Inclusiveness of contract farming along the vertical coordination continuum: Evidence from the Vietnamese rice sector

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ABSTRACT

The Vietnamese government is currently attempting to upgrade rice value chains in the Mekong River Delta by encouraging (i) vertical coordination between exporters and farmers through contract farming, and (ii) horizontal coordination among farmers through the “small farmers, large field” program. Previous studies on the determinants of contract farming participation assume that firms offer only a single contract type, whereas in reality, farmers may face a continuum of exclusive contract options. Devising correct and targeted policies for fostering contract inclusiveness hence crucially hinges on deploying correct econometric specification of the decision to participate in contract farming. We model contract farming participation and intensity in four different ways along the vertical coordination continuum: as a discrete, categorical, ordered, and continuous choice. We find that older, smaller and horizontally coordinated farmers with higher levels of trust in buyers tend to secure higher levels of buyer investment through increased vertical coordination. In contrast with the common finding in the literature that contract participation is biased towards larger farms, our findings from Vietnam suggest that the scale bias of contract farming could be successfully relaxed through horizontal coordination and even reversed under increasing levels of vertical coordination as smaller farmers are found to secure higher levels of buyer investment. These findings highlight the role both policies can play in fostering inclusiveness of contract farming in rice value chain upgrading in Vietnam.

1. Introduction

The Vietnamese rice industry has been successful in becoming a major exporter of low-medium quality rice since the eighties. This achievement was mainly attributed to economic reforms and an efficient cost competitiveness strategy (World Bank, 2012). However, the reverse side of the medal was that Vietnam acquired a reputation for being an exporter of rice of inferior quality (Nielsen, 2003), a damaging reputation that continues to persist in highly competitive international markets, leading to cost-price squeeze due to rising production costs. With the demise of input subsidies, smallholders who can no longer absorb high production costs buy inputs of inferior quality and produce low-quality rice. Using poor harvesting and post-harvest techniques, they create little added-value and record declining profitability. One way to break the vicious circle of poverty caused by the cost-price squeeze and reassess the country’s position in the international rice market could be to upgrade the rice value chains, enabling farmers to tap into higher quality markets (Demont and Rutsaert, 2017).

Recently, vertical coordination has been identified as a crucial development strategy to boost the performance of Vietnamese rice value chains (Demont and Rutsaert, 2017). Contract farming is a form of vertical coordination in which firms support farmers during the production and/or marketing process by providing them with improved access to high-quality agricultural inputs, technical support, storage facility, and secured output markets. A body of empirical literature—summarized in Oya (2012), Wang et al. (2014), Otsuka et al. (2016), Ton et al. (2017), and Bellemare and Bloem (2018)—has investigated the socio-economic impacts of contract farming. In general, findings are mixed with studies pointing towards both positive and negative effects, which highlights the diversity that exists in terms of commodities involved, contracts offered, and regions studied. Recently, the debate has focused on the legitimacy of the evaluation approach of contract farming.
We define “inclusiveness” in this study as the extent to which farmers are determinants that affect farmers’ participation and, hence, inclusive contract farming on a large scale, however, requires information about the exporters are based (Table 1). Promotion and implementation of contract farming may increase farmers’ exposure to risks from compliance to management decisions as the buyers may take control of the farms, impeding smallholder farmers to act independently (Sivramkrishna and et al., 2005).

On the other hand, however, some existing studies found that contract farming participation might entail negative welfare effects for farmers. Some authors reported that the institution does not always include poor small-scale farmers and is mainly profitable to large farms, which could increase rural inequality (Glover, 1987; Key and Runsten, 1999; Simmons et al., 2005; Guo et al., 2007; Miyata et al., 2009). In addition, Little and Watts (1994) and Singh (2002)—among others—accused buyers of exploiting farmers under a contract farming arrangement by paying them less than the minimum wage. Soullier and Moustier (2018) found a negative income impact of production contracts in the rice sector in Senegal due to lower selling prices compensating for the implicit cost of interest and insurance. The monopoly tendency of the firm is also stressed by Eaton and Shepherd (2001) who reported that buyers might not be transparent in price and/or quality control. Farmers may even lose their autonomy regarding the field management decisions as the buyers may take control of the farms, impeding smallholder farmers to act independently (Sivramkrishna and Jyotishi, 2008). Furthermore, some authors reported that contract farming may increase farmers’ exposure to risks from compliance to unknown production techniques (Eaton and Shepherd, 2001; Simmons, 2002; Bellemare et al., 2013; Cahyadi and Waibel, 2016).

The Vietnamese government perceives contract farming as an excellent opportunity to boost rural economic development; it reveals its strong interest in contract farming through the issuance of a legal framework for its implementation. Since 2013, we observe an emerging strong interest in contract farming through the issuance of a legal framework by paying them less than the minimum wage. Soullier and Moustier (2018) found a negative income impact of production contracts in the rice sector in Senegal due to lower selling prices compensating for the implicit cost of interest and insurance. The monopoly tendency of the firm is also stressed by Eaton and Shepherd (2001) who reported that buyers might not be transparent in price and/or quality control. Farmers may even lose their autonomy regarding the field management decisions as the buyers may take control of the farms, impeding smallholder farmers to act independently (Sivramkrishna and Jyotishi, 2008). Furthermore, some authors reported that contract farming may increase farmers’ exposure to risks from compliance to unknown production techniques (Eaton and Shepherd, 2001; Simmons et al., 2005).

The present article contributes to the literature in three ways. First, contract farming participation by farmers for higher-value crops (Masakure and Henson, 2005; Musara et al., 2011). In these studies, however, the authors implicitly assume that contract farming is a homogenous institution in which farmers decide to participate or not. This approach is particularly restrictive in cases where multiple contract models are available. Singh (2002) distinguishes between (i) procurement contracts, (ii) partial contracts, and (iii) total contracts. Williamson (1985) alternatively placed governance mechanisms on a vertical coordination continuum ranging from spot-market transactions to hierarchical governance structures. Procurement contracts could be assimilated with marketing contracts; they describe an agreement between a buyer and one or more farmers exclusively on sale/purchase conditions of a product without any active involvement in production by the buyer. The conditions include harvesting schedule, delivery time, quantity, quality, and price of the product. Partial and total contracts are variants of resource-providing contracts where the buyer provides farmers with a subset of inputs (for example, only certified seed) or all inputs and services (for example, certified seed, fertilizer, pesticides, and private extension). Contract farming is, therefore, a combination of components that are available individually or jointly as a package. Contract heterogeneity has received little attention in the literature on the determinants or inclusiveness of contract farming participation because in many regions the same firm usually offers only one contractual choice to farmers. However, as farmers differ in terms of their socio-economic characteristics (for example, land size or income sources) and in terms of their managerial or entrepreneurial abilities (for example, their allocative efficiencies in terms of input use), the agribusiness firm may consider farmers’ heterogeneity when offering contracts. Another avenue through which contract heterogeneity presents itself is when different companies offer different contracts in the same region. Wang et al. (2014) suggest that the empirical literature on contract farming models could benefit from further investigation into their heterogeneity as assuming contract homogeneity while contractual heterogeneity exists may lead to biased econometric estimates and thus, erroneous policy recommendations. Hence, to identify the determinants of contract farming participation, this research contributes to the literature by providing clear evidence from regional contract heterogeneity in the Vietnamese rice sector. When farmers have the choice between several contracts—as is the case in the Mekong River Delta in Vietnam—analysing the determinants of contract farming participation is important because the implications of different contracts may vary in terms of farmers’ welfare and sustainability of rice value chains (Demont and Rutsaert, 2017). To the best of our knowledge, this study is the first that addresses this gap with the aim of formulating policy recommendations for Vietnam.

The present article contributes to the literature in three ways. First, we extend the conventional binary approach to contract farming participation by accounting for contract heterogeneity along the vertical coordination continuum. More specifically, we compare four different econometric approaches to assess the determinants and intensity of

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<th>Year</th>
<th>Can Tho</th>
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participation in alternative contractual arrangements, each gradually dealing with contract heterogeneity in an increasingly rigorous way, that is (i) a conventional binary model, assuming contract homogeneity; (ii) a multinomial model, acknowledging contract heterogeneity; (iii) an ordered model assuming contract heterogeneity is ordered; and (iv) a continuous model, assuming contract heterogeneity is reflected by the amount of pre-financing rice farmers are willing to accept. Secondly, we generate useful insights on the validity and robustness of policy recommendations based on the determinants of contract farming participation under alternative contract heterogeneity assumptions. Thirdly, we assess inclusiveness of contract farming for small-scale farmers in the Vietnamese rice sector and formulate policy recommendations for inclusive rice value chain upgrading that may be applicable to other Southeast and South Asian countries.

2. Upgrading in Vietnamese rice value chains

2.1. Value chain upgrading

In Vietnam, rice production takes place in two main regions: the Red River Delta (RRD) in the north and the Mekong River Delta (MRD) in the south (see Fig. 3). The MRD is the biggest delta in Vietnam and the first region in terms of rice production. Although about 70% of its production is exported, the value of rice exports remains considerably low as Vietnam typically exports low-medium quality rice at a significantly lower price compared to Thailand (Nielsen, 2003).

The main reason behind Vietnam’s low added-value from exported rice is its poor quality. Demont and Rutsaert (2017) describe traditional rice value chains in the MRD as characterised by many intermediaries with little horizontal and vertical coordination between value chain actors (market linkages towards the left in Fig. 1). They observe that supply is highly scattered and heterogeneous, and consolidated and mixed by traders and millers in an attempt to achieve economies of scale. As a result, there is little differentiation in terms of prices at farm level and farmers receive little price incentives for the provision of quality. Exporters often find it difficult to consistently source high and premium quality rice with high levels of purity through traditional value chains. Therefore, contract farming is emerging as an efficient procurement tool for sourcing high-quality paddy rice or govern the production of it. Rice quality upgrading in this context relates to using the same variety of high quality seeds instead of a mix of varieties, and reducing dry paddy exposure to impurities (foreign matters such as stones or dust). Exporters are increasingly integrating upstream by upgrading their processing infrastructure and coordinating with rice farmers by providing certified seeds to them and procuring paddy rice through out-grower contracts; this vertical coordination is depicted in Fig. 1 by connecting their business to seed supply. The provision of certified seeds by the buyer aims at achieving varietal purity, while the technical advice at farm level may improve farmers’ postharvest practices such as sun drying which likely exposes the paddy to impurities. On the other hand, rice farmers are looking for strategies to overcome input market failures and increase their net revenue. Therefore, a restructuring of Vietnamese rice value chains is already taking place, producing a shift from traditional to modernised procurement systems (Demont and Rutsaert, 2017). To generate a supportive institutional environment for upgrading in Vietnamese rice value chains, the government issued a series of resolutions.

2.2. Institutional upgrading

Promotion of contract farming by the Vietnamese government is not new. In 1980, a contract system was introduced to increase rice productivity (Giesecke et al., 2013). This was guided by Decision 100 CT/TW (in 1981) and Resolution 10/NQ-TW, which aimed at promoting contracts between farmers and cooperatives. Under this system, rice production was strictly managed by the government. Land assigned to farmers was devoted to a fixed volume of rice production under contract. The contracted quota had to be sold to the state cooperative at a fixed price; any surplus could be sold to private traders or saved for home consumption. The cooperative provided farmers with seed, fertilizers, pesticides and extension services. Between 1981 and 1987, this system had boosted rice production in the MRD by more than 2.5 million tons. However, the limited financial capacity of cooperatives to provide timely inputs led to high rates of governmental contract breach and the abandonment of the system with the Doi Moi policy reform program in 1986.

Despite the fact that the Civil Code and Trade Law include general stipulations related to the regulation of contracts, in recent years, with the need for upgrading rice value chains, the government issued a series of specific resolutions exclusively related to contract farming. Decision 80/2002/QD-TTG on 24 June 2002 provides a legal and regulatory framework for contract farming. Cooperation with the private sector.
research institutes, and financial structures is highly encouraged to increase contract efficiency. This decision, however, faced many constraints in its application. First, only few agricultural sectors have adopted contract farming. Second, high rates of contract breach discouraged firms to invest. Third, large-scale farmers were more likely to participate in contract farming than smallholders. Hence, on 25 October 2013, Decision 80 was revised and replaced by Decision 62/2013/QD-TTg. This new decision aims at supplementing the previous one with the inclusion of the “small farmers, large field” (SFLF) program and new regulations on contract breach. The SFLF program aims at encouraging horizontal coordination among farmers; under this program, farmers pool their land, adopt uniform varieties and production techniques, and synchronise planting and harvesting of their rice crops. Participation in the SFLF program was expected to decrease farmers’ production costs and to enable them to achieve economies of scale, and by so doing, to increase their bargaining power in contractual arrangements. The SFLF program was also expected to attract investment in contract farming from large export companies interested in monitoring one large field rather than several fragmented plots of land and reducing their costs by signing one single contract with a lead-farmer rather than dealing with large numbers of small farms. Finally, in 2018, Decision 62 was changed to Decree 98/2018/ND-CP which provides incentives for farmer organizations for joining a SFLF programme. In the MRD, the Department of Agriculture and Rural Development (DARD) takes the lead in establishing and organising the SFLF areas. Farmers are selected based on their willingness to join the program and adjacency of their rice fields. SFLF areas range from 100 to 5,000 ha.

Despite the Vietnamese government’s efforts in creating a supportive institutional environment and the recent removal of the rice export quota, many private export companies still face barriers to enter the market (Nielsen, 2003). In the MRD, export licenses are delivered by the Vietnam Southern Food Corporation (VINAFood II), the largest state-owned enterprise (SOE) which controls together with the Vietnam Northern Food Corporation (VINAFOOD I) 50% of Vietnam’s rice exports (Fulton and Reynolds, 2015). Consequently, the export market is dominated by SOEs that are more likely to have privileged access in lucrative government-to-government export contracts than private companies have. It may, however, be crucial to increase the participation of private export companies as they can offer contracts to farmers and their costs can be four to sixteen times lower than state-owned companies (Nielsen, 2003).

3. Analytical framework of contract farming participation

3.1. Theoretical framework

Barrett et al. (2012) conceptualise the development of contract farming as a game where the agribusiness firm is the first mover. In a first stage, the firm selects a suitable location to source agricultural commodities based on the agro-ecological conditions of the site, the existence of adequate infrastructure and the political stability of the region. Next, the firm identifies farmers to work with and offers them a contract. These farmers are selected, among other factors, based on their farm performance, farm size, and proximity to road and irrigation infrastructure. In a third stage, farmers decide to accept or reject the contract offer. When farmers reject the contract, both players revert to the spot market. Upon acceptance, in a fourth stage, the firm and the farmers decide whether to comply with the contractual agreement by honouring the terms of the agreement.

Our framework focuses on the second and the third stage of such a game and generates insights in the characteristics of farmers that are offered contracts and accept them in the Vietnamese rice sector. However, while Barrett et al. (2012) assume that the agribusiness firm is offering a single type of contract, we extend this scenario to the case where farmers are offered several contract types, which is more consistent with reality in the Vietnamese rice sector. There, some scope for bargaining is often observed regarding some of the contract attributes, for example, farmers can negotiate to buy and use their own inputs rather than the inputs provided by the buyer. In some cases, though, contracts are inflexible and the choice of the type of contract is mostly in hands of the exporter. Furthermore, we extend the framework of Barrett et al. (2012) by considering the role of the institutional environment (governmental rural agricultural agencies) in firms’ and farmers’ decision to participate in contract farming.

The theoretical foundation of firms’ and farmers’ participation in contract farming is rooted in transaction cost theory (Coase, 1937), which emphasises the existence of information, negotiation, and monitoring costs associated with economic transactions. Information costs are incurred before a transaction takes place. Also called ex ante costs, they include costs associated with searching for reliable trading partners and discovering prices. The negotiation costs are incurred when the parties involved try to reach consensus on carrying out the transaction. Next, ex post the transaction, both monitoring and enforcement costs are incurred, which are the costs of control to ensure that the other parties respect the terms of the transaction and the costs of mediation in case of dispute during the exchange process. The optimal governance structure for a particular transaction is selected in such way to attenuate related transaction costs.

Williamson (1985) places governance mechanisms on a continuum ranging from spot-market and hybrid exchanges to a hierarchical governance structure (Fig. 2). The market is the place in which one shot, handshaking, and unrepeated transactions between buyers and sellers occur, with the price system working as the coordination mechanism. In hierarchical form or vertical integration, one single firm is controlling all stages of production and/or distribution in the same industry (Peterson et al., 2001). Hybrid forms of governance, such as contracts, are long-term relationships positioned between spot markets and
vertical integration. In this continuum of governance modes, marketing contracts are closer to spot markets while total resource-providing contracts are closer to vertical integration, and partial contracts are situated somewhere in between (Fig. 2).

When market conditions are similar to those of a perfect market (i.e. complete information, atomicity, and homogeneous goods), spot market transactions are usually favoured. Under such conditions, the transaction costs are low. In developing and emerging countries, however, agricultural markets are hazardous and unreliable. Micro-level analysis reveals failures in input markets, asymmetric information, price variability and opportunistic behaviour by producers (for example, side selling) or buyers (for example, downgrading of crop quality). Carrying out a transaction in such markets is therefore associated with high transaction costs, which could inhibit farmers’ participation in open markets. Therefore, transactions tend to be internalised rather than occurring in imperfect spot markets (Abebe et al., 2013). Swinnen and Maertens (2007) show that shifting transactions from spot markets to vertical coordination by the means of contract farming offers a number of potential transaction cost reductions for farmers. First, contract farming may offer opportunities for producers to reduce search costs by improving access to information on price and guaranteed markets by buyers. Furthermore, input provision contracts may facilitate farmers’ access to inputs, credit and extension services (Barrett et al., 2012). These are contract-specific assets used to palliate input market failures in spot markets (Otsuka et al., 2016). Second, contract farming induces negotiation costs. Third, contract farming induces monitoring costs but, when exchanges between buyers and sellers are repeated, this tends to build trust between the two parties involved, which in turn could reduce the incentive for betrayal.

3.2. Choice of explanatory variables

As summarised in transaction cost theory above, all transactions involve costs of information seeking, negotiating and monitoring/enforcing trading partner relationships. Agribusiness firms frequently offer to pre-finance a package of inputs required for cultivation and, in return, commit to purchasing the produce after harvest. We assume that agribusiness firms choose farmers and the type of contract that minimises their transaction costs. Likewise, we assume that chosen farmers prefer the type of organizational arrangement along the vertical coordination continuum that minimises their transaction (and production) costs. The amount of pre-financing in a contractual agreement proposed and accepted could be interpreted as the “intensity” of the relationship or the degree of “commitment” or vertical coordination between the farm and the firm. The chosen variables discussed in this section are categorized under the three cost categories (information costs, negotiation costs, and monitoring costs). However, we acknowledge that some of the variables potentially affect more than one of the cost categories.

The starting point for identifying the factors related to information costs is given by the underlying assumption of bounded rationality and opportunistic behaviour of economic agents. An individual cannot process all the information on current and future market conditions to anticipate all contingencies. In addition, their transaction partner can cheat or lie in pursuit of their own interest (Williamson, 1985). Under these conditions, economic agents spend considerable resources gathering information on price and reliable trading partners with whom to exchange. Hence, the higher the uncertainty, the higher the transaction costs of accessing markets. Contract farming participation, however, may reduce uncertainty because the contract guarantees output market security. This may significantly reduce search costs for farmers and increase the likelihood they accept to participate in contract farming.
rather than operating in spot markets. Some studies indicated that a guaranteed market was a determining factor in farmers’ participation in contract farming (Elepu and Nalukenge, 2009; Masakure and Henson, 2005; Guo et al., 2007). Here, we hypothesise that farmers’ perception that contract farming participation provides guaranteed access to markets positively affects the likelihood that they accept a contract, but we do not expect it to affect the intensity of the contract. We also have to consider exporters’ incentive to propose a contract to a given farmer, which depends on their own information costs. As the conditions of the contract are laid down, educated farmers are supposed to face lower information costs as they may more easily understand the terms of the contract. In addition, it may be easier for educated farmers to better align their production process with the buyer’s requirements. This could reduce exporters’ perceived quality uncertainty of the final product. Educated farmers are, therefore, supposed to attract greater buyer investment and face lower transaction costs in contract farming than non-educated farmers. Katchova and Miranda (2004) found that more educated soybean farmers are more likely to participate in contract farming in the United States of America (U.S.A). However, education was also found to be an insignificant predictor of contract farming participation by Birthal et al. (2005) in broiler production in India, by Wang et al. (2014) in China. In this study, we expect education or human capital to positively affect contract farming participation and investment by the exporter. Although they may have completed basic schooling, women, however, could still face higher information costs than men due to gender inequity. Gender bias could thereby increase their transaction costs both on the spot market and in contract farming transactions. Some authors revealed the existence of gender bias in contract farming participation due to male asset ownership over women (Bellemare, 2012; and Wainaina et al., 2012). More specifically, Bellemare (2012) observed that female households were 47% less likely to participate in rice contract farming in Madagascar. Yet, Preguić-Gresh et al. (2012) found no gender effect in contract farming participation in South Africa. In our study, we expect male-headed households to have a higher probability of joining contract farming and receive greater amounts of pre-financing.

Negotiation costs include the costs of negotiating input or output prices, expected commodity quality standards, and other non-financial services (for example storage facility, private extension, and so forth). During the negotiation process, the bargaining power reflects the ability to obtain the most favourable package. However, buyers’ dishonesty tends to increase smallholders’ negotiation costs, as farmer interests may not be well defended. Moreover, scholars attribute the low bargaining strength of farmers to a large variety of factors, including small land-holding size or the lack of desirable skills. Possessing a distinct advantage, however, may increase farmers’ attractiveness to the exporter, and, consequently, could increase their bargaining power. For instance, evidence from the literature reveals that contract farming is not scale-neutral, that is, large-scale farmers are more likely to participate in contract farming than their smaller counterparts (Swain, 2012; Abebe et al., 2013). Rather than having numerous contracts with several small-scale farmers, agribusiness firms prefer a small number of contracts with large farmers to reduce transaction costs, while ensuring desirable volume and quality of supply (Abebe et al., 2013; Maertens and Swinnen, 2009). However, Wainaina et al. (2012) found insignificant effects of land size on contract farming participation. In summary, while small land-holding sizes and low volumes of rice output could weaken the bargaining power of small-scale farmers, big land size is a valuable asset to strengthen large-scale farmers’ bargaining power and reduce their negotiation costs in contract farming. We, therefore, hypothesise that contract farming is scale-biased. It remains to be empirically tested whether the amount of pre-financing offered by exporters is also scale-biased.

However, to strengthen their bargaining power, small-scale farmers could opt for horizontal coordination. For instance, by merging their land, farmers could apply uniform production standards and supply larger, consolidated volumes of high quality produce. By doing so, they could reduce transaction costs drastically and enable the agribusiness firm to capture economies of scale (Otsuka et al., 2016). Participation in government programs, such as the SFLF program in Vietnam is, therefore, assumed to raise small-scale farmers’ bargaining power and attenuate farmers’ negotiation costs in contract farming. Therefore, it is expected to attract investment from agribusiness firms and relax scale bias of contract farming. However, other forms of horizontal coordination such as membership in farmer associations may also facilitate information exchange among members and increase the likelihood to become connected to a buyer (Ito et al., 2012). Indeed, Moustier et al. (2010) found that membership in farm organizations increases farmers’ likelihood to participate in contract farming in Hanoi, Vietnam. Given the anticipated reduction in transaction costs, we expect to find a similar positive relationship between organization membership and the level of vertical coordination in our sample of rice farmers, measured through the amount of pre-financing farmers receive from exporters. It remains to be empirically tested, however, whether this effect is robust over all contract types and to all our econometric specifications.

The economic size of the farm can also be represented by its labour force as measured through its number of household members. Larger families tend to be poorer and more dependent on agriculture, thereby more specialised than smaller families (World Bank, 2012). Furthermore, human assets or the technical expertise that is needed to satisfy buyers’ requirements can also increase farmers’ bargaining power. Some authors (Swain, 2012; Cai et al., 2008) found that farmers having large family sizes are more likely to participate in contract farming because of the larger labour force. Yet, household size was found an insignificant predictor of contract farming participation by Bellemare (2012) and Ito et al. (2012). As part of the promotion of rice contract farming, the Vietnamese governmental agencies in rural areas are providing agricultural extension services to farmers. The training aims at improving farmers’ production techniques and fostering adoption of sustainable production standards such as “three reductions, three gains” or “one must, five reductions” standards. These standards were found to add value to the final product and are more likely to attract greater buyer investment (My et al., 2018). Therefore, farmers who have benefited from public training develop specific skills that may increase their attractiveness and consequently their bargaining power in contract farming. Empirical evidence from Anim (2011) suggests that small-scale farmers who received training are more likely to participate in maize contract farming in South Africa. Hence, we expect to find a positive effect of public training on the probability of participation in contract farming and on the amount of pre-financing offered by the firm. The effect of experience in rice farming can be ambiguous. On the one hand, older or more experienced farmers are expected to face lower negotiation costs as they have better knowledge of their needs, costs, and risks involved in farming, and hence are expected to be more likely to participate in contract farming and attract greater buyer investment. On the other hand, they may be less sensitive to the advantages of contracts in terms of reduced information costs, since they can rely on long experience and a well-established network. Finally, they may be less willing to give up some degree of sovereignty and be reluctant to accept increasing levels of governance—in return for increasing levels of pre-financing—from the buyer. As pointed out by many authors, farmers may prefer to maintain their managerial autonomy to strict control under resource-providing contracts (Key, 2005). It is interesting to empirically test which effect will dominate. During the negotiation

2 “Three reductions, three gains” (3R3G) is a production standard aiming at reducing the use of seed, nitrogen fertilizer, and pesticides. The three gains include rice yield, rice quality and economic efficiency. The “one must, five reductions” (1MSR) standard recommends farmers to use certified seeds. This will reduce the seed rate, fertilizer dose, pesticide dose, water amount in irrigation, and post-harvest loss.
phase, young farmers, however, may be expected to have less bargaining power than their older counterparts do. While Sambuo (2013) found that younger farmers were less likely to participate in tobacco contract farming in Tanzania, Cai et al. (2008) found that young farmers are more likely to participate in rice contract farming in Cambodia. Katchova and Miranda (2004) found no age effect in corn and wheat production under contract in the U.S.A. We expect that participation in contract farming is not youth-inclusive and that investment by exporters is biased towards older farmers. Although age is often used as a proxy variable for experience, we include both variables in the regression models, as age is more a catchall variable that incorporates many effects, including years of experience.

Monitoring costs are incurred to ensure that the other party will honour the terms of the agreement. In imperfect markets, farmers tend to face high monitoring and enforcement costs due to their inability to foresee the actions of their trading partners. For instance, traders may underreport the quality of the output and offer lower prices or delay the payment. This leads to necessary monitoring and enforcement costs. However, repetitive transactions with the same trading partner (frequency of transactions) can build a trustworthy reputation over time and reduce the threat of opportunism in transactions. We assume that farmers who perceive their buyer to be more reliable and trustworthy are more likely to participate in contract farming and accept increasing levels of pre-financing and governance from the buyer, thereby giving up increasing levels of sovereignty. Kumar (2007) found that favourable perceptions of the contractor’s trustworthiness significantly affected farmers’ participation in contract farming in India.

### 3.3. Econometric models

We use four econometric models, each modelling contract farming participation and treating contract heterogeneity differently along the vertical coordination continuum (Fig. 2). In a first model, we assume contract homogeneity and model contract farming participation as a simple binary choice between two points on the continuum based on the following latent variable model:

$$CF_i = X\beta + \epsilon_i$$

where $CF_i$ represents the propensity of farmer $i$ to engage in contract farming (ranging from $-\infty$ to $+\infty$), $X$ is a vector of explanatory variables, $\beta$ is a vector of parameters to be estimated and $\epsilon_i$ is the error term. $CF_i$ is unobserved, but can be linked to the binary observed variable $CF$ as follows: $CF_i = 1$ if $CF_i > 0$, $CF_i = 0$ if $CF_i \leq 0$. For a given vector $X_i$,

$$Pr(CF_i = 1 | X_i) = Pr(CF_i^* > 0 | X_i) = Pr(\epsilon_i > -X\beta | X_i).$$

(2)

Assuming $\epsilon_i$ is distributed logistically with variance $\sigma^2/3$, Eq. 2 leads to the following binary logit model:

$$Pr(CF_i = 1 | X_i) = \frac{e^{X\beta}}{1 + e^{X\beta}}$$

(3)

In a second model, we introduce contract heterogeneity and model contract farming participation as a categorical choice using a multinomial logit model. In the MRD, farmers have the choice among three mutually exclusive contract categories along the vertical coordination continuum: (i) a marketing contract (MC), (ii) a partial resource-providing contract (PC), or (iii) a total resource-providing contract (TC) (Fig. 2). Hence in this model, the dependent variable $CF_i$ now has $J$ outcomes numbered from 0 to 3 (that is, 0 for non-participation in any contract model, 1 for participation in a MC, 2 for participation in a PC, and 3 for participation in a TC) and the model is a generalization of the model in Eq. 3:

$$Pr(CF_i = j | X_i) = \frac{e^{X\beta_jb_j}}{1 + \sum_{j=1}^{J} e^{X\beta_jb_j}}, \quad j = 0, 1, 2, 3,$$

(4)

where $Pr(CF_i = j | X_i)$ is the probability that farmer $i$ selects contract farming model $j$ and $b$ is the base outcome (in this study non-participation in any contract model).

Next, we acknowledge the ordered nature of contract farming participation along the continuum using an ordered logit model with the dependent variable defined as in the multinomial model. The ordered logit model can be derived from the same latent variable model defined in Eq. 1, where now $CF_i^*$ is divided into four ordinal categories by identifying three cut points $\alpha_1, \alpha_2$ and $\alpha_3$ (with $\alpha_1 < \alpha_2 < \alpha_3$). The relation between the latent variable $CF_i^*$ and the observed variable $CF_i$ is now given by $CF_i = 0$ if $CF_i^* < \alpha_1$; $CF_i = 1$ if $\alpha_1 \leq CF_i^* < \alpha_2$; $CF_i = 2$ if $\alpha_2 \leq CF_i^* < \alpha_3$; $CF_i = 3$ if $CF_i^* \geq \alpha_3$. The response probabilities of the four events are given by:

$$Pr(CF_i = 0 | X_i) = Pr(CF_i^* < \alpha_1 | X_i) = F(\alpha_1 - X\beta),$$

$$Pr(CF_i = 1 | X_i) = Pr(\alpha_1 \leq CF_i^* < \alpha_2 | X_i) = F(\alpha_2 - X\beta) - F(\alpha_1 - X\beta),$$

$$Pr(CF_i = 2 | X_i) = Pr(\alpha_2 \leq CF_i^* < \alpha_3 | X_i) = F(\alpha_3 - X\beta) - F(\alpha_2 - X\beta),$$

$$Pr(CF_i = 3 | X_i) = Pr(CF_i^* \geq \alpha_3 | X_i) = 1 - F(\alpha_3 - X\beta).$$

(5)

where $F$ represents the cumulative distribution function of $\epsilon$ (which is still assumed to be logistically distributed with variance $\pi^2/3$). An important assumption crucial for the use of an ordered logit model is the test of parallel regression lines. This assumption states that the slope coefficients in the model are the same across response categories. In other words, the relationship between independent variables and the dependent variable should not change for the dependent variable’s categories and parameter estimations do not change for cut points $\alpha_1, \alpha_2$ and $\alpha_3$ (Long and Freese, 2014). If the test rejects the assumption of parallel regression lines, ordered logit coefficients are not equal across the levels of the outcome, and one should only consider the multinomial model results.

The final econometric specification models contract farming participation as a continuous choice along the vertical coordination continuum. The amount of pre-financing for inputs per unit of land farmers are willing to accept from the agribusiness firm as an investment in the contractual agreement is used as a measure of the “intensity” of the relationship or the degree of “commitment” or vertical coordination between the farm and the firm. We only observe the amount of pre-financing for those farmers who ended up accepting the offer, which is equivalent to Heckman’s (1979) classic example of sample selection bias. The determinants of contract farming are a function of observable characteristics of the farm household (for example, age, education, gender, household size, gender, membership in farmer associations, farming experience, and farm size), but the decision to participate in contract farming depends on the amount of pre-financing the buyer is offering. We, therefore, follow the Heckman procedure test and deal with this potential selection bias. In a first stage, a probit model is estimated on the entire sample of farmers to model the decision to participate in contract farming (Eq. 3, with a normally distributed error term). Next, the Inverse Mills Ratio (IMR) is derived from that first equation and introduced into the second stage of the Heckman model as

---

3It is important to note that because alternative contract types in the continuum can be considered ordered, it does not imply they should be modelled as such. As suggested by Long and Freese (2014: 434), one should explore the implications of imposing ordinality by comparing the ordered logit model results with the multinomial logit results. The ordered model implies that changes in extreme categories should be in opposite directions; if this pattern is not observed in the multinomial model, care should be taken in running the ordered model.

4The effect of age may have a non-linear relationship with the independent variable (i.e. the effect of age could be positive up until a certain age, then negative thereafter). Age squared is therefore added to measure more accurately the marginally decreasing effect of age.
an additional variable to control for self-selection bias. This allows the remaining regressors to explain the degree of vertical coordination through the amount of pre-financing farmers receive from agribusiness firms. Therefore, the second stage is conditional on a given probability of farmers’ acceptance of a positive amount of pre-financing. The IMR is incorporated into the Ordinary Least Squares (OLS) equation in the second step of the Heckman model:

\[ \text{PREF}_i = X_i \beta + \gamma \theta + \epsilon_i \]  

(6)

where \( \text{PREF}_i \) is the amount of pre-financing farmer \( i \) is willing to accept, \( X \) a vector of observed explanatory variables, \( \beta \) is a vector of parameters to be estimated, \( \gamma \) the inverse Mills Ratio (IMR), \( \theta \) the coefficient of the IMR, and \( \epsilon_i \) the error term. The error terms in the probit and the OLS equation are independent and normally distributed with mean zero. In case the IMR is insignificant in this second stage model, Eq. 6 simplifies to a basic OLS regression model:

\[ \text{PREF}_i = X_i \beta + \epsilon_i \]  

(7)

Given the cross-sectional nature of our data/models, we are not able to control for unobservable factors that may affect farmers’ participation into contract farming. As these factors might correlate to some of our explanatory variables—in particular our main policy variable of interest SFLF—this could lead to potential omitted variable bias. Given that we cannot identify valid instruments, we refrain from an instrumental variable estimation to control for unobserved heterogeneity in all of our models. Accordingly, the results reported in the results section are potentially overestimated.

4. Study area and description of the data

4.1. Study area and data collection

This study uses primary data collected in the Can Tho province of Vietnam, one of the major leading rice producing provinces in the MRD (Fig. 3). The province has three rice cropping seasons: the winter-spring cropping season (planted in November and harvested in March), the summer-autumn cropping season (planted in April and harvested in July), and the autumn-winter cropping season (planted in July and harvested in October). A two-stage random sampling design was used. First, we purposely selected four areas in the Can Tho province on the basis of the adoption of good agricultural practices (G.A.P.) and contract farming (Stuart et al., 2018). Then, respondents were randomly selected from the list of farmers in each area obtained from the local agricultural extension office. In total, 180 farmers were surveyed in Thanh An town (n = 50), Thanh Loi commune (n = 50), Thanh An (n = 40), and Thanh Thang commune (n = 40). Data was collected in two phases. First, baseline data was collected during the summer-autumn (March 2014–July 2014) and winter-spring (November 2014–March 2015) cropping seasons by an International Rice Research Institute (IRRI) expert assisted by a group of ten enumerators selected among the local staff of the DARD in Can Tho. Next, a follow-up survey was conducted with the same group of rice farmers during the winter-spring cropping season (December 2014–April 2015).

The baseline questionnaire contained two parts: (i) socio-demographic characteristics; and (ii) current farming practices (including rice production and marketing choices, various input costs for rice production, and sources of information on crop management options). The follow-up survey complemented the baseline questionnaire with information specific to contract farming. In order to ensure data quality, the raw survey data was verified by a research assistant who investigated peculiar values and contacted the farm households again when clarifications were in order.

5. Results and discussion

Table 2 presents definitions and descriptive statistics of the socio-economic variables affecting farmers’ decision of contract farming participation discussed in Section 3.2. We classified contracts in three categories along the vertical coordination continuum, namely, (i) marketing contracts, (ii) partial (resource-providing) contracts, and (iii) total (resource-providing) contracts with the amount of pre-financing for inputs as a continuous variable measuring the degree of vertical coordination (Fig. 2). The total amount pre-financed by export companies varied between zero—in the case of marketing or no contracts—and 1424 USD per hectare, and averaged around 118 USD per hectare. Partial contracts pre-financed around 108 USD per hectare, while total contracts provided almost four times as much at 419 USD per hectare on average. Among the 180 surveyed farmers, 14 (8%) were operating under a marketing contract, 68 (38%) under a partial input providing contract, 33 (18%) under a total input providing contract, and the remaining 65 (36%) sold their production on spot markets. Most of the farmers (92%) were male. The average age across the entire sample is 49 years and on average, farmers attended nine years of schooling and had 25 years of farming experience. Average farm size exceeded two hectares and average household size counted around five members. While a minority of farmers claimed to be part of a formal farmer association (27%), the large majority was part of a SFLF program (69%) and had received public training (88%) from the DARD. Finally, 88% of the farmers perceived to have good market access and 73% claimed to trust their buyers.

Coefficient estimates of the models are reported in Table 3. For the nonlinear (i.e. binary, multinomial and ordered) models, the sign and significance levels of the variables can be interpreted, but as the size of the coefficients does not have a direct interpretation regarding the magnitude of the effect, changes in predicted probabilities based on average marginal effects (AME) are also discussed and plotted for selected variables. For farmers who do not participate in contract farming, it was not clear whether this is due to the fact that they were not proposed a contract or whether they rejected an offer. As a consequence, in all models, when we interpret the role of rice farmers’ characteristics, we have to consider the fact that these characteristics determine both farmers’ and exporters’ decisions, not just the former. We report the marginal effects in Appendix A, from which we derive the changes in the probability of contract farming as a function of the change in an explanatory variable of interest, holding all other variables in the model constant. Starting with the binary model results, we find that there are farmers with predicted probabilities (i.e. the likelihood of contract farming participation as estimated by the binary model) that span almost the entire range from 7 to 99% (mean 64%), with roughly two-thirds of the observations between 60 and 80%. The large range reflects that our sample contains both farmers with very large and very small predicted probabilities of contract farming participation.

Related to information costs, we provide empirical support for the hypothesis that perceived access to secured markets reduces farmers...
The predicted probability of contract farming participation was calculated using Eq. (3). The increase in the predicted probabilities was calculated as the difference between the average predicted probability for those farmers with a favourable perception of contract farming and the average predicted probability for those farmers with an unfavourable perception of contract farming. This method is based on calculating average marginal effects and was performed using the *mchange* command in Stata (see Long and Freese, 2014: 11).

Note that only once farmers are organized in a SFLF, the DARD will introduce them to an exporter who may or may not offer them a contract. Hence we have no reason to expect any reverse causality issues regarding this effect.

### Table 2

Descriptive statistics of socio-economic variables affecting farmers’ participation in contract farming.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unit</th>
<th>Whole sample</th>
<th>Min</th>
<th>Max</th>
<th>Non-contract farmers</th>
<th>Marketing contract</th>
<th>Partial contract farmers</th>
<th>Total contract farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-financing</strong></td>
<td>USD/ha</td>
<td>118.48</td>
<td>0.00</td>
<td>1424.04</td>
<td>0.00^a</td>
<td>0.00^a</td>
<td>108.05^b</td>
<td>418.76^c</td>
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<tr>
<td><strong>Information costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market access^a</td>
<td>Dummy</td>
<td>0.88</td>
<td>0.00</td>
<td>1.00</td>
<td>0.75^a</td>
<td>1.00^b</td>
<td>0.97^b</td>
<td>0.88^c</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.23)</td>
<td>(0.43)</td>
<td>(0.43)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.17)</td>
<td>(0.33)</td>
</tr>
<tr>
<td>Education</td>
<td>Years</td>
<td>9.23</td>
<td>2.00</td>
<td>16.00</td>
<td>9.28^a</td>
<td>9.29^a</td>
<td>9.28^a</td>
<td>9.03^a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.43)</td>
<td>(1.59)</td>
<td>(1.59)</td>
<td>(2.50)</td>
<td>(2.50)</td>
<td>(2.42)</td>
<td></td>
</tr>
<tr>
<td>Male^b</td>
<td>Dummy</td>
<td>0.92</td>
<td>0.00</td>
<td>1.00</td>
<td>0.94^a</td>
<td>0.93^b</td>
<td>0.88^b</td>
<td>0.94^b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.28)</td>
<td>(0.24)</td>
<td>(0.24)</td>
<td>(0.27)</td>
<td>(0.32)</td>
<td>(0.24)</td>
<td></td>
</tr>
<tr>
<td><strong>Negotiation costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>Hectares</td>
<td>2.21</td>
<td>0.50</td>
<td>7.50</td>
<td>2.07^a</td>
<td>2.76^a</td>
<td>2.24^a</td>
<td>2.17^b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.04)</td>
<td>(1.62)</td>
<td>(1.62)</td>
<td>(1.74)</td>
<td>(1.93)</td>
<td>(1.38)</td>
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<tr>
<td>SFLF^c</td>
<td>Dummy</td>
<td>0.69</td>
<td>0.00</td>
<td>1.00</td>
<td>0.46^a</td>
<td>0.57^b</td>
<td>0.82^b</td>
<td>0.94^b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.46)</td>
<td>(0.50)</td>
<td>(0.50)</td>
<td>(0.51)</td>
<td>(0.38)</td>
<td>(0.24)</td>
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</tr>
<tr>
<td>Household size</td>
<td>Persons</td>
<td>4.66</td>
<td>1.00</td>
<td>11.00</td>
<td>4.52^a</td>
<td>4.57^a</td>
<td>4.68^a</td>
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<tr>
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<td>(1.71)</td>
<td>(1.62)</td>
<td>(1.62)</td>
<td>(1.74)</td>
<td>(1.93)</td>
<td>(1.38)</td>
<td></td>
</tr>
<tr>
<td>Public training^d</td>
<td>Dummy</td>
<td>0.88</td>
<td>0.00</td>
<td>1.00</td>
<td>0.80^a</td>
<td>0.93^b</td>
<td>0.90^b</td>
<td>1.00^b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.32)</td>
<td>(0.40)</td>
<td>(0.40)</td>
<td>(0.27)</td>
<td>(0.31)</td>
<td>(0.00)</td>
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</tr>
<tr>
<td>Farming experience</td>
<td>Years</td>
<td>25.30</td>
<td>4.00</td>
<td>55.00</td>
<td>26.28^a</td>
<td>25.07^b</td>
<td>24.34^a</td>
<td>25.45^c</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.01)</td>
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<td>(8.75)</td>
<td>(10.47)</td>
<td>(7.22)</td>
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<tr>
<td>Age</td>
<td>Years</td>
<td>49.44</td>
<td>27.00</td>
<td>74.00</td>
<td>49.66^a</td>
<td>51.29^b</td>
<td>48.00^b</td>
<td>51.18^c</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.49)</td>
<td>(10.17)</td>
<td>(10.17)</td>
<td>(8.38)</td>
<td>(9.72)</td>
<td>(7.87)</td>
<td></td>
</tr>
<tr>
<td>Association membership^e</td>
<td>Dummy</td>
<td>0.27</td>
<td>0.00</td>
<td>1.00</td>
<td>0.09^a</td>
<td>0.00^a</td>
<td>0.38^b</td>
<td>0.52^b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.45)</td>
<td>(0.29)</td>
<td>(0.29)</td>
<td>(0.00)</td>
<td>(0.49)</td>
<td>(0.51)</td>
<td></td>
</tr>
<tr>
<td><strong>Monitoring costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust^f</td>
<td>Dummy</td>
<td>0.73</td>
<td>0.00</td>
<td>1.00</td>
<td>0.60^a</td>
<td>0.79^b</td>
<td>0.79^b</td>
<td>0.85^b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.44)</td>
<td>(0.49)</td>
<td>(0.49)</td>
<td>(0.43)</td>
<td>(0.41)</td>
<td>(0.36)</td>
<td></td>
</tr>
<tr>
<td>Sample size n</td>
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<td>180</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Standard deviations are presented in parentheses. Non-contract farmers are households selling on the spot market. Marketing, partial and total contract farmers produce paddy respectively through a marketing, partial and total resource-providing contract with the export companies. The categories are mutually exclusive; each household can belong to only one category. ^a The “market access” dummy is equal to one when the farm head perceived that contract farming participation provides good market access and zero otherwise. ^b The “male” dummy is equal to one when the farm household is male-headed and zero otherwise. ^c The “SFLF” dummy is equal to one when the farm household is part of a “small farmers, large field” (SFLF) program and zero otherwise. ^d The “public training” dummy is equal to one when the farm household has received public training from the Department of Agriculture and Rural Development (DARD) and zero otherwise. ^e The “membership association” dummy is equal to one when the farm household head is member of any form of structured farmer association and zero otherwise. ^f The “trust” dummy is equal to one when the farm head claimed to have trust in his/her buyer and zero otherwise. Means that do not share superscripts differ by p < 0.05 according to Tukey’s Honestly Significant Difference (HSD) test.

search costs and increases the likelihood that farmers participate in contract farming. The predicted probability of contract farming participation increases from 43 to 67% (p = 0.039) for those farmers with a favourable perception of contract farming as a way to facilitate market access. Our sample was not equally balanced in terms of gender since 92% of respondents are male (Table 2). This characteristic of our sample, in itself, can be interpreted as a bias in rice farming, but it prevents us from finding a potential gender effect on the probability of joining contract farming.

With respect to negotiation costs, we find that farmers are more likely to participate in contract farming when they are members of the SFLF program, have benefitted from public training, are older, have larger families, or are member of a farmer’s association. Membership in the SFLF program increases farmers’ probability of contract farming participation from 46 to 73% (p < 0.01) in our sample. One interpretation is that, by pooling their land and standardizing their production techniques, SFLF farmers become more attractive to buyers, just like large-scale farmers. This tends to increase the probability of being offered a contract by exporters. Consequently, farmers’ bargaining power is strengthened, and they are more willing to participate in contract farming. Analogous to the conclusion of Otsuka et al. (2016), we find that training programs increase farmers’ participation in contract farming in our sample. Indeed, our predicted probability of participating in contract farming increases from 43 to 67% (p = 0.024) for farmers who have benefitted from public training. The coefficient estimates of age (and age squared) suggest an inverse U-shaped relationship (p < 0.1), i.e. the probability of participating in contract farming increases as farmers get up to a certain age after which it decreases again (the AME suggest this inflexion point is at 55 years, p < 0.01). Being member of a farmer association is found to increase farmers’ probability of participating in contract farming from 59 to 80% (p < 0.01). This result suggests that farmer associations are a platform for information sharing which enables farmers to have greater opportunities to link to buyers at a lower negotiation cost. Qualitative interviews with farmers undertaken during the data collection period have highlighted that farmers rely on farmer associations for a variety of different services, including networking, sharing advice on crop management or on suitable technology (e.g. which tractor to lend/from whom), information exchange on input and output prices, finding reliable buyers, and market opportunities. Moreover, in formalized farmer associations such as the SFLF program, farmers receive training on G.A.P. from the DARD. These trainings give farmers the tools they need to comply with buyers’ requirements in terms of new production techniques or the adoption of production standards. These skills will increase farmers’ attractiveness and their likelihood to be offered a contract and to secure higher levels of buyer investment. According to a survey we conducted with export firms, 90% of them reported that the fact that farmers were trained by the DARD encourage them to establish...
a contract with farmers. Furthermore, the DARD acts as a facilitator to connect members of SFLF farmer organizations to firms for the establishment of a contract. However, the role of non SFLF farmer organizations in facilitating small farmers’ access to contractual arrangements may be further investigated in future research. In order to fully explore the role of farm size on contract farming, Fig. 4 presents the predicted probability of contract farming participation as a function of farm area for both farmers participating or not in the “small farmers, large field” (SFLF) program. The figure demonstrates that contract farming may be biased towards larger farms, yet the SFLF institution could help relaxing this scale bias, particularly for small farms. This empirical result supports the common assumption in contract farming literature that farmer cooperatives may reduce entry barriers for small-scale farmers (Reardon and Barrett, 2000; Boselie et al., 2003; Henson et al., 2005; Barrett et al., 2012).

Finally, in line with our hypothesis that trustworthiness reduces anticipated monitoring costs, we find that a good perceived trustworthiness tends to increase the predicted probability of contract farming participation from 51 to 69% (p = 0.022) in our sample. Our result is consistent with similar findings in the Indian Punjab (Singh, 2002) and Thailand (Schipmann and Qaim, 2011), where a lack of trust towards firms constitutes a serious obstacle for farmers to engage in contract farming.

The multinomial models corroborate the binary model results based on the assumption of contract homogeneity, but by explicitly acknowledging contract heterogeneity, they provide more detailed information on the inclusiveness of three different categories of contracts.

### Table 3

<table>
<thead>
<tr>
<th>Information costs</th>
<th>Marketing contract</th>
<th>Partial contract</th>
<th>Total contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market access</td>
<td>1.37**</td>
<td>16.78</td>
<td>-0.48</td>
</tr>
<tr>
<td>Education</td>
<td>-0.05</td>
<td>0.01</td>
<td>-0.04</td>
</tr>
<tr>
<td>Male</td>
<td>0.11</td>
<td>0.18</td>
<td>-0.16</td>
</tr>
<tr>
<td>Area</td>
<td>0.32</td>
<td>0.77**</td>
<td>0.20</td>
</tr>
<tr>
<td>SFLF</td>
<td>1.53***</td>
<td>0.34</td>
<td>1.48</td>
</tr>
<tr>
<td>Household size</td>
<td>0.25***</td>
<td>0.10</td>
<td>0.25**</td>
</tr>
<tr>
<td>Public training</td>
<td>1.41**</td>
<td>2.86**</td>
<td>0.85</td>
</tr>
<tr>
<td>Farming experience</td>
<td>-0.05</td>
<td>-0.09’</td>
<td>-0.03</td>
</tr>
<tr>
<td>Age</td>
<td>0.31’</td>
<td>0.60</td>
<td>0.18</td>
</tr>
<tr>
<td>Age²</td>
<td>-0.00’</td>
<td>-0.01</td>
<td>-0.00</td>
</tr>
<tr>
<td>Association membership</td>
<td>1.37**</td>
<td>-15.15</td>
<td>1.45”</td>
</tr>
<tr>
<td>Monitoring costs</td>
<td>Trust</td>
<td>1.05**</td>
<td>0.56</td>
</tr>
<tr>
<td>Constant</td>
<td>-12.31***</td>
<td>-37.86</td>
<td>-8.85</td>
</tr>
<tr>
<td>Sample size n</td>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>LR test</td>
<td>65.10***</td>
<td>116.17***</td>
<td>80.65***</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.28</td>
<td>0.26</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Notes: Standard errors are presented in parentheses. In the multinomial model, having no contract is the reference category. The large standard errors in the multinomial regression can be explained by the fact that the sample size n is split into three and some variables perfectly predict probability of participation in one of the three contract categories. That is, 100% of farmers under a marketing contract perceive good market access, 0% are member of an association and 100% of farmers under a total contract have received public training (see Table 2). Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.
Our multinomial logit analysis\textsuperscript{10} reveals that the probability of participating in a marketing contract ranges from 0 to 60\% (mean 8\%); the probability of participation in a partial input-providing contract ranges between 3 and 89\% (mean 38\%); and the probability of participation in a total input-providing contract ranges between 0 and 95\% (mean 18\%). The multinomial model results further highlight that limiting the analysis to binary results only would lead to different and potentially misleading policy recommendations. For example, the results indicate that putting efforts in rural training programs—which lower farmers’ negotiation costs—may be only likely to increase participation in marketing contracts, and not for any form of resource-providing contract. Our interpretation is that, since under resource-providing contracts farmers are closely monitored, such contract types often implicitly include private extension services operated by the company. Hence providing public training might not be a relevant determinant for farmers under a resource-providing contract, but more for their counterparts under a marketing contract whose agreement does not require private governance of the production process by the buyer. However, the sample size of farmers under a marketing contract is relatively small (N = 14). The results of the multinomial model (and the ordered model) for all variables regarding the marketing contract model are therefore to be interpreted with caution. While the binary model uncovers the existence of age bias in contract farming participation, we observe that the argument mainly holds for total input-providing contracts being biased towards older farmers (p = 0.012), while age was not found to be a determining factor in marketing or partial input contracts in our sample. While the binary model results indicated that contract farming is biased in favour of larger farms (see Fig. 4), the multinomial model results specify that it only matters for marketing contracts, which makes sense since these contracts are predominantly based on output levels. The results also shed further light on the potential role of the SFLF institution in relaxing this scale bias as, under the SFLF program, farmers appear to move further in the vertical coordination continuum by participating in resource-providing contracts, while individual large-scale farmers tend to opt for marketing contracts. This suggests that although small farm size could be a barrier to contract farming participation, this barrier could be overcome through horizontal coordination, that is, participation in the SFLF program. This is a relevant insight for regions where farmers hold highly fragmented plots of land and face input and output market barriers. Being in the SFLF program increases the predicted probability of being in a total input-providing contract by 18 percentage points (p < 0.01) in our sample compared to a farmer who is not in the SFLF program.

The multinomial model indicates that household size only significantly matters for (partial and total) resource-providing contracts and not for marketing contracts. This may suggest that households participating in resource-providing contracts are more specialised in agriculture than farmers under marketing contracts are. Experienced farmers are found to be less likely to participate in both marketing (p < 0.1) and total contracts (p < 0.05), which suggests that, for those who were offered a contract, their experience in rice farming provided them a chance to negotiate a pre-financing and the loss of sovereignty may be a dominant factor in their decision to reject a total contract. More experienced farmers may value autonomy more, thereby not be willing to trade autonomy for input provision. They may also perceive a lower need for pre-financing and services such as private extension. This is in line with the findings from Key and McBride (2008) in the United States. Farmer associations are once again found to be a platform for information sharing which seems to enable farmers to link to buyers at lower negotiation costs for partial and total resource-providing contracts; the predicted probability increases by 17 (p < 0.05) and 14 (p < 0.05) percentage points respectively. Finally, we find that while trust is not a determinant for participation in marketing contracts, it is so for participation in resource-providing contracts. On average, for farmers similar in other characteristics, perceived trustworthiness of the buyer increases farmers’ probability to participate in total input-providing contracts by 13\%, compared to farmers who do not trust their buyers (p < 0.05). This makes sense as under such contracts, farmers totally delegate field management sovereignty to the buyer; this shift in decision rights is only feasible when both parties trust each other.

The multinomial model provides significantly more precise information for policy recommendations compared to the binary model, but assumes contract heterogeneity is unordered. The ordered logit model considers this information, and allows us to further scrutinise what factors potentially nudge farmers towards stronger vertical alliances.\textsuperscript{11} The (more parsimonious) results mainly corroborate the findings of the multinomial model, i.e. older, less experienced farmers with larger families who are trained and part of a SFLF program or a farmer association tend to more likely participate in contract farming in our sample. However, by assuming now that contract types are ordered, we find that public training significantly moves farmers further in the vertical coordination continuum.

Both the multinomial and ordered models assume that farmers are offered all contract types. However, as discussed earlier, this assumption is a strong one, not likely to always hold. In the case of inflexible contracts, farmers have to accept or reject the only contract type offered by the firm. Therefore, in such situation the multinomial and ordered models are not quite realistic. To go beyond this limitation, as a last contribution, we model contract farming participation as a continuous variable along the vertical coordination continuum, by considering the amount of pre-financing farmers are willing to accept from the agribusiness firm as an investment in the contractual agreement.\textsuperscript{12} A continuous treatment of contract farming provides a major step forward compared to the preceding categorical models, as the value of firms’ investment is of major significance for devising policies aiming to promote private sector investment in rice value chain upgrading.

As explained in Section 3.3 in order to test for potential selection issues, we specified a Heckman selection model. As the inverse Mill’s ratio was insignificant in the second stage model, we report only the more efficient OLS model results (Eq. 7) and not the Heckman model results (Eq. 6; results are available from the authors upon request).

All variance inflation factors are below 2.5, indicating no multicollinearity issue in the OLS model. While the multinomial model results already highlighted that the scale bias in contract farming may be predominantly coming from marketing contracts (that are purely

\textsuperscript{10} We formally tested the independence of irrelevant alternatives (IIA) assumption using the Hausman-McFadden and Small-Hsiao tests. While the former test did not provide evidence against the IIA (p values > 0.1), the latter test was inconclusive and sensitive to the division of the sample. This was also noted by Long and Freese (2014: 408) who “[...] do not believe that tests of IIA are useful.” We do feel confident that our three contract types can be plausibly assumed distinct and weighted independently by our Vietnamese farmers simply based on their description in Fig. 3.

\textsuperscript{11} In our multinomial model results, we do not find any evidence of matching effects in extreme categories (for example, a positive and significant coefficient for both the marketing contract and total contract equations, but not for the partial contract equation) and hence report the ordered model results (see also Note 4). We also conducted a Brant test and a Wald test and found no evidence that the assumption of parallel regression lines is violated (p = 1.00 and 0.23 respectively). A score and a likelihood ratio test, however, did indicate a violation of this assumption (p < 0.01). As these results are inconclusive, care needs to be taken when interpreting the results as the strong assumption of parallel regression lines is made.

\textsuperscript{12} Note that treating contracts as a continuous variable using the amount of pre-financing as a measure for the degree of vertical coordination implicitly treats marketing contracts as being similar to no contracts. This is obviously a shortcoming of this measure.
defined on farm output), we now find that pre-financing is in fact smallholder-inclusive. Farmers with a hectare less of farm size tend to attract 66 USD per hectare more of pre-financing. Complementary results from a choice experiment on contract attributes undertaken on the same sample of farmers suggests that this inverse relationship could be related to a trade-off between securing higher levels of pre-financing and lower farmers’ autonomy. As smaller farmers may face higher input market failures with limited access to credit and quality inputs, they may be more willing to forego some autonomy in exchange of more pre-financing; as we found that the greater the level of pre-financing, the higher the input governance (see Fig. 2), and the lower farmers’ autonomy. As these pre-financing packages may include only certified seeds in the case of a partial contract up to a whole package of inputs (i.e. certified seeds, fertilizer and pesticides) in a total contract, this result suggests that participation in contract farming could help smallholders to overcome the barriers they face in dysfunctional input markets.

6. Conclusion

Despite its impressive strides in improving rice export volumes, the Vietnamese rice sector still struggles with input market failures, quality-based competitiveness and sustainability. The Vietnamese government is currently attempting to upgrade rice value chains in the MRD by encouraging (i) vertical coordination between exporters and farmers through contract farming, and (ii) horizontal coordination among farmers through the SFLF program. In order to devise correct and targeted policies for fostering contract inclusiveness, we compare four different econometric approaches to assess the determinants of participation in alternative contractual arrangements, each gradually dealing with contract heterogeneity in an increasingly rigorous way.

We find that the decision of households on whether to participate in contract farming is influenced by various transaction costs. However, in contrast with the common finding in the literature that contract participation is biased towards larger farms, we find that scale bias of contract farming may be successfully relaxed through horizontal coordination, encouraged through government intervention, and even potentially reversed under increasing levels of vertical coordination as smaller farmers are found to secure higher levels of buyer investment. These findings highlight the role both policies can play in fostering the inclusiveness of contract farming in rice value chain upgrading in Vietnam.

To achieve policy goals under Decision 80, promotion efforts for farmers’ participation in contract farming should focus on promoting farmer organizations. As the SFLF program shows great potential to be internalised in rice value chains through contract farming, Vietnam’s policy makers, therefore, need to grasp the opportunity to create an enabling policy and regulatory environment and providing the necessary support services. Our study provides useful insights on the inclusiveness of contract farming under the assumption of contract heterogeneity. While we believe our various cross-sectional model specifications to be reasonable, we recognise unobserved heterogeneity as a limitation of our research. Future research based on panel data could overcome this issue in order to control for omitted variables bias. Future research could also delve deeper into jointly modelling contract participation and intensity under contract heterogeneity. As an extension of our continuous model, this approach would require larger sample sizes from regions where contract heterogeneity is abundant. Much more remains to be explored as well. To scale up contract farming participation in the Vietnamese rice sector, empirical evidence from exporters is needed. To the best of our knowledge, no studies have investigated rice contract farming in Vietnam from the perspective of exporters. This is crucial as rice exporters are the ones offering contracts to farmers. Likewise, future research should assess the impact of participation in heterogeneous contracts on farmers’ welfare and performance; even though the literature is mostly supportive of positive effects, contract heterogeneity within one study region is still largely overlooked. Finally, the government should promote the adoption of more environmentally and socially sustainable rice production and natural resource management practices. As suggested by Demont and Rutsaert (2017), sustainability can be internalised in rice value chains through contract farming. Vietnamese policy makers, therefore, need to grasp the opportunity to deploy contract farming as a vehicle for sustainable rice value chain upgrading.

Contributors

All authors contributed to the design of the research, the methodology for analysis, the interpretation of the results, and the manuscript writing.

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Appendix A

Table A1

<table>
<thead>
<tr>
<th>Variables</th>
<th>Binary</th>
<th>Multinomial</th>
<th>Partial contract</th>
<th>Total contract</th>
<th>Ordered</th>
<th>Partial contract</th>
<th>Total contract</th>
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<td>SFLF</td>
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<td>-0.04</td>
<td>0.13*</td>
<td>0.18***</td>
<td>0.01</td>
<td>0.17***</td>
<td>0.16**</td>
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<td>0.02</td>
<td>0.00**</td>
<td>0.01**</td>
<td>0.03**</td>
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<td>0.08***</td>
<td>-0.04</td>
<td>0.20***</td>
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<td>-0.01**</td>
<td>0.00*</td>
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<td>-0.02**</td>
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<td>Trust</td>
<td>0.17***</td>
<td>-0.00</td>
<td>0.05</td>
<td>0.13***</td>
<td>0.00</td>
<td>0.09**</td>
<td>0.11***</td>
</tr>
</tbody>
</table>

Note: Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

References


Bellemare, M.F., Lim, S., 2018. In all shapes and colors: varieties of contract farming.


Negotiation costs

Note: Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

SFLF 0.27*** –0.04 0.13* 0.18*** 0.01 0.17*** 0.16*** 105.05***

Public training 0.24*** 0.08*** –0.04 0.20*** 0.00 0.10* 0.11** 48.07

Farming experience –0.01* 0.00 0.00 –0.01* 0.00* 0.00** 0.00** –1.59

Age 0.00 0.00 –0.01 0.00** 0.00* 0.00** 0.00** 1.58

Association membership 0.21*** –0.11*** 0.17** 0.14** –0.02** 0.06** 0.17** 79.15**

Monitoring costs

Monitoring costs

Trust 0.17*** –0.00 0.05 0.13*** 0.00 0.09** 0.11*** 22.03


“Small Farmers, Large Field” scheme in eastern India. Rice Today 16 (1), 35-36.