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# Impacts of contract farming in domestic grain chains on farmer income and food insecurity. Contrasted evidence from Senegal

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## ABSTRACT

Contract farming in export chains may upgrade producers' livelihoods thanks to the access to improved inputs and high-value markets. We tested the hypotheses that contracts in domestic grain chains improve farmers' incomes and reduce food insecurity. We studied the rice value chain in Senegal, where the national agricultural bank and rice millers draw up production and marketing contracts. We applied instrumental variables and propensity score matching models to a dataset of 470 observations to correct selection bias. We found that as a financial device, marketing contracts had no impact on agricultural practices, product quality or income but reduced food insecurity by mitigating price seasonality. Production contracts had a positive impact on the income of producers who were excluded from bank credit but included implicit interest and insurance costs, meaning that these producers make less profit than those financed by the bank. Policies supporting the modernization of domestic grain value chains in West Africa should promote credit insurance systems and support the negotiation of an incentive price in contracts.

## 1. Introduction

Contract farming is an intermediary form of vertical coordination that has been expanding in the private sector since the 1960s in response to the demand for high-quality products (Swinnen and Maertens, 2007). It is likely to appear when uncertainty and asset specificity are high, such as in the trade of products that are perishable, difficult to store and transport and probably of heterogeneous quality (Minot and Sawyer, 2016). Since the 1980s, this institutional innovation has been increasingly used in Africa where agricultural and input markets often fail. Contract farming in Africa mainly concerns tropical, horticultural and animal products produced by small-scale farmers and exported to northern markets (Swinnen and Maertens, 2007).

The scientific literature over the last 15 years mainly reports on the positive impacts of contract farming on family farms. Contractors support producers in improving the quality of their products by providing access to improved inputs and technical advisory services (Reardon et al., 2009). Such contracts increase yields, farm gate prices and income (Bellemare, 2012; Bolwig et al., 2009; Girma and Gardebroeck, 2015; Leung et al., 2008; Maertens and Swinnen, 2009; Maertens and Vande Velde, 2017; Minten et al., 2009; Mishra et al., 2016; Miyata

et al., 2009; Rao and Qaim, 2011; Saenger et al., 2013; Simmons et al., 2005; Trifković, 2016; Wang et al., 2014; Warning and Key, 2002).

Contract farming is widely documented in export value chains (VCs) for high value products (Minot and Sawyer, 2016), but little has been published about the impacts of contract farming in domestic grain chains. Indeed, contractual arrangements in these VCs are less likely to be adopted because demand for high-quality products is limited, thereby preventing the appearance of a premium. Furthermore, the low perishability of grain facilitates side selling (Swinnen et al., 2010). Nevertheless, contract farming recently appeared in certain domestic grain chains in sub-Saharan Africa. Factors that favor such contracts include demand for high-quality cereals (Demont and Ndour, 2015), state policies implemented after the world food price crisis in order to modernize domestic food chains (MA, 2009) and support from international organizations. As a result, contract farming is increasingly implemented by private companies in Madagascar (Bellemare, 2012), Benin (Maertens and Vande Velde, 2017), Ghana (Ragasa et al., 2018) and Senegal. However, questions remain about the capacity of chains targeting high-quality staple domestic markets to increase producers' income.

Furthermore, in the case of staple chains, analysis of the impacts of

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contract farming needs to be extended to food insecurity. The implementation of contract farming in grain chains could create competition between sales and domestic consumption. Few studies have examined the impact pathways between contract farming and farmers' food insecurity. Minten et al. (2009) found that contract farming in the horticultural sector shortens lean periods. Bellemare and Novak (2017) found that contracts improve producers' income and therefore reduce the hungry season, especially for households with more children. The present paper will add research to this body of evidence.

Finally, the existing literature considers that producers market their products either in traditional VCs through spot transactions or in modern VCs through contracts. However, producers sometimes combine contracts and spot transactions because these two types of marketing fulfill specific functions. For instance, contract farming provides access to improved inputs and profitable markets, while spot transactions ensure rapid payment (Masuka, 2012), access to credit for unexpected expenses and outlets for products rejected by contractors (Mujawariya et al., 2013). Such a combination of marketing modes is sometimes cited in the literature, but without its impacts on farmers' income being documented (Da Silva, 2005; Gow and Swinnen, 1998; Rao and Qaim, 2011).

The objective of this paper is to assess the impact of two types of contract on farmers' incomes and food insecurity in a domestic grain chain. The hypothesis is that contracts improve farmers' incomes through access to credit, improved inputs and technical advice, thereby increasing yields and improving quality (Reardon et al., 2009). Contracts also reduce farmers' food insecurity by increasing their income (Bellemare and Novak, 2017). The paper helps fill the knowledge gap relating to the impacts of contract farming in domestic grain chains. It breaks down the impacts of contract farming and of the combination of two marketing modes on farmers' incomes while highlighting different pathways from contract farming to food insecurity. It also helps understand the conditions under which contract farming may fail to generate higher incomes for producers. Finally, it provides recommendations for policies aimed at modernizing domestic food chains in West Africa.

The rice VC in the Senegal River valley provides empirical insight into the impact of contract farming in domestic staple chains in sub-Saharan Africa. We use a sample of 470 observations specifically developed for this study. We apply instrumental variable and propensity score matching models to correct selection bias. We compare the income and food insecurity of producers adopting two types of contracts. Marketing contracts were set up by the government in order to secure the repayment of loans to the national agricultural bank and to support rice millers' supplies. Its price takes the paddy quality into consideration. Production contract were established by rice millers to ensure the quantity and quality of their supplies. Millers provide farmers with credit inputs and, sometimes, technical support, and the farmers' repayments are made in paddy.

Section 2 presents the empirical background of contract farming in the Senegalese rice VC. Section 3 describes the method used while Section 4 presents the results. Section 5 concludes.

## 2. Background

### 2.1. Agricultural policies and modernization of the rice value chain

Imports of rice in Senegal increased by 2.2% per year between 1960 and 2011 (Fig. 1) and accounted for 80% of domestic consumption between 2001 and 2010. The particularity of Senegal among West African countries is that 98% of rice consumption refers to broken rice, a byproduct of milling (Hathie and Ndiaye, 2015). Domestic production therefore faces competition from cheap imports. However, the shift in demand towards higher-quality products also concerns broken rice (Demont et al., 2013).

Since independence in 1964, several programs have been

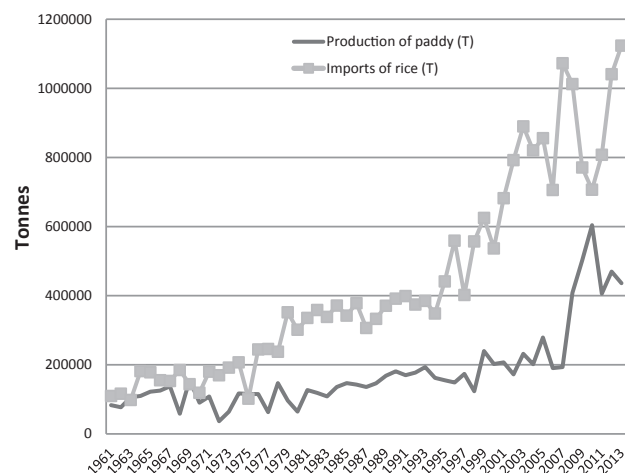


Fig. 1. Rice imports and production in Senegal (data from FAOSTAT). Note: the paddy to milled rice conversion factor is 0.67.

implemented by the government and international organizations with a view to developing the rice VC in Senegal (Fall, 2006). In the wake of the world price crisis, and following the example of several governments in Africa, the inter-ministerial council created a new national program for rice self-sufficiency (MA, 2009) with the support of the Coalition for African Rice Development. This program aimed at expanding land used for rice farming from 55,000 ha in 2008 to 175,580 ha in 2012 in order to increase national production from 535,000 tons of paddy to 1,500,000 tons. These goals were subsequently postponed until 2017 (MA, 2014). The main target area is the Senegal River valley which accounted for 80% of domestic rice production in 2014 (USDA, 2015). The two main agencies implementing these policies are the national agricultural bank (French acronym CNCAS) and the national company which supports irrigated agriculture in the Senegal River valley (French acronym SAED).

Since 1964, agricultural financing has been used extensively by the government to support rice farming. The CNCAS is now the main source of credit in the Senegal River valley because diversification (income from horticulture, breeding, trade, handicrafts and salaried work) and other sources of credit are limited. In 2005, diversification accounted for between 20% and 30% of rice production costs and only 2% of farms took out a loan from a small-scale processor (Fall, 2006). Small-scale producers access to credit from CNCAS via producer organizations. These organizations obtain a loan if they have repaid previous loans, if they farm irrigated land and if their technical production specifications are validated by SAED. Producer organizations also enable the collective purchase of seeds, fertilizers and herbicides. Producer organizations with a loan from CNCAS buy fertilizer with a 50% subsidy and the rate of interest on the loan is also subsidized, thereby reducing it from 12.5% to 7.5%. Nevertheless, in 2005, delays in obtaining the loan reduced the associated impact on technical efficiency and on farmers' incomes. The poorest farmers used fewer inputs than recommended because they did not have sufficient cash-flow to purchase inputs in advance (Fall, 2006). Finally, producer organizations sell the paddy to repay the bank loan.

The CNCAS has experienced difficulties in being repaid. The government has intervened four times since 1991 to implement turnaround plans. The last intervention cost FCFA 13.6 billion<sup>1</sup>. Producer organizations that do not repay loans cannot obtain another loan until either they or the government repays the previous one.

In the Senegal River valley, rice is grown in two seasons on irrigated land. Intensive agricultural practices include the use of certified seeds, synthetic fertilizers and herbicides as well as mechanization for

<sup>1</sup> 1 euro = 655.957 FCFA.

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