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Access and Impact of Trade Credit on the Benefits of Rice Growing Households in the Mekong Delta, Viet Nam

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ABSTRACT

The study aims to estimate the access to and impact of trade credit on the benefits of rice-growing households in the Mekong Delta, Vietnam, a region where formal financial access remains limited for smallholder farmers. Using primary data collected from 574 rice farming households across four provinces, the study applies the Propensity Score Matching (PSM) method to address selection bias and ensure robust comparison between households with and without access to trade credit. In the first stage, a Probit regression model identifies seven key factors influencing trade credit access. Among them, household income and farming experience negatively affect access, suggesting that wealthier or more experienced farmers may rely less on dealer base credit. In contrast, landholding size, duration of familiarity with input suppliers, geographic distance, social status, and number of suppliers positively influence access, highlighting the importance of trust, reputation, and market connectivity. The second stage of the PSM method, using four matching techniques nearest neighbor, radius, stratification, and kernel demonstrates that access to trade credit improves both yield and profitability. Specifically, households with access achieve rice yields

8.26%–10.61% higher and profits 0.135–0.392 million VND greater per 1,000 m² than non-accessing households. The study proposes policy recommendations to improve credit accessibility for farmers, enhance input supply relationships, and reduce rural financial exclusion, thereby contributing to sustainable agricultural development in the region.

Keywords: Agricultural Supply Dealer; Farmer; Mekong Delta; Trade Credit

1. Introduction

The Mekong Delta, the country's largest rice granary, contributes over 50% of the annual rice production. However, rice farming households here still face numerous difficulties, especially the issue of capital shortage. Due to financial limitations, farming households often have to purchase agricultural inputs on credit from dealers, creating a dependence on trade credit (TC). This indicates that TC plays a significant role in supporting rice production in the Mekong Delta, but it also poses many new challenges. For suppliers, TC helps reduce transaction costs, facilitates sales, and builds sustainable relationships with customers. For TC recipients, it provides access to initial materials for production when capital is limited. As a result, TC becomes an important alternative source of financing for credit recipients, especially for small and medium-sized enterprises.

In the Mekong Delta, TC is most clearly shown through the form of farming households purchasing agricultural inputs on credit. Therefore, this study focuses on analyzing the benefits (yield and profits) of farming households engaged in rice production who purchase agricultural inputs on credit. Studies by Amrago and Mensah[1] and Dary and James[2] have demonstrated that access to TC has a positive relationship with the profits of credit recipients. This is a favorable condition for demonstrating the reality of farming households in the Mekong Delta.

Although TC has been widely examined in the international literature, most studies have focused on firms and supplier–buyer relationships, while research explicitly addressing smallholder rice farmers, particularly in the Mekong Delta, remains limited. Prior works have emphasized bank credit, microcredit, or firm dealer interactions, leaving the role of trade credit between agricultural input dealers and farming households underex-

plored. This gap is particularly significant in both academic and practical terms, as TC serves as a crucial alternative financing source for smallholders who often lack access to formal credit.

Therefore, this paper aims to analyze the impact of access to TC on the benefits of rice farming households in the Mekong Delta. Methodologically, the study employs a Probit model to estimate the determinants of household access to TC. The choice of this model is rooted in the theoretical framework of trade credit, where access is conceptualized as a binary outcome (yes/no) influenced by factors such as landholding size, income, social relationships, and social status. To address selection bias and evaluate the causal effects of TC on household outcomes, the study further applies the Propensity Score Matching (PSM) approach. This method is directly informed by theories of transaction costs and rural credit markets, which suggest that participation in TC is non-random and depends on household characteristics, thereby requiring a counterfactual-based matching technique for robust comparisons.

2. Theoretical Basis and Research Methodology

2.1. Theoretical Basis of Factors Affecting Farmers' Access to Trade Credit

TC is credit that arises when a seller provides goods to a customer and allows them to pay at a future date instead of requiring immediate payment[3]. Specifically, the seller transfers a quantity of goods to the buyer, and after a period agreed upon by both parties, the buyer repays the seller the agreed amount. This demonstrates that TC acts as an intermediary in the transaction because it separates the payment role from the business cycle.

To ensure scientific rigor, the paper develops a Pro-

bit model based on the results of relevant studies. According to these studies, the primary condition for farmers to obtain TC (purchase inputs with deferred payment) is to possess agricultural land. Agricultural land is a prerequisite for farmers to use TC goods for their intended purpose. In addition, agricultural land is a valuable asset that allows agricultural input dealers to sell the land to mitigate risk if the buyer defaults on the debt. Therefore, farmers will have easier access to TC if they own a larger land area.

Furthermore, income also plays an important role in farmers' access to TC, as high-income farmers have a better ability to repay debts. High income also implies that farmers use money effectively. Therefore, when borrowing, farmers will increase their repayment ability and are more likely to be approved for loans[4]. From another perspective, high-income farmers will prioritize using their own capital to avoid paying interest, especially in countries with underdeveloped credit systems[5]. Thus, high-income farmers are more likely to buy on credit when needed.

TC relies on customer reputation, so relationships and acquaintance time will be important factors in the decision of input dealer owners to sell on credit. The longer the acquaintance, the better the seller and buyer understand each other, making it easier for the seller to agree to sell on credit. In other words, the level of relationship is the basis for the seller to decide whether to grant TC[6]. Similarly, when buyers and sellers live close to each other, they understand each other well, reducing the incentive to default due to fear of damaging relationships. Conversely, when living near the buyer, the seller has more information to monitor the buyer, thus making it easier to agree to sell on credit[7].

In a market with many competitors (suppliers), buyers can easily switch to another supplier[8]. Sellers may feel pressured to offer more credit to customers in order to avoid losing market share. This is especially noteworthy in markets for homogeneous goods, such as plant protection products used in rice production. Conversely, due to information asymmetry, competition can reduce the incentive for suppliers to establish costly but fleeting connections with buyers, thereby reducing the amount of TC granted[9].

The number of household members is also an important factor influencing farmers' access to TC[10]. When a household has more members, it tends to have more social connections, which in turn provides greater access to information and makes it easier to approach agricultural input dealers, thereby facilitating credit-based purchases. Therefore, farming households with more members may find it easier to buy agricultural inputs on credit compared to households with fewer members[4]. Similarly, Fabbri and Menichini[11] suggest that the relationship between formal and informal credit is positive. This means that farmers who have previously borrowed from banks will find it easier to buy agricultural inputs on credit because they are considered reputable. In addition, formal credit and TC are complementary[12]. Therefore, farmers who have previously borrowed from banks will be more readily accepted for credit sales by dealers.

Factors such as the age, education, and gender of the household head are also quite important, as higher education levels enable farmers to use capital effectively[13]. Meanwhile, older people often have more production experience and maintain a good reputation, making them less likely to default[4]. Additionally, the assets accumulated by older people over time also foster trust and encourage lenders to provide credit. Conversely, women tend to participate less in social activities, thus limiting their communication with others, and men do the majority of farm work, so dealers may have a lower assessment of women's repayment capacity, potentially leading to loan refusal[14].

In rural areas, social relationships play an important role in farmers' trade transactions[15]. Indeed, social relationships facilitate the exchange of information between actors. This helps farmers improve their ability to adapt to the natural, social, and economic environment to minimize risks. Social relationships facilitate the exchange of information between individuals, thereby enhancing its accuracy, comprehensiveness, and value. Therefore, when farming households have a household head or members working in local state agencies or organizations, they will have an advantage in establishing relationships with agricultural input dealers. This helps farmers easily access dealers for credit purchases be-

cause of their reputation. In addition, people with broad social relationships are often afraid of losing their reputation and therefore strive to repay debts, which may lead to agricultural input dealers giving them more favorable treatment in credit sales[16]. Based on the theoretical analysis above, the paper develops the following empirical model [Equation (1)]:

$$\begin{aligned}
TC = \alpha_0 &+ \alpha_1 land_i + \alpha_2 income_i \\
&+ \alpha_3 acquainted_i + \alpha_4 distance_i \\
&+ \alpha_5 agents_i + \alpha_6 labor_i + \alpha_7 loans_i \\
&+ \alpha_8 education_i + \alpha_9 age_i + \alpha_{10} gender_i \\
&+ \alpha_{11} position + \varepsilon
\end{aligned} \quad (1)$$

In Equation (1), the dependent variable (TC) represents the likelihood that rice farming household i purchases agricultural inputs on credit. If household i is able to purchase agricultural inputs on credit from input dealers, the variable (TC) is set to 1. Conversely, the variable (TC) has a value of 0. Model 1 will be estimated using Probit regression to determine the propensity score. Based on the propensity score, the paper uses the Propensity Score Matching (PSM) estimation method for further analysis.

2.2. Theoretical Basis of the Impact of Trade Credit on Farmers' Benefits

Benefits are determined by the ratio of earnings before interest and taxes (EBIT) to total assets (ROA) or to total equity (ROE)[17]. In this article, the benefits for rice-farming households are examined in two scenarios. Firstly, the impact of access to TC on rice yield. Secondly, the impact of TC on the profits of rice farming households. Rice yield is measured by the production value per 1,000 square meters of land, and profits are calculated as the amount of money farmers earn from rice production minus their rice production costs per 1,000 m² of land.

From the perspective of transaction costs, the profit of borrowers when using TC arises from reduced transaction costs[18]. TC borrowers, instead of paying invoices each time goods are delivered, can accumulate invoices over a certain period to make a single payment at the end of the period[19]. In addition, due to the season-ality of production (especially agricultural inputs in rice production), sellers must stock large quantities of goods to ensure they do not run out, leading to high storage costs. Therefore, providing TC helps suppliers reduce costs, prompting them to expand further to earn more profit. This also helps buyers obtain inputs for production and reduce the costs of multiple transactions, thus increasing profits.

From a financial perspective, firms can view TC as a profitable investment. Companies with idle capital may invest in accounts receivable from TC to earn returns[20]. For buyers, delaying payment allows them to use that temporary capital for other activities to maximize economic benefits. If early payment discounts are not attractive enough, buyers tend to extend payment periods to take advantage of this cash flow. The study by Amrago and Mensah[1] also highlights a positive relationship between access to TC and the economic benefits of firms.

TC is also seen as a business strategy that enhances competitiveness. Companies can use TC as a marketing tool to expand market share and boost sales[21]. Providing TC helps businesses build long-term relationships with customers, especially those with limited access to formal credit. In a market where bank credit is not always readily available, TC becomes an attractive alternative, even if it comes with higher costs[19]. This not only helps buyers sustain their production activities but also fosters long-term relationships between the two parties.

Additionally, TC also serves as a quality assurance mechanism, allowing customers to inspect products before making payments[22]. This is especially important for newly established businesses, as it helps them build customer trust through product quality. Conversely, for buyers, TC reduces the risk of receiving low-quality goods, particularly when the credit period is extended. To encourage early payment, suppliers may offer discount policies, thereby balancing the benefits for both parties.

As just explained, TC increases benefits for buyers because they obtain production inputs and reduce borrowing costs. In this study, the buyer is considered to be the farming household, participating in TC by purchasing agricultural inputs on credit. The hypothesis put forward in this paper is that farming households with access to TC will have higher benefits from rice cultivation

than farming households without access to TC.

2.3. Research Methodology

2.3.1. Survey Design and Data Collection

This study uses primary data collected from four provinces in the Mekong Delta region: namely An Giang, Đồng Tháp, Cần Thơ, and Vĩnh Long. A structured questionnaire was designed based on theoretical frameworks and previous research on agricultural commercial credit. The survey covers the following content: Demographic characteristics of the household head and the household (age, gender, education level, household size, production experience); Production conditions (cultivated land area, distance to the nearest supplier, number of suppliers the household deals with, frequency of formal credit borrowing); Social networks and level of familiarity with input suppliers; Rice yield and profit; and Whether the household had access to commercial credit (yes or no).

To ensure representativeness, the study employed a stratified sampling method based on the proportion of each province's rice cultivation area relative to the total for the region. The planned sample size was 600 households, determined by the scale of cultivated rice land area and the number of farming households (General Statistics Office, 2023). The number of households allocated to each province was proportional to that province's share of the region's total rice area [23]. For example, if a province accounted for 30% of the total regional rice area, the number of households surveyed in that province would likewise account for about 30% of the total sample.

In each province, the research team selected the six communes with the largest rice cultivation areas for surveying. Within each selected commune, households were randomly chosen by simple random sampling from the list of rice-producing households provided by the local authorities. As a result, the study obtained 574 valid observations, distributed as follows: An Giang, 199 households (34.67%); Đồng Tháp, 91 (15.85%); Cần Thơ, 186 (32.30%); Vĩnh Long, 98 (17.07%). This distribution corresponds to the share of rice area of each province in the region, ensuring the representativeness of the sample.

All data were collected through direct interviews with the household heads in the study area. The interviews were conducted by a team of well-trained enumerators, ensuring data consistency and reliability.

2.3.2. Estimation Method

It can be difficult to accurately estimate the impact of TC (purchasing agricultural inputs on credit) on farmers' profits due to selection bias, which implies that the treatment factor (being able to purchase on credit) is not randomly assigned and depends on the characteristics of the farming household. Therefore, the Propensity Score Matching (PSM) estimation method is chosen for implementation based on the data of 574 rice farming households [24–27]. This method helps control for selection bias by constructing a counterfactual. The counterfactual indicates what would happen to rice farming households who were able to purchase agricultural inputs on credit (the treatment group) if they were not able to do so. The core assumption of the PSM method is that the farming households selected into the treatment group (able to purchase on credit) and the control group (not able to purchase on credit) have outcomes that can be observed in both scenarios—one is the observed situation and the other is the unobserved (counterfactual) situation. Let D = 1 represent the situation where the farming household is able to purchase inputs on credit (treatment group), and D = 0 represent the situation where the farming household is unable to purchase on credit.

The PSM method estimates the difference between the treatment and control groups. This is done using a measure called the average treatment effect on the treated (ATT). According to this method, the paper first needs to determine the propensity score through Probit regression (step 1). Based on the propensity score obtained (step 2), four matching methods are implemented to compare the difference in profits between farming households that can purchase inputs on credit and those that cannot. According to Becker and Ichino [28], the four matching methods implemented are:

The nearest neighbor matching (NNM) method is the most frequently used, where each treated unit is compared with n control units that have the closest propensity scores (n = 5 is commonly used).

The stratification matching (SM) method compares observations with propensity scores within a certain range.

The radius matching (RM) method divides the common support into several strata and calculates the treatment effect within each stratum.

The kernel matching (KM) method uses a weighted average of all subjects in the control group to construct the counterfactual outcome; therefore, the variance will be low because it uses all the information from the control group.

The sequence of the analysis process is as follows:

Step 1. PSM Method (Factors Affecting Farmers' Access to Credit)

The factors affecting farmers' access to TC are estimated through the Probit regression method to find the propensity score. The Probit regression method is used when the dependent variable has two states [29]. The Probit model assumes that the random error follows a normal distribution, which allows for a more appropriate estimation of probabilities in agricultural economics research characterized by diverse demographic and production features. Meanwhile, the number of collected observations is 547, which is sufficiently large to be considered asymptotically normal. Therefore, the binary Probit model is the most suitable.

The Probit model has the following form [Equation (2)]:

$$Y_i^* = \beta_0 + \sum \beta_j X_{ij} + U_i \qquad (2)$$

where Yi* is unobserved, often called a latent variable, with two possible outcomes:

$$Y_i^* = \begin{cases} 0 \ if \ Y_i^* < 0 \\ 1 \ if \ Y_i^* > 0 \end{cases}$$

In the context of this study, the dependent variable is the ability of rice farming households in the Mekong Delta to access TC. If a farming household can access TC, the variable takes the value of 1; conversely, if a farming household does not receive TC, the variable takes the value of 0.

Step 2. Impact of TC on the Profits of Rice Farming Households

Based on the propensity score obtained in step one, the second step of the PSM method involves examining farming households with similar or very close propensity scores to assign them to the treatment and control groups. For each farming household in the treatment group, a corresponding farming household in the control group will be constructed using a matching tool (the four matching tools in PSM).

To ensure that the compared farming households do not differ too much in their propensity scores, the paper uses a caliper of 0.01. Specifically, for a farming household that purchased inputs on credit, the profit from rice cultivation (observed) is $E(\pi_1|D = 1)$ and the counterfactual profit (unobserved) is $E(\pi_0|D = 1)$. Similarly, for a farming household that did not purchase on credit, the profit from rice cultivation is $E(\pi_0|D = 0)$ and the counterfactual profit (unobserved) is $E(\pi_1|D = 0)$, where E (.) is the expectation.

Rosenbaum and Rubin [26], the ATT is [Equation (3)]:

$$\begin{aligned} ATT = \ & E((\pi_1 - \pi_0)|D = 1) \\ = \ & E(\pi_1|D = 1) - E(\pi_0|D = 1) \end{aligned} \qquad (3)$$

The quantity to be estimated is not but $E(\pi_0|D = 0)$ so $E(\pi_0|D = 1)$. To do this, the PSM method uses the propensity score to calculate the profit of farming households that were not able to purchase inputs, making them comparable to the characteristics of households that were able to purchase. Specifically, PSM uses $E(\pi_0|D = 0)$ to estimate the counterfactual quantity $E(\pi_0|D = 1)$. To estimate this quantity, we need $E(\pi_0|D = 1) - E(\pi_0|D = 0) = 0$ to ensure that the ATT is not affected by selection bias.

Based on the theoretical framework presented, the ability to access TC and the profit from rice cultivation for farming households are expected to have a positive relationship. This means that farming households with access to TC are expected to earn higher profits than those without.

3. Results

3.1. Sample Description

Among the 574 surveyed farming households, 400 households had access to TC from input dealers (accounting for 69.69% of the total observations), while

174 households (accounting for 30.31%) did not have access to TC, despite needing it. Among the surveyed households, 490 households had male heads (accounting for 85.37%), and 539 (accounting for 93.90%) households did not have relatives or acquaintances working in state agencies. This result indicates that farming households mainly rely on agriculture, so they have few relatives or acquaintances involved in and working for state agencies. This is also a disadvantage when farming households access TC. Additionally, the results also indicate that rice production is mainly undertaken by men. Therefore, men have a greater advantage in accessing TC due to their relationships or ease of communication with dealer owners.

The results in **Table 1** show that the average age of the household head is 53 years, and the average education level is equivalent to 7th grade. With a relatively low education level, household heads find it difficult to grasp advanced science and technology and specialized knowledge to serve production effectively, making it harder for dealers to agree to sell on credit. The reason for the low education level is that agricultural production is often carried out based on experience passed down through generations, so many household heads do not pay attention to the education of their family members. The number of household members in the survey sample is relatively low (an average of 4 people/household). Therefore, households have the advantage of making production-related decisions easily; however, this can be a hindrance in the agricultural production process, especially during peak seasons when a large amount of labor is required. With an average land area of 11,160 m^2/household, it is very difficult for farming households to ensure income if they do not participate in economic activities other than agricultural production (profit from rice cultivation is 2.3 million VND/1000m^2). Household income is not only for consumption but also needs to be reinvested for subsequent crops. As a result, farming households will fall into a vicious cycle of lacking investment capital, leading to purchasing on credit at high interest rates, which in turn results in low income and further lack of investment capital.

Table 1. Characteristics of agricultural input dealers and rice farming households in the Mekong Delta.

Criteria	Average	Standard Deviation	Minimum	Maximum
Household size (people)	4.21	1.27	1.00	9.00
Age (years)	53.69	11.00	21.00	81.00
Education level (grade)	6.45	3.22	0.00	16.00
Geographical distance (km)	3.47	3.72	0.40	20.00
Rice farming area (1,000 m^2)	11.16	10.11	1.00	100.00
Duration of relationship between household and input dealer (months)	29.00	11.51	1.00	60.00
Number of formal loans (times)	1.14	1.60	0.00	10.00
Number of dealers (dealers)	2.99	1.02	1.00	5.00
Rice farming profit (million VND/1,000 m^2)	2.30	0.67	0.92	3.88
Income (million VND/household/year)	210.511	163.535	11.72	1,340.00

The distance from farming households to agricultural input dealers is relatively short, averaging around 3.5 km. This is because there are many level-2 and level-3 input dealers operating throughout rural areas. This makes it easier for farming households to access and purchase inputs, including buying on credit. However, due to low incomes (an average of 210 million VND per household per year), households do not have sufficient funds to reinvest or collateral to borrow from formal credit institutions (the average number of formal loans per household is 1.4 times). Therefore, households are often left with no choice but to purchase inputs on credit from familiar agricultural input dealers. On average, the duration of acquaintance between farming households and input dealers is 29 months. This is a long enough period for households to build trust with dealers, making it easier to buy on credit. Additionally, to mitigate the risk of dealers refusing to sell on credit, households often engage with multiple dealers (on average, 3 dealers per household) for their input needs. Some households, however, do not buy from dealers but receive supplies directly from companies (these households are members

of cooperatives).

The results presented in **Table 2** show that the average rice yield of the surveyed farming households is 7.26 tons/ha, which is relatively high compared to the national average of 6.32 tons/ha [23]. The findings also indicate that farming households with access to TC achieve an average yield of 7.45 tons/ha, whereas those without access to TC have a lower average yield of 6.82 tons/ha. This result highlights a yield gap between households with and without access to TC.

Table 2. Rice yield and income of households.

Criteria	Average	Standard Deviation	Min	Max
Rice yield (tons/ha)	7.26	1.80	3.85	11.73
Rice yield of households without access to TC	6.82	1.72	3.85	11.32
Rice yield of households with access to TC	7.45	1.80	3.88	11.73
Income (million VND/household/year)	210.511	163.535	11.72	1,340.00
Income from rice cultivation (million VND)	110.089	102.203	1.918	1080
Income from rice cultivation/1,000m^2 (million VND/1,000m^2)	4.168	1.902	2	9.044

3.2. Factors Affecting Households' Access to Trade Credit

The results presented in **Table 3** are based on the Probit regression method. These results indicate the factors that influence access to TC for rice-producing households in the Mekong Delta. Households with larger agricultural land areas are more likely to purchase agricultural inputs on credit from dealers, as the land area variable has a positive coefficient at the 5% significance level. On the other hand, the income variable has a negative coefficient at the 10% significance level, meaning that higher-income households are less likely to buy inputs on credit compared to lower-income households. This implies that it is relatively easy for rice farmers with production assets such as agricultural land to buy inputs on credit, but households with higher incomes tend to purchase inputs with cash.

The duration of acquaintance variable has a positive coefficient significant at the 1% level, meaning that the longer the relationship between the household and the agricultural input dealer, the easier it is to establish a TC agreement. This result highlights the close ties between farming households and agricultural input dealers. A long-term relationship reduces information asymmetry, making it easier for the buyer to be granted credit [30].

In contrast, geographical distance is generally considered a barrier to credit access, as greater distance tends to increase information asymmetry. However, in this study, the distance variable has a positive coefficient significant at the 1% level, implying that the farther a household is from the input dealer, the more likely it is to be granted credit. This result contradicts the initial theory [31], which suggested that longer distances increase information asymmetry and reduce access to TC. Nevertheless, the finding aligns with the reality in rural areas of the Mekong Delta, where households located far from dealers (typically in remote areas) often have strong reputations for repaying loans, as they fear being denied credit in the future. Additionally, it is difficult for such households to find alternative input suppliers nearby. Therefore, they strive to maintain their creditworthiness to continue being eligible for future credit purchases.

Social status is another factor that affects households' ability to buy inputs on credit. In rural areas, individuals with higher social status tend to have more trust and are thus more likely to be granted credit by dealers. The estimation results show that the social status variable has a positive coefficient significant at the 5% level. Similarly, the number of dealers connecting with a household also has a positive coefficient significant at the 10% level, indicating that households with relationships with multiple agricultural input dealers are more likely to receive TC. This reflects a competitive environment among dealers in providing credit services.

On the other hand, the experience variable has a negative coefficient significant at the 5% level, suggesting that more experienced farmers are less likely to purchase inputs on credit compared to those with less experience [1]. The variables gender, number of formal loans, age, and education level have statistically insignificant

coefficients, indicating that these factors do not affect households' access to TC.

Table 3. Effects of factors on households' access to trade credit.

Variable	Variable Description	Estimated Coefficient	Z-Value
Constant (C)		0.142	0.32
Land	Rice land area (1,000 m^2)	0.010***	3.72
income	Household income (million VND/year)	−0.001*	−1.65
acquaintance	Duration of acquaintance between household and dealer (months)	0.002**	2.32
age	Household head's age (years)	−0.005	−0.95
education	Household head's education level (years of schooling)	−0.024	−1.22
gender	Household head's gender (male = 1, female = 0)	0.288	1.53
distance	Distance to nearest dealer (km)	0.060***	5.49
loans	Number of times borrowing from formal credit institutions	0.005	0.09
position	Household member working in state agencies/units (yes = 1, no = 0)	0.549**	2.15
agents	Number of agents of farmer relationship ((agent)	0.091*	1.83
experience	Number of years the household has been growing rice	−0.011**	−2.27
Number of observation (N)		574	
Significance level		0.000	
Log likelihood		−295.14277	

Note: *, **, *** are significant levels of 10%, 5%, and 1%, respectively. Dependent variable: access to trade credit by households = 1; otherwise = 0.

3.3. The Impact of Trade Credit on Benefits of Farm Households in the Mekong Delta

The PSM estimates of the impact of access to TC on rice yields of farm households in the Mekong Delta are presented in subsection 3.3.1., and the impact of access to TC on the profits of farming households in the Mekong Delta is presented in subsection 3.3.2. Four matching algorithms were used for estimation: NNM, RM, SM, and KM to examine whether the results differ. The results indicate that different matching methods are consistent and have positive coefficients, meaning there is a positive relationship between access to TC and rice yield and profits of farm households. Additionally, to verify the reliability of the research results, the study also employs the direct nearest neighbor matching method "nn-match"[28].

3.3.1. The Impact of Trade Credit on Rice Yield of Farm Households

The results show that the coefficient difference remains positive (as seen in the last row of **Table 4**), indicating consistent test results. In other words, the estimated results in this study are reliable for further analysis.

Table 4. Comparison of rice yield between households with and without access to trade credit.

Comparison Method	Treatment Group	Control Group	Coefficient Difference	t-Value
NNM	398	171	0.074*	1.754
SM	398	171	0.074***	5.611
RM	398	171	0.060***	3.294
KM	398	171	0.074***	7.245
SAFF			0.077***	3.560

Note: *, **, and *** indicate significance levels of 10%, 5%, and 1%, respectively.

With four comparison methods (**Table 4**), all coefficients are positive at significance levels of 1% and 10%. This proves that access to TC has increased the rice yield of households. The yield difference found ranges from 0.060 tons/1,000 m^2 to 0.077 tons/1,000 m^2, corresponding to NNM, SM, RM, and KM methods. The rice yield of households with access to TC is higher than that of those without access by approximately 8.26% (0.060/0.726) to 10.61% (0.077/0.726) per 1,000 m^2. This result aligns with the theoretical foundation presented, indicating that TC positively impacts the rice yield of households participating in TC.

Compared to previous studies, this research result is higher than the findings of Ciaian et al.[25], which examined transition economies in Central Europe and found a yield change of 1.6%. However, it is lower than the study by Ali et al.[32], which focused on developing countries and reported a yield difference of 17%, and the 26% yield gap found by Guirkinger and Boucher[33] in Peru. The findings suggest that households in the Mekong Delta achieve better yields when accessing TC compared to many other developing countries. This advantage is partly due to the fertile land in the region, though many farmers do not fully utilize its potential, leading to suboptimal yield. One reason is that low education levels make it difficult for farmers to apply modern agricultural techniques to improve yield. Additionally, low-income households often lack the capital to invest in optimal input factors[12], especially in urgent situations like pest infestations affecting rice crops. Therefore, access to TC enables farmers to take better care of their rice fields, ultimately improving yield.

3.3.2. Impact of Access to Trade Credit on the Profits of Rice Farming Households

The results in **Table 5** show that all matching methods have positive coefficients at the 1% and 5% significance levels. This demonstrates that farming households with access to TC have higher profits in rice production compared to those without access. The profit difference found ranges from 0.135 million VND/1,000m^2 to 0.392 million VND/1,000m^2, corresponding to the RM, KM, SM, and NNM methods, respectively. This difference accounts for approximately (0.135/2.3) = 5.9% to (0.392/2.3) = 17.04% of the profit per 1,000 m^2 of rice cultivation for farming households. This result is consistent with the theoretical basis presented, which states that TC positively affects the profits of credit users. This research finding also aligns with the results of Amrago and Mensah[1]. The research results of Amrago and Mensah[1] showed that farming households with access to TC had an increase in profit of approximately Gh¢ 4,247 compared to farming households without access to TC.

Table 5. Comparison of profits between rice farming households with and without access to trade credit.

Comparison Method	Treatment Group	Control Group	Difference Coefficient	t-Value
NNM (Nearest Neighbor Matching)	400	117	0.369***	3.315
SM (Stratification Matching)	307	267	0.247**	2.822
RM (Radius Matching)	144	110	0.135*	1.672
KM (Kernel Matching)	400	174	0.392***	4.353
SAFF			0.247***	3.060

Note: *, **, *** indicate significance levels of 10%, 5%, and 1%, respectively.

This research result aligns with the reality in rural areas of the Mekong Delta, where farming households with access to TC have higher profits than those without. The reason is that when accessing TC, farmers only use inputs for production purposes, meaning they utilize the products of TC for their intended use. This leads to an increase in rice yield, consequently boosting the income or profit of the farmers. On the other hand, farmers with access to TC will have timely access to inputs to address rice pests and diseases, and use these inputs at the right growth stages of the rice plant, thereby increasing rice yield and ultimately enhancing the farmers' profits. Conversely, farmers without access to TC will face difficulties. If they cannot access TC and manage to borrow elsewhere (from friends, relatives, or informal credit groups) to purchase inputs, they will likely miss the optimal time for providing nutrients to the plants. As a result, farmers with access to TC will have higher profits. Furthermore, farmers often participate in TC during urgent situations, so the added value of using agricultural inputs is higher than under normal conditions. Therefore, TC in the case of purchasing agricultural inputs on credit yields higher profits for farming households.

4. Discussion

The findings reveal that access to TC significantly enhances both rice yields and profits among farming households in the Mekong Delta. Specifically, households with TC access achieve yields 8.26%–10.61%

higher and profits 5.9%–17.04% greater per 1,000 m^2 compared to those without access. These results directly address the research question posed in the Introduction: Does access to TC generate measurable economic benefits for rice farmers? The empirical evidence clearly indicates yes, with statistically and economically significant impacts.

From the perspective of the theoretical framework, the results are consistent with transaction cost theory, which posits that deferred payments reduce the frequency of transactions, lower the costs of seeking alternative credit, and allow households to allocate temporary capital more efficiently. Moreover, TC access reflects the importance of information and trust embedded in rural social networks, as emphasized in rural credit theory. Hence, the findings not only confirm our initial hypothesis but also provide empirical validation of key theoretical arguments.

An interesting point is that the mechanism of social networks in trade credit resonates with findings beyond agriculture. An et al.[34] demonstrated that in the non-fungible token (NFT) market, platform reputation and popularity significantly influence the value of digital assets. This implies that reputation and network effects are universal factors that play a critical role in shaping transaction values and access to resources, both in digital contexts and in traditional agriculture.

5. Conclusion and Recommendations

TC is quite common in the Mekong Delta region due to the convenience of transactions, the urgency of disease treatment, and the timely provision of inputs during the growth stages of rice production, prompting farming households to seek agricultural input dealers to purchase inputs on deferred payment terms to serve their production needs. Based on relevant theoretical frameworks, this paper uses the PSM method to estimate the impact of access to TC on the profits of rice farming households. The results show that land value, income, acquaintance time, geographical distance, the number of agricultural input dealers, the number of times borrowing from formal credit institutions, and household labor contribute to helping farming households access TC. Meanwhile, factors such as age, gender, education, and social status do not significantly facilitate farmers' access to TC.

The estimation results further reveal that access to TC enhances the yield of rice-farming households. In other words, households that have access to TC achieve higher rice yields. The average rice yield difference between households with and without access to TC ranges from 0.060 to 0.077 ton per 1,000 m^2, depending on radius matching, kernel matching, stratification matching, and nearest neighbor matching methods. This finding reflects the reality that the convenience of transactions and the urgency of pest control drive farmers to purchase agricultural inputs on credit from input dealers. Furthermore, survey data indicate that most rice-farming households in the Mekong Delta operate on a relatively small scale, limiting their ability to generate high income for reinvestment or offer collateral for loans from formal financial institutions. As a result, access to TC becomes an inevitable choice for farmers to sustain production.

The estimation results also indicate that access to TC increases the profits of rice farming households. In other words, if they have access to TC, farming households will increase their profits in rice production. The average profit difference between farming households with access to TC and those without access ranges from VND 0.135 to 0.392 million/1,000 m^2 according to the radius matching, kernel matching, stratification matching, and nearest neighbor matching methods. These results reflect the reality that the convenience of transactions, the urgency of treating rice diseases, and the timely availability of inputs lead farmers to seek agricultural input dealers for purchases on deferred payment terms to serve their production. Furthermore, the results from the descriptive sample analysis show that the production scale of most rice farming households in the Mekong Delta is quite small, so they cannot generate high income for reinvestment and collateralize assets to borrow from formal credit institutions. Therefore, accessing TC for production purposes is an inevitable issue for these farmers.

Therefore, to help farming households improve their profits in rice production, the Government should

develop appropriate TC policies. These policies should support agricultural input dealers in extending credit while also ensuring the benefits for farming households. A legal framework will provide input to dealers with risk management tools, thus encouraging them to expand this type of credit. Consequently, farming households will have easier access to TC from agricultural input dealers, which will help them increase their yields and profits. In addition, developing the transportation system in rural areas of the Mekong Delta is necessary to help farming households easily access agricultural input dealers. Additionally, developing the transportation system will also enable credit institutions to easily reach farming households, providing them with more options for financing their production.

For farming households, it is necessary to establish sustainable relationships with agricultural input dealers to facilitate easy credit purchases when needed, thereby enhancing production, yield, and profits. In addition, farming households need to be proactive in securing their own capital for production because agricultural production faces risks and uncertainties in many aspects.

Beyond these contributions, this study also addresses an important research gap in the literature. While previous works have largely concentrated on firm-level trade credit and formal credit markets, few studies have investigated the role of TC between agricultural input dealers and smallholder farmers, particularly in the context of rice production in the Mekong Delta. By providing empirical evidence on this underexplored dimension, the study adds value to both the academic discourse and policy debates.

Nevertheless, some limitations remain, which open avenues for future research. First, the analysis is cross-sectional and limited to one region; future studies could adopt panel data or extend to other regions for broader comparisons. Second, while the study examined direct impacts on yields and profits, future work could explore the long-term and indirect effects of TC, such as household resilience, investment behavior, and adaptive capacity under climate change. Third, with the rapid rise of digital platforms and fintech solutions, future studies could examine how digitalization affects TC provision, reduces information asymmetry, and reshapes input–

farmer relationships. Finally, embedding TC within the entire rice value chain, from production to processing and export, would provide a more holistic understanding of its role in agricultural and rural development.

Author Contributions

Conceptualization, H.V.C. and D.L.N.; methodology, H.V.C. and D.L.N.; validation, H.V.C., D.L.N., and H.T.C.; formal analysis, H.V.C., D.L.N., and T.Y.T.D.; investigation, H.V.C., D.L.N., and T.Y.T.D.; data curation, H.V.C., D.L.N., and T.Y.T.D.; writing—original draft preparation, H.V.C., D.L.N., N.B.H., and H.T.C.; writing—review and editing, H.V.C. and D.L.N.; supervision, H.V.C. and D.L.N. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

All data is published in this research article.

Conflicts of Interest

The authors declare that there is no conflict of interest.

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