# IMPACTS OF THE 2007/2008 FOOD PRICE SPIKE

# ON THE LOCAL ECONOMIES

## - AN EVIDENCE FROM RICE MARKET INTEGRATION IN VIETNAM -

**NGUYEN DUC KIEN**

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NGUYEN DUC KIEN


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Supervised by


Ito Shoichi

Professor

Hiroshi Isoda

Associate Professor

Hisamitsu Saito

Assistant Professor


Laboratory of Food and Agricultural Policy

Department of Agricultural and Resource Economics

Graduate school of Bioresource and Bioenvironmental Sciences

Kyushu University, Fukuoka, Japan


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# TABLE OF CONTENTS

## CHAPTER 1: INTRODUCTION

## CHAPTER 2: REVIEW OF LITERATURE

# CHAPTER 3: BACKGROUND OF THE INTERNATIONAL RICE MARKET AND RICE POLICIES

# CHAPTER 4: VIETNAM'S RICE ECONOMY AND RICE MARKET IN 2007/2008

# CHAPTER 5: DATA AND METHODOLOGY

**CHAPTER 6: EMPIRICAL RESULTS AND DISCUSSIONS**

**CHAPTER 7: CONCLUSIONS AND POLICY IMPLICATIONS**

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF ACRONYMS AND ABBREVIATIONS

## Names of organizations

FAO   Food and Agriculture Organization of the United Nations

IFPRI   International Food Policy Research Institute

IPSARD  Institute of Strategy and Policy for Agriculture and Rural Development

OECD   Organization of Economic Co-operation and Development

USDA   United States Department of Agriculture

## Econometric terminologies

ADF test  Augmented Dickey-Fuller test

OLS    Ordinary Least Squares

VAR    Vector Autoregression

VECM   Vector Error Correction Model

## ABSTRACT

Since 2007, global food prices have spiked dramatically, especially for three of the world's major grains (rice, wheat and maize), leading to an increasing interest among economists in price volatility and market performance in many countries. The price surge in 2007/2008 put many countries into various difficulties. In order to insure food security, many governments have issued various types of policies such as placing export bans and removing import tariffs for stabilizing domestic rice markets.

Numerous articles concerning this unexpected "food crisis" have been published since 2008 (Shigetomi, Kensuke, and Tsukada, 2011). Especially, price linkages among markets have been extensively examined to study the impacts of the food price crisis in 2007/2008 on developing countries. So far, most of the studies dealing with the impacts of the current food crisis on food market integration have been carried out only in net food importers, particularly in Sub-Saharan countries, and do not address this issue in food surplus areas. Yet the impacts of rising food prices may be different in each country mainly depending on their economic conditions and the situation of food production, consumption and trade.

In this study, we fill this gap in the literature by analyzing the rice market in Vietnam - the second largest rice exporter in the world. The goal of this paper is to evaluate the local impacts before, during and after the global food crisis in 2007/2008 on rice market integration. We use the multivariate co-integration techniques to measure the price transmission among six local markets over a long

time period, i.e. at least four years. In particular, we test for long-run spatial market integration and examine the speed of adjustment from disequilibria among selected rice markets during three different study periods.

Using weekly data from 2007 to 2010, this paper explored the spatial integration of local rice markets in different regions of Vietnam before, during and after the food price crisis in the 2007/2008 period. The shocks in international and domestic rice markets and intervention policies caused negative impacts on market integration in terms of both long-run relationships and short-run adjustment processes.

Using Johansen's co-integration test, we determined clear long-run relationships among market places. Yet market integration weakened considerably between surplus and deficit regions and it tended to be severer in the post-spike period. Moreover, the adjustment speed remained extremely low after the price crisis because rice prices behaved locally among different groups of In order to mitigate the impacts of food price increases; the analysis indicates that policy interventions need to concentrate on improving the integration between rice-surplus and deficit regions. More specifically, improving transportation networks and distribution systems connecting production markets in the southern area (An Giang, Can Tho and Tien Giang) and consumption markets in the northern area (Ha Noi and Da Nang) will increase trade flow among markets. In addition, subsidy policies are needed to improve incentives for traders to transfer rice from surplus markets to deficit markets between the North and the South of Vietnam market places.

**CHAPTER 1**

**INTRODUCTION**

## 1.2. Background and statement of problems

Since 2007, global food prices have spiked dramatically, especially for three of the world's major grains (rice, wheat and maize), leading to an increasing interest among economists in price volatility and market performance in many countries. In the international market, the prices of the Thai white rice 100% grade B, a representative rice of the world market, more than doubled since January, rising from USD$ 385 to USD$ 949 per ton by mid-May 2008 (FAO, 2008). Domestic rice prices in developing countries increased by up to 90 percent between the third quarter of 2007 and the same quarter in 2008, with a typical year-on-year change of about 30 percent (FAO, 2008).

The price surge in 2007/2008 put many countries into various difficulties. In order to insure food security, many governments have issued various types of policies such as placing export bans and removing import tariffs for stabilizing domestic rice markets. Moreover, rice-exporting countries started to restrict rice exports in order to secure the domestic supply. India raised the floor price for allowing export of non-basmati rice to prevent low grade rice from flowing out of the country in October 2007. In the same month, China levied an export tax on rice. In March 2008, Egypt and Cambodia prohibited the export of rice entirely. In April 2008, Pakistan declared the lowest price for allowing export, and Brazil temporarily banned export. In Vietnam, rice prices increased by about 50 percent

from the end of April to the end of May 2008, namely from VND7.400/kg to more than VND11.000/kg (Ngan, 2010). Coping with the new situation in 2007/2008, the Vietnamese government decided to reduce its export target, issued temporary export restrictions and imposed an export tariff to protect domestic markets. However, these policies apparently failed to prevent rice prices from increasing sharply in a short period (Ngan, 2010; Speedy, 2008).

Numerous articles concerning this unexpected "food crisis" have been published since 2008 (Shigetomi, Kensuke, and Tsukada, 2011). Most of the literature discusses the causes of the price surge (Childs & Kiawu, 2009; Timmer, 2008; Headey, 2010; Demeke, 2008), the impact of the price surge (Pandey, 2008; Aksoy & Isik-Diknelik, 2008; Warr, 2008; Ivanic & Martin, 2008; Abbott & de Battisti, 2009; Benson et al., 2008), and the policy implications to prevent future crises (Abbott, 2009; World Bank, 2008; Timmer, 2008). As for the causes of the rice price spike, there seems to be a common understanding that the export ban or restrictions by major rice exporters, such as India and Vietnam, and the panic purchase by major importers, such as the Philippines, pushed the price to this height (Childs & Kiawu, 2009; Timmer, 2008; Headey 2010; Demeke, 2008).

Moreover, measurement of market integration helps improve our understanding of the impacts of food crisis on specific markets. Especially, price linkages among markets have been extensively examined to study the impacts of the food price crisis in 2007/2008 on developing countries.

Studies of market integration during crisis periods have found various results. For example, by performing the Johansen's test for co-integration, Ulimwengu, Workneh and Paulos (2009) show that none of the Ethiopian regional maize markets had a long-term connection to the world market, nor could they establish evidence of market integration among regional markets. In addition, Cudjoe, Breisinger and Diao (2010) point out that price transmission of cereals in Ghana is high between major production areas and markets in the largest cities, but not between towns far from major production areas. So far, most of the studies dealing with the impacts of the current food crisis on food market integration have been carried out only in net food importers (Cudjoe, Breisinger and Diao, 2010; Minot, 2011; Rashid, 2011; Ulimwengu, Workneh and Paulos, 2009), particularly in Sub-Saharan countries, and do not address this issue in food surplus areas. Yet the impacts of rising food prices may be different in each country mainly depending on their economic conditions and the situation of food production, consumption and trade.

In this study, we fill this gap in the literature by analyzing the rice market in Vietnam - the second largest rice exporter in the world. The goal of this research is to evaluate the local impacts before, during and after the global food crisis in 2007/2008 on rice market integration. We use the multivariate co-integration techniques to measure the price transmission among six local markets over a long time period, i.e. at least four years. In particular, we test for long-run spatial market integration and examine the speed of adjustment from disequilibria among selected rice markets during three different study periods.

**1.2. Objectives of the study**

The main purpose of this study is to understand the performance of Vietnam's rice market before, during, and after the food price spike in the 2007/2008 periods. More specifically, we try to measure the degree of changes in market integration for domestic rice markets to determine the existence of long-run price relationships among markets over the study periods. For this purpose, the following objectives are set:

- To investigate the long-run relationship of selected rice markets in six different regions of Vietnam

- To analyze the short term adjustment process of rice prices

- To examine and compare the changes in the degree of integration in domestic rice markets during different study periods

- To provide some policy implications and recommendations for the future price shock in the domestic market

**1.3. Expected outcomes**

This study is expected to provide an overview of the international rice market, Vietnam's rice economy, and rice policies in recent years, especially in the 2007/2008 period. Moreover, we focus on the impacts of rising rice prices on different domestic markets by taking a look at rice market integration. We use co-integration analysis to clarify the long-run relationships and short-run adjustment processes among market places. By comparing the situation of market integration over three different study periods, the study will figure out the changes of price linkages among markets under the price spike periods. Based on the analyses of

the impacts of price shocks on domestic markets, we will provide some policy implications to deal with any unexpected movements of rice prices in the future.

## 1.4. Outline of the study

The thesis is arranged as follows: the next chapter introduces the review of literature. Chapter 3 provides the background of the international rice market and rice policies. In chapter 4, an overview of Vietnam's rice economy and rice market in 2007/2008 is discussed. Chapter 5 outlines the conceptual framework, econometric techniques and data used in the study. Chapter 6 covers the empirical results and discussions. The final chapter provides some concluding remarks and policy implications.

# CHAPTER 2

# REVIEW OF LITERATURE

In this chapter, we review the early works in the area of market integration using time series data, and the impacts of food price spikes. Numerous articles and studies concerning the linkages among agricultural markets have been published. However, studies of market integration during food crisis periods have been quite limited and these studies have found variable results.

## 2.1. Time series analysis

Time series data is frequently used in empirical analyses. Empirical work based on the time series data assumes that the underlying time series is stationary and but usually faces with the problem of autocorrelation. Gujarati (2004) pointed out that when we regress of a time series variable on another time series variable(s) we often obtain a very high $R^2$ (in excess of 0.9) even though there is no meaningful relationship between the two variables. This situation shows the problem of spurious, regression in non-stationary data. The phenomenon of spurious or non-sense regression first discussed by Yule (1926). Yule (1926) showed that (spurious) correlation could persist in non-stationary time series even if the sample was very large. It is therefore necessary to test for the order of integration before conducting a regression on time series data to find out if the relationship between economic variables is spurious or nonsensical.

## 2.2. Market integration analysis

Measurement of market integration can be viewed as basic data for an understanding of how specific markets work (Dawson and Dey, 2002). Recently, price linkages among markets have been extensively examined for agricultural products in many countries. Rapsomanikis, Hallam and Conforti (2004) pointed out that several authors have studied price transmission within the context of market integration (Ravallion, 1986; Sexton *et al*, 1991; Palaskas and Harriss 1993; Zanias, 1993; Gardner and Brooks, 1994; Blauch 1997). The concept and the analytical techniques have also been used to evaluate policy reform, such as *ex post* assessment of market integration after the implementation of the structural adjustment programmes (Goletti and Babu, 1994; Alexander and Wyeth, 1994; Dercon, 1995).

Harris (1979) made a detailed survey of market performance and market integration. The survey includes case studies in various countries such as India, U.K., Africa, and Nigeria.

Ravallion (1986) sheds light on the potential problem of using bivariate correlation or regression coefficients as a measure of spatial market integration in agriculture. By accepting short-run dynamic adjustment process, Ravallion offers an approach to test long-run market integration.

Goodwin and Schroeder (1991) evaluated spatial price relationships among 11 regional slaughter cattle markets in the U.S. using co-integration tests of regional price series. The results showed that co-integration was limited. The regional cattle markets and the regional fed cattle prices neither were nor fully co-

integrated during the 1980s. The authors concluded that over time, co-integration increased across the study markets.

Liu and Wang (2003) used Johansen's multivariate co-integration test to determine egg market integration of six U.S states. The study indicated that eggs from these states substituted for each other to some extent, and pointed out arbitrage possibilities through egg prices. In addition, the authors found that transportation and other transaction costs might prevent the markets in the six states from being perfectly integrated in the short-run.

Faminow and Benson (1990) used weekly pig prices to test for short-run and long-run integration over partitioned data periods, between five cities in Canada. The results showed that possible markets inefficiencies in a period resulted from substantial change in the industry.

Fafechamps and Gavian (1995) investigated market integration of livestock markets in Niger. The authors tested for co-integration and Granger causality, estimated a version of Ravallion's model, computed average price differentials, and estimated a Parity Bounds Model (PBM). They found that livestock markets in Niger were closely related but not closely integrated. The authors indicated that the lack of market integration could be ascribed in part to the long distances involved and to the rudimentary way in which animals were transported from one market to another.

Goodwin and Piggott (2001) evaluated spatial price linkages and daily price dynamics among four maize and four soybean regional markets in North Carolina utilizing asymmetric, threshold auto-regression and error correction

models to account for the effects of transportation costs on price relationships. The authors found that price equalizing arbitrage activities occurred in response to localized shocks that exceeded the thresholds of the neutral band. The results were consistent with long-run market integration, as positive shocks elicited positive responses and negative shocks elicited negative responses, and the study confirmed the significance of transaction costs to spatial linkages.

Many previous studies showed that market integration was affected by many factors such as marketing infrastructure, institutional conditions, transaction costs, and distance between markets.

The large body of research on market integration and price transmission, both spatially and vertically, has applied different quantitative techniques and has highlighted several factors that impede the pass-through of price signals. Agricultural policy instruments such as import tariffs, tariff rate quotas, and export subsidies or taxes, intervention mechanisms, as well as exchange rate policies insulate the domestic markets and hinder the full transmission of international price signals by affecting the excess demand or supply schedules of domestic commodity markets (Gardner, 1975; Mundlak and Larson, 1992; Quiroz and Soto, 1996; Baffes and Ajwad, 2001; Abdulai, 2000; Sharma, 2002).

Apart from policies, domestic markets can also be partly insulated by large marketing margins that arise due to high transfer costs. Especially in developing countries, poor infrastructure, transport and communication services give rise to large marketing margins due to high costs of delivering the locally produced commodity to the border for export or the imported commodity to the domestic

market for consumption. High transfer costs and marketing margins hinder the transmission of price signals, as they may prohibit arbitrage (Sexton, Kling and Carman, 1991; Badiane and Shively, 1998). As a consequence, changes in world market prices are not fully transmitted to domestic prices, resulting in partial adjustment to shift in world supply and demand.

Most of the studies utilize time series econometric analysis techniques to test for the co-movement of prices. The development of these techniques, such as co-integration and error correction models, has become the standard tool for analyzing spatial market relationships, replacing earlier empirical tools, such as the bivariate correlation coefficient and regressions. Nevertheless, time series analysis has also being criticized as unreliable (Blauch, 1997; Barrett and Li, 2002) with recent research focusing on switching regime models that incorporate data on prices, volumes traded and transactions costs. The debate on the application methodology for testing for market integration and price transmission has a relatively long history starting with Harriss (1979). Blauch (1997) provides a review of the debate and examines the statistical performance of econometric tests for market integration. In essence, linear tests for market integration and price transmission are considered to be crude and inappropriate (Blauch, 1997; McNew, 1996; McNew and Fackler, 1997; Fackler and Goodwin, 2002 and Barrett and Li, 2002). Non-linearity in market relationships that arise from arbitrage conditions, unsynchronized price cycles, discontinuous trade and non-stationary transfer costs renders linear representations and models not useful and inaccurate.

## 2.3. Impacts of food price spikes

From 2007 to 2008, the world experienced a dramatic increase in global food prices which especially affected the poor, whose diets depend on staple commodities such as maize, rice, and wheat. There is an emerging and reasonable consensus among policy makers and academics about the range of causes. There is certainly no one, single cause; rather, many factors are interacting in different, locally specific ways.

According to the report of Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP), key causal factors of recent rises in food prices are:

- Weather disruptions, including serious droughts, have affected output in several key producing countries (Australia, Turkey, Ukraine and parts of North America) in the mid-2000s. This has led to the negative growth in world cereal production.

- The growth of world cereal production has slowed, causing a decline in stocks over the last decade. This has weakened the ability of the world food system to cope with shocks and created conditions in which short-term shocks cause large price fluctuations (Wiggins, 2008).

- High cost of oil and energy affects transportation of agricultural inputs and outputs, mechanical cultivation, fertilizers and pesticides.

- Increased demand due to the use of food crops in biofuel production has resulted in reduced soybean and wheat cultivation.

- Increasing and changing demand in China and India, due to economic growth, has led to increased consumer purchasing power and consequent shifts from traditional staples toward highly-valued foods like meat and milk. However, some analysts believe that the effect on world prices has been exaggerated.

- Reactivations of export bans in some developing countries, and biofuel subsidies in Western countries (FEG Consulting, 2008).

- Topsoil erosion: overgrazing, fertilizer and pesticide use result in the steady depletion of worldwide topsoil. Water and winds carry away the soil, when it is not fixed by plant cover. An estimated 25 billion tons of topsoil are lost to erosion each year. The UN estimates that erosion has now seriously degraded about 40 per cent of the world's agricultural land.

- Speculative capital: speculation in international commodity markets may have contributed to upward pressure on food prices. Big institutional investors have moved billions of dollars into commodities markets like oil, metals and foods in response to the stock-market decline and the slide in real-estate values. Food-processing companies, governments, large farmers and even aid agencies have entered the markets to hedge their future costs, leading to an increased activity in futures markets. This clearly affects market sentiment, and some analysts see this significant contributes to price rises, but the point remains debated.

- Under-investment in rural infrastructure and agricultural innovation.

- Increasing urbanization often means that more people are becoming consumers rather than producers of food.

Higher food prices may have different effects across countries and population groups. A recent IFPRI report (IFPRI, 2008b) provides the most detailed analysis of the impact of food prices rises. Broadly speaking, at the country level, net food exporters will benefit from improved terms of trade, although the benefits may be offset in situations where exports are being banned to protect consumers. Net food-importing nations, however, will struggle to meet domestic food demand.

FAO report published in June 2008 highlighted twenty two developing countries that are especially vulnerable due to a combination of high levels of chronic hunger (more than 30 per cent under-nourishment), and high dependence on imports of petroleum products (100 per cent in most countries) and, in many cases, also of major grains (rice, wheat and maize) for domestic consumption (FAO, 2008). Food-price increases also have serious consequences for the purchasing power of the poor (KFSSG/FAO, 2008). Affected groups include the rural landless, pastoralists, small-scale farmers and the urban poor.

According to FAO and OECD report, during the 2007-2008 price spike and subsequent decline, there were quite significant differences among regions and products in speed and degree to which world price movements were transmitted to regional or local markets. Many factors explain these differences including policy responses, exchange rate movements, competition policy, market structure and degree of market openness.

Headey and Fan (2010) pointed out that energy prices also rose sharply over this period of 2007/2008, and that these price increases contributed to the

changes in food prices both through supply-side and demand-side effects (e.g. the enhanced incentive to use food to produce biofuels). In the analysis, they specifically focused on the impact of changes in food prices on poverty. This is partly because food prices are likely to have the largest direct impact on poverty given the large shares of food in the expenditures of the poor, and the importance of agricultural income for many poor households. It is also because food prices are influenced by a number of factors, such as agricultural trade policies, stockholding policies and policies on research and extension that are quite separate from the factors affecting energy prices.

Miguel Robles and Lora Iannotti (2010) examined the nutritional impact of shocks in global food prices in Latin America by measuring the changes in calorie consumption in relation to the recommended calorie intake.

Recently, price linkages among markets have been extensively examined to study the impacts of the food price crisis in 2007/2008 on developing countries. Studies of market integration during crisis periods have found variable results. For example, by performing the Johansen's test for co-integration, Ulimwengu, Workneh and Paulos (2009) showed that none of the Ethiopian regional maize markets had a long-term connection to the world market, nor could they establish evidence of market integration among regional markets.

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# CHAPTER 3

# BACKGROUND OF THE INTERNATIONAL RICE MARKET

# AND RICE POLICIES

The international rice market continues to be regarded as "highly distorted", "segmented", "thin" and "volatile" (Calpe, 2004). Sellers and buyers enter the market depending on their domestic crop situation. Five major exporters account for more than 80 percent of rice trade volume in 2010, while there are few large and many smaller rice importers.

## 3.1. Major exporters

Rice is the main staple crop in many countries, especially in Asia. The largest rice producers and exporters are mainly concentrated in Asian area. Thailand, Vietnam, India, Pakistan, and the United States are dominating the world rice trade for several years.

Rice is vital for the nutrition of much of the population in Asia, as well as in Latin America and the Caribbean and in Africa; it is central to the food security of over half the world population, not to mention to the culture of many communities. Rice is therefore considered a "strategic" commodity in many countries and is, consequently, subject to a wide range of government controls and interventions.

Developing countries are the main players in the world rice trade, accounting for 83 percent of exports and 85 percent of imports in 2010. The

concentration is particularly high on the export side, since five countries (Thailand, Viet Nam, China, the United States and India) cover about three-quarters of world trade, among these countries, Thailand is the largest exporting country. Rice trade is considered as a thin market because more than 90 percent of total rice production is domestically consumed (Shigetomi, 2011).



*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
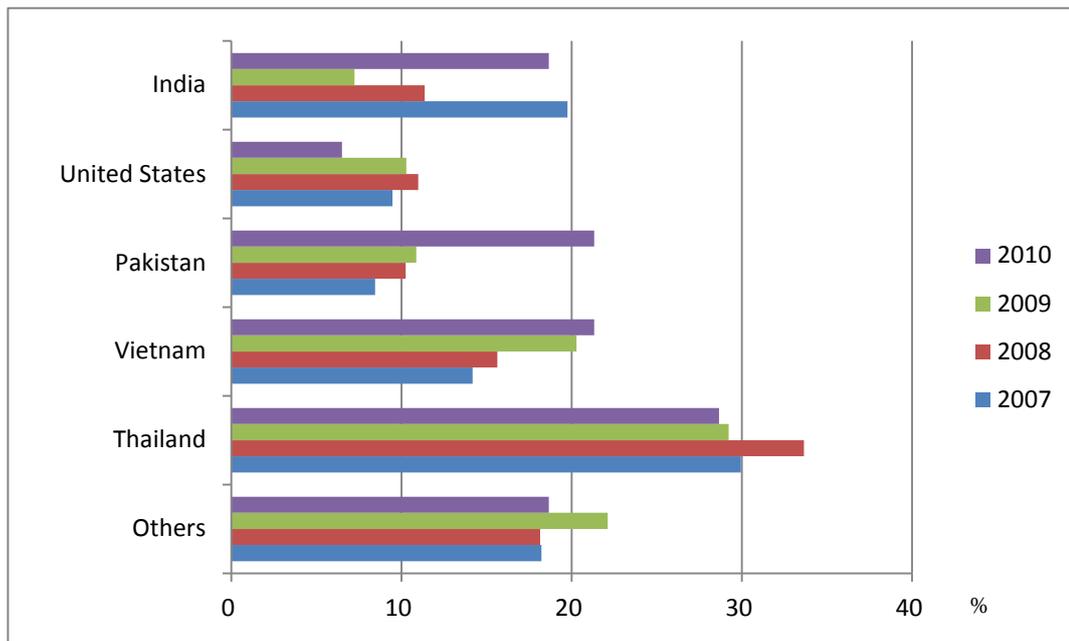
**Figure 3.1 Market shares of major rice exporters (2007-2010)**

### 3.1.1. Thailand

The total cultivated area in Thailand amounts to 20,900 thousand hectares of which around half is devoted to rice farming (Forssell, 2008). According to USDA, in 2006, the total production of paddy rice was 29.5 million tons. Thailand produced around 18.4 million tons of milled rice in 2007. Of the total milled rice, around 9 million tons were exported, making Thailand the largest exporter of rice in the world with a market share of around 30 percent for all varieties and qualities. Around 50 percent of the Thai exports are high quality

long grain rice, which receives the highest price in the market (Vanichanont, 2004).
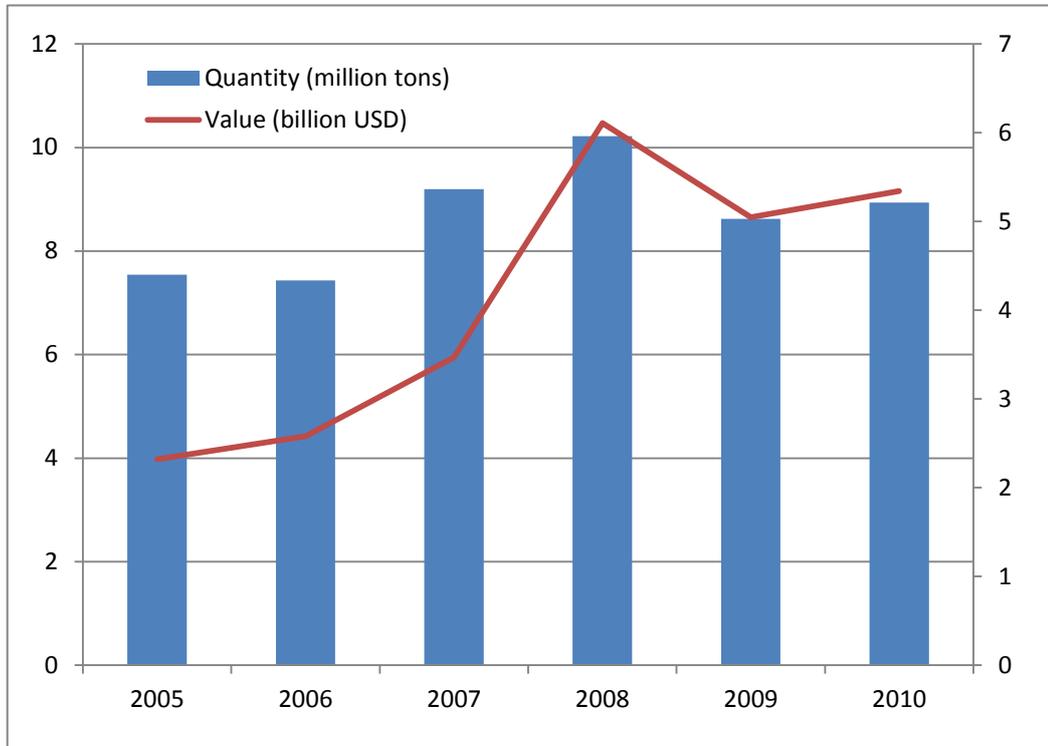
**Figure 3.2 Thai rice export volume and export value (2005-2010)**

### 3.1.2. Vietnam

Since 1989, Vietnam has been exporting one to two million tons of rice each year, making it the third largest exporting country in the world. Vietnam's re-acquired status as a rice exporter came as a surprise since it had been a net importer of rice since 1968. From being a net rice importer in the 1980s, Vietnam has become one of the world's leading rice exporters. Vietnamese rice export increases gradually every year in terms of both export volume and export value.
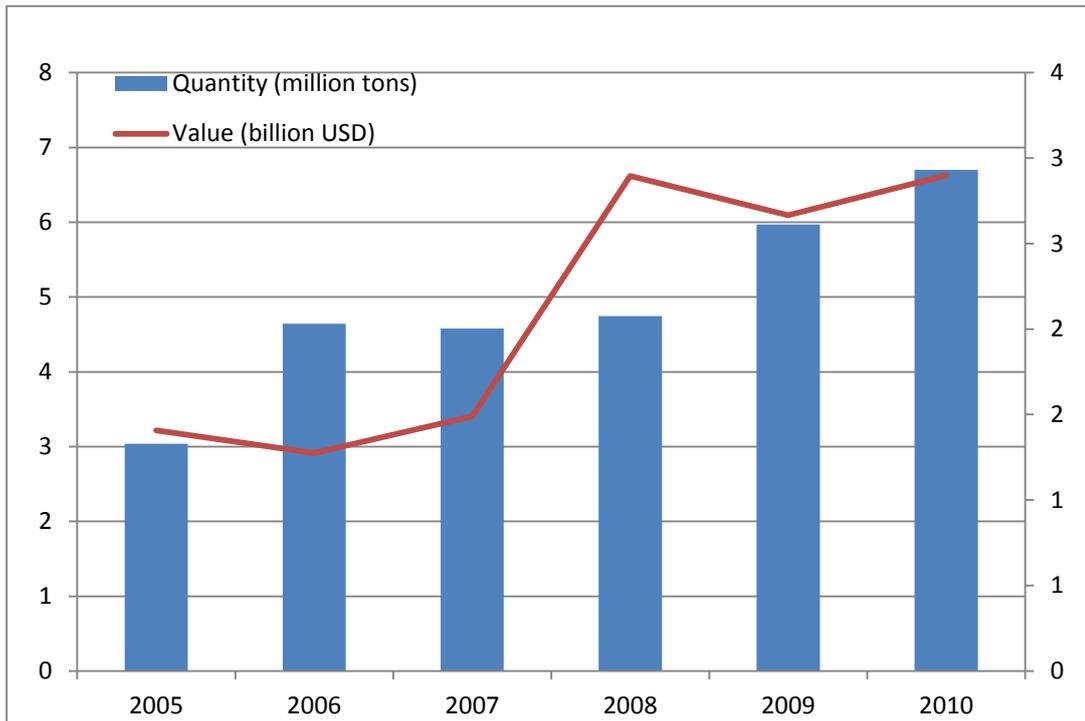
**Figure 3.3 Rice export volume and export value of Vietnam (2005-2010)**

Agricultural production, which mainly depends on rice production, still plays an important role in Vietnam's economy. Vietnamese rice is cheaper than Thai and Pakistani rice, which leads to a larger demand of Vietnamese rice than Thailand and Pakistani rice. The government of Vietnam strictly controls the prices as well arranges government to government agreement with major importing countries.

Vietnam's major export markets within the region are Indonesia, Malaysia and the Philippines. Sales to Iraq, Iran and Cuba are also important to Vietnamese rice exports. Vietnam exports primarily indica rice, mainly of intermediate and low quality

*3.1.3. U.S.*

According to USDA (2010), total U.S. rice export in 2010/11 is projected at 119.0 million cwt., 8 percent increase from 2009. U.S. rough-rice export is projected at a record 45.0 million cwt., 10 percent higher than year 2009. Latin America accounts for most of the expected increase in U.S. rough-rice exports in 2010/11. U.S. milled rice exports (combined milled and brown rice exports on a rough basis) remain projected at 74.0 million cwt., 7 percent larger than a year earlier. Sub-Saharan Africa and North Africa account for much more expected increase in U.S. milled rice exports in 2010/11. The U.S. rice export has fluctuated around 3.9 and 5.2 million tons over time, and the main export varieties are long-grain, medium-grain and short-grain, with long-grain accounting for more than 75 percent of total volume.
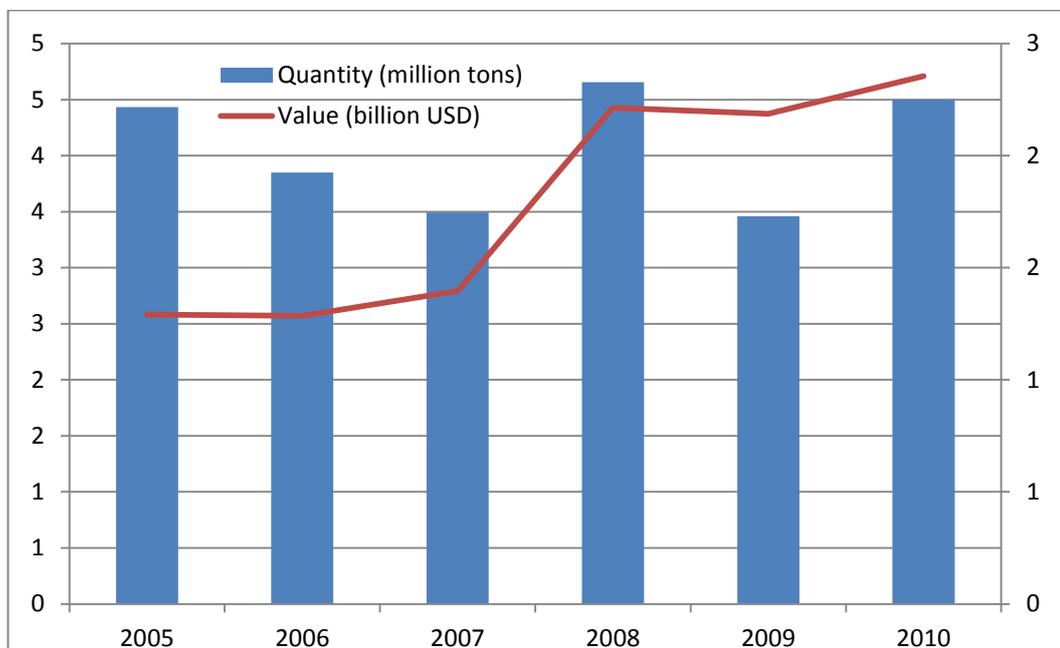


*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
**Figure 3.4 Rice export volume and export value of the U.S. (2005-2010)**

### 3.1.4. Pakistan

In Pakistan, rice is the third largest crop after wheat and cotton. Rice production occupies 10 percent of the total cropped area, and rice is highly valued cash crop accounting for 6.7 percent in value added in agriculture and 1.6 percent in GDP (REAP, 2011). According to Khan (2010), during 2008/2009 period, the total rice production increased by 24.9 percent; among which 16.9 percent due to land expansion and 6.9 percent due to improvement in yield. The production of basmati rice has increased by 4.4 percent because of expansion in area whereas the yield fell down by 5.7 percent. On the other hand, Pakistan is ranked of 12th in world rice production and the total production is 6,700 thousand MT, in which around 3,500 thousand MT tons are available for export purposes. Rice export volume of Pakistan fluctuates between 3 and 4.4 million tons per year, and Basmati rice is the main variety.



*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
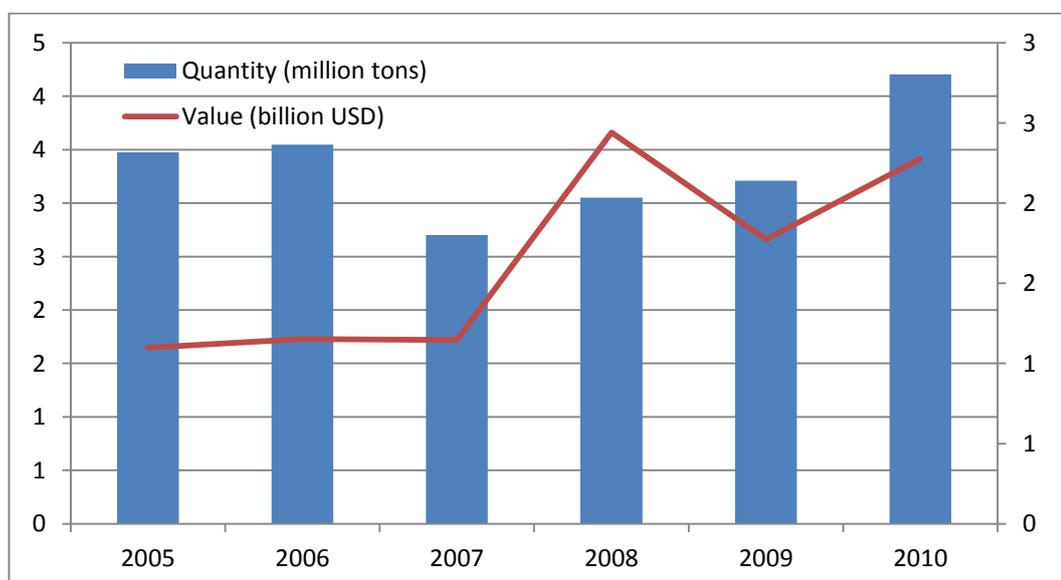
**Figure 3.5 Rice export volume and export value of Pakistan (2005-2010)**

*3.1.5. India*

India is the second largest rice producer after China. Rice is one of the important cereals in India. Rice contributes to 43 percent of total food grain production and 46 percent of total cereal production in the country. It continues to play vital role in the national exports. The share of rice in total national export was around 4.5 percent, and the share of agricultural export in total national export was 18.25 percent. Thus, rice export contributes nearly 25% of total agriculture export from the country. India has regularly exported high quality basmati rice (aromatic) and non-basmati rice, for over (US) $800 million per annum. Over 80 percent of Basmati rice grown in India is produced for export. During the 2008/2009 period, India had reduced its export volume in order to protect domestic market.



*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
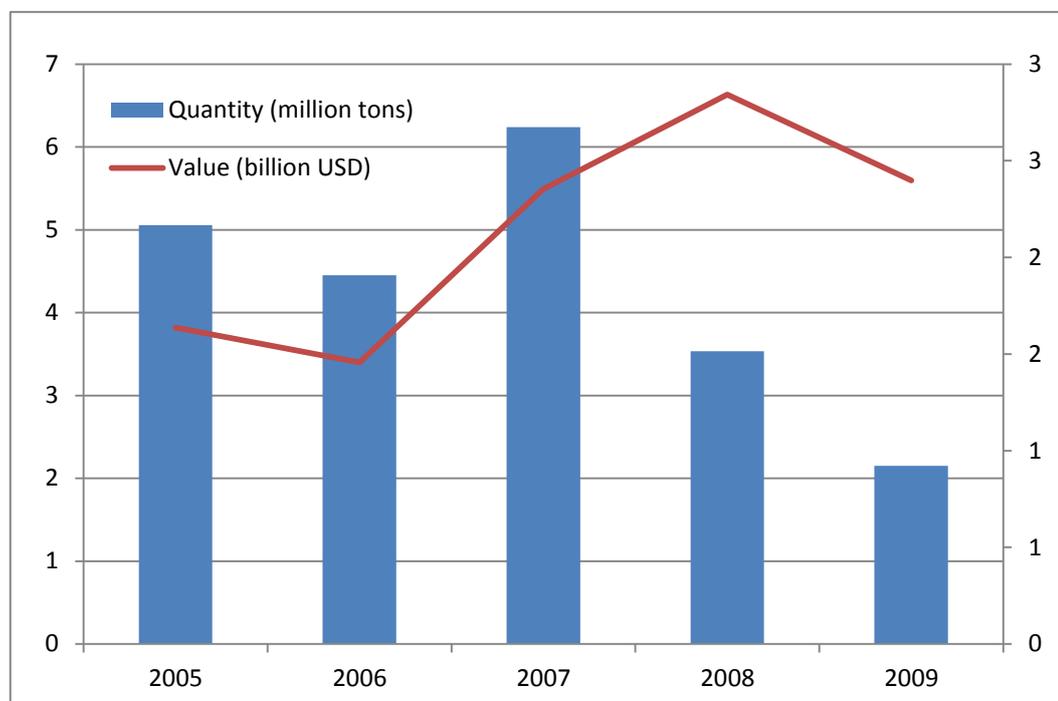
**Figure 3.6 Rice export volume and export value of India (2005-2009)**

## 3.2. Major importers

There are many small rice importers all over the world and the top 10 rice-importing nations account for only a third of overall global rice imports. The main rice importing countries are in Asia, in which the Philippines is a leading rice importer.

In addition, rice demand from other regions such as Africa (e.g. Nigeria), Middle East (e.g. Iran, Saudi Arabia, Iraq) is increasing over time, especially during price spike period of 2007/2008. Thailand and the U.S. provide rice for almost all continents. On the other hand, export from Vietnam, India, and Pakistan are mainly consumed in Asian, Middle Eastern and African countries.



*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
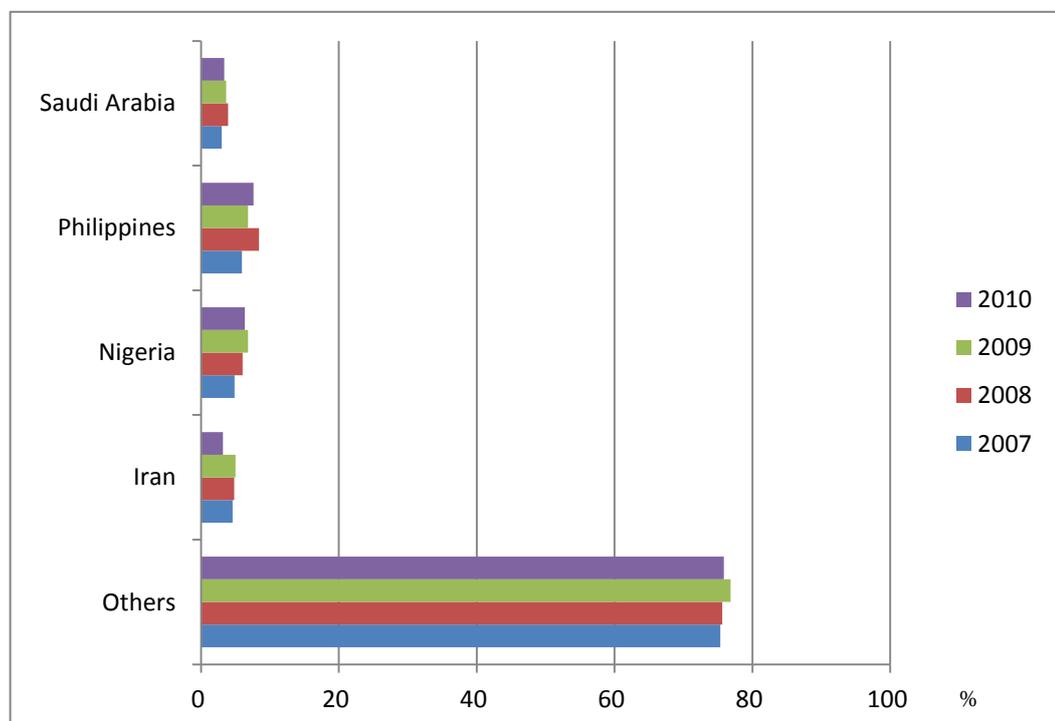
**Figure 3.7 Market shares of major rice exporters (2007-2010)**

### 3.2.1. Philippines

In Philippines, rice is an important commodity especially for the poor. For the poorest 30 percent of families, rice constitutes more than 20 percent of the value of total consumption (Dawe et al., 2008). Therefore, rice production is important for the secure food supply.

The country is the 8th largest rice producer in the world, accounting for 2.8 percent of global rice production (FAO, 2011). However, the country is also the world's largest rice importer in 2010. The government usually imports rice to plug production shortfall and to ensure that the National Food Authority (NFA) has a buffer stock.
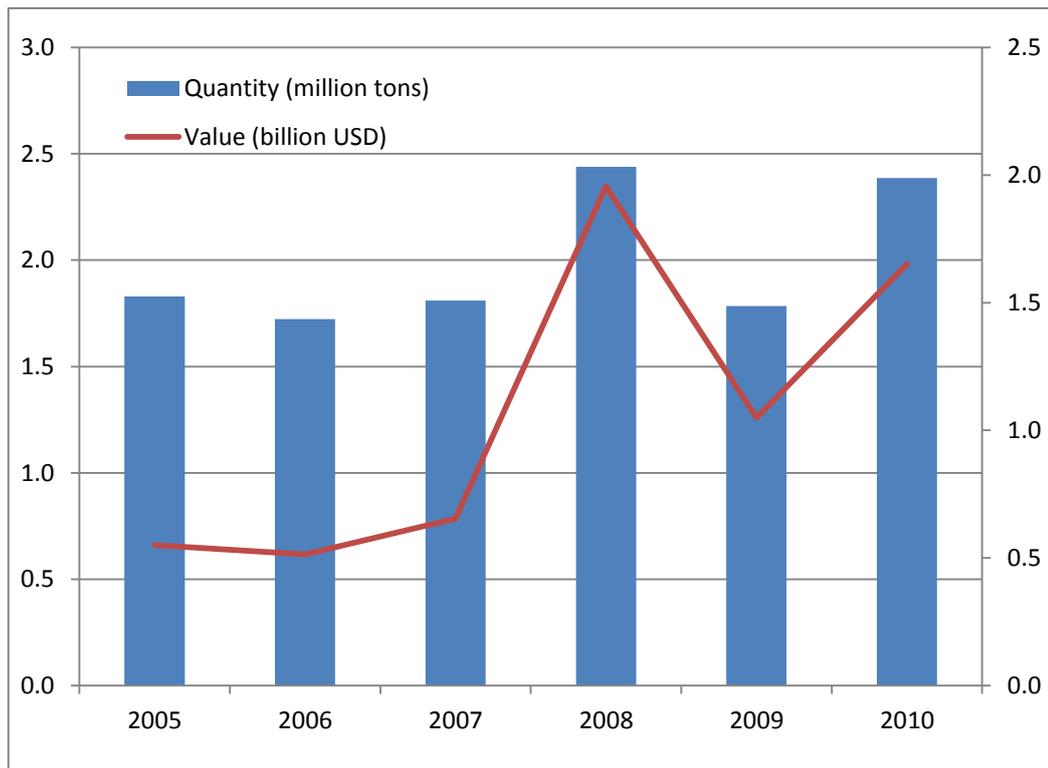


*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
**Figure 3.8 Rice import volume and import value of the Philippines (2005-2010)**

### 3.2.2. Nigeria

Akande (2009) pointed out that Nigeria is the most populous country in Africa, with a population of over 130 million people. Its domestic economy is dominated by agriculture, which accounts for about 40% of the Gross Domestic Product (GDP) and two-thirds of the labor force.

Agriculture supplies food and raw materials and generates household income for the majority of the people. Domestic rice production has never been able to meet the demand, leading to considerable imports which today stand at about more than 500,000 M.T per year. Nigeria has become one of the largest rice importing countries and most of import Thailand, the U.S., India, and Pakistan. Thailand has been the main supplier for long time, but the competition from the U.S. becomes fierce in recent years.



*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
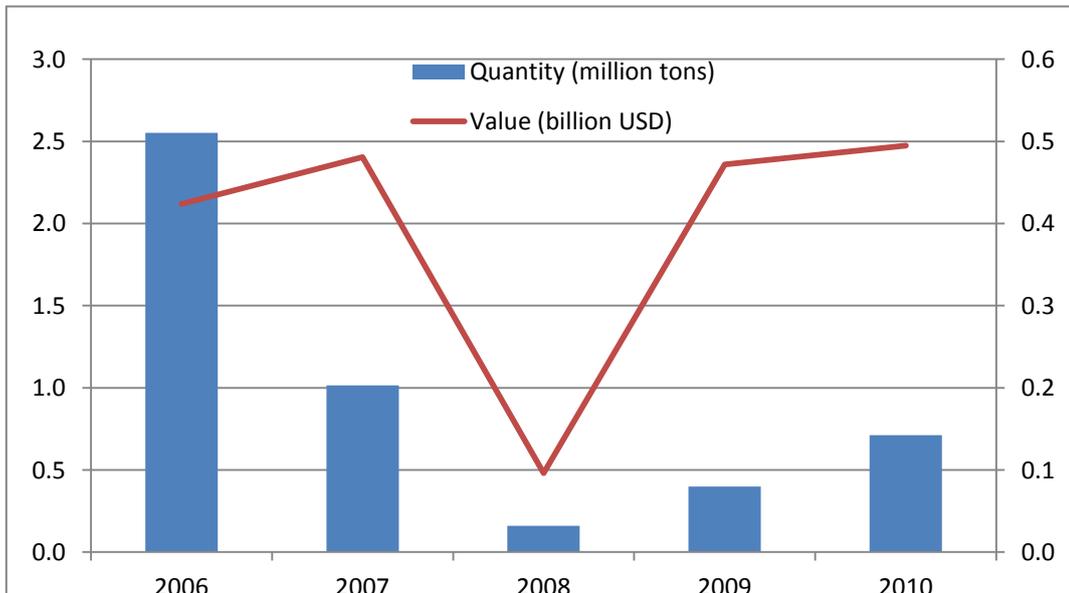
**Figure 3.9 Rice import volume and import value of Nigeria (2005-2010)**

### 3.2.3. Iran

Located in the Middle East area, where the weather is not really suitable for rice production, Iran mainly depends on rice import for insuring its food security. Only 12% of the total land area is under cultivation (arable land, orchards and vineyards) and less than one-third of the cultivated area is irrigated; the rest is devoted to dry farming. In 2008, Iran's total rice production was 2.2 million tons, whereas annual consumption was about three million tons. Iran has imported about 630,000 tons of rice from UAE, Pakistan and Uruguay ($271 million) in 2008 and 1.4 million tons of rice, ($800 million) in 2009.

### 3.2.4. Saudi Arabia

During the past decade, the Kingdom of Saudi Arabia has undergone rapid economic growth and development. However, despite this growth, Saudi Arabia is one of the top foodstuff importers among developing countries (Duwais, 1983). Among agricultural imports, rice is entirely imported from abroad, since the local production of rice is very insignificant.

According to the U.S. Foreign Commercial Services, Saudi Arabia imports more than one million metric tons of rice annually. With 60 percent of market share, Indian remained as the dominant rice supplier to Saudi Arabia, followed by Pakistan, United States and Thailand. In 2008, the rice export value from the United States reached $117 million, an increase of 47 percent compared to 2007. According to a recent U.S. Customs data, U.S. rice exports to Saudi Arabia increased by 10 percent in January-October 2009 compared to the same period in the previous year ($109 million vs. $99 million). Local rice importers attribute the

sharp increase in U.S. exports in recent years to a decrease in exportable rice from India and U.S. price competitiveness compared with other Asian rice exporters. The higher values of total rice imports in 2007 and 2008 reflect the sharp increase in the world prices during that period. In November 2009, the Saudi government removed the subsidy at $267 per metric ton on imported rice. The Saudi government lifted the import subsidy due to reduced world rice prices compared to 2007 and early 2008.



*Source: The United States Commodity Trade Statistics, http://comtrade.un.org*
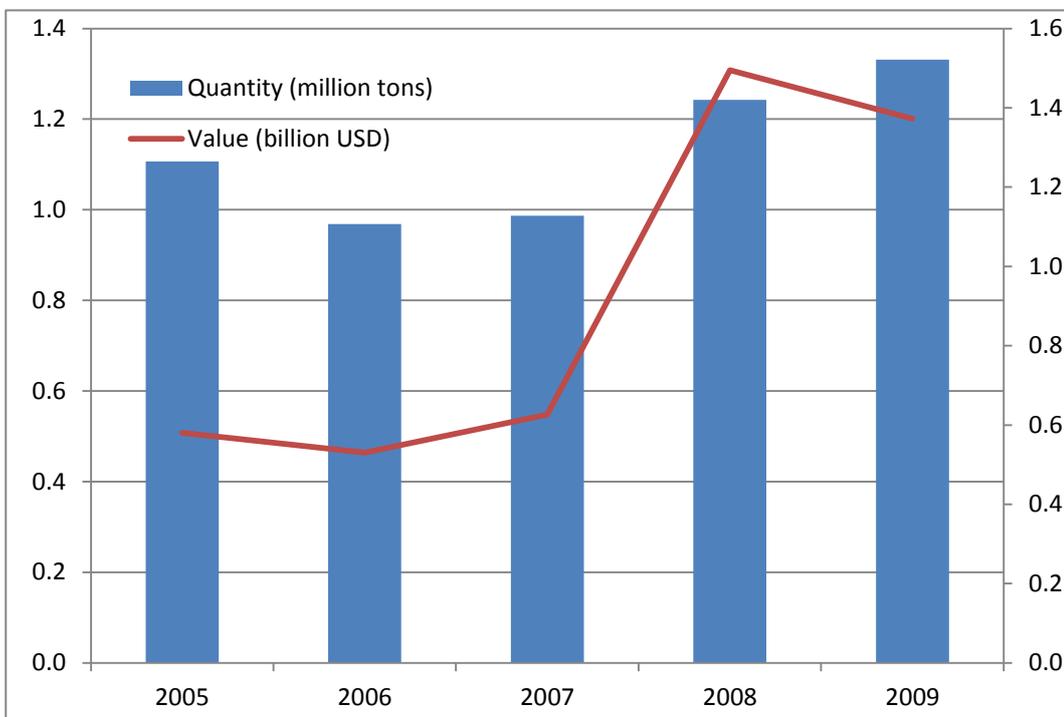
**Figure 3.10 Rice import volume and import value of Saudi Arabia (2005-2009)**

### 3.3. Rice price spike in the 2007/2008 period and policy responses

After slow and steady increase from historic lows, world rice prices tripled in just six months during 2007-2008 (FAO, 2011). Recent sharp increases in international rice prices are of particular concern in East Asia. According to Brahmbhatt and Christianensen (2008), food comprises 30 to 50

percent of the consumption basket of the average household in East Asia (compared to 15 percent in the United States). Within that, rice accounts for one third of the daily caloric intake, followed by wheat (12.4%), pork (8.8%), corn (4.4%), soybean and palm oil (3.4% and 1.8 % respectively). Hence, the spike in the international rice price had affected many countries and raised the problem of food insecurity.

All types of rice commodities showed sharp upward spike toward the end of 2007 and early 2008. This spike peaked in May 2008 and since then prices have come down quite sharply, but still seem to be far above their prices two years before (Sarris, 2010). For the last two months of 2008 and January 2009, rice prices have been on average between 51 and 94 percent higher than those of the first three months of 2006 (Sarris, 2010).
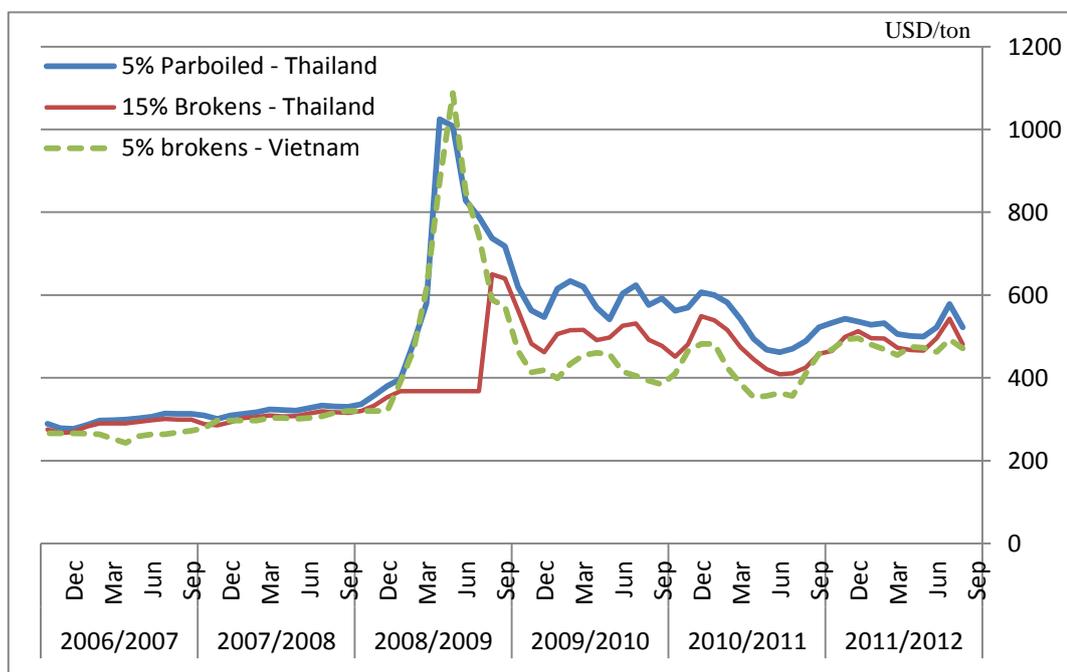


*Source: Shoichi Ito, World Food Statistics and Graphics, http://worldfood.apionet.or.jp*
**Figure 3.11 Movement of Thai and Vietnamese export rice prices**

28

Rice price increases in both importing and exporting countries. In Bangladesh, the domestic rice price was higher than that in the world market in the 1970s, when the world experienced a similar surge in food prices (Hossain and Deb, 2010). In the domestic market, rice prices increased from $225 per ton in January 2004 to $318 per ton in November 2007, and $462 per ton in April 2008. In Indonesia, the rice prices at wholesale market increased by 52 percent, but compared with world prices, nominal domestic prices have been relatively stable.

The dramatic surge of grain prices in 2007/2008 has triggered increasing concern about a global food crisis. In the international market, the prices of the Thai white rice 100% grade B, a representative rice of the world market, more than doubled since January, rising from USD$ 385 to USD$ 949 per ton by mid-May 2008 (FAO, 2008). Domestic rice prices in developing countries increased by up to 90 percent between the third quarter of 2007 and the same quarter in 2008, with a typical year-on-year change of about 30 percent (FAO, 2008). In order to insure food security, many governments have issued various types of policies such as placing export bans and removing import tariffs for stabilizing domestic rice markets.

During rice price spike, each country has issued different intervention policies to protect domestic markets and consumer's welfare. Some rice exporters such as Vietnam, India, and Cambodia imposed export restrictions and export bans, whereas importing countries such as the Philippines increased rice purchase in order to keep domestic prices lower than international prices.
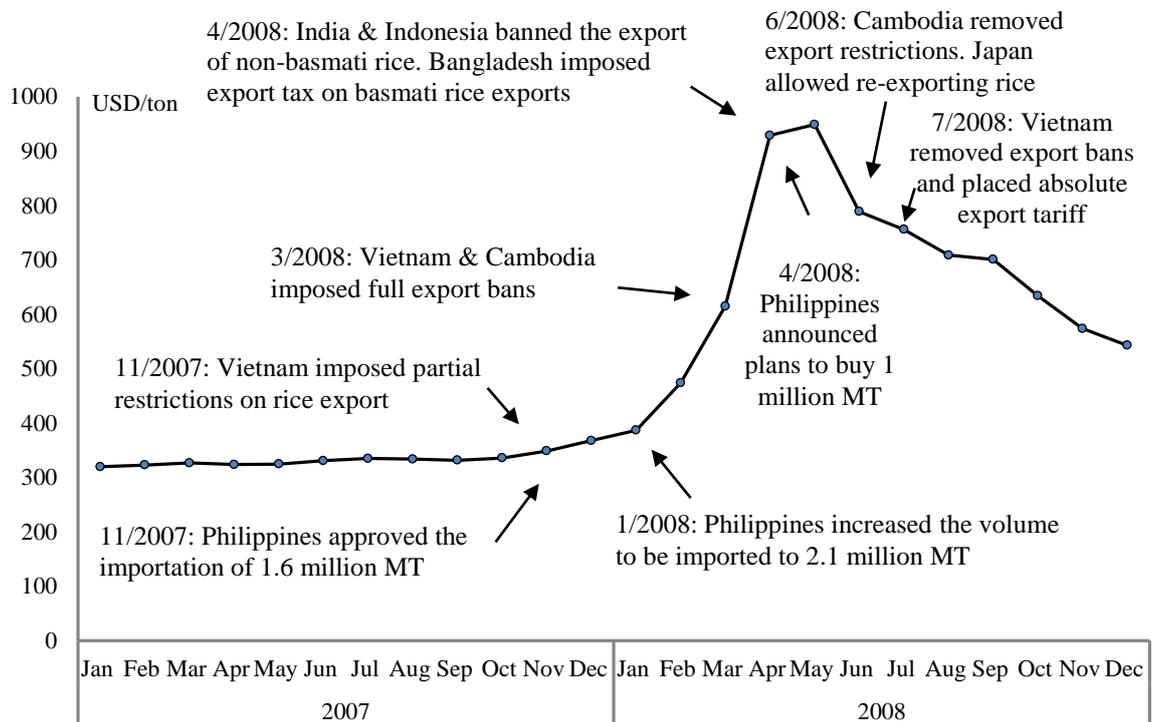
*Source:* *Prices of white rice 100%B are collected from Thai Rice Exporter Association.*
*Policies are collected from various articles and reports*

**Figure 3.12 Trend of Thai rice price and policy responses in 2007/2008**

According to FAO (2008), in total, 14 countries placed quantitative restrictions or outright bans on rice exports. Among others, however, export restrictions in India and Vietnam were considered to have the most disruptive impacts on global rice markets, because of their big presence as exporters in recent years.

By surveying 77 countries, FAO (2008) indicated that approximately half of the governments reduced grain import taxes. The figure shows that 55 percent

of the countries used price controls or consumer subsidies in an attempt to reduce the transmission of price increases to the consumer.
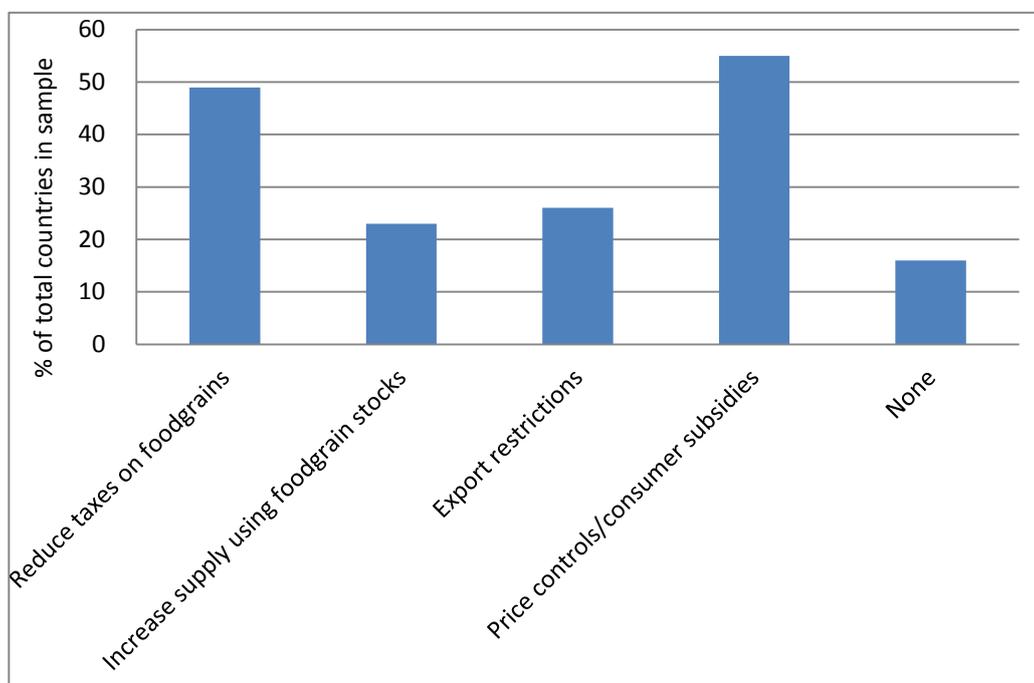


*Source: FAO, 2008*

**Figure 3.13 Policy actions to address high food prices**

One-quarter of the governments imposed some kind of export restriction, and roughly the same proportion took action to increase supply, drawing on food grain stocks. Only 16 percent of countries surveyed showed no policy activities whatsoever. FAO (2008) also pointed out that policy actions varied considerably across regions. The governments in East Asia, South Asia and the Middle East and North Africa have undertaken significant activities in all four areas of intervention.

In every geographical region except sub-Saharan Africa, 50 percent or more of the countries reported they employed price controls or consumer subsidies. Sub-Saharan Africa and Latin America and the Caribbean regions

employed number of the lowest policy activities, with roughly 20 percent and 30

percent of them, respectively, employing no activity any of the policy categories.
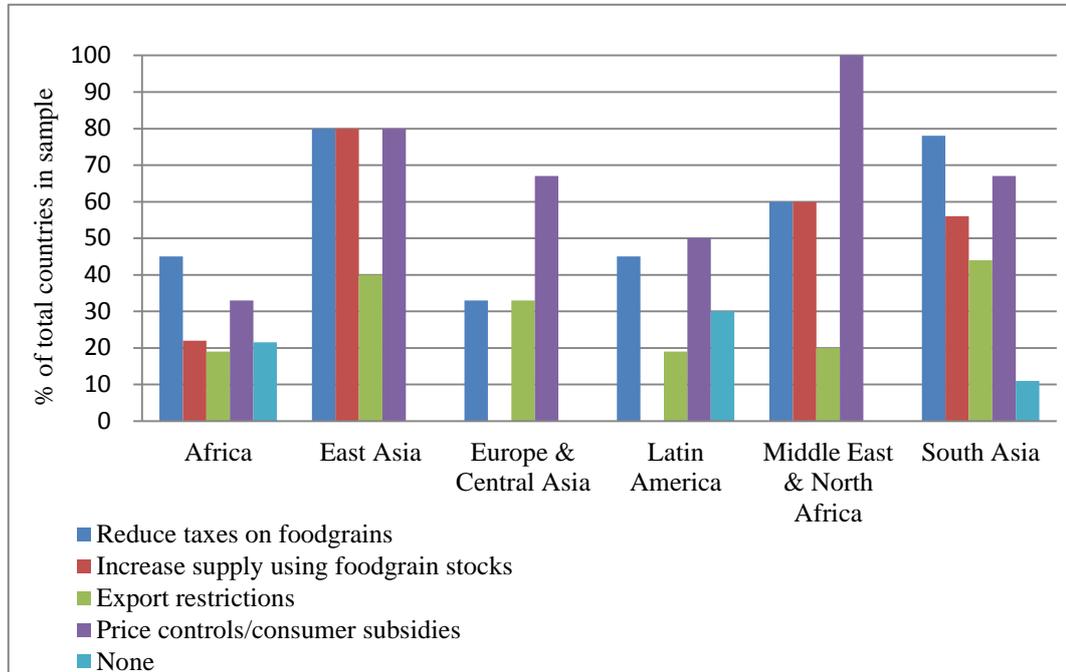


*Source: FAO, 2008*

**Figure 3.14 Policy actions to address high food prices by region**

# CHAPTER 4

# VIETNAM'S RICE ECONOMY AND RICE MARKET IN 2007/2008

This chapter provides some major information about Vietnam's rice economy (agricultural land use, rice production and export, contribution of rice to the economy) and the situation and policy responses of Vietnamese government during rice price hike in the 2007/2008 period.

## 4.1. Vietnam rice economy

Of all Vietnam's agricultural products, rice is the most important and politically sensitive consumption good (Ngan, 2010). From the late 1980s, Vietnamese government has implemented a number of economic reforms in the agricultural sector, including the liberalization of domestic rice markets. Despite some deficiencies, the reforms have triggered rapid growth in the economy generally and in the rice sector particularly (Minot and Goletti, 2000). Recently, Vietnam has become one of the world's leading rice exporters with annual export amounts oscillating around 4 million tons during the 1995-2009 periods

Rice is very important to the Vietnamese economy. First, it is planted on more than seven million hectares, almost 87 percent of the total cultivated area of cereals. Second, it accounts for more than 85 percent of the total food grain output. Third, on average, the gross output of agriculture contributes more than 20 percent of GDP and the rice export value accounts for around 20 percent of the current total export value of agricultural products.

**Table 4.1 Agricultural land use (2000-2008)**

*Unit: 1000ha*

| Year | Agricultural Land (1) | Land for planting paddy (2) | % of (2)/(1) | Planted area of cereals (3) | Planted area of paddy (4) | % of (4)/(3) |
|------|------|------|------|------|------|------|
| 2000 | 9345 | 4268 | 45.7 | 8399 | 7666 | 91.3 |
| 2001 | 9383 | N/A[*] | N/A | 8225 | 7493 | 91.1 |
| 2002 | 9407 | N/A | N/A | 8323 | 7504 | 90.2 |
| 2003 | 9532 | 4022 | 42.2 | 8367 | 7452 | 89.1 |
| 2004 | 9407 | N/A | N/A | 8438 | 7445 | 88.2 |
| 2005 | N/A | N/A | N/A | 8383 | 7329 | 87.4 |
| 2006 | 9412 | 4152 | 44.1 | 8360 | 7325 | 87.6 |
| 2007 | 9436 | 4131 | 43.8 | 8305 | 7207 | 86.8 |
| 2008 | 9420 | 4106 | 43.6 | 8542 | 7414 | 86.8 |

[*] *N/A: Not Available*

*Source: Vietnam General Statistics Office (GSO) – 2009*

We survey the details of agricultural land use, production, the cultivating area, and the yield of rice economy from 1990 to 2008. Table 4.2 shows that the paddy production raised continuously during this period with an average annual growth rate of 4%.

The output of paddy production increased by about 8.5 percent within only four years (2006-2009) owing to the new high-yielding rice varieties and advanced cultivation methodologies.

**Table 4.2 Area, production and contribution of rice to the economy**

|  | Unit | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| 1. Planted area of paddy | Million hectares | 7.32 | 7.21 | 7.40 | 7.44 |
| 2. Paddy production | Million tons | 35.85 | 35.94 | 38.73 | 38.89 |
| 3. Total rice export | Million tons | 4.64 | 4.58 | 4.74 | 5.96 |
| 4. Share of rice in agricultural export values | % | 14.2 | 13.3 | 20.4 | 20.1 |
| 5. Gross output of agriculture in GDP | % | 20.4 | 20.3 | 22.2 | 20.9 |

*Source: GSO, 2009*

The two major producing areas of Vietnam are the Red River Delta in the north and the Mekong River Delta in the south, connected by a relatively narrow strip of land (Minot and Goletti, 2000). The Red River Delta in northern Vietnam occupies 15.5% of the total rice cultivating area and contributes about 17.5% of national paddy output, while the Mekong River Delta in the south occupies 52.1% of the rice cultivating area and contributes about 53.4% of national output. The Central Coastal region occupies 16.4% of the rice area and contributes 15.8% of total output. The remaining portions are from rain-fed lowland or upland rice in the mountainous and highland areas.
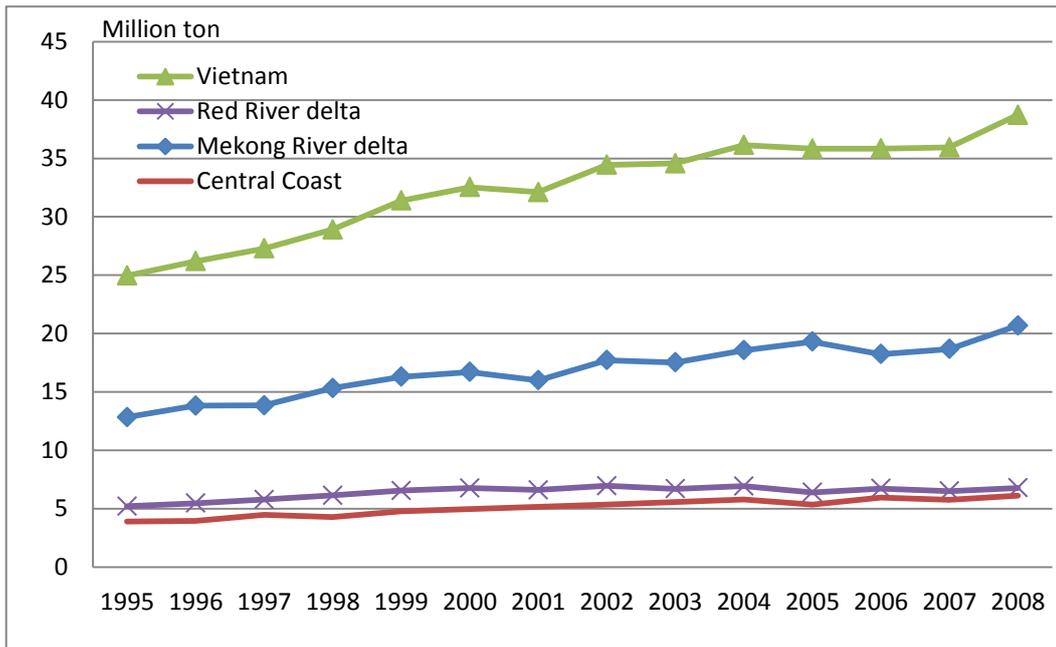
**Figure 4.1 Paddy production by region (1995-2008)**

Located in the tropical monsoon area, rice production in Vietnam has two or three seasons, which vary across regions depending on their weather conditions and irrigation systems. As Minot and Goletti (1999), and Luu (2003) explain, in the north, there are mainly two rice production seasons (winter–spring and summer–autumn).

In the south, there are usually three paddy crops per year (summer–autumn, autumn–winter and winter–spring). However, winter-spring is always the main rice production season and this season accounts for approximately 46% of total output, whereas the summer–autumn and autumn–winter crops each account for just over one quarter. By producing rice across the year, Vietnamese farmers can supply paddy to the market almost continuously throughout the year.
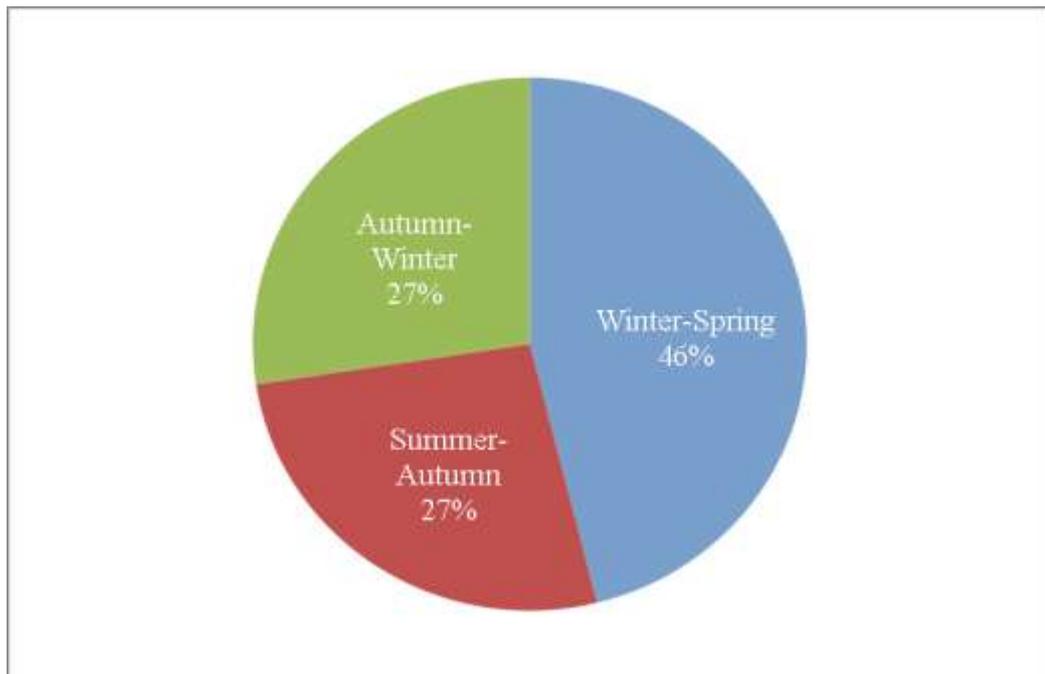
**Figure 4.2 Paddy production by season (average output of 1990-2008)**

Rice export occupies an important role in Vietnam's economy. From being a rice importer in 1980s, Vietnam became a leading rice exporter in the late of 1980s. Rice export has increased steadily over years in terms of both export volume and value.

The main rice markets of Vietnam are Asian countries, such as the Philippines, Malaysia, and Indonesia. The largest importer of Vietnamese rice is the Philippines with around more than 20% of the total export volume from Vietnam.

As a strategic commodity, the government maintains strict control on rice export. Ministry of Agriculture and Rural Development (MARD) and Vietnam Food Association (VFA) are the main stakeholders in the rice exporting activities.

There are more than 200 local rice exporters/importers operating in Vietnam but market remains in a strong monopoly nature; analysis of the rice market share shows that the top quintile of rice exporters comprises 92.6% of national export values in 2008 (IPSARD, 2008).
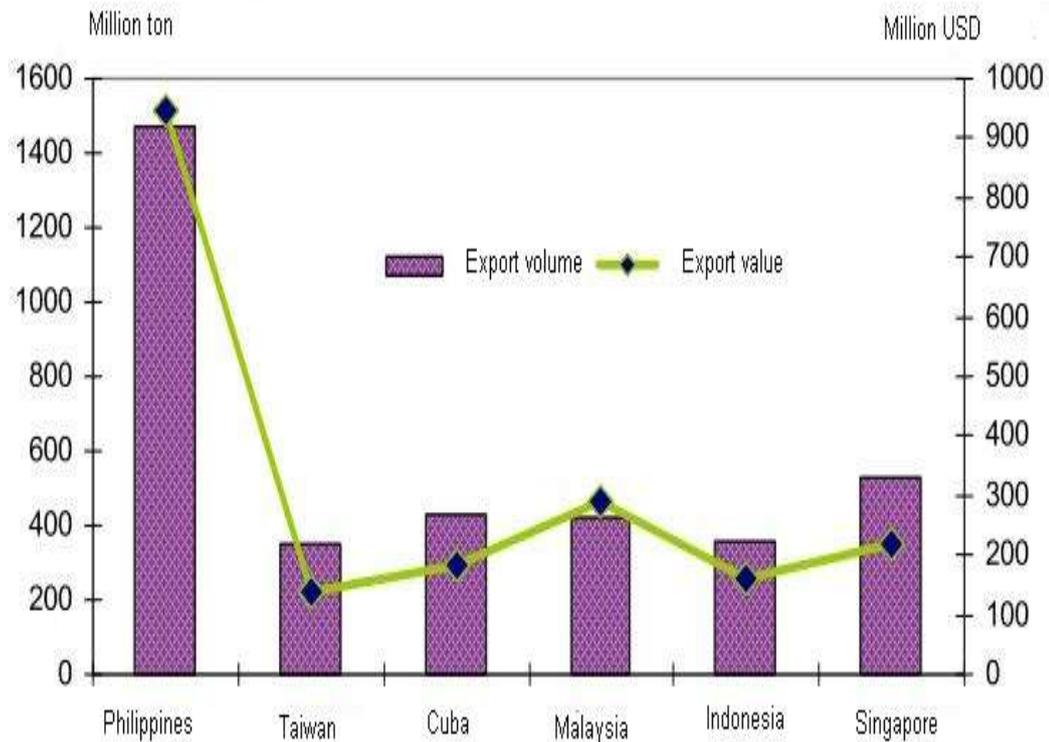


*Source: Vietnam customs*

**Figure 4.3 Rice export by destinations (2010)**

Among them, the two leading exporters, the Vietnam Northern Food Corporation (Vinafood 1) and the Vietnam Southern Food Corporation (Vinafood 2) occupy 40% and 11% of total rice export volumes and values, respectively (IPSARD 2008). With the exception of Vinafood 1 in the northern Vietnam, the biggest rice exporters are located in the south.

**Table 4.3 Top 10 rice exporting companies in Vietnam (2007-2008)**

Unit: 1000 tons

| | 2007 | | 2008 | |
|---|---|---|---|---|
| | Rank | Export volume | Rank | Export volume |
| Vinafood 2 | 1 | 1929 | 1 | 1732 |
| Vinafood 1 | 4 | 429 | 2 | 518 |
| Kiengiang Trade and Tourism Company | 5 | 210 | 3 | 293 |
| GENTRACO | 11 | 110 | 4 | 204 |
| Kiengiang Agro-Forestry Joint Stock Company | 21 | 59 | 5 | 113 |
| An Giang Export-Import Company | 8 | 140 | 6 | 89 |
| Tien Giang Food Company | 7 | 142 | 7 | 88 |
| Vinh Long Food Company | 6 | 164 | 8 | 100 |
| Long An Food Company | 12 | 110 | 9 | 89 |
| Kiengiang Agro-Forestry Trade Joint Stock Company | 9 | 136 | 10 | 92 |

*Source: IPSARD (2008)*

## 4.2. Rice market in 2007/2008 and policy responses

The rice price spike in 2007/2008 affected not only importing countries but also many exporting countries including Vietnam – the second largest rice

exporter in the world. In the domestic market, rice prices started increasing from the end of 2007, and since then prices surged dramatically in many provinces in March 2008. More specifically, in the Mekong River Delta, the prices of ordinary rice in Cantho increased by about 10% from the previous two months. In the Red River Delta, ordinary rice price increased by more than 12% within only two months.

Coping with the new fluctuations in the domestic market in March 2008, Vietnam's government decided to reduce export target from 4-4.5 million tons to 3.5-4 million tons; and also stopped signing new contracts of rice export. Later on, in order to insure food security and stabilize export, the government decided to issue the guide for rice purchases according to Decision No. 612.

However, these policies apparently failed to prevent rice prices from increasing sharply in a short period (Ngan, 2010; Speedy, 2008). The suspension of new rice–export contracts cannot necessarily keep domestic rice markets at low level when facing such a stark rise in global rice market, unless the government's commitment to preserve sufficient rice supply to domestic markets is properly understood by consumers (Tsukada, 2011). Rice prices increased by about 50 percent from the end of April to the end of May 2008, namely from VND7.400/kg to more than VND11.000/kg.

In the beginning of June, rice prices started decreasing slowly and rice supply increased because farmers harvested winter-spring crop – the main rice crop in a year. The government decided to lift export ban in July 2008, and imposed absolute export tax according to Decision No. 104 of the Prime Minister.

**Table 4.4 Absolute export tax on rice export in July 2008**

|   | Export price (FOB) | Absolute tax (VND/ton) |
|---|---|---|
| 1 | 600 USD/ton - 700 USD/ton | 500.000 |
| 2 | 700 USD/ton - 800 USD/ton | 600.000 |
| 3 | 800 USD/ton - 900 USD/ton | 800.000 |
| 4 | 900 USD/ton - 1000 USD/ton | 1.200.000 |
| 5 | 1000 USD/ton - 1100 USD/ton | 1.500.000 |
| 6 | 1100 USD/ton - 1200 USD/ton | 1.900.000 |
| 7 | 1200 USD/ton - 1300 USD/ton | 2.300.000 |
| 8 | > 1300 USD/ton | 2.900.000 |

*Note: Exchange rate in July 2008: 1 USD = 20.622 VND*

*Source: Decision No. 104, 2008 of the Prime Minister*

This decision was issued when domestic supply of rice increased, and international rice prices declined sharply; hence rice prices in the domestic market jumped down dramatically. It affected somewhat rice farmers and eliminated incentives for export activities, thus the government decided to remove this decision in November 2008.

In 2008, despite of many policy intervention of Vietnamese government, rice prices kept increasing sharply in a short period, and in some periods, export prices of Vietnam were higher than international rice prices.

**Table 4.5 Vietnam's rice export, quantity and value, monthly, 2008**

| Month | Export quantity (1000 ton) | Export value (million USD) | Average export price (USD/ton) | World rice export price (IRRI) (USD/ton) | VN price compared to world price (%) |
|-------|-----|-----|-----|-----|-----|
|       | (1) | (2) | (3) | (4) | (5) |
| 1 | 131 | 51.0 | 389 | 376 | 103.5 |
| 2 | 328 | 139.1 | 424 | 465 | 91.2 |
| 3 | 558 | 255.0 | 457 | 594 | 76.9 |
| 4 | 657 | 371.2 | 565 | 907 | 62.3 |
| 5 | 560 | 444.1 | 793 | 941 | 84.3 |
| 6 | 210 | 211.1 | 1005 | 805 | 124.8 |
| 7 | 350 | 339.9 | 971 | 706 | 137.5 |

*Note: (3) = (2)/ (1), (5) = (3)/ (4)*

*Source: International Rice Research Institute; Vietnam's General Statistic; Ngan, 2008*

# CHAPTER 5

# DATA AND METHODOLOGY

In this chapter, we provide the sources of data used for analysis. We also discuss the methodology in detail and present the estimation procedure applied in this study.

## 5.1. Data

This study employs data on weekly nominal prices of ordinary rice, the most popular type of rice, from Vietnam Market Analysis and Forecast Joint Stock Company (AgroMonitor) and Information Centre of Agriculture and Rural Development (ICARD) from 2007 to 2010. The movements of the retail rice prices in selected markets are shown in Figure 5.1. We limit our study area to the six largest rice production and consumption markets. Three urban markets are located in the Red River Delta (Ha Noi), the Central Coast (Da Nang) and the Southeastern area (Ho Chi Minh); three rice surplus markets are located in the Mekong River Delta (An Giang, Tien Giang, and Can Tho).

Based on our literature review, the rice price crisis in Vietnam started in late 2007 and prices skyrocketed until the middle of 2008. More specifically, domestic rice prices started increasing from October 2007, after the government placed partial restrictions on export, until June 2008 when rice prices declined and export bans were removed. After the price hike period, the rice prices in the two markets An Giang (AG) and Tien Giang (TG) remained at a low level compared with other markets because the markets are in rice-surplus regions (two of largest rice production areas in Vietnam) in the Mekong River Delta.
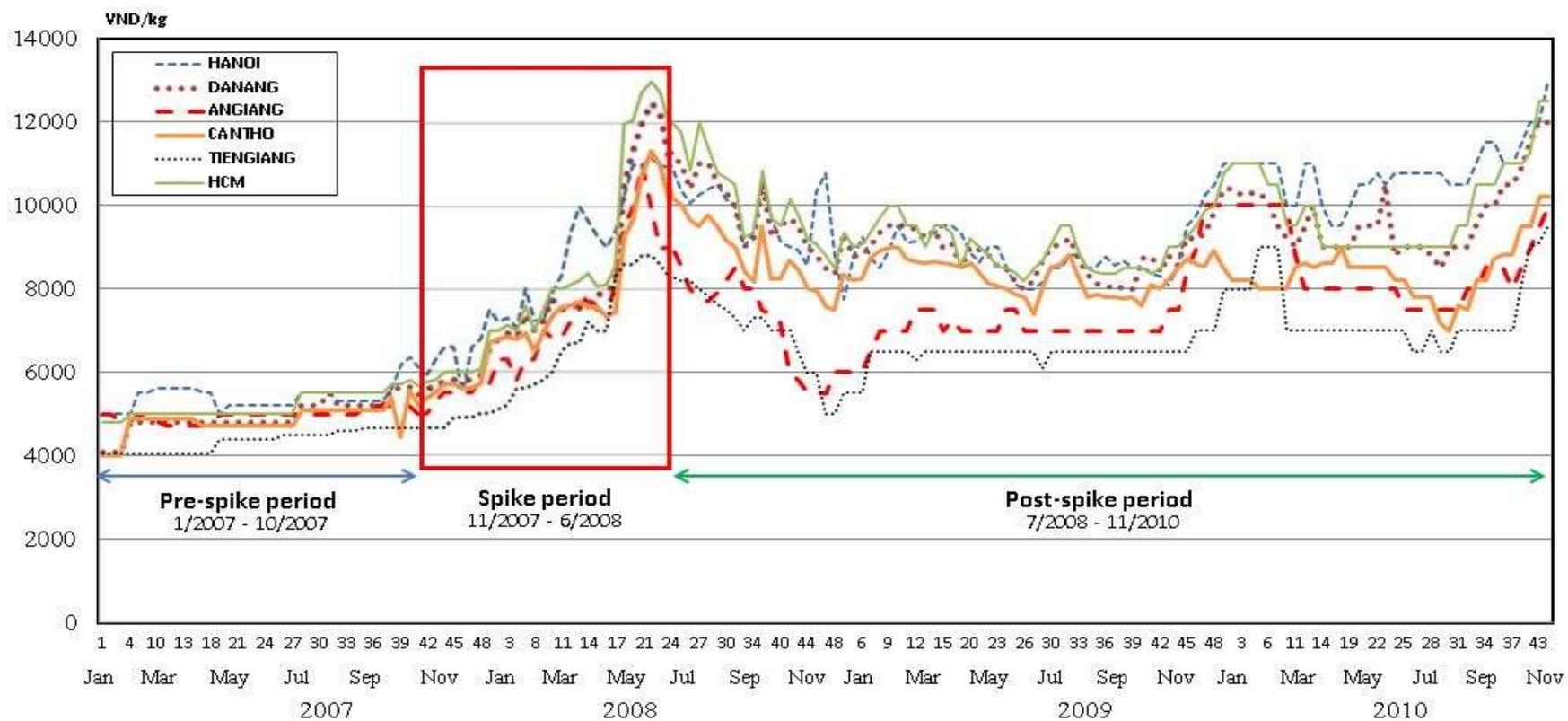
*Source: Weekly ordinary rice prices (2007-2010) from ICARD and AgroMonitor*

**Figure 5.1 Weekly retail rice price in selected markets (2007-2010)**

In addition, in the beginning of 2009, the Winter-Spring season - the main rice production season – was harvested with very high yield in these areas. Thus, the rice price decreased sharply in these markets.

In order to see how the degree of market integration changed over the study periods, we analyzed linkages among markets in three distinct periods: pre-crisis (January 2007 - October 2007), crisis period (November 2007 - June 2008) and post-crisis (July 2008 - November 2010).

## 5.2. Methodology

### 5.2.1. Co-integration analysis

Engle and Granger (1987) developed a procedure for evaluation of spatial linkage by taking the presence of stochastic trends in the price series into account. Co-integration approach clarifies that deviation from equilibrium for two or more time series variables which are individually stationary in the short-run may be stationary in the long-run. It means that there is a long-run relationship existing among these variables.

The two-step estimation procedure was developed by Engle and Granger (1987) to test for market integration. First, the co-integration regression is estimated by Ordinary Least Squares (OLS) to obtain residuals from the co-integrating relationships among variables. Secondly, the procedure focuses on estimating Vector Error Correction Model (VECM). This method has been widely applied in many empirical analyses, but it has some limitations. Diakosavvas (1995) argues that the use of OLS is inconsistent because almost all time series variables are non-stationary. Hence estimation may lead to the spurious

regression. Moreover, Engle and Granger's procedure is based on bivariate estimation while many researchers are interested in examining the relationships among many economic time series data. As a result, Johansen's procedure was developed for the multivariate framework. Thus, in order to examine the relationship among six different rice market places, we applied Johansen's procedure in this study.

### 5.2.2. Spatial market integration

Many studies applied Engle and Granger (1987), and Johansen's multivariate procedure to test for spatial market integration among economic variables, especially in the context of rising food prices in many commodity markets in recent years. In general, two approaches have been widely employed to estimate the effects of rising global food prices (Hag, Nazil, and Meilke, 2008). The first approach focuses on examining the impacts of the transmission of high international food prices to domestic markets. Another approach estimates ex-post impacts of the food crisis by considering that high food prices are already transmitted to the domestic markets. In our study, we use the second approach to evaluate domestic price transmission processes in local rice markets. Most price transmission analyses are based on the Law of One Price (LOP) which can be defined as follows:

$$|P_{1t} - P_{2t}| > K_t \qquad (1)$$

$P_{1t}$ and $P_{2t}$ are the prices in two different markets; K is the full transportation cost, including taxes, profits and risk premiums. If (1) holds, there is an incentive to trade between two markets and the prices will move toward each other to reach

equilibrium point:

$$|P_{1t} - P_{2t}| = K_t \qquad (2)$$

In this case, any change in the price in one market would be reflected in a change in the other markets. Hence, we can identify the changes in market integration by analyzing price transmission processes among separated markets.

The LOP has been studied extensively in many commodity markets using bivariate tests of Engle and Granger (1987), and Johansen's multivariate procedures (1988). However, Goodwin (1992) pointed out that the Engle and Granger's bivariate tests have recently been recognized as being subject to a number of serious limitations if more than two price series are modeled. In contrast, the multivariate co-integration testing procedures developed by Johansen (1987) may provide estimates of all the co-integrating vectors existing among a group of variables. Goodwin (1992) used the multivariate co-integration test to evaluate the LOP in five international wheat markets. The results indicated that the LOP was fully supported when wheat prices were adjusted for freight rates. Nanang (2000) used multivariate co-integration analysis for five regional markets of softwood lumber in Canada and identified the hypothesis that the LOP held for all five markets was not supported by the Johansen's test.

The Johansen's likelihood estimation and testing approach is based on the following unrestricted Vector Auto Regression (VAR) model:

$$P_t = \mu + A_1 P_{t-1} + \ldots + A_k P_{t-k} + \varepsilon_t \qquad (3)$$

*Where:* P refers to ordinary rice price in n markets;

t = 1, 2... refers to week from 2007 to 2010;

A are coefficient matrices to be estimated;

k is lag length;

$\mu$ represents a constant term;

$\varepsilon_t$ is an error term.

Equation (3), an unrestricted VAR including $n$ variables and $k$ lags, assumes the present market prices are related to their own and others' past values. According to Engle and Granger (1987), the vector $P_t$ has vector autoregressive error correction representation:

$$\Delta P_t = \mu + \Gamma_1 \Delta P_{t-1} + \ldots + \Gamma_{k-1} \Delta P_{t-k+1} + \Pi P_{t-1} + \varepsilon_t \quad (4)$$

*Where:* $\Delta$ represents the first difference operator;

$\Gamma_{1\ldots}$ $\Gamma_{k-1}$ are ($n$ x $n$) parameter matrices which summarize the short-run relationships among $\Delta P_1$... $\Delta P_n$;

$\Pi$ represents the long-run relationship in the system.

Johansen (1988) defines two matrices $\alpha$ and $\beta$, both of dimension $n$ x $r$, where $r$ is the rank of $\Pi$, such that:

$$\Pi = \alpha \beta^{'} \quad (5)$$

The matrix $\beta$ is the matrix of co-integrating relations, representing long-run relationships and the matrix $\alpha$ is the matrix of weight with which each co-integrating vector enters the $n$ equations of the VECM. Matrix $\alpha$ measures the adjustment speed toward long-run equilibrium. In the case of a bivariate system where two price series are examined, the rank $r$ would be equal to 1 and the LOP is based on the co-integrating vector (1, -1). Alternatively, Nanang (2000), and Shashi, Kant, and Yang (2006) indicated that in a multivariate framework, the

hypothesis which the LOP holds for all prices simultaneously is determined by the rank *r* of the system and if r = n-1, then the LOP holds for all prices simultaneously; If r < n-1, then the LOP is rejected for all prices simultaneously. In this study, with 6 rice markets, the LOP holds for all prices simultaneously when r = 5, and it will be rejected for all prices simultaneously when r < 5.

Before performing the Johansen co-integration test, it is necessary to pre-test the order of integration of all price series by using Augmented Dickey Fuller (ADF) because the test is appropriate when each variable is non-stationary and integrated to degree 1. For each individual price ($P_{it}$), the ADF statistic is measured using the following regression:

$$\Delta P_{it} = \beta_o + \beta T + \sigma P_{it-1} + \sum_{m=1}^{k} \alpha_m \Delta P_{it-m} + \varepsilon_t \qquad (6)$$

*Where*: $\beta_o$ is constant and T is a time trend.

Since the results of the co-integration test can be quite sensitive to the lag length, pre-test for lag order is a very important step. In this study, the lag order is determined by using lag selection criteria for choosing the appropriate lag length.

### 5.2.3. Analysis procedure

In this study, we first test for the order of integration. According to Engle ad Granger (1987), a series is integrated of order (d) if it is differenced d times to be stationary. Two series are integrated of the order (d, b) if individually they are of order d and b and their linear combination is integrated of order (d-b), where b>0. In order to apply Johansen's test, all variables should be integrated of order 1

or I (1). It means that each variable is required a single differencing to remove trend and make it stationary.

After confirming the order of integration of each time series variable, we apply Johansen's test to examine the long-run relationship among price series. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. The stationary combination may be interpreted as co-integration, or an equilibrium relationship between the variables.

Johansen's co-integration tests use both trace and maximum eigenvalue tests at the same time in order to test the number of co-integrating equations in the models. However, Juselius (2006) suggests that the trace test is more robust to skewness and excess kurtosis in the residuals than the maximum eigenvalue test. Using the Jarque - Bera test statistic based on the sample kurtosis and skewness in the residuals of price series, we test for skewness and excess kurtosis in the residuals of price data.

In the last step, if Johansen's test indicates that there are long-run relationships among variables, we proceed to estimate the Vector Error Correction Model (VECM). The crucial point of using VECM is the requirement of co-integration among variables with a co-integrating vector. The results from the previous steps indicate long-run integration in price series with two co-integrating equations. Thus, we use residuals from the equilibrium regression to estimate the VECM. The VECM is interpreted as the speed of adjustment of price series when it deviates from the long-run equilibrium and helps to understand how much the

deviations of the previous period could be corrected to converge to the long-run

equilibrium in the current period.



**Step 1**
- Unit root test to see if each variable is I(1)

**Step 2**
- Johansen's test to determine whether the price series are co-integrated

**Step 3**
- If Johansen's test indicates that there are long-run relationships among variables→estimate the VECM
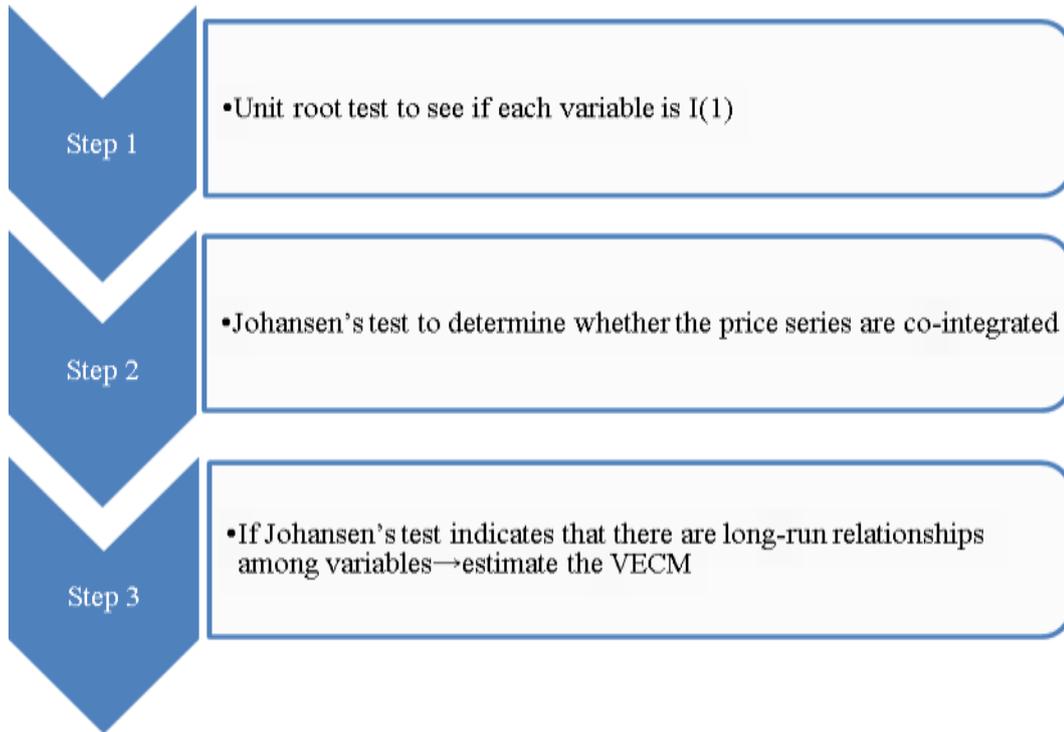
**Figure 5.2 Analysis procedure**

# CHAPTER 6

## EMPIRICAL RESULTS AND DISCUSSIONS

In this chapter, rice market integration during study periods is examined deeply in terms of both long-run relationships and short-run adjustment processes among different market places. We also discuss the impacts of rising rice prices on the market performance in Vietnam in the context of many policy interventions issued by the government to cope with global food price crisis.

### 6.1. Empirical Results

#### *6.1.1. Unit root test*

First of all, we pre-test the order of integration of the time series for the variables before performing the co-integration analysis. The results of the Augmented Dickey-Fuller (ADF) test for unit roots are shown in Table 2 for three different study periods and for urban or rice-surplus markets: Ha Noi (HN), Da Nang (DN), Ho Chi Minh (HCM), An Giang (AG), Can Tho (CT) and Tien Giang (TG). The null hypothesis ($H_0$) is that the price series have a unit root, and the alternative ($H_1$) is that the series do not have any unit root.

All t-statistics on levels are smaller than the critical values in MacKinnon (1996), implying all time-series variables are non-stationary or have at least one unit root. By contrast, the unit root tests on first differences confirm that all price series are stationary or integration of order 1, I (1). These results suggest the change in prices ($\Delta P_t$) for a VECM is more appropriate than the level of prices ($P_t$) with an autoregressive model.

**Table 6.1 Unit root tests on rice price series in selected markets**

| Test | Pre-crisis | | Crisis period | | Post-crisis | |
|---|---|---|---|---|---|---|
| | Levels | FD | Levels | FD | Levels | FD |
| Ha Noi (HN) | -2.51 | -6.08$^*$ | -1.07 | -3.83$^*$ | -0.46 | -11.2$^*$ |
| Da Nang (DN) | -2.5 | -6.0$^*$ | -0.19 | -4.4$^*$ | -2.28 | -11.8$^*$ |
| Ho Chi Minh (HCM) | 0.85 | -5.46$^*$ | -0.22 | -5.52$^*$ | -2.06 | -10.9$^*$ |
| An Giang (AG) | -1.26 | -4.31$^*$ | -0.52 | -4.81$^*$ | -1.47 | -7.34$^*$ |
| Can Tho (CT) | -2.57 | -5.42$^*$ | -0.64 | -7.19$^*$ | -2.48 | -11.2$^*$ |
| Tien Giang (TG) | -0.52 | -5.69$^*$ | 0.04 | -5.09$^*$ | -1.65 | -9.16$^*$ |
| Critical values | | | | | | |
| 1% level | -3.68 | | -3.66 | | -3.5 | |
| 5% level | -2.97 | | -2.96 | | -2.89 | |
| 10% level | -2.62 | | -2.62 | | -2.58 | |

*Notes: $^*$ denotes significance at 1% level. FD: First differences*

*Source: Computed on weekly rice price series (2007-2010) from ICARD and AgroMonitor*

### 6.1.2. Testing for long-run market integration

The results of co-integration tests are quite sensitive to the selection of lag length. We determine the lag order using lag selection criteria that maximizes the Likelihood Ratio Criterion (LR), or minimizes Schwarz Information Criterion (SIC) and Hannan-Quin Information Criterion (HQ). The results show that the lag order 1 is chosen for pre-crisis and crisis period while the lag lengths for post-crisis period are found to be from 1 to 3.

Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. The stationary combination may be interpreted as co-integration, or an equilibrium relationship among the variables. Johansen's co-integration tests use both trace and maximum eigenvalue tests at the same time in order to test the number of co-integrating equations in the models. However, Juselius (2006) suggests that the trace test is more robust to skewness and excess kurtosis in the residuals than the maximum eigenvalue test. Using the Jarque - Bera test statistic based on the sample kurtosis and skewness in the residuals of price series, we reject the hypothesis of normal distribution at 5% level. This means that the distributions are not normal due to either skewness or kurtosis. Hence, we use the trace test in our analysis and the results are shown below.

**Table 6.2 Testing for number of co-integrating equations**

| Test | Number of co-integrating equations | | |
| --- | --- | --- | --- |
| | Pre-crisis | Crisis period | Post-crisis |
| Trace | 2 | 2 | 2 |

*Note:  Significance level is 5%*

*Number of co-integrating equations is the rank r of Π in equation (5)*

*Source: Weekly rice price series (2007-2010) from ICARD and AgroMonitor*

For all three study periods, $\lambda_{trace}$ test statistics exceed the critical values in MacKinnon, Haug, and Michelis (1999) with the null hypothesis of r ≤ 2. The results indicate that only two co-integrating equations exist among six price series at the 5% significance level. Hence, the LOP cannot hold for all six price series simultaneously.

Long-run price integration in rice markets is obtained by using normalized

co-integrating coefficients which capture the existence of long-run linear relationships among price series. We chose two of the largest rice production and consumption markets (Ha Noi in the Red River Delta and An Giang in the Mekong River Delta) for normalizing co-integrating coefficients to clarify the changes in the relationship among rice surplus and deficit areas. The long-run relationship of rice price in a market to that in other markets is expressed in Table 6.3.

**Table 6.3 Long-run rice price integration among markets**

| | | |
|---|---|---|
| Pre-crisis | Eq. 1 | $AG = 14.6 + 2.46\,DN^* - 2.24\,CT^* - 0.91\,HCM^{**} - 2.34\,TG^*$ |
| | Eq. 2 | $HN = -9.49 - 2.44\,DN^* + 2.71\,CT^* + 1.00\,HCM^* + 2.37\,TG^*$ |
| Crisis period | Eq. 1 | $AG = 0.52 - 0.83\,DN^* + 1.36\,HCM^* + 0.36\,TG^*$ |
| | Eq. 2 | $HN = -0.21 + 1.35\,CT^* - 1.06\,HCM^{**} + 1.14\,TG^*$ |
| Post-crisis | Eq. 1 | $AG = -8.65 + 2.66\,CT^* + 2.56\,TG^*$ |
| | Eq. 2 | $HN = 6.85 + 4.82\,DN^* - 3.41\,CT^* - 1.97\,HCM^*$ |

*Notes: $^*$ and $^{**}$ denote significance at 1%, 5%, level*

*Insignificant parameter estimates are not shown in the table*

*Source: Computed on weekly rice price series (2007-2010) from ICARD and AgroMonitor*

Table 6.3 shows that domestic prices for rice transmit well among urban and rice-surplus regions in the pre-crisis period. The rice price in An Giang - the largest rice production area - and the one in Ha Noi - the most rice-deficit area - appear to trend well with all other markets. During the crisis period, the rice price increased remarkably even after the government placed export restrictions to

protect the domestic market. The upward trend of grain prices in the domestic and international markets and intervention policies have influenced somewhat the performance of the local rice markets. More specifically, there is no evidence to show an integration between An Giang and Can Tho in the Mekong River Delta. In addition, the linkage does not exist between two rice consumption markets, Ha Noi and Da Nang during the crisis period from November 2007 to June 2008. On the other hand, the impact of soaring food prices on local market integration tends to be severer in the post-crisis period. During this time, rice prices behave separately among only three rice-surplus markets in the Mekong River Delta area (An Giang, Tien Giang, and Can Tho) and among urban markets in the Red River Delta (Ha Noi), the Central Coast (Da Nang) and the Southeastern area (Ho Chi Minh).

The literature on market integration indicates that there are many factors affecting the linkages between spatial market places, such as transportation costs (Cudjoe, Breisinger, and Diao, 2010; Goodwin, 1992), distance between markets and the sizes of markets (Cudjoe, Breisinger, and Diao, 2010; Nanang, 2000), trade policies (Shashi, Kant, and Yang, 2006), and price spikes (Abbott, 2011; Cudjoe, Breisinger, and Diao, 2010). In this study, besides the spike of rice prices, trade policies can be seen as one of the crucial factors affecting rice market integration. In the domestic market in Vietnam, state-owned enterprises (SOEs) take the role to transfer rice surplus from the South to the North due to the small margins available for private traders. However, during the price spike period of 2007/2008, transportation costs increased sharply and the government imposed tariff and export controls on rice export. Thus, as Ngan (2010) mentioned, profit

from rice export of the SOEs was reduced considerably, and then the enterprises only focused on rice-surplus areas to minimize their costs and ensure their profits from export activities.

The results indicate that after the rice price hike, the price transmission kept increasing between production markets, but there was only a weak integration between surplus and deficit rice markets which could be observed. The weak integration among these markets leads to concerns about the impacts of any future shock in the rice market on market stabilization and food security. Therefore, we recommended that policy intervention should focus on improving the linkage between production and consumption markets of rice in Vietnam. More specifically, improving transportation networks and distribution systems connecting production markets in the southern area (An Giang, Can Tho and Tien Giang) and consumption markets in the northern area (Ha Noi and Da Nang) will increase trade flow between markets. In addition, in spite of high transaction costs between the North and the South, implementing subsidy policies are needed to improve incentives for traders to transfer rice from surplus to deficit markets.

There are many factors affecting rice market integration. Inflation rate can be seen as one of the factors. The inflation growth rate of Vietnam is very high in recent years and it affects the volatility of prices and market performance. Consumer price Index (CPI) in the three study periods was: 9.45% (pre-spike period), 18.44% (spike period), and 17.51% (post-spike period). CPI was very high in the spike period; but even the price declined dramatically in the post-spike

period, CPI still remained at a high level (17.51%). Hence, CPI growth rate may be only one of many factors affecting price increases and market performance.

### *6.1.3. Testing for short-run adjustment process*

The crucial point of using VECM is the requirement of co-integration among variables with a co-integrating vector. The results from the previous steps indicate long-run integration in price series with two co-integrating equations. Thus, we can use the residuals from the equilibrium regression to estimate the VECM. The VECM is interpreted as the speed of adjustment of price series when it deviates from the long-run equilibrium and helps to understand how much the deviations of the previous period could be corrected to converge to the long-run equilibrium in the current period. The result of VECM is shown in Table 6.4.

The results show that the adjustment process of rice prices to the equilibrium was significantly affected by the food price crisis of 2007/2008. The speed of adjustments fluctuates between 37 and 70 percent in the pre-crisis period, but when the crisis occurred, the deviations from the long-run equilibrium corrected rapidly with a speed of around 54 to 93 percent.

However, in the post-crisis period the adjustment process suffered a dramatic change in spite of the weak long-run relationships among rice-surplus and deficit areas; the adjustment speed remains extremely low, from around 9 to 15 percent. For instance, the adjustment speed to the long-run equilibrium of Ha Noi market after the crisis declines to only 9 percent, compared with 37 percent in the pre-crisis period. The weak price transmission among markets in the long-run after the price hike period causes a slow reaction from the disequilibrium of rice

prices. This implies the soaring rice price in 2007/2008 periods exerted a considerable short-term influence on domestic market integration in various regions of Vietnam.

**Table 6.4 Estimating adjustment speed in the short-run using VECM**

| Error Correction | | D(HN) | D(DN) | D(HCM) | D(AG) | D(CT) | D(TG) |
|---|---|---|---|---|---|---|---|
| Pre-crisis | Eq. 1 | -0.37$^{**}$ | | | -0.69$^{*}$ | | |
| | Eq. 2 | -0.7$^{*}$ | | | -0.52$^{*}$ | | 0.38$^{**}$ |
| Crisis period | Eq. 1 | | | | -0.93$^{*}$ | | 0.57$^{*}$ |
| | Eq. 2 | -0.78$^{*}$ | | | | 0.54$^{*}$ | |
| Post-crisis | Eq. 1 | -0.09$^{*}$ | 0.11$^{*}$ | | | 0.09$^{*}$ | 0.15$^{*}$ |
| | Eq. 2 | | 0.1$^{***}$ | | | | 0.15$^{*}$ |

*Notes: $^{*}$, $^{**}$, and $^{***}$ denote significance at 1%, 5%, 10% level*

*Speed of adjustment parameters are given by α in equation (5)*

*Source: Computed on weekly rice price series (2007-2010) from ICARD and AgroMonitor*

**6.2. Discussions**

From 2007 to 2008, the world experienced a dramatic increase in global food prices which especially affected the poor, whose diets depend on staple commodities such as maize, rice, and wheat. Higher food prices can have radically different effects across countries and population groups.

Studies of market integration during crisis periods have various results. Most of the studies dealing with the impacts of the current food crisis on food

market integration have been carried out only in net food importers, particularly in Sub-Saharan countries, and do not address this issue in food surplus areas.

In the case of Vietnam, rice price boom in the domestic market during 2007-2008 periods has affected market performance and price volatility, especially the integration among different market places in the long-term and short-term. The results show that market integration weakened considerably between surplus and deficit regions and it tended to be severer in the post-spikes period. Moreover, the adjustment speed remained extremely low after the price crisis because rice prices behaved locally among different markets.

Comparing with previous studies, we found that long-run market integration among domestic markets was weakened in recent years, and rice prices seem to be more volatile in the domestic market. Minot and Goletti (2000) studied rice market integration in Vietnam during liberalization period (1986-1995). They concluded that the degree of spatial market integration has increased somewhat since the late of 1980s. In addition, the study showed that macroeconomic stabilization has reduced rice price volatility during study period. Examining rice market integration in the Mekong River Delta during 1998-2001 periods, Lutz et al. indicated that rice markets in the Mekong River Delta were integrated. There were also the long-run relationships between these markets with rice market in the Central Coast (Lam Dong) and in the North (Hanoi). Hence, comparing with previous studies, we found that rice market integration in Vietnam was weakened somewhat during price spike period.

# CHAPTER 7

# CONCLUSIONS AND POLICY IMPLICATIONS

## 7.1. Summary and conclusions

Our analysis of market integration focused on the price in a local market and its transmission among different market places. Using weekly data from 2007 to 2010, this paper explored the spatial integration of local rice markets in different regions of Vietnam before, during and after the food price crisis in the 2007/2008 period.

The soaring rice prices had a dramatic effect not only on many importing countries but also on exporting countries, such as Vietnam - the world's second largest rice exporter. The shocks in international and domestic rice markets and intervention policies caused negative impacts on market integration in terms of both long-run relationships and short-run adjustment processes.

Using Johansen's co-integration test, we determined clear long-run relationships among market places. Yet market integration weakened considerably between surplus and deficit regions and it tended to be severer in the post-spike period. Moreover, the adjustment speed remained extremely low after the price crisis because rice prices behaved locally among different groups of market places.

**7.2. Policy implications**

In order to mitigate the impacts of food price increases, the analysis indicates that policy interventions need to concentrate on improving the integration between rice-surplus and deficit regions.

More specifically, improving transportation networks and distribution systems connecting production markets in the southern area (An Giang, Can Tho and Tien Giang) and consumption markets in the northern area (Ha Noi and Da Nang) will increase trade flow among markets.

In addition, subsidy policies are needed to improve incentives for traders to transfer rice from surplus markets to deficit markets between the North and the South of Vietnam.

**7.3. Limitation of this study and suggestions for further studies**

This study only focused on analyzing the impacts of price spike on domestic rice markets from a macro point of view. However, rising food prices may also have impact on livelihood of residents, especially poor people, and net-food sellers and net-food buyers may have different strategies to cope this situation. Hence, in the next study, it is necessary to clarify the impacts of price hike at the household level by analyzing household welfare using survey data.

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