



## Analysis

## How do rainfall variability, food security and remittances interact? The case of rural Mali



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## ABSTRACT

In this paper, we rely on the CFSVA survey of 2005 to assess the impact of rainfall variability and remittances on the food security of rural households in Mali. To this end, we first design a composite food security index which enables us to distinguish households depending on their level of food security (low, intermediate, high). Then, we estimate a partial proportional odds logistic model in order to evaluate the main determinants leading to a switch from one level of food security to the other. We show that inter-annual and seasonal rainfall variability have a negative impact on food security. This is especially true in southern Mali, although agro-ecological conditions in this region are usually more favorable. As for remittances, their impact is positive, though it needs to be qualified: they enable households to solve temporary food security situations, but they have no effect on structural food security issues.

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## 1. Introduction

Climate variability is perceived as being the greatest threat to agricultural production and food security in sub-Saharan countries, especially in those characterized by a Sahelian climate, in which cereal and rain-fed agriculture predominate. Mali is highly exposed to climate variability and has experienced several food crises during the last decade. Northern parts of the country have been subject to particular attention because of the repeated locust invasions and droughts that have threatened crop yields. These chronic food insecurity situations also spread from the northern to the southern parts of the country. According to [de Bruijn et al. \(2005\)](#), the exposure of rural households in southern Mali results from the alternation of good and bad harvests, from the demographic pressure and from the evolution of the crop- and livestock-farming systems. [Baquedano et al. \(2010\)](#) also stress the role of the cotton sector crisis since the 2000s in worsening the food situation of rural households and in increasing household exposure to rainfall variability. Indeed, the declining trend and high volatility in cotton price since 2000

has encouraged Malian farmers to switch from cotton to cereal production, mainly millet and sorghum<sup>1</sup>; those productions are sensitive to rainfall variability, and usually suffer from the collapse of grain market prices after harvest ([Vitale and Sanders, 2005](#)).

These demographic, social and environmental pressures have encouraged significant migration in the southern area of Mali and particularly in the Sikasso region, which was in 2006 the poorest region of Mali with 33% of households below the poverty line ([IOM, 2009](#)). This acceleration of migratory movements has led to an increase in remittances. Their share in the households' total consumption has also increased markedly from 7% in 1994 to 15.3% in 2006 ([Gubert et al., 2010](#)).

Previous studies have shown the strong potential of remittances for reducing poverty through their positive effect on income and

<sup>1</sup> In the early 2000s, the Malian parastatal cotton company, which ensures the supply of input and advice to producers, the purchasing of the seed cotton at a guaranteed price as well as the processing and marketing of cotton fiber, faced a severe financial crisis which was precipitated by the decline in international cotton prices. A large decline in cotton production has been observed over the last decade due to a combination of factors: declining cotton fiber prices in the international market from 1998 until 2009, changes in the dollar-euro exchange rate, low productivity of cotton farms (lower yields), and management issues resulting in general indebtedness in the sector.

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**Table 1**

Distribution of the dominant livelihood systems.  
Source: CFSVA (2005), authors' calculations.

Livelihood systems	Sahelian zone		Sudanian zone	
	Frequency	Percent	Frequency	Percent
Agriculture	267	43.34	223	41.91
Agropastoralism	124	20.12	105	19.73
Pastoralism	75	12.17	62	11.66
Artisans/Merchants	99	16.07	93	17.48
Employees	18	2.92	13	2.44
Hunting and gathering	32	5.19	36	6.77
Total	616	100	532	100

consumption (Gubert, 2002). However, little attention has been paid to the effects of remittances on food security to this day. Thus, political endeavors to use their potential for increasing the food security of rural households have been few and far between (Maphosa, 2007).

It is nevertheless accepted that remittances can influence household consumption and nutrition in several ways. They can have a direct positive impact on household income and thus on their food security as well as on the variety and quality of the food eaten. By contributing directly to the income of households, remittances allow for better economic access to food and to health services. Households are thus more likely to face shocks, and in particular sudden increases in food prices. According to Nyikahadzo et al. (2013), remittances limit the probability for Mozambican senior-headed households to experience food insecurity while public transfers have no significant effect. According to Babatunde and Martinetti (2011), households benefiting from remittances in the Kwara State (Nigeria) have better food access. But the authors find evidence that this additional revenue doesn't necessarily improve the quality of diet; instead it is used to smooth consumption and to buy necessities goods.

This paper extends previous works by analyzing the impact of remittances on the ability of households to cope with food insecurity risks in a context of climate variability. Using data from the CSFVA-Mali household survey (*Comprehensive Food Security and Vulnerability Analysis*) conducted throughout Mali in December 2005 by the WFP<sup>2</sup> in association with CFS<sup>3</sup> and UNICEF,<sup>4</sup> we first compute a composite index of food security in order to distinguish households depending on their level of food security (low, intermediate, high). We then use a *partial proportional odds logistic model* (Peterson and Harrell, 1990) to estimate the impact on food security of remittances and rainfall fluctuations. The key advantage of this approach is that it provides estimates of the impact of explanatory variables on the probability to switch from one level of food security to another, while allowing the estimated parameters to vary between these different levels. Finally, the other contribution of the paper is to study the impact of remittances on the ability of households to guarantee their food security by reinforcing their productive capacity. To this end, we use an asset threshold based approach following Carter and Barrett (2006) in order to distinguish between households experiencing "structural" and "chronic" food insecurity.

The paper is organized as follows. In Section 2, we present the method used to assess the food security level of Malian households, as well as the results. In Section 3, we introduce the methodological framework and discuss the results regarding the main factors of exposure and adaptation to food insecurity in Mali. In Section 4, we investigate more deeply the role played by remittances in the ability of households to cope

with food insecurity risks in a context of climate variability. Section 5 concludes.

## 2. Household Food Security in Mali

### 2.1. Scope of the Study

We use the CFSVA (2005) survey to estimate the food security level of Malian rural households.<sup>5</sup> The CFSVA survey provides a national picture of the food security of rural households and constitutes significant progress since the food situation in Mali had until then only been studied locally, and in the northern part of the country in particular.<sup>6</sup> 2074 rural households were surveyed in 209 villages located within seven agro-climatic zones, which are defined by WFP and FEWS-NET Mali. This zoning system gives a representative sample on the national scale. It enables us to work around the biases linked to the regional heterogeneity in standards and ways of living by identifying homogeneous zones which are rather defined by their agro-climatic characteristics.

In this article, we focus on the Sahelian and Sudanian agro-climatic zones (Fig. A.1).<sup>7</sup> Our sample is made up of 1158 rural households, 626 of which are in the Sahelian zone (northern and southern Sahel), and the other 532 in the Sudanian zone (northern and southern Sudan). The Sahelian zone includes all the localities surveyed in the agro-pastoral and dry agriculture areas located between isohyets 200 and 750 mm. From north to south, the whole zone stretches from Timbuktu to Ségou and also includes the northern part of the Kayes region as well as the Mopti region. The Sahelo-Sudanian climate includes the localities set between isohyets 750 and 1200 mm (Rodier, 1964). This climate zone is characterized by more abundant rainfall. It stretches over the northern Sudanian zone, where millet and sorghum are the main food cultures and cotton the main commercial one, and the southern Sudanian zone, where maize, cotton, fruit and tubers are the main cultivated foods.

At first glance, the two climate zones share some common characteristics. Indeed, the migration rate as well as the amount of remittances per capita received by households (in FCFA) are equivalent in the two regions. According to the CFSVA survey (2005), the average migration rates in the Sahelian and the Sudanian regions are respectively 0.150 and 0.132. The average amount of remittances per capita received is 4795.189 FCFA in the Sahelian region and 4533.851 FCFA in the Sudanian one. Furthermore, both climate regions show identical distribution in dominant livelihood systems (Table 1).

### 2.2. Construction of the Food Security Index

International organizations give several definitions of food security.<sup>8</sup> The World Bank (1986) defines food security as "access by all people at all times to enough food for an active, healthy life". In 2002, the FAO

<sup>5</sup> The 2004 season has suffered from the shortened rainy season and locust invasions creating significant losses and a deficit that resulted in a particularly difficult lean with a very significant increase in prices. 2005 is thus a year during which households were recovering from past difficulties, thanks to generally good harvests and can be considered as a relevant date to take into consideration adequate responses of households facing the risk of crop failure.

<sup>6</sup> A first CFSVA survey was conducted in 2002 but it was limited to the areas located above the 14th parallel, which were deemed the most vulnerable. WFP and EWS (Early Warning System) then realized a quick survey in October 2004, assessing the impact of an invasion of locusts on the food security of households in the Northern parts of Mali south of the 14th parallel and affected by the invasion. Finally, a household food security survey funded by ECHO was conducted in June 2005 by WFP and EWS in the three northern regions of the country.

<sup>7</sup> The specific climates found in the desert and in the Niger delta were deemed to be beyond the scope of this study. This is best justified by the importance of nomadism in the desert zones situated at the northernmost limit of Mali and by the hydrographic specificities of the floodplains: these stretch over more than 350 km between the 17th and 13th parallel north and between the 2°30' and 6°30' meridians west, and human organization in this area relies willingly on climate hazards.

<sup>8</sup> According to Gunning et al. (2000), almost 200 definitions and 450 indicators can be identified.

<sup>2</sup> World Food Program.

<sup>3</sup> Committee on World Food Security.

<sup>4</sup> United Nations Children's Fund.

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