

Maize Production, Prices and Related Policy in Thailand

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Abstract

The objectives of this study were to compare farmer's perception regarding different schemes, calculate break even price of maize production, analyze supply response, and analyze co-integration on maize prices. The paper found that farmers preferred income guarantee scheme to pledging scheme. Since 2003, farm prices had increased above break even price. Supply response of maize mainly depended on price received in the previous year, area in the previous year and cost. This price related to government policy in two different schemes: income guarantee scheme and pledging scheme. This study applied co-integration analysis for farm price with wholesale price and F.O.B. price for maize. Farm price was affected positively by wholesale price and F.O.B. price. The estimated coefficients associated with explanatory variable agreed with a priori expectations, and were statistically significant. Signs of all estimated coefficients agreed with expectations and were statistically significant.

Keywords: maize, Thailand, supply response, co-integration.

1. Introduction

Maize is the important agricultural product in Thailand due to the fact that maize has impacts on food industry. Recent agricultural implemented policy related to maize were income guarantee scheme versus pledging scheme. The schemes were launched by two political parties in Thailand. Maize is also important to Thailand since maize is a major input in poultry raising industry. Figure 1 shows that farmers sell their products to either field merchants or agricultural cooperatives, sell to local merchants and then sell to silo company, exporters or animal farm. Silo companies sell maize to exporters or their feed mills. Feed mills sell their products to exporters, distributors and their farms. Most silo companies, feed mills, poultry farms and distributors belong to the same owners.

Figure 1 Marketing Channel of Maize and Feed Mill Industry in Thailand

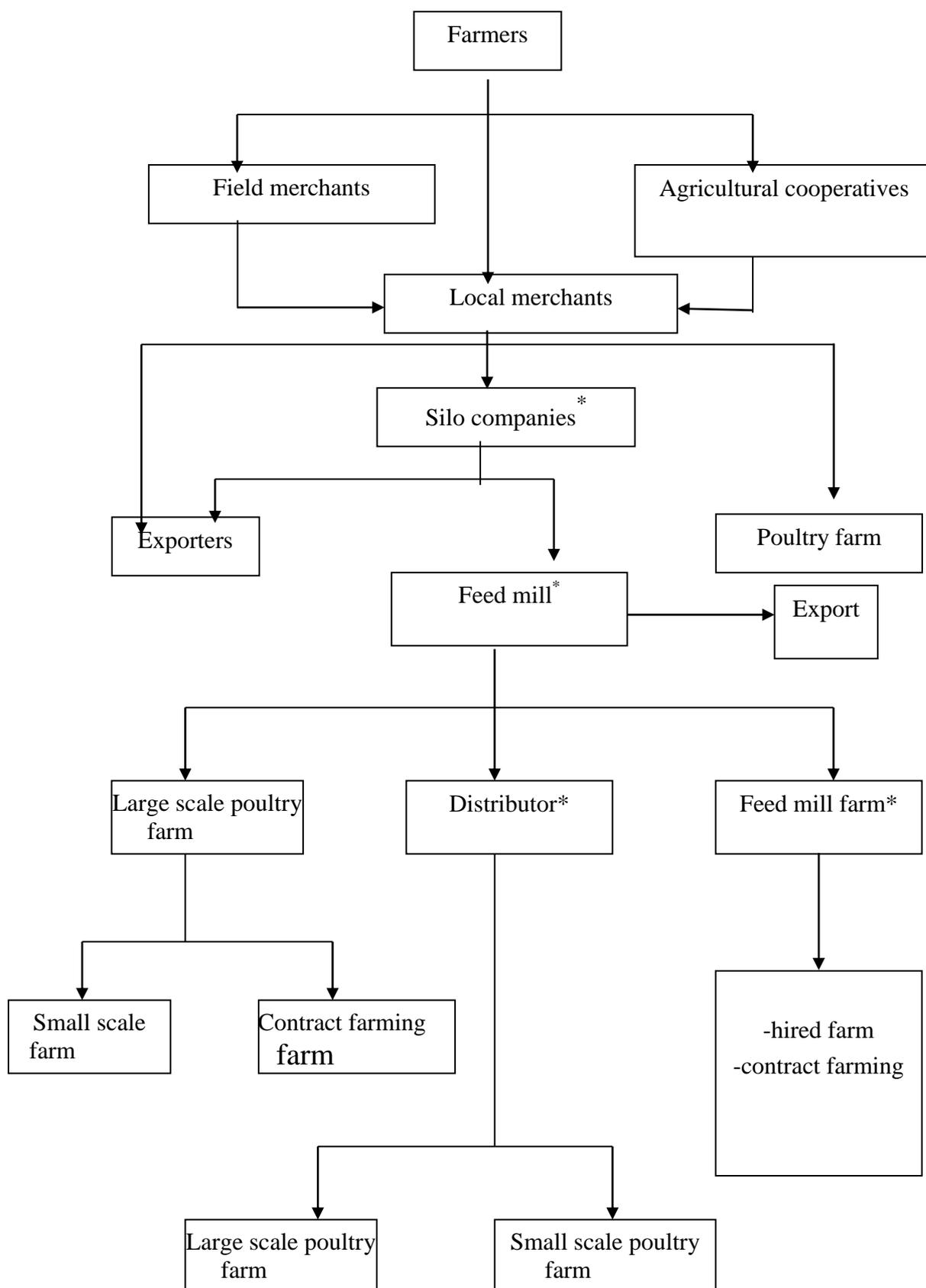


Table 1 Grain Production of the World in 2012

Unit: million metric ton

Maize	Wheat	Barley	Rice	Other					
U.S.	300	EU	222	EU	53	China	127	Sorghum	60
China	140	China	197	Russia	16	Russia	87	Oat	24
EU	131	India	72	Canada	13	Vietnam	22	Maize	60
Brazil	43	U.S.	57	Australia	10	Thailand	18	Other	16
Other	86	Other	72	Other	45	Other	146	Total	160
Total	700	Total	620	Total	137	Total	400		



Figure 2 Maize production of the world in 2012

Table 1 and figure 2 shows that the U.S. produces the largest share on maize at 43%, followed by China, EU and Brazil.

2. Previous Research

As importance of maize to Thailand, this study emphasized 2 main components: supply response of maize and co-integration of maize prices. There were several literatures related to these topics.

Ryan (1977) developed a supply response model with the independent variables of the price of pinto beans lagged one year, the difference between the prices of pinto in year $t-1$ and $t-2$, the average farm price of sugar beets, and the square of the covariance of pinto bean and sugar beet prices divided by the preceding three year average pinto bean price and divided by the variance of the sugar beet price.

Erjavec et al (1998) addressed a supply response model in Slovene agriculture for wheat, maize, potato, pork, beef and milk. The quantities of each product supplied reacted to variation in both its own price and the price of related product. The explanatory variables for maize are lagged prices of maize, beef and pork and land used in maize production. They found high elasticity in maize supply.

Yu et.al (2010) developed supply response model and yield response model of expected prices of the crop and of other competing crops, input price, natural condition, infrastructure, investment and tax rate and subsidy as independent variables.

On the other hand, Ibrahim M. and Florkowski J.W (2005) applied the seasonal co-integration methodology to pecan price analysis. The result suggests pecan data were nonstationary. They found the relationships of prices with pecan cold storage inventories.

Therefore, the pecan price inventory relationship is seasonal in nature. There was no long run equilibrium in the pecan market, when only cold storage inventories were considered.

Hossain(2010) examines the regional rice markets have become spatially integrated

following the liberalization of the rice market in Bangladesh. Wholesale weekly coarse rice prices at six different levels over the period of 2004-2006 to test the degree of market integration using co-integration analysis and a vector correction model (VECM). This study follows Ryan, Erjavec et al, and Yu et al for supply response model, using annual data 2002-2010. Similar to Hossain study, this study applied monthly data covered the period 2007-2011 for co-integration analysis.

3. Objectives

The objectives of this study were to:

- 1) compare farmer's perception regarding different schemes
- 2) calculate cost and return of maize production
- 3) analyze supply respond of maize production
- 4) analyze co-integration on maize prices

4. Research Method

Data

The primary data on farmers' perception regarding two different rice schemes. The research interviewed farmers in Petchaboon province. Secondary data were used for break even analysis, supply respond and co-integration analysis on prices. Monthly data on farm price, wholesale price and F.O.B. prices are used in the analysis. The data covered the period 2007- 2011. Prices are expressed in current terms on a common unit basis of 1,000 kilogram. The data are taken from various issues and web sites of Department of Agricultural Economics, Department of Interior Trade of Thailand and Department of Custom of Thailand.

Analysis

The research would compare farmer's perception regarding to different schemes: income guarantee scheme and pledging scheme. Income guarantee scheme performance of maize in Thailand during 2009-2011 was shown.

4.1 Cost and Return Analysis

P = farm price (USD/ton)

Q = yield (ton/acre)

F = fixed cost (USD/ton)

V = variable cost (USD/ton)

R = return (USD/ton)

$R = (P \times Q) - (F + V)$

4.2 Maize Supply Respond Model

$A_t = f(A_{t-i}, P_{t-1}, C, D)$

A_t = Cultivated area in recent year

A_{t-i} = Cultivated area in the previous year

P_{t-1} = farm rice price in the previous year

C = cost per area

D = pledging scheme or income guarantee scheme

4.3 Co-integration Analysis

The study estimated price transmission from different level using unit root and co-integration methods. Market co-integration involves a test of price efficiency by examining how market in different regions responds jointly to supply and demand forces. Each price series are tested for the order of integration to determine which variables are stationary and non-stationary in levels. The Augmented Dickey and Fuller test (ADF) developed by Dickey and Fuller (1979 and 1981) was used for a unit root test for all variables. The null hypothesis of a unit root is rejected if variable is stationary. To elaborate a long-term relationship between farm price and wholesale price and F.O.B. price, the two step procedure of Engle and Granger (1987) was employed. First a simple linear model is estimated using ordinary least square and then the residues were tested for stationary. Then the Johansen co-integration test, based on the Dickey-Fuller procedure, determines the number of co-integration equation. Co-integration methods are useful when time series data are non-stationary and conventional model would encounter the problem of spurious regression (Harris, 1995)

Long Run Co-integration

$$P_{fi} = \alpha_i + \beta_i P_{wi} + e_{ii}$$

$$P_{fi} = \alpha_i + \beta_i P_{fobi} + e_{ii}$$

Short Run Co-integration

$$\Delta P_{fi} = a + \delta_i \Delta P_{wi} + \gamma_i \varepsilon_{it-1}$$

$$\Delta P_{fi} = b + \delta_i \Delta P_{fobi} + \gamma_i \varepsilon_{it-1}$$

5. Results and Discussion

By interview 113 farmers in Wichianburi district, Petchaboon province-in the North region, 98.23% of farmers grow maize, depending on rain. 38.94% of farmers received the loan from Bank for Agriculture and Agricultural Cooperatives (BAAC). In 2009/2010, farmers sold maize at the average of baht 4,520 per metric ton. They received the difference price compensation for baht 582.62 per metric ton (total of USD18.20). Farmers preferred income guarantee scheme to pledging scheme at 84.31%. Due to the reason that income guarantee scheme had fewer procedures than pledging scheme. Farmers could sell their product at any price level when they wanted. In addition after register as growers they could receive the difference even when the crop was lost by disease or flood.

Table 2 shows the performance of income guarantee scheme for maize in Thailand during 2010-2011. Total maize farmers involved in Income guarantee policy during 2010-2011 were 379,000 farmers and there were the maximum 263,000 farmers in the north of Thailand. Total government budget used for the policy was USD million 181.83 and each farmer received the payment approximately USD 478.81.

Table 2 Performance of Income Guarantee Scheme for Maize during 2010-2011.

	Number of farmer(thousand)	Amount (USD million)	Average(USD/person)
North	263	127.32	482.81
Northeast	83	37.77	452.81
Central	32	16.67	513.52
South	0.02	0	161.42
Total	379	181.83	478.81

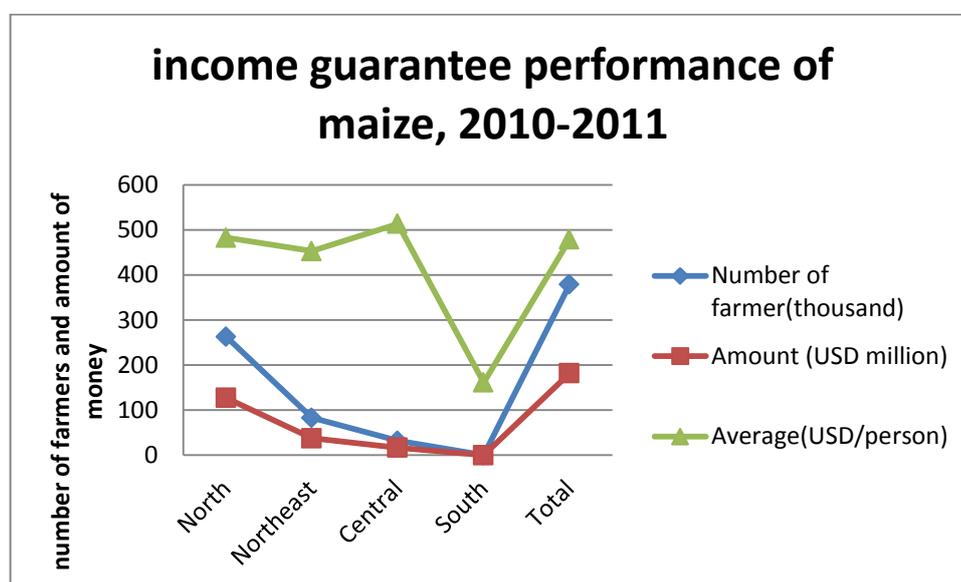


Figure 3: Income Guarantee policy performance in 2010-2011

Source: Bank for Agriculture and Agricultural Cooperatives and calculation

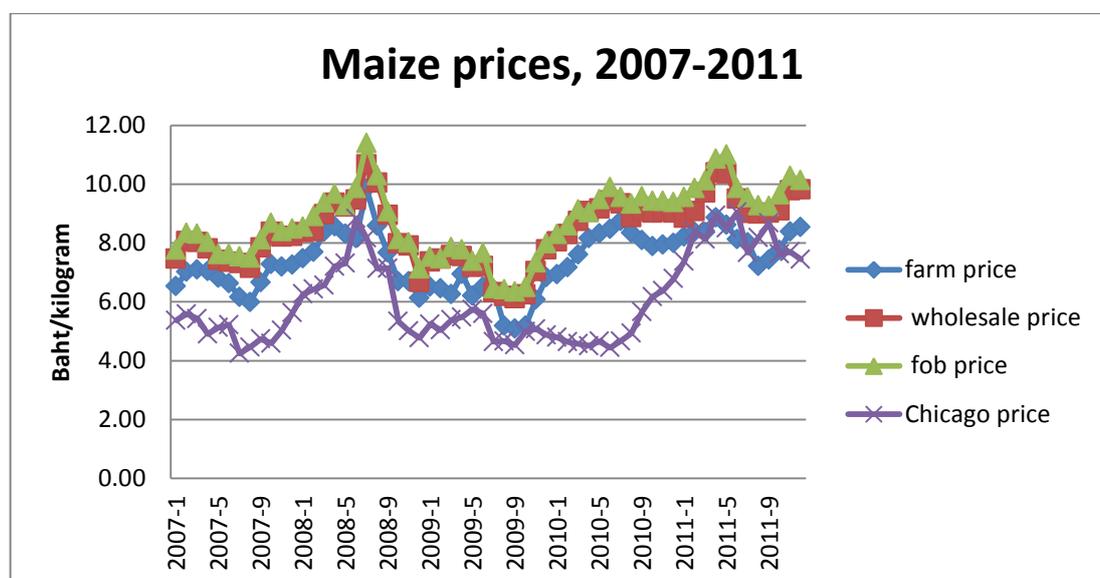


Figure 4 Prices of Maize, 2007-2011

Source: Office of Agricultural Economics, Department of Interior Trade and Department of Custom, various issues.

Figure 4 shows monthly prices of maize, during 2007 and 2011. Unit of Thai Baht in 1 kilogram was shown. Prices reached the highest in 2008. Farm price of maize reached Baht 18 per 1 kilogram in September 2008 and similarly in 2011. F.O.B. price and wholesale price are closed related. Due to the fact that maize production in Thailand is mainly for domestic use because of the boom of poultry farm and food sector. The margin of wholesale price and farm price is approximately Baht 2 per kilogram.

5.1 Cost and Return Analysis and Supply Respond Analysis

Table 3 Yield, Farm Price and Growth Rate

Year	Yield per acre (kilogram)	Growth rate (percent)	Farm price (USD per metric ton)	Growth rate (percent)
2001	1,336.50		133.54	
2003	1,388.25	0.03	148.06	0.10
2006	1,417.50	0.02	175.80	0.18
2010	1,496.25	0.05	262.25	0.49

Source: Office of Agricultural Economic and calculated

For the period of 2001-2010, yield per acre increased from 1,336.50 kilogram to 1,496.25 kilogram in 2010. Yield growth rate increased from 0.03% to 0.05% in 2010 which means maize production had little production improvement. Farm price increased from USD 133.54 in 2001 to USD 262.25 in 2010. Farm price growth rate increased from 10% in 2001 to 49% in 2011 due to the boom of food industry.

Table 4 Variable Cost, Fixed Cost and Growth Rate

Year	Variable cost (USD/acre)	Fixed cost (USD/acre)	total cost (USD/acre)	growth rate of total cost (percentage)
2002	122.37	20.32	142.69	
2006	170.34	20.32	190.66	0.33
2008	235.74	34.11	269.85	0.41
2010	224.27	35.78	260.05	-0.03

Source: Office of Agricultural Economic and calculated

For the period of 2002-2010, fixed cost per acre increased slightly but variable cost per acre increased from USD 122.37 in 2002 to USD 224.27 in 2010. Growth rate of total cost increased from 33% in 2006 to 41% in 2008 but growth rate reduced to 3% in 2010. This corresponded to the fact that Thai farmers depended more on machine, herbicide and hired labor than in the past. It was obviously a burden on cost (table 4).

In the year 2002, variable cost and fixed cost were USD 91.61 and USD 15.20 per metric ton and these costs increased to USD 150.00 and USD 23.91 in 2010. Yield increased slightly from 1.33 metric ton per acre in 2002 to 1.49 metric ton per acre in 2010. Table 5 shows Thai maize productions during 2002 and 2010 farm price were above total cost. There were positive net returns in maize production. It is mainly because maize is the major input in poultry industry.

Table 5 Cost and Return of Maize, the Period of 2002-2010

	2002	2006	2008	2010
yield(ton/acre)	1.33	1.41	1.46	1.49
variable cost(USD/ton)	91.61	120.32	160.64	150.00
fixed cost (/ton)	15.20	14.33	23.25	23.91
total cost (USD/ton)	106.81	134.65	183.89	173.91
farm price (USD/ton)	133.54	175.80	226.12	262.25
net return (USD/ton)	26.72	41.14	42.23	88.34

Source: calculated

5.2 Maize Supply Respond Model

$$A_t = f(A_{t-1}, P_{t-1}, Sub, C, D)$$

A_t = Cultivated area in recent year

A_{t-1} = Cultivated area in the previous year

P_{t-1} = farm rice price in the previous year

$$A_t = 2.7882 + 0.6115A_{t-1} + 0.8527P_{t-1} - 1.05cost_t$$

$$(0.01)** \quad (0.04)** \quad (0.04)**$$

Adjusted R-squared = 0.9367

**p<0.05

Factors determined maize supply were cultivated area in the previous year, cost and maize price in the previous year. Maize price had related to government policy and the boom of feed mill industry and food industry.

5.3 Co-integration Analysis and Unit Root Test

Unit Root Test

The first step is to determine which variables are stationary and non-stationary in levels. Unit root test in table 6 showed that all variables are non-stationary and stationary at first different with constant and trend.

Table 6 Unit Root Test

Variable	I(0) Test-statistic With constant and trend	At first different: I(1) With constant and trend
P _f	-2.3531	-4.8812***
P _w	-2.4597	-4.6301***
P _{F.O.B.}	-2.4445	-5.0504**

***Denote statistically significant estimates at $p < 0.01$ level.

Co-integration Analysis

Farm price was affected positively by wholesale price and F.O.B. price. The estimated coefficients associated with explanatory variable agreed with a priori expectations, and were statistically significant at 1percent or 5 percent levels. Signs of all estimated coefficients agreed with expectations and were statistically significant (table 7).

Long run co-integration

Long run coefficients of farm price and wholesale price and long run coefficients of farm price and F.O.B. price were 0.8811 and 0.8130, respectively. That indicated that if a price of wholesale price changed by 1 baht (Thai currency) then farm price would change by 0.8811 baht in the same direction. Similarly, if F.O.B. price changed by 1 baht (Thai currency) then farm price would change by 0.8130 baht at the same direction.

Short run co-integration

Short run coefficients of farm price and wholesale price and short run coefficients of farm price and F.O.B. price were 0.8471 and 0.7402, respectively. That indicated that if wholesale price changed by 1 baht then farm price would change by 0.8471 baht at the same direction. The ECM coefficient suggested that the speed of adjustment of the model was 61.57%. The negative sign implied that the adjustment would cause the system to gradually convert to equilibrium. Similarly, F.O.B. price changed 1 baht then farm price would change by 0.7402 baht at the same direction. The ECM coefficient suggested that the speed of adjustment of the model was 63.42%. The negative sign implied that the adjustment would cause the system to gradually convert to equilibrium.

Table 7 Long Run Coefficient and Short Run Coefficient

	Long run coefficient	Adj-R ²	Short run coefficient	Adj-R ²
Farm price and wholesale price	0.8811***	0.9137	0.8471***	0.7127
T statistic from Augmented Dickey-Fuller test	-4.2478***	0.3085		
ECM coefficient			-0.6157**	
Farm price and F.O.B. price	0.8130***	0.9130	0.7402***	0.7081
T statistic from Augmented Dickey-Fuller test	-3.8312***	0.3201		
ECM coefficient			-0.6342***	

**p<0.05

***p<0.01

6. Summary and Concluding Remarks

Farmers preferred income guarantee scheme to pledging scheme due to rules of income guarantee scheme after register as growers they could receive the difference even when the crop was lost. Since 2003, farm prices had increased above total cost. Supply response of maize depended on cost and price received in the previous year. This price related to government policy in two different schemes: income guarantee scheme to pledging scheme and maize used in feed mill industry. This study applied co-integration analysis for farm price with wholesale price and F.O.B. price for maize. Farm price was highly affected positively by wholesale price and F.O.B. price, approximate 0.7402-0.8471. Wholesale price had slightly higher related to farm price than F.O.B. price. The estimated coefficients associated with explanatory variable agreed with a priori expectations, and were statistically significant. Signs of all estimated coefficients agreed with expectations and were statistically significant.

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