The Degree of Decoupling of Direct Payments for Korea's Rice Industry

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I. Introduction

In 2005, Korean government newly introduced the direct payments program for rice industry which had long been strongly supported with a purchasing scheme. This policy shift to direct payment from the typical price support is aimed at adapting the rice market to the market-oriented system as is required under the WTO regime. The abolition of government purchasing scheme which had lasted for more than half a century came as a shock to Korean farmers in that rice has been their main income source.

An important question regarding such a policy change is whether the new policy can be in harmony with the goal of market orientation. In other words, can it meet the requirement of decoupling as is stipulated in the Agreement on Agriculture (AoA) appendix 2 (Green Box)? One way to answer this question is to estimate the degree of decoupling of the program.

Empirical works on this issue in association with the WTO agricultural policy reform have been done recently since late 1990s. Previous works are relatively rare at the early stage in this field, and most of them are for the EU and US domestic policies. Studies on this issue for Asian agriculture-protective nations such as Korea and Japan are hardly found yet, although they are now rapidly moving toward market orientation as is seen in the agricultural policy reform for the Korean rice described above.

First attempt on this issue for Korean rice was made by Lee (2005). This study, using simple static model under deterministic environment focusing on the development of theoretical framework, shows that the degree of decoupling of the Korea's direct payments varies depending on predetermined target price, the rate of support, market price, and the share of fixed direct payments. Also, the simulation result of this paper carefully leads to the tentative claim that the Korea's new direct payments program is highly unlikely to meet the Green Box requirement as is provided in the AoA appendix 2. However, this result cannot be conclusive, and it might be misleading the true consequences of the newly adopted program since it does not consider the uncertainty and producer's risk preference.

Unlike the first preliminary paper discussed above, this study will be conducted within a stochastic framework under uncertainty. As Hennessy demonstrated in the *AJAE* (1998), it is generally believed that the direct payments are more likely to affect production due to wealth and insurance effects when producer's risk preference is considered. Producer's problem will then be modeled to maximize the expected utility of the farm profits for the single rice market.

The purpose of this study is to estimate the degree of decoupling of newly adopted direct payments for Korea's rice industry in order to see how the program is decoupled or coupled with rice production. This will help us to determine whether the new program could be classified as being under the so-called Green Box category, as was initially intended by the Korean government. For this purpose, the structure and characteristics of the Korea's direct payments program will be briefly examined first. Then, theoretical framework featuring the structural characteristic of the program will be built to estimate the degree of decoupling under uncertainty, assuming that rice producers are risk averse. The degree of decoupling of the program will be empirically estimated, and discussions on whether the program can meet the AoA decoupling conditions based on the estimated results will follow.

II. Model for Direct Payments Program

2.1 Structural Characteristics of Direct Payments Program

The goal of the newly introduced direct payments for Korean rice industry is to compensate for the income loss resulting from the elimination of government purchasing program which served as market price support in such a manner as not distorting rice market. This program consists of two types of direct payments, i.e., fixed and variable direct payments. The nature of fixed payment is like lump-sum transfer whereas variable payment is price-dependable.

The fixed payment is provided based on the fixed land area on which rice had been grown during the past three years 1998-2000. This payment is given without any prerequisites on rice production as long as producers are eligible for this requirement. Any farmers who own farmland which had been used for rice production during the past three years above can receive this payment regardless of producing rice currently or in the future. The payment is not linked to production of any crop. The land can even be idled. The amount of 600,000 won per hectare is given as fixed payment. All that farmers have to do is to maintain the farmland as it has been in an environment-friendly manner by keeping water on it.

The second type is variable direct payment which is linked directly and indirectly to rice production. To receive this payment farmers have to produce rice on the farmland suitable for fixed payment described above. Actual payment occurs when some condition is fulfilled that market price falls substantially below predetermined target price. If market price of rice is lower than the target price, some part of the gap between these two prices is compensated by variable payment. Farmers receive the additional amount of money as variable direct payment when market price is so low that fixed direct payment is short of 85% of the difference between target price and market price. Government sets a target price which is normally higher than market price. If it is small enough to be fully covered by fixed payment no variable payment is financed.

But if market price is so low that fixed payment is not enough to cover the amount of 85% of the price gap, variable direct payment is additionally given to farmers so as to fully compensate for the amount.

Currently, the target price is set at 170,000 won/80kg. Rice price is usually measured by the unit of g*ama*, which is equivalent to 80kg. Yield is fixed for this program as 61 g*ama* per hectare (4,880 kg/ha) which is annual average yield during the recent five years. Therefore, the amount of fixed payment 600,000 won/ha is equivalent to 9,836 won/80kg in terms of variable payment. When 85% of the gap between target price and market price exceeds 9,836 won/80kg the variable direct payment is provided additionally. Consequently, under the current direct payment program, eligible farmers can receive the market price plus 85% of the difference between target and market prices.

2.2 Analytical Model

Under the current direct payments program, profit for a representative farmer who is price-taker can be expressed as:

(1) $$\pi = pq + rx_o + \left(\theta(\hat{p} - p) - \frac{r}{Y} \right) q - wx$$

where p is market price which is random variable and determined in a closed economy. $E(p) = \overline{p}$ and $Var(p) = \sigma^2$. Production function is assumed to depend only on land x, i.e. $q = q(x)$. Production is also stochastic variable, the nature of which risk is assumed multiplicative, i.e. $q = \delta \overline{q}$, where $E(\delta) = 1$ and $Var(\delta) = \sigma_q^2 = \frac{Var(q)}{\overline{q}^2}$. r is the amount of fixed payment per hectare for the total land area x_o which were used for rice production during 1998-2000, and hence are fixed. θ is the rate of support ranging from 0 to 1 $(0 \le \theta \le 1)$. $\hat{p}$ is a predetermined target price which is normally higher than market price. Y is an average yield per hectare for the land applied to direct payments and is assumed fixed. Since q is a function solely of land x and Y is fixed, production here can also be expressed as $q = xY$. Therefore, r/Y becomes fixed direct payment per *gama*(80kg). w is price of factor (land).

Producers receive rx_o as fixed direct payment and $(\theta(\hat{p} - p) - r/Y)q$ as variable direct payment unless $\theta(\hat{p} - p) \le r/Y$. It is assumed here that $\theta(\hat{p} - p) - r/Y \ge 0$. Here it is also assumed, without loss of generality, that the choice variable x is not greater than x_o, i.e.

$x \le x_o$. The quantity produced for variable payment is determined by the area planted with fixed yield (xY), which is in turn to be multiplied by its unit price per *gama* to calculate total amount of variable direct payment. The actual quantity produced may differ from it because actual yield each year may be different from average yield Y, which is fixed for the program, due to uncertainty such as weather conditions. However, since actual yield as a whole will be equal to Y on average, it is assumed here that actual production is equal to the production for variable direct payment.

Risk-averse producer will then maximize the von Neumann-Morgenstern's expected utility of profit under price uncertainty as follows.

(2) $$Max \;\; EU(\pi) = EU\left(pq + rx_o + \left(\theta(\hat{p} - p) - \frac{r}{Y} \right) q - wx \right)$$

In this study, however, producer is assumed to maximize certainty equivalent of the profit without introducing specific utility function as is the case in OECD(2004). With concave utility function for risk-averse preference, certainty equivalent profit $(\hat{\pi})$ can be expressed as:

(3) $$\hat{\pi} = E(\pi) - \rho = \bar{\pi} - \rho$$

The risk premium ρ is approximately measured as follows using Taylor series expansion (Newberry and Stiglitz, 1981).

(4) $$\rho = \frac{1}{2} A \cdot Var(\pi) = \frac{1}{2} \frac{R}{\bar{\pi}} Var(\pi)$$

where A and R are coefficient of absolute risk aversion and coefficient of relative risk aversion, respectively, i.e. $A = -\frac{U''(\pi)}{U'(\pi)}$, $R = -\frac{\pi \cdot U''(\pi)}{U'(\pi)}$. Then, certainty equivalent profit can be expressed as follows for the two cases, constant absolute risk aversion (CARA) and decreasing absolute risk aversion (DARA).

(5) $$\hat{\pi} = \bar{\pi} - \frac{1}{2} A \cdot Var(\pi) \qquad \text{for CARA}$$

$$= \bar{\pi} - \frac{1}{2} \frac{R}{\bar{\pi}} Var(\pi) \qquad \text{for DARA}$$

Risk tends to decline as income rises so that the assumption of decreasing absolute risk aversion will be more realistic. Constant relative risk aversion is associated with decreasing absolute risk aversion assumption. Both DARA and CARA cases will be examined in measuring the degrees of decoupling for the direct payments program.

Expected value and variance of profit under price and quantity uncertainties are derived as follows, respectively.

(6) $$E(\pi) = (1-\theta)\overline{q}E(p\delta) + \left(\theta\hat{p} - \frac{r}{Y}\right)\overline{q} + rx_o - wx$$

(7) $$Var(\pi) = \overline{q}^2\left[(1-\theta)^2 Var(p\delta) + \left(\theta\hat{p} - \frac{r}{Y}\right)^2 Var(\delta) + 2(1-\theta)\left(\theta\hat{p} - \frac{r}{Y}\right)Cov(p\delta,\ \delta)\right]$$

From (5) using equations (6) and (7), first order condition is obtained under constant absolute risk aversion as:

(8) $$\frac{d\overline{q}}{dx} = \frac{w}{(1-\theta)E(p\delta) + \left(\theta\hat{p} - \frac{r}{Y}\right) - A\overline{q}z}$$ for CARA

where

$$z = \left[(1-\theta)^2 Var(p\delta) + \left(\theta\hat{p} - \frac{r}{Y}\right)^2 Var(\delta) + 2(1-\theta)\left(\theta\hat{p} - \frac{r}{Y}\right)Cov(p\delta,\ \delta)\right]$$

Since this condition always holds at optimal point, following expression can also be obtained by solving it for $\overline{q}$.

(9) $$\overline{q}^* = \frac{1}{Az}\left[(1-\theta)E(p\delta) + \left(\theta\hat{p} - \frac{r}{Y}\right) - \frac{w}{d\overline{q}/dx}\right]$$ for CARA

The expected rice production depends on various factors as seen above. It is directly affected by not only risk and uncertainty-related variables but direct payment-related variables as well. Without the program, the output would be $\overline{q}^* = \frac{1}{A \cdot Var(p\delta)}\left[E(p\delta) - \frac{w}{d\overline{q}/dx}\right]$. Here,

$\frac{w}{d\bar{q}/dx}$ is regarded as marginal cost at optimal point.

Similar procedure for the DARA assumption yields following first-order condition.

(10) $$\frac{d\bar{q}}{dx} = \frac{\left(1+\frac{R}{2}\frac{k^2}{\bar{p}^2}z\right)w}{\left[(1-\theta)E(p\delta)+\left(\theta\hat{p}-\frac{r}{Y}\right)\right]\left(1+\frac{R}{2}\frac{k^2}{\bar{p}^2}z\right)-\frac{R}{\bar{\pi}}\bar{q}z}$$ for DARA

where $k = \frac{\bar{p}\bar{q}}{\bar{\pi}}$ which is assumed to be constant at equilibrium. This first-order condition always holds at optimal production with optimal use of input. Hence, by solving equation (10) for $\bar{q}$ we can obtain the optimal production as follows.

(11) $$\bar{q}^* = \frac{\bar{\pi}}{Rz}\left[(1-\theta)E(p\delta)+\left(\theta\hat{p}-\frac{r}{Y}\right)-\frac{w}{d\bar{q}/dx}\right]\cdot\left(1+\frac{R}{2}\frac{k^2}{\bar{p}^2}z\right)$$ for DARA

Under DARA assumption, the parenthesis term on the right-hand side is added compared with CARA case. Without direct payment program, it would be $\bar{q}^* = \frac{\bar{\pi}}{R\cdot Var(p\delta)}\left[E(p\delta)-\frac{w}{d\bar{q}/dx}\right]\cdot\left(1+\frac{R}{2}\frac{k^2}{\bar{p}^2}Var(p\delta)\right)$.

To calculate the degree of decoupling, fully decoupled output $(\bar{q}_o)$ and fully coupled output $(\bar{q}_1)$ are defined. Fully decoupled output is obtained by setting θ and r to zero ($\theta = r = 0$) under closed economy, which is the output without program. Fully coupled output is obtained when $\theta = 1$ and $r = 0$, which is considered the equivalent output resulting from price support program with its support price set at target price $\hat{p}$. Then the degree of decoupling (DD) for the rice direct payment program can be calculated as follows.

(12) $$DD = 1-\frac{\bar{q}^*-\bar{q}_o}{\bar{q}_1-\bar{q}_o}$$

Complex expressions stemming from uncertainty are included in optimal output equations. Now suppose that λ is correlation coefficient between price and quantity produced, i.e.

$\lambda = \frac{Cov(p, q)}{\sigma\sigma_q} = \frac{\bar{q}\,Cov(p, \delta)}{\sigma\sigma_q}$. Then following expressions will hold, which will be used to facilitate computing the degrees of decoupling (see Newbery and Stiglitz (1985) Ch. 13 and Appendix therein).

(13) $$E(p\delta) = \bar{p}\left(1 + \lambda \frac{\sigma}{\bar{p}} \sigma_q\right)$$

(14) $$Var(p\delta) = \bar{p}^2 \left[\left(\frac{\sigma}{\bar{p}}\right)^2 + 2\lambda \frac{\sigma}{\bar{p}} \sigma_q + \sigma_q^2 + (1 + \lambda^2)\left(\frac{\sigma}{\bar{p}}\right)^2 \sigma_q^2\right]$$

(15) $$Cov(p\delta, \delta) = \bar{p}\left(\sigma_q^2 + \lambda \frac{\sigma}{\bar{p}} \sigma_q\right)$$

III. Empirical Analysis

3.1 Data and Calibration for risk aversion coefficients

In this chapter, *ex ante* simulation is conducted to see the degree of decoupling for the Korea's direct payment in rice industry. Past four years from 2001 to 2004 before the implementation of direct payment program is used for base year for empirical examination. Data, most of which are obtained from *Major Statistics on Agriculture and Forestry* by the Ministry of Agriculture and Forestry, are summarized in Table 1. The average rice production per farm is 5.1032 ton (63.75 *gama*). Monthly market prices during this period were used to calculate average rice price, variance and coefficient of variation. Data for these price variables are obtained from the database of *Korea Agro-Fisheries Trade Corporation*. They are computed as $\bar{p} = 161{,}637$ won/80kg, $Var(p) = 17{,}361{,}614$ and $CV(p) = 0.025778$. Average yield per hectare is assumed 4,880kg (61 *gama*).

Assuming that marginal and average products of land are the same, rice yield per hectare is used for the proxy of $d\bar{q}/dx$ as rice production can also be approximated from $q = xY$. Land is only input used in this model so that total cost is equal to land cost. Since total cost per hectare is 5,614,490 won, $\frac{w}{d\bar{q}/dx} = 92{,}040.8$ won/80kg. This is equivalent to marginal or average cost in this study. Therefore, profit at equilibrium per *gama* is automatically estimated as 69,596.2 won (Table 2).

Using these data, the absolute and relative coefficients of risk aversion are estimated, respectively, as $A = 0.0000036$ and $R = 31.9$ by calibrating the model at base year production with $\theta = r = 0$ (Table 2). These figures differ from previous empirical work (Kwon, 2002) where average A and R are estimated as 6.26×10^{-7} and 3.198, respectively.

[Table 1] Summary of Historical Data Used

Variables	Descriptions	Values
$\bar{p}$	Average market price	161,637 won/80kg
$\hat{p}$	Target price for direct payments program	170,000 won/80kg
$\bar{q}$	Average rice production per farm household	5.1 ton (63.75 *gama*)
r	Amount of fixed payments per hectare	600,000 won/ha
Y	Average rice yield applied to direct payments program	4,880kg (61 *gama*)
r/Y	Amount of fixed payments per *gama*	9,836 won/80kg
$\bar{\pi}$	Average profit per farm household from rice production	4,436,758 won/farm (69,596 won/*gama*)
w	Average production cost per hectare	5,614,490 won/ha

[Table 2] Summary of the Estimated Data for Empirical Analysis

Variables	Descriptions	Values
$\sigma^2(\sigma)$	Variance (standard deviation) of market price	17,361,614(4,167)
$\sigma/\overline{p}$	Coefficient of variation for market price	0.025778
$\sigma_q^2(\sigma_q)$	Variance (standard deviation) of δ	0.0006938(0.08329)
$Cov(p,q)$	Covariance between price and production	67,807.42
λ	Correlation coefficient between price and production	0.93
$\frac{w}{d\overline{q}/dx}$	Marginal (average) cost of rice production	92,040.8 won/gama
$E(p\delta)$	Expected value of $p\delta$	161,960
$Var(p\delta)$	Variance of $p\delta$	303,191,000
$Cov(p\delta,\delta)$	Covariance between $p\delta$ and δ	1,444.189
z	-	-
$k\left(=\frac{\overline{pq}}{\overline{\pi}}\right)$	Ratio of revenue to profit	2.322497
A	Coefficient of absolute risk aversion	0.0000036
R	Coefficient of relative risk aversion	31.9

3.2 Production effects and Degrees of Decoupling

Table 3 shows the *ex ante* simulation results of the degrees of decoupling for Korea's rice direct payment program under the current target price at 170,000 won/80kg and $r/Y = 9{,}836$ won/80kg. Simulation is conducted by varying θ between 1.0 and 0.5, assuming that the average market price is expected to remain at 153,000 and 136,000 won/80kg. Degrees of decoupling under uncertainty for CARA and DARA cases are also compared with previous work (Lee, 2005) which was done under deterministic environment without considering risk factors. Degree of decoupling by his simple model is calculated by following expression.

(16) $$DD = 1 - \left(\theta - \frac{r/Y}{\hat{p} - \bar{p}} \right)$$

Under the current support level of $\theta = 0.85$, the degrees of decoupling turn out to be significantly low, ranging between 0.208 and 0.234 for CARA case and between 0.303 and 0.367 for DARA case when market prices are expected to move at 136,000 – 153,000 won/80kg, on average. This can be interpreted as current direct payment program substantially affecting rice production. No significant differences in degrees of decoupling are found depending on the levels of expected market prices. Even under very low market prices being assumed like 136,000 won/80kg the results are not significantly different from those with fairly high market price of 153,000 won/80kg. This is because the high target price and θ play a key role to strongly support rice prices received by producers no matter how low market prices fall.
Degrees of decoupling under DARA assumption tend to be larger than those under CARA assumption. This tendency becomes more conspicuous as support level θ becomes larger. Compared with the results in this study, the results of previous work are much higher.

If $\theta = 1.0$, degree of decoupling under CARA is nearly zero, implying that production effects of direct payment program is as strong as price support policy while that of previous work is fairly high. Moreover, according to the previous results, there exist big differences in degrees of decoupling depending on market price levels, which should not be the case as discussed above. When θ declines to 0.5, the degrees of decoupling rise up to higher than 0.6, reaching even 0.756.

Now, the same simulation is conducted under the assumption that fixed payment is increased to $r/Y = 15{,}000$ won/80kg, of which results are shown in Table 4. The increase in fixed direct payment lead to the fall in degrees of decoupling as is expected. However, the production effects is relatively small even though it has increased more than 1.5 times the current level of 9,836. This implies that the increase in the share of fixed payment does not play an important role in reducing production as long as current variable direct payment scheme is in place, because current direct payment program with high target price provides minimum rice price for producers as high as 1445,000 won/80kg, for instance, with $\theta = 0.85$.

Table 5 shows the simulation results under the assumption of $r/Y = 0$. No fixed payment is paid in this case. Production effects become significantly worse as is indicated by lower degrees of decoupling. In this case, the production effects of direct payment program with $\theta = 1.0$ become exactly the same as price support program as degrees of decoupling are all zeroes. However, as θ decreases degrees of decoupling become larger. Two interesting points are found in this case. The degrees of decoupling under DARA assumption are smaller, although not significant, than those of CARA case, which is reversed compared with Table 3 and 4. One possible interpretation can be attributable to the income effect. Fixed payment, unlike variable one, is believed to have income or wealth effect under uncertainty. As income effect disappears with r/Y approaching zero, the difference in production effects between CARA and DARA cases becomes smaller. Another point is that both results of this study and previous one get very close each other in this case as is seen in the Table.

[Table 3] Degrees of Decoupling for the Korea's Rice Direct Payments Program ($r/Y = 9{,}836$)

θ	$\overline{p}$	Risk Averse		Previous Work
		CARA	DARA	
1.00	153,000	0.037	0.183	0.579
	136,000	0.033	0.139	0.289
0.95	153,000	0.104	0.245	0.629
	136,000	0.092	0.194	0.339
0.90	153,000	0.170	0.307	0.679
	136,000	0.150	0.248	0.389
0.85	153,000	0.234	0.367	0.729
	136,000	0.208	0.303	0.439
0.80	153,000	0.296	0.426	0.779
	136,000	0.265	0.358	0.489
0.75	153,000	0.357	0.484	0.829
	136,000	0.323	0.412	0.539
0.70	153,000	0.416	0.541	0.879
	136,000	0.380	0.466	0.589
0.65	153,000	0.473	0.596	0.929
	136,000	0.436	0.520	0.639
0.60	153,000	0.529	0.651	0.979
	136,000	0.493	0.574	0.689
0.55	153,000	0.584	0.704	1.029
	136,000	0.549	0.628	0.739
0.50	153,000	0.637	0.756	1.079
	136,000	0.605	0.681	0.789

[Table 4] Degrees of Decoupling for the Korea's Rice Direct Payments Program ($r/Y = 15{,}000$)

θ	$\bar{p}$	Risk Averse		Previous Work
		CARA	DARA	
1.00	153,000	0.068	0.287	0.882
	136,000	0.061	0.217	0.441
0.95	153,000	0.138	0.352	0.932
	136,000	0.123	0.275	0.491
0.90	153,000	0.206	0.415	0.982
	136,000	0.185	0.332	0.541
0.85	153,000	0.272	0.477	1.032
	136,000	0.246	0.388	0.591
0.80	153,000	0.337	0.538	1.082
	136,000	0.307	0.445	0.641
0.75	153,000	0.400	0.597	1.132
	136,000	0.368	0.501	0.691
0.70	153,000	0.461	0.655	1.182
	136,000	0.429	0.558	0.741
0.65	153,000	0.520	0.712	1.232
	136,000	0.489	0.614	0.791
0.60	153,000	0.578	0.768	1.282
	136,000	0.549	0.669	0.841
0.55	153,000	0.634	0.822	1.332
	136,000	0.608	0.725	0.891
0.50	153,000	0.689	0.876	1.382
	136,000	0.667	0.781	0.941

[Table 5] Degrees of Decoupling for the Korea's Rice Direct Payments Program ($r/Y = 0$)

θ	$\overline{p}$	Risk Averse		Previous Work
		CARA	DARA	
1.00	153,000	0.000	0.000	0.00
	136,000	0.000	0.000	0.00
0.95	153,000	0.063	0.059	0.05
	136,000	0.052	0.051	0.05
0.90	153,000	0.124	0.117	0.10
	136,000	0.104	0.103	0.10
0.85	153,000	0.183	0.174	0.15
	136,000	0.156	0.154	0.15
0.80	153,000	0.241	0.230	0.20
	136,000	0.208	0.205	0.20
0.75	153,000	0.298	0.285	0.25
	136,000	0.260	0.256	0.25
0.70	153,000	0.353	0.339	0.30
	136,000	0.311	0.306	0.30
0.65	153,000	0.407	0.392	0.35
	136,000	0.362	0.357	0.35
0.60	153,000	0.460	0.444	0.40
	136,000	0.412	0.407	0.40
0.55	153,000	0.511	0.495	0.45
	136,000	0.463	0.458	0.45
0.50	153,000	0.561	0.545	0.50
	136,000	0.513	0.508	0.50

The decoupling-related problems are drawing much attention recently, especially in the arena of the WTO trade negotiations as the reduction of domestic supports becomes one of the most important issues in the Doha Development Agenda talks. The AoA demands that the production effects of domestic supports be zero or 'at most minimal' in order for them to be exempted from reduction commitments. Then, question is how can we use and interpret the resulting degrees of decoupling to judge the 'at most minimal' criterion. In other words, what is the dividing line between Green and Blue Box categories in terms of the degree of decoupling expressed as some numbers normally ranging between 0 and 1.

The greater the degrees of decoupling, the closer approaches the direct payment program to Green Box category, i.e. “at most minimal” production effects. However, it seems too arbitrary to draw clear dividing line in terms of calculated degrees of decoupling to distinguish between Green and Amber Boxes, although not impossible. Based on the overall *ex ante* simulation results above, current direct payment program for Korea’s rice industry with target price of 170,000 won/80kg and the rate of support of 85% could not be safely included in Green Box category. This study also shows that the increase in the share of fixed payment may not be a good solution as long as variable payment with high target price exists. If the government wishes to adapt Korea’s rice industry to market-oriented system as is in the Green Box criteria of AoA, current variable direct payment may need to be replaced by fixed payment, or at least be substantially weakened by reducing target price and/or the rate of support along with the increase in fixed payment. But this would not avoid another problem of how to maintain domestic production of rice.

IV. Conclusions

The purpose of this study is to estimate the degrees of decoupling for the direct payments program newly introduced in Korea’s rice industry to see whether it can fall under the Green Box category of AoA or not. First, structural characteristics of the program are examined briefly to be captured in the model. This program is characterized by the two different types of direct payments, fixed and variable ones, combined together in it.

It is assumed here that risk-averse producer maximizes certainty equivalent profit under uncertainty instead of specifying empirical utility function. To calculate the degrees of decoupling, optimal outputs are found for CARA and DARA cases from the maximization problem of certainty equivalent profit using risk premium.

Ex ante simulations were conducted to identify production effects and estimate the degrees of decoupling by varying the rates of support and fixed payments. The results show that there is high possibility that current direct payment program has substantial effects on rice production, being unable to meet Green Box requirement due to variable direct payment. For the variable direct payment, unlike fixed payment, the target price set higher than market price is directly linked to payment, boosting market prices that producers receive. The increase in the share of fixed payment helps ease production effects. But its effect would be limited as minimum price could be provided by variable payment depending on the target price level and the rate of support. For the current direct payment program to be in full harmony with Green Box criteria, it would be necessary to replace the variable payment with fixed payment along with the increase in fixed payment. However, this choice does not seem to be plausible in the foreseeable future for Korea seeking to maintain certain level of domestic rice production.

To make this study more interesting and practically useful, further research is necessary with more sophisticated methodology. Disaggregation of insurance and wealth effects of the total production effects along with the examination of risk-reducing effects of the program can be a useful theme associated with this study as a future research direction. Also, such study needs to be conducted within a dynamic framework using specific utility function.

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