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Credit Rationing and Trade Credit Use by Farmers in Vietnam

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Abstract

The purpose of this paper is to estimate the impact of credit rationing on the amount of trade credit used by farmers in Vietnam. This study employs a survey data collected through direct interviews with heads of 1,065 rice households randomly selected out of provinces and city in the Mekong River Delta (MRD). In each province or city, the village with the largest area of land devoted to rice production from the district with the largest area of land devoted to rice production was picked up for survey. In each village, 200 rice farmers were randomly chosen for interview. Based on a probit model and a semi-parametric propensity score matching (PSM) estimator while controlling socio-demographic traits of rice farmers, the estimated results show that non-credit rationed farmers use less trade credit to finance production compared to their credit rationed counterparts. Moreover, the amount of trade credit used by farmers decreases as the degree of credit rationing drops. This paper provides evidence of the substitutive relationship between bank credit and trade credit. It also implicitly suggests that banks can drive trade creditors out of the market if they manage to solve the problem of information asymmetry and transaction cost.

Keywords: Credit Rationing, PSM, Rice Farmer, Trade Credit, Vietnam

JEL Classification Code: E50, E51, G21, G51

1. Introduction

Researchers have spent a great deal of effort exploring the rationale behind the coexistence of formal and informal credits in rural areas of developing countries, although the latter is often deemed by authorities as a malady to farmers, which induces them to conduct numerous rigorous schemes to drive it out of the market. Given the defects of those schemes in terms of addressing relevant problems of asymmetric information, disincentive, enforcement, and lack of collateral, formal credit is only able to reach those farmers who are wealthy and can provide acceptable collaterals. Consequently, informal credit emerges and even flourishes since it caters to a distinct niche of borrowers who are desperately denied access to formal credit. Since then, the interplay between formal and informal credits has been deliberately examined by researchers to see if they are substitutes or complements.

In rural Vietnam, credit market imperfections prevail, and transaction cost is substantial, giving rise to an inadequate access to formal credit for farmers, especially those who are poor and/or reside in remote areas. Therefore, informal credit comes out to fill in the gap thanks to its flexibility in solving the credit intermediation problem. Specifically, trade credit, by making use of market interlinkages where credit is linked to commodity transactions, is well capable of mitigating adverse selection, moral harzard, and enforcement problems that are embedded in every single credit transaction, but not effectively tackled by banks. Such interlinkages enhance the ability of trade creditors to monitor borrowers' behavior and motivate them to repay due debts by making commodity transactions contingent upon debt repayment (Burkart & Ellingsen, 2004).

As such, trade credit – a sort of 'in-kind' credit – acts as a prominent alternative to bank credit in localities with a limited financial sector development (Le et al., 2020; Kwon et al., 2020). From this perspective, trade credit and bank credit should be substitutes. However, studies on the interplay between bank credit and trade credit in rural areas

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of developing countries are scant, making any study focusing on this topic highly deserve in terms of contributing to the extant finance literature. Therefore, the novelty of this paper is to shed light on the relationship between bank credit and trade credit from the angle of credit rationing using relevant data from farmers in Vietnam.

This paper is structured as follows. The introduction in Section 1 is followed by Section 2 and Section 3 about the theoretical background of the empirical model developed to be tested later on. Section 4 discusses the methodology and the data used in this paper to estimate the impact of credit rationing on the amount of trade credit used by farmers. Then, the results are presented in Section 5. Section 6 concludes the paper.

2. Literature Review

2.1. Quantity Rationing and Risk Rationing in Rural Credit Markets

If the credit market is competitive with perfect information and costless enforcement, the interaction between supply and demand will determine the price of credit (or interest rate). Since borrowers with the most promising investment opportunties are often willing to pay the highest interest rate, they should theoretically be granted credit. Such a credit market is efficient in the standard economic sense of Pareto efficiency, i.e., it is not possible to make anyone better off without making someone else worse off (Besley, 1994). Yet, the model of perfectly competitive market where numerous buyers and sellers trade with symmetric information and costless enforcement is not applicable to rural credit markets.

A distinct attribute of agriculture – the main source of farmers' income – is the risk of income shock, which stems from weather events that strike the entire region and from volatilities in commodity price that affect all producers of a specific agricultural produce (Santos & Barret, 2011). Income shock exacerbates the functioning of rural credit markets since it may induce many farmers to default at the same time. The risk of income shock can be avoided if banks diversify loan portfolios, but rural credit markets are basically segmented in the sense that a bank's portfolio centers on a category of farmers facing a common income shock – e.g., those in a certain geographic locality and/or cultivating the same crop. Insurance markets that help attenuate the adversity of income shock are virtually absent in rural areas of developing countries. If farmers could insure their income, defaults might be less troublesome. A device to get rid of the default problem is to garner creditworthiness histories so as to sanction delinquent borrowers. Yet, such a device requires reliable information that seldom exists in rural areas. Thus, rural credit markets face severe problems arising from asymmetric information that gives rise to adverse selection and moral hazard (Stiglitz & Weiss, 1981).

Adverse selection spontaneously comes out when banks do not realize inherent traits of farmers, e.g., their attitude toward risk or their incentive to repay debts. Then, they may consequently ration credit, leading to a dearth of credit for farmers. The reason for this fact goes as follows. Assume that farmers borrowed from a bank to finance risky projects, but do not earn enough to repay their debts. Then, the bank will suffer losses due to defaults, so he must charge a risk premium to break even. Yet, pushing up the interest rate to curb losses leads to an unfavorable impact on the bank's profit. Given a higher interest rate, farmers with safe projects will leave the market, since they are most probable to repay their debts, and hence are most frustrated. On contrary, farmers who are least likely to repay are most curious to borrow in spite of high interest rates. Consequently, profits plummet as the interest rate goes beyond a certain threshold, implying that the bank is better off rationing credit at a lower interest rate rather than further increasing it. Such an adverse selection urges the bank to sort out borrowers by asking for collaterals. If being asked to put up collaterals, highly risky borrowers will be least willing to do that since they are most likely to lose their precious assets (Berger et al., 2011). Given the shortage of acceptable collaterals and the difficulty to repossess them, sorting out highly risky borrowers seems impossible.

Rural credit markets are also affected by moral hazard that emerges when banks cannot perceive borrower behaviors due to information asymmetry. Then, banks face the risk that borrowers do not try to make projects successful or even change the type of projects taken up after being granted credit. Investing a bank loan in a project in fact shares the risk between the bank and the borrower since, if the project fails and the loan is not repaid, the bank must bear at least part of the loss. Consequently, it is possible that the borrower opts for risky projects, hence suppressing the probability of repayment. Again, the bank rations credit, exposing borrowers to informal lenders who have substantial information and transaction cost advantages that enable them to monitor borrowers and impose timing punishes for defaulting.

Due to the information asymmetry that results in adverse selection and moral hazard, banks terminate lending to risky borrowers, leading to the incidence of 'quantity rationing' in which potential borrowers who lack assets to collateralize are denied access to credit. Given the absence of insurance markets in rural areas, information asymmetry also induces banks to shift so much contractual risk to borrowers that they decide to cease borrowing for a fear of losing collaterals, even though they have collaterals that may well qualify for a credit grant. Boucher et al. (2008) calls this 'risk rationing', and argues that both quantity and risk credit rationed individuals will retreat to lower expected return activities and occupations. However, in many cases farmers have to switch to informal credit to acquire funds needed for taking care of crops. Then, informal credit, including trade credit,

flourishes since it has a better access to inside information that allows them to substitute information-based screening, monitoring, and enforcement for physical collaterals, and to offer credit to farmers who are rationed out by banks.

2.2. Trade Credit

Trade credit is simply a credit arrangement between a seller and a buyer of a commodity in which the seller transfers a quantity of the commodity and an amount of credit equivalent to the value of the transacted commodity to the buyer for a certain period of time. When it is due, the buyer has to pay back the seller the amount of money that both parties agreed upon.

The price discrimination theory maintains that sellers employ trade credit to discriminate price so as to attract buyers. Buyers who resort to trade credit are normally denied access to formal credit, so they constitute the most price elastic segment of the market (Petersen & Rajan, 1997). Then, trade credit turns out to be a practical means of price discrimination as sellers reduce the price of the commodity to trigger demand (Teng et al., 2014). Sellers also apply price discrimination because of being concerned about the survival of buyers, specifically when they have no potential substitutes for them. Given the price discrimination policies pursued by sellers, buyers who are credit rationed for engaging in a risky business like agricultural production may deem trade credit underpriced, thus tending to use more of it.

The financing advantage theory argues that sellers have a substantial advantage over banks since the former are better able to fetch right information about buyers via commodity relationships, thus reducing the default risk resulted from moral hazard, and enabling them to better enforce repayment (Jain, 1999; Aaronson et al., 2004). As a result, suppliers do not ask for collateral (e.g., land). As for farmers, land is a precious asset, so they are not always willing to pledge it to borrow and thus turn to trade credit for funds. Therefore, trade credit prospers since it manages to satisfy the demand of farmers for funds, especially at the onset of cropping seasons (Gupta & Chaudhuri, 1997).

According to the transaction cost theory, sellers use trade credit as an effective device to cope with transaction cost. Trade credit mitigates the transaction cost of paying bills because buyers can gather obligations and pay them once instead of every time when the commodity is delivered (Ferris, 1981). There could also be a typical seasonality in the demand for the commodity supplied by the sellers like agricultural production inputs. In order to smooth business, sellers have to maintain large stocks, inducing a considerable warehousing cost. By granting trade credit selectively across buyers and over time, sellers may better control that cost. This strategy is attractive to those farmers who are denied access to bank credit since agriculture is time-dependent, so production inputs have to be acquired at the right point in time, and they cannot wait till banks change their mind.

The marketing theory of trade credit contends that buyers, especially those who are credit rationed, opt for trade credit since it enables them to check out the quality of the commodity to be purchased. This opportunity is vital to the success of production in places where information asymmetry about commodity quality is widespread, and cheating behaviors prevail like rural areas of many developing countries.

3. Research Method

3.1. Estimation Model

As just explained, credit rationing increases the use of trade credit in the sense that farmers facing quantity and risk credit rationings will use more of trade credit in the form of deferred payment to agricultural input purchases due to a fear of losing crops.

It is difficult to estimate the impact of credit rationing on the amount of inputs purchased by rice farmers on the basis of deferred payment (i.e., trade credit) due to the selection bias, implying the assignment to treatment (i.e., having full access to bank credit) is non-random and depends the farmer's traits. This paper addresses the problem by using a relatively large size data set of 1,065 rice farmers, which allows us to employ a semi-parametric propensity score matching (PSM) estimator. PSM is commonly used in empirical studies (e.g., Rosenbaum & Rubin, 1983; Roberts & Key, 2008; Briggeman et al., 2009; Pufahl & Weiss, 2009; Katchova, 2010; Ciaian & Kancs, 2012) thanks to its ability to control the selection bias by constructing the counterfactual. The counterfactual is what would have happened to those farmers who had in fact got full access to bank credit if they had not. The key assumption of PSM is that farmers selected into treatment (i.e., having full access to bank credit) and non-treatment groups have potential outcomes in both states – the one in which they are observed and the one in which they are not actually observed. Let $D = 1$ denote the state in which farmer i gets full access to bank credit (the treatment), and $D = 0$ denote the state when he does not get full access to bank credit (the control).

PSM is employed to determine the difference between the treatment and the control, which is called the average treatment effect on the treated (ATT), after controlling for differences among them. For a given farmer who gets full access to bank credit, the observed amount of trade credit is $E(Y_1|D = 1)$ and the unobserved (hypothetical) amount of trade credit is $E(Y_0|D = 1)$. Identically, for a given farmer who does not get full access to bank credit, the observed outcome is $E(Y_0|D = 0)$, and the unobserved (hypothetical) outcome that a farmer who does not get full access to bank credit

would have realized had he indeed had full access to bank credit $E(Y_1|D = 0)$, where $E(\cdot)$ is the expectation operator in each of the expressions. Following Rosenbaum and Rubin (1983), the parameter of interest of this paper is the ATT.

$$\text{ATT} = E(Y_1 - Y_1|D = 1) = E(Y_1|D = 1) - E(Y_0|D = 1)$$

The central interest of impact evaluation of this paper is not on $E(Y_0|D = 0)$, but $E(Y_0|D = 1)$. For that purpose, PSM uses balancing scores to extract the observed outcome of the farmers who do not get full access to bank credit and are most similar in observed traits to the farmers who get full access to bank credit, i.e., it uses $E(Y_0|D = 0)$ to estimate the counter factual $E(Y_0|D = 1)$. In order for the true parameter to be estimated, it is required that:

$$E(Y_0|D = 1) - E(Y_0|D = 0) = 0$$

Which ensures that the ATT is free from self-selection bias.

Using Probit estimator, a probability for each farmer of getting full access to bank credit (propensity score) is computed. Based on this propensity score, for each treated observation a counterfactual is estimated using the kernel matching procedure. This allows to compare each treated observation only with the control having similar values of observable traits. To assure that the compared farmers are not too different in terms of propensity score, this paper employs matching with caliper of 0.01.

To compute the propensity score, there is a must to specify an empirical model on the factors affecting farmers' access to bank credit. In this paper, that model is specified based results of previous studies. According to them, when making lending decisions, banks consider collateral, income, and other relevant traits of the farmer, such as land value, income, and duration of residence, age, education, gender, experience, and social status.

To get access to bank credit, a farmer has to have acceptable collaterals that enable the bank to recoup losses if the farmer defaults. Pledging collateral signals the goodwill of using the loan effectively because the farmer will lose that valuable asset if defaulting. Since collateral alleviates default risk, the bank may even lower the interest rate to favor the farmer and develop a long-lasting relationship with him (Berger et al., 2011). Often, collateral must be of high value (e.g., land in the case of farmers) so that the bank can nullify default risks resulted from the uncertainties on rice yield and price – the determinants of the farmer's income and debt repayment capacity (Kislat et al., 2017). Sizable land that is often of high value enables the farmer to make use of the economies of scale in order to boost production efficiency and repayment possibility. As a result, farmers having land of higher value are less likely to face credit rationing (Fletschner, 2009).

Income has a vital role in attenuating credit rationing confronting farmers since income determines their debt repayment capacity. Wealthy farmers tend to use loans wisely, enabling them to repay loans and thus alleviating credit rationing (Feder et al., 1990). Wealthy farmers usually prefer own funds of which cost is lower, especially in countries where credit systems are underdeveloped, and information and transaction costs are high (Fischer et al., 2019). Using own funds emanates creditworthiness, thereby improving access to credit for them. Those farmers are also better able to make use of resources of all kinds to generate income, thus being less adversely affected by external shocks that would dampen their debt repayment capacity. Another advantage of wealthy farmers is the large-scale production and strong bargaining powers when selling produces and purchasing inputs, which largely improves efficiency (Tiessen & Funk, 1993).

Farmers residing longer in the locality may face less acute credit rationing since banks have more information to appraise their creditworthiness (Kislat et al., 2017). According to Abbink et al. (2006), Dufhues et al. (2012), and Shoji et al. (2012), banks have sufficient time to develop intimate relationships and effective sanction mechanisms as to those farmers, which helps mitigate the risk of defaulting. Intimate relationships also render mutual trust and enable banks to ease requirements (especially, collateral), creating better opportunities for farmers to get access to credit (Brewer et al., 2014; Kislat et al., 2017).

Age is also taken into account by a number of empirical studies on credit rationing, such as Freeman et al. (1998), Winter-Nelson and Temu (2005), Franklin et al. (2008), and Awunyo-Vitor et al. (2014). According to those studies, older farmers may have established relationships with a wide range of partners, making it easy for them to get necessary supports and guarantees. Assets they have accumulated also create trust by banks. Older farmers are shrewd in making decisions on production, investment, and consumption. Therefore, they are highly regarded for creditworthiness, which helps improve their access to credit from banks.

As an essential element of human capital, education attainment affects the degree of credit rationing facing farmers (Kuwornu et al., 2012; Kislat et al., 2017). Better educated farmers may possess a good ability to improve production efficiency, thus being better to repay debts and less credit rationed. They are also competent in applying new production techniques and accessing market and credit information, implying that they are better able to deal with production and market risks, and to get access to credit (Fletschner, 2009).

Females in rural areas of developing countries are usually responsible for housework in accordance with the division of labor in the family. As a result, they lack social relations, understanding of borrowing procedures, and communication skills, making it hard for them to get access to bank credit (Alesina et al., 2013). Females have a trivial role in production and in the process of making use of family resources (Petrick, 2004; Awunyo-Vitor et al., 2014). This dearth of power on those tributes induces banks to see females as less adept in repaying debts because they seldomly get their husbands' approval for that. Females are hardly bequeathed estates, thus lacking collaterals to pledge to borrow, so it is likely that banks refuse to grant them credit (Fletschner, 2009).

Information asymmetry is prevalent in rural credit markets since it is hard for banks to garner sufficient information about borrowers owing to geographical distance (Cerqueiro et al., 2011; Bellucci et al., 2013; Witte et al., 2015; Kislat et al., 2017). Because farmers sparsely reside over an extensive rural area, geographical distance and its concomitant asymmetric information between a bank and a farmer are considerable. As a result, many farmers are unable to get access to credit because the information necessary for banks to screen, monitor, and enforce debt repayment is less accurate as the bank is located further from farmers. Differently stating, geographical closeness helps banks grasp creditworthiness and inspect activities of farmers (Gershon et al., 1990; Degryse & Ongena, 2005; Barslund & Tarp, 2008). Therefore, it is more beneficial for banks to grant credit to farmers who live nearby, or geographical distance may have an unfavorable effect on the likelihood of a farmer being given bank credit.

Social relationships that promote trade prove important to farmers since they mitigate risks resulted from external factors by sharing human, material, and financial resources to create funds to safeguard oneselves (Baird & Grey, 2014). In addition to helping form a solid underpinning to enhance decision quality, social relationships also smooth information exchanges, thus boosting the ability to adapt to natural, social, and economic uncertainties so as to contain risks. If heads or members of households have got a position in organizations or businesses, they may enjoy a better social relationship that enables them to gather essential information and to be guaranteed by someone, which significantly helps alleviating the degree of credit rationing. In addition, people with rich social relationships are normally appreciated for prestige, and usually try to repay debts to sustain reputations. This may prompt banks to grant them more credit (Qin et al., 2018).

An important factor affecting credit access for farmers is the number of years engaging in agricultural production (i.e., experience). Farmers are basically afflicted by risks regarding production, market, and financing, which can be softened by knowledge gradually amassed while undertaking agricultural production. Agricultural production is a continual process that enables farmers to gain useful knowledge. Such knowledge is beneficial in the sense that it allows them to well handle unpredictabilities stemming from weather and market. Moreover, knowledge as an intrinsic product of experience improves farmers' ability to pinpoint problems and apply appropriate solutions to overcome risks that may devastate their businesses from time to time. Knowledge also guides farmers toward sustainable production in order to improve productivity and creditworthiness, which may enable them to get better access to bank credit (Sumane et al., 2018).

Based on the above mentioned arguments, this paper specifies an empirical model to estimate the impact of factors affecting credit rationing facing farmers in Vietnam as follows:

$$\begin{aligned} \text{creditrationing}_i = {} & \beta_0 + \beta_1 \text{land}_i + \beta_2 \text{income}_i \\ & + \beta_3 \text{residence}_i + \beta_4 \text{age}_i \\ & + \beta_5 \text{education}_i + \beta_6 \text{gender}_i \\ & + \beta_7 \text{distance}_i + \beta_8 \text{socialposition}_i \\ & + \beta_9 \text{experience}_i + \varepsilon_i \end{aligned} \quad (1)$$

In Model (1), the dependent variable (creditrationing_i) is constructed based on the ratio of the amount of bank credit granted to the farmer and the amount of credit he applies for (borrowrate_i). If $\text{borrowrate}_i \geq 1$, there is no credit rationing, so creditrationing_i has a value of 0. If $0 \leq \text{borrowrate}_i < 1$, there is credit rationing, so creditrationing_i has a value of 1. Model (1) will be estimated using Probit estimator to identify the propensity score. Based on the propensity score identified, this paper uses PSM to compute the impact of credit rationing on the amount of trade credit used by farmers.

3.2. Data

The empirical model specified previously requires data on the determinants of access of rice farmers to credit and variables capturing the amount of trade credit used by them. The data used in this paper were collected through direct interviews with heads of 1,065 rice households randomly selected out of provinces and city in the MRD. In each province (city), the village with the largest area of land devoted to rice production from the district with the largest area of land devoted to rice production was picked up for survey. In each village, 200 rice farmers were randomly chosen for interview. Questionnaires were directly administered through face-to-face interviews with household heads. Yet, due to difficulties in reaching household heads, being refused be informants, and missing information, we were able to create a data set of 1,065 rice farmers as much.

The size of the sample is sufficiently large and diverse to represent the target farmers of interest, which includes 200 rice farmers in An Giang (18.78% of the total sample), 117 in Bac Lieu (10.99%), 100 in Ca Mau (9.39%), 126 in Can Tho (11.83%), 118 in Hau Giang (10.08%), 145 in Kien Giang (13.62%), 92 in Soc Trang (8.64%), 70 in Tra Vinh (8.90%) and 97 in Vinh Long (9.11%). The data also include socio-demographic traits of rice farmers such as age, education, gender, major occupation, farming experience, family size, duration of residence, and distance to the nearest bank, in addition to the amount of trade credit used by farmers to obtain production inputs.

4. Results

4.1. Sample Description

The sample includes 1,065 rice farmers randomly selected in the MRD. The average age of household heads is 50.89 (Table 1). Number of people per household is 3.15. The farmers have resided quite long in the locality (47.08 years on average). Their education attainment is relatively low, with an average schooling of just 6.29 years. Education reflects the ability to acquire and apply technological advances and market information into production. Therefore, such a low level of education may adversely affect rice yield and production efficiency of the farmers.

Due to lack of collateral (the average of agricultural land area is only 22,220 m^2 per household with 3.15 people each), it is hard for the farmers to get access to bank credit because of uncertainties about price and weather, which create substantial risks for banks. Long distance to banks (9.983 km on average) also hinders the farmers' access to bank credit since it intensifies the degree of information asymmetry and pushes up transaction cost for both farmers and banks.

The average size of bank loans to a farmer is VND41.48 million per year, with a deviation of VND55.56 million. This information discloses a large disparity in the access to bank credit among rice farmers. Indeed, as many as 817 farmers (76.71%) managed to borrow only part of the amount of credit they requested from banks or totally denied, implying that they are credit rationed and face severe problems in financing production (Table 2). A much smaller portion of the surveyed farmers (23.29%) are not rationed by banks since they are basically wealthy and able to offer acceptable collaterals.

Due to credit rationing, farmers turn to trade credit to obtain production inputs needed for ensuring successful harvests. Indeed, the average amount of trade credit granted to a rice farmer is VND51.08 million per year as much, about 1.2 times of bank credit (Table 1). The reason for being granted that much trade credit was explained in Section 2.2 of this paper. Moreover, since offering trade credit is commonly perceived as a source of competitive advantage, the stronger competition among input sellers, the greater their incentive to grant trade credit to farmers in order to preempt competitors and internalize more benefits. In addition, input suppliers sporadically conduct joint investments in the farms of those farmers whose crops have been disease-aggravated to get them out of the adverse situation. This specific attribute

Table 2: *Status quo* of the Access to Credit of Rice Farmers

Criteria	Number of Observations (Farmers)	Percentage of Total
Non-rationed	248	23.29
Rationed	817	76.71
Totally rationed	106	9.95
Partially rationed	711	66.76
Total	1,065	100.00

Source: The Authors' Survey (2018).

Table 1: Characteristics of Rice Farmers in the MRD

Criteria	Mean	SD	Min.	Max.
Age of household head (years)	50.89	10.88	20.00	78.00
Number of people per household	3.15	1.06	1.00	8.00
Residence in the locality (years)	47.08	12.87	2.00	78.00
Schooling of household head (years)	6.29	3.28	0.00	16.00
Area of agricultural land (m^2)	22,220	17.475	1,000	130,000
Distance to the nearest bank (km)	9.983	4.04	1.00	31.00
Bank loans (million VND/year)	41.48	55.56	0.00	370.00
Amount of trade credit (million VND/year)	51.08	59.21	0.00	405.00

Source: The Authors' Survey (2018).

Table 3: Determinants of Credit Rationing Facing Rice Farmers

Dependent Variable: Creditrationing$_i$ (1 if there is credit rationing and 0 if otherwise)			
Variables		**Estimated coefficient**	**Z-value**
C	Constant	0.9826***	2.75
landvalue$_i$	Value of land (VND million)	–0.0001***	–6.42
income$_i$	Income (VND million)	–0.0019***	–3.13
residence$_i$	Residence in the locality (years)	–0.0004	0.07
age$_i$	Age of household head	–0.0014	–0.20
education$_i$	Formal schooling of household head (years)	–0.0324**	–2.19
gender$_i$	Gender of household head (male = 1)	–0.0202	–1.27
distance$_i$	Distance to nearest bank (km)	0.0333***	7.17
position$_i$	Position of household head (yes = 1)	0.0243	0.26
experience$_i$	Number of years engaging in rice production	–0.0073	–1.44
Number of observations (*N*)		1,065	
Significance level		0.0000	
Log likelihood		492.8344	

Notes: (*), (**), and (***) designate statistical significance at the 10%, 5% and 1%, respectively.
Source: The Authors' Survey (2018).

of input sellers in Vietnam brings about mutual benefits that encourage them to grant more trade credit since it mitigates the risk of default by combining the farmer's experience with capital and market access of the supplier to make crops more profitable.

4.2. Determinants of Rice Farmers' Access to Credit

Several factors affect the access of rice farmers to bank credit. The results shown in Table 3 are based on a Probit model, which identify the factors that determine the likelihood of a rice farmer getting access to bank credit. Rice farmers with a higher value of land are less credit rationed as landvalue$_i$ has a negative coefficient at a significance level of 1%. Given the fact that income$_i$ has a negative coefficient at a significance level of 1%, credit rationing is less likely to occur to wealthy farmers. Likewise, education$_i$ has a negative coefficient at a significance level of 5%, divulging that it is easier for better educated farmers to get credit from banks.

As previously analyzed, geographical distance from the nearest bank is a proxy for the degree of information asymmetry and transaction cost facing the farmer. Table 3 shows that the further away a rice farmer is located from a bank, the more probable credit rationing occurs because distance$_i$ has a positive coefficient at a significance level of 1%. Other variables such as residence$_i$, age$_i$, gender$_i$, position$_i$, and experience$_i$ have coefficients that are not statistically significant, so there is no conclusion about the effect of the duration that a farmer has resided in the locality, age, gender, social position, and experience of household heads on the likelihood of credit rationing.

Table 4: Impact of Credit Rationing on Trade Credit Used by Farmers

Categories Compared	Estimated Coefficient (ATT)	*t*-value
Credit rationed vs non-credit rationed farmers	1.136***	10.111
(2) vs (1)	–0.723***	–5.490
(3) vs (2)	–0.511**	–2.716
(4) vs (3)	–0.501**	–2.154
(5) vs (4)	–0.463*	–1.892

Notes: (*), (**), and (***) designate statistical significance at the 10%, 5%, and 1%, respectively.
Source: The Authors' Survey (2018).

5. Discussion

According to Table 4, the estimated coefficient of 1.136 (with a significance level of 1%) reveals that bank credit and trade credit are substitutes, implying that the rationing imposed by banks increases the amount of trade credit used by rice farmers. In other words, if not being able to get access to bank credit, rice farmers will seek trade credit

Table 5: Bank Credit and Trade Credit used by Rice Farmers

Category	Degree of Credit Rationing	Amount of Bank Credit Borrowed (VND million/household)	Amount of Trade Credit (VND million/household)
1	$0 \leq borrowrate_i < 0.2$	35.080	72.387
2	$0.2 \leq borrowrate_i < 0.4$	75.269	63.792
3	$0.4 \leq borrowrate_i < 0.6$	101.000	50.025
4	$0.6 \leq borrowrate_i < 0.8$	104.000	13.936
5	$0.8 \leq borrowrate_i < 1.0$	122.994	13.040

Source: The Authors' Survey (2018).

so as to obtain production inputs since production is pivotal for their income. This finding reflects the fact that the production scale of most rice farmers in Vietnam is basically small, so it is hard for them to get access to bank credit for lacking collateral, reliable information, and high transaction costs. Therefore, they must resort to trade credit in the form of deferred payment to obtain needed production inputs, especially at the start of each production cycle.

To provide a more precise picture of the impact of credit rationing on trade credit use by farmers, we split up the sample of 1,065 rice farmers into 5 categories with descending degrees of credit rationing. Specifically, the first category includes rice farmers with $0 \leq borrowrate_i < 0.2$, category 2 with $0.2 \leq borrowrate_i < 0.4$, category 3 with $0.4 \leq borrowrate_i < 0.6$, and so on. Table 4 shows the estimated result received from comparing category 2 with category 1, category 3 with category 2, category 4 with category 3, etc.

When comparing categories of various degrees of credit rationing, we get statistically significant coefficients having a negative sign and decreasing magnitudes (Table 4). According to this finding, as the degree of credit rationing drops, farmers borrow more from banks and use less trade credit (i.e., a phenomenon that is also confirmed by Table 5), since the implicit interest rates that farmers have to pay trade creditors (i.e., 1.79 per cent per month on average) are much higher than those charged by banks (0.89 per cent per month on average). Moreover, when purchasing production inputs on the basis of trade credit farmers face the hold-up problem, i.e., it is difficult for them to switch to other sellers for better quality inputs with lower prices. This finding is an obvious evidence of the substitutive relationship between bank credit and trade credit that previous studies have come up with.

Table 4 also shows that the less credit rationing facing the farmer, the faster the amount of trade credit used by them decreases, implying that bank credit can drive trade credit out of the market if banks manage to tackle the problem of information asymmetry and transaction cost, which helps reduce the degree of credit rationing imposed on farmers.

6. Conclusion

Credit rationing prevails in Vietnam due to asymmetric information and transaction cost, which affects the amount of trade credit used by rice farmers to acquire needed production inputs. Based on the relevant theoretical background, this paper uses PSM to estimate the effect of credit rationing on the amount of trade credit used by rice farmers in this country. The result shows that land value, income, and level of education of household head significantly contribute to relieving the degree of credit rationing facing rice farmers. Meanwhile, rice farmers who are male or reside afar from banks confront with more severe credit rationing.

It is also found that credit rationing magnifies the use of trade credit by rice farmers. In other words, if being denied access to bank credit, rice farmers will seek trade credit so as to have needed production inputs since production is crucial for their income. This finding reflects the fact that the production scale of most rice farmers in Vietnam is basically small, so it is hard for them to get access to bank credit for lacking collateral, reliable information, and high transaction cost (Le & Kim., 2020). Therefore, they must turn to trade credit in the form of deferred payment to obtain production inputs. Moreover, as the degree of credit rationing drops (i.e., farmers get a higher possibility to access bank credit), rice farmers borrow more from banks and use less of trade credit, since the implicit interest rates that farmers have to pay trade creditors (input sellers) are much higher than those charged by banks. When purchasing production inputs on the basis of trade credit farmers face the hold-up problem, i.e., it is difficult for them to switch to other sellers for better quality inputs with lower prices. This finding is an obvious evidence of the substitutive relationship between bank credit and trade credit. It can be inferred from the results that banks can drive trade creditors out of the market if they manage to solve the problem of information asymmetry and transaction cost.

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