



# Contract-farming in Staple Food Chains: The Case of Rice in Benin

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**Abstract.** — In this paper, we analyze the impact of smallholder participation in a contract-farming scheme in the rice sector in Benin. We use data from a cross-sectional farm-household survey and different propensity score matching estimations to reveal how participation in a contract-farming scheme affects smallholder rice production. We find that contract-farming results in expansion of the rice area, intensification of rice production, increased commercialization of rice, and higher farm-gate prices, and ultimately contributes to rice output growth and increased income. Our findings imply that contract-farming can contribute to upgrading the rice supply chain and the development of the rice sector in Benin. Promoting and supporting the spread of contract-farming schemes in the sector might be an effective way to contribute to reaching the government goals of expanding rice production to become self-sufficient and improving rice quality to compete with imported rice. While there is a large empirical literature on contract-farming in high-value and commodity export sectors, studies on contract-farming in staple food sectors are very scarce. Our results document that contract-farming for staple food crops can be sustainable and benefit smallholder farmers; which is against theoretical expectations that contracting for staple food crops is not feasible because of contract-enforcement problems that stem from a low value of produce, low storage and transport costs, and a larger number of buyers in the chain. Our study contributes to understanding the role that contract-farming might play in the much needed upgrading of domestic and staple food crop sectors in developing countries.  
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*Key words* — contract-farming, staple food supply chains, Rice, Africa, Benin

## 1. INTRODUCTION

Contract-farming is put forward as an institutional innovation that can reduce transaction costs in food supply chains and solve market imperfections in linking smallholder farmers to markets (Key & Runsten, 1999; Oya, 2012; Swinnen & Maertens, 2007). Contract-farming can improve farmers' access to inputs, credit, and technology, and ultimately benefit farm productivity and incomes. Contract-farming can reduce the risk faced by farmers as contracts offer a guaranteed market outlet and, depending on the type of contract, share production risks between farmers and buyers. There is a quite large body of empirical literature, based on case-studies from around the world, that documents positive productivity and welfare effects of contract-farming for smallholder farmers in developing countries—see Minot and Sawyer (2016), Otsuka, Nakano, and Takahashi (2016), Oya (2012), Wang, Wang, and Delgado (2014) and for a review of that literature.

In this paper we assess the implications of contract-farming for the performance of smallholder farms in the rice sector in Benin. We use data from a cross-sectional farm-household survey and different propensity score matching estimations—that are corroborated by a difference-in-difference estimation based on recall information—to reveal how participation in a contract-farming scheme affects smallholder rice income and the expansion, intensification, and commercialization of smallholder rice production. Understanding the implications of smallholder rice contract-farming in Benin is particularly relevant because the country aims at expansion of the domestic rice sector and increased competitiveness to imported rice, and ultimately at rice self-sufficiency—and so do many other countries in West Africa (Futakuchi, Manful, & Sakurai, 2013; Wopereis, Johnson, Ahmadi, Tollens, & Jalloh, 2013). Our analysis and findings can shed light on whether and how contract-farming can contribute to reaching those goals in Benin.

Our focus is also relevant with respect to the broader literature on contract-farming in developing countries. There is a

large body of empirical micro-economic literature on smallholder participation in contract-farming schemes and the productivity and welfare implications of this participation, with case-studies from countries in Africa (e.g., Bolwig, Gibbon, & Jones, 2009; Minten, Randrianarison, & Swinnen, 2009; Rao, Bruemmer, & Qaim, 2012), Asia (e.g., Cahyadi & Waibel, 2013; Ramaswami, Birthal, & Joshi, 2009), Latin-American (e.g., Berdegué, Reardon, Balsevich, Flores, & Hernandez, 2007; Key & Runsten, 1999), and comparative studies across countries (e.g., Barrett *et al.*, 2012). Yet, most of these studies focus on high-value products (mostly fruits and vegetables and products from animal origin—e.g., Berdegué *et al.*, 2007; Minten *et al.*, 2009; Ramaswami *et al.*, 2009; Rao *et al.*, 2012) or industrial commodities (mostly palm oil, coffee, cocoa, rubber, and cotton—e.g., Bolwig *et al.*, 2009; Cahyadi & Waibel, 2013) that are destined for export, large-scale processing, or supermarket retail in high-value urban market segments. There is very few evidence on contract-farming in staple and domestic food chains, and our study contributes to this scarce evidence.

Upgrading of domestic and staple food chains in developing countries, e.g., through contract-farming, is recognized to be particularly important (Gómez *et al.*, 2011). Increasing efficiency in these chains has the potential to benefit a large number of smallholder farmers; as opposed to high-value and export chains that are often exclusive and more limited in terms of the number of farmers involved (Reardon, Chen, Minten, & Adriano, 2012). Upgrading staple and domestic

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food supply chains is needed for a more efficient supply to fast growing urban markets and to sustain access to affordable food for urban consumers (Minten, Murshid, & Reardon, 2013). It has been argued that the development of staple food chains can contribute more to poverty reduction and food security in poor countries than the development of high-value export chains (Diao, Thurlow, Benin, & Fan, 2012). Our analysis and findings contribute to understanding the role contract-farming can play in the much-needed upgrading of domestic staple food supply chains in developing countries.

The remainder of the paper is structured as follows: In the next section we present a short review of the literature on contract-farming in order to frame our case-study. In Section 3 we give detailed background information about the rice sector in Benin and our research area. In Section 4 we discuss our methods, including the survey data collection and the econometric methods. In Section 5 we present some descriptive statistics. In Section 6 we present and discuss the econometric results, and in Section 7 we conclude.

## 2. LITERATURE REVIEW

Contract-farming is usually defined as agricultural production being carried out based on a pre-plant agreement between the buyer and the farm producer (Minot & Sawyer, 2016). The agreement can involve specifications about the transaction only such as product quantity, delivery time and sales price—usually referred to as a marketing contract—and specifications about the production process and product attributes such as quality attributes, chemical use, seed variety, etc—usually referred to as a production contract (Swinnen & Maertens, 2007). Contract-farming can involve input supply, managerial assistance, or technical extension to the farmer by the buyer. Contract-farming is described as a form of vertical coordination in between market coordination (0% vertical coordination) and vertical integration (100% vertical coordination), and has been studied using different theoretical approaches—see Rehber (2007) for a review of the theoretical approaches to contract-farming.

Within transaction cost theory, contract-farming is explained as a form of governance to reduce transaction costs when market imperfections are large (Hobbs & Young, 2001; Williamson, 1979). The principle-agent theory explains contract-farming by asymmetric information and moral hazard problems and stresses the need for complete and self-enforcing contracts to avoid opportunistic behavior leading to contract-breach and side-selling (Barry, Sonka, & Lajili, 1992; Rehber, 2007). These theories predict contract-farming to be more common in sectors with large uncertainty (e.g., due to food safety risks) and a high degree of asset specificity (i.e., large and sector-specific investments); in markets with few buyers and with large transaction costs (e.g., due to poor transport infrastructure); and for products that are less homogeneous (e.g., due to quality differentiation), more perishable, and more difficult to store and transport. Swinnen and Vandeplass (2011) and Swinnen, Vandeplass, and Maertens (2010) have built a conceptual model based on these theories and point to a number of difficulties for contract-farming to be successful in staple food sectors. First, contract enforcement is particularly difficult. The low value of staple food crops and the limited possibilities for quality upgrading and value adding

impede the use of a price premium as contract enforcement mechanism. Second, the fact that staples are bulky and not highly perishable and therefore relatively easy to store and transport, increases the likelihood of opportunistic sales and contract breach. Third, the large number of small buyers in staple food chains increases the likelihood of opportunistic sales and reduces the likelihood that buyers have the financial means to initiate contract-farming schemes. In addition, these conceptual studies show that, if sustainable, contract-farming creates surpluses. Contract-farming improves farmers' access to inputs, credit, and technology and increases output and productivity. Contract-farming can reduce the risk faced by farmers as contracts offer a guaranteed market outlet and share production risks between farmers and buyers. Contract-farming can result in a price premium and higher farm-gate prices. Yet, imbalance of power in the chain might result in contract terms that are less favorable for producers, resulting in the distribution of the benefits of contract-farming being squeezed.

There are numerous empirical studies on the impact of contract-farming; mainly concurring in the positive impact of contract-farming on farm-gate prices, farm productivity, and farm-household income.<sup>1</sup> A recent review of some 30 empirical studies on contract-farming in developing countries (Minot & Sawyer, 2016) concludes that contract-farming improves farm productivity and incomes, with income effects mainly in the range of 25 to 75%. Similar conclusions were put forward by Otsuka *et al.* (2016) and Wang *et al.* (2014) in review articles of contract-farming in developed and developing countries and by Swinnen (2006) in a large and comparative study on contract-farming in Eastern Europe and Central Asia. Empirical studies on contract-farming have mostly focused on industrial commodities (e.g., Bolwig *et al.*, 2009; Cahyadi & Waibel, 2013; Delarue & Cochet, 2013; Jones & Gibbon, 2011; Ruf, 2013), livestock sectors (e.g., Begum, Alam, Buysse, Frija, & Van Huylenbroeck, 2012; Gulati, Minot, Delgado, & Bora, 2007; Ramaswami *et al.*, 2009), and high-value produce (e.g., Barrett *et al.*, 2012; Berdegue *et al.*, 2007; Dedehouanou, Swinnen, & Maertens, 2013; Minten *et al.*, 2009; Narayanan, 2014; Rao & Qaim, 2011; Rao *et al.*, 2012; Warning & Key, 2002) destined for large-scale processing, export, or supermarket retail in high-value urban market segments. There are hardly any studies on the impact of contract-farming in domestic staple food and grain sectors. A notable exception is a study on maize and rice seed sectors in Indonesia, that document positive effects of contract-farming in terms of increased return to capital and secure market access (Simmons, Winters, & Patrick, 2005). A study on smallholder contract-farming in Madagascar, that documents a modest positive effect of contract-farming on farm income, includes rice and maize contract-farming schemes but does not distinguish this from contract-farming for high-value crops (Bellemare, 2010).

On the other hand, various studies have shown that contract-farming schemes are to some extent exclusive as participation is biased toward relatively better-off farmers among the smallholder population (e.g., Freguin-Gresh, d'Haese, & Anseeuw, 2012; Maertens & Swinnen, 2009; Simmons *et al.*, 2005). Moreover, it has been estimated that only a very small fraction of smallholder farms in developing countries (between 1% and 5%) is included in contract-farming schemes (Minot & Sawyer, 2016). This has led some authors to conclude that

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