considering the increasing number of skilled people and lack of employment opportunities at home, I-Kiribati are now migrated with their families to overseas countries, notably to New Zealand, given a favourable NZ policy of allowing Pacific countries with specific quotas for residence permit. This means that it is doubtful whether they will remit some money to Kiribati or not, because they are living with their families overseas. In essence, labour mobility seems important to the MIRAB economies, given their low absorptive capacity for employment.

However, one important question regarding the MIRAB is that: Is it sustainable in the long run? It solely depends on overseas economies and if there is short-run fluctuation in such economies, or diplomatic ties is not favourable, it will also likely affect the remittances. In addition, such overseas countries in which the MIRAB depends on have their own internal problems such as they have also high population and limited employment opportunities. Moreover, there will be competition in the skilled labour placement in the developed countries among the Pacific islands and the Asian developing countries, which can cause the declining in remittance by some countries. For example, in Kiribati the number of seafarers working overseas is encouraging due to the quality of workmanship rendered. However, given the cheap labour force from the pacific-rim developing Asian countries such as the Philippines can affect Kiribati's seafarers' job and remittances. In actual fact, the best option for the MIRAB economies is to develop their own economies for longer-term sustainability in terms of employment and income.

3.2. Examining the relevancy of growth models

The Solow model really is imperative to the real world. It states that a sustained increase in the investment ratio increases the growth rate only temporarily, based on the

fact that the ratio of capital to labour goes up but the marginal product of additional units of capital decline, making the economy to move to the long term equilibrium level of output. In the steady state, real GDP, capital and the workforce are growing at the same rate, meaning that output and capital per worker are constant. The key argument of the Neo-classical economists is that, to raise an economy's long-term growth rate, they need to increase the productivity of labour and capital. In other words, increase the efficiency of the production processes. Given the fact that the level of development and economic growth is differing between economies, such differences are attributed to the differences in the rate of technological progress between these countries.

Despite the label that MIRAB conveys for Kiribati, may imply that Kiribati is a technologically backward country with labour intensive technology. It may be noted that these economies are currently adopting capital-intensive industries in the area of manufacturing. For example, Kiribati has already established a copra mill; a biscuit and some private owned bread-manufacturing units which use semi automatic machines. Nonetheless, growth in the MIRAB economies is low due to the slow pace of private sector development and lack of foreign direct investment.

There is more than one way of applying the Solow model to develop growth policies for the developing countries, including the MIRAB countries. In other words, the usefulness and applicability of the Solow model is not limited to the problems of the developed countries.

Firstly, as pointed out in the previous section, it can be used for growth accounting to determine the relative importance of factor accumulation to growth, even though we do not know what determines the Solow residual. Determinants of the Solow residual become important if the Solow residual is high. In many developing countries this residual may not be high. For example, it is well known that Young (1994&1995) has shown that factor accumulation is the dominant determinant of growth in the leading East-Asian countries, although some overtly sensitive economists have challenged his findings from these countries. If factor accumulation plays a dominant role in growth,

then increasing the investment ratio and growth of employment are necessary to increase the growth rate.

The fact that technical progress is low in these countries is a secondary issue. It is true that increase in factor accumulation does not have effect on the long run BGP growth rate of an economy. Nevertheless, as we shall argue below, results from growth accounting exercises are useful for designing growth policies.
Secondly, as Rao (2006) has shown that an increase in the investment ratio (`s' in our earlier equations) will boost the growth rate of an economy for couple of less than decades. Generally the economy may take well over 50 years to reach its BGP. These findings by Rao are based on the simulation results with the Sato (1999a) closed form solution for the Solow model. Many economists have neglected and forgot the use of this closed form solution for the short to medium term growth policies in the developing countries. Furthermore, the high growth rates experienced by the East-Asian countries through high rates of factor accumulation for decades supports Rao's simulation results. Therefore, the closed form solution for the Solow model can be used to compute the dynamics of the growth rates, for given investment ratios or compute the required dynamics of the investment ratio for given targets of the growth rate.

Thirdly, based on the results from some growth accounting exercises for Fiji, one may expect that in small island countries like the Pacific Island countries, the size of the Solow residual would be very low. For example, in Fiji, the Solow residual is small and contributed less than 10% to the growth rate. When the production function for Fiji is estimated, the rate of technical progress, proxied with the coefficient of time trend, was hardly half a percent. [4]

[4] These results are based on the computer laboratory exercises set for EC401 (Advanced Macro Economics) at the University of the South Pacific, in 2006. The lectures were given by Prof. Rao and the lab-sessions were supervised by Mr. Rup Singh.

Although some, like the East-Asian economists, may feel disappointed with the low contribution of technological progress to the growth rate, one may take a positive view and get an idea about the scope for improvements in efficiency in the growth processes. It is hard to improve a rate of technical progress of 2% to 4%, but not so hard to improve from 0.5% to 1%. Whether these small island countries aspire for 1% or 2% rate of technical progress and therefore a 1% or 2% long run BGP growth rate, it should be realized that it is hard to increase this rate of growth of technology in one or two decades. These improvements may need historical time units, especially given the cultural factors of these countries, which were not influenced by the impact of an industrial culture for long periods like the Western countries. These hurdles for improving technological progress in the non-western industrialized countries are not adequately recognized by many Western-minded economists.

The fact that the Solow residual is small is to be taken seriously by the development economists and policy makers. That is, they should begin to think about what are the long term policies, e.g., improving education, health and good governance practices etc, that are necessary to maintain the current higher but temporary growth rates achieved through higher investment rates. This way, there is no conflict between the medium and long-term objectives and policies for growth and development. This is a more appropriate approach.

One of the important steps for the fulfillment of such aforesaid vision is through the establishment and provision of training institutions for the labour force. Kiribati for example, has already established two big important training institutions such as the Marine Training Center and Kiribati Fisheries Training Center. Overseas companies such as the South Pacific Marine Services and the Japan Tuna are currently employing healthy young men and women, after completing their course from such institutions. It is estimated that about 2,000 seamen are working overseas on merchant and fishing boats, and the amount remitted to Kiribati is around A$6 million annually, which is about one third of household consumption expenditure in 2005 and 2004.

It can be eventually expensive if, for example, Kiribati invests in high level of education to increase labour productivity, out of proportion to its needs. This is so, because there are no opportunities to employ them at home and therefore they may migrate to the neighboring advanced countries like Australia and New Zealand. They may send money back home, which is useful for the families.

Although the quality of the labour force is a key for technical progress, one should not lose sight of the needs of the economy while thinking about policies to increase technical progress. It is true that research and development expenditure may have a high impact on the growth rates of the USA, Germany and Japan. However, it is unlikely that high R & D expenditures will have similar effects in Fiji or Kiribati, given their small developing economies and small scale industries.

Another major problem with the MIRAB economies is that, the levels of school attainment rates are high at the primary and secondary levels. Only a fraction proceeded to higher institutions. Therefore, even though education, through human capital formation may contribute by one third to the growth rate, such as in the MRW estimates, in the MIRAB economies there is already sufficiently educated work force, relative to their current needs. What they lack are investments in industries to absorb the work force, perhaps after training for short periods, to learn the specific skills required in the new factories.

4. CONCLUSION

Based on the fact in which the Solow model is formulated, it totally renders insightful analysis of the real world open economies growth rates. We cannot know what the differences in the growth rates in factors of production are, unless we apply the growth accounting exercise. This device is useful as it can be used to determine the relative importance of factor accumulation to growth, even though we do not know what determines the Solow residual or total factor productivity. However, the results from

growth accounting exercises are useful for designing growth policies. It is estimated that there is low percentage of the Solow residual in all of the MIRAB economies.

Rao (2006) based on his simulation results stresses that an increase in the investment ratio ('s') will boost the growth rate of an economy for a couple decades or even more. The high growth rates experienced by the East-Asian countries through high rates of factor accumulation for decades support Rao's findings.

Development economists and policy makers should begin to think about what are the appropriate long-term policies for growth? For example, improving education, health and good governance etc, that are imperative to maintain the current higher but temporary growth rates achieved through higher investment rates.

Growth in the MIRAB economies has been characterized as poor. For example, in Kiribati the economic growth is low due to the slow pace of private sector development and lack of foreign direct investment with limited employment opportunities. Given the increasing population, unemployment and poverty will prevail.

A key argument by the Neoclassical is that, to raise an economy's long run growth rate, they need to increase the productivity of labour and capital or increase the efficiency of the production processes. Although this is a common approach, it has limited success in Kiribati given the very small number of its manufacturing industries. The variation on the level of development and economic growth between economies is attributed to the differences in the rate of technological progress.

4. DATA

1. Introduction

Applied econometric work needs reliable data. National accounts aggregates are the major sources of time series data. Unfortunately, it is a problem in Kiribati. Only few time series data for macroeconomic variables are available locally. Therefore, data are acquired from external source mainly from the United Nations Statistic Department (UNSD) or have to be estimated provided they are not available from both sources.

The structure of this chapter is as follows: In section 2 provides definitions, data sources, the trend analysis of variables and method to analyze data and concludes in section 3.

2. Definitions, Data Sources, Trend Analysis of Variables and Method to Analyze Data

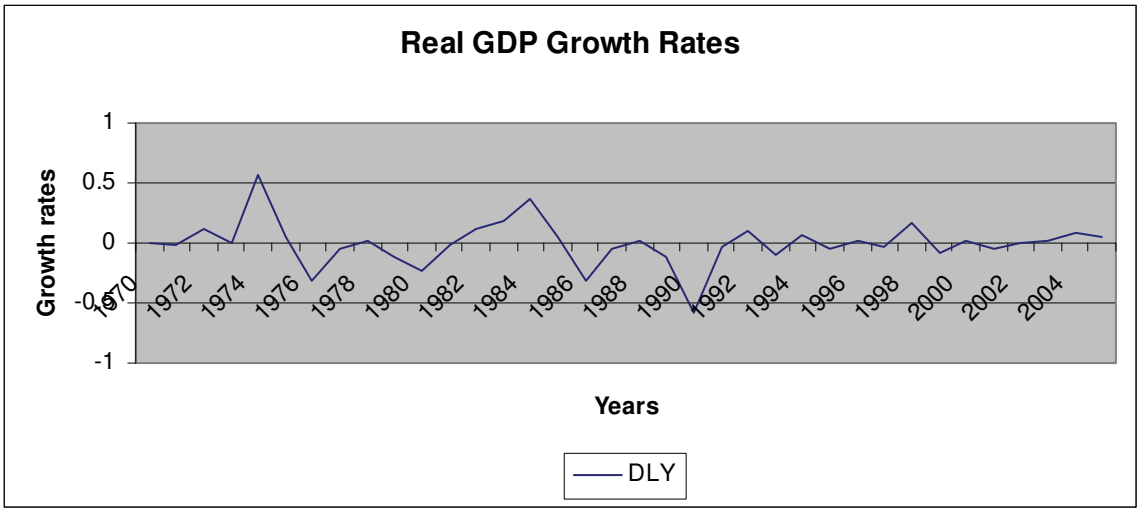
2.1. Nominal and Real GDP

Gross Domestic Product (GDP) is the market value of all final goods and services produced within a country during a given time period. In terms of measuring GDP, there are two methods used. The first one is the Nominal GDP, which is the dollar value of production at current-year prices. The second is the Real GDP calculated by valuing all the productive activity within the country at a specific year's prices. Based on data for instance, the real GDP in 1991 prices for Kiribati is $38,444,000. This real GDP is an important variable where most economic analysts focus on as it shows the underlying strength of an economy.

2.2. Real GDP growth rate

The average rate of growth of GDP from 1971-2005 was negative at only half a percent. The highest growth rate was 0.56% in 1974 and the lowest was -0.57% in 1990. The reason was that, there was robust export earning from phosphate mining in the early 1970s and ceased in 1979. In the 1980s copra and fish were the major export items and the fishing access fee and the drawdown of the RERF were major foreign exchange earnings contributing to government revenues. The high negative growth rate in 1990 was related with the fall on consumption recording $49 million in 1990 compared with $51 million in 1989 and the fall on export earnings to $40 million in 1989 compared with only $8 million in 1990. The standard deviation was 0.18 implying that the variation in the growth rate has been very high. Figure 1 conveys the growth rate of the real GDP from 1971 to 2005, after adjusting the UNSD data (see procedure in estimating capital).

Figure 1.



Source: Author's calculation from UNSD data.

We can breakdown the periods 1971 to 2005 into three components to see their average growth rate and standard deviation. From 1971 to 1979, the average growth rate was

0.026 and its standard deviation was 0.235, inferring a high variation in the growth rate. For the periods 1980 to 1990, the average growth rate was -0.053 and its standard deviation was 0.259, meaning that there was also a high variation in the growth rate. The trend on the growth rate from 1991 to 2005, have been quite stable with an average growth rate of 0.0116. Its standard deviation was 0.075, implying that there was small variation in the growth rate.

Further more during 1971 to 1989, while the average growth rate of GDP was about 1%, from 1990 to 2005 this positive growth has become negative. In this latter period the average growth rate of GDP was -2.6%. However, if we exclude 1990, the average growth of GDP from 1991 to 2005 was again positive and is about 1.2%. Therefore, it might be necessary to leave 1990 data in our subsequent analysis or introduce a dummy variable for 1990 to minimize a large one off decline in the rate of growth of real GDP. Similarly, it might be also necessary to introduce another dummy for a one off high rate of growth of GDP in 1974. It may be also noted that the variance of GDP growth has declined from 0.19 during 1971-1989 to 0.075 during 1991-2005.

2.3. Estimating Capital

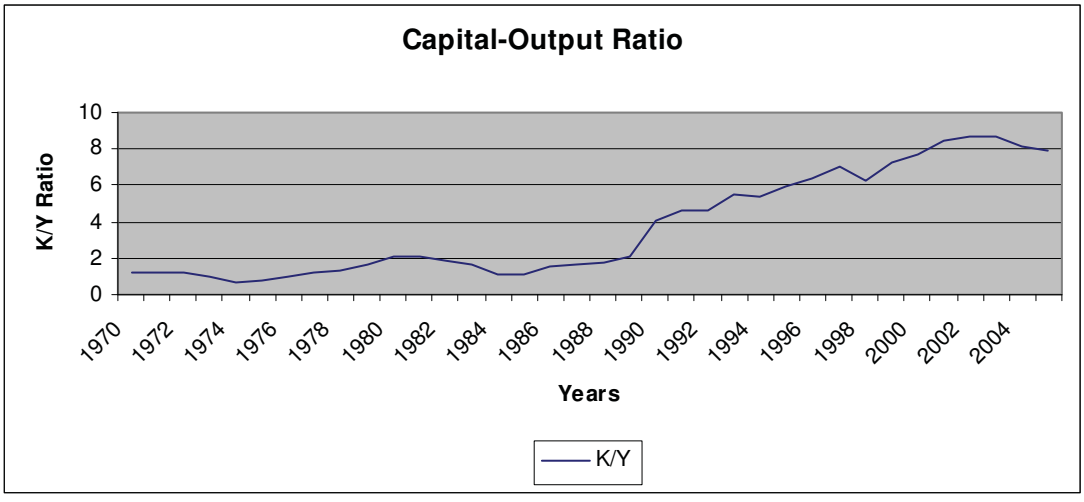
There are some problems with the UNSD data for Kiribati, although these data are comprehensive.[1] Firstly, the nominal and real values of the components of GDP are not equal in the base year of 1991. In solving this problem, the implicit GDP deflator was computed in the usual manner by deflating nominal GDP with the real GDP. Secondly, this GDP deflator was used to deflate all the nominal values of the GDP components to estimate their real values. Thirdly, the estimate of real GDP is computed by using the usual GDP identity. The justification for this procedure is that estimates of the nominal values of GDP and its components are likely to be more accurate than estimates of their real values. This assumption is used subsequently to estimate the real capital stock with the standard perpetual inventory method.

[1] I acknowledge the comments by Professor Bill Rao on capital estimation.

Capital stock is estimated with the perpetual inventory method. The assumed initial period value of capital stock in 1970 was 1.2 multiplied with the level of output and the depreciation rate assumed at 4%. These assumptions are justified and consistent with the assumption used by Collins and Bosworth (2003), who have estimated capital stock in several developed and developing countries, although they have used higher capital-output ratio of more than two for the developed countries to estimate the initial period capital stock. In applying this procedure to Kiribati, the capital-output ratio turned out to be implausibly high such as after 1988 it suddenly increased up to 13 in 1995.

Estimate of capital stock, with the original UNSD estimate of real GDP components showed a modest, but nevertheless has significant increases in the capital-output ratio. It reached a high value only in a few years but on the average it was about 3.7 compared to an average of 8.7 based on the estimates from our real values. We shall later address this high estimate of capital-output ratio later in the thesis. Figure 2 shows the capital-output ratio for Kiribati from 1970 to 2005.

Figure. 2



Source. Author's calculation from UNSD data.

There seem to be two plausible reasons for the high capital output ratio for Kiribati. Firstly, the data may be weak by UNSD mainly on the fixed investment figures.

Secondly, even if the UNSD's investment figures are acceptable, the increase in capital output ratio is basically related to the increase in investment on non-value added or unproductive projects. In other words, such investment, mainly by aid donors and the government through high government's expenditure did not increase output. Some of the investment expenditures are on infrastructure development, where expensive machineries and equipments are purchased overseas, school development projects such as on improvement on classrooms and curriculum materials and expatriates salaries etc, social projects in the outer islands for strengthening capacity development such as on construction of village permanent and public buildings, roads and seawalls. Also, in 1986, the Japanese government funded the construction of the biggest multi million dollar permanent causeway linking Betio islet to the main island of Tarawa. Moreover, in the early 1980s, Japan had also constructed the fish storage facilities and the port and the British had constructed the jetty at the port. The Government of Kiribati on the other hand spent about $9 million dollars on its new parliament complex constructed by Dai Nippon construction in 1998, which completed in 2000 to coincide with the Pacific Islands Forum meeting in Kiribati. We may say that these are unproductive investments and mainly for infrastructure developments etc, and much of the funds may have been wasted and/or paid to foreign experts as salaries, contracts and importation of materials or equipments.

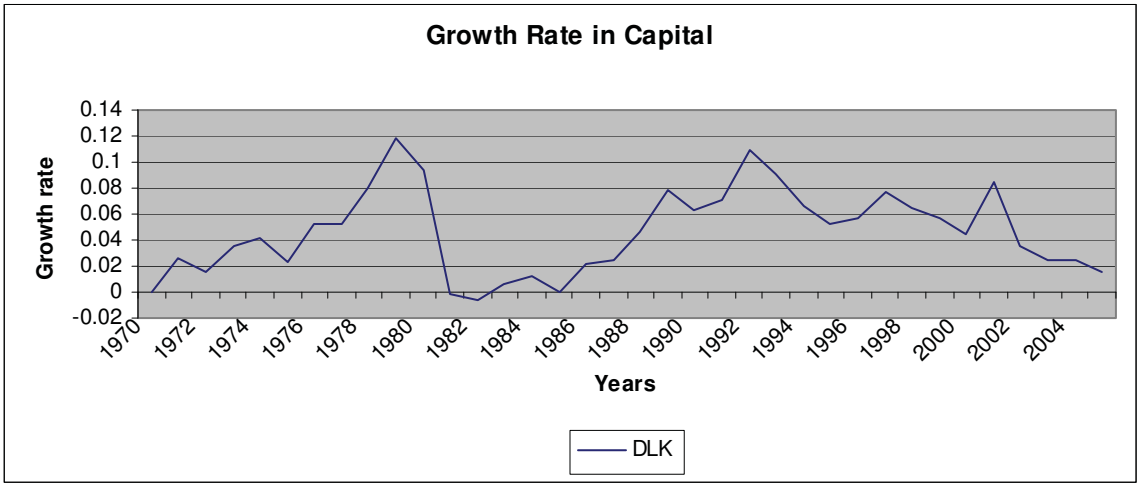
The report from the Statistic office of Kiribati (2001) stated, on similar line that the significant portion of capital spending was on buildings and civil constructions such as roads and port construction, which reached a total expenditure of $6.8 million in 2000. Since this Office had pointed out that they did not get data on projects actual spending and cost breakdown, the presumption was that the UNSD data might have been based on some estimates and aid data.

2.4. Real Capital Growth Rate

The average growth rate of real capital for 1971 to 2005 was 0.047 with a standard deviation of 0.032. This showed that there was a high variation in the growth rates. The

highest growth rate for capital was in 1979 of 0.13, 1992 with 0.12 and 2001 recording 0.085. The reasons for the high growth rates were as follows. Fixed investment in 1978 was only $93 million compared with $105 million in 1979. The same pattern occurred in in the 1991 and the 1992 level. The high growth rate for 2001 was also based on the high investment in 2001 recording $319 million, while as in 2000 it recorded $293 million. The lowest growth rates were in 1981 and 1982 recording -0.01 and -0.02 respectively, because the amount of investment in 1981 was $163,000.00 and in 1982 fell to $114 million. Figure 3 reflects the growth rate in capital from 1971 to 2005.

Figure 3.



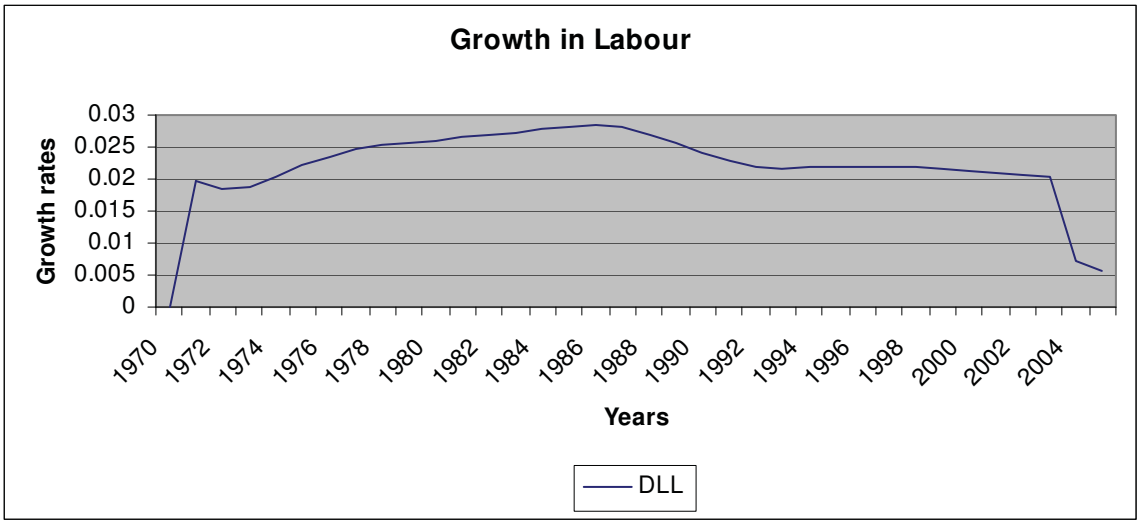
Source: Author's calculation from UNSD data.

2.5. Labour Force.

Labour represents active labour force in formal employment in the public and the private sectors and the active work force in the rural production sector. The UNSD does not provide estimate for employment. Therefore, in estimating Labour, local sources from the Statistic office and the taxation office were used.

Active labour falls within the age group of 24-49 years of age or 36% of the total population. This specified percentage figure is used to estimate active labour force from 1970 to 2005. Figure 4 shows the growth rate in labour from 1970 to 2005.

Figure 4.



Source: Calculated by author from UNSD data

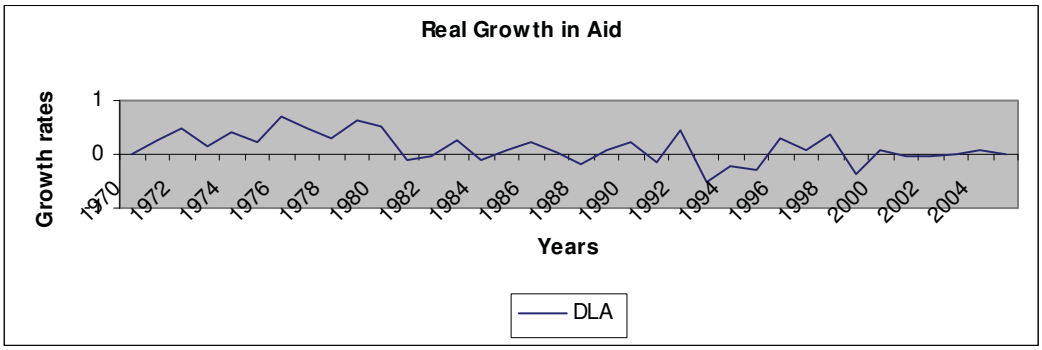
The mean growth rate of Labour stands at 0.23 with a standard deviation of 0.005, meaning that there is also variation in the growth rates. There was a consistent increase in mployment from 1972 until 1987 as shown from their growth rates and fell from 1988 to 1993 due to the big increase in employment and quite stabilized until 2003. Also, there was a big drop in the growth rate in 2004 and a gradual fall as well in 2005 reaching 0.006. The fluctuation was related with the fact that Kiribati at times experiences high increase in employment from year to year based on the economic activity of the country, as well as the drop in employment relating to economic short run fluctuation.

2.6. Official Development Assistance or AID

Aid figures for 1970 to 1979 are estimated, due to their unavailability in local and external sources. The other source of data is from the Statistic Office in the Government Finance Statistic (2001).

The mean growth rate for aid from 1970 to 2005 stood at 0.124 with a standard deviation of 0.28, implying that there was a big variation in the growth rate. The big increase in aid was in 1976 coinciding with the self-government of the Gilbert and Ellice Islands Colony, where foreign governments provided some aid such as the British, Australia, New Zealand and Japan. Also since independence in 1979, the inflow of aid was increasing, but at times dropped due to some other commitment by such aid donors, inferring that aid donors have specific interest, hence it was unreliable. For example, funding of project by aid donors would be ceased once they were completed. In 1992 the total amount of ODA reached $33 million due mainly from the implementation of numerous government projects on the outer islands such as seawall, causeways and so forth. Figure 5 shows the growth in the real ODA flow to Kiribati from 1970 to 2005 in national currency.

Figure 5.



Source: Calculated by Author from Statistic Office (Government finance statistic), 2001.

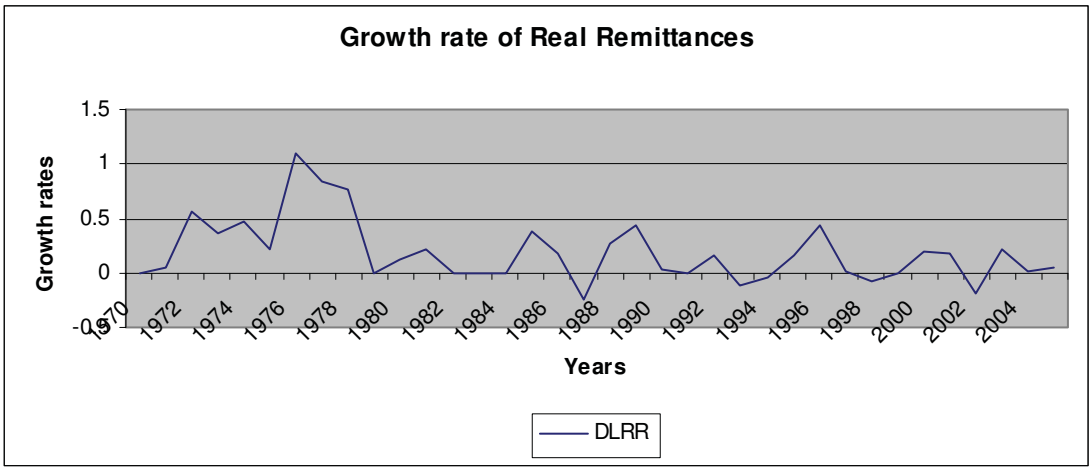
From 2000 until 2005, there was stability in the growth rate, given that some aid donors such as Australia, New Zealand for instance, had specific annual aid programmes to Kiribat,.including the European Union and Japan, meaning that the flow of aid was more reliable by such aid donors. Kiribati had already received a total of US$593 million of aid since 1970 with an average annual aid flow per capita since 1970 of $217 millions (Hughes.2003).

2.7. Remittance

Remittance is one of the major sources of foreign exchange earnings for Kiribati. There were small amounts of remittances in the early 1970s. This was due mainly to the first operation of the marine training school (MTS) in the late 1960s. A further increase in the remittance was experienced in subsequent years following the on-going passing out, continue intake of trainees of the MTS known now as the Marine Training Center (MTC), and the on going employment of seafarers overseas. The source of data for remittance in Kiribati is from the South Pacific Marine Services, the Kiribati Fisheries Services and Borovnik (2005).

The average growth rate of remittances was 0.19 with a standard deviation of 0.29. Again there was also a big variation in the growth rate. The remittance in 1976 stood at approximately hundred thousand dollars, while as in 1975 it was only eighty thousand dollars. In 1979 and 1980 the figure remained at $1.5 million, but increased in 1981 to $1.7 million. In the early 1990s, the amounts were increasing, recording $6 million in 1990, $11 million in 1998 with a peak of $14 million in 2003. These increases reflect the increasing number of seafarers working on overseas vessels. The inclusion of fishermen's remittances working on Japanese tuna fishing vessels and seamen on the Norwegian cruise liners were also factors responsible for the increased inflow of remittances to Kiribati. Figure 6 below shows seafarers' remittances for Kiribati from 1970 to 2005.

Figure 6.



Sources: Calculated by author from SPMS data 1999 unpublished, KFS data 2004 unpublished, Borovnik (2005).

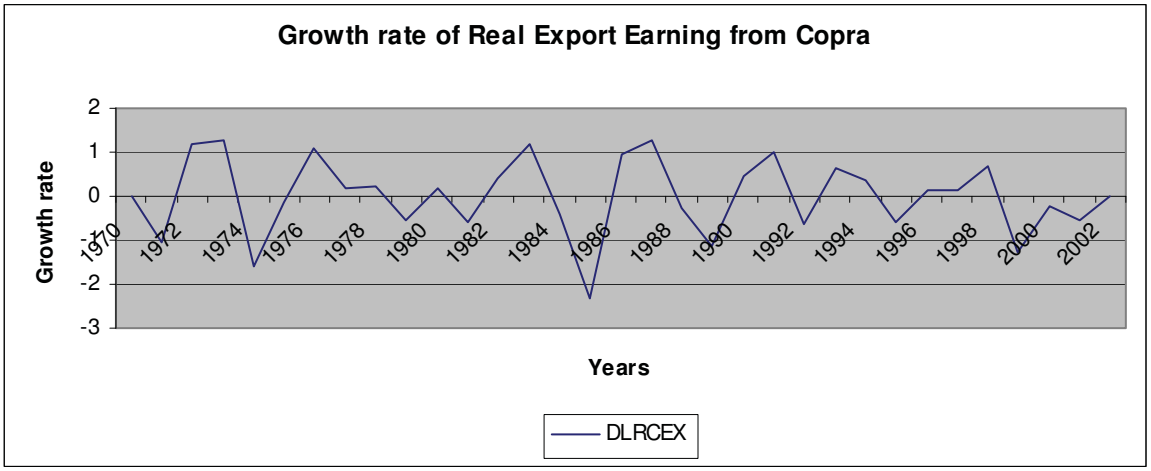
Obviously, the fluctuation in the growth rates show the fluctuation in the amount of remittances sent back to Kiribati. One major reason was that, the employment of I-Kiribati seafarers depended on the availability of ships and demand from such overseas based employing agencies, as the number and quality of seafarers was adequate, consistent and maintained. Also, the foreign exchange rate had some effects in the amount of remittances received, given that seafarers were paid in the United States currency, which must be converted to the Australian dollar or national currency.

2.8. Real Export Earnings from Copra

The mean growth rate for the real earning from the export of copra stood at –0.0008 with a standard deviation of 0.88, implying a more consistent growth rate. There were higher exports earnings recorded in 1974 ($4.8 millions), 1984 ($7 m), 1988 ($4.2m), 1992 (4.3 m), 1995 ($6.4 m) and in 1999 with $8.7 millions and gradually fell from 2000 onward. The export earnings also showed a big drop as reflected in the growth rate and vice versa. One major factor was the fluctuation or instability in the world price of copra, exchange rate and volume of copra exported. The export earning from 1970 to 2001 was mainly from the export of raw copra, while as from 2002 onwards

copra has been exported mostly in valued added product form such as crude oil and so forth, due to the operation of the copra mill. Figure 7 presents the real export earnings from copra.

Figure 7.



Source: Calculated by author from Kiribati Statistic Office (1979).

Kiribati faces many inherent constraints in seeking to diversify her exports. Some pertinent reasons include scarcity of domestic resources, acute shortages of skilled manpower, a lack of adequate economic infrastructure, geographical isolation from main trading partners creating higher transportation costs. Also, Kiribati's export/GDP ratio is small recording an average of 16%. Moreover, there is high instability in export earnings for Kiribati as it relies very heavily on the exports of one or two commodities.

2.9. Method for analyzing Data

The Microfit 4.1 and Eview are used. Eviews is used for unit root test and the Microfit for regression analysis. The data for variables of interest are inputted first in Excel and then imported into the Microfit. The general to specific approach (GETS) and the Johansen VECM techniques are used to derive regression results on the growth performance for Kiribati. Also, in terms of econometric analysis, the shift variables are transformed into their respective ratios such as export ratio is acquired from

export/GDP, aid ratio is equal to aid/GDP and the remittance/employment is the remittance ratio.

3. Conclusion

The work in compiling time series data on national account aggregates in Kiribati is weak. Some time series macroeconomic data for variables such as copra production and trade are available locally while others are not and they are obtained from external sources such as from the UNSD. The real values are computed by deflating nominal with the new GDP deflator in order to get consistent estimate for the GDP components using the 1991 prices. Capital is estimated using the PIM methodology. Labour on the other hand is estimated using the percentage active work force in Kiribati equivalent to 36% of the total population within the age group of 24 to 49 years old. Data sources for the ODA and remittance are estimated when they are not appeared in the publication of the Kiribati Statistics Office or external sources. Only the copra export earning data that is available locally. Data on GDP and its components are obtained from the UNSD.

The results from the data analyses give important policy implications. Much investment had been invested on projects that were not directly contributing to output, due to the high capital-output ratio and it was reflected in the average rate of growth of GDP from 1971-2005 recording negative half percent. Therefore, it is important that foreign assistance and the local government initiate projects that are contributing directly to output. The mean growth rate for aid from 1970 to 2005 stood at 0.124 or 12%. It was also high given the adequate number of aid donors. Kiribati had already received a total of US$593 million since 1970 with an average annual aid flow per capita since 1970 of $217 millions, but not contributing much to output (Hughes.2003). However, aid can be effective to increase GDP if aid donors do not attach political motives in their aid. The average growth rate of real capital for 1971 to 2005 was 0.047 or 4%, which was quite high and had caused the high capital-output ratio. The mean growth rate of Labour was 0.23 or 20%, based on the assumption of the composition of the active labour force of 36% of the total population. If formal employment was used alone, the growth rate would be very low. The average growth rate of remittances was 0.19 or 19%. However,

government should encourage more employment opportunities abroad given its limited absorptive capacity. The mean growth rate for the real earning from export of copra stood at –0.0008. It should be noted that although it was negative, but in reality there were increases in the export earnings in most of the years.

5. GROWTH ACCOUNTING

1. Introduction

In order to measure an economy's overall level of productivity, economists typically use a method known as growth accounting. Growth accounting provides a useful framework for analysing the medium to longer term developments in real GDP and supply-side factors, and can thus help in assessing potential output growth. Solow (1957) pioneered this methodology. He performed a simple accounting exercise to break down growth in output into growth in capital, growth in labour and growth in technological change (residual). Even though growth accounting is an empirical tool based on the theory of economic growth, relevant assumptions must be made at the beginning of the analysis, which provides a framework, a perspective from which economic data can be interpreted. This is important because variables of interest in which data is available, significant in macroeconomic analyses can be incorporated and used in line with the theoretical underpinning of a subject matter.

This chapter will use that methodology on Kiribati's economy and it organizes as follows: Section 2 will provide useful definitions. In section 3 presents the growth accounting result for Kiribati and in section 4 concludes.

2. Definitions

2.1. What is Growth Accounting?

Growth accounting is a method whereby a set of economic techniques or theories are used to determine what specific factor, or factors, contribute to an economy's growth.

In other words, growth accounting allows one to examine the different aspects of growth: production per worker, technology, and savings, to determine which factor most likely created the increase in real GDP. Growth accounting is not a theory of growth, because it fails to explain how the sources relate to growth (Barro and Sala-i-Martin, 1995, p. 352).

According to Barro (1998) he stressed, “Growth accounting breaks down economic growth into components associated with changes in factor inputs and the Solow residual, which reflects technological progress and other elements.”

The factor inputs meant here are the growth of the capital stock and of the labor force, and to a *residual* factor—often, in fact, called the *Solow residual*—that is the portion of growth left unaccounted for by increases in the standard factors of production. The logic for the use of this framework as he argued, was considered as a preliminary step for the psychotherapy of fundamental determinants of growth and is most useful if the determinants of factor growth rates are to a large extent autonomous from those that matter for technological change (ibid).

2.2. What is Factor Accumulation?

Briefly, factor accumulation is an increase in the quantity of the four basic factors used to produce goods and services in the economy-labor, capital, land, and entrepreneurship. Increases in these "factors of production" enable an economy to produce more goods and services and therefore the long-run expansion of the economy's ability to produce output--that is, economic growth.

Young (1992,1995) and Krugman (1994) argued that economic growth in Asia was driven by the accumulation of the inputs in the production process rather than by increases in productivity. Krugman believed that the Asian economic miracle was largely attributable to an increase in the quantity and not the quality of the factors of production. Further evidence showed that as countries become more developed and

more closer to the limits of factor accumulation, they would rely more on increasing productivity to sustain the economic growth process. The works by such researchers stimulate further empirical work on such countries by others.

2.3. What is Total Factor Productivity?

APO (2004) provided recent usage of TFP as a measure of overall productivity. The report stated that it had been gaining recognition and acceptance not only for its theoretical correctness but also for its practicality among policy makers and economic analysts. Some governments have begun to include the TFP growth rate as a target in national development plans.

Wong and Seng (1997) defined TFP growth as the difference between the growth of output and the growth of a combination of all factor inputs, usually labour and capital. According to Diewert and Nakamura (2002), they defined TFP as the rate of transformation of total input into total output. Hornstein and Krusell (1996) distinctly stated that growth in total factor productivity is simply output growth not accounted for by the growth in inputs. Further more, clarification can be rendered in mathematical notation using the familiar Cobb-Douglas equation as shown below.

$$Y = A \times K^{\alpha} \times L^{1-\alpha} \qquad (1)$$

The said equation shows total output (Y) as a function of total factor productivity (A), capital input (K), labour input (L) and the two inputs' respective shares of output denoted by α and (1-α) (ibid).

A change in the residual (TFP) represents the change in national income that is not explained by changes in the level of inputs (capital and labour or factor accumulation) used. This is normally taken as a measure of the level of technology employed, and is sometimes measured as the Solow residual. Abramovitz and Rao calls this part a "measure of our ignorance".

In the successive studies from the 1950s on, the residual is reduced from 90 per cent to even less than 40 per cent, but it still accounts for a large part of the economic growth. Technological progress is usually assumed to account for a large part of the residual, in addition to factors, which could not be measured and measurement errors. Factors such as economies of scale and institutional changes for example, form part of TFP.

Technology is embodied in capital and intermediate goods so the direct import of these goods is one channel of transmission. Foreign direct investment by multinational corporations (MNCs) may be another channel for the international transmission of technology; this is indeed one of the (reputed) benefits of FDI that many theories emphasize (see Grossman and Helpman (1991), Caselli and Wilson (2002), and Eaton and Kortum (2001)).

According to CBO (2002), gains in total factor productivity imply higher income and a rising material standard of living from a given quantity of capital and labor. TFP gains have a cumulative impact on economic growth because the productive skills and knowledge, which expand TFP growth and they do not normally depreciate over time as do, for example, additions to the stock of physical capital in the economy. Hence, even a small up tick in the rate of TFP growth can eventually have a sizable impact on the level of economic activity.

3. Growth Accounting Result

Growth accounting is important as it renders growth rates for TFP and factor accumulation. The average growth rate of TFP from 1971-2005 was –0.03562 or -3%. This implies that the growth of technical progress in Kiribati is negative and disappointing, meaning that production efficiency has declined. Obviously there was a growth rate of 0.38 in 1973 and fell to negative 0.38 in 1975 until 1980 with an improved rate reaching –0.04. After 1981 a positive growth rate was recorded with a peak of 0.038 in 1983. Again TFP fell to -0.337 in 1985 with a trough recorded in 1990 of – 0.6. The fluctuation in the TFP growth rate reflected the absence of technical progress. This fact is justified given the stage of the Kiribati's economy where there are

no heavy industries or manufacturing industries existed. Only the copra mill is recently established in 2002, while the small bread shops and one government biscuit industry have been operating on small scale since the 1990s. Investment by the private sector on manufacturing is none existence. All manufactured or value added products are imported from abroad. Table 1 and Figure 1 present growth accounting results.

Table 1. Growth Accounting Result

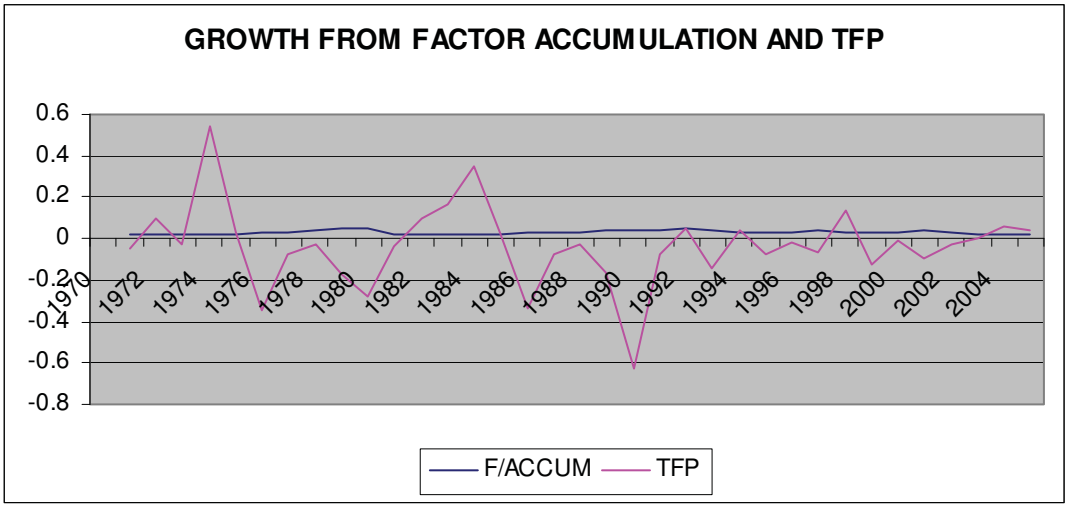
Year	Factor Accm	TFP	Year	Factor Accm	TFP
1970	Missing	Missing	1988	0.033324	-0.02278
1971	0.023345	-0.04651	1989	0.042323	-0.16545
1972	0.018578	0.095456	1990	0.036868	-0.62465
1973	0.023596	-0.0236	1991	0.038087	-0.07341
1974	0.025503	0.538024	1992	0.048576	0.048032
1975	0.020956	0.031107	1993	0.042401	-0.14555
1976	0.030997	-0.34254	1994	0.035045	0.039316
1977	0.032203	-0.07943	1995	0.030843	-0.07807
1978	0.041105	-0.03056	1996	0.032442	-0.017
1979	0.053333	-0.17646	1997	0.03832	-0.06943
1980	0.046181	-0.28129	1998	0.034878	0.132697
1981	0.017841	-0.04101	1999	0.032333	-0.12181
1982	0.016567	0.097469	2000	0.028456	-0.00735
1983	0.020822	0.169053	2001	0.040216	-0.09594
1984	0.022642	0.351008	2002	0.025529	-0.02722
1985	0.019612	0.032453	2003	0.021792	0.001082
1986	0.026285	-0.33783	2004	0.021493	0.063702
1987	0.027086	-0.07431	2005	0.018657	0.036108
Average growth				0.030521	-0.03562

Source: Author's calculation from UNSD data

On the other hand, the average growth rate of Kiribati from factor accumulation from 1970 to 2005 is positive at 0.030521 or 3%. For example, in 1970 it stood at 0.024 and had reached 0.053 in 1979, due to export earning from phosphate. In 1980 it slightly fell to 0.046 with a trough in 1981 recording 0.0178, signifying the complete cessation

of phosphate mining. Figure 1 below reflects the growth from factor accumulation and TFP from 1971 to 2005 for Kiribati.

Figure 1.



Source: Author's calculation from UNSD data

Major factors contributing to the growth in factor accumulation are labour, capital and none value added investment. These factors were responsible to the high factor accumulation growth occurred in 1989 and 1992 recording 4% and 5% respectively. The fall of factor accumulation in 2001 to 2004 is caused by the fall in some of those factors.

To put into perspective, there are works on growth accounting executed worldwide. For instance, we have the following. Kundu (2005) argued that protection from international competition had a depressing effect on TFP growth in India during 1960-70. The TFP environment, however, had seen changes in the past 20 years. In the 1980s, India carried out some degree of reforms and liberalization, which was accelerated during the 1990s, resulting to certain restrictive regulations that had earlier suppressed efficiency disappeared or was diluted significantly. Foreign technologies and efficient practices began to trickle in and the removal of import barriers and entry restrictions after 1991 unleashed competitive forces. The disappearance of government

protection and the reality of foreign competition forced Indian entrepreneurs to seek urgent measures for cost-effectiveness. Since the early 1980s such activities made India's average growth in TFP faster.

Weerasinghe and Fane (2005) also provided TFP growth for Asian countries. In their results the fastest average annual rate of TFP growth was Japan at about 3 per cent. Fukao (2003) provided supporting fact to this high TFP growth in Japan, stating that: "foreign-owned firms have about 10% higher TFP and a 2-percentage point higher current profit-sales ratio. The latter result is consistent with the fact that the average of current profit-sales ratio of foreign-owned firms is substantially higher than industry average of all Firms". Also, Weerasinghe and Fane (2005) further stated that Taiwan came in second place recording 2.5 per cent. Thailand and Korea had about 2 per cent. Indonesia's rate was about 1 per cent and Malaysia's was about 0.5 per cent. Singapore is estimated to have had almost no TFP growth, but if it was based on Hsieh's argument, then the 1995 estimate for Singapore must be adjusted up to about 1.5 per cent per year.

Also, Fajnzylber and Lederman (1999) found that TFP growth was faster in periods when the Latin American countries were "reformed," on average by approximately 1.5 percentage points per year. In fact, the average rate of TFP growth is negative during the periods of "no-reform," and becomes positive during the reform periods. Gregorio and Lee (1999) also found that the rate of TFP growth was the main factor explaining changes in growth rates overtime within the Latin American countries as well as the lower growth of Latin America relative to other regions.

Relating to that, Bosworth and Collins (1995) executed a combination of growth accounting and regression analysis to examine economic growth experiences of 88 developing and industrial economies over the period 1960-1992. The decomposition showed that increases in total factor productivity (TFP) had been surprisingly small in developing countries, and that accumulation of physical and human capital account for most of the growth per worker. Dbareshwar (1994) also stressed that the fastest

growing developing economies have based their growth more on the rapidity with which they have accumulated physical and human capital than on high TFP.

Furthermore, Bosworth and Collins (1995) showed that their regression results strongly support the growing consensus that stable, orthodox macroeconomic policy, combined with outward oriented trade policies foster economic growth. They explore the channels through which determinants of growth operate. They found out that larger budget deficits slow growth through reducing capital accumulation, while real exchange rate volatility operates mainly through slowing TFP growth. Outward orientation appears to work through both channels.

4. Conclusion

Growth accounting is a dominant device and useful in the analyses of growth rates. Factor accumulation (capital and labour), contributes more to Kiribati's growth than TFP. The average growth rate of factor accumulation stood at 3% compared with the TFP average negative growth rate of 3%. The absence of growth from TFP is a combination of factors such as the private sector is underdeveloped; there is no economies of scale; no manufacturing industries and no major institutional reforms that will encourage investment and protection from international competition still in imposition. The reported growth accounting results may also provide some policy options to Kiribati relating to its economic growth policies.

6. SOLOW MODEL AND ITS EXTENSION

1. Introduction

The purpose of this chapter is to explore the use of the Solow model and its extended versions. This is an unexplored area for PICs except for Fiji by some University of the South Pacific economists like Rao, Singh and Saten and Rao and Rao (2006). In doing so, we examine and analyze the significance of export ratio, remittance ratio and aid ratio, besides the two basic conditioning variables viz., capital (K) and labour (L), for output and its growth rate in Kiribati. In this respect, the aforesaid USP applied growth methodology differs from many ad hoc applications where growth rate is simply regressed on any variable or variables without incorporating the conditioning variables into their specifications. At the least this amounts to gross misspecification and the effects of the selected variables may be overestimated. Such ad hoc studies are too many to cite.[1] We shall later use one or two examples to illustrate the consequences of these ad hoc specifications.

The aforesaid USP methodology of Rao et al is similar to the Mankiew, Romer and Weil (1992), MRW hereafter, extension to the Solow model by augmenting with a shift variable human capital (HK), into the neo classical production function. MRW found out that the "measure of our ignorance" (the Solow residual) could be considerably reduced without the need for changing the basic simplifying assumptions of the Solow model. Acemoglu (2004) considers the work of MRW as an attempt to revive the usefulness of the basic Solow growth model; see also Bernanke and Gurkaynak (2001);

[1] Often these authors are somewhat sensitive to criticisms on their ad hoc methodologies and uncritically accept time series econometric results.

Rao and Singh and Nisha (2006) and Asteriou and Price (2004). Our attempt in this thesis follows the USP methodology of Rao et.al i.e., make an attempt to apply the MRW approach (to cross section data) for the time series data.

At the outset, it may be stated that although it is desirable to use a few alternative methods of estimating cointegrating equations, only the general to specific approach (GETS) and the Johansen Maximum Likelihood techniques yielded meaningful results for our data. Furthermore we have used the instrumental variable approach in GETS to minimize any endogenous variable bias. Needless to say these two techniques are second to one. Nevertheless, given the exploratory nature of our attempt, whatever policy implications are derived from our empirical estimates need further investigations. Therefore, our findings should be interpreted cautiously.

The structure of this chapter is as follows. Section 2 discusses unit root results and cointegration. Section 3 analyzes the model and empirical results are in sections 4 and 5. It concludes in section 6.

2. Unit Roots and Cointegration

The purpose of unit root tests is to test for the stationarity of a time series. Stationary series are said to be integrated of order zero I(0). There are numerous unit root testing procedure, each claiming that it has more power against the null of unit root in a variable. Therefore, we shall use some popular alternative tests to test for unit roots in our variables viz., output per worker, capital per worker, export ratio (export divided by output), aid (ratio to output) and remittance ratio (remittance divided by employment). In doing so, the following tests are used namely the augmented Dickey Fuller (ADF), the ADF with generalized least squares (ADFGLS) of Pantula which is more powerful than OLS ADF, the Phillips-Perron non-parametric test (PP), KPSS and the Elliot-Rothenberg-Stock test (ERS).[2] These tests did not yield uniform results, but it is

[2] I acknowledge Professor Bill Rao in providing software for unit root test and comments.

generally believed that ADFGLS and ERS are more powerful and these two indicate that all our variables are unit root variables.

Our unit root test results are as follows. The null hypothesis of unit root is rejected in first difference in all of the variables except for dlogk under the ADF, PP and KPSS. Also logk has unit root for other tests except under KPSS at 10 per cent critical value. Likewise, the computed test statistics for the ERS are more than the 5 per cent critical values, implying that all the levels of the variables are non-stationary. In essence, the null hypothesis in all tests except in ADFGLS and ERS is that the variables are non-stationary. The variables in their first difference under the ADFGLS and ERS are all stationary, meaning that they are I(1). Since the ADFGLS and ERS are more powerful, we conclude that we should apply time series methods of estimation. Otherwise the summary statistics of the estimates will be biased and unreliable.

Table 1. Unit Root Tests Results
(p-values are in the parentheses)

VARIABLES	ADF	ADFGLS	PP	KPSS	ERS
ln (Y/L)	-3.426 (-3.549)	-2.950 (-3.190)	-2.533 (-3.544)	0.094 (0.146)	7.007 (5.720)
Δln (Y/L)	-4.247 (-2.951)	-4.313 (-1.951)	-4.059 (-2.951)	0.091 (0.463)	1.502 (2.970)
ln (K/L)	-2.585 (-3.548)	-2.614 (-3.190)	-1.785 (-3.544)	0.144 (0.119**)	6.481 (5.720*)
Δln (K/L)	-2.503 (-2.951)	-2.431 (-1.951)	-2.642 (-2.951)	0.125 (0.463)	2.939 (2.970)
ln EXRATIO	-2.480 (-3.544)	-2.563 (-3.190)	-2.330 (-3.544)	0.182 (0.146)	9.295 (5.720)
Δln EXRATIO	-6.198 (-2.954)	-6.231 (-1.951)	-10.435 (-2.951)	0.384 (0.463)	0.659 (2.970)
ln AIDRATIO	-1.749 (-3.544)	-1.127 (-3.190)	-1.754 (-3.544)	0.174 (0.146)	84.246 (5.720)
Δln AIDRATIO	-5.096 (-2.951)	-5.101 (-1.951)	-5.175 (-2.951)	0.548 (0.463)	1.495 (2.970)
ln RERATIO	-1.310 (-3.544)	-0.842 (-3.190)	-1.332 (-3.544)	0.171 (0.146)	116.725 (5.720)
Δln RERATIO	-3.871 (-2.951)	-3.438 (-1.951)	-3.387 (-2.951)	0.425 (0.463)	1.793 (2.970)

Notes: (1) Figures in brackets are the critical values at the 5% level denoted by *, but in most cases the * sign is not used and figures without that sign are also at the 5% level. Figures in some brackets with a double star sign (**) show critical values at 10%

level. (2) In EViews the trend and intercept are included for testing unit root in level form, while as in first difference only intercept is included. (3) Also ln is the same as log and Dln is also known as Δln, which represents the first difference of a variable.

2.1. Cointegration

In the circumstance where variables are in the order of I(1) and therefore I(0) in first differences, means that such variables with a long run equilibrium relationship cannot drift very far apart in the long run because economic forces will act to correct any disequilibrium (see Bierens (2006); Felmingham and Jackson (2003)). In other words, the concept of cointegration is developed from the belief that certain economic variables should not diverge from each other by too far a distance or diverge without bound (see Liow (2004)). Any linear combination of I(1) variables is typically spurious. However if there is a long-run relationship, errors have tendency to become small and return to zero i.e. are I(0).

Nevertheless, having determined the order of integration for each variable of the time series as per the unit root test results from the ADFGLS and the ERS techniques in Table 1 above, we next employ all the popular techniques of cointegration to estimate a baseline equation or to examine the existence of long run and short run dynamic relationships based on the error correction adjustment model (ECM), to obtain meaningful relationships between the level of output (and by implication its rate of growth) and its determinants. The GETS, Engle-Granger, Fully Modified Ordinary Least Squares (FMOLS) and JML VECM are used. However, only GETS and JML VECM have given plausible results. These techniques will be used in the rest of this chapter to examine whether or not the variables like aid ratio, export ratio and remittance ratio have any effects besides the basic inputs of labour and capital assuming constant returns to scale. To conserve space we shall not report results with FMOLS and Engle-Granger methods.

3. The Model

In this empirical work, the basic Solow model and its extensions are used. Therefore, some restrictions should be noted. Firstly, unlike in the cross section work with the Solow model where the steady state growth equation is estimated, what is estimated in time series work is the basic Cobb Douglas production function and not a growth equation. Because of the transformations necessary to use time series methods (to overcome unit root problem), the dependent variable is the rate of growth of output. This does not mean that the estimated equation is the steady state growth equation and many applied workers mistake this to be so. This is not correct. What is estimated in time series models is the steady state production function. To derive steady state growth equation, this production function should be combined with other equations in the Solow growth model. Second, we also assume that there are constant returns. Third, additional variables, such as the export ratio etc., are introduced into the model as shift variables in the production function. We feel that it is adequate for our purpose although these additional variables can be introduced into the production function in other different ways.

Essentially we follow Rao and Rao (2006) and our basic production function with constant returns and Hicks neutral technical progress is:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$
$$= A_0 e^{gt} K_t^{\alpha} L_t^{1-\alpha} \qquad (1)$$

where A_0 represents the initial stock of knowledge, t is time, K is capital and L is labour.

An important assumption for illustrative purpose is that the stock of knowledge not only changes with time but also depends on a shift variable Z. For example this Z could be education or the ratio of exports or the ratio of aid to output. Now Z may have a permanent and/or a temporary effect on output. To distinguish between the temporary and permanent effects of Z, these two procedures are important. The first procedure is

to include Z in the cointegrating equation with capital and labour inputs. The latter two variables may be treated as the conditioning variables. One should note that ignoring them could cause serious misspecification and the estimates are unreliable. If there is no cointegrating equation with Z, K and L but there is a cointegrating equation with only K and L, then Z has no permanent effects on Y.

The second procedure is that, to test if Z has a temporary effect, its rate of change may be included into the short run dynamic equation based on the lagged residuals of the cointegrating equation and the error correction mechanism (ECM) adjustment process. If Z has no temporary effect, then changes in Z and its lagged values will have insignificant coefficients.[3]

This specification (intercept and trend are ignored for convenience) based on the GETS shows how the (long and/or short run) effects of Z on Y can be captured and tested.

$$\Delta \ln Y = -\lambda(\ln Y_{t-1} - (\beta_1 \ln K_{t-1} + \beta_2 \ln L_{t-1} + \beta_3 \ln Z_{t-1})) + \sum \gamma_n \Delta \ln K_{t-n} + \sum \gamma_j \Delta \ln L_{t-j} + \sum \gamma_m \Delta \ln Z_{t-m} + \sum \gamma_k \Delta \ln Y_{t-(t-(k+1)} \qquad (2)$$

If Z has both permanent and short run effects then β_3 and some γ_m would be significant. If Z has only permanent effects β_3 would be significant and if Z has only short run effects then β_3 would be insignificant while some γ_m would be significant.

4. Empirical Results

4.1. The Solow Model with GETS

The London School of Economics-Hendry's general to specific approach (GETS) is widely used with its autoregressive distributed lag structure and the error correction mechanism of adjustment. We shall estimate the GETS based specifications with the non-linear instrumental variable method to minimize endogeneity bias. On the other hand, the GETS method has also been criticized. This is due to the fact that there was no cointegration test and it estimates equations with both I(0) and I(1) variables.

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[3] . I acknowledge Professor Bill Rao for suggesting these alternatives.

However, the recent work by Ericsson and MacKinnon (2003) who have developed cointegration tests for GETS equations, which is an extension of the well known MacKinnon tests (1991) for the Engle-Granger equations make those criticisms untenable now.

First we estimate a baseline equation with only the two inputs viz., capital and labour. We include an intercept and trend and retrain the constant returns constraint, but without any Z shift variable. This yields the baseline estimate for subsequent comparisons. However, a shift dummy is included for a break in the intercept term because since 1990 there seems to be a break in the trends of many of our variables.[4] The specification for the baseline equation is as follows.

$$\Delta lny_t = \alpha_0 + \alpha_1 T - \lambda(lny_{t-1} - (\beta_1 lnk_{t-1})) + \sum\gamma_i \Delta lnk_{t-i} + \sum\gamma_n \Delta lnY_{t-(n+1)} + \gamma DUM90 \qquad (3a)$$

where *DUM90* is one after 1990 and zero before and T is time trend. The lower case letters are in per worker values. Thus $y = (Y / L)$ *and* $k = (K / L)$ etc. The estimate of this baseline equation for the period 1970-2005 is as follows:

$$\underset{}{\Delta lny_t} = \underset{(4.4)*}{4.291} - \underset{(-5.3)*}{0.030}T - \underset{(7.5)*}{0.721}(lny_{t-1} - \underset{(3.0)*}{.337}lnk_{t-1}) + \underset{(6.9)*}{.467}Dlny_{t-1} - \underset{(-4.0)*}{3.213}Dlnk_{t-2} - \underset{(-4.7)*}{0.271}dum90. \qquad (3b)$$

R bar^2 =0.53; GR bar^2=0.50, Sargan's CHSQ(8)=8.850[p=0.355]

SER=0.117; χ^2_{sc}=4.42 (0.035); χ^2_{ff} = 3.14 (0.076); χ^2_n = 0.38 (0.83),), χ^2h = 19.933(0.00).

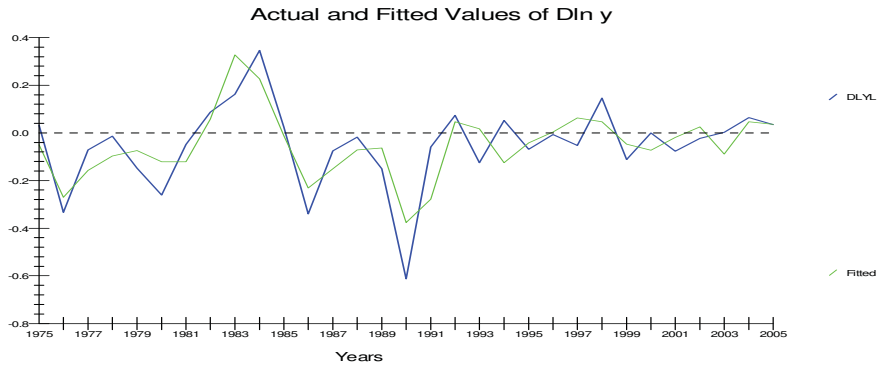
* indicates significance at 5% level.

The above estimate indicates that this baseline equation is satisfactory (for full details refer to *Table 1A* in the appendix*).* All the coefficients are significant at the conventional 5% level. The R bar square and the GR bar square are close, indicating

[4] Cointegration with structural breaks is both hard and often misused. As far as we are aware, such tests by Gregory and Hansen (1996) are available for only the Engle-Granger equations and not for GETS and the JML VECM models.

that the specification and selected instrumental variables are appropriate. This is further confirmed by the Saragan Chi-square test, which is insignificant. The summary chi-square tests show that there is some serial correlation at the 5% but not at the 1% level. Because there is heteroscedasticity in the residuals, the t-ratios are White adjustment based. The standard error of regression (SER), although high, is plausible for a small island country where output growth rate is highly volatile. In addition, the estimate of the adjustment coefficient lambda is highly significant with a t-ratio of 7.5, which exceeds the Ericsson-MacKinnon critical value at the 5% level. Thus per worker output and capital variables are cointegrated. The error correction coefficient is –0.721, which is less than one signifies that convergence to equilibrium will be smooth. Also, the dummy variable has a negative and significant coefficient implying that output has declined by 0.27 per cent since 1990 due to the following factors. The government major commercial fishing company (Te Mautari Ltd) was closed down in late 1980s coupled with the cessation of phosphate mining for export, low world copra price prevailed affecting the copra industry and an escalating trade deficit caused by the increasing import of consumable items etc. Another noteworthy, although disappointing, finding is that the rate of TFP captured by the coefficient of trend (T) is negative implying that in Kiribati efficiency has declined with time at the rate of 3 per cent per year. This may be due to lack of good management skills, closed down and unproductive investments to which we referred to earlier and due to the immigration of skilled workers elsewhere. The implied profit share of 0.337 is plausible and very close to our stylized value of one-third in the growth accounting exercise. The actual and predicted values of output growth are shown below in Figure 1, which seems to be satisfactory.

Figure 1



4.2. The Solow Model with JML VECM

Johansen proposes two tests to determine the number of cointegrating vectors. The first is the likelihood ratio test based on the maximal eigenvalues and the second is the likelihood ratio test based on the trace test. The power of the trace test is lower than the power of the maximal eigenvalue test. If the null hypothesis of no cointegrating vector can be rejected, it indicates that there is a long run relationship among the variables in the model. As a result, the error correction mechanism can be presented (see Shrestha (2005), Haug and Mackinnon and Michelis (1999)).

The baseline equation in 2 above is also valid for our purpose, which is testing with JML VECM whether or not there is cointegration between output and capital per worker. The two tests for cointegration (*refer to Table 2A in the appendix*) indicated that there is one cointegrating vector between ln y and ln k. When normalized on ln y, it is as follows.

$$\ln y = 0.535 \ln k \qquad (4)$$

Equation 4 implies that the share of profit is 0.535, which is higher than 0.337 of GETS, but this higher estimate is also plausible. The JML VECM parsimonious dynamic adjustment equation for this version with trend is as follows (*refer to Table 3A in the appendix).*

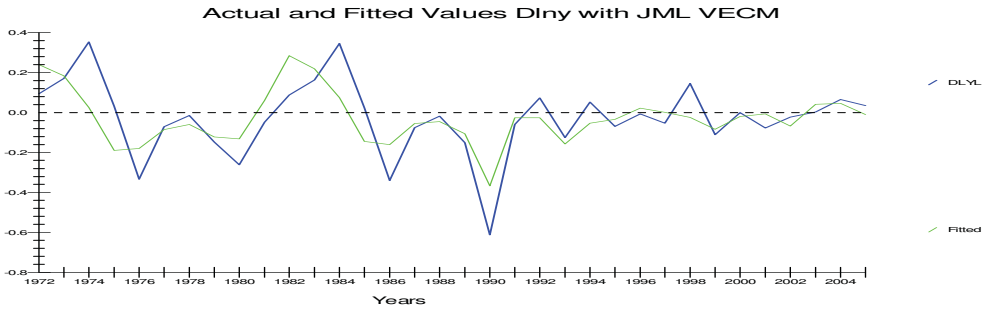
$$\Delta LYL = 2.24 - 0.02T - 0.525ECM_{t-1} - 2.39\Delta LKL_{t-1} - 0.23DUM90$$

(4.96)* (-3.48)* (-4.91)* (-2.67)* (-1.94)** *(5)*

R bar^2= 0.439; SER=0.137; χ^2_{sc}= 1.2359[.266]; χ^2_n=1.9869[.370] χ^2_{ff}=11.4778[.001]; χ^2h=4.2993[.038, * and ** indicates significance at the 5% and 10% level respectively.

The result from the above JML VECM baseline equation is satisfactory. Although the R bar square is slightly less than the GETS equation, the actual and fitted values are reasonably good. As in the GETS equation, the dummy variable recording a negative coefficient of -0.253 and the coefficient of trend of negative -0.023, are higher than the coefficients of a dummy and trend in the JML VECM in equation 5 above. Thus this equation also implies that technical progress in Kiribati has been negative. Moreover, the coefficient of the error correction term in the JML VECM is -0.53, which is similar with the ECM in the GETS of -0.72, meaning that convergence to equilibrium will also be smooth. The plot of actual and fitted values is in figure 2.

Figure 2



5. Extension to the Solow Model with other variables

The next task here is to apply the extension to the Solow model. Using the GETS approach, the test is executed on variables like export ratio, aid ratio and remittance ratio to examine whether they have any permanent and/or temporary effects on output. To conserve space we shall not report all the details, as none of these variables are found to have any permanent effects on output. Similarly, except the export ratio, the remittance ratio and aid ratio do not have even any short run effects on output per worker and when they have an effect these are negative. These findings hold whether the GETS or JML VECM method is used, although often JML VECM yielded implausible estimates for the coefficient of ln k. To conserve space, we shall only report results with GETS using the IV option in Mfit.

5.1. GETS Result with export ratio

The parsimonious equation where the export ratio has only temporary effects is as follows. The detailed output is in Table 4A in the Appendix.

$$\Delta Lny_t = 3.5 - 0.027T - 0.66(Lny_{t-1}) + 0.41Lnk_{t-1}) + 0.44\Delta ln\, y_{t-1} + -2.70\Delta Ln\, k_{t-2} +$$

(3.4)* (-5.2)* (7.7)* (2.8)* (5.9)* (-3.5)*

$$-0.27dum90 + \mathbf{0.046}\Delta\mathbf{LnEXRATIO}. \qquad (6)$$

(6.2)* (1.96)**

$R\ bar^2 = 0.55$, $GR\ bar^2 = 0.493$, Sargan's CHSQ(8)=8.8668[p=0.2773.92(0.05); $\chi^2_{ff} = 2.8(0.094)$; $\chi^2_n = 0.42(0.809).=4.42\ (0.035)$; $\chi^2_{ff} = 3.14\ (0.076)$; $\chi^2_n = 0.38\ (0.83)$, χ^2h =20.362(0.00).

* and ** indicate significance at 5% and 10% levels respectively. T-ratios are White adjusted.

Compared to the baseline equation, without export ratio, this equation is very close in all respects and only with minor changes to the estimated coefficients. The share of

profits increased marginally to 0.41 from 0.337. It is noteworthy that the coefficient of ΔLnEXRATIO is significant at only the 10% level. This equation implies that a 10% increase in export ratio will increase growth in output temporarily by about half a percent. Such low increase in output may be due to the fact that any increase in exports fail to have any significant backward and forward linkage effects in Kiribati.

When the JML VECM approach is used, the null hypothesis of no cointegration vector is rejected at the 5 and 10 per cent levels and the null of one cointegrating vector is not rejected. However, the cointegrating vector showed that the coefficient of export ratio is negative and the share of profit is 5. These are implausible values and the output is in table 5A in the Appendix. Therefore, there is no meaningful long run relationship between export ratio and output.

5.2. GETS Result with aid

To put into perspective, it is worth considering having a proper GETS specification with aid, with linear and then a non-linear specification of aid (*refer to table 6A in the appendix).* Results with only a linear aid term are significant and the results are as follows.

$$\Delta \ln Y = 2.93 - \underset{(1.28)}{0.04T} - \underset{(5.56)*}{0.73}(\ln Y_{t-1} + \underset{(1.96)}{0.65}\ln K_{t-1} - \underset{(-2.46)*}{0.07}\ln RAIDl_{t-1})$$

$$+ \underset{(3.36)*}{0.44}\Delta \ln Y_{t-1} \underset{(-4.49)*}{-3.69}\Delta \ln K_{t-2} \underset{(-3.53)*}{-0.338}dum90 \underset{(-1.81)}{-0.31}\Delta \ln RAIDl \qquad (7)$$

$R\ bar^2 = .23981$; $GR\text{-}bar^2 = .45515$; $SER = .14983$; $\chi^2_{sc} = 4.6579[.031]$; $\chi^2_{ff} = 3.1585[.076]$; $\chi^2_{n} = .40260[.818]$; $\chi^2_{h} = 4.2257[.040]$.

It can be seen that all the coefficients are significant, but the effects of aid, in both long and short runs, is negative. It is pointless to think about how large are these negative effects and the results support Professor Hughes (2003) concerns that aid has been

unproductive in many island countries. Estimation on the effects of aid was also executed with JML VECM but none of the options yielded any sensible results.

5.3. GETS Result with remittances

GETS specifications with linear and non-linear remittance terms are estimated but the linear specification gave better results although the coefficient of capital is insignificant. Therefore, we re-estimate by constraining that the coefficient of capital is 0.337, which is the estimate in the baseline equation (*refer to table 7A and 8A in the appendix*). The following is the result.

$$\Delta LYL = \underset{(5.97)^*}{5.39} - \underset{(-5.59)^*}{0.033T} - \underset{(7.3)^*}{0.83}(LYL_{t-1} - \underset{\text{(constrained)}}{0.337}LKL_{t-1} - \underset{(4.6)^*}{0.097}LRREML_{t-1}) + \underset{(-5.9)^*}{0.41}\Delta LYL_{t-1}$$

$$-\underset{(-5.99)^*}{0.38}dum90 - \underset{(-1.4)}{0.335}\Delta LRREML \qquad (8)$$

R bar^2=.48010;GR-Bar^2 =.53615; SER =.12391; χ^2_{sc}=3.0260[.082]; χ^2_{ff}=4.8827[.027]; χ^2_n=.50889[.775]; χ^2_h= 12.2192[.000].

As can be noted the long run effect of remittance is negative and significant. Although its short run effect is negative it is insignificant. Therefore, we removed the short term effect and estimated the equation. However, the coefficient of remittance has become insignificant. We also tried to estimate an equation in which remittance has only short run effect, but this equation was unsatisfactory and although the coefficients of changes in remittances were negative they were all insignificant. Therefore, we may say that remittances like aid, remittances have only negative permanent effects.

5.4. Ad hoc specifications

In order to get an idea of the nature of ad hoc specifications, we used JML VECM to test the effects of aid in an ad hoc manner.[5] The assumed ad hoc specifications are: lny = a+b ln aid and lny = a+b ln aid +c ln aid^2 . While there was no cointegrating vector in the linear specification, the trace and eigen value tests showed that there is one cointegrating vector in the non-linear specification (*refer to table 9A in the appendix*). Normalized on output, this cointegrating equation is:

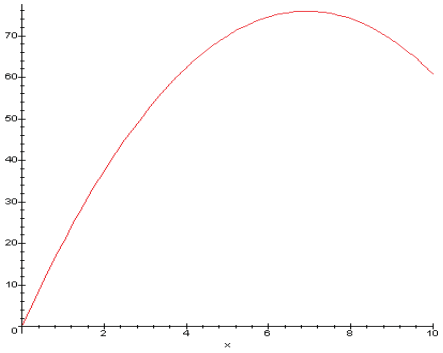
ln y =21.918 ln aid -1.583 (ln aid)^2 *(9)*

This implies that the maximum effect of aid per worker is reached when log of aid per worker is about 7. The plot of this effect is given in figure 3 below where x = log of aid per worker and on the vertical axis its effect on output worker is shown.

Although this result looks impressive it should be noted that the implied elasticity of output per worker with respect to aid per worker is implausibly high. In 2005 the value of log aid per worker is 5.5765 and the elasticity at this value is 4.27, implying that a 10% increase in aid will cause about 43% increase in per worker output! Similar results were also found with JML VECM, by Jayaraman and Choong (2006), with ad hoc specifications, that a 1% increase in per capita aid for Fiji will increase per capita output by 65%! Such results with ad hoc specifications are not only unreliable but show how many applied economists are mesmerized with techniques and pay little attention to interpretation and evaluation of their findings. Rao (2006) consider some of these pitfalls in applied econometric work with time series econometrics.

[5] There are several other ad hoc specifications in which growth of output is simply regressed on aid etc and the equation is estimated with OLS. We shall not examine all such ad hoc specifications.

Figure 3.



6. Conclusion

This chapter analyzed the application of the Solow model and its extension for Kiribati. In the empirical results, the Solow model baseline equation from GETS and the JML VECM are satisfactory. The result for the Solow model shows that the dummy variable has a negative and significant coefficient of 0.27, a kind of downward intercept shift in the production function due to increased inefficiency, inferring that growth rate in output has declined since 1990, due to close down of Te Mautari L:imited, adverse effects of low world copra price and escalating trade deficit. Another noteworthy finding is that (based on the baseline results from the GETS and the JML VECM), the rate of TFP captured by the coefficient of trend is negative; implying that Kiribati's efficiency has declined at the rate of 3 per cent per year. The implied profit share is plausible and very close to the stylized value of one-third in the growth accounting exercise. The lack of managerial skills, close down of businesses and unproductive investments, including the effect of brain drain are vital factors responsible for that inefficiency.

In terms of the extension to the Solow model, none of the shift variables (aid ratio, remittance ratio and export ratio) have permanent positive effects on output. Remittance and aid have only negative permanent effects. This is contrary to the result of the ad hoc specifications, in particular on aid, which has significant and positive effect on output. For Kiribati, its output (Y) and growth are determined by capital stock and therefore investment. However, only export ratio has a small temporary effect on

output and the result from the GETS implies that a 10% increase in export ratio will increase per capita output to about 0.5 % annually. This empirical result confirms the answer to the research question on what the determinants of the growth rates in Kiribati are.

Furthermore, there are notable reasons why aid and remittances have no positive permanent and/or short run effects on Kiribati's output. Both are channeled to consumption. Aid has been channeled to unproductive investment as earlier reported based on the finding of the high capital-output ratio and the current criteria of providing aid by aid-donors, which also supports Hughes (2003) assertion. Moreover, Lloyd and Morrissey and Osei (2001) reported their empirical finding in Ghana saying that the coefficient of aid on growth is insignificant. Any impact of aid on short-run growth was negligible. Also, the level of income in Kiribati is very low and the remittances normally channel to the families of seafarers for their living, which are utilized for their consumption, implying that there is likely no saving by the majority of seafarers for business purposes. Currently, there is no provident fund for these seafarers and it is significant that arrangement be made on it for their future activities.

In order to increase the contribution of export to output, will require more and higher export earnings. The increase in domestic productive investment such as value added products from the available natural resources is an area to be considered. For example, it can be in processing or semi-processing fish and other available domestic resources for overseas markets.

In terms of improving the contribution of aid to productive investment, it can be as investment in joint projects, which does not only increase K, but also because of more efficient management skills & technology acquired, may improve TFP. This implies the need to have foreign direct investment in Kiribati, and since we have bilateral diplomatic ties with most of the developed and fast growing economies, such as Australia, New Zealand, Taiwan and Japan etc, these countries may consider

encouraging a few firms in their countries to invest in Kiribati under bilateral economic cooperation aimed for economic development. This also applies to multilateral aid.

More over such aid donors may allocate some of their aid in financing machineries, technical expertise etc to entrepreneurs and entrepreneurs' training for establishing their small-scale manufacturing industries, which can be expanded if successful by owner's expenditure. Likewise, aid donors may render assistance to fund public productive investment. It is also significant that both aid donors and the host government may even provide financial incentives to foreign firms and local entrepreneurs.

The operational mechanism for this framework of cooperation will be under the joint responsibility of aid donors and government. Therefore, part or much of the aid can be in this form, which renders the foundation for cooperation called *"Cooperation between Aid donors and Government for Economic Development through Productive Investment and Increasing Participation of the Private Sector"*. Currently, the Pacific Islands Forum leaders persuade Australia to allow recruiting seasonal workers to be employed in her economy. Although there are benefits from this proposed scheme, it does not solve the root of the economic problem of low growth rate in the Island economies, but create more dependency on external economies, which may be unstable in the long term. What the PIF leaders should consider is to convince aid donors to develop the economies of the Island countries, through allocating their aid in productive investment, in order to be able to provide employment and income for their population in the long term.

Investing more in productive investment domestically based on the right economic policies, will mean that the economy will be more productive, and can have sustained economic growth when such productive investment have management and technical expertise as well as embodied or embraced technological advance in their industries in the long term.

7. CONCLUSION

1. Introduction

In this thesis we have examined what the main factors that determine the growth rate in Kiribati are. We have used the Solow growth model and its extensions as are our framework for the empirical study. However, given various constraints, especially data limitations, this thesis has concentrated on the two conditioning variables viz., labour and capital and examined the long and short run effects of three additional variable viz., exports, aid and remittances. Our main findings, subject to several caveats, are that (a) technical progress in Kiribati has been negative, (b) capital per worker adequately explains output per worker (c) neither aid nor remittances have significant long or short run effects on the level of output and (d) exports seem to have only a small and significant short run effects on output. In this process we have shown that the simple Solow framework can be usefully extended to explain the determinants of output in a small island country like Fiji.

2. Summary of Quantitative Results

How can we assess the performance of Kiribati's output? The findings from our growth accounting exercise, which can show the growth from factor accumulation and total factor productivity is important on that area. Factor accumulation contributes more to Kiribati's output growth due to its higher average growth rate of 3% per annum than the TFP, which recorded an average growth rate of negative –3% per annum. This makes the net growth rate of Kiribati almost insignificant.

The major reason for this disparity includes: The absence of growth from TFP, implies the underdevelopment of the production sector, mainly the private sector, the absence

of economies of scale, no major institutional reforms and protection from international competition remain in imposition.

What are the determinants of the growth rates in Kiribati? The result from the growth accounting is also significant. However, the empirical findings after using the applied econometric and conforming to the Solow model and its extensions are satisfactory. The result for the Solow model shows that the 1990 dummy variable has a negative and significant coefficient of 0.27, a kind of downward intercept shift in the production function due to the increased inefficiency, inferring that growth rate in output has declined since 1990. Some relevant reasons are: Government public enterprises such as Te Mautari Ltd catered for commercial production had been closed down in late 1980s. Also, there is adverse effect of low world copra price on copra production, thus export earnings plummeted. Further more, given the narrow export base, the trade deficit escalated, meaning that Kiribati depends heavily on overseas countries for aid, foods and goods etc. Another noteworthy finding is that (based on the baseline results from the GETS and the JML VECM), the rate of TFP captured by the coefficient of trend is negative; implying that Kiribati's efficiency has declined at the rate of 3 per cent per year, which is the same with the growth accounting results. The implied profit share is plausible and also very close to the stylized value of one-third in the growth accounting exercise. The lack of managerial skills, close down of businesses and unproductive investments, including the effect of brain drain are vital factors responsible for that inefficiency.

The results from the extension to the Solow model show that none of the shift variables (aid ratio, remittance ratio and export ratio) have permanent positive effects on output. Remittance and aid have only negative effects. This is contrary to the result based on ad hoc specifications, where some works found that aid has significant and positive effect on output. For Kiribati, its output (Y) is determined by capital stock and therefore investment. However, the export ratio has a small temporary effect on output and the result from the GETS implies that a 10% increase in export ratio will increase per

capita output by about 0.5 % annually. Based on this empirical result, we can provide answer to the determinants of the growth rates in Kiribati.

The justification for aid and remittances for being not contributing much to growth in Kiribati include the followings. Aid has been channeled to unproductive investment and consumption. This is justified by the finding on the high capital-output ratio and the current criteria of providing aid by aid-donors, which also supports Hughes (2003) assertion. Unemployment and the very low income in Kiribati make the remittances fully utilized on consumption by the seafarers' families.

3. Some Data Limitations

Applied econometric work requires time series macroeconomic data depending on the nature of the study. In Kiribati the formulation and compilation of time series data on macroeconomic variables are incomplete and not up to date. Only the data for the export of copra, transformed into the export ratio, in the form of export earnings and annual production are available. The major time series data source for Kiribati's GDP and its components are obtained from the United Nations Statistic Department website, while employment, remittance and foreign aid figures are available locally, having more than half of the time series data from 1970 to 2005 requirement. The rest are estimated in compliance with estimate from the Taxation office of the Kiribati government, population census report of the Statistic office and figures from external sources. Therefore, given this circumstance, the result of the empirical study should be interpreted cautiously; unless we have a more reliable source for time series data.

4. Additional Observations

The theories of economic growth are significant in the understanding of disparity between economic growth rates and development between different countries. The Solow model and its extensions are useful for that purpose, embracing as well the MIRAB model, which specifically reflects the stylized facts of the Island Economies in

the South Pacific, although it defaulted to stress the correct source for the remittance in Kiribati, which is mainly from the seafarers.

Kiribati's foreign exchange earnings from the access fee, foreign aid, remittances and the draw down from the RERF and trade openness are significant, given the underdevelopment of the private sector to provide employment, income and government's revenue, for the development and sustainability of Kiribati's economy. The revenue equalization reserve fund (RERF), the access fee and export earnings have more direct positive effects on government financing requirement, while the foreign aid and remittances are channeled to consumption.

There are issues concerning the sustainability of such significant foreign exchange earnings. Firstly, they are vulnerable to short run fluctuations from external economies, instability in the financial capital markets, weather and diplomatic ties. For instance, the RERF is susceptible to instability in the financial capital markets. The revenue from the access fee depends heavily on the weather pattern, which affects the location of tuna species in the ocean. More over, the remittance and foreign aid can be unstable if a diplomatic relationship is unfavourable with the country relying on for labour mobility, remittance and aid. Trade openness and the export of copra etc, relies on overseas demand, foreign income, weather, world price and stability in the economies where it exports its copra to.

Domestically, the question is what are the other sources of government's revenue apart from foreign exchange earnings? Since independence, however, some meager major reliable sources of revenue for government's recurrent budget are on personal tax, company tax, and other fees and taxes, dividend shares etc. The income from personal tax is much higher than the revenue from the company tax, implying the underdevelopment of the private sector.

Based on such revenues determine how much the government can budget for its expenditure. Since independence in 1979 after the cessation of phosphate mining,

government revenue from phosphate tax plummeted greatly. The first government under the leadership of the National Progress Party encountered that economic problem. Fortunately, its budget of $33 million was adequate indeed given its low population, few employees in the public service and lower salary. As the population increases as well as the increase in the size of the public service, require extra outlay, and other major expenditure items promised during the campaigns, such as the increase in the price of copra and elderly pension, put pressure on government financial resource. These developments experienced during the government of the Maneaban Te Mauri Party from 1994 to 2002, resulting in its recurrent budget reaching $98 million in 2002, and the same level of expenditure experienced during the government of the Boutokan TE Koaua Party from 2003 to 2006. The increase in recurrent budget would have adverse effects to the real value of the RERF.

On the issue of the gross domestic product and its growth rates, they were fell after the cessation of phosphate mining, but recovered since late in the 1980s at lower level of growth. Government expenditure provides much to GDP and its growth. In addition, the gross national per capita income for Kiribati based on the UNSD data remains stabilized at US$1,500.00, which falls under the category of the Least Developed Countries. Kiribati's GNI is lower due to limited revenue from productive sectors abroad such as from the RERF, the access fee, the aid and the remittance. Given the increase in the population, it has eaten up the GNI per capita. Stabilizing population has been one area of government's policy.

The effects of the current wave for the implementation of trade-liberalization on Kiribati remain under consideration. The positive effects of this free trade may be having a cheaper price for imported goods etc. Unfortunately, there is trade off. Island economies such as Kiribati will lose out from their import duty revenue stood approximately Australian dollar 10 million annually. How to compensate this source of revenue? VAT and other forms of taxes may be considered. There may be price increased on imported goods etc through the imposition of the VAT. Free trade will maintain the productive powers of the developed countries and to keep their

employment and income, given the availability of their markets for their products in other economies. For Small economies, their industries, income and employment may be affected if they are flooded with cheaper imported goods.

5. Recommendations

Based on the findings, it is worth considering suggestions on foreign exchange earnings. These major foreign exchange earnings for Kiribati are vital for output and should be managed prudently such as on the RERF and the access fee; render incentives and negotiations where necessary especially on labour mobility and employing agencies abroad and based in the country as well, and a thorough diplomatic negotiation is required on aid for their long-term sustainability and economic benefits to Kiribati.

In addition, aid should be provided to productive investment. Aid donors should consider encouraging their firms to invest in Kiribati in order to develop Kiribati's economy. This also applies to multilateral aid. Aid donors and government should also provide incentives to such firms. Also, the provision of machineries for small scale manufacturing of entrepreneurs is significant. This render the basis for cooperation called "Aid donors and government cooperation for economic development through productive investment and increasing the participation of the private sector." The mechanism for this cooperation framework will be under the sole responsibility of an aid donor and the host government.

The high level of government expenditure is not sustainable in the long term, given its limited financial resource and only the RERF that has been the backbone of the government for a long time. The high draw down of the RERF per annum will affect the real value of the fund and is unsustainable. Therefore, prudent government financial management is required.

Based on the empirical findings, the following recommendations are significant. In the Solow model, Kiribati's output and its growth rates are determined by capital stock and therefore investment. Therefore, it is imperative to increase investment in productive industries. Further more, given the fact that only export ratio has temporary positive effects on output, efforts should be focus on increasing its contribution on output. This will require more and higher export earnings. Expanding the export base to include manufacturing of value added products from the available natural resource or semi finished products for domestic manufacturing imported from overseas are crucial.

By investing more in productive investment, provided there is a right economic policy, will make such economy productive, and can have sustained economic growth in the long term when such industries have management and technical expertise, as well as embodied technological advance. This will also improve the contribution of total factor productivity to growth.

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APPENDIX

APPENDIX TO CHAPTER 6

TABLE 1A

```
               Non-Linear Two-Stage Least Squares Estimation
             The estimation method converged after 5 iterations
   Based on Newey-West adjusted S.E.'s Bartlett weights, truncation lag= 10
********************************************************************************

 List of instruments:
 C               T               LKL(-2)         LYL(-2)         DUM90
 DLKL(-3)        DLY(-2)         LYL(-3)         DLYL(-3)        DLKL(-4)
 DLYL(-4)        LL(-1)          DLL(-1)         LEXRATIO(-1)    LEXRATIO(-2)
 31 observations used for estimation from 1975 to 2005
********************************************************************************
 Parameter                Estimate       Standard Error         T-Ratio[Prob]
 A0                         4.2912            .97468             4.4027[.000]
 A1                       -.030065          .0056939            -5.2803[.000]
 LAMBDA                     .72090            .096599             7.4628[.000]
 B1                         .33750             .11098             3.0412[.006]
 G1                         .46716            .067984             6.8716[.000]
 G2                        -3.2127             .80917            -3.9703[.001]
 G3                        -.27149            .058037            -4.6778[.000]
********************************************************************************
 R-Squared                     .62620   R-Bar-Squared                    .53275
 GR-Squared                    .60150   GR-Bar-Squared                   .50188
 S.E. of Regression            .11746   F-stat.    F(  6,  24)    6.7009[.000]
 Mean of Dependent Variable  -.050676   S.D. of Dependent Variable       .17184
 Residual Sum of Squares       .33115   Value of IV Minimand             .12211
 DW-statistic                 2.7319   Sargan's    CHSQ( 8)    8.8502[.355]
********************************************************************************


                              Diagnostic Tests
********************************************************************************
*    Test Statistics  *        LM Version        *         F Version          *
********************************************************************************
*                     *                          *                            *
* A:Serial Correlation*CHSQ(   1)=   4.4215[.035]*       Not applicable       *
*                     *                          *                            *
* B:Functional Form   *CHSQ(   1)=   3.1445[.076]*       Not applicable       *
*                     *                          *                            *
* C:Normality         *CHSQ(   2)=   .37562[.829]*       Not applicable       *
*                     *                          *                            *
* D:Heteroscedasticity*CHSQ(   1)=  19.9327[.000]*       Not applicable       *
********************************************************************************


********************************************************************************
```

TABLE 2A

```
 Cointegration with unrestricted intercepts and unrestricted trends in the VAR
   Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
*****************************************************************************
 34 observations from 1972 to 2005. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:

 List of eigenvalues in descending order:
.44998     .20756
*****************************************************************************
 Null    Alternative    Statistic     95% Critical Value     90%Critical Value
 r = 0      r = 1        20.3253           18.3300                16.2800
 r<= 1      r = 2         7.9098           11.5400                 9.7500
*****************************************************************************
 Use the above table to determine r (the number of cointegratingvectors).


 Cointegration with unrestricted intercepts and unrestricted trends in the VAR
          Cointegration LR Test Based on Trace of the Stochastic Matrix
*****************************************************************************
 34 observations from 1972 to 2005. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LYL             LKL
 List of eigenvalues in descending order:
.44998     .20756
*****************************************************************************
 Null    Alternative    Statistic     95% Critical Value     90%Critical Value
 r = 0      r>= 1        28.2351           23.8300                21.2300
 r<= 1      r = 2         7.9098           11.5400                 9.7500
*****************************************************************************
 Use the above table to determine r (the number of cointegratingvectors).


 Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
*****************************************************************************
 34 observations from 1972 to 2005. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LYL             LKL
 List of eigenvalues in descending order:
.44998     .20756
*****************************************************************************
 Rank      Maximized LL        AIC             SBC             HQC
 r = 0        91.0968         83.0968         76.9914         81.0147
 r = 1       101.2595         90.2595         81.8645         87.3965
 r = 2       105.2144         93.2144         84.0562         90.0912
*****************************************************************************
 AIC = Akaike Information Criterion    SBC = Schwarz Bayesian Criterion
 HQC = Hannan-Quinn Criterion


Estimated Cointegrated Vectors in Johansen Estimation (Normalized in Brackets)
 Cointegration with unrestricted intercepts and unrestricted trends in the VAR
*****************************************************************************
 34 observations from 1972 to 2005. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LYL             LKL
*****************************************************************************
                  Vector  1
 LYL                  .67509
                  (  -1.0000)

 LKL                 -.36144
                  (   .53540)

*****************************************************************************
```

TABLE 3A

PARSIMONIOUS EQUATION FOR JML VECM

Ordinary Least Squares Estimation

Dependent variable is DLYL
34 observations used for estimation from 1972 to 2005

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	2.2382	.45144	4.9579[.000]
JMLECM(-1)	-.52486	.10689	-4.9104[.000]
DLKL(-1)	-2.3891	.89309	-2.6751[.012]
DUM90	-.25248	.12973	-1.9462[.061]
T	-.022699	.0065082	-3.4878[.002]

R-Squared	.50786	R-Bar-Squared	.43998
S.E. of Regression	.13682	F-stat. F(4, 29)	7.4815[.000]
Mean of Dependent Variable	-.027955	S.D. of Dependent Variable	.18283
Residual Sum of Squares	.54288	Equation Log-likelihood	22.0888
Akaike Info. Criterion	17.0888	Schwarz Bayesian Criterion	13.2729
DW-statistic	1.6378		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 1.2359[.266]	F(1, 28)= 1.0562[.313]
B:Functional Form	CHSQ(1)= 11.4778[.001]	F(1, 28)= 14.2693[.001]
C:Normality	CHSQ(2)= 1.9869[.370]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 4.2993[.038]	F(1, 32)= 4.6322[.039]

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

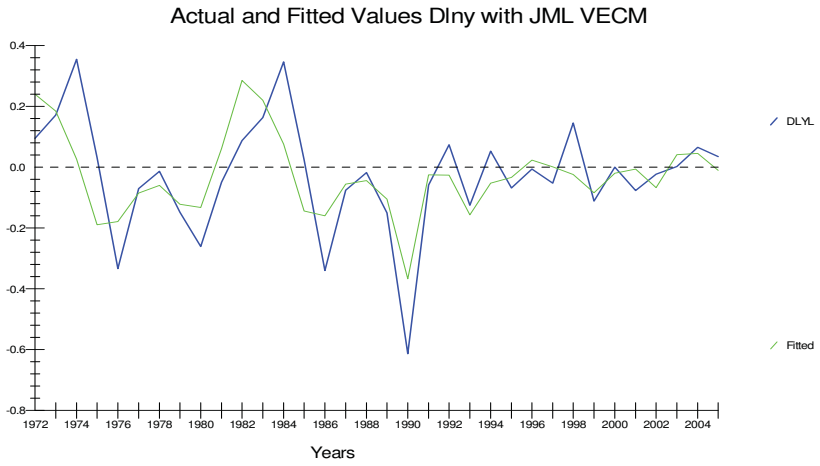

TABLE 4A

Short run effect of export ratio (GETS RESULT)

```
               Non-Linear Two-Stage Least Squares Estimation
             The estimation method converged after 5 iterations
   Based on Newey-West adjusted S.E.'s Bartlett weights, truncation lag= 10
*******************************************************************************

 List of instruments:
 C               T               LKL(-2)         LYL(-2)         DUM90
 DLKL(-3)        DLY(-2)         LYL(-3)         DLYL(-3)        DLKL(-4)
 DLYL(-4)        LL(-1)          DLL(-1)         LEXRATIO(-1)    LEXRATIO(-2)
 31 observations used for estimation from 1975 to 2005
*******************************************************************************
 Parameter                 Estimate       Standard Error          T-Ratio[Prob]
 A0                         3.5229            1.0379            3.3943[.002]
 A1                        -.027600          .0053468           -5.1619[.000]
 LAMBDA                     .65700            .085138            7.7169[.000]
 B1                         .40655            .14369             2.8293[.010]
 G1                         .44355            .074934            5.9192[.000]
 G2                        -2.7020            .78315            -3.4502[.002]
 G3                        -.27417            .044664           -6.1385[.000]
 G4                         .046731           .023812            1.9626[.062]
 ..............................................................................
 R-Squared                      .65985   R-Bar-Squared                  .55633
 GR-Squared                     .61115   GR-Bar-Squared                 .49281
 S.E. of Regression             .11446   F-stat.    F(  7,  23)     6.3740[.000]
 Mean of Dependent Variable  -.050676   S.D. of Dependent Variable     .17184
 Residual Sum of Squares        .30133   Value of IV Minimand           .11357
 DW-statistic                  2.6952    Sargan's     CHSQ( 7)     8.6683[.277]
*******************************************************************************


                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version          *
*******************************************************************************
*                     *                          *                            *
* A:Serial Correlation*CHSQ(   1)=   3.9179[.048]*       Not applicable       *
*                     *                          *                            *
* B:Functional Form   *CHSQ(   1)=   2.8116[.094]*       Not applicable       *
*                     *                          *                            *
* C:Normality         *CHSQ(   2)=   .42405[.809]*       Not applicable       *
*                     *                          *                            *
* D:Heteroscedasticity*CHSQ(   1)=  20.3602[.000]*       Not applicable       *
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

TABLE 5A.

JML VECM RESULT ON EXPORT RATIO

Cointegration with unrestricted intercepts and unrestricted trends in the VAR. Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

33 observations from 1973 to 2005. Order of VAR = 2.
List of variables included in the cointegrating vector:
LYL LKL LEXRATIO
List of eigenvalues in descending order:
.58871 .37738 .19091

Null	Alternative	Statistic	95% Critical Value	90%Critical Value
r = 0	r = 1	29.3194	24.3500	22.2600
r<= 1	r = 2	15.6362	18.3300	16.2800
r<= 2	r = 3	6.9909	11.5400	9.7500

Use the above table to determine r (the number of cointegratingvectors).

Cointegration with unrestricted intercepts and unrestricted trends in the VAR Cointegration LR Test Based on Trace of the Stochastic Matrix

33 observations from 1973 to 2005. Order of VAR = 2.
List of variables included in the cointegrating vector:
LYL LKL LEXRATIO
List of eigenvalues in descending order:
.58871 .37738 .19091

Null	Alternative	Statistic	95% Critical Value	90%Critical Value
r = 0	r>= 1	51.9466	39.3300	36.2800
r<= 1	r>= 2	22.6271	23.8300	21.2300
r<= 2	r = 3	6.9909	11.5400	9.7500

******* Use the above table to determine r (the number of cointegratingvectors).

Cointegration with unrestricted intercepts and unrestricted trends in the VAR Choice of the Number of Cointegrating Relations Using Model Selection Criteria

33 observations from 1973 to 2005. Order of VAR = 2.
List of variables included in the cointegrating vector:
LYL LKL LEXRATIO
List of eigenvalues in descending order:
.58871 .37738 .19091

```
*******************************************************************************
*******
 Rank      Maximized LL        AIC             SBC             HQC
 r = 0        70.3962         55.3962         44.1724         51.6197
 r = 1        85.0559         65.0559         50.0908         60.0206
 r = 2        92.8740         69.8740         52.6642         64.0834
 r = 3        96.3695         72.3695         54.4114         66.3271
*******************************************************************************
*******
 AIC = Akaike Information Criterion    SBC = Schwarz Bayesian
Criterion
 HQC = Hannan-Quinn Criterion

Estimated Cointegrated Vectors in Johansen Estimation (Normalized in Brackets)
 Cointegration with unrestricted intercepts and unrestricted trends in the VAR
*******************************************************************************
 34 observations from 1972 to 2005. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LYL            LEXRATIO       LKL
*******************************************************************************
                 Vector  1
 LYL                -.35140
                   (  -1.0000)

 LEXRATIO           -.17254
                   (  -.49102)

 LKL                 1.9001
                   (   5.4072)

*******************************************************************************
```

TABLE 6A: AID LINEAR TERM EQUATION

```
               Non-Linear Two-Stage Least Squares Estimation
             The estimation method converged after 5 iterations
   Based on Newey-West adjusted S.E.'s Bartlett weights, truncation lag= 10
*******************************************************************************

 List of instruments:
 C              T              LKL(-2)         LYL(-2)         DUM90
 DLKL(-3)       DLY(-2)        LYL(-3)         DLYL(-3)        DLKL(-4)
 DLYL(-4)       LL(-1)         DLL(-1)
 31 observations used for estimation from 1975 to 2005
*******************************************************************************
 Parameter                 Estimate       Standard Error         T-Ratio[Prob]
 A0                         2.9316            2.2913             1.2794[.214]
 A1                        -.039828           .0092413           -4.3098[.000]
 LAMBDA                     .73109            .13141             5.5634[.000]
 B1                         .65045            .33035             1.9690[.062]
 B2                        -.070886           .028773           -2.4636[.022]
 G1                         .44040            .13167             3.3448[.003]
 G2                        -3.6942            .82184            -4.4951[.000]
 G3                        -.33861            .096040           -3.5258[.002]
 G5                        -.31067            .17147            -1.8118[.084]
*******************************************************************************
R-Squared                     .44252   R-Bar-Squared                  .23981
 GR-Squared                   .60045   GR-Bar-Squared                 .45515
 S.E. of Regression           .14983   F-stat.    F(  8,  22)     2.1830[.070]
 Mean of Dependent Variable  -.050676  S.D. of Dependent Variable     .17184
 Residual Sum of Squares      .49387   Value of IV Minimand          .060972
 DW-statistic                2.9185    Sargan's    CHSQ( 4)     2.7161[.606]
*******************************************************************************
```

```
                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version          *
*******************************************************************************
*                     *                          *                            *
* A:Serial Correlation*CHSQ(   1)=   4.6579[.031]*       Not applicable       *
*                     *                          *                            *
* B:Functional Form   *CHSQ(   1)=   3.1585[.076]*       Not applicable       *
*                     *                          *                            *
* C:Normality         *CHSQ(   2)=   .40260[.818]*       Not applicable       *
*                     *                          *                            *
* D:Heteroscedasticity*CHSQ(   1)=   4.2257[.040]*       Not applicable       *
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
   residuals on squared fitted values
```

TABLE 7A: REMITTANCES

```
               Non-Linear Two-Stage Least Squares Estimation
             The estimation method converged after 5 iterations
   Based on Newey-West adjusted S.E.'s Bartlett weights, truncation lag= 10
*******************************************************************************

 List of instruments:
 C               T               LKL(-2)         LYL(-2)         DUM90
 DLKL(-3)        DLY(-2)         LYL(-3)         DLYL(-3)        DLKL(-4)
 DLYL(-4)        LL(-1)          DLL(-1)         LEXRATIO(-1)    LEXRATIO(-2)
 LRAIDL(-2)      DLRREML(-1)     LRREML(-2)
 31 observations used for estimation from 1975 to 2005
*******************************************************************************
 Parameter                 Estimate       Standard Error         T-Ratio[Prob]
 A0                         5.7927            3.1878             1.8172[.083]
 A1                       -.031675           .017533            -1.8066[.085]
 LAMBDA                     .83689           .094684             8.8387[.000]
 B1                         .28389            .50567              .56142[.580]
 B2                       -.097949           .047175            -2.0763[.050]
 G1                         .41614           .099313             4.1902[.000]
 G2                        -3.7628            1.2658            -2.9726[.007]
 G3                        -.39043           .082392            -4.7387[.000]
 G5                        -.32815            .30349            -1.0813[.291]
*******************************************************************************
R-Squared                    .60612   R-Bar-Squared                  .46289
 GR-Squared                  .64453   GR-Bar-Squared                 .51527
 S.E. of Regression          .12594   F-stat.    F(  8,  22)     4.2318[.003]
 Mean of Dependent Variable -.050676  S.D. of Dependent Variable      .17184
 Residual Sum of Squares     .34894   Value of IV Minimand           .10608
 DW-statistic               2.5618    Sargan's    CHSQ( 9)     6.6879[.670]
*******************************************************************************


                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version          *
*******************************************************************************
*                     *                          *                            *
* A:Serial Correlation*CHSQ(   1)=   3.0453[.081]*       Not applicable       *
*                     *                          *                            *
* B:Functional Form   *CHSQ(   1)=   5.4402[.020]*       Not applicable       *
*                     *                          *                            *
* C:Normality         *CHSQ(   2)=   .51275[.774]*       Not applicable       *
```

```
*                     *                          *                           *
* D:Heteroscedasticity*CHSQ(   1)=  11.9391[.001]*       Not applicable      *
```

TABLE 8A: CONSTRAINED EQUATION

```
               Non-Linear Two-Stage Least Squares Estimation
             The estimation method converged after 5 iterations
   Based on Newey-West adjusted S.E.'s Bartlett weights, truncation lag= 10
*******************************************************************************
List of instruments:
 C               T               LKL(-2)         LYL(-2)         DUM90
 DLKL(-3)        DLY(-2)         LYL(-3)         DLYL(-3)        DLKL(-4)
 DLYL(-4)        LL(-1)          DLL(-1)         LEXRATIO(-1)    LEXRATIO(-2)
 LRAIDL(-2)      DLRREML(-1)     LRREML(-2)
 31 observations used for estimation from 1975 to 2005
*******************************************************************************
 Parameter                 Estimate       Standard Error         T-Ratio[Prob]
 A0                         5.3959            .90308             5.9751[.000]
 A1                        -.033043          .0059056            -5.5952[.000]
 LAMBDA                     .83089            .11405             7.2855[.000]
 B2                        -.097449           .050725            -1.9211[.067]
 G1                         .40995            .089993            4.5554[.000]
 G2                        -3.8393            .65035             -5.9035[.000]
 G3                        -.38115            .063556            -5.9971[.000]
 G5                        -.33470            .24285             -1.3782[.181]
*******************************************************************************
 R-Squared                      .60141   R-Bar-Squared                  .48010
 GR-Squared                     .64438   GR-Bar-Squared                 .53615
 S.E. of Regression             .12391   F-stat.    F(  7,  23)    4.9577[.002]
 Mean of Dependent Variable  -.050676   S.D. of Dependent Variable     .17184
 Residual Sum of Squares        .35311   Value of IV Minimand           .10621
 DW-statistic                  2.5698   Sargan's    CHSQ(10)    6.9178[.733]
*******************************************************************************


                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version          *
*******************************************************************************
*                     *                          *                           *
* A:Serial Correlation*CHSQ(   1)=   3.0260[.082]*       Not applicable      *
*                     *                          *                           *
* B:Functional Form   *CHSQ(   1)=   4.8827[.027]*       Not applicable      *
*                     *                          *                           *
* C:Normality         *CHSQ(   2)=   .50889[.775]*       Not applicable      *
*                     *                          *                           *
* D:Heteroscedasticity*CHSQ(   1)=  12.2192[.000]*       Not applicable      *
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

TABLE 9A

AD HOC EQUATION

Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

34 observations from 1972 to 2005. Order of VAR = 2.
List of variables included in the cointegrating vector:
LYL LRAIDL LRAIDL2
List of eigenvalues in descending order:
.52473 .39784 .14868

Null	Alternative	Statistic	95% Critical Value	90%Critical Value
r = 0	r = 1	25.2915	24.3500	22.2600
r<= 1	r = 2	17.2460	18.3300	16.2800
r<= 2	r = 3	5.4731	11.5400	9.7500

Use the above table to determine r (the number of cointegratingvectors).

Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Cointegration LR Test Based on Trace of the Stochastic Matrix

34 observations from 1972 to 2005. Order of VAR = 2.
List of variables included in the cointegrating vector:
LYL LRAIDL LRAIDL2
List of eigenvalues in descending order:
.52473 .39784 .14868

Null	Alternative	Statistic	95% Critical Value	90%Critical Value
r = 0	r>= 1	48.0106	39.3300	36.2800
r<= 1	r>= 2	22.7190	23.8300	21.2300
r<= 2	r = 3	5.4731	11.5400	9.7500

Use the above table to determine r (the number of cointegratingvectors).

Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria

34 observations from 1972 to 2005. Order of VAR = 2.
List of variables included in the cointegrating vector:
LYL LRAIDL LRAIDL2
List of eigenvalues in descending order:
.52473 .39784 .14868

Rank	Maximized LL	AIC	SBC	HQC
r = 0	-20.3891	-35.3891	-46.8368	-39.2931
r = 1	-7.7434	-27.7434	-43.0070	-32.9487
r = 2	.87963	-22.1204	-39.6735	-28.1065
r = 3	3.6162	-20.3838	-38.7002	-26.6302

AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
HQC = Hannan-Quinn Criterion

```
Estimated Cointegrated Vectors in Johansen Estimation (Normalized in Brackets)
 Cointegration with unrestricted intercepts and unrestricted trends in the VAR
********************************************************************************
 34 observations from 1972 to 2005. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LYL             LRAIDL          LRAIDL2
********************************************************************************
                  Vector  1
 LYL                -.092513
                   (  -1.0000)

 LRAIDL              2.0277
                   (  21.9184)

 LRAIDL2            -.14640
                   (  -1.5825)

********************************************************************************
```