Geoprogress Journal, Vol. 3, Issue 1, 2016, Ed. Geoprogress

INDEX-BASED INSURANCE CHALLENGES AND SOCIO-ECONOMIC CONSIDERATIONS. THE IBLI-KENYA CASE

Federica Di Marcantonio*

Abstract

This paper summarises experiences of index-based weather insurance initiatives in Kenya, and drafts preliminary conclusions about lessons learnt as well as some recommendations for decision makers and implementers. In particular, we highlight some key issues related to index insurance products in order to gain insights into the effectiveness of this instrument. We describe specific examples of pilot programmes, identify the main challenges, and suggest possible improvements to the economic sustainability of the index insurance market. We also describe technical developments, commercial challenges and sale performance, mainly linked to the Index-Based Livestock Insurance (IBLI) project. We have seen that neither the provision of discount coupons nor the number of assets insured approach a level of commercial viability. We conclude that the low uptake and increasing disaffection of those that tested the product brings us to rethink the role of index insurance as a product to protect farmers/pastoralists, and particularly to improve their food security.

1. Introduction

Index insurance is a well-established tool, but has only recently been introduced in developing countries to reduce the impact of adverse weather-related events (Skees, 2008)[1]. Index insurance is one of several risk management mechanisms. Primarily used in the agricultural sector, this instrument basically covers agricultural risks deriving mostly from weather-related perils such as droughts, floods, frosts and storms.

There are currently two types of index products: Area yield index insurance and Weather Index Insurance (WII). With Area yield index insurance, the indemnity is based on the average yield of an area (such as a county or district), rather than the actual yield of the insured party. The insured yield is established as a percentage of the average yield of the area. An indemnity is paid if the insured yield is less than the average yield of the area, regardless of the actual yield of the policyholder. This type of index insurance requires historical yield data for the area being insured.

---

* Federica Di Marcantonio. Joint Research Centre, MARS Unit, Via Fermi, 2749, I-21027 Ispra (VA). E-mail: Federica.di-marcantonio@jrc.ec.europa.eu.

[1] "Multiple peril crop insurance began in the late 1930s. The program exhibited only slow growth, and by 1994 less than 100 million acres were enrolled. With successive reform acts, passed in 1994 and 2000, the increased premium subsidy levels, particularly at higher levels of coverage, led to a higher uptake (by 2011 over 265 million acres were enrolled in the program). Japan implemented a multiple peril crop insurance program in 1939, subsidizing 15% of premium costs. Canada passed legislation authorizing multiple peril crop insurance in 1959, and after World War II multiple peril crop insurance programs were gradually introduced with subsidized programs in Austria in 1955, Italy in 1970, Spain in 1980, and France in 2005." Smith and Glauber (2012)

WII is based on observable parameters (such as rainfall anomalies) as a proxy for crop loss. Ideally, the index is readily available, objective, transparent, independently verifiable, reportable in a timely manner, and sustainable over time (World Bank, 2005). In this case an indemnity is paid whenever the value of the index exceeds a predefined threshold (for example, when protecting against excessive rainfall) or when the index is less than the threshold (for example, when protecting against a rainfall deficit). More sophisticated forms of index insurance use satellite imagery to determine potential losses of crops or livestock forage (used as a proxy to predict livestock mortality).

Unlike traditional insurance, index insurance is expected to respond to objective parameters that farmers or insurers cannot influence[2] (Miranda and Farrin, 2012). This removes much of the inefficiency of conventional insurance (i.e. moral hazard and adverse selection are removed, administrative costs are low, and payments are made in due time; Mirnada and Farrin, 2012), while eliminating some administrative costs, such as those associated with on-farm loss assessment.

Beyond the many advantages usually associated with this product as compared to conventional insurance mechanisms, index insurance products are intrinsically imperfect mainly because they rely on estimations and calculations that might contain errors. This error, which translates into the incapacity of an index to detect losses and trigger payouts, is called basis risk, which mainly consists of a mismatch between the value of the weather parameter identified by the index and the actual losses. Basis risk is bi-directional, since the error can affect both the insurer and insured – the index can trigger a payment where there hasn't been any loss, or can fail to trigger an indemnity when the insured faced a loss.

In this context, "the effectiveness of index insurance, as a risk management tool, depends on how strongly farm yield losses are correlated with the underlying index. In general, the more homogeneous the area, the lower the basis risk and the more effective area-yield insurance will be as a farm-level risk management tool. Similarly, the more closely a given weather index actually represents weather events on the farm, the more effective the index will be as a farm-level risk management tool" (World Bank, 2005).

To overcome some of the issues linked to limited and poor information sources for index design, the insurance market has seen a steady increase in recent years in the use of remote sensing, which is seen as a potential alternative to other forms of information (Leeuw et al., 2014). Nevertheless, although remote sensing can complement the technical improvement of the indexes, it has limited applicability to the insurance industry. A number of technical factors that constrain the use of remote sensing in index design will be discussed in section two, together with other socio-economic factors that have to date hampered the uptake of index insurance.

The remaining parts of the paper are structured as follows: section three provides a detailed discussion of the development of a particular form of index-based insurance in Kenya: Index-Based Livestock Insurance (IBLI); section four focuses on discussing the

[2] However, though the parameter itself cannot be arbitrary influenced, the insurer have the advance of owing a set of information that they can still manage to their own benefit. Indeed, insurance companies have the possibility of setting the thresholds at which payouts for a given peril are triggered at a slightly lower level than the one that would make them to pay a number of predefined times.

opportunity of exploring alternative approaches; and some conclusions and recommendations are drawn in section five.

2. Challenges related to index-based insurance

Despite the potential advantages of index insurance, uptake has not met expectations. Johnson (2013) reports that targeted clients have often not purchased insurance coverage to the extent expected by development agencies, economists and insurance companies. The low uptake raises a number of questions not only linked to the understanding of the limiting factors of product uptake, but also with regard to the need for government intervention in the form of relief programmes for the uninsured where insurance coverage is low (Binswanger-Mkhize, 2012).

There are several possible explanations for low uptake, the most common being lack of product awareness (IFAD, 2010), limited premium affordability (Carter, 2012; Burke et al., 2010), lack of familiarity with or trust in the external agent and cultural acceptance (BFA, 2013; Cole et al., 2013, Dercon et al., 2011; Patt et al., 2009), insufficient financial literacy (Cole et al., 2009; Giné and Yang, 2009), cognitive failure (Skees, 2008), rising of risk and ambiguity aversion mixed with basis risk (Clarke, 2016; Bryan 2010); low willingness to pay for insurance products (Chantarat et al., 2009) and time inconsistencies (Duflo et al., 2010). In the following sub-section we try to group and discuss the most challenging points into three broad areas: efficiency, affordability and scalability.

2.1 *Efficiency*

Product efficiency in terms of index-based insurance can be referred to as the capacity of an index to capture the loss of the insured. The underlying assumption at the basis of an efficient product is that the index, on which the payout is established, is highly correlated with what is insured (i.e. livestock or crop), and that the risk is spatially correlated (as is typical in the case of drought). The first hypothesis implies that the parameters used in the construction of a weather index should not only reproduce the condition of the weather variable(s), but should also be "correlated with yield or revenue outcomes for farms across a large geographic area" (Manuamorn, 2007). This aspect relates to the second assumption, which suggests that in order for an index to work efficiently, the risk should occur across a vast area. This is "because it is the covariate nature of a hazard that allows the insurer to predict losses and determine indemnity payments for a large number of policyholders over a wide geographical area" (de Leeuw et al., 2014).

Thus, for index insurance to provide effective protection to crops and productive assets, a basic requirement is that the chosen weather parameters need to be measurable, objective and representative of the predominant risk to the crop/livestock insured.

If, for instance, the purpose of an index is to insure an individual against drought (which might cause loss of yield or assets), we will need to find a variable that can measure the amount of rainfall in a certain period. Rainfall can be measured, and it is also an objective variable because in theory it does not depend on any individual actions. Nevertheless, de Leeuw et al. (2014) note that for weather-based index insurance that uses rain gauges, the condition of impartiality (intended here as objectivity) is sometimes impractical in remote areas when farmers with an interest in insurance also maintain the rainfall stations.

However, meteorological variables are not the only types of information necessary to build an index. Indeed, whilst yield-based or cumulative rainfall indices simply require the use of actual and historical outcome records, indices that use proxies of weather variables (rainfall/temperature estimates such as satellite-measured vegetation indexes) also need information on the meteorological variable they represent. For example, in the case of index insurance that uses rainfall estimates (satellite sensors do not measure rainfall but a proxy - e.g. cloud-top temperature or microwave radiometry), the product designer will need:

- satellite-based rainfall estimates: usually available for more than 30 years[3] and in near-real time, with full spatial coverage of a region, and generally free of charge;

- ground-based meteorological variables: to establish a correlation between satellite estimates and measured rainfall (this correlation can be biased if the rain gauge or the automated station is not maintained); and

- the yield or revenue, to prove that the index correlates well with the performance of the insured product.

The same applies to other examples of remote sensing indices, such as the Normalized Difference Vegetation Index (NDVI). Thus, to have an index that correlates well with losses, the index (i.e. the underlining variable) should be calibrated with ground data. Graphical representation of the relationship between crop yields (or any other ground data) and rainfall estimates is often omitted from empirical research, which raises some doubts about the ability of these indices to capture the real losses of farmers, and thus to meet their needs.

In addition, the fact that the majority of pilot tests were carried out in areas close to weather stations[4] and where ground data was available raises concerns about the future scalability of the product in more remote areas. In general, it is assumed that index insurance represents a valid instrument in areas with dense station networks that are representative of the effective spatial rainfall. From an index prospective, the lack of a complete set of such information increases the risk of commercialising an index that cannot accurately determine losses. The idea of minimising basis risk by installing more weather stations has to be considered with caution, as investment might not yield the expected returns. Similarly, the adoption of satellite information as an alternative source of weather information should be limited to those areas where calibration with ground-based rainfall measurements is possible (de Leeuw, 2014). Thus, the use of satellite rainfall estimates cannot be considered as an independent alternative source for index-based insurance, but rather as a support to further improve their accuracy

Another aspect to consider is the representativeness of the predominant risk. Index insurance is considered to be a suitable and appropriate risk transfer mechanism in areas with homogeneous climatic conditions (Hess, 2007). This is because "basis risk will be

[3] Records of both ground- and satellite-based estimates have to be sufficiently long to be able to properly underwrite the risk and accurately price the insurance product.

[4] Washington et al. (2006) estimated that the African network "has an average station density of only one per 26,000 km^2, which is 8 times lower than the WMO minimum recommended level

high in areas with microclimates where the weather risk is not correlated" (Carter, 2014). Thus, the high relevance of idiosyncratic risk could offset the benefit of any product designed for highly correlated risk.

An attempt to improve the exploitation of index-based insurance in areas with low weather station density was made by Gommes and Göbel (2012). They concluded that real-world insurance cannot function without at least some form of spatial interpolation, and that indices based on rainfall interpolation and/or crop growth modelling simulate yields more accurately than the standard methods that are based on station rainfall data only.

2.2 *Affordability*

High premium prices have been identified as the main constraint faced by farmers when purchasing insurance. That is why product expansion has mainly been driven by subsidies and the support of donors. Sina (2012) states that "the cost for index-based insurance is often considered high by low-income farmers as incomes of the vast majority in developing countries are absorbed by basic necessities such as food and housing", implying that low uptake by smallholders might be mainly due to a lack of economic means.

Sensitivity to price increases has been proven by different authors. Cole et al. (2013), show how a 10% decline in the price of insurance increases the probability of purchase by 10.4%. Similarly, McIntosh et al. (2013) show that demand for the rainfall index insurance offered was very price elastic and highly correlated with the amount of coupons distributed. While in Kenya, although the reduced price of the insurance through the provision of discount coupons significantly increases the uptake of IBLI (Takahashi et al., 2014), the overall uptake level across the four sale windows remains disappointing (ranging from 26% of the first sale in August-September 2012 to 12% of the last sale in January-February 2014).

However, the idea that lack of economic means hampers scalability is contrasted by the fact that, although the insured receive premium subsidies[5], the overall purchase rate remains very low (see section 3.1), which would probably prevent private insurers from entering the market.

A related concern refers to the willingness of donors (the main suppliers of funds) and governments to continue to financially support subsidies. Should this support end, due to lack of resources or unwillingness to continue, the market would probably collapse. In addition, it has to be considered that the allocation of subsidies requires a careful examination of other investment options that might provide comparable social benefits (Fuchs et al., 2011) and a higher long-term impact on development and growth (such as irrigation facilities, roads or other infrastructure). Furthermore, although subsidies can lead to an increased level of uptake, they could have an anchoring effect (i.e. relying too heavily on the first piece of information offered to make subsequent judgments). However, it is preferable to use a smart subsidy[6] (where beneficiaries pay a

---

[5] In some cases, premium subsidies are considered to distort the market, because they crowd out alternative risk transfer or risk mitigation strategies (GlobalAgRisk, 2011).

[6] "Smart" subsidies are designed and implemented in ways that provide maximum social benefits while minimising distortions in the market and the mistargeting of clients. A subsidy should have a clearly stated and well-documented purpose. It should address a market failure or equity concern, and

fair price, referred to as the sum of pure prime plus the premium loading - the amount an insurer needs in order to cover its expenses and generate profit).

2.3 *Scalability*

For the reasons discussed above, scaling up to the commercial level implies massive investment in both infrastructure and delivery channels. Such investments can be put in place only if the product becomes profitable for the insurers. Companies will thus consider the size of potential clients, affinity with distribution partners, and cost effective means of distribution. So far, uncertainty about the scalability of the product, confirmed by the low uptake of different pilots, led private companies to hold back on investing time and resources in building internal capacity and in funding "new experiments". However, in some cases this is also the result of little concrete and long-term business thinking in relation to the products, which may have been exacerbated by a lack of technical expertise (Bankable Frontier Associates-BFA, 2013). In other cases, sales were limited by the inappropriateness of the product[7] and misleading behaviour of sales agents that led to misunderstandings about the product features (Bankable Frontier Associates-BFA, 2013). Overall, the scalability of index insurance products remains uncertain.

Probably, in order to reduce the risk of offering an imperfect product, targeted analyses should be carried out to identify primary risk and to simultaneously compare the costs and benefits associated with product scalability before undertaking further experiments. Furthermore, being the use of satellite estimates considered the most suitable alternative to scares and incomplete data deriving from rain gauge network, it would probably be worth to further investigate the magnitude of the error (basis risk) associated to an index. This type of study, currently lacking, would provide a clear explanation of the capacity of this product to function as a protection toll for vulnerable farmers and pastoral.

In the long term, the increasing number of pilot projects carried out with imperfect products, limited distribution channels and emergent marketing skills can lead to incorrect perceptions by customers about a product, and destroy the trust of potential consumers. In developing and piloting insurance products, customer perception and trust deserve high priority.

3. Index based insurance in Kenya

Index insurance was first introduced in Kenya in 2005, and the Financial Sector Deepening of Kenya (FSD) has been involved since the beginning. The evolution of WII in the country has been covered in a number of reports and academic articles by the

---

should successfully target those in need with minimum inefficiency. Smart subsidies are designed with a clear exit strategy or with a long-term financing strategy in mind. Additionally, a good monitoring and evaluation system that tracks the performance of subsidies is paramount for the success of any subsidised insurance scheme.

[7] For instance in the case EPIICA, a four-year research project carried out in Ethiopia (McIntosh et al., 2013), sales fell in West Gojam because the primary risk faced by farmers was hailstorms and excessive rainfall rather than drought, whilst in some localities of North Wollo the index did not trigger the payouts, leading farmers to question the reliability of the product.

World Bank (2011), IFAD (2010), and Clarke (2012). A number of different forms of index insurance have been piloted in Kenya in recent years[8].

Most of the pilots carried out in Kenya were undertaken with the technical guidance of the World Bank. Others are independently led by the Syngenta Foundation for Sustainable Agriculture (now the Agriculture and Climate Risk Enterprise - ACRE), the International Livestock Research Institute (ILRI) and, more recently, Planet Guaranty (together with other donors) and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit). In general, a general lack of innovation (in terms of long-term business perspectives) and the focus of different pilots on a short-term horizon have contributed to hindering the assessment or prediction of future viability and sustainability of the various initiatives.

Whilst the majority of pilots carried out in the country all suffer from common limiting factors (i.e. imperfections in the construction of the index ,product awareness, financial literacy (Awel, 2015) and premium affordability (Burke et al., 2010)) in the next sub-section we will focus on those aspects that so far prevent the upscaling of one particular project, the Index-Based Livestock Insurance (IBLI).

3.1 *IBLI: product design and commercial challenges*

The Index-Based Livestock Insurance (IBLI) project was developed to cover livestock mortality related to forage scarcity due to drought, and was originally tested in 2010 in the Marsabit district. The product is designed to indemnify pastoralists in the event that their animals die because of drought. Under the IBLI, the pastoralists cover 15% of the herd loss, and any losses above 15% are compensated by the insurance company signing the product (Ngare et al., 2015). That is, indemnity payouts are triggered if the predicted livestock mortality index exceeds a threshold of 15%. A double threshold (10% and 15%) was introduced for the sales period August-September 2013.

As reliable rainfall information was not available, the index was developed by using the Normalized Difference Vegetation Index (NDVI) as a proxy of forage scarcity. The original index, designed for the Marsabit district, predicted livestock mortality rates using 20 years of historic data of livestock mortality and satellite measures of NDVI to generate an area-specific response function to map NDVI to average mortality rates (Chantarat et al., 2013). As Turvey and McLaurin (2012) suggest, area-specific ground data (in this case mortality data) are essential in order to meet one of the core assumptions for an NDVI to work as an insurance index. This condition was met in some areas of northern Kenya (and southern Ethiopia), where data on mortality are provided by the ALRMP database[9]. With regard to the performance of the index, Jensen et al. (2014) studied the correlation between the index (in its first version of Chantarat et al., 2012, applied to four divisions) and the full out-of-sample mortality data. The index was found to perform poorly in estimating drought-related mortality[10]. Consequently,

---

[8] In 2011 over 34 index-based weather insurance contracts were counted as having been developed (BFA, 2013).

[9] In other regions and in the absence of local mortality data, the model can be extended if agro-climatic conditions are very similar. But this would still require local fine tuning

[10] After that, three major improvements were adopted:

(1) The use of eMODIS NDVI at 250-m resolution instead of the NOAA-AVHRR NDVI at 8 km;

the algorithm described in Woodard et al. (2014) was applied from 2013, and the area covered extended to other counties[11]. Hence, starting from 2013, “the IBLI Marsabit index no longer explicitly predicted livestock mortality rates. Similar to the IBLI-Ethiopia product launched in August 2012 and other IBLI products in Kenya, the IBLI Marsabit product now makes indemnity payments according to an index developed using only NDVI values” (Mills et al., 2015).

Challenges associated with the utilisation of short-term NDVI time series as compared to constructed long-term NDVI time series are explained in more detail in Vrieling et al. (2014). An important aspect revealed by this study is that various NDVI products identify the occurrence of droughts in specific seasons. However, by looking at figure 1 on the comparison of different z-scored NDVI level and the two strike options (10% and 15%), it can be seen that the product would start to pay not only when zNDVI is greater than -0.6 (for the 10% strike) and -1.1 (for the 15% strike) but also in the case where zNDVI is greater than 1.6 and 2.1 respectively for a 10% and 15% strike level

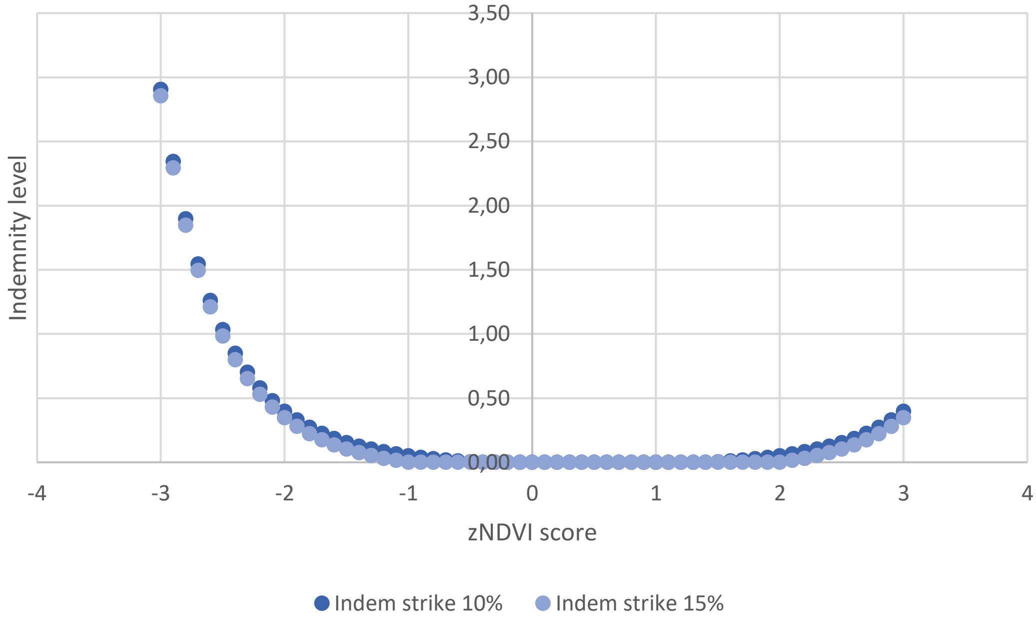

Figure 1: *Payout rate at either 10% and 15% strike level.*

(Source: Elaborated by the authors based on Vrieling et al. 2014)

Besides different technical constraints, lessons from IBLI have informed and supported the World Bank’s design of the Government of Kenya’s (GoK’s) Kenya Livestock Insurance Programme (KLIP), a macro-coverage insurance scheme sponsored

(2) The extension of the MODIS time series from 13 to a 33-year MODIS+AVHRR time series with the methodology supported by the consultant from Twente University and the JRC (Vrieling et al., 2014);
(3) The use of a spatially lagged econometric model to map the derived remote sensing indicator to mortality.

The resulting index was then used for 108 divisions. as described in Woodard et al., 2014. The division-level model appears to be accurate in fitting (overall time/space R2 = 0.99). More statistics (including out-of-sample R2 by division) would be needed to evaluate more precisely the correlation between the proposed index and the mortality rates.

[11] IBLI expanded into Isiolo (August 2013), Wajir (August 2013), Garissa (January 2015), and Mandera (January 2015).

by the Ministry of Agriculture, Livestock and Fisheries (MALF). In contrast to the IBLI, which will remain a micro-insurance scheme that will continue to be sold on a commercial basis across northern Kenya, the government-sponsored livestock insurance scheme launched in October 2015 is intended to cover selected households in the counties of Wajir, Turkana, Marsabit and Mandera. The selected herders covered by the KLIP will receive a 100% subsidy of the product.

From a retailing point of view, the Village Insurance Promoters (VIPs) found that the major impediment to IBLI was the commission structure. It was estimated that the net revenue per contract was very low (BFA, 2013). This may have led to an overselling of the product in order to increase sales volumes. Indeed, the problem that IBLI faced in one of the sales windows was that agents hid some of the key characteristics of the product from the insured (they did not properly explain that there was a possibility of not receiving an indemnity in case of loss – basis risk)[12]. While a misunderstanding of product characteristics is common in index-insurance pilots (McIntosh et al., 2013), better knowledge of the product does not appear to substantially increase the uptake of IBLI (Takahashi et al., 2014).

Difficulties in launching a successful roll out of different sales are exacerbated by the difficult environment in which the product is piloted. Some of the factors that impeded scaling up are: low population density[13] and poor infrastructure, high cost of collecting premiums, lack of strong distribution partners with a strong brand – Equity, the report says, has that brand but is losing interest- and high costs of individual agents (BFA, 2013). Furthermore, Jensen et al. (2014b) show that in some areas the benefits of reduced exposure to covariate risk (an average of 62.8%) are offset by high exposure to idiosyncratic risk[14]. In this study, the authors found high variations in covariate risk between sublocations (from 15 to 40), meaning that some sublocations face more idiosyncratic than covariate risks. If this is the case, that is if drought does not represent the main widespread correlated risk, then the index insurance product is inappropriate, and alternative risk management mechanisms would produce more beneficial results.

3.2 *IBLI: sales performance*

The product is marketed and sold during two periods occurring directly before the two rainy seasons (August-September and January-February), with insurance coverage periods lasting one year and the potential for two indemnity payouts, one after each dry season. This means that for two consecutive purchases of IBLI there is an overlapped coverage period which might generate more than one payout.

Despite the continue expansion, sales figures have still not reached large scales; at the end of 2014, sales were still at a critical level. Overall uptake level across the different sales windows remains disappointing (ranging from 35% of the first sale

---

[12] Information collected during our field mission in Kenya.

[13] The more successful programmes in India operate at a density of 386 per square kilometre; the Index-Based Crop Insurance (IBCI) initiatives vary from 59 (Narok– Ololunga) to 743 per square kilometre (Murang'a South- Sabasaba), whereas IBLI varies from 2 (Marsabit Chalbi) to 9 per square kilometre (North Horr). BFA (2013).

[14] Covariate risks affect many enterprises simultaneously (e.g. major droughts or floods, fluctuating market prices), while idiosyncratic risks usually affect only individual farms or firms (e.g. plant and animal pests and diseases, illnesses of the owner or labourers). Jaffee et al. (2010).

in January-February 2011 to 4.7% of the last sale in August-September 2013).[15]. Demand was found to be sensitive to discount coupons. This result is in line with those of Chantarat et al. (2009). They estimate that demand for IBLI falls by 55% when the fair premium rate is loaded by 20%; a further 26% reduction is expected with an additional 20% premium loading. Furthermore, the average number of livestock insured was 3 TLU in Kenya, which is far below the country averages of 17 and 12 TLU of livestock herded and owned. Additionally, the data show that in Kenya the number of TLU insured is constantly declining as shown in figure 2.

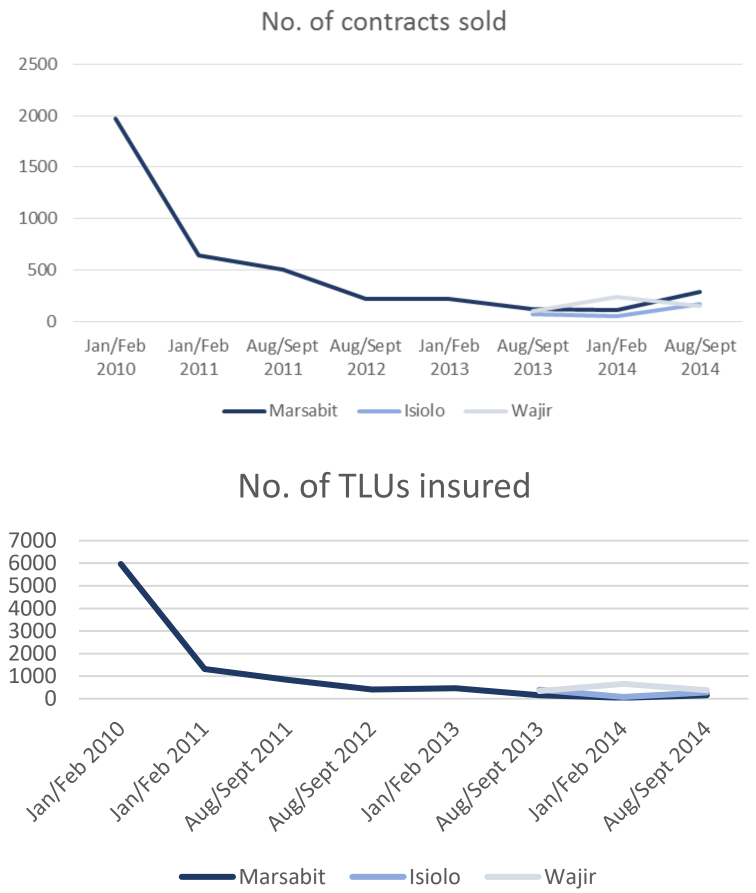

Figure 2: *Sales performance by season and location.*

Source: Elaborated by the authors based on Dror et al., 2015

However, sales of IBLI by the KLIP increased sharply in August/September 2015, when roughly 3,500 policies were sold. Although the coverage of the KLIP is still evolving, the focus has moved to asset protection. That is, the evaluation of the growing season is made during the season to allow for an earlier pay-out that should enable pastoralists to put in place measures to keep the livestock alive. While the product that is offered on a voluntary basis by the KLIP is completely subsidy-based (MALF set aside resources to provide a 100% subsidy to 5,000 selected herders) will in general boost awareness of IBLI, it may also suppress sales of commercial insurance products.

15 Data from the Marsabit and Borena Household Survey

Detailed figures of the performance of IBLI are offered by the five-year (ten seasons) longitudinal household surveys launched in Marsabit in 2009. The Marsabit annual surveys collected socio-economic information in addition to details on IBLI sales for five different years, each covering 924 households. These data indicate that the uptake of IBLI was below expectations. Figure 3 shows the share of people purchasing insurance across the five different sales rounds by discount percentage[16].

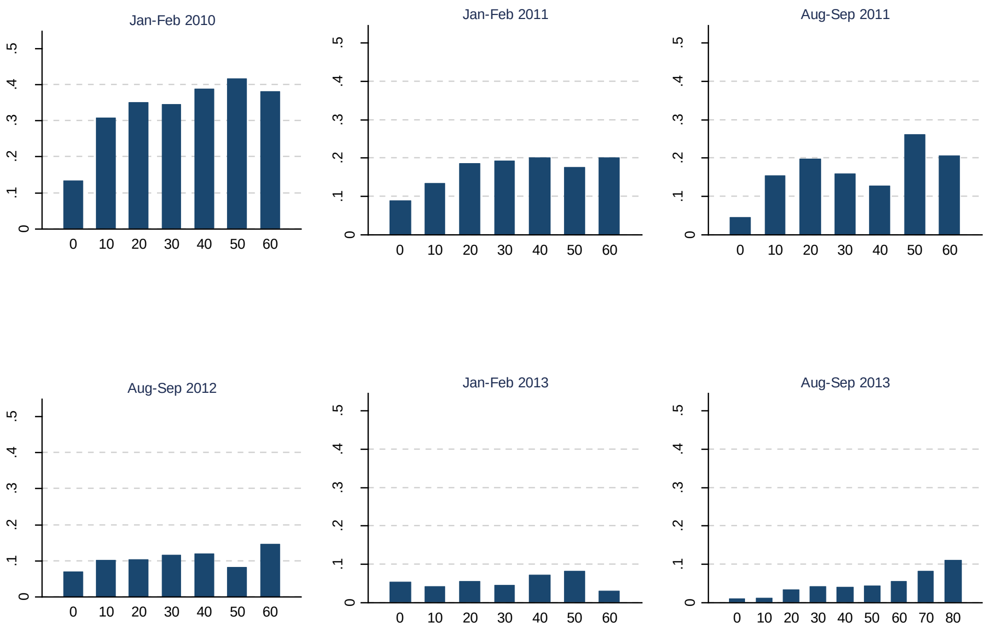

Figure 3: *Share of herders insured by discount percentage received.*

Source: Elaborated by the authors based on IBLI datasets

With the exception of the first sales period, the share of insured herders is consistently below 20%. The leverage effect of coupons on purchases does not appear to be very strong.

Contrary to other types of finding, which show that aggregated demand for IBLI is considered to be very price elastic, with a 55% reduction in demand when the fair premium rate is loaded by 20%, and a further 26% reduction with an additional 20% premium loading (Chantarat et al., 2009)[17], we see that the increase in uptake associated with discount coupons is mostly marginal, in the range of 3-7%.

Most importantly, data show that interest in the product decreases over time, confirming the challenge of generating effective demand for the upscaling of the

[16] In each round, discount coupons were randomly distributed to a rotating sub-sample of 60% of surveyed households in each sub-location. Coupons range from 10 to 60% (80% in Round five), at an interval of 10, and can be used to get a discount on the premium for the first 15 TLUs insured

[17] The three main findings are: 1) large herd owners will be the key drivers of a commercially sustainable IBLI product; 2) small premium reduction (e.g. through subsidisation) can potentially lead to large increases in quantity demanded (i.e. a decrease in premium loading from 40% to 20% could potentially lead to more than a doubling of aggregate demand; 3) while IBLI appears to be most valuable for the most vulnerable pastoralists (those with herd sizes of around 10-30 TLUs), most of their willingness to pay (WTP) lies well below the commercially loaded IBLI premium (i.e. at least a 20% loading).

product. These results are in line with the findings of Jensen et al. (2014a), which report that "uptake was healthy during the first sales window (27.8% of the sample purchased), but has dropped off rather dramatically in the following sales periods." Hence, we cannot generally state that high-discount coupons are good predictors of uptake. On the basis of these results, we believe that subsidising the product 100% in order to increase understanding and thus uptake of the product is not an optimal choice. In this regard Skees and Collier (2012) by identifying a number of concerns regarding the provision of subsidies for moderate losses, have also highlighted the risk associated with the use of premium subsidies, which may undermine the long-term sustainability of the scheme.

Besides, by looking at the share of livestock insured at a discounted rate (Table 1), we found that, on average, less than 50% of the assets owned are usually insured. This level of insurance is still far below the global coverage that would insure people against catastrophic risks. A proxy of dissatisfaction is represented by the level of consecutive purchasing in the five consecutive rounds. Our analysis reveals that about 35% of the insured bought IBLI twice, but only 7% of them bought more than two times.

	Share of herded and owned livestock insured											
	Round 2		**Round 3**				**Round 4**		**Round 5**			
	Jan-Feb 2010		**Jan-Feb 2011**		**Aug-Sep 2011**		**Aug-Sep 2012**		**Jan-Feb 2013**		**Aug-Sep 2013**	
Discount Rate	%	n	%	n	%	n	%	n	%	n	%	n
0	45	(49)	44	(36)	35	(16)	34	(26)	34	(20)	27	(2)
10%	49	(28)	31	(12)	35	(14)	34	(10)	49	(4)	59	(1)
20%	43	(31)	36	(17)	42	(17)	38	(10)	29	(4)	57	(3)
30%	39	(30)	51	(19)	38	(16)	26	(11)	44	(3)	62	(4)
40%	40	(34)	46	(19)	56	(12)	61	(11)	52	(7)	63	(4)
50%	60	(36)	47	(17)	36	(24)	53	(8)	18	(8)	57	(4)
60%	49	(34)	51	(16)	32	(21)	28	(14)	62	(3)	51	(5)
70%	-	-	-	-	-	-	-	-	-	-	55	(8)
80%	-	-	-	-	-	-	-	-	-	-	50	(12)
Total	**46**	**(242)**	**44**	**(136)**	**38**	**(120)**	**38**	**(90)**	**37**	**(49)**	**54**	**(43)**

Table 1: Share of herded and owned livestock insured by discount

Source: *Author's calculation based on the IBLI dataset (Marsabit).*

The results suggest three important implications: i) the attractiveness of the product can vanish even in the presence of high-value discount coupons; ii) as the quantity of Tropical Livestock Units (TLUs) insured is too small to protect herders against covariate risks, many remain vulnerable to weather risks; iii) there is a growing disaffection on the part of the consumers, which leads to the product losing its attractiveness even in the presence of high-value discount coupons, probably due to issues linked to product design rather than lack of economic means. This aspect should act as a warning bell for those interested in upscaling the product to a larger scale. Additionally, if we consider the limited knowledge about insurance among pastoralists, it would be difficult for any insurance product to improve market penetration unless efforts are made to improve marketing practices. Thus, to reach the high potential number of customers, it is also important to further improve product design (both in terms of minimising basis risk and improving marketing and delivery channels) or find alternative solutions that can minimise the drawbacks of the index. An embedded (and compulsory) product, such as that offered by Kilimo Salama[18], could be a valuable alternative approach to marketing IBLI. For instance, livestock vaccinations (already largely subsidised) could be tied to the insurance product so as to have a unique subsidised product. These steps have to be taken before attempting to move towards an expansion of pilots or an intensification of insurers' competition in the area

4. Research trends and alternative approaches

Despite several attempts to improve product design (reduce basis risk), positive results are still far from being achieved. While experience in India taught that increasing the number of weather stations will reduce specific basis risk problems (BFA, 2013), hybrid index/claims assessment (fall-back)[19] approaches are also expected to be developed (e.g. MiCRO in Haiti). Explaining the product as a protection against loss of yield or livestock might create false expectations, and high basis risk could generate distrust and disappointment. Furthermore, the issue of complex versus simple index insurance has been already discussed by many (i.e. Gommes and Göbel, 2013) and, while the tendency is to promote simple index insurance, this usually implies a loss of product efficiency.

While there are quite important and clear lessons to be learned from previous pilots, more can be learned from pilot programmes that pertain to meso-, and macro-index insurance products. Miranda and Farrin (2012) highlight the pros and cons of these products, and we remark that while remaining in the context of a community level it facilitates the understanding of the limits of the index and lessen the investment in extensive delivery mechanisms, macro-level products, such as the African Risk Capacity (ARC), have the great advantage of redistributing basis risk over a large geographic area, and can thus be less damaging than at the micro or meso level. Similarly, the impact of the KLIP on the commercial uptake of insurance will bring some insight into the effect of the public-private initiative of the GoK on macro-insurance for livestock.

[18] Kilimo Salama is an agricultural insurance initiative of the Syngenta Foundation for Sustainable Agriculture, and is now led by ACRE. It develops and distributes index insurance for farmers so that they feel confident in investing in quality seeds and fertiliser for their farms, and can access agricultural loans. The initiative has developed insurance products to cover a variety of crops against drought, excess rain, and disease.

[19] Claims assessment approaches that involve inspecting sentinel farms provide ground-truths for the index and serve as a fall-back mechanism when farmers incur losses. While it is still experimental, investigating the potential for subsidising 'basis risk insurance' would be beneficial. BFA (2013).

Basis risk is not, however, the only constraint in upscaling insurance. There are several challenging aspects that dampen the effectiveness of index insurance, and therefore new pilots should not be prioritised until innovation in the delivery approach and product design has been thoroughly worked out. On the contrary, the synergic effect of a combination of different risk management mechanisms, including micro-, meso-, and/or macro-insurance, remain an open area to be investigated. Attempts to develop a more integrated risk management framework have been made by IFAD and the World Bank (IFAD-PARM and RapAgRisk)[20], but there is still no general model that can identify options for risk management either by supply chain participants (individually or collectively) or by third parties (e.g. government). Understanding how to efficiently combine multiple strategies by categorising the instruments and prioritising interventions could be a preliminary step before endorsing any decision. In this regard, a cost-benefit analysis of different risk management mechanisms would help to understand not only the magnitude of investments in both infrastructure and delivery channels (endorsed by donors), but also the feasibility of scaling up insurance products compared to investments in other risk management mechanisms. So far, such an analysis has not been undertaken.

5. Conclusions

We commented on the issues related to index insurance as well as challenging aspects faced in different pilot projects that focus particularly on IBLI. While there have generally been many improvements from the technical point of view, a sustainable and scalable product is still lacking. The systematic commitment to piloting products has generated a degree of 'pilot-itis': products have been extensively piloted, but there is little evidence that they can become commercially sustainable and scalable. The general trend seems to be to incentivise pilots rather than make innovations in terms of concrete and long-term business thinking about the product. Such long-term measures could include, for instance, improving understanding of the needs of small-scale farmers and pastoralists, developing effective client communication strategies, encouraging private companies to invest adequate time and resources into building internal capacity, optimising the process of developing and introducing products, and reducing the number of players involved.

Data constraints must be considered when designing indices. Lack of data that are highly correlated with what is insured leads to imperfect product design which in turn translates into high basis risk. Managing basis risk comes up against the trade-off

[20] IFAD - PARM is developing a holistic framework, to which we could contribute by assessing the effectiveness of index insurance compared to other risk management mechanisms. Similarly, the methodology for a Rapid Agricultural Supply Chain Risk Assessment (RapAgRisk), developed by the Agricultural Risk Management Team (ARMT) of the World Bank, provides a system-wide approach for identifying risks, risk exposure, the severity of potential loses, and options for risk management either by supply chain participants (individually or collectively) or by third parties (e.g. government). It is designed to provide a first approximation of major risks, vulnerabilities, and areas that require priority attention for investment and capacity building. World Bank (2010).

:

between more complex and precise versus simple and less precise indices. So far, in many pilot tests, simplicity has been preferred over complexity, although this has not helped to avoid problems of data consistency and representativeness. These considerations lead us to a first set of conclusions whereby we strongly invite academic researchers, multilateral international non-governmental organisations, and national governments to think about how to first overcome the physical constraints associated with the development of index-based products or how to best reduce the negative impact of imperfect products. In light of what we discussed, we do not think that index-based insurance represents a suitable solution for very low-income smallholder farmers at this stage for two reasons: effective indices require a strong and high quality network with long-term, clean, and internally consistent historical records (elements that are currently lacking in many African countries, including Kenya), and very complex indices make the product unattractive to poor smallholder farmers.

The low uptake and increasing disaffection of those that tested the product also impede the development of the market. We have seen that neither the provision of discount coupons nor the number of assets insured approach a level of commercial viability. In all IBLI sales rounds, the impact of coupons on uptake is mixed and is less effective with respect to people who have already tried the product. In the case of IBLI, the average uptake fell from 41% in the first sale to 10% in the last sale (August-September 2013).

This second set of considerations brings us to rethink the role of index insurance as a product to protect farmers/pastoralists, and particularly to improve their food security. It seems that the potential for developing the insurance market is not great under these conditions.

Furthermore, after several experiments and ambiguous results, national or international financial support becomes the main vehicle for addressing issues of affordability. In turn, sustainable funding mechanisms become the main concern for many decision-makers. The challenge of balancing the responsibility for providing support between governments and/or donors and the private sector is still unsolved. It is not clear to which extent public support should endorse the scalability of the product and, more importantly, to which extent this support should sustain the improvement of the product's efficiency. In the present document we questioned the long-term sustainability in terms of efficiency, feasibility and scalability. We tried to shed light on some challenges that have undermined the product scalability, although further studies are required to estimate the extent to which benefits associated with this product outweigh the costs. In addition, exploiting alternative forms of the same product or combining insurance with complementary mechanisms can lead to better and more satisfactory results.

In drawing our recommendations, we endorse the conclusions of the recent conference on Information for Meeting Africa's Agricultural Transformation and Food Security Goals (IMAAFS), which stated that: "Weather-indexed insurance (WII) should generally be assessed as part of an overall risk management strategic portfolio. The size of most WII pilots is often too small to make them financially sustainable without donor subsidies. And several practical limitations keep the uptake of these products by small scale farmers low, such as for example insufficient transparency and efficiency in payouts and limited consultation of farmers in the pilot design phase". It was also mentioned that the best approach to managing agricultural risk is a holistic one; all mechanisms, including WII, should be assessed and combined most efficiently, with a better knowledge and use of community-based risk management strategies.

6. References

Awel, Y. M. (2015), *Risk preference or financial literacy?: Behavioural experiment on index insurance demand*. Maastricht : UNU-MERIT [u.a.].

Bankable Frontier Associates (BFA), (2013), Review of FSD's Index Based Weather Insurance Initiatives.

Binswanger-Mkhize H P, (2012), Is there too much hype about index-based agricultural insurance?, in *The Journal of Development Studies,* 48, 187–200.

Carter M.R.,(2011), Innovations for Managing Basis Risk under Index Insurance for Small Farm Agriculture, Ferdi, Policy brief B41.

Carter M. R., A. de Janvry, E. Sadoulet, and A. Sarris, (2014), Index-based weather insurance for developing countries: A review of evidence and a set of propositions for up-scaling. Working Paper.

Chantarat S., A.G. Mude and C.B. Barrett, (2009), Willingness to Pay for Index Based Livestock Insurance: A Field Experiment from Northern Kenya. Working Paper, Cornell University.

Chantarat S., A.G. Mude, C.B. Barrett, and C.G. Turvey, (2010), The Performance of Index Based Livestock Insurance: Ex Ante Assessment in the Presence of a Poverrty Trap. Mimeo.

Chantarat, S., A.G. Mude, C.B. Barrett. and M.R. Carter, (2013), Designing Index-Based Livestock Insurance for Managing Asset Risk in Northern Kenya. *Journal of Risk and Insurance*, 80, 205–237.

Clarke D., (2012), What have we learned from all the agricultural microinsurance pilots? Blog available at http://blogs.csae.ox.ac.uk/2012/11/what-have-we-learned-from-all-the-agricultural-microinsurance-pilots/

Clarke D., and S. Dercon, (2009), Insurnace, Credit and Safety Nets for the Poor in a World of Risk. New York: United Nation, Department of Economics nad Social Afairs, Working paper 81.

de Leeuw J., A.Vrieling, A. Shee, C. Atzberger, K.M. Hadgu, C.M. Biradar, H. Keah and C. Turvey, (2014), The potential and uptake of remote sensing in insurance. A review. *Remote Sensing* (6),10888–10912.

Fuchs, A., and R-C. Lourdes, (2011), Voters Response to Natural Disasters Aid: Quasi-Experimental Evidence from Drought Relief Payment in Mexico, University of California at Berkeley.

GlobalAgRisk, Inc., (2011), Market Development for Weather Index Insurance Key Considerations for Sustainability and Scale Up. Innovation in Catastrophic Weather Insurance to Improve the Livelihoods of Rural Households.

Gommes R, and W. Göbel, (2013), Beyond simple, one-station rainfall indices, *In The challenges of index-based insurance for food security in developing countries*. Luxembourg, Publications Office of the European Union, JRC77278. Pp 205-221.

Gunning J.W., (2012), *Risk Management and Coping Mechanisms in Developing Countries*, (External report, Commissioned Review), London: Foresight, Government Office for Science.

Hess U., (2007), Weather Index Insurance for Coping with Risks in Agricultural Production. In Sivakumar, M. V. K.; Motha, R. P. (eds.): Managing Weather and Climate Risks in Agriculture. Berlin: Springer Verlag.

Hess U., and P. Hazell, (2009), *Sustainability and Scalability of Index-Based Insurance for Agriculture and Rural Livelihoods*. IFPRI 2020 Focus 17, Brief 5. Washington, DC: International Food Policy Research Institute.

Vargas Hill R. and M. Torrero (eds.), 2009, *Innovations in Insuring the Poor,* IFPRI 2020 Focus 17, Brief 5. Washington, DC: International Food Policy Research Institute.

IFAD, (2010), The potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods.

Information for Meeting Africa's Agricultural Transformation and Food Security Goals (IMAAFS) Key Conference Findings and Conclusions *1-3 October 2014 UN Conference Center, Addis Ababa, Ethiopia.*

Jensen N., A. Mude, and C.B. Barrett, (2014a), How Basis Risk and Spatiotemporal Adverse Selection Influence Demand for Index Insurance: Evidence from Northern Kenya. Working paper, Cornell University.

Jensen N.D., C.B. Barret, and A.G. Mude, (2014b), Basis Risk and the Welfare Gains from Index Insurance: Evidence from Northern Kenya, *MPRA Paper No. 59153*, http://mpra.ub.uni-muenchen.de/59153/.

Gommes, R, and W. Göbel, 2013, Beyond simple, one-station rainfall indices, In *The challenges of index-based insurance for food security in developing countries*, Publications Office of the European Union.

Johnson L., (2013), Index insurance and the articulation of risk-bearing subjects *Environment and Planning* 45(11) 2663 – 2681.

Leeuw J.D., A. Vrieling, A. Shee, C. Atzberger, K.M. Hadgu, C. Biradar, H. Keah, C. Turvey, (2014), The Potential and Uptake of Remote Sensing in Support of Insurance: a review. *Remote Sensing*. 6, no.11: 10888-10912.

Manuamorn O.P., (2007), Scaling-Up Micro Insurance: The Case of Weather Insurance for Smallholders in India, Agriculture and Rural Development Discussion Paper 36. Washington, DC: World Bank.

Mills C. J., Nathaniel D.J., Barrett C.B., Mude A.G., (2015), Characterization for Index Based Livestock Insurance, IBLI publication.

Miranda M.J., and K. Farrin, (2012), Index Insurance for Developing Countries, *Applied Economic Perspectives and Policy* 34(3), 391–427.

Sina J., and P. Jacobi, (2012), Index-Based Weather Insurance -International & Kenyan Experiences. Kenya: Adaptation to Climate Change and Insurance (ACCI).

Skees J.R., (2008), Innovations in Index Insurance for the Poor in Lower Income Countries, *Agricultural and Resource Economics Review* 37(1), 1-15.

Smith V.H., and J.W. Glauber, (2012), Agricultural insurance in developed countries: where have we been and where are we going? *Applied Economic Perspectives and Policy*, 34(3), 363–390.

Vrieling A., M. Meroni, A. Shee, A., Mude, J. Woodard, K. de Bie, F. Rembold, (2014), Historical extension of operational NDVI products for livestock insurance in Kenya. *International Journal of Applied Earth Observation and Geoinformation*, 28, 238-251.

Woodard et al., 2013. A Spatial Econometric Approach to Designing and Rating Scalable Index Insurance in the Presence of Missing Data, CSAE conference 2014 (https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=CSAE2014&paper_id=709), under review; J. of Risk and Insurance.

Washington R., M. Harrison, D. Conway, E. Black, A. Challinor, D. Grimes, R. Jones, A. Morse, G. Kay, M. Todd. 2006, African climate change: taking the shorter route, *Bulletin of the American Meteorological Society*, 87 (10):1355-1366.

World Bank, (2005), Managing Agricultural Production Risk: Innovations in Developing Countries. Report No. 32727-GLB. The World Bank, Agriculture and Rural Development Department (ARD), Washington, DC.

World Bank, (2011), Weather Index Insurance For Agriculture: Guidance For Development Practitioners.