THE NEXUS OF RICE MARKET-GDP GROWTH IN CHINA, INDIA, INDONESIA, BANGLADESH AND VIETNAM

ANGEL KOO

KOH GEN YOU

NG LI HONG

NG YONG KANG

WONG CHUN KEAT

BACHELOR OF BUSINESS ADMINISTRATION (HONS) BANKING AND FINANCE

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE

DEPARTMENT OF FINANCE

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DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.
(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.
(3) Equal contribution has been made by each group member in completing the research project.
(4) The word count of this research report is 9544 words.

Name of student:	Student ID:	Signature:
1. ANGEL KOO	13ABB06470	_____________
2. KOH GEN YOU	14ABB04360	_____________
3. NG LI HONG	13ABB03059	_____________
4. NG YONG KANG	13ABB03378	_____________
5. WONG CHUN KEAT	13ABB02797	_____________

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DEDICATION

Firstly, we would like to dedicate our research project to our beloved supervisor, Mr. Go You How for his sincere guidance, advice, valuable supports throughout the completion of this research.

Next, we would like to dedicate our research to our respective family members and friends as an appreciation of their encouragement in completing this research and share our achievements with them.

Last but not least, this research is dedicated to the potential researchers in assisting them in their future studies.

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GDP	GDP growth
RC	Rice Consumption
RP	Rice production
PP	Philips-Perron

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PREFACE

Rice is the staple food for majority of Asian countries and this may influence their economic performance. To investigate either rice consumption or production can explained more portion of GDP growth, dynamic regression model is used in this research.

This research could provide relevant information to several parties such as researchers, academicians, and institutions who tend to understand the rice market.

ABSTRACT

This study examines whether rice consumption or rice production have larger influence on Gross Domestic Product (GDP) growth in China, Bangladesh, India, Indonesia, and Vietnam between the sample period of 1990-2015. The empirical results indicate that rice production has larger influence than rice consumption towards GDP growth. Philips-Perron unit root test has indicated that sample countries' GDP growth show stationary at level and first difference, while only India stationary at level and Indonesia's rice production show stationary in both level and first difference, others show stationary in first difference. For rice production, only India and Vietnam show stationary in both level and first difference, yet others show stationary in first difference. Follow by Granger Causality test and variance decomposition, the results show China bidirectional Granger causes relationship and Vietnam show unilateral Granger causes relationship. Yet, excluding the relationship between rice consumption and rice production, all the variables are explained by each other.

CHAPTER 1: INTRODUCTION

1.0 Background of world rice market

Rice has been a staple food for many Asian countries like China, Japan and India and the rice has been cultivated in Asia for thousands of years. In 2006 until 2010, 91 per cent of rice are produced in Asia and this remain unchanged since the early 1960s. Other than Asian countries, Sierra Leone, Madagascar, and Liberia in West Africa plus Guyana, French Guiana, Suriname, and Panama in Latin America are the only countries that rice accounts for more than 30 per cent of total crop area harvested. Yet, Madagascar, Sierra Leone, Guinea, Guinea-Bissau, and Senegal are the countries that rice contribute more than 30 per cent of caloric intake. In the early 1960s, Asia's per capita rise consumption shows a steady rise from 85 kilograms per year to nearly 103 kilograms per year in the early 1990s (Figure 1.1). During the same period, global per capita rice consumption has rose from 50 kilograms per year to 65 kilograms per year (Figure 1.2).

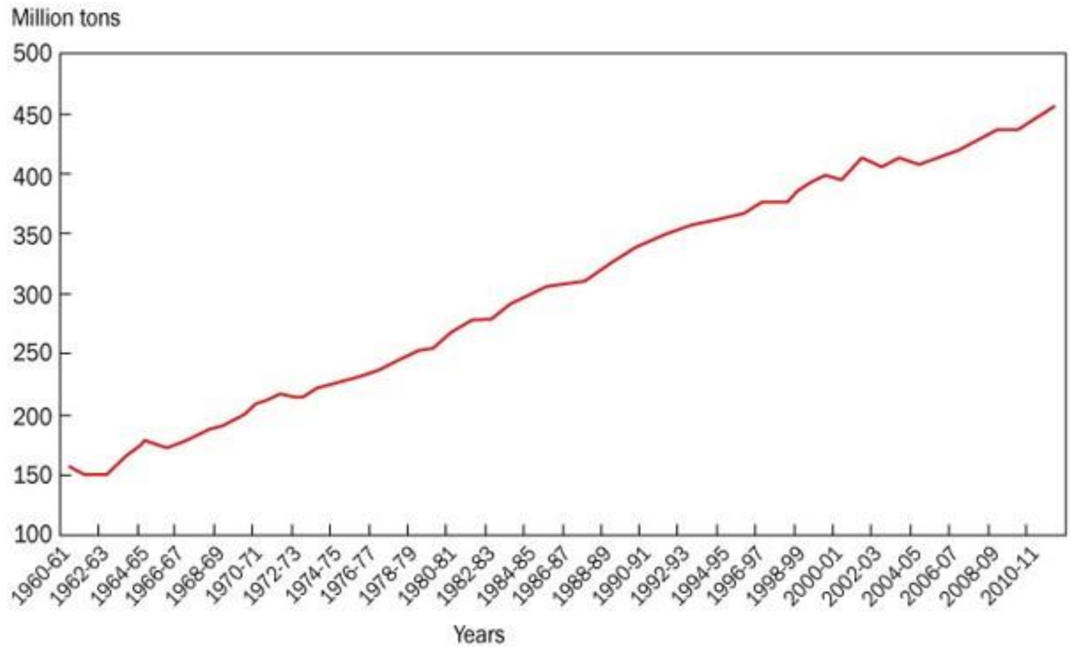


Figure 1.1: Total global rice consumption, from 1960-2011
Data source: PSD online database (USDA)

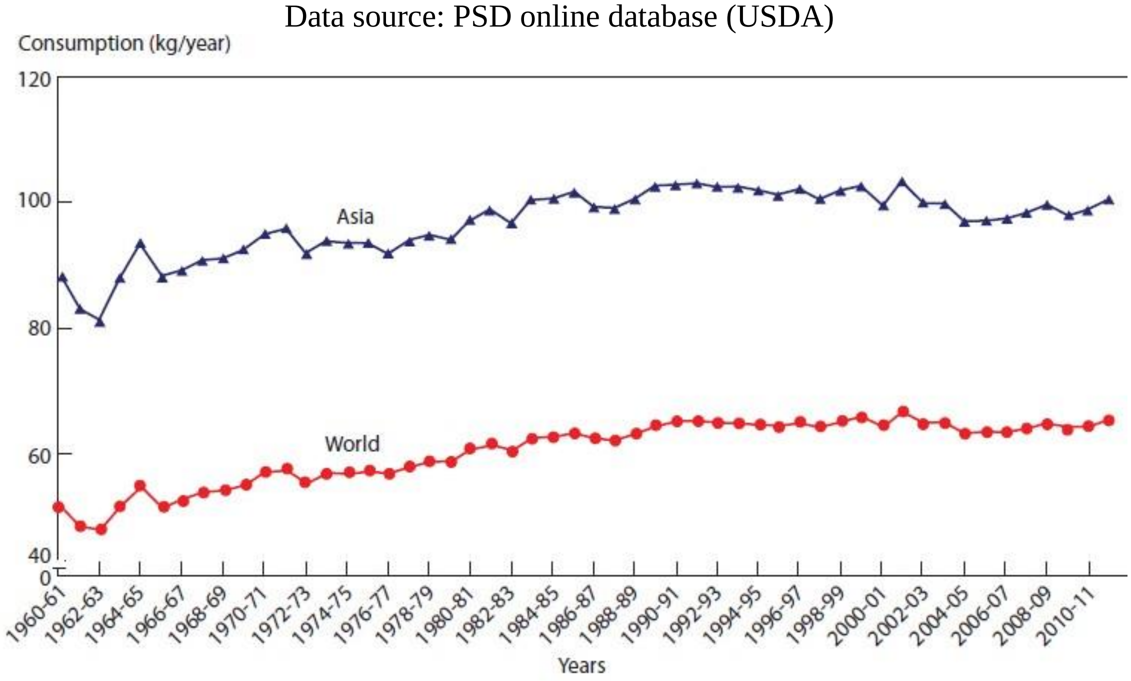


Figure 1.2: Global and Asian per capita rice consumption, 1960-2011
Data sources: PSD online database (USDA) and FAOSTAT population database (FAO)

China, India, Indonesia, Bangladesh and Vietnam are the top five largest rice producers and consumption countries. In February 2016, the annual rice production of China, India, Indonesia, Bangladesh, and Vietnam are 144560, 104800, 35560, 34500, and 28234 thousands metric tonnes (Figure 1.3). The upward trend in Asian per capita rice consumption as consumers has diversified their diet from rice to high-value foods for examples, meat, fruits, and vegetables have been halted by those strong economic growth countries in Asia like China and India since the early 1990s. From 1992 until 2005, per capita rice consumption in Asia declined from 103 kilograms to 96 kilograms. The declining trend in per capita rice consumption has been reversed in last few years and per capita consumption has started rising again even though there is a declining trend in per capita consumption in large countries like China, India, and Indonesia between 1992 and 2005 (Figure 1.4).

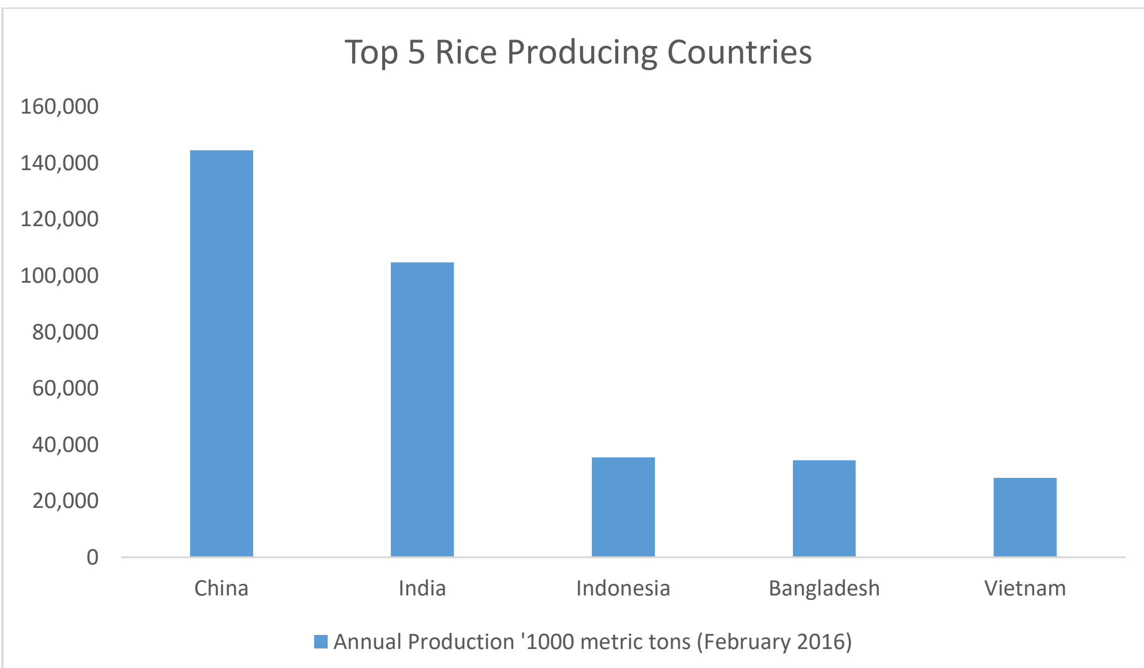


Figure 1.3: Top 5 rice producing countries, 2016
Source: Rice Outlook, Economic Research Service, United States Department of Agriculture (USDA)

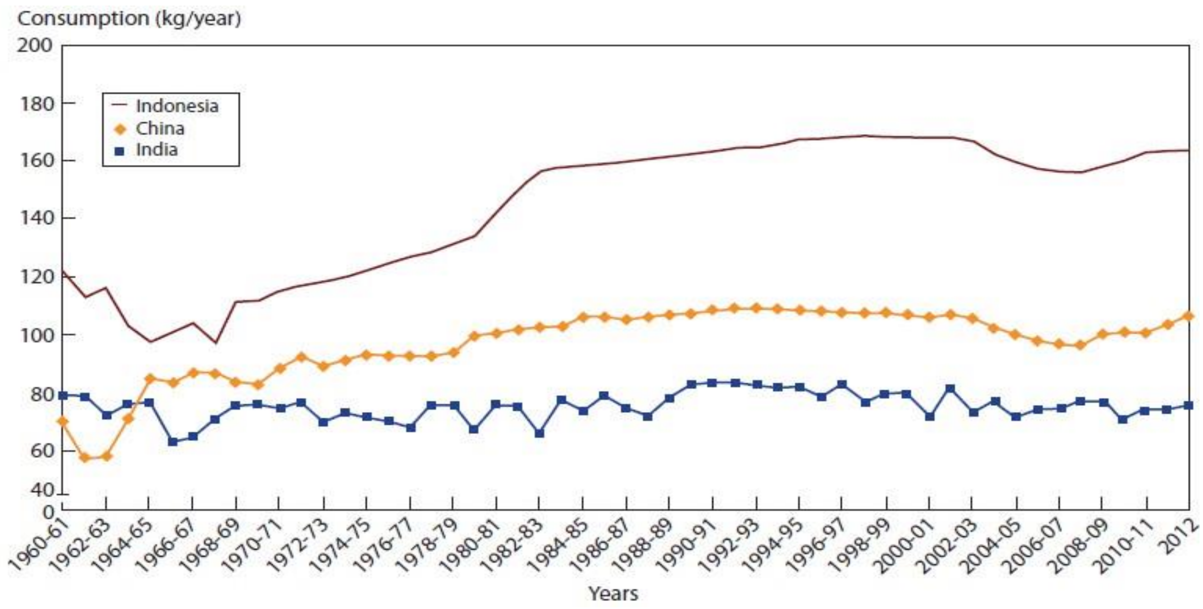


Figure 1.4: Per capita rice consumption in Indonesia, China, and India, 1960-2012
Data sources: PSD online database (USDA) and FAOSTAT population database (FAO)

According to the United Nations' 2010 population projections, Asian population will reach nearly 5 billion by 2035 and 5.15 billion by 2050. The total consumption growth may even exceed population growth if the recent uptrend in per capita consumption in China, India, and Indonesia (International Rice Research Institute, 2013).

GDP would be affected by both rice consumption and production. The study of Chung and Tan (2015) stated that rice consumption would have a positive effect on GDP. However, it would weaken in the long run. In terms of rice production affecting GDP, with sufficient production, local citizens could secure a low priced food source while also increasing employment opportunities. This would also increase the country's GDP.

1.1 Countries background

China

China's traditional culture can be considered a "rice culture" due to the fact that the people of china had cultivated their lands for a few millenniums China.org (2002). Many aspects of ancient China were strongly influenced by rice and had centered on rice for a long time.

China is the largest producer for rice because its agricultural sector has been strong since a long time ago. Other than rice, many other crops are also cultivated in China. The reason is China has the required manpower, land, and climate for the production of these crops, especially rice.

As mentioned earlier, rice has been cultivated since ancient times, mainly around the southern region because of the climate, the availability of water, and the fertility of the land. Rice grows best in high temperature and adequate rainfall, although irrigation is still needed. The northern area of China however, produces a different type of rice due to low temperatures, rare rainfalls, and so on (International Rice Research Institute, 2013). Figure 1.5 as below shows the distribution of the areas where rice is grown.

Figure 1.5: Rice production areas in China, 2016
Source: www.chinasage.info

Next, regarding the consumption of rice in China, China holds the top spot in consumption of rice too. Rice represents two-thirds of the Chinese' staple food and therefore can be found in most menus of the Chinese restaurants, the main reason behind it is the culture of the Chinese. Since ancient times, other than being eaten with other dishes, rice also has many functions. For example, glutinous rice can be wrapped in bamboo leaves to form "zong zi" where Chinese eat every year to commemorate the Dragon Boat festival, and rice can also be fermented to produce rice wine (Chinasage.com, 2016). Rice has been a part of the Chinese culture, and this is the main reason why China's rice consumption is the largest in the world.

The production of rice in China had declined since the mid-1970s, this was caused by the government's policy of diversifying the crops that are planted in the countries. While production had decreased, the consumption on the other hand increased as the population of China grew (International Rice Research Institute, 2013). To overcome this problem, the Chinese government had implemented several strategies to increase the production of rice in China. The first program introduced is the machinery subsidies, targeting rice farmers to help them monetarily. In addition, the government also provides subsidies to farmers who grow different varieties of rice. Other than that, the Rice Price Guarantee Scheme introduced by the government also protects the farmers if problems were to arise (International Rice Research Institute, 2013).

As the population of China rises, the country would face problem constraining their crops' growth. China should increase their production of rice by 20 per cent before 2030 to achieve the domestic rice consumption requirement per capita to maintain the current level. The opportunities that the Chinese government can utilize to improve production are simple, it is to mitigate the constraints set by the policies and developing varieties of hybrid rice. The rice should hold several qualities: increase the crops potential, to be able to resist heat and drought, to overcome pests and diseases, and so on (International Rice Research Institute, 2013).

India

Since ancient times, rice has been cultivated in India. The proof for the statement can be found from Yajur Veda text, where rice was first mentioned there (Rice Knowledge Management Portal, nd.). The Indians have a saying that the rice grains should be close like brothers, but not stuck together (Binney, 2006). The people also believe that rice is a symbol of prosperity and fertility. From these statements, we can see that rice plays an important role other than being a simple source of food for the people in India.

India, being the second largest country in the production and consumption of rice has achieved this ranking due to a few reasons. For production, firstly, the climate of India is tropical monsoon, meaning that they are able to get sufficient rainfall for the cultivation of rice. Secondly, is the labour force. India is the second most populous nation in the world, and the country is a developing country. Data from International Rice Research Institute (2013) showed that 18 per cent of the country's GDP comes from agriculture, but this sector has provided about 51 per cent of the country's employment.

Next, for the consumption Figure 1.6, India is considered a poor country and most developing and poor countries rely on rice as their main food source. It can also be seen that rice represents the staple food for over 50 per cent of the nation's total population (International Rice Research Institute, 2013). Due to rice being cultivated since ancient times, eating rice has been a culture for the people in India.

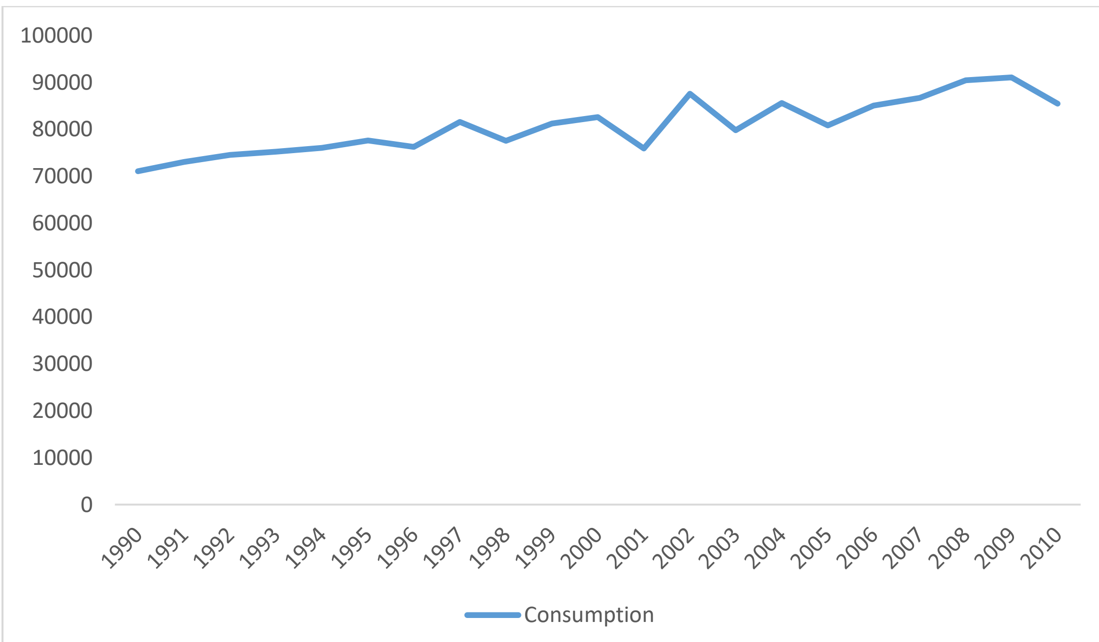


Figure 1.6: Rice consumption '000 metric tonnes, 1990-2010
Data retrieved from Bloomberg (2016)

To increase the production of rice in India, the government has supported India by initiating several development schemes. For example, Special Rice Development Program (SRPP) and National Food Security Mission (NFSM) Promotion of Hybrid Rice (International Rice Research Institute, 2013). Other than that, some policies were also implemented to pump up the production, such as subsidies, ranging from fertilizer to irrigation, electricity, seeds, machinery, and food. The Ministry of Agriculture in India also implemented a Production and Distribution of Quality Seeds Scheme, ensuring quality seeds of various crops are available at prices that the farmers can afford (International Rice Research Institute, 2013).

Even though India is the second largest rice producing country, India also faces several constraints during production. The main constraint is the weather, the rainfall in India is irregular and may cause drought or flood problems (International Rice Research Institute, 2013). Other constraints include land, and other inputs. Insect pests also pose a threat to the rice production.

The opportunities that India has and can utilize to improve their production is to develop the facilities that are needed for the production of rice, such as watering facilities, subsidies, fertilizing, and so on (International Rice Research Institute, 2013).

Indonesia

Rice is a strategic commodity that deeply influences the social issues, economy, rural development, politics and employment in Indonesia (Dawe, 2010). It is the most important staple food for Indonesian people and it contributes as an essential element of rural development in Indonesia. It holds the central place in Indonesian culture and Indonesian cuisine. In the aspect of employment, rice sector plays a dominant role in generating employment that is about 21 million households are engaged in rice production.

Indonesia is known as the world third highest rice production. However, it is being used by 93 per cent of its population as shown in Figure 1.7. In order to fulfil a high demand of rice, Indonesia pays heavy amount on importing rice that imbalances its economy, Figure 1.8. A trade deficit occurred when import was greater than export. As a result, GDP of Indonesia was decreased. (Tumrani, Pathan, & Suleman, 2015).

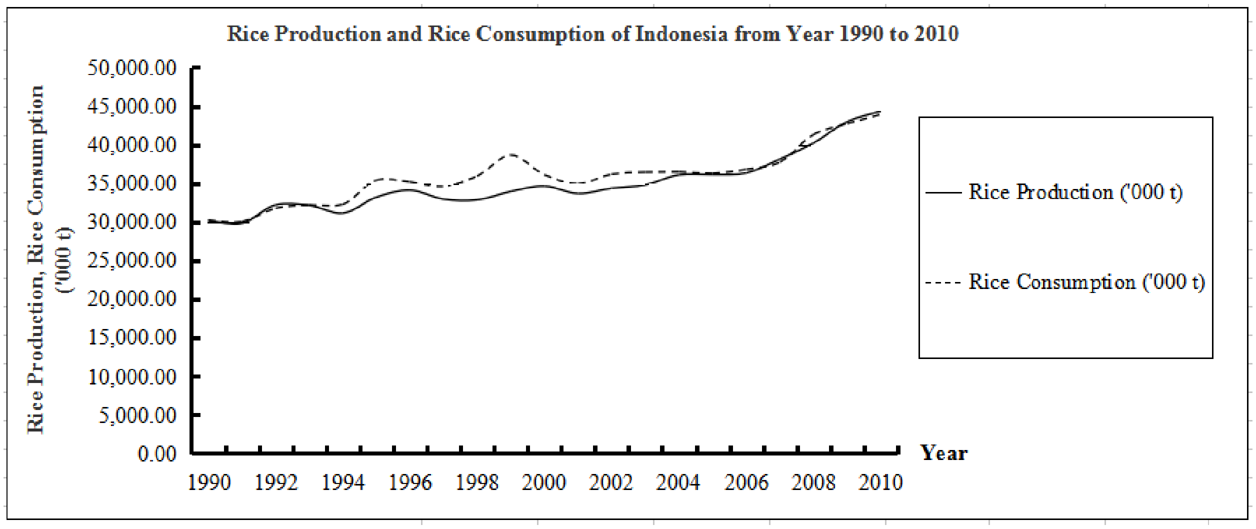


Figure 1.7: Rice production and consumption of Indonesia, 1990-2010
Source: International Rice Research Institute (2013)

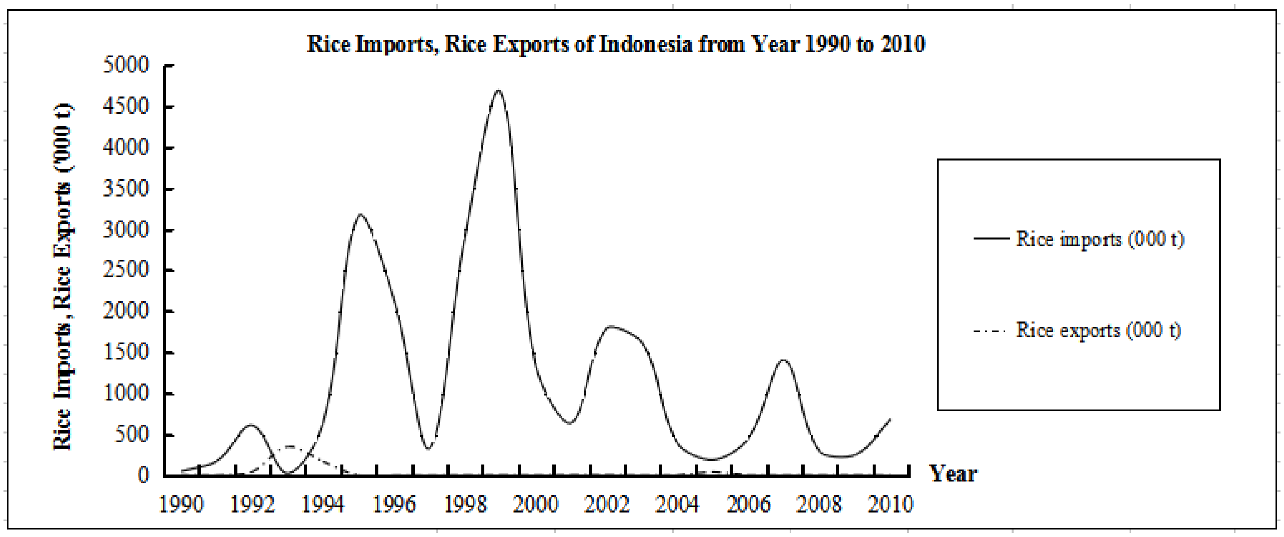


Figure 1.8: Indonesia rice import and rice export, 1990-2010
Source: International Rice Research Institute (2013)

In order to avoid food shortage and huge imports of rice, Indonesian government has adopted the economic and sustainable policy of rice production to make sure the self-sufficiency in food grains. For example, in the Rice transmigration scheme 2009, Indonesian government had done a revival of the Suharto-era transmigration scheme wherein large numbers of farmers from Java would be provided land on the outer islands to grow rice. On the other hand, Merauke

Integrated Food and Energy Estate, MIFEE (2009) focused a remote section of the province of Papua for major commercial-scale agricultural activities including rice. There is a proposed allocation of 1.2 - 2.5 million ha for commercial companies to produce food and energy crops with a 12-ha minimum farm size (International Rice Research Institute, 2013).

Bangladesh

Bangladesh is the fourth largest rice producer in the world. There are low, flat, and fertile land in such country and there are about 230 rivers and a total length of 24,140 kilometres tributaries flow across the country. Since Bangladesh enjoys a subtropical monsoon climate, the alluvial soil is continuously enriched by heavy slit deposited by the rivers through frequent flooding during the rainy season. Yet, agriculture in Bangladesh covers 70 per cent of the land area (International Rice Research Institute, 2013).

The rice area harvested increased form almost 10 million hectare in 1995 to almost 12 million hectare in 2010 even though Bangladesh's arable land decline in 1971. Rice yield in Bangladesh also from 2.7 tonnes per hectare in1995 increased to almost 4.3 tonnes per hectare in 2010. The growth in rice production is nearly doubled from over 26 million tonnes in 1995 to 50 million tonnes in 2010 because the increased in rice area harvested and rice yield. Bangladesh has almost 149 million population and rice is the staple food for them. The annual milled rice consumption in 2009 was 173.3 kilograms. Bangladesh has increased rice production over many years, so the imports of rice has declined from about 1 million tonnes in 1995 to a mere 0.017 in 2009 but slightly increased to 0.66 million tonnes in 2010 and the exports are began in the 2000s (International Rice Research Institute, 2013).

The United States Agency for International Development (USAID), Asian Development Bank (ADB), International Development Research Centre (IDRC) of Canada, and Rockefeller Foundation supported International Rice Research Institution's (IRRI) initiatives to help Bangladesh in its effort to overcome the rice insufficiency in 1970. Improving cultivation practices in various cropping patterns, managing water, nutrients, rodents, insect pests, and farm mechanization are the efforts that have been focused.

The population keep increasing yet lead to the difficulty in sustaining the rice production level. Drought, flood and the fewer resources, for example, land cause their production difficult to maintain in the same level of rice production (International Rice Research Institute, 2013). The government has implemented major rice policies to increase production and reduce imports but they still imported some rice in order to control domestic prices for rice. The government has provided subsidy support for example, cash subsidies to small and marginal farmers.

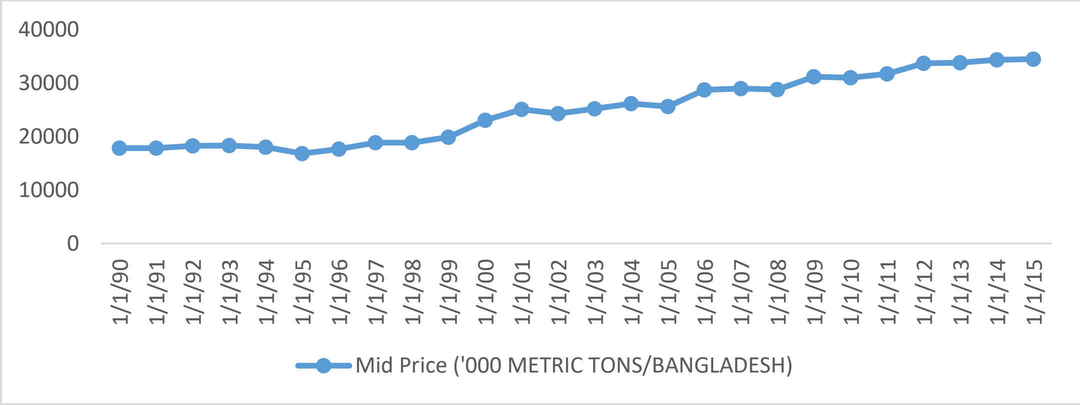


Figure 1.9: Mid Price '000 metric tonnes, 1990-2015
Source: Bloomberg (2016)

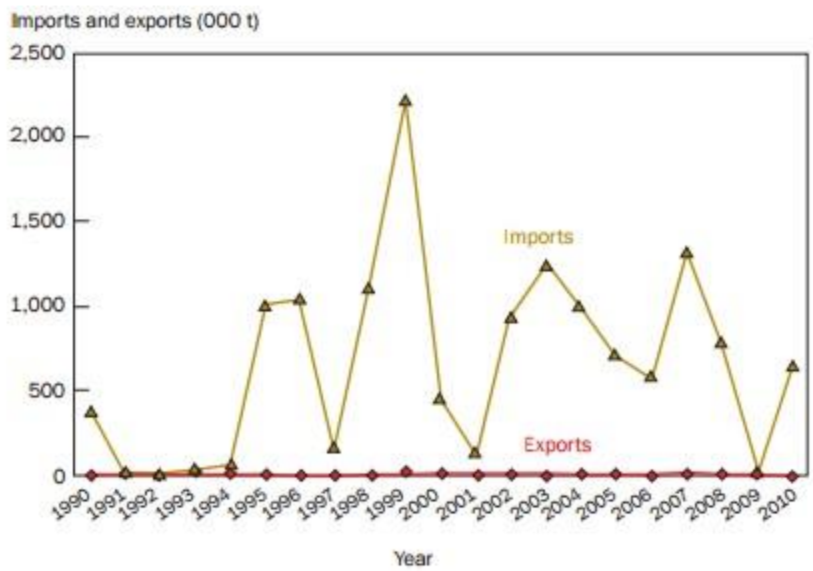


Figure 1.10: Imports and exports '000 tonnes, 1990-2010
Source: International Rice Research Institute (2013)

Vietnam

Rice is an important agriculture product to fulfil 89 million Vietnamese' food security. The rice demand for Vietnamese is considered as higher than other countries. Besides, rice market can be used to promote economic growth by generating revenue through exportation and providing job opportunity for 60 per cent of the country's labour force (Vietnam Trade Promotion Agency, 2011). Based on the statistic, the population grew from 2005 to 2010. There were about 87 million population in 2010. The country's total labour force was above 47 million, with more than 50 percent of their resident are engaged in agriculture (International Rice Research Institute, 2013).

Before 1975, there were two rice areas, the northern delta and the southern region, comprising of 1.8 million and 2.7 million hectares respectively which produced between 2.4 to 3 million tonnes of rice a year (Hong Duc, 2011). During the time, the productivity of rice was very less since they were mainly focusing on old grain. In 1979 to 1985, rice production increased from

11.8 to 15.9 million tonnes per year. However, the Vietnamese were still facing food shortage because of border war, debt payment and ineffective management under cooperative farm of state economy (Hong Duc, 2011). In addition, the Doi Moi policy was implemented by the Vietnam government in 1986. This policy causes the country economy getting better and encouraging the development of agriculture (Vietnam Trade Promotion Agency, 2011). The main purpose of running this policy is to promote a multi-sector economic system while encouraging the private sector. Vietnam has transformed to commercialised agriculture since it has large area of land for agriculture production. Over the years, Vietnam has become the second largest rice exporter in the world. For this reason, the livelihoods of farmers have significantly improved by exporting rice (Tran Thi Que and To Xuan Phuc, 2016).

The rice production has increased significantly over the years as shown in Figure 1.11. The average production increased from 13 million metric tonnes in 1995 to almost 30 million metric tonnes in 2010 (International Rice Research Institute, 2013). It is due to the advancement technology, sufficient fertilizer and the land used for planting rice has expanded under irrigation account for high yields in recent years. The area with the highest rice production is Red River Delta in the north and Mekong River Delta in the south with 1.1 million hectares and 4.1 million hectares of rice field, respectively (Vietnam Trade Promotion Agency, 2011). These two places are suitable for planting rice because the climate is moist and tropical type (Moussons, 2006). Ayambila, Kwadzo and Asuming-Brempong (2008) revealed that rice production in Ghana significantly has contributed 39.5 per cent to GDP. The policy maker had put attention on the domestic rice production in order to reduce dependency on imports.

If the local production is active, the citizens could maintain a stable and low priced source of food. Besides, the macroeconomic variables such as employment rate and household income would be increased as the rice production provides job opportunity to the people. Therefore, rise in employment rate and household income would directly increase GDP. On the other hand, Chung and Tan (2015) found that change in household income and rice price were one of the factors that affect rice consumption. As the rice price increase, it would reduce the volume of rice consumption in the long run. Furthermore, there is positive relationship between income and rice consumption. An increase in consumption will increase the Vietnam's GDP but the effect is not large in the long run.

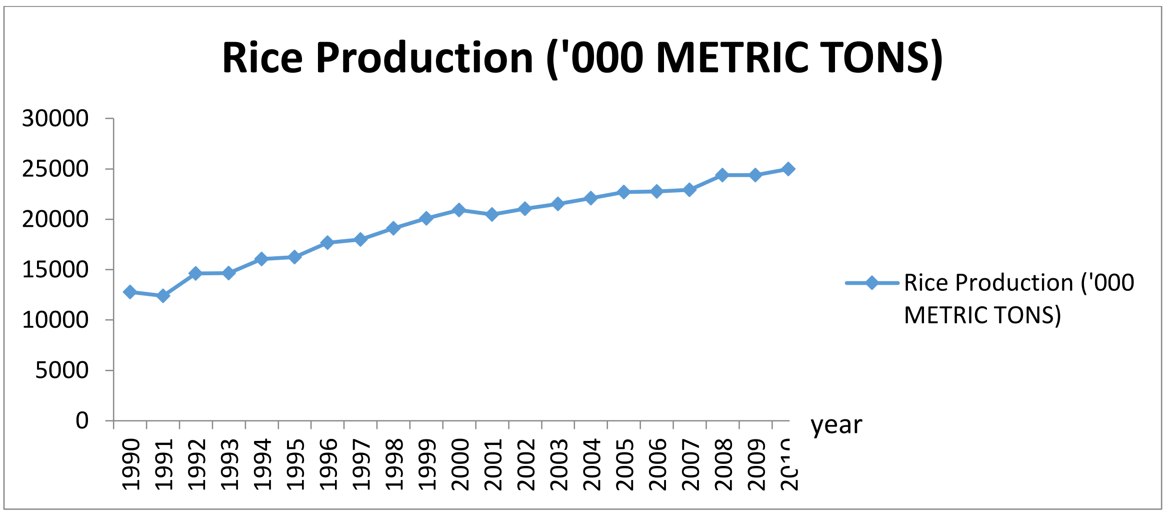
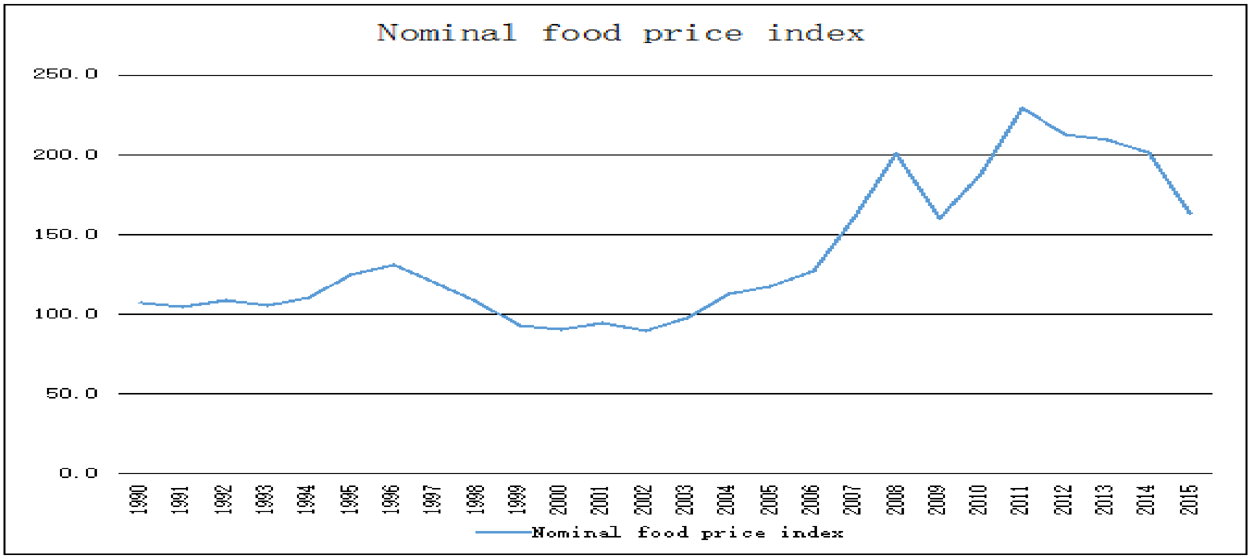


Figure 1.11: Rice productions from1990-2010
Source: International Rice Research Institute (2013)

1.2 Problem statement

The first reason we chose China, India, Indonesia, Bangladesh, and Vietnam is due to the food shortage issue. Food shortage is a critical issue in the world. China has reported that their local production is insufficient to fulfil the local demand. Therefore, the country requires importing foods from other countries. In the long run, not only will China's economy be affected, the global economy will also be affected as well due to the rising food prices (Wright, 2014; Song, 2013; Blue & Green Tomorrow, 2014). Evidence of rising food prices is shown in figure 1.12 below.

Figure 1.12: Nominal food price index (2002-2004 = 100), 1990-2015



Source: Food and Agriculture Organization of the United Nations

In addition, the price of rice has shot up in the early 2008's due to the increase in demand and decrease in supply. This has troubled the less developed countries because of two reasons. First, the domestic rice price swelling. Second, the people rely on rice as their staple food (Dawe, 2010).

The reason for choosing China, India, Indonesia, Bangladesh, and Vietnam as our samples because they represent the top five countries in the production and consumption of rice. From here, it shows that the rice market plays an important role in the economy of these countries. Rice production is considered one of the most important economic activities in the world and represents the most crucial source of employment and income for rural people from underdeveloped countries (International Rice Research Institute, 2013).

Following that, the cause of food shortage is the imbalance between the production and consumption of the food, which in our case is rice. The rice market will also affect the economy of the country. Therefore, production of rice, consumption of rice, and GDP growth has been chosen as the indicators for our research.

1.3 Research Question

- To what extent rice production and consumption contribute to economic growth in China, India, Indonesia, Bangladesh, and Vietnam, respectively?

1.4 Research Objective

- To examine either rice production or consumption significantly affect economic growth in China, India, Indonesia, Bangladesh, and Vietnam, respectively.

1.5 Significance of Study

This study provides the expected contribution to governments and rice producers in making decisions. Firstly, it gives the concepts and better understanding about the impacts of rice production and rice consumption toward economic growth of a country. This finding from the study can provide which indicator in the rice market should be focused by the government in reallocating financial resources from the wealthy to those that are most in need. For example, to ensure food security for the nation, a government may improve the infrastructure development and research and development (R&D) of rice. While the introducing of input subsidies, tariff and quota on rice help to reduce the cost of production and strengthen the competitive force of local rice producers. To ensure rice supply for consumers at reasonable prices, a government may take this information into consideration to implement guaranteed maximum price on rice.

Furthermore, this study suggests a benchmark to rice producers in making decisions. The finding on rice production and rice consumption can be used in determining the market price of rice in the future. As a result, rice producers are able to make appropriate pricing decisions based on the demand from consumers in the market. Furthermore, it may enable rice producers to predict rice demand so that there is always enough rice to fulfil customer orders with 3short lead times.

CHAPTER 2: LITERATURE REVIEW

2.0 Overview

This chapter provides a systematic review regarding the effect of rice production and consumption on the gross domestic product (GDP). This chapter consists of two sections. For the first section, the existing finding on the relationship between rice production and GDP is reviewed and discussed. The following section is to provide a discussion on the findings related to the relationship between rice consumption and GDP.

2.1 Rice production

Rice production only loses to the production of wheat in terms of volume and both these crops uses up to a quarter of the world's arable land (Barker, Herdt, Rose and Rose, 1985). The authors also stated that most farmers of these rice producing countries allocate more than fifty per cent of the farm labour force to the production of rice. Additionaly, the authors also mentioned that if a country manages to create food surpluses through rice production, that country will be able to achieve economic development.

Koo, Karmana and Erlandson (1985) studied the analysis of demand of rice in Indonesia over the period of 1960-1980. The Independent variables include the price of rice, maize, and income per capita were regressed with the annual rice consumption per capita. By using OLS approach, the results indicate that there is a positive relationship between the annual demand of rice for the price of rice and maize.

According to Fairhurst and Dobermann (2002), rice production has contributed to more than 25 per cent of gross domestic product (GDP) in Asian countries such as Bangladesh and Vietnam. The authors have analyzed the population, rice production and consumption and changes in rice trade around the world with the sample period between 1990 and 1998. Rapid growth in rice production has an advantage of lower rice price for poor urban and rural consumers due to the volume of supply over demand. Therefore, the growth of rice production will help Asian countries to alleviate poverty.

Economic factors affecting rice production in Thailand were also examined by Sachchamarga and Williams (2004) over the period of 1971-1999. The explanatory variables used in the empirical model include lagged area planted, the annual amount of rainfall, paddy rice prices, and the availability of agricultural labour. The results suggest that paddy fields in Thailand are more responsive to changes than those of previous years, the amount of rainfall, and the availability of agricultural labour than to changes in paddy rice prices.

In addition, Odusina (2008) stated that the imperfect of the Nigeria's agricultural sector to satisfy their local demand can cause a country to face rice importation. Besides, the author also found that the rapid population growth is also one of the reasons on rice importation. If the local production can fulfill their citizen demand, it will bring a significant breakthrough in the reformulation of economic policies as it affects food importation and able to save the country some foreign exchange. Odusina (2008) reported that the volume of rice imports Nigeria increased every year. The over dependence on imports will cause the country to face budget deficits and depreciation of home currency.

Other than that, Diao, Hazell and Thurlow (2010) conducted several debates by using six countries located in African, namely Ethiopia, Ghana, Kenya, Rwanda, Uganda and Zambia as their sample. The debates are concerned about the potential roles of agriculture and industry in improving African economy development and poverty reduction where economy-wide simulation model is used. The empirical results show that growth in agriculture is more significant in poverty reduction as compared to non-agricultural growth. A 1 per cent increase in Ethiopia's annual per capita GDP which generated from agricultural growth will result in 1.7 per cent reduction in the country's poverty headcount rate per year, while non-agricultural sector able to reduce poverty rate by 0.7 per cent. Such finding is consistent in their selected six countries. This was due to most of the households that live in rural area are dependent on agricultural activities as their major source of income. Besides, urban citizens also have the benefit from the booming of agricultural growth because the rise in production of crops would lower the foods prices. Hence, an increase in rice production would promote economy growth and alleviate poverty. Thereby, it would indirectly increase GDP.

Meanwhile, Vijulie, Manea, Tîrlă, Matei, Preda and Cuculici (2016) studied on the advantages and disadvantages of reviving the rice production in the south of Romania. The authors performed diachronic analysis from year 1950 to 2014. They stated that the benefit from rice production exceed its drawback which consist 75 per cent pros and 25 per cent cons. The revival of rice production could attract foreign direct investment, generate job opportunity and increase income by collecting additional taxes and protecting biodiversity. As a consequence, it would affect both economic performance and environmental condition. However, some of the results indicated that expanding rice production would reduce the land for grazing due to conversion. Such conversion has made unstoppable conflict between farmers and livestock breeders. Moreover, high water demands for irrigations and use of pesticide were found as the reasons for local authorities to against the recovery of rice paddy.

2.2 Rice consumption

Consumption of rice plays an important role in the world economy. The market price will become volatile since the reduction of rice consumption causes over-supply of rice in the market. It brings benefit to the importing countries as they can enjoy cheaper prices while the rice producers may suffer and the poverty condition in the rural area might become more serious.

Abdullah, Ito and Adhana (2006) found that an increase in per capita income was the main factor in reducing rice consumption in the Asian region. Their study focused on Bangladesh, China, India, Indonesia, Myanmar, Philippines, Sri Lanka, Thailand and Vietnam with the sample period of 1967-2004. Rising income levels mean that the country's economy was performing well. High cost quality foods were more preferred by consumers. However, this decline could be offset by the population growth. Furthermore, the authors mentioned that there were a few Asian countries that preferred to import rice although they could achieve self-sufficiency. The reason was the countries allocated part of their production resources to more profitable activities. In the long run, these Asian countries would lose one of their vital strengths.

Since consumers aimed to maximize their satisfaction based on their limited money income as compare to the substitution of particular goods, Odusina (2008) adopted the consumer behaviour theory and concluded that income, price and household size have significant effect on rice consumption. For local rice, there are negative relationship between income and rice consumption while positive relationship between price and rice consumption. Furthermore, the sign of the regression coefficient for household size was positive too. It means that as household size increased, people consume more local rice.

From the perspective of imported rice, for those have focused on the rice quality were willing to buy imported rice as their income increased. From the perspective of price, result showed that people preferred to consume rice at a lower price. As the price rise, lesser imported rice would be consumed. From the perspective of household size, there was a positive relationship between household size and imported rice consumed. For example, if the household size was small, they would increase their consumption on the amount of imported rice.

Furthermore, Bamidele, Abayomi and Esther (2010) used a multinomial logit model to investigate the nature and rice consumption pattern in the case of Nigeria. Their survey was conducted by using 110 rice consumer households which came from two villages and six towns in Kwara State. Their result indicated that the education level has a significant influence on the consumption pattern. For example, people with a higher education level preferred to import rice due to its superior quality. In addition, larger households would consume cheaper local rice as compared to imported rice because they have less per capita income than small households. Besides, the occupation is the main element in determining a consumers' income level. In conducting the survey, most of their respondents were farmers while a small portion were in trading and civil service job. Based on their respondents, they found that farmers with a lower disposable income more preferred to consume the domestic rice instead of imported rice.

Moreover, Serkan (2012) conducted a study on the relationship between change in income and rice consumption in the case of China and India. By using the data of 1965-2007, the author's results demonstrated that rice could be considered as a luxury food or staple food. This suggested that recently both selected countries were slowly classified into luxury food based on the preferences of the citizens of the countries. If they considered rice as a luxury food, an increase in income would increase the amount consumed, and vice versa.

In the case of Malaysia, Rajamoorthy, Rahim and Munusamy (2015) studied the future rice demand based on the data of 1963-2013. They used variables such as production, consumption, import and export in their analysis and revealed that the issue of high demand with decreasing supply of rice could only be solved by importation in the coming years. Although Malaysia is a net importer in the rice market, it is still exporting their rice to other countries. Since rice is a staple food for Malaysians, if they often rely on imported rice, it will contribute to a negative impact on the country's economy.

However, Mustapha (1996) stated that rice import could result in cost saving but it is risky for security reasons with the unpredictable consumption pattern in the future. For example, the implementation on subsidy policy that aims to increase the local production would increase the government expenditure. As a consequence, it would influence the fiscal budget as well. To overcome the shortage problem, the author suggested that the amount of rice exported should be reduced in the short run.

Wudil, Katanga and Nasiru (2015) examined the econometric effect of rice production and importation on domestic consumption in Nigeria over the period of 1999-2013. Based on Granger causality test, their result showed a unidirectional relationship between total national rice importation (TNRI) and total national rice consumption (TNRC), TNRI and total national rice production (TNRP). However, they did not find any evidence of causality between TNRP and TNRI. To enhance their result reliability, they further provided the following statement as below.

"Nigeria need to improve its local rice production in order to meet the increasing domestic consumption owing to its significance as the main diet of typical Nigerians as well as the main source of livelihood to its value chain actors in the country."

Wudil, Katanga, and Nasiru (2015)

The most of past findings demonstrate on how rice consumption and production promote economy development and alleviate poverty. However, researchers are found to overlook on how rice consumption and production influence GDP growth and vice versa. To fill the gap, this study attempts to examine whether rice consumption or production has more effect on GDP growth.

Table 2.1: Summary of production on rice market

Authors (year)	Journal	Countries	Sample period	Methodology	Finding
Barker, Herdt, Rose and Rose (1985)	The rice economy of Asia	Asian countries	-----	-----	Large volume of rice production could achieve economic development.
Koo, Karmana and Erlandson (1985)	Analysis of demand and supply of rice in Indonesia	Indonesia	1960-1980	OLS approach *Demand function:* $\boldsymbol{Y}$:Quantity of rice demanded per capita, per year $\boldsymbol{X_1}$:Retail price of rice per kilogram $\boldsymbol{X_2}$:Retail price of maize per kilogram $\boldsymbol{X_3}$:Net annual income per capita *Supply function:*	Price of rice and maize are positively affected the annual demand of rice. Paddy price is positively affected rice production. Maize and cassava price are negatively affected rice production.

				$\boldsymbol{Y}$:Annual paddy production $\boldsymbol{X_1}$:Producer paddy prices per kilogram $\boldsymbol{X_2}$:Rural maize prices per kilogram $\boldsymbol{X_3}$:Rural cassava prices per kilogram	
Fairhurst and Dobermann (2002)	World	Global	1990-1998	-----	Rice production contributes 25 per cent of GDP to countries such as Vietnam and Bangladesh.

Sachchamarga and Williams (2004)	the economic factors affecting rice production in Thailand	Thailand	1971-1999	OLS approach $\boldsymbol{Y}$: Area planted (1,000 $rais^{a}$) $\boldsymbol{X_0}$: Lagged area planted (1,000 $rais^{a}$) $\boldsymbol{X_1}$: Average rainfall (millimeters) $\boldsymbol{X_2}$: Paddy prices (baht/tonne) $\boldsymbol{X_3}$: Agricultural labour Force (1,000 workers)	Paddy fields in Thailand are more responsive to changes than those of previous years, the amount of rainfall, and the availability of agricultural labour than to changes in paddy rice prices.
Odusina (2008)	Middle-East Journal of scientific research	Nigeria	-----	-----	Breakthrough in the local rice production will affects rice importation and save foreign exchange.
Diao, Hazell and Thurlow (2010)	World Development	Ethiopia, Ghana, Kenya, Rwanda, Uganda and Zambia	-----	Economy-wide simulation model	Agriculture growth has more effect on economy growth and poverty

					reduction as compared to industrial growth.
Vijulie, Manea, Tîrlă, Matei, Preda and Cuculici (2016).	Procedia Environmental Science	South of Romania	Diachronic analysis (1950-2014)	Field observation, diachronic analysis using GIS technique and survey	Revival of rice crop can increase income by collecting additional taxes, generating new job and environmental advantage.

Table 2.2: Summary of consumption on rice market

Authors (year)	Journal	Countries	Sample period	Methodology	Finding
Mustapha (1996)	Jurnal Ekonomi Malaysia	Asian countries	1979-1990	Forecasting models	Rice import can result in cost saving but it is risky for security reasons with the unpredictable consumption pattern in the future.
Abdullah, Ito and Adhana (2006)	In Proceedings for Workshop and Conference on Rice in the World at Stake	Bangladesh, China, India, Indonesia, Myanmar, Philippines, Sri Lanka, Thailand and Vietnam	1967-2004	-----	Income per capita negatively affects rice consumption.
Odusina (2008)	Middle-East Journal of scientific research	Nigeria	-----	-----	Breakthrough in the local rice production will affect rice importation and save foreign exchange.
Bamidele, Abayomi and Esther (2010)	Journal of Agricultural Science and Technology	Nigeria	-----	Descriptive statistics and multinomial logit model	Education level, household size and occupation have significant effect on rice consumption pattern.

Serkan (2012)	Scientific Research and Essays	India and China	1965-2007	Log-inverse-log model	If rice as a luxury good, there will be positive relationship between per capita income and rice consumption.
Rajamoorthy, Rahim and Munusamy (2015)	Procedia Economics and Finance	Malaysia	1963-2013	Economic equation	High demand with decreasing supply of rice can only be solved by importation in the coming years.
Wudil, Katanga, and Nasiru (2015)	The econometric effect of rice production and importation on domestic consumption in Nigeria	Nigeria	1999-2013	Granger causality test $\boldsymbol{Y}$:Total National Rice Consumption (TNRC) $\boldsymbol{X}_1$:Total National Rice Importation (TNRI) $\boldsymbol{X}_2$:Total National Rice Production (TNRP)	There is a unidirectional relationship between TNRI and TNRC, TNRI and TNRP but no causality between TNRP and TNRI.

CHAPTER 3: DATA AND METHODOLOGY

3.0 Overview

In this chapter, the study presents the methodologies used such as unit root test, vector autoregressive (VAR) model, variance decomposition, and Granger causality test.

3.1 Data sources

For this research, we used time series data of GDP per capita growth, rice production, and rice consumption for 5 countries spanning from 1990 to 2015. The 5 countries are China, India, Indonesia, Bangladesh, and Vietnam. The data for the rice production and consumption were in metric tons, therefore we recalculated into a natural logarithm. All data are retrieved from Bloomberg Database.

3.2 Methodology

A unit root test is used to detect the time series variable is stationary or non-stationary (Gujarati& Porter, 2009). If non-stationary is found in variables, the estimates of the variable will change over time. This will lead to misleading result and causes undesirable outcome. Unit root test must be conducted before the cointegration test. If non stationary is presented, a cointegration test should be formed. In contrast, cointegration test can be exempted when the null hypothesis is rejected.

The Phillips-Perron (PP) test is further used to investigate for stationarity of rice production and consumption against gross domestic product (GDP).

3.2.1 Phillips-Perron (PP) test

Philips-Perron test is a non-parametric statistical method to incorporate an automatic correction to the DF procedure to allow for autocorrelated residuals. In addition, asymptotic distribution of the PP test is the same as the ADF test statistic, which normally provides the same conclusion with the ADF test. Hence, we can make the same conclusion as long as the ADF test result tallies with the PP test result (Brooks, 2008). Two models are applied in this study, which are the constant model and the constant model with a trend.

3.2.2 Vector autoregressive (VAR) model

The term “autoregressive” is due to the appearance of the lagged value of the dependent variable on the right-hand-side. Next, the term “vector” is due to the fact that we are dealing with a vector of two or more variables. VAR superficially resembles simultaneous-equation modeling in that it considers several endogenous variables together. However, each endogenous variable is explained by its lagged values and the lagged values of all other endogenous variables in the model; usually, no exogenous variables are present in the model. Before estimating a VAR model, the equation in the system must be identified. The identification is often achieved by assuming that some of the predetermined variables are present only in some equations.

To explain how a VAR is estimated, each equation is assumed to contain k lag values of GDPG, RP, and RC in this case, one can estimate each of the following equations by OLS.

$$GDPG_{1t} = \alpha + \sum_{j=1}^{k} \beta_j GDPG_{t-j} + \sum_{j=1}^{k} Y_j \Delta RP_{t-j} + \mu_{1t} \quad (3.3.1)$$

$$GDPG_{1t} = \alpha + \sum_{j=1}^{k} \beta_j GDPG_{t-j} + \sum_{j=1}^{k} Y_j \Delta RC_{t-j} + \mu_{1t} \quad (3.3.2)$$

Where the μ stand for the stochastic error terms, called impulses, innovations, or shocks in the language of VAR.

3.2.3 Granger causality test

The Granger causality is used to examine whether one group of series is reliable in predicting another group of series. The relationship between the variables does not justify that there is an existence of causality or direction of influence. The formula for the test statistic is as below:

Test statistic: Wald F test

$$F = \frac{(SSE_{Reduced} - SSE_{Full})/(K_{Full} - K_{Reduced})}{SSE_{Full}/(n - K_{Full} - 1)}$$

Critical value: $F_{\alpha}(K_{Full} - K_{Reduced})$, $(n - K_{Full} - 1)$

Where, SSE = Error sum of square; K = Number of variables; and n = Sample size

3.2.4 Variance decomposition

Variance decomposition is used to measure the proportion of the shocks to the forecast error variance. It determines the amount of forecast error variance for each of the variables which can be explained by exogenous shocks to the other variables.

CHAPTER 4: RESULTS AND DISCUSSION

4.0 Preliminary analysis

Table 4.1 shows the results obtained from the Philips-Perron test. For the GDP growth, both the constant model and the constant and trend model shows that all sample countries have a stationary result at the level form with the exception of Bangladesh. Bangladesh's GDP growth is only stationary at the first difference of the constant model.

Based on the model with a constant term and model with constant and deterministic trend, the rice productions for China, Indonesia, and Bangladesh are found to have a non-stationary movement at the level form. Only the results of Vietnam is stationary at the constant model's level form and the results of India is stationary at the constant and deterministic trend's level form. For the series in the first difference form, the results from both models show that rice productions in China, Indonesia, and Bangladesh have stationary movement.

On the other hand, for the rice consumption, the constant term shows that China, India, Bangladesh, and Vietnam are only stationary at the first difference. The results based on the model with a constant term show that such variable in the level form for Indonesia is stationary.

Since the results show that all variables are stationary, the cointegration test is not required to be conducted.

Table 4.1: The results of Philips-Perron unit root test

	GDP		***Rice production***		***Rice Consumption***	
	Level	First Difference	Level	First Difference	Level	First Difference
China						
Constant	-3.4686 **	-5.4310 ***	-1.6737	-4.7772 ***	-1.3520	-3.1132 **
Constant and Trend	-3.5207 *	-4.6169 ***	-1.8976	-4.8018 ***	-1.7878	-2.9884
India						
Constant	-3.3621 **	-13.6411 ***	-1.4895	-15.5986 ***	-0.9996	-19.3377 ***
Constant and Trend	-4.3131 **	-18.5618 ***	-5.3207 ***	-15.5047 ***	-6.7572 ***	-21.5974 ***
Indonesia						
Constant	-3.4609 **	-9.5771 ***	-2.0420	-5.8722 ***	-3.4344 **	-2.1571
Constant and Trend	-3.3691 *	-11.3134 ***	-2.3823	-9.1497 ***	-1.9630	-2.7208
Bangladesh						
Constant	-1.3513	-9.6141 ***	-0.1143	-4.8279 **	-0.3238	-3.0051***
Constant and Trend	-4.0732 **	-9.3342 ***	-2.4504	-4.6921	-1.9342	-2.9226***
Vietnam						
Constant	-2.9421 *	-4.1309 ***	-2.6479*	-1.8675 ***	-1.9932	-6.6141 ***
Constant and Trend	-3.2493 *	-4.0095 **	-1.8675	-9.7016 ***	-2.6739	-7.1311 ***

Notes: *****, **, *** Reject the null hypothesis of the presence of a unit root at 1%, 5% and 10% significance level respectively

4.1 Dynamic causality between GDP growth and rice consumption

Table 4.2 shows the results of Granger causality between GDP and rice consumption for the five countries namely China, India, Indonesia, Bangladesh and Vietnam. The results of F-statistic value from Wald test are summarized in Table 4.2.

Table 4.2: Results of Ganger causality test between GDP and rice consumption

			Estimated statistic
China			
GDP	→	RC	0.7350
RC	→	GDP	2.8696
India			
GDP	→	RC	0.5286
RC	→	GDP	0.0215
Indonesia			
GDP	→	RC	0.0486
RC	→	GDP	0.0013
Bangladesh			
GDP	→	RC	0.1061
RC	→	GDP	0.1070
Vietnam			
GDP	→	RC	0.0002
RC	→	GDP	2.9958 *

Notes: "GDP → RC" denotes as GDP growth Granger causes rice consumption

"RC → GDP" denotes as rice consumption Granger causes GDP growth

* Reject the null hypothesis of no Granger causality at the 10% level

By looking at the results of Vietnam, the rice consumption Granger causes GDP growth at 10% significance level. This result indicates that the past information contained in rice consumption can predict the GDP growth. In the past, rice has been treated as an important product to meet the food security of the Vietnamese but now it is a strategic plant which can earn billion dollars annually through exportation. In other word, the rice consumption in Vietnam is reduced for the purpose of export. Therefore, the export of rice influences the GDP growth in Vietnam.

As per the results show in the Table 4.2, China, India, Indonesia and Bangladesh do not have Granger causality relationship between rice consumption and GDP growth in two direction. In China, the Chinese consumption pattern has change to meat oriented due to increase in per capita income. Luxury food is affordable by the local consumers. Hence, the demand for rice is dropping gradually. It is similar to the case of India, the increase of urbanization has influence the Indian's life-styles and food intake. Since their income and working hour increased, the labors eat more outside food. The Indian worker could not prepare traditional meal such as rice because it is time consuming. The consumption of ready-made meals is more preferable for the family daily diet. Hence, the rice consumption does not affect GDP growth.

While for Indonesia and Bangladesh, both of these countries is the net importer of rice since the rice consumption exceeds its production. It can be discovered that the rice is only to fulfill the daily needs of the local citizen. It is because majority of their population in rural area is mainly involved in agriculture sector. In order to be more productive, they mainly consume rice. As a result, it does not bring significant effect on GDP growth.

Table 4.3 shows the results of variance decomposition of GDP and rice consumption for China, India, Indonesia, Bangladesh and Vietnam from year 2 to 20. In the case of China, it shows the highest percentage of proportion of GDP by the rice consumption at 2.5236 per cent and follow by India with the proportion 1.4287 per cent. While the percentage of proportion of Bangladesh, Indonesia and Vietnam are low with around 0.0004 to 0.9912 per cent. The main reason of this finding is the population size between countries. China and India show a higher percentage of proportion because both countries have a large population size while Indonesia, Bangladesh and Vietnam have a smaller population size. Furthermore, it suggests that rice is a staple food of China and India due to its rice culture for a long time.

Besides that, China shows the highest percentage of proportion of rice consumption by the GDP at 30.8354 per cent and follow by Vietnam, India, Indonesia, and Bangladesh with the proportion 23.1082, 19.3289, 4.1018 and 0.7062 per cent respectively. China shows the highest percentage of proportion among these countries because the unique economic and cultural factors are making food waste in China. While the shock in the GDP in Bangladesh possesses the lowest influence of 0.7062 per cent toward its rice consumption. The reason of this finding is households in Bangladesh are willing to spend more on other goods and services instead of purchasing rice since the rice price in Bangladesh is low. According to Numbeo (2017), the rice price of Bangladesh is 0.61$/kg which is the third-lowest among 123 countries. It is due to the government has attempted to stabilize rice prices through open market sales since 2004 and provide subsidy support for rice producers (International Rice Research Institute, 2013).

Table 4.3: Results of variance decomposition of GDP and rice consumption

	Horizon (Year)	By innovations in GDP	Rice consumption		GDP	Rice consumption
China						
GDP	2	100.0000	0.0000	Rice consumption	25.9057	74.0943
	4	98.1515	1.8485		27.7931	72.2069
	6	97.5468	2.4532		30.3818	69.6182
	8	97.4777	2.5223		30.8174	69.1826
	10	97.4768	2.5232		30.8356	69.1644
	12	97.4767	2.5233		30.8345	69.1655
	14	97.4765	2.5235		30.8352	69.1649
	16	97.4764	2.5236		30.8354	69.1646
	18	97.4764	2.5236		30.8354	69.1646
	20	97.4764	2.5236		30.8354	69.1646
India						
GDP	2	99.0480	0.9520	Rice consumption	19.0958	80.9042
	4	98.7270	1.2730		19.2673	80.7327
	6	98.6175	1.3825		19.3116	80.6884
	8	98.5848	1.4152		19.3239	80.6761
	10	98.5752	1.4248		19.3274	80.6726
	12	98.5724	1.4276		19.3285	80.6715
	14	98.5716	1.4284		19.3287	80.6713
	16	98.5714	1.4286		19.3288	80.6712
	18	98.5713	1.4287		19.3289	80.6711
	20	98.5713	1.4287		19.3289	80.6711
Indonesia						
GDP	2	99.9978	0.0022	Rice consumption	4.1018	95.8982
	4	99.9913	0.0087		3.9843	96.0157
	6	99.9885	0.0138		3.9397	96.0603
	8	99.9826	0.0174		3.9185	96.0815
	10	99.9802	0.0198		3.9069	96.0931
	12	99.9786	0.0214		3.9000	96.1000
	14	99.9775	0.0225		3.8957	96.1043
	16	99.9768	0.0232		3.8930	96.1070
	18	99.9763	0.0237		3.8912	96.1088
	20	99.9759	0.0241		3.8900	96.1100
Bangladesh						
GDP	2	99.7269	0.2731	Rice consumption	0.1237	99.8763
	4	99.2813	0.7187		0.4423	99.5577
	6	99.1002	0.8998		0.6126	99.3874
	8	99.0385	0.9615		0.6753	99.3247
	10	99.0183	0.9817		0.6962	99.3038
	12	99.0119	0.9881		0.7030	99.2970
	14	99.0098	0.9902		0.7052	99.2948
	16	99.0091	0.9909		0.7059	99.2941
	18	99.0089	0.9911		0.7061	99.2939
	20	99.0088	0.9912		0.7062	99.2938

Table 4.3 (Continued)

	Horizon	By innovations in				
	(Year)	GDP	Rice consumption		GDP	Rice consumption
Vietnam						
GDP	2	99.9996	0.0004	Rice consumption	22.8647	77.1353
	4	99.9996	0.0004		23.0554	76.9446
	6	99.9996	0.0004		23.1019	76.8981
	8	99.9996	0.0004		23.1076	76.8924
	10	99.9996	0.0004		23.1081	76.8919
	12	99.9996	0.0004		23.1082	76.8918
	14	99.9996	0.0004		23.1082	76.8918
	16	99.9996	0.0004		23.1082	76.8918
	18	99.9996	0.0004		23.1082	76.8918
	20	99.9996	0.0004		23.1082	76.8918

4.2 Dynamic causality between GDP growth and rice production

Table 4.4 shows the results of Granger causality between GDP and rice production. There are two ways causality has been shown which are rice production Granger causes GDP and GDP Granger cause rice production.

Table 4.4: Results of Ganger Causality test between GDP and rice production

			Estimated statistic
China			
GDP	→	RP	4.0768 *
RP	→	GDP	5.7705 **
India			
GDP	→	RP	0.8843
RP	→	GDP	0.7609
Indonesia			
GDP	→	RP	0.0947
RP	→	GDP	0.0020
Bangladesh			
GDP	→	RP	0.0001
RP	→	GDP	0.1691
Vietnam			
GDP	→	RP	3.6458 *
RP	→	GDP	7.21E-07

Notes: "GDP → RP" denotes as GDP growth Granger causes rice production
"RP → GDP" denotes as rice production Granger causes GDP growth
**, * Reject the null hypothesis of no Granger causality at the 5%, 10% level respectively

Based on the results of Table 4.4, there are only China and Vietnam have Granger causality relationship between GDP growth and rice production. In China, the rice production and the GDP growth exhibit a bidirectional causal relationship. This finding suggests that the rice production consist of useful past information to predict the future GDP growth in two way. In the case of Vietnam, the GDP growth Granger causes rice production but the rice production does not Granger causes GDP growth.

Since there are several policies have been implemented by the governments of China and Vietnam, the policy included Doi Moi policy in Vietnam and the machinery subsidies provided by China government. These policies are help to increase the volume of rice production in order to promote economic growth. Therefore, the Granger causes relationship between rice production and GDP growth are exist in China and Vietnam.

However, there is no Granger causality relationship is found in India, Indonesia Bangladesh. Since Bangladesh and Indonesia are the net rice importer, most of the rice production in these two countries is used to fulfill their local consumption. In Bangladesh, the damage of natural disaster and growing population have caused their local production is unable to meet its local demand. The level of rice import in Bangladesh is much higher than the rice export. While Indonesia, the country has converted many arable lands to non-agricultural purpose and resulting in total output dropped.

On the other hand, the government of India realise that the agriculture sector will not has much contribution in reducing poverty level. In order to alleviate the poverty, the local government has invested many resources to establish heavy infrastructure industry in those areas that were backward and poorer. Furthermore, the government also mentioned that there must have large scale of investment to boost the economy growth. This action has generated a large quantity of job opportunity and the development of poor area. Therefore, the rice production in India, Indonesia and Bangladesh does not influence the GDP growth at large.

From Table 4.5, the results show that China has a larger percentage portion of their rice production in explaining their GDP growth among five of the countries. China's GDP can be explained by its rice production around 12.7717 per cent and has a large gap compared to other countries. The gap between China with them is approximately 10 per cent. China has a high percentage because they are populous, suitable weather, and fertile land compared to other countries. Yet, the farmers of China also focus on developing hybrid rice to increase the rice production.

The results show that Bangladesh's rice production has a lower percentage in explaining its GDP. Bangladesh's GDP only can be explained by its rice production at 0.0005 per cent. Since Bangladesh faced a lot of natural disaster, therefore they may not mainly focus on the rice production.

Besides, the results in Table 4.5 show the percentage of rice production can be explained by GDP. China still enjoying large percentage portion among the five countries. Since China's economic performance is stable than other selected countries, therefore China is able to invest more in developing hybrid rice. China currently is investigating the fifth generation hybrid rice. In contrast, Bangladesh's rice production could only explained by 0.6971 per cent of GDP because Bangladesh mainly focus on textile industry although they are one of the largest rice producer. Therefore their GDP only able to explain their rice production in a small portion.

From the results obtained, it can be shown that if there is Granger causality, there will be a spillover effect between the variables; however, if there is no Granger causality, there might be spillover effects.

Table 4.5: Results of variance decomposition of GDP and Rice production

	Horizon (Year)	By innovations in GDP	Rice production		GDP	Rice production
China						
GDP	2	100.0000	0.0000	Rice production	1.3360	98.6640
	4	87.2463	12.7537		19.6242	80.3758
	6	87.2463	12.7537		19.6242	80.3758
	8	87.5543	12.4457		19.2100	80.7900
	10	87.2296	12.7704		19.6503	80.3498
	12	87.2296	12.7704		19.6503	80.3498
	14	87.2379	12.7622		19.6393	80.3607
	16	87.2281	12.7719		19.6525	80.3475
	18	87.2281	12.7719		19.6525	80.3475
	20	87.2283	12.7717		19.6522	80.3478
India						
GDP	2	97.8122	2.1878	Rice production	9.8384	90.1616
	4	97.4250	2.5750		10.2968	89.7032
	6	97.3435	2.6565		10.3840	89.6160
	8	97.3294	2.6706		10.3990	89.6010
	10	97.3271	2.6729		10.4015	89.5985
	12	97.3267	2.6733		10.4019	89.5981
	14	97.3266	2.6734		10.4019	89.5981
	16	97.3266	2.6734		10.4019	89.5981
	18	97.3266	2.6734		10.4019	89.5981
	20	97.3266	2.6734		10.4019	89.5981
Indonesia						
GDP	2	100.0000	0.0000	Rice production	6.1543	93.8457
	4	99.7705	0.2295		6.3608	93.6393
	6	99.6914	0.3086		6.4095	93.5905
	8	99.6649	0.3351		6.4242	93.5758
	10	99.6560	0.3440		6.4289	93.5711
	12	99.6530	0.3470		6.4305	93.5695
	14	99.6520	0.3480		6.4310	93.5690
	16	99.6517	0.3483		6.4312	93.5688
	18	99.6516	0.3484		6.4313	93.5687
	20	99.6516	0.3484		6.4313	93.5687
Bangladesh						
GDP	2	99.9997	0.0003	Rice production	0.3698	99.6303
	4	99.9995	0.0005		0.5902	99.4098
	6	99.9995	0.0005		0.6622	99.3378
	8	99.9995	0.0005		0.6857	99.3143
	10	99.9995	0.0005		0.6934	99.3066
	12	99.9995	0.0005		0.6959	99.3041
	14	99.9995	0.0005		0.6967	99.3033
	16	99.9995	0.0005		0.6969	99.3031
	18	99.9995	0.0005		0.6970	99.3030
	20	99.9995	0.0005		0.6971	99.3029

Table 4.5 (Continued)

	Horizon (Year)	By innovations in				
		GDP	Rice consumption		GDP	Rice consumption
Vietnam						
GDP	2	99.6648	0.3352	Rice production	4.6447	95.3553
	4	98.2122	1.7878		4.6418	95.3582
	6	96.6071	3.3929		4.6403	95.3597
	8	95.2753	4.7247		4.6395	95.3605
	10	94.2450	5.7550		4.6390	95.3610
	12	93.4600	6.5400		4.6387	95.3613
	14	92.8625	7.1375		4.6385	95.3615
	16	92.4068	7.5932		4.6384	95.3616
	18	92.0586	7.9414		4.6383	95.3617
	20	91.7919	8.2081		4.6382	95.3618

CHAPTER 5: CONCLUSION

5.0 Major findings

There are two major findings based on Granger causality and variance decomposition. To answers the research question of the extent to which rice consumption contributes to the economic growth of the sample countries, the first finding shows that Vietnam's rice consumption Granger causes the GDP growth. However, the variance decomposition results show that there is a spillover effect for China, India, Indonesia, and Vietnam.

To answer the research question of the extent to which rice production affects the economic growth, the second finding shows that there is a bidirectional Granger cause relationship between the GDP growth and rice production in China, but rice production has a stronger influence on GDP growth. GDP growth is found to Granger causes rice production in Vietnam. Furthermore, there is spillover effect between GDP growth and rice production for China, India, Indonesia, and Vietnam.

Overall, both our findings suggests that China, India, and Indonesia's main GDP does not rely on the rice market for it to grow. China and India does not focus on the agricultural sector for their GDP but focuses on the services and manufacturing sector. In Indonesia, the agricultural sector contributes a large portion to their GDP, however, the main crops that Indonesia focuses on are palm oil and rubber. Therefore, there is no Granger causality between the GDP growth and rice consumption and production.

In addition, China, India, and Indonesia have spillover effects for both rice consumption and rice production with GDP growth because of their large population. Due to the fact that the population is large, the rice consumption will be high and the production will also increase to fulfill the local demands, which in turn causes the spillover effect. For Vietnam's case, although their population is not as large, the government of Vietnam implemented several policies to increase rice production because it will increase their GDP growth. Therefore there is both Granger causality and spillover effect for Vietnam.

5.1 Implications of study

The finding indicates that rice production and consumption of a high population country would influence its GDP growth. However, there is an exception of Vietnam even though its population is low. Therefore, it suggests that the government should focus on rice market in order to increase GDP growth. The sample countries is recommended to improve their rice production systems by implementing effective rice-based policies and coordinated efforts across the public and sectors in order to support rice development and research. For example, the imposed of subsidies to marginal and small farmers and human-resources strengthening.

On the other hand, the government should implement rice policies in order to control rice consumption and import of rice. Consumption will shift to substitute products when prices to consumers increase. Therefore, the government is suggested to reduce rice subsidies to consumer and impose tax on imported rice in order to reduce a high consumption of rice.

5.2 Limitation of study

The limitation that can be found in this research is the data collected for GDP growth is based on an overall basis and are not separated into primary, secondary and tertiary sector which represent raw material, manufacturing and service respectively. Due to this limitation, the results are not as informative because there are unable to explain the amount of rice consumption and production that contributes to each of the sectors.

5.3 Recommendation

Based on the limitation, the researchers are recommended to divide GDP into disaggregate level based on primary, secondary, and tertiary sectors. By dividing GDP into three sectors, the results obtained can be more informative.

References

Abdullah, A. B., Ito, S., & Adhana, K. (2006, March). Estimate of rice consumption in Asian countries and the world towards 2050. *In Proceedings for Workshop and Conference on Rice in the World at Stake,* 2, 28-43.

Ayambila, S. N., Kwadzo, G. T., & Asuming-Brempong, S. (2008). Economics of rice production: an economic analysis of rice production systems in the upper east region of Ghana. *Ghana Journal of Development Studies*, 5(1).

Barker, R., Herdt, R. W., Rose, B., & Rose, B. (1985). Overview. In *The rice economy of Asia* (p. 1). Washington, DC: Resources for the Future.

Binney, R. (2006). The Power of Plants. In *Nature's Ways: Lore, Legend, Fact and Fiction*(p. 65).

Brooks, C. (2008). *Introductory econometrics for finance*. (2nd ed.). Cambridge:Cambridge University Press.

Chinasage. (2013). Rice in China. Retrieved from http://www.chinasage.info/rice.htm

Chung, B. H. and Tan, J. R. (2015). Time series analysis of factors affecting the demand for local rice in Malaysia. *International Food Research Journal*, 22(5), 1870-1877.

Dawe, D. (2010). The Rice Crisis. Retrieved from http://www.fao.org/3/a-an794e.pdf

Diao, X., Hazell, P., & Thurlow, J. (2010). The Role of Agriculture in African Development. *World Development*, 38(10), 1375-1383.

Fairhurst, T., & Dobermann, A. (2002). Rice in the global food supply. *World*, 5(7,502), 454-349.

Guisan, M.C. (2001). Causality and cointegration between consumption and GDP in 25 OECD countries: Limitations of the cointegration approach. *Applied Econometrics and International Development*, 1(1), 39-611

Gujarati, D. N., & Porter, D. C. (2009). Basic Econometrics. (5th ed.). McGraw. Hill International Edition.

International Rice Research Institute, (2013). Rice Almanac, 4th edition. Retrieved from http://ricepedia.org/vietnam

Koo, W. W., Karmana, M. H., Erlandson, G. W., (1985, July). Analysis of Demand and Supply of Rice in Indonesia. Retrieved 22 January 2016, from http://ageconsearch.umn.edu/bitstream/23419/1/aer202.pdf

Li, J. H. (2002). Rice Culture of China. Retrieved from http://www.china.org.cn/english/2002/Oct/44854.htm

Moussons. (2006). Retrieved from https://moussons.revues.org/2042
Mustapha, N. H. (1996). Sustainable Development of Malaysian Rice Industry in the Context of Asian Countries: An Assessment. *Jurnal Ekonomi Malaysia*, *30*, 67-86.

Nguyen, N. V. (2016). Sustainable Intensification of Rice Production For Food Security In The Near Future. Retrieved from http://www.fao.org/fileadmin/templates/agphome/documents/Rice/sustintriceprod.pdf

Odusina, O. (2008). Urban Rice Demand Analysis: A Case Study of Ijebu Ode Township.*Middle-East Journal of Scientific Research*, 3(2), 62-66.

Rajamoorthy, Y., Rahim, K. B., & Munusamy, S. (2015). Rice Industry in Malaysia: Challenges, Policies and Implications. *Procedia Economics and Finance*, 31, 861-867.

Rice Production Indonesia. (2015). Retrieved from http://www.indonesia investments.com/business/commodities/rice/item183

Rice Production in Vietnam. (2011). Retrieved from https://travelindochinaguidehelpdesk.wordpress.com/2011/11/25/rice-production-in-mekong-delta/

Sachchamarga, K., & Williams, G. W., (2004, March). Economic Factors Affecting Rice Production in Thailand. Retrieved 22 January 2016, from http://afcerc.tamu.edu/publications/Publication PDFs/IM%2003%2004%20Thai%20Rice.pdf

Serkan GÜRLÜK. (2012). Convergence impacts of two growing Asian countries on rice consumption: The case of India and China. *Scientific Research and Essays*, 7(17), 1709-1715.

The Doi Moi Policy and Its Impact on the Poor. (2016). Retrieved from http://www.socialwatch.org/node/10854

Vietnam Trade Promotion Agency. (2011). Retrieve from http://www.vietrade.gov.vn/en/index.php?option=com_content&id=2026:strengths-of-vietnams-rice-industry&Itemid=232

Vijulie, I., Manea, G., Tîrlă, L., Matei, E., Preda, M., & Cuculici, R. (2016). Revival of the Rice Crops in the South of Romania: Pros and Cons. *Procedia Environmental Sciences*, 32, 373-385.

APPENDIX 1: Unit Root Test

China's GDP

Level without trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.468556	0.0178
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.520694	0.0588
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

China's Rice Consumption

Level without trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.351969	0.5889
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.787770	0.6802
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First difference without trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.113203	0.0390
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

First difference with trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.988387	0.1555
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

China's Rice Production

Level without trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.673726	0.4317
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.897608	0.6258
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.777205	0.0009
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.801835	0.0041
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

India's GDP

Level without trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.362087	0.0225
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.313115	0.0114
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

India's Rice Consumption

Level without trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.999643	0.7373
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.757193	0.0000
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-19.33770	0.0001
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

India's Rice Production

Level without trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.489495	0.5223
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.320701	0.0012
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.59864	0.0000
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Indonesia's GDP

Level without trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.460870	0.0181
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.369136	0.0785
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Indonesia's Rice Consumption

Level without trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.434415	0.0192
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.962952	0.5923
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.720771	0.2376
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

India's Rice Production

Level without trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant
Bandwidth: 21 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.042005	0.2682
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.382296	0.3789
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant
Bandwidth: 23 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.872216	0.0001
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 16 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.149693	0.0000
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Bangladesh's GDP

Level without trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.351256	0.5892
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.073185	0.0191
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(GDPG) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.614071	0.0000
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Bangladesh's Rice Consumption

Level without trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.323792	0.9079
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.934221	0.6071
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.005141	0.0487
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.922596	0.1733
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Bangladesh's Rice Production

Level without trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.114276	0.9374
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.450416	0.3473
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.827930	0.0008
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.692125	0.0053
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Vietnam's GDP

Level without trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.942059	0.0547
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: GDPG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.249315	0.0980
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Vietnam's Rice Consumption

Level without trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.993210	0.2877
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.673856	0.2544
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference without trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.614130	0.0000
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.131095	0.0000
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Vietnam's Rice Production

Level without trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.647861	0.0972
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Level with trend

Null Hypothesis: LNRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.867501	0.6410
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

First Difference with trend

Null Hypothesis: D(LNRP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.701615	0.0000
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

APPENDIX 2: Granger Causality Test

China

GDP → Rice Consumption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.735045	(1, 20)	0.4014
Chi-square	0.735045	1	0.3913

Rice Consumption → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.869569	(1, 20)	0.1058
Chi-square	2.869569	1	0.0903

GDP → Rice Production

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.076831	(1, 19)	0.0578
Chi-square	4.076831	1	0.0435

Rice Production → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	5.770505	(1, 19)	0.0267
Chi-square	5.770505	1	0.0163

India

GDP → Rice Consumption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.528550	(1, 21)	0.4752
Chi-square	0.528550	1	0.4672

Rice Consumption → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.021528	(1, 21)	0.8848
Chi-square	0.021528	1	0.8834

GDP → Rice Production

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.884252	(1, 21)	0.3577
Chi-square	0.884252	1	0.3470

Rice Production → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.760912	(1, 21)	0.3929
Chi-square	0.760912	1	0.3830

Indonesia

GDP → Rice Consumption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.048630	(1, 22)	0.8275
Chi-square	0.048630	1	0.8255

Rice Consumption → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.001292	(1, 22)	0.9717
Chi-square	0.001292	1	0.9713

GDP → Rice Production

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.094748	(1, 20)	0.7614
Chi-square	0.094748	1	0.7582

Rice Production → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.001952	(1, 20)	0.9652
Chi-square	0.001952	1	0.9648

Bangladesh

GDP → Rice Consumption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.106090	(1, 21)	0.7479
Chi-square	0.106090	1	0.7446

Rice Consumption → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.107030	(1, 21)	0.7468
Chi-square	0.107030	1	0.7436

GDP → Rice Production

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.000110	(1, 21)	0.9917
Chi-square	0.000110	1	0.9916

Rice Production → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.169141	(1, 21)	0.6850
Chi-square	0.169141	1	0.6809

Vietnam

GDP → Rice Consumption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.000170	(1, 21)	0.9897
Chi-square	0.000170	1	0.9896

Rice Consumption → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.995814	(1, 21)	0.0981
Chi-square	2.995814	1	0.0835

GDP → Rice Production

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.645829	(1, 22)	0.0693
Chi-square	3.645829	1	0.0562

Rice Production → GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	7.21E-07	(1, 22)	0.9993
Chi-square	7.21E-07	1	0.9993

APPENDIX 3: Variance Decomposition

China (GDP & Rice Consumption)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	D(LNRC)
1	1.937638	100.0000	0.000000
		(0.00000)	(0.00000)
2	1.937638	100.0000	0.000000
		(0.00000)	(0.00000)
3	2.106945	98.15146	1.848537
		(5.53313)	(5.53313)
4	2.106945	98.15146	1.848537
		(5.53313)	(5.53313)
5	2.120519	97.54679	2.453210
		(7.68875)	(7.68875)
6	2.120519	97.54679	2.453210
		(7.68875)	(7.68875)
7	2.121318	97.47768	2.522324
		(8.11935)	(8.11935)
8	2.121318	97.47768	2.522324
		(8.11935)	(8.11935)
9	2.121596	97.47675	2.523248
		(8.22878)	(8.22878)
10	2.121596	97.47675	2.523248
		(8.22878)	(8.22878)
11	2.121671	97.47668	2.523320
		(8.33106)	(8.33106)
12	2.121671	97.47668	2.523320
		(8.33106)	(8.33106)
13	2.121680	97.47647	2.523527
		(8.38345)	(8.38345)
14	2.121680	97.47647	2.523527
		(8.38345)	(8.38345)
15	2.121681	97.47643	2.523568
		(8.39956)	(8.39956)
16	2.121681	97.47643	2.523568
		(8.39956)	(8.39956)
17	2.121681	97.47643	2.523571
		(8.40869)	(8.40869)
18	2.121681	97.47643	2.523571
		(8.40869)	(8.40869)
19	2.121681	97.47643	2.523571
		(8.41710)	(8.41710)
20	2.121681	97.47643	2.523571
		(8.41710)	(8.41710)
21	2.121681	97.47643	2.523571
		(8.42155)	(8.42155)
22	2.121681	97.47643	2.523571
		(8.42155)	(8.42155)
23	2.121681	97.47643	2.523571
		(8.42339)	(8.42339)
24	2.121681	97.47643	2.523571
		(8.42339)	(8.42339)
25	2.121681	97.47643	2.523571
		(8.42520)	(8.42520)
26	2.121681	97.47643	2.523571

		(8.42520)	(8.42520)
		Variance Decomposition of D(LNRC):	
Period	S.E.	GDPG	D(LNRC)
1	0.014164	25.90568	74.09432
		(14.3388)	(14.3388)
2	0.014164	25.90568	74.09432
		(14.3388)	(14.3388)
3	0.014875	27.79306	72.20694
		(14.1336)	(14.1336)
4	0.014875	27.79306	72.20694
		(14.1336)	(14.1336)
5	0.015150	30.38180	69.61820
		(14.4690)	(14.4690)
6	0.015150	30.38180	69.61820
		(14.4690)	(14.4690)
7	0.015205	30.81739	69.18261
		(14.3853)	(14.3853)
8	0.015205	30.81739	69.18261
		(14.3853)	(14.3853)
9	0.015210	30.83564	69.16436
		(14.4241)	(14.4241)
10	0.015210	30.83564	69.16436
		(14.4241)	(14.4241)
11	0.015210	30.83452	69.16548
		(14.4876)	(14.4876)
12	0.015210	30.83452	69.16548
		(14.4876)	(14.4876)
13	0.015211	30.83515	69.16485
		(14.5205)	(14.5205)
14	0.015211	30.83515	69.16485
		(14.5205)	(14.5205)
15	0.015211	30.83536	69.16464
		(14.5662)	(14.5662)
16	0.015211	30.83536	69.16464
		(14.5662)	(14.5662)
17	0.015211	30.83538	69.16462
		(14.6081)	(14.6081)
18	0.015211	30.83538	69.16462
		(14.6081)	(14.6081)
19	0.015211	30.83538	69.16462
		(14.6436)	(14.6436)
20	0.015211	30.83538	69.16462
		(14.6436)	(14.6436)
21	0.015211	30.83538	69.16462
		(14.6809)	(14.6809)
22	0.015211	30.83538	69.16462
		(14.6809)	(14.6809)
23	0.015211	30.83538	69.16462
		(14.7145)	(14.7145)
24	0.015211	30.83538	69.16462
		(14.7145)	(14.7145)
25	0.015211	30.83538	69.16462
		(14.7461)	(14.7461)
26	0.015211	30.83538	69.16462
		(14.7461)	(14.7461)

Cholesky Ordering: GDPG D(LNRC)

Standard Errors: Monte Carlo (100 repetitions)

China (GDP & Rice Production)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	D(LNRP)
1	1.806559	100.0000	0.000000
		(0.00000)	(0.00000)
2	1.806559	100.0000	0.000000
		(0.00000)	(0.00000)
3	1.806559	100.0000	0.000000
		(0.00000)	(0.00000)
4	1.953195	87.24630	12.75370
		(10.2257)	(10.2257)
5	1.953195	87.24630	12.75370
		(10.2257)	(10.2257)
6	1.953195	87.24630	12.75370
		(10.2257)	(10.2257)
7	1.977952	87.55430	12.44570
		(10.2393)	(10.2393)
8	1.977952	87.55430	12.44570
		(10.2393)	(10.2393)
9	1.977952	87.55430	12.44570
		(10.2393)	(10.2393)
10	1.982454	87.22958	12.77042
		(10.6008)	(10.6008)
11	1.982454	87.22958	12.77042
		(10.6008)	(10.6008)
12	1.982454	87.22958	12.77042
		(10.6008)	(10.6008)
13	1.983184	87.23785	12.76215
		(10.6863)	(10.6863)
14	1.983184	87.23785	12.76215
		(10.6863)	(10.6863)
15	1.983184	87.23785	12.76215
		(10.6863)	(10.6863)
16	1.983329	87.22809	12.77191
		(10.7198)	(10.7198)
17	1.983329	87.22809	12.77191
		(10.7198)	(10.7198)
18	1.983329	87.22809	12.77191
		(10.7198)	(10.7198)
19	1.983351	87.22829	12.77171
		(10.7426)	(10.7426)
20	1.983351	87.22829	12.77171
		(10.7426)	(10.7426)
21	1.983351	87.22829	12.77171
		(10.7426)	(10.7426)
22	1.983356	87.22800	12.77200
		(10.7423)	(10.7423)
23	1.983356	87.22800	12.77200
		(10.7423)	(10.7423)
24	1.983356	87.22800	12.77200
		(10.7423)	(10.7423)
25	1.983357	87.22800	12.77200
		(10.7521)	(10.7521)
26	1.983357	87.22800	12.77200

		(10.7521)	(10.7521)

Variance Decomposition of D(LNRP):			
Period	S.E.	GDPG	D(LNRP)
1	0.038071	1.335974	98.66403
		(7.83643)	(7.83643)
2	0.038071	1.335974	98.66403
		(7.83643)	(7.83643)
3	0.038071	1.335974	98.66403
		(7.83643)	(7.83643)
4	0.042280	19.62421	80.37579
		(13.1955)	(13.1955)
5	0.042280	19.62421	80.37579
		(13.1955)	(13.1955)
6	0.042280	19.62421	80.37579
		(13.1955)	(13.1955)
7	0.042832	19.21001	80.78999
		(13.1793)	(13.1793)
8	0.042832	19.21001	80.78999
		(13.1793)	(13.1793)
9	0.042832	19.21001	80.78999
		(13.1793)	(13.1793)
10	0.042950	19.65025	80.34975
		(13.3133)	(13.3133)
11	0.042950	19.65025	80.34975
		(13.3133)	(13.3133)
12	0.042950	19.65025	80.34975
		(13.3133)	(13.3133)
13	0.042968	19.63927	80.36073
		(13.4179)	(13.4179)
14	0.042968	19.63927	80.36073
		(13.4179)	(13.4179)
15	0.042968	19.63927	80.36073
		(13.4179)	(13.4179)
16	0.042971	19.65247	80.34753
		(13.4090)	(13.4090)
17	0.042971	19.65247	80.34753
		(13.4090)	(13.4090)
18	0.042971	19.65247	80.34753
		(13.4090)	(13.4090)
19	0.042972	19.65221	80.34779
		(13.4442)	(13.4442)
20	0.042972	19.65221	80.34779
		(13.4442)	(13.4442)
21	0.042972	19.65221	80.34779
		(13.4442)	(13.4442)
22	0.042972	19.65260	80.34740
		(13.4325)	(13.4325)
23	0.042972	19.65260	80.34740
		(13.4325)	(13.4325)
24	0.042972	19.65260	80.34740
		(13.4325)	(13.4325)
25	0.042972	19.65260	80.34740
		(13.4513)	(13.4513)
26	0.042972	19.65260	80.34740
		(13.4513)	(13.4513)

Cholesky Ordering: GDPG D(LNRP)
Standard Errors: Monte Carlo (100 repetitions)

India (GDP & Rice Consumption)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	D(LNRC)
1	1.950646	100.0000	0.000000
		(0.00000)	(0.00000)
2	2.019911	99.04801	0.951987
		(3.78071)	(3.78071)
3	2.033459	98.88266	1.117343
		(4.53279)	(4.53279)
4	2.035098	98.72701	1.272993
		(5.82989)	(5.82989)
5	2.036265	98.65802	1.341984
		(6.76303)	(6.76303)
6	2.036746	98.61751	1.382492
		(7.66694)	(7.66694)
7	2.037031	98.59637	1.403633
		(8.38889)	(8.38889)
8	2.037179	98.58479	1.415207
		(9.00017)	(9.00017)
9	2.037260	98.57858	1.421423
		(9.48861)	(9.48861)
10	2.037303	98.57521	1.424788
		(9.89284)	(9.89284)
11	2.037327	98.57340	1.426604
		(10.2280)	(10.2280)
12	2.037340	98.57241	1.427586
		(10.5182)	(10.5182)
13	2.037347	98.57188	1.428116
		(10.7777)	(10.7777)
14	2.037350	98.57160	1.428402
		(11.0199)	(11.0199)
15	2.037352	98.57144	1.428557
		(11.2532)	(11.2532)
16	2.037353	98.57136	1.428640
		(11.4843)	(11.4843)
17	2.037354	98.57131	1.428685
		(11.7170)	(11.7170)
18	2.037354	98.57129	1.428710
		(11.9536)	(11.9536)
19	2.037354	98.57128	1.428723
		(12.1951)	(12.1951)
20	2.037355	98.57127	1.428730
		(12.4413)	(12.4413)
21	2.037355	98.57127	1.428734
		(12.6915)	(12.6915)
22	2.037355	98.57126	1.428736
		(12.9441)	(12.9441)
23	2.037355	98.57126	1.428737
		(13.1974)	(13.1974)
24	2.037355	98.57126	1.428737
		(13.4497)	(13.4497)
25	2.037355	98.57126	1.428738
		(13.6988)	(13.6988)

26	2.037355	98.57126	1.428738
		(13.9431)	(13.9431)

		Variance Decomposition of D(LNRC):	
Period	S.E.	GDPG	D(LNRC)
1	0.038071	18.17363	81.82637
		(14.5424)	(14.5424)
2	0.047451	19.09582	80.90418
		(16.3052)	(16.3052)
3	0.051774	19.19229	80.80771
		(16.7798)	(16.7798)
4	0.053974	19.26726	80.73274
		(16.9690)	(16.9690)
5	0.055124	19.29564	80.70436
		(17.0529)	(17.0529)
6	0.055736	19.31160	80.68840
		(17.0987)	(17.0987)
7	0.056064	19.31958	80.68042
		(17.1291)	(17.1291)
8	0.056240	19.32390	80.67610
		(17.1473)	(17.1473)
9	0.056335	19.32619	80.67381
		(17.1620)	(17.1620)
10	0.056386	19.32742	80.67258
		(17.1715)	(17.1715)
11	0.056414	19.32809	80.67191
		(17.1799)	(17.1799)
12	0.056429	19.32845	80.67155
		(17.1857)	(17.1857)
13	0.056437	19.32864	80.67136
		(17.1911)	(17.1911)
14	0.056441	19.32874	80.67126
		(17.1952)	(17.1952)
15	0.056443	19.32880	80.67120
		(17.1989)	(17.1989)
16	0.056445	19.32883	80.67117
		(17.2018)	(17.2018)
17	0.056445	19.32885	80.67115
		(17.2046)	(17.2046)
18	0.056446	19.32886	80.67114
		(17.2068)	(17.2068)
19	0.056446	19.32886	80.67114
		(17.2089)	(17.2089)
20	0.056446	19.32886	80.67114
		(17.2106)	(17.2106)
21	0.056446	19.32887	80.67113
		(17.2122)	(17.2122)
22	0.056446	19.32887	80.67113
		(17.2136)	(17.2136)
23	0.056446	19.32887	80.67113
		(17.2149)	(17.2149)
24	0.056446	19.32887	80.67113
		(17.2161)	(17.2161)
25	0.056446	19.32887	80.67113
		(17.2171)	(17.2171)
26	0.056446	19.32887	80.67113
		(17.2180)	(17.2180)

Cholesky Ordering: GDPG D(LNRC)
Standard Errors: Monte Carlo (100 repetitions)

India (GDP & Rice Production)

Variance Decomposition of GDPG:

Period	S.E.	GDPG	D(LNRP)
1	1.934728	100.0000	0.000000
		(0.00000)	(0.00000)
2	2.016061	97.81216	2.187840
		(5.81908)	(5.81908)
3	2.031282	97.61856	2.381441
		(6.78702)	(6.78702)
4	2.033419	97.42495	2.575049
		(7.93204)	(7.93204)
5	2.034362	97.37031	2.629690
		(8.68032)	(8.68032)
6	2.034659	97.34354	2.656465
		(9.32415)	(9.32415)
7	2.034789	97.33362	2.666378
		(9.84861)	(9.84861)
8	2.034839	97.32942	2.670578
		(10.3041)	(10.3041)
9	2.034860	97.32776	2.672243
		(10.7014)	(10.7014)
10	2.034868	97.32707	2.672925
		(11.0556)	(11.0556)
11	2.034871	97.32680	2.673200
		(11.3747)	(11.3747)
12	2.034873	97.32669	2.673311
		(11.6657)	(11.6657)
13	2.034873	97.32664	2.673357
		(11.9336)	(11.9336)
14	2.034873	97.32663	2.673375
		(12.1825)	(12.1825)
15	2.034873	97.32662	2.673382
		(12.4156)	(12.4156)
16	2.034874	97.32661	2.673385
		(12.6354)	(12.6354)
17	2.034874	97.32661	2.673387
		(12.8438)	(12.8438)
18	2.034874	97.32661	2.673387
		(13.0423)	(13.0423)
19	2.034874	97.32661	2.673387
		(13.2320)	(13.2320)
20	2.034874	97.32661	2.673387
		(13.4137)	(13.4137)
21	2.034874	97.32661	2.673387
		(13.5881)	(13.5881)
22	2.034874	97.32661	2.673387
		(13.7555)	(13.7555)
23	2.034874	97.32661	2.673387
		(13.9162)	(13.9162)
24	2.034874	97.32661	2.673387
		(14.0704)	(14.0704)
25	2.034874	97.32661	2.673387

		(14.2181)	(14.2181)
26	2.034874	97.32661	2.673387
		(14.3594)	(14.3594)

		Variance Decomposition of D(LNRP):	
Period	S.E.	GDPG	D(LNRP)
1	0.070849	5.404968	94.59503
		(8.88657)	(8.88657)
2	0.085008	9.838437	90.16156
		(10.8924)	(10.8924)
3	0.089858	10.06091	89.93909
		(11.2064)	(11.2064)
4	0.091794	10.29684	89.70316
		(11.5288)	(11.5288)
5	0.092557	10.35484	89.64516
		(11.6479)	(11.6479)
6	0.092867	10.38402	89.61598
		(11.7277)	(11.7277)
7	0.092991	10.39449	89.60551
		(11.7682)	(11.7682)
8	0.093042	10.39897	89.60103
		(11.7955)	(11.7955)
9	0.093062	10.40073	89.59927
		(11.8128)	(11.8128)
10	0.093071	10.40145	89.59855
		(11.8254)	(11.8254)
11	0.093074	10.40174	89.59826
		(11.8346)	(11.8346)
12	0.093075	10.40186	89.59814
		(11.8416)	(11.8416)
13	0.093076	10.40190	89.59810
		(11.8472)	(11.8472)
14	0.093076	10.40192	89.59808
		(11.8517)	(11.8517)
15	0.093076	10.40193	89.59807
		(11.8553)	(11.8553)
16	0.093076	10.40193	89.59807
		(11.8584)	(11.8584)
17	0.093076	10.40194	89.59806
		(11.8609)	(11.8609)
18	0.093076	10.40194	89.59806
		(11.8631)	(11.8631)
19	0.093076	10.40194	89.59806
		(11.8650)	(11.8650)
20	0.093076	10.40194	89.59806
		(11.8667)	(11.8667)
21	0.093076	10.40194	89.59806
		(11.8681)	(11.8681)
22	0.093076	10.40194	89.59806
		(11.8693)	(11.8693)
23	0.093076	10.40194	89.59806
		(11.8704)	(11.8704)
24	0.093076	10.40194	89.59806
		(11.8714)	(11.8714)
25	0.093076	10.40194	89.59806
		(11.8722)	(11.8722)
26	0.093076	10.40194	89.59806

		(11.8730)	(11.8730)

Cholesky Ordering: GDPG D(LNRP)
Standard Errors: Monte Carlo (100 repetitions)

Indonesia (GDP & Rice Consumption)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	LNRC
1	3.975005	100.0000	0.000000
		(0.00000)	(0.00000)
2	4.166008	99.99777	0.002234
		(0.06643)	(0.06643)
3	4.184610	99.99449	0.005508
		(0.15018)	(0.15018)
4	4.186581	99.99129	0.008710
		(0.23042)	(0.23042)
5	4.186853	99.98850	0.011498
		(0.30296)	(0.30296)
6	4.186932	99.98616	0.013835
		(0.36681)	(0.36681)
7	4.186979	99.98423	0.015772
		(0.42181)	(0.42181)
8	4.187015	99.98263	0.017368
		(0.46840)	(0.46840)
9	4.187044	99.98132	0.018683
		(0.50742)	(0.50742)
10	4.187068	99.98023	0.019765
		(0.53988)	(0.53988)
11	4.187087	99.97934	0.020656
		(0.56682)	(0.56682)
12	4.187103	99.97861	0.021388
		(0.58917)	(0.58917)
13	4.187116	99.97801	0.021992
		(0.60773)	(0.60773)
14	4.187127	99.97751	0.022488
		(0.62315)	(0.62315)
15	4.187136	99.97710	0.022896
		(0.63598)	(0.63598)
16	4.187143	99.97677	0.023232
		(0.64665)	(0.64665)
17	4.187149	99.97649	0.023509
		(0.65553)	(0.65553)
18	4.187154	99.97626	0.023736
		(0.66291)	(0.66291)
19	4.187158	99.97608	0.023923
		(0.66905)	(0.66905)
20	4.187162	99.97592	0.024077
		(0.67416)	(0.67416)
21	4.187164	99.97580	0.024204
		(0.67840)	(0.67840)
22	4.187167	99.97569	0.024309
		(0.68192)	(0.68192)
23	4.187169	99.97561	0.024394
		(0.68485)	(0.68485)
24	4.187170	99.97553	0.024465
		(0.68729)	(0.68729)

25	4.187171	99.97548	0.024523
		(0.68932)	(0.68932)
26	4.187172	99.97543	0.024571
		(0.69101)	(0.69101)

Variance Decomposition of LNRC:

Period	S.E.	GDPG	LNRC
1	0.008541	4.241897	95.75810
		(8.79247)	(8.79247)
2	0.011523	4.101810	95.89819
		(9.28452)	(9.28452)
3	0.013490	4.027339	95.97266
		(10.6188)	(10.6188)
4	0.014914	3.984255	96.01575
		(11.6942)	(11.6942)
5	0.015991	3.957427	96.04257
		(12.5049)	(12.5049)
6	0.016826	3.939674	96.06033
		(13.1186)	(13.1186)
7	0.017483	3.927344	96.07266
		(13.5894)	(13.5894)
8	0.018006	3.918455	96.08154
		(13.9547)	(13.9547)
9	0.018425	3.911861	96.08814
		(14.2407)	(14.2407)
10	0.018763	3.906862	96.09314
		(14.4664)	(14.4664)
11	0.019036	3.903008	96.09699
		(14.6456)	(14.6456)
12	0.019258	3.899997	96.10000
		(14.7888)	(14.7888)
13	0.019439	3.897621	96.10238
		(14.9038)	(14.9038)
14	0.019587	3.895731	96.10427
		(14.9965)	(14.9965)
15	0.019707	3.894217	96.10578
		(15.0716)	(15.0716)
16	0.019806	3.893000	96.10700
		(15.1326)	(15.1326)
17	0.019887	3.892015	96.10798
		(15.1822)	(15.1822)
18	0.019953	3.891218	96.10878
		(15.2228)	(15.2228)
19	0.020007	3.890569	96.10943
		(15.2559)	(15.2559)
20	0.020052	3.890040	96.10996
		(15.2830)	(15.2830)
21	0.020089	3.889609	96.11039
		(15.3052)	(15.3052)
22	0.020119	3.889256	96.11074
		(15.3233)	(15.3233)
23	0.020144	3.888968	96.11103
		(15.3382)	(15.3382)
24	0.020164	3.888731	96.11127
		(15.3504)	(15.3504)
25	0.020181	3.888537	96.11146
		(15.3604)	(15.3604)

26	0.020194	3.888378	96.11162
		(15.3685)	(15.3685)

Cholesky Ordering: GDPG LNRC
Standard Errors: Monte Carlo (100 repetitions)

Indonesia (GDP & Rice Production)

Variance Decomposition of GDPG:

Period	S.E.	GDPG	D(LNRP)
1	4.303291	100.0000	0.000000
		(0.00000)	(0.00000)
2	4.303291	100.0000	0.000000
		(0.00000)	(0.00000)
3	4.309261	99.77046	0.229542
		(3.81747)	(3.81747)
4	4.309261	99.77046	0.229542
		(3.81747)	(3.81747)
5	4.311101	99.69141	0.308594
		(4.78852)	(4.78852)
6	4.311101	99.69141	0.308594
		(4.78852)	(4.78852)
7	4.311717	99.66491	0.335094
		(5.59917)	(5.59917)
8	4.311717	99.66491	0.335094
		(5.59917)	(5.59917)
9	4.311924	99.65602	0.343980
		(6.16157)	(6.16157)
10	4.311924	99.65602	0.343980
		(6.16157)	(6.16157)
11	4.311993	99.65304	0.346960
		(6.61315)	(6.61315)
12	4.311993	99.65304	0.346960
		(6.61315)	(6.61315)
13	4.312016	99.65204	0.347960
		(6.97149)	(6.97149)
14	4.312016	99.65204	0.347960
		(6.97149)	(6.97149)
15	4.312024	99.65170	0.348296
		(7.26564)	(7.26564)
16	4.312024	99.65170	0.348296
		(7.26564)	(7.26564)
17	4.312027	99.65159	0.348408
		(7.51050)	(7.51050)
18	4.312027	99.65159	0.348408
		(7.51050)	(7.51050)
19	4.312028	99.65155	0.348446
		(7.71778)	(7.71778)
20	4.312028	99.65155	0.348446
		(7.71778)	(7.71778)
21	4.312028	99.65154	0.348458
		(7.89539)	(7.89539)
22	4.312028	99.65154	0.348458
		(7.89539)	(7.89539)
23	4.312028	99.65154	0.348463
		(8.04927)	(8.04927)
24	4.312028	99.65154	0.348463

		(8.04927)	(8.04927)
25	4.312028	99.65154	0.348464
		(8.18381)	(8.18381)
26	4.312028	99.65154	0.348464
		(8.18381)	(8.18381)

		Variance Decomposition of D(LNRP):	
Period	S.E.	GDPG	D(LNRP)
1	0.023949	6.154291	93.84571
		(10.0280)	(10.0280)
2	0.023949	6.154291	93.84571
		(10.0280)	(10.0280)
3	0.027696	6.360754	93.63925
		(11.7444)	(11.7444)
4	0.027696	6.360754	93.63925
		(11.7444)	(11.7444)
5	0.028844	6.409482	93.59052
		(12.5237)	(12.5237)
6	0.028844	6.409482	93.59052
		(12.5237)	(12.5237)
7	0.029219	6.424173	93.57583
		(12.7685)	(12.7685)
8	0.029219	6.424173	93.57583
		(12.7685)	(12.7685)
9	0.029344	6.428934	93.57107
		(12.8329)	(12.8329)
10	0.029344	6.428934	93.57107
		(12.8329)	(12.8329)
11	0.029385	6.430513	93.56949
		(12.8621)	(12.8621)
12	0.029385	6.430513	93.56949
		(12.8621)	(12.8621)
13	0.029399	6.431041	93.56896
		(12.8751)	(12.8751)
14	0.029399	6.431041	93.56896
		(12.8751)	(12.8751)
15	0.029404	6.431218	93.56878
		(12.8822)	(12.8822)
16	0.029404	6.431218	93.56878
		(12.8822)	(12.8822)
17	0.029406	6.431277	93.56872
		(12.8865)	(12.8865)
18	0.029406	6.431277	93.56872
		(12.8865)	(12.8865)
19	0.029406	6.431297	93.56870
		(12.8894)	(12.8894)
20	0.029406	6.431297	93.56870
		(12.8894)	(12.8894)
21	0.029406	6.431304	93.56870
		(12.8916)	(12.8916)
22	0.029406	6.431304	93.56870
		(12.8916)	(12.8916)
23	0.029406	6.431306	93.56869
		(12.8931)	(12.8931)
24	0.029406	6.431306	93.56869
		(12.8931)	(12.8931)
25	0.029406	6.431307	93.56869

		(12.8943)	(12.8943)
26	0.029406	6.431307	93.56869
		(12.8943)	(12.8943)

Cholesky Ordering: GDPG D(LNRP)
Standard Errors: Monte Carlo (100 repetitions)

Bangladesh (GDP & Rice Consumption)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	D(LNRC)
1	0.791833	100.0000	0.000000
		(0.00000)	(0.00000)
2	0.996558	99.72692	0.273084
		(3.74417)	(3.74417)
3	1.097853	99.46364	0.536363
		(6.92967)	(6.92967)
4	1.152022	99.28126	0.718737
		(9.04951)	(9.04951)
5	1.181836	99.16770	0.832302
		(10.3189)	(10.3189)
6	1.198462	99.10020	0.899805
		(11.1010)	(11.1010)
7	1.207796	99.06098	0.939019
		(11.6335)	(11.6335)
8	1.213053	99.03847	0.961528
		(12.0359)	(12.0359)
9	1.216020	99.02564	0.974365
		(12.3667)	(12.3667)
10	1.217697	99.01834	0.981659
		(12.6602)	(12.6602)
11	1.218644	99.01420	0.985797
		(12.9385)	(12.9385)
12	1.219180	99.01186	0.988140
		(13.2106)	(13.2106)
13	1.219483	99.01053	0.989467
		(13.4741)	(13.4741)
14	1.219655	99.00978	0.990218
		(13.7204)	(13.7204)
15	1.219752	99.00936	0.990643
		(13.9404)	(13.9404)
16	1.219807	99.00912	0.990884
		(14.1283)	(14.1283)
17	1.219838	99.00898	0.991020
		(14.2812)	(14.2812)
18	1.219855	99.00890	0.991097
		(14.3995)	(14.3995)
19	1.219865	99.00886	0.991141
		(14.4851)	(14.4851)
20	1.219871	99.00883	0.991165
		(14.5411)	(14.5411)
21	1.219874	99.00882	0.991179
		(14.5712)	(14.5712)
22	1.219876	99.00881	0.991187
		(14.5791)	(14.5791)
23	1.219877	99.00881	0.991191
		(14.5687)	(14.5687)

24	1.219877	99.00881	0.991194
		(14.5432)	(14.5432)
25	1.219878	99.00880	0.991195
		(14.5057)	(14.5057)
26	1.219878	99.00880	0.991196
		(14.4589)	(14.4589)

		Variance Decomposition of D(LNRC):	
Period	S.E.	GDPG	D(LNRC)
1	0.025665	0.028135	99.97187
		(4.41146)	(4.41146)
2	0.027811	0.123727	99.87627
		(5.58480)	(5.58480)
3	0.028177	0.293138	99.70686
		(7.56681)	(7.56681)
4	0.028252	0.442296	99.55770
		(9.22971)	(9.22971)
5	0.028275	0.546709	99.45329
		(10.4501)	(10.4501)
6	0.028285	0.612634	99.38737
		(11.3549)	(11.3549)
7	0.028290	0.652186	99.34781
		(12.0523)	(12.0523)
8	0.028294	0.675291	99.32471
		(12.6023)	(12.6023)
9	0.028296	0.688597	99.31140
		(13.0403)	(13.0403)
10	0.028297	0.696200	99.30380
		(13.3924)	(13.3924)
11	0.028297	0.700525	99.29947
		(13.6795)	(13.6795)
12	0.028298	0.702980	99.29702
		(13.9186)	(13.9186)
13	0.028298	0.704371	99.29563
		(14.1218)	(14.1218)
14	0.028298	0.705158	99.29484
		(14.2978)	(14.2978)
15	0.028298	0.705604	99.29440
		(14.4526)	(14.4526)
16	0.028298	0.705857	99.29414
		(14.5911)	(14.5911)
17	0.028298	0.705999	99.29400
		(14.7167)	(14.7167)
18	0.028298	0.706080	99.29392
		(14.8321)	(14.8321)
19	0.028298	0.706126	99.29387
		(14.9389)	(14.9389)
20	0.028298	0.706152	99.29385
		(15.0385)	(15.0385)
21	0.028298	0.706166	99.29383
		(15.1315)	(15.1315)
22	0.028298	0.706175	99.29383
		(15.2183)	(15.2183)
23	0.028298	0.706179	99.29382
		(15.2989)	(15.2989)
24	0.028298	0.706182	99.29382
		(15.3731)	(15.3731)

25	0.028298	0.706184	99.29382
		(15.4405)	(15.4405)
26	0.028298	0.706184	99.29382
		(15.5003)	(15.5003)

Cholesky Ordering: GDPG D(LNRC)
Standard Errors: Monte Carlo (100 repetitions)

Bangladesh (GDP & Rice Production)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	D(LNRP)
1	0.793828	100.0000	0.000000
		(0.00000)	(0.00000)
2	0.994971	99.99967	0.000335
		(5.36437)	(5.36437)
3	1.093402	99.99958	0.000423
		(7.12387)	(7.12387)
4	1.145846	99.99954	0.000461
		(7.90495)	(7.90495)
5	1.174757	99.99952	0.000479
		(8.26732)	(8.26732)
6	1.190959	99.99951	0.000489
		(8.45445)	(8.45445)
7	1.200117	99.99951	0.000495
		(8.55677)	(8.55677)
8	1.205317	99.99950	0.000498
		(8.61943)	(8.61943)
9	1.208278	99.99950	0.000500
		(8.65790)	(8.65790)
10	1.209967	99.99950	0.000500
		(8.68559)	(8.68559)
11	1.210930	99.99950	0.000501
		(8.70494)	(8.70494)
12	1.211480	99.99950	0.000501
		(8.72150)	(8.72150)
13	1.211794	99.99950	0.000502
		(8.73500)	(8.73500)
14	1.211974	99.99950	0.000502
		(8.74809)	(8.74809)
15	1.212076	99.99950	0.000502
		(8.76009)	(8.76009)
16	1.212135	99.99950	0.000502
		(8.77237)	(8.77237)
17	1.212168	99.99950	0.000502
		(8.78433)	(8.78433)
18	1.212187	99.99950	0.000502
		(8.79673)	(8.79673)
19	1.212198	99.99950	0.000502
		(8.80914)	(8.80914)
20	1.212205	99.99950	0.000502
		(8.82196)	(8.82196)
21	1.212208	99.99950	0.000502
		(8.83493)	(8.83493)
22	1.212210	99.99950	0.000502
		(8.84826)	(8.84826)
23	1.212211	99.99950	0.000502

		(8.86178)	(8.86178)
24	1.212212	99.99950	0.000502
		(8.87561)	(8.87561)
25	1.212212	99.99950	0.000502
		(8.88963)	(8.88963)
26	1.212213	99.99950	0.000502
		(8.90390)	(8.90390)

Variance Decomposition of D(LNRP):

Period	S.E.	GDPG	D(LNRP)
1	0.051024	0.090314	99.90969
		(4.37465)	(4.37465)
2	0.051122	0.369752	99.63025
		(5.46656)	(5.46656)
3	0.051158	0.509903	99.49010
		(6.22853)	(6.22853)
4	0.051178	0.590241	99.40976
		(6.76753)	(6.76753)
5	0.051190	0.636069	99.36393
		(7.14531)	(7.14531)
6	0.051197	0.662232	99.33777
		(7.43332)	(7.43332)
7	0.051201	0.677172	99.32283
		(7.66483)	(7.66483)
8	0.051203	0.685706	99.31429
		(7.85583)	(7.85583)
9	0.051204	0.690580	99.30942
		(8.01798)	(8.01798)
10	0.051205	0.693365	99.30664
		(8.15788)	(8.15788)
11	0.051205	0.694955	99.30504
		(8.28142)	(8.28142)
12	0.051205	0.695864	99.30414
		(8.39253)	(8.39253)
13	0.051206	0.696383	99.30362
		(8.49479)	(8.49479)
14	0.051206	0.696680	99.30332
		(8.59087)	(8.59087)
15	0.051206	0.696849	99.30315
		(8.68325)	(8.68325)
16	0.051206	0.696946	99.30305
		(8.77394)	(8.77394)
17	0.051206	0.697002	99.30300
		(8.86486)	(8.86486)
18	0.051206	0.697033	99.30297
		(8.95769)	(8.95769)
19	0.051206	0.697051	99.30295
		(9.05402)	(9.05402)
20	0.051206	0.697062	99.30294
		(9.15532)	(9.15532)
21	0.051206	0.697067	99.30293
		(9.26293)	(9.26293)
22	0.051206	0.697071	99.30293
		(9.37802)	(9.37802)
23	0.051206	0.697073	99.30293
		(9.50162)	(9.50162)
24	0.051206	0.697074	99.30293

		(9.63451)	(9.63451)
25	0.051206	0.697074	99.30293
		(9.77721)	(9.77721)
26	0.051206	0.697075	99.30293
		(9.92994)	(9.92994)

Cholesky Ordering: GDPG D(LNRP)
Standard Errors: Monte Carlo (100 repetitions)

Vietnam (GDP & Rice Consumption)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	D(LNRC)
1	0.988832	100.0000	0.000000
		(0.00000)	(0.00000)
2	1.127850	99.99957	0.000428
		(3.86110)	(3.86110)
3	1.166832	99.99958	0.000417
		(3.66496)	(3.66496)
4	1.178353	99.99957	0.000430
		(3.99533)	(3.99533)
5	1.181825	99.99957	0.000430
		(3.96413)	(3.96413)
6	1.182874	99.99957	0.000431
		(4.06562)	(4.06562)
7	1.183191	99.99957	0.000431
		(4.06897)	(4.06897)
8	1.183287	99.99957	0.000431
		(4.11149)	(4.11149)
9	1.183316	99.99957	0.000431
		(4.12090)	(4.12090)
10	1.183325	99.99957	0.000431
		(4.14216)	(4.14216)
11	1.183328	99.99957	0.000431
		(4.15097)	(4.15097)
12	1.183329	99.99957	0.000431
		(4.16309)	(4.16309)
13	1.183329	99.99957	0.000431
		(4.17008)	(4.17008)
14	1.183329	99.99957	0.000431
		(4.17767)	(4.17767)
15	1.183329	99.99957	0.000431
		(4.18292)	(4.18292)
16	1.183329	99.99957	0.000431
		(4.18799)	(4.18799)
17	1.183329	99.99957	0.000431
		(4.19186)	(4.19186)
18	1.183329	99.99957	0.000431
		(4.19538)	(4.19538)
19	1.183329	99.99957	0.000431
		(4.19822)	(4.19822)
20	1.183329	99.99957	0.000431
		(4.20072)	(4.20072)
21	1.183329	99.99957	0.000431
		(4.20280)	(4.20280)
22	1.183329	99.99957	0.000431
		(4.20460)	(4.20460)

23	1.183329	99.99957	0.000431
		(4.20612)	(4.20612)
24	1.183329	99.99957	0.000431
		(4.20744)	(4.20744)
25	1.183329	99.99957	0.000431
		(4.20855)	(4.20855)
26	1.183329	99.99957	0.000431
		(4.20951)	(4.20951)

Variance Decomposition of D(LNRC):

Period	S.E.	GDPG	D(LNRC)
1	0.038037	11.72069	88.27931
		(13.3956)	(13.3956)
2	0.043058	22.86471	77.13529
		(16.0268)	(16.0268)
3	0.043280	22.66241	77.33759
		(15.9569)	(15.9569)
4	0.043423	23.05544	76.94456
		(16.3330)	(16.3330)
5	0.043433	23.07799	76.92201
		(16.4241)	(16.4241)
6	0.043441	23.10191	76.89809
		(16.5865)	(16.5865)
7	0.043442	23.10575	76.89425
		(16.6864)	(16.6864)
8	0.043442	23.10755	76.89245
		(16.7964)	(16.7964)
9	0.043442	23.10797	76.89203
		(16.8839)	(16.8839)
10	0.043442	23.10812	76.89188
		(16.9684)	(16.9684)
11	0.043442	23.10816	76.89184
		(17.0416)	(17.0416)
12	0.043442	23.10817	76.89183
		(17.1097)	(17.1097)
13	0.043442	23.10818	76.89182
		(17.1707)	(17.1707)
14	0.043442	23.10818	76.89182
		(17.2268)	(17.2268)
15	0.043442	23.10818	76.89182
		(17.2778)	(17.2778)
16	0.043442	23.10818	76.89182
		(17.3246)	(17.3246)
17	0.043442	23.10818	76.89182
		(17.3675)	(17.3675)
18	0.043442	23.10818	76.89182
		(17.4071)	(17.4071)
19	0.043442	23.10818	76.89182
		(17.4434)	(17.4434)
20	0.043442	23.10818	76.89182
		(17.4769)	(17.4769)
21	0.043442	23.10818	76.89182
		(17.5079)	(17.5079)
22	0.043442	23.10818	76.89182
		(17.5365)	(17.5365)
23	0.043442	23.10818	76.89182
		(17.5630)	(17.5630)

24	0.043442	23.10818	76.89182
		(17.5875)	(17.5875)
25	0.043442	23.10818	76.89182
		(17.6103)	(17.6103)
26	0.043442	23.10818	76.89182
		(17.6315)	(17.6315)

Cholesky Ordering: GDPG D(LNRC)
Standard Errors: Monte Carlo (100 repetitions)

Vietnam (GDP & Rice Production)

		Variance Decomposition of GDPG:	
Period	S.E.	GDPG	LNRP
1	0.895595	100.0000	0.000000
		(0.00000)	(0.00000)
2	1.001761	99.66484	0.335162
		(0.43867)	(0.43867)
3	1.028123	99.01435	0.985649
		(1.18485)	(1.18485)
4	1.037131	98.21222	1.787777
		(2.03843)	(2.03843)
5	1.042308	97.38670	2.613300
		(2.88829)	(2.88829)
6	1.046561	96.60709	3.392907
		(3.68355)	(3.68355)
7	1.050413	95.90125	4.098747
		(4.40608)	(4.40608)
8	1.053914	95.27526	4.724738
		(5.05396)	(5.05396)
9	1.057059	94.72556	5.274441
		(5.63282)	(5.63282)
10	1.059856	94.24502	5.754981
		(6.15123)	(6.15123)
11	1.062328	93.82570	6.174302
		(6.61834)	(6.61834)
12	1.064505	93.45997	6.540032
		(7.04262)	(7.04262)
13	1.066418	93.14092	6.859079
		(7.43136)	(7.43136)
14	1.068097	92.86247	7.137531
		(7.79054)	(7.79054)
15	1.069571	92.61931	7.380693
		(8.12500)	(8.12500)
16	1.070865	92.40684	7.593162
		(8.43852)	(8.43852)
17	1.071999	92.22108	7.778919
		(8.73409)	(8.73409)
18	1.072995	92.05860	7.941404
		(9.01407)	(9.01407)
19	1.073869	91.91640	8.083601
		(9.28030)	(9.28030)
20	1.074635	91.79191	8.208095
		(9.53424)	(9.53424)
21	1.075308	91.68287	8.317129
		(9.77706)	(9.77706)
22	1.075899	91.58734	8.412655

		(10.0097)	(10.0097)
23	1.076417	91.50363	8.496371
		(10.2330)	(10.2330)
24	1.076872	91.43025	8.569754
		(10.4476)	(10.4476)
25	1.077271	91.36591	8.634095
		(10.6540)	(10.6540)
26	1.077622	91.30948	8.690518
		(10.8528)	(10.8528)

		Variance Decomposition of LNRP:	
Period	S.E.	GDPG	LNRP
1	0.039423	4.647282	95.35272
		(7.81430)	(7.81430)
2	0.054026	4.644700	95.35530
		(8.16838)	(8.16838)
3	0.064165	4.642968	95.35703
		(9.56308)	(9.56308)
4	0.071899	4.641775	95.35822
		(10.8907)	(10.8907)
5	0.078062	4.640932	95.35907
		(11.9772)	(11.9772)
6	0.083097	4.640320	95.35968
		(12.8440)	(12.8440)
7	0.087280	4.639865	95.36014
		(13.5365)	(13.5365)
8	0.090794	4.639519	95.36048
		(14.0940)	(14.0940)
9	0.093772	4.639251	95.36075
		(14.5466)	(14.5466)
10	0.096311	4.639040	95.36096
		(14.9171)	(14.9171)
11	0.098486	4.638871	95.36113
		(15.2228)	(15.2228)
12	0.100358	4.638733	95.36127
		(15.4770)	(15.4770)
13	0.101973	4.638620	95.36138
		(15.6899)	(15.6899)
14	0.103371	4.638527	95.36147
		(15.8698)	(15.8698)
15	0.104583	4.638449	95.36155
		(16.0230)	(16.0230)
16	0.105636	4.638383	95.36162
		(16.1545)	(16.1545)
17	0.106552	4.638328	95.36167
		(16.2684)	(16.2684)
18	0.107350	4.638280	95.36172
		(16.3677)	(16.3677)
19	0.108046	4.638240	95.36176
		(16.4550)	(16.4550)
20	0.108653	4.638205	95.36179
		(16.5323)	(16.5323)
21	0.109184	4.638176	95.36182
		(16.6011)	(16.6011)
22	0.109648	4.638150	95.36185
		(16.6629)	(16.6629)
23	0.110054	4.638128	95.36187

		(16.7185)	(16.7185)
24	0.110409	4.638109	95.36189
		(16.7688)	(16.7688)
25	0.110720	4.638092	95.36191
		(16.8146)	(16.8146)
26	0.110992	4.638078	95.36192
		(16.8563)	(16.8563)

Cholesky Ordering: GDPG LNRP
Standard Errors: Monte Carlo (100 repetitions)