Chapter V

MARKETING COSTS, MARGINS AND PRICE TRANSMISSION

This chapter described the detail analysis of mung bean marketing costs, marketing margins and marketing channels in the study areas. Additionally, this study also high lighted the wholesale market price transmission analysis of two major mung bean markets in Myanmar.

5.1 Cost and return analysis

In this study, enterprise budget was used to be analyzed cost and return for mung bean of Thonegwa and Pyinmana areas. Only variable costs of production were considered which included material input costs, hired labor costs, family labor opportunity costs and interest on cash costs. Returns of mung bean production included the yield per hectare, return from sale to government with procurement price and return from sale with average current price of mung bean during the study period. The study did not assign price of the land, given the difficulty of estimating land value. Thus fixed cost was excluded in this study.

The enterprise budget analysis for mung bean in Thonegwa area was presented in Table 5.1. It was found that the average gross revenue was about 1,836,22 myk for mung bean growing farmers. The total variable cash cost and total variable cost were 307,433 myk/ha and 225,151 myk/ha respectively. Return above cash cost, return above variable cost, return per unit of cash cost and return per unit of capital invested were used as the measurement of cost and return analysis. The result showed that the return per unit of cash cost was 8.16 and return per unit of capital invested was 5.97. We can conclude that if one myk invested on variable cash cost, net return could yield of cost was about 8.16 myk/ha and net return for capital invest was 5.97 myk/ha. The total average cost was 49.22 myk/kg indicated that farmers' return was 9.88 times of the incurred cost.

Table 5.1 The enterprise budget for production mung bean in Thonegwa.

Outputs and Inputs	Unit	Value	Value/kg
Average yield	kg/ha	4,158.79	-
Average producer price	myk	486.22	486.22
Return from sale to Government	myk	159,037.00	229.71
Return from outside sale	myk	1,677,187.00	486.22
Total gross benefit	myk	1,836,224.00	357.97
Total cost			
a. Total variable cost	myk/ha	204,696.18	49.22
b. Family labor	myk/ha	82,282.84	19.79
c. Hired labor	myk/ha	12,750.00	3.07
d. Interest rate	myk/ha	7,704.38	1.85
Total average cost	myk/kg	-	49.22
Total variable cash cost	myk/ha	307,433.00	73.92
Total farm cost	myk/ha	225,151.00	54.14
Return above cash cost	myk	1,611,073.44	387.39
Return above variable cost	myk	1,528,790.60	367.60
Return per unit of family labor	myk	110,676.88	26.61
Return per unit of cash cost	myk	8.16	-
Return per unit of capital invested	myk	5.97	-

Source: Own calculation

Note: US 1 $ = 1,200 myk

The result of the enterprise budget for mung bean in Pyinmana area was presented in Table 5.2. It showed the average gross revenue was about 651,112.23 myk/ha for mung bean growing farmers. The total variable cash cost and total variable cost were about 85,866.00 myk/ha and 73,303.00 myk/ha. The result showed that the return per unit of cash cost was 8.88 and return per unit of capital invested was 7.58.

We can be concluded that if one myk invested on variable cash cost, net return could yield of cost was about 8.88 myk/ha and net return for capital invest was 7.58 myk/ha. The total average cost was 40.95 myk/kg indicated that farmers' return was 10.10 times of the incurred cost. It was shown that farmer's return in Pyinmana is slightly higher than farmer in Thonegwa area.

Table 5.2 The enterprise budget for production mung bean in Pyinmana

Outputs and Inputs	Unit	Value	Value/kg
Average yield	kg/ha	1,600.94	-
Average producer price	myk	413.48	413.48
Return from Government sale	myk	66,250.43	229.71
Return from outside sale	myk	584,861.80	413.48
Total gross benefit	myk	651,112.23	321.60
Total cost	myk		
a. Total variable cost		65,553.33	40.95
b. Family labor	myk/ha	12,563.10	7.85
c. Hired labor	myk/ha	5,366.67	3.35
d. Interest rate	myk/ha	2,382.96	1.49
Total average cost	myk/kg	-	40.95
Total variable cash cost	myk/ha	85,866.00	53.63
Total farm cost	myk/ha	73,303.00	45.79
Return above cash cost	myk	577,809.27	360.92
Return above variable cost	myk	565,246.17	353.07
Return per unit of family labor	myk	122,994.24	72.40
Return per unit of cash cost	myk	8.88	-
Return per unit of capital	myk	7.58	-

Source: Own calculation

Note: US 1 $ = 1,200 myk

Additionally, return to family labor was also used as the measurement to be compared with ruling farm and non-farm wage rate. The survey result shown that return to family labor per day for mung bean grower was average at 26.61 myk/kg while it was 72.40 myk/kg for green grower in Thonegwa and Pyinmana respectively. Therefore, we could say that farmers growing mung bean was worthier than working as hired labor.

5.2 Marketing costs of market participants

The marketing cost was the important issue in the mung bean marketing in Myanmar. The first marketing cost was the preparation of produce to be sold. After that, the marketing cost associated with handling, storage, processing and transport occurred. For farmer, the break-even cost of production and marketing was calculated to be decided the selling price for their mung bean. The marketing cost and marketing margin for farmers and traders were studied in the both regions. In this study, opportunity cost was considered as cost such as family labor and interest of loan from bank. Marketing costs were calculated for market participants of the channels such as producers, collectors, town wholesalers, Yangon wholesalers and exporters in mung bean marketing channels.

5.2.1 Producers

The farmers interviewed planted mung bean for (1-8) ha in May 2006 as second crop after harvesting of monsoon rice in Thonegwa and mid-monsoon rice in Pyinmana. The first harvest and second harvest were done in the last week of January to February in the former region and August to September in the later one. The crop production practices were done by his family labor due to the lack of working capital but harvesting was done by hired labors. The hired laborers picked mung bean pods and carried them to the farmer's home to be processed the grains. Total production were 4,158.79 kg and 1600.94 kg of which 65.3 kg are kept to use as seed for the next planting season and 700.34 kg and 293.85 kg were sold to MAPT and surplus of sale for traders was 3,458.45 kg and 1307.09kg in Thonegwa and Pyinmana.

Mung bean production for average 4.34 ha cost 118,315.37 myk of which input and labor cost share 67 percent and 80 percent of the total cost in Thonegwa and the production for average 1.81 hectare cost 104,307.04 myk of which input and labor share 63 percent and 17 percent of the total cost in Pyinmana. Revenue from the selling to MAPT and traders were 1,836,22.00 myk and 651,112.23 myk and marketing cost for selling to MAPT is 21.00 myk/kg and 21.50 myk/kg in Thonegwa and Pyinmana respectively.

The average marketing cost occurred to farmers was none for selling to traders because the traders came to their farm to purchase mung bean. The interest rate of private moneylender was 8 percent per month. The interest of four months for the cost of production was 7,704.38 myk/ha in Thonegwa and 2,382.96 myk/ha in Pyinmana. The farmer's net margin was 385.14 myk/kg and 314.83 myk/kg in both areas.

5.2.2 Agent in study areas

The agents in the study areas purchased mung bean for town wholesalers and marketing period were from January to April in Thonegwa and from August to November in Pyinmana. To collect mung bean, the agent went out to the rural area. Before mung bean collection, town wholesalers offered the daily buying price and the cost of transport, loading and unloading was paid by town wholesaler. The agent received fixed commission rate, 3.06 myk per kg and had responsibility for the quality and weight. During the study period, the agents purchased 171.41 ton and 97.95 ton for both study areas for town wholesalers.

5.2.3 Traders

On average, town wholesalers in both study areas purchased 346.91 ton and 763.19 ton during the study period. After collection of mung bean, it was packaged with polythene bags delivered to Yangon warehouse by hired truck and stored them. The storage periods were 6 months from April to September in Thonegwa and November to April in Pyinmana. The buying price was 486.22 myk per kg and the selling price was 566.62 myk per kg in the last week of March and April in Thonegwa and 413.48 myk per kg of buying price and 566.62 kg of selling price in the last week of September and April in Pyinmana areas. During the study period, costs associated with maintenance of the product quality while it stored, hired storage cost based on (15-25) myk per kg for a month.

Town wholesalers interviewed used their own money for their marketing activities however it was considered as opportunity cost in term of bank interest lost. According to the calculation of marketing cost, interest lost, hired storage cost, prevention of product quality by using with pesticide, other costs such as handling cost, transport cost and packaging material were accounted for 26.32 myk per kg. The net margin for town wholesalers was 38.75 myk per kg.

5.3 Average marketing cost and margin for mung bean producers and traders

Marketing costs were calculated for market agents of channels such as producers, collector, town wholesalers, city wholesalers and exporters in mung bean marketing channel. Because of the lack of capital and mung bean price fluctuation, collectors in this study serve as the agents for the town wholesalers therefore; marketing margin of the collectors was the commission fees for buying mung bean.

Mung bean price was collected during the main harvesting season in Thonegwa and after harvesting season in Pyinmana production areas because of different sowing time. Table 5.3 showed the average marketing margin for mung bean in Thonegwa. The average price received by farmer was 486.22 myk/kg which can be interpreted that 56.80 percent of the average export price was received by farmers. And the calculated unit production and marketing cost was 100.85 myk/kg so that farmers' net margin was 385.14 myk/kg which was 44.99 percent of the export price. Most of the farmers sold to primary collectors (village brokers or assemblers) or to small town wholesalers who operated as commission agents and obtained the commission rate of 3.06 myk/kg in net.

The price given by the Thonegwa town wholesalers was set up based on Bayintnaung wholesale market in Yangon which was about 100-300 myk/kg difference. Sometime, town wholesalers operated as independent traders or as commission agents for the Yangon exporters. The average price received by town wholesalers was 566.62 myk/kg in which the calculated gross margin and net margin were 9.37 percent and 4.53 percent respectively.

However, the margin can be increased if mung bean was stored and sold at higher price in the peak season according to the need of demand because most of the speculators bought mung bean during the harvest season at the time of low price.

The price obtained from the Yangon traders was about 635.53 myk/kg calculated from the average price of Bayinnaung market. So, it can be seen that their net margin was 5.22 percent. The average export price paid from India export market was 856.05 myk/kg during the study period. Then the calculated exporters gross margin and net margin were 25.76 percent and 23.62 percent respectively. According to this margin the exporters got higher profit than the other intermediaries.

Average marketing margin and percentage of export price for mung bean in Pyinmana was described in Table 5.4. According to the price obtained by farmers, the net margin was 36.78 percent of the exporters' price. The assembler who collected the crops from the farmers took their profit as commission base. The average price of town wholesalers was 566.62 myk/kg in which the net margin kept by the town wholesalers was about 11.63 percent.

Sometimes, the intermediaries who stored the crop received more profit if the price was fluctuated. The average price obtained by Yangon wholesalers was 635.53 myk/kg in which the calculated net margin in percent based on export price was 5.22 percent. The net margin for exporters was 23.62 percent calculated from their average export price of 856.05 myk/kg.

Table 5.3 Average marketing cost and marketing margin for mung bean in Thonegwa

Description	Value (myk/kg)	Percent of export price
Price received by farmers [a]	486.22	56.80
Unit production and marketing cost	101.08	11.81
Farmers' net margin	385.14	44.99
Town wholesalers price [a]	566.62	66.19
Town wholesalers' gross margin	80.40	9.37
Handling cost	15.62	1.82
Transportation cost	4.59	0.54
Storage cost	18.38	2.15
Commission for agents	3.06	0.36
Town wholesalers' net margin	38.75	4.53
Yangon wholesalers price [b]	635.53	74.24
Yangon wholesalers gross margin	68.91	8.05
Handling cost	9.49	1.11
Storage cost	14.70	1.72
Yangon wholesalers' net margin	44.72	5.22
Exporters price [b]	856.05	100.00
Exporters' gross margin	220.52	25.76
Port charge,stevedoring	3.06	0.36
Handling cost	15.30	1.79
Exporters' net margin	202.16	23.62

Source: Own calculation, May 2006

Note: [a]. Average mung bean price at the producers and wholesalers level.

[b]. Average monthly price collected from the Agri-business journals at May 2006.

Table 5.4 Average marketing cost and marketing margin for mung bean in Pyinmana

Description	value(myk/kg)	percent of export price
Price received by farmers [a]	413.48	48.30
Unit production and marketing cost	98.65	11.52
Farmers' net margin	314.83	36.78
Town wholesalers price [a]	566.62	66.19
Town wholesalers' gross margin	153.14	17.89
Handling cost	9.80	1.14
Transportation cost	26.03	3.04
Storage cost	14.70	1.72
Commission for agents	3.06	0.36
Town wholesalers' net margin	99.55	11.63
Yangon wholesalers price [b]	635.53	74.24
Yangon wholesalers gross margin	68.91	8.05
Handling cost	9.49	1.11
Storage cost	14.70	1.72
Yangon wholesalers' net margin	44.72	5.22
Exporters price [b]	856.05	100.00
Exporters' gross margin	220.52	25.76
Port charge	3.06	0.35
handling cost	15.30	1.79
Exporters' net margin	202.16	23.62

Source: Own calculation, May 2006

Note: [a]. Average mung bean price at the producers and wholesalers level.

[b]. Average monthly price collected from the Agri-business journals at May 2006.

5.4 Marketing channels

5.4.1 The mung bean marketing channel for Thonegwa area

The survey results showed that the three major outlets for mung bean producers were primary collectors, town wholesalers and Yangon wholesalers. And growers generally used only one main marketing outlet to sell their mung bean to primary collectors. A 38 percent of mung bean supply was sold by growers to assemblers, 26 percent of mung bean supply to town wholesalers and the rest 19 percent of the supply was sold to Yangon wholesalers. Figure 5.1 showed the product flow of mung bean supply sold by growers during the study period. About 48 percent of mung bean supply went to Yangon wholesale channel by the town wholesalers.

Mung bean marketing channel in Thonegwa was presented in Figure 5.1. In this channel, there were 6 primary collectors, 4 town wholesalers, 3 Yangon wholesalers and 2 exporters. In this area, some sample farmers had not only directly contacted with primary collectors, but also town wholesalers and city wholesalers in Yangon. This channel was more complex than other channel because Thonegwa was situated only 30 miles distance from Yangon so that it was easy to transport by means of vehicle or by boats.

Most of the primary collectors collected mung bean from the farms who were the agents of the town wholesalers, those of Yangon wholesalers and the exporters. Before mung bean collection, the town wholesalers offered the daily buying price and the cost of transport, loading and unloading was paid by town wholesalers. The collectors receive a fixed commission rate, 3.06 myk per kg. Sometimes they received a margin when the price fluctuated. A 22 percent of mung bean supply was sold by primary collectors to town wholesalers and 16 percent of mung bean supply to Yangon wholesalers. However, some large farmers in Thonegwa went to Yangon wholesale market to obtain the higher price. In this channel, town wholesalers bought about 48 percent from farmers and primary collectors as well.

After collection of mung bean, the town wholesalers packaged mung bean with polythelene bags and delivered mung bean to Yangon warehouse by hired truck and stored them and also to Yangon wholesale market. Some town wholesalers stored their mung bean for a period of 3 to 6 months to be obtained higher price at a later season. During the storage period, costs associated with maintenance of mung bean quality while it stored, hired storage cost based on 50 myk/ bag for a month and interest lost were incurred. They also had direct contact with exporters.

The town wholesalers receive the daily price information from Bayintnaung wholesale market in Yangon and then they give the buying price to their agents in the study areas. Bayintnaung market is a kind of wholesale market. Most town wholesalers sold their mung bean to this market. It supplies Yangon area and is a point to transit for export. The town wholesalers collected mung bean from their agents as well as from farmers. Mung bean was sorted, cleaned, packed and then transported to Yangon traders in Bayintnaung market during the time at the need of demand for the export. Some town wholesalers had directly contact with an export company who provides 1 percent of the total purchasing value as a commission basis.

Private exporters bought mung bean from Bayintnaung wholesale market and also from the town wholesalers who had specific contact with the exporters. The exporters used cleaning devices and hand labor to sort out the export standard quality according to the requirement of the demand. Most of the export demand was arising from India, Singapore and China. Myanmar Agricultural Produce Trading (MAPT) served as an exporter for the government and made an advanced payment of 250 myk/kg to farmers used on their areas growing during the study period. At the end of the growing season, MAPT started to collect the delivery quota 65.7 kg/ha from each farmer. Sometimes the state enterprise purchased mung bean from town wholesalers and Yangon wholesalers as the need of demand.

In the study period, Yangon traders as well as private exporters purchased mung bean for the increase demand of oversea trade. They had different procurement forms. Advanced payment from MAPT was 250 myk/kg for mung bean farmers in Thonegwa during the study period. Toward the end of the season they collected mung bean from farmers on delivery quota of about 65.7 kg per ha. MAS in Thonegwa collected mung bean by paying with the average market price of 486.22 myk/kg during the study period. In some years there existed relationship among the town wholesalers, MAS and MAPT. It was shown as dotted lines. Town wholesalers delivered their mung bean to Yangon wholesale market (Bayintnaung market) by vehicle and boats.

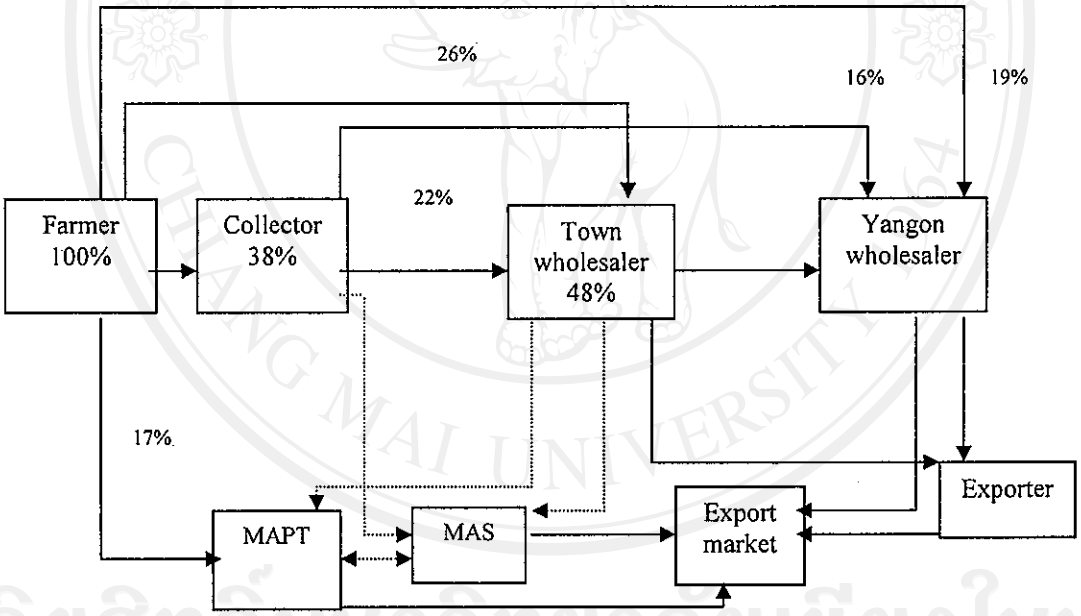

Figure 5.1: General flows of mung bean in Thonegwa area

Source: Survey, May 2006.

Note: ——▶ Regular flow

- - - -▶ Irregular flow

5.4.2 Marketing channel for Pyinmana area

Figure 5.2 presented mung bean marketing channel in Pyinmana during the study period. There were 6 primary collectors, 4 town wholesalers, 3 Yangon wholesalers and 2 exporters in mung bean channel. In that channel, town wholesalers were the most important marketing outlet for mung bean. More than 83 percent of mung bean supply was sold through this channel. The second most important marketing channel was farmers direct sold to primary collectors. This channel sold about half 50 percent of mung bean supply.

Some the farmers carried their mung bean by oxcarts to the collectors store. At the time of harvest, the primary collectors (agents from town wholesalers) started to buy at the farms. Some large farmers purchased mung bean from other farmers during the harvest time to make profit. These farmers stored mung bean for around 2 months to get the good price in out of season. However, small farmers cannot store longer because of their financial constraint. During the harvest season of study period, MAPT started their mung bean quota buying from farmers.

The primary collectors who worked on a commission basis transported their mung bean to Pyinmana town wholesalers. The average price offered by their town wholesalers was 413.48 myk/kg during the study period. The Pyinmana traders obtained the prevailing price information of Yangon market from Pyinmana traders association at 8 to 9 am every morning. They got this information from Bayintnaung market in Yangon. The Pyinmana wholesalers transported their mung bean to both Yangon and Mandalay wholesale markets according to the need of the export demand. Sometimes, the town wholesalers stored their mung bean like as Thonegwa channel. Mung bean from Mandalay market pass through Muse and exported to China. The other steps in this channel were the same as in the previous channel.

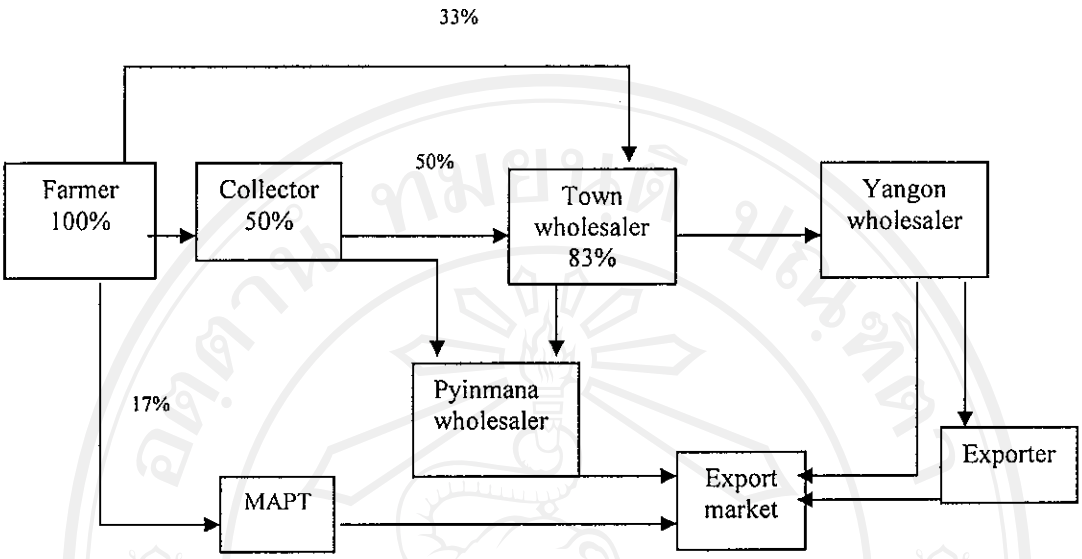

Figure 5.2 General flows of mung bean in Pyinmana area
Source: Survey, May 2006.

5.5 Analysis of price transmission

The terms spatial market integration and spatial market efficiency are extensively used in price analysis. Barrett (1996) mentioned that market integration concerns the free flow of goods and information and thus prices over form, space and time and is thus closed related to concepts of efficiency.

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

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

5.5.1 The basic statistic of mung bean price

The basic statistics of wholesale prices for mung bean were presented in Tables 5.5 and 5.6. In Tables, yearly minimum, maximum and mean prices were observed with the standard error and the coefficient of variance for each year. Table 5.5 showed that mung bean kept yearly mean price of 20.55 myk/kg in 2000 with maximum price of 24.20 myk/kg and minimum price of 18.14 myk/kg. In 2001, mean price increased to 23.16 myk/kg in which maximum price was 27.30 myk/kg and minimum price was 20.20 myk/kg. In 2002, wholesale price had drastically increased to 24.22 myk/kg as mean price ranging from 21.48 myk/kg to 28.61 myk/kg. Wholesale price of mung bean reached the maximum price of 30.89 myk/kg and the minimum price of 24.03 myk/kg in 2003, but it begun to decline in 2004. In 2005, price was continued to become lower, mean was 24.37 myk/kg, maximum and minimum were 28.16 myk/kg and 21.89 myk/kg.

Table 5.5 Basic statistics for Yangon prices during 2000-2005

Year	Min	Max	Mean	Std. error	C.V
2000	18.14	24.20	20.55	2.13	10.38
2001	20.20	27.30	23.16	2.75	11.89
2002	21.48	28.61	24.22	2.91	12.02
2003	24.03	30.89	26.89	3.05	11.33
2004	22.28	29.71	24.93	2.96	11.87
2005	21.89	28.16	24.37	2.69	11.02

Source: Weekly mung bean price series from 2000 to 2005. Market Information Service project, Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Myanmar.

Note: C.V = Coefficient of variance

Table 5.6 showed that mung bean kept yearly mean price of 20.08 myk/kg in 2000 with maximum price of 23.79 myk/kg and minimum price of 18.04 myk /kg. In 2001, mean price increased to 22.86 myk/kg in which maximum price was 26.40 myk/kg and minimum price was 20.10 myk/kg. In 2002, wholesale price had drastically increased to 23.55 myk/kg as mean price ranging from 21.12 myk/kg to 28.06 myk/kg. Wholesale price of mung bean reached the maximum price of 29.52 myk/kg and the minimum price of 21.79 myk/kg in 2003, but it begun to decline in 2004. In 2005, price continued to become lower, mean was 23.19 myk/kg, maximum and minimum were 27.73 myk/kg and 20.33 myk/kg.

Table 5.6 Basic statistics for Mandalay prices during 2000-2005

Year	Min	Max	Mean	Std. error	C.V
2000	18.04	23.79	20.08	2.25	11.21
2001	20.10	26.40	22.86	2.65	11.60
2002	21.12	28.06	23.55	2.82	11.99
2003	21.79	29.52	25.38	3.03	11.95
2004	21.64	28.67	24.25	2.87	11.83
2005	20.33	27.73	23.19	2.75	11.87

Source: Weekly mung bean price series from 2000 to 2005. Market Information Service project, Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Myanmar.

The coefficient of variances indicated that yearly variation of wholesale price for mung bean. The coefficient of variation were (10.38-12.02 percent) and (11.21-11.99 percent) in Yangon and Mandalay respectively. In yearly variations, the year 2000 was the lowest variation of monthly wholesale prices while the year 2002 was the highest variation of monthly wholesale prices in Yangon and Mandalay as well. Therefore, we could say that prices were fluctuated depending on the change in supply and demand.

5.5.2 Descriptions of the data and their movement

In Myanmar, daily price was available for only a few market places. Therefore, weekly wholesale mung bean price for six years from first week of January, 2000 to last week of December, 2005 were used. The analysis was based on average wholesale price of mung bean in Myanmar: two market places were chosen, Yangon and Mandalay markets.

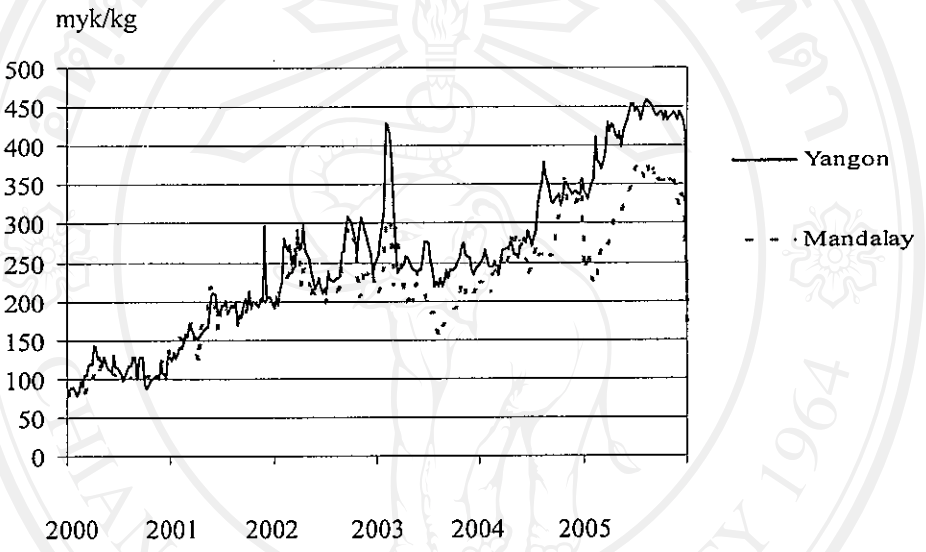

Figure 5.3 Yangon and Mandalay wholesale mung bean price in 2000-2005

Source: Weekly mung bean price series from 2000 to 2005. Market Information Service project, Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Myanmar.

Note: Mmung bean wholesale price per kg

The present study proved forward and backward price transmission using mung bean weekly wholesale price. The weekly mung bean wholesale prices for Yangon and Mandalay markets were presented in Figure 5.3. In the above Figure, the weekly mung bean wholesale price in the two markets increased in 2000 to 2002 in a similar way. But there existed higher margins in 2003 as well as 2005 however, a smaller margin occurred during 2004.

5.5.3 Notation and definition

Selected mung bean markets were divided into M local markets and P central market, P^M denoted the price data of local market and P^Y denoted the price data of central market. t denoted the time and j denoted the number of time lag. Let the subscript $j=1$ to 2 denoted the time lag from 1 to 2. Δ denoted the price first difference of the selected market.

First price difference (price change) of local market:

$$\Delta P_t^M = P_t^M - P_{t-1}^M$$

First price difference (price change) of central market:

$$\Delta P_t^Y = P_t^Y - P_{t-1}^Y$$

First price difference of lag price of local market:

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

First price difference of lag price of central market:

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

5.6 Model result and interpretation

5.6.1 Test for stationary of price series

Variables whose means and variances changed over time are known as non-stationary or unit root variables. Analysis using non-stationary variables can result in spurious regression, for this reason, unit root tests are applied to determine if the variables in a regression are stationary or non-stationary.

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

$$\Delta P_t = c_1 + \delta P_{t-1} + \sum_{j=1}^{n} \delta_{1j} \Delta P_{t-j} + \varepsilon_{1t} \tag{7}$$

$$\Delta^2 P_t = c_2 + \delta_2 \Delta P_{t-1} + \sum_{j=1}^{n} \delta_{3j} \Delta^2 P_{t-j} + \varepsilon_{2t} \tag{8}$$

Where:

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

Then the t-statistics of the estimated coefficient of P_{t-1} is used to test the hypothesis. In equation (4) with $H_0 : \delta = 0$ implying non stationary of the time series at level and P_t , t=1,2,.....,T or $P_t \sim I(1)$ and $H_1 : \delta < 0$ implying stationary or $P_t \sim I(0)$. If the value of ADF statistic is less (that is more negative, because these values are always negative) than the critical values and one cannot reject the null hypothesis, it shows that P_t is non-stationary.

Since P_t is non stationary, it should be determined whether P_t is stationary in the first difference by using equation (5), $H_0 : \delta_2 = 0$ implying non stationary of the time-series at first difference $\{\Delta P_t \sim I(1)$ or $P_t \sim I(2)\}$ and $H_1 : \delta_2 < 0$ implying stationary of series at first difference $\{\Delta P_t \sim I(0)$ or $P_t \sim I(1)\}$. The ADF test can be rejected for the null hypothesis, as is usually the case with price series, it can be concluded that $P_t \sim I(1)$.

ADF test as described in Tables 5.7 and 5.8 tested with one lags and reported the resulting ADF (2) statistics. The test in price levels with equation (7) showed that t-values were too small to reject the null hypothesis. Hence, none of the mung bean price series were stationary.

The test for integration of order 2 with the first difference by using equation (8) indicated that the null hypothesis was rejected at one percent in the case and the price series were I (1) process and were stationary at first difference level.

Table 5.7 ADF level test for Yangon and Mandalay market price series

Market	Price series	Number of observation	Price level $\Delta P_t = c_1 + \delta P_{t-1} + \sum_{j=1}^{n} \delta_{1j} \Delta P_{t-j} + \varepsilon_{1t}$	
			δ	t-value
Yangon	$\ln P^Y$	314	-0.03	-2.48
Mandalay	$\ln P^M$	314	-0.03	-2.54
Critical Values for ADF statistics			Significant level	ADF
			1%	-3.45
			5%	-2.87
			10%	-2.57

$H_0 : \delta = 0$ = Non stationary

$H_1 : \delta < 0$ = Stationary

Null hypothesis cannot be reject non-stationary at level.

No serial correlation is detected (5% significant level)

Source: Weekly mung bean price series from 2000 to 2005. Market Information Service Project, Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Myanmar.

This result implied that instead of using normal price series as variables in the model, inclusion of first differences as variables can eliminate the stochastic trend to which the nominal series were revealed. Therefore, it is interesting to investigate the hypothesis that P_t^M and P_t^Y were co-integrated.

Table 5.8 ADF first different test for Yangon and Mandalay price series

Market	Price series	Number of observation	First difference $\Delta^2 P_t = c_2 + \delta_2 \Delta P_{t-1} + \sum_{j=1}^{n} \delta_{3j} \Delta^2 P_{t-j} + \varepsilon_{2t}$	
			δ_2	t-value
Yangon	$\ln P^Y$	314	-1.15	-18.02
Mandalay	$\ln P^M$	314	-1.14	-17.60
Critical Values for ADF statistics			Significant level	ADF
			1%	-3.45
			5%	-2.87
			10%	-2.57

$H_0 : \delta_2 = 0$ = Non stationary

$H_1 : \delta_2 < 0$ = Stationary

H_0 = Reject non-stationary at first difference

Null hypothesis can reject non-stationary at first difference.

No serial correlation was detected (5% significant level)

Source: Weekly mung bean price series from 2000 to 2005. Market Information Service Project, Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Myanmar.

5.6.2 Co-integration

Co-integration is tested by using Engle and Grangers (1987) two steps residual-based test. The first step in the test is the OLS regression of one price series say P_t^M on the other price series, say P_t^Y, plus a constant.

The long-run forward price transmission model is:

$$\ln P_t^Y = \alpha_1 + \alpha_2 \ln P_t^M + \varepsilon_t^Y \quad (9)$$

The long-run backward price transmission model is:

$$\ln P_t^M = \beta_1 + \beta_2 \ln P_t^Y + \varepsilon_t^M \quad (10)$$

Where:

$\ln P_t^Y$ = Yangon price at t^{th} week (myk/kg)

$\ln P_t^M$ = Mandalay price at t^{th} week (myk/kg)

$\varepsilon_t^Y, \varepsilon_t^M$ = Error terms

$\alpha_1, \alpha_2, \beta_1, \beta_2$ = Coefficients

The second step is to test whether the residuals, ε_t, from the co-integration regression is non stationary using a modified ADF test.

$$\Delta\varepsilon_t = \lambda\varepsilon_{t-1} + \theta_k \sum_{k=2}^{n} \Delta\varepsilon_{t-k} + \mu_t \quad (11)$$

$$\Delta\varepsilon_t = \varepsilon_t - \varepsilon_{t-1}; \Delta\varepsilon_{t-k} = \varepsilon_{t-k} - \varepsilon_{t-k-1}$$

Where:

$\varepsilon_t, \varepsilon_{t-1}, \varepsilon_{t-k}, \varepsilon_{t-k-1}$ = Residuals at time $t, t-1, t-k$ and $t-k-1$ respectively

λ, θ_k = Coefficients

μ_t = Error term

The null hypothesis is $\lambda = 0$. This is a test of residual stationary rather than original time series. If the t statistical value is less than the reference value, the null hypothesis is rejected and two price series are integrated to order 1, so the two markets were integrated in the long-term.

5.6.2.1 Long-run forward price transmission model

Yangon and Mandalay weekly mung bean wholesale prices during first week of January 2000 to last week of December 2005 were tested for co-integration. Then long-run for forward and backward price transmission were illustrated below:

The estimated model for Yangon mung bean wholesale price was obtained.

$$\ln P_t^Y = \underset{(-3.49)}{-0.38} + \underset{(53.97)}{1.11 \ln P_t^M}$$

Note: The number in parentheses below the estimated coefficients was the respective t values.

In this model, the coefficient of Mandalay mung bean weekly wholesale price at week t was significant at 1 percent level. And Mandalay mung bean wholesale price was positively related to Yangon mung bean wholesale price. The coefficient of determination R^2 was 0.90, indicating that 90 percent of the total variation in Yangon mung bean wholesale price was explained by Mandalay mung bean wholesale price were presented in Table 5.7. The value of coefficient implied that in the long-run the market was slightly less efficient in sending the price signal from Yangon to Mandalay market.

Table 5.7: Estimated coefficients of long-run forward price transmission model

Variable	Coefficient	t statistic
c	-0.38	-3.49*
$\ln P_t^M$	1.11	53.97*

R^2 = 0.90

$H_0 : \alpha_1 > 0, \alpha_2 < 1$ = No market efficiency exist

$H_1 : \alpha_1 = 0, \alpha_2 = 1$ = Market efficiency exist

Note: * significance at the 1% level.

5.6.2.2 Long-run backward price transmission model

The estimate model for Mandalay mung bean wholesale price was obtained.

$$\ln P_t^M = \underset{(9.89)}{0.83} + \underset{(53.97)}{0.82} \ln P_t^Y$$

Note: The number in parentheses below the estimated coefficients is the respective t values.

In this model, the coefficient of Yangon mung bean wholesale price at week t was significant at 1 percent level. And Yangon mung bean wholesale price was positively related to Mandalay mung bean wholesale price. The coefficient of determination R^2 was 0.90, indicating that 90 percent of the total variation in Mandalay mung bean wholesale price was explained by Yangon mung bean wholesale price were reported in Table 5.8. The value of coefficient implied that in the long-run the market was more efficient in sending the price signal from Mandalay to Yangon market.

Table 5.8: Estimated coefficients of long-run backward price transmission model

Variable	Coefficient	t statistic
c	0.83	9.89*
$\ln P_t^Y$	0.82	53.97*

$R^2 = 0.90$

$H_0 : \beta_1 > 0, \beta_2 < 1$ = No market efficiency exist

$H_1 : \beta_1 = 0, \beta_2 = 1$ = Market efficiency exist

Note: * significance at the 1% level.

The OLS estimated of the models in (9) and (10) showed that prices were transmitted in both directions as α_2 and β_2 were highly significant. The estimated Coefficient, α_2=1.11 was almost identical to 1 but statistically different from 1; (see in Appendix 4.2) that of β_2 equal 0.82 which was statistically insignificantly different from 1.(See in Appendix 4.5). The value of coefficients imply that in the long run the market was slightly less efficient in sending the price signal from Yangon wholesale market to Mandalay wholesale market than vice versa. Engle and Granger co-integration analysis tested the existence of market efficiency between markets. This indicated that there was less perfect market efficiency in Yangon and Mandalay as well. The estimated elasticity of Yangon wholesale price was 1.11, it indicated that if Mandalay wholesale price increased by 1 percent, Yangon wholesale price would be increased by 1.11 percent. Similarly, 0.82 of estimated elasticity of Mandalay wholesale price explained that if Yangon price increased by 1 percent, Mandalay wholesale price would be increased by 0.82 percent. Therefore, we could say that there existed asymmetric price transmission between two markets. It also shown that Yangon market had certain degree of imperfection or market power over Mandalay market.

5.6.3 Error Correction Mechanism

After testing for co-integration of the two price series, Engle and Granger estimate the existence of short-run dynamic by constructing Error Correction Model. Error correction term as a mean of capturing adjustment in a dependent variable which depends not only on the level of some explanatory variables, but also on the extent to which dependent variable itself deviates from an equilibrium relationship dependent. A particular advantage of the error correction mechanism is that the extent of adjustment in a given period to deviations from long-run equilibrium is given by the estimated equation without any further calculation.

5.6.3.1 Short-run forward price transmission model

The short-run forward price transmission model is:

$$\Delta \ln P_t^Y = \alpha_1 + \alpha_2 \Delta \ln P_t^M + \alpha_Y \varepsilon_{t-1}^Y + \alpha_{11} \Delta \ln P_{t-1}^M + \alpha_{12} \Delta \ln P_{t-1}^Y + \varepsilon_t^Y \quad (12)$$

Where:

$\Delta \ln P_t^Y$	=	Change in Yangon price at t^{th} week
α_Y	=	Speed of adjustment coefficient
ε_{t-1}^Y	=	Error correction term
ε_t^Y	=	Error term
$\Delta \ln P_t^M$	=	Change in Mandalay price at t^{th} week
$\Delta \ln P_{t-1}^Y$	=	Change in Yangon price at one lag t^{th} week
$\Delta \ln P_{t-1}^M$	=	Change in Mandalay at one lag t^{th} week
$\alpha_1, \alpha_2, \alpha_{11}, \alpha_{12}$	=	Coefficient

The estimated of ECM for Yangon mung bean wholesale price was obtained as shown in Table 5.9. In ECM, the coefficient of the error correction term was significant with the magnitude of -0.16 indicating 16 % of deviation was reduced weekly. It would take about 6 weeks for the wholesale price in Yangon to converge to the long-term equilibrium when a stock occurred. It was therefore evident that the markets were linked in the short-run.

Besides, the ECM provided other useful knowledge; the coefficient of Mandalay mung bean wholesale price at week *t* was significant at 1 percent level. And Mandalay mung bean wholesale price was positively related to Yangon mung bean wholesale price. The coefficients of the lagged differenced term of Yangon mung bean wholesale price was negative sign. The coefficient of one lag week Mandalay mung bean wholesale price at week *t* was not significant. Durbin-Watson was nearly 2, which indicated that no autocorrelation in the ECM. In the analysis, it was observed that *F* statistic was 19.52 and its probability was 0.00. It meant that the estimated model satisfactorily fits the given data set.

Table 5.9: Estimated coefficients of short-run forward price transmission model

Variable	Coefficient	Std. Error	t statistic
c	0.00	0.00	0.59
$\Delta \ln P_t^M$	0.41	0.06	7.46*
$\Delta \ln P_{t-1}^Y$	-0.13	0.06	-2.09**
$\Delta \ln P_{t-1}^M$	0.06	0.07	0.85
ε_{t-1}^Y	-0.16	0.03	-4.79*

R^2 =0.19 DW =1.88 F -test=19.52

$H_0 : \alpha_{11} = \alpha_{12} = 0, \alpha_Y = 1$ (Short-term integration exist)

$H_1 : \alpha_{11} < 0, \alpha_{12} < 0, \alpha_Y < 1$ (No short-term integration exist)

Note: * significance at the 1% level.

** 5% level.

5.6.3.2 Short-run backward price transmission model

The short-run backward price transmission model is:

$$\Delta \ln P_t^M = \alpha_1 + \alpha_2 \Delta \ln P_t^Y + \alpha_M \varepsilon_{t-1}^M + \alpha_{11} \Delta \ln P_{t-1}^Y + \alpha_{12} \Delta \ln P_{t-1}^M + \varepsilon_t^M \quad (13)$$

Where:

$\Delta \ln P_t^M$ = Change in Mandalay price at t^{th} week

α_M = Speed of adjustment coefficient

ε_{t-1}^M = Error correction term

ε_t^M = Error term

$\Delta \ln P_t^Y$ = Change in Yangon price at t^{th} week

$\Delta \ln P_{t-1}^Y$ = Change in Yangon price at one lag t^{th} week

$\Delta \ln P_{t-1}^M$ = Change in Mandalay price at one lag t^{th} week

$\alpha_1, \alpha_2, \alpha_{11}, \alpha_{12}$ = Coefficient

The estimated of ECM for Mandalay mung bean wholesale price was obtained as shown in Table 5.9. In ECM, the coefficient of the error correction term was significant with the magnitude of -0.17 indicating 17 % of deviation was reduced weekly. It would take about 6 weeks for the wholesale price in Mandalay to converge to the long-term equilibrium when a stock occurred. Therefore, we could say that the markets were linked in the short-run.

Besides, the ECM provided other useful knowledge; the coefficient of Yangon mung bean wholesale price at week t was significant at 1 percent level. And Yangon mung bean wholesale price was positively related to Mandalay mung bean wholesale price. The coefficient of one lag week Mandalay mung bean wholesale price was negative sign however, it was significant at 10 percent level. The coefficient of one lag week Yangon mung bean wholesale price at week t was significant at 10 percent level. Durbin-Watson was nearly 2, which indicated that no autocorrelation in this model. In the analysis, it was observed that F statistic was 19.50 and its probability was 0.00. It meant that the estimated model satisfactorily fits the given data set.

Table 5.10: Estimated coefficients of short-run backward price transmission model

Variable	Coefficient	Std. Error	t statistic
c	0.00	0.00	0.29
$\Delta \ln P_t^Y$	0.37	0.05	7.47*
$\Delta \ln P_{t-1}^M$	-0.10	0.06	-1.67***
$\Delta \ln P_{t-1}^Y$	0.10	0.06	1.74***
ε_{t-1}^M	-0.17	0.04	-4.62*

R^2 =0.20 DW =1.88 F -test=19.50

$H_0 : \alpha_{11} = \alpha_{12} = 0, \alpha_M = 1$ Short-term integration exist)

$H_0 : \alpha_{11} < 0, \alpha_{12} < 0, \alpha_M < 1$ No short-term integration exist

Note: * significance at the 1% level.

*** 10% level.

As the result, there was weakness of market integration or of complete pass-through of price changes from one market to another. And the two markets also have incomplete price transmission arising due to market structure was less than perfect competition and poor communication infrastructure. This resulted in a reduction in the price information available to market intermediaries and consequently may lead to decisions that contribute to inefficient outcomes.

Moreover, Mandalay market was situated in a region of mung bean surplus area and regional surpluses were mostly sold to the border areas. The demand of mung bean in that division can mainly influence the price formation at Mandalay market. Lack of a developed infrastructure was also the main factor for the price sluggishness. Because lack of a stable communication infrastructure between Mandalay market and Yangon market, the price changed in Yangon market do not have any considerable influenced on Mandalay market price.