HAPPINESS AND PROFITABILITY UNDER PHILIPPINE RICE TARIFFICATION LAW: REGRESSION AND *K*-MEANS CLUSTERING APPROACH

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Abstract

Good economic profitability in rice farming is known to have a positive influence on the happiness or well-being of farmers. This study investigated the relationship between profit and happiness of rice farmers in Leyte, Philippines under the carrying out of Rice Tariffication Law (RTL) in the country. The study employed cross-sectional and secondary data from an existing study from rice farming literature that measures the profit and corresponding happiness of a farmer in one cropping season. Regression modeling was used to elucidate the correlation between profit and happiness, and K-means clustering was employed to categorize a group of farmers that have more or less the same characteristics. Results showed that, on average, profit and happiness are relatively low during the implementation of RTL. The bivariate linear regression model has shown that there is a positive relationship between profit and happiness. This implies that as profit increases, the happiness of a farmer also increases. In addition, the logistic regression has revealed that the likelihood of a farmer being happy increases by 0.324% when the profit increases by 1%. Moreover, the ordered logistic regression has shown that as profit increases by 1%, farmers' log odds of being happy increase by 0.0129. Furthermore, by K-means clustering, the dominant of the farmers (45.76%) are grouped as low profit and happiness, and only 7.91% are categorized as high profit and happiness under RTL. Hence, the study recommends that the Philippine government must subsidize the local farmers' needs to increase their economic profit and improve their well-being as a farmer.

Key words: *happiness, economic profit, rice tariffication law, regression model, k-means clustering*

INTRODUCTION

Happiness is not only defined as the individual's conditions of economic prosperity but also refers to the condition of a great and meaningful life [7], [8], [24]. Measuring happiness is scrutiny of subjective well-being and meaning of life of an individual and it is highly studied in the area of social sciences. In particular, there are researches in economics that deals with the relationship between happiness and income [9], [10], [11], [19], [23]. In fact, some social scientists are puzzled about the correlation between these two variables since their relationship is very dynamic across different demographic profiles and life management [12], [19], [21]. On the face of it, happiness research is considered intriguing and interesting to social scientists due to its fluctuating behavior as a function of income inequality. Apparently, studying the economic predictors of happiness will understand the nature of an individual's well-being which is a function of different life events and life profiles [12].

In particular, in the study of Kumar et al. [13], income and satisfaction in life events are strong predictors of farmers' happiness. Income or profit is the main reason why an individual is motivated to work. In fact, good business performance is determined by higher economic profitability. However, during the time that Rice Tariffication Law (RTL) was implemented in the Philippines, profitability (or income) and satisfaction in rice farming has an inverse effect on each other [4]. This means that a farmer with a high income tends to be more unhappy due to corresponding high agricultural expense that leads them to access credit. Apparently, the country Philippines is an agricultural economy where rice is the main crop and main source of income for many Filipinos. In fact, the Philippine government is focusing on the agricultural sector, especially for rice as

Filipinos' main staple food to progress by making programs and laws, and one of them is RTL. RTL was issued in the year 2019 and was destined to lift the import restriction of rice in the country [4], [20], [25]. The main purpose of RTL is to allow the importation of rice to meet the required supply for all Filipinos which offer customers rights and affordable rice prices, especially to the poor [3].

However, the rice output price in the country has lower down due to the high supply. In that case, rice farmers' profitability is adversely affected as well as their well-being or happiness in farming. The most affected by RTL are small-scale (poor) farmers in the rural areas of the country. According to the paper of Briones [2], RTL is worsening the income inequality in the Philippines where rice farmers are experiencing economic poverty. In fact, there are studies in rural areas in the Philippines that rice farmers are having a hard time compensating for their expenses in farm inputs due to the low marketability profit of rice outputs [3], [4], [20]. In addition, aside from the low price of rice outputs, farmers are also facing difficulties in acquiring agricultural inputs since their prices are also rising over time [4], [6].

Although the investigation of happiness and profitability is well-research in the economics literature, however, the relationship between these two variables concerning rice farmers experiencing the implementation of RTL in the Philippines has never been done. In fact, elucidating the association of the said variables using the regression analysis and K-means clustering approach is scarce. In light of it, this correlation study is realized. Generally, the purpose of this study is to explain the features of the relationship between happiness scale and profitability in rice farming under RTL in Leyte, Philippines. Specific objectives are as follows: (1) construct a regression model for happiness and profitability of rice farmers in one cropping season under RTL, and (2) create clusters or groups with the same characteristics in regards to the correspondence between happiness and profitability in rice farming under RTL using K-means clustering approach. The significance of this study is to provide richer information that may help policy-making bodies in the government in improving the productivity and well-being of small-scale rice farmers in the Philippines.

MATERIALS AND METHODS

In this study, a complex-correlational research design was employed to elucidate the influence of the level of profitability in rice farming on the happiness of farmers. The study considered secondary data from the study of Casinillo and Seriño [6]. The study deals with predicting the determinants of happiness using econometric modeling, however, it does not focus on the effect of profit on the subjective well-being (happiness scale) of farmers under the RTL, particularly, in Leyte, Philippines. In that case, the following variables were considered: (1) happiness (scale of 1 to 10) and (2) profit in one cropping season under the implementation of RTL (in PHP). Table 1 presents the interval happiness perception scores and their corresponding verbal description.

Table 1. Happiness perception scores and their verbal description

Perception Score	Description
1.00 - 2.80	Not Happy
2.81 - 4.60	Slightly Happy
4.61 - 6.40	Moderately Happy
6.41 - 8.20	Happy
8.21 - 10.00	Very Happy

Source: Authors' own guidelines (2022).

Moreover, the study employed 177 respondents in Leyte, Philippines as small-scale (mean paddy farm area is 0.71 hectare) rice farmers that have experienced the effect of RTL in the remote area of the country.

As for data analysis, the study dealt with regression modeling to determine the association of the said two variables. Henceforth, the regression model can be written as:

$$\text{Happiness}_i = \partial_1 + \partial_2 \log(\text{profit} + 1)_i + \varepsilon_i$$

where: Happiness$_i$ refers to the level of happiness (scale of 1 to 10), log (profit + 1)$_i$ refers to the logarithm (base of 10) of profit (in PHP) plus 1 (normalized), $i = 1, ..., n$ and n refer to the number of rice farmers, ∂_1 and ∂_2 refers to the parameters to be approximated and ε_i captures the remaining random error in the model. Firstly, ordinary least square (OLS) regression was considered as the dependent variable happiness scale (1-10) was used. The OLS model will approximate the increase (or decrease) of the happiness level as the profit increases (or decreases) [22].

Secondly, the binary logistic model was constructed by transforming the dependent variable as follows: 0 - not happy (scale of 1 to 5) and 1 - happy (scale of 6 to 10). The logistic model determined the association between dependent and independent variables in terms of the log of odds [17]. Additionally, in the binary logistic model, the marginal effect was computed to determine the probability of binary outcome (dependent variable) change as the predictor also changes [18]. Thirdly, the ordered logistic model was also employed by decoding the dependent variable as follows: 0 - not happy (scale of 1 to 3), 1 - moderately happy (scale of 4 to 6), and 2 - very happy (scale of 7 to 10). This model also elucidates the relationship between dependent variables (ordinal categories) and their predictors concerning the ordered log-odds scale[17], [22].

Moreover, the K-means clustering method was used to cluster or group that data set into similar categories. This approach aims to partition a data set of observations (correspondence between happiness scale and profit in PHP) into different clusters (K). Note that the K-means clustering approach uses centroids, that is, the K different random points in the data were assigned to clusters with the nearest centroid.

As for optimizing the value of K, the approach uses the sum of squared errors or variation by comparison [14], [15].

All statistical calculations and graphs are done with the aid of software programs called STATA and R-statistics.

RESULTS AND DISCUSSIONS

This section discusses the behavior of the relationship between happiness and profitability of rice farming as an influence of RTL. The correlation of these two variables is vital in rice production as well as the farmers' efficiency and well-being. Perhaps, elucidating the relationship between these two variables may suggest a plan of action or policy that will improve or modify the promulgated RTL in the country which favors the affected and poor rice farmers. Figure 1 presents the scatter plot of subjective happiness (Scale of 1 to 10) and economic profit in rice farming for one cropping season (in PHP). The graph shows that the impact of RTL on the well-being of farmers is somewhat negative showing a low level of happiness which corresponds to low economic profit for most of the farmers.
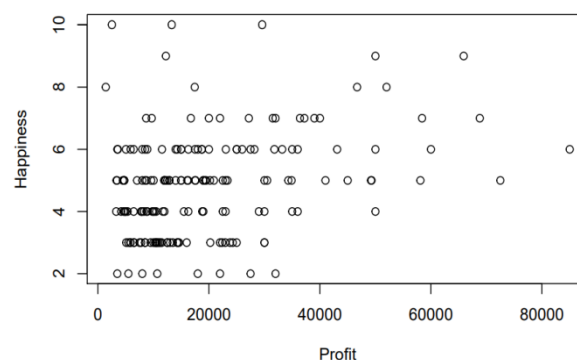

Fig. 1. Scatter plot for happiness and profit of farmers
Source: Authors' own construction based on data (2022).

This means that farmers' well-being is adversely affected by low prices of rice outputs due to the volume of imported supply brought by the RTL [20]. According to Calicdan et al. [3] and Casinillo [4], most of the small-scale rice farmers' well-being is negatively affected because of low income from rice production during the implementation of RTL. This is because several of the rice farmers in the rural areas are not supported by the Philippine government concerning their farm inputs while suffering from low prices of outputs [25]. Hence, Fig. 1 only shows a few rice farmers that are happy during the promulgated RTL in the country. Table 2 shows that the

mean subjective happiness of rice farmers is considered low (4.85 out of 10) (SD=1.67), in particular, it can be interpreted as "moderately happy" based on Table 1. In addition, the average profit of farmers in one cropping season is close to PHP 19,607.70 (SD=15,222.69) and is considered relatively low as opposed to no existing RTL in the country. This result is parallel to the study of Casinillo and Seriño [6] which stated that the actual happiness in rice farming is low compared to their expected happiness under the RTL. It is worth noting that in some studies, happiness or well-being is directly related to income and productivity [4], [10], [19], [23]. In other words, the happiness of an individual is dependent on their economic gain and satisfaction as being productive in their work. Moreover, the result suggests that lower income (or profit) is associated with the worst feeling (stress) and not being satisfied with their life experiences [10], [21].

Table 2. Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Happiness[a]	4.85	1.67	2	10
Profit[b]	19,607.70	15,222.69	516	85,000

Note: a - Scale of 1 to 10, b - one cropping season (in PHP)
Source: Authors' own calculation based on data (2022).

Regression analysis
Regression analysis was constructed to explain the behavior of the relationship between happiness and profitability of rice farmers. However, before the interpretation of the constructed regression models, diagnostic tests were employed first. In that case, the model is considered heteroscedastic by the Breusch-Pagan test (χ^2 =8.26, p-value=0.0041). Hence, the model is corrected using the robust command in STATA to have the constant residuals in the model and eliminate the biased caused by standard errors [5]. With the aid of the Shapiro-Wilk test, it has been shown that the OLS model's residuals are not normal (W=0.96, p-value<0.001). However, the graph of Kernel density estimate for residuals in the model and the normal density is almost the same as shown in Figure 2, that is, the residuals of the regression model are almost normal [22]. On the face of it, the regression models are valid

for concluding the relationship between happiness and profitability of rice farmers under the promulgated RTL as shown in Table 3.
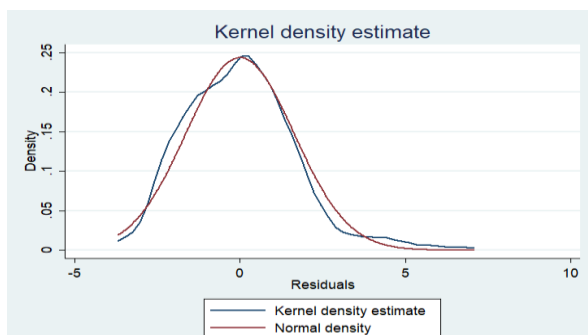

Fig. 2. Kernel density estimate and normal density for residuals
Source: Authors' own construction based on data (2022).

Fig. 3 (happiness versus actual profit) and 4 (happiness versus normalized profit) show that the regression line is increasing in nature. This implies that as profit increases, the happiness or well-being of a farmer will also increase. In other words, the happiness of a farmer that is associated with productivity is directly proportional to the economic profit which they get through farming. It is worth noting that income (or profit) will bring benefits and comfort to the farmers' families [6]. In fact, several studies in the literature have studied the relationship between happiness and income, in which they found a positive relationship between the two variables [6], [9], [11].
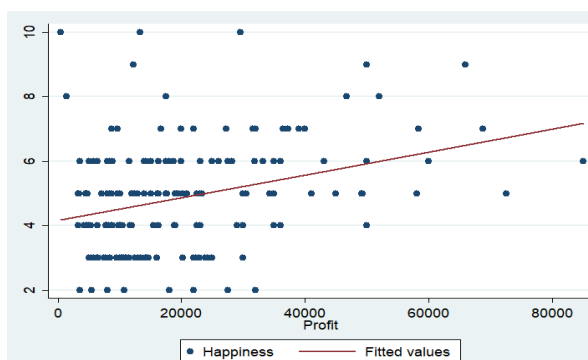

Fig. 3. Regression line as fitted values to the actual values of profit
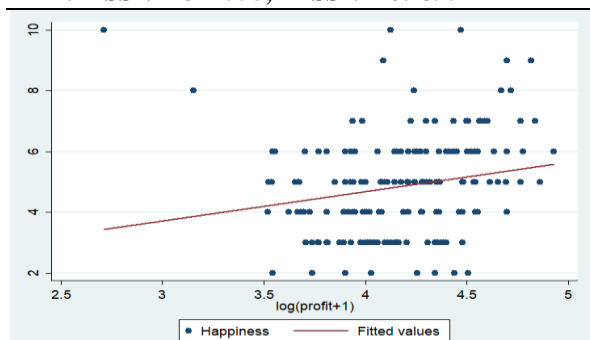Source: Authors' own construction based on data (2022).

Fig. 4. Regression line as fitted values to the normalized profit
Source: Authors' own construction based on data (2022).

Table 3 reveals that OLS model is significant at 10% level (F_c=2.76, p-value=0.098). Additionally, it reveals that economic profitability is a significant predictor of the happiness of a farmer under the implementation of RTL at a 10% level. This implies that as profit increases by 1%, there is a significant increase of 0.0096 in the level of happiness in farming. In that case, farmers' well-being and motivation are to maximize their profit and improve their productivity in the paddy farm. This finding is parallel to the existing studies on the economics of happiness that income (or profit) is a significant predictor of an individual's subjective happiness [1], [7], [9]. The goodness of fit indicates that only 4% of the variability in the response variable is explained by the model. This low increment in happiness in relation to their economic profit can be explained by the effect of RTL. In the study of Casinillo [4], farmers have low satisfaction in their work due to the low marketability price of rice outputs and expensive agricultural inputs. Moreover, the binary logistic model is significant at a 1% level (χ^2=9.19, p-value=0.002). This implies that profit as a predictor of happiness is significantly influenced. In fact, the model reveals that in every 1% increase in the profit, there is a corresponding increase of 0.0151 log odds of being a happy farmer and it is significant at a 1% level. In addition, by marginal effects, the model reveals that the probability of a farmer with high profit being happy is higher by 0.324% as opposed to a farmer with low profit. In other words, a farmer who has a good profit during the

implementation of RTL is more likely to be happy. Furthermore, the ordered logit model is also significant at a 1% level. This indicates that profit is a significant predictor of (p-value=0.006) happiness.
The model depicts that as the profit increases by 1%, farmers are more likely happy. The results suggested that the main target of a farmer is a good profit that will compensate for their expenses and hard work. The same results in the existing studies in literature, the farmers' well-being (or happiness) is directly associated with their economic gain (or profit) [4], [16]. In the study of Casinillo [6], farmers must be supported by the government in relation to their agricultural needs and expenses to maintain the rice farmers' productivity in the country. In that case, farmers' economic profit will tend to increase as well as their well-being if they are supported and allocated with a budget as subsidies for farm inputs.

Table 3. Regression analysis for happiness and profitability

	OLS Model	Binary Logit Model	Ordered Logit Model
Constant	0.822ns (2.450)	-7.086** (2.214)	-
log (profit[b]+1)	0.966* (0.582)	1.510** (0.522)	1.286** (0.476)
n	177	177	177
F	2.760	-	-
χ^2	-	9.19	7.56
p-value	0.098	0.002	0.006
R^2	0.040	-	-
Pseudo R^2	-	0.041	0.023
Marginal effects	-	0.324	-

Note: b - one cropping season (in PHP); Standard errors are enclosed by parenthesis; ns - not significant; *p<0.1; **p<0.01.
Source: Authors' own calculation based on data (2022).

***K*-Means Clustering**
Table 4 shows the *K*-means clustering results with the optimal solution *K*=4. This implies that the data set can be clustered into four groups with the same characteristics. Cluster 1 shows the highest mean average of happiness (Mean=6.43) and profitability (Mean=PHP 58278.57) in rice farming in one cropping season under RTL. This group of farmers is happy (Table 1) and productive in rice farming even with the adverse effect of RTL

on the rice output marketability price. Such group of farmers are considered the least affected by RTL, or somewhat the government has supported their agricultural inputs and other expenses [3]. However, this actual happiness is significantly lower as opposed to the expected happiness in relation to the implemented RTL [6]. The second cluster represents the group of moderately happy farmers (Mean=5.41; Table 1) to their profit (Mean=PHP 33,548.28) under RTL. This type of farmer is moderately affected by the implemented RTL in which their profit and happiness are lowered compared to the previous cropping season (non-existence of RTL). As for the third cluster, farmers of this group can be interpreted as moderately happy (Mean=4.79; Table 1) which corresponds to a profit of PHP 19,170.94. Farmers of this type are approximately the same as cluster 2 (moderately happy), however, a little lower is observed due to the big difference in economic profit. The last group (cluster 4) of farmers is the most affected by RTL and can be represented as slightly happy (Mean 4.41; Table 1) farmers with an economic profit of PHP 8,218.56.

Table 4. *K*-Means clustering for happiness scale and profitability in rice farming (n=177)

Cluster (*K=4*)	Descriptive Statistics	Happiness[a]	Profit[b]
1	n	14	14
	min	4	46,700
	mean	6.43	58,278.57
	max	9	85,000
2	n	29	29
	min	2	27,200
	mean	5.41	33,548.28
	max	10	45,000
3	n	53	53
	min	2	14,000
	mean	4.79	19,170.94
	Max	8	26,000
4	N	81	81
	Min	2	516
	Mean	4.41	8,218.56
	Max	10	13,500

Note: a - Scale of 1 to 10, b - one cropping season (in PHP)
Source: Authors' own calculation based on data (2022).

This type of farmer is dominant among all farmers who experience the effect of RTL in the Philippines [2], [3], [4], [6], [20], [25].

In light of it, the happiness and profitability of rice farmers in the rural areas in the country are negatively lowered when there is a continuous importation as the government sustains the economic supply for rice.

Figure 5 depicted a graphical representation of *K*-means clustering results with different colors that categorized the different clusters or groups of farmers with the same characteristics. Only 7.9% (color green) of the farmers in Leyte are considered happy as shown in Figure 5. About 16.38% (color red) and 29.94% (color mint blue) of the farmers can be represented as moderately happy (Figure 5). Dominantly, on average, 45.76% (color blue) of these farmers are considered as slightly happy to their profit under RTL (Figure 5). Overall, the figure shows that the effect of RTL in rice farming in rural areas in the country the Philippines is adverse and has affected the well-being and productivity of farmers. This result is consistent with the existing studies in the literature [2], [4]. On the face of it, the poor farmers must be supported by the Philippine government to progress rice production in the country [26].
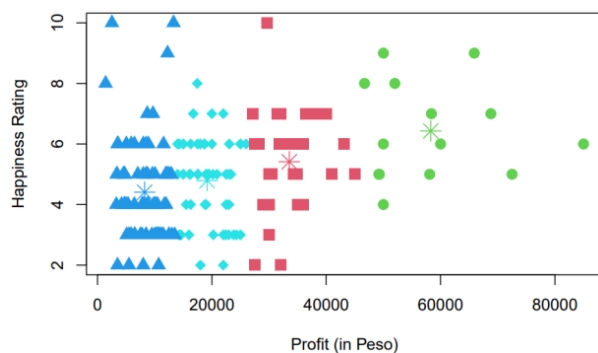

Fig. 5. *K*-means clustering results with *K*=4
Source: Authors' own construction based on data (2022).

CONCLUSIONS

The study's purpose is to elucidate the association between the happiness and profitability of rice farmers in a rural areas in the Philippines under the promulgated RTL. The study revealed that the level of happiness in rice farming during the RTL is relatively low as well as the profitability.
This implies that RTL harms farmers' productivity due to the high agricultural input

costs and low marketability price of rice outputs in the country.

The regression analysis has depicted that profitability is a significant predictor of happiness in rice farming under RTL. Additionally, it is revealed that happiness is directly associated with economic profitability. Hence, it is concluded that as profit increases, rice farmers are more likely to be happy.

However, the increase in happiness is just a little due to the low profitability in farming (one cropping season) under RTL. In addition, the *K*-means clustering has revealed that the dominant rice farmers have a low level of happiness that corresponds to a low level of profitability due to RTL and very few are in the category of happy farmers with high profit. Conclusively, the Philippine government must take an action to modify the promulgated RTL in the country that will favor the small-scale rice farmers, especially in remote areas. The government also must allocate a budget for subsidies and support to the poor farmers concerning their agricultural inputs as well as farm equipment that somehow helps their productivity and profitability under RTL. Moreover, the local government must conduct seminars and training on how to be efficient and productive (e.g. Farmer Field School) in rice farming as well as orientation about the advantages and disadvantages of the implemented RTL in the country. The study recommends that one may consider conducting a study that involves farmers' cooperatives and access to credit as a potential gap in the argument of this current study for future research.

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