MODELING PROFITABILITY IN RICE FARMING UNDER PHILIPPINE RICE TARIFFICATION LAW: AN ECONOMETRIC APPROACH

Leomarich F. CASINILLO

Visayas State University, Department of Mathematics, Visca, Baybay City, Leyte, Philippines;
E-mail: leomarichcasinillo02011990@gmail.com

Corresponding author: leomarichcasinillo02011990@gmail.com

Abstract

This research study aimed to elucidate the significant predictors of profitability in rice farming under the implementation of the Rice Tariffication Law (RTL) in the Philippines. Data from 177 rice farmers in Hilongos, Leyte, Philippines were analyzed using descriptive analysis and econometric modeling. Results showed that the profitability of rice farmers is decreasing since the implementation of RTL in the country. This happens because of a large supply of rice (imported) in the country which resulted in a decrease in farmers' produce rice marketability price. Meanwhile, the agricultural inputs during RTL are also high. The econometric model has revealed that there are only a few significant predictors of profitability in rice farming during the implementation of RTL such as leisure time (p-value=0.076), perception of government (Scale of 1 to 10; p-value<0.001), and farm assets (p-value<0.001). Conclusively, farmers must reduce their allotted time for unnecessary leisure activities and engage more in productive farming activities to increase economic profit amid the promulgated RTL. The results suggested that government support and development program is needed for the poor farmers' sustainability especially in rural areas to continue during the implementation of RTL. The local government must take an initiative to form farmers' associations and cooperatives to provide for farmers' needs and can access credit for farm inputs. Furthermore, the government must provide training and seminars for farmers concerning RTL to become aware and knowledgeable about the pros and cons of the policy.

Key words: *Rice Tariffication Law, economic profit, econometric modeling, rural areas in the Philippines*

INTRODUCTION

Economic profitability is the main target of a farmer. According to Brožová [8], profit will vary depending on the costs and revenues which are considered as main economic constituents. In the Philippines, rice production is one of the main sources of income (profit) for Filipino people in rural areas. Rice is known as "Palay" in the country and it is considered a staple food for millions of Filipinos [27]. In fact, Casinillo [12] stated that rice farming is one of the issues in the agricultural sector that is a focal point of the Philippine government to progress. Hence, the government has implemented different agricultural programs that might improve the production of rice as well as the well-being of rice farmers.

Recently, one of the government programs that intrigues a lot of agricultural economists is the Rice Tarifficationl Law (RTL). RTL is also known as landmark policy reform or Republic Act (RA) 11203 [7]. The law was signed by the Philippine president "Rodrigo R. Duterte" last February 14, 2019, that modifies the Act of 1996 which is Agricultural Tariffication [26], and was promulgated in March 2019 [4]. The purpose of this law is to liberalize the import-export and trading of rice from different countries, particularly, by lifting restrictions for imported rice to increase the supply in the Philippines [26], [18]. In other words, the main target of RTL is to increase the purchasing power of rice consumers in the country. However, the implementation of the law has become a controversial issue on how it would change the poverty and food security in the Philippines. RTL has drastically changed the landscape of the rice sector in the country and generates debates between economists and policy makers [4]. Several studies have shown that RTL decreases the rice prices for both producers and consumers which affects the production and consumption of every household in the country [4], [20], [23]. Hence, some groups of people with a

high-profile object to the implementation of RTL because of the negative impact on rice producers. In particular, some rice farmers in rural areas are adversely impacted by the Law considering that they are net sellers [12]. In that case, the negative impact of tariffication policy for rice revolves around the well-being of farmers through prices.

Accordingly, because of the low prices of domestic rice, results in low satisfaction in farming due to reduced economic profit [12], [10]. Additionally, prices of agricultural inputs are dramatically increasing and farmers are clamant for government support to sustain their rice production every cropping season [12], [20], [26]. Although the Law has mandated a fund for annual rice production as support or assistance to rice farmers, there are rural areas in the country that are not benefited from the said funding [6], [10]. On the face of it, farmers in rural areas are not satisfied with the impact of RTL on their rice production as their source of income. Hence, it is necessary to investigate some factors that might influence rice farmers' economic profit and this study is realized.

Elucidating the predictors of economic profit in rice farming under the implementation of RTL is scarce in the literature. In general, this study constructed an econometric model that predicts the significant causal factors of profit in rice production. To be specific, the study answers the following goals: (1) to summarize the socioeconomic profile of farmers; (2) to document causal factors that significantly influence the rice farmers' economic profit in one cropping season under Philippines RTL. The purpose of this study is to provide new information or policy that will improve the current law and progress the economic behavior in the country. The results of this study may also supply some suggestions that might improve the economic profit of farmers as well as well-being in farming to achieve sustainable rice production. Furthermore, the findings of this study might help as a basis for other researchers in agriculture and contribute new knowledge to rice production literature.

MATERIALS AND METHODS

Research Location

The site of this study is the rice farm land of Barangay Tabunok (Bato-Tabunok Barangay Road) Hilongos, Leyte, Philippines. In fact, Barangay Tabunok has a wide farm area for rice production and most of the residents are dependent on rice farming as a source of main income [12]. The study only considers farmers with at most 2 hectares of land area intended for rice farming alone. This is to investigate the effect of RTL on small-scale rice farmers in rural areas in Leyte, Philippines. Map 1 shows the location site where the research study is conducted.

Map 1. Location of Barangay Tabunok (Bato-Tabunok Barangay Road) Hilongos, Leyte, Philippines
Source: [16].

Sampling procedure

As for the sample size, a probabilistic sample procedure was employed. In that case, the sample size was approximated with the aid of a 95% confidence interval, where the Z computed value is equivalent to 1.96. In this study, there is a piece of limited information about the farmers, thus, we used a p=0.5 proportion as assumed. Hence, the sample size formula is given by the equation 1:

$$n_0 = \frac{Z_{\alpha/2}^2(p)(1-p)}{e^2} \qquad (1)$$

where e refers to the margin of error and it is set by the researcher as 5%. Since the population of rice farmers is known to be finite in the study site, the computed sample size was adjusted with the aid of the equation 2:

$$n = \frac{n_0}{1+\frac{n_0}{N}} \qquad (2)$$

where N is the population number of farmers. So, the number of participants for this study was 175 rice farmers. After that, simple random sampling was employed.

Research instrument and data gathering

A developed structured questionnaire was used to gather relevant data needed for this study utilizing a face-to-face interview.

The questionnaire consists of socio-demographic profile (first part) of rice farmers such as age (in years), sex (0-female, 1-male), role in the family (0-nonhead of the family, 1-head of the family), household size, years in education, civil status (0-unmarried, 1-married), leisure time (scale of 1 to 10), social relationship (scale of 1 to 10), health status (scale of 1 to 10) and perception to government (scale of 1 to 10).

The second part of the questionnaire is economic variables such as household assets (₱), monthly household expenses (₱), and farm assets (₱).

For the third part, farmers were asked how much is there total expense or cost (₱) and total revenue (₱) for one cropping season under the implementation of RTL.

And economic profit was calculated as total revenue (₱) less total expense or cost (₱). Prior to the conduct of the survey, the approval of the Barangay captain was asked and respondents were informed that the participation is voluntary.

Data analysis and empirical model

This study considered a complex correlational design to investigate the relationships between dependent variables and several independent variables using regression modeling [19]. Descriptive statistics such as minimum value (min), maximum value (max), mean (M) and standard deviation (SD) were used to summarize the data.

Multiple linear regression (econometric modeling) was employed to capture the significant predictors of profitability in farming under the implementation of RTL using the ordinary least square (OLS) model. Hence, the econometric model takes the form:

$$P_i = \beta_0 + \beta_1 age_i + \beta_2 male_i + \beta_3 h\_head_i$$

$$+\beta_4 hhsize_i + \beta_5 y\_educ_i + \beta_6 married_i$$
$$+\beta_7 \log(hhassets + 1)_i +$$
$$+\beta_8 \log(hhexpense + 1)_i$$
$$+\beta_9 leisure_i + \beta_{10} socialrltn_i$$
$$+\beta_{11} health_i + \beta_{12} government_i$$
$$+\beta_{13} \log(farmasset + 1)_i + e_i \qquad (3)$$

where: P_i refers to the profit in one cropping season under RTL, age_i refers to the age of farmers in years, $male_i$ is a dummy variable that represents male farmer, h_head_i is a dummy variable that captures a farmer that is head of their family, $hhsize_i$ refers to the number of family members, y_educ_i refers to the farmers' number of years in education, $married_i$ is a dummy variable that captures married farmer, $\log(hhassets + 1)_i$ refers to the logarithm of household assets (₱) plus 1, $\log(hhexpense + 1)_i$ refers to the logarithm of household expense per month (₱) plus 1, $leisure_i$ refers to the farmers perception on their leisure time (scale of 1 to 10), $socialrltn_i$ refers to the farmers perception on their social relationships (scale of 1 to 10), $health_i$ refers to the farmers perception on their health aspect (scale of 1 to 10), $government_i$ refers to the farmers perception on their health aspect (scale of 1 to 10), $\log(farmasset + 1)_i$ refers to the logarithm of farm assets (₱) plus 1, and e_i represents as random error in equation 3.

RESULTS AND DISCUSSIONS

Socioeconomic profile of rice farmers

This section depicts and summarizes the different socioeconomic profiles of rice farmers in a particular cropping season under the implementation of RTL. Table 1 shows that the age of farmers is approximately 54 ($\pm$12.79) years old. According to Casinillo [12], farmers are relatively old since the younger generation is sent to school to obtain decent work. Most (80%) of the farmers are male and only 20% of them are female. Dominant of these farmers are head of their families (82%) that carries responsibility for needs. The average number of family members of farmers is close to 4 ($\pm$1.56). On average, these farmers are elementary graduates (7.58 ($\pm$3.07) years in education)

and 79% are in married life. Approximately, farmers' household assets are close to ₱45,006.47 (±₱91,370.21) and their monthly household expense is about ₱4,940.33 (±₱2,943.36).

On a scale of 1 to 10, farmers' leisure time is just about 3.91 (±1.88) which is considered relatively low. This is because of the adverse effect of RTL, farmers need to do hard work on their rice farm to maintain its productivity which needs to reduce their usual leisure activities. Moreover, the Philippine government is rated low (3.46±1.92) on a scale of 1 to 10 by farmers due to the effect of RTL on rice prices. Farmers' social relationships and health were rated 5.69 (±2.22) and 5.92 (±2.68), respectively, which can be interpreted as moderate. Farmers' farm assets are more or less ₱10,246.69 (±₱23,579.87). Furthermore, in one cropping season under the implementation of RTL in the Philippines, the farmers' profit is approximately ₱4,804.09 (±₱3,712.52). All respondents (farmers) of this study said that the profit is decreased as opposed to the previous cropping season (before the implementation of RTL). The impact of RTL in the country has lowered the rice output prices of farmers which occur simultaneously as the farm inputs are increasing. Hence, the economic profit of farmers especially in rural areas is negatively affected by RTL [10].

Table 1. Socioeconomic profile (n=175).

Variables	M±SD	min	max
Age (in years)	53.99±12.79	22	89
Male[a]	0.79±0.41	0	1
Head of the family[a]	0.82±0.38	0	1
Household size	3.89±1.56	1	9
Years in Education	7.58±3.07	1	16
Married[a]	0.79±0.41	0	1
Household assets[b]	45,006.47±91,370.21	500	1,126,510
Household expense[b]	4,940.33±2,943.36	1,100	22,433
Leisure[c]	3.91±1.88	1	9
Social relationship[c]	5.69±2.22	1	10
Health[c]	5.92±2.68	1	10
Government[c]	3.46±1.91	1	9
Farm assets[b]	10,246.69±23,579.87	0	2,090,000
Profit[b,d]	4,804.09±3,712.52	129	21,250

Note: a-dummy variable; b-in Philippine Peso (₱); c-Scale of 1 to 10; d-one cropping season under RTL.
Source: Own calculation and analysis based on data gathered (2022).

An econometric model for profitability

Table 2 presents the four diagnostic tests for the econometric model to ensure the validity of the results. The model was tested for heterogeneity of the variance of all observations in the data set with the aid of the Breusch-Pagan test and found that it is heterogeneous at a 1% level of significance. In that case, the model was corrected using a robust standard error in the model [13]. Using the Ramsey RESET test, it is found that there is no omitted variable bias exists (p-value=0.142) in the constructed linear regression model as shown in Table 2.

The variance inflation factor is equal to 1.56, which implies that the constructed model is safe from multicollinearity problems, that is, no correlation exists between pairwise independent variables [2]. Moreover, with the aid of the Shapiro-Wilk test, it is depicted that the residuals of the model are not normal at a 1% level (Table 2). However, it is shown in Fig. 1 that the Kernel density estimate graph of residuals is almost normal relative to the normal density graph. Hence, the model is considered valid for the interpretation of results.

Table 2. Diagnostic test for the regression model.

Assumptions	Test Statistic		p-value
Homoscedasticity	Breusch-Pagan	χ^2=6.45	0.011
Omitted variables bias	Ramsey RESET	F=1.84	0.142
Multicollinearity	Variance inflation factor (VIF)	VIF=1.56	-
Normality of Residuals	Shapiro-Wilk test	Z=2.58	0.005

Source: Own calculation and analysis based on data gathered (2022).
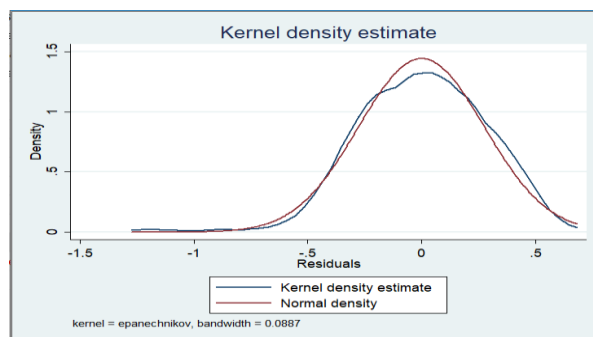

Fig. 1. Kernel density estimate graphs for residuals.
Source: Own calculation and analysis based on data gathered (2022).

Table 3 shows that the constructed model is significant (F_c=9.65, p-value<0.01) at a 1%

level of significance. This implies that several significant predictors influence the profitability of rice farming. Notice that several of the variables in the regression model are not significant, in fact, the goodness of fit (R^2) is only 0.35. It is worth noting that farmers are in a culture shock or upset mood due to the impact of RTL on rice prices. In that case, some socioeconomic profile of farmers does not correlate with their economic profit due to the unproductive or unsatisfied behavior in farming. Table 3 depicts that the following socioeconomic variables are not significant factors in the profitability in rice farming under RTL: (1) age of farmers (p-value=0.795); sex (p-value=0.604); being a head of the family (p-value=0.408); household size (p-value=0.963); years in education (p-value=0.502); civil status (p-value=0.416); household assets (p-value=0.617); monthly household expense (p-value=0.618); social relationship (p-value=0.356); and health (p-value=0.996).

Table 3. Linear regression model for profitability in rice farming and its determinants.

Predictors	OLS Model		
	Coefficient	Std. Error	p-value
Constant	2.6487**	0.549	<0.001
Age (in years)	-0.0005[ns]	0.002	0.795
Male[a]	0.0349	0.067	0.604
Head of the family[a]	-0.0589[ns]	0.071	0.408
Household size	0.0006[ns]	0.013	0.963
Years in Education	0.0062[ns]	0.009	0.502
Married[a]	0.0663[ns]	0.081	0.416
log (Household assets[b]+1)	0.0289[ns]	0.058	0.617
log (Household expense[b]+1)	0.0743[ns]	0.148	0.618
Leisure[c]	-0.0244*	0.013	0.076
Social relationship[c]	0.0160[ns]	0.017	0.356
Health[c]	0.0001[ns]	0.011	0.996
Government[c]	0.0833**	0.017	<0.001
log (Farm assets[b]+1)	0.0590**	0.016	<0.001
Participants	175		
F-computed	9.65		
p-value	<0.001		
Goodness-of-fit (R^2)	0.349		

Note: a-dummy variable; b-in Philippine Peso (₱); c-Scale of 1 to 10; d-one cropping season under RTL; ns- not significant; * - significant at 10% α level; ** - highly significant at 1% α level.
Source: Own calculation and analysis based on data gathered (2022).

This finding is not parallel to the existing studies in the literature which stated that farm business profitability is associated with a socioeconomic profile and farmers' attitudes [11], [17], [21], [22].

Table 3 reveals that for every 1 unit increase in the perception of leisure time (scale of 1 to 10), there is a decrease of ₱0.0244 in farmers' profit while other variables were held constant. This result is significant at the 10% level which indicates that if a farmer spends time on leisure activities, then their productivity is slightly decreasing. In other words, the result goes to infer that if a farmer works harder in rice farming, they tend to reduce their leisure time. In fact, allocating more time to leisure will increase the well-being of farmers because they can spend more time with their families and friends. However, the work engagement in rice farming will reduce, where in fact, it needs more focus due to the effect of RTL. Hence, farmers need to sacrifice leisure time over work engagement to maintain productivity in farming [3], [15]. Additionally, findings suggest that farmers need to adopt a sustainable activity such as reducing costs that increases labor savings and avoiding unsuitable expensive practices [14]. The model depicted that the farmers' perception of government support is a significant predictor (p-value<0.001) of profitability in rice production (Table 3). For every 1 unit increase in farmers' perception of government, there is ₱0.0833 corresponding increase in economic profit while holding other predictor variables constant. In that case, farmers need help for their rice production activity by the government to maintain farmers' sustainability under the implementation of RTL. Government sustainability programs [24] and agricultural inputs support [1] are a great help to rice farmers in rural areas to continue despite the low rice price brought by RTL. Moreover, the result suggests that the government must modify the policies in RTL and invest in farm inputs that favor the local rice farmers' well-being to continue the rice production in the rural areas of the country [25]. Plus, the aid of government concerted investment and rural development projects as well as training can help rice farmers produce a higher sustainable agricultural experience that strengthens the

livelihoods of local farmers in the country [14].

Furthermore, the regression model shows that farmers' farm asset is significant as a predictor of farmers' economic profit. Farm assets refer to the agricultural tools and equipment needed in rice farming. On average, for every 1% increase in farm assets value (₱), there is an increase of ₱0.00059 in farmers' economic profit, ceteris paribus. In fact, if a farmer owns agricultural tools, then it is an advantage since they will not spend any more on borrowing in every cropping season. Additionally, if a farmer owns agricultural equipment (e.g. tractor), they will no anymore hire a labor force for hauling agricultural inputs and other machinery. In that case, farmers can minimize the cost needed for the cropping process and even in harvesting. Findings suggested that the agricultural sector in the country must support and help the poor farmers' needs in farming to progress as independent business farmers in the remote areas of the country [9]. This support will lower the input costs involve in rice production and positively impact their profitability despite the RTL's effect. Furthermore, supporting the rice farmers in relation to the water irrigation program will enhance the productivity of rice yields as well as its economic profit [5].

CONCLUSIONS

The study revealed a low economic profit in rice farming during the implementation of RTL and farmers utterly said that their income has decreased as opposed to the previous cropping seasons (before the implementation of RTL). Although the law targeted a high supply of rice in the country as the main staple food and a low price of rice to consumers, rice farmers were affected by low rice output prices while agricultural input prices are simultaneously increasing. The econometric model has shown that the significant determinants of profitability in rice farming include a low perception score of leisure time, a high perception score of government support, and farm assets. This implies that farmers need to increase their

work engagement in rice farming to positively influence their profitability during the implementation of RTL while decreasing their involvement in leisure activities. Farmers are necessary to spend their time on essential activities on the farm rather than spending it on unsuitable and useless human action. Additionally, poor farmers especially in rural areas in the country are in need of government support to sustain and continue to grow rice amid the negative effect of RTL. In that case, the government must find ways to mitigate the adverse impact of the law on poor and non-competitive rice farmers. The government must propose a budget to support poor farmers concerning agricultural inputs because it has a significant role to help farmers to gain more profit and it has a positive effect on rice production. Moreover, the government must provide machinery and equipment for farming to increase the productivity and efficiency of rice production in remote areas in the country. Results recommended that the local government unit must conduct training and seminars that will enhance the farmers' knowledge, attitude, and practices to progress their production despite the promulgated RTL. On the farmers' side, they should plant other crops aside from rice to increase their economic profit. It is also recommended that a related study must be realized in other remote (rural) areas in the country to gather more sufficient data that will elucidate the well-being of rice farmers under the implementation of RTL. Furthermore, for future study and empirical analysis, one may consider other economic variables like savings and access to credit to strengthen the current results of this study.

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