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Trade credit use by shrimp farmers in Ca Mau province

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Abstract

Purpose – The purpose of this paper is to investigate the determinants of the amount of trade credit granted to shrimp farmers in Ca Mau.
Design/methodology/approach – Based on the literature review, the authors proposed six hypotheses on the determinants of the amount of trade credit granted to shrimp farmers. Data collected from 120 shrimp farmers in Ca Mau were used to test the proposed hypotheses.
Findings – Two out of six determinants, i.e. the size of input order (a pulling factor) and the competition among input suppliers (a pushing factor), are significantly positively associated with the amount of trade credit granted to shrimp farmers. No impact of the other determinants was found. The findings imply that shrimp farmers should join cooperatives to enhance access to trade credit and mitigate the risk for input suppliers.
Originality/value – This paper sheds light on the fact that trade credit is still granted to such risky buyers as shrimp farmers, which has not been explored by previous studies.

Keywords Trade credit, Cooperative, Mekong river delta (MRD), Shrimp farmer
Paper type Research paper

1. Introduction

Trade credit that takes the form of deferred payment on good purchase is widely used by input suppliers. Trade creditors do not require collateral but use personal contacts and relationships instead, allowing those who are denied by credit institutions to get access to funds for business activities. Since trade credit benefits both suppliers and buyers, it prevails in countries where financial intermediation is limited due to information imperfection and transaction cost. Trade credit enables credit constrained buyers to secure needed goods with sufficient quality and quantity, thus facilitating the functioning of product markets and boosting productivity through prompt access to input markets.

Trade credit mitigates the misuse of the loans and improves the ability to repay (Burkart and Ellingsen, 2004). Granting trade credit as a part of trading relationships helps to build loyalty and mutual dependence between the suppliers and the buyers, so trade creditors face less severe risks than credit institutions. However, relevant risks remain because of the default from buyers who legitimately lack financial resources to repay and the deliberate non-repayment by buyers who hope to steal the owed credit. This asks for proper screening, tight monitoring and effective enforcement which are hard to get done due to a lack of information on buyers and the absence of court devices, while trade creditors make decisions based mostly on informal relationships.

There is a vast body of literature on the prevalence of trade credit but none has dealt with the determinants of trade credit granted to highly risky producers like shrimp farmers

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in Vietnam. Strongly driven by a surge in international market demand, enhancement in farming technology, diversification of species, intensification of production and official supports, shrimp production in Vietnam has grown rapidly and contributed significantly to the country's economic development (Joffre *et al.*, 2018). However, the introduction of genetically modified, exotic species and new farming systems creates pollution and environment degradation, leading to a recurrence of disease outbreaks that confront farmers with huge production risks. Global warming, rising sea levels, saline intrusion and extreme weather make shrimp farming more vulnerable. Another crisis is imminent as the obliteration of mangrove forests exposes shrimp farms to storms and sea-level rises resulting from climate change. Shrimp is displaced from its natural environment, provided with artificial feed, stocked in high density, exposed to stress through changes in water quality and transported regionally, nationally and internationally. This increases the pathogenicity of infections and the transboundary spread of disease.

The globalization of shrimp value chains magnifies market risk for farmers. Shrimp is among the first farmed species to be traded internationally but shrimp value chains are hardly coordinated through market exchanges. They are instead influenced by strategies of "lead" firms that maneuver access to final markets at international, national and local levels and assign who does what along shrimp value chains, at what price, using what standards and delivering at what time (Jespersen *et al.*, 2014). This structure interacts with complex networks of value chain actors, business managers, farmer associations, certifiers, multi-stakeholder initiatives, expert communities and government officials. It is impossible for shrimp farmers to acquire information required to sustain a particular transaction due to the complex transmission of information between actors in the value chain. Shrimp processors source raw materials from farmers without contract. All this means that international market volatilities create huge risks for shrimp farmers.

Production and market risks make shrimp farming a gamble, leading to financial risk since shrimp farmers are denied access to formal credit (Joffre *et al.*, 2018). So, trade credit with flexible terms emerges to finance them. Given trade credit, shrimp farmers quickly have needed inputs to start production and control diseases, thereby avoiding loss due to a lack of capital and other disrupts. Motivated by this fact, this paper is conducted to explore the determinants of trade credit granted shrimp farmers in Ca Mau – the largest shrimp producer of Vietnam.

2. Literature review

2.1 Rural credit market failures and credit rationing

In a perfectly competitive credit market, the interest rate – the price of credit – is determined through supply and demand. Because those people with the best investment opportunities are willing to pay the highest interest rate, they should theoretically be picked up. Such a credit market is efficient in the standard economic sense of Pareto efficiency – i.e. it is not possible to make someone better off without making someone else worse off (Besley, 1994). However, perfect competition, where a large number of buyers and sellers trade without transaction cost, is not an ideal model for rural credit markets. Rural credit markets are plagued by the issue of non-repayment, since borrowers are unable to repay or are unwilling to repay if lenders do not have sufficient sanctions against delinquent borrowers. To avoid this adverse problem, lenders need the ability to enforce the borrower. Yet, reclaiming loans through courts is not a well-established procedure in rural areas of developing countries. The enforcement problem is even exacerbated by poor property rights. Credit contracts are usually backed by collateral (land), but the ability to foreclose this asset is not straightforward since property rights are poorly codified. Rights to land are usufructural (i.e. based on using the land) and less possible to transfer to others, including a lender wishing to realize the value of the collateralized land. Consequently, lenders may terminate

lending – a phenomenon that often emerges in rural areas of many developing countries. Difficulties in enforcement thus explain the widespread use of informal credit arrangements that replace physical collateral with informal sanctions (social collateral). Informal sanctions based on personal powers, relationships and informational advantage from being insiders force the borrower to repay loans in situations where formal credit institutions are actually impotent (Udry, 1990; Bose, 1998).

Rural credit markets also deviate from an idealized market due to imperfect information. A lender's desire to lend to a certain borrower hinges on having sufficient information about the latter's reliability and on ascertaining that he will use the borrowed funds wisely. Imperfect information makes the screening and monitoring of the borrower very costly, thereby intensifying the problem of repayment. A solution to the repayment problem in rural credit markets is to have the borrower pledge a physical asset that the lender can claim if the borrower fails to honour the promise. Such assets are usually hard to come by in rural credit markets because borrowers are too poor to have assets that can be collateralized and/or because poorly developed property rights make seizing collateral in the event of default prohibitive.

A specific feature of agriculture, which provides most rural residents with income, is the risk of income shock stemming from extreme weather that hits the whole region and fluctuations in commodity prices affecting all producers of a particular commodity (Santos and Barret, 2011). Such shocks affect the operation of credit markets since they create the potential for a number of farmers to default simultaneously. The risk of default may be avoided if lenders can diversify loan portfolios, but rural credit markets are segmented, implying that a lender's portfolio of loans focusses on a category of borrowers facing common shocks to their income – e.g. those in a certain geographic area or producing a particular crop. The virtual lack of an insurance market to attenuate the problem of income shocks is an obvious fact in rural areas of developing countries, such as Vietnam (Le, 2013). If borrowers could insure their income, default might be less problematic. A means to get rid of the default problem is to gather credit histories so as to sanction delinquent borrowers. However, such a means requires reliable information that seldom exists in rural areas. Therefore, rural credit markets face severe problems arising from imperfect information that leads to adverse selection and moral hazard (Stiglitz and Weiss, 1981).

Adverse selection occurs when lenders do not know intrinsic characteristics of borrowers, e.g. preference for undertaking risky projects or incentive to repay debts. Then, lenders may consequently reduce the amount that they lend or ration credit, resulting in too little credit catering to the economy's demand. The rationale for that problem goes as follows. Suppose that the projects to which a lender's funds are allocated are risky and that borrowers do not earn enough to repay their loans. The lender will lose money because of the defaults by the borrowers, so he/she must charge a risk premium to break even. Yet, raising the interest rate to contain losses creates adverse consequences for the lender. If the interest rate is raised to offset losses from defaults, those people with the least risky projects will not borrow, since they are most likely to repay and hence are most disappointed from borrowing at a higher interest rate. In contrast, those who are least likely to repay are most encouraged to borrow at a higher interest rate. Profits then plunge as the interest rate goes beyond some point, implying that the lender is better off rationing credit rather than raising the interest rate further. Adverse selection urges the lender to find a way out by sorting borrowers into various groups according to their likelihood of repayment. A device for sorting out poor-quality borrowers is to require collateral. If the lender requires borrowers to pledge collateral, high-risk borrowers will be least inclined to comply because they are most likely to lose the collateral if their project fails (Berger *et al.*, 2011). Given the scarcity of collateral and the difficulty of foreclosure, sorting out high-risk borrowers is difficult. Then, informal lenders come in since they have better access to inside information that allows

them to substitute information-intensive screening, monitoring and enforcement for physical collaterals and to offer credit to those who are rationed out of the formal sector (Boucher and Guirkinger, 2007).

Rural credit markets are also aggravated by moral hazard – a problem that spontaneously emerges when lenders are unable to discern borrowers' actions due to imperfect information. A risk for lenders is that borrowers may lack efforts to make the project successful or may change the type of project taken up. Borrowing money to invest in a project shares the risk between the lender and the borrower, since if the project fails and the loan is not repaid, the lender must bear the cost of the loan. So, there is a tendency for the borrower to increase risk taking, reducing the probability of repayment. Again, the lender rations credit, leaving individuals exposed to informal credit. Informal lenders' information advantage enables them to monitor borrowers and impose penalties for shirking. By doing so, the informal credit sector not only absorbs the spillover demand of those excluded from the formal sector, but is also preferred by agents who could even obtain a formal loan.

As in contrast to formal credit markets, informal credit markets operating outside government control and regulation appear in diverse forms, including trade credit, moneylenders, rotating credit associations, etc. (Tang, 1995). As identified, formal credit markets can only cater to the need of a limited portion of the population, i.e. those who can provide collateral or documented credit references. Credit needs of many actors (particularly farmers) remain unsatisfied by formal credit because they are unable to provide collateral and the loans they request are so small that administrative costs for lenders outweigh expected returns. Moreover, formal credit institutions tend to be rigid while farmers lack accounting records. Therefore, informal credit markets emerge to fill the gap in terms of solving the credit intermediation problem. Because of the absence of direct government regulations, informal credit markets are flexible in operation. By utilizing mechanisms like social networks and market interlinkage, informal credit arrangements reduce adverse selection, moral hazard and enforcement problems that are not effectively handled by a formal creditor. Specifically, trade credit is based on market interlinkage where credit is linked to commodity transactions. Such an interlinkage increases lenders' ability to monitor borrowers' behaviour and motivates them to repay loans by making other transactions contingent upon loan repayment (Burkart and Ellingsen, 2004). However, studies focussing on trade credit use by farmers are desperately scant, so any study on this topic is highly deserved.

2.2 A brief overview of trade credit

Trade credit is a relationship between a supplier and a buyer of a good under the form of deferred payment in which the supplier transfers a quantity of the good and a concomitant amount of credit equivalent to the value of the transacted good to the buyer for a certain period of time. When it is due, the buyer has to repay the supplier the amount of money previously agreed upon (Le and Cao, 2013). The reasons why suppliers grant buyers trade credit and how it has become so prevalent, despite the existence of specialized credit institutions, attract much attention of researchers.

The financing advantage theory of trade credit contends that the supplier has an advantage over credit institutions with regard to evaluating and controlling risks facing the buyer. Indeed, the supplier obtains needed information at low costs via the normal course of business, visits to the buyer's premises and from other suppliers (Petersen and Rajan, 1997). The supplier is also better able to influence the buyer's behaviour since it may be in the nature of the good being supplied that there are few alternative sources other than the supplier. Then, the threat to cut off future supplies if the buyer acts in such a way that harms the possibility to repay is creditable as the buyer accounts for an unimportant portion of the supplier's sales. It is also effective for the supplier in salvaging value from the buyer's used assets. If the buyer defaults, the supplier can seize the good supplied to resell through

her established networks. The cost of repossessing and reselling the good is much lower than that of a credit institution.

The theory of price discrimination argues that suppliers use trade credit to discriminate price to allure customers. Buyers who rely on trade credit for funds are often credit rationed, so they constitute the most price-elastic segment of the market (Petersen and Rajan, 1997). Therefore, trade credit is an effective means of price discrimination if suppliers lower the price to entice higher demand (Teng *et al.*, 2014). Buyers with high profit margins who may be riskier find trade credit underpriced, thus are eager to use more of it. A supplier applies price discrimination also for the long-term concern of the survival of customers, especially when he/she has no potential substitutes for them.

According to the transaction cost theory, the seller uses trade credit as a means to mitigate transaction costs. Trade credit reduces the transaction cost of paying bills since the buyer can cumulate obligations and pay them once instead of every time when the good is delivered (Ferris, 1981). Moreover, there may be a strong seasonality in the demand pattern for the good the seller supplies. To maintain smooth production cycles, the seller has to build up large inventories, which incurs high costs of warehousing and financing them. By offering trade credit selectively, both across buyers and over time, the seller better manages the inventory position and transaction costs.

At the other end, there are reasons why a producer resorts to trade credit. First, the financing theory argues that trade credit is a perfect complement to formal credit for those who need capital but are denied access to formal credit. Second, trade credit enables the buyer to check out the quality of the good supplied, which is important where the information asymmetry about the quality of goods is widespread and cheating behaviour prevails (the marketing theory). Third, trade credit conveys reliable information about the buyer's creditworthiness to credit institutions which helps improve her access to formal credit (Biais and Gollier, 1997). Finally, trade credit allows the buyer to mitigate transaction cost and better handle risks.

2.3 Determinants of trade credit for shrimp farmers

The previous arguments imply that access to trade credit will enable shrimp farmers to utilize resources more efficiently to enhance income. Accordingly, there has been an enormous demand for trade credit from credit constrained shrimp farmers who are denied access to formal credit due to risk. However, granting trade credit incurs risk for trade creditors, so they have to screen buyers carefully on a number of dimensions to mitigate the risk of default. The first dimension is profit. To increase profit, the farmer should be able to generate more revenue while cutting costs, which is tough since shrimp farming is a high-risk industry concerning production, marketing and financing. Since revenue is quantity times price, the farmer must have a larger quantity of product sold at a higher price if wishing to get higher revenue (Yu and Leung, 2005; Yu *et al.*, 2006). This can be done only if the farmer has good farming techniques to enhance survival rate (which depends on biomass, density, temperature and age), growth rate and quality of the shrimp. The farmer should also have better marketing skills and long-lasting relationships with the buyer to establish mutual trust to sell products at a higher price and to deal with price seasonality. The farmer has to trim production costs that depend on exogenous and unpredictable conditions like weather, diseases and input markets. This entails good expertise in acquiring and using inputs and running equipment used in shrimp production. Thus, profit has an effect on the decision of trade creditors since shrimp farmers with a high profit are often less risky, better able to honour repayment and stay longer in the business. Moreover, profit is a source for investment capital essential for shrimp farmers to ensure a good harvest, therefore being better able to repay the debt. In order not to lose those clients, trade creditors tend to grant them more trade credit.

Another concern of trade creditors is land area owned by the farmer since land represents tangible wealth positively related to repayment capacity. Indeed, land is an inevitable condition for the farmer to apply inputs and practice good cultivation methods to fetch higher income to repay the debt. Land is a valuable asset that can be seized and liquidated by the trade creditor if the buyer fails to honour the promise. Since it is efficient for the supplier to liquidate collateralized land for the proximity and in-depth knowledge of the farmer, they grant more trade credit to farmers who own larger areas of land. Moreover, a larger land area constitutes a greater proportion of the farmer's income, encouraging her to make long-lasting investments in acquiring better production technologies using human and financial resources to make the crop more successful and to enhance land productivity (Koirala *et al.*, 2016). Because of inadequate *ex ante* risk management and *ex post* shock-coping abilities, farmers aim to diversify land usage to survive risk and enhance income (Lehmann *et al.*, 2013). Indeed, production and market risks are crucial to farmers' decision making. While market risk reflects the fluctuations in prices of output and inputs, production risk arises because crops depend on the environment (weather and pest pressure) that instantly varies. To cope with production and market risks, farmers have several on-farm, self-insuring options and risk-mitigating measures to safeguard income. An effective on-farm risk-mitigating strategy is to diversify land usage. That wise behaviour is effective if having a larger area of land. Thus, the farmer's repayment ability will improve and the supplier may raise the amount of credit given to her.

Shrimp farming needs a substantial amount of capital for pond preparation, feed, seeds and chemicals. Given the limited access to formal credit, a higher production cost means a larger quantity of input ordered by the farmer-cum-buyer, which raises the supplier's profit since it reduces costs of warehousing and financing inventories (Petersen and Rajan, 1997). This manner creates an incentive for the supplier to grant more trade credit to the buyer with a larger size of orders. The buyer ordering a large quantity may have a stronger bargaining power that urges the supplier to accept her request. According to Teng *et al.* (2014), it makes economic sense for a buyer to order small quantities and take the benefit of deferred payments offered by the supplier because doing so helps reduce the amount of inputs stored and avoid quality deterioration, especially if he/she does not have well-equipped storage facilities to keep inputs. That buyer's behaviour increases the cost for the supplier, urging her to grant more trade credit to those buyers that order larger quantity to induce the existing buyer to order a large quantity and allure new ones. This strategy improves the supplier's efficiency.

Researchers have often treated bank credit and trade credit separately, but they are somehow either substitutes or complements. One strand of the literature that focusses on the relationship between bank credit and trade credit argues that buyers rely on trade credit when facing difficulty in accessing bank loans due to information asymmetry and transaction cost (Danielson and Scott, 2004). In countries where financial systems are less developed, commercial banks have often lent carelessly for a prolonged period. In the course of time, the loans turn sour and the full extent of bad debts emerges. To tackle the problem, commercial banks reduce the availability of loans or tighten the conditions required to obtain loans, as adverse information about the financial soundness of borrowers and the dropped value of collateral becomes apparent. In that case, trade credit acts as a substitute for bank credit (Mateut *et al.*, 2006). However, other researchers argue that trade credit in the form of deferred payment and bank loan availability are complements (Aktas *et al.*, 2012; Tsuruta, 2015). Given intimate relationships, the supplier has an advantage that enables her to well grasp information about the financial standing of the buyer, which may be sound if the latter gets access to bank credit. Then, the supplier grants more trade credit since bank credit enables the buyer to conduct better investments to become successful, thus enhancing the capacity of repayment. This hypothesis implies that trade credit is positively related to bank credit.

Another determinant of the amount of trade credit given is the length of the relationship between the supplier and the buyer. Relationships foster the exchange of information and goods at various scales and degrees of intensity regarding centrality, connectedness, openness and density, thereby rendering reciprocity, trust, support and solidarity between individuals (Shoji *et al.*, 2012; Mogues, 2019). Thus, relationships enable the supplier to get chances to verify the integrity of borrowers to select the right ones, mitigating losses due to their cheating, shirking and opportunistic behaviour. Consequently, relationships facilitate the selection of creditworthy borrowers, the mutual monitoring of loan use and peer pressures for repayment, which are important in rural areas where formal means of screening, monitoring and enforcement are absent (Van Bastelaer and Leathers, 2006). Given the knowledge accumulated via relationships, the supplier can impose sanctions by threatening to stop giving credit, which is a powerful incentive for repayment for those borrowers who need capital but are banned by formal creditors. The combination of these factors contributes to lowering the lending cost, allowing the supplier to reach a wider range of buyers. Trade credit is conducted without contracts and collateral, so the enforcement to repay using courts is hardly the case and is costly for the former. So, the supplier pays a great deal of attention to the incentive to repay the buyer, which can be evaluated via the length of the relationship between the two (Le and Cao, 2013). Therefore, the supplier grants more credit to the buyer with intimate relationships.

Another factor relevant for the trade credit granted to shrimp farmers is the number of years they have engaged in shrimp farming (experience). Shrimp farmers face multiple complicated risks regarding production, marketing and financing, which need to be mitigated. That complication requires practical knowledge resulting from information evolving over time as farmers manage their shrimp business. Shrimp farming is a continuous learning process where farmers learn from their own experience and mistakes and exchange knowledge with others. Such knowledge is crucial as it contains an intimate understanding of the shrimp business to cope with uncertainties regarding policy, price, technology, climate and market demand. This experience-based knowledge improves the farmer's managerial capability regarding problem detection, analysis and solution implementation, enabling her to react properly to all risks that can ruin the business. The knowledge orients farmers to sustainable aquaculture that well integrates environmental, social and economic aspects, boosting productivity and income, mitigating failures and creating trust from the trade creditor, which stimulates her to grant more credit (Sumane *et al.*, 2018).

All the above-mentioned factors are pulling ones. There are pushing factors urging suppliers to grant trade credit to buyers. Despite risk, suppliers grant trade credit because of competition. A buyer usually seeks suppliers other than the one with whom she has a relationship to avoid the holdup problem spontaneously emerging from monopolistic power which allows the monopolistic supplier to extract all *ex post* profits from the buyer. In a competitive market with numerous suppliers, a buyer can easily switch from one to another supplier with low cost. This option enables the buyer to obtain a larger share of the generated profits and create an incentive for her to invest in establishing relationships with new suppliers (Fisman and Raturi, 2004; Fabbri and Klapper, 2016). The fear of losing customers forces the seller to grant more credit to them. This is acute in markets that sell homogenous goods like inputs for shrimp production. However, due to information asymmetry and agency cost, competition may deprive suppliers of the incentive to establish relationships with buyers which are costly but does not last long, thus reducing the amount of trade credit granted. The threat to stop granting credit to clients is only fruitful for monopolistic sellers but not for competitive ones. The fact that those failing to honour repayment will be punished is not effective if several suppliers operate in the same market. Since competition boosts risk for suppliers, it may reduce the amount of trade credit a supplier grants (McMillan and Woodruff, 1999).

All the aforementioned rationales allow us to specify the following empirical model to test for determinants of trade credit granted to shrimp farmers in Ca Mau:

$$tradecredit_i = \beta_0 + \beta_1 profit_i + \beta_2 landarea_i + \beta_3 ordersize_i + \beta_4 bankcredit_i + \beta_5 relationship_i + \beta_6 \text{exp}erience + \beta_7 competition + \varepsilon_i \quad (1)$$

The expected sign of the coefficients of the independent variables is shown in Table I.

3. Methodology

The secondary data used in this paper were retrieved from relevant organizations of Ca Mau province (mainly, the province's Statistical Office and the Department of Agriculture and Rural Development) and studies published in the country and abroad.

The primary data were collected using a multi-stage sampling frame. First, according to the Department of Agriculture and Rural Development of Ca Mau province, shrimp farming of this province is concentrated in the three districts of Dam Doi, Phu Tan and Cai Nuoc, which together account for 70 per cent of the land area devoted to shrimp farming of the province. The other six districts make up the remaining 30 per cent of the land. Therefore, we collected data in these three districts to make our data set a good representative of the province and to minimize sampling error. Because shrimp farmers are scattered over a vast area while our time and financial capacity were limited, we decided to construct a sample of 120 shrimp farmers. Second, in each district we chose the number of shrimp farmers to survey using the sampling method of probability proportional to size. Concretely, since Dam Doi, Phu Tan and Cai Nuoc account for 35.4, 25.4 and 45.8 per cent of the number of shrimp farmers of the province, the number of shrimp farmers selected for interviewing in Dam Doi, Phu Tan and Cai Nuoc is 42, 32 and 46 out of a total of 120 shrimp farmers in the sample, respectively. Finally, given the list of shrimp farmers obtained from each district, we randomly selected shrimp farmers to interview using a questionnaire.

The primary data set consists of several features of shrimp farmers, regarding demography (number of members, labourers, gender, education and experience) and the shrimp business (farming area, cost, output, inputs and selling methods). In this paper, the Ordinary Least Square estimation method is applied to examine the determinants of trade credit granted to shrimp farmers in Ca Mau.

4. *Status quo* of shrimp farming in Ca Mau

Ca Mau is the southernmost province of Vietnam, which has eight districts and one provincial city, with a population of 1.2m people of which a large portion engages in agriculture, aquaculture and forestry. The province is endowed with a favourable nature suitable for shrimp farming. It has a shoreline of 254 km and an area of 240 km^2 of mud flats that are 0.5–1.5 meters above sea level. Ca Mau has a mingled system of rivers and canals supporting a strong aquacultural sector and providing a convenient means of transport. Given 32 river mouths, a large part of its land is intruded by salt water and affected by

Variable	Meaning	Expected sign of β_i
$profit_i$	Profit of the previous breeding crop (Vietnamese Dong million)	–
$landarea_i$	Land area owned by the farmer (hectare)	+
$ordersize_i$	Size of the order (Vietnamese Dong million)	–
$bankcredit_i$	Amount of bank credit borrowed (Vietnamese Dong million)	–/+
$relationship_i$	Number of years of business relationship	+
$experience_i$	Number of years engaging in shrimp farming	+
$competition_i$	Competition pressure, measured by the number of competitors	+

Table I. Expected sign of the coefficients of the independent variables

complicated tide regimes, i.e. a semidiurnal tide by the East Sea and a diurnal tide by the West Sea, which are utilized by shrimp farmers to get water in and out of their ponds.

Shrimp farming is a key business in Ca Mau province. In 2014–2016, land areas devoted to shrimp farming increased by 0.68 per cent per year and shrimp production grew by 5.54 per cent per year, especially in 2010–2013 (about 9 per cent) and declined afterwards. Dominant shrimp species raised by farmers in Ca Mau are *Penaeus monodon* (black-tiger shrimp) and *Penaeus vannamei* (whiteleg shrimp). *Penaeus monodon* has a higher market price but a longer growth cycle. *Penaeus vannamei* is more resistant to diseases, has a shorter growth cycle, is more tolerant to a larger range of water salinity and temperature, and is more consistent in terms of quality and size. *Penaeus vannamei* has a lower market value but can be stocked at higher density, resulting in higher productivity with a shorter growth cycle (Joffre *et al.*, 2018). Shrimp farming in Ca Mau is distinguished according to the species cultivated and the level of intensification, i.e. extensive, improved extensive, intensive and super-intensive (Table II).

Shrimp farming is the main cause of deforestation, opening up vast stretches of coastline to erosion and threatening the future of shrimp farming in Ca Mau and the ecosystem. If the coastline turns bare, all the land behind it is exposed to storm surges, winds and typhoons. Another impending problem is land subsidence, so seawater intrudes further into the land. High salt levels cause a decline in shrimp yield since shrimps can only tolerate up to a certain level of salinity. Pollution also prompts threats, since shrimp farmers rely on a range of chemicals to keep their shrimp healthy, much of which is released directly into waterways. All this explains why shrimp yield in the longer-established farming types like extensive and intensive ones has declined (Table III), urging farmers to embark on new systems (i.e. the improved extensive and the super-intensive) to get rid of the problem, which asks for so much investment that many farmers cannot tolerate it. Given that investment, the yield of newly developed farming types has improved but has not been sustainable.

Rapid growth of shrimp farming and poor infrastructure has led to pollution, disease outbreaks, shrimp deaths and huge losses for farmers. Along one canal, many farmers scrambled for water and when shrimps got sick, they discharged the contaminated waste into waterways, paving paths for pathogens to disperse. In Ca Mau, shrimp die from early mortality syndrome, white feces disease and white spot syndrome virus. These diseases can

Table II.
Production of shrimp in Ca Mau

Type of farms	2014 Quantity (tonnes)	2014 % of total	2015 Quantity (tonnes)	2015 % of total	2016 Quantity (tonnes)	2016 % of total
Extensive	71,091	50.8	65,299	44.6	52,705	35.5
Improved extensive	26,236	18.7	35,063	23.9	45,390	30.5
Intensive and super-intensive	42,640	30.5	46,065	31.5	50,584	34.0
Total	139,967	100.0	146,427	100.0	148,679	100.0

Source: Department of Agriculture and Rural Development of Ca Mau province (2017)

Table III.
Yield by type of shrimp farming (tonnes/hectare/year)

Type of farms	2014	2015	2016
Extensive	0.36	0.35	0.30
Improved extensive	0.44	0.44	0.48
Intensive	5.20	4.80	4.63
Super-intensive	–	–	20.00

Source: Department of Agriculture and Rural Development of Ca Mau province (2017)

break out most often in the super-intensive and intensive systems. The environment has become so polluted that farmers often use antibiotics to prevent diseases. Besides its prophylactic purpose, antibiotics overuse increases the production cost.

5. Financing sources for shrimp farmers in Ca Mau

Ca Mau hosts 30 commercial bank branches of which 17 take part in lending to shrimp farmers. Their lending policies have been revised in that the lending quota increases and requirements have become less constrained. However, only 15 out of 120 surveyed farmers borrowed from banks, with an amount of Vietnamese Dong (VND) 58.26m each, with an average interest rate of 0.83 per cent per month and a loan term of 22.8 months. About 42.2 per cent of the money borrowed (VND 24.56m) was invested in shrimp breeding.

As much as 22.86 per cent of shrimp farmers did not borrow from banks due to the small size of loans as compared to their capital demand. Cumbersome procedures precluded 34 farmers from borrowing (28.33 per cent). Surprisingly, 48 shrimp farmers (40 per cent) reported not to have any demand for bank credit. Regardless of being a prerequisite requirement for accessing bank credit, collateral appears not to be an impediment for shrimp farmers since most of them have a certain area of land for shrimp breeding that can be collateralized.

The production cost of shrimp farming in Ca Mau is VND 710.32m per hectare per crop while farmers' owned capital amounts only to VND 239.64m (33.73 per cent of production cost). There are farmers without owned capital who were totally financed by input suppliers. Among 120 farmers surveyed, 105 used only trade credit (87.5 per cent), 15 used neither bank loans nor trade credit (12.5 per cent), while 16 used both (13.33 per cent). This means that shrimp farmers depend too much on trade credit. The fact that shrimp farmers purchase feed and chemicals on deferred payment has become popular in Ca Mau. Yet, they were not accepted by suppliers when requesting for seeds on the basis of deferred payment but were asked to pay cash in advance instead.

Most shrimp farmers chose to buy inputs on trade credit because of its attractive flexibility and their lack of cash. About 6.67 per cent of the surveyed farmers bought inputs on deferred payment, since they want to save cash for other opportunities and 5.71 per cent used trade credit due to the opportunity to inspect input quality. The prime concern of shrimp farmers is that trade credit brings about benefits, according to 53.33 per cent of the farmers surveyed (Table IV).

Most farmers repay debt at the time of harvest (in 2.5–3.5 months from the time of starting production). Farmers practicing the super-intensive farming have a shorter growth cycle of shrimp, so repayment duration is also shorter. For farmers whose crops were disease-aggravated and had to harvest shrimp earlier than expected, suppliers postpone the repayment till the next crop. Sometimes, suppliers conduct joint investments in borrowers' farms to get them out of adverse situations. This specific trait of input suppliers brings mutual benefits since it combines the farmer's experience with capital and market access of the supplier to make the crop successful.

The prices farmers have to pay for inputs purchased on deferred payment are often higher than that in cash payment. Sources of information for shrimp farmers about trade

Criteria	Mean	SD	Min.	Max.
Feed	93.71	105.33	0	561.60
Chemicals	22.41	28.52	0	146.19
Total	116.12	126.40	0	641.60

Source: The authors' survey

Table IV. Trade credit used by shrimp farmers (VND million/farmer)

creditors vary. Many used own information (32.38 per cent), were introduced by relatives or friends (25.71 per cent) or were approached by suppliers themselves (28.57 per cent). Farmers introduced by relatives or friends are subject to due inspections of input suppliers. The implicit interest rate that farmers have to pay to suppliers is 49.11 per cent per year (Table V).

6. Results

6.1 Sample description

Among the 120 shrimp farmers surveyed, 16 practiced super-intensive farming (13.33 per cent) and the rest intensive and semi-intensive farming (Table VI). Up to 104 farmers (86.67 per cent) raised whiteleg shrimp that has a shorter growth cycle and a higher yield. The remaining 16 farmers cultivated black-tiger shrimp (13.33 per cent).

The average age of the farmers is 46. The average time of their engaging in shrimp farming is 4.74 years (Table VII). The relationship duration between a farmer and an input supplier is 4.99 years. Land area owned by a farmer is around 2.38 hectares. Most of the farmers have resided in the village for quite a long time and have switched from extensive farming to intensive farming since the latter brings about higher profits.

Shrimp farming requires large ponds. The average pond area of a farmer is 0.49 hectare, and the labour needed is 1.96, of which 0.21 is hired (Table VII). The average size of juvenile

Table V.
Reasons for using trade credit

Reason	Percentage of total
Convenience	31.43
Lack of cash	24.76
No collateral required	8.57
Saving cash for other profitable purposes	6.67
Being able to inspect quality before paying	5.71
Time saving	3.81

Source: The authors' survey

Table VI.
Sample distribution by shrimp species and farming type

Shrimp type	Farming type		Total
	Intensive/semi-intensive	Super-intensive	
Black-tiger	16 (100%)	0 (0%)	16 (13.33%)
Whiteleg	88 (84.62%)	16 (15.38%)	104 (86.67%)
Total	104 (86.67%)	16 (13.33%)	120 (100%)

Source: The authors' survey

Table VII.
Characteristics of shrimp farmers

Criteria	Mean	SD	Min.	Max.
Average age (year)	45.95	10.55	25	75
Number of years engaging in shrimp farming	4.74	3.08	1	20
Household size (people)	4.98	1.25	2	8
Members taking part in shrimp farming (people)	1.75	0.85	1	6
Hired labour (people)	0.21	0.50	0	2
Owned land (hectare)	2.38	2.26	0.43	22.5
Pond area (hectare)	0.49	0.59	0.09	4

Source: The authors' survey

shrimp is of Postlarve 11.5. The average stocking density is 93.06 individuals/m^2 and the duration to harvest is 93.57 days. The average yield is 8.96 tonnes/breeding crop per hectare. The yield and breeding duration is closely related to disease status because it affects the growth rate of shrimp and even causes its death. The survey reveals that 62 out of 120 farmers surveyed (51.7 per cent) were impacted by diseases mainly related to liver and white feces.

Feed costs the most, making up 54.3 per cent with VND 385.87m (Table VIII). Medicine cost is VND 115.39m (16.2 per cent) and seed cost is VND 76.92m (10.8 per cent). Farmers harvest shrimp when it gets to a size of around 85 shrimps per kilogram and sell them at a price of VND 124,210 per kilogram on average, mostly to private traders on a cash basis. Prices at the farm gate are low and fluctuating due to a lack of market information and the deficiency of the shrimp marketing systems that allows traders to act as a monopsony. The average revenue is VND 1,175.26m per hectare for a crop, and the average cost is 710.32m. The average profit is 464.96m per hectare for a breeding crop, amounting to 39.6 per cent of revenue (Table IX).

6.2 Determinants of trade credit for shrimp farmers in Ca Mau

Before estimating Model (1), the authors tested for the multicollinearity between the independent variables using correlations and variance inflation factor (VIF). The test shows that the coefficients are smaller than 0.5 and the VIF is 1.23, implying that the problem of multicollinearity is negligible. We performed the White test for heteroskedasticty, which shows that the model has a problem of heteroskedasticity, which was corrected using the robust regression of Stata.

The coefficient of variable $ordersize_i$ is positive at a significance level of 1 per cent (Table X), implying that the economy of scale acts as a pulling factor inducing suppliers-cum-trade creditors to grant more trade credit so as to enhance profit. The coefficient of variable $competition_i$ – a pushing factor – has a positive value at a 1 per cent significance level since competition urges input suppliers to raise the trade credit amount granted to shrimp farmers. This result reflects the fact that there exist a lot of chemicals – an important input for shrimp disease control – with various qualities and prices, stimulating many actors to engage in this business and urging them to grant trade credit to those who buy chemicals of low quality with a high level of toxicity.

Criteria	Mean	SD	Min.	Max.
Seeds	76.92	78.87	0.75	409.09
Feed	385.87	472.93	7.5	2,759.36
Chemicals	115.39	144.55	0.75	827.81
Others (electricity, pond cleaning, etc.)	96.50	113.77	1.25	760.50
Total	674.68	761.54	13.12	4,405.36

Source: The authors' survey

Table VIII. Variable cost (VND million/hectare/ breeding crop)

Criteria	Mean	SD	Min.	Max.
Revenue	1,175.28	1,583.98	0	9,896.15
Cost	710.32	792.27	15.47	4,605.36
Profit	464.96	889.83	926.81	5,554.69

Source: The authors' survey

Table IX. Revenue and cost of shrimp farming (VND million/hectare/ breeding crop)

Variables	$\hat{\beta}_j$
$profit_i$	–0.081 (–1.04)
$landarea_i$	1.911 (0.63)
$ordersize_i$	0.610*** (9.73)
$bankcredit_i$	–0.154 (–1.03)
$relationship_i$	–0.178 (–0.57)
$competition_i$	14.890*** (3.16)
Number of observations (n)	120
R^2	0.7533

Notes: Dependent variable: the amount of trade credit used by farmers (VND million). *,**,***Significant at 10, 5 and 1 per cent levels, respectively
Source: The authors' survey

Table X.
Estimation results

Variable $profit_i$ (profit of the previous crop) has a negative coefficient that is not statistically significant. This reflects the fact that, given proximity and close relationships, suppliers can appraise buyers' creditworthiness to make decisions on granting trade credit rather than doing that based on the previous crop's profit. That is because there are farmers who earned profits but did not repay the debt because of moral hazard. Moreover, it becomes popular that suppliers invest in borrowers' farms, especially those who lost their previous crop and were not able to honour repayment.

Variable $landarea_i$ does not have a significant coefficient since suppliers only take account of this aspect when granting trade credit the first time because of lack of information. Afterwards, they make decisions according to own evaluation of the buyer's prestige. The coefficient of variable $bankcredit_i$ is not statistically significant since few farmers have borrowed from banks and invested a small part of the borrowed money in shrimp breeding. The coefficient of variable $relationship_i$ is not statistically significant since most of the shrimp farmers have resided and engaged in shrimp farming for a substantial period of time, so there is small gap among them with respect to the duration of their relationships with suppliers.

7. Conclusion

Shrimp farmers in Ca Mau face diverse risks regarding uncertainties in production and the market. Consequently, they have been denied access to formal credit. In that case, trade credit becomes important because it brings about chances for farmers to make use of the potential of their labour and land through prompt access to input markets. This explains the prevalence of trade credit in this province despite the risks facing trade creditors resulting from defaults from buyers who lack financial resources to honour repayment and the deliberate non-repayments by buyers who hope to steal the owed credit. The regression results show that the amount of trade credit granted to shrimp farmers depends on the size of input orders (a pulling factor) and the pressure of competition among input suppliers-cum-trade creditors (a pushing factor that strongly affects their profits).

It is inferred from the results that by forming cooperatives, shrimp farmers can improve the chance of being granted trade credit since cooperatives will enlarge the size of orders of inputs for production, thus improving production efficiency and enabling better access to output and credit markets. Cooperatives allow for effective contracts and enforcement, which reduces the risk of moral hazard and secure better prices for farmers when selling products. Grouping shrimp farmers into cohesive cooperatives serves to boost close relationships between financial and non-financial actors. Non-financial technical and advisory services are needed to improve the attractiveness of shrimp farmers to credit providers. Links between financial and product-market actors offer ways to harness the

advantages of both. Such arrangements lower selection and monitoring costs for creditors and reduce lending risk. Through the involvement of traders, processors and input suppliers, financial institutions can ensure that clients have market outlets, timely access to needed inputs and appropriate product-related advice.

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Further reading

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