The Effect of Rice Harvest Collateral Credit Policy on Rice Price : Statistical Evidence during 1979 – 1997[*]

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Introduction

The price of rice in 1984 was relatively lower than the price in 1983 for both the annual average price (3,023.67 baht per ton and 3,239.83 baht respectively) and all of the month on month (MoM) bases except for July and August. In November and December 1984 compared with the same periods in 1983, the monthly prices were the lowest in terms of the percentage decreases (14.95 % and 19.55 % respectively) (Table 1). The annual average price in 1984 was the lowest since 1980. The farmers suffered from the low price. Consequently, the government launched the rice harvest collateral credit (RHCC) policy in the same year. The RHCC policy attempted to provide financial liquidity to farmers with the argument that the farmers could afford to wait longer for a higher price rather than sell their rice at the beginning of the harvesting season at a lower price with the hope for a higher price later in the same year. The policy, in fact, came into effect in 1986 when the 1986 annual average price was the lowest compared with at least the past seven single

annual averages. The average price of the last two months in 1986 and January 1987 was even lower at 2,343 baht per ton. The number of farmers who went to the RHCC programme had jumped from 12,547 in 1984 to 360,269 farmers in 1986/1987. Again, during the last two months of 1992 and the first three months of 1993, the average price of these five months had been the lowest since 1988 at 3,410.8 baht per ton. As a result, the number of the farmers entering to the RHCC programme had increased tremendously to 465,755, the greatest number ever since the beginning of the RHCC programme (Table 2).

Three important arguments of the RHCC policy arose which are the main objective of this study. The first was, "Was the rice price actually, on average, better since 1986?" The second argument was "Did the RHCC policy help lift the rice price during the harvest season (November year t to March year t+1)?" Third, "Did the RHCC policy help stabilize the price within the production year?"

Data

The data used in this study were monthly data of paddy prices from 1979 - 1997 from two sets. The first set was the paddy price at rice mills in Bangkok during 1979 - 1983, while the second set was the price at the farm gate from 1984 - 1997. The first set was adjusted by the average cost of transportation at 161.9 baht per ton. The raw data of rice price after adjustment was presented in Table 1.

Table 1: Price of rice at the farm gate (after adjustment).

Year	Price/ton (baht)												
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	dec.	mean
1979	2,325	2,420	2,495	2,560	2,590	2,630	2,650	2,835	3,000	3,050	2,975	3,000	2,710.83
1980	3,100	3,100	3,125	3,125	3,175	3,250	3,225	3,250	3,300	3,375	3,525	3,588	3,261.50
1981	3,550	3,625	3,825	3,850	3,950	4,050	4,050	4,050	3,950	3,850	3,850	3,850	3,870.83
1982	3,850	3,300	3,350	3,050	3,050	2,850	2,700	3,100	3,255	3,350	3,240	3,183	3,189.83
1983	3,250	2,894	3,000	3,011	3,150	3,150	3,150	3,252	3,534	3,550	3,536	3,401	3,239.83
1984	2,930	2,814	2,841	2,917	2,905	3,013	3,249	3,374	3,311	3,187	3,007	2,736	3,023.67
1985	2,735	2,677	2,792	2,823	2,858	2,920	2,883	2,896	2,863	2,823	2,757	2,666	2,807.75
1986	2,467	2,348	2,239	2,101	2,176	2,242	2,464	2,768	2,655	2,523	2,531	2,246	2,396.67
1987	2,252	2,519	2,683	2,705	2,724	3,044	2,909	3,271	3,685	3,855	3,417	3,420	3,040.33
1988	4,068	4,290	4,149	4,236	4,144	4,300	4,552	4,517	4,489	4,424	3,888	3,739	4,233.00
1989	3,939	4,056	4,135	4,249	4,450	4,775	5,184	5,049	4,963	4,952	3,839	3,743	4,444.50
1990	3,865	4,002	4,033	3,937	3,758	3,808	3,800	3,891	3,806	3,750	3,588	3,274	3,792.67
1991	3,692	3,987	3,879	3,858	3,584	4,062	4,282	4,788	4,544	4,635	3,987	3,704	4,083.50
1992	3,763	3,830	3,867	3,893	3,918	3,970	5,250	4,218	3,981	3,860	3,578	3,616	3,978.67
1993	3,347	3,327	3,186	3,037	2,911	2,915	3,018	3,255	3,180	3,348	3,748	3,938	3,267.50
1994	4,071	4,091	3,878	3,657	3,664	3,725	3,777	3,907	4,006	3,904	3,813	3,660	3,846.08
1995	3,619	3,729	3,741	3,771	3,843	4,177	4,702	4,949	4,891	5,160	4,580	4,443	4,300.42
1996	4,738	4,870	4,920	5,026	5,246	5,458	5,483	5,546	5,895	5,973	5,338	5,681	5,347.83
1997	5,335	5,333	5,358	5,418	5,387	5,555	5,868	6,134	6,030	5,920	na.	na.	5,633.80

Source :   1/ Department of Foreign Trade

2/ Office of Agricultural Economics

Methodology

Since the RHCC policy has effectly implemented in 1986, it was interesting to investigate if the rice price was actually better since implementation. In order to analyse this the following model was used:

$$P_t = \beta_1 X_1 + \beta_2 X_2 + \varepsilon_t \qquad \ldots(1)$$

where P_t = average price at year t

X_1 = 1 if 1979-1985

    = 0 otherwise

X_2 = 1 if 1986-1997

    = 0 otherwise

β_1, β_2 = parameters

ε_t = error term at year t

Table 2 : Number of farmers using rice harvest collateral credit (RHCC), total amount of RHCC and total amount of rice harvest as collateral 1984/85 - 1997/98

Production Year	No. of farmers Using RHCC	Total amount of RHCC (million baht)	Total amount of rice harvest as collateral
1984/85	12,547	20.17	90,467.00
1985/86[1]	-	-	-
1986/87	360,269	380.96	2,275,939.00
1987/88	65,493	83.27	349,115.00
1988/89	76,295	129.50	517,277.00
1989/90	147,711	266.01	1,081,912.80
1990/91	142,297	223.88	798,357.60
1991/92	138,326	303.91	1,060,206.50
1992/93	465,744	1,055.02	3,383,324.00
1993/94	199,956	366.42	1,202,718.00
1994/95	211,409	422.94	1,402,931.00
1995/96	181,999	393.87	1,182,259.00
1996/97	123,870	296.87	865,113.00
1997/98	111,107	293.87	786,363.00

[1] Note : No RHCC policy was implemented in 1985/86

Source : Bank for Agriculture and Agricultural Cooperatives

To statistically test if the average price during 1979 - 1985 was equal to the average between 1986 and 1997 an F-test was conducted by imposing the restriction that $\beta_1 = \beta_2$ and used to test the hull hypothesis $H_0 : \beta_1 = \beta_2$. If the hull hypothesis was rejected in favor of the alternative hypothesis that the average price of rice between 1986 and 1997 was higher, it did not directly imply that the RHCC policy was successful. It might be only the coincidence of the policy and the better trend of the rice price. However, it would be useful information at least in terms of the price trend and could be used to answer the first question.

The alternative model which could be used to test the equality of the average prices from these two periods was:

$$P_t = b_0 + b_1 D2 + \omega_t \qquad \ldots(2)$$

where $D2$ = 1 if 1979-1985

= 0 otherwise (1986-1996)

b_0, b_1 = parameters

ω_t = error terms

The average price during 1979 - 1985 could be obtained from $\hat{\beta}_0 + \hat{\beta}_1 \times 1 = \hat{\beta}_0 + \hat{\beta}_1$ while the average price 1986 − 1996 from $\hat{\beta}_0 + \hat{\beta}_1 \times 0 = \hat{\beta}_0$. The null hypothesis of equal average prices between 1979 - 1985 and 1986 - 1996 could be conducted statistically $H_0 : b_1 = 0$. The statistic test used was the student-t test.

In order to investigate the effect of the RHCC policy on lifting the rice price, a price ratio was imputed from the simple average price of November in year t to March year t+1 to the average price of April in year t+1 to October year t+1. The reason for selecting such time periods was that almost all RHCC was conducted during November year t to March year t+1 except the credit in the southern part of Thailand, which was relatively a small amount. The credit was provided by the Bank for Agriculture and Agricultural Cooperatives (BAAC). After March the credit was expected to return to BAAC. Algebraically, the price ratio, is:

$$PR = \frac{(\text{Average price in November year } t + \ldots + \text{average price in March year } t + 1) / 5}{(\text{Average price in April year } t + \ldots + \text{average price in October year } t + 1) / 7}$$

This ratio was expected to be higher if the RHCC policy did really work. Since the RHCC policy was effective in 1986, the data were then separated into two periods, the periods before and after the RHCC policy 1979 - 1985, and 1986 - 1997. A dummy variable, D2, was applied in order to investigate the effect of the RHCC policy in the model to follow by defining D2 as

$$D2 = 1 \text{ if } 1979 - 1985$$
$$= 0 \text{ otherwise } (1986 - 1996)$$

Consequently, the model employed to investigate the effect on lifting the rice price in this study was

$$PR_t = \beta_0 + \beta_1 D2 + u_t \qquad \ldots(3)$$

where u = error term.

To investigate whether the RHCC policy help stabilize the rice price within the production year, coefficient of variation (CV) of monthly price within the production year, which is the standard deviation of monthly prices within the production year / the mean of those prices within the same production year, was regressed on the same dummy variable, D2 = 1 if 1979 - 1985 and D2 = 0 otherwise (1986 - 1997). The statistical model could be written as:

$$CV_t = \alpha_0 + \alpha_1 D2 + \varepsilon_t \qquad \ldots(4)$$

Where ε_t = error term.

CV_t was obtained from the farm gate prices of rice from November of year t to October of year t+1.

It might be possible that the methods of obtaining CV could vary the estimated values of the CV and hence result in a possible different statistical inference. The CVs within the calendar year from rice prices with and without transportation cost adjustment during 1979 - 1983 were, then, calculated. Now, CV2 and CV1 were defined as the coefficients of variations with and without transportation cost adjustment respectively. Then two more models were specified as:

$$CV2_t = \gamma_0 + \gamma_1 D2 + v_t \qquad \ldots(5)$$
$$\text{and } CV1_t = \omega_0 + \omega_1 D2 + \mu'_t \qquad \ldots(6)$$

where v_t and μ_t = error terms.
$\gamma_0, \gamma_1, \omega_0, \omega_1$ = parameters

Empirical Results

The empirical results were presented according to the models specified; models (1) and (2), model (3), models (4), (5) and (6).

The empirical results of models (1) and (2)

The empirical results of model (1) were presented in Table 3 with the average price of 3,042.08 and 3,884.65 baht per ton during the periods of 1979 - 1985 and 1986 - 1996 respectively. The average prices obtained from model (1) were the same as those in model (2) in Table 5. From Table 5, the average price was 3,884.65 which was the constant term while the average price of the period 1979 - 1985 was obtained by 3,884.65 - 842.57x1 = 3,042.08 baht

per ton. To test whether these two period average prices were equal, the F-statistic and student t-ratio were calculated to test the null hypotheses $H_0 : \beta_1 = \beta_2$ and $H_0 : b_1 = 0$ against alternative hypotheses $H_a : \beta_1 < \beta_2$. and $H_a : b_1 < 0$ respectively. The calculated F statistic with 1 and 17 degrees of freedom was 7.0805 while the t-ratio with 16 degrees of freedom was - 2.661 (see Tables 4 and 5). We reject these null hypotheses at the 0.05 significance level in favor of the alternative hypotheses that the 1986 - 1996 average price was higher than that of 1979 - 1985. Therefore, it could be concluded that the average price of rice after the implementation of RHCC policy was significantly higher than before the policy.

Table 3 : Estimated coefficients of model (1); $P_t = \beta_1 X_1 + \beta_2 X_2 + e_t$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
X1	3042.08	247.5	12.290	(.00000)
X2	3884.65	197.5	19.673	(.00000)
Sigma	654.915	109.2	6.000	(.00002)

F (1,16) = 7.0805, D.W. = 2.1730, N = 18

Source : Computation

Table 4 : Estimated coefficients model (1) with the restriction $\beta_1 = \beta_2$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
ONE1	3556.98	154.4	23.043	(.00000)
ONE2	3556.98	154.4	23.043	(.00000)
Sigma	763.103	127.2	6.000	(.00002)

F (1,16) = 7.080, significance level of test statistic = 0.0170844.

Source : Computation

Table 5 : Estimated coefficients of model (2); $P_t = b_0 + b_1 D2 + \omega_t$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
Const	3884.65	197.5	19.673	(.00000)
D	-842.572	316.5	-2.661	(.01708)
Sigma	654.915	109.2	6.000	(.00002)

R^2 = .30677, F (1,16) = 7.0805, D.W. = 1.0649, N = 18

Source : Computation

Table 6 : Estimated coefficients of model (3); $PR_t = \beta_0 + \beta_1 D2 + u_t$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
ONE	.912930	.3049E-01	29.942	(.00000)
D2	.845657E-01	.4889E-01	1.730	(.10294)
Sigma	.101123E-01	.1685E-01	6.000	(.00002)

R^2 = 1.5752, F (1,16) = 2.99162, D.W. = 2.1730, N = 18

Source : Computation

The empirical results model (3)

The empirical results of model (3) were shown in Table 6. D2 was significant at .10294 level of significance. And since D2 = 1 between 1979 - 1985, the price ratio during the period before the effective implementation of the RHCC policy tended to be higher compared with the period of the implementation. This implied that during the effective period of the RHCC policy, the (average) price between November year t and March year t+1, the time that the farmers could receive RHCC from Bank for Agriculture and Agricultural Cooperatives (BAAC), relative to the rest of the production year was lower compared with the year before the policy.

The average PR before the effective implementation of the RHCC policy was 0.99749 which implied that the price during the harvesting season of which the majority of rice was still in hands of farmers was very close to the rest of the year. After the policy implementation the ratio, on average, was down to 0.91293. This might be because the price after 1985 was relatively better (as shown in Table 2 and Tables 3, 4 and 5) and profitable to farmers. Then, there was relatively less need for the government to use the price support policy, and the government also realized that there had already been the RHCC policy.

Table 7 : Estimated coefficients of model (4); $CV_t = \alpha_0 + \alpha_1 D2 + \varepsilon_t$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
ONE	9.36336	1.224	7.652	(.00000)
D2	-2.54686	1.962	-1.298	(.21271)
Sigma	4.05844	.6764	6.000	(.00002)

R^2 = .09526, F (1,16) = 1.68465, D.W. = 2.2013, N = 18

Source : Computation

Table 8 : Estimated coefficients of model (5); $CV2_t = \gamma_0 + \gamma_1 D2 + v_t$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
ONE	9.29465	.9737	9.545	(.00000)
D2	-2.72333	1.561	-1.744	(.10031)
Sigma	3.22948	.5382	6.000	(.00002)

R^2 = .1597, F (1,16) = .10723, D.W. = 2.8377, N = 18

Source : Computation

Table 9 : Estimated coefficients of model (6); $CV1_t = \omega_0 + \omega_1 D2 + \mu_t$

Variable	Coefficient	Std. Error	T-ratio	(Sig.Lvl)
ONE	9.29465	.9579	9.703	(.00000)
D2	-2.99084	1.536	-1.9747	(.06930)
Sigma	3.17710	.5295	6.000	(.00002)

R^2 = .19155, F (1,16) = 3.7909, D.W. = 2.8809, N = 18

Source : Computation

The empirical results of models (4), (5), (6)

The result from model (4) tended to be that CV was less before the implementation of the RHCC policy. However, statistically, it could be inferred that the variations or the price stabilities within single years between these two periods, the periods before and after the RHCC policy, were insignificantly different from each other at the 0.05 level of significance. And, the results from models (5) and (6) which were presented in Tables (8) and (9) were similar to those in Table 7 with the significance level at 0.05.

Conclusion

The RHCC policy has not helped lift the rice price during the harvest season. Instead, the relative average rice price of the harvest season tended to be lower after the implementation of the RHCC policy compared with the period before. However, the tendency was not statistically significant. In the meantime, the price variations within single years were not reduced during the implementation of the policy but rather statistically insignificantly increased. However, the annual average price tended to increase compared with the period before the RHCC policy. It was not certain to conclude that it was the effect of the policy unless the effects of shifting in demand and supply, inflation as well as the foreign exchange rate had been removed.

Recommendation for Further Research

To make a better picture of the effect of RHCC policy on price lifting, the effects of the exchange rate shifting in demand and supply of rice and inflation should be taken out.

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