A STUDY OF RICE MARKET PERFORMANCE IN MYANMAR

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ABBREVIATION AND CONVERSION FACTOR

avg	average
Bskt	basket
CSO	Central Statistical Organization
FAO	Food and Agriculture Organization
HHH	household head
Ks	Kyats (Myanmar Currency)
Kg	Kilogram
MAS	Myanma Agriculture Service
MAPT	Myanma Agricultural Produce Trading
M. t	Metric ton

1 kilogram (Kg)	= 2.205 pounds (lb)
1 basket of paddy	= 20.86 Kg or 46 lb
1 basket of rice	= 34.01 Kg or 75 lb
1 hectare (ha)	=2.47 acres (ac)

ABSTRACT

Rice, a staple food of Myanmar, is designated as "National crop". Produce of paddy fields needs not only to supply enough for domestic consumption but also for exporting purposes. However, the present rice marketing system (after the market liberalization in 2003) is incipient and not all market mechanisms are expected to be operational. Rice market activities can be curtailed by various obstacles: insufficient market institutions, lack of exchange information, inadequate infrastructure and improper behavior of intermediaries etc.

The overall objective of the study is to analyze the current performance of the Myanmar rice market in critical areas. With the results, appropriate policy applications are recommended to improve its development. The specific objectives of the study are as follows:

1. To examine rice distribution system of Myanmar and Japan as well-organized institution enhance specialization and economies of scales;
2. To verify the activities of rice farmers and marketing agents in order to know the market performance of the study sites of Myanmar;
3. To appraise the price signal between local and central rice markets of Myanmar by evaluating the degree of spatial market integration which will recognize the pricing efficiency of rice markets.

Efficiency in Myanmar's Rice Market is an important means for promoting the economic development of the country as well as increasing the current living standard of farmers which is below poverty levels. Moreover, policies to improve the efficiency of rice marketing followed to build up the well-organized marketing channel would also support a self-accelerating impact on productivity. Before formulating any such policies, it is necessary to find out and examine in detail marketing system of the country and then it is beneficial to compare and analyze the developed market institution of the other country (Japan).

Moreover, with the purpose of success in privatizing the rice market, there is a need for adequate information on the current situation of rice production and marketing system especially on: rice marketing channels, traders' behavior and competitiveness in the markets. An economic survey was conducted in June 2004 with 60 farmers in Hlegu and Pathein areas in order to specify the production and marketing activities in these major rice producing areas. Besides that, 30 intermediaries in Hlegu and Pathein areas and 8 central

wholesalers in Yangon market were also interviewed to further understand marketing activities of the rice marketing system in the respective regions.

On the other hand, there has also to be certain specific market improvement in behaviors and relationships between central and local rice markets in order to liberalize the rice market. Wholesale price integration for selected rice markets in Myanmar from April 2001 to May 2004 was analyzed. The interest to investigate price movement in each market and price correlation among the central and local markets was to specify and point out the market signals and transparency of market information.

Rice market constitution, intermediaries performance and the spatial price differences in the selected rice markets of Myanmar were analyzed in order to understand market functioning. There is a weak market institution not only for the domestic rice distribution but also for rice exports. Therefore, motivation of institutional development in several rice distribution channels is needed to accelerate the market intelligence of intermediaries. Marketing channel and margin analysis shows the increasing market power of millers in both study sites. So as to avoid imbalances in bargaining power between buyers and sellers in the study areas, it is necessary to promote market infrastructure, exchange market information and cooperative institution in these areas.

According to the market integration analysis in this study, existence of long-run integration between pairs of markets indicated the influence of central market price on the local markets to an extent. Price integration process is far from optimal in the short run because of lack of price transparency, inadequate transportation and communication facilities and inefficient economic activities of middlemen. But, several markets show a significant time lag. The scope of improvement in market performance is ample. However, privatization process in this market will face major challenges unless this situation is corrected. This information serves as a guide for lawmakers to make policy interventions in order to correct the rice market. Further studies which will show types of market imperfections and multivariate framework are needed to get the complete picture of Myanmar Rice Market.

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

As Myanmar is an agricultural country, agriculture sector is the backbones of its economy. Agriculture sector contributed 48 percent of GDP, 17.8 percent of total export earnings and employed 57 percent of the labor force (2001-2002). 75 percent of the total population resides in agriculture, livestock and fishery sector for their livelihood. (Calculation based on data from Central Statistical Organization, 2002)

Rice, a staple food of Myanmar, is designated as "National crop". Produce of paddy fields needs not only to supply enough for domestic consumption but also for exporting purposes. In 2001-2002, the total rice area was 6.45 million hectare, accounting for approximately 40.71 percent of the total cultivated area (15.85 million hectare) in Myanmar. Rice production of Myanmar was 13.1 million tons in 1980-81 and 21.57 million tons in 2001-2002, averaging 0.65 million tons increased per year and rice yield per hectare was about 3.3 tons. The export earning from rice and rice product in 2001-2002 was about 754 million Kyats which account for 24.96 percent of total agricultural export earning (Fig 1.1).

In 2003, Myanmar has adopted a New Rice Trading Policy in order to enhance the market oriented economy policy that has been implemented since 1988. Since the government abolished the state monopoly of rice marketing, most of the crop prices have become more attractive to the farmers. The new system of rice trading aims at ensuring local paddy price to be beneficial to farmers and at the same time to enable consumers to get rice at a fair price (Tin Shwe, 2003).

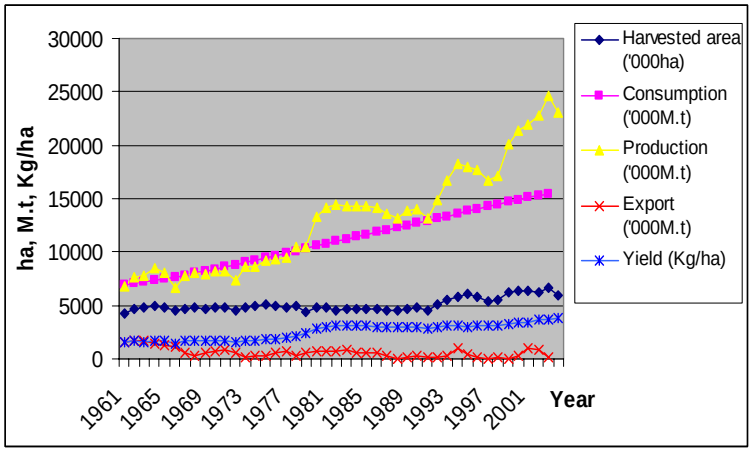

Fig 1. 1: Rice Production and Export in Myanmar
Data source: FAO statistics

1.2 PROBLEM STATEMENT

A stable and sufficient supply of rice in Myanmar is seen as directly related to people's livelihood and to the security of the nation. Rice shortage and price rises can generate riots and then acceleration of rice sector becomes the top priority of the government. Concerning with the objectives of the rice sector in Myanmar, rice is not only to provide sufficiently for the annually increasing population but also to generate more foreign exchange earnings through rice export.

It also seems that rice production sector of Myanmar experiences difficulties as the developing countries commonly encountered. First, rice production farms are mainly small-scaled farms and scatter in un-uniformity size of land. Second, because of the low education level and low technology acceptance of farmers, the rate of production technology distribution is still slow as it is needed and suitable labor saving device is still scare. Third, capital investment requirement, input demand and rice varieties are closely linked problems for farmers. Differentiated high yielding rice varieties demand high amount of fertilizer input and that leads to the capital requirement problems for the rice production. However labor sources and land resources are the strength to increase the productivity. Monsoon climate and hot weather can also give the favorable development of the rice production.

One of the serious considerations in rice sector of Myanmar is marketing. Regarding with domestic rice marketing, price incentive is the focal point and price uncertainty can decrease the market responses and the productivity. A very inadequate road network, un-transparency of market and price information and lack of the consistency of weighing measurement leads to a badly functioning marketing system. Insufficient capital investment hits particularly most small-scaled farmers by selling their products at the time of low price even though they expected the high price in future.

Regarding with the new rice trading policy, it can be probable to get the positive impacts on farmers, traders and related organizations. As the main aim of new policy is that to abolish the government intervention in domestic and international rice trading, it can be expected that the trade flow becomes lack of blocking and price incentive can create the quick market response and accelerate market functioning. However, the new rice marketing system is very young and not all market mechanisms are expected to be operational. In order to get success in privatization, there is a need for adequate information on the market performance of the rice markets especially on rice marketing channels, traders' behavior and price competitiveness in the markets.

1.3 OBJECTIVES OF THE STUDY

The overall objective of the study is to analyze the current performance of the Myanmar rice market in critical areas. With the results, appropriate policy applications are recommended to improve its development.

The specific objectives of the stuffy are as follows:

- to examine rice distribution system of Myanmar and Japan
- to verify the activities of rice farmers and marketing agents in the study sites of Myanmar
- to appraise the price signal between local and central rice markets of Myanmar by evaluating the degree of spatial market integration.

1.4 RESEARCH HYPOTHESIS

The following hypotheses are composed for this study:

1. A competent agricultural marketing structure is an imperative way to elevate the earnings of farmers and to endorse the development of country's economy.
2. Well-organized market institution enhances the specialization and economies of scales.
3. The performance of a marketing channel is related with the composition of its structure and the behavior of the intermediaries conducting in these channels.
4. Pricing efficiency points out the ability of the market system to efficiently allocate resource.

1.5 EXPECTED OUTCOME OF THE STUDY

An efficient agricultural production and marketing system is an important means for raising the income levels of farmers and for promoting the economic development of the country. Moreover, policies to improve the efficiency of agricultural marketing followed to build up the well-organized marketing channel would also support a self-accelerating impact on productivity.

Before formulating any such policies, it is necessary to find out and examine the detail marketing system of the country and then it is beneficial to compare and analyze the developed market institution of the other country. The descriptive analysis of this study can also be expounded the systematic document for the current situation of rice production and marketing system of the studied area concerned.

Spatial competitive equilibrium of an economy will exist if trade takes place at all between any two regions, then price in the importing region equals price in the exporting

region plus the unit transport cost incurred moving between twos. However, prices are the only data readily available in developing countries to examine spatial relationships and spatial market integration is applied as an indicator for an understanding of how specific markets work. The interest to investigate price movement in each market and price correlation among the central and local markets can specify and point out the market signals and transparency of market information. The results of this study are expected to give the appropriate policy recommendation needed for the policy makers in order to formulate the strategies for the development of the agriculture sector.

1.6 ORGANIZATION OF THE STUDY

The study is composed with seven chapters as follow:

Chapter 1 includes the background information of agricultural sector and rice production conditions of Myanmar. Problem statement, objective of the study and usefulness of the study are presented in this chapter.

Chapter 2 provides the theoretical background and conceptual framework for this study. In this chapter, the literature review for the concept of marketing, the growth and role of marketing, farm marketing problems and the conceptual framework for the market analysis have been revised.

Chapter 3 gives the general description of historical and current situation of rice sector in Myanmar and Japan including production of rice, rice distribution system and government policy intervention in rice sector.

Chapter 4 describes the methodology accepted for the selection of the study sites; primary and secondary data collection methods and sources prevailed in the survey. The data analysis method for this study is also prescribed.

Chapter 5 focuses on the descriptive analysis of resource uses, cropping patterns in rice production and rice marketing of the study sites of Myanmar. This study also describes the detail study of rice marketing channel and marketing margin analysis of study areas.

Chapter 6 presents the rice price analysis of selected areas in Myanmar. The study is concerned with the wholesale price integration analysis of the selected rice markets. The required parameter in the Spatial Market Integration is measured and analyzed in this study.

Chapter 7 deals with the synthesis of the results and findings of the study. This final chapter encompasses with the drawing conclusion, policy application and suggestion for the further studies.

CHAPTER 2
LITERATURE REVIEW

2.1 THEORETICAL BACKGROUND OF MARKETING

2.1.1 The core concept of marketing

Marketing is a kind of system in order to accelerate the moving of goods from the producers to the consumers. That system encompasses two major types of activities: physical handling and exchange or price setting process. Marketing is getting the right goods and services to the right people at the right places at the right time at the right price with the right communication and promotion.

Marketing has been defined in various ways depending on the point of aspect and morals. Kotler (1994) defined that marketing is a social and managerial process by which individual and groups obtain what they need and want through creation, offering, and exchanging products of value with others.

Another definition by Rodger (1971), widely applied by Barker (1989), include a perception of management aspect. Rodger defined marketing as the primary management function, which organizes and directs the aggregate of business activities involved in converting consumer purchasing power into effective demand for a specific product or service to the final customer or user so as to achieve company-set profit or other objectives.

Barker (1989) assumed that at the farm level, marketing can be defined as any deliberate activity undertaken by the farmer with the purpose of aiming his output towards pre-selected market areas so as to maximize, or at least optimize profits.

The definition of marketing which is most applicable to agriculture is given by Kohls and Uhi (2002). Food marketing can be defined as the performance of all business activities involved in the flow of goods and services from the point of initial agricultural production until they are in the hands of the consumers. This definition of marketing also suggests a mutual interdependence between farmers and food marketing middlemen.

The food production process does not stop at the farm gate. The food marketing activities complement the agricultural production process. Although it is true that there would be no food without farmers, it is also true that consumers rely on the food marketing system to complete the food production process begun on the farm. The relationship between farmers and food marketing firms is at the same time competitive and complementary.

2.1.2 Growth and role of marketing

Kohls and Uhi (2002) demonstrated that the food marketing system is a complex and expensive network of channels, middlemen, and marketing activities that facilitate the production, distribution, and exchange of the nation's food supply. Marketing is a productive process that adds form, place, time, and possession utility to farm commodities. Agricultural production and food marketing must develop hand-in hand. They are partners in a progressive system. Without modern marketing systems, including communications, transportation, storage facilities, and financing arrangements, it is impossible to accelerate the agricultural productivity.

Vincent (1967) mentioned that the agricultural marketing system operates to move goods from producers to consumers, and to establish economic incentives and market conditions to facilitate this movement. In providing an efficient link between consumer and producer, the marketing system must function to faithfully reflect back to the producer the demands of the consumer, to provide the facilities, organization, and practices required, to provide the incentives necessary to get the farmer to produce for the market, to undertake the physical movement of produce from the point of production to the point of consumption, to transform the product so as to conform to consumer demand, and, finally, to undertake the holding of the product from the time it is produced until it is sold on the market.

Therefore market places perform three basic functions: (1) the import of goods to the local region and their retail distribution; (2) the bulking and export of goods from the local region; (3) the exchange of goods within the local region. An economic market encompasses the whole of the physical market infrastructure, actors, product characteristics and different regulations, which all play a role in the realization of the exchange.

2.1.3 Farm marketing problems

Agricultural marketing encompasses everything that happens between the farm-gate and the consumer, including food processing. Indeed the size of the marketing sector is sometimes defined in terms of the difference between farm-gate receipts and consumer expenditure on food (Wollen and Turner, 1970).

Abbott (1958) mentioned that one of the most persistent obstacles to the improvement of marketing systems and procedures in the less developed countries is the production pattern itself. Modern marketing is difficult without modern production. Efficient marketing demands a fairly high degree of uniformity in most farm products, an attribute

which cannot always be achieved later if it is not there when the crop leaves the farm. Costs of marketing are usually high due to poorly developed facilities such as transport, storage, handling, packing and processing techniques. Moreover poorly developed marketing channels enhance low producer incentives.

Bateman (1976), in his review of marketing theory showed that the study of agricultural marketing in Britain derived much of its impetus between the two world wars from the problem of low farm prices. The low prices were believed to be associated with inefficiencies in the distribution of agricultural produce from farmer to consumer, with farmers' inadequate bargaining power and with the lack of grading of agricultural produce. The solution was considered to lie in the hands of the government rather than of the farmers themselves and institutional means such as Marketing Boards were seen as the appropriate lines of intervention.

Food industry trends create farmer marketing problems. There is a wide and growing gulf between farmers and the food marketing system. In some cases, farmers have fewer market opportunities than they did formerly. Farmers need more and better market information in order to make production and marketing decisions**.** They also need periodic educational programs to learn about new market alternatives and choices. Farmers are also increasingly called upon to provide input into the public policy process that influences prices, markets, and regulations (Kohls and Uhl 2002).

Thus, agricultural marketing was strongly oriented towards logistics and towards policy. The view that marketing problems are synonymous with low farm prices and with rapacious or inefficient middlemen and that the government should do something about it is still prevalent amongst farmers. Those results made clear that in order to improve the channels of distribution in the market the role of government policy is important.

2.2 CONCEPTUAL FRAME WORK FOR MARKET ANALYSIS

2.2.1 Market performance and efficiency

Kohls and Uhi (2002) defined market performance as a measure how well the food marketing system performs what society and the market participants expect of it. Attempts to measure and influence market performance have given rise to another approach to market analysis. Bressler and King (1979) also referred market performance as economic results: product suitability in relation to consumer preferences (effectiveness); rate of profits in relation to marketing costs and margins; price seasonality and price integration between

markets (efficiency). In sum, market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output.

Market performance according to Stern et.al (1996) is a multi-dimensional concept; the performance of marketing channels and institutions therefore can be assessed by considering a number of dimensions including effectiveness, equity, productivity, and profitability. By analyzing the level of marketing margins and their cost components, it is possible to evaluate the impact of the structure and conduct characteristics on market performance (Bain, 1968).

Efficiency in the food industry is the most frequently used measure of market performance (Kohls and Uhi 2002). Improved efficiency is a common goal of farmers, food marketing firms, consumers, and society. Efficiency marketing is the maximization of this input-output ratio. Improved operational efficiency refers to the situation where the costs of marketing are reduced without necessarily affecting the output side of the efficiency ratio. Operational efficiency is frequently measured by labor productivity or output per labor-hour. Pricing efficiency is a second form of marketing efficiency. It is concerned with the ability of the market system to efficiently allocate resources and coordinate the entire food production and marketing process in accordance with consumer directives. The goal of pricing efficiency is efficient resource allocation.

Competition plays a key role in fostering pricing efficiency. Marketing firms compete for the consumer's favor by lowering marketing costs and increasing operational efficiency wherever possible. At the same time, there is competitive pressure for firms to add more utility to foods in order to gain an increased market share by catering to consumer preferences.

2.2.2 Market channel

Many researchers have studied the market performance by measuring the extent in order to fulfill the conditions required for a perfect competition. Literally, market access, concentration, and information are the limiting factors for perfect competition. However, markets are always less than perfect and it is a very rare case to fulfill simultaneously all the conditions for a perfectly competitive market.

Knowing that markets do not attain a stationary equilibrium, and that information is always imperfect, the market is driven by entrepreneurship (Kirzner, 1973). It is a process where actors adjust their decisions in time owing to the availability of new information. It is

important to verify whether the process leading to channel improvement is not hampered. This competitive process will force the market to look for improved production and distribution on the basis of past experiences. Therefore, analyzing market competition in relation with the market process will help to examine whether the process of competition promotes channel improvements.

According to Stern et al (1996), marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use. The complexity of these channels depends upon the distance between the producers and the consumers, the availability of marketing facilities, the size of farms, and the time available for the farmer to do the marketing.

Kohls and Uhl (2002) define marketing channels as alternative routes of product flows from producers to consumers. They focus on the marketing of agricultural products, as does this study. Their marketing channel starts at the farm's gate and ends at the consumer's front door. The marketing channel approach focuses on firm's selling strategies to satisfy consumer preferences.

The performance of a marketing channel is related with the composition of its structure and the behavior of the intermediaries conducting in these channels. To consider the link between intermediaries and the movement of the product from producer to consumer, the concept of marketing channels or channels of distribution need to be analyzed. In the case of Myanmar's rice market all important intermediaries, institutions will be focused on analyzing that operate in different channels of distribution as well as the availability of marketing facilities such as infrastructure, transportation, storage and market information etc.

2.2.3 Market integration

Market analysis depends on available data. Market integration testing methods are important because empirical findings elucidate market conditions, which in turn are central to the modeling of an economy. One cannot establish the competitiveness of a market without first establishing the relevant spatial market (Stigler and Sherwin 1985). Market integration concerns the free flow of goods and information- and thus prices- over form, space, and time and is thus closely related to concepts of efficiency.

Barret (1996) mentioned that vertical market integration involves stages in marketing and processing channels, spatial integration relates spatially distinct markets, and

intertemporal integration refers to arbitrage across periods. If two markets are integrated, a shock to the price in one market should be manifest in the other market's price as well. Among perfectly segmented markets, price series should be independent. Comovement of prices has thus become synonymous with market integration.

Measures of integration have not advanced much, however. There have been several attempts to apply regression analysis to market integration but perhaps the best known was by Ravallion (1986), who used it to analyze the relationship between prices in different markets around the time of the 1984 famine in Bangladesh. By permitting each local price series to have its own dynamic structure (and allowing for any correlated local seasonality or other characteristics) as well as an interlinkage with other local markets, the main inferential dangers of the simpler bivariate model can be avoided.

The equation Ravallion introduced has been extended by several others since then, most notably by Timmer (1987) who applied it to the corn market of Indonesia and used it to construct an 'Index of Market Connection' (IMC) which provides an easily understood measure of short-run integration levels between two markets. Faminow and Benson (1990) applied it to hog prices in Canada, although stressing the importance of a prior understanding of both market structure and institutions in order to interpret results and avoid coming to misleading conclusions about market integration.

Sexton, Kling and Carman (1991) explained a lack of market integration by three factors: (a) markets are autarkic, i.e., no arbitrage is possible because, for example, transaction costs are too high in relation to price differences or because of public market protection; (b) there are impediments to efficient arbitrage, e.g., trading barriers, imperfect market information, or risk aversion; (c) there is imperfect competition because of, for example, collusion or preferential access to scarce resources (e.g., transport, credit) that may lead to higher price differences between markets than transaction costs can justify.

Lutz (1995) said that market integration among two or more markets is a multidimensional concept implying similarity in price variation (price integration), standardization of measures and common trade habits. Price integration is, therefore, one of several necessary conditions for market integration. In a competitive price market, price integration is the outcome of an arbitrage process: exchange (trade) between actors in different markets who aim to take advantage of price differences that exceed transaction costs.

CHAPTER 3
RICE PRODUCTION AND DISTRIBUTION SYSTEM IN MYANMAR AND JAPAN

3.1 AGRICULTURAL PRODUCTION AND RICE SECTOR IN MYANMAR

3.1.1 Overview of the status of agricultural production

Myanmar still remains one of the developing countries and its economy mainly depends on agricultural production. Food cultivation for self-sufficiency and security is being always a priority issue. A considerable share of total export value occupied by Agriculture sector can contribute to the needs for the structural change of economy towards industrialization and modernization of the country. The crucial purposes in Agriculture sector have been the acceleration of cereals and industrial crops production in order to (a) provide sufficient domestic consumption; (b) meet requirement of domestic agro-based industries adequately and (c) promote increasing exports.

Since 1988, Government introduced the market-oriented economic policies expected a lot of progress has been achieved in the economy. Over 15 years of economic revolution, agricultural production has experienced a high and stable growth rate. Agricultural production value, calculated by fixed price of 1985, increased from 19,470 million Kyats in 1990 to 33,658 million Kyats in 2001, equivalent to the average growth rate of 7.3 percent per year. The production of some agricultural crops increased remarkably after the liberalization of agricultural marketing. Pulses and beans for export, especially to India, is a prominent example of the improvement. The export of pulses and beans was 71 thousand metric tons in 1988-89, but increased rapidly to 610 thousand metric tons in 1995-96 and 1,035 thousand metric tons in 2001-02, which was accounted for more than 80 percent of the total agricultural product. This evidence points out the victorious effort of the pulses production of the country and it also indicates a high development potential of Myanmar agriculture once the institutional barriers are removed.

The priority of the diet of the people can distinguish the role of difference between pulses and rice. Rice is designated as national crop to highlight its great importance as the main food of the increasing population, so that its price hike can easily hit the consumers badly, which does not allow policy-makers to liberalize the market as easily as the other agricultural commodities including pulses and beans. In Myanmar, rice is also used for a variety of snacks, for example, rice noodle, rice cake and vermicelli, etc. Due to the heartily

consumption of rice, per capita consumption of rice per year is estimated to be 190 kg, which is very high compared to neighboring countries.

3.1.2 Agro-ecological and natural resource of Myanmar

Myanmar is situated on the Southeast Asia mainland, lying between 9˚58′ and 28˚31′ N latitudes and between 92˚ 10′ and 101˚ 9′ E longitudes. The total arable land is 676,577 square kilometer and 2,200 kilometer extending from the North to the South, and 950 kilometer from the East to the West. Myanmar shares a land boundary of 5,858 kilometer with five neighboring countries- Bangladesh and India on the northwest, China on the northeast and Laos and Thailand on the southeast. The total coastline extends 2,276 kilometer along the Bay of Bengal, Gulf of Mottama and the Andaman Sea.

There are 3 seasons in Myanmar, the hot and dry season lasting from mid-February to mid-May, the rainy season (monsoon) season from mid-May to mid-October and the cool season from mid-October to mid-February. Southwest monsoon is the major source of rainfall in the rainy season. Generally, the precipitation varies depending on the locality and elevation ranged average annually from about 800 mm to nearly 5,000 mm. Recorded temperatures in various part of Myanmar range from 0.3 ˚C (32.5 ˚F) to 46 ˚C (114.8 ˚F).

The river system is the navigable through the center of the country and supports as the major water resource for the cultivation of the crops. The Ayeyarwady River forms a large delta region which developed as the major rice production area. The estimated population of Myanmar is 52.17 million in 2002 and the recent population growth rate has averaged 2.02 percent annually with a population density of 77.11 per square kilometer. (CSO 2002)

3.1.2.a Land utilization

Total land area of Myanmar is 67.7 million hectares of which 9.99 million hectares are utilized for crop cultivation. The reserved forest area contributes 20.66 percent of the total land area of the country. Extendable land area is approximately 7.2 million hectares, which can be brought under crop cultivation and livestock farming.

Several kinds of agricultural crops are grown based on the prevalence of different agro-ecological zones. The total crop area including both seasonal and perennial crops amounted to 15.85 million hectare in 2001-02. The sown area of crops under irrigation is

2.53 million hectare, which is only about 16 percent of the total gross sown area and the considerable percentage of crop cultivation depends on the rain-fed.

3.1.3 Rice production

Large variation of the agro-climate and natural endowment across the country discriminates the physical environment, farming system and socio-economic conditions for agriculture in Myanmar. It has been documented that crop cultivation in Myanmar depends on three different water sources, namely rainfall, residual moisture/ high water table and irrigation.

Regarding with paddy production, Ayeyarwady, Bago, Yangon Divisions and Mon State situated at the lower part of Myanmar are the major paddy producing and surplus areas of the country. The central part of the country consisting of Magway, Mandalay and Sagaing Divisions and Shan State are the deficit areas.

Until 1992-93, domestic consumption and export relied only on monsoon paddy produce. However, in order to fulfill the domestic requirements for the increasing population and to possess greater exportable surplus, summer paddy cultivation program was introduced in 1992-93. Depending on the availability of irrigation facilities, summer paddy is planted after the harvest of the main, monsoon crop. The sown areas of monsoon and summer paddy in 2001-02 were 5.25 and 1.16 million hectares respectively. Total paddy production was over 21 million metric tons.

Summer paddy cultivation provides rice surplus in Myanmar. If new paddy cultivated area to be extended, more investment must be needed for transportation, labors and reclamation of the land. Summer paddy cultivation has good basis for more paddy yields because of the favorable weather and natural environment, also has a potential to extend by using and providing effective cultivation techniques, irrigation services, machineries and diesel oil and fertilizer.

3.1.3.a Rice calendar

Monsoon paddy plantation is started in May and is completed in September. It is harvested 3 to 4 months after planting from November up to February. Depends on the agro-ecological condition and sources of irrigation, summer paddy sowing is deviated from November to February and harvesting from March to May. In the lower part of Myanmar, summer paddy is harvested from March to April in order to escape the showers of Southwest

monsoon during the harvesting period. In the central dry zone area, summer paddy starts to harvest in July.

Picture 3. 1: Land preparation for paddy cultivation

Picture 3. 2: Paddy plantation by using manual power

Due to the cropping pattern and cultivated area, paddy and rice prices go up in the rainy season; namely July, August and September. Because of the fact that the cultivated areas of monsoon paddy are usually higher than that of summer paddy and consequently monsoon paddy harvest can influence rice price in the whole year. The summer paddy production of the country is insufficient to lower the prices significantly during the rainy

season. The prices go down substantially after the harvest of monsoon paddy from October to January.

3.1.3.b Variety and yield

Literally, more than 1000 different rice varieties have been used in the whole country and the local names are given to the same varieties in different locations. In order to facilitate the internal and external trade, all Myanmar local rice varieties were standardized as Emata, Letywezin, Ngasein, Medon and Byat. It is known as Beale Classification and Ngasein, Medon and Byat groups are short grains while Emata and Letywezin are long grains.

Picture 3. 3: Paddy harvesting

According to the Green Revolution in 1960's, high yielding varieties and new technologies were introduced. These modern varieties, having higher yield than local varieties, were widely cultivated by farmers and consequently, the area of high yielding variety had increased significantly within a short period of time. In order to facilitate the standardizing the milling outturn and grain quality for rice export, the paddy varieties were grouped into three different categories, namely early matured variety (Kaukyin), medium (Kauklatt) and late variety (Kaukkyi) depending on their life period.

3.1.4 Government intervention in rice production

3.1.4.a Land accessibility of farmers

Myanmar's agriculture, featured by relatively large population and limited arable land, has led to highly intensive farming system. Introducing of land saving technologies in agriculture such as new high-yielding varieties, fertilizers and pesticides becomes imperative. On the other hand, importance of food securities implies that each piece of land needs to be allocated effectively according to the expected productivity.

Generally speaking, farmers are free to select the crops what they want to grow on their own field. However, if his own land is specified as "le" which is suitable for the paddy cultivation in the monsoon season, it is an obligation to grow paddy on his land. After implementing summer paddy cultivation program, farmers are often forced to grow summer paddy on their land especially in the case that the areas where irrigation facilities initiated by the Government.

Another distinct feature of Myanmar's agriculture is a strong government intervention in farm land ownership. All farm land is still owned by the State. Farmers are granted land use rights (the right to occupy and cultivate land) on their holdings, which cannot be transferred, mortgaged or taken over in lieu of loan repayment. Because of the economic reform, even the compulsory paddy procurement system and national monopoly marketing have been abolished, it still remains. This is a result of centralized political system and also because of the incomplete economic reforms.

3.1.4.b Input subsidization

In Myanma agriculture, rice production has been of major importance as it is directly related to food supply for the population. Rice production has had highest priority in agricultural policy and this will remain so in the future. Government imported and distributed chemical fertilizers and pesticides since 1958-59. Official records prescribed that agricultural mechanization was also introduced by importing tractors for land preparation work. However, farmers did not realize the benefit of chemical fertilizers and pesticides and not widely used in rice production during that period. With the introduction of fertilizer-responsive high-yielding varieties, demand for chemical fertilizer became increasing.

During that era, the government monopolized the supply of chemical fertilizers which were obtainable from the local plants and from import. Chemical fertilizers were

distributed at subsidized price to the farmers. Therefore, the use of chemical fertilizers in paddy cultivation had reached the highest level in 1985-86. Records showed that 80 percent of the chemical fertilizer was used in rice production and the rest was used for pulses, oilseed crops, jute, rubber and cotton. After the period 1985-86, the Government faced a tight economic situation and could no longer provide the required agricultural inputs such as chemical fertilizers, spare parts and fuel as it did before.

This reduction has contributed to the static yield problem and leveling off in use of HYVs, although the increased irrigation facilities are beneficial to crop yield. Fertilizer supply has improved since the government has allowed private imports, but the private market price has been steeply higher than the government price. Therefore, nowadays the usage of fertilizer and chemical in rice production depends largely on the rice price incentive.

3.1.4.c The problems in credit market

Government also provided agricultural loans since 1953-54. Agricultural loan has been subjected through Myanmar Agricultural Bank since 1978-79 and became Myanmar Agricultural and Rural Development Bank (MADB). Government raised agricultural credit year by year for 25Ks per acre in 1972-73 to 2,000-5,000 Ks per acre in 2003-04.

It is clear that institutional credit did not cover the cash requirements for cost of cultivation. As a consequence, farmers continued to look for private lenders to meet their credit requirements with high interest rate. Moreover, credit was distributed on a per acre basis and farmers with larger land holdings benefited from this system. It is easy to imagine that the prolonged rice price collapse accelerated the shortage of working capitals to cultivate for farmers, which resulted in high dependency on informal credit market and the high opportunity cost for the self-supplied capitals.

3.1.4.d Agricultural Extension Service

The role of public-supported agricultural extension services has traditionally been to provide the important link between agricultural research and farmers and the farming community, especially for technology transfer in support of agriculture and rural development. Although this role is still played by extension services, the demands for support, as well as the targets, mechanisms, processes and strategies, require more varied

and comprehensive attention regarding customers and strategies to address their specific needs.

After World War II, Myanmar established formal agricultural extension services not only to support educational trainings but also to supply inputs and credit. However, public extension services, unfortunately, have been ineffective in reaching farmers and farm communities with information and technologies needed to ensure food security and sustainable development. When information has been insufficient, farmers have managed to obtain from other sources. Insufficient technical training of field staff and budgetary instability hampered the effectiveness of the program.

3.1.5 Domestic rice marketing

As already mentioned rice is not only the most important crop to millions of farmers but also to some landless farmhands who derive their income from working as seasonal labors. Rice farmers are used to store seeds from their production for next planting season and for the family consumption in granary. The store amount of surplus for sale is varied from farmer to farmer depending on the production volume and financial condition. Some farmers hired laborers as barter system paid paddy as wages. Generally, larger farmers usually keep in hand their surplus with the expectation of higher price in lean season. After that, stored paddy is taken out and sold to primary collector (village brokers) or agents of millers or rice millers.

Concerning with selling, some farmers sell paddy at farm and some deliver to the nearest rice mill. After milling, farmers will keep part of milled harvest as home consumption and the rest will be sold either to traders or to millers. In addition, by-products of rice such as broken rice and bran are taken back for feed. On the other hand, most small farmers cannot hold surplus of rice to sell at the lean season when rice price is high. The main reason is that working capital urgently required for second crops such as pulses or summer paddy after harvesting monsoon crop.

Farmers sell their produce at the farm to the traders who purchase with basket in terms of volume basis. There are different size of paddy baskets in rural area. In transaction, rice farmers and traders negotiate depending on paddy variety, quality, moisture content, foreign matter content and size of baskets. Officially, one basket of paddy is equals to 46 lb (20.86 kg).

In the domestic marketing, rice from surplus area is usually supplied to the markets in deficit areas or through the Yangon central market. Because of the relatively price inelastic demand for rice, increasing price of rice could not change very much in quantities consumed. Rice price varies depending on the quality, variety, old rice and new rice. Regarding the variety, Pawsan rice is the most expensive compared to other varieties. Each variety has again three different qualities: first quality (a-htat-sa), medium quality (a-lat-sa) and the lowest quality (auk-sa). This grading relates to the rice milling quality. Regarding the preference, consumers in Shan State located in hilly region ore prefer sticky rice. In the lower part of the country, consumers prefer slightly sticky rice and in the central Myanmar non-sticky rice varieties.

3.1.6 Government intervention in rice marketing

Successive governments are concerned with securing a stable flow of rice supply to the population, an adequate diet for consumers at the poverty level, stable prices and an adequate income for farmers. To cope with the food problems, governments implement many different policies including buffer stocks, internal price stabilization, direct government procurement and distribution, various trade policies and combination of these.

Various types of government economic policies affect the agricultural marketing system in Myanmar. General fiscal and monetary and exchange rate policies affect a broad spectrum of economic activities that concern producers, consumers and marketing firms. Under the centrally planned economy from 1962-63 to 1987-88, agricultural marketing system in Myanmar was regulated by the State which was fully responsible for the rice distribution system to the whole population. After implementing of market oriented economy in 1989, the government direct intervention in grain marketing has been gradually reduced and encouraged the private sector to play a larger role.

However, regarding with staple food, rice, the government has manipulated its foreign trade volume to ensure sufficient domestic supplies. Therefore, Myanma Agricultural Produce Trading, under the ministry of Commerce, performed as a state marketing agency. MAPT was the sole rice exporter and the volume of rice export was well scrutinized by the government. Apart from export of rice, MAPT also maintained the buffer stocks for emergency use and possible market intervention domestically. MAPT purchased paddy from farmers under the quota system which was applied to all monsoon rice production at the rate of 10-12 baskets per acre, depending on the yield level. In a few areas

there was also a quota for summer rice production. After milling, the rice was used for supplying Government employees, Police and Army at subsidized price and also for exports.

Starting from the harvest season of the monsoon paddy of 2003, the new rice trading policy was enacted. Since then the government will not buy paddy directly from farmers, and adopt the new rice trading policy ensuring free trade of the crop in the interest of the entire peasantry and helping develops the market oriented economy.

The new policy was launched to enhance the ability of the farmers and the national entrepreneur to realize the objectives and to enable farmers to produce farm goods with might and main supporting the new policy. The policy also enables consumers to buy rice at reasonable price with full satisfaction and to extend export of the surplus rice to earn foreign exchange in accord with export policy.

All nationals have the right to the rice trading excluding government organizations. Pricing will be according to the prevailing price and monopoly on rice trading will not be allowed to anyone or organizations. All nationals can trade rice freely at the domestic market. Export of rice can be carried out under the guidance of the Myanmar Rice Trading Leading Committee. Rice will be exported only when there is surplus.

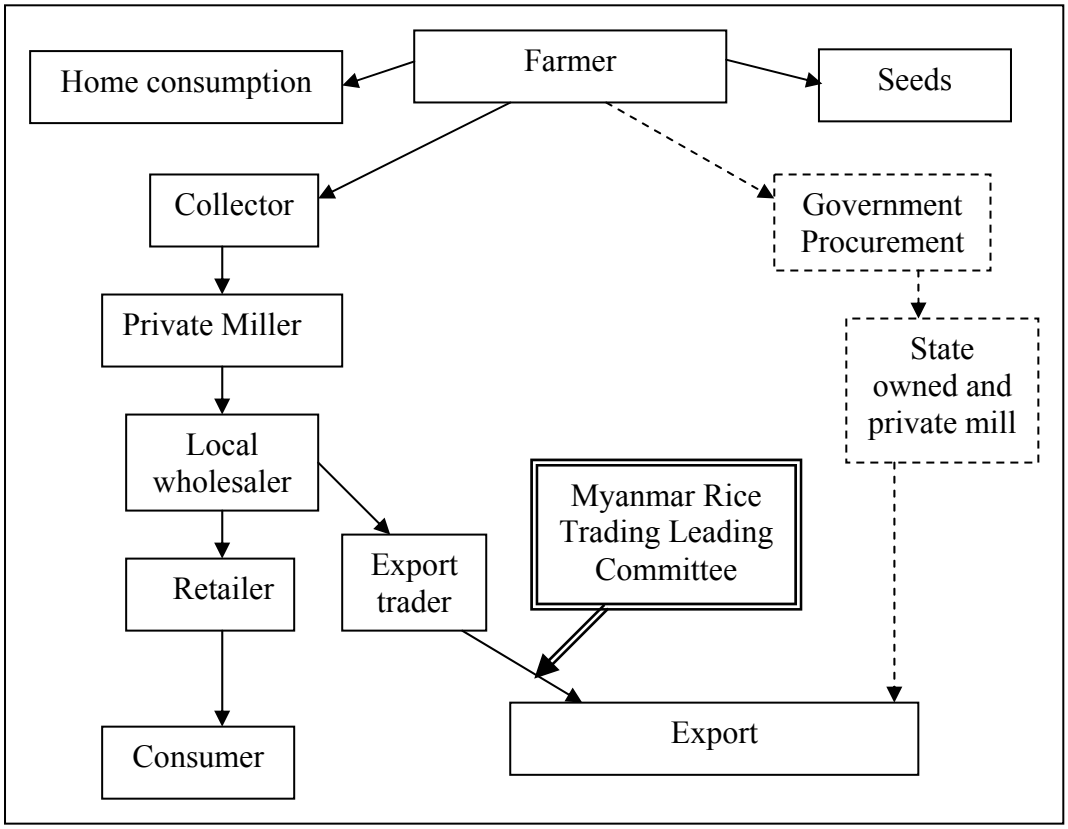

Fig 3. 1: **Transformation of rice distribution system in Myanmar**
Note: ------- indicates the government's direct buying channel disappeared after 2003

3.2 JAPAN RICE SECTOR AND DISTRIBUTION SYSTEM

3.2.1 Agro-ecological zone and role of agriculture sector

Japan consists of 4 major islands: Hokkaido, Honshu, Shikoku and Kyushu and a number of island chains. The archipelago, lying off the eastern coast of the Asian Continent, stretches in an area 3,800 kilometers long and covering an area of 378 thousand square kilometers. The climate is generally mild and the four seasons are clearly distinct. Rainfall is abundant, averaging about 2,000 mm a year.

The mountainous and the limited cultivated land of the country lead to 4,736 thousand hectare cultivated land (2003) which is about 12.5 percent of the total land area. Paddy fields (2,592 thousand hectare) occupy 54.7 percent of total cultivated area and average farm size of Japanese farm is 1.6 hectares per household. The land under cultivation decreases in number continuously with the main reason that the conversion to residential property and the abandonment of cultivated land.

As in most developed countries, the agricultural production in Japan is of minor importance when compared with the whole country economy. In 2002, Agriculture, Forestry and Fisheries sector contributed 1.3 percent of Japan's total GDP. Agricultural products occupied only 0.38 percent of total export earning and covered 4.76 percent of the total agricultural products import value of the country. Population of agricultural activities is about 2.6 million people that are only 2.06 percent of total population (127 million). (Calculation based on data from Monthly Statistics of Agriculture, Forestry and Fisheries, 2004 Nov)

Agriculture sector is supported by 2.98 million farming households, representing 6.05 percent of total Japanese households which is 49.26 million. The farming population is approximately 9.65 million which is 7.62 percent of the total population (12.67million). Because of the rapid economic growth of nation, the number of farming households, as well as that of the farming population, has been steadily decreasing since 1960.

In 2003, Japan had about 2.98 million farm households which were roughly half of the farm household numbers of 1960 (6.06 million). As mentioned in Fig (3.2), 74 percent of total farm households are commercial farm households that produce agricultural products for sale and only 26 percent of total farm households produce only for their own use and is known as non-commercial farm households. Among the commercial farm households, only 20 percent of them are full-time farm household which means no household member of them

engaged in other jobs than farming. 80 percent of commercial farm households are part-time farm households and percentage of part-time farm households are increasing year by year.

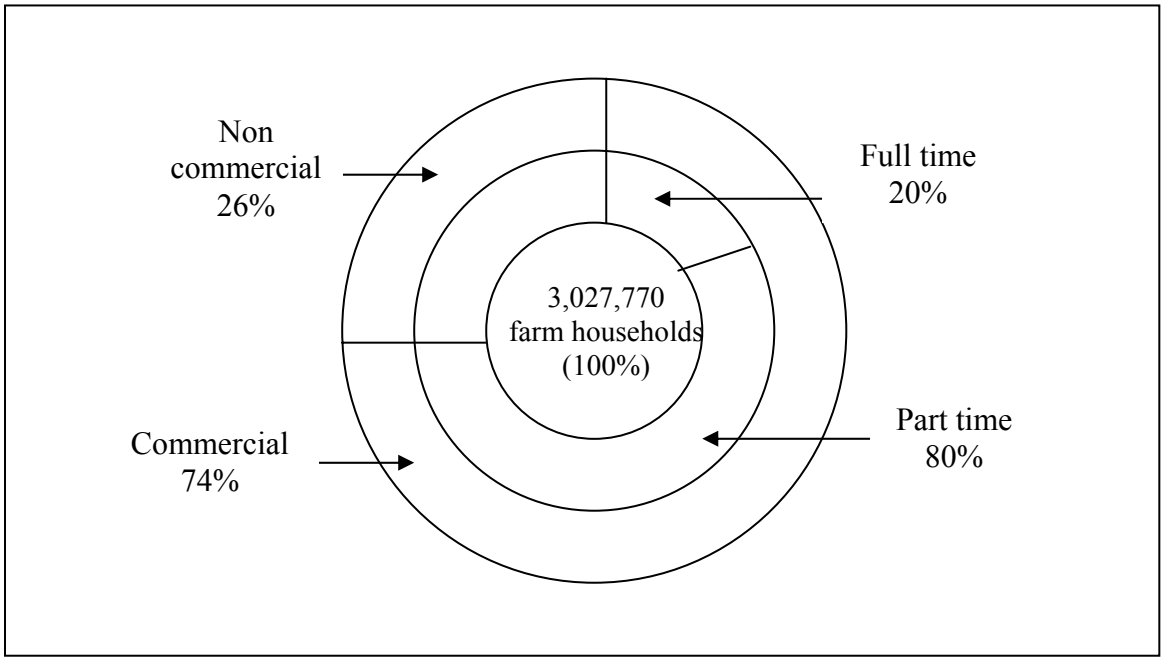

Fig 3. 2: Farm household classification
Source: MAFF 2001~2003

3.2.2 The status of rice production and consumption

Unlike the other OECD countries, rice still prolong as the traditional staple food in Japan and is grown throughout the main islands of the country. George (2000) mentioned that "rice is the Japanese culture that has lasted for several thousand years. It is the Japanese people themselves." Under the climate of the East Asian Monsoon which is characterized by summer rains and an extensive network of irrigation facilities, rice originally a tropical marsh crop, has become a predominant food crop in Japan. Almost all rice is japonica—a short-grain variety widely grown in Northeast Asia.

Concerning with the rice production system, Ministry of agriculture, Forestry and Fisheries (MAFF) laid down rice production adjustment program in order to reduce the surplus stock by using crop diversion program since 1971. Even rice production area is decreasing year by year; rice is still a basic commodity in Japan and accounted for 24.4 percent of the total value of agricultural products in 2001. Moreover, paddy fields represent 54.7 percent of total cultivated land area (4.7 million hectare). Rice production amount in 2003 was 7.8 million tons that was 12.4 percent reduction of last year total production amount and its yield was 4.69 tons per hectare. Rice consumption in Japan is dropped

consistently because of the changing of the eating habits by adopting western and convenience foods.

Picture 3. 4: Paddy plantation by using 4 rows planter

Picture 3. 5: Paddy seedling near paddy field

3.2.3 Rice policy on production and marketing

3.2.3.a Land Reform Policy

Land Reform Policy enacted in the early 1950s divided the holding of rice-growing area into less than 3 hectares in size. During the reform, many households received their own land that had rented from large landowners and felt that the new, small-scale land tenure

system was fair and needed to be defended. However, rapid economic development of the country in the succeeding 50 years cause the income from farming less than 3 hectare of rice is dwarfed by other income opportunities. Farmers have shifted to off-farm employment, and rice cultivation has become a part-time household activity for most farms.

3.2.3.b Food Control Law

The government had managed the production and marketing of rice based on the Food Control Law (1942) in Japan targeting the expansion of total production as the domestic supply could rarely meet demand until the middle of the 1960s. However, the government started to do pressure on producer prices and at the same time introduced some important policy measures because of the accumulation of huge stock pile of surplus rice at the beginning of the 1970 rice year.

The first measure was the establishment of voluntary marketing for rice (VM rice) in 1969 which intended to be rice production more sensitive to demand changes as well as reducing the financial burden of the government. The second was target setting for the maximum volume of rice to be marketed. Since 1971, the total amount of prior booking of rice which individual producers plan to sell to the government had been limited. The third measure was the Production Diversion Program which started in 1971. Being facing the widening gap between the potential production capacity and actual demand, Rice Production Diversion has been intensified under the Paddy Field Reorientation Program since 1978.

In 1981, The Food Control Law was substantially revised so as to formulate the regime responsive to changing social and economic conditions. The rationing system was abolished except for emergency periods. The rice marketing channel was rearranged. Under the revised of The Food Control Law, every year the government establishes the “Basic Plan for Rice Control”, which sets forth the basic discipline and method of rice control, the supply-demand prospects and the rice quantity to be controlled by the government.

3.2.3.c The Law for Stabilization of Supply-Demand and Price of Staple Food

Because of the changing production distribution, consumption of rice, the adaptation of products to consumer needs and rationalization of the distribution structure, the government decided to abolish the Food Control Law and establish The Law for Stabilization of Supply-Demand and Price of Staple Food in 1994. Under the new law, the

government adjusted the overall supply and demand of rice and deregulated the distribution of rice by defining both voluntarily marketed and government-marketed rice as orderly marketed rice. The obligation of the farmers to sell their rice to the government was abolished.

After that the price formation market for voluntarily marketed rice was institutionalized by ensuring fair prices of rice that reflect the actual supply and demand situation. Voluntarily marketed rice dealt through private-sector channels became the main channel of rice distribution, the government managed rice stockpile and supply imported rice under the minimum access commitment, through the operations of government-marketed rice. To ensure the smooth management of stockpiles, the government purchased rice from farmers who participate in its rice production adjustment program.

3.2.3.d Compensation for declines in producer prices

The Rice Farming Income Stabilization Program has been started in 1998; rice farmers are compensated when the market price in a crop year falls below a standard price, which is calculated as the moving average market price of preceding years. If current-year market prices fall below the standard price, producers can collect 80 percent of the difference between the current year price and the standard price, multiplied times current production. The compensation money is supported from the Rice Farming Income Stabilization Fund, filled by contributions from participating farmers (2 percent of the standard rice price times their output volume) and the government (6 percent of the standard rice price times national output volume) each year.

Participation in the Income Stabilization Program is voluntary, and some farmers have chosen not to participate. To get the full benefits, participating farmers are required to join the current Production Adjustment Promotion Program (PAPP), which diverts some of their paddy land away from rice. Thus, a farmer diverting a paddy field to another crop receives the revenue from selling that crop, plus the diversion payment and the right to be eligible for income stabilization payments based on the farm's remaining rice production. Japan notified the WTO that the Income Stabilization Program was a "blue box" policy—where payments to farmers are linked to output-limiting measures, such as the diversion requirement.

3.2.3.e Rice diversion policies

Rice area diversion has been administered under five different plans since 1971. The current plan, Production Adjustment Promotion Program (PAPP), was started in 1998. The Ministry of Agriculture, Forestry and Fisheries (MAFF) determines adjustments of rice paddy area in order to get the balance of supply and demand.

Farmers are offered payments if they use paddy land for certain purposes other than growing rice for food use. Per hectare payments from the government (revised annually) vary according to the justified diverted land. The main source of funds for the diversion payments is the national budget. However, farmers participating in the PAPP are required to pay 4,000 yen per 10 Ares for the land kept in rice into a mutual compensation fund. Because the diversion is on an area basis and is voluntary, the program cannot completely protect overproduction of rice. If yields are higher than expected, Japan's farms can still flood the market with more rice than planned for.

3.2.3.f Insurance

Rice farmers are eligible for insurance against yield losses, except those caused by farmer negligence. The insurance is part of a national system that includes a local level (a municipality or insurance association), and prefectural and national levels. Rice farmers can choose coverage for individual plots or their entire rice farming operation. In the case of plot coverage, indemnities are paid when losses are greater than 30 percent of a predetermined yield. For rice farm coverage, farmers can choose to be insured against yield losses greater than either 10 percent or 20 percent of the standard yield, applied to the output of all the farm plots. Farmers can choose how much, in yen per kilogram, they wish to be indemnified for each kilogram of lost output. The premium is determined by multiplying a premium rate times the coverage amount.

3.2.3.g Tariffs and the tariff-rate quota

Japan's government has resisted rice imports for over 30 years. At the termination of the Uruguay Round (UR) of global trade negotiations in 1995, Japan agreed rice imports quota system that now brings 682,000 tons of import rice annually, on a milled rice equivalent basis. This represents 7.2 percent of average consumption in the 1986-88 base periods. However, most of this rice is not released directly into Japan's market. Instead, imported rice often remains in government stocks until it is released as food aid to developing countries or sold as an input to food processors.

Since 1999, Japan has used a tariff-rate quota (TRQ) system for rice imports. Within the quota, the tariff is zero. However, since the MAFF Food Agency has the sole right to import rice within the quota, the tariff level is irrelevant Imports outside the quota are legally possible and not subject to state trading (exclusive purchasing by the Food Agency), but are effectively prohibited by the high tariff (341 yen per kg).

3.2.3.h State trading and markups in the TRQ

Most imported rice is delivered to Food Agency stocks. This is known as the Ordinary Market Access (OMA) portion of the quota. Later, this rice is either sold into Japan's market or donated as food aid. For rice imports within the quota, the Food Agency can collect a markup of up to 292 yen per kilogram. In practice, the actual markup varies. The markup is very important in the remaining portion of the quota that the Food Agency designates as a Simultaneous-Buy-Sell (SBS) component.

Under the SBS system, the Food Agency conducts a kind of auction. Prospective importing firms specify what the markup (the difference between the price at which they sell the rice to the Food Agency and the price at which they later buy it back from the Food Agency) will be, as well as the quantity and type of rice involved.

3.2.3.i Prices

By isolating its markets from world rice markets, Japan's policies have caused domestic prices to be higher than they would be given free trade. Within its isolated national market, Japan's rice area diversion policy has further restricted supply to keep prices higher. As a group, rice farmers have received a subsidy from Japan's policies. Border measures have, for the most part, kept foreign rice out of competition for Japan's market. Any imported rice available to Japan's consumers is sold at a steep markup; so that price competition with Japan's domestic rice is reduced. While higher prices stemming from reduced competition have been the main subsidy to farmers, they have also benefited from the Rice Income Stabilization Program. Most of these farms are small, and incur high costs when they grow rice. The small scale of farming is made economically rewarding by the very high producer prices. Higher prices have affected both supply and demand.

Japan's farmers produce japonica rice, a round grain rice with low amylose starch content. Other producing regions are Korea, Taiwan, northern China, California, and New

South Wales (Australia). Foreign producers in all these areas produce rice at a lower price than most Japanese farmers. In recent years, typical prices received by Japan's producers have been 60 percent higher than in South Korea and more than 10 times higher than U.S. prices. Consumers pay a high price for rice. At retail, Japan's rice prices tend to be 2.5-3 times higher than U.S (USDA, 2003).

3.2.3.j Revised Food Law

Food Law was revised in April 2004 and removed some institutional control in the domestic rice marketing system. Under the revision, the government abandons its responsible for adjusting the demand and supply of rice and supervising price setting and government assistance and allows market forces to fully control rice distribution. Moreover, the revised law allows rice traders to do business by reporting to the authorities instead of registering as authorized traders. The government does not have the duty to inspect farm products, including tests on the quality and safety of rice. Therefore, inspection process becomes optional for the traders.

3.2.4 Domestic rice marketing system and practices

The Food Agency also plays a role in domestic rice marketing. Although the influence of the Food Agency decreased in the last years due to smaller amounts of domestic rice purchased by the Food Agency and the increasing significance of the general auction system, the domestic market cannot be called a free market. Two major categories can be differentiated in the Japanese domestic rice distribution system. Orderly marketed rice (government marketed rice plus voluntary marketed rice) and non-orderly marketed rice (rice farmers own consumption and rice sold directly to wholesalers, retailers and consumers). The voluntarily marketed rice under the orderly marketed rice program accounts for about 50 percent of Japan's total rice sales. Under the new rice policy, the distinction between "orderly marketed rice" and "non-orderly marketed rice" was abolished. The Japanese consumers prefer medium size, round Japonica type rice. They are also sensitive to the taste of rice and prefer fresh and milled rice. These preferences of consumers characterize the rice marketing system and practices such as inspection, storage, milling and packing sizes for consumers.

3.2.4.a Paddy processing

Paddy harvest by individual farmers is processed to meet quality standards using small machines, such as dryers, huskers, sifters and weighing machine. Brown rice is packed in 30 kg or 60 kg sacks of paper or polyethylene bags. There are 250 agricultural cooperatives which receive paddy from farmers for drying and storage at the country elevators. Husked rice is forwarded in bulk. In Japan, forwarding in bulk mainly means to transport in a flexible container which holds about a ton of brown rice.

3.2.4.b Inspection of rice and storage facilities

Under the Farm Produce Inspection Law, the Food Agency officials inspect the collected rice in bags. The law provides quality standards for paddy, brown rice and milled rice. The objectives of the law are to ensure the quality for smooth marketing and encourage farmers to produce high quality rice. Inspection is practiced at 14,000 places, mostly storage facilities, by 6,500 inspectors. Rice in bags, after inspection by inspectors-in-charge, is stored until a transportation order is issued. Inspection of the quality and food safety was obligatory before food law revision and now it is changed to optional.

Since the moisture content of Japanese rice is as high as 15 percent, the quality of rice tends to deteriorate in storage. To prevent this, the government introduced a method of storage under environmentally controlled conditions, which was about 15 ℃; damages from harmful insects and deterioration in quality are minimized, if not prevented. Storage facilities in both producing and consuming areas require government approval to ensure satisfactory storage condition.

Storage facilities are located in both producing and consuming areas. The storage facilities mostly belong to the agricultural cooperatives in the producing area. At the agricultural cooperatives with grain silos, the government purchases in paddy form, not in husked rice. Just before forwarding, the paddy is first husked.

The Government-purchased rice is mainly stored in private storage facilities before they are transported to the consuming areas. The rice under the semi-controlled system is transported directly to the wholesalers' facilities. Rice is harvested in autumn and consumed over the following year. Some of the rice is consumed after hot and humid summer.

3.2.4.c Transportation

Transportation of rice is executed through assembling transportation (from farmers to storage facilities in producing areas), and government transportation (from storage facilities in producing areas to those in consuming areas). In case of semi-controlled rice, it is directly transported to wholesalers, mostly by trucks, to meet their accurate demand. Transportation facilities for producers and retailers are comparatively small, such as small trucks. Government transportation uses trains, trucks and ships and deal with larger volumes and longer distances.

3.2.4.d Milling and packing

The milling process of brown rice produces white rice and rice bran, from which salad oil is extracted. Since Japanese rice is medium-sized, round, sticky and with high moisture content, milling loss is smaller compared with other kinds of rice. In the past, the milling was widely operated in retailer's workshops with small scale facilities. Nowadays, wholesalers are milling most of the rice in their large computer-operated mills. Packing process is also mechanized so as to produce the popular 10-kg or 5-kg vinyl plastic packs.

3.2.4.e Rice prices transaction

Voluntarily Marketed Rice Price Formation Center established to ensure that fair prices that can serve as an index for the dealing of voluntarily marketed rice are formed through tenders. Government purchase prices will reflect price trends of voluntarily marketed rice, taking into account production conditions and the need to ensure the continuous production of rice. The center will perform business as follows. To open price formation facilities to conduct the buying and selling of voluntarily marketed rice necessary for the formation of prices that will serve as an index for the trading of voluntarily marketed rice.

For the 2001 crop, 15 tenders were held with a total volume of traded rice of 977,070 metric tons. For the 2002 crop, ten tenders have been held so far with the remaining tenders scheduled to be held through July 2003. Because of transformation of the new rice policy since April 2004, the role of rice price formation center becomes low in the voluntarily marketing.

After the revision of Food Law, Voluntarily Marketed Rice Price Formation Center was renamed to Rice Price Formation Center. Even there was a tentative price decided by the center for the famous brand and large dealing varieties before the revision law, the market price are determined by the competition of the market after revising. The main transformation in the center is that bidding 30 percent of the production of Province as minimum line was also abolished. Moreover, rice traders do business by reporting to the authorities instead of registering as authorized traders.

3.2.5 Development of agricultural cooperatives in postwar Japan

After World War II, the Agricultural Cooperative Society law, enacted in 1947, established agricultural cooperative (Nokyo) as economic organizations to replace Nogyokai and guaranteed farmers' independence. Consequently, from 1948 to 1949, an increasing in number of agricultural cooperatives was established throughout Japan.

Because of encountering serious financial difficulties in these agricultural cooperatives, the Agricultural Cooperative Society Law was revised in 1954, and an apex organization, the Central Union of Agricultural Cooperatives (JA-ZENCHU) was established to guide and coordinate Japan's agricultural cooperative movement at the national level. Similarly, the Prefectural Central Union of Agricultural Cooperative was established to carry out the same tasks at the prefectural level.

In 1961, the Agricultural Cooperatives Amalgamation Assistance Law was enacted, and by 1965 the number of primary multipurpose agricultural cooperatives decreased from 11,586 to 1,320. Increases in size as a result of this reduction in the number made it possible to solidify the business and management base, improve facilities, and enter into new fields of activity. Moreover, with an increase in the associate membership (non-farmers), agricultural cooperative activities became even more widespread.

Agricultural cooperatives accelerated to use more energy toward international participation and in 1963 established the Institute for the Development of Agricultural Cooperation in Asia (IDACA). The IDACA was established to train cooperative leaders from developing countries, including those in Asia. Since then, the IDACA has accepted more than a hundred trainees annually. JA membership is approximately 9,125 thousand (as of the end of March 2000), and includes almost all farmers in Japan. A typical cooperative (5,633members, on average) consists of farmers as regular members and non-farmers as associate members.

JA encompasses both multipurpose and single purpose cooperatives, the difference determined member farmhouses and the type of service provided. Multi-purpose cooperatives offer guidance on farming and lifestyle matters, market agricultural products, supply production materials and daily necessities, loan and saving service, provide insurance against emergencies, and establish facilities for joint use. Single-purpose agricultural cooperatives are organized by farmers, who are active in specific areas of production such as dairy farming, raising livestock, horticulture and other specialized farming. They focus on marketing member farmers' products and supplying production materials and guidance.

Picture 3. 6: Japan Agricultural cooperatives (JA) Fukuoka

Picture 3. 7: JA's paddy seedling house

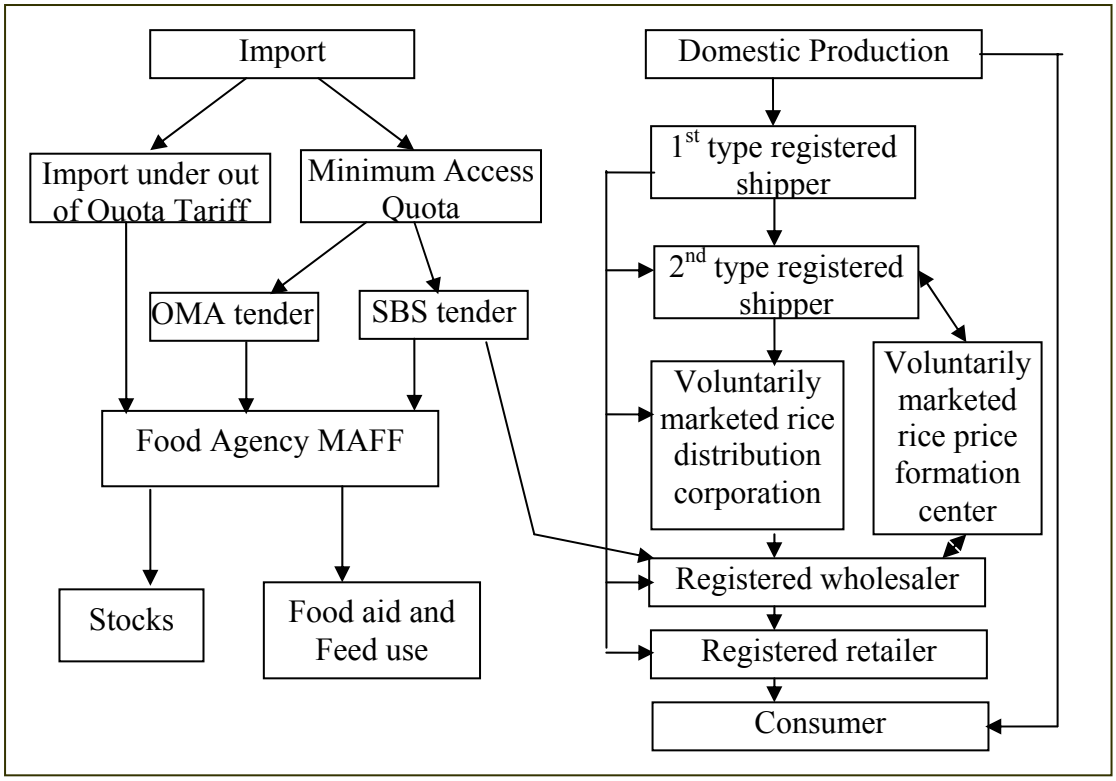

Fig 3. 3: Rice distribution system before revision of food law
Source: Own discussion

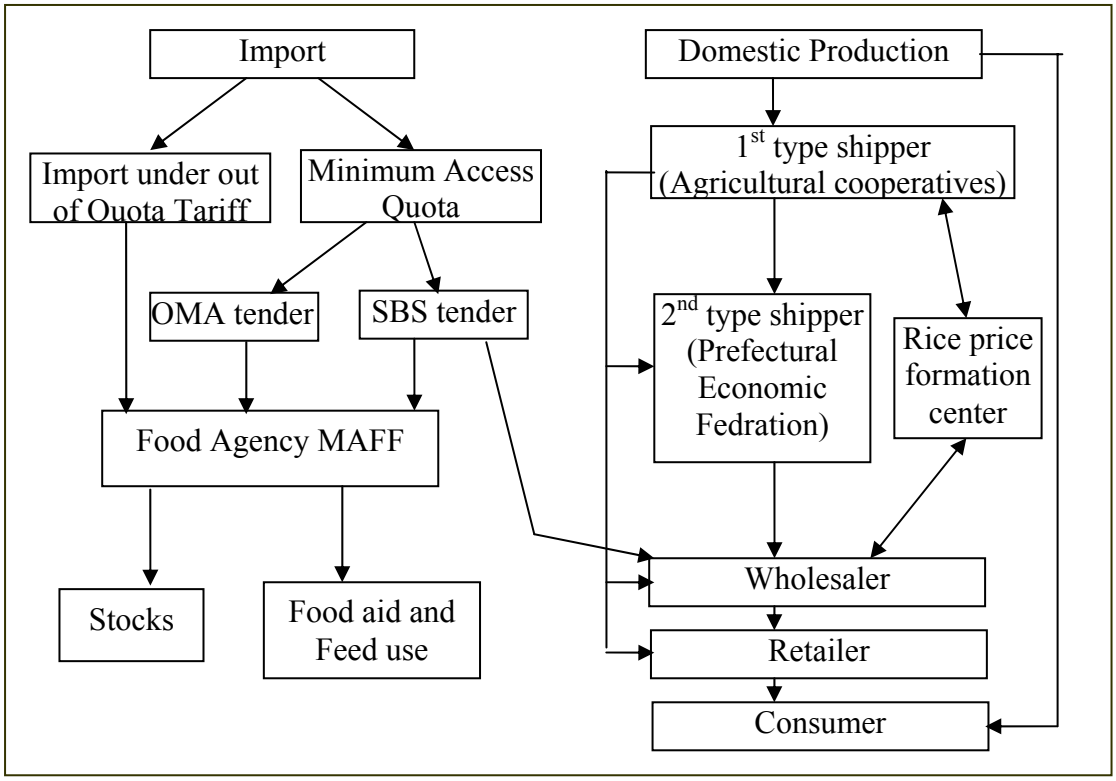

Fig 3. 4: Rice distribution system after revision of food law
Source: Own discussion

CHAPTER 4
METHODOLOGY OF DATA COLLECTION AND ANALYSIS

4.1 PROFILE OF THE SELECTED STUDY SITES FOR PRIMARY DATA

The socioeconomic features, cultivation practices and market performance of farmers and intermediaries have been studied in Pathein and Hlegu townships of Myanmar. Besides that, marketing activities of central rice wholesalers were investigated in the Yangon central rice market.

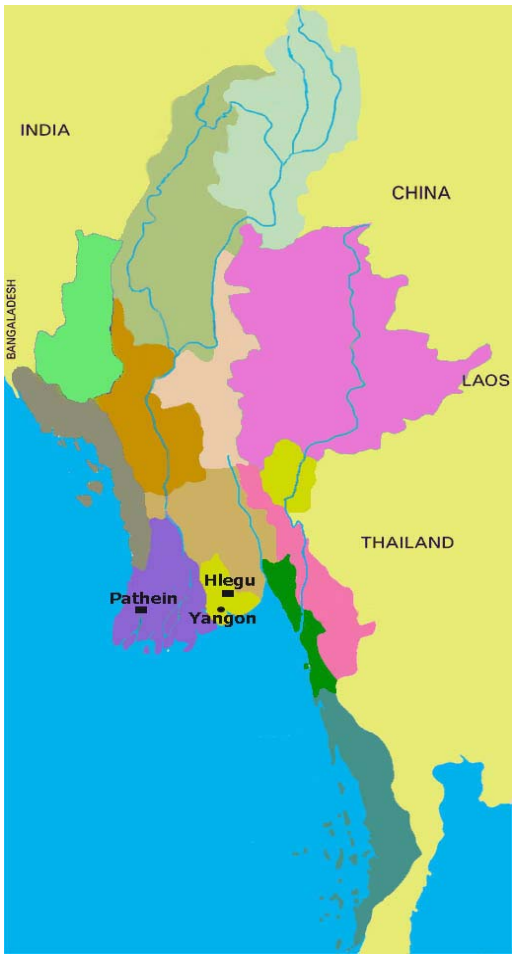

Fig 4. 1: Survey area in 2004

4.1.1 Criteria for the selection of study areas

The study areas were selected in view of the following criteria:

1) The homogeneity of the study sites in terms of cropping system and socio-economic features of the farmers in Hlegu and Pathein Townships is the prime basis for selection of the study areas.

2) To precisely examine the existence and performance of market intermediaries in rice marketing channel, Hlegu, Pathein and Yangon markets are selected as study sites.

4.1.2 Description of the study sites

Hlegu is one of the largest townships in Yangon Division which is the third highest rice producing area in Myanmar. Hlegu Township is just 18.8 kilometer far away from Yangon city. The total land area of Hlegu Township is 1,496.2 square kilometer and total cultivated land area is 147.8 thousand hectares. The number of farming households in Hlegu Township is 9,352 households. Because of the short distance to Yangon capital city, Hlegu Township possesses the high potential opportunity of the agricultural development by easily assess to the capital market.

Pathein is one of the major cities of Ayeyarwady Division which is composed of a large and fertile delta region traversed by the country's longest river, the Ayeyarwady river. Ayeyarwady Division is the largest rice producing area and is well known as the country's "rice bowl". The total rice growing area of 2.02 million hectare is equivalent to 32 percent of the national total. The highest surplus areas in this Division are Myaungmya, Pyapon and Pathein. The marketed surplus of rice is transported to Yangon and also to Magway, Pakokku, Monywa and Pyay. The major crop of Pathein Township is rice and 60 thousand hectare is grown throughout the township. The total area of Pathein Township is 1,556.9 square kilometer and total population is estimated 0.35 million. The distance between Pathein and Yangon is 70.6 kilometer and trucks and boats are the main transportation means to trade the commodities to Yangon and other local areas.

Yangon is the capital of the country and is the focal point of the internal and external trade. The total area of Yangon Division is 10,176.1 square kilometer and its total population over 6.1 million leads to the highest population density in the country. Moreover, Agricultural produce enters Yangon City from surplus producing areas by road, rail and waterway. Ocean vessels can reach the City by way of the Yangon River, which has port facilities for international trade.

Agricultural production and marketing of agricultural products are the major economic activities in these study areas. Most farmers produce for home consumption as well as for the marketing. Therefore, agriculture is the most important for individual smallholders as the essential production units.

4.1.3 Sampling procedure and data collection for primary data

Primary data were gathered by using structured questionnaire in the study sites. Primary sources included interviews with farmers and marketing intermediaries including assemblers, millers, local wholesalers, central wholesalers and retailers. The survey of rice farmers was carried out in rural regions surrounding the selected market places by using stratified random sampling. In order to obtain reliable qualitative data to interpret the functioning of the market, a stratified sample of assemblers, wholesalers, millers, and retailers was taken.

Table 4. 1: Number of interviewees in survey 2004

	Hlegu Township	Pathein Township	Yangon market	Total
Farmers	28	32	nil	60
Middlemen	13	17	8	38

The several questionnaires used in the survey covered the following topics:

1. The demographic questionnaires investigated the social and economic characteristics of households and their members of farmers and the market intermediaries.
2. The agricultural questionnaires were applied to all sampled farmers in order to collect the cropping system and farm expenses.
3. The market related questionnaires were used to collect marketing activities and marketing cost at farm-level and market level.

4.2 METHOD OF SECONDARY DATA COLLECTION

Weekly wholesale rice prices of major cities are officially released from Department of Agricultural Planning which is under Ministry of Agriculture and Irrigation and are therefore the ones used. The weekly wholesale rice price of six large cities [Yangon (P1), Mandalay (P2), Pathein (P3), Pyay (P4), Mawlamyine (P5), Taunggyi (P6)] are taken from the period of April 2001 to May 2004. In total, 166 weekly observations of average prices are available. This is a complex task, both logistically and empirically because rice comes in a number of varieties which differ widely in value.

Not only because of the interaction of changing technology but also because of the spatially and temporally changing taste and preference of the consumers, it is impossible to compare prices for the same rice in all different areas in medium and long-time periods (Alexander, C. and J. Wyeth, 1994). To solve this problem and maintain a continuous series, it is reasonably to use the coarse variety of rice in selected cities.

Since it is few gaps in it the coarse price series is easier to work with than series of individual rice varieties. It should be recognized, however, that it is far from perfect: it refers only to urban areas, a different variety is used in each area and the variety designated as "Coarse" in any one location may change along with technology and tastes. Although this does lead to discontinuities in the price series it remains the best series to use because of the lack of gaps and because of the fact that, even though rice varieties in different areas are different, they are chosen so that they are of similar quality and popularity and are broadly comparable both between cities and over time. Those data are necessary for summarizing the recent situation of rice production and marketing problems.

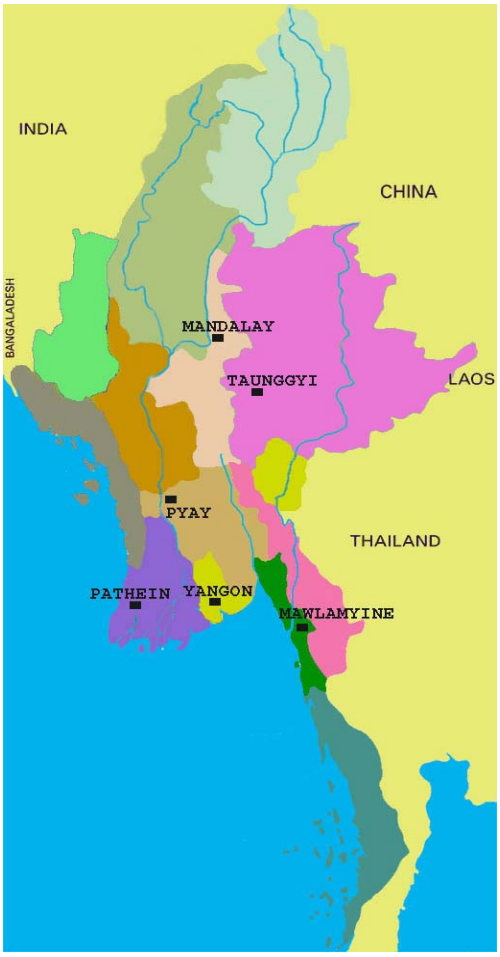

Fig 4. 2: Selected Rice Markets

4.2.1 Profiles of Market places

Market 1, Yangon market, the capital of the country, is the focal point of the internal and external rice trade. Agricultural produce enters Yangon City from surplus producing areas by road, rail and waterway.

Market 2, Mandalay market is the focal point of Upper Myanmar. It is an important terminal market and also a major transit market and Mandalay division as a whole is a large rice deficit area.

Market 3, Pathein market is located in the major town of the Ayeyarwady division, the largest rice producing area and is well known as the country's "rice bowl".

Market 4, Pyay market is situated in the western part of Bago division, the second largest rice area after Ayeyarwady Division. This market serves as transit area to go to the Rakine State and border area of Bangladesh.

Market 5, Mawlamyine market is situated in Mon State, a rice surplus region and is supplied to Taninthayi division and other destinations.

Market 6, Taunggyi is the major town of Shan state. Rice production is insufficient for the local consumption. Transportation from Yangon to Taunggyi is limited only by truck and it takes approximately 24 to 30 hours to reach.

Table 4. 2: Rice markets in surplus and deficit area

Surplus area		Deficit area	
Market	Price series	Market	Price series
Yangon	P1	Mandalay	P2
Pathein	P3	Taunggyi	P6
Pyay	P4		
Mawlamyine	P5		

4.2.2 Missing data

Ryan, K. F. and D. E. A. Gilies, (1988) analyzed time-series data with missing observations. These include: ignoring the gaps, replacing the gaps with the last available observation and filling the gaps with a linear interpolation method. The power of unit root testing by Augmented Dickey Fuller was superior when the gaps were replaced with last know observation.

The collected price series are not complete. Due to the lag structure of the model, missing data limit the number of useful observations considerably. To overcome this problem, missing gaps were replaced by the last available observation as Ryan and Gilies (1988) analyzed.

4.3 MARKETING COST AND MARGIN ANALYSIS

Primary data are collected to estimate marketing cost and margin of various rice traders. Direct marketing costs including costs for transportation, storage, processing, financing will also be taken into account. Economic efficiency will be evaluated in terms of

the profit margin, which measures the rate of return on gross sales after all costs in rendering marketing services have been deducted. The profit margin will be calculated as follows:

Profit margin of each type of trader	= Total marketing margin of each type of trader	- Variable marketing cost of each type of trader

In the rice marketing channel, the commodity types handled by the middlemen are different as paddy in collectors and millers and rice in others. In order to compare their achievement in the marketing channel, the percentage of profit per cost price indicator is used in this study. Cost price means the summation of buying price and total handling cost. On the other hand, the percentage of profit per cost price means return on investment. A comparison of profit per cost price percentage in each marketing level can examine return on investment of each type of rice traders and can point out their market power condition in the rice marketing channel.

4.4 TIME SERIES PRICE DATA ANALYSIS

4.4.1 Time series data, static and dynamics

From the theoretical point of view a time series is a collection of random variables $\{P_t\}$. Such a collection of random variables ordered in time is called a stochastic process.
The model

$$P_{it} = \beta P_{1t-1} + \mu_t$$

is static. If P_1 changes, P_i immediately responds and no further change takes place in P_i if P_1 then remains constant. The system is therefore always observed in an equilibrium position.

A dynamic element may be injected into the above equation by introducing lagged values of the explanatory variable. A very simple modification is

$$P_{it} = \beta_0 P_{1t} + \beta_1 P_{1t-1} + \mu_t$$

if P_1 increases by one unit, the expected value of P_i increases immediately by β_0 units, but the full change of units is $\beta_0 + \beta_1$ only felt after one whole time period has elapsed.

An alternative way of introducing dynamic effects into a model is by means of a lagged dependent variable. Consider the specification

$$P_{it} = \alpha P_{it-1} + \beta P_{1t} + \mu_t$$

where α and β are the parameters.

A structural time series model is one which is formulated directly in terms of component of interest, such as trend, cycle and seasonal.

4.4.2 Serial correlation problems in time series data

A common finding in time series regressions is that the residuals are correlated with their own lagged values. This serial correlation violates the standard assumption of regression theory that disturbances are not correlated with other disturbances. The primary problems associated with serial correlation are:

- OLS is no longer efficient among linear estimators. Furthermore, since prior residuals help to predict current residuals, this information is useful for a better prediction of the dependent variable.
- standard errors computed using the textbook OLS formula are not correct, and are generally understated.
- if there are lagged dependent variables on the right-hand side, OLS estimates are biased and inconsistent.

4.4.3 Stationary and non-stationary

A stochastic process is said to be stationary (or, more precisely, is stationary in a strict or strong sense), if the joint and conditional probability distributions of the process are unchanged if displaced in time. In practice, it is more usual to deal with weak sense stationarity, restricting attention to the means, variances and covariance of the process. Then, a stochastic process $\{P_t\}$ is said to be stationary if:

E(P) = constant = μ ; Var(P) = constant = σ^2 ; and: Cov $\left(X_t X_{t+j}\right) = \sigma_j$

Thus the means and the variances of the process are constant over time, while the value of the covariance between two periods depends only on the gap between the periods, and not the actual time at which this covariance is considered. If one or more of then conditions above are not fulfilled, the process is nonstationary (Harvey, 1990).

4.4.4 Unit root testing

When discussing stationary and non-stationary time series, it is needed to test for the presence of unit roots in order to avoid the problem of spurious regression. If a variable contains a unit root then it is non-stationary, regressions involving the series can falsely

imply the existence of a meaningful economic relationship. In principle it is important to test the order of integration of each variable in a model, to establish whether it is non-stationary and how many times the variable needs to be differenced to result in a stationary series.

A nonstationary series which can be transformed to a stationary series by differencing *d* times is said to be integrated of order *d*. A series integrated of order *d* is conventionally denoted as $P_t \sim I(d)$. Thus, for example, if $P_t \sim I(2)$, the first differences of the first differences of P_t achieve stationarity, that is:

$$\Delta\Delta P_t = \Delta\left(P_t - P_{t-1}\right) = \left(P_t - P_{t-1}\right) - \left(P_{t-1} - P_{t-2}\right) = P_t - 2P_{t-1} + P_{t-2}$$

In order to illustrate the application of the conditions for stationarity by using first order autoregressive process AR (1),

$$P_t = \phi P_{t-1} + \varepsilon_t, \quad t = \ldots,-1,0,1,\ldots$$

where ε_t is assumed to define a consequence of independently and identically distributed (IID) random variables with expected value zero and variance σ^2. The process is stationary when ϕ is less than one in absolute value, i.e. $-1<\phi<1$.

The fact that $E(P_t)$, $\text{var}(P_t)$ and $\text{cov}\left(P_t, P_{t-\tau}\right)$ do not depend on *t* means that the AR(1) process is indeed stationary when ϕ is less than one in absolute value. The AR(1) process has a unit root, if and only if ϕ is 1. In this case the stationarity condition is not satisfied. The AR(1) process with a unit root is non-stationary.

The AR(1) case can be readily extended to higher order autoregressive processes. Consider the AR(2) process defined by

$$P_t = \phi_1 P_{t-1} + \phi_2 P_{t-2} + \varepsilon_t$$

4.4.5 Spurious Regression

Trends in the data can lead to spurious correlations that imply relationships between the variables in a regression equation, when all that presents are correlated time trends. The time trend in a trend-stationary variable can either be removed by regressing the variable on time (with the residuals from such a regression forming a new variable which is trend-free and stationary) or nullified by including a deterministic time trend as one of the regressors in the model. In such circumstances, the standard regression model is operating with stationary series which have constant means and finite variances, and thus statistical inferences (based on t- and F –tests) are valid.

Regressing a non-stationary variable on a deterministic trend generally does not yield a stationary variable (instead the series needs to be differenced prior to processing). Thus, using standard regression techniques with non-stationary data can lead to the problem of spurious regressions involving invalid inferences based on t- and F –tests. As a consequence, there is often a problem of falsely concluding that a relationship exists between two unrelated non-stationary series. This problem generally increases with the sample size and it cannot be solved by attempting to detrend the underlying series as would be possible with trend-stationary. This leads to the question of when it is possible to infer a causal long-run relationship(s) between non-stationary time series, based on estimating a standard regression.

4.4.6 Cointegration

If a non-stationary series must be differenced *d* times before it becomes stationary, then it contains *d* unit roots and is said to be integrated of order *d,* denoted *I(d)*. Consider two time series P_{it} and P_{1t}, which are both *I(d)*. In general, any linear combination of the two series will also be *I(d)*; for example, the residuals obtained from regressing P_{it} on P_{1t} are *I(d)*. If, however, there exists a vector β, such that the disturbance term from the regression $\left(\mu_t = P_{it} - \beta P_{1t}\right)$ is of a lower order of integration, *I(d-b)*, where *b>0*, then Engle and Granger (1987) defined P_{it} and P_{1t} as cointegrated of order *(d, b)*. Thus, if P_{it} and P_{1t} were both *I(1)*, and μ_t*~I(0)*, then the two series would be cointegrated of order *CI(1, 1)*.

The economic interpretation of cointegration is that if two (or more) series are linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e., be non-stationary) they will nevertheless move closely together over time and the difference between them will be stable (i.e., stationary). Thus the concept of cointegration mimics the existence of a long-run equilibrium to which an economic system converges over time, and μ_t defined above can be interpreted as the disequilibrium at time *t*. Thus, following directly from the identification of cointegration with equilibrium, it is possible to make sense of regressions involving non-stationary variables. If these are cointegrated then regressions analysis imparts meaningful information about long-run relationships.

CHAPTER 5
RICE PRODUCTION AND MARKETING IN SELECTED AREAS OF MYANMAR

5.1 FARM HOUSEHOLD INFORMATION AND AGRICULTURAL PRACTICES

The prevailing characteristics of farm households can influence rice farming system as well as consumption and marketing systems. 60 farmers in the two studied sites were interviewed in 2004 June. The household heads and family members are the main source of the agricultural labor force in all farms activities. While age and sex composition directly affect the farm labor supply; the education level of each family member, the farm assets and farm production information also affect farm productivities.

5.1.1 Age and education of farm household

Table 5. 1: Criteria for the classification of farmers

Classification	Criteria	
	Hlegu Township	Pathein Township
small farmers	1-10 acres	1-10 acres
medium farmers	>10-20 acres	>10-20 acres
large farmers	>20 acres	>20 acres

Source: Individual Interviews of Farmers 2004

Depending on the farm size, farmers in the study sites are classified into small, medium and large. The following tables and figures present some characteristics of the farm households in the study areas including age, education level, male household heads, full time farmers, and successors and so on.

Table 5. 2: General information of farm household heads

Indicator	Unit	Hlegu Township				Pathein Township			
		small	medium	large	avg	small	medium	large	avg
farm HHH age	Year	53.4 (10.6)	47.0 (10.4)	47.8 (12.0)	50.6 (10.9)	49.9 (16.0)	50.3 (11.0)	42.1 (11.4)	48.3 (13.3)
farming entry	Year	35.1 (12.9)	26.3 (12.6)	28.5 (13.5)	31.5 (13.1)	31.4 (18.0)	30.4 (13.6)	22.3 (11.9)	29.0 (15.2)
age of family member	Year	25.0 (13.5)	23.4 (12.5)	30.7 (16.1)	26.2 (14.2)	26.4 (15.8)	28.2 (18.1)	22.5 (18.7)	26.2 (17.4)
male HHH	%	100	100	100	100	92.3	100	100	96.9
female HHH	%	0.0	0.0	0.0	0.0	7.7	0.0	0.0	3.1
farm successor	%	86.7	85.7	83.3	85.7	100.0	91.7	100.0	96.9
full time farmer	%	73.3	85.7	83.3	78.6	84.6	75.0	100.0	84.4

Source: Individual Interviews of Farmers 2004

According to the survey data, the age of the household heads ranges from 32 to 73 with an average of 50.6 years old in Hlegu area and ranges from 28 to 72 with an average of

48.3 years old in Pathein study site. According to the results of survey, most head of households are male and have farming experience averaging 29 to 31.5 years. About 85.7 to 96.9 percent of farmers inherited the land from their forefathers and 78.6 to 84.4 percent of farmers are the full time farmers.

Moreover, educational background of household head is also a key factor for the agricultural technological innovation. The low education level not only discourages farmers from adopting modern agricultural technology and knowledge, but they can also have some difficulties in operating farms and marketing outputs. Fig 5.1 and Fig 5.2 show the education level of sampled farmers and the highest education level of children in sampled farm households. According to the findings, education level of household heads in both regions is literate and most of them are in primary level. Although about 40 percent of large-scaled farmers are in high school level at Hlegu area, almost all farmers are in primary level at Pathein area.

Concerning with highest education level of children in farm households, education level of the children is higher than that of parents. It shows the strength and the future consideration of the household heads by educating children. Moreover, Hlegu area is not far away from the capital, Yangon and it can give a good chance to access the higher education for the children of farm households.

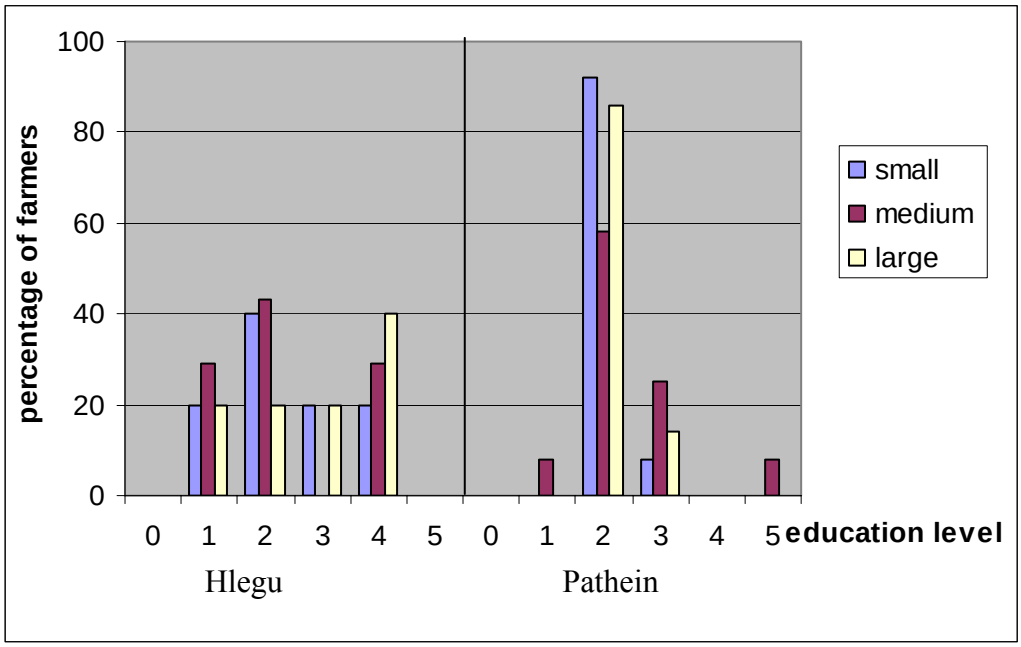

Fig 5. 1: Education level of household head in the study sites compared to farm size
Source: Individual Interviews of Farmers 2004

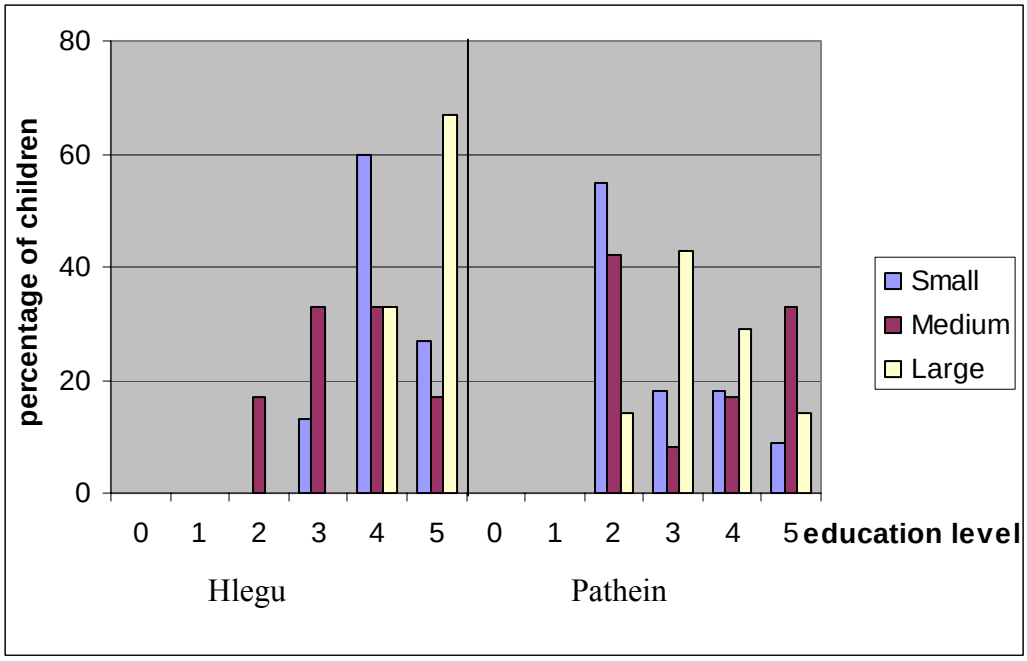

Fig 5. 2: Highest education level of children
Source: Individual Interviews of Farmers 2004

0 = illiterate
1 = literate
2 = primary school
3 = secondary school
4 = high school
5 = university and got degree

5.1.2. Family size, labor and farm assets

Table 5. 3: Family information of the farm household

Indicator	Unit	Hlegu Township				Pathein Township			
		small	medium	large	avg	small	medium	large	avg
family size	Person	6.0 (1.4)	4.1 (1.7)	5.7 (1.8)	5.4 (1.8)	4.6 (1.6)	4.7 (1.2)	4.7 (1.5)	4.7 (1.4)
male sex ratio	%	49.4	55.2	50.0	50.7	50.0	48.2	48.5	49.0
female sex ratio	%	50.6	44.8	50.0	49.3	50.0	57.8	51.5	51.0
age of family member	Year	25.0 (13.5)	23.4 (12.5)	30.7 (16.1)	26.2 (14.2)	26.4 (15.8)	28.2 (18.1)	22.5 (18.7)	26.2 (17.4)
dependent ratio	%	28.8	31.8	12.5	25.0	40.0	33.0	74.0	43.0
active labor	Person	4.4 (1.9)	3.1 (2.1)	5.3 (1.5)	4.3 (2.0)	3.3 (1.6)	3.5 (1.2)	2.7 (1.0)	3.3 (1.3)
family labor	Person	2.8 (1.5)	2.0 (1.6)	2.3 (1.4)	2.4 (1.4)	2.9 (1.8)	2.3 (1.1)	2.3 (0.8)	2.5 (1.3)

Source: Individual Interviews of Farmers 2004

Note: $Depedent \quad ratio(\%) = \frac{Family \quad size - active \quad labor}{active \quad labor} \times 100$

In the survey areas, the average household size ranges from 4.7 to 5.4. The average age of family members in both areas is 26.2 years old. While average male sex ratio of the farm household in the study sites ranges from 49 to 50.7 percent, average female sex ratio is 49.3 to 51 percent. Family labor force ranges from 2 to 2.9 persons with an average of 2.4 and 2.5 persons. Labor in the age group of 16-60, average active labor force, ranges from 3.3 to 4.3 persons per household and dependent ratio varies between 25 percent in Hlegu Township and 43 percent in Pathein Township. Compared to Pathein area, lower dependent ratio in Hlegu Township indicates the attainment of better job opportunities.

Table 5. 4: Farm assets

Indicator	Unit	Hlegu Township				Pathein Township			
		small	medium	large	total	small	medium	large	total
average farm asset value	M. Ks	0.2	0.3	1.0	0.4	0.1	0.2	0.4	0.2
plowing machine	no.	1.0 (0.0)	1.6 (0.5)	3.2 (1.5)	1.4 (1.1)	0.9 (0.6)	1.9 (1.2)	1.4 (1.4)	1.4 (1.1)
harrowing machine	no.	1.0 (0.0)	1.1 (0.4)	2.2 (0.8)	1.3 (0.6)	0.9 (0.6)	1.6 (0.8)	1.4 (1.4)	1.3 (0.9)
cutting machine	no.	0.6 (0.5)	0.7 (0.8)	0.5 (0.8)	0.6 (0.6)	0.9 (0.6)	1.4 (1.0)	1.4 (1.0)	1.2 (0.9)
bullock	no.	1.0 (1.0)	1.4 (1.9)	3.5 (3.3)	1.5 (2.1)	1.6 (1.0)	3.9 (2.5)	3.9 (2.9)	3.0 (2.3)
bullock cart	no.	0.9 (0.3)	1.1 (0.7)	2.0 (1.0)	1.2 (0.6)	0.5 (0.5)	0.8 (0.4)	0.6 (0.5)	0.6 (0.5)
tractor	no.	0.0 (0.0)	0.0 (0.0)	2.0 (0.3)	0.1 (0.3)	0.0 (0.0)	0.0 (0.0)	0.1 (0.4)	0.03 (0.2)
tractor trailer	no.	0.0 (0.0)	0.0 (0.0)	0.2 (0.4)	0.1 (0.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
power tiller	no.	0.1 (0.4)	0.0 (0.0)	0.7 (0.8)	0.4 (0.5)	0.1 (0.3)	0.1 (0.3)	0.4 (0.5)	0.2 (0.4)
inter-cultivator	no.	0.0 (0.0)	0.0 (0.0)	0.2 (0.4)	0.04 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
sprayer	no.	0.5 (0.5)	0.7 (0.5)	2.0 (1.4)	1.0 (0.8)	0.4 (0.5)	0.8 (0.6)	0.6 (0.5)	0.6 (0.6)
water pump	no.	0.3 (0.5)	0.0 (0.0)	0.5 (0.6)	0.3 (0.4)	0.5 (0.7)	1.0 (0.6)	1.1 (0.9)	0.8 (0.7)
threshing machine	no.	0.0 (0.0)	0.0 (0.0)	0.3 (0.5)	0.1 (0.3)	0.1 (0.3)	0.1 (0.3)	0.3 (0.5)	0.1 (0.3)
ware house	no.	0.5 (0.5)	0.7 (0.5)	0.8 (0.4)	0.6 (0.5)	0.6 (0.5)	0.8 (0.5)	0.4 (0.5)	0.6 (0.5)

Source: Individual Interviews of Farmers 2004

The average farm asset value of farm households is 0.4 million Kyats in Hlegu Township and 0.2 million Kyats in Pathein Township. The assets of farmers are varied from group to group shown in tabel (5.4). Most small-scaled farmers own low-tech tools, while larger scaled farmers invest in tractors, power tillers, threshing machines, and other equipments. Especially, large-scaled farmers are better equipped both in terms of quality and

quantity compared to other groups. The farm households also share the equipment such as tractors, plowing and harrowing machines with relatives and neighbors. But in most cases, farmers who own tractor and thresher provide services for other farmers in the same village or near village on payment basis. Even though farmers can use the machine for land preparation and threshing activities by hiring, the current physical infrastructure is inadequate to support the prospective increases in agricultural production.

5.1.3 Cropping pattern, rice varies and average yield

Concerning one year crop rotation pattern of the study sites, monsoon paddy cultivation area is 64.6 to 71.2 percent of the total crop cultivation area. While pulses area is 7.3 percent of the total crop cultivation area in Hlegu Township, all farmers in Pathein Township grow only monsoon paddy and summer paddy crop.

Table 5. 5: Cropping pattern

Indicator	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
Monsoon paddy area	71.0	64.1	74.3	71.2	59.3	63.9	68.1	64.6
Summer paddy area	20.6	17.9	23.3	21.5	40.7	36.1	31.9	35.4
Pulses area	8.4	17.9	2.4	7.3	0.0	0.0	0.0	0.0
Total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

Concerning with the paddy varieties in the study sites, only small-scaled farmers use one variety because of the few asset land. In order to prevent the risk of low price and damage, the medium and large scaled farmers use 2 to 3 varieties in Hlegu Township and use till 5 varieties in major rice producing area, Pathein Township. In both study sites, the monsoon crop is seeded during May to September and harvested from November to January. The summer crop is seeded from November to February and harvested from March to May.

Table 5. 6: Percentage of household by using number of paddy varieties (Unit = %)

Crop	Variety	Hlegu Township				Pathein Township			
		small	medium	large	avg	small	medium	large	avg
Monsoon paddy	1	26.7	0.0	0.0	14.8	23.1	0.0	0.0	9.4
	2	46.7	83.3	16.7	48.1	61.5	50.0	28.6	50.0
	3	26.7	16.7	83.3	37.0	15.4	41.7	28.6	28.1
	4	0.0	0.0	0.0	0.0	0.0	8.3	28.6	9.4
	5	0.0	0.0	0.0	0.0	0.0	0.0	14.3	3.1
Total		100	100	100	100	100	100	100	100
Summer paddy	1	83.3	80.0	100	86.7	100	100	100	100
	2	16.7	20.0	0.0	13.3	0.0	0.0	0.0	0.0
Total		100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

Table (5.7) mentions the paddy yield difference in regions and seasons. In Hlegu region, there is not too much yield difference among the farmers in monsoon paddy. However, summer paddy yield level is different among the farmers. Small-scaled farmers produce only 36.3 paddy baskets per acre and large-scaled farmers generate 65 baskets per acre. It concerns with the capital investment for the productivity of the summer rice and the possession of farm irrigation equipment facilities.

Table 5. 7: Average yield **(Unit = basket of paddy / acre)**

Region	Monsoon Paddy				Summer Paddy			
	small	medium	large	avg	small	medium	large	avg
Hlegu Township	45.2 (9.2)	49.0 (7.0)	46.1 (9.0)	46.3 (8.7)	36.3 (22.5)	54.7 (25.1)	65.0 (16.8)	49.5 (24.2)
Pathein Township	53.5 (10.0)	52.7 (11.2)	52.6 (9.3)	52.9 (10.2)	64.6 (11.0)	67.8 (9.0)	77.1 (13.8)	68.7 (11.7)

Source: Individual Interviews of Farmers 2004
Note: 1 basket of paddy = 20.86 Kg; 1 hectare = 2.47 acre

In Pathein Township, the gap of yield difference is not distinct between small farms and large farms. It can evident the low productivity of small farms at Hlegu area especially in summer paddy. Moreover, the average yield level of both monsoon and summer paddy in Pathein region is higher than that of Hlegu region. Hlegu Township is very close to the capital, Yangon and farmers would have other off-farm income opportunities which lead to less interest in rice farming.

5.2 MARKETING PRACTICES OF FARM HOUSEHOLDS

5.2.1 Marketable surplus and storage

In this study, marketed surplus is defined as the paddy sales by farmers as a proportion of production. In table (5.8), the portion of marketed surplus to total production is higher in large farms than that of in small farms. In Hlegu, percentage of marketable surplus in monsoon paddy is 67.1, 66.7 and 86.0 percent relative to farm size. It is evident that in summer paddy there is more marketed surplus contribution than in monsoon paddy such as 86.1, 80.8 and 94.9 percent in small, medium and large farm.

In Pathein, large farmers have also high marketed surplus proportion than that of small farmer in both seasonal crops. Marketable surplus are 76.7, 82.6 and 83.0 percent respectively in the case of monsoon paddy and 95.2, 96.9 and 96.1 percent respectively in summer paddy.

Table 5. 8: Production and product marketed of monsoon paddy and summer paddy

Region	Farm size	Monsoon paddy			Summer paddy		
		Production (bskt)	Marketed (bskt)	Marketed (%)	Production (bskt)	Marketed (bskt)	Marketed (%)
Hlegu Township	small	348.8 (102.8)	234.1 (106.1)	67.1	252.5 (208.6)	217.5 (159.1)	86.1
	medium	750.8 (206.6)	500.7 (235.4)	66.7	377.5 (194.5)	305.0 (117.4)	80.8
	large	2172.0 (981.0)	1868.2 (980.4)	86.0	1750.0 (70.7)	1660.0 (28.3)	94.9
	avg	850.0 (852.6)	658.9 (794.1)	77.5	793.3 (754.7)	727.5 (728.9)	91.7
Pathein Township	small	325.0 (141.8	249.2 (130.5)	76.7	328.6 (214.6)	312.7 (225.7)	95.2
	medium	776.0 (195.8)	640.9 (148.1)	82.6	527.5 (292.9)	511.3 (292.8)	96.9
	large	1468.3 (181.9)	1218.3 (234.7)	83.0	772.5 (290.7)	742.5 (307.5)	96.1
	avg	746.1 (470.7)	622.8 (414.9)	83.5	470.0 (295.7)	472.9 (510.0)	97.5

Source: Individual Interviews of Farmers 2004

In Hlegu area, 53.3 percent of small-scaled farmers cannot store their products and 71.4 percent of medium-scaled farmers and 66.7 percent of large–scaled farmers store paddy with the expectation of getting high price in the future. In Pathein area, 53.9 percent of small-scaled farmers store paddy for home consumption and seed purpose only and 58.3 percent of medium farmers store for the agricultural expense. Even in large-scaled farmers, 57.1 percent of them store for agricultural expense of next crop and only 28.6 percent of them store for getting higher price. It can show that the storage capacity and the capital requirement for the next crop cannot let them to wait until the price rise in the lean season.

Table 5. 9: Storage purpose of farmers **(Unit = %)**

Storage	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
no storage	53.3	28.6	0.0	35.7	0.0	25.0	0.0	9.4
home consumption and seed only	20.0	0.0	0.0	10.7	53.9	0.0	14.3	25.0
agricultural expense	0.0	0.0	33.3	7.1	46.2	58.3	57.1	53.1
getting high price	26.7	71.4	66.7	46.4	0.0	16.7	28.6	12.5
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

It is shown that a large proportion of large-scaled farmers, 83.3 percent, in Hlegu area can hold their commodity for more than 3 months. In Pathein area, 71.4 percent of large-scaled farmers store their product one to 3 months.

Table 5. 10: Duration of storage **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
no storage	53.3	28.6	0.0	35.7	0.0	25.0	0.0	9.4
≤ 1 month	0.0	0.0	16.7	3.6	46.2	0.0	14.3	21.9
>1 to 3 month	0.0	14.3	0.0	3.6	53.8	66.7	71.4	62.5
more than 3 month	46.7	57.1	83.3	57.1	0.0	8.3	14.3	6.3
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

For the volume which they decided to sell on the market, only a few percentages of farmers sell their commodities immediately after harvesting. 35.7 percent of total farmers in Hlegu area sell paddy right away after harvest and 64.3 percent of them store for sometime. In Pathein area 90.6 percent of farmers store for a period and only 9.4 percent sell immediately after harvest.

Table 5. 11: Time to sell rice **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
right away after harvest	53.3	28.6	0.0	35.7	0.0	25.0	0.0	9.4
storage for sometime	46.7	71.4	100	64.3	100	75.0	100	90.6
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

The decision of farmers to sell paddy immediately seems to be motivated by the need for the cash to repay credit and by the high cost or unavailability of and poor storing facilities. Also due to poor drying condition and inadequate drying spaces, storing paddy over an extended period of time is infeasible, even if desired.

Picture 5. 1: Storage Facilities at Pathein Township

5.2.2 The rice distribution system

Rice marketing is a dynamic and complicated process of interaction among numerous market agents. This section describes the channels through which rice flows, dynamics of the interaction between farmers and market participants and factors considered by farmers and traders as important in the pricing process.

Table 5. 12: Methods used to sell rice **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
buyers come to farmers	66.7	33.3	50.0	55.6	84.6	50.0	57.1	65.6
look for buyers	26.7	66.7	33.3	37.0	7.7	0.0	14.3	6.3
both	6.7	0.0	16.7	7.4	7.7	50.0	28.6	28.1
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

Traders through several unscheduled farm visits generally initiate and establish the contact with farmers. About 55.6 percent of Hlegu farmers and 65.6 percent of Pathein farmers responded that traders usually visit farms and their home. 37 percent of Hlegu farmers and only 6.3 percent of Pathein farmers look for buyers especially millers as an initial step in deciding to whom to sell their rice.

Table 5. 13: Differentiation of selling commodity type **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
sell paddy	66.7	42.9	33.3	53.6	84.6	66.7	42.9	68.8
sell rice	20.0	57.1	16.7	28.6	7.7	0.0	28.6	9.4
sell paddy and rice	13.3	0.0	50.0	17.9	7.7	33.3	28.6	21.9
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

After harvesting, farmers then sell either paddy or rice. Paddy will be sold to traders especially who come and buy at farm. Traditionally farmers are not the owners of the mills and use rented mills for about 250 to 300 Kyats per 1 bag of rice. Farmers will keep part of the milled harvest as home consumption and the rest will be sold either to traders or to the millers. 53.6 percent of Hlegu farmers and 68.8 percent of Pathein farmers sell only paddy and 28.6 percent farmers in Hlegu and 9.4 percent in Pathein sell rice. 17.9 percent of Hlegu farmers and 21.9 percent of Pathein farmers sell both paddy and rice.

16.7 percent of large-scaled Hlegu farmers and 8.3 percent of medium-scaled Pathein farmers have the chance to sell their rice to rice shop directly. However, selling paddy to a collector is in high proportion on average as 59.3 percent in Hlegu Township and 65.6 percent in Pathein Township.

Table 5. 14: Use of middlemen in marketing **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
collector	73.3	50.0	33.3	59.3	84.6	50.0	57.1	65.6
miller	26.7	50.0	33.3	33.3	7.7	0.0	14.3	6.3
collector and miller	0.0	0.0	16.7	3.7	7.7	41.7	28.6	25.0
rice shop	0.0	0.0	16.7	3.7	0.0	8.3	0.0	3.1
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

As in other developing economies, market information is relayed and transmitted across markets inexpensively, by word of mouth. News about price changes and relevant price-making forces in pertinent terminal markets are generally obtained from informal sources.

Table 5. 15: Getting Price Information **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
collector	53.3	28.6	16.7	39.3	36.4	50.0	50.0	44.4
miller	26.7	28.6	16.7	25.0	0.0	0.0	0.0	0.0
miller and collector	6.7	14.3	50.0	17.9	9.1	40.0	33.3	25.9
neighborhood	13.3	28.6	0.0	14.3	54.5	10.0	16.7	29.6
rice shop	0.0	0.0	16.7	3.6	0.0	0.0	0.0	0.0
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

As presented in the table (5.15), local collectors are the main source of price information. About 39.3 percent of farmers in Hlegu area and 44.4 percent of farmers in Pathein area usually get the price information from local collectors. 17.9 percent of Hlegu farmers and 25.9 percent of Pathein farmers inquire the selling price more than one sources especially from millers and collectors. This indicates that the informal market information is dominant and plays an important role. Farmers do not rely on formal information sources provided by the Government.

Table 5. 16: Price Formation Process **(Unit = %)**

Activity	Hlegu Township				Pathein Township			
	small	medium	large	avg	small	medium	large	avg
collector	57.1	40.0	40.0	47.1	50.0	44.4	40.0	45.8
miller	42.9	40.0	40.0	41.2	20.0	11.1	60.0	25.0
farmer	0.0	20.0	0.0	5.9	0.0	0.0	0.0	0.0
rice shop	0.0	0.0	20.0	5.9	0.0	0.0	0.0	0.0
negotiation	0.0	0.0	0.0	0.0	30.0	44.4	0.0	29.2
total	100	100	100	100	100	100	100	100

Source: Individual Interviews of Farmers 2004

Generally, rice prices are formed privately (individual), on the spot through negotiation between farmers and traders. In accordance with the formation of rice price in Hlegu region, about 47.1 percent of farmer respondents indicated that the collectors setting the price, while about 41.2 percent reported the millers as offering the price and only about

5.9 percent described as themselves offering price for traders. In Pathein area, 45.8 percent of farmers accepted the price set by collectors and 29.2 percent indicated a negotiation as the process for setting the price with the traders.

5.3 INFORMATION OF MARKET INTERMEDIARIES IN RICE MARKETING CHANNEL

Thirty-eight intermediaries including collectors, millers, local wholesalers and retailers from the two study sites and central wholesalers from Yangon market were interviewed in order to collect the information about activities of those groups in rice marketing channel.

5.3.1 General profiles of millers and collectors

Local millers are categorized by milling capacity of mill. Large mills have the capacity of up to 20 tons of paddy per day. Medium mills process about over 5 tons to 19 tons of paddy per day and small mills handle less than 5 tons of paddy per day. General information about collectors and 3 milling groups on age, gender, education level and business experience are presented in table (5.17).

Collectors are relatively young with an average age of 35 to 36 in the two study sites. The education level of household head of collectors is 100 percent secondary level in Hlegu and is quite low with 100 percent primary level in Pathein. Most of them have done their business with 8 years of working experience in Hlegu and with 6 years experience in Pathein. The family size is no too different in both area with 4.5 and 5.0 in Hlegu and Pathein respectively.

Table 5. 17: General information of collectors and millers

Indicator	unit	Hlegu Township				Pathein Township			
		Miller			Collector	Miller			Collector
		small	medium	avg		medium	large	avg	
age	Year	51.0	48.3	49.4	36.0	42.0	43.3	42.7	35.0
Gender of HHH									
male	%	100	66.7	80.0	100	0.0	66.7	33.3	100
female	%	0.0	33.3	20.0	0.0	100	33.3	66.7	0.0
Education level									
primary	%	50.0	0.0	20.0	0.0	0.0	0.0	0.0	100
secondary	%	50.0	0.0	20.0	100	0.0	0.0	0.0	0.0
high school	%	0.0	66.7	40.0	0.0	0.0	66.7	33.3	0.0
got degree	%	0.0	33.3	20.0	0.0	100	33.3	66.7	0.0
business experience	Year	4.0	9.0	7.0	8.0	8.7	9.3	9.0	6.0
family size	Person	4.5	5.3	5.0	4.5	4.3	4.0	4.2	5.0

Source: Individual Interviews of Millers and collectors 2004

Most of the mills operated in Hlegu area are small and medium size and most are medium and large size in Pathein area. Male household headed are mostly found in both areas. 40 percent of millers in Hlegu have high school level education and impressively 66.7 percent of millers in Pathein got the bachelor degree. Most millers have 7 years business experience in Hlegu area and 9 years experience in Pathein area.

5.3.2 Summary activities of collectors

Traditionally, there are 2 types of collectors. The first type of collectors directly buy paddy from farmers and carry paddy to their storage places, either they sell back paddy to millers or other collectors with profit. Second type of collectors (commission middlemen for the miller) buy paddy from farmers with the decided price by the millers and send to the mills getting the commission fees from the millers. According to the survey, first type of collectors was gradually disappearing because of paddy and rice price fluctuation and lack of capital investment.

Table 5. 18: Summary activities of collectors

Indicator	Hlegu Township	Pathein Township
total purchase paddy (ton/year)	166.9	417.3
Methods used to buy paddy (%)		
looking for farmers	100.0	100.0
farmers come	0.0	0.0
Source of information (%)		
miller	100.0	100.0
other traders	0.0	0.0
Important factors of rice pricing (%)		
grain quality	100.0	100.0
others	0.0	0.0
To whom assembler sell rice (%)		
miller	100.0	100.0
other traders	0.0	0.0
Type of service (%)		
commission	100.0	100.0
with profit	0.0	0.0
commission fees (Kyats/ton of paddy)	958.6	479.3

Source: Individual Interviews of Collectors 2004

While collectors in Hlegu area buy 166.9 tons of paddy in one year, the transaction is Pathein area is 417.3 tons. All collectors in both study sites serve as commission men to purchase commodities for the millers. Commission fees are two times difference as 958.6 Kyats per ton in the Hlegu area while 479.3 Kyats per ton in Pathein area. Millers are the only source of price information for the collectors in both study sites.

5.3.3 Activities of rice milling household

The large-scaled and medium-scaled millers mainly provide milling service for farmers, traders and some collectors. Additionally they also buy paddy from farmers and collectors, process it and sell rice to the wholesalers and traders. The small-scaled plants, which are numerous in numbers, are widely spread in the rice producing area. Generally, almost all of them are privately owned and mainly process paddy from their own farms and for the neighborhood farmers.

Picture 5. 2: Medium mill at Hlegu Township

Some main activities and behavior of those groups are summarized in the table (5.19). Depending on the scale of mill, the mill capacity varies from 704 to 5206 tons per year. Nearly all mills operate at full capacity mainly during the harvesting season and operate just a few hours at the seeding season. Harvest season of monsoon crop November to February and that of summer crop March to May are the busiest months. But during the monsoon crop-planting season, there are few jobs for the millers. The conversion ratio between paddy and white rice is not varied between small and large scaled mills.

Table 5. 19: Main activities and behavior of local miller

Indicator	Unit	Hlegu Township		Pathien Township	
		small	medium	medium	large
milling capacity	tons/year	704	2201	2324	5206
storage capacity	ton	0	31.3	62.6	166.9
holding period	month	0	3	3	3
conversion rate	%	61.1	61.1	61.1	61.1

Source: Individual Interviews of Millers 2004

Milling cost per ton of paddy on average is lowest in large mills and the cost of labor occupies the largest proportion of overall processing costs. In the small and medium scale

mills, fuel and oil expenses are the highest processing costs. This is due to the different types of machinery; large-scaled mills in Pathein area use boiler engines which do not have the high cost in fuel and oil and result in low processing cost. However, tax payment by the large mills is relatively high in comparison with other mills.

Table 5. 20: Cost of milling and Milling fees of paddy **(Unit = Kyats/ton)**

Item	Hlegu Township				Pathein Township			
	small	%	medium	%	medium	%	large	%
fuel and oil	2827.9	71.2	2939.7	65.6	2564.3	63.0	245.7	24.5
spare parts	535.4	13.5	846.0	18.9	699.7	17.2	176.4	17.6
maintenance cost	47.9	1.2	71.9	1.6	26.1	0.6	12.0	1.2
labor	532.6	13.4	613.4	13.7	753.0	18.5	529.9	52.9
tax	28.6	0.7	10.3	0.2	26.3	0.6	38.0	3.8
total	3972.4	100.0	4481.3	100.0	4069.3	100.0	1001.9	100.0
milling fees	4313.7		5221.7		4313.7		3594.8	

Source: Individual Interviews of Millers 2004

According to survey, the main obstacles for rice milling and processing households are: restriction of surface area used for production, low level operation of machine, and lack of capital. Environment pollution such as dirt, dust and noise coming from the rice milling process needs attention which will affect the life of many residents and may pose a future threat.

Table 5. 21: Selling activity of miller **(Unit = %)**

Type	Hlegu Township			Pathein Township		
	small	medium	avg	medium	large	avg
consumer	50.0	0.0	20.0	0.0	0.0	0.0
retailer	50.0	33.3	40.0	0.0	0.0	0.0
local customers	0.0	66.7	40.0	50.0	33.3	42.9
Yangon and other places	0.0	0.0	0.0	50.0	66.7	57.1
total	100	100	100	100	100	100

Source: Individual Interviews of Millers 2004

Almost all small-scaled rice mills in Hlegu area sell their products to consumer and retailer. Medium size mills in both areas mainly sell rice to local customers including retailers and other small traders. About 66.7 percent of large millers in Pathein area send their products to Yangon wholesaler.

Table 5. 22: Source of price information **(Unit = %)**

Activity	Hlegu Township			Pathein Township		
	small	medium	avg	medium	large	avg
local market	100	0.0	50.0	33.3	0.0	16.7
other mill	0.0	0.0	0.0	33.3	0.0	16.7
Yangon market	0.0	100	50.0	33.3	100	66.7
total	100	100	100	100	100	100

Source: Individual Interviews of Millers 2004

In Hlegu area, 100 percent of small mills usually get the price information from local market while medium mills get it from Yangon market. All of the large mills in Pathein

area also contact Yangon market for rice price information while only 33.3 percent of medium mills use Yangon market rice price. Therefore, Yangon market plays a main role in price information of Millers.

5.3.4 Marketing activities of local wholesalers

Local wholesalers are the main intermediaries and usually operate a large scale on their business activities. Wholesalers frequently report the information of buying and selling prices to other wholesalers or millers and retailers. Therefore, wholesalers also play a key role in the distribution of rice price information in local areas. However, local wholesalers in the Hlegu area are disappearing due to the fact of increasing millers' market power by doing milling and rice trading business simultaneously.

Table 5. 23: General profile of local wholesaler (Pathein Township)

Indicator	Unit	small	medium	large	total
age	Year	41.7	41.5	44.5	42.4
Gender of HHH					
male	%	100.0	100.0	50.0	85.7
female	%	0.0	0.0	50.0	14.3
Education level					
primary	%	0.0	0.0	0.0	0.0
secondary	%	0.0	0.0	0.0	0.0
high school	%	33.3	50.0	50.0	42.9
educated	%	66.7	50.0	50.0	57.1
business experience	Year	11.0	4.0	16.5	10.6
family size	Person	6.0	5.0	4.0	5.1

Source: Individual Interviews of Local Wholesalers 2004

Local wholesalers in Pathein area are also classified into 3 types depending on the amount of working capital. Small-scaled wholesaler occupies less than 10 million Kyats working capital; medium scale owns 10-20 million Kyats working capital and large scale runs the business with over 20 million Kyats.

Average age of the household heads is 42.4 years and almost all are male headed business except in the case of large scale. Education level is as high as usual case which the businessmen usually accompany by a high education level. Even in small scale 66.7 percent of wholesalers got the bachelor degree and 50 percent each in middle and large scale. Business experience is highest in the large scale with 16.5 years and average family size in overall is 5.1.

Local wholesalers handle the commodities in two ways; one way is as only the trading of rice and others integrate the buying of paddy, processing and then selling. On average, 42.9 percent of wholesalers use the integration method and 57.1 percent of them use

the rice trading method. About 42.9 percent of wholesalers send commodities to Yangon and other areas while only 14.3 percent of them send commodities to local area only.

Table 5. 24: Business of local wholesaler **(Unit = %)**

Activities	small	medium	large	average
trading paddy and rice	66.7	0.0	50.0	42.9
trading rice	33.3	100	50.0	57.1
total	100	100	100	100
sending commodities to Yangon and other local area	66.7	0.0	50.0	42.9
sending commodities to Yangon only	0.0	100	50.0	42.9
sending commodities to Local area only	33.3	0.0	0.0	14.3
total	100	100	100	100

Source: Individual Interviews of Local Wholesalers 2004

All local wholesalers are members of the rice wholesaler association. About 85.7 percent usually get the price information from Yangon Center market and only 14.3 percent get from other merchants. Cooking rice quality is important in setting rice prices of Japonica variety with color and content of broken rice as the main factors in deciding the price of hard variety. According to the survey, the smooth trade flow and enough capital investment are the major factors for the rice marketing improvement. Rice price is fluctuated more than the paddy price and it is difficult for them to adjust accordingly.

Table 5. 25: Other activities **(Unit = %)**

Activity	Small	Medium	Large	average
participation in Wholesaler association	100.0	100.0	100.0	100.0
Getting price information				
Yangon market	66.7	100.0	100.0	85.7
other merchant	33.3	0.0	0.0	14.3
total	100.0	100.0	100.0	100.0

Source: Individual Interviews of Local Wholesalers 2004

Picture 5. 3: Local wholesaler's depot at Pathein Township

5.3.5 Marketing activities of central wholesalers

Table 5. 26: General profile of Central Wholesaler

Indicator	unit	small	medium	large	total
age	Year	46.7	43.0	57.0	47.9
Gender of HHH					
male	%	66.7	66.7	100.0	75.0
female	%	33.3	33.3	0.0	25.0
Education level					
primary	%	0.0	0.0	0.0	0.0
secondary	%	0.0	0.0	0.0	0.0
high school	%	0.0	0.0	100.0	25.0
educated	%	100.0	100.0	0.0	75.0
business experience	Year	10.3	6.7	17.5	10.3
family size	Person	4.7	4.3	5.0	4.6

Source: Individual Interviews of Central Wholesalers 2004

Yangon Bayintnaung market and Crop Exchange Center are not only the major rice distribution center but also the main source of rice price formation for the domestic rice marketing. Central wholesalers from Yangon Bayintnaung Market are categorized according to their working capital. Small-scaled central wholesalers run their business with 30 million Kyats and below, medium scale own above 30 million Kyats to 60 million Kyats and Large scale occupy above 60 million Kyats.

Picture 5. 4: Central Wholesaler's depot at Yangon Bayintnaung Market

General information of central wholesaler is mentioned in the table (5.26). Overall age of central wholesaler is 47.9 years and male heads 75 percent of the business. Education level is as high as usual, all small and medium scale got the bachelor degree and large-scaled central wholesalers are in high school education level. Business experience is highest in the large scale 17.5 years and on average 10.3 years.

Table 5. 27: Business activities of central wholesaler (Unit = %)

Activity	small	medium	large	total
Trading activity				
Yangon only	100.0	0.0	0.0	37.5
Yangon and other place	0.0	100.0	100.0	62.5
Variety				
all kinds of variety	33.3	100.0	100.0	75.0
Japonica variety only	33.3	0.0	0.0	12.5
Indica variety only	33.3	0.0	0.0	12.5
Buying Place				
local only	66.7	0.0	0.0	25.0
crop exchange center only	33.3	33.3	0.0	25.0
both	0.0	66.7	100.0	50.0

Source: Individual Interviews of Central Wholesalers 2004

Most small-scaled wholesalers run their business by handling the specific variety of rice while all medium and large scaled wholesalers handle all kinds of rice varieties. Small-scaled wholesalers sell their commodities within Yangon market only. All medium and large scales do rice shipment business not only within Yangon but also to other local markets. 66.7 percent of small scales buy rice from local and 33.3 percent of them buy from crop exchange center. 100 percent of large scales mostly buy rice from crop exchange center and 66.7 percent of medium scale buy both local and crop exchange center.

Picture 5. 5: Business at Crop Exchange Center (Yangon)

5.3.6 Marketing activities of retailers

Retailers are the last or final intermediaries in the marketing channel through which rice reaches the consumers. They are reported as buying rice from local wholesalers or millers and transporting to their shop by trishaw or rental car. There is no price negotiation between retailers and wholesalers or millers in order to supply rice, retailers usually buy rice

with market price and set the selling price depends on the buying rice price. Some characteristics and behavior of this group are presented in the table (5.28).

Table 5. 28: General Profile of retailer

Indicator	Unit	Hlegu Township	Pathein Township
Gender of HHH			
male	%	50.0	66.7
Education level			
primary	%	16.7	33.3
secondary	%	16.7	33.3
high school	%	33.3	33.3
got degree	%	33.3	0.0
business experience	Year	8.0	5.0
family size	Person	3.6	6.3

Source: Individual Interviews of Central Wholesalers 2004

Male headed households are distributed as 50 percent in Hlegu area and 66.7 percent in Pathein area. In Hlegu area, 33.3 percent of retailers got the bachelor degree while the highest education level in Pathein is the high school level, 33.3 percent. Business experience ranges from 5 to 8 years in Pathein and Hlegu.

Picture 5. 6: Retailer Shop at Pathein Township

As mentioned early, Hlegu area is not far away from Yangon market and 54.6 percent of retailers mostly buy rice from central wholesaler. 27 percent of them buy rice from local farmers. Pathein retailers buy rice from local farmers, millers and local wholesalers. Almost all retailers set the selling price depending on the buying price of rice.

Table 5. 29: Buying activities (Unit = %)

Source	Hlegu Township	Pathein Township
local farmer	27.3	33.3
mill	18.2	66.7
local wholesaler	0.0	0.0
central wholesaler	54.6	0.0

Source: Individual Interviews of Retailers 2004

5.4 MARKETING COST AND MARKETING MARGIN OF SOME MARKET AGENTS

The services of various agencies constituting a marketing channel are remunerated out of the marketing "margin". This term is used to denote the difference between the price paid to the first seller and that paid by the final buyer (Kohls, 2002).

Marketing cost and marketing channel are calculated for some main agents of the channel such as collectors, small, medium and large scale millers, local wholesalers and retailers and central wholesalers in the rice marketing channel. Because of the lack of capital and paddy and rice price fluctuation, collectors in this study serve as the agents for the millers. Therefore, marketing margin of the collectors is the commission fees for buying paddy.

As already mentioned, the commodity types handled by the middlemen are different in the rice marketing channel as paddy in collectors and millers and rice in others. The percentage of profit per cost price indicator (return on investment) is used in this study in order to compare their achievement in the marketing channel.

Some millers provide milling service only for farmers and traders while most millers purchase paddy either directly from farmers and collectors. Processing and selling business of millers could receive higher net margin than that of other intermediaries. The percentage of profit per cost price is also high in the millers. Among millers, large-scaled millers attain highest profit per cost price and surprisingly small-scaled millers get higher profit than medium-scaled millers.

This could be explained that, using fuel-save-type milling machines (boiler engine) and huge amounts of capital investment can create the highest profit per cost price ratio for the large-scale miller. Not using the agents (commissioner) for buying paddy supports small-scaled mill that gets the chance to exploit the profit by operating the business in appropriate scale. Although the rice millers obtain the highest marketing margin, they also incur the highest marketing cost in terms of payment for drying, storing, manufacturing, and other service costs. Local wholesalers get a profit as a percentage of the cost price (1.9 percent),

retailers obtain a relatively high profit as 6.1 percent and central wholesalers occupy profit as 3.2 percent.

Table 5. 30: Marketing cost, marketing margin and profit of some agents

Collector	Unit	Hlegu	Pathein
Buying price of paddy	Kyats/ton	43137.0	50326.5
Commission price per ton of paddy	Kyats/ton	958.6	479.3
Cost Price	Kyats/ton	44095.6	50805.8
Selling price per ton of paddy	Kyats/ton	44095.6	50805.8
Marketing margin	Kyats/ton	958.6	479.3
Profit per ton of paddy	Kyats/ton	958.6	479.3
Profit per cost price	%	2.2	0.9

Miller		Hlegu		Pathein	
	Unit	small	medium	medium	large
Buying price of paddy	Kyats/ton	43137.0	43137.0	50326.5	50326.5
Marketing cost	Kyats/ton	1858.3	2406.6	3380.5	3620.2
Milling cost	Kyats/ton	3972.4	4481.3	4069.3	1001.9
Commission service	Kyats/ton	0.0	958.6	479.3	479.3
Total cost	Kyats/ton	5830.7	7846.5	7929.1	5101.4
Cost Price	Kyats/ton	48967.7	50983.5	58255.6	55427.9
Selling price of paddy	Kyats/ton	52800.0	52800.0	60750.0	60750.0
Marketing margin	Kyats/ton	9663.0	9663.0	10423.5	10423.5
Profit per ton of paddy	Kyats/ton	3832.4	1816.5	2494.4	5322.1
Profit per cost price	%	7.8	3.6	4.3	9.6

Local wholesaler	Unit	Hlegu	Pathein
Buying price of rice	Kyats/ton	n.a	99960.0
Marketing cost	Kyats/ton	n.a	2013.2
Cost Price	Kyats/ton	n.a	101973.2
Selling price rice	Kyats/ton	n.a	103880.0
Marketing margin	Kyats/ton	n.a	3920.0
Profit	Kyats/ton	n.a	1906.8
Profit per cost price	%	n.a	1.9

Retailer	Unit	Hlegu	Pathein
Average buying price of rice	Kyats/ton	91728.0	99960.0
Marketing cost	Kyats/ton	3681.9	2940.0
Cost price	Kyats/ton	95409.9	102900.0
Average selling price of rice	Kyats/ton	101236.4	105855.7
Marketing margin	Kyats/ton	9508.4	5895.7
Profit	Kyats/ton	5826.5	2955.7
Profit per cost price	%	6.1	2.9

Central Wholesaler	Unit	Yangon
Average buying price of rice	Kyats/ton	87360.0
Marketing cost	Kyats/ton	6066.2
Cost Price	Kyats/ton	93426.2
Average selling price of rice	Kyats/ton	96447.9
Marketing margin	Kyats/ton	9087.9
Average profit	Kyats/ton	3021.7
Profit per cost price	%	3.2

Source: Individual Interviews 2004

5.5 MARKETING CHANNEL

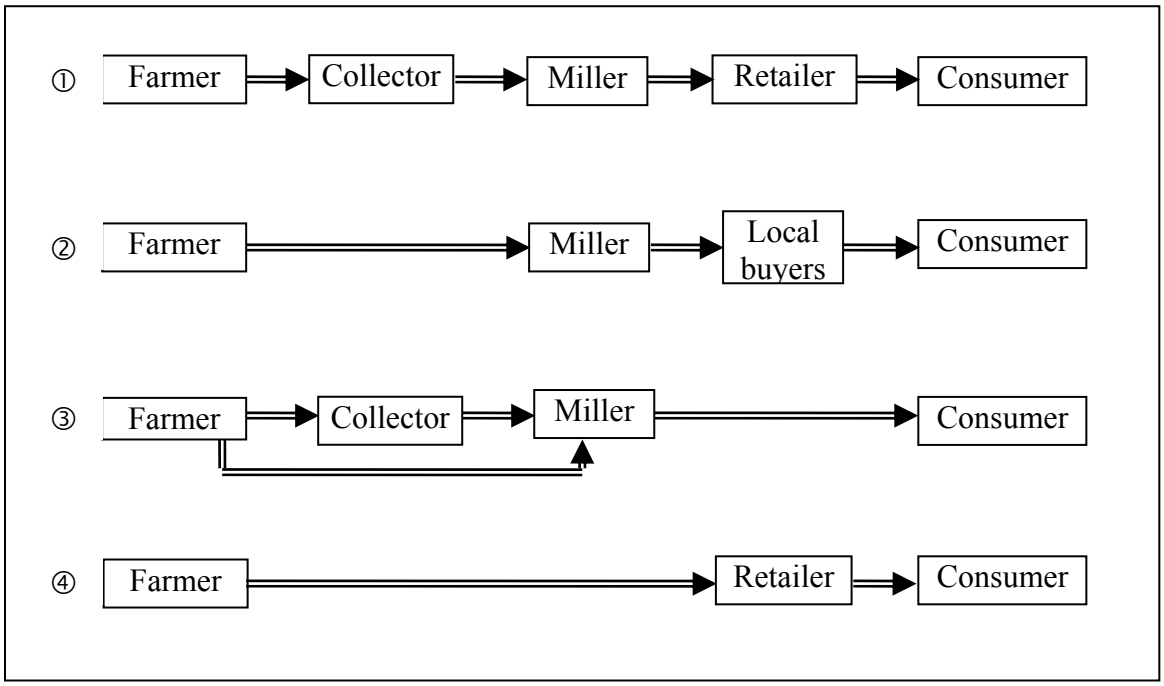

Fig 5. 3: Main rice marketing channel in Hlegu Township
Source: Individual survey 2004

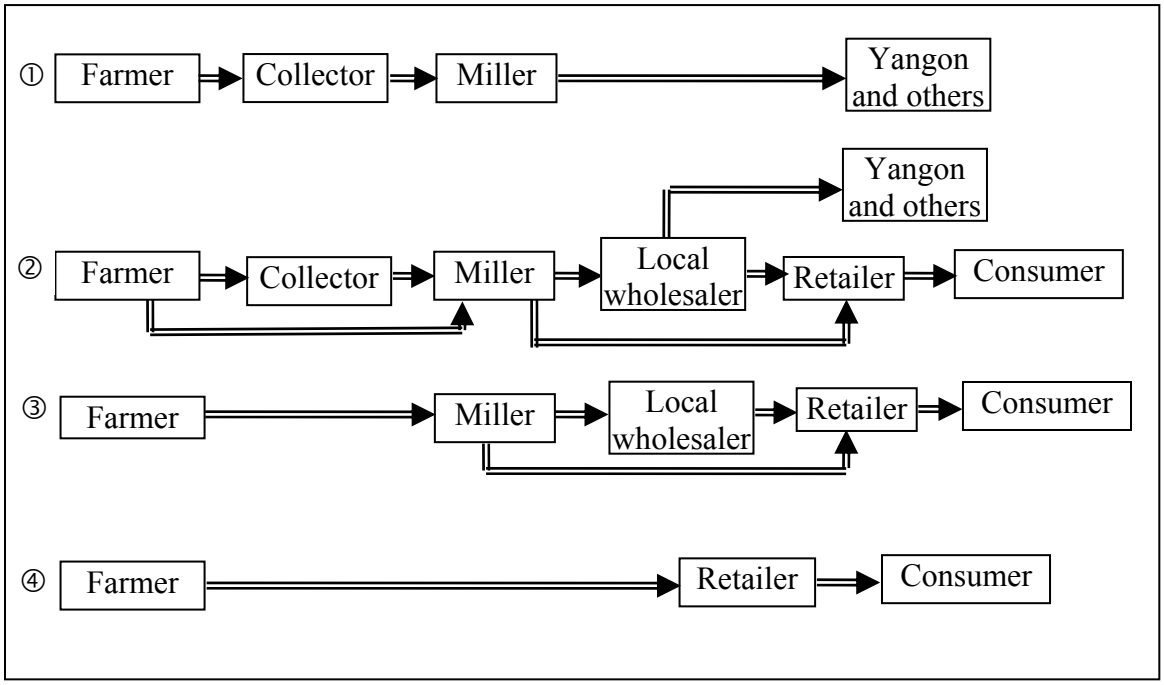

Fig 5. 4: Main rice marketing channel in Pathein Township
Source: Individual survey 2004

Rice distribution system is a bit different in this two study sites. According to the survey, there are 4 main rice marketing channels in Hlegu area. All collectors in this area serve as agents of millers. The first three main marketing channels show that almost all of

farmers' products flow to the millers and consequently, the market power of miller is boosting at the farm-gate level. Moreover, because of the business integration of millers doing milling and trading of rice activities simultaneously by investing large amount of capital, trading of rice as local wholesaler activities is diminishing in Hlegu area. Only existence of small and medium mills can give the chance to the consumers to buy rice directly form the millers even while large scale millers do not prefer to do such kind of transaction.

In Pathein area, almost all of farm products also flow to millers who have the market power at farm-gate level. As Pathien area is located in the largest rice producing area, several intermediaries are participating in the rice marketing channel and interstate trading of rice is occurred by sending surplus to Yangon and other local markets. Even millers do marketing activities with huge amount of investment, local wholesalers' trading of rice by buying rice from mill and sending to Yangon and other local markets also play a main role. On the other hand, the existence of medium and large mills, consumers have no chance to buy rice directly from the mills for their home consumption. Therefore, retailers also play a key role in this marketing channel.

Picture 5. 7: Yangon Crop Exchange Center

CHAPTER 6
EMPIRICAL ANALYSIS OF MARKET INTEGRATION IN SELECTED RICE MARKETS OF MYANMAR

6.1 MARKET INTEGRATION ANALYSIS

Market integration can be viewed as a measurement to understand how specific markets work. A competent agricultural marketing structure is an imperative way to elevate the earnings of farmers and to endorse the development of country's economy. The farmers allocate their resources according to their comparative advantage and invest in modern farm inputs to obtain enhanced productivity and production. Overall market performance may be indicated by spatial price behavior among regional markets and central market.

6.1.1 Spatial market integration and spatial market efficiency condition

The terms "spatial market integration" and "spatial market efficiency" are extensively used in price analysis and need to distinguish the difference between them. Barret, C. B. (1996) mentioned that market integration concerns the free flow of goods and information- and thus prices- over form, space, and time and is thus closely related to concepts of efficiency.

Spatial market integration is defined as the extent to which demand and supply shocks arising in one location are transmitted to other locations (Fackler, 1996; McNew, 1996; McNew and Fackler, 1997; Fackler and Goodwin, 2001). Therefore, market integration will be taken as a measure of the expectation of the price transmission allotment.

Analysts have adopted that market integration is a distinct concept from the absence of arbitrage. Observing trade flows is a sufficient but not necessary condition for some degree of spatial market integration (Barrett et al., 2000; Barett and Li, 2002). It is not necessary for two regions to be direct trading partners for a high degree of integration to be present. If regions are part of a common trading network, price shocks may therefore be transmitted indirectly through the network via the trading linkages that connect the regions (Fackler and Goodwin, 2001).

Spatial market efficiency is an equilibrium condition whereby all potential profitable spatial arbitrage opportunities are exploited. In equilibrium condition the price differential should be less than or equal to the transfer costs. If the spatial price differential is greater than transfer cost the market is said to be inefficient with or without trade (Negass and et.al,

2003). Therefore, prices generated by an efficient market should precisely reveal all concerned market information about demand and supply conditions as well as transactions costs.

Therefore, spatial market integration is neither crucial nor satisfactory for spatial market efficiency (and vice versa) and as a consequence tests for integration do not always point out the suitable inference regarding spatial market efficiency. In developing countries prices are the only data readily available to examine spatial relationships and spatial market integration is applied as an indicator of the market performance of these economies.

6.1.2 Modelling price integration

Several methods beginning with simple bivariate correlation coefficients have been used for measuring spatial price relationships. Various researchers have discussed the limitations of this method: 'While it is true that prices in an efficient market system tend to move together, they may do so for other reasons. Common price trends (general inflation), common seasonality (likely in agriculture), or any other synchronous common factor may produce sympathetic but unrelated price changes', (Heytens, 1986). Models measuring the degree of price integration have been improved to take the limitation adjustment into account. In general, two classes of models can be distinguished: those that ignore the dynamics of price adjustments and those explicitly depicting price adjustments over time.

Until a decade or so ago, analysts were typically interested in bivariate correlation coefficients between distinct markets and at the difference between distinct markets and the difference between inter-market price spread. Even though much maligned, static price correlations remain the most common measure of spatial market integration in agriculture. By this method, bivariate correlation or regression coefficients are estimated between the time series of spot prices for an otherwise identical food or bundle of goods at different market locations (Ravallion, 1986).

Economists soon recognized serious methodological problems in these studies. Inter-seasonal flow reversals, which are common where infrastructure is poor, make price spread observations unreliable indicators of market integration or competition, since those spreads include a seasonal component (Timmer, 1974). It is sure that imprecision in a test equation based on the static bivariate model would be yielded by any measurement error or omitted variables.

Moreover, simple bivariate correlation coefficients require filtering to eliminate bias toward spurious integration due to common exogenous trends (e.g., general inflation), common periodicity (e.g., agricultural seasonality), of autocorrelation (Harriss, 1979). On the other hand, contemporaneous correlation tests may overestimate segmentation if lags in information, delivery, or contract expiration produce a natural lag in the price response between markets. Finally, these simple statistics fail to recognize the heteroskedasticity common in price data of reasonably high frequency.

Ravallion (1986) developed an Autoregressive Distributed Lag (ADL) Model to evaluate both the long- and short-run adjustment processes. The 'dynamic' structure of the model accounts the sluggishness of price adjustments. And markets are integrated in the short run when instantaneous and full price adjustment prevails.

The price formation process can be represented by two equations assuming the central market price is influenced by prices of all relevant rural markets and then central market is assumed to dominate price formation in rural markets.

$$P_{1t} = \sum_{j=1}^{n} a_{1j} P_{1t-j} + \sum_{k=2}^{N} \sum_{j=0}^{n} b_{1j}^{k} P_{kt-j} + X_{1t} c_1 + e_{1t} \qquad (6.1)$$

$$P_{it} = \sum_{j=1}^{n} a_{ij} P_{it-j} + \sum_{j=0}^{n} b_{ij} P_{1t-j} + X_{it} c_i + e_{it} \qquad (6.2)$$

t is the number of period, t = 1,2,…,T

i is the number of the rural markets, i = 1,2,…, N

j is the number of time lags, j = 0,1,2,…, n

and X is a vector of market characteristics affecting prices

An adapted version of this model, has been used to measure price relationships between markets by various analyst (e.g., Alderman, 1993; Faminow and Benson, 1990; Goodwin and Schroeder, 1991; and Heytens, 1986). Two major problems exist with this type of model when price series tend to be non-stationary, resulting in problems of inference and multicollinearity in the estimated equations.

Ravallion (1986) tests first price integration in the long run. When this is confirmed, the condition of long-run integration is imposed and the model is rewritten as an Error Correction Model to test for short-run integration.

6.2 THE EMPIRICAL MODEL

The law of one price (LOP) states that, for a single homogeneous commodity, arbitrage in efficient markets must equalize prices, expressed in a common currency, when there are no obstacles to trade or no transportation costs. Particularly it is assumed that markets for primary commodities adjust their prices after a price shock. Consequently, the market is expected to adjust fully and immediately and prices do not gradually approach a new equilibrium. However, empirical analysis of the LOP does not necessarily imply full and immediate adjustment to a new equilibrium.

6.2.1. Notation and definition

Selected rice markets are divided into i local markets and 1 central market. P_i denotes the price data of local markets and P_1 denotes the price data of central market. t denotes the time and j denotes the number of time lag. Let the subscript $j = 1$ *to* 2 denotes the time lag from 1 to 2. Δ denotes the price first difference of the selected market.

X_t is a vector of other influences on local markets . Two variables are selected as likely non-price influences on local markets aiming to capture the seasonality of the main harvest season of November to January and local time trend.

First price difference (price change) of each local market:

$$\Delta P_{it} = P_{it} - P_{it-1}$$

First price difference (price change) of central market:

$$\Delta P_{1t} = P_{1t} - P_{1t-1}$$

First price difference of lag price of each local market:

$$\Delta P_{it-j} = P_{it-1} - P_{it-2} \text{ for j = 1,2,…,n}$$

First price difference of lag price of central market:

$$\Delta P_{1t-j} = P_{1t-1} - P_{1t-2} \text{ for j = 1,2,…,n}$$

6.2.2 Formula Derivation

Typical formula with lag 3

$$P_{it} = k + c_1 P_{it-1} + c_2 P_{it-2} + c_3 P_{it-3} + d_0 P_{1t} + d_1 P_{1t-1} + d_2 P_{1t-2} + d_3 P_{1t-3} + X_t + \varepsilon_t$$

subtract P_{it-1} from both sides and add and subtract $d_0 P_{1t-1}$ on the right hand side.

$$P_{it} - P_{it-1} = k + c_1 P_{it-1} - P_{it-1} + c_2 P_{it-2} + c_3 P_{it-3} + d_0 P_{1t} - d_0 P_{1t-1} + d_0 P_{1t-1} + d_1 P_{1t-1} + d_2 P_{1t-2}$$
$$+ d_3 P_{1t-3} + X_t + \varepsilon_t$$

$$\Delta P_{it} = k + (c_1 - 1) P_{it-1} + c_2 P_{it-2} + c_3 P_{it-3} + d_0 \Delta P_{1t} + (d_0 + d_1) P_{1t-1} + d_2 P_{1t-2} + d_3 P_{1t-3} + X_t + \varepsilon_t$$

subtract and add $(c_1 - 1)\ P_{it-2}$ and $(d_0 + d_1)\ P_{1t-2}$

$$\Delta P_{it} = k + (c_1 - 1) P_{it-1} - (c_1 - 1) P_{it-2} + (c_1 - 1) P_{it-2} + c_2 P_{it-2} + c_3 P_{it-3} + d_0 \Delta P_{1t} + (d_0 + d_1) P_{1t-1}$$
$$- (d_0 + d_1) P_{1t-2} + (d_0 + d_1) P_{1t-2} + d_2 P_{1t-2} + d_3 P_{1t-3} + X_t + \varepsilon_t$$

$$\Delta P_{it} = k + (c_1 - 1) \Delta P_{it-1} + (c_1 + c_2 - 1) P_{it-2} + c_3 P_{it-3} + d_0 \Delta P_{1t} + (d_0 + d_1) \Delta P_{1t-1}$$
$$+ (d_0 + d_1 + d_2) P_{1t-2} + d_3 P_{1t-3} + X_t + \varepsilon_t$$

subtract and add $(c_1 + c_2 - 1)\ P_{it-3}$ and $(d_0 + d_1 + d_2)\ P_{1t-3}$

$$\Delta P_{it} = k + (c_1 - 1) \Delta P_{it-1} + (c_1 + c_2 - 1) P_{it-2} - (c_1 + c_2 - 1) P_{it-3} + (c_1 + c_2 - 1) P_{it-3} + c_3 P_{it-3} + d_0 \Delta P_{1t}$$
$$+ (d_0 + d_1) \Delta P_{1t-1} + (d_0 + d_1 + d_2) P_{1t-2} - (d_0 + d_1 + d_2) P_{1t-3} + (d_0 + d_1 + d_2) P_{1t-3} + d_3 P_{1t-3} + X_t + \varepsilon_t$$

$$\Delta P_{it} = k + (c_1 - 1) \Delta P_{it-1} + (c_1 + c_2 - 1) \Delta P_{it-2} + (c_1 + c_2 + c_3 - 1) P_{it-3} + d_0 \Delta P_{1t} + (d_0 + d_1) \Delta P_{1t-1}$$
$$+ (d_0 + d_1 + d_2) \Delta P_{1t-2} + (d_0 + d_1 + d_2 + d_3) P_{1t-3} + X_t + \varepsilon_t$$

$$\Delta P_{it} = k + \alpha_1 \Delta P_{it-1} + \alpha_2 \Delta P_{it-2} + (c_1 + c_2 + c_3 - 1) P_{it-3} + \beta_0 \Delta P_{1t} + \beta_1 \Delta P_{1t-1} + \beta_2 \Delta P_{1t-2}$$
$$+ (d_0 + d_1 + d_2 + d_3) P_{1t-3} + X_t + \varepsilon_t$$

$$\Delta P_{it} = k + \sum_{j=1}^{2} \alpha_i \Delta P_{it-j} + (c_1 + c_2 + c_3 - 1) P_{it-3} + \sum_{j=0}^{2} \beta_j \Delta P_{1t-j} + (d_0 + d_1 + d_2 + d_3) P_{1t-3} + X_t + \varepsilon_t$$

$$\alpha_1 = c_1 - 1$$
$$\alpha_2 = c_1 + c_2 - 1$$
$$\beta_0 = d_0$$
$$\beta_1 = d_0 + d_1$$
$$\beta_2 = d_0 + d_1 + d_3$$

long-run integration can be supposed then:

$$c_1 + c_2 + c_3 + d_0 + d_1 + d_2 + d_3 = 1$$

then the following the ECM can be derived:

$$\Delta P_{it} = k + \delta (P_{it-3} - P_{1t-3}) + \sum_{j=1}^{2} \alpha_i \Delta P_{it-j} + \sum_{j=0}^{2} \beta_j \Delta P_{1t-j} + X_t + \varepsilon_t$$
$$c_1 + c_2 + c_3 - 1 = -(d_0 + d_1 + d_2 + d_3) = \delta$$

6.2.3 Model usefulness

The model can provide insights into future regional relationships assuming the structure of the agricultural industry does not substantially change. Market integration

testing methods are important because empirical findings elucidate market conditions, which in turn are central to the modeling of an economy. One cannot establish the competitiveness of a market without first establishing the relevant spatial market (Stigler and Sherwin,1985).

One similarly must establish the spatial (intertemporal) extent of markets before sectoral or macroeconomic analysis, for if markets are not spatially (intertemporally) integrated, cross-sectional (intertemporal) aggregation of demand and supply loses its logical foundation. Segmented markets demand more costly, disaggregated analysis. Moreover, segmented markets are less likely to be perfectly competitive, in part because smaller markets are more susceptible to the emergence of natural monopolies due to the minimum efficient scale of intermediation technologies.

6.3 MODEL RESULT AND INTERPRETATION

6.3.1 Test for stationary of price series

The classical assumption in the applied econometrics is that the means and variances of the variables are well defined constants and independent of time. However, macroeconomists have been aware that many macroeconomic time- series are non-stationary in their levels and that are most adequately represented by first differences. Variables whose means and variances change over time are known as non-stationary or unit root variables. As a consequence, unit root tests are applied to determine if the variables in a regression are stationary or non-stationary.

Before applying the cointegration tests, Augmented Dickey–Fuller (ADF) unit root tests are applied to each price series and their first differences to determine the stationarity of each individual price series. The ADF test requires regressing ΔP_t on a constant, P_{t-1} and several lags of ΔP_{t-j} in order to avoid autocorrelated disturbance as follows:

$$\Delta P_t = c_1 + \delta P_{t-1} + \sum_{j=1}^{n} \delta_{1j} \Delta P_{t-j} + \varepsilon_{1t} \tag{6.3}$$

$$\Delta^2 P_t = c_2 + \delta_2 \Delta P_{t-1} + \sum_{j=1}^{n} \delta_{3j} \Delta^2 P_{t-j} + \varepsilon_{2t} \tag{6.4}$$

where $\Delta P_t = P_t - P_{t-1}, \Delta P_{t-1} = P_{t-1} - P_{t-2}, \Delta^2 P_t = \Delta P_t - \Delta P_{t-1}, \Delta^2 P_{t-j} = \Delta P_{t-j} - \Delta P_{t-j-1}$

Then the t-statistics of the estimated coefficient of P_{t-1} is used to test the hypothesis. In equation (6.3) with H_0: $\delta = 0$ implying non-stationary of the time-series at level and P_t, t =

1,2,…, T or $P_t \sim I(1)$ and H_1: $\delta < 0$ implying stationary or $P_t \sim I(0)$. If the value of the ADF statistic is less (that is, more negative, because these values are always negative) than the critical values and cannot reject the null hypothesis, it shows that P_t is non-stationary. If P_t is non-stationary, it should be determined whether P_t is stationary in the first difference by using equation (6.4), H_0: $\delta_2 = 0$ implying non-stationary of the time-series at first difference $\{\Delta P_t \sim I(1) \text{ or } P_t \sim I(2)\}$ and H_1: $\delta_2 < 0$ implying stationary of series at first difference$\{\Delta P_t \sim I(0) \text{ or } P_t \sim I(1)\}$.If the ADF test can be rejected for the null hypothesis, as is usually the case with price series, it may be concluded that $P_t \sim I(1)$.

Table 6. 1: Augmented Dickey-Fuller Test

Market	Price series	N	m	Price levels		First Differences	
				δ	t-value	δ_2	t-value
Yangon	P1	166	14	-0.015	-0.65	-1.37	-8.15
Mandalay	P2	166	14	-0.018	-1.29	-0.69	-6.79
Pathein	P3	166	16	-0.024	-1.26	-1.16	-8.19
Pyay	P4	166	13	-0.017	-1.08	-0.97	-8.13
Mawlamyine	P5	166	15	-0.017	-1.05	-1.01	-7.58
Taunggyi	P6	166	16	-0.017	-0.82	-1.24	-7.54
Critical Values for ADF statistics				Significant level		ADF	
				1%		-4.02	
				5%		-3.44	
				10%		-3.14	

Note: N = number of observations; m = missing variables; No serial correlation was detected (5% significant level)

Source: Weekly rice price series from 2001 April to 2004 May. ADF analysis was carried out in EVIEWS©3.1

ADF test as described above table (6.1) tested with two lags and reports the resulting ADF (2) statistics. All of the tests in price level with equation (6.3) show that t-values are too small to reject the null hypothesis. Hence none of the rice price series is stationary. The test for integration of order 2 with the first difference by using equation (6.4) indicates that the null hypothesis is rejected at one percent in all cases and all the price series are I (1) process and are stationary at first difference level. This result implies that instead of using normal price series as variables in the model, inclusion of first differences as variables can eliminate the stochastic trend to which the nominal series are revealed.

6.3.2 Co-integration test based on an ADL model specification

Current prices of markets entirely and correctly reflect all relevant information in an efficient market system. Price series P_{it} (local price) and P_{1t} (central price) are said to be co-

integrated to the order of d, b where $d \geq b \geq 0$ (written as P_{it}, $P_{1t} \sim CI(d, b)$ if P_{it} *and* $P_{1t} \sim I(d)$ and $P_{it} - \beta P_{1t} \sim I(d-b)$). $[1 - \beta]$ is the co-integration vector. Several authors indicated that co-integration vector for the price series P_{it} and P_{1t} should be $[1, -1]$ in an efficient market system where the difference between the prices in the two price series is a white noise process.

Co-integration between P_{it} (local price) and P_{1t} (central price) is tested with an Autoregressive Distributed Lag model by identifying the long-run dynamic of the price series. According to the econometric theory, the non-stationary price series cannot be investigated by the F-test in order to find out the long-run integration. In order to solve this problem by rewriting ADL model as follows in equation (6.5): (Boswijk, 1992)

$$\Delta P_{it} = k + \sum_{j=1}^{n-1} \alpha_i \Delta P_{it-j} + (c_1 + c_2 + c_3 - 1) P_{it-n} + \sum_{j=0}^{n-1} \beta_j \Delta P_{1t-j} + (d_0 + d_1 + d_2 + d_3) P_{1t-n} + X_t + \varepsilon_t$$

where X_t is the seasonal dummy variable and time trend variable.

The appropriate number of lag for the ADL model is determined by the general to specific modelling (Charemza and Deadman, 1992; Kiviet 1986). Langrange multiplier F test with the lag order 8 is carried out for all the regression.

Concerning with the Ravallion's restriction on long-run integration:

$$\sum_{j=1}^{n} c_j + \sum_{j=0}^{n} d_j = 1$$

The long run multiplier is:

$$\beta^* = \frac{\sum_{j=0}^{n} d_j}{1 - \sum_{j=1}^{n} c_j}$$

when price series are related, then $\beta^* \approx 1$.

When $\sum (c + d)$ and β^* are not significantly different from 1, prices can converge in the long run. If $\sum (c + d)$ and β^* differ significantly from 1, prices can diverge in the long run and it is difficult to interpret. On the other hand, an acceptable condition for co-integration is that $\sum c \neq 1$ and $\sum d \neq 0$. F test can be used to clarify by the following null hypothesis $\sum c = 1$ and $\sum d = 0$. When these tests are satisfied, some error term will exist in the model in order to capture the equilibrium situation and ECM model can be derived.

When integration does not exist in the long run, it does not make sense to test for integration in the short run. (Lutz, C. 1995)

Table 6. 2: Test for co-integration based on an ADL model

Local Market	Central Market	Test for Co-integration							
		Lags	d	F-coin[a]	∑c	∑d	∑c + ∑d	β*	F-LR[b]
Mandalay (P2)	Yangon (P1)	8	2	3.61	0.82	0.22	1.04	1.23	2.34
Pathein (P3)	Yangon (P1)	3	2	3.89	0.85	0.13	0.98	0.84	1.68
Pyay (P4)	Yangon (P1)	2	2	6.60	0.80	0.20	1.00	1.00	0.0001
Mawlamyine(P5)	Yangon (P1)	3	2	1.26*	0.94	0.05	1.00	0.92	0.04
Taunggyi (P6)	Yangon (P1)	2	2	2.05*	0.89	0.10	0.99	0.91	0.25

Note: d is the number of dummies used to indicate seasonal (main harvest season) period from November to January and time trend variable. Langrange multiplier test with order 8 at 5% significant level is carried out for each regression and the appropriate number of lag is decided.

a. F-coin, Wald test for co-integration , H_0: $\sum c = 1, \sum d = 0$ (no co-integration exist), critical value at 5% level is 3.00 to 3.07. The values marked with an asterisk do not reject H_0, indicating a lack of co-integration.

b. F-LR, test for long-run integration: H_0: ∑c + ∑d=1 (Long-run integration exists), the results do not reject the existence of long-run integration at the 5% level critical value 3.84 – 3.92.

The results in table (6.2) indicated that, according to F-coin test: $\sum c = 1, \sum d = 0$, 2 market pairs cannot exist in the long-run integration condition. However, F-LR test, ∑c + ∑d=1 confirms the existence of long-run integration in all market pairs: β^* does not differ significantly from 1. These two tests can support that the co-integrating vector equals [1, -1]. Especially in the case of Mawlamyine and Taunggyi Markets, the price co-integration with Yangon market is rejected. Therefore, the results of F-LR test for these two market pairs become ambiguous because $\sum c$ is close to 0 and $\sum d$ is close to 1.

However, the overall tests support that the majority of market pairs are integrated in the long-run and the ADL model is reformulated in an ECM model.

6.3.3 Short run integration tested with an error correction model.

After testing for co-integration of the two price series, the ADL model of Ravallion can estimate the existence of short run dynamics by constructing an Error Correction Model. Sargan (1964), Henery and Anderson (1977), Davidson et al. (1978) used Error correction terms as a means of capturing adjustments in a dependent variable which depended not on

the level of some explanatory variable, but on the extent to which an explanatory variable deviated from an equilibrium relationship with the dependent variable. A particular advantage of the error-correction mechanism is that the extent of adjustment in a given period to deviations from long-run equilibrium is given by the estimated equation without any further calculation.

Even though Ravallion distinguishes lags for the error-correction term and the price changes in the reference market, the following equation (6.6) is chosen for the ease of testing including lags for price changes in local and central markets and together with one error-correction term.

$$\Delta P_{it} = k + \delta(P_{it-n} - P_{1t-n}) + \sum_{j=1}^{n-1} \alpha_i \Delta P_{it-j} + \sum_{j=0}^{n-1} \beta_j \Delta P_{1t-j} + X_t + \varepsilon_t \qquad (6.6)$$

where the existence of short run integration is tested with the null hypothesis of $\beta_0 = 1$ and $\delta = -1$. The market segmentation is also tested with the null hypothesis of $\beta_j = \delta = 0$ by Ravallion's restriction.

Table (6.3) shows the results of the parameters in the ECM model and the combination of local and central price series. The existence of short-run integration ($\beta_0 = 1$ and $\delta = -1$) was rejected for all pairs of markets even though the market segmentation $\beta_j = \delta = 0$ does not exist between the markets. The error-correction term is significant in all cases except the market pair Mawlamyine (local market) and Yangon (central market). This shows that the short-run adjustment of price changes at most market places react significantly on the deviation from the long-run equilibrium.

The ADL test results already indicated that Mawlamyine (local market) and Yangon (central market) were only weakly integrated in the long run because of the nonexistence of co-integration between markets. Although the coefficient (δ) is insignificant, (β_0) is significant in ECM test and, consequently, the hypothesis of market segmentation is rejected. It is evident that there is an indirect link between Yangon central market and the Mawlamyine market.

Moreover, Mawlamyine market is situated in a region of rice surplus area and regional surpluses are mostly sold at Taninthayi Division. The demand of rice in that division can mainly influence the price formation at Mawlamyine market. Lack of a developed transportation infrastructure is also the main indicator for the price sluggishness. Because of transportation inconveniences and lack of a stable communication infrastructure

between Mawlamyine market and Yangon market, the price changes in Yangon market do not have any considerable influence on Mawlamyine market price.

Table 6. 3: Error Correction Model illustrating the short-run integration process

Dependent Market	Central Market	Lag	R^2	δ	α_1	α_2
Mandalay (P2)	Yangon (P1)	8	0.41	-0.10*	0.26*	-0.17*
Pathein (P3)	Yangon (P1)	3	0.24	-0.17*	-0.16*	-0.17*
Pyay (P4)	Yangon (P1)	2	0.17	-0.20*	0.14*	
Mawlamyine(P5)	Yangon (P1)	3	0.17	-0.06	0.10	-0.11
Taunggyi (P6)	Yangon (P1)	2	0.14	-0.11*	-0.35*	
Dependent Market	Central Market	α_3	α_4	α_5	α_6	α_7
Mandalay (P2)	Yangon (P1)	-0.16*	-0.22*	-0.12	-0.16*	-0.20*
Pathein (P3)	Yangon (P1)					
Pyay (P4)	Yangon (P1)					
Mawlamyine(P5)	Yangon (P1)					
Taunggyi (P6)	Yangon (P1)					
Dependent Market	Central Market	β_0	β_1	β_2	β_3	β_4
Mandalay (P2)	Yangon (P1)	0.20*	0.19*	0.33*	0.19*	0.14*
Pathein (P3)	Yangon (P1)	0.22*	0.28*	0.51*		
Pyay (P4)	Yangon (P1)	0.11*	0.26*			
Mawlamyine(P5)	Yangon (P1)	0.28*	-0.09	0.10		
Taunggyi (P6)	Yangon (P1)	0.21*	0.20*			
Dependent Market	Central Market	β_5	β_6	β_7	F-short	F-seg
Mandalay (P2)	Yangon (P1)	0.17*	0.22*	0.33*	251.08	5.43
Pathein (P3)	Yangon (P1)				99.31	10.76
Pyay (P4)	Yangon (P1)				145.35	5.71
Mawlamyine(P5)	Yangon (P1)				321.91	6.44
Taunggyi (P6)	Yangon (P1)				139.63	3.33

Note: *Coefficients are significant at 5 percent level where t (5%, 120-∞) = 1.658-1.645.
F-short, test for short run integration: $\beta_0 = 1$ and $\delta = -1$, F (5%, 120- ∞, 1) = 3.84 – 3.92
F-seg, test for segmentation: $\beta_j = \delta = 0$, F(5%, 120 - ∞, 4) = 2.60 – 2.68, F(5%, 120 - ∞, 5) = 2.37 – 2.45, F(5%, 120 - ∞, 9) = 1.88 – 1. 96.

If there is a lack of direct price link between a pair of markets, there can be an indirect link through an intermediate market or a series of intermediate markets, entailing

indirect market integration. More insights might be obtained by testing multivariate co-integration on these markets.

Concerning the relationship between Taunggyi market and Yangon market pair, the coefficients (δ) and (β_0) are significant in ECM test and there is no market segmentation between these markets. However, their long-run integration in ADL shows only a weakly integration. Even though the Taunggyi market is situated in rice deficit area; it appears that the price integration process is far from optimal in the short run. Transportation infrastructure and communication facilities can distort the transmission of price information. A further study of the functioning of this market emphasized on the practices of market intermediaries is necessary.

The influence of the Yangon central market is strong with regards to Mandalay, Pathein and Pyay markets. This result is expected and demonstrated that market intermediaries perform a key function with their services. They directly affect the price integration of the local and urban areas. But, as in most developing countries, there are inefficiencies. This inefficiency in price information leads to price sluggishness. At present analysis none of the markets are fully integrated in the short-run.

CHAPTER 7
CONCLUSIONS

The results of this research opened up new venues of further research by leaving open-ended questions. Following is a detailed summary of the findings per objective and the recommendations for policy change. Although there are vast evidence of changes both in conduct and performance in the rice sector, urgent attention should be placed in policy changes with regard to composition of market structure, growing market power of the miller and transmission of price signals among markets.

7.1 SUMMARY FINDINGS AND CONCLUSION

7.1.1 The route of amendment in rice sector

Even though agriculture sector of Myanmar has achieved progress during recent years, rice production mainly exploited natural and biological factors with the intention of increase yield and output. In summer paddy cultivation program, favorable weather and natural environment are the good basis for more paddy yields. However, the sown area of summer paddy, 1.16 million hectares in 2001-02 was only about 22 percent of the monsoon paddy cultivation area. Insufficient irrigation facilities including dam, water pump and diesel and oil cannot give the chance to increase summer cultivation area easily.

Another distinct feature of Myanmar's agriculture is a strong government intervention in ownership of farm land. All farm land is still owned by the State. Farmers are granted land use rights which cannot be transferred, mortgaged or taken over for loan repayment. Moreover, farmers are often forced to grow summer paddy on their land especially in the areas where irrigation facilities are initiated by the Government even though alternative crops are more price incentive in future.

As such the rice productivity is still based on manual and simple labor use with very limited technology usage. The use of fertilizer in rice production remains relatively low and often not efficiently used since fertilizer supply has been reduced by the government which results to the static yield problem and leveling off in use of HYVs. Currently no significant new rice varieties are expected to increase the rice production substantially mainly due to the inadequate support services received by the farmers. Therefore, average paddy yields per hectare are still lower than that of similar areas in the major exporting Asian nations such as Thailand and Vietnam. Other significant problems such as the practice of primitive

cultivation methods, poor communication and existence of exploitative marketing systems with poor dissemination of market information are also responsible for further worsening the situation.

In general, lack of capital is mainly due to the limited access of farmers to credit facilities at favorable interest rates to benefit for the rice growing. Moreover, the institutional credits do not totally cover the cost requirement for the crop cultivation. Also the loans have focused on short term promissory notes and no long term credits with lower interest rates. These 2 factors have created an informal market of merchants and traders who lend the money in longer periods but with higher interest rates. As a result investment into farm machineries, production tools, and infrastructure development are very limited and insignificant. Lack of marketing infrastructure and services like grading, storage and processing facilities further hinders the rice production.

After implementation of market oriented economy in 1989, direct intervention in grain marketing by the government has been gradually reduced while encouraging the private sector to play a larger role. The new rice trading policy enacted in 2003 which also aimed to liberalize domestic rice market and rice exporting. Liberalization of the markets have brought improvements in rice marketing channels, however, there is still room for further improvements of the private marketing system.

Rice export can be carried out under the guidance of the Myanmar Rice Trading Leading Committee. A distinction is to be made between competition in the local rice market and competition in the world market. Private rice companies still face barriers to entry on the export market – since April 2003, the Government announced that private companies could only export rice paddy surpluses. However, the uncertainty of domestic rice surplus has allowed the government to halt all exports by the private sector. As our study was focusing on the domestic trade relationships we did not analyze this issue in detail. However, further research is necessary to pay proper attention to this growing concern.

7.1.2 The process of competition in the rice market system

This study is based on the data results of survey data 2004. According to the findings, education level of household heads in both regions is literate and most of them are in primary level. Most small-scaled farmers own low-tech tools, while large-scaled farmers invest in tractors, power tillers, threshing machines, and other equipments. Specifically,

large-scaled farmers are better equipped both in terms of quality and quantity compared to other groups.

Summer paddy cultivation areas in both study sites are just half or one third of monsoon paddy producing areas. Concerning the usage of paddy varieties, the medium and large scaled farmers use 2 to 5 varieties so as to prevent the risk of low price and damage. Although the use of quality seed is one of the main factors to increase rice yield, this is not the general case for the farmers in survey areas. The level of quality seed usage is not satisfactory for the country as a whole. Implementing the use of quality seeds in Myanmar could increase its current yield per hectare. In selling of paddy at farm-gate level, storage capacity and capital requirements for the next crop cannot let farmers to wait until the price rise in the lean season.

In the studied rice markets, private rice traders including collectors, wholesalers, and millers have an important role in distributing products to regional and inter-regional consumers. With regard to rice market conduct, rice traders perform different marketing functions: transportation, storage, negotiation, processing, market information, and financing. Collectors in the studied areas serve as agents of millers because of paddy and rice price fluctuation and lack of capital investment.

The large-scaled and medium-scaled mills mainly provide milling services for farmers, traders and some collectors. Additionally they also buy paddy from farmers and collectors, process it and sell rice to the wholesalers and traders. Using boiler engines in large-scaled mills that do not have high cost in fuel and oil is a prime basis to result the low processing costs. Moreover, the main rice marketing channels in the studied sites indicate that almost all products of farmers flow to collectors and millers. Lack of formal cooperative structures, farmers support groups and growing market power of millers at the farm-gate level result that farmers possess low bargaining power in the trading of paddy and rice at the studied areas.

In accordance with the open-ended questions in the interviews, millers, local wholesalers and central wholesalers mentioned that lack of working capital is the most difficult barrier for their continued growth. Storage for speculative purpose becomes a minor activity for rice traders during these years because of the unreliable price rise in the lean season. The transaction relationship between rice traders is mostly based on reputation and trust.

With respect to the assortment of product quality we observed that at the farm-gate, rice farmers cultivate many varieties of rice. Moreover, the existing wholesale grading system for rice quality still has some deficiencies. At the Yangon wholesale markets, rice wholesalers classify the rice products only into three kinds: Upper, Medium and lower quality. This grading system facilitates the domestic channel reflecting consumer preferences in the domestic market but does not reflect the export market which depends on the percentage of broken rice. As long as supply of preferred qualities in the local market is abundant, this can be led to differentiation of several varieties. However, in order to export specific varieties in the future, it is recommended that identified quality varieties be taken into account. In addition, rice is marketed mostly as a general commodity without specific packaging and brand name. This has negative impact to rice product quality and hampers any opportunity for rice traders to signal quality to the consumers.

Traders through several unscheduled farm visits generally initiate and establish the contact with farmers. As in other developing economies, market information is relayed and transmitted across markets inexpensively, by word of mouth. News about price changes and relevant price-making forces in pertinent terminal market are generally obtained from informal sources. This indicates that the informal market information is dominant and plays an important role. Farmers do not rely on formal information sources provided by the Government. Collectors obtained market information mainly through other traders (wholesalers or millers) in the channel of distribution. Rice retailers and wholesalers obtain the information mostly from millers and central wholesalers. However, due to the variety of sources of market information, the available information is not always systematic and reliable.

The services of the various agencies constituting a marketing channel are remunerated out of the marketing "margin". As already mentioned, the commodity types handled by the middlemen are different in the rice marketing channel as paddy in collectors and millers and rice in others. The percentage of profit per cost price indicator (return on investment) is used in this study in order to compare their achievement in the marketing channel. Because of the business integration of millers by doing milling and trading of rice simultaneously, the percentage of profit per cost price is highest in the millers' case. The study indicates the boosting market power of millers not only at the farm-gate level but also among rice market intermediaries. The degree of market power of middlemen at several

marketing channels and the extent of farmers' bargaining power at farm-gate level are to be questionable for further research on the performance of market intermediaries in Myanmar.

7.1.3 The course of price signal transmission among rice markets

This study analyzed the spatial price differences for selected rice markets in Myanmar from April 2001 to May 2004 to understand the price signal transmission from the central market to the local markets. In order to liberalize the rice market there has to be certain specific market improvement in behaviors and relationships between central and local rice market.

The First conclusion that results from each data series showed that there existed a non-stationary, but the first differences in prices series are stationary. The Autoregressive Distributed Lag model establishes existence of a long-run integration between pairs of markets. This indicates the influence of the Yangon Central Market price in the long-run to other markets.

Second conclusion is that short-run integration is affected by the transparency of the prices, which can lead to inefficient price adjustment of the markets. The existence of short-run integration was rejected for all pairs of markets even though the market segmentation does not exist between the markets. The error-correction term is significant in all cases except the market pair Mawlamyine (local market) and Yangon (central market). This shows that the short-run adjustment of price changes at most market places react significantly on the deviation from the long-run equilibrium. The lack of reliable market information shows the producers' unawareness of equilibrium market price. This creates uncertainty among all participants in the market.

Third conclusion is that the selected rice markets in this study reflect a working arbitrage system. Lack of adequate transportation and communication infrastructure between local and central markets distort the price adjustment in the short-run. Moreover, the performance of market intermediaries and their supporting services affect the price signal transmission in domestic rice market. But, several markets show a significant time lag. The scope of improvement in market performance is ample. However, privatization process in this market will face major challenges unless this situation is corrected.

The method used in this study demonstrates that price integration models are useful for lawmakers in formulating policies because the indications of where there is sub-optimal competition. This result was expected and demonstrates that market intermediaries perform a

key function with their services. They directly affect the price integration of the local and urban areas. But, as in most developing countries, there are inefficiencies. This inefficiency in price information leads to price sluggishness. At present analysis, none of the markets are fully integrated.

Traditionally the analysis of market integration is often confined to studies of price integration. This is done between prices on different markets. To interpret the results of this integration correctly studies at participant and market level are necessary. Further studies in these markets will show which types of market imperfections prevail: entry or exit barriers, general lack of market information, etc.

Finally, a much more complete picture could also be obtained by using a multivariate framework which provides statistically more robust results, and analysis which makes it possible to distinguish the different types of common trends and periodicities in the data.

7.2 POLICY IMPLICATION

7.2.1 Requirements for the improvements in rice production and marketing efficiency

In general, a favorable environment by removing major obstacles for the development of an efficient and effective marketing system has created the process of competition and institutional development in the market. An Agrarian reform should be enacted by amending the existing law and by relaxing some regulations. A further liberalization of the land law allowing longer term user rights, and removal of the difficulties related to transfer of land use rights and the acquisition of land titles would encourage further investment in land improvement and agricultural activities that would lead to higher labor productivity.

When technologies are transferred to the farmers, priorities should be focused on improving rice seed and varieties, technology of row seeding, the IPM program, post harvest technologies like drying and milling. Research activities and seed supply network should be reinforced, through those channels high-quality varieties have been disseminated to farmers. The current extension organization also plays a very important role in disseminating the modern technology and new varieties to the farm households. The extension services organization should be improved. Training programs should be specific, easy to understand and applicable, with measurable results and lessons learned.

The current credit system should be modified to create favorable conditions to access cheap credit for farmers, specifically for small farmers. Credit procedures should be

improved and simplified to cut off required documents and policies should be made to allow the increase in types of medium and long-term credit. Developing the rural infrastructure is considered an important macro policy. Upgrading road and irrigation systems will help farmers reduce rice production costs while at the same time increase yields. Improvement of processing and storage facilities should also be placed under immediate attention.

Moreover the growth of agriculture has mostly been the result of the remarkable success in increasing production of rice but in the long term, the demand for rice, and real price of rice may have a trend of decline. At the same time export growth will be constrained by slow growth in world trade and a decline in world rice price, and then consequently land productivity will decrease if farmers still continue rice production. Therefore, for long run development, the rural area will benefit the most if there is a gradual change from rice into higher demand goods. With the current change in the demand of world market and growth of world income, together with the reduction of barriers through WTO or other regional agreement such as ASEAN and AFTA, opportunities for Myanmar to produce higher value-added commodities other than rice will be created.

The Ayeyarwady Delta was, is and will still play a major role in development of agriculture of Myanmar. With the great potential that has not been fully exploited yet, the delta should be paid attention on the process of development. Care must be taken in the development of the delta as it serves as a natural resource to many goods. A farming system approach for sustainable agricultural development and resource management should be adapted as a routine procedure for research and development in the future. Appropriate government policies such as land policy, financial policy, technology adoption, and rural infrastructure improvement policy, play an important role to orient development of farming in the delta toward the period of liberalization, modernization and industrialization, and could help farmers to get higher income and improve their living standard.

In recent years, agricultural prices and marketing policies have been liberalized to allow market forces to determine domestic price levels and allow private businesses to operate. This would reduce marketing costs and enable farmers to gain from the growth of external trade in agricultural commodities. In the case of the liberalized rice market, farmers adopt the most profitable combination of cropping system according to agro-climatic sustainability and market potential, the viability and sustainability of small farms and agricultural development are to be certain by implementing a wide range of technological, infrastructural and organizational measures while at the same time unprofitable farmers

would be moved away from farming into more profitable areas. However, the average farm in Myanmar is small and rural labor force is growing at such a high rate that unless there is adequate development of non-farming sectors, there is no alternative market scope for sustainable agricultural and industrial development and to absorb the shift in the factors of production. In fact, the integrated development of agricultural and non-agricultural sectors through the various factors of production (i.e. capital accumulation, technological development, labor acquisition) and policy changes would hold the key to sustainable development Myanmar's economy in the long term.

7.2.2 Requirements for the development of organizational structure

An appropriate organizational structure for the efficient delivery of inputs, technology, credit and other services to small farmers is crucial. In order to take advantage on economies of scale, specification and promote exchange of information, investment and mobilization of funds, marketing activities, infrastructure and other activities in various forms of voluntary and mandatory organization in rural areas should be encouraged. Active participation by farmers is needed in order to informal groups to market their surpluses and ensure a fair return for the risks they take with their innovations; their family labor investment and purchased inputs.

Japan domestic rice distribution system is highly protected but the market institutional development is a typical example all over the world of a well organized system. On the other hand, Myanmar rice marketing system is organized with insufficient marketing structures and government supervisory institutions. Various forms of agricultural cooperatives and unions should be supported and stimulated in order to provide better services for farmers through the exchange of ideas, technology, seminars and even supervision if necessary. The success of agricultural cooperatives in Japan should be used as the model for upgrading agricultural cooperatives in Myanmar to enter and compete aggressively world rice markets.

Nowadays, vertical trading relationships between rice collectors, millers, brokers, long-distance buyers, wholesalers, and retailers have become important. This kind of vertical trading networks will reduce marketing costs and credit constraints in the marketing systems. By establishing an ongoing relationship with the members of their business groups, traders can save costs in terms of reducing the search time when signing a contract and they also can offer credit to their members in the network (using advance or deferred payment). As a

whole, this vertical trading network will create favorable conditions for further improvements. This implies that the creation of these networks should be supported by government policy.

Financial constraints hamper procurement operations, storage activities, and investment in processing machinery. Private rice traders need access to credit and State and non-state commercial banks have to facilitate this process. They should offer better services with regard to lending money (offer flexible credit, simplify borrowing procedures) for private rice traders and exporters.

The existing wholesale grading system for rice quality still has some deficiencies. This grading system facilitates the domestic channel reflecting consumer preferences in the domestic market but does not reflect the export market which depends on the percentage of broken rice. Therefore, the organization of grading and quality control is important to facilitate both the domestic and the export channel system.

There is a need for improvement in the flow of information among the administrative regions for the quantities available for crop exporting. Also the area of distribution within the region, pricing, transportation costs, and other important variables need to be systematically recorded and stored. Nowadays, the available information is not always systematic and reliable due to the variety of sources of market information. To solve this problem a public market information center is necessary to facilitate rice traders. Related to the export activity, the office of international trade promotion is important. Since, it will support both private and state export companies to advertise their trademarks and search for new export markets in the world.

In addition, there would be a need for promotion of trade and elaboration of terms of trade through the NGOs' organizations such as Myanmar Rice Trading Leading Committee (MRTLC), Rice and Paddy Traders Association and other private organizations. Considerable efforts will also be required at the administrative regions level to ensure a more regular and timely flow of agricultural commodity market and trade related data among the regions. This would facilitate the understanding by private and public sector of the dynamics and the potential of the regional market.

Currently, the government realizes the importance of internal trade development for the complete agricultural market liberalization. However international exporting and the effects of internal market liberalization on the overall economy are not clearly expressed and understood.

As of this writing the quantity of scholarly research done on the liberalization of agricultural exports with focus on Myanmar is rather scarce. To consider a complete liberalization and the implementation of market determined policies without proper research would be inefficient. It is up to the government to facilitate the economic resources needed for researchers to come up with appropriate scenarios of policy implementation and suggested courses of action. Moreover, the authorities need to give serious consideration to the effect of their recommended liberalization proposals. Measures and recommendations made by specialized researchers or consultant groups should be taken into account to the extent that resources and capacities in the country permit.

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APPENDICES

Appendix 1: ADF Level test for Yangon Market price series

ADF Test Statistic	-0.645074	1% Critical Value*	-4.0168
		5% Critical Value	-3.4381
		10% Critical Value	-3.1430

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P1)
Method: Least Squares
Date: 11/19/04 Time: 16:49
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P1(-1)	-0.015011	0.023269	-0.645074	0.5198
D(P1(-1))	-0.291878	0.081272	-3.591365	0.0004
D(P1(-2))	-0.074238	0.080269	-0.924866	0.3564
C	134.9395	77.23854	1.747048	0.0826
@TREND(4/01/2001)	-0.652957	0.807915	-0.808200	0.4202

R-squared	0.095363	Mean dependent var	12.26380
Adjusted R-squared	0.072461	S.D. dependent var	366.5677
S.E. of regression	353.0370	Akaike info criterion	14.60122
Sum squared resid	19692351	Schwarz criterion	14.69612
Log likelihood	-1184.999	F-statistic	4.163931
Durbin-Watson stat	1.997550	Prob(F-statistic)	0.003109

Appendix 2: ADF First Difference test for Yangon Market price series

ADF Test Statistic	-8.146525	1% Critical Value*	-4.0172
		5% Critical Value	-3.4382
		10% Critical Value	-3.1431

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P1,2)
Method: Least Squares
Date: 11/19/04 Time: 18:53
Sample(adjusted): 4/29/2001 5/30/2004
Included observations: 162 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(P1(-1))	-1.373885	0.168647	-8.146525	0.0000
D(P1(-1),2)	0.070828	0.130928	0.540971	0.5893
D(P1(-2),2)	-0.009506	0.079765	-0.119181	0.9053
C	101.5682	58.87918	1.725027	0.0865
@TREND(4/01/2001)	-1.005129	0.608376	-1.652153	0.1005

R-squared	0.642749	Mean dependent var	-0.339506
Adjusted R-squared	0.633647	S.D. dependent var	585.8481
S.E. of regression	354.5968	Akaike info criterion	14.61022
Sum squared resid	19741007	Schwarz criterion	14.70551
Log likelihood	-1178.428	F-statistic	70.61677
Durbin-Watson stat	1.999445	Prob(F-statistic)	0.000000

Appendix 3: ADF Level test for Mandalay Market price series

ADF Test Statistic	-1.289507	1% Critical Value*	-4.0168
		5% Critical Value	-3.4381
		10% Critical Value	-3.1430

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P2)
Method: Least Squares
Date: 11/19/04 Time: 18:32
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P2(-1)	-0.017691	0.013719	-1.289507	0.1991
D(P2(-1))	0.414646	0.079190	5.236092	0.0000
D(P2(-2))	-0.031348	0.080503	-0.389404	0.6975
C	108.4748	59.58985	1.820357	0.0706
@TREND(4/01/2001)	0.112836	0.673560	0.167522	0.8672

R-squared	0.175858	Mean dependent var	21.80982
Adjusted R-squared	0.154994	S.D. dependent var	298.0491
S.E. of regression	273.9794	Akaike info criterion	14.09418
Sum squared resid	11860223	Schwarz criterion	14.18908
Log likelihood	-1143.675	F-statistic	8.428630
Durbin-Watson stat	2.002306	Prob(F-statistic)	0.000003

Appendix 4: ADF First Difference test for Mandalay Market price series

ADF Test Statistic	-6.788131	1% Critical Value*	-4.0172
		5% Critical Value	-3.4382
		10% Critical Value	-3.1431

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P2,2)
Method: Least Squares
Date: 11/19/04 Time: 18:51
Sample(adjusted): 4/29/2001 5/30/2004
Included observations: 162 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(P2(-1))	-0.690396	0.101706	-6.788131	0.0000
D(P2(-1),2)	0.094733	0.092414	1.025091	0.3069
D(P2(-2),2)	0.075265	0.080498	0.935001	0.3512
C	64.14261	45.60613	1.406447	0.1616
@TREND(4/01/2001)	-0.575811	0.469731	-1.225832	0.2221

R-squared	0.311603	Mean dependent var	0.209877
Adjusted R-squared	0.294065	S.D. dependent var	327.7854
S.E. of regression	275.4051	Akaike info criterion	14.10474
Sum squared resid	11908134	Schwarz criterion	14.20004
Log likelihood	-1137.484	F-statistic	17.76656
Durbin-Watson stat	2.005124	Prob(F-statistic)	0.000000

Appendix 5: ADF Level test for Pathein Market price series

ADF Test Statistic	-1.256754	1% Critical Value*	-4.0168
		5% Critical Value	-3.4381
		10% Critical Value	-3.1430

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P3)
Method: Least Squares
Date: 11/19/04 Time: 18:35
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P3(-1)	-0.024219	0.019271	-1.256754	0.2107
D(P3(-1))	-0.027645	0.079979	-0.345658	0.7301
D(P3(-2))	0.009803	0.080029	0.122490	0.9027
C	134.3741	71.65751	1.875227	0.0626
@TREND(4/01/2001)	0.015067	0.728024	0.020696	0.9835

R-squared	0.019092	Mean dependent var	19.73620
Adjusted R-squared	-0.005741	S.D. dependent var	316.8647
S.E. of regression	317.7730	Akaike info criterion	14.39075
Sum squared resid	15954788	Schwarz criterion	14.48565
Log likelihood	-1167.846	F-statistic	0.768812
Durbin-Watson stat	1.998272	Prob(F-statistic)	0.547026

Appendix 6: ADF First Difference test for Pathein Market price series

ADF Test Statistic	-8.191771	1% Critical Value*	-4.0172
		5% Critical Value	-3.4382
		10% Critical Value	-3.1431

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P3,2)
Method: Least Squares
Date: 11/19/04 Time: 18:50
Sample(adjusted): 4/29/2001 5/30/2004
Included observations: 162 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(P3(-1))	-1.159166	0.141504	-8.191771	0.0000
D(P3(-1),2)	0.116640	0.114754	1.016429	0.3110
D(P3(-2),2)	0.109490	0.079583	1.375804	0.1708
C	81.24347	52.53903	1.546345	0.1240
@TREND(4/01/2001)	-0.686289	0.540533	-1.269654	0.2061

R-squared	0.526809	Mean dependent var	0.000000
Adjusted R-squared	0.514753	S.D. dependent var	457.0953
S.E. of regression	318.4111	Akaike info criterion	14.39494
Sum squared resid	15917539	Schwarz criterion	14.49024
Log likelihood	-1160.990	F-statistic	43.69748
Durbin-Watson stat	1.990860	Prob(F-statistic)	0.000000

Appendix 7: ADF Level test for Pyay Market price series

ADF Test Statistic	-1.076533	1% Critical Value*	-4.0168
		5% Critical Value	-3.4381
		10% Critical Value	-3.1430

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P4)
Method: Least Squares
Date: 11/19/04 Time: 18:37
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P4(-1)	-0.016931	0.015728	-1.076533	0.2833
D(P4(-1))	0.261565	0.079124	3.305781	0.0012
D(P4(-2))	-0.096947	0.079667	-1.216898	0.2255
C	106.9215	58.34701	1.832510	0.0688
@TREND(4/01/2001)	-0.267745	0.557678	-0.480107	0.6318

R-squared	0.085468	Mean dependent var	12.61350
Adjusted R-squared	0.062316	S.D. dependent var	271.2542
S.E. of regression	262.6666	Akaike info criterion	14.00984
Sum squared resid	10901008	Schwarz criterion	14.10474
Log likelihood	-1136.802	F-statistic	3.691506
Durbin-Watson stat	2.020352	Prob(F-statistic)	0.006670

Appendix 8: ADF First Difference test for Pyay Market price series

ADF Test Statistic	-8.130363	1% Critical Value*	-4.0172
		5% Critical Value	-3.4382
		10% Critical Value	-3.1431

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P4,2)
Method: Least Squares
Date: 11/19/04 Time: 18:47
Sample(adjusted): 4/29/2001 5/30/2004
Included observations: 162 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(P4(-1))	-0.967658	0.119018	-8.130363	0.0000
D(P4(-1),2)	0.207279	0.098379	2.106952	0.0367
D(P4(-2),2)	0.128474	0.079136	1.623460	0.1065
C	70.92890	43.49543	1.630721	0.1050
@TREND(4/01/2001)	-0.701480	0.449426	-1.560834	0.1206

R-squared	0.403337	Mean dependent var	-0.666667
Adjusted R-squared	0.388135	S.D. dependent var	335.2029
S.E. of regression	262.2016	Akaike info criterion	14.00648
Sum squared resid	10793700	Schwarz criterion	14.10178
Log likelihood	-1129.525	F-statistic	26.53254
Durbin-Watson stat	1.978747	Prob(F-statistic)	0.000000

Appendix 9: ADF Level test for Mawlamyine Market price series

ADF Test Statistic	-1.049923	1% Critical Value*	-4.0168
		5% Critical Value	-3.4381
		10% Critical Value	-3.1430

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P5)
Method: Least Squares
Date: 11/19/04 Time: 18:39
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P5(-1)	-0.017024	0.016215	-1.049923	0.2954
D(P5(-1))	0.107158	0.079389	1.349793	0.1790
D(P5(-2))	-0.076063	0.079691	-0.954466	0.3413
C	118.5595	68.12978	1.740200	0.0838
@TREND(4/01/2001)	-0.192008	0.720383	-0.266535	0.7902

R-squared	0.031209	Mean dependent var	19.55215
Adjusted R-squared	0.006683	S.D. dependent var	335.8780
S.E. of regression	334.7538	Akaike info criterion	14.49486
Sum squared resid	17705496	Schwarz criterion	14.58976
Log likelihood	-1176.331	F-statistic	1.272483
Durbin-Watson stat	2.002049	Prob(F-statistic)	0.283097

Appendix 10: ADF First Difference test for Mawlamyine Market price series

ADF Test Statistic	-7.583160	1% Critical Value*	-4.0172
		5% Critical Value	-3.4382
		10% Critical Value	-3.1431

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P5,2)
Method: Least Squares
Date: 11/19/04 Time: 18:46
Sample(adjusted): 4/29/2001 5/30/2004
Included observations: 162 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(P5(-1))	-1.009665	0.133146	-7.583160	0.0000
D(P5(-1),2)	0.105545	0.107187	0.984683	0.3263
D(P5(-2),2)	0.019906	0.079759	0.249579	0.8032
C	77.19215	55.57816	1.388894	0.1668
@TREND(4/01/2001)	-0.683627	0.573055	-1.192953	0.2347

R-squared	0.459515	Mean dependent var	-0.259259
Adjusted R-squared	0.445745	S.D. dependent var	452.5518
S.E. of regression	336.9172	Akaike info criterion	14.50793
Sum squared resid	17821575	Schwarz criterion	14.60323
Log likelihood	-1170.142	F-statistic	33.36996
Durbin-Watson stat	2.000595	Prob(F-statistic)	0.000000

Appendix 11: ADF Level test for Taunggyi Market price series

ADF Test Statistic	-0.818429	1% Critical Value*	-4.0168
		5% Critical Value	-3.4381
		10% Critical Value	-3.1430

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P6)
Method: Least Squares
Date: 11/19/04 Time: 18:41
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P6(-1)	-0.016909	0.020660	-0.818429	0.4143
D(P6(-1))	-0.272956	0.080805	-3.377968	0.0009
D(P6(-2))	-0.025905	0.080119	-0.323332	0.7469
C	150.2353	82.35236	1.824299	0.0700
@TREND(4/01/2001)	-0.445081	0.785468	-0.566644	0.5718

R-squared	0.089080	Mean dependent var	18.50920
Adjusted R-squared	0.066018	S.D. dependent var	345.1216
S.E. of regression	333.5349	Akaike info criterion	14.48757
Sum squared resid	17576793	Schwarz criterion	14.58247
Log likelihood	-1175.737	F-statistic	3.862735
Durbin-Watson stat	1.992176	Prob(F-statistic)	0.005059

Appendix 12: ADF First Difference test for Taunggyi Market price series

ADF Test Statistic	-7.537028	1% Critical Value*	-4.0172
		5% Critical Value	-3.4382
		10% Critical Value	-3.1431

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(P6,2)
Method: Least Squares
Date: 11/19/04 Time: 18:44
Sample(adjusted): 4/29/2001 5/30/2004
Included observations: 162 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(P6(-1))	-1.242799	0.164892	-7.537028	0.0000
D(P6(-1),2)	-0.039686	0.129624	-0.306161	0.7599
D(P6(-2),2)	-0.057338	0.079708	-0.719344	0.4730
C	88.64484	55.65747	1.592686	0.1132
@TREND(4/01/2001)	-0.798121	0.572462	-1.394190	0.1652

R-squared	0.639820	Mean dependent var	-1.851852
Adjusted R-squared	0.630643	S.D. dependent var	550.1485
S.E. of regression	334.3512	Akaike info criterion	14.49264
Sum squared resid	17551140	Schwarz criterion	14.58793
Log likelihood	-1168.904	F-statistic	69.72331
Durbin-Watson stat	2.003736	Prob(F-statistic)	0.000000

Appendix 13: ADL test for P2 and P1 with lag 8

Dependent Variable: D(P2)
Method: Least Squares
Date: 11/18/04 Time: 18:44
Sample(adjusted): 5/27/2001 5/30/2004
Included observations: 158 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	54.19685	58.64255	0.924190	0.3570
D(P2(-1))	0.236709	0.082955	2.853449	0.0050
D(P2(-2))	-0.198022	0.087802	-2.255311	0.0257
D(P2(-3))	-0.185285	0.090604	-2.044988	0.0428
D(P2(-4))	-0.255864	0.092987	-2.751617	0.0067
D(P2(-5))	-0.163143	0.097177	-1.678835	0.0954
D(P2(-6))	-0.220619	0.098197	-2.246695	0.0262
D(P2(-7))	-0.251984	0.090240	-2.792395	0.0060
P2(-8)	-0.176356	0.067209	-2.623994	0.0097
D(P1)	0.213996	0.060968	3.509984	0.0006
D(P1(-1))	0.215927	0.067473	3.200189	0.0017
D(P1(-2))	0.372041	0.071692	5.189470	0.0000
D(P1(-3))	0.235543	0.079489	2.963224	0.0036
D(P1(-4))	0.199944	0.083629	2.390848	0.0182
D(P1(-5))	0.233127	0.085452	2.728175	0.0072
D(P1(-6))	0.291110	0.088843	3.276682	0.0013
D(P1(-7))	0.418102	0.092102	4.539555	0.0000
P1(-8)	0.217193	0.088658	2.449781	0.0155
P7	-60.71049	53.15910	-1.142053	0.2554
@TREND	1.126517	0.754346	1.493370	0.1376

R-squared	0.420570	Mean dependent var	19.05063
Adjusted R-squared	0.340793	S.D. dependent var	301.5033
S.E. of regression	244.7952	Akaike info criterion	13.95654
Sum squared resid	8269604.	Schwarz criterion	14.34421
Log likelihood	-1082.567	F-statistic	5.271846
Durbin-Watson stat	2.065460	Prob(F-statistic)	0.000000

Appendix 14: ADL test for P3 and P1 with lag 3

Dependent Variable: D(P3)
Method: Least Squares
Date: 11/14/04 Time: 10:38
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	136.7768	65.20976	2.097490	0.0376
D(P3(-1))	-0.161937	0.076405	-2.119450	0.0357
D(P3(-2))	-0.162615	0.078737	-2.065306	0.0406
P3(-3)	-0.152010	0.068917	-2.205702	0.0289
D(P1)	0.214120	0.071315	3.002460	0.0031
D(P1(-1))	0.267828	0.080953	3.308436	0.0012
D(P1(-2))	0.492996	0.085684	5.753679	0.0000
P1(-3)	0.127342	0.074641	1.706056	0.0900
P7	-53.64195	56.64796	-0.946935	0.3452
@TREND	0.904910	0.664819	1.361137	0.1755

R-squared	0.248700	Mean dependent var	19.73620
Adjusted R-squared	0.204506	S.D. dependent var	316.8647
S.E. of regression	282.6131	Akaike info criterion	14.18542
Sum squared resid	12220131	Schwarz criterion	14.37522
Log likelihood	-1146.112	F-statistic	5.627460
Durbin-Watson stat	1.900263	Prob(F-statistic)	0.000001

Appendix 15: ADL test for P4 and P1 with lag 2

Dependent Variable: D(P4)
Method: Least Squares
Date: 11/14/04 Time: 10:48
Sample(adjusted): 4/15/2001 5/30/2004
Included observations: 164 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	114.9566	57.07856	2.014006	0.0457
D(P4(-1))	0.144524	0.076824	1.881238	0.0618
P4(-2)	-0.199322	0.055772	-3.573881	0.0005
D(P1)	0.111955	0.064368	1.739294	0.0840
D(P1(-1))	0.262799	0.072395	3.630054	0.0004
P1(-2)	0.199189	0.060999	3.265459	0.0013
P7	-119.4748	52.49911	-2.275750	0.0242
@TREND	-0.633395	0.580412	-1.091287	0.2768

R-squared	0.166359	Mean dependent var	12.23171
Adjusted R-squared	0.128952	S.D. dependent var	270.4650
S.E. of regression	252.4248	Akaike info criterion	13.94765
Sum squared resid	9940055.	Schwarz criterion	14.09887
Log likelihood	-1135.708	F-statistic	4.447280
Durbin-Watson stat	1.991086	Prob(F-statistic)	0.000155

Appendix 16: ADL test for P5 and P1 with lag 3

Dependent Variable: D(P5)
Method: Least Squares
Date: 11/20/04 Time: 13:48
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	96.46830	71.56145	1.348049	0.1796
D(P5(-1))	0.103532	0.083175	1.244747	0.2151
D(P5(-2))	-0.108790	0.082095	-1.325184	0.1871
P5(-3)	-0.055498	0.042737	-1.298591	0.1960
D(P1)	0.279429	0.076872	3.634996	0.0004
D(P1(-1))	-0.093135	0.087081	-1.069530	0.2865
D(P1(-2))	0.096692	0.087137	1.109657	0.2689
P1(-3)	0.050894	0.057771	0.880957	0.3797
P7	-68.66944	65.94701	-1.041282	0.2994
@TREND	-0.082517	0.722073	-0.114278	0.9092

R-squared	0.174128	Mean dependent var	19.55215
Adjusted R-squared	0.125547	S.D. dependent var	335.8780
S.E. of regression	314.0869	Akaike info criterion	14.39660
Sum squared resid	15093542	Schwarz criterion	14.58640
Log likelihood	-1163.323	F-statistic	3.584291
Durbin-Watson stat	1.979625	Prob(F-statistic)	0.000452

Appendix 17: ADL test for P6 and P1 with lag 2

Dependent Variable: D(P6)
Method: Least Squares
Date: 11/14/04 Time: 10:24
Sample(adjusted): 4/15/2001 5/30/2004
Included observations: 164 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	189.0248	86.31987	2.189818	0.0300
D(P6(-1))	-0.346714	0.078979	-4.389965	0.0000
P6(-2)	-0.114114	0.057791	-1.974595	0.0501
D(P1)	0.206822	0.078100	2.648186	0.0089
D(P1(-1))	0.195499	0.084139	2.323513	0.0214
P1(-2)	0.103570	0.061066	1.696036	0.0919
P7	-41.94006	66.31435	-0.632443	0.5280
@TREND	0.027957	0.766682	0.036465	0.9710

R-squared	0.141895	Mean dependent var	18.39634
Adjusted R-squared	0.103391	S.D. dependent var	344.0643
S.E. of regression	325.7926	Akaike info criterion	14.45795
Sum squared resid	16557971	Schwarz criterion	14.60916
Log likelihood	-1177.552	F-statistic	3.685144
Durbin-Watson stat	2.009504	Prob(F-statistic)	0.001030

Appendix 18: ECM test for P2 and P1 with lag 8

Dependent Variable: D(P2)
Method: Least Squares
Date: 11/20/04 Time: 14:05
Sample(adjusted): 5/27/2001 5/30/2004
Included observations: 158 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	91.89936	53.47568	1.718526	0.0879
P2(-8)-P1(-8)	-0.100863	0.045879	-2.198469	0.0296
D(P2(-1))	0.264898	0.081275	3.259259	0.0014
D(P2(-2))	-0.168076	0.086008	-1.954193	0.0527
D(P2(-3))	-0.156721	0.089089	-1.759148	0.0808
D(P2(-4))	-0.219215	0.090285	-2.428044	0.0165
D(P2(-5))	-0.116664	0.092756	-1.257758	0.2106
D(P2(-6))	-0.160645	0.090476	-1.775550	0.0780
D(P2(-7))	-0.197825	0.083414	-2.371607	0.0191
D(P1)	0.196686	0.060199	3.267285	0.0014
D(P1(-1))	0.187852	0.065245	2.879158	0.0046
D(P1(-2))	0.334871	0.067779	4.940634	0.0000
D(P1(-3))	0.187591	0.073408	2.555470	0.0117
D(P1(-4))	0.141949	0.074913	1.894836	0.0602
D(P1(-5))	0.171180	0.075624	2.263575	0.0251
D(P1(-6))	0.218048	0.075293	2.895974	0.0044
D(P1(-7))	0.332246	0.073406	4.526165	0.0000
P7	-54.98758	53.28303	-1.031990	0.3039
@TREND	1.198082	0.756524	1.583666	0.1155

R-squared	0.410732	Mean dependent var	19.05063
Adjusted R-squared	0.334424	S.D. dependent var	301.5033
S.E. of regression	245.9750	Akaike info criterion	13.96072
Sum squared resid	8410014.	Schwarz criterion	14.32901
Log likelihood	-1083.897	F-statistic	5.382546
Durbin-Watson stat	2.085055	Prob(F-statistic)	0.000000

Appendix 19: ECM test for P3 and P1 with lag 3

Dependent Variable: D(P3)
Method: Least Squares
Date: 11/14/04 Time: 13:53
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	87.41643	53.03466	1.648289	0.1013
P3(-3)-P1(-3)	-0.167625	0.068004	-2.464938	0.0148
D(P3(-1))	-0.164294	0.076551	-2.146191	0.0334
D(P3(-2))	-0.166393	0.078856	-2.110094	0.0365
D(P1)	0.221869	0.071220	3.115261	0.0022
D(P1(-1))	0.281237	0.080465	3.495137	0.0006
D(P1(-2))	0.514089	0.084307	6.097797	0.0000
P7	-61.99542	56.40348	-1.099142	0.2734
@TREND	0.381033	0.528826	0.720526	0.4723

R-squared	0.240461	Mean dependent var	19.73620
Adjusted R-squared	0.201004	S.D. dependent var	316.8647
S.E. of regression	283.2345	Akaike info criterion	14.18406
Sum squared resid	12354156	Schwarz criterion	14.35488
Log likelihood	-1147.001	F-statistic	6.094307
Durbin-Watson stat	1.882129	Prob(F-statistic)	0.000001

Appendix 20: ECM test for P4 and P1 with lag 2

Dependent Variable: D(P4)
Method: Least Squares
Date: 06/05/05 Time: 17:45
Sample(adjusted): 4/15/2001 5/30/2004
Included observations: 164 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	114.6803	45.23558	2.535180	0.0122
P4(-2)-P1(-2)	-0.199401	0.054712	-3.644541	0.0004
D(P4(-1))	0.144507	0.076550	1.887740	0.0609
D(P1)	0.112014	0.063739	1.757373	0.0808
D(P1(-1))	0.262911	0.070779	3.714516	0.0003
P7	-119.5259	51.94093	-2.301190	0.0227
@TREND	-0.636524	0.426526	-1.492345	0.1376

R-squared	0.166359	Mean dependent var	12.23171
Adjusted R-squared	0.134500	S.D. dependent var	270.4650
S.E. of regression	251.6197	Akaike info criterion	13.93546
Sum squared resid	9940059.	Schwarz criterion	14.06777
Log likelihood	-1135.708	F-statistic	5.221740
Durbin-Watson stat	1.991043	Prob(F-statistic)	0.000063

Appendix 21: ECM test for P5 and P1 with lag 3

Dependent Variable: D(P5)
Method: Least Squares
Date: 11/20/04 Time: 14:31
Sample(adjusted): 4/22/2001 5/30/2004
Included observations: 163 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	87.62967	55.11454	1.589956	0.1139
P5(-3)-P1(-3)	-0.059406	0.037604	-1.579802	0.1162
D(P5(-1))	0.102720	0.082810	1.240424	0.2167
D(P5(-2))	-0.109029	0.081829	-1.332408	0.1847
D(P1)	0.281375	0.075979	3.703302	0.0003
D(P1(-1))	-0.089876	0.085187	-1.055053	0.2931
D(P1(-2))	0.101286	0.083613	1.211372	0.2276
P7	-71.83851	63.70330	-1.127705	0.2612
@TREND	-0.167602	0.572735	-0.292634	0.7702

R-squared	0.173923	Mean dependent var	19.55215
Adjusted R-squared	0.131010	S.D. dependent var	335.8780
S.E. of regression	313.1042	Akaike info criterion	14.38458
Sum squared resid	15097275	Schwarz criterion	14.55540
Log likelihood	-1163.343	F-statistic	4.052919
Durbin-Watson stat	1.977610	Prob(F-statistic)	0.000213

Appendix 22: ECM test for P6 and P1 with lag 2

Dependent Variable: D(P6)
Method: Least Squares
Date: 11/20/04 Time: 14:41
Sample(adjusted): 4/15/2001 5/30/2004
Included observations: 164 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	164.8107	71.04311	2.319869	0.0216
P6(-2)-P1(-2)	-0.113390	0.057634	-1.967424	0.0509
D(P6(-1))	-0.345991	0.078776	-4.392103	0.0000
D(P1)	0.208287	0.077856	2.675268	0.0083
D(P1(-1))	0.199119	0.083621	2.381203	0.0185
P7	-43.58392	66.07245	-0.659638	0.5105
@TREND	-0.215960	0.587085	-0.367852	0.7135

R-squared	0.140540	Mean dependent var	18.39634
Adjusted R-squared	0.107694	S.D. dependent var	344.0643
S.E. of regression	325.0098	Akaike info criterion	14.44733
Sum squared resid	16584123	Schwarz criterion	14.57964
Log likelihood	-1177.681	F-statistic	4.278808
Durbin-Watson stat	2.008256	Prob(F-statistic)	0.000506