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THESIS

A STUDY ON SESAME PRICE TRANSMISSION IN MYANMAR

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A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
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The purpose of this research was to analyze current sesame market performances and price transmission between domestic and export markets and itself. The primary data were collected from own survey in 2008 and secondary data were collected from CSO and DAP. Respondents were randomly and accidently selected. Marketing channels in each Township were classified and marketing costs and margins were calculated. Cointegration analysis with Engle and Granger's and Johansen's cointegration methods, Error Correction Model and Granger Causality tests were employed to estimate price transmission. Mandalay farmers got the highest gross margins for both white and black sesame. Farmers received the highest gross margins for white sesame to China. All exporters received the highest gross margins for black sesame to Japan. Wholesalers received the highest share to export price in both channels. Wholesalers' margins depend on storage time and price.

Mandalay market was integrated with Monywa(white sesame) and Pakokku(black sesame) markets. Mandalay market was central market and the first price setter for domestic markets and did not show any response to long run equilibrium. Increase in white sesame price in Monywa market and black sesame in Pakokku market could correct deviation from long run equilibrium with respect to Mandalay market. All domestic markets were integrated with export market because exporters used domestic wholesale price as cost of sesame seed to set export price. The speed of adjustment for export price to correct deviation from long run equilibrium was faster than that of all domestic prices. Long run equilibrium could be obtained by increasing export price and decreasing domestic wholesale price of white sesame in Monywa and black sesame in Pakuokku market. For white sesame, Monywa price caused Mandalay price. For black sesame, Mandalay price caused Pakokku price. All domestic prices caused export price. All surplus sesame oil markets were integrated each other and Mandalay markets did not response to long equilibrium. Surplus and deficit sesame oil markets were also integrated and showed significant responses to long run equilibriums. Because, domestic sesame oil market was competitive and there was no intervention for sesame oil markets. The price transmissions of sesame oil were quite fast and completed during two months. Based on this finding, transportation, irrigation systems, more inputs should be provided for sesame farmers to reduce production costs and to increase yields. Improvement of processing technologies, supply of electricity and storage facilities should also be put under immediate attention. To achieve sufficient domestic supply, increase export volume and to achieve full price transmission in short run, government should review policy on liberalization quality driven sesame seed exports. Marketing analysis of farmers and wholesalers should be implied the regions which are not near major markets. Further research should concern with India, China and regional economic integrations play the important role in sesame world market. Detail marketing costs and margins of millers should also be analyzed and identify how to promote the efficiency and quality of processing of sesame oil.

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Student's signature Thesis Advisor's signature

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LIST OF ABBREVIATIONS

ac	=	Acre
ADF	=	Augmented Dickey Fuller
AIC	=	Akaike Information Criteria
CEXC	=	Crop Exchange Centre
CSO	=	Central Statistical Organization
DAP	=	Department of Agricultural Planning
ECM	=	Error Correction Model
E- trade	=	Electronic Trade
FPE	=	Final Prediction Error
ha	=	hectare
HQ	=	Hannan-Quinn
kg	=	Kilogram
km	=	Kilometer
LM	=	Lagrange Multiplier test
LR	=	Maximum Likelihood Ratio
MADB	=	Myanmar Agricultural Development Bank
MAS	=	Myanmar Agricultural Service
MIS	=	Market Information Service
ml		milliliter
mm/yr	=	Millimeter per year
MOAI	=	Ministry of Agriculture and Irrigation
SIC	=	Schwartz Information Criterion (SIC)
SMS	=	Short Message Service
SPDC	=	State Peace and Development Council
USD	=	United State Dollar

CHAPTER I

INTRODUCTION

This chapter includes the overview of sesame, the role of agriculture in Myanmar, problem statement, hypothesis and objectives of the study, research questions and expected outputs.

Overview of Sesame and Role of Agriculture in Myanmar

1. Background of sesame

Sesame (*Sesamum indicum* L.) is one of the oldest cultivated plants in the world. The species has a long history of cultivation, mostly for its yield of oil. The original area of domestication of sesame is obscured but it seems likely to have first been brought into cultivation in Asia or India. Sesame is now cultivated around the dry tropics between the latitudes of 40° N and S. It was scarcely cultivated in the USA or Europe, not only because of climate but also because of the low returns per unit area (USAID, 2002). About 65 percent of sesame crop production was processed into oil while 35 percent was used as food consumption. Sesame assumed commercial importance as staple food of mankind.

The seeds come in several colors like red, white, black, yellow, depending upon the variety of the seeds. Its seed can be consumed raw; or in roasted or crushed form; or incorporated with other eatables while its extracted oil is utilized as sesame oil, for cooking as well as salad dressing purpose (Nyein Set Lin, 2005). In addition, sesame oil was used for the production of margarine, soaps, pharmaceuticals, paints and lubricants (The Financial Express, 2009). Sesame is a rich source of oil and primary use of sesame is cooking oil in Asia which is the largest consumption of sesame over the world. The oil contents of the sesame seed ranged from 43.4 to 58.8 percent and varied inversely with the percentage of hull. The percentage of natural

antioxidants sesamin in the oil ranged from 0.07 to 0.61percent and that of sesamolin from 0.02 to 0.48percent (Tashiro *et al*., 1991). Therefore the sesame oil has excellent stability due to presence of such as sesamolin, sesamin and sesamol. Dry sesame seed contains 4.5percent to 6.5percent of moisture, 19 percent to 26 percent of protein, 5 to 8 percent of Ash, 1 percent of Calcium and 0.7 percent of Phosphorus. The amount of nutrients depended on variety, climate and land type (Nyein Set Lin, 2005). After oil extraction, the remaining meal contains 35 to 50 percent protein, and is rich in tryptophan and methionine.

Total global production of sesame seed was 3.4 million ton in 2007. World sesame production by major producing countries was presented in Figure 1. India was the largest producer (0.764 million ton) followed by Myanmar (0.59 million ton) and China (0.56 million ton) respectively. Global sesame export was 1.03 million ton in 2007 and accounted for 30 percent of world production.

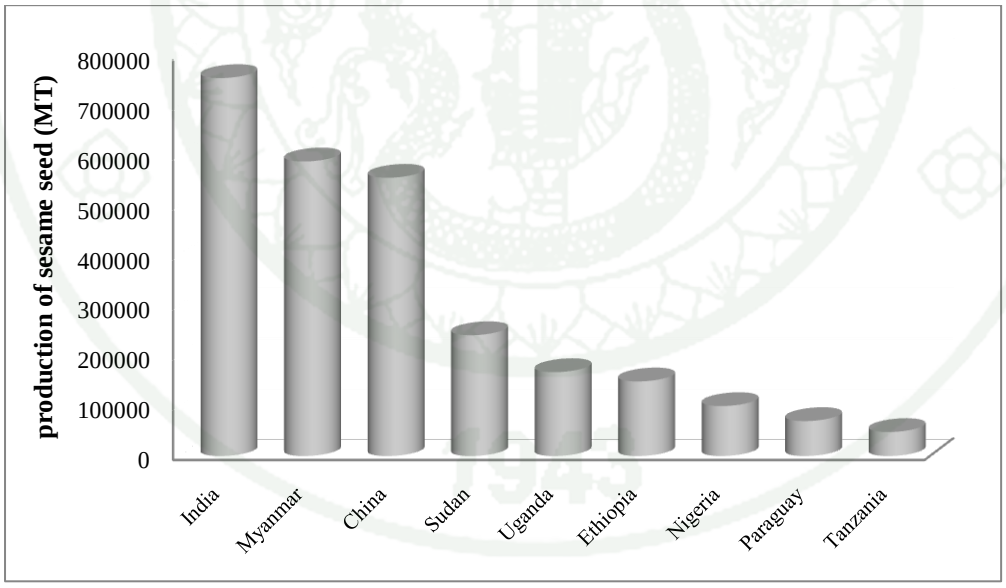

Figure 1 World productions of sesame seed in 2007
Source: FAOSTAT (2009)

Figure 2 depicted the major exporters and importers of sesame in 2007. In 2005, the first number in sesame trading value was Ethiopia with 35 percent of world sesame trading value followed with India, Sudan, Nigeria and China. In 2007, India

became the largest exporter with 30 percent of world export followed by Ethiopia (14 percent), Sudan (10 percent), Nigeria (8 percent), Myanmar (6 percent) and China (4 percent) respectively.

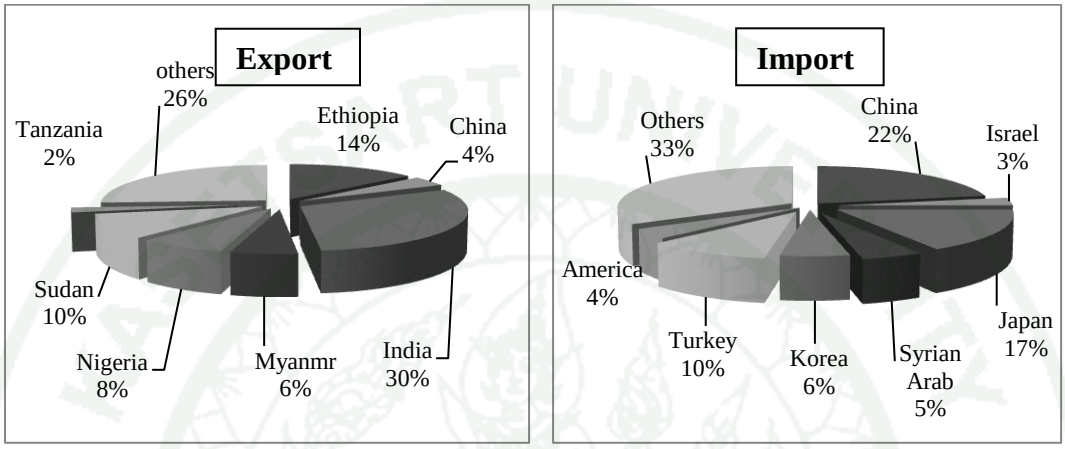

Figure 2 World major sesame exporting and importing countries in 2007
Source: FAOSTAT (2009)

Myanmar had become fifth largest sesame exporter in 2007. At the turn of this century Myanmar's sesame crop under cultivation stood at 18 percent and its production at 12.5 percent of the total global area under sesame (Nyein Set Lin, 2005). In 2007, global import (1 million ton) was accounted for 30 percent of total world production. About 22 percent of global import came from People's Republic of China, 17 percent was from Japan followed by South Korea and Turkey. China was the largest importer of the sesame seed (0.22 million ton) and Japan was the second largest importer (0.17 million ton) in 2005 (FAOSTAT, 2009). According to latest information, sesame seed exports from India was estimated to surge over 0.3 million tons in 2008-09 on accounted of lower production in Sudan and Ethiopia (Business Standard, 2009). The total global production of sesame seed sums up into around 3 million tons annually. The world production of sesame was dominated by a few countries that lie in the African and Asian continents. China produced the maximum out of them all sharing approximately 25 percent share of the world's total production in 2009. Other producers included Nigeria, Pakistan, Ethiopia, Bangladesh, Central

African Republic, Thailand, Tanzania, Egypt, Guatemala, Chad, Paraguay, Iran, Senegal, Turkey and Mexico (The Financial Express, 2009).

2. Role of agriculture in Myanmar

Myanmar is the second largest country in South East Asia and is covered by total land area of 676, 577 square kilometer, stretching for 2,276 kilometer along the sea coasts of Bay of Bengal (MOAI, 2009). The country has borders with Bangladesh, India, People's Republic of China (PRC), the Lao People's Democratic and Thailand. The western, northern and eastern parts of the country are hilly regions with altitude varying from 915 to 2,134 meters above the sea level (MOAI, 1998). Myanmar possesses tropical and sub-tropical climates with three general seasons, (i) the raining season from middle of May to middle of October, (ii) the dry cold season from middle of October to middle of February and (iii) the hot season from middle of February to middle of May. The average annual rainfall varies over the country, ranging from 2,480 mm to 5,690 mm in the coastal and hilly regions and 657 mm to 1,220 mm in the central core of Myanmar. The temperature in the southern part of the country differs only a little during the different seasons. In the central plain of the country seasonal variation of the temperature lies in the magnitude of 34.1^{o}- 40.2^{o} C in hot season and 10^{o} to 13.2^{o} C in cold season. It is considerably cooler in hilly regions where the average daily maximum temperature is 29.2^{o} C and the minimum 7.9^{o} C (CSO, 2001).

Myanmar is endowed with natural resources such as arable land, forestry, minerals (including gas and oil) and fresh water and marine resources. As Myanmar has a wide range of climatic conditions due to geographical positions, over 60 different crop species can be grown of which 22 crops are economically important. Population in 2007/08 was 57.5 million with growth rate of 1.75 percent (MOAI, 2009). As being traditionally agricultural country, agriculture sector is the backbone of Myanmar's economy and accounted for 36 percent of GDP, 13.3 percent of total export earnings and 61.2 percent of labor force in 2007-2008 (MOAI, 2009). The

Gross Domestic Products (GDP) of Myanmar in 2007-2008 was presented in Figure 3.

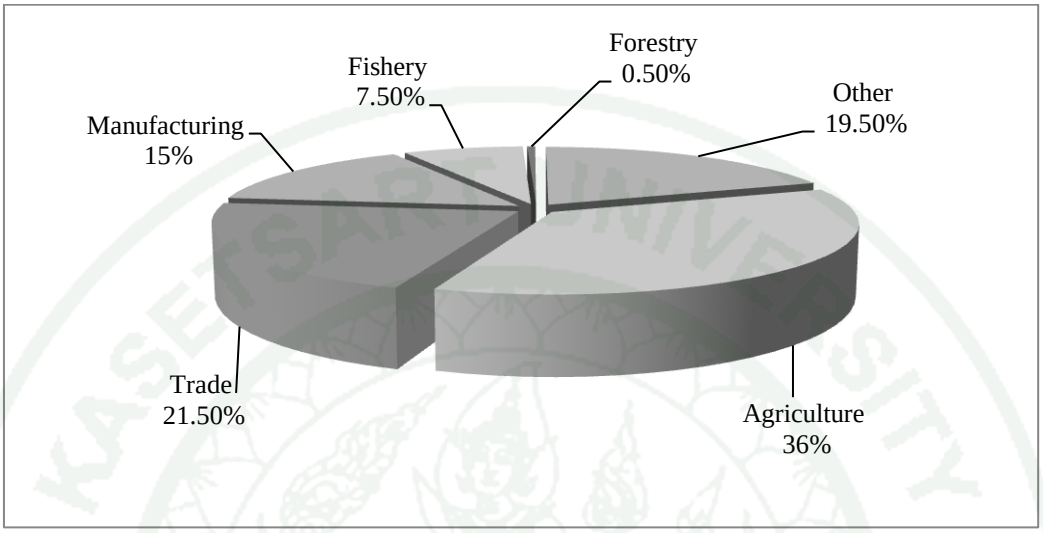

Figure 3 Gross Domestic Products (GDP) in 2007-2008
Source**:** MOAI (2009)

Main objectives of agriculture sector are to fulfill of domestic consumption, to export of agricultural products surpluses and to give assistance to rural development through agricultural development. Myanmar had shifted its economy from a planned economy to a market-oriented economic system since 1988. Government's open door policy had normalization of border trades with People's Republic of China, Thailand, India and Bangladesh. It enhanced the participating of the private sector in agricultural trade with bordering countries. Export values of principal commodities were shown in Table1. Agricultural export value in 1989/90 registered about 51 percent of total export (DAP, 2007) and it fell down to 13.3 percent of total export in 2007/08. Agricultural products such as, pulses (Beans and Peas), rice, corn, sesame, rubber plays a vital role in export (Table 2). Pulses were the largest export share of the country and sesame seed was the fourth largest export share (39.4 thousand ton) in 2006/07. Sesame is only one oilseed crop allow to export and is also one of the major oilseed crops in Myanmar as a source of edible oil.

Table 1 Export values of principal commodities (Million Kyats)

Particular	1989/90[1]	1995/96	1999/00	2001/02	2003/04	2004/05	2005/06	2006/07
Agricultural Export	1,452	3,863	3,395	5,802	5,393	5,167	6,174	8,399
1. Crop	426	2,223	1,574	2,955	2,296	1,786	2,520	3,974
2. Live stock & Fishery Product	132	568	801	861	963	1,046	1,029	1,355
3. Timber	894	1,072	1,020	1,986	2,134	2,335	2,625	3,070
Other Product	1,382	1,181	5,552	11,329	8,727	11,530	14,473	21,627
Total Export	2,384	5,044	8,947	17,131	14,119	16,697	20,647	30,026
Percentage of total export	51.2	76.6	37.9	33.9	38.2	31	29.9	28.0

Source**:** DAP (2007)

Table 2 Export of principal agricultural commodities (Thousand ton)

Items	1989/90 [1]	1995/96	1999/00	2001/02	2003/04	2005/06	2006/07
Rice	168.50	354.00	54.90	939.20	168.40	180.00	14.50
Maize	13.90	62.00	88.80	90.10	150.90	90.00	183.30
Black gram	26.50	185.00	235.00	320.40	457.90	379.60	487.20
Green gram	14.50	185.90	144.60	207.30	233.00	174.10	248.50
Other pulses	15.10	238.70	187.60	507.00	519.60	323.80	419.80
Sesame seed	0.10	50.30	19.50	13.20	50.70	21.50	39.40
Niger Seeds	-	-	14.40	5.90	7.90	0.30	1.30
Onion	-	-	26.80	52.50	1.10	24.30	8.70
Tamarind	-	-	1.80	4.60	13.60	7.10	11.80
Oilcakes	28.90	31.10	11.00	0.60	-	-	-
Raw rubber	1.70	24.80	29.70	25.00	19.50	29.30	9.50
Total	269.20	1,131.80	814.10	2,165.80	1622.60	1,230.0	1,424.00

Source: DAP (2007)

[1] In Myanmar, the official fiscal year starts from the April and end on the March of next year. For example, 1989/90 means the data during the period April, 1989 to March, 1990.

3. Sesame in Myanmar

Sesame is a not only exportable agricultural crop but also one of the major oilseed crops in Myanmar. Myanmar sesame has comparative advantages in the oil crop sector for the export markets. The use of sesame in Myanmar is highly extensive and it stands for an integral part in Myanmar's daily meals and numerous varieties of chewing snacks. Sesame oil has been premium one in upper Myanmar since time immemorial. For those reasons, sesame also occupied into important role, like rice, in Myanmar's various traditional cultures and customs. Particularly, the cultivation of sesame for domestic self-sufficiency as edible oil, and a pretty high quality commodity for export has commended major attention. Sesame seed is used as a source of edible oil, traditional snack and oil cake as animal feed. Major annual oilseed crops are groundnuts, sunflower, niger, mustard, soybean and Oil palm is perennial oil seed crop in Myanmar. Oilseed crops are the second most important items after paddy in Myanmar's diet and national requirement. Total area of oilseed crop growing in Myanmar is shown in Table 3.

Table 3 Oilseed crops growing area in Myanmar (Thousand hectare)

Oilseed crops	**1995 /96** [2]	**1996 /97**	**1997 /98**	**1998 /99**	**1999 /20**	**2000 /01**	**2001 /02**	**2002 /03**	**2003 /04**	**2004 /05**	**2005 /06**	**2006 /07**	**2007 /2008**
Groundnut	513	479	450	503	567	591	569	581	655	685	731	756	815
Sesame	1,277	1,145	1,035	1,200	1,357	1,424	1,383	1,417	1,466	1,496	1,339	1,443	1,508
Sunflower	199	221	125	120	343	487	519	498	460	511	516	689	835
Mustard	18	18	20	30	41	52	55	60	64	68	66	75	92
Niger	47	47	49	57	82	91	91	60	104	112	129	121	147
Total	**2,053**	**1,911**	**1,680**	**1,909**	**2,390**	**2,646**	**2,617**	**2,616**	**2,750**	**2,871**	**2,781**	**3,084**	**3,398**

Source**:** MOAI (2009)

[2] In Myanmar, the official fiscal year starts from the April and end on the March of next year. For example, 1995/96 means the data during the period April, 1995 to March, 1996.

Among the principal oilseed crops, sesame is adaptable and feasible to different seasons and growing conditions occupies the largest growing area. Sesame had taken the largest growing area since many years ago. Sesame occupied 44 percent (1,508 thousand hectare) of all oilseed crops area and supplies 30 percent of domestic edible oil in 2006-2007 (Table 4). Major growing area of sesame is central Dry Zone Area which is composed of Mandalay, Sagaing and Magway Division. Dry zone is the central tropical region of the country and is characterized by semiarid climate with less annual rainfall about 700-900 millimeters (DAP, 2007). The usual climate in this area is adaptable for oilseed crop especially for sesame and groundnut. Sesame is short duration crops and requires less water to compare with the other crops (Favre and Kyaw Myint, 2009).

Table 4 Edible oil supply and demand balance in 2006/2007

Items	Estimated production (ton)	% of Domestic production	%of Total supply
Groundnut	95,058	33.0	15.4
Sesame	90,906	31.6	14.7
Sunflower	36,105	12.5	5.8
Niger	19,236	6.7	3.1
Mustard	12,584	4.4	2.0
Soybean	9,348	3.2	1.5
Rice Bran	1,122	0.4	0.2
Cotton Oil	20	0.0	0.0
Palm Oil production	23,751	8.2	3.8
Total Domestic Production	288,131	100.0	46.7
Total Demand	630,000		102.0
Domestic Deficit	341,869		55.4
Palm Oil Formal Import	274,440		44.4
Palm Oil Informal Import	54,888		8.9
Total Import	329,328		53.3
Total Supply	617,459		100.0

Source**:** Favre and Kyaw Myint (2009)

Central dry zone area (Mandalay, Sagaing and Magway Division) accounts for 90 percent of total sesame area (Figure 4). The crop can be grown in pre-monsoon, monsoon and cool season. Pre-monsoon sesame is the largest growing area which represented 50 percent of the total areas planted and 53 percent of production. However, the sesame is weather dependent crop and rain fall in dry zone is very variable in every year. Regarding to the cultivation of rain fed sesame, over 40 percent is subjected to damage due to variable of weather (Nyein Set Lin, 2005). Pre monsoon sesame was accounted for 50 percent of total sesame area in 2007/2008 and could not be harvest all sown area because of variable rainfall (Figure 5).

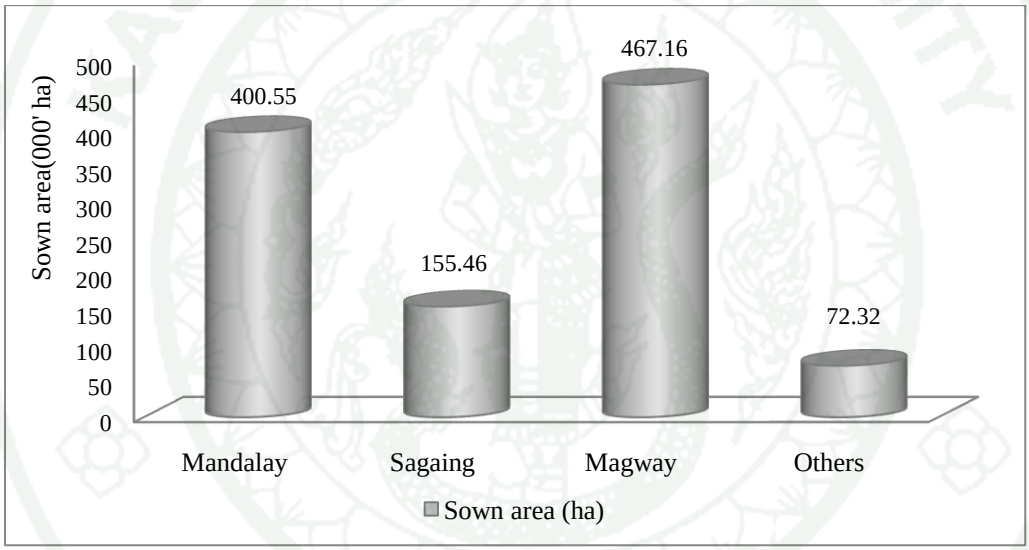

Figure 4 Premonsoon sesame growing area in Myanmar (2006 / 2007)
Source: MAS (2007)

Historical data showed that the least stable yield was found in cool season sesame. Therefore yield per unit area is also important for higher margin. Average yield of sesame in Myanmar was 373.40 kg/ha in 2007 which was lower than the world average yield, 464.6 kg/ha (FAOSTAT, 2007). In central dry zone, 62 percent of land is up land on which sesame entirely depends on monsoon rain fall, on late rain fall and residual moisture during the cool season. Farmers can get higher margins only from the irrigated sesame in low land area.

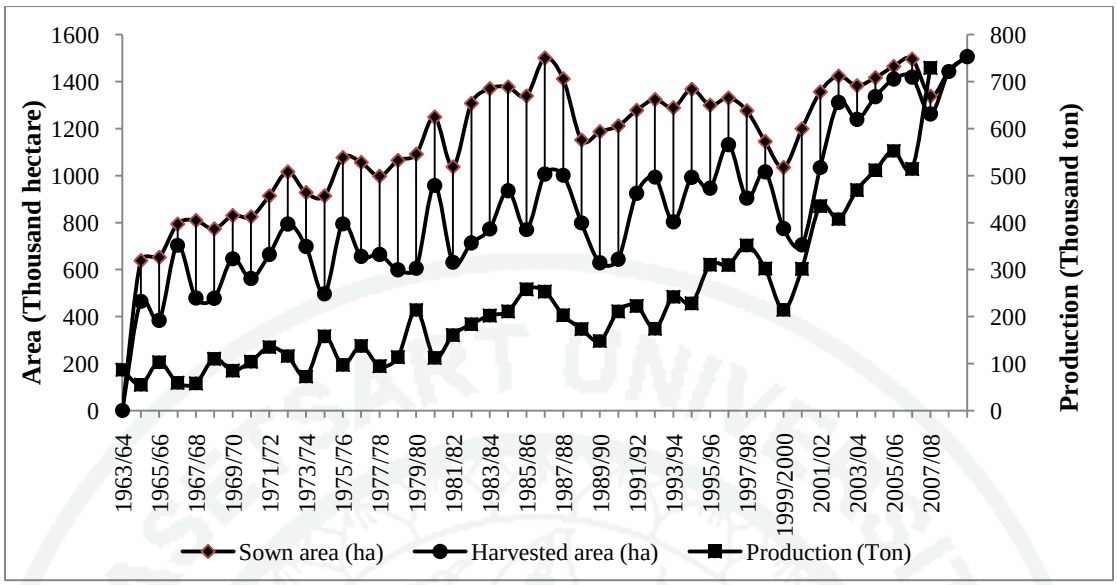

Figure 5 Sown area, harvested area and production of pre monsoon sesame (1962/63[3]-2006/07)

Source: MAS (2008)

Statement of the Problem

Myanmar is currently deficit producer of edible oil for several decades and self sufficiency of edible oil is vital problem for the country. In 2006, per capita consumption of edible oil was about 10 kg. In 2006, total domestic production of various types of edible oil was around 0.3 million ton, half of the domestic demand. The volume of imported palm oil was 0.3 million tons in 2006/07 and the government has been utilizing US$ 50-70 million per year under current policies. In order to achieve edible oil sufficiency and to save an average outflow of foreign exchange for import of the palm oil, the primary objective is to accelerate efforts the steadily increased in domestic production of oilseeds crops. The current problems in oilseed sectors are reduced household incomes, small land holding of farmers, a lack of productivity growth, reduced oil extraction level and quality, high cost of production and increased net foreign exchange cost.

[3] In Myanmar, the official fiscal year starts from the April and end on the March of next year. For example, 1962/63 means the data during the period April, 1962 to March, 1963.

Regarding to aspect of marketing, timely market intelligence is essential for both domestic and international markets. All participants in supply chain make decision based on market information such as up to date information and historical trends analysis. Private sectors information services in Myanmar are Crop Exchange Center (CEXC) and E-Trade. The primary role of CEXC is to facilitate business for its members who have applied the member fee every year. Electronic Trade (E-Trade) service was established in 2003 to provide trade and business intelligence to Myanmar traders and exporters with some charges. Government market information service (MIS) is currently implementing by Department of Agriculture Planning in the Ministry of Agriculture and Irrigation. MIS is publishing weekly prices especially for agricultural commodities in terms of Agri-Business Journal and Bulletins but it cannot get in hand to famers in time.

None of existing market information service is made available to farmers in rural area but while the traders and wholesalers are able to obtain this market information from CEXC of respective townships. At present situation, MIS is not available to broadcast market data through radio and E-Trade disseminates market information through internet and Short Message Service (SMS) by mobile phones which are expensive and not available in rural areas. Other limitations of the current market information system is that international market intelligence remains limited to few commodities such as sesame seed, sesame oil, edible/snack groundnut for which export is well established. As a result, inefficiencies of market exist by marketing policies and access to timely market information by the farmers and all participants in sesame market. These include access to international market, lack of quality standards, trade standards and measures, poor infrastructures and utilities, energy price structures, as well as macroeconomic policies related to finance and trade policies which are severely distorting the market. Another limitation for the sesame industry is different gap of official and market exchange rate (Figure 6) within the country. As shown in figure, the market exchange rate gradually increased, and moved together with CPI, the official exchange rate was still flat. This effected directly exerted to exporters and after that moved to others intermediaries in marketing channel.

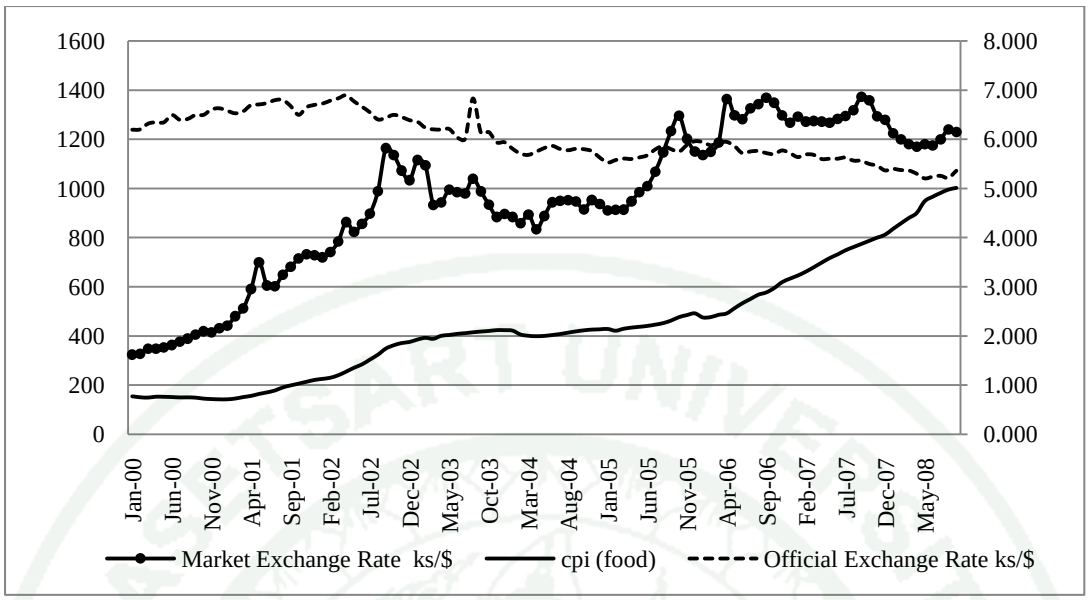

Figure 6 Official exchange rate, market exchange rate and Consumer Price Index (CIP) for food of Myanmar.

Source: CSO (2000-2008)

Myanmar is currently using the multiple exchange rate regimes it takes the form of dual foreign exchange markets that are effectively segmented for public and private sector external transactions. In the official foreign exchange market, Myanmar's currency was highly overvalued in terms of the exchange rate with the US dollar (USD), which was pegged at about 5.3 kyat per dollar in September, 2008. At the same time, the prevailing rate was 1,230 kyat per dollar in the free or open market. Faced with foreign exchange constraint, some public sector agents have procured imported goods through private imports and effectively accept the use of the market determined exchange rate. In the private sector, while private exporters are allowed to retain all export earnings, there is no legal way for private importers to acquire foreign currencies other than through their own export receipts (Hori and Wong, 2008). The parallel foreign exchange markets and rates have not only caused to distort the market and prices but also negatively affect the exports and imports of the agricultural products and farm inputs in Myanmar (Tin Soe, 2004). Unification of the multiple rates will allow Myanmar to benefit from more efficient allocation of resources (Hori and Wong, 2008). Therefore the price transmission between the

export and domestic prices is necessary to analyze the impact of the current multiple exchange rate on sesame trade. Major weakness in sesame and other oilseed crops marketing come from current policies which are affecting the competitiveness of the oil seed sub-sector. Major contributor to the decline in prices paid for oilseed has been competition from imported palm oil in the domestic markets. Given the lower cost of producing palm oil, prices for traditional oilseed crops (sesame/groundnut) have been forced down.

Myanmar sesame is great potential in the world market and has the opportunity to take the larger market share among the sesame producing countries. International price of sesame is 30 percent higher than domestic price (Favre and Kyaw Myint, 2009). It makes economic sense to import cheaper palm oil and export sesame seed instead of producing domestic sesame oil. But the producer price was weak trend since last two decades because of closed economy of country (Figure 7). The producer price increased in 2003 because of decreased domestic production of sesame as a result of flooding in 2003. Then the price fell down in 2004 because of temporary ban for sesame seed export. The slow oilseed crop price and household income have also limited the ability and willingness of farmers to adopt improved seed varieties and technology package and have been a direct cause of stagnation in domestic production level over last few decades (FAO, 2004).

In addition there is a need to explain the price relationship between the producer price and export price to improve the market efficiency and to observe how much the producer receive the share of export price. It is hard to make inference which price effect on the other without price analysis. Price mechanism of sesame in Myanmar is quite complicated under current policies. It is important to know the efficient price relationship between domestic and export market for the producers and traders to improve domestic sesame production and export.

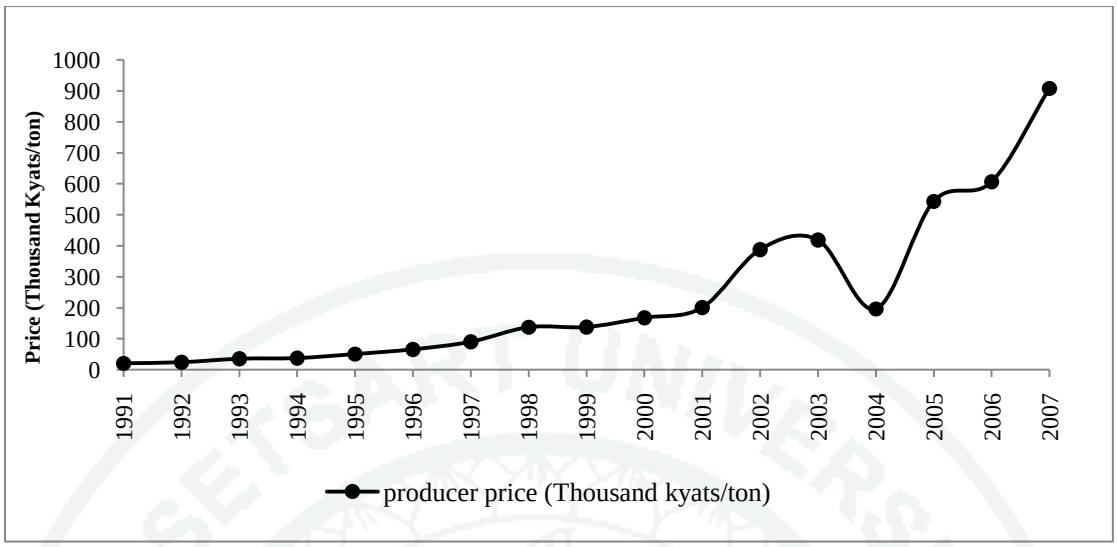

Figure 7 Producer's price of sesame in 1991-2004
Source: FAOSTAT (1991-2007)

On the other hand the restriction of sesame seed export from 1998 to 2006 by private sectors caused lower price for oilseed producers. Again, price control policy for palm oil in domestic market until 2007 has encouraged the lower price for sesame and groundnut producers. Oilseed price in Myanmar are the result of the interaction of various factors, including world prices, government's policy and the availability of substitutes (FAO, 2004). Regarding with domestic oilseed marketing, price incentive is the focal point and price uncertainty can decrease the market responses and productivity. The price is key factor to increase domestic production. The effect of low prices has been exacerbated by serious deficiencies in management, operation and funding of the agricultural research system, seed production division and extensions service.

Price stabilization is an important determinant of the long term growth of oilseed crops, edible oil supply and important element of food policy in Myanmar. As well known, sesame is one of the major oilseed crops in Myanmar and its price stabilization is also important for the growth potential for in the production of edible oils and improves the nutritional security of Myanmar households. If there is no intervention, the price can fully transmit between domestic and international market.

The concept of price transmission is closely related to market efficiency (Emerick, 1994). While efficiency considerations suggest the linking of domestic to world prices, extreme fluctuations in price have undesirable consequences both at the macro and micro levels.

There is a need for adequate information on the market performance of the sesame markets especially on sesame marketing channels, traders' behavior and price competitiveness in the markets. Degree of price transmission would be used as the tool to measure the price responses between different markets. There was no previous academic research on market and sesame in Myanmar.

However, Myanmar rice market performance was estimated by Hinn Yu Lwin (2005) and market integration and price causality of Myanmar rice was done by Theingi Myint (2007). In case of pulses, impact if agriculture market reform on pulses market integration was conducted by Aung Kyaw Moe (2008) and market performance of selected pulses was done by Nyein Nyein Thaung (2007). Official data do not completely reflect reality of oilseed crops sector therefore there is urgent need to develop a sound database. This study has to be undertaken within the limited timeframe, data and resources available**.**

Research Questions

1. How are the costs and margins affected along the marketing channels, by the conduct of market intermediaries?

2 What are the relationships between domestic prices of major sesame markets and export price, and the relationships between domestic sesame oil prices in selected markets as well?

Objectives

This study would focused on the following objectives

1. To study the classification of marketing channels for the selected sesame markets in Myanmar

2. To estimate the marketing costs and margins along the various marketing channels

3. To investigate the price relationship between domestic sesame seed prices and export prices and domestic sesame oil prices in selected markets as well**.**

Hypotheses of the Study

1. Farmers gain the largest share of export price in current market situation of Myanmar.

2. There is a complete price transmission between the domestic prices and export price of the sesame seed since Myanmar is a sesame seed exporter**.**

3. There is a complete price transmission between the prices of the sesame oil in different domestic markets.

Expected Outputs

Marketing system is an important means for raising the income levels of farmers and for promoting the economic development of the country. From the results of this analysis, marketing margins between different levels could be identified and it could also examine who was having the highest gross margins. Reliable and prompt price signals of sesame seed could be provided to farmers and traders. Moreover, policies to improve the efficiency of sesame marketing followed by the

well-organized marketing channel could also support a self-accelerating impact on productivity. The interest to investigate price movement and price correlation among the selected domestic markets and export market could specify and point out the market signals and transparency of market information. The results of this study were expected to give the appropriate policy recommendation needed for the policy makers in order to formulate the strategies for the development of the oilseed crops sector. Finally this finding of this study would provide the knowledge of how sesame market was operating and price information of the whole sesame industry to all participants along the channel, researchers and policy makers.

Outlines of the Thesis

The thesis was divided into five chapters. This chapter introduced the study and the problem statement. The second chapter provided a review of related theories; theoretical and conceptual framework of the thesis, review of previous researches about the marketing channels marketing costs and marketing margins and price transmission. The third chapter explained research methodology research methods used this study and data collection. The fourth chapter presented the results of the study. The last chapter discussed research results, conclusions and the recommendations of the thesis.

CHAPTER II

REVIEW OF LITERATURE

This chapter composed of conceptual framework, theoretical framework and previous research findings related to market analysis and price transmission.

Conceptual Framework

The issue of this part was how sesame industry was operating along with current policies on oil seed sectors. This study could be divided in to two parts; the first one was to estimate the sesame marketing performance of all participants along the marketing channels, marketing cost and marketing margins through domestic to export. The second was the spatial price transmission focused on market integration between prices in the different markets (selected domestic markets and export market) by using cointegration technique. Overall performances of the sesame market and price behavior in the long run were affected not only by the efficiency of marketing system but also the distorted macroeconomic policies indirectly. A marketing channel is an organized network of agencies and institutions which perform all the activities required to link producers with users to accomplish the marketing task (Bennett 1988). Marketing costs and margins are required to understand for all who involved with agricultural marketing. Farmers, who seek to produce a crop, need to be aware not only has the production cost but also the cost of marketing and the demand condition. Wholesalers, retailers and processors must be fully aware of their costs if they want to trade profitably. Also government officials should concern to have fully understood of marketing cost and margin to monitor the efficiency of agricultural marketing regularly for improvement. The conceptual framework for this study therefore could be laid out as the Figure 8.

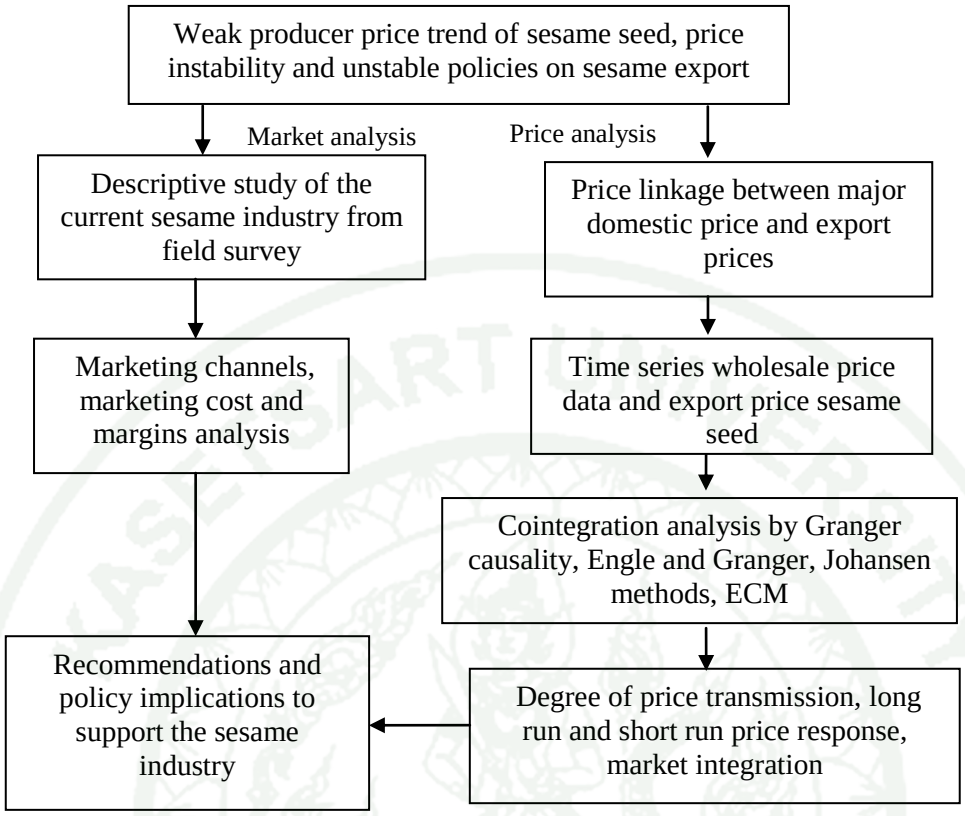

Figure 8 Conceptual framework

Source: Modified from Rapsomanikis *et al*., (2004), Andrew (1993) and ILRI (1995)

Macroeconomic policies (monetary policy, pricing policy, trade and exchange rate policy) affect agricultural price through their effects on the real exchange rate, export and import of agricultural commodities. Agricultural price along with non price factors including exogenous shocks determine agricultural production. Agricultural production is a very important one as it has an impact on growth, poverty and consumption as well. Therefore, the policies affect the farmer's income, and terms of trade between rural and urban as well as the terms of trade between tradable and non-tradable goods (Jaeger and Humphrey, 1988). In a market driven economy, the marketing system serves at both the micro and macro levels as mechanism to transmit to market participants' information that is useful in decision making. Transparent, accurate and timely price signals play a significant role in the conduct and performance of an efficient marketing system. In a competitive economy the

pricing mechanism is expected to transmit orders and directions to determine the flow of market activities. Pricing signals guide and regulate production, consumption and marketing decisions over time, form and place (Kohls and Uhl, 1998).

To increase the sesame production, the market should be efficient and price received by producers should be stable. The marketing system has the main role of transferring sesame from producers to exporters through transport, storage, and processing activities. The transportation facility and informal export to other may separate domestic markets also. In order to address the research issues on the market performance and prospect for price for long term, it is important to understand the links between domestic and export sesame market and macroeconomic policies. If the trade is allowed, the marketing system will also transfer and receive price signal to the producer, consumer, market participants and government from the world market.

Although the domestic sesame markets are competitive but the present sesame marketing system is affected by the current policies on oil seed sector to get the price signal from the international sesame market. The overall performances of sesame market and price behavior in the long run are affected not only by the efficiency of marketing system but also the distorted macroeconomic policies indirectly. The limitation of this study was the lack of detailed costs for processing of the sesame seed into sesame oil and the prices analysis on the other colored sesame seeds.

Theoretical Framework

1. The concept of market and price analysis

Kohls and Uhl (2002) also 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. Identifying the causes of differences in prices in interregional or spatial markets has therefore become an important economic analytical tool to understand markets better. 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. Theory of marketing

Marketing is the management process responsible for identifying, anticipating and satisfying customer requirements profitably (the UK's Chartered Institute of Marketing). The aim of marketing is to make selling superfluous. The aim is to know and to understand the customer so well that the product or service fits him/her and sells itself (Drucker, 1993). The definition of marketing which is most applicable to agriculture is given by Kohls and Uhl (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.

2.1 Marketing channels

A marketing channel is an organized network of agencies and institutions which, in combination, performs all the activities required to link producers with users to accomplish the marketing task (Bennett 1988). It is a process of making a product or service available to the end-users for used and consumption also known as distribution channel. Here agricultural marketing channels refer to the outlets or routes through which commodities pass to reach final consumers. Key constitutions of marketing channels are manufacturers: the producers of the good and service that is being sold, intermediaries: they do not involve themselves with the title but only acts as facilitators and end users: they received the merchandise from the other members and are call final consumers (Tyagi and Gupta, 2009).

Some traditionally accepted definitions assist to classy and identify the participants in the marketing process. The first link in the marketing chain is the *producers* who harvest crop and supplies the product to the second agent. From the moment the producer choose what to grow and makes marketing decision. *Rural assembler or primary collectors* are the first link between the producer and other middlemen. Wholesalers concentrate the various, intermediate-sized loads and put the product into large, uniform units. These activities all contributes to price formation. In so doing, wholesalers provide information to suppliers and assumes to a various degree the risks associated with the transfer of property rights attached goods and services being bought and sold. Wholesalers also facilitate mass and specialized storage operations, transportation. *Millers and food processing companies* use agricultural commodities as raw materials. *Exporters* sell agricultural product in foreign markets. Marketing agents work for commission on behalf of other participants is called *broker*. They operate at all level of marketing chain. Typically they work for either flat rate or percentage (of the selling price) commission. Institution such as "Marketing Board" may be mixed public-private or solely private entities with some semi-monopolistic concessions (private company, export cartels, etc). Consumers are the last link of marketing chain; families are usually personifying the final consumers. However the processing and millers may also be considered as the customers, although at the intermediate stage (Mendoza, 1995).

2.2 Marketing costs

Marketing costs are the expenditure incurred by various market intermediaries from the time when commodity leaves the farm until it reaches the consumers. Such costs are necessarily incurred to create form, time, place and possession utilities in the products to make them marketable. Marketing costs indicate the actual expenses of a marketing agency including fixed and variable costs. These costs are incurred by the producers and other marketing intermediaries and have impact on prices as well as on the margins of the market intermediaries. The major cost components include grading, packing, loading, unloading, transportation, products loss, storage, fees and commission charges (Khushk and Lashari, 2001). It

needs to be able to calculate the costs involved so that farmers can be sure they would be better off using a different marketing procedure.

Marketing costs and margins are required to understand for all who involved with agricultural marketing. Farmers, who seek to produce a crop, need to be aware not only has the production cost but also the cost of marketing and demand condition. Wholesalers, retailers and processors must be fully aware of their costs if they want to trade profitably. Also government officials should concern to have fully understood of marketing cost and margin to monitor the efficiency of agricultural marketing regularly for improvement (Andrew, 1993).

2.3 Costs of production

The cost of production per unit area is important to calculate the marketing costs and margins for producers. Before the calculation of gross marketing margin all production costs and income of a particular crop on per unit basic should be calculated (Brown, 2009). A firm's costs are incurred by using variables resources to produce its product. All production costs can be divided into two general groups, explicit cost and implicit costs. Those costs are sometime referred to as "direct" and "indirect", "cash" and "noncash" or "operating" and "overhead" costs with the same basic meaning intended. An explicit cost has been incurred when money is spent to hire labor, repair machinery, buy seed, fuel, or other things for which cash expenditures are made. An implicit cost has been incurred in using any resource for which there was no cash outlay during the period that resource was being used. For instance, the cost of the tractor cannot be charged against one year because it would last for several years. The flow of its cost matches the flow of its services over the tractor's productive life. Other implicit costs are the cost of operator's own labor and management (Creamer and Jensen, 1994).

After the true meaning of costs, the production costs are classified into fixed costs and variable costs. The cost which does not vary but remains constant within a given period of time and a range of activity in spite of the fluctuations in production is

known as fixed cost (FC). Fixed cost incurred even if the resource is not used. Fixed costs do not change as the level of production changes. The cost which varies directly in proportion with every increase or decrease in the volume of output or production is known as variable cost (TVC). If the production increases variable costs will increase. Total variable costs are the summation of the individual variable costs. Variable costs exist in the short-run and long-run (Kohls and Uhl, 2002).

Total cost (TC) of the firm is the sum of its total fixed costs (TFC) and total variable costs (TVC). Total cost also rises because of its increasing cost as output is increased. Total revenue (TR) is derived by multiplying the price of the product (per unit) and the unit of product, at each output level. Subtracting from total cost from total revenue is the firm's net revenue or net return (NR) (Creamer and Jensen, 1994).

$$TC = TFC+TVC \quad (2.1)$$

$$TR = P.Q \quad (2.2)$$

$$NR = TR-TC \quad (2.3)$$

Where,

TC = total cost

TFC = total fixed cost

TVC = total variable cost

TR = total revenue

NR = net return

P = price

Q = yield per unit area

2.4 Marketing margins

Marketing margins are the differences between prices at two market levels. Marketing margins have been examined on the basis of data obtained on prices at different stages of the marketing chain. Marketing margins have been

calculated through computing the absolute margins or price spread, which is essentially the same as the difference between the prices, paid and received by each specific marketing agency (Khushk and Lashari, 2001). "Margins" are often used in the analysis of the efficiency of marketing systems. Often they are misused even if they are correctly calculated. Kohl and Uhl (2002) stated that marketing margin was the portion of consumer's food dollar paid to food marketing firms, for their services and value-adding activities; the "price" of all food marketing activities. The presentation of a trader's share of the final selling price in percentage terms can give a totally misleading impression unless the costs involved were known (Andrew, 1993). Generally, marketing margins can be calculated for different levels of the market, so that:

$$\text{Marketing margin} = P_1 - P_2 \qquad (2.4)$$

Where,

P_1 = price at one level or stage in the market

P_2 = price at another level

2.5 Price spread

When the margin is expressed in monetary terms, it is called price spread and when the margin is express as a percentage, it is known as the percentage margin. Price spread is a measure of marketing margins as in monetary terms. It represents payments, including profits, for all marketing function performed in assembling, processing and after it left the farm. The price difference between farm and retail levels for the same product is called farm-retail price spread. Changes in farm-retail price spreads reflect changes in marketing costs, profits or both (Kohl and Uhl, 2002). The price spread is the costs and profit of the marketing system that moves the farm product from the farm to its final form (Hahn, 2004). Price spreads simply indicate differences in calculated values for a consistent (same product) equivalent quantity and quality of product as it is successively measured at the farm, wholesale, and retail levels (USDA, 1997).

Again, a price spread is the difference between the cost of an item at one stage of the marketing channel and a different stage. If the prices are collected at three different stages of marketing chain for a product; the farm, wholesale and retail, three sets of price spreads can be used to calculate as farm-wholesale, wholesale-retail and farm retail. Producers often blame low producer prices on high price spreads but consumers often blame high retail prices on high price spreads. The farm to retail price spread is the difference between what the consumer pays and what the farmers receives. Price spread can become lower if farm prices increase and/or retail decrease (Hahn, 2004).

2.6 Gross margin

Gross margin is different between the price a farm pays for products (cost of goods sold including all marketing costs) and the price it changes its customers; it is also called gross profit, and expressed as percentage of the firm's selling price (Kohl and Uhl, 2002). Cost of Sales (also known as Cost of Goods includes variable costs and fixed costs directly linked to the sale, such as material costs, labor, supplier profit, shipping costs, etc. It does not include indirect fixed costs like office expenses, rent, administrative costs, etc. The gross margin represents the percent of total sales revenue that the firm retains after incurring the direct costs associated with producing the goods and services sold by a firm. Gross margins and price spread are related and increases in gross margins are likely to cause increases in price spread. Price spread can become lower, if farm prices increase and/or retail (export) price decrease (Hahn, 2004). Gross margin percentage shows how much gross marketing margin the retailer makes percentage of sales (Marketing principle and best practices author team, 2005).

2.7 Farmer's share

Calculation of farmer's share by the market basket approach is the ratio of the farm value of a market basket of domestically produced food items to their retail values (Kohls and Uhl, 2002). In this study farmer's share to export price were calculated for the farmers from selected villages. Calculations of the price spread,

gross margins, farmer's share and wholesaler's share to export price were presented in equations 2.5 to 2.8.

$$\text{Price spread} = P_f - P_{ex} \quad (2.5)$$

$$\text{GM (percent)} = (P_s - P_b)/P_s \times 100 \quad (2.6)$$

$$FS_{ex} = (P_f/P_{ex}) \times 100 \quad (2.7)$$

$$WS_{ex} = (P_w/P_{ex}) \times 100 \quad (2.8)$$

Where,

GM = gross margin

P_b = buying price (costs of good sold)

P_s = selling Price

FS_{ex} = farmer's share to export price

WS_{ex} = wholesaler's share to export price

P_f = price received by farmers

P_w = price received by wholesaler

Source: Kohl and Uhl (2002)

The costs and margins of marketing reflect the efficiency of a marketing system since the costs of marketing are affected by the marketing channel used and marketing service received. The general misconception is that the presence of many intermediaries causes the high retail prices and low producer's prices. Intermediaries usually cannot affect prices significantly. If they try to widen the margins by changing ore than their services are worth, the demand for their services will decrease. If the farmers distribute their product one by one to each consumer, without the use of intermediaries, the market will be exactly inefficient. Therefore in some cases, using intermediaries lowers marketing margins (Amir and Kinpscheer, 1998).

The calculation of marketing margins will vary according to the complexity of the marketing channel, whether there is processing or not, and how many intermediaries there are. Scarborough and Kydd (1992) stated that marketing margin indicated the amount received by the different marketing agencies for providing their services. There are also other definitions of gross marketing margin. Gross marketing margin is the difference between revenue and production cost of producer (Son *et al.,* 2003). Again, Abbott (1986) defined that the gross marketing margin was the different between the price at which a marketing enterprises bought produces and that at which it sold. This was also the gross income from business activities less the variable cost of activities.

3. Theory of market integration and price transmission

Price analysis is a widely-used evaluation method which looks at the spatial correlation of markets through time. The assumption is that if market prices in different regions move together, then the overall market is operating effectively, in that supply is being distributed regionally in a way which meets domestic demand. It also assumes information and transport are operating effectively (ILRI, 1995).

Price is the key mechanism by which domestic and international markets are linked. In theory, if a country is linked by trade to the international market in a free market regime, global demand, or supply shocks will have an equal impact on the domestic and international prices. Trade ensures that markets are integrated and that the transmission of price signals is complete, thus resulting in an efficient functioning of the market, with all actors in the supply chain and the consumer having accurate information to make decisions on how much to produce, or consume. Nevertheless, there are many factors that can obstruct price transmission and create inefficient outcomes. Price transmission is one of the most heavily studied equity issue related to pricing studied in industrial organization. Price transmission refers to the way at one level in the product chain react to changes at another level. Market power may explain that price changes at one level are not transmitted to other levels.

There are three types of imperfect price transmission:

1. Price changes are not fully transmitted

2. There is time lag between the price adjustments at the respective stages

3. There is an asymmetry in reaction between positive and negative price shocks (Bunte, 2006).

In theory, spatial price determination models suggest that, if two markets are linked by trade in a free market regime, excess demand or supply shocks in one market will have an equal impact on price in both markets. The implementation of import tariffs and export taxes allows international price changes to be fully transmitted to domestic markets in relative terms. However, if the import tariff, or export tax level is high, changes in the international price would be only partly, if at all, transmitted to the domestic market (Rapsomanikis *et al.*, 2003). If the marketing system is well-integrated, then price increases should be transmitted to the same extent as the price decreases, i.e., there is no rigidity of price adjustment in the marketing system (Goletti and Babu, 1994).

A fundamental issue when analyzing trade policy reform in global agricultural markets is the extent to which domestic agricultural commodity markets in developing countries respond to changes in international prices. Price transmission from the world to domestic markets is central in understanding the extent of the integration of economic agents into the market process. The absence of market integration or of complete pass-through of price changes from one market to another has important implications for economic welfare. Incomplete price transmission arising either due to trade and other policies, or due to transaction costs such as poor transport and communication infrastructure, results in a reduction in the price information available to economic agents and consequently may lead to decisions that contribute to inefficient outcomes (Rapsomanikis *et al.*, 2003).

Domestic markets can also be separated by large marketing margins that arise due to high transfer costs. Especially in developing countries, poor infrastructure, transport and communication services can give rise to large marketing margins due to high costs of delivering the domestically produced commodity to the export port, or the imported commodity to the domestic market, hindering the transmission of price signals, and thus preventing arbitrage (FAO, 2005). Non-competitive behavior can also hinder market integration. Pricing-to-market behavior, whereby firms may absorb part of exchange rate movements by altering export prices in home currency, oligopolistic behavior and collusion among domestic traders may retain price differences between international and domestic prices greater than those determined by transfer costs.

Deviations from complete price transmission may occur in the short run, although in the long run price transmission is, in general, expected to be complete. In the short run, price transmission may not be complete due to lagged responses of consumer prices to changes in the producer prices and vice versa and the corresponding slow speed of adjustment of prices along the supply chain. This slow adjustment may occur as a consequence of many factors including storage and inventory holding, delays caused in transportation or processing due to a large number of vertical stages in the supply chain, 'price-leveling' practices and the nature of price reporting and collection methods. The concept of price transmission can be thought of as being based on three notions such as co-movement and completeness of adjustment; causality, dynamics and speed of adjustment and asymmetry of response.

These notional components imply that complete price transmission can be ascertained when prices co-move being in a form of long run equilibrium. If price changes are not passed-through instantaneously, transmission is incomplete in the short run, but complete in the long run, taking into account the possibility of asymmetric adjustment. The distinction between short run and long run price transmission is important and the speed and the manner, by which prices adjust to their equilibrium is essential in understanding the extent to which markets are integrated in the short run (FAO, 2005). However, the literature indicated that there

are 6 groups of factors effecting the price transmission such as transport and transaction costs, market power, increasing return to scale in production, product homogeneity and differentiation, exchange rates and border and domestic policies (Conforti, 2004).

A number of time series techniques can be used to test each of the components of price transmission and thus ultimately assess the extent of price transmission. These are cointegration, causality, error correction mechanism and symmetry. Each of the above tests is taken to present evidence about the components of transmission thus providing particular insights into its nature. Collectively, these techniques offer a framework for the assessment of price transmission and market integration (Rapsomanikis *et al.,* 2003).

Comprehensive analytical framework for this econometrics approach was found by Balcombe and Morrison (2002), and Rapsomanikis *et al.* (2003). Co-integration between the price series implies that two prices may behave in a different way in the short run, but that they will converge toward a common behavior in the long run. If this property is verified, the characteristics of the dynamic relationship between the prices can be described by an Error Correction Model (ECM). Despite a number of limitations (Barrett and Li, 2002; Rapsomanikis *et al.*, 2003), the short-run adjustment parameter of this type of model can be interpreted as a measure of the speed of price transmission, while the long run multiplier can be interpreted as a measure of the degree of price transmission of one price to the other (Prakash, 1999).

The properties of co-integrated series also imply the existence of a causality relation, as defined by Granger, that can be tested by assessing if the past observations of one of the two prices (fail to) predict those of the other. Therefore, most analyses start by investigating the dynamic properties of the price series, through tests for the presence of unit roots, and then proceed with co-integration tests, and with the specification of ECMs.

Previous Research Findings

Previous research findings in marketing channels and margins, and market integration and price transmission are as follows.

1. Marketing channels and margins

Theingi Myint (2007) conducted the research on the Myanmar rice market: market Integration and price causality on 6 different domestic markets including surplus and deficit regions. The important findings of the study were structure of the rice sector and marketing, description of rice marketing participants, rice marketing channels, costs and margins and market integration and price causality. Myanmar paddy farmers could not respond to the market price signal in their paddy production. Because of some restrictions in rice trading near the border areas, rice export ban for the private sector and no transparent information system in rice market, there was no right price signal to the market intermediaries and policy makers.

Regarding the paddy farmers, farmers were taking part in the marketing activities to get more profit even though they needed capital investment for storage, processing and transportation activities. Among the market intermediaries, rice millers in surplus regions and wholesalers in all markets had more market power and led in spatial arbitrage of Myanmar rice marketing system. The marketing margin analysis pointed out that more complex rice marketing channel was found in deficit markets, and more competitive signal was observed in the Yangon market. Nevertheless, overall margins were relatively high in all rice markets. Farmers received less profit share than market participants in Yangon and Taunggyi markets. All retailers obtained the highest profit share.

Marketing cost model that was first proposed theoretically by Tomek and Robison (1990) offers an interesting alternative to the mark up model. Wohlgenant and Mullen (1987) had interpreted this structural model as reduced empirical from. The marketing cost model had been widely used in several industries to explain the

farm-retail price spread (Wohlgenant and Mullen, 1987(beef); Thompson and Lyon, 1989 (orange); Farminow and Laubsher, 1991 (corn); Lyon and Thompson, 1993 (milk) (Frigon *et al.*, 1999). Lyon and Thompson (1993) indicated that the marketing cost model performed especially well with monthly spatially-disaggregated data. The marketing model in a competitive market situation can be expressed as follow: M=*f* (Q, MC), Where, M is the farm-retail price spread, Q is the quantity of commodity market and MC is a marketing cost.

Hadi (1994) studied the effect of supply changes on marketing margins and farm gate price using a descriptive analysis approach for south Sumatra's fresh pineapple in four seasons in 1991. It was found that domestic wholesale and farm gate prices decreased while marketing margins increased as pineapple supply increased. The major cause of increased margins was the increased transportation costs due to increased demand for transport services. Domestic wholesalers who involved as major role in marketing of pineapple in the study area had not made excess profits. They reduced their profit as supply increased and increase their profits as supply reduces. The middlemen's profits varied inversely with transportation costs. This was, profits decreased (increased) when transportation costs increased (decreased) as pineapple supply increased (decreased). There was no strong evidence that middlemen made excessive losses to farmers by suppressing farm gate prices.

Pedersen *et al*., (2005) examined different cropping practices, cost structure s and gross margins for conventional table potato cropping in 6 different regions within the European Union; Czech Republic, Denmark, Italy, Poland, Portugal and Slovakia. The findings from the study showed that potato cropping practices were significantly different between various countries with major differences in yield and costs. Italy and Denmark were the two regions with highest gross margins due to high yields and revenues. Poland was by far the largest potato producing country among the 6 countries. However, the production was primarily based on small scale farming with low yields and economic revenues.

2. Market integration and price transmission

The study of marketing margins and price transmission on various commodity markets has been a popular research topic of the past decades however with a few exceptions these studies focused on developed economies. Numerous studies had analyzed asymmetric price transmission because it was perceived as a symptom of market imperfection. With respect to government intervention, the price support policy in the United State dairy industry might affect the behavior of middleman and lead to asymmetric price transmission. Under such regulation, intermediaries might see a farm price decrease as being lonely a temporary phenomenon, so that changing the retail price of milk is not necessary to remain competitive (Kinnucan and Forker, 1987).

Market integration and price causality in Myanmar rice market in Pathein, Pyay (surplus markets), Mandalay, Magway and Taunggyi (deficit markets) and Thai rice (5 percent broken, FOB) monthly price series were tested by Engle and Granger two-step co-integration method and restructured Ravallion model of unrestricted Vector Auto-Regression (VAR) error correction form. Myanmar rice price movement could not receive accurate price information from international rice market price over time. Deficit market prices were driving the CPI and the CPI was forcing the Yangon market price and surplus rice market price. Deficit markets were the prime movers in rice price changes in Myanmar. Government should give attention to manage the inflationary pressure instead of direct involvement in the rice marketing sector to control the domestic rice price stability in the long run. The result of the government monopoly in rice export had been the segmentation between domestic market and international market. Myanmar rice market could not get the correct price signal from the international market. If the private rice export was allowed through the trade policies, the marketing system would be able to transfer price signal from the world market to the producer, consumer, market participants and finally the government. Myanmar rice market would no longer be isolated from the international market and getting the right price co-integration that might push the efficient market oriented economy to go on faster (Theingi Myint, 2007).

Hinn Yu Lwin (2006) analyzed rice market constitution, intermediaries performance and spatial price differences in Hlegu, Pathein and Ynagon markets. Weak market institution was found not only for domestic rice distribution but also for rice exports. Therefore, motivation of institutional development in several rice distribution channels was needed to accelerate the market intelligence of intermediaries. Marketing channel and margin analysis indicated 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 was necessary to promote market infrastructure, exchange market information and cooperative institution in these areas. The existence of long-run integration between pairs of markets indicated the influence of central market price on domestic markets to an extent. Price integration process was far from optimal in short run because of lack of price transparency, inadequate transportation and communication facilities and inefficient economic activities of middlemen. Privatization process in this market would face major challenges unless this situation is corrected. Further studies of market imperfections and multivariate framework were needed to get the complete picture of Myanmar Rice Market.

Aung Kyaw Moe (2007) investigated the impact of agricultural market reform on regional wholesale markets of pulses such as, Yangon, Mandalay, Pyay, Myingyan, Monywa and Pakokku markets in Myanmar by using Johansen's multivariate cointegration method and Granger causality test. One cointegrating equation was found in long run for all markets, but there was disequilibrium condition in short run market integration. Mandalay prices Granger caused all prices of markets of black gram and green gram, and Yangon prices Granger caused all markets except Myingyan in pigeon pea. Because Mandalay and Yangon markets were central market and were the leading the markets for price formation.

Aung Kyaw Moe (2008) examined the impact market liberalization on international pulses trade of Myanmar and India by using Johansen's conintegraion and Vector Error Correction Model. There were major trade restrictions of pulses such as minimum support price program, high levy of import tax and export banning policy in India, and high levy of export tax and misalignment exchange rate system in

Myanmar. It was found that all prices of international markets were weakly integrated in long run. In VECM test, India had negative equilibrium condition in all pulses while Myanmar had positive equilibrium conditions. India could correct the deviation of price in long run equilibrium with 19 percent in black gram, 16 percent in green gram, and 35 percent in pigeon pea, within a month. In Granger causality test, all prices of Myanmar Granger caused India except in black gram. India Granger caused Myanmar black gram price. Myanmar is a leading country for international price formation. But, there was unidirectional causality in international price of pulse. This finding indicated the monopolistic behavior and asymmetry price transmission in the international markets of pulses. This imperfect and asymmetry price transmission might be the results of quantitative restrictions of trade, misalignment exchange rate system and high levy of export and import taxes in pulses trade.

Nyein Nyein Thaung (2007) also studied the marketing cost and margins and market integration of chick pea, green gram and pigeon pea in Yangon and Mandalay townships by using Engle and Granger's cointegration method. It was found that the Yangon and Mandalay markets were cointegrated under the assumption of that Mandalay current wholesale price depended upon the Yangon current wholesale price and taking from one to five lags prices of both Yangon and Mandalay wholesale markets. Farmers got highest margins within the domestic market.

Comprehensive analytical framework for this econometrics approach could be found in Balcombe and Morrison (2002), and Rapsomanikis *et al*., (2003). Co-integration between the price series analyzed implies that two prices might behave in a different way in the short run, but that they would converge toward a common behavior in the long run. If this property was verified, the characteristics of the dynamic relationship between the prices could be described by an Error Correction Model (ECM).

Price transmission and marketing margins on the Hungarian pork market was studied by using monthly farm-gate and consumer prices from January 1992 to April 2005 in the transition economies. The Johansen (maximum likelihood) or Engle and

Granger (two steps) cointegration tests did not reject the no-cointegration null hypothesis between the Hungarian pork producer and retail price series. Therefore Gregory and Hansen procedure was applied with recursively estimated breakpoints and ADF statistics, and found that the prices are cointegrated with a structural break occurring in April 1996. Exogeneity tests revealed the causality running from producer to retail prices both on long and short run. Homogeneity tests were rejected, suggesting a mark-up pricing strategy. According the results, price transmission on the Hungarian pork meat market was symmetric on the long, but asymmetric on the short-run, i.e. processors, wholesalers or retailers might take temporary advantage should price changes occur (Bakucs and Fertő , 2006).

Chavas and Metha (2004) developed a reduced form model of price transmission in a vertical sector allowing for refined asymmetric, contemporaneous and lagged, won and cross-price effects under time varying volatility. This model was used for wholesale-retail price dynamic in U.S. butter market. The analysis focused on the non linear price dynamic in a vertical sector. The result was found that the strong evidence of asymmetric retail price responses, both in short term and longer term but only week evidence of asymmetric wholesale price responses. Asymmetric retail responses played a major role in generating a skewed distribution of butter prices. The empirical results indicated the presence of imperfect competition at the retail level.

Srinivasan (2004) examined the impact of alternative price stabilization policies for edible oils and oilseeds in India on farmers growing oilseeds, the consumers of edible oils and the processing sector with the help of a multi market equilibrium dynamic simulation model. The questions addressed in this study included the following. What was the effectiveness of alternative price stabilization mechanisms in stabilizing oilseed and edible oil prices? Could variable levies that vary within the bound tariff level provide adequate protection against world price fluctuations? What were the costs to the government, benefits to producers and consumers? What was the impact on prices of oilseeds due to the operation of variable levies edible oil imports and vice versa? As the results of this study, higher

import tariffs on edible oils lead to more variable domestic prices. This indicated that a fixed level of tariff even at a higher level was not useful in stabilizing oil prices. A system of variable levied which adjust to international price and domestic supply situation was what would be required. Tariff protection on oils mainly promoted the benefit to the processing sector and the benefits to oilseed growers were relatively smaller. Tariff protection to growers by increasing tariffs on oilseed imports helped the producers of oilseeds, but at the cost of consumers and the processing sector. The distribution of benefits to different agents varied with the different alternative mechanisms used for price stabilization. The maximum import tariff rate required to stabilize prices within a reasonable price band was as low as 25 percent.

Conforti (2004) estimated to provide the evidence on price transmission in a number of agricultural markets, both *per se* (by itself or in itself) and in support of analytical efforts in the area of agricultural trade policy analysis. The study work was based on a price database collected from various sources in sixteen countries Argentina, Brazil, Chile, Costa Rica, Egypt, Ethiopia, Ghana, India, Indonesia, Mexico, Pakistan, Senegal, Thailand, Turkey, Uganda, and Uruguay - primarily for basic food commodities. Both spatial and vertical price relations were considered, as the database included prices at the producer, wholesale and retail levels. These were supplemented with information from FAOSTAT. Data were analyzed with an econometric framework based on the estimation of Autoregressive Distributed Lag models, and of the corresponding Error Correction specification. Tests for Granger causality and for asymmetric transmission were also performed. Results indicated that the African markets included in the sample were characterized by more incomplete transmission compared to Latin American and Asian markets.

Abdulai (2002) used a Momentum-Threshold Autoregressive Model (M-TAR) when studying the price transmission on the Swiss pork market. The conclusion was that the price transmission between producer and retailer market levels was asymmetric, i.e. increased in producer prices that would diminish the marketing margin were passed on more quickly than producer price decreased that widen marketing margins**.**

Antigi-Ego (2006) studied the extend of price transmission from international to domestic markets for selected agricultural products in Uganda, to assess the likely impact of increased market access on agricultural household poverty in rural Uganda. The study applied the variety of econometric techniques such as cointegration analysis, Granger causality and error correction model to assess the various components of market integration using monthly data over the period 2000 through 2004. In case of cotton, tea and tobacco, there was insufficient evidence of price transmission from border prices to producer prices. It was also found evidence to support the null of no price transmission from border to producer prices for the non-traditional exports of beans, maize and banana, which were mostly exported to the regional market. Recommendation for the study was that government should strengthen the information network on agricultural marketing and distribution to reduce exploitation of smallholder farmers by well-informed middlemen and should also strive to increase investment in the agricultural sector to improve marketing and transport infrastructure.

Rapsomanikis *et al.,* (2004) used cointegration analysis together with Granger causality tests and Vector Error Correction Models (VECM) to determine the extent of price transmission in the Ugandan coffee sector using monthly data on producer and international prices for the period January 1990 to December 2001. Using the Johansen (1988; 1991) test, the sufficient evidence for the alternative of one cointegrating relationship was found indicating that the domestic and international markets were integrated. Granger causality tests also suggested that world market prices Granger-caused domestic producer prices. In the VECM, the error correction coefficient of -0.18 suggested that the adjustment to the long run relationship was relatively fast, with the producer price adjusting fully to changes in world market prices after approximately five months. They also found that shocks in the international price were instantaneously, although not fully, passed through to the domestic market. The VECM tests also indicated that, in the long run, the world market price Granger-causes the producer price, but not vice versa, confirming that Uganda was a price taker in the world market. Finally, it could be concluded that adjustment to the long run equilibrium is not asymmetric. Overall, the tests suggested

that the Ugandan coffee market was integrated with the international market and adjustment to long run equilibrium was fairly fast.

McCorriston *et al.* (2000), showing, on the one hand, how market power was expected to reduce the degree of price transmission compared to competitive markets, given that producers would be able to gain extra profits by holding prices higher than in competitive market conditions; while increasing returns to scale, on the other hand, were able to increase the degree of price transmission beyond the level of perfect competition.

Jensen and Moller (2007) studied the price transmission of six food chains such as, pork, chicken, eggs, milk, sugar and apples in Danish food marketing chains by using Error Correction Model. Danish food marketing chains forms primary production to processing, from processing to wholesale and from wholesale to retail prices. Specifically, the purpose was to investigate price transmission patterns through selected Danish food marketing chains. This study was conducted to investigate the extent of commodity prices transmitted from one stage to another in the food chain, the time horizon in the price transmission, the short run and the long run price transmission. These questions were analyzed theoretically and empirically using econometric analysis. Empirical results suggested that for most commodities, price transmission tends to be upward asymmetric, i.e. stronger impact of upward than downward price changes. Most asymmetries in price transmission occurred in the retail stage, fewest asymmetries occur in the wholesale stage. At the same time, most asymmetries in price transmission were found in the short run, whereas price transmission was symmetric in the long run in every case except one. Price transmission for commodities subjected to price regulation tended to be less asymmetric than for commodities without price regulation.

CHAPTER III

RESEARCH METHODOLOGY

This chapter explained which and how methods were used in this study. This section included calculations of marketing costs and gross margins, price spread, share of export prices, time series econometric model used in this study, data source and data collection, methods and procedures.

Calculation of Marketing Costs and Marketing Margins

In this study production costs per unit area, total variables costs, returns above variable costs and revenues cost ratios of sesame farmers were calculated. Regarding to marketing margins, gross margins, marketing costs and shares to export prices for all respondents were calculated by simple Microsoft Excel 2007. Producer to export price spread for all selected area were also estimated. Cost of production per unit area was calculated for the farmers in each selected villages to compare the revenue cost ratio. In addition, the cost of production per unit area is essential for the calculation of farmer's marketing margins. Regarding to the cost of production, fixed cost was not included and assumed as constant because the data were from single period survey and only variable cost was accounted. Boyd *et al*., (1998) stated that indirect costs involved certain fixed costs that could not be linked directly to a single unit of analysis. Therefore, total cost of production per unit area was equal to total variable costs since the fix cost was assumed as constant.

$$TC = TVC \quad (3.1)$$

$$TR = P \times Q \quad (3.2)$$

$$NR = TR\text{-}TVC \quad (3.3)$$

Where,

TC = total cost (total cost of production)

TVC = total variable cost

P = price received by farmers

Q = yield per unit area

TR = total revenue (gross revenue)

NR = net return (return above variable costs)

Regarding to marketing margins, according to data availability, producer to export price spread for the same product (sesame seed) was calculated. In this study farmer's share and wholesaler's share to export price were calculated. Gross margins as the percentage of selling prices for producers, wholesalers and exporters were calculated. Calculations of the price spread, gross margins and farmer's and wholesaler's share to export price for the sesame seeds in Mandalay, Monywa and Pakokku markets were presented in equations 2.5 to 2.8. Marketing costs in this study were transportation costs, labor costs, commissions, license fee and export tax.

Econometric Models for Price Transmission

In this section, concept of cointegration and empirical analysis are explained.

1. Concept of cointegration

Cointegration is simply defined as the stationary linear combination of non stationary time series data and such series are called *cointegrated series* (Charemza and Deadman, 1997). Theories of spatial competition suggest that in the short run, prices of similar products in various markets might differ. For series to be cointegrated, they must have comparable long-run properties. That is, suppose a series must be differenced *d* times before it becomes stationary; it is said to be integrated of order *d*, denoted *I(d).* Consider two time series y_t and x_t which are both *I(d).* In general, any linear combination of the two series will also be *I(d)*, the residual

obtained from regressing y_t on x_t are *I(d).* If however, there exists a vector β, such that disturbance term from the regression ($u_t = y_t - \beta x_t$) is of a lower order of integration, *I*(*d-b*), where $b>0$, then Engle and Granger (1987) defined y_t and x_t as cointegrated of order (*d-b*). Thus if y_t and x_t were both *I*(1), and $u_t \sim I(0)$, then the two series would be cointegrated of order *CI*(1,1) (Harris, 1995). The vector β is call cointegration vector. There are four important points to note about the definition of cointegration.

1. Cointegration refers to a linear combination of non stationary variables. Theoretically, it is possible that non linear long-run relationship exist among a set of integrated variables.

2. From Engle and Granger's original definition, cointegration refers to variables that are integrated. This does not imply that all integrated variables are cointegrated: usually a set of *I*(d*)* variable is not conintegrated. Such a lack of cointegration implies no longer equilibrium among the variables, so that they can wonder arbitrarily far from each other. If two variables are integrated of different orders, they cannot be cointegrated. But it is possible to find out the equilibrium relationship among the group of variables that are integrated in different orders. Suppose that x_{1t} and x_{2t} are *I*(2) and that the other variables are *I*(1). There cannot be cointegration relationship between x_{1t} (or x_{2t}) and x_{3t}. However, if x_{1t} and x_{2t} are *CI*(2,1), there exists a linear combination of the form $\beta_1 x_{1t} + \beta_2 x_{2t}$ which is *I*(1). This combination of x_{1t} and x_{2t} is cointegrated with the *I*(1) variables.

3. If x_t has non stationary components contains only two variables and there can be at most one independent cointegration vector. The number of cointegration vector is called cointegration rank of x_t.

4. Most of cointegration literature focused on the case in which each variable contains a single unit root. The reason is that the traditional regression or time series analysis applies when variables are I(0) and few economic variables are integrated higher than unity (Enders, 2004).

Various possibilities of integration and cointegration of two variables in case of $y_t = \beta x_t + u_t$ can be considered as following.

1. if $y_t \sim I(1)$ and $x_t \sim I(1)$, then $u_t \sim I(1)$ and the variables x_t, y_t are not cointegrated;

2. if $y_t \sim I(1)$ and $x_t \sim I(1)$, then it may be that $u_t \sim I(0)$ and the variables x_t and y_t are cointegrated only if $[\beta, -1]$ constitutes conitegraiton vectors;

3. if $y_t \sim I(0)$ and $x_t \sim I(0)$, then $u_t \sim I(0)$ and inquiry about cointegraiton does not really make sense;

4. if $y_t \sim I(0)$ and $x_t \sim I(1)$, then $u_t \sim I(1)$ and the variables x_t, y_t are not cointegrated. Consequently, in a long run relationship between two variables both must be integrated of the same order if the error term is to be $I(0)$ (Charemza and Deadman, 1997). The two most widely used cointegration tests are the Engle-Granger two-step method (Engle and Granger, 1987) and Johansen's multivariate approach (Johansen, 1988).

2. Empirical analysis

This analysis consist of a set of econometric applications where as monthly price information were analyzed by testing mostly for the existence of long run equilibrium between price series with the paying attentions to dynamic of the relation between prices, to their causality and to the symmetry of transmission.

2.1 Testing for unit root test and order of integration

The first step of co-integration is to test whether the series are stationary. Testing for the present of unit root is required for both stationary and non stationary time series data in order to avoid the problem of spurious regression. If variable contains unit root then it is non stationary. It is important to test the order of

integration for each variable in the model to establish whether it is stationary and how many times the variable needs to be differenced to result in a stationary series. There are several methods to test for unit roots, e.g. Augmented Dickey Fuller approach (ADF), Srgan-Bhargava (1983) CRDW test based on the usual Durbin Waston statistic; non parametric test developed by Phiillips and Perron (1987) Z- test. But ADF test is the most popular because of either their simplicity or their more general nature (Harris, 1995). By definition, cointegration necessitates that two variables be integrated of the same order. Thus the first step was to test for stationary or the order of integration of each variable by using the Augmented Dickey Fuller (ADF) method (Dickey and Fuller, 1979). The $\boldsymbol{\tau}$ (Tau) statistic on the estimated coefficient of P_{t-1} is used to test from the based equation as follow;

$$P_t = \alpha + \rho P_{t-1} + \varepsilon_t \tag{3.4}$$

This equation is the well known autoregressive AR(1) model, if $\rho = 1$, P_t is the a non-stationary series at random walk with drift and the variance of the price series may increase steadily with time from the starting point and violating the condition of weak stationary. Price series is stationary only if $|\rho|<1$, white noise error term and distributed normally with zero mean and unit variance. Then, the equation is subtracted by P_{t-1} using the lag operator from both sides,

$$P_t - P_{t-1} = \alpha + \rho P_{t-1} - P_{t-1} + \varepsilon_t$$
$$P_t - P_{t-1} = \alpha + (\rho - 1) P_{t-1} + \varepsilon_t$$
$$\Delta P_t = \alpha + \beta P_{t-1} + \varepsilon_t \tag{3.5}$$

Where,

$\beta = \rho - 1$, $H_0: \beta = 0$, $H_1: \beta < 0$

If the coefficient of $\boldsymbol{\tau}$ (Tau) statistic on P_{t-1} (β) otherwise ADF statistic is not large and negative, the price series will not be stationary *I*(1). In this case, the test should repeat with ΔP_t as the dependent variable and so on, until the order of integration is determined. The substantial weakness of the original Dickey Fuller test

is that it does not take account of possible autocorrelation in the error process ε_t. If ε_t is auto correlated then the ordinary least square estimates of equation (3.2) is not efficient. Therefore Dickey and Fuller (1981) approved to use lagged left-hand side variables as additional explanatory variables to approximate the autocorrelation. This test is called Augmented Dickey Fuller test (ADF) (Charemza and Deadman, 1997). ADF approach has a power over higher-order correlation of disturbances by including lagged difference terms of the dependent variable to the equation. If the price series include the trend, there will be fluctuation around a non-zero mean. The ADF regression should be taken as constant and time trend. Therefore, each of price series to be tested for null hypothesis is that $\beta = 0$ by using the following equation with constant and time trend.

$$\Delta P_t = \alpha + \beta P_{t-1} + \gamma t + \sum_{k=1}^{n} \delta \Delta P_{t-k} + \varepsilon_t \qquad (3.6)$$

Where,

$\Delta P_t = P_t - P_{t-1}$; $\Delta P_{t-k} = \Delta P_{t-k} - \Delta P_{t-k-1}$ (Δ is the difference prices)

$k = 2, 3...n$ (k is the number of lagged differences)

P_t = the price at time t

α = vector of constants

γ = trend coefficient

β and δ = parameters to be estimated and

ε_t = the white noise error term ($\varepsilon_t \sim$iid $N(0,\sigma^2)$).

If the value of the ADF statistic is less (that is, more negative, because these values are always negative) than the critical values which are provided by Mackinnon (1990), it show that P_t is non stationary, and it may be concluded that $P_t \sim I(1)$. If P_t is non-stationary, it should be determined whether P_t is stationary in the first difference (that is, to test $P_t - P_{t-1} \sim I(1)$) by repeating the above procedure. It the series are integrated of the same order (say $I(1)$), the next step can be proceed by testing the null of non cointegration against the alternative hypothesis of one cointegrating vector

using the Engle and Granger (1987) cointegration method and Johansen procedure (Johansen 1988, 1991). Granger causality within a Vector Autoregression (VAR) framework is applied to assess price transmission between the markets or along the supply chain. In the event that the null of non cointegration is not rejected, it is concluded that the markets are not integrated, and/or that is unable to conclude that price transmission along the supply chain is complete. In opposite, the tests indicate that the price series are *I*(1) cointegrated, the procedure is focused on the error correction representation, in the form of a Vector Error Correction Model ((V) ECM)) and on examining the short run dynamics, the speed of adjustment and the direction of Granger causality in the short or the long run following Granger (1969, 1988). Finally, the results and comments discussed on the nature of price transmission and market integration.

2.2 Lag length selection for VAR

There are $(n+kn^2)$ coefficients to be estimated in VAR. Choosing the appropriate lag length is important for VAR. If the lag length is too large, VAR will be over parameterized and the estimation of coefficients will be insignificant and power of test will be reduced. Too few lags mean that the regression residuals do not behave like white noise process. There are so many criteria used in the literature to determine the lag length of an VAR process such as, Maximum likelihood Ratio (LR), Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), Final Prediction Error(FPE) criterion, Hannan-Quinn (HQ), and so on. Among the many information criteria, the most commonly used are Maximum likelihood Ratio (LR), Akaike Information Criterion (AIC). In this study AIC and SIC criterion were used to select the appropriate lag length for VAR with smaller values of the information criterion being preferred.

The selection process starts with maximum lag length and number of lag is reduced to get until the appropriate lag length. The likelihood test the null hypothesis of the coefficient of lag *k* are zero by using Chi square statistic (χ^2) and the number of lag is decreased one at a time until the null hypothesis is rejected. However , this

study used all selected information criteria mention above to selecte the appropriate lag length. The likelihood ratio test is specified as:

$$LR=(T-c)\ \{\log|\Omega_{k-1}| - \log|\Omega_{k}|\ \} \quad (3.7)$$

Where,

T = number of observation, k=lag length

C= the number of parameters per equation under the alternative

$|\Omega_{k}|$= determinant of the estimated residual variance-covariance matrix obtained from the VAR (k) model.

AIC finds the best prediction while SIC finds the model with the highest posterior probability of being the true model. A consistent lag order criterion SIC is better suit for infinite lag order and AIC is appropriate for finite lag order autoregression (Azzam, 2007). Of the two criteria the SIC has superior large sample properties. The SIC is asymptotically consistent while the AIC is biased toward selecting an overparameterized model. However in small samples, the AIC can work better than SIC (Ender, 2004).

$$AIC=(-2.\log L+2k)T \quad (3.8)$$

$$SIC = \log\hat{\sigma}^2 + (k.\log T)T \quad (3.9)$$

Where,

T = number of observation

k = number ofparameters to be estimated

log L= log of the likelyhood function

$\hat{\sigma}^2$ = an biased estimate of the residual variance

Source: Charemza and Deadman (1997)

2.3 Granger causality test

Granger (1969) set up the concept of causality which under suitable condition, is fairly easy to deal with in the context of VAR models (Helmut, 2006). The idea is that a cause cannot come after the effect. Causality test will identify the relationship between the variables. If a variable or a group of variables *x* is found to be helpful for prediction another variables or group of variables *y* then *x* is said to Granger cause ***y*** otherwise it is said to fail to Granger cause *y*. In theory, the idea has several components:

1. *Temporality*: Only past values of *x* can "cause" y.

2. *Exogeneity*: Sims (1972) points out that a necessary condition for *x* to be exogenous of y is that *x* fails to Granger-cause y.

3. *Independence*: Similarly, variables *x* and y are only independent if both fail to Granger-cause the other.

A bivariate VAR to test the Granger causality to determine the dependent variable in this study is as followed.

$$\begin{pmatrix} P_{1t} \\ P_{2t} \end{pmatrix} = \begin{pmatrix} \alpha_1 \\ \alpha_2 \end{pmatrix} + \begin{pmatrix} \Phi_{11}(L) & \Phi_{12}(L) \\ \Phi_{21}(L) & \Phi_{22}(L) \end{pmatrix} \begin{pmatrix} P_{1t-1} \\ P_{2t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \quad (3.10)$$

Test hypothesis can be set as,

H_0: $\Phi_{21}(L) \neq 0$ (P_{1t} Granger-causes P_{2t})

H_0: $\Phi_{12}(L) \neq 0$ (P_{2t} Granger-causes P_{1t})

P_{1t}, P_{2t} = the price of market 1 and 2 at time t

α_1, α_2 = constant term

ε_{1t}, ε_{2t} = white -noise error terms

$\Phi_{11}, \Phi_{12}, \Phi_{21}, \Phi_{22}$ = parameters to estimated

The hypothesis that P_{1t} Granger-causes P_{2t} and vice versa can be assessed within a Vector Autoregression (VAR) framework by testing the null that the coefficients of a subset of these jointly determined variables, the lagged P_{1t} terms, are equal to zero meaning that P_{1t} Granger-causes P_{2t} if Φ_{21} (L) $\neq 0$ and P_{1t} Granger-causes P_{2t} if Φ_{12} $(L) \neq 0$. Granger causality tests seek to answer questions such as "Do changes in P_{1t} cause changes in P_{2t}?" If P_{1t} causes P_{2t}, lags of P_{1t} should be significant in the equation for P_{2t}. If this is the case, we say that P_{1t} "Granger-causes" P_{2t}. If *y* causes P_{1t}, lags of P_{2t} should be significant in the equation for P_{1t}. If both sets of lags are significant, there is "bi-directional causality". The application of the standard Granger's causality test requires that the series of variables to be stationary. Granger causality test also identify the dependent and independent variables for the long run regression.

2.4 Engle-Granger methodology.

After determining dependent and independent variables long run equilibrium relationship has to be estimated with the OLS equation of;

$$P_{1t}=\beta_0+\beta_1 P_{2t}+ e_t \qquad (3.11)$$

Where,

P_{1t}, P_{2t} = the price of market 1 and 2 at time t

β_0,= constant term

β_1 = cointegration parameters

If the variable are cointegrated, an OLS regression yield a "super consistent" estimator of the cointegration parameters β_0 and β_1 faster than in OLS models using stationary variables. These Cointegrtion vectors' are estimated by using the critical values by Makinnon (1991) (Enders, 2004). These critical values depend on sample size and number of variables used in analysis. In order to determine if the variables are actually cointegrated, the residual ($\hat{e}_t$) is denoted. The residual ($\hat{e}_t$) series are the estimated values of the deviations from the long-run relationship. Dickey Fuller test

could be perform on these the residual ($\hat{e}_t$) to determine the order of integration with the autoregression with the null hypothesis of $a_1 = 0$.

$$\Delta\hat{e}_t = a_1\hat{e}_{t-1} + \varepsilon_t \quad (3.12)$$

H_0: $a_1 = 0$, unit root in cointegrating regression's residuals

H_1: $a_1 \neq 0$, residuals from cointegrating regression are stationary

Before the τ (Tau) statistic is examined the regression of residual should not be included constant term because the mean of regression residual is zero (Hill *et al*, 2008). If the residuals of (3.12) do not appear to be white noise, meaning that ε_t exhibits the serial correlation augmented form of test (3.13) should be used instead of (3.12). If the null hypothesis (a_1=0) is rejected, it can be concluded that the residual sequences is stationary and that two variables are said to be cointegrated. Again, if the null hypothesis a_1=0 is rejected, the residual series is stationary and that the variables are cointegrated (Enders, 2004).

$$\Delta\hat{e}_t = a_1\hat{e}_{t-1} + \sum_{i=1}^{n} a_{i+1}\,\Delta\,\hat{e}_{t-1} + \varepsilon_t \quad (3.13)$$

2.5 Johansen's cointegration test

The Johansen approach to testing for cointegration has become widely accessible to applied economics (Harris, 1995). Johansen's test has a number of desirable properties, including the fact that all test variables are treated as endogenous variables (Wassell and Saunders, 1996). The procedure is based on estimating of matrix (A) and its rank. It has the advantage that it allows for the existence of more than one cointegrating relationship (vector) and the speed of adjustment towards the long-term equilibrium are easily computed. The procedure is a Maximum Likelihood (ML) approach in a multivariate autoregressive framework with enough lags introduced to have a well-behaved disturbance term (Bakucs and, Ferto, 2006).

This approach requires to specify the correctly Vector Error Correction Model (VECM) because it is necessary to ensure the residuals in the model are white noise. Johansen's approach allows us to deal with models with several endogenous variables and has a number of other advantages. The Engle-Granger and single equation ECM approaches suffer from a number of weaknesses and they assume there is only one cointegrating relationship between variables. This is possibly incorrect when dealing with more than two variables. They assume one variable can be treated as the dependent variable, the other(s) as exogenous. This is often silly in economics tests relating to the LR parameters are not possible often such tests are of interest. Johansen's procedure addresses all these problems. But this approach sensitive to variables selection and number of lags included and it does not perform very well in small sample. A key aspect of this Johansen's approach is isolating and identifying the cointegrating combinations among a set of k integrated variables and incorporating them into an empirical model. The procedure begins with unrestricted VAR involving potentially non-stationary variables. The Johansen's procedure of cointegration tests is based on the maximum likelihood estimation of the VAR model so call reduced rank test. Johansen's methodology takes it's starting point in the vector autoregression (VAR) of order *i* given by

$$P_t = A_0 + \sum_{i=1}^{k} A_i P_{t-i} + u_t \qquad (3.14)$$

Where,

P_t = an (n x 1) column vector containing n variables included in VAR at time ($P_{1t,}$ P2t$_{,\ldots}P_{nt}$)

A_0 = (n x 1) vector of intercept terms

A_i = (n x n) matrix of coefficients with no zero element

u_t = (n x 1)column vector of random error which are possibly serially correlated normally distributed disturbances, but not autocorrelated

I = a time lag for (i=1, 2, 3…k)

n = number of variables

This VAR can be re-written as

$$\Delta P_t = \Pi P_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta P_{t-i} + u_t \quad (3.15)$$

The Π (n x n) contains the information of long run relationship and it can be written as tow (n x r) matrices α, β (1≤ r ≤ n-1= number of cointegraiton vector) meaning that Π= αβ′, where α represents the speed of adjustment towards long run equilibrium, while β′ is matrix of long-run coefficients. If Π has reduced rank, there are r ≤ n-1 cointegration vectors (Harris, 1995). This approach starts with unrestricted vector autoregression (VAR) involving potentially non stationary variables. The rank of matrix (Π) is a key to impose restriction. The rank of matrix is a number of linearly independent rows in the matrix which can be determined by counting the number of its eigenvalues that differ from zero. Johansen derived the distribution of two different likelihood ratio tests statistics for cointegration as the Trace and the eigenvalue tests. Formal test hypothesis for Trace test and maximum eigenvalue test are set as follow.

Trace test

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1-\hat{\lambda}_i) \quad (3.16)$$

H_0: number of cointegration vectors ≤ r

H_1: number of cointgeration vectors > r

Maximum eigenvalue test

$$\lambda_{max}(r,r+1) = -T \ln\left(1-\hat{\lambda}_{r+1}\right) \quad (3.17)$$

H_0: number of cointegration vectors = r

H_1: number of cointgeration vectors = r +1

Here T is the sample size, $\hat{\lambda}_i$ is the estimated values of the characteristic roots (also call eigenvalues) obtained from the estimated matrix (Enders, 2004). The rank

of matrix is r (1< r <n. (n= number of variables). If the rank of matrix (Π) is n (full rank, r=n), all rows in the matrix (Π) are linearly independent and all variable are stationary. If the rank of matrix (Π) is zero there are no cointegration relationships. When (Π) has reduced rank r meaning that there are r ≤ (n-1) cointegration vectors (Harris, 1995).

Trace test and Maximum eigenvalue test are used to determine the rank of matrix. If the rank of Π is full rank (that is there are r=n linearly dependent columns) then the variables in P_t are *I*(0), while if the rank of Π is zero then there are no cointegration relationships. The most interesting case is that, if Π has reduced rank; that is there are r ≤ (n-1) cointegration vectors present (Harris, 1995). It has the advantage that it allows for the existence of more than one cointegrating relationship (vector) and the speed of adjustment towards the long-term equilibrium are easily computed. This approach requires to specify the correctly Vector Error Correction Model (VECM) because it is necessary to ensure the residuals in the model are white noise.

2.6 Error Correction Model (ECM)

Then the residuals from the equilibrium regression can be used to estimate the error correction model (ECM). The principle behind these models is that there often exists a long-run equilibrium relationship between two or more economic variables. In the short run, however, there may be disequilibrium. With the error correction mechanism, a proportion of the disequilibrium in one period is corrected in the next period. For instance, the change in price in one period may depend on the excess demand in the previous period. Engle and Granger propose the direct estimation of ECM by for two variables with constant in cointegration equations as follows.

$$\Delta P_{1t}=\alpha_{01}+\alpha_{p1}(P_{1t-1}-\beta_0-\beta_1 P_{2t-1})+\sum_{i=1}^{k}\alpha_{11}(i)\Delta P_{1t-i}+\sum_{i=1}^{k}\alpha_{12}(i)\Delta P_{2t-i}+\varepsilon_{1t} \qquad (3.18)$$

$$\Delta P_{2t}=\alpha_{02}+\alpha_{p2}(P_{1t-1}-\beta_0-\beta_1 P_{2t-1})+\sum_{i=1}^{k}\alpha_{21}\ (i)\Delta P_{1t-i}+\sum_{i=1}^{k}\alpha_{22}(i)\Delta P_{2t-i}+\varepsilon_{2t} \quad (3.19)$$

It is possible to used saved residual $\hat{e}_t$ from the equation (3.11) for ECM. The magnitude of $\hat{e}_{t-1}$is deviation of long run equilibrium period (t-1). Thus, using the saved residuals of the long run equilibrium relationship, ECM as;

$$\Delta P_{1t}=\alpha_{01}+\alpha_{p1}\,\hat{e}_{t-1}+\sum_{i=1}^{k}\alpha_{11}\ (i)\Delta P_{1t-i}+\sum_{i=1}^{k}\alpha_{12}(i)\Delta P_{2t-i}+\varepsilon_{1t} \quad (3.20)$$

$$\Delta P_{2t}=\alpha_{02}+\alpha_{p2}\,\hat{e}_{t-1}+\sum_{i=1}^{k}\alpha_{21}\ (i)\Delta P_{1t-i}+\sum_{i=1}^{k}\alpha_{22}(i)\Delta P_{2t-i}+\varepsilon_{2t} \quad (3.21)$$

Where, i=1, 2,

…, k-1 (k=number of lag)

P_{1t}, P_{2t} = the price of market 1 and 2 at time t

$\beta_{1=}$ parameter of the cointegration vector

ε_{1t} , ε_{2t} = white-noise error terms

$\alpha_{p1,}$ α_{p2} =parameters of speed of adjustments

$\alpha_{01,}$ α_{02}= constant terms

α_{11} (i), α_{21} (i) = parameters of ΔP_{1t-i}

α_{12} (i), α_{22} (i) = parameters of ΔP_{2t-i} (Ender, 2004)

The parameters of the ECM equation can be estimated by the OLS method since all the variables are stationary because they are in their first difference form. The coefficient of the lagged residual in the ECM equation is of particular interest because it represents the speed of adjustment parameter. The number of lags to be included in the ECM equation is determined that the errors in this equation become white noise. Appropriate lag length test has to be performed here to ensure white noise error term. One of the selected information criterions for VAR can be used for selecting the optimum lag lengths. The value of the speed of adjustment parameter is expected to be less than one in absolute terms for stability of the system and for the

variables in the long-run regression to be co-integrated. The sign of this parameter would indicate the direction of the adjustment process. If the system deviates from its long-run path, the sign and magnitude of this parameter would indicate the direction of adjustment and speed at which the variables would adjust in the short-run in order to go back to its long-run equilibrium path (Anisul and Syed, 1999).

Related to negative signs of the coefficients for the speed of adjustments of both prices series in all ECM estimates, both prices would move to the same direction to correct the deviation from long run equilibrium. According to Enders (2004), the gap between the last period's prices can be closed by three following actions.

1. An increase in one prices and/or a decrease in other price (in this case, both adjustment are positive and negative signs.)

2. An increase in one price but a commensurately large rise in other price (in this case, both adjustment are negative signs.)

3. A fall in one price but smaller fall in other price (in this case, both adjustment are positive signs.).

If there are more than two variables in the model, there can be more than one cointegration vector. Assuming there is only one cointegration vector, when in fact may lead to inefficiency in the sense that only linear combination of these vectors can be obtained when estimating a single equation model. However, this approach extend beyond its in ability to validity estimate the long run relationship between the variables, even if there is only one cointegration relationships, estimating the single equation is potentially inefficient (i.e. it does not lead to the smallest variance against alternative approaches). The information will be lost unless each endogenous variable appears on the left hand size of estimated equation in the multivariate model, except the case where all the left hand size of variables is weekly exogenous (Harris, 1995). The zero adjustment coefficient restriction for the variables in right hand size implicitly requires that to be weakly exogenous to the left hand size variables.

2.7 Long run causality test

Because cointegration itself cannot be used to make inferences about the direction of causation between the variables, and thus causality tests are necessary. Although cointegration between two prices series implies Granger causality in at least one direction, the opposite is not necessarily true, that is causality in a least one direction does not imply the existence of a cointegration relationship (Atingi-Ego, 2006). Granger causality provides additional evidence as to whether, and in which direction, price transmission is occurring between two series. However, Granger causality may exist, indicating that, although the two price series drift apart due to other factors such as non stationary transaction costs, some price signals are passing through from one market to another. On the other hand, lack of Granger causality may not imply an absence of transmission, as price signals may be transmitted instantaneously under special circumstances (Rapsomanikis *et al*., 2004).

Granger (1988) discussed that if two price series were cointegrated, the standard Granger causality tests might be no longer appropriate. The reason was that the two series were generated by an error correction mechanism, without correcting the error using the identified cointegrating relationship could be mis-specified. To rectify this problem, if the variables were *I*(1) and cointegrated, Granger causality test with the Error Correction framework was used to estimate long run causality. According to estimate the direction of causality, Pair wise Granger causality test with χ^2 statistic was used under ECM frame work, by equation (3.18) and (3.19). Rejection of the null was taken as evidence that Granger causality. If all α_{12} are zero P_2 granger caused $P_1$and if α_{21} are zero, P_1 granger caused P_2. Selection of lag length tests can be performed on any variable or any set variables. This is true regardless of whether the variables in question are stationary. If the variables are non stationary and I(1), Granger causality test can be made only in first differences and F test can be used. Standard VAR with F test was used for the variables which are not cointegrated (Enders, 2004).

Methods and Procedures

The purpose of methods and procedures for this study was to provide the plan, and its description, of how the objectives of the study would be achieved. It was the what, why and how of the research: step by step specification and description of what would be done, how it would be done and why it would be done in the specification manner.

Source of Data and Data Collection

This study included both primary data and secondary time series data to understand the sesame market and price transmission.

1. Primary data collection

To collect the primary data, the field survey was conducted at the major sesame growing area Mandalay, Sagaing and Magway division during November to December, 2008. Selection of study site were based on their sesame growing area, number of growers, accessibility for communication and majority of sesame markets in central Myanmar. To access the current performances of sesame markets, informal interviews with different structured questionnaires for all actors along supply chain such as farmers, traders, wholesalers, millers and exporters were conducted. Questionnaires were prepared for both quantitative and qualitative analysis. All respondents were accidently selected and interviewed. The interviews were carried out with total 106 sesame farmers from Kula village, Kyatsae Township in Mandalay Division, Kyawe Ye village, Monywa Township in Sagaing Division and Miethwekan village, Pakokku Township in Magway Divisions. The map of study site was attached in Appendix Figure 1.

In addition, 16 wholesalers and 19 millers from Mandalay, Monywa and Pakokku Townships were interviewed at Crop Exchange Centers (CEXCs) in each township, at their mills and their transactional business to understand the market

structure and market information of the sesame. In addition, 5 exporters from Mandalay and 3 exporters from Yangon Townships were also interviewed for the information about sesame export. Yangon is not only sesame growing area but also deficit region of sesame seed and edible oil. Therefore, it was not available to interview with farmers over there. The numbers of respondents from different markets were as shown in Table 5. Primary data of demographic characteristics of all respondents, agricultural characteristics of farmers, market performances of farmers and middlemen were also collected.

Table 5 Numbers of respondents in selected site, 2008

Respondents	Markets			
	Mandalay	**Monywa**	**Pakokku**	**Yangon**
Farmers	43	30	33	-
Millers	7	7	5	-
Wholesalers	4	6	6	-
Exporters	5	-	-	3
Total	59	43	44	3

Source: Own survey (2008)

2. Time series price data collection

If the distance between the markets is far, or for the studies of long run integration, the seasonal, monthly or two week price data are appropriate. If the distance between the markets is short, or for the studies of short run integration, the ten-day, weekly or even daily prices are appropriate, because the price transmission information spreads fast between two markets near each other, and the price difference between markets can disappear quickly. For the study of integration between provincial markets, monthly prices are sufficient (Wu, 2004). Therefore, monthly prices series in different markets were used in this study. In order to identify the long run price performance, monthly wholesale prices of white and black sesame seed and sesame oil data (September, 2002 to October 2008) were collected from

Mandalay, Monywa and Pakokku markets. Additionally, export price of black and white sesame seeds, were collected. Secondary data collections were explained in Table 6. The required secondary data were obtained from Central Statistical Organization (CSO) and Department of Agricultural Planning (DAP).

Table 6 Selected monthly wholesale price series, 2008

No of wholesale price series in Selected	Time Range	Total Observation
White sesame seed in Mandalay	2002:09-2008:10	74
Black sesame in Mandalay	2002:09-2008:10	74
Black sesame in Pakokku	2002:09-2008:10	74
White sesame in Monywa	2002:09-2008:10	74
Export price of sesame seed (FOB)	2002:09-2008:10	74
Export Volume of sesame seed	2002:09-2008:10	74
Wholesale price of sesame oil in Mandalay, , Monywa, Pakokku and Yangon markets	2002:09-2008:10	74

Source: CSO (2002-2008), DAP (2002-2008)

Descriptive Analysis

The primary data obtained from field survey were coded and entered to SPSS computer software for descriptive analysis. Frequency and means for different variables included in demographic characteristics of all respondents, agricultural characteristics of farmers, market performances of farmers and middlemen were estimated. In order to explain the whole current sesame industry, the evaluation was based on the results of primary data at the time of survey. Furthermore, costs of sesame production per unit area and revenue cost ratio were also calculated.

Marketing Costs and Marketing Margins Analysis

Marketing costs in this study including transportation costs, labor costs, commissions and processing costs were taken to estimate the marketing margins between different levels. Marketing costs of sesame were observed in kyat per basket and then transformed to kyat per kilogram (kyat/kg). For the farmers, production costs per unit area, total revenue and net revenues were calculated by equation 3.1, 3.1 and 3.3. The ratios of revenue to cost were also calculated for all selected villages. Regarding to marketing margin analysis, marketing margins were measured as gross margins percents for all actors along the supply chain. Price spread from farmer's price to export's prices was calculated by equation 2.5. Gross margins for farmers, wholesalers and exporters were estimated by equations 3.22, 3.23 and 3.24. Farmer's shares and wholesaler's shares were calculated by equations 3.25 and 3.26.

$$GM_f\ (\text{percent}) = (P_f - P_{fb})/P_f \times 100 \quad (3.22)$$

$$GM_w(\text{percent}) = (P_w - P_{wb})/P_w \times 100 \quad (3.23)$$

$$GM_{ex}(\text{percent}) = (P_{ex} - P_{exb})/P_{ex} \times 100 \quad (3.24)$$

$$FS_{ex} = (P_f/P_{ex}) \times 100 \quad (3.25)$$

$$WS_{ex} = (P_w/P_{ex}) \times 100 \quad (3.26)$$

Where,

GM_f, GM_w, GM_{ex}= Gross margins of farmers wholesalers and exporters

P_f, P_w, P_{ex}= Prices received by farmers, wholesalers and exporters

P_{fb}, P_{wb}, P_{exb}=Buying prices of farmers, wholesalers and exporters.

FS_{ex}, WS_{ex}=Farmer's and wholesaler's share to export price

Time Series Data Analysis

There are 5 sectors in this section: data generation process, testing for unit root and order of integration, test for cointegration, error correction model and long run Granger causality test.

1. Data generation process

Statistical software of Eviews 4.0 was used to generate the time series data. The co-integration method was used in the integration analysis of Myanmar sesame seed and sesame oil market. Symbol and notation of variables for sesame price series used in this data generating process were illustrated in Table 7. According to the econometric methodology, one of the first steps in co-integration analysis is to test for the stationary properties of the univariate time series.

The test of the stationary is important because there is a one-to-one relationship between the number of stationary variable and number of co-integration relationships (Theingi Myint, 2007). The main reason why it is important to know whether time series is stationary or non stationary embarks on regression analysis is that there is a danger of obtaining apparently significant regression results from unrelated data when non stationary series are used in regression analysis (Hill, 2007). In the presence of non stationary variables, there might be spurious regression which has high R^2 and t-statistic appear to be significant, but the results are without any economics meaning (Enders, 2004).

2. Testing for unit root and order of integration

In this study, Augmented Dickey Fuller (ADF) test was used for unit root test. ADF test is comparable to the simple Dickey fuller (DF) test but it involves adding an unknown number of lagged first differences of the dependent variable to capture autocorrelated omitted variables (Harris, 1995). All sesame seed and oil prices series in this study were tested for unit root by ADF test with draft and/linear deterministic

trend. When performing unit root test, it was needed to decide whether to use with no constant or that include a constant term or that includes a constant and deterministic time trend. In order to select the equation of ADF all of sesame prices series were plotted and make line graph. All price series were fluctuated around none zero mean and constant term was included in ADF equations.

Table 7 Symbols and notations of variable for sesame price series, 2008

Symbol	Explanations	Unit
Market *a*	Mandalay market	
Market *b*	Monywa market	
Market *c*	Pakokku market	
Market *d*	Yangon market	
PW_a	Wholesale price of white sesame seed in Mandalay market	kyats/basket
PW_b	Wholesale price of white sesame seed in Monywa market	kyats/basket
PBl_a	Wholesale price of black sesame seed in Mandalay market	kyats/basket
PBl_c	Wholesale price of black sesame seed in Pakokku market	kyats/basket
FOB	FOB Myanmar of sesame seed	kyats/basket
PSO_a	Wholesale price of sesame oil in Mandalay market	kyats/viss
PSO_b	Wholesale price of sesame oil in Monywa market	kyats/viss
PSO_c	Wholesale price of sesame oil in Pakokku market	kyats/viss
PSO_d	Wholesale price of sesame oil in Yangon market	kyats/viss

Note**:** kyat = Myanmar currency,

viss = Myanmar measurement for weight (1 viss =1.63 kg)

basket= Myanmar measurement for volume

1 basket of sesame seed =15viss = 24.49 kg = 54 lb

The ADF tests were performed with drift plus trend plus lag up to 11 lagged terms of the differenced terms in the regression and optimum lag length are determined based on Schwartz Information Criterion (SIC). The ADF tests without trend were also tests at the same time. Unit root test for wholesale price of white sesame was generated by ADF equations with and without trend (equation 3.27 and 3.28).

$$\Delta PW_t = \alpha + \beta\, PW_{t-1} + \gamma t + \sum_{k=1}^{n} \delta\, \Delta PW_{t-k} + \varepsilon_t \qquad (3.27)$$

$$\Delta PW_t = \alpha + \beta\, PW_{t-1} + \sum_{k=1}^{n} \delta\, \Delta PW_{t-k} + \varepsilon_t \qquad (3.28)$$

H_0: $\beta=0$ (Price series have unit root and they are non stationary)

H_1: $\beta<0$ (Stationary)

PW_t=Wholesale prices of white sesame seed in market a, b and export market (FOB) at time t

t = Time trend of each price series

Correspondingly, the same tests were applied for black sesame seed and sesame oil price series in all selected markets.

3. Tests for cointegration

In this study, the residual-based test of Engle and Granger (1987) and the VAR-based tests of Johansen's cointegration test (1988) were applied to test cointegration between each pair of sesame seeds and sesame oil price series in different markets. Johansen's cointegration test statistics for the null of no cointegration referred as the Trace and eigenvalue tests.

3.1 Engle and Granger cointegration test

After data generating process, sesame seeds and sesame oil price series were tested for integration between different markets. When the price series were cointegrated, they had already tied together in same way. The first step of Engle and Granger's procedure was to determine the OLS regression of one price series against others price series with a constant. Long run equilibrium relationship of the sesame seed and sesame oil prices between the different markets were estimated by using the equation the OLS equation (3.11). Long run equilibrium relationships used for the

prices series of white sesame seeds for market *a, b* and export market (FOB), the prices series of black sesame seeds for market *a, c* and export market (FOB) and sesame oil for market *a, b, c,* and *d* were as follows. Dependent and independent variables were determined by the results of causality tests.

White sesame seeds,

$$PW_{at}=\beta_0+\beta_1 PW_{bt}+e_t \quad (3.29)$$

$$FOB_t=\beta_0+\beta_1 PW_{at}+e_t \quad (3.30)$$

$$FOB_t=\beta_0+\beta_1 PW_{bt}+e_t \quad (3.31)$$

Where,

PW_{at}, PW_{bt} = wholesale price of white sesame seed in Mandalay market (*a*) and Monywa market (*b*) at time *t.*

FOB_t =Average export price of white and black sesame seed at time t

β_1 = cointegration parameters

β_0 = constant term

Black sesame seeds,

$$PBL_{ct}=\beta_0+\beta_1 PBL_{at}+e_t \quad (3.32)$$

$$FOB_t=\beta_0+\beta_1 PBL_{at}+e_t \quad (3.33)$$

$$FOB_t=\beta_0+\beta_1 PBL_{ct}+e_t \quad (3.34)$$

Where,

PBL_{at} , PBL_{ct} = wholesale price of black sesame seed in Mandalay (*a*) and Pakokku (*c*) markets at time t.

FOB_t =Average export price of white and black sesame seed at time t

β_1 = cointegration parameters

β_0 = constant term

Sesame oil,

$$PSO_{dt}=\beta_0+\beta_1 PSO_{at}+e_t \quad (3.35)$$

$$PSO_{dt}=\beta_0+\beta_1 PSO_{bt}+e_t \quad (3.36)$$

$$PSO_{dt}=\beta_0+\beta_1 PSO_{ct}+e_t \quad (3.37)$$

$$PSO_{bt}=\beta_0+\beta_1 PSO_{at}+e_t \quad (3.38)$$

$$PSO_{ct}=\beta_0+\beta_1 PSO_{at}+e_t \quad (3.39)$$

$$PSO_{bt}=\beta_0+\beta_1 PSO_{ct}+e_t \quad (3.40)$$

Where,

PSO_{at}, PSO_{bt}, PSO_{ct} , PSO_{at} = wholesale price of sesame oil in Mandalay (a), Monywa market (*b*), Pakokku (*c*) and Yangon (*d*) market at time t.

β_1 = cointegration parameters

β_0 = constant term

However, to overcome the problem of small sample bias, ADF test was applied two times for each pair of prices series by using dependent variable in turn. The steps for cointegration were necessary to evaluate whether the residuals were a stationary process. Therefore the residuals, e_t from the co-integrating regression were saved and tested by using the ADF test with the help of equation (3.12) and (3.13). Since, the residual sequence was estimated residual from the long run regression and there was no need to include constant term and trend.

If the null hypothesis was rejected, the residual series was stationary (*I*(0))and that the variables were cointegrated (Enders, 2004. p. 336). When they were cointegrated in *I*(1), ECM was continued to estimate the dynamics of both sort run and long run adjustment as well as causal factors that affected the variables. Mackinnon (1991) critical values (with constant in cointegration vector) were used as the critical values of Engle-Granger cointegation test for two variables in cointegration equations (Ender, 2004, p: 441). Sample size (T) is 74 and the average critical value between sample size 50 and 100 were taken for this study.

3.2 Johansen's cointegration test

To ensure the existence of long run equilibrium for the sesame seeds and oil price series, Johansen's maximum likelihood method was applied to all prices series. Although Engle-Granger cointegration method could be adequate in a bivariate system, additional evidence about cointegration was provided by applying the more general technique developed by Johansen (1988) and Johansen-Juselius (1990). Trace test and maximum eigenvalue test by equation (3.16) and (3.17) were used to determine the rank of matrix. The appropriate lag lengths were selected by AIC and SIC with minimum value. Largrange Multipier statistic (LM) test was applied to make sure the appropriate lag length has no serial correlation. In formulating the dynamic model for the test, the question of whether an intercept and trend should enter the short- and/or long-run model was raised (Harris, 1995, p.95). There were five assumptions for Johansen cointegration test and the assumption three was used for this study. Because the original data were assumed to include linear deterministic trends and all cointegration equations had constant term.

4. Error Correction Model (ECM)

In this study all tested model included two variables and there would be at most one cointegration between them. Since series had cointegration and error correction representation was specified to estimate the short run response to the previous period's deviation from the long run equilibrium. This was also the estimating the speed of adjustment. If the price series were cointegrated, at least one of the speeds of adjustment must be non zero. Estimated ECMs with constant term for white sesame prices in market *a* and *b* were as follows.

$$\begin{pmatrix}\Delta PW_{at}\\ \Delta PW_{bt}\end{pmatrix}=\begin{pmatrix}\alpha_{0a}\\ \alpha_{0b}\end{pmatrix}+\Pi\begin{pmatrix}PW_{at-1}\\ PW_{bt-1}\end{pmatrix}+\sum_{i=1}^{k}\Gamma_i\begin{pmatrix}\Delta PW_{at-i}\\ \Delta PW_{bt-i}\end{pmatrix}+\begin{pmatrix}\varepsilon_{at}\\ \varepsilon_{bt}\end{pmatrix} \qquad (3.41)$$

Where,

$\Pi=(\alpha\beta)$= n x n matrix of long run relationship

Γ= n x n matrix of parameters to be estimate

$$\Delta PW_{at}=\alpha_{0a}+\alpha_a\,(PW_{at-1}-\beta_0-\beta_1 PW_{bt-1})+\sum_{i=1}^{k}\alpha_{11}\,(i)\Delta PW_{at-i}+\sum_{i=1}^{k}\alpha_{12}(i)\Delta PW_{bt-i}+\varepsilon_{at} \qquad (3.42)$$

$$\Delta PW_{bt}=\alpha_{0b}+\alpha_b\,(PW_{at-1}-\beta_0-\beta_1 PW_{bt-1})+\sum_{i=1}^{k}\alpha_{21}(i)\Delta PW_{at-i}+\sum_{i=1}^{k}\alpha_{22}(i)\Delta PW_{bt-i}+\varepsilon_{bt} \qquad (3.43)$$

Where,

i =1, 2, …, k-1 (k=number of lag)

α_{0a}, α_{0b}= constant terms

α_a, α_b = speed of adjustment to disequilibrium

β_1= cointegration vector

ε_{at}, ε_{bt} = with noise error term from each equation

$\alpha_{11}(i)$,$\alpha_{12}(i)$,$\alpha_{21}(i)$,$\alpha_{22}(i)$= parameters to be estimated.

The similar tested equations were applied for other prices series of sesame seed and sesame oil in different markets.

5. Long run Granger causality test

If the tested price series were cointegrated, it could be further proceed to determine the direction of causality, in Granger's sense, among the sesame seed and sesame oil price series. Again, the existence of a long run relationship between prices series suggested that all variables were casually related at least one direction. Since the price series were cointegrated and had long run relationship, Granger causality within the Error Correction frame work was employed to explore the direction of causality. The causality relation as defined by Granger was applied to test if the past observations of the one of the two price series fail (to predict) to those of another. Chi-square ($\chi 2$) (Wald) statistics was used for the joint significance of each of the other lagged endogenous price series in each equation of the model. Rejection of the null was taken as evidence that Granger-causality. The estimated ECM for causality test for white sesame seed in market *a* and *b* were tested with single equation as follows.

$$\Delta PW_{at}=\alpha_{0a}+\alpha_a\,(PW_{at-1}-\beta_0-\beta_1 PW_{bt-1})+\sum_{i=1}^{k}\alpha_{11}\,(i)\,\Delta PW_{at-i}+\sum_{i=1}^{k}\alpha_{12}(i)\Delta PW_{bt-i}+\varepsilon_{at} \quad (3.44)$$

$$\Delta PW_{bt}=\alpha_{0b}+\alpha_b\,(PW_{at-1}-\beta_0-\beta_1 PW_{bt-1})+\sum_{i=1}^{k}\alpha_{21}\,(i)\,\Delta PW_{at-i}+\sum_{i=1}^{k}\alpha_{22}(i)\Delta PW_{bt-i}+\varepsilon_{bt} \quad (3.45)$$

Where,

i =1, 2,…, k-1 (k=number of lag)

β_1, β_1 = cointegration vectors from (3.19)

ε_{bt}, ε_{at} =white noise disturbance

α_{0b},α_{0a} = constant terms

$\alpha_{11}(i)$,$\alpha_{12}(i)$,$\alpha_{21}(i)$,$\alpha_{22}(i)$= parameters to be estimated.

If $\alpha_{12}(i)=0$, ΔPW_{bt} did not Granger cause ΔPW_{at} and if $\alpha_{21}(i)=0$, ΔPW_{at} did not Granger cause ΔPW_{bt}. Since the independent variables were identical for each equation, this specification assured that the error term was not correlated between all equations and it allowed us to use Ordinary Least Square (OLS) rather than the more sophisticated procedure. In model, the error term was a white noise error. The same procedures were applied to the rest of white sesame seed prices, black sesame seed prices and sesame oil prices in domestic and export markets. The overall results would be discussed in the Chapter 4.

CHAPTER IV

RESULTS AND DISCUSSIONS

This chapter presents the descriptive results of the survey and the results of the time series data analysis by dividing four parts as follows:

Part 1: The Results and Discussions of the Descriptive Analysis

Part 2: Estimated Marketing Channels and Discussions

Part 3: The Results and Discussions of the Marketing costs and Marketing margins

Part 4: The Results and Discussions of the Time Series data Analysis

Part 1: The Results and Discussions of the Descriptive Analysis

This part explained the results and discussion on the demographic and socioeconomic characteristics, agricultural characteristics, the costs of production, return above variable costs and revenue cost ratio. In addition, the demographic and socioeconomic characteristics, marketing performances and opinions of wholesalers and millers on current sesame industry were also presented in this part.

1. Demographic and socioeconomic characteristics of sample farmers in selected villages

The demographic and socioeconomic and agricultural characteristics of farmers, wholesalers, millers and traders and how they performed their farming system, farming practices and marketing activities were summarized by descriptive data. This study described the demographic and socioeconomic and agricultural characteristics of farmers, wholesales, millers and exporters. Table 8 illustrated the average age, experience and educational level of sample farmers in selected sites.

According to survey, average ages of farmers in Kula village, Kyawe Ye village and Miethwekan villages were 45.5, 48.43 and 49.60 respectively. Each family had average members of 5 in both Kula village and Miethwekan village whereas the largest household size 6 was found in Kyawe Ye village. Farming experience was vital role for the farmers to make successful farming business. The experienced years of growing sesame were divided into 3 groups as shown in Table 8. About 47.37 percent of farmers from Kula village, 4.35 percent of farmers from Kyawe Ye village and 20 percent of farmers in Miethwekan village had 5 to 10 years experiences of growing sesame while 10.53 percent of farmers in Kula village, 30.43 percent of farmers in Kyawe Ye and 20 percent farmers in Miethwekan village had 11 to 15 years experience of growing sesame in each respective regions. Accordingly, 42.11 percent of farmers from Kula village, 21.74 percent of farmers from Kyawe Ye village and 60 percent of farmers from Miethwekan village had grown sesame more than 15 years ago. Moreover, educational background of household head was a key

factor for the agricultural technological innovation. Low education level not only discouraged farmers from adopting modern agricultural technology and knowledge, but they could also have some difficulties and low ability to solve the problems in operating farms and marketing outputs.

Table 8 Average ages, experiences and education levels of sample farmers in selected villages, 2008

No.	Classifications	Names of Villages		
		Kula (43)	**Kyawe Ye (30)**	**Miethwekan (33)**
1.	Average age (Year)	45.5	48.43	49.60
	Std. deviation	6.53	12.35	15.24
	Range	35-57	31-77	25-79
2.	Average family members	5	6	5
	Std. deviation	1.92	2.05	1.50
	Range	3-11	3-10	4-80
3.	Experience (percent)			
	5-10 year	47.37	4.35	20.00
	11-15 year	10.53	30.43	20.00
	>15 year	42.11	21.74	60.00
4.	Education level (percent)			
	Primary	26.32	30.43	70.00
	Secondary	63.16	17.39	20.00
	High school	10.53	13.04	10.00
	Graduated	0.00	31.15	0.00

Source: Own survey (2008)

Depending upon the respondents' education ranges, education levels were classified into 4 groups such as primary level, secondary level, high school level and graduated level. In this survey, 63.16 percent of farmers from Kula village and 17.39 percent of farmers from Kyawe Ye village and 20 percent of farmers from Miethwekan village had secondary level. Most of farmers (70 percent) in Miethwekan village had primary level but the percentage of the farmers with primary

level in Kula village and Kyawe Ye village were 26.32 and 30.43. Among the farmers, only 31.15 percent of farmers in KyaweYe village were graduated.

2. Agricultural characteristics of the sample farmers

2.1 Land holding, sesame growing area, yield per acre and average sesame production of sample farmers selected villages

In Central Dry Zone, 62 percent of the total areas are dry upland (Yar Mye[4]), 33 percent were low land (Lae Mye[5]) and the rests are delta region (Kaing Mye[6]) (Favre and Kyaw Myint, 2009). All selected areas in Kula village were irrigated low land (Irrigated Lae Mye) but all selected areas in Miethwekan village were upland (Yar Mye). Both low land and upland areas were found in Kyawe Ye village (Table 9). Land holding is the important role for the economy of scale of production. If land holding is very small, crop production cannot be done efficiently.

Table 9. Land type and land holding of sample farmers in selected villages, 2008

No.	Classifications	Names of Villages		
		Kula	**Kyawe Ye**	**Miethwekan**
1.	Land Type	Lae Mye	Lae Mye,Yar Mye	Yar Mye
2.	Average total land holding (ha)	2.23	5.38	7.65
3.	Std. deviation	2.47	8.26	10.48
4.	Range	0.8-4.01	1.62-14.78	2.83-16.19

Source: Own survey (2008)

Among the survey area, the highest average land holding 7.65 hectare was found in Miethwekan viallage with the range of 2.83-16.19 hectares. The second largest land holding (5.38ha) could be seen in Kyawe Ye village and the smallest land holding (2.23ha) was found in Kula village**.**

[4] Yar Mye is less fertile and gently sloping dry upland.
[5] Lae Mye (paddy field) is leveled cultivated plain and have high clay content.
[6] Kaing Mye is exposed by failing river and fertile land.

2.2 Sesame production of the sample farmers

Regarding to the sesame production, average largest sesame growing area (3.87ha) was found in Miethwekan village but the yield was only 373.83 kg/ha (Table10). The second largest sesame growing area (2 ha) was found in Kula village where all land were irrigated low land (Lae Mye) with the highest average yield of 799.68 kg/ha. Finally, the smallest average sesame growing area (1.47ha) was accounted by farmers in Kywe Ye village with the yield of 514.17 kg/ha. About 62.50 percent of farmers irrigated to sesame growing and 37.50 percent of farmers did not irrigate because of growing sesame in Yar Mye.

The farmers from the Miethwekan village hold the large area of land but they sown only half of the average total land areas because the uncertain yield. Farmers cultivated cool season sesame in September and harvest in December. The crop depended entirely on the late rainfall. If the late rainfall was not available at right time and they could not get enough moisture for their sesame growing consequently it might cause the low yield and risk to farmers. The farmers from Kula village took good care of summer sesame growing and they did all required cultural practices very well. The land was irrigated low land as well as good fertility. Actually, summer sesame is called Irrigated sesame or pre monsoon irrigated sesame. In addition, summer sesame was planted in February to March while irrigated water was supplied when necessary and had lead to successful growth. This area was also well known as good sesame production area in Mandalay Division. Therefore, the average yield of Kula village area was the highest. In particular, it was found that the farmers captured the highest margin from all cropping options with the pre-monsoon irrigated sesame (summer sesame). About 27.27 to 28.57 percent of farmers in all selected villages were available to get credit supported by Myanmar Agricultural Development Bank (MADB) and State Peace and Development Council (SPDC). The average amount of credit was 4,000 kyat per acre with the interest rate of 1.5 percent per month and the payback period was three months. It was only one to three percent of the total production cost.

Table 10 Sesame growing area, yield per unit area, types of sesame, time sowing, harvesting, source of water and credit, 2008

No.	Classifications	Names of Villages		
		Kula	**Kyawe Ye**	**Miethwekan**
1.	Average sesame growing area (ha)	2	1.47	3.87
	Std. deviation	2.47	3.20	6.71
	Range (ha)	0.8-4.05	0.4-4.86	1.01-10.12
2.	Average yield per acre of sesame seed (kg/ha)	799.68	514.17	373.83
	Std. deviation	1.57	2.18	2.01
	Range (kg/ha)	605-907	242-726	181-544
3.	Average production per farmer (kg)	3,940	1,872	3,235
4.	Types of sesame and percentage of total area			
	White	Sin-Yadana-4 Thar-Tun-phyu 100 %	Sin-Yadana-4 29.41 %	Sin-Yadana-4 19.32 %
	Black	-	Gwa-kyaw-net 57.84 %	Gwa-kyaw-net 71.98 %
	Brown	-	Yoe-sein 12.75 %	Yoe-sein 8.7 %
7.	Sowing time and Harvesting time	March-June	March-June	September-December
8.	Source of water			
	Irrigation (percent)	100	62.50	0
	Without irrigation / Late monsoon (percent)	0	37.50	100
9.	Availability of Credit supported (percent)	27.78	27.27	28.57

Source: Own survey (2008)

2.3 Cropping patterns of the sample farmers

Cropping patterns of the dry zone were variable because both annual rainfall and its distribution were variable particularly in central dry zone of Myanmar. General cropping patterns of sesame farmers in selected sites at the time of survey were shown in Table 11. In Kula village, most common cropping pattern was growing summer sesame before monsoon paddy. Land type was irrigated low land

and land could be cultivated all year round. In this area, summer sesame was cultivated under irrigation and monsoon paddy was sown as second crop. This cropping pattern was quite efficient for the farmers in this area. General cropping pattern in low land of Kyawe Ye village was the summer sesame followed by monsoon paddy and another common pattern was monsoon paddy and winter sesame. There were two common cropping patterns, the winter sesame and the winter vegetables in the upland of Kyawe Ye village. However the general cropping pattern in Miethwekan village was the monsoon groundnut followed by the winter sesame because of more proper rainfall in this area.

Table 11 General cropping patterns of sample farmers in study sites, 2008

No.	Name of village	Land type	General Cropping Pattern
1.	Kula village	Lae Mye	Summer sesame-monsoon paddy
2.	Kyawe Ye village	Lae Mye	Summer sesame-monsoon paddy Monsoon paddy-winter vegetable
		Yar Mye	Winter sesame Winter vegetable
3.	Miethwekan village	Yar Mye	Monsoon groundnut-winter sesame

Source: Own survey (2008)

3. Cost of production, return above variable costs and revenue cost ratio of the sample farmers

Total variable costs were the one of the important factor for the costs of production. The highest total variable cost 424,277.66 kyats/ha was found in Kula village, at the same time total variable cost in Kyawe Ye and Mithewekan village were 290,823.39 kyats/ha and 253, 162.12 kyats/ha respectively (Table 12). The market price at that time for the white sesame was 26,500 Kyats/basket (1,082.07 kyat/kg) and black sesame seed was 22,500 kyats/basket (918.74kyat/kg) and average price of other color was about 24,500 kyats/basket (1,000.41 kyat/kg) set by CEXC.

With this price the highest total revenue (gross return) (865,313.19kyats/ha) and return above variable cost (441,035.53 kyats/ha) were also created by the sample farmers in Kula village. The variables costs of the farmers in other two villages were comparatively lower than the farmers in Kula village.

Table 12 Cost of production, return above variable cost and revenue cost ratio of sample farmers, 2008

No.	Items	Unit	Names of villages		
			Kula (White)	**Kyawe Ye (White/Brown)**	**Miethwekan (Black)**
1.	Material Cost	Kyats/ha	81,228.69	59,238.83	74,541.61
2.	Marketing cost	kyat/kg	14.97	9.19	18.43
3.	Marketing cost	kyats/ha	11,972.91	4,723.88	6,888.15
4.	Transportation cost	kyats/ha	13,063.56	8,398	6,107.64
5.	Total labor cost	kyats/ha	318,012.5	218,462.68	165,624.73
6.	**Total variable cost**	**kyats/ha**	**424,277.66**	**290,823.39**	**253,162.12**
7.	Yield	kg/ha	799.68	514.17	373.83
8.	Price per basket	kyats/basket	26,500.00	24,500.00	22,500.00
9.	Price per kilogram	kyat/kg	1,082.07	1,000.41	918.74
10.	Total revenue (gross return)	kyats/ha	865,313.19	514,379.95	343,453.45
11.	Return above variable cost	kyats/ha	441,035.53	223,556.56	90,291.33
12.	**Revenue cost ratio**		**2.04**	**1.77**	**1.36**
13	**Unit cost**	**kyat/kg**	**530.56**	**565.62**	**677.21**

Source: Own survey (2008)

Regarding with the revenue cost ratio, the highest revenue cost ratio was 2.04 in Kula village and the second highest value was found in Kyawe Ye village (1.77) followed by the smallest revenue cost ratio (1.36) in Miethwekan village. Unit costs of those three villages were 530.56 kyat/kg and 565.62 kyat/kg and 677.21 kyat/kg

respectively as shown in last row of Table 12. The farmers in Kula village did all farming practices needed for sesame growing such as, weeding, thinning and intercultivation and they applied pesticides and fertilizer as well.

Therefore the total labor cost (318,012.50 kyats/ha) and total material costs (81,228.69 kyats/ha) were relatively higher than that of other villages. Famers used low input supply such as foliar, pesticides as well as did not carry out thinning in Kyewe Ye and Miethwekan village the material costs were relatively low. All selected farmers in Miethwekan villages possessed up land area (Yar Mye) and grown winter sesame depending on the rain fall. The yield of winter sesame in Yar Mye depended on the monsoon rainfall, or late rainfall and residual moisture during the cool season. But the rain fall in central dry zone was not only unpredictable but also uneven and sesame farmers in this area were exposed to considerable risk of crop loss meaning that low yield and low benefit. Because of low yield the unit cost became high (677.21 kyat/kg in Miethwekan village).

4. Marketing performances of sample farmers

To identify sesame marketing system, it is essential to understand marketing performances of sesame farmers. The relationship between sesame farmers and marketing system is important and the entire sesame marketing system is set up with how and where the farmers sell their products to. According to discussion with the farmers, sesame farmers did not sell all of their sesame seeds as they had to keep for household consumption for fresh and processing to edible oil. Table 13 expressed the average sale percentage per farmers in each site. Average sale percentage of sesame seeds per farmers were 83.10 percent in Kula village and 98 percent in Miethwekan village while they kept a little percentage for home consumption. Average 16.90 percent of total productions in Kula village and average 2 percent of the total production in Miethwekan village were kept for home consumption. In a different manner, average sale percentage by each farmer in Kyawe Ye village was only 23.21 percent of total production and kept more percentage (76.79 percent) for home consumption and processing. It could be seen that famers in this region were small

farmers and they processed all of their sesame for household consumption and sometime they sold sesame oil to villagers.

Table 13 Marketing performance of sample farmers, 2008

	Classifications	Names of villages		
		Kula	**Kyawe Ye**	**Miethwekan**
1.	Sale percent of total production			
	Average sale (percent) per farmer	83.10	23.21	98
	Average processing and home consumption (percent) per farmer	16.90	76.79	2
	Total production of farmers (percent)	100	100	100
2.	Time of sale in (percent)of farmers			
	At the time of harvesting	0	35.71	40.0
	One month after harvesting	47.37	7.14	30.0
	Two months after harvesting	52.63	57.14	30.0
	Total (percent) of farmers	100	100	100
3.	Sell to			
	Wholesalers and millers (percent)	100	28.57	100
	Wholesaler and retailer (percent)	0	14.29	0
	Farmers who did not sell seed (percent)	0	57.14	0
	Total	100	100	100
4.	Percentage of total production sale as in seed	83.12	23.78	96.37
	Percentage of total production go to process for home consumption and villagers	16.92	46.43	3.63
	Percentage of total production sale to mills	0	30.36	0
	Total	100	100	100
5.	Mode of transportation			
	By car (percent)	94.70	14.29	20.00
	By bullock/horse cart (percent)	5.30	85.71	70.00
	By bicycle	0	0	10.00
6.	Distance from Town wholesalers (mile)	11	2-3	6

Source: Own survey (2008)

With respect to the time of selling, 35.71 percent of and 40 percent of sample farmers from Kyawe Ye and Miethwekan village sold their sesame seed at the time of

harvesting while no farmers from Kula village sold at the time of harvesting Therefore, 47.37 percent of the sample farmers sold sesame at one month after harvesting and the other 52.63 percent sold at about 2 months after harvesting in Kula village. More than half of the sample farmers (57.14 percent) from Kyawe Ye village sold at two months after harvesting and only a few percentages of farmers (7.14 percent) sold their product at one month after harvesting. About 30 percent farmers in Miethwekan village sold of their sesame seed at one month and another 30 percent sold at two months after harvesting. But 40 percent of farmers sold at the time of harvesting.

In general, time of selling sesame seeds by farmers depends on the prices and sequentially, the prices vary depending on seasons and market demand. Usually, prices are low during the harvest time while they rise as sowing time draw near. In addition, the prices of sesame seed in central dry zone was prominently influenced by export demand especially from China. Kula village was just (11) miles far from Mandalay which was the central sesame market of central Myanmar. Market information was available to get in time and the farmers in that area did not sell their sesame as soon as after harvesting. The farmers could sell sesame seeds very easy as soon as they got the market information of high prices from Mandalay. They expected the high price from the Mandalay market as a result of high export demand from China.

Furthermore, price of sesame was going down at the time of survey because of less demand from China which was affected by economic crisis in 2007. According to the discussion with interviewed farmers form Kyawe Ye and Miethwekan village, some farmers sold their crop at harvesting time in order to get investment for the next crop and to pay back for their credit that had agreed to pay back at the time of harvesting. All sample farmers from the Kula and Miethwekan villages sold their sesame seeds directly to the town wholesalers. However, 28.57 percent of the farmers sold sesame seeds to the town wholesalers and another 14.29 percent sold to both wholesalers and retailers in Kyawe Ye village while about 57.14 percent of farmers kept sesame seed for processing of edible oil and sold directly to consumers in

village. Mode of transportation to the market was mostly by car in Kula village where the farmers sold the sesame seed to the wholesalers in Kyautsae Township. Unlikely, majority of the farmers 85.71 percent from Kyawe Ye and 70 percent Miethwekan village transported their sesame seeds by the bullock cart or the horse cart. This was because of that the markets are just 2-6 miles far from each village.

5. Opinions of the farmers on sesame production

In relation to the respondents' opinions on the whole sesame industry, the most common possible opinions were set up. After the survey, the additional opinions were added. The attitudes of the farmers in all selected villages were illustrated in Appendix Table 1. Majority of farmers from the Kula village highly recommended that high quality sesame seed could earn more profits and sesame was preferred as second crop after monsoon paddy. The farmers also wanted to provide more subsidies, more irrigation facilities and more cheap and sufficient credits and transportation system. Because, all of these items were important for growing of sesame but they did not react to statement concerned the current policy on oil seed sector. According to the results of interview with the farmers, farmers in Kyawe Ye village did not provide their opinions on half of the all statements (6 to 12) even though some of these statements were essential for them. Along with the answers by farmers from Miethwekan village, about 70 percent of sample farmers wanted high quality sesame varieties to earn more profit whereas the small range percentages of farmers evenly spread out for three actions of opinions. Exceptionally, 60 percent of farmers in Kyawe Ye village did not recommend the current policies on oil seed sector.

6. Demographic and socioeconomic characteristics of wholesalers

In order to understand the market performances at wholesale level, sesame wholesalers from each selected township were interviewed. According to basic demographic and socioeconomic data average ages of all wholesalers from all townships were between 40 and 50 years (Table 14). The largest average age of the

wholesaler in Mandalay was 50.50 years and the smallest age 41.67 was found in Monywa Township. The largest family size, 6 was found in Mandaly and the smallest family size, 4 was stated by Monywa Township. The second largest average age and average family size was found in Pakokku Township. Again, the respondent from Pakokku had the longest years (19.70 years) of working experience of wholesaling to compare with the other two townships, 16.50 years in Mandalay and 10.33 years in Monywa. All the wholesalers educated at high school and graduated level.

Table 14 Demographic and socioeconomic characteristics of wholesalers, 2008

	Classifications	**Names of Townships**		
		Mandalay	**Monywa**	**Pakokku**
1.	Average age (year)	50.5	41.67	49.67
	Std. deviation	6.24	4.41	6.92
	Range	41-55	36-45	41-61
2.	Average family members	6	4	5
	Std. deviation	1.73	70.80	1.47
	Range	4-7	3-5	3-7
3.	Experience (years)	16.50	10.33	19.17
	Std. deviation	5.45	7.50	8.61
	Range	10-23	5-20	10-35
4.	Education level (percent)			
	Primary	0	0	0
	Secondary	0	0	0
	High school	50	33.30	50
	Graduated	50	66.70	50
	Total	100	100	100

Source: Own survey (2008)

7. Marketing performances of wholesalers

As a consequence of survey and discussing with wholesalers, most of the wholesalers were acting as commissioners and traders depending on the market situations. Marketing performances of wholesalers were illustrated in Table 15. All the wholesalers from Mandalay, Monywa and Pakokku Townships were undertaking as wholesalers, traders and commissioners. The maximum sale volume, 443.75ton per season was operated by the wholesalers from Pakokku where the wholesalers sold sesame to both Yangon and Mandalay market.

Table 15 Marketing performance of wholesalers in selected Townships, 2008

	Classifications	**Names of Townships**		
		Mandalay	**Monywa**	**Pakokku**
1.	Other business	Commissioner/ Traders	Commissioner/ Traders	Commissioner /Traders
2.	Average sale volume per season (2 months)	186,124kg (190ton)	171,430kg (175 ton)	434,698kg (443.75ton)
3.	No of competitors	>700	473	18
4.	Source of buying	Farmers/CEXC Wholesalers	CEXC	CEXE
5.	Price determination by	CEXC	CEXC	CEXC
6.	Buying system	Cash down	Cash down	Cash down
7.	Sell to	Wholesalers & Exporters	Wholesaler & Retailers	Wholesaler & Retailers
8.	Mode of transportation	By car	By car	By car
9.	Market Access	Easy	Easy	Easy
10.	Commission	1-2 percent	1-2 percent	1-2 percent

Note: Viss = Myanmar traditional measurement of weight

1 basket =24.49kg, 1 basket=15viss, 1 ton =612viss

Source: Own survey (2008)

The volume of sale by the wholesalers from Monywa and Mandalay was not extremely different by showing the data of 190 ton and 175 ton per season

respectively. The wholesalers form Mandalay was competing with more than 700 traders since Mandalay had been the central market for export of agricultural products. Therefore wholesalers were doing their business with not only with sesame seeds but also other agricultural products such as black gram, green gram, and groundnut. In Mandalay, wholesalers purchased sesame directly from farmers, Kyautsae town wholesalers and CEXC. Wholesalers in Mandalay resold the sesame seeds to other wholesalers, millers and exporters. Selected wholesalers from Monywa and Pakokku Township purchased sesame seeds from CEXC. Usually, market price was set by CEXC and buying and reselling systems were cash down system and mostly the products was transported by car. If wholesalers performed as wholesalers, they purchased sesame seeds from the farmers and they cut all marketing costs labor charges and took 1-2 percent of total value of sale as commissioners. If the wholesalers performed as commissioners, they made their profit by taking 1 to 2 percent of total volume of trade. All costs for transaction were charged by exporters or companies who offer to buy sesame. Sometime, they behaved as traders they bought sesame with their own credits and resold by making some profits on the market price. In such case, all marketing costs were charged by wholesalers.

8. Opinions of the wholesalers on sesame production

Regarding to the opinions of wholesalers on sesame production, all respondent from Mandalay and Pakokku Townships answered the questionnaires. The opinions on the most common statements were demonstrated in Appendix Table 2. Relating to the ideas of wholesalers in Mandalay, all respondents did not recommend sowing sesame as second crop after paddy, requirement of more irrigation water and improving transportation system. In this region, farmers planted sesame before monsoon paddy and this area was also successful irrigated sesame growing area and the farmers preferred summer sesame with irrigation. They worried about the risk from monsoon sesame. Moreover transportation system was quite well as the farm and markets were not so far each other.

Mandalay wholesalers did not want the price set by government because they wanted to bargain price according to market situation. Other than they had already had CEXC to regulate the basic daily price. With respect to the opinions of Monywa wholesalers, all wholesalers did not recommend the price set by government and showed the negative senses to current policies. However, the majority of wholesalers desired to liberalize the export of sesame seed and believed that high quality of sesame seed could earn more benefit for producers and traders. The wholesalers in Pakokku also gave positive response to liberalization of high quality sesame seeds export. However, they recommended to statement that price stability caused direct risk to farmers and agreed the current policies on oil seed sector.

9. Demographic and socioeconomic characteristics of millers

With the purpose of understanding processing of sesame, 16 millers from selected township were interviewed. Table 16 expressed the demographic and socioeconomic characteristics of millers. Average ages of millers were between 47 and 51 years. The largest family size was found in Mandalay Township followed by Pakokku and Monywa. Mandalay millers had longer experience of processing sesame oil and Pakokku millers had relatively shorter experiences of processing. All millers were educated at least secondary level and all millers form Monywa were graduated.

10. Marketing performance of millers

All selected millers were doing the wholesalers in their townships. There were 3 different size mills based on the milling capacity such as small, large and median mills. Ratios of oil to cake to processed wastes were 0.46:0.53:0 in Mandalay Township, 0.46:0.5:0.03 in Monywa Township and 0.43:0.47:0.1 in Pakokku Township respectively. There was 1-3 percent of waste due to processing in traditional oil press. Detailed information of marketing performances of millers was presented in Table 17. Millers from Monywa and Pakokku purchased sesame seeds from CEXC while the millers from Mandalay directly purchased from farmers. However, the buying prices were mostly determined by CEXC. All millers used cash

down system for buying raw sesame seed and selling sesame oil. They sold sesame oil and oil cake to the township wholesalers and retailers. Regarding to processing of sesame, millers used cheaper sesame seeds such as yellow, red and brown colored sesame for processing

Table 16 Demographic and socioeconomic characteristics of millers, 2008

	Classifications	Names of Townships		
		Mandalay	**Monywa**	**Pakokku**
1.	Average age (year)	50.57	47.50	50.20
	Std. deviation	3.51	4.95	12.89
	Range	43-53	44-51	34-70
2.	Average family members	6	4	5
	Std. deviation	2	1.41	0.71
	Range	4-10	3-5	4-6
3.	Experience years	22.57	20	14.40
	Std. deviation	3.82	14.14	7.36
	Range	20-30	10-30	2-20
4.	Education level (percent)			
	Primary	0	0	0
	Secondary	14.30	0	40
	High school	42.90	0	40
	Graduated	42.90	100	20
	Total	100	100	100

Source: Own survey (2008)

According to market demand of low income consumers, some millers mixed sesame oil with palm oil or sunflower oil and classified as lower grade and sold at a lower price than pure sesame oil. Some millers were also processing customer's sesame seed by taking only processing charge. The important constraints for the processing system complained by respondents were problem of electricity and inefficient processing infrastructures.

Table 17 Marketing performances of millers, 2008

No.	Classifications	Mandalay	Monywa	Pakokku
1.	Other business	Wholesalers	Wholesalers	Wholesalers
2.	Size of mill			
	No of Small mill (up to 1ton/day)	4	0	2
	No of Median mill (1.5 to 3 ton/day)	3	2	3
	No of Large mill (>3ton/day)	0	2	0
3.	Ratios of oil, oilcake and waste	0.46:0.53:0	0.46:0.5: 0.03	0.43:0.47:0.1
4.	Source of buying	Farmers	CEXC	CEXC
5.	Price determination	CEXC	CEXC	CEXC
6.	Buying system	Cash down	Cash down	Cash down
7.	Sell to	Wholesalers	Wholesalers & Retailers	Wholesalers & Retailers
8.	Mode of transportations	By car	By car	By car

Source: Own survey (2008)

11. Opinions of the millers on sesame production

Opinions of millers on current sesame productions and polices were attached in Appendix Table 3.The majority of farmers in Mandalay and Monywa did not recommend to provides more subsidies to farmers, more supply of irrigation for sesame growing, improved transportation system and price stability which caused direct risk to farmers. All millers in Monywa and Pakokku Townships and about 86 percent of the millers in Mandalay recommended improving milling system. With respect to current policies on oil seed sector, all millers in Monywa did not recommend and all millers in Mandalay did not respond. However, 60 percent of millers in Pakokku recommended to current policies and another 40 percent did not recommend current policies on oil seed sectors.

12. Demographic and socioeconomic characteristics of exporters

In this study, 5 exporters from Mandalay and 3 exporters from Yangon markets were interviewed to understand their marketing performances of sesame export. Selected exporters were representative of all exporters in each township. Demographic and socioeconomic characteristics of exporters were illustrated in Table 18. Average age of exporters in Mandalay and Yangon were 45 and 51 receptively. Exporters had long enough experiences years of exporting such as 14 and 15 years in Mandalay and Yangon. All exporters in Yangon were graduated and most of the exporters in Mandalay were high school level and graduated level.

Table 18 Demographic and socioeconomic characteristics of exporters, 2008

No.	Classifications	Name of Township	
		Mandalay	**Yangon**
1.	Average age (year)	45	51
2.	Average family members	5	6
3.	Experience (years)	14	15
4.	Education level (percent)		
	High school	60	0
	Graduated	40	100
	Total	100	100
5.	Other business	traders	millers

Source: Own survey (2008)

13. Marketing performance of exporters

Average traded volumes of export were 1,500 ton per year in Mandalay and 1,037 ton per year in Yangon (Table 19). Bothe black and white sesame was exported to China and only black sesame were exported to Japan. Export price of FOB Shweli was 1,490USD/ton and FOB Yangon was 1,450-1,700$/ton depend on the quality. All exports and importers required export permit from the Ministry of Commerce. Exporters were trying to get export permit by applying theirself or by buying from the

other large scale exporters. License would be expired within 3 months. Export tax was 10 percent of total export values. Myanmar exporters could not withdraw the foreign currencies from export earning and they are authorized to open bank accounts in foreign currencies which could only be used in foreign transactions or account transfer. Exporters are allowed to import 90 percent of the value of the export. With respect to opinion on sesame export, all exporters recommended trade liberalization of sesame export as well as to lower export tax. Regarding to opinions of the exporters, all exporters strongly recommended the liberalization of export of sesame seed and reduction of export tax.

Table 19 Marketing performance of exporters, 2008

No.	Classifications	Name of Township	
		Mandalay	**Yangon**
1.	Average export volume (ton/yr)	1,500	1,037
2.	Number of competitors	15	5
3.	Export color of sesame	black/white	black
4.	Other export	Pulses	Pulses
5.	Source of buying	CEXC	CEXC
6.	Buying system	Cash down	Cash down
7.	Exporting country	China/Japan	Japan
8.	Export Price	1,490$/ton	1,450-1,700$/ton
9.	Export license	Apply/Buy	Apply
10.	Export tax	10 percent	10 percent
11	Mode of export	By truck	By Ship
12.	Application period for the export permit	2-3 weeks	2-3 weeks

Source: Own survey (2008)

Part 2: Estimated Marketing Channels and Discussions

This part provided the estimated general marketing channels for whole sesame industry, specific marketing channels observed from selected area and explanation about contract agreement on sesame production.

1. General marketing channels

This study also built up a general of marketing channels of the sesame industry in Myanmar based on interview with all participants along the channels. The channel started from the farmers through exporters for the foreign market and consumers for the domestic market. The different marketing channels of the sesame seeds, sesame oil and oilcake along the marketing chain were demonstrated in Figure 9. One of the marketing channels was producers to wholesalers through commission agents or primary collectors.

Then sesame seeds were sold to traditional snack and food industries for the domestic markets and to exporters for both formal and informal exporters. Another channel was producers to millers either directly or through wholesalers from CEXC. Millers sold to consumers directly or through wholesalers and retailers and supermarket depending on the different qualities such as brand oil, special oil (100 percent sesame oil) and ordinary oil (mixed with palm oil and sunflower oil). Oilcake channel initiated from millers directly to livestock and fishery industries and as feed through wholesalers, retailers. The constraints for the production of sesame were high costs of fertilizers, limited quality of the seeds and low access to credits. The constraints along the channels were poor storage facilities, high cost of transportation and poor quality sees. With respect to processing level, the constraints included low technology in processing, adulteration practices, lack of quality control, insufficient electricity supply.

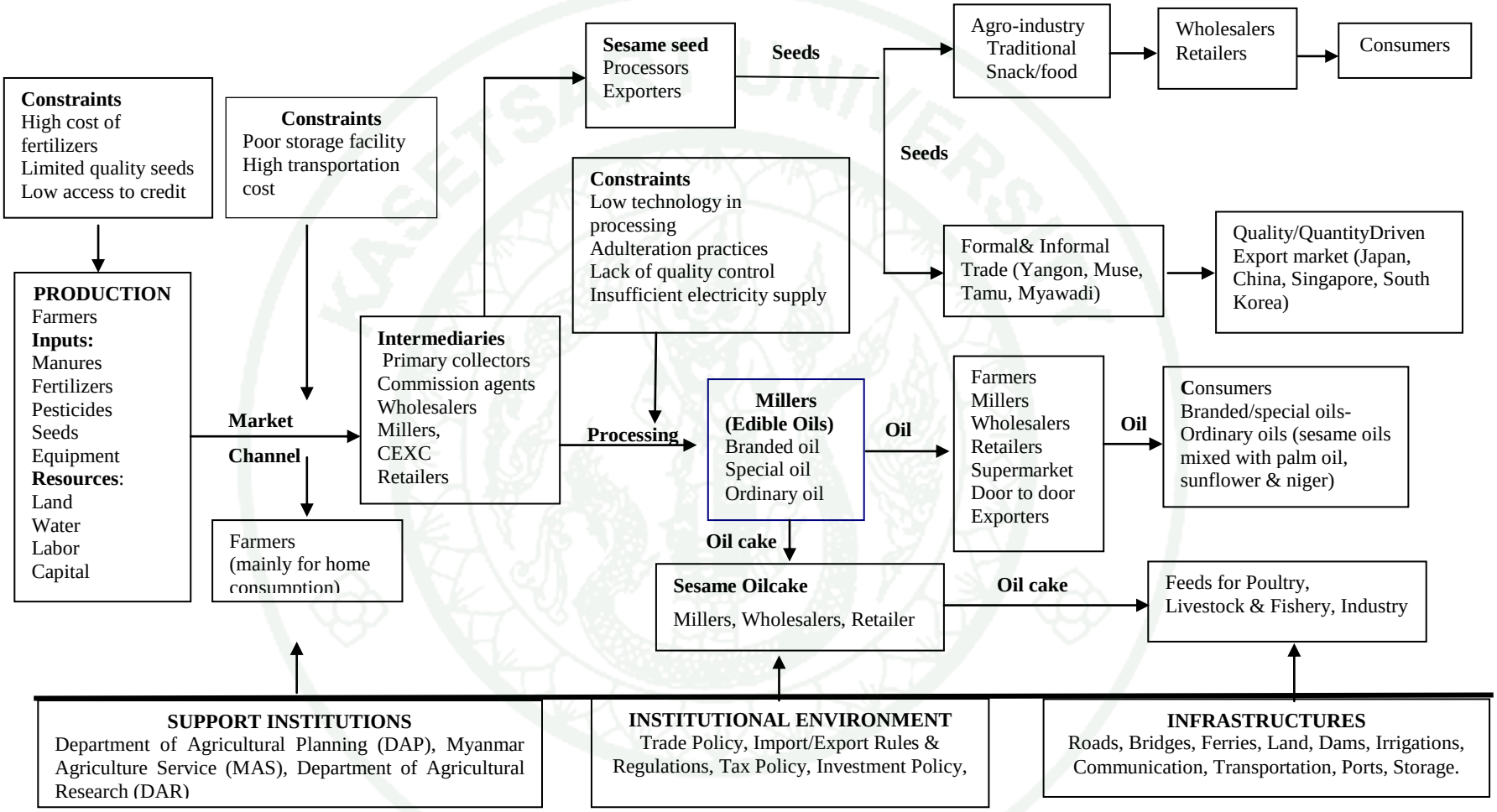

Figure 9 General marketing channel of sesame industry

Source: Modified from Kyaw (2007), Own survey (2008)

2. Specific marketing channels in selected areas

Based on interviews, current market channels and marketing performances of all participants for the sesame market were estimated. Market channels of sesame in selected Townships were shown in Figure 10, 11 and 12. In Mandalay area, all farmers cultivated white sesame in Kula village. About 83.10 percent of total production was traded as in seed and 16.90 percent of total production was processed for edible oil. Regarding to the market channels in Monywa, black sesame was accounted for 57.84 percent of total area (Table 10). The farmers also cultivated white sesame (29.41percent of total cultivated area) and red and brown color of sesame (12.75 percent of total cultivated area) receptively (Table 10). Large amount of seseame seed in Monywa sold for processing (Figure 11) since the producers and wholesalers were more interested to deliver sesame oil than sesame seed to other deficit region in upper Myanmar. All white sesame, 52.42 percent of black and 38 percent of other colored sesame seeds were exported and 47.58 percent of black and 62 percent of other colored sesame seeds were processed. In Myanmar, black sesame oil is famous for the various purposes such as medical used, for edible oil and so on.

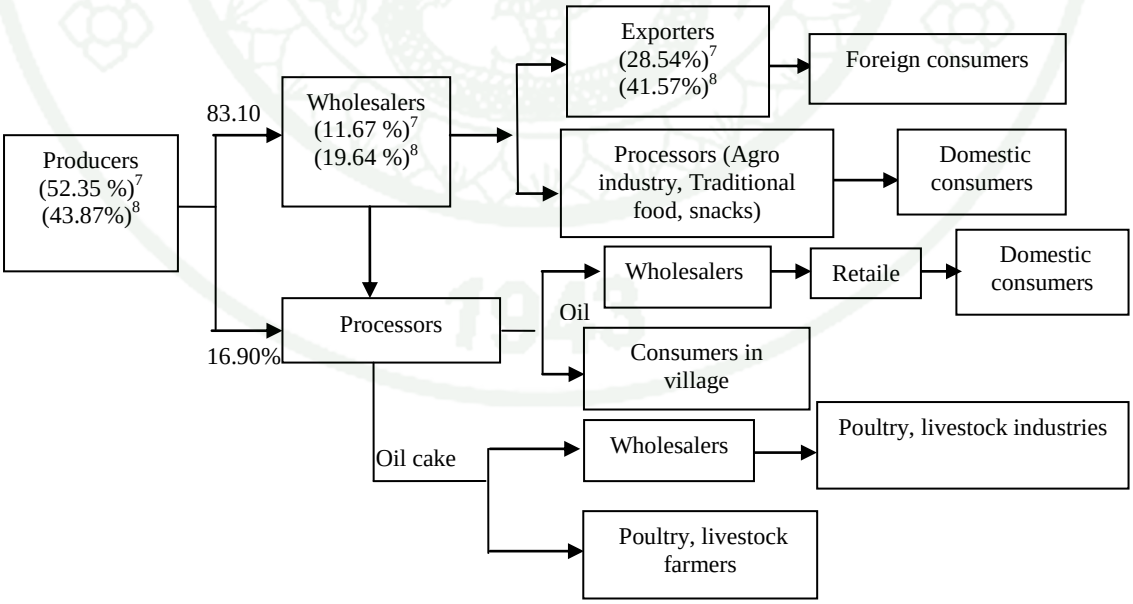

Figure 10 Marketing channel of sesame in Mandalay

Source: Own survey (2008)

[7] net marketing margin as in percentage of export price for exporting sesame seed to China
[8] net marketing margin as in percentage of export price for exporting sesame seed to Japan

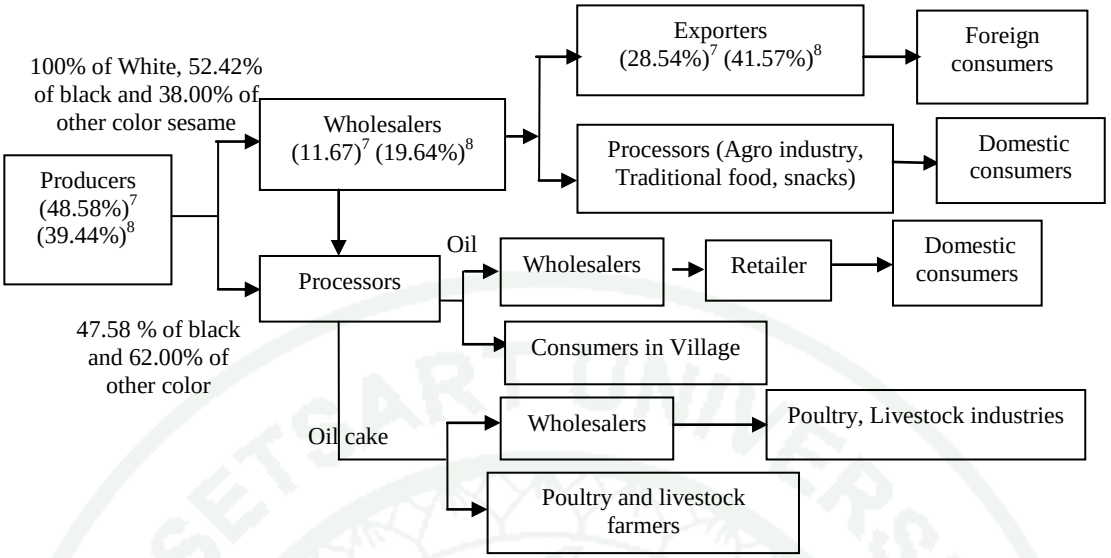

Figure 11 Marketing channel of sesame in Monywa

Source: Own survey (2008)

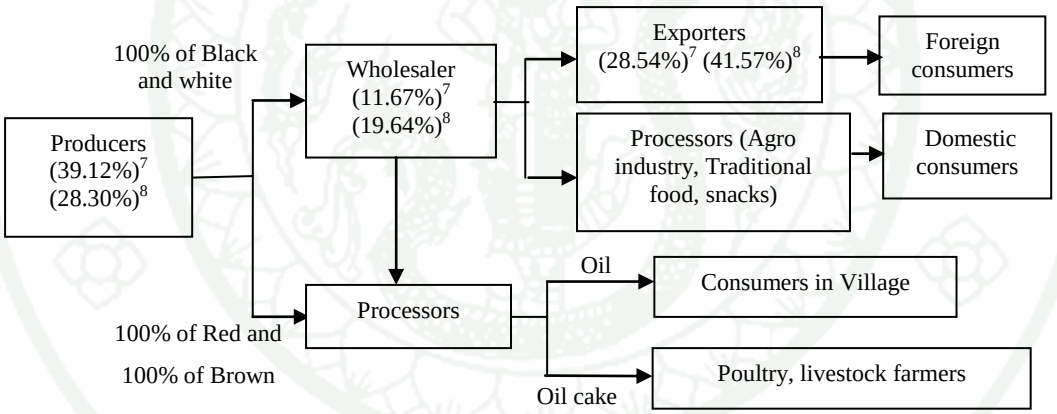

Figure 12 Marketing channel of sesame in Pakokku

Source: Own survey (2008)

All white and black sesame seeds in Pakokku were exported and all other colored sesame seeds were processed for edible oil. In Pakokku Township, farmers cultivated the large area of black sesame and small area of white and other colored sesame seeds since good quality black sesame seeds in this area were famous for Japan market. Oil cakes were sold to poultry and livestock industries through wholesalers or directly sold to poultry and livestock farmers. Gross margins as in

[7] net marketing margin as in percentage of export price for exporting sesame seed to China
[8] net marketing margin as in percentage of export price for exporting sesame seed to Japan

percentage of selling prices of producers, wholesalers and exporters were put together in their respective boxes. The values in first bracket represented the gross margins of sesame seeds which were exported to China and the second bracket represented the gross margins of sesame seeds which were exported to Japan.

Based on these marketing channels, the producers directly sold sesame seed to the wholesalers who in turn sold to other wholesalers, millers and exporters for the higher market, Japan and China. There were no primary collectors between the producers and wholesalers, because the selected villages were near to each Township and the farmers were kept in touch with wholesalers. Another channel was that the producers directly sold to the millers who in turn sold sesame oil and oilcake to domestic wholesalers, retailers and poultry and livestock industries. Some small millers directly sold sesame oil to consumers in village and oilcake to poultry and livestock farmers. It was mostly found in Kyawe Ye village where the small farmers processed the sesame seed for their home consumption and sold the surplus sesame oil directly to the villagers. As a consequence of survey, most of the wholesalers from Mandalay, Monywa and Pakokku Townships acted as commissioners depending on the condition of the market.

Part 3: The Results and Discussions of Marketing Costs and Marketing Margins

This part focused on the calculation of marketing margins of white and black sesame from the farmers through exporters. Calculations of marketing costs and margins were divided into two channels. One channel was white sesame seeds to China market and the other was black sesame to Japan market.

1. Results of marketing costs and marketing margins

Marketing costs and margins of white sesame seeds were calculated between farmers and exporters for China market since most of the white sesame seeds from Mandalay market were assumed to export to China (Table 20). On the other hand, the marketing margins of the black sesame seeds were calculated between farmers and exporters for Japan market (Table 21). Detailed calculations of marketing costs and margins were supported in Appendix Table 4 and 5. Regarding to calculation of marketing margins, price received by farmers was taken from the average current price at the time of survey such as 26,500kyats/basket (1082.07kyat/kg) for white sesame and 22,500kyats/ basket (918.74kyat/kg) for black sesame. Regarding to wholesalers, they were assumed to buy sesame seed from commissioners and resold without storage. The amount of commission was considered as costs of the wholesalers. The commission was one percent of total sale value.

In case of the white sesame seeds to China (Table 20), farmers received the gross margins of 566.46, 525.64 and 423.39 in Mandalay, Monywa and Pakokku Townships respectively meaning that farmers obtained 52.35, 48.58 and 39.12 percent their selling prices. The price spread between farm and export was 632.20. The price spread was composed of wholesaler's gross margin (142.93 kyat/kg) and exporter's gross margin (489.27kyat/kg). The highest gross margin of the farmer was found in Mandalay because of high yield per unit area (799.68 kg/ha) during the survey period. Marketing costs of farmers were 14.90, 9.19 and 18.43 kyat/kg in Mandalay, Monywa and Pakokku respectively.

Table 20 Calculations of marketing costs and margins of white sesame seeds between farmers through exporters for China market, 2008

Items	Mandalay	Monywa	Pakokku
Farmers			
Average yield per unit area (kg/ha)	799.68	514.17	373.38
Sale price of famers (kyat/kg)	1,082.07	1,082.07	1,082.07
Costs of farmers (including marketing costs) (kyat/kg)	515.65	556.43	658.78
Marketing costs (kyat/kg)	14.90	9.19	18.43
Farmer's gross margin (kyat/kg)	566.42	525.64	423.29
Farmer's gross margin (percent)	52.35	48.58	39.12
Price spread (kyat/kg)	632.20	632.20	632.20
Farmer's share to export price (Percent)	63.12	63.12	63.12
Wholesalers			
Sale price of wholesaler (kyat/kg)	1,225.00	1,225.00	1,225.00
Marketing cost of wholesaler (kyat/kg)	26.82	16.94	24.06
Wholesaler's gross margin (kyat/kg)	142.93	142.93	142.93
Wholesaler's gross margin (percent)	11.67	11.67	11.67
Wholesaler's share to export price (Percent)	71.46	71.46	71.46
Exporters			
Export price (Kyat/kg)	1,714.27	1,714.27	1,714.27
Marketing cost of exporters (kyat/kg)	76.52	76.52	76.52
Exporter's gross margin (kyat/kg)	489.27	489.27	489.27
Exporter's gross margin (percent)	28.54	28.54	28.54

Note: Export price is FOB Shwe Li (Ruili)

Export price = 9.3 Yun/kg (on 7/12/2008)

Exchange rate= 184.33kyats/Yun (7/12/2008)

Source: Own calculation (2009)

Farmer's share to export price was 63.12 percent meaning that farmers received 63.12 percent of export price for the white sesame seed exported to China. Wholesaler obtained relatively low gross margin, 11.67 percent of the sale prices because wholesale prices used in this calculation was the price set by CEXC and wholesalers were assumed to resold sesame seed without storage for the expectation of high prices. However, wholesaler's share to export price was 71.46 percent in all Townships which was higher than farmer's share to export price. Exporters incurred large marketing costs (76.52 kyat/kg) because of transportation, packaging,

loading/unloading costs and license fee (including export tax). Exporter's gross margin was 489.27 and it was about 28.54 percent of their sale price (export price).

For the marketing margins of the black sesame to Japan (Table 21), Mandalay farmers obtained the highest gross margin about 43.87 percent. Pakokku farmers received the lowest gross margin (28.30 percent) because of low yields. Farm export price spread was 1,037.84 and it was composed of wholesalers' and exporters' gross margins. Farmer's share to export price for black sesame was 46.96 percent which was lower than farmer's share to export price for white sesame (63.12 percent) in Table 20. The highest marketing cost (41.18 kyat/kg) was found in Monywa wholesalers because of high transportation costs of black sesame to Yangon. Wholesaler's gross margin was 19.64 percent and wholesaler's share to export price was 58.43 percent for all Townships because wholesale prices used in this study was set by CEXC in each Township. Exporter's gross margin was 813.26 kyat/kg and it was 41.57 percent of their sale value.

In sum, farmers received highest gross margins for the white sesame exported to China. For the black sesame exported to Japan, Mandalay farmers received higher gross margin than Monywa and Pakokku farmers and exporters as well. Because Mandalay was central wholesale market and farmers could get easy access to wholesale market and the yield of Mandalay farmers was higher than the yield of other Townships. As sesame crop is dependent on weather and if the weather is favorable and kind, farmers can expect to obtain full basket of sesame potential yield. When the weather fails, the yield may be very little and farmers can lose even production costs. With respect to farmer's share, farmers got higher share to export price for white sesame (63.12 percent) than that of black sesame (46.96 percent) although the export price of white sesame was lower than that of black sesame. The reason was that the price collected for white sesame was higher than that of black sesame in domestic market. The gross margin of exporter for black sesame exported to Japan (41.57 percent) was larger than that of white sesame exported to China (28.54 percent) because of high export price to Japan.

Table 21 Calculations of marketing costs and margins of black sesame seeds between farmers through exporters for Japan market, 2008

Items	Mandalay	Monywa	Pakokku
Farmers			
Average yield per unit area (kg/ha)	799.68	514.17	373.38
Sale price of famers (kyat/kg)	918.74	918.74	918.74
Cost of farmers (including marketing cost) (kyat/kg)	515.65	556.43	658.78
Marketing costs (kyat/kg)	14.90	9.19	18.43
Farmer's gross margin	403.09	362.31	259.96
Farmer's gross margin (percent)	43.87	39.44	28.30
Price spread	1,037.84	1,037.84	1,037.84
Farmer's share to export price (Percent)	46.96	46.96	46.96
Wholesalers			
Sale price of wholesalers (kyat/kg)	1,143.32	1,143.32	1,143.32
Marketing cost of wholesaler(kyat/kg)	39.18	41.18	34.18
Wholesaler's gross margin (kyat/kg)	224.58	224.58	224.58
Wholesaler's gross margin (percent)	19.64	19.64	19.64
Wholesaler's share to export price (percent)	58.43	58.43	58.43
Exporters			
Export price (Kyat/kg)	1,956.58	1,956.58	1,956.58
Marketing cost of exporters (kyat/kg)	58.93	58.93	58.93
Exporter's gross margin	813.26	813.26	813.26
Exporter's gross margin (percent)	41.57	41.57	41.57

Note: 1 basket=24.49kg

Export price = 1700$/ton (FOB Myanmar)

Exchange rate=1150kyats/$ (on January 2008)

Source: Own calculation (2009)

Because of the economic crisis in 2007, the demand from China fell down to the some extent. According to the discussion with the exporters, because of the low demand from China, more volume of the sesame seeds entered the domestic markets and the price fell down especially at the harvesting time. Generally, when the farmers sold their products to the wholesalers, they were responsible for all costs including transportation cost, labor charges, even the commission for selling of their products. When the wholesalers acted as traders, they had some marketing costs for the transportation, storage, loading, repackaging and purification. Some wholesalers had good storage facilities to wait such a period for expecting of higher price. Therefore,

wholesalers and traders were able to search out profits from export of sesame seeds. But farmers could not do these function theirself and they could not be effected by the high price from the offseason and the export price.

2. Discussion on the results of marketing costs and marketing margins

For the first channel to China, famers got higher gross margins than the wholesalers and exporters. Regarding with second Channel to Japan, exporters, farmers in Mandalay and Monywa townships got the higher gross margin than wholesalers except Pakokku farmers. Among the farmers, Mandalay farmers received the highest gross margin and Pakokku farmers received the lowest gross margins. Since gross margins included all costs of selling sesame seeds including profits and yield per unit area and marketing costs reflected gross margins. As Pakokku farmers incurred low yield and high marketing costs, they got the lowest gross margins. Collected domestic prices of white sesame seeds were higher than the price of black sesame seeds therefore; farmer's gross margins for white sesame were higher than that of black sesame.

Wholesalers obtained the lowest gross margins and highest share to export price in both channels. It was assumed that wholesalers purchased sesame seed from farmers via commissioners and resold without storage. Another reason was that the price paid by exporter to wholesaler depended on the export demand and export demand was depended on export policies and domestic supply of good quality sesame seed. If wholesalers stored sesame for some periods and resold at the time of price rise, their marketing costs and gross margin would be high.

Exporters were doing their business under current export policies and their profits might be depended on export demand, export policies, exchange rates, and domestic prices and supply as well. They could make high gross margin when black sesame was exported because of high export price to Japan and low domestic prices. During the period of survey, export price of black sesame to Japan was higher than that of sesame seeds to China. Because of the economic crisis in 2007, the demand

from China fell down to the some extent. Furthermore, the demand from China decreased and the domestic price fell down at the time of survey as a result of economic crisis. As a result of that, export price at the China border also fell down (9.60Yun/kg to 9.30 Yun/kg during 2 months). But the exporters got the substantial lager profit margins especially when they export to Japan. According to discussion with exporters, because of low demand from China, more volume of sesame seeds enter the domestic markets and the price of sesame seed fall down especially at the harvesting time.

If the farmers obtained the high yield, they would have high gross margin from their cost of production. Therefore, the wholesalers, traders and exporters could search out more profits from export of sesame seeds. But the farmers could not do these function theirself and they were not affected by high price from offseason and the export price. Export price was high but the domestic price collected was low. Moreover, farmers were facing some constraints to sesame cultivation especially rainfall (moisture) caused the low yield. Yield per unit area is also crucial for getting the high margins. As sesame is weather dependent crop and if the weather is favorable and kind, the sesame farmers could expect to obtain the full basket of potential yield. When the weather fails the yield may be as little as just a group-hold of sesame seed. Annual rainfall is fluctuated every year in dry zone. If the weather is favorable and kind, sesame farmers could expect to obtain full basket of potential yield. On the other hand, when the weather fail the yield may as little as just a group-hold of sesame seed. Figure 13 proved the evidence of fluctuated annual rainfall (mm/yr) of selection area in dry zone, Myanmar.

Generally when the farmers sold their products to wholesalers, they were responsible for all cots including, transportation cost, labor charges, even commission for selling their product. Increase in marketing margins due to increases in marketing cost might not mean increase profits made by doing the marketing (Andrew, 1993). In this study, however, the farmers were directly reflected the wholesale prices, as there were no primary collectors and other middle men between the farmers and wholesalers because of easy access to the town wholesale center. Total margins

depend on the length of the marketing chain and the extent to which the product is stored or processed (Andrew, 1993).

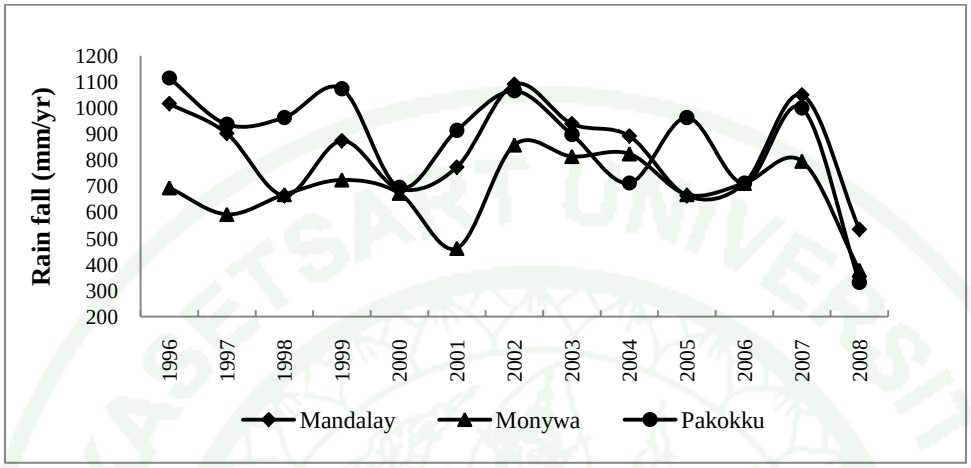

Figure 13 Annual rainfall of selection area in dry zone, Myanmar (mm/yr)

Note: mm/yr= millimeter per year

Source: CSO (1997-2008)

Part 4:.The Results and Discussions of the Time Series Data Analysis

This section reported the results of time series data analysis for the wholesale prices of sesame seeds and sesame oil including the results of ADF tests, Engle and Granger's cointegration tests, Johansen's cointegration tests, ECM estimates and long run Granger causality tests. In addition the discussions on the results were also included.

1. Plotting the selected price series of sesame seeds and sesame oil

The selected wholesale price series of sesame seeds and sesame oil in different markets were plotted in Figure 14, 15 and 16 respectively. All price series of sesame were not available for the same markets and the price series of same color of sesame from two different markets were taken into account for analysis. Regarding observed price series of sesame seeds, prices usually rises on April and May because of the shortage of sesame in the market. At that time irrigated sesame (summer) has not been harvested and all the sesame form previous winter sesame had been sold out.

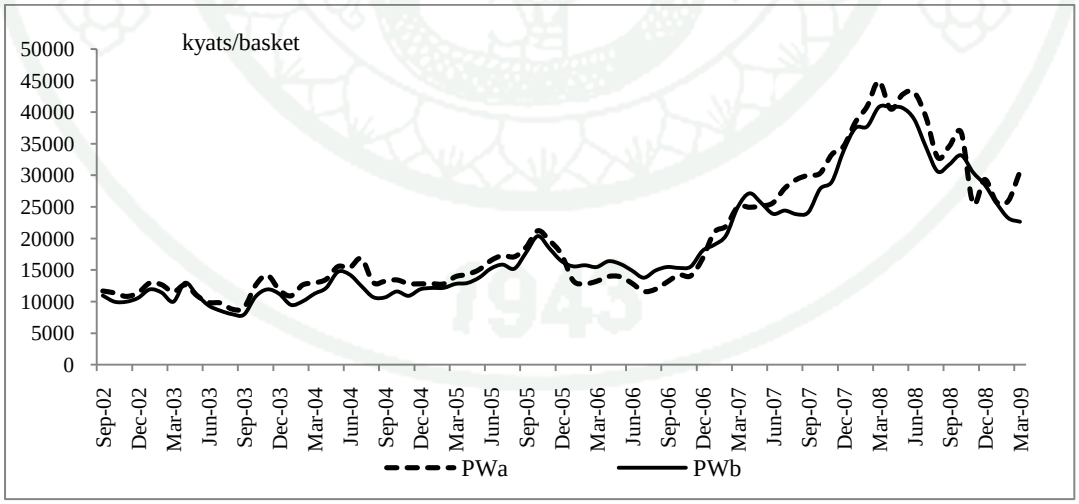

Figure 14 Observed price series of white sesame seeds in Mandalay market (*a*) and Monywa market (*b*).

Source: DAP (2002-2009)

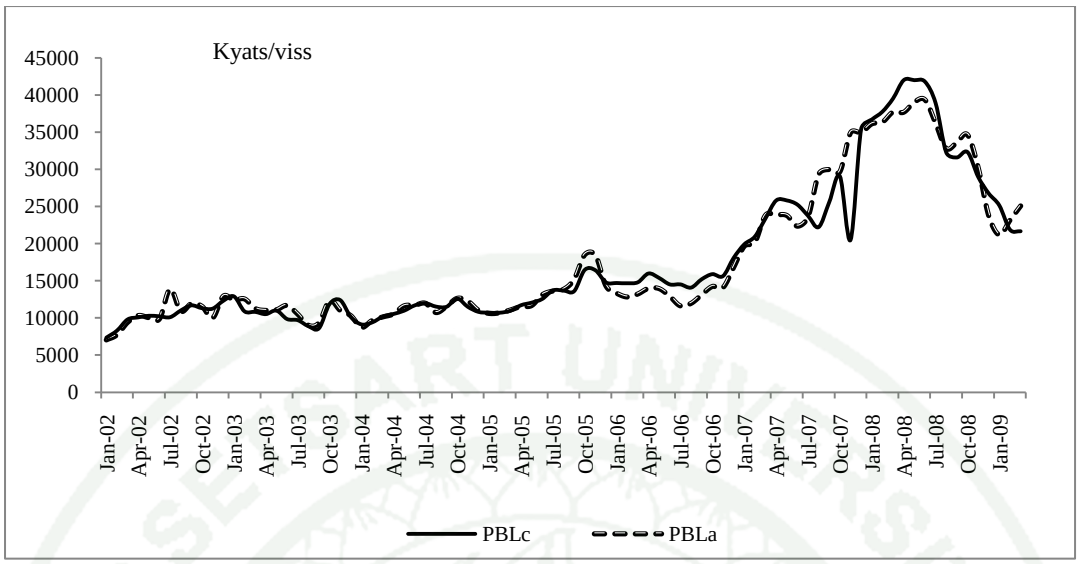

Figure 15 Observed wholesale price of series of black sesame seeds in Mandalay market (*a*) and Pakokku market (*c*).

Source: DAP (2002-2009)

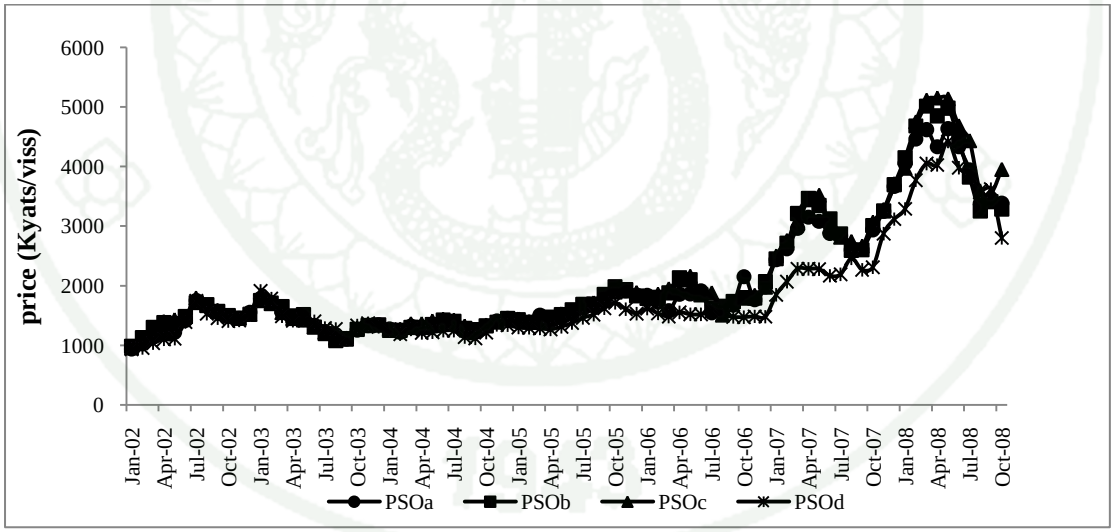

Figure 16 Observed wholesale price series of sesame oil in Mandalay market (*a*), Pakokku market (*c*), Monywa market (*b*) and Yangon market (*d*).

Source: DAP (2002-2009)

On the other hand, price of sesame fell during July and August because of the new arrival of irrigated sesame form the central dry zone. Especially, from the start

of August, 2007, the government restricted to sesame seeds exports on black and the white varieties. The government restrictions on sesame seeds exports had coincided with the arrival of new harvests and this caused prices to fell on the domestic market (The Myanmar Times, 2007).

2. Results of unit root tests

Augmented Dickey-Fuller method was used to test the order of integration for all sesame price series by using equation 3.19 through 3.20 with the null hypothesis of having unit root test. The ADF test statistics presented in Table 22 corresponded to the regressions that had minimized the SIC. The ADF test was performed by including up to 11 lagged terms of the differenced terms in the regression and optimum lag length was determined based on Schwartz Information Criterion (SIC).

Testing the price series were monthly data with the same periods with different color of sesame seeds in different markets. Each price series were tested for unit root by using level data. The results of ADF test indicated that coefficients (β) for one lag of all selected price series were not significantly different from zero in original price level. It showed ADF values of all price series in level of both with and without a deterministic trend were not less than critical value (less negative) of Mackinnon (1990). Therefore, all price series were tested again on first differences. Then, results of coefficients for prices series were significantly different from zero, which meant that null hypothesis was rejected. ADF values of all sesame seeds and sesame oil prices series were less than critical value (more negative). According to the results of ADF tests, all price series of sesame seeds including FOB were stationary at their first difference [$I(1)$] which proved that these series were integrated in order 1. That was the strong reason to take the first difference price series for the testing of cointegration analysis. If the price series included the trend, there would be fluctuation around a non-zero mean. The figures of first differences for the monthly prices series and original monthly price series of sesame seeds and sesame oil prices were shown in Figure 17 to 24 respectively.

Table 22 Results for unit root test for sesame seeds price series, 2008 (Sample: 2002:09-2008:10)

No.	ADF Test	Γ- Statistic (Level)		Γ- Statistic (First differences)		Order of Integrati-on
		Drift	Drift & trend	Drift	Drift & trend	
1.	PW_a	-0.0642	-1.6140	-6.8775***	-6.9129***	I(1)
2.	PW_b	-0.7599	-2.4819	-5.8205***	-5.8139***	I(1)
3.	PBL_a	-0.0183	-1.5237	-7.7055***	-7.7891***	I(1)
4.	PBL_c	-0.7097	-2.3008	-10.2929***	-10.2899***	I(1)
5.	FOB	-0.3296	-2.6474	-12.3115***	-12.7243***	I(1)
6.	PSO_a	-0.8780	-2.4107	-6.3181***	-6.3167***	I(1)
7.	PSO_b	-1.7151	-3.2997	-4.2808***	-5.847***	I(1)
8.	PSO_c	3.692	1.344	-5.233***	-6.4276***	I(1)
9.	PSO_d	-0.6846	-1.7595	-5.9928***	-3.6596**	I(1)

Note: 1. Critical values of τ (Tau) statistic with draft are -3.5, -2.9, -2.58 and; with trend and drift are -4.06, - 3.46, -3.16 at 1, 5 and 10 percent significant level respectively (Enders, 2004)

2. ***, ** and * indicated the rejection of null hypothesis at 1 percent, 5 percent, 10 percent significant level

Source: DAP (2002-2009)

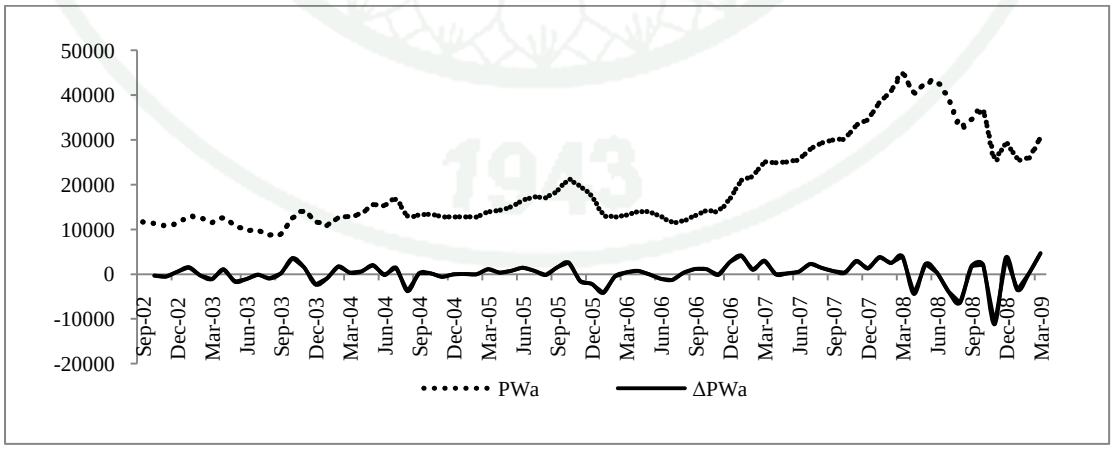

Figure 17 Non stationary and first differences stationary series of wholesale price of white sesame seeds in Mandalay market (a)

Source: DAP (2002-2009)

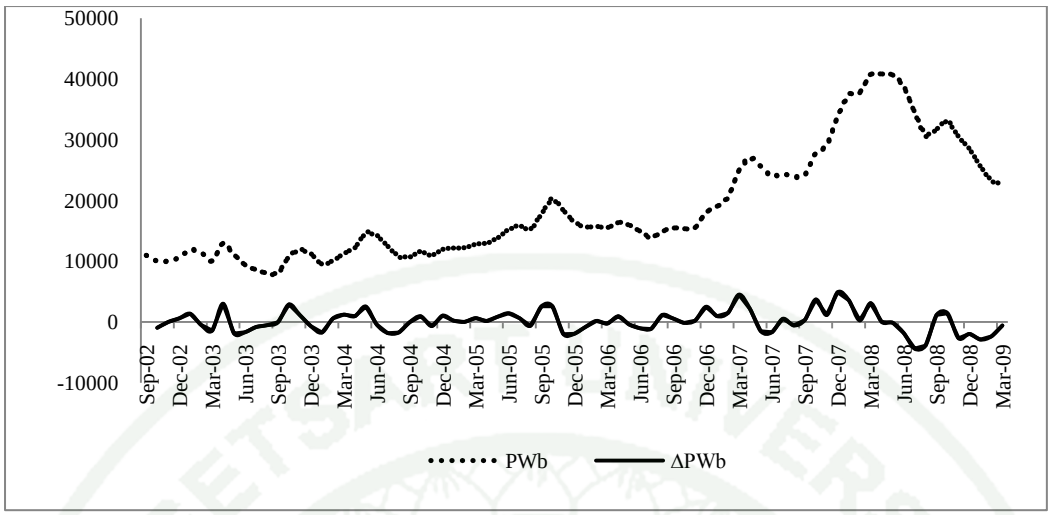

Figure 18 Non stationary and first differences stationary series of wholesale price of white sesame seeds in Monywa market (b)

Source: DAP (2002-2009)

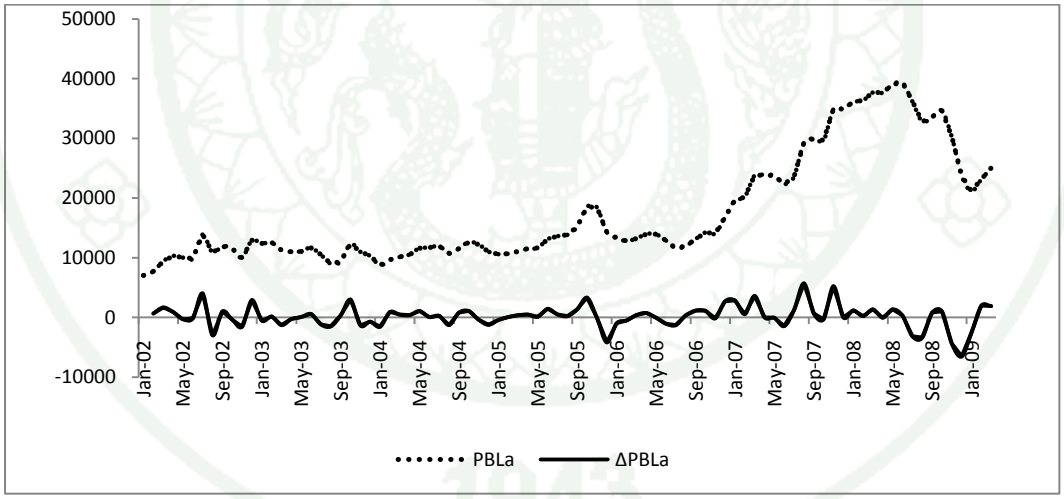

Figure 19 Non stationary and first differences stationary series of wholesale price of black sesame seeds in Mandalay markets (a)

Source: DAP (2002-2009)

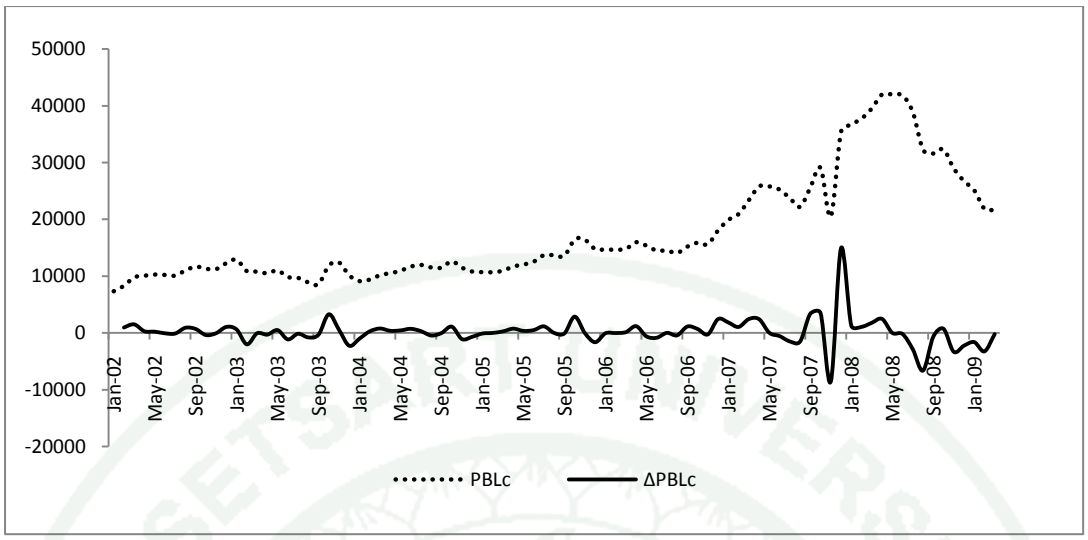

Figure 20 Non stationary and first differences stationary series of wholesale price of black sesame seeds in Pakokku market (c)

Source: DAP (2002-2009)

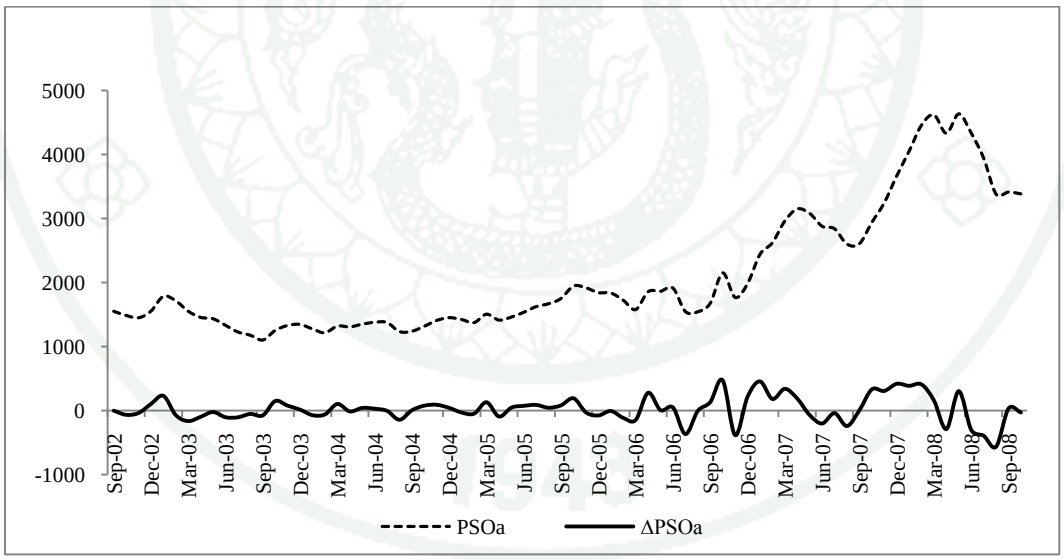

Figure 21 Non stationary and first differences stationary series of wholesale price of sesame oil in Mandalay market (a)

Source: DAP (2002-2009)

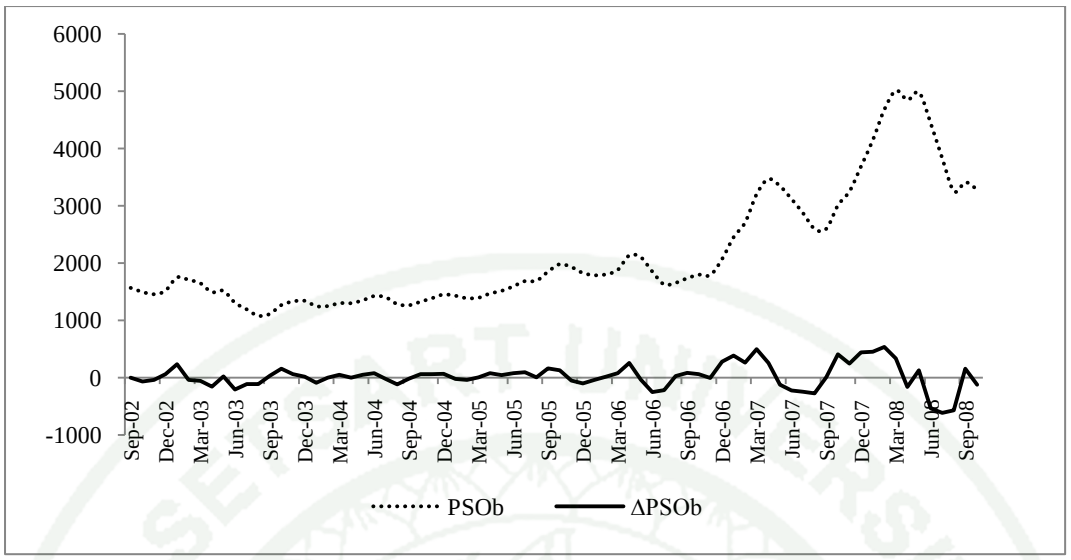

Figure 22 Non stationary and first differences stationary series of wholesale price of sesame oil in Monywa market (b)

Source: DAP (2002-2009)

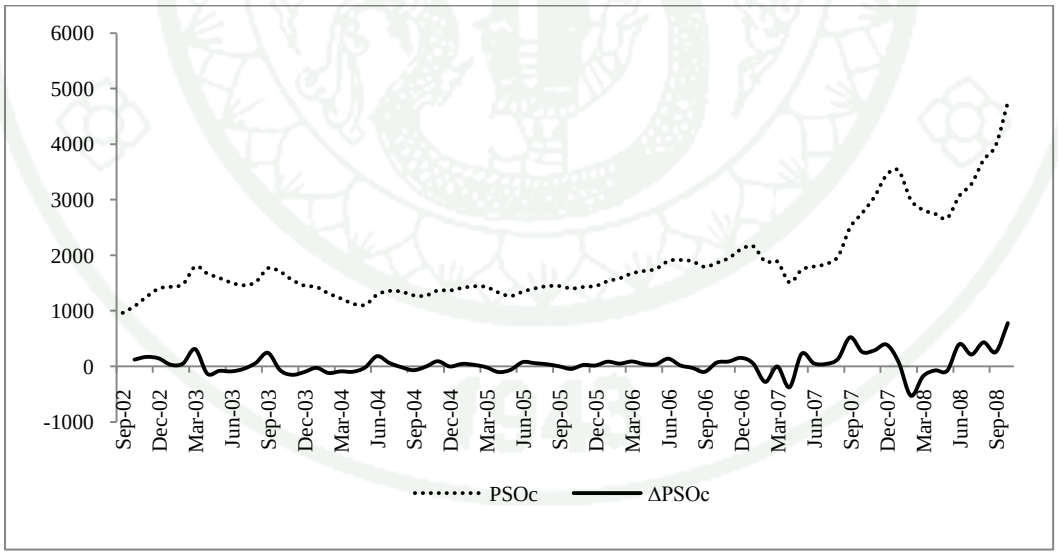

Figure 23 Non stationary and first differences stationary series of wholesale price of sesame oil in Pakokku market (c)

Source: DAP (2002-2009)

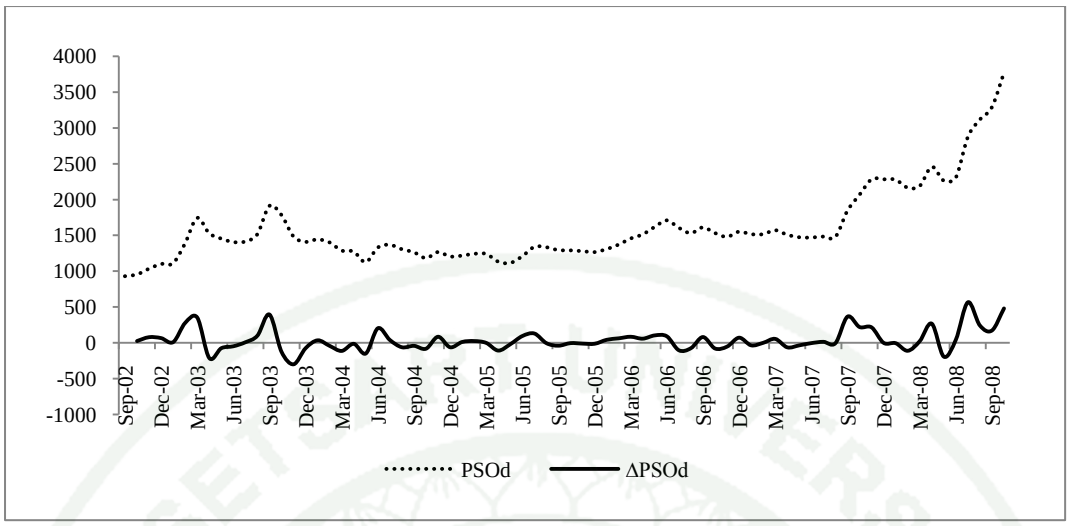

Figure 24 Non stationary and first differences stationary series of wholesale price of sesame oil in Yangon market (d)

Source: DAP (2002-2009)

3. VAR lag order selection

One of the biggest problem and common practical problems in the VAR model is to select the optimal lagged term. Ender (2004) suggested that, lag length tests on any variable of any set of variables could be performed regardless of whether the variable in question was stationary. Too short lag length in the VAR may not capture the dynamic behavior of the variables (Chen and Patel, 1998). Secondly, Dejong *et al*., (1992) pointed out that too long a lag length would distort the data and lead to a decrease in power. The choice of lag lengths analysis can be decided by common selection of criteria such as Maximum likelihood Ratio (LR), Hannan-Quinn (HQ), Akaike Information Criteria (AIC), Schwarz information Criteria (SIC) and Final Prediction Error (FPE) criterion. LM test was used for serial correlation of error term. In this study the appropriate lag length for VAR were selected by AIC and SIC.

4. Results of Granger causality tests for all sesame seed and oil price series

The results of Granger causality tests for all prices pairs were presented in Table 23 showing the direction of causality. Regarding to domestic white sesame price series, PW_b caused PW_a and PW_a was assumed to be dependent variable. As for domestic black sesame PBL_a caused PBL_c and PBL_c was used as dependent variable. With respect to export price, all domestic prices, PW_a, PW_b, PBL_a and PBl_c caused FOB and FOB was used as dependent variables. However, all sesame oil prices caused each other except PSO_d and PSO_c. PSO_c caused PSO_d and PSO_d was used as dependent variable. Since the domestic sesame oil market was competitive and the price in minor markets (PSO_b, PSO_c) were assumed to be dependent variables wih respect to central market (PSO_a) and deficit markets (PSO_d) was assumed to be dependent variables.

5. Results of cointegration tests for wholesale price of white sesame seed

` **5.1** Results of Engle and Granger's conitegration tests

The results of ADF test on residual obtained from long run relations of each pairs of white sesame seeds prices were presented in Table 24. The values of τ (Tau) statistic for unit root tests of residuals from long run relation of all tested prices pairs for white sesame seeds were less (more negative) than Mackinnon critical value at 1 percent and 5 percent level. Those residuals from the long run regressions were also stationary meaning that there were evidence for the cointegration between export price (FOB) and domestic wholesale prices of sesame seeds (PW_a, PW_b). It meant that the residuals from long run regression equations of domestic and export markets of white sesame seeds prices were stationary. Based on these results, two domestic markets, namely Mandalay market (a) and Monywa market (b) were integrated. Again, the tow domestic markets and the export market (FOB) were also found to be cointegrated.

Table 23 Results of Granger causality tests for all sesame seed and oil price series

No	Variables	Lag	F statistic	Prob.
1	$PW_b \rightarrow PW_a$	1	8.3588***	0.0051
	$PW_a \rightarrow PW_b$	1	0.0036	0.9525
2	$PW_a \rightarrow FOB$	1	2.6318**	0.0123
	$FOB \rightarrow PW_a$	1	1.0859	0.4036
3	$PW_b \rightarrow FOB$	1	3.5811***	0.0033
	$FOB \rightarrow PW_b$	1	1.3200	0.2601
4	$PBL_c \rightarrow PBL_a$	8	1.4451	0.2026
	$PBL_a \rightarrow PBL_c$	8	9.5284***	8.9E-08
5	$PBL_a \rightarrow FOB$	1	4.4408***	0.0003
	$FOB \rightarrow PBL_a$	1	0.9401	0.5076
6	$PBL_c \rightarrow FOB$	4	2.6820**	0.0399
	$FOB \rightarrow PBL_c$	4	1.0412	0.3936
7	$PSO_b \rightarrow PSO_a$	3	10.6388***	1.1E-06
	$PSO_a \rightarrow PSO_b$	3	7.04185***	9.0E-05
8	$PSO_a \rightarrow PSO_c$	11	3.5234***	0.0012
	$PSO_c \rightarrow PSO_a$	11	4.1949***	0.0002
9	$PSO_a \rightarrow PSO_d$	10	3.4921***	0.0015
	$PSO_d \rightarrow PSO_a$	10	2.4860**	0.0164
10	$PSO_b \rightarrow PSO_c$	6	12.2737***	0.0000
	$PSO_c \rightarrow PSO_b$	6	1.9689*	0.0840
11	$PSO_b \rightarrow PSO_d$	10	3.9319***	0.0005
	$PSO_d \rightarrow PSO_b$	10	3.5302***	0.0013
12	$PSO_c \rightarrow PSO_d$	10	4.8866***	0.0001
	$PSO_d \rightarrow PSO_c$	10	1.6399	0.1219

Note: ***,** and * indicated the rejection of null hypothesis of non causality at 1percent, 5 percent and 10 percent significant level.

Source: Own calculation (2009)

Table 24 Results of Engle and Granger cointegration test for wholesale price of white sesame seeds, 2008

No.	Pairs of Price Series	Coefficient of Residual	Standard Error	τ (Tau) Statistics	R^2
1.	PW_b -PW_a	-0.3109	0.0856	-3.6308**	0.1547
	PW_a-PW_b	-0.3104	0.0861	-3.6053**	0.1528
2.	PW_a - FOB	-0.3547	0.0945	-3.7541**	0.2202
	FOB - PW_a	-0.4054	0.1105	-3.6708**	0.2350
3.	PW_b - FOB	-0.4958	0.1052	-4.7129***	0.2653
	FOB- PW_b	-0.6019	0.1248	-4.8221***	0.2849

Notes**:** 1. First variables were dependent variables in cointegrating regression.

2. Critical values of two variables in cointegration equations were -4.0655 (1 percent), -3.4295 (5 percent) and -3.1055 (10 percent) (Ender, 2004, p: 441)

3. ***, **and * indicated market integration in 1 percent, 5 percent, 10 percent significant level.

Source: Own calculation (2009)

5.2 Results of Johansen's cointegration test for the wholesale price of white sesame seeds, 2008

For wholesale prices of white sesame seeds, both trace and max-eigen statistic rejected the null of no cointegration between PW_a and FOB, and PW_b and FOB (Table 25). These results consistent with the results of Engle and Granger's cointegraion test. It could be interpreted that the two domestic markets namely, Mandalay (a) and Monywa (b) markets were found to be integrated with the export market (FOB). However Johansen's test pointed out no cointegration between the domestic markets, Mandalay (a) and Monywa (b) meaning that these markets were not cointegrated in the long run since different methods may give different results.

Table 25 Results of Johansen's cointegration test for wholesale price of white sesame seeds, 2008

No	Price series	H_0	H_1	Eigenvalue	Trace Stat.	5 % level	1 % level	Max-Eigen Stat.	5 % level	1 % level
1.	PW_a vs. PW_b	None r=0	r>0	0.1540	12.271	15.41	20.04	12.048	14.07	18.63
		At most 1 r≤1	r>1	0.0030	0.2231	3.76	6.65	0.2231	3.76	6.65
2.	PW_a vs. FOB	None r=0	r>0	0.1963	15.784 **	15.41	20.04	15.741 **	14.07	18.63
		At most 1 r≤1	r>1	0.0005	0.0429	3.76	6.65	0.0429	3.76	6.65
3.	PW_b vs. FOB	None r=0	r>0	0.2700	22.957 ***	15.41	20.04	22.660 ***	14.07	18.63
		At most 1 r≤1	r>1	0.0041	0.2963	3.76	6.65	0.2963	3.76	6.65

Note: ***,**and *denoted rejection of the null hypothesis of no cointegration at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

6. Results of Error Correction Model (ECM) for wholesale price of white sesame seeds

Testing for short run integration could be incorporated in ECM using the same price series, only when long run integration was observed. Error correction term represents percent of correction to any deviation in long run equilibrium price in a single period and also represents how fast the deviations in the long run equilibrium. The results of ECM for the wholesale price of white sesame seeds were demonstrated in Table 26. All coefficients of speed of the speed of adjustments were less than one and appropriate sign meaning that the systems were stable.

Related to the results of domestic prices, Mandalay (PW_a) and Monywa (PW_b) markets, ΔPW_a(-0.11) showed insignificant and negative sign of speed of adjustment and Δ PW_b indicated that the positive speed of adjustment (0.19) which was

significantly different from zero at 10 percent level**.** Positive sign of coefficient of speed of adjustment indicated that (PW_{at-1}-$\beta_1 PW_{bt-1}$) > 0 (where, intercept term β_0 was omitted because it had no economic meaning, (Hill *et al*., 2008)) and the negative change in PW_a and positive change in PW_b could correct the cointegration error. In opposite, negative sign of speed of adjustment proved that the (PW_{at-1}-$\beta_1 PW_{bt-1}$) < 0 and increase in PW_a and decrease in PW_b could reach the long run equilibrium. It was found that monthly adjustment of PW_b would be about 19 percent of the deviation of PW_{bt-1} from its cointegration values. The full adjustment of the previous period's deviation from long run equilibrium could be obtained within 5 months by increasing the price in Monywa market.

Table 26 Results of Error Correction Model (ECM) for wholesale price of white sesame seeds, 2008

No.	Price series	Dependent variable	lag	Coefficient of (α)	Std. Error	t-Statistic	Prob.
1.	PW_a vs. PW_b	ΔPW_a	1	-0.1122	0.1243	-0.9032	0.3680
		ΔPW_b	1	0.1983*	0.1107	1.7936	0.0751
2.	FOB vs. PW_a	ΔFOB	1	-0.2754***	0.0731	-3.7664	0.0002
		ΔPW_a	1	0.0241	0.0445	0.5413	0.5892
3.	FOB vs. PW_b	ΔFOB	1	-0.3105***	0.0730	-4.2555	0.0000
		ΔPW_b	1	0.0773*	0.0382	2.0247	0.0449

Note: ***,**and *denoted rejection of the null hypothesis at the 1 percent, 5 percent and 10 percent significant level.

Source: Own calculation (2009)

Related to PW_a and FOB, ΔFOB showed significant and negative sign of speed of adjustment (-0.27) which was significantly different from zero at 1 percent level and Δ PW_a indicated the insignificant and positive speed of adjustment (0.02). The negative change in PW_a and positive change in ΔFOB could correct the cointegration error. It was found that the monthly adjustment of FOB would be about 27 percent deviation of FOB_{at-1} from its cointegration values. The full adjustment of the previous period's deviation from long run equilibrium could be obtained within 4

months by increasing the export price only since the coefficients of speed of adjustment of PW_a was not significant.

The similar interpretation could be made for PW_b and FOB. Both coefficients of speed of adjustment for PW_b and FOB were significantly different from zero at 10 percent and 1 percent respectively. However, PW_b also showed significant response to long run equilibrium and it could correct 7.73 percent of the previous period's deviation from long run equilibrium. Therefore it could be concluded that the previous period's equilibrium of FOB and PW_b could be obtained by increasing FOB and by decreasing PW_b. In both cases, ΔFOB provided negative and significant coefficients for speed of adjustment, -0.27 and -0.31. Monthly adjustment of FOB would be about 27 percent of the deviation of FOB_{t-1} from its cointegrating value with respect to PW_{at-1} and 31 percent of the deviation of FOB_{t-1} from its cointegrating value with respect to PW_{bt-1}.

7. Results of Granger causality tests for wholesale price of white sesame seeds

The results of Granger causality rest within ECM frame work were demonstrated in Table 27. The results of χ^2 statistic showed unidirectional causality for all tested price pairs by rejection the null hypothesis at 5 percent level. Monywa white sesame price caused Mandalay white sesame prices. Farmers in Monywa Township cultivated not only white sesame but also red and brown color since there was large number of oil mills to compare with sesame production (Table 10). One reason was that there was separated informal and formal export of sesame seeds from Monywa to India through Tamu. If the demand from Informal and formal export to India and from other deficit regions of upper Myanmar increased, the price in Monywa would rise and sometime higher than the price in Mandalay. In that case, the price in Mandalay was affected since the two markets were integrated. All domestic prices caused the export price and export price did not cause any domestic wholesale prices of white and black sesame. Both Mandalay and Monywa domestic prices caused export price.

Table 27 Results of Granger causality tests for wholesale price of white sesame seeds, 2008

No.	Granger causality with ECM			
	Variables	**$\chi 2$**	**df**	**Prob.**
1.	$PW_b \rightarrow PW_a$	5.3649**	1	0.0205
	$PW_a \rightarrow PW_b$	0.4713	1	0.4924
2.	$PW_a \rightarrow FOB$	1.4481**	1	0.0288
	$FOB \rightarrow PW_a$	1.9897	1	0.1584
3.	$PW_b \rightarrow FOB$	5.4343**	1	0.0197
	$FOB \rightarrow PW_b$	1.7367	1	0.1876

Note: ***,** and *denoted rejection of the null hypothesis at the 1 percent, 5 percent and 10 percent significant level.

Source: Own calculation (2009)

. 8. Results of cointegration test for wholesale price black sesame seed

8.1 Results of Engle and Granger Cointegration test for the wholesale prices of black sesame seed

The results of Engle and Granger's conitegration test for wholesale price of black sesame seeds were exhibited in Table 28. The values of **τ** (Tau) statistic from ADF test of residual from long run relation of PBL_c vs. PBL_a, PBL_a vs. FOB and PBL_c vs. FOB were found to be more negative than Mackinnon critical value at 1 percent, 5 percent and 1 percent level respectively. Therefore, null of unit root were rejected and the residuals were stationary. The results indicated the strong cointengration relations between these price pairs.

Table 28 Results of Engle and Granger Cointegration test for wholesale prices of black sesame seeds, 2008

No.	Pairs of Price Series	Coefficient of Residual	Standard Error	τ (Tau) Statistics	R^2
1.	PBL_c-PBL_a	-0.8354	0.1699	-4.9175***	0.4831
	PBL_a-PBL_c	-0.7642	0.1648	-4.6384***	0.4584
2.	PBL_a- FOB	-0.3195	0.0879	-3.6340**	0.2462
	FOB- PBL_a	-0.3507	0.0942	-3.7239**	0.2586
3.	PBL_c –FOB	-0.5549	0.1329	-4.1755***	0.2722
	FOB- PBL_c	-0.6604	0.1593	-4.1456***	0.2761

Notes: 1. First variables were dependent variables in cointegrating regression.

2. Critical values of two variables in cointegration equations were -4.0655 (1 percent), -3.4295 (5 percent) and -3.1055 (10 percent) (Ender, 2004, p: 441)

3. ***,** and *denoted rejection of the null hypothesis at the 1 percent, 5 percent and 10 percent significant level.

Source: Own calculation (2009)

8.2 Results of Johansen's cointegration test for wholesale price of black sesame seeds

The results of Johansen's conitegration tests for the wholesale price of black sesame seeds were consistent with the results of Engle and Granger cointegration tests (Table 29). Both trace statistic and maximum eigen statistic rejected the null of no cointegration for PBL_a vs. PBL_c and PBL_c vs. FOB at 5percent and 1 percent levels. Regards to FOB and PBL_a, max-eigen statistics provided the long run cointegration at 5 percent significant level while trace statistic could not reject the null of no cointegration. It could be interpreted that the both domestic black sesame markets (Mandalay and Pakokku) and the export markets were integrated. In addition, Mandalay and Pakokku markets were found to be integrated.

Table 29 Results of Johansen's cointegration test for wholesale prices of black sesame seeds, 2008

No.	Price series	H_0	H_1	Eigenv -alue	Trace Stat.	5 % level	1% level	Max-Eigen Stat.	5 % level	1% level
1.	PBL_a vs. PBL_c	None r=0	r>0	0.2106	18.365 **	15.41	20.04	15.377 **	14.07	18.63
		At most 1 r≤1	r>1	0.0449	2.9877	3.76	6.65	2.9877	3.76	6.65
2.	PBL_a vs. FOB	None r=0	r>0	0.1835	14.892	15.41	20.04	14.800 **	14.07	8.63
		At most 1 r≤1	r>1	0.0012	0.0922	3.76	6.65	0.0922	3.76	6.65
3.	PBL_c vs. FOB	None r=0	r>0	0.3592	31.544 ***	15.41	20.04	30.703 ***	14.07	18.63
		At most 1 r≤1	r>1	0.0121	0.8409	3.76	6.65	0.841	3.76	6.65

Note: ***,**and *denoted rejection of the null hypothesis of no cointegration at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

9. Results of Error Correction Model (ECM) for wholesale prices of black sesame seeds

Regarding to black sesame prices in Mandalay and Pakokku markets, the coefficients of speed of adjustment for ΔPBL_c (-0.45) was negative sign and significantly responded to long run equilibrium at 1 percent level while ΔPBL_a showed significant response (-0.29) at 10 percent level. The response of PBL_c could correct 45 percent of the previous period's deviation from long run equilibrium within one month. With respect to ΔFOB vs. ΔPBL_a and ΔFOB vs. ΔPBL_c, the coefficients of speed of adjustment for ΔFOB (-0.25 and -0.46) were negative signs and significantly different from zero at 1 percent level. However, ΔPBL_a was unresponsive and ΔPBL_c was responsive (at 5 percent level) to last period's deviation

from the long run equilibrium with respect to FOB. It can be interpreted only export price would be likely to increase to correct the last period deviation from long run equilibrium with the speed of adjustment of 25 percent within one month.

Table 30 Results of Error Correction Model (ECM) for wholesale price of black sesame seeds, 2008

No.	Price series	Dependent variable	Lag	Coefficient of (α)	Std. Error	t-Statistic	Prob.
1.	PBL_c vs. PBL_a	ΔPBL_c	8	-0.4578***	0.1639	-2.7929	0.0063
		ΔPBL_a	8	0.2973*	0.1714	1.7353	0.0860
2.	FOB vs. PBL_a	ΔFOB	1	-0.2560***	0.0851	-3.0088	0.0031
		ΔPBL_a	1	0.0289	0.0433	0.6685	0.5050
3.	FOB vs. PBL_c	ΔFOB	4	-0.4653***	0.0917	-5.0742	0.0000
		ΔPBL_c	4	0.1777**	0.0841	2.1117	0.0368

Note: ***,**and *denoted rejection of the null hypothesis at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

However, increase in FOB and decrease in PBL_c would attain their long run equilibrium since both parameters of speed of adjustment were statistically significant. FOB would correct 46 percent and PBL_c would correct 17.77 percent of last period's deviation from the long run equilibrium within one month. In sum, Mandalay central market was unaffected by all long run price sequences except black sesame price in Pakokku market but the response was not strong.

10. Results of Granger causality tests for wholesale prices of black sesame seeds

According to the long run Granger causality test results in Table 31, Mandalay black sesame prices (PBL_a) Granger caused Pakokku black sesame price (PBL_c) each other because $\chi 2$ statistic rejected the null of non Granger causality at 1 percent level. Both domestic black sesame prices caused export price (FOB) since they had shown

long run relation and **χ2** statistic rejected the null of non causality at 1 percent level. However, FOB did not cause any domestic price.

Table 31 Results of Granger causality tests for wholesale prices of black sesame seeds, 2008

No.	Exclude	Granger causality with ECM		
		χ2	**df**	**Prob.**
1.	$PBL_c \rightarrow PBL_a$	22.2660***	8	0.0044
	$PBL_a \rightarrow PBL_c$	13.3789*	8	0.0995
2.	$PBL_a \rightarrow FOB$	5.1021***	1	0.0001
	$FOB \rightarrow PBL_a$	1.5875	1	0.3905
3.	$PBL_c \rightarrow FOB$	21.6809***	4	0.0002
	$FOB \rightarrow PBL_c$	7.2531	4	0.1231

Note: ***,** and *denoted rejection of the null hypothesis of non causality at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

11. Discussion on the results of black and white sesame seeds

Regarding to the results of domestic white sesame markets, (PW_a, PW_b) Engle and Granger's and Johansen's test gave different results. However, the result of Engle and Granger's test was taken for Mandalay and Monywa markets meaning that Mandalay and Monywa white sesame markets were integrated. Results of ECM and Granger causality test confirmed the cointegration between these price series by presenting at significant speed of adjustment for PW_b and unidirectional causality from Monywa to Mandalay. Again, Mandalay (PW_a) was central market and did not show any response to long run equilibrium while increase in white sesame price in Monywa and black sesame price in Pakokku would approach the equilibrium. Since Mandalay was central market and Mandalay black sesame caused Pakokku black sesame price. Mandalay CEXC was first price setter and CEXCs in other Townships look prices in Mandalay and set the specific price for their transactions.

However, Mandalay white sesame price (PW_a) did not caused Monywa white sesame price (PW_b). Even though, the CEXC in Monywa looked the price in Mandalay CEXC, the price may reset again within township according to the domestic supply, demand from local millers and the demand from and India border. The production of white sesame seed was relatively small to compare with other color sesame (red and brown) for the purpose of processing since Monywa has large number of oil mills nearly the same as Mandalay (Table 36) and traders were more interested to trade sesame oil than sesame seed. According to demand from other separated deficit markets in upper Myanmar and from India border, the price of white sesame seed would vary and this variation would affect to the price in Mandalay since two markets were cointegrated.

In case of domestic black sesame prices, Mandalay (PBL_a) and Pakokku (PBL_c) black sesame seeds markets were integrated. The reason was the same as white sesame. Mandalay CEXC was the first market to operate the daily price and it was the price setter of oil crop in Myanmar. Other CEXCs existing in Yangon, Monywa, Pakokku, Magway, Myingyan and Taunggyi townships looked into price information and demand in Mandalay market. CEXCs in each township were not only the major wholesale distribution center but also the main source of price formation for domestic agricultural products marketing. The traders, exporters and farmers bargained based on the price set by CEXC and some traders negotiated the new prices according to quality and demand of sesame seeds within the township. Therefore, the price of black sesame in Pakokku markets depended on the prices of black sesame in Mandalay market. In addition the prices in Mandalay market did not response to the long run equilibrium. Majority of the sesame from Pakokku was traded to Mandalay because the transportation facility (Highway road)was not very good from Pakokku to Yangon which was another major market in lower Myanmar for export to Japan. If the sesame was transported to Yangon it could not get one step transport by car and it needed to across the Ayeyawaddy River. Therefore, the Pakokku market was strongly integrated with the Mandalay market.

With respect to domestics and export markets, Mandalay white and black sesame seed market, Monywa white sesame market and Pakokku black sesame market were integrated with export market. In this study, FOB price represented the average export price of black and with sesame seeds of Myanmar and which was agreed by exporters and buyers at the border. Because of the situation in Myanmar, it was not available to get separate data for black and white sesame at the time of survey. One of important reason was that, exporters used the wholesale prices as a cost of sesame seed to set the export price. Therefore all domestic prices caused export prices and FOB did not cause any domestic prices. It might be because of unstable export policies on sesame seed export. When the export price rise, traders could not export because of export ban and change in FOB could not cause the price of domestic markets.

However, export prices may also be affected by the export policies, the cost of transportation, shortage or surplus of domestic supply. Because of unstable policies imposed on sesame export in Myanmar, all tested prices series were apart in short run but they would converge after some months. It could cause the markets to be fragmented in the short run and the country case could not be understandable. Myanmar government often imposed the policy of export ban if the domestic prices become rise. Some examples of the unstable policies on the sesame seeds had been explained subsequently. These might cause the price to be separated in the short run.

Government banned sesame export in 1995. Because, the palm nut from Malaysia for the country's famously oily curries was taking up 10 to 15 per cent of the import bill, they banned the export of domestic sesame seed. After that the trade was free again in1996-1997 (Barnes, 1999). In October 1998, the private export of sesame seed was suddenly prohibited, and Myanmar Agriculture Produces Trading (MAPT) assumed the role of monopoly exporter. As a result of this change, exports of sesame seed fell sharply, to less than half of the average of more than 50,000 ton per year that had been seen in previous years. Export volumes had continued to decline as exports of sesame seed at the granted rates of foreign exchange were only profitable when domestic prices fall to below average levels (FAO-ASR, 2004). In January, 2004, the

export ban was imposed on Chili, Onion, Maize and Sesame seeds again to keep domestic price down on and the prices for these goods fell by 10-20 percent (UN, 2004). The export stopped and the domestic price was flattened. In June, 2005, the government announced that sesame seeds exports was re-allowed and export of sesame seed was started by Htoo Trading Company to Japan with US$ 1070 per ton (The Voice, 2005). In sum, domestic wholesale and export prices moved together for long run but the price transmission was not complete during single period. The rate of transmission of export price to change in domestic price was faster than that of one domestic price to another. But there were incomplete price transmissions in the short run and the period of complete transmission depended on the parameter and level of significant of speed of adjustment.

12. Cointegration results of wholesale price of sesame oil

12.1 Results of Engle and Granger cointegration Test

The wholesale prices of sesame oils in four different domestic markets, *a*, *b*, *c* and *d* were tested for the existence of long run relation by Engle and Granger cointegration method. The results of 12 pairs of tested sesame oil prices series were supported in Table 32. As shown in Table 32, all $\boldsymbol{\tau}$ (Tau) statistics rejected the null of existence of unit root in residuals from the long run relations except PSO_b and PSO_c. The results verified that all pairs of prices with respect to markets *a*, *b*, *c* were cointegrated but $\boldsymbol{\tau}$ (Tau) statistics for the one price pair of market *a* and *b* could not reject the null of unit root on residual. It could be interpreted that prices of sesame oil in Monywa market (*b*) and Pakokku market (*c*) were not integrated.

12.2 Results of Johansen's conitegration test

To verify the existence of long cointegration between the wholesale prices sesame oil, Johansen's cointegration test was applied to all tested pairs of pries series and the results were presented in Table 33. Correspondingly, Johansen's results were strongly supported to Engle and Granger's cointegration results.

Table 32 Results of Engle and Granger's cointegration test for wholesale prices of sesame oils in selected domestic markets, 2008

No.	Pairs of Price Series	Coefficient of Residual	Standard Error	τ (Tau) Statistics	R^2
1.	PSO_a vs. PSO_b	-0.4890	0.1054	-4.6396***	0.2295
	PSO_b vs. PSO_a	-0.4851	0.1049	-4.6673***	0.2318
2.	PSO_a vs. PSO_c	-0.7363	-0.1177	-6.2562***	0.3518
	PSO_c vs. PSO_a	-0.7400	0.1186	-6.2401***	0.3506
3.	PSO_a vs. PSO_d	-0.3070	0.0862	-3.5611**	0.1492
	PSO_d vs. PSO_a	-0.3119	0.0862	-3.6189**	0.1537
4.	PSO_b vs. PSO_c	-0.5257	0.2099	-2.5043	0.4650
	PSO_c vs. PSO_b	-0.4906	0.2251	-2.1799	0.4662
5..	PSO_b vs. PSO_d	-0.2915	0.0776	-3.7547***	0.1792
	PSO_d vs. PSO_b	-0.2251	0.0745	-3.0223**	0.1126
6.	PSO_d vs. PSO_c	-0.3737	0.0971	-3.8477***	0.1693
	PSO_d vs. PSO_c	-0.3791	0.0961	-3.9437***	0.1768

Notes: 1. First variables were dependent variables in cointegrating regression.

2. Critical values of two variables in cointegrating equation were -4.0655 (1 percent), -3.4295 (5 percent) and -3.1055 (10 percent) (Ender, 2004, p: 441)
3. ***, ** and * indicated the rejection of no cointegration in 1 percent, 5 percent, 10 percent significant level.

Both trace and maximum eigen statistic rejected the null of no cointegration for the prices pairs of PSO_a vs. PSO_b, PSO_a vs. PSO_c, PSO_a vs. PSO_d, PSO_b vs. PSO_d and PSO_c vs. PSO_d indicating long run relation between them but accepted the null hypothesis of no cointegration between PSO_b and PSO_c. Johansen's test result agreed with the results of Engle and Granger cointegration test for all pairs of sesame oil prices. It was found that the evidence of strong cointegrations between sesame oils

markets, such as, Mandalay market (*a*) and Monywa market (*b*), Mandalay market (*a*) and Pakokku market (*c*), Mandalay market (*a*) and Yangon market (*d*), Monywa market *(b*) and Yangon market (*d*), Pakokku market (*c*) and Yangon market (*d*) respectively. However, there was no cointegration between Monywa market (*b*) and Pakokku market (*c*).

Table 33 Results of Johansen's conitegration test for wholesale price of sesame oils selected domestic markets, 2008

No	Price series	H_0	H_1	Eigen value	Trace Statistic	5 % level	1% level	Max-Eigen Stat.	5 % level	1% level
1.	PSO_a vs. PSO_b	None r=0	r>0	0.415	39.800***	15.41	20.04	39.620***	14.07	18.63
		At most 1 r≤1	r>1	0.002	0.1802	3.76	6.65	0.1802	3.76	6.65
2.	PSO_a vs. PSO_c	None r=0	r>0	0.203	17.543**	15.41	20.04	16.158**	14.07	18.63
		At most 1 r≤1	r>1	0.019	1.387	3.76	6.65	1.386	3.76	6.65
3.	PSO_a vs. PSO_d	None r=0	r>0	0.282	24.925***	15.41	20.04	23.895***	14.07	18.63
		At most 1 r≤1	r>1	0.014	1.0297	3.76	6.65	1.029	3.76	6.65
4.	PSO_b vs. PSO_c	None r=0	r>0	0.144	11.535	15.41	20.04	11.53	14.07	18.63
		At most 1 r≤1	r>1	6.15E-05	0.005	3.76	6.65	0.0046	3.76	6.65
5.	PSO_b vs. PSO_d	None r=0	r>0	0.361	32.787***	15.41	20.04	32.241***	14.07	18.63
		At most 1 r≤1	r>1	0.007	0.546	3.76	6.65	0.546	3.76	6.65
6.	PSO_c vs. PSO_d	None r=0	r>0	0.318	31.329***	15.41	20.04	27.545***	14.07	18.63
		At most 1 r≤1	r>1	0.051	3.784	3.76	6.65	3.784	3.76	6.65

Note: ***,**and *denoted rejection of the null hypothesis of no cointegration at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

13 Results of Error Correction Model (ECM)

All price pairs of sesame oils which showed long run cointegrations were analyzed to estimate the short run adjustments under ECM. The results of ECM estimates were illustrated in Table 34. Regarding to the ECM results between the surplus markets (PSO_b vs. PSO_a and PSO_c vs. PSO_a), coefficients of error correction terms for PSO_a in both tests were not statistically significant from zero. It meant that Mandalay market (a) did not show any response to long run equilibrium because it was the central markets among surplus markets. However, coefficients of adjustment for PSO_b in and PSO_c were negative signs and statistically significant at 1 percent and 5 percent level. The speeds of adjustment were quite fast and 99 and 81 percent of their deviations from the long run equilibrium would be corrected during one month.

Table 34 Results of Error Correction Model (ECM) for wholesale price of sesame oils in selected domestic markets, 2008

No.	Price series	Lag	Dependent variable	Coefficient of (α)	Std. Error	t-Statistic	Prob.
1.	PSO_b vs. PSO_a	3	ΔPSO_b	-0.9921***	0.3182	-3.1179	0.0022
			ΔPSO_a	-0.1471	0.3366	-0.4371	0.6627
2.	PSO_c vs. PSO_a	10	ΔPSO_c	-0.8191**	0.2754	-2.9743	0.0037
			ΔPSO_a	-0.1475	0.2876	-0.5128	0.6092
3.	PSO_d vs. PSO_a	9	ΔPSO_d	-0.8379***	0.1901	-4.4072	0.0000
			ΔPSO_a	-0.7088***	0.2308	-3.0714	0.0027
4.	PSO_d vs. PSO_b	9	ΔPSO_d	-0.8196***	0.1675	-4.8927	0.0000
			ΔPSO_c	-0.6427***	0.1607	-4.0003	0.0001
5.	PSO_d vs. PSO_c	9	ΔPSO_d	-0.7164***	0.1664	-4.3044	0.0000
			ΔPSO_b	-0.6620***	0.2163	-3.0601	0.0028

Note: ***,** and *denoted rejection of the null hypothesis at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

It could be interpreted that the long run equilibrium of PSO_b and PSO_c with respect to PSO_a would attain by only increasing PSO_b and PSO_c since the coefficients of speed of adjustment of PSO_a in each tests were not statistically significant. Again, the estimated results of ECM between surplus markets (Mandalay, Monywa and Pakokku) and deficit markets (Yangon) explained that the coefficients of speed of adjustment terms for ΔPSO_a , ΔPSO_b, ΔPSO_c , and ΔPSO_d were negative signs and statistically significant at 1 percent level. It could be interpreted that change in both prices series in each test were responded to their respective long run equilibrium. Among the results, coefficients of speed of adjustment for ΔPSO_d against all surplus markets (PSO_a , PSO_b and PSO_c) were -0.83, -0.81 and -0.71 respectively. ΔPSO_d responded very fast to long run equilibrium with respect to all surplus markets because which was the deficit market in lower Myanmar and the supply and prices of sesame oil in surplus directly affected to sesame oil price in Yangon.

Price changes in Yangon market could correct the 83, 81 and 71 percent of deviation from last period's price equilibrium with respect to the prices in Mandalay, Monywa and Pakokku markets and full response of its cointegration value would get during 2 months. In addition, significant coefficients of speed of adjustments for ΔPSO_a , ΔPSO_b and ΔPSO_c also indicated the responses to long run long run equilibrium but the speed of adjustments were slower than that of ΔPSO_d because of being surplus markets. ΔPSO_a , ΔPSO_b and ΔPSO_c would correct 70, 64 and 66 percent of last period's deviation from long run equilibrium. Since the coefficients of all speed of adjustments showed negative sings, all prices would increase until the full respond was obtained (Enders, 2004),. However the rates of increasing were different according to the absolute value the coefficients of speed of adjustments. For instance, both ΔPSO_d and ΔPSO_a would increase to reach the long run equilibrium by correcting the deviation of PSO_{dt-1} and PSO_{at-1} from their cointegration values but the speeds of adjustments were different. ΔPSO_d would correct 83.87 percent of the deviation from long run equilibrium while ΔPSO_a would correct 70.88 percent of deviation from long run equilibrium. These results were consistent in real world, the central market might show less response to economic change but both prices were necessary to increase with different amount to meet the long run equilibrium.

14 Results of Granger causality tests

The results of long run Granger causality tests were demonstrated in Table 35. Granger causality test was applied to wholesale prices of sesame oil in different domestic markets to verify that which price in one market caused to other. In this study, causality tests within ECM frame work were imposed to sesame oil price series which showed long run cointegration. All tested results made evidence of strong causality between the all tested price series**.**

Table 35 Results of Granger causality tests for wholesale prices of sesame oil in selected domestic markets, 2008

No.	Exclude	Granger causality with ECM		
		χ2	**df**	**Prob.**
1.	$PSO_b \rightarrow PSO_a$	34.2335***	2	0.0000
	$PSO_a \rightarrow PSO_b$	29.5519***	2	0.0000
2.	$PSO_a \rightarrow PSO_c$	29.4461***	10	0.0011
	$PSO_c \rightarrow PSO_a$	46.5611***	10	0.0000
3.	$PSO_a \rightarrow PSO_d$	18.9869**	9	0.0253
	$PSO_d \rightarrow PSO_a$	26.9287***	9	0.0014
5.	$PSO_b \rightarrow PSO_d$	25.3031***	9	0.0027
	$PSO_d \rightarrow PSO_b$	39.1515***	9	0.0000
6.	$PSO_c \rightarrow PSO_d$	35.0071***	9	0.0001
	$PSO_d \rightarrow PSO_c$	25.8590***	9	0.0022

Note: ***,** and *denoted rejection of the null hypothesis of causality at the 1 percent, 5 percent and 10 percent significant level

Source: Own calculation (2009)

It could be interpreted that all domestic sesame oil prices in selected markets caused each other meaning that Mandalay (a), Monywa (b) and Pakokku (c) sesame oil markets caused each other. Similarly, sesame oil prices in Mandalay caused the

prices in Yangon markets and the opposite was also true. There were also bi-directional causalities between surplus and deficit markets.

15. Discussion on the results of sesame oil

With respect to sesame oil markets, all domestic sesame oil markets were strongly integrated except Monywa and Pakokku markets. Among the selected domestic markets, Mandalay, Monywa and Pakokku markets are not only major sesame seed growing area but also the producing area of the sesame oil. In contrast, Yangon was not sesame growing area and also deficit region of the sesame oil. According to trade flow of sesame oil in Figure 25 and the location of the markets as shown Appendix Figure 1, sesame oil form Monywa and Pakokku directly traded to Mandalay central market and there was no sesame oil trade between them. Mandalay was central market and wholesale prices of sesame oil in Mandalay market caused wholesale prices of sesame oil in other markets. In Mandalay, 273 mills were operating and total annual capacity of edible oil supply was 206, 400 ton. Total numbers of mills and the annual capacity of Monywa, Pakokku and Yangon (East) Township were smaller than that of Mandalay (Table 36). However, Mandalay, Monywa and Pakokku markets responded very fast to long run equilibrium with respect to Yangon market and Yangon market showed very fast response to long run equilibrium of surplus markets.

Table 36 Number of oil mills and estimated milling capacity, 2007

Types of mills	Capacity	Townships			
		Mandalay	**Monywa**	**Pakokku**	**Yangon (East)**
Number of small oil mills	0.5 ton/8hr/day	164	165	125	0
Number of median oil mills	2.25ton/8hr/day	72	37	53	4
Number of large oils mills	12 ton/8hr/day	37	6	8	6
Total number of oil mills		273	208	186	10
Total annual capacity	ton/25days/month	206, 400	71, 325	83, 325	24300

Source: Favre and Kyaw Myint (2009)

Full correction of error from equilibrium would be obtained during 2 months. Even though Yangon was deficit region of sesame oil and demand in Yangon might affect the prices in producing area. Mandalay and Monywa are capital cities of Mandalay Division and Sagaing Division. Pakokku is also large Township in Magway Division. Therefore, the accesses of market information between these markets were probably good. Similarly, sesame oil prices in surplus markets such as Mandalay, Monywa and Pakokku markets caused prices of sesame oil in Yangon market. There were some median and large oil mills in Yangon but which were typically producing groundnut oil and palm oil according to consumers' preference in lower Myanmar.

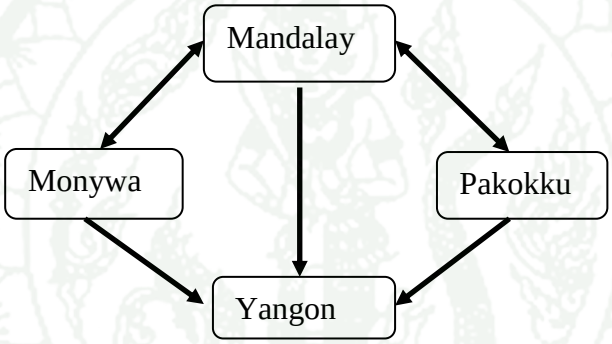

Figure 25 Trade flow of Sesame oil between the selected markets.
Source: Own survey (2008)

Therefore the price of sesame oil in Yangon strongly depended on prices of sesame oil in Mandalay, Monywa and Pakokku markets. It could be interpreted that surplus sesame oil markets were found to be integrated and Mandalay central market did not response to long run equilibrium while other surplus markets such as Monywa and Pakokku markets. Monywa and Pakokku markets showed very fast response to long run equilibrium and full correction would get during 2 months. With respect to deficit and surplus markets, Mandalay Monywa and Pakokku also showed fast response to long run equilibrium with respect to Yangon market. Yangon markets also proved very fast correction of deviation from long run equilibrium. All prices would correct fully the deviation from long run equilibrium during 2 months. Therefore price transmission of sesame oil will be completed during 2 months.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter revealed the attention to summary, important findings for the objectives of this study, brief conclusion based on the findings, and recommendations for the policy and further studies.

Conclusions of the Study

1. Descriptions of sesame marketing participants

In the context of sesame marketing structure, sample farmers were mostly primary and secondary education levels and some graduated farmers were found in Kyawe Ye village, Monywa Township. The farmers in Miethwekan village had the longest years of experiences of the growing sesame and also had large landholding size. Most of the selected farmers cultivated sesame as winter and summer crops. The largest sesame growing area was found in Miethwekan village. All farmers in Kula and Kyewe Ye village showed the summer sesame and farmers in Kula village applied the irrigation for the sesame growing.

The highest yield, highest total variable costs and highest return above variable cost were found in Kula village. The highest revenue cost ratio was found in Kula village and the second highest value was found in Kyawe Ye village followed by the smallest revenue cost ratio in Miethwekan village. About 28 to 29 percent of farmers in all villages were supported by credits from Myanmar Agricultural Development Bank (MADB) and State Peace and Development Council (SPDC). However the credit was only for the short term period and the amount did not cover the cost of cultivation. Farmers sold sesame at least two times per season and famers in Kula village did not sell at the time of harvesting. Most of farmers sold their product to town wholesalers and local millers.

Most sample wholesalers were between 40 to 50 years of age with more than 10 years of experience in doing wholesalers. Sample wholesalers were mostly high school level and graduated level of education. They also performed as commissioners and traders depending on the situation of market. Sample wholesalers bought sesame seed from local CEXC. Wholesalers sold sesame seed to other wholesalers, exporters and retailers. Commission was 1 to 2 percent of total sale value of sesame seed.

Selected millers were between 47 to 51 years of age with the experience of more than 14 years in processing. Most of the millers were the secondary, high school and graduated level of education. Millers from Mandalay purchased sesame seeds directly from the farmers. Millers form Monywa and Pakokku Township purchased from regional CEXC and resold sesame oil and oilcake to wholesalers and retailers. Buying price of the sample farmers, wholesalers and millers were determined by CEXC and the buying and selling systems were cash down system. Modes of transportation for farmers were by car and by bullock cart. Wholesalers and millers transported their products by car.

Based on descriptive results, it could be concluded that irrigated summer sesame provided high yields and high benefits under application of good cultural practices. Farmers who were near central market had more expectation of high price signal and they were able to decide the appropriate time to sell. Small farmers processed their sesame seed for their home consumption of edible oil and sold surplus sesame oil to the villagers. Role of the CEXC was important to set daily first market price of sesame. All wholesalers recommended liberalization of sesame seed export.

2. Marketing channels

According to survey, marketing performances of all intermediates along marketing channels were well organized. Marketing channels of the same colored sesame were mostly the same in selected townships. The most common channels of selected areas were producers to wholesalers who sold to other wholesalers at CEXC and to the exporters for the higher markets, Japan and China. Next channel was that

the producers directly sold to the millers who in turn sold sesame oil and oilcake to the domestic wholesalers, retailers and to poultry and livestock industries. No primary collectors and sale agents involved in observed marketing channels. Therefore, farmers were free from service charge of primary collectors who take 5 to 7 percent of total sale value for the marketing costs and service. The farms were near to town wholesale centers and market access was easy for farmers to sell their products directly to wholesalers and millers. It could be concluded that good transportation facilities to access the centre market could improve the benefit of producers and also could smooth the marketing channels even the farm was far from market centre. However, farmers who were near central market could access the timely market information and could make more profit from selling their sesame.

3. Marketing costs and marketing margins

In this study, marketing costs and marketing margins of the white sesame seeds were calculated between farmers and exporters for China market and the marketing costs and marketing margins of black sesame were calculated between farmers and exporters for Japan market. Mandalay farmers received the highest gross margins for both white and black sesame. All farmers received the highest gross margins for the white sesame to China. Pakokku farmes got the lowest gross margins because of high marketing costs and low yield per unit area. All exporters and Mandalay farmers received the highest gross margins for the black sesame to Japan. Wholesalers received the highest share to export price in both channels. Wholesalers' gross margins depended on the time of storage and the price of selling. High yield per unit area and low marketing costs reflect the gross margins.

4. Price responses and market cointegration among sesame seed markets

This study analyzed the price relationships between domestic sesame prices and export prices through cointegration model. Augmented Dickey Fuller test was applied to determine whether prices series were stationary. The domestic monthly wholesale prices of sesame seeds and sesame oil in selected markets during

September, 2002 to October 2008 were used for price analysis. According to ADF test, all price series were non stationary but stationary at first difference. It could be concluded that all tested price series were *I*(1). Then the prices were applied by Engel and Granger two steps cointegration method as well as Johansen's cointegration method in order to determine whether there was any long run relationship between the selected domestic wholesale prices and export prices of sesame seed and sesame oil.

Regarding to sesame seed, all domestic markets had long run integrations with the export market. With respect to domestic markets, Mandalay and Monywa white sesame seed markets were integrated. Mandalay and Pakokku black sesame markets were also integrated. Because Mandalay was central domestic market and Mandalay CEXC was the first domestic wholesale price setter and other Townships looked this price and set their local wholesale prices again. All domestic markets were integrated with export market because traders used domestic wholesale price as a cost of export price. The domestic markets might be separated in the short run because of shortage of supply by undesirable weather condition and such as flooding. Again, if the export demand increases, the domestic price would increase but increase in export prices did not reflect to domestic price because of the government's unexpected ban on export and domestic price.

Major domestic black and white sesame seed markets were integrated each other and also integrated with export markets for the long run but in the short run, all markets might be deviated from long run equilibrium for some periods. Mandalay central market did not show any respond to the long run equilibrium for white sesame price with respect to Monywa market but showed response for black sesame price with respect to Pakokku. The adjustment of Monywa white sesame prices could attain the long run equilibrium within 5 months and that of Pakokku black sesame prices could attain during 3 months. The responses of export price to changes in domestic prices for black and white sesame seed were relatively large and the speeds of adjustment to correct the deviation from long run equilibrium were quite fast. It could be concluded that sesame seed prices were not fully transmitted in the short run

but the transmission would be completed in the long run between different domestic markets and also between export and domestic markets.

According to the Granger causality results, domestic wholesale prices of the sesame seed caused the export prices. Mandalay black sesame prices caused Pakokku black sesame prices since these markets had shown long run relationship. The export prices used in this study were the average export price of black and with sesame seeds of Myanmar. This was agreed by exporters and buyers at the border. In addition trades used the domestic wholesale price to set the export price. It could be concluded that he export price could not lead the domestic prices because of the export policies, multiple exchange rates and poor infrastructures of the marketing especially for the transportation and the shortage or surplus of domestic supply.

5. Price transmission and market cointegration among sesame oil markets

Regarding to sesame oil, four domestic markets, Mandalay, Monywa Pakokku and Yangon markets were selected for cointegration test. Yangon was deficit region of sesame oil and other markets were surplus region of sesame oil. All markets were found to be cointegrated expect the Monywa and Pakokku markets. Yangon market was strongly integrated with the other markets and all markets respond significantly to long run equilibrium. However among the surplus markets, Mandalay market did not show any response to long run equilibrium because it was central domestic market where the daily first wholesale price was set. Change in sesame oil prices in Mandalay central markets did not fully transmitted to other domestic surplus markets but the transmission would be complete after some months since they had shown cointegration. The price transmission were fairy complete between surplus (Mandalay, Monywa and Pakokku) and deficits (Yangon) markets and because the correction of the deviations from the long run equilibriums were quite fast and these markets could get fully transmission within two months. All markets corrected fully long run deviation from the equilibrium within 2 to 4 months. But Monywa market showed full respond within one month.

According to the Granger causality results, all sesame oil prices caused each other. It could be concluded that the sesame oil markets were well integrated and the prices fully responded from one market to the other within 2 to 4 months. Because sesame oil markets were competitive and there was no intervention for the sesame oil markets and also access of market information was timely and easy. Demand of sesame oil from Yangon markets affected the prices in Mandalay, Monywa and Pakokku markets and the opposite was also true.

Recommendations of the study

The results were compatible with expected outputs and the results from the market and price analysis were consistent each other. Upgrading transportation and irrigation systems would help farmers to reduce production costs and to increase yields since the yield per unit area and good transport facilities had supported the high gross margins for the farmers. In order to eliminate low yield and to increase their gross margin, the farmers should be provided more credit, high quality seeds, and regular fertilizer supply system by supported institutions and good transportation facilities. Current credit system should be modified to create favorable conditions to access cheap and enough credit specifically for small farmers. Improvement of processing (processing technologies and supply of electricity) and storage facilities should also be put under immediate attentions. Regarding to the results of this study, the sesame marketing channels in selected areas were well organized with all participants in selected areas because of good market access, and the immediate transmission of price formation by CEXC affected to the selected townships. Long run market performance was good for all markets, but there was disequilibrium condition in the short run. In order to achieve the sufficient domestic supply and to increase export volume of sesame, government should review the policy on liberalization quality driven sesame seed exports.

Because of the unstable policies for the export of sesame, export tax, multiple exchange rate, inefficient infrastructures, and volume of domestic supply, the export price did not cause the domestic price and there would be large gap between domestic

price collected and the export price. The communication system should be liberalized to assist the market activities for the whole oilseed sector. Supported institutions such as MAS, DAR should also be strengthened to enhance the farm productivity, to provide the post harvest technologies and the good quality seeds and to conduct further market researches to develop the sesame trade at least in Asia.

Since Myanmar sesame has good potential for export to China and Japan market, government should support the traders to find the new markets by attending International Trade Fairs which are very important for the new market opportunity. Further study should be concerned with the market integration and price transmission of sesame between the all major domestic markets and export markets. Market analysis of farmers and wholesalers should be implied the regions which are not near the major markets. The detailed marketing costs and margins of millers should also be analyzed and identified how to promote the efficiency and quality of processing of sesame oil. In addition to further research, probably India, China and regional economic integrations should play the important role in sesame world market.

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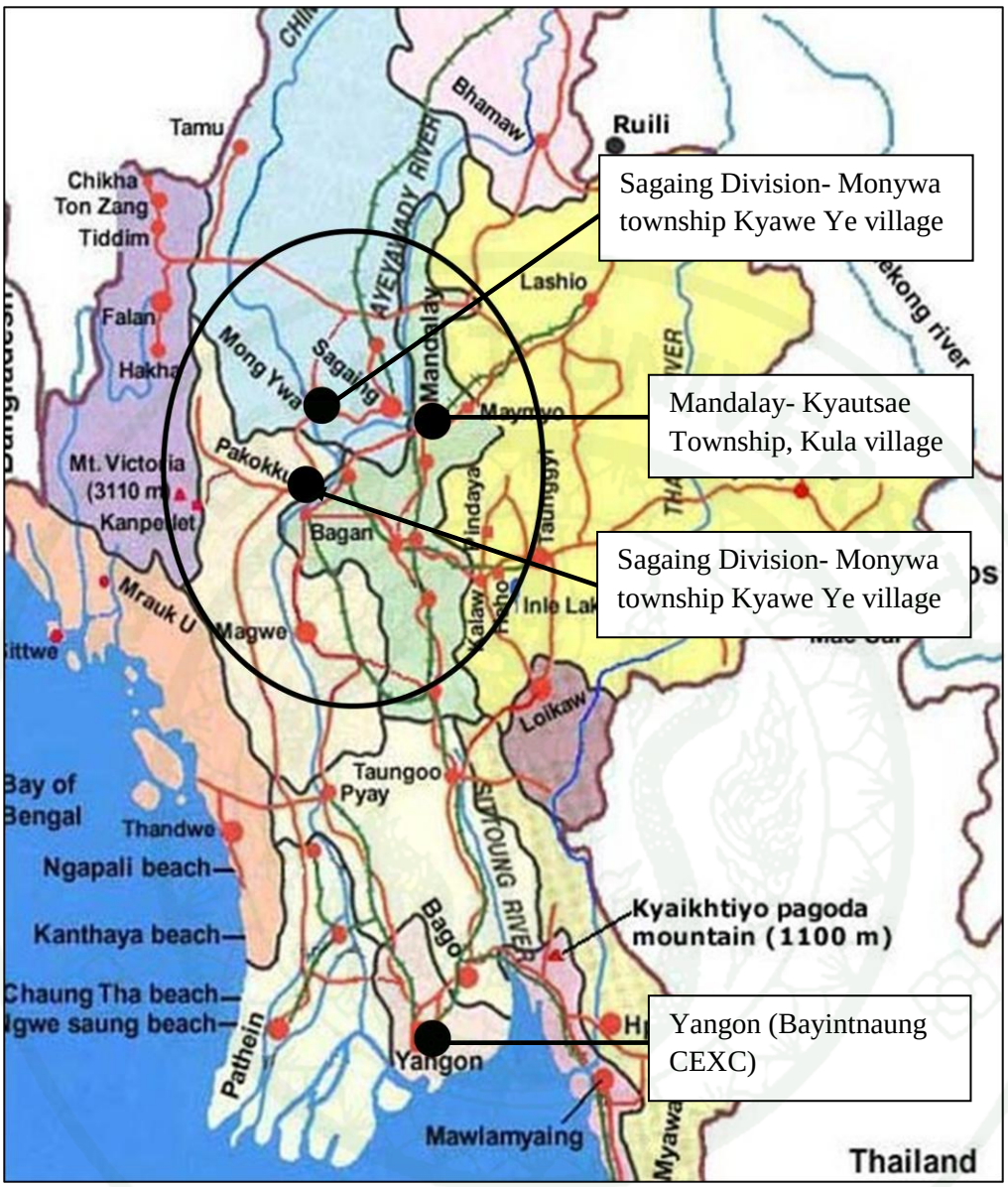
APPENDICES

Appendix A

Map of Study site



Appendix Figure 1 Map of study site

Source: Online: www.ggi-myanmar.com/Myanmar/map/index.html

Appendix B

Some Important Results of Descriptive Analysis

Appendix Table 1 Opinions of farmers on sesame production in all selected villages, 2008

No.	Statements	Kula (%)			Kyawe Ye (%)			Miethwekan (%)		
		No	Yes	Nil	No	Yes	Nil	No	Yes	Nil
1.	High quality sesame variety can earn more profit	5	95	0	43	14	43	0	70	30
2.	Sesame is more preferred for second crop after paddy	16	82	0	50	7	43	30	40	30
3.	Government should provided more subsidies	21	79	0	21	50	29	20	50	30
4.	Required more irrigation for sesame growing	5	95	0	57	7	36	30	40	30
5.	Farmers should get more formal credit	5	95	0	29	50	21	0	70	30
6.	Required improved milling system	0	100	0	0	0	100	30	30	40
7.	Required improved transportation system	0	100	0	0	0	100	20	40	40
8.	Price stability causes the direct risk to farmers	36	32	32	0	0	100	30	30	40
9.	More investment is urgently needed for storage and marketing	42	11	47	0	0	100	30	30	40
10.	Government should set the guarantee price	0	26	74	0	0	100	20	50	30
11.	Export of sesame should be more liberalized	47	21	32	29	71	0	20	40	40
12.	The current policy n oilseed sector	0	5	95	7	0	93	60	0	40

Note: No = Not recommended the statements

Yes= Recommended the statements

Nil = No respond to the statements

Source: Own survey (2008)

Appendix Table 2 Opinions of wholesalers on sesame production in selected Townships, 2008

No.	Statements	Mandalay (%)			Monywa (%)			Pakokku (%)		
		No	Yes	Nil	No	Yes	Nil	No	Yes	Nil
1.	High quality sesame variety can earn more profit	0	100	0	25	75	0	17	83	0
2.	Sesame is more preferred for second crop after paddy	100	0	0	50	25	0	33	67	0
3.	Government should provided more subsidies	50	50	0	75	25	0	67	33	0
4.	Required more irrigation for sesame growing	100	0	0	50	25	0	33	67	0
5.	Farmers should get more formal credit	50	50	0	25	50	25	50	50	0
6.	Required improved milling system	50	50	0	50	25	25	50	50	0
7.	Required improved transportation system	100	0	0	50	25	25	50	50	0
8.	Price stability causes the direct risk to farmers	0	100	0	50	25	25	17	83	0
9.	More investment is urgently needed for storage and marketing	100	0	0	50	25	25	67	33	0
10.	Government should set the guarantee price	100	0	0	100	0	0	17	83	0
11.	Export of sesame should be more liberalized	0	100	0	0	100	0	0	100	0
12.	The current policy on oilseed sector	50	50	0	100	0	0	17	83	0

Note**:** No = Not recommended the statements
Yes= Recommended the statements
Nil = No respond to the statements

Source: Own survey (2008)

Appendix Table 3 . Opinions of millers on sesame production in selected Townships, 2008

No.	Statements	Mandalay (%)			Monywa (%)			Pakokku (%)		
		No	Yes	Nil	No	Yes	Nil	No	Yes	Nil
1.	High quality sesame variety can earn more profit	43	43	14	75	25	0	20	80	0
2.	Sesame is more preferred for second crop after paddy	100	0	0	100	0	0	20	80	0
3.	Government should provided more subsidies	86	14	0	100	0	0	0	100	0
4.	Required more irrigation for sesame growing	86	14	0	50	50	0	0	100	0
5.	Farmers should get more formal credit	43	57	0	50	50	0	0	100	0
6.	Required improved milling system	14	86	0	0	100	0	0	100	0
7.	Required improved transportation system	71	29	0	100	0	00	0	100	0
8.	Price stability causes the direct risk to farmers	71	29	0	50	50	0	20	80	0
9.	More investment is urgently needed for storage and marketing	43	57	0	100	0	0	20	80	0
10.	Government should set the guarantee price	43	57	0	50	50	0	40	60	0
11.	Export of sesame should be more liberalized	43	29	25	50	50	0	40	60	0
12.	The current policy on oilseed sector	0	0	100	100	0	0	40	60	0

Note: No = Not recommended the statements
Yes= Recommended the statements
Nil = No respond to the statements

Source: Own survey (2008)

Appendix Table 4 Calculation of marketing cost and margins of the white sesame seeds between the farmers through the exporters for China market, 2008

Classification	Mandalay	Monywa	Pakokku
Farmers			
Average yield per unit area (kg/ha)	799.68	514.17	373.38
Sale price of famers (kyat/kg)	1082.07	1082.07	1082.07
Production cost (kyat/kg)	515.65	556.43	658.78
Farmers' gross margin (kyat/kg)	566.46	525.64	423.29
Farmers' gross margin (percent)	52.35	48.58	39.12
Marketing cost (kyat/kg)	14.90	9.19	18.43
Price spread (kyat/kg)	632.20	632.20	632.20
Farmers' share to export price (percent)	63.12	63.12	63.12
Wholesalers			
Sale price of wholesaler (28000ks/basket)	1225.00	1225.00	1225.00
Wholesalers' gross margin (kyat/kg)	142.93	142.93	142.93
Wholesalers' gross margin (percent)	11.67	11.67	11.67
Commission paid by wholesaler (1percent of total sale value)	10.82	10.82	10.82
Transportation, labor costs of wholesaler to Mandalay (kyat/kg)	16.00	6.12	13.24
Total marketing costs (kyat/kg)	26.82	16.94	24.60
Wholesalers' share to export price (percent)	71.46	71.46	71.46
Exporters			
Export price (1Yun=184.33kyats)	1714.27	1714.27	1714.27
Exporters' gross margin (kyat/kg)	489.27	489.27	489.27
Exporters' gross margin (percent)	28.54	28.54	28.54
Transportation cost (packaging to store)	2.30	2.30	2.30
Transportation cost from Mandalay to 105 mile (kyat/kg)	36.70	36.70	36.70
105 mile to Shwe Le (Ruli)	4.00	4.00	4.00
Packaging (kyat/kg)	6.00	6.00	6.00
loading/unloading (kyat/kg)	2.00	2.00	2.00
License fee (including export tax) (kyat/kg)	25.52	25.52	25.52
Total marketing cost of exporters (kyat/kg)	76.52	76.52	76.52

Note: CEXC set the daily wholesale price in each township,

Export price (FOB Shwe Li (Ruili)) = 9.3 Yun/kg (on 7/12/2008)

Source: Own calculation (2009)

Appendix Table 5 Calculations of marketing costs and margins of black sesame seeds between the farmers through the exporters for Japan market, 2008

Classification	Mandalay	Monywa	Pakokku
Farmers			
Average yield per unit area (kg/ha)	799.68	514.17	373.38
Sale price of famers (kyat/kg)	918.74	918.74	918.74
Production cost (kyat/kg)	515.65	556.43	658.78
Farmers' gross margin (kyat/kg)	403.09	362.31	259.96
Farmers' gross margin (percent)	43.87	39.44	28.30
Marketing cost (kyat/kg)	14.90	9.19	18.43
Price spread (kyat/kg)	1037.84	1037.84	1037.84
Farmers'share to export price (percent)	46.96	46.96	46.96
Wholesalers			
Sale price of wholesaler (28000ks/basket)	1143.32	1143.32	1143.32
Wholesalers' gross margin (kyat/kg)	224.58	224.58	224.58
Wholesalers' gross margin (percent)	19.64	19.64	19.64
Percentage margin (percent)	24.44	24.44	24.44
Commission paid by wholesaler (1percent)	9.18	9.18	9.18
Marketing cost of wholesaler to Yangon (kyat/kg)	30.00	32.00	25.00
Total marketing costs (kyat/kg)	39.18	41.18	34.18
Wholesaler's share to export price (percent)	58.43	58.43	58.43
Exporters			
Export price (1700$/ton)	1956.58	1956.58	1956.58
Exporters' gross margin (kyat/kg)	813.26	813.26	813.26
Exporters' gross margin (percent)	41.57	41.57	41.57
Transportation (packaging to Yangon board) (kyat/kg)	12.23	12.23	12.23
Handling/ Repackaging/bag (kyat/kg)	15.00	15.00	15.00
Waste value per kg (kyat/kg)	4.00	4.00	4.00
Other cost (kyat/kg)	5.70	5.7.	5.70
Storage (kyat/kg)	2.00	2.00	2.00
License fee with export tax) (kyat/kg)	20.00	20.00	20.00
Total Marketing cost of exporters (percent)	58.93	58.93	58.93

Note: 1 basket=24.49kg, Export price = 1700$/ton (FOB Myanmar)

Exchange rate=1150kyats/$ (on January 2008)

Source: Own calculation (2009)

Appendix C

Important Econometric Outputs

Appendix C Long run equations for the sesame seeds and oil prices

Sesame seeds prices

$PW_a = -173.4356302 + 1.066904144\ (PW_b)$

(487.9679) (0.023947)

[-0.355424] [44.5530***]

$FOB = 5606.976627 + 1.042508321\ (PW_a)$

(1267.134) (0.058489)

[4.424928***] [17.82390**]

$FOB = 5253.454497 + 1.121728388\ (PW_b)$

(1346.2278) (0.066066)

[3.902352***] [16.97899***]

$PBL_c = 504.3759002 + 0.974960971\ (PBL_a)$

(597.6041) (0.029756)

[0.843997*] [32.76515***]

$FOB = 5797.103 + 1.120545\ (PBL_a)$

(1132.927) (0.056411)

[5.116923***] [19.86395***]

$FOB = 6380.265163 + 1.084096042\ (PBL_a)$

(1276.688) (0.063305)

[4.997514***] [17.12491***]

Note: Standard Error in ( ) and t-statistic in [ ]

, **, *** indicated that rejection of null hypothesis at 10 percent, 5 percent and 1 percent significant level.

Sesame oil prices

PSO_b= -66.39532084 + 1.056614652 (PSO_a)
(32.54755) (0.014087)
[-2.039948*] [75.00887***]

PSO_c = -147.5493758 + 1.114912588 (PSO_a)
(38.83050) (0.016806)
[-3.799832***] [66.34102***]

PSO_d = 179.8593837 + 0.7887970367 (PSO_b)
(65.31880) (0.027398)
[2.753562***] [28.79068***]

PSO_d= 225.1464879 + 0.7533240351(PSO_c)
(56.02686) (0.022897)
[4.018545***] [32.90023***]

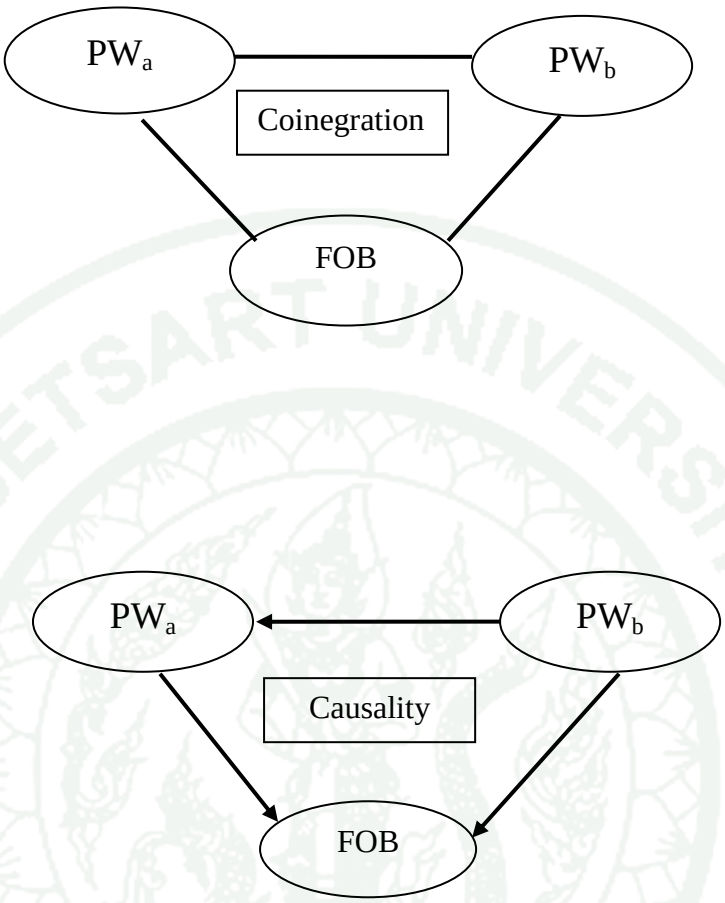
PSO_d = 97.68347945 + 0.8476703291 (PSO_a)
(58.46608) (0.025304)
[1.670772*] [33.49942***]

Note: Standard Error in ( ) and t-statistic in [ ]

, **, *** indicated that rejection of null hypothesis at 10 percent, 5 percent and 1 percent significant level.

Appendix D

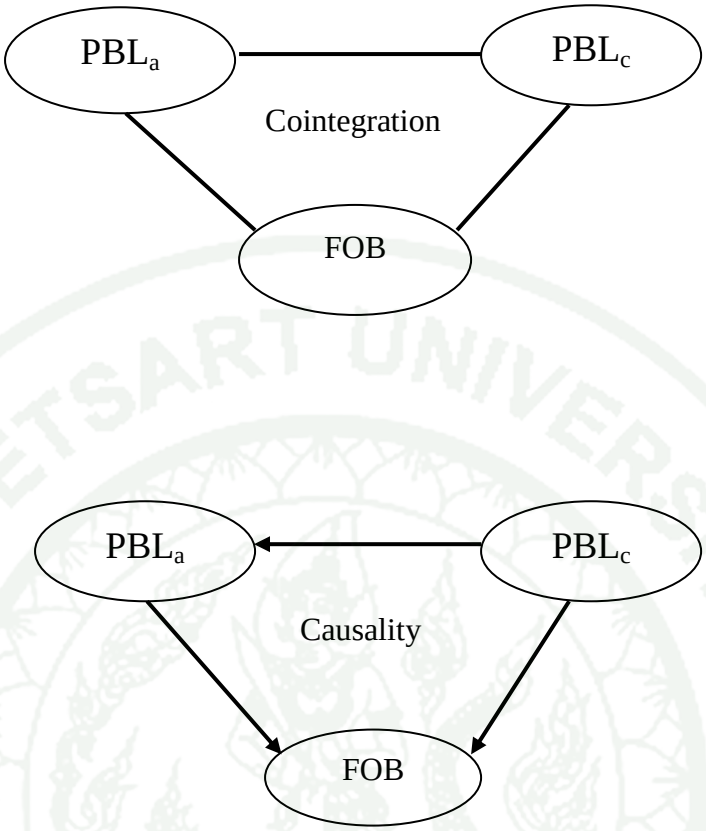
Map of Cointegration and Granger causality results



Appendix Figure 2 Maps of the results of cointegration and Granger causality tests for the wholesale prices of white sesame seeds

Note: Lines without arrow represent the cointegraiton relations between the price series and the line with arrows indicate the direction of causality between the price series

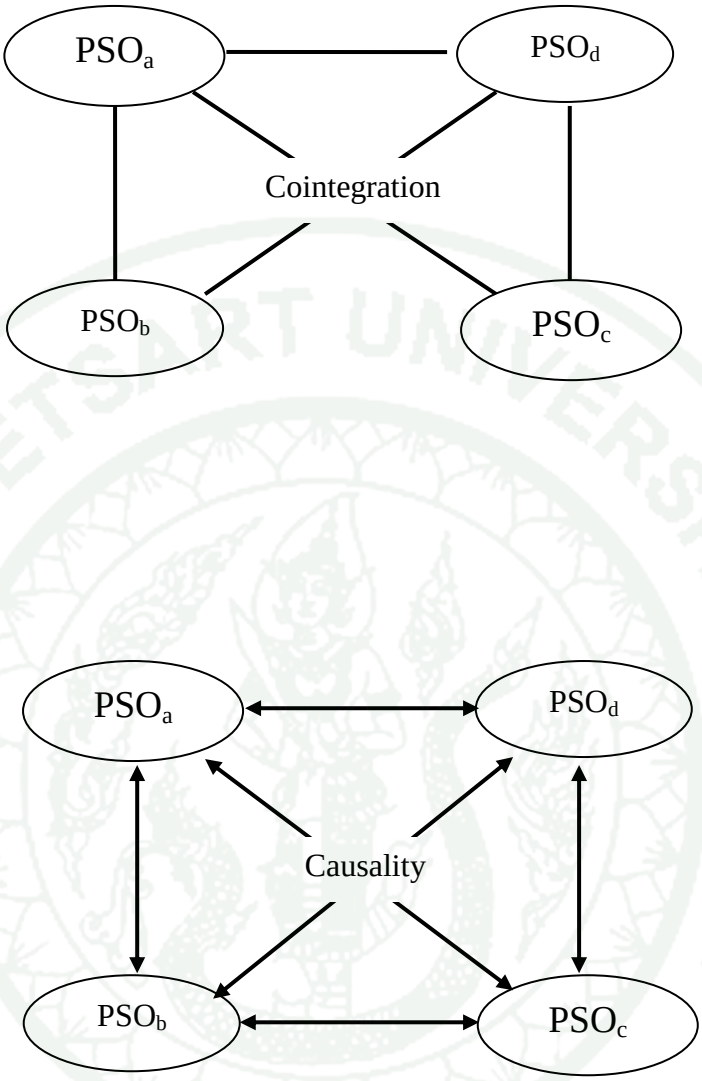
Source**:** Own calculation (2009)



Appendix Figure 3 Maps of the results of cointegration and Granger causality tests for the wholesale prices of black sesame seeds

Note: Lines without arrow represent the cointegraiton relations between the price series and the lines with arrows indicate the direction of causality between the price series

Source**:** Own calculation (2009)



Appendix Figure 4 Maps of the results of cointegration and Granger causality tests for the wholesale prices of sesame oil

Note: Lines without arrow represent the cointegraiton relations between the price series and the lines with arrows indicate the direction of causality between the price series

Source**:** Own calculation (2009)

Appendix E

Data and Myanmar official standard weight and unit for oilseed crops

Appendix Table 6 Wholesale prices of black and white sesame seeds in selected domestic markets and the export prices (kyat/basket [9])

Period	PWa	PWb	PBL_a	PBL_c	FOB
Sep-02	11672	10975	11908	11692	18042
Oct-02	11365	10000	11550	11308	21846
Nov-02	10816	10000	10000	11250	13502
Dec-02	11375	10600	12919	12300	16431
Jan-03	12945	11950	12393	12900	18720
Feb-03	12665	11450	12549	10883	19421
Mar-03	11536	10000	11270	10817	15480
Apr-03	12632	13000	11000	10511	14609
May-03	10946	11100	11083	11000	16268
Jun-03	9866	9400	11667	9850	15339
Jul-03	9773	8575	10500	9700	14266
Aug-03	8802	8025	9006	8900	13608
Sep-03	9003	7952	9336	8600	13661
Oct-03	12595	10830	12324	11875	13841
Nov-03	14170	11952	11000	12400	13395
Dec-03	11865	11250	10289	10130	14643
Jan-04	10904	9500	8728	9125	13792
Feb-04	12635	10067	9652	9396	13415
Mar-04	12947	11267	10125	10168	11795
Apr-04	13534	12200	10528	10531	16680
May-04	15549	14735	11615	10967	13342
Jun-04	15363	14293	11685	11686	15340
Jul-04	16815	12467	11972	11988	19603
Aug-04	13020	10725	10715	11529	19865
Sep-04	13227	10690	11538	11500	20801
Oct-04	13428	11621	12629	12600	21472
Nov-04	12837	10933	12256	11500	21442
Dec-04	12807	11967	11026	10817	21083
Jan-05	12828	12183	10598	10707	20498
Feb-05	12804	12200	10676	10700	20542
Mar-05	13952	12827	11053	10964	20565
Apr-05	14303	12967	11528	11708	23700
May-05	15056	13813	11649	12055	24772
Jun-05	16498	15250	13099	12550	13348
Jul-05	17281	15875	13611	13701	24060
Aug-05	17093	15233	13831	13689	23860
Sep-05	18608	17792	15189	13600	24158
Oct-05	21212	20392	18500	16463	29582
Nov-05	19646	18397	18440	16417	25532
Dec-05	17497	16438	14276	14772	24364
Jan-06	13308	15604	13308	14700	23883
Feb-06	12809	15777	12809	14670	21984
Mar-06	13216	15492	13216	14800	25040

[9] Kyat is Myanmar currency and the market exchange rate at the time of survey was 115 kyat per USD. 1 basket of sesame seed is equal to 24.49 kg

Appendix Table 6 (Continued)

Period	PWa	PWb	PBL_a	PBL_c	FOB
Apr-06	13972	16413	13972	15983	27018
May-06	13932	15983	13932	15374	26563
Jun-06	12894	14938	12894	14515	21015
Jul-06	11606	13800	11606	14515	22404
Aug-06	11950	14938	11950	14083	23949
Sep-06	13111	15500	13111	15208	24148
Oct-06	14222	15350	14222	15891	24850
Nov-06	14074	15563	14074	15627	23981
Dec-06	16783	18063	16783	18069	23809
Jan-07	20949	19017	19625	19900	25604
Feb-07	21953	20500	20181	20948	25207
Mar-07	24976	25000	23806	23385	26167
Apr-07	24931	27167	23833	25800	26121
May-07	25100	25625	23780	25815	26014
Jun-07	25644	23917	22333	25250	32421
Jul-07	27950	24438	23583	23750	34500
Aug-07	29332	23854	29300	22225	36493
Sep-07	30012	24168	29962	25595	43316
Oct-07	30310	27867	29667	29063	43240
Nov-07	33295	29000	34905	20500	39923
Dec-07	34582	33900	34919	35428	37804
Jan-08	38401	37500	36102	36700	37466
Feb-08	40906	37750	36340	37763	36890
Mar-08	44895	40833	37700	39533	47639
Apr-08	40484	40833	37667	42000	40472
May-08	42770	40700	39024	42000	49121
Jun-08	43120	38900	39333	41800	55144
Jul-08	39218	34500	36188	38917	49932
Aug-08	32812	30618	32800	32280	5497
Sep-08	34621	31750	33592	31600	54713
Oct-08	36771	33188	34630	32325	53839

Note**:** PW_a =Wholesale price of white sesame seed in Mand\alay market

PW_b =Wholesale price of white sesame seed in Monywa market

PBL_a =Wholesale price of black sesame seed in Mandalay market

PBL_c =Wholesale price of black sesame seed in Pakokku market

FOB = Average Export price of sesame seed

Appendix Table 7 Wholesale prices of sesame oil in selected domestic markets (kyat/viss [10])

Period	PSO_a	PSO_b	PSO_c	PSO_d
Sep-02	1552	1568	1588	1456
Oct-02	1487	1498	1500	1408
Nov-02	1450	1457	1457	1416
Dec-02	1554	1518	1520	1517
Jan-03	1785	1750	1766	1912
Feb-03	1715	1708	1700	1786
Mar-03	1552	1650	1550	1486
Apr-03	1456	1494	1450	1411
May-03	1435	1516	1425	1446
Jun-03	1332	1308	1308	1403
Jul-03	1228	1194	1220	1290
Aug-03	1177	1081	1125	1276
Sep-03	1103	1113	1105	1127
Oct-03	1253	1268	1290	1331
Nov-03	1330	1330	1355	1370
Dec-03	1346	1343	1342	1308
Jan-04	1275	1250	1275	1266
Feb-04	1216	1250	1270	1184
Mar-04	1320	1300	1364	1269
Apr-04	1308	1300	1364	1207
May-04	1350	1350	1410	1219
Jun-04	1380	1425	1439	1244
Jul-04	1376	1404	1425	1243
Aug-04	1234	1283	1325	1135
Sep-04	1240	1264	1264	1116
Oct-04	1318	1326	1342	1211
Nov-04	1409	1388	1401	1341
Dec-04	1452	1452	1441	1336
Jan-05	1422	1431	1444	1296
Feb-05	1375	1388	1400	1292
Mar-05	1506	1395	1427	1281
Apr-05	1414	1470	1445	1268
May-05	1461	1516	1531	1310
Jun-05	1536	1595	1582	1373
Jul-05	1625	1686	1672	1458
Aug-05	1670	1692	1715	1516
Sep-05	1753	1852	1754	1620
Oct-05	1946	1981	1894	1711
Nov-05	1918	1932	1913	1607
Dec-05	1843	1828	1887	1532
Jan-06	1837	1788	1790	1613

[10] Kyat is Myanmar currency and the market exchange rate at the time of survey was 115 kyat per USD. 1 viss of sesame oil is equal to 1.62 kg

Appendix Table 7 (Continued)

Period	PSO_a	PSO_b	PSO_c	PSO_d
Feb-06	1724	1805	1860	1534
Mar-06	1578	1880	1950	1481
Apr-06	1857	2134	2105	1553
May-06	1864	2101	2160	1518
Jun-06	1914	1849	1882	1518
Jul-06	1548	1628	1882	1573
Aug-06	1544	1656	1508	1510
Sep-06	1677	1736	1737	1475
Oct-06	2151	1798	1794	1471
Nov-06	1768	1792	1840	1485
Dec-06	1983	2069	1976	1480
Jan-07	2440	2452	2501	1846
Feb-07	2622	2713	2760	2067
Mar-07	2962	3210	3050	2283
Apr-07	3150	3467	3443	2283
May-07	3081	3345	3519	2278
Jun-07	2880	3119	2994	2167
Jul-07	2841	2870	2815	2190
Aug-07	2601	2594	2744	2458
Sep-07	2607	2602	2667	2265
Oct-07	2939	3010	3067	2308
Nov-07	3246	3256	3281	2875
Dec-07	3665	3695	3715	3117
Jan-08	4052	4146	3973	3290
Feb-08	4461	4681	4752	3771
Mar-08	4619	5013	5115	4050
Apr-08	4332	4850	5152	4025
May-08	4636	4979	5138	4417
Jun-08	4335	4440	4685	3980
Jul-08	3943	3825	4435	3858
Aug-08	3381	3256	3577	3600
Sep-08	3415	3410	3546	3620
Oct-08	3386	3288	3952	2800

Note**:** PSOa = Wholesale price of sesame oil in Mandalay market

PSO_b = Wholesale price of sesame oil in Monywa market

PSO_c =Wholesale price of sesame oil in Pakokku market

PSO_d =Wholesale price of sesame oil in Yangon market

Appendix Table 8 Myanmar official standard weight and unit for oilseed crops

Oilseed crop	Unit	Viss	Pound	kg
Sesame	1 basket	15	54	24.49
Groundnut with shell	1 basket	6.9	25	11.34
Sunflower	1 basket	8.9	32	14.51
Niger	1 basket	15	54	24.49
Mustard	1 basket	16	57.6	26.12
Soybean	1 basket	20	72	32.65

Appendix Figure 5 Photo of a basket

Appendix F

Questionnaires

Questionnaires for Sesame Farmers

*Please ticket the circle from multiple choices and give and fill the corresponding blank.

A. Description

1. Date of Survey DD/MM/YY ……/…../2008 Name of interviewer……
2. Division O Mandalay O Sagaing O Magway
3. Name of township …….
4. Name of Village group ……...
5. Name of Village ……

B. Socio Economic Data of Respondents

6. Name of Respondents …… Sex O Male O Female Age (……..)years
7. Head of Farm Household O Male O Female
8. Age O <20 years O 20-40 years O40-60 years O >60years
9. Family size …… No. of Adult Male (……..) No. of Male Active Labor .. (…….) No. of Adult Female (……....) No. of Female Active Labor .. (……...) No. of Children <16 yrs (……..…)
10. Farm Size O 5-10 ac O 10-20 ac O >20ac
11. Farm Experience O 5-10 years O 10-15 years O > 15years
12. Education Level O Primary Level O Secondary Level O High School Level O Graduate Level
13. Land Type O Irrigated Le My O Non-Irrigated Mye O Yar Mye O Kaing Mye

Farm Assets

Indicators	Quantity	Value (Myanmar Kyats)
Plowing machine		
Harrowing machine		
Cutting machine		
Bullock		
Bullock cart		
Tractor		
Tractor trailer		
Power tiller		
Inter-cultivator		
Sprayer		
Water pump		
Threshing machine		

C. Cropping Pattern

14. Cropping pattern in O Monsoon rice- Pulses

	Irrigated Le Mye	O Pre-monsoon Sesame and Chickpea (Intercropping)
15.	Cropping pattern in Non-Irrigated Mye	O Pre-monsoon Sesame- Rice- Cotton O Pre-monsoon Rice- Cotton
16.	Cropping pattern in Yar Mye	O Monsoon Sesame O Monsoon Green gram O Monsoon Black gram O Monsoon Sesame-Groundnut O Monsoon Groundnut- Black gram O Groundnut – Sesame O Sunflower
17.	12. Kaing Mye	O Groundnut O Pulses O Soybean O Vegetables
18.	13. Type of Farming	O Own-Farm O Contract Farming a) Collector/ Company/millers..…… b) Amount of contract ……kyat/ac c) Pay Back by Sesame……basket/ac O Credit a) Source of Credit (Gvt. / Private) b) Credit amount……. Kyats/ac c) Interest rate /month…… d) Duration (Month)……

C. Sesame growing season and Sown Acres

19. Pre-monsoon sown acre

O White (……) ac Variety ……. Sowing time ……
O Black (……) ac Variety ……. Harvesting time ……
O Others (……) ac Variety …… Yield/ac ……

20.. Monsoon sown acre

O White (……) ac Variety …… Sowing time ……
O Black (……) ac Variety …… Harvesting time ……
O Other (……) ac Variety …… Yield/ac ……

21. Cool season sown acre

O White (……) ac Variety …… Sowing time ……
O Black (……) ac Variety …… Harvesting time ……
O Others (……) ac Variety …… Yield/ac ……

E. Sesame Marketing Data

22. Sale Volume …….. (Baskets)
23. Storage expecting high price..... (Baskets)
24. Household Expenditure ……..(Baskets)
25. Market Share O Large (……%) O Median (…….%) O Small (…….%)
26. Sell sesame seed to O Primary collectors O Commission agent /Brokers O Small millers O Wholesalers

27. Time of selling O At harvesting time
O One month after harvesting
O Two month after harvesting

28. Farm gate price O White …….Kyats/basket
O Black …… Kyats/basket
O Red …… Kyats/basket
O Brown ……. Kyats/basket

29. Does has access to domestic market? O Easy O Difficult

30. How Far away from the market? ……. (miles)

31. How many times go to market to sell? …….times/Year

32. Transport good to the market.
O By car
O By bullock cart with
O By train
O By shipping

33. <u>Marketing cost</u>
a) Transportation cost…… Kyat/Basket/mile
b) Handling cost ……. Kyats/basket
c) Storage cost ……. Kyats/basket
d) Packaging Cost ……. Kyats/basket
e) Others …… Kyats/bask
f) Loss ……..
Total Marketing cost …… Kyats/bask

34. What are the barriers to assess market?

35. Getting price and market information in time. O Yes O No

36. If yes, by O Phone O By post O Others O By Neighborhood

37. Price Determination Process O Accept the price given by primary collectors
O Inquiry form millers and negotiation
O Inquiry form wholesalers and negotiation

E. Cost of Production Per Acre

1. Crops and Season
O Pre-monsoon season
O Monsoon season
O Cool season

2.. Water Resource
O Irrigayion
O Rain fall and residual Moisture
O Rain fall

3. Land Type
O Irrigated Le Mye
O Non Irrigated Le Mye (Rainfed)
O Yar mye
O Kaing

4. Variety ……
5. Sowing time ……
6. Harvesting time ……

	Title	Unit	Family labor	Hired labor	Price/Unit
	Grain yield Production/ac	Basket			
	Residue for the next year	Basket			
	Total Revenue				
	Fixed cost				
	Variable cost				
	Input Cost				
1.	Seed	Pyi / ac			
2.	Foliar Fertilizer	Lt			
3.	FYM	Bullock cart			
4.	Pesticides	Lt			
5.	Rental back pump	Lump sum			
6.	Rhizobium	Pcs			
7.	Bags	Pcs			
8.	Land tax	Kyats			
	Total input Cost				
	labor Cost				
1.	Land preapring-Ploughing	Oxen Day			
2.	Land Preparation-Harowing	Oxen Day			
3.	Land preparation-Levelling-row	Oxen Day			
4.	FYM application	Manday			
5.	Seeding	Manday			
6.	Weeding (2 / 3..Times)	Manday			
7.	Intercultivaion	Oxen Day			
8.	Foliar Fertilizer Spraying	Manday			
9.	Pesticides Spraying	Manday			
10.	Harvesting	Ks/Basket			
11.	Harvestin and bunding	Manday			
12.	Threshing and winnoing	Mnaday			
13.	Transportation	Bullock cart			
14.	Drying	Manday			
	Total labor cost				
	Total Variable cost				
	Total Fix cost				
	Total				
	Return above variable cost				
	Return above total cost				
	Revenue cost Ratio				

D. **Opinions from Sesame farmers**

For Production

O High quality sesame variety can earn more profit
O Other crops are more preferred for second crop rather than sesame
O Government should subsidize fertilizer
O To get sufficient irrigated water for sesame
O Want to get more formal credit

For Marketing

O Improved Milling system
O Improve Transportation system
O Price instability is the risk
O Investment is urgently needed for storage and marketing

For the Policy

O Government. should set the guarantee price
O Should more liberalize in sesame export
O Like the current policy in oilseed sector
O Don't like the current policy in oilseed sector

Survey Questionnaires for the Sesame seed wholesalers and Exporters

**Please ticket the circle from multiple choices and give and fill the corresponding blank

1.	Date of Survey	DD/MM/YY ……/……/2008	Name of interviewer ……
2.	Division O Yangon	O Mandalay	O Sagaing O Magway
3.	Name of township	……..	
4.	Name Village	……..	
5.	Name of Respondents	……	
6..	Age	……..…… years	
7.	Gender	O Male O Female	
8.	Family size (……)	No. of Adult Male No. of Adult Female No. of Children <16 yrs	(…….) (……....) (……..…)
9.	Education Level O Primary Level O Secondary Level O High School Level O Graduate Level		
10.	Working Experience ……years		
11.	Other business O Farmers O primary collectors O Retailer O Miller		
13.	Volume of trade/Export volume	O White O Black ……...ton/year	
14.	No. of competitive wholesaler/Exporters	……	
	Getting export license	O applying to ministry of Commence O buying license from other large exporters	
	Period of application of license	……weeks/months	
	Duration of Liense	……weeks/months	
15.	Contacted Sellers	……times/month	
	Type of shipment	…….	
	Countries to export	……..	
	Export prices	……..…$/ton	
	Storage	……..weeks/months	
16.	Main buyers from the Wholesaler as in estimated percentage of the Total Sale volume	O Domestic retailer ……...% O Domestic consumer ...……..% O Other wholesale market ……..% O Millers ….……..% O Exporters …….…...…% O If others, please specify…….…..%	
17.	Major source of purchasing and place of source	O Primary Collectors…… O Commission Agent/Brokers…….. O Wholesalers ……..	
18.	Type of Purchasing	O Advance payment O Cash down system O Commission basis	

		O Credit System
		O If others, Please Specify…….
19.	Type of Selling	O Only Cash down system
		O Only Credit system
		O Both
		O If others, Please Specify…….
20.	Mode of transport	O By ship ……....times/year
		O By truck……times/year
		O Both ……..times/year
21.	Destination of selling	Major markets…….
		Minor Market……..
22.	Buying sesame seed in different color and buying Price to wholesaler	O White ……... Kyat/Basket
		O Black …….. Kyat/Basket
		O Other …….. Kyat/Basket
23.	Selling Price (Wholesale price)	……..Kyats/basket (based on color and grades)
24.	Price determination Process by wholesaler and communication	Adjusting with central wholesaler (By Phone, Personal contact)
		Depending on the Mandalay market price (By Phone, Personal contact))
		Depending on the Yangon market price (By Phone, Personal contact))
25.	Storage Duration	…….days
		……month

26. <u>Marketing cost</u>

Transportation cost	…….....Kyat/Basket
Handling cost	…….….Kyats/basket
Storage cost	……..…Kyats/basket
Packaging Cost	……..…..Kyats/basket
Cost of estimated loss	……..…..Kyats/basket
Cost of shop	……..…..Kyats/basket
Overhead cost	…….....…Kyats/basket
Cost of telephone	……..……Kyats/basket
Others	……..…… Kyats/basket
Total Marketing cost	……Kyats/baske

27. What are the barriers to assess market?

1)……

2)……....

Note: Questions for the opinions of wholesalers and exporters are the same as farmers

Survey Questionnaires for Millers

**Please ticket the circle from multiple choices and give and fill the corresponding blank.

20. Size of mill
O large (1ton/day)
O median (1.5 to 3 ton/day)
O small (>3ton/day)

21. Buying sesame seed in different color and buying Price to wholesaler
O White ……... Kyat/Basket
O Black …….. Kyat/Basket
O Other …….. Kyat/Basket

22. Selling Price (Wholesale price) ……..Kyats/basket (based on color and grades)

23. Method of processing
O Expeller O Solvent

24. Total variable cost of millers (processing cost)

g) Cost of repairing ……Kyat/Basket/mile
h) Cost of chemical ……Kyats/basket
i) Cost of Fuel ..……Kyats/basket
j) Cost of electricity ……Kyats/basket
k) Cost of Labor ..……...Kyats/basket
l) Overhead cost ……Kyats/basket
m) Packaging Cost ……Kyats/basket
n) Others ……Kyats/basket
o) Cost of estimated loss ……Kyats/basket

Total Variable cost ……...Kyats/bask

25. Return from milling fee ……...
Return from by-product -oil cake ……..
Returned from Sesame oil ……
Seed to oil to oil cake ration

26. What are the barriers to Processing?
1)……
2)……....

Note: Question 1-19 are the same as wholesalers and exporters. Questions for the opinions of millers are the same as farmers

BIOGRAPHICAL DATA

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